GOVERNMENT OF ODISHA
DEPARTMENT OF WATER RESOURCES

BIDDING DOCUMENT

NAME OF WORK
REM OF SUB-MINOR CANALS OF HLC RANGE-I CANAL SYSTEM INCLUDING IMPROVEMENT/MODERNISATION OF STRUCTURES (Bhuban S/M, Bhabi loft S/M, Munda Mala S/M).

PACKAGE NO. CW-NCB-HLC-14

EMPLOYER: DEPARTMENT OF WATER RESOURCES
GOVERNMENT OF ODISHA
COUNTRY - INDIA
GOVT. OF ODISHA
Department of Water Resources
OFFICE OF THE SUPERINTENDING ENGINEER
EASTERN CIRCLE-II, CHANDIKHOLE
Invitation for Bids

Identification No. SEEC-03/ADB-02 of dt.11.08.2017
MFF 0022: Odisha Integrated Irrigated Agriculture and Water Management Investment Program (OIIAWMIP)
Deadline for Submission of Bids:- Dt. 20.09.2017 up to 3.30 PM.

1. India has signed for loans from the Asian Development Bank (ADB) towards the Cost of Odisha Integrated Irrigated Agriculture and Water Management Investment Program (OIIAWMIP), Project-2. Part of the loan proceeds will be used for payments under the contract for the said project. Bidding is open for bidders of eligible class from ADB’s listed eligible sources countries (refer www.adb.org for details). The eligibility rules and procedures of the ADB will govern the bidding process.

2. The Department of Water Resources, Government of Odisha (‘the Employer’) invites separate sealed bids from eligible bidders of eligible Class Contractor, Registered with the State Govt. of Odisha or from Contractors registered with other State Govt./ Central Govt. of India/ M.E.S/ Railways for any other Govt. undertakings for the following works:

Table-I

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Package No.</th>
<th>Description of works</th>
<th>Non-refundable fee (Cost of bid document) in INR.</th>
<th>Bid Security (in Million INR)</th>
<th>Period of Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CW-NCB-HLC-11</td>
<td>REM of Sub-Minor Canals of HLC Range-I Canal System including improvement/Modernisation of Structures (Disty No-6A1, Barimul Sub-minor, Disty No-7 1/2).</td>
<td>10,000/-</td>
<td>0.14</td>
<td>1 year</td>
</tr>
<tr>
<td>2</td>
<td>CW-NCB-HLC-12</td>
<td>REM of Sub-Minor Canals of HLC Range-I Canal System including improvement/Modernisation of Structures (Sendhapur, Minor, Kantigadia S/M, Rathia S/M, Chania Dandi S/M, Disty No-15).</td>
<td>-Do-</td>
<td>0.15</td>
<td>1 year</td>
</tr>
<tr>
<td>3</td>
<td>CW-NCB-HLC-13</td>
<td>REM of Sub-Minor Canals of HLC Range-I Canal System including improvement/Modernisation of Structures (Debabara S/M &amp; Patapur S/M).</td>
<td>-Do-</td>
<td>0.11</td>
<td>1 year</td>
</tr>
<tr>
<td>4</td>
<td>CW-NCB-HLC-14</td>
<td>REM of Sub-Minor Canals of HLC Range-I Canal System including improvement/Modernisation of structures (Bhuban S/M, Bhabilo S/M, Munda Mala S/M).</td>
<td>-Do-</td>
<td>0.16</td>
<td>1 year</td>
</tr>
</tbody>
</table>

3. Only the eligible bidders with the following key qualifications for these works can participate in biddings:
<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Key Qualifications</th>
<th>CW-NCB-HLC-11</th>
<th>CW-NCB-HLC-12</th>
<th>CW-NCB-HLC-13</th>
<th>CW-NCB-HLC-14</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Average annual construction turnover considering preceding 5 years <em>(in Million INR)</em></td>
<td>27.81</td>
<td>28.84</td>
<td>20.92</td>
<td>31.66</td>
</tr>
<tr>
<td>2</td>
<td>Successfully or substantially completed at least one work within the last 5 years and that is similar to the proposed work <em>(in Million INR)</em></td>
<td>11.12</td>
<td>11.54</td>
<td>8.37</td>
<td>12.66</td>
</tr>
<tr>
<td>3</td>
<td>Minimum Construction experience in the following key activities in any year within last 5 years.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>i Concrete work of all grades <em>(in cum per year)</em></td>
<td>1720.85</td>
<td>1763.02</td>
<td>651.88</td>
<td>1415.04</td>
</tr>
<tr>
<td></td>
<td>ii Earth work <em>(in Cum per year)</em></td>
<td>21873.55</td>
<td>26158.99</td>
<td>44546.11</td>
<td>47359.25</td>
</tr>
</tbody>
</table>

4. To obtain further information and inspect the bidding documents, bidders should contact:
   (i) Superintending Engineer, Eastern Circle-II, Chandikhole
       e-mail seec2chandikhole@gmail.com, Telephone: +91 6725-214500
   (ii) Executive Engineer (Project Manager), Jaraka Irrigation Division, Jaraka
       e-mail eeidjaraka@yahoo.com, Telephone: +91 6725 283069

5. To purchase of any one or more of the bidding documents eligible bidders should write in English to above mentioned address, requesting for the bidding documents for Package No. CW-NCB-HLC-11, CW-NCB-HLC-12, CW-NCB-HLC-13, CW-NCB-HLC-14.

- The bid documents can also be down loaded from official web site of DoWR Government of Odisha i.e. www.dowrorissa.gov.in

6. Pay for each package, a non-refundable fee of INR 10,000/- in shape of Bank Draft in favour of Executive Engineer, (Project Manager), Jaraka Irrigation Division, Jaraka as per Table-I. The bidders, in case of down loading the bid documents from the Govt. website will have to submit the Bank Draft towards the cost of bid documents enclosed in a separate envelope marked as “Cost of bid document down loaded from internet” along with the bid.

7. Deliver your bid:
   - To the Chief Engineer-cum-Project Director, PMU (OIIAWMIP), 5th floor, Rajiv Bhawan, Bhubaneswar on or before the deadline dated 20.09.2017 upto 3.30 P.M. together with a Bid Security in shape of (a) **an unconditional bank guarantee** (b) **an irrevocable letter of credit** (c) **a cashier’s or certified cheque** only as mentioned in section-1, clause-19 for each bid as mentioned above against each work in Bid Security Column of Serial No.5.
   - Bids will be opened by S.E. Eastern Circle-II, Chandikhole in the office of the Chief Engineer-cum-Project Director, PMU (OIIAWMIP), 5th floor, Rajiv Bhawan, Bhubaneswar, Odisha, on Dt.20.09.2017 at 4.00 P.M. in presence of bidders or their authorized representatives who wishes to attend.
   - There will be **pre-bid conference** on dt. 06.09.2017 at 11.00 AM at the conference hall of PMU, 5th floor, Rajiv Bhawan, Bhubaneswar, Odisha interested bidders may attend the pre-bid conference in the aforesaid date.
   - If the scheduled day for any event is a Government holiday, the next working day will be considered with same schedule time.
   - The authority reserve all rights to cancel any or all the tender without assigning any reason thereof.

Sd/-  
Superintending Engineer, 
Eastern Circle-II, Chandikhole
STANDARD BIDDING DOCUMENT

Procurement of Works

- Single-Stage: Two-Envelope Bidding Procedure -

Asian Development Bank
December 2015
Foreword

This Standard Bidding Document for the Procurement of Works – Small Contracts (SBD Works-Small) has been prepared by the Asian Development Bank (ADB) and is based on the Master Document for Procurement of Small Works", prepared by multilateral development banks and other public international financial institutions which reflects the majority view of these institutions. This document has the structure and the provisions of the Master Procurement Document, except where ADB-specific considerations have required a change.

This SBD is supported by a User’s Guide. The User’s Guide contains detailed explanations and recommendations to Employers on how to prepare a specific bidding document for the procurement of works – small contracts and how to evaluate bids. The User’s Guide is not a part of the bidding document.

To obtain further information on procurement under ADB-financed projects, contact

Operations Services and Financial Management Department (OSFMD)
Asian Development Bank
6 ADB Avenue, Mandaluyong City
1550 Metro Manila, Philippines
Email: procurement@adb.org
Tel +63 2 632 2444
Fax +63 2 636 2444 [Attn: Director General, OSFMD]
www.adb.org
Procurement of Works

Bidding Document for
Procurement of

“REM of Sub-Minor Canals of HLC Range-I Canal System including improvement/Modernisation of structures (Bhuban S/M, Bhabilo S/M, Munda Mala S/M)”

Issued on: 11.08.2017
Invitation for Bids No.: SEEC-03/ADB-02 of 2017-18
NCB No: CW-NCB-HLC-14
Employer: Department of Water Resources, Government of Odisha
Country: INDIA
Preface

This Bidding Document for the Procurement of Works has been prepared by the Executive Engineer, Jaraka Irrigation Division, Jaraka is based on the Standard Bidding Document for the Procurement of Works–Small Contracts (SBD Works-Small) issued by the Asian Development Bank dated December 2015.

ADB’s SBD Works-Small has the structure and the provisions of the Master Procurement Document entitled “Bidding Documents for the Procurement of Works–Small Contracts”, 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

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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 the Works as specified in Section 6 (Employer’s Requirements). The name, identification, and number of contracts of this bidding 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 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 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 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; 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.
Section 1 - Instructions to Bidders

3.2 Furthermore, Bidders shall be aware of the provisions of GCC 28.3 and 73.2 (i).

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, or incorporated, 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 this 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 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 Invitation for Bids (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 prior to the deadline for submission of bids, within a period given in the BDS. 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 risk and 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, at Bidder’s option and 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, or as stipulated in the BDS;
   (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, and all documents listed under Clause 11, 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 When specified in the BDS pursuant to ITB 13.1, and subject to 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 Schedules shall conform to the requirements specified below.

14.2 The Bidder shall submit a bid for the whole of the works described in ITB 1.1 by filling in prices for all items of the Works, as identified in Section 4 (Bidding Forms). In case of admeasurement contracts, 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 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 Conditions of Contract, the prices quoted by the Bidder shall be fixed. If the 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, the Bidder shall furnish the indexes and weightings for the price adjustment formulas in the Table(s) of Adjustment Data 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 currency(ies) of the Bid and payment shall be as specified in the BDS.

15.2 Bidders may be required by the Employer to justify, to the Employer's satisfaction, their local and foreign currency requirements, and to substantiate that the amounts included in the prices shown in the appropriate form(s) of Section 4, in which case a detailed breakdown of the foreign currency requirements shall be provided by Bidders.

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 in accordance with 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 bank 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 arithmetical corrections in accordance with ITB 33; or

      (iv) furnish a domestic preference security, if applicable, in accordance with ITB 42.

19.8 The bid security or the 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 the 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 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 Bid 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 21.3.

(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 as provided in 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 prior to 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 choose 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 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 and 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 a 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 the 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 a 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 for 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 Schedules are to be initialed by at least three representatives of the Employer attending the 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 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 omission.

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) Only for unit price contracts, 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 for admeasurement contracts, or Schedule of Prices for lump sum contracts, 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 to award multiple contracts to a single Bidder, 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 for an admeasurement contract, which results in the lowest Evaluated Bid Price, is seriously unbalanced, front loaded or substantially below updated estimates 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

A. General

<table>
<thead>
<tr>
<th>ITB 1.1</th>
<th>The number of the Invitation for Bids (IFB) is: SEEC-03/ADB-02 of 2017-18</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITB 1.1</td>
<td>The Employer is: Department of Water Resources, Government of Odisha</td>
</tr>
<tr>
<td>ITB 1.1</td>
<td>The name of the bidding process is: Single stage – Two envelope</td>
</tr>
<tr>
<td></td>
<td>The identification number of the bidding process is: CW-NCB-HLC-14</td>
</tr>
<tr>
<td></td>
<td>The number and identification of lots comprising this bidding process is: One</td>
</tr>
<tr>
<td>ITB 2.1</td>
<td>The Borrower is: India</td>
</tr>
<tr>
<td>ITB 2.1</td>
<td>The name of the Project is: Orissa Integrated Irrigated Agriculture and Water Management Investment Program, Project – 2.</td>
</tr>
</tbody>
</table>

B. Contents of Bidding Documents

<table>
<thead>
<tr>
<th>ITB 7.1</th>
<th>For clarification purposes only, the Employer's address is:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Attention: Superintending Engineer, Eastern Circle-II, Chandikhole, Department of Water Resources, Govt. of Odisha</td>
</tr>
<tr>
<td></td>
<td>Chandikhole, District - Jajpur</td>
</tr>
<tr>
<td></td>
<td>PIN Code: 755024</td>
</tr>
<tr>
<td></td>
<td>Country: India</td>
</tr>
<tr>
<td></td>
<td>Telephone: 06725-214500</td>
</tr>
<tr>
<td></td>
<td>Electronic mail address: <a href="mailto:seec2chandikhole@gmail.com">seec2chandikhole@gmail.com</a></td>
</tr>
<tr>
<td></td>
<td>Requests for clarification should be received by the Employer no later than: Ten (10) days before the bid submission date.</td>
</tr>
<tr>
<td>ITB 7.4</td>
<td>A Pre-Bid meeting will take place, it will be at the following date, time and place:</td>
</tr>
<tr>
<td></td>
<td>Date: 06.09.2017</td>
</tr>
<tr>
<td></td>
<td>Time: 11.00 A.M.</td>
</tr>
<tr>
<td></td>
<td>Place: Office of the Chief Engineer-cum-Project Director, PMU, OIIAWMIP</td>
</tr>
<tr>
<td></td>
<td>A site visit conducted by the Employer will be organized on dt.04.09.2017</td>
</tr>
</tbody>
</table>
## C. Preparation of Bids

<table>
<thead>
<tr>
<th>ITB 10.1</th>
<th>The language of the Bid is: <strong>English</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>ITB 11.2 (g)</td>
<td>The Bidder shall submit with its Technical Bid the following additional documents: The bidder is required to submit an affidavit in legal stamp paper certifying that all the statements made in the required attachments and all the documents enclosed by him in this bid are true and correct.</td>
</tr>
<tr>
<td>ITB 11.3 (b)</td>
<td>In accordance with ITB 12 and ITB 14, the following schedules shall be submitted with the bid, including the priced Bill of Quantities for admeasurement contracts and Activity Schedule for lump sum contracts: <strong>Only the priced Bill of Quantities.</strong></td>
</tr>
<tr>
<td>ITB 11.3 (d)</td>
<td>The Bidder shall submit with its Price Bid the following additional documents: <strong>NONE</strong></td>
</tr>
<tr>
<td>ITB 12.1</td>
<td>The units and rates in figures entered into the Bill of Quantities and Day work Schedule should be typewritten or if written by hand, must be in print form. Bill of Quantities and Day work Schedule not presented accordingly may be considered nonresponsive.</td>
</tr>
<tr>
<td>ITB 13.1</td>
<td>Alternative bids <strong>shall not</strong> be permitted.</td>
</tr>
<tr>
<td>ITB 13.2</td>
<td>Alternative times for completion <strong>shall not</strong> be permitted.</td>
</tr>
<tr>
<td>ITB 13.4</td>
<td>Alternative technical solutions shall be permitted for the following parts of the Works: <strong>Shall not be permitted.</strong></td>
</tr>
<tr>
<td>ITB 14.5</td>
<td>The prices quoted by the Bidder <strong>shall be</strong> subject to adjustment during the performance of the Contract.</td>
</tr>
<tr>
<td>ITB 15.1</td>
<td>The prices shall be quoted by the bidder and shall be paid in: <strong>Indian Rupees</strong> (INR).</td>
</tr>
<tr>
<td>ITB 18.1</td>
<td>The bid validity period shall be <strong>Ninety (90) days.</strong> Bid validity for a shorter period shall be rejected by the Employer as non-responsive.</td>
</tr>
<tr>
<td>ITB 19.1</td>
<td>The Bidder shall furnish a bid security in the amount of <strong>INR 0.16 million</strong></td>
</tr>
<tr>
<td>ITB 19.2</td>
<td>The ineligibility period will be <strong>NOT APPLICABLE</strong></td>
</tr>
<tr>
<td>ITB 19.4</td>
<td>Any bid not accompanied by an irrevocable and callable bid security shall be rejected by the Employer as nonresponsive. However, if a bidder submits a bid security that deviates in form, amount and/or period of validity, the Employer shall request the Bidder to submit a compliant bid security <strong>within seven (7) days</strong> 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.</td>
</tr>
</tbody>
</table>
### D. Submission and Opening of Bids

<table>
<thead>
<tr>
<th>ITB 21.1</th>
<th>Bidders shall not have the option of submitting their Bids electronically.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITB 21.1 (b)</td>
<td>If bidders shall have the option of submitting their Bids electronically, the electronic bidding submission procedures shall be: Not Applicable</td>
</tr>
</tbody>
</table>
| ITB 22.1 | For bid submission purposes only, the Employer’s address is:  
Attention: Chief Engineer-cum-project Director, PMU, OIIAWMIP, Department of Water Resources, Government of Odisha  
Street Address: Rajiv Bhawan  
Floor/Room number: 5th Floor  
City: Bhubaneswar  
PIN Code: 751001  
Country: INDIA  
The deadline for bid submission is:  
Date: 20.09.2017  
Time: 3.30 P.M. |
| ITB 25.1 | The opening of the Technical Bid shall take place at:  
Street Address: Office of the Chief Engineer-cum-Project Director, PMU, OIIAWMIP  
Floor/Room number: 5th Floor, Rajiv Bhawan  
City: Bhubaneswar  
Country: INDIA  
Date: 20.09.2017  
Time: 4.00 P.M. |
### E. Evaluation and Comparison of Bids

| ITB 25.1 | If electronic bid submission is permitted in accordance with ITB 21.1, the specific bid opening procedures shall be: **Not applicable** |
| ITB 25.5 | The Letter of Technical Bid shall be initialed by **at least three** representatives of the Employer attending the Bid opening. |
| ITB 25.10 | The Letter of Price Bid and Schedules shall be initialed by **at least three** representatives of the Employer attending the Bid opening. |

| ITB 34.1 | **Not applicable.** |
| ITB 35.1 | A margin of preference **shall not** apply. |
# Section 3 - Evaluation and Qualification Criteria

## Table of Criteria

1. **Evaluation**
   1.1 Adequacy of Technical Proposal
   1.2 Completion Time
   1.3 Technical Alternatives
   1.4 Quantifiable Nonconformities and Omissions
   1.5 Margin of Preference
   1.6 Multiple Contracts

2. **Qualification**
   2.1 Eligibility
      2.1.1 Nationality
      2.1.2 Conflict of Interest
      2.1.3 ADB Eligibility
      2.1.4 Government-Owned Enterprise
      2.1.5 United Nations Eligibility
   2.2 Pending Litigation and Arbitration
   2.3 Financial Situation
      2.3.1 Historical Financial Performance
      2.3.2 Average Annual Construction Turnover
      2.3.3 Financial Resources
   2.4 Construction Experience
      2.4.1 Contracts of Similar Size and Nature
      2.4.2 Construction Experience in Key Activities
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 noncompliance 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 Margin of Preference (Applicable for ICB only)

If a margin of preference shall apply under ITB 35.1, the procedure will be as follows: Not applicable
1.6 **Multiple Contracts**

Works are grouped in multiple contracts and pursuant to ITB 36.4, the Employer shall evaluate and compare Bids on the basis of a contract, or a combination of contracts, or as a total of contracts in order to arrive at the least-cost combination for the Employer by taking into account discounts offered by Bidders in case of award of multiple contracts.

If a Bidder submits several successful (lowest evaluated substantially responsive) bids, the evaluation will also include an assessment of the Bidder’s capacity to meet the following aggregated requirements as presented in the bid:

- Average annual construction turnover,
- Financial resources,
- Equipment to be allocated, and
- Personnel to be fielded.
# 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

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Requirement</th>
<th>Compliance Requirements</th>
<th>Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Single Entity</td>
<td>Joint Venture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All Partners</td>
<td>Each Partner</td>
</tr>
<tr>
<td>Nationality</td>
<td>Nationality in accordance with ITB Sub-clause 4.2.</td>
<td>must meet requirement</td>
<td>must meet requirement</td>
</tr>
<tr>
<td>Conflict of Interest</td>
<td>No conflicts of interest in accordance with ITB Sub-clause 4.3.</td>
<td>must meet requirement</td>
<td>must meet requirement</td>
</tr>
<tr>
<td>ADB Eligibility</td>
<td>Not having been declared ineligible by ADB, as described in ITB Sub-clause 4.4.</td>
<td>must meet requirement</td>
<td>must meet requirement</td>
</tr>
<tr>
<td>Government-Owned Enterprise</td>
<td>Bidder required to meet conditions of ITB Subclause 4.5.</td>
<td>must meet requirement</td>
<td>must meet requirement</td>
</tr>
<tr>
<td>United Nations Eligibility</td>
<td>Not having been excluded by an act of compliance with a UN Security Council resolution in accordance with ITB Sub-clause 4.7.</td>
<td>must meet requirement</td>
<td>must meet requirement</td>
</tr>
</tbody>
</table>
2.2 Pending Litigation

Pending litigation and arbitration criterion shall not apply.¹

2.2.1 Pending Litigation and Arbitration

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Compliance Requirements</th>
<th>Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Requirement</td>
<td>Single Entity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All Partners Combined</td>
</tr>
<tr>
<td>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 (50) percent of the Bidder’s net worth calculated as the difference between total assets and total liabilities.</td>
<td>must meet requirement by itself or as partner to past or existing Joint Venture</td>
<td>not applicable</td>
</tr>
</tbody>
</table>

¹ The employer may choose to apply this criterion on exceptional basis. If the employer chooses to apply this criterion, it should indicate “shall apply” and use the table below.
### 2.3 Financial Situation

#### 2.3.1 Historical Financial Performance

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Compliance Requirements</th>
<th>Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirement</td>
<td>Single Entity</td>
<td>Joint Venture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All Partners Combined</td>
</tr>
<tr>
<td>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 last five (5) 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.</td>
<td>must meet requirement</td>
<td>not applicable</td>
</tr>
</tbody>
</table>

#### 2.3.2 Average Annual Construction Turnover

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Compliance Requirements</th>
<th>Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirement</td>
<td>Single Entity</td>
<td>Joint Venture</td>
</tr>
<tr>
<td></td>
<td></td>
<td>All Partners Combined</td>
</tr>
<tr>
<td>Minimum average annual construction turnover of INR 31.66 Million, calculated as total certified payments received for contracts in progress or completed, within the last five (5) years.</td>
<td>must meet requirement</td>
<td>must meet requirement</td>
</tr>
</tbody>
</table>

Note; - 1: (Financial turnover of previous years shall be given weightage of 10% per year based on Indian Rupee value to bring them to current price level.)
2.3.3 Financial Resources

If the bid evaluation process and the decision for the award of the Contract takes more than one (1) year from the date of bid submission, Bidders shall be asked to resubmit their current contract commitments and latest information on financial resources supported by latest audited accounts/audited financial statements, or if not required by the law of the Bidder’s country, other financial statements acceptable to the Employer, and the Bidders’ financial capacity shall be reassessed on this basis.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Compliance Requirements</th>
<th>Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirement</td>
<td>Single Entity</td>
<td>Joint Venture</td>
</tr>
<tr>
<td>The Bidder must demonstrate that it has the financial resources to meet</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) its current contract commitments, as defined in FIN-4 (Total Financial Requirements for Current Contract Commitments), plus</td>
<td>must meet requirement</td>
<td>not applicable</td>
</tr>
<tr>
<td>(b) the requirements for the Subject Contract of INR 2.64 million</td>
<td>must meet requirement</td>
<td>must meet requirement</td>
</tr>
</tbody>
</table>

1 The employer has the option to move this criterion from Section 3 (Evaluation and Qualification Criteria) to Section 6 (Employer’s Requirements), in which case:
   a) the employer shall confirm compliance with the financial resources prior to award of contract in accordance with ITB 39.1 Award Criteria; and
   b) in place of the Financial Resources criterion, the employer shall require the bidder to submit together with its bid, and for confirmation during bid evaluation, a Letter of Undertaking to comply with the financial resources given in Section 6 prior to award of contract.
### 2.4 Construction Experience

#### 2.4.1 Contracts of Similar Size and Nature

<table>
<thead>
<tr>
<th>Criteria Requirement</th>
<th>Compliance Requirements</th>
<th>Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Participation in at least one contract that has been successfully or substantially completed within the last five (5) years and that is similar to the proposed works, where the value of the Bidder’s participation exceeds INR 12.66 Million.</strong></td>
<td></td>
<td>Form EXP-1</td>
</tr>
</tbody>
</table>

**Note:** Employer should delete this row if participation is required in at least two contracts.

#### 2.4.2 Construction Experience in Key Activities

<table>
<thead>
<tr>
<th>Criteria Requirement</th>
<th>Compliance Requirements</th>
<th>Documents</th>
</tr>
</thead>
<tbody>
<tr>
<td>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:</td>
<td></td>
<td>Form EXP-2</td>
</tr>
<tr>
<td>Concrete of all grades in cum per year – 1415.04 cum per year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Earthwork in cum per year – 47359.25 cum per year</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Section 4 - Bidding Forms

Table of Forms

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<tr>
<th>Form Type</th>
<th>Page</th>
</tr>
</thead>
<tbody>
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<td>4-2</td>
</tr>
<tr>
<td>Letter of Price Bid</td>
<td>4-4</td>
</tr>
<tr>
<td>Bid Security</td>
<td>4-6</td>
</tr>
<tr>
<td>Bid-Securing Declaration</td>
<td>4-7</td>
</tr>
<tr>
<td>Technical Proposal</td>
<td>4-8</td>
</tr>
<tr>
<td>Personnel</td>
<td>4-8</td>
</tr>
<tr>
<td>Form PER – 1: Proposed Personnel</td>
<td>4-8</td>
</tr>
<tr>
<td>Form PER – 2: Resume of Proposed Personnel</td>
<td>4-9</td>
</tr>
<tr>
<td>Equipment</td>
<td>4-10</td>
</tr>
<tr>
<td>Site Organization</td>
<td>4-11</td>
</tr>
<tr>
<td>Method Statement</td>
<td>4-11</td>
</tr>
<tr>
<td>Mobilization Schedule</td>
<td>4-11</td>
</tr>
<tr>
<td>Construction Schedule</td>
<td>4-11</td>
</tr>
<tr>
<td>Bidder’s Qualification</td>
<td>4-12</td>
</tr>
<tr>
<td>Form ELI - 1: Bidder’s Information Sheet</td>
<td>4-13</td>
</tr>
<tr>
<td>Form ELI - 2: Joint Venture Information Sheet</td>
<td>4-14</td>
</tr>
<tr>
<td>Form LIT - 1: Pending Litigation and Arbitration</td>
<td>4-15</td>
</tr>
<tr>
<td>Form FIN - 1: Historical Financial Performance</td>
<td>4-16</td>
</tr>
<tr>
<td>Form FIN - 2: Average Annual Construction Turnover</td>
<td>4-17</td>
</tr>
<tr>
<td>Form FIN - 3: Availability of Financial Resources</td>
<td>4-18</td>
</tr>
<tr>
<td>Form FIN - 4: Financial Requirement for Current Contract Commitments</td>
<td>4-19</td>
</tr>
<tr>
<td>Form FIN - 5: Compliance Check of Financial Resources</td>
<td>4-20</td>
</tr>
<tr>
<td>Form EXP - 1: Contracts of Similar Size and Nature</td>
<td>4-21</td>
</tr>
<tr>
<td>Form EXP - 2: Construction Experience in Key Activities</td>
<td>4-22</td>
</tr>
<tr>
<td>Schedules</td>
<td>4-23</td>
</tr>
<tr>
<td>Schedule of Payment Currencies</td>
<td>4-23</td>
</tr>
<tr>
<td>Tables of Adjustment Data</td>
<td>4-24</td>
</tr>
<tr>
<td>Activity Schedule</td>
<td>4-25</td>
</tr>
<tr>
<td>Bill of Quantities</td>
<td>4-26</td>
</tr>
</tbody>
</table>
Letter of Technical Bid

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

Date: ..................................................
NCB No.: ..................................................
Invitation for Bid No.: ..................................................

To:............................................................................................................................................................

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: __________

(c) Our Bid consisting of the Technical Bid and the Price Bid shall be valid for a period of _______ 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 ITB4.5].

(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

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

Date: ..................................................
NCB No.: ..................................................
Invitation for Bid No.: ..................................................

To: ............................................................................................................................................................

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: __________

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

\[
\text{[amount of foreign currency in words], [amount in figures], and [amount of local currency in words], [amount in figures]}
\]

The total bid price from the Summary of Bill of Quantities for admeasurement contracts or Activity Schedule for lump sum contracts 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 as follows:

\[
\text{[discounts offered and methodology]}
\]

(e) Our Bid shall be valid for a period of _____ 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:

<table>
<thead>
<tr>
<th>Name of Recipient</th>
<th>Address</th>
<th>Reason</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

(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

Beneficiary: ........................................, Name and address of 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 figures . . . . . . . . . ( . . . . . . amount in words . . . . . . ) 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 Letter of Technical Bid and Letter of 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 the 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; and (b) if the Bidder is not the successful Bidder, upon the earlier of (i) our receipt of a copy 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

........................................ Bank’s seal and authorized signature(s) . . . . . .

--- 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 (NOT APPLICABLE)

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 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 the number of months or years 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 Letter of Technical Bid and Letter of Price Bid; or

(b) do not accept the correction of errors in accordance with the Instruction to Bidders (hereinafter “the ITB”); or

(c) having been notified of the acceptance of our Bid by the Employer during the period of bid validity, (i) fail or refuse to execute the Contract, if required, (ii) fail or refuse to furnish the Performance Security, in accordance with the ITB, or (iii) fail or refuse to furnish the 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 bidder]

Dated on __________ day of __________________, _______

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

### 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:

<table>
<thead>
<tr>
<th></th>
<th>Title of position*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Name</td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Name</td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Name</td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Name</td>
</tr>
</tbody>
</table>

**etc.**

<table>
<thead>
<tr>
<th></th>
<th>Title of position*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Name</td>
</tr>
</tbody>
</table>

--- **Note** ---

*As listed in Section 6 (Employer's Requirements).*
Form PER – 2: Resume of Proposed Personnel

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

<table>
<thead>
<tr>
<th>Position</th>
<th>Personnel information</th>
<th>Name</th>
<th>Date of birth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Professional qualifications</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Present employment</th>
<th>Name of employer</th>
<th>Address of employer</th>
<th>Telephone</th>
<th>Contact (manager / personnel officer)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Contact (manager / personnel officer)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fax</th>
<th>E-mail</th>
<th>Job title</th>
<th>Years with present employer</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>From</th>
<th>To</th>
<th>Company / Project / Position / Relevant Technical and Management Experience</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
**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.

<table>
<thead>
<tr>
<th>Item of Equipment</th>
<th>Information</th>
<th>Details of current commitments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Equipment</strong></td>
<td>Name of manufacturer</td>
<td>Model and power rating</td>
</tr>
<tr>
<td>Information</td>
<td>Capacity</td>
<td>Year of manufacture</td>
</tr>
<tr>
<td><strong>Current Status</strong></td>
<td>Current location</td>
<td></td>
</tr>
<tr>
<td><strong>Source</strong></td>
<td>Indicate source of the equipment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Owned</td>
<td>Rented</td>
</tr>
</tbody>
</table>

Omit the following information for equipment owned by the Bidder.

<table>
<thead>
<tr>
<th>Owner</th>
<th>Name of owner</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address of owner</td>
<td></td>
</tr>
<tr>
<td>Telephone</td>
<td>Contact name and title</td>
</tr>
<tr>
<td>Fax</td>
<td>Telex</td>
</tr>
</tbody>
</table>

| Agreements | Details of rental / lease / manufacture agreements specific to the project |
Site Organization

Method Statement

Mobilization Schedule

Construction Schedule
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

<table>
<thead>
<tr>
<th>Bidder’s Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bidder’s legal name</td>
</tr>
<tr>
<td>In case of Joint Venture, legal name of each partner</td>
</tr>
<tr>
<td>Bidder’s country of constitution</td>
</tr>
<tr>
<td>Bidder’s year of constitution</td>
</tr>
<tr>
<td>Bidder’s legal address in country of constitution</td>
</tr>
<tr>
<td>Bidder’s authorized representative (name, address, telephone numbers, fax numbers, e-mail address)</td>
</tr>
</tbody>
</table>

Attached are copies of the following documents.

1. In case of single entity, articles of incorporation or constitution of the legal entity named above, in accordance with ITB 4.1 and ITB 4.2.
2. Authorization to represent the firm or Joint Venture named above, in accordance with ITB 20.2.
3. In case of Joint Venture, letter of intent to form Joint Venture or Joint Venture agreement, in accordance with ITB 4.1.
4. In case of a government-owned enterprise, any additional documents not covered under 1 above required to comply with ITB 4.5.
**Form ELI - 2: Joint Venture Information Sheet**

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

<table>
<thead>
<tr>
<th><strong>Joint Venture / Specialist Subcontractor Information</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bidder’s legal name</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Joint Venture Partner's or Specialist Subcontractor’s</strong></td>
</tr>
<tr>
<td><strong>legal name</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Joint Venture Partner’s or Specialist Subcontractor’s</strong></td>
</tr>
<tr>
<td><strong>country of constitution</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Joint Venture Partner’s or Specialist Subcontractor’s</strong></td>
</tr>
<tr>
<td><strong>year of constitution</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Joint Venture Partner’s or Specialist Subcontractor’s</strong></td>
</tr>
<tr>
<td><strong>legal address in country of constitution</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Joint Venture Partner’s or Specialist Subcontractor’s</strong></td>
</tr>
<tr>
<td><strong>authorized representative information</strong></td>
</tr>
<tr>
<td>(name, address, telephone numbers, fax numbers, e-mail</td>
</tr>
<tr>
<td>address)</td>
</tr>
</tbody>
</table>

Attached are copies of the following documents.

- 1. Articles of incorporation or constitution of the legal entity named above, in accordance with ITB 4.1 and ITB 4.2.
- 2. Authorization to represent the firm named above, in accordance with ITB 20.2.
- 3. In the case of government-owned enterprise, documents establishing legal and financial autonomy and compliance with commercial law, in accordance with ITB 4.5.

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 joint ventures, each Joint Venture Partner must fill out this form separately, and provide the Joint Venture Partner name below:

Joint Venture Partner: __________________

<table>
<thead>
<tr>
<th>Year</th>
<th>Matter in Dispute</th>
<th>Value of Pending Claim in INR</th>
<th>Value of Pending Claim as a Percentage of Net Worth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

- Note -

This form shall only be included if Criterion 2.2 of Section 3 (Evaluation and Qualification Criteria) is applicable.
Form FIN - 1: Historical Financial Performance
Each Bidder must fill out this form.

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

Joint Venture Partner: ___________________

<table>
<thead>
<tr>
<th>Financial Data for Previous five (5) Years [INR]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1:</td>
</tr>
</tbody>
</table>

Information from Balance Sheet

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Assets (TA)</td>
<td></td>
</tr>
<tr>
<td>Total Liabilities (TL)</td>
<td></td>
</tr>
<tr>
<td>NetWorth = TA – TL</td>
<td></td>
</tr>
<tr>
<td>Current Assets (CA)</td>
<td></td>
</tr>
<tr>
<td>Current Liabilities (CL)</td>
<td></td>
</tr>
<tr>
<td>Working Capital = CA - CL</td>
<td></td>
</tr>
</tbody>
</table>

Most Recent Working Capital

<table>
<thead>
<tr>
<th>Information from Income Statement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Revenues</td>
</tr>
<tr>
<td>Profits Before Taxes</td>
</tr>
<tr>
<td>Profits After Taxes</td>
</tr>
</tbody>
</table>

Attached are copies of financial statements (balance sheets including all related notes, and income statements) for the last five (5) 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 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 specified exchange rate.

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

Joint Venture Partner: ___________________

<table>
<thead>
<tr>
<th>Year</th>
<th>Amount Currency (INR)</th>
<th>Exchange Rate</th>
<th>INR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Average Annual Construction Turnover
Form FIN – 3: Availability of Financial Resources

Bidder 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 joint ventures, each Joint Venture Partner must fill out this form separately and provide the Joint Venture Partner name below:

Joint Venture Partner: ________________

<table>
<thead>
<tr>
<th>Financial Resources</th>
<th>Source of financing</th>
<th>Amount (INR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Working Capital (to be taken from FIN-1)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Credit Line[^]</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Other Financial Resources</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Available Financial Resources</td>
<td></td>
</tr>
</tbody>
</table>

[^] To be substantiated by a letter from the bank issuing the line of credit.
Form FIN- 4: Financial Resources Requirement

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 joint ventures, each Joint Venture Partner must fill out this form separately and provide the Joint Venture Partner name below:

Joint Venture Partner: ___________________

<table>
<thead>
<tr>
<th>No.</th>
<th>Name of Contract</th>
<th>Employer's Contact (Address, Tel, Fax)</th>
<th>Contract Completion Date</th>
<th>Outstanding Contract Value (X)</th>
<th>Remaining Contract Period in months (Y)</th>
<th>Monthly Financial Resources Requirement (X / Y)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total Monthly Financial Requirements for Current Contract Commitments: INR …………………………….
Form FIN - 5: Compliance Check of Financial Resources (Criterion 2.3.3 of Section 3)

Form FIN-5A: For Single Entities

<table>
<thead>
<tr>
<th>For Single Entities:</th>
<th>Total Available Financial Resources from FIN-3 (C)</th>
<th>Total Monthly Financial Requirement for Current Contract Commitments (CCC) from FIN-4 (D)</th>
<th>Available Financial Resources net of CCC (C-D)</th>
<th>≥</th>
<th>Requirement&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Name of Bidder)</td>
<td></td>
<td></td>
<td></td>
<td>≥</td>
<td>100% of Requirement from Section 3 - 2.3.3(b)</td>
</tr>
</tbody>
</table>

Form FIN-5B: For Joint Ventures

<table>
<thead>
<tr>
<th>For Joint Ventures:</th>
<th>Total Available Financial Resources from FIN-3 (C)</th>
<th>Total Monthly Financial Requirement for Current Contract Commitments (CCC) from FIN-4 (D)</th>
<th>Available Financial Resources net of CCC (C-D)</th>
<th>≥</th>
<th>Requirement&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>One Partner:</td>
<td></td>
<td></td>
<td></td>
<td>≥</td>
<td>40(%) of Requirement</td>
</tr>
<tr>
<td>(Name of Partner)</td>
<td></td>
<td></td>
<td></td>
<td>≥</td>
<td>25(%) of Requirement</td>
</tr>
<tr>
<td>Each (Other) Partner:</td>
<td></td>
<td></td>
<td></td>
<td>≥</td>
<td>25(%) of Requirement</td>
</tr>
<tr>
<td>(Name of Partner 1)</td>
<td></td>
<td></td>
<td></td>
<td>≥</td>
<td>25(%) of Requirement</td>
</tr>
<tr>
<td>(Name of Partner 2)</td>
<td></td>
<td></td>
<td></td>
<td>≥</td>
<td>25(%) of Requirement</td>
</tr>
<tr>
<td>(Name of Partner 3)</td>
<td></td>
<td></td>
<td></td>
<td>≥</td>
<td>25(%) of Requirement</td>
</tr>
<tr>
<td>All partners combined</td>
<td></td>
<td></td>
<td></td>
<td>≥</td>
<td>100% of Requirement from Section 3 - 2.3.3(b)</td>
</tr>
</tbody>
</table>

Form FIN - 5 is made available for use by the bidder as a self-assessment tool, and by the employer as evaluation work sheet, to determine compliance with financial resources.

<sup>a</sup> Requirement for the subject contract is defined in Criterion 2.3.3(b) of Section 3. Value A is the required percentage of the subject contract, which each partner must meet; and value B is the required percentage of the subject contract, which one partner must meet. A and B values are defined in Criterion 2.3.3 of Section 3 (Evaluation and Qualification Criteria).

<sup>b</sup> \( \sum (C - D) = \text{sum of available financial resources net of current contract commitments (CCC) for all partners.} \)
Form EXP – 1: Contracts of Similar Size and Nature

Fill up one (1) form per contract.

<table>
<thead>
<tr>
<th>Contract No. . . . of . . . .</th>
<th>Contract Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Award Date</td>
<td>Completion Date</td>
</tr>
<tr>
<td>Total Contract Amount</td>
<td>INR</td>
</tr>
<tr>
<td>If partner in a Joint Venture or subcontractor, specify participation of total contract amount</td>
<td>Percent of Total</td>
</tr>
<tr>
<td>Employer’s Name</td>
<td></td>
</tr>
<tr>
<td>Address</td>
<td></td>
</tr>
<tr>
<td>Telephone/Fax Number</td>
<td></td>
</tr>
<tr>
<td>E-mail</td>
<td></td>
</tr>
</tbody>
</table>

Description of the similarity in accordance with Criterion 2.4.1 of Section 3

Participation in at least one contract that has been successfully or substantially completed within the last five (5) years and that is similar to the proposed works, where the value of the Bidder’s participation exceeds INR 12.66 Million. The similarity of the Bidder’s participation shall be based on the physical size, nature of works, complexity, methods, technology or other characteristics as described in Section 6 (Employer’s Requirements).
Form EXP - 2: Construction Experience in Key Activities

Fill up one (1) form per contract.

<table>
<thead>
<tr>
<th>Contract No. . . . . of . . . .</th>
<th>Contract Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Award Date</td>
<td>Completion Date</td>
</tr>
<tr>
<td>Total Contract Amount</td>
<td>INR</td>
</tr>
<tr>
<td>If partner in a Joint Venture or subcontractor, specify participation of total contract amount</td>
<td>Percent of Total</td>
</tr>
<tr>
<td>Employer’s Name</td>
<td></td>
</tr>
<tr>
<td>Address</td>
<td></td>
</tr>
<tr>
<td>Telephone Number</td>
<td></td>
</tr>
<tr>
<td>Fax Number</td>
<td></td>
</tr>
<tr>
<td>E-mail</td>
<td></td>
</tr>
</tbody>
</table>

**Description of the key activities in accordance with Criterion 2.4.2 of Section 3**

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:

1. Concrete of all grades in cum per year – **1415.04 cum per year**

2. Earthwork in cum per year – **47359.25 cum per year**
Schedules (NOT APPLICABLE)

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.

<table>
<thead>
<tr>
<th>Name of Payment Currency</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local Currency</td>
<td></td>
<td></td>
<td></td>
<td>100.00</td>
</tr>
<tr>
<td>Foreign Currency #1</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Foreign Currency #2</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
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<tr>
<td>Foreign Currency #3</td>
<td></td>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Net Bid Price</td>
<td></td>
<td></td>
<td>100.00</td>
<td></td>
</tr>
<tr>
<td>Provisional Sums</td>
<td></td>
<td></td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Expressed in Local</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Currency</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

**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.
Table(s) of Adjustment Data  (NOT APPLICABLE)

### Table A - Local Currency

<table>
<thead>
<tr>
<th>Index Code</th>
<th>Index Description</th>
<th>Source of Index</th>
<th>Base Value and Date</th>
<th>Bidder’s Local Currency Amount</th>
<th>Bidder’s Proposed Weighting (coefficient)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nonadjustable</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>a: (by Employer)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>b:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>c:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>d:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>e:</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
</tr>
</tbody>
</table>

### Table B - Foreign Currency

**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.*

<table>
<thead>
<tr>
<th>Index Code</th>
<th>Index Description</th>
<th>Source of Index</th>
<th>Base Value and Date</th>
<th>Bidder’s Currency in Type/Amount</th>
<th>Equivalent in FC1</th>
<th>Bidder’s Proposed Weighting (coefficient)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nonadjustable</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>a: (by Employer)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>b:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>c:</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>d:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>e:</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
<td></td>
</tr>
</tbody>
</table>

--- **Note** ---

"Base Date" means the date 28 days prior to the deadline for submission of bids.

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

[Schedules of Prices – Lump Sum Contract]

The Employer shall indicate the list of major activities comprising the works and the number of measurement units consistent with the description of works, drawings, and specifications in Section 6 (Employer’s Requirements). Each work item shall be described in sufficient detail to provide clear guidance to Bidders with respect to the type of works, their scope and complexity, and compliance with the required standards.

Bidders are required to enter the prices against each work item on a lump sum basis. Work items against which no lump sum price is entered by the Bidder will not be paid by the Employer when executed and shall be deemed covered by other work items against which the lump sum prices were entered. The sum of prices entered against each work item will represent the total bid price.

The whole cost of complying with the provisions of the Contract shall be included in the Items provided in the Activity Schedule, and where no Items are provided, the cost shall be deemed to be distributed among the Amounts for the related Items of Work.

NOT APPLICABLE
# Bill of Quantities

**REM of Sub-Minor Canals of HLC Range-I Canal System including improvement/Modernisation of structures**  
*(Bhuban S/M, Bhabilo S/M, Munda Mala S/M)*

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description of Items</th>
<th>To be Executed as per Technical specification section of Bid document</th>
<th>Quantity</th>
<th>Unit</th>
<th>Rate per unit</th>
<th>Amount in INR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Clearing grass and removal of rubbish from working area up to required distance of periphery of the working area as per the direction of the Project Manager</td>
<td>Section 1, 2 &amp; 3</td>
<td>85055.380</td>
<td>Per Sqm</td>
<td>85055.380</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Dismantling brick or stone masonry in lime or cement mortar of all heights including stacking the useful materials for reuse and removing the debris from work site complete including labour charges, cess &amp; T&amp;P etc. as per the direction of the Project Manager.</td>
<td>Section 1, 2, 4 &amp; 10</td>
<td>27.600</td>
<td>Per Cum</td>
<td>27.600</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Dismantling and removing cement concrete including stacking the useful materials for reuse and removing the debris away from work site complete including labour charges, cess &amp; T&amp;P etc. as per direction of the Project Manager.</td>
<td>Section 1, 2, 4 &amp; 10</td>
<td>5.400</td>
<td>Per Cum</td>
<td>5.400</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Removing old lime or cement plaster from walls including racking out joints 12mm deep and removing the debris away from work site complete including labour charges, cess &amp; T&amp;P etc. as per direction of the Project Manager.</td>
<td>Section 1, 2 &amp; 3</td>
<td>38.740</td>
<td>Per Sqm</td>
<td>38.740</td>
<td></td>
</tr>
<tr>
<td>Sl. No.</td>
<td>Description of Items</td>
<td>To be Executed as per Technical specification section of Bid document</td>
<td>Quantity</td>
<td>Unit</td>
<td>Rate per unit</td>
<td>Amount in INR</td>
</tr>
<tr>
<td>--------</td>
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<td>----------------</td>
</tr>
<tr>
<td>Sl. No.</td>
<td>Description of Items</td>
<td>To be Executed as per Technical specification section of Bid document</td>
<td>Quantity</td>
<td>Unit</td>
<td>Rate per unit</td>
<td>Amount in INR</td>
</tr>
<tr>
<td>--------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------</td>
<td>----------</td>
<td>------</td>
<td>--------------</td>
<td>---------------</td>
</tr>
<tr>
<td></td>
<td>Providing and laying Cement Concrete confirming to M15 grade for PCC works using 40mm and down graded size black hard granite(crusher broken) stone aggregates as per approved drawing and specification including hoisting and laying with cost, carriage, royalty and taxes of all material etc complete as per direction of the Project Manager.</td>
<td>Section 1,2, 4 &amp; 10</td>
<td>593.706</td>
<td>Per Cum</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Providing and laying Cement Concrete confirming to M15 grade for PCC works using 20 mm and down graded size black hard granite(crusher broken) chips as per approved drawing and specification including hoisting and laying with cost, carriage, royalty and taxes of all material etc. complete as per direction of the Project Manager.</td>
<td>Section 1,2, 4 &amp; 10</td>
<td>813.531</td>
<td>Per Cum</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Providing and laying Cement Concrete confirming to M20 grade for RCC works using 20 mm and down graded size black hard granite(crusher broken) chips as per approved drawing and specification including hoisting and laying with cost, carriage, royalty and taxes of all material etc. complete as per direction of the Project Manager.</td>
<td>Section 1,2, 4 &amp; 10</td>
<td>7.803</td>
<td>Per Cum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sl. No.</td>
<td>Description of Items</td>
<td>Quantity</td>
<td>Unit</td>
<td>Rate per unit</td>
<td>Amount in INR</td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>----------</td>
<td>---------</td>
<td>------------------------------------------------------------------------------</td>
<td>----------------</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Supplying, providing and straightening the coiled or bent up un-coated HYSD bars / reinforcement for RCC work including cutting, bending, binding and tying the grills and placing in position including cost of binding wire 18 to 20 gauge as per approved design, drawing and specifications with all cost, conveyance, labour, cess &amp; taxes etc. complete the work as per the direction of the Project Manager.</td>
<td>Section 1, 2, 4 &amp; 10</td>
<td>191.334</td>
<td>Per Qtl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Providing rigid and smooth centering and shuttering for R.C.C. works including false work and dismantling the same after the required period of casting including cost of all materials, labour and T &amp;P with all costs to complete the work as per drawing and specification etc. as per the direction of the Project Manager.</td>
<td>Section 1, 2, 4 &amp; 10</td>
<td>23.100</td>
<td>Per Sqm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Providing form work for concrete with F2 finish with steel shutter rigidly fixed and removal of forms and making good to the surfaces where necessary complete with all labour, materials and T &amp;P with all costs to complete the work as per drawing and specification and direction of the Project Manager..</td>
<td>Section 1, 2, 4 &amp; 10</td>
<td>3126.945</td>
<td>Per Sqm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sl. No.</td>
<td>Description of Items</td>
<td>Quantity</td>
<td>Unit</td>
<td>Rate per unit</td>
<td>Amount in INR</td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>----------</td>
<td>------</td>
<td>---------------</td>
<td>---------------</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Supplying, laying &amp; fixing in position R.C.C. Spun pipes of NP3 class conforming to ISI standard with collars jointed filled in cement mortar (1:3) with all costs conveyance, labour, cess &amp; taxes etc. to complete the item of work as per drawing, specification and direction of the Project Manager.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a</td>
<td>150mm dia</td>
<td></td>
<td></td>
<td>317.000</td>
<td>Per Rmt</td>
<td></td>
</tr>
<tr>
<td>b</td>
<td>600mm dia</td>
<td></td>
<td></td>
<td>37.500</td>
<td>Per Rmt</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Laterite stone masonry in cement mortar (1 : 4) in foundation and plinth including cost, carriage, royalty, taxes of all materials, labour, T&amp;P etc. complete but excluding cost and carriage of laterite stone etc complete as per the specification and direction of the Project Manager.</td>
<td></td>
<td></td>
<td>16.560</td>
<td>Per Cum</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Providing 20 mm thick cement plaster using cement mortar (1:4) over stone masonry works at all heights including cost of all materials, carriage, royalty etc complete as per the specification and direction of the Project Manager.</td>
<td></td>
<td></td>
<td>33.340</td>
<td>Per Sqm</td>
<td></td>
</tr>
<tr>
<td>Sl. No.</td>
<td>Description of Items</td>
<td>To be Executed as per Technical specification section of Bid document</td>
<td>Quantity</td>
<td>Unit</td>
<td>Rate per unit</td>
<td>Amount in INR</td>
</tr>
<tr>
<td>--------</td>
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<td>------</td>
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</tr>
<tr>
<td>1</td>
<td></td>
<td>Section 1,2, 4 &amp; 10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Fine dressing of earth work and turfing the surface with compact dub grass including cost, conveyance, labour, cess and T&amp;P etc. with cost to complete the work as per design, drawing, specification and direction of the Project Manager.</td>
<td>21600.000 Per Sqm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total 18 (Eighteen) Items only</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Say:

Total :

Say:
# Section 5 - Eligible Countries

This section contains the list of eligible countries.

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>AFG</td>
<td>Afghanistan</td>
<td>35</td>
</tr>
<tr>
<td>2.</td>
<td>ARM</td>
<td>Armenia</td>
<td>36</td>
</tr>
<tr>
<td>3.</td>
<td>AUS</td>
<td>Australia</td>
<td>37</td>
</tr>
<tr>
<td>4.</td>
<td>AUT</td>
<td>Austria</td>
<td>38</td>
</tr>
<tr>
<td>5.</td>
<td>AZE</td>
<td>Azerbaijan</td>
<td>39</td>
</tr>
<tr>
<td>6.</td>
<td>BAN</td>
<td>Bangladesh</td>
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<tr>
<td>7.</td>
<td>BEL</td>
<td>Belgium</td>
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<td>8.</td>
<td>BHU</td>
<td>Bhutan</td>
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<tr>
<td>9.</td>
<td>BRU</td>
<td>Brunei Darussalam</td>
<td>43</td>
</tr>
<tr>
<td>10.</td>
<td>CAM</td>
<td>Cambodia</td>
<td>44</td>
</tr>
<tr>
<td>11.</td>
<td>CAN</td>
<td>Canada</td>
<td>45</td>
</tr>
<tr>
<td>12.</td>
<td>PRC</td>
<td>China, People’s Republic of</td>
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</tr>
<tr>
<td>13.</td>
<td>COO</td>
<td>Cook Islands</td>
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<tr>
<td>14.</td>
<td>DEN</td>
<td>Denmark</td>
<td>48</td>
</tr>
<tr>
<td>15.</td>
<td>FIJ</td>
<td>Fiji</td>
<td>49</td>
</tr>
<tr>
<td>16.</td>
<td>FIN</td>
<td>Finland</td>
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<td>17.</td>
<td>FRA</td>
<td>France</td>
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</tr>
<tr>
<td>18.</td>
<td>GEO</td>
<td>Georgia</td>
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<td>Germany</td>
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<tr>
<td>20.</td>
<td>HKG</td>
<td>Hong Kong, China</td>
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</tr>
<tr>
<td>21.</td>
<td>IND</td>
<td>India</td>
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<tr>
<td>22.</td>
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<tr>
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<td>IRE</td>
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<td>JPN</td>
<td>Japan</td>
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<td>26.</td>
<td>KAZ</td>
<td>Kazakhstan</td>
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<td>27.</td>
<td>KIR</td>
<td>Kiribati</td>
<td>61</td>
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<td>28.</td>
<td>KOR</td>
<td>Korea, Republic of</td>
<td>62</td>
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<td>29.</td>
<td>KGZ</td>
<td>Kyrgyz Republic</td>
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<td>30.</td>
<td>LAO</td>
<td>Lao PDR.</td>
<td>64</td>
</tr>
<tr>
<td>31.</td>
<td>LUX</td>
<td>Luxembourg</td>
<td>65</td>
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<tr>
<td>32.</td>
<td>MAL</td>
<td>Malaysia</td>
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</tr>
<tr>
<td>33.</td>
<td>MLD</td>
<td>Maldives</td>
<td>67</td>
</tr>
<tr>
<td>34.</td>
<td>RMI</td>
<td>Marshall Islands</td>
<td></td>
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</tbody>
</table>
Section 6 – Employer’s Requirements

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GOVERNMENT OF ODISHA
DEPARTMENT OF WATER RESOURCES

MODIFIED
TECHNICAL SPECIFICATION

FOR

CONSTRUCTION OF CIVIL WORKS
FOR
ADB ASSISTED SCHEMES
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>SECTION</th>
<th>PARTICULARS</th>
<th>PAGE NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section – 1</td>
<td>GENERAL REQUIREMENT AND SPECIFICATION</td>
<td>6-6</td>
</tr>
<tr>
<td>Section - 2</td>
<td>SITE OF WORK</td>
<td>6-30</td>
</tr>
<tr>
<td>Section – 2.1</td>
<td>Setting out of work</td>
<td></td>
</tr>
<tr>
<td>Section – 2.2</td>
<td>Clearing and grubbing</td>
<td></td>
</tr>
<tr>
<td>Section – 2.3</td>
<td>Use of water</td>
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</tr>
<tr>
<td>Section – 2.4</td>
<td>Site Drainage</td>
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<td>Monsoon Damage</td>
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<td>Khariff Irrigation</td>
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<td>Removal of Silt and Water</td>
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<td>Procedure for Measurement</td>
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<tr>
<td>Section – 3</td>
<td>EARTH WORK</td>
<td>6-35</td>
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<td>Section – 3.1</td>
<td>General</td>
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<tr>
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<td>Excavation for canal &amp; for Structure</td>
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</tr>
<tr>
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<td>Disposal of materials</td>
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</tr>
<tr>
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<td>Embankment</td>
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</tr>
<tr>
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<td>Compacting earth materials</td>
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</tr>
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<td>Section – 3.6</td>
<td>Slope protection</td>
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SECTION – (1)
GENERAL REQUIREMENT

1.1 PREAMBLE:

The Technical Specification shall form a part of the contract and shall be read in conjunction with other bidding documents. If required, the Project Manager may issue special specifications modifying, amending, or supplementing the requirements spelt out in this Technical Specification. In such a case, the provision in the Special Specification shall prevail over those in the Technical Specification.

1.2 ACRONYMS

<table>
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<th>Abbreviation</th>
<th>Full Form</th>
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<tr>
<td>BM, B.M.</td>
<td>Bench Mark</td>
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<tr>
<td>BOQ, B.O.Q.</td>
<td>Bill of Quantities</td>
</tr>
<tr>
<td>CE, C.E.</td>
<td>Chief Engineer</td>
</tr>
<tr>
<td>M, m, Met, met.</td>
<td>Meter</td>
</tr>
<tr>
<td>mm</td>
<td>Millimetre</td>
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<tr>
<td>MT</td>
<td>Metric Tonne</td>
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<tr>
<td>M³</td>
<td>Cubic meter</td>
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<tr>
<td>MDD</td>
<td>Maximum Dry Density</td>
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<tr>
<td>N</td>
<td>Newton</td>
</tr>
<tr>
<td>No, no</td>
<td>Number</td>
</tr>
<tr>
<td>OMC</td>
<td>Optimum Moisture Content</td>
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<tr>
<td>RM, Rm, rm</td>
<td>Running Meter</td>
</tr>
<tr>
<td>Kg, KG</td>
<td>Kilogram</td>
</tr>
<tr>
<td>Sq. M, Sqm, Sq Met</td>
<td>Square Meter</td>
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</table>

1.3 STANDARDS AND SPECIFICATIONS:

The term, Indian Standard specifications herein after referred to as BIS as used herein means the relevant Bureau of Indian Standard codes with all amendments published up to the date of submission of tenders. A Statement of BIS as applicable to the context of present work is listed below. The list is not exhaustive.

### LIST OF INDIAN STANDARDS

<table>
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<th>Sl. No.</th>
<th>Short title</th>
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<td>CEMENT</td>
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<td>(2)</td>
<td>Specification for Portland Pozzolana Cement</td>
<td>1489 – 1991</td>
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<td>Portland slag cement (Third Revision)</td>
<td>455 – 1989</td>
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<td>(4)</td>
<td>Method for Physical tests for hydraulic cement (Reaffirmed 1980)</td>
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<td>(5)</td>
<td>Method of chemical analysis of hydraulic cement (First revision)</td>
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<td>(6)</td>
<td>Rapid hardening Portland cement</td>
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<td>High strength ordinary Portland cement</td>
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<td>(1)</td>
<td>Specification for coarse and fine AGGREGATE from natural source for concrete</td>
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<td>(2)</td>
<td>Specification for Sand for Masonry Mortars</td>
<td>2116 – 1980</td>
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<td>Method of Tests for aggregates for Concrete</td>
<td>2386 - 1969 (Part – I to Part – VIV)</td>
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<td>(4)</td>
<td>Standard sand for testing of cement (First revision) with amendment 1 &amp; 2 Reaffirmed 1980</td>
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<td>Method of test for determining aggregates impact value of soft coarse aggregates</td>
<td>5640 – 1970</td>
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### BUILDING STONES

1. Method of Test for Determination of strength properties of natural building stones (Part – I to Part – IV)
   - Part- I Compressive Strength
   - Part – II Transverse Strength
   - Part – III Tensile Strength
   - Part – IV Shear Strength

### STEEL

2. Specification for cold worked steel deformed bars for concrete reinforcement 1786 – 1985
5. Specification of Mild Steel and Medium Tensile Bars for concrete reinforcement 432 - 1966 (Part – I)
7. Code for practice for Fire precautions in welding and Cutting operations 3016 – 1966
9. Code of procedure for manual or metal ARC welding of Mild Steel 823 – 1964

### MASONRY


### CONCRETE

1. Method of Measurement of building and Civil Engineering works Part – II cement concrete works (Part – II)
7. General requirements for Concrete
<table>
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<th>(8) Vibrators – immersion type</th>
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<td>General requirement for concrete vibrator</td>
<td>2506 – 1985</td>
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<td>screed board type (first revision)</td>
<td>2506 – 1985</td>
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<td>(9) Code of practice for use of immersion vibrator for consolidating concrete (first revision)</td>
<td>3558 – 1983</td>
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<td>(10) Method for testing performance of batch type concrete mixer</td>
<td>4634 – 1990</td>
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<td>Form vibrators for concrete</td>
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<td>Concrete slump test apparatus</td>
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<td>Method of making curing and determining compressive Strength of accelerated cured concrete test specimen</td>
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<td>(18) Guidelines for concrete mix design</td>
<td>10262 – 1982</td>
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(VII) **EARTH WORK**

| Safety code for piling and other deep foundations | 5121 – 1994 |
| Code of practice Design Installation, observation and maintenance of uplift pressure pipes for Hydraulic structures on permeable foundation | 6532 – 1992 |
| Safety code for excavation works | 3764 – 1992 |
| Code of practice for Protection of slope for reservoir embankments | 8237 – 1990 |
| Code of Practice for earth work on Canals | 4701 – 1982 |
| Guidelines for lining of Canals in expansive soils | 9451 – 1991 |
| Method of test for soils Determination of dry density of soils in place by the sand replacement method (Part – XXVIII) | 2720 – 1974 |
| Method of test for soils Determination of dry Density of soils in place by the core cutter method (Part – XXIX) | 2720 - 1975 |
| Classification & identification of soils for general Engineering purpose (first revision) | 1498 – 1970 |
| Safety code for working with construction machinery | 7293 – 1996 |
| Filtration media – sand & gravel | 8419 – 1990 |
| (Part – I) | |
| Under drainage arrangements of lined canals | 4558 – 1995 |
| Precast cement concrete slabs for canal lining | 3868 – 1995 |
| Methods of tests of soils | 2720 - 1997 |
| (Part – I to X) | |
| Method of load test on soils (Second revision) | 1888 – 1999 |
| Method for standard penetration tests for soils (First revision) | 2131 – 1997 |
| Method of sampling and preparation | 4332-1995 |
of stabilized soils for testing

(VIII) OTHER SUBJECTS

1. Safety code for scaffolds and Ladders Part – I Scaffolds 3696 - 1966 (Part - I)
2. Safety code for scaffolds and ladders Part – II Ladders 3696 - 1966 (Part – II)
3. Recommendations on stacking and storage of Construction materials at site 4082 - 1977
4. Plywood for general purposes (Second revision) Amendment 1 to 3 303 – 1975 (Part – 1 to 3)
5. Test sieves 460 – 1985
7. Code for practice for in-situ permeability test 5529 (Part – 1 to 2)

In addition to the relevant BIS code, the specifications prescribed and guidelines issued by Central Water Commission Standard Specifications, IRC, MoRTH shall also be followed.

The BIS Codes which have been referred above, if updated, the updated code of practice shall be followed.

Any materials for which no standard is referred to or has not been fully specified in the Specifications then it shall be of 1st class quality and the contractor is to carry out the necessary tests based on International Testing Standard as per direction of Project Manager.

1.4 GENERAL CHARACTERISTICS OF THE PROJECT SITE

The sub-minor canals of HLC Range-I canal system includes Bhuban S/M, Bhabilo S/M, Munda Mala S/M.

1.5 BRIEF DESCRIPTION OF THE WORKS:

1. Raising & strengthening of canal banks of as per approved LS & DS.
2. Renovation of outlets. VRB, CD, fall, lining, field channel and tail cluster has been proposed.
3. Other structures as directed by the Project Manager.

1.6 CONTRACTOR’S TEMPORARY FACILITIES

1.6.1 Contractor’s Offices, Stores, etc.

The Contractor shall be responsible for the land he deems necessary for his offices, stores, and warehouse and for the housing and welfare of his employees. The Contractor shall also be responsible for the construction, maintenance, operation and subsequent removal of such temporary facilities. These facilities shall be equipped with adequate electricity and potable water supplies.

The temporary quarters and camp accommodation shall be run and maintained in an efficient manner for the duration of the Contract, and shall be open to the inspection of the Government Medical Officer of Health at all times, and any instruction given by him for the cleaning, disinfecting, and general maintenance thereof shall be carried out by the Contractor.

The above buildings shall from the time of their erection until the completion of the Works will remain the property of the Employer and the Contractor shall not demolish or remove any buildings or part thereof without the written permission of the Project Manager. On the
completion of the Works they shall become the property of the Contractor who shall, if so ordered remove them and the associated services and restore the Site to the approval of the Project Manager.

The Contractor shall submit, for the approval of the Project Manager, within fourteen (14) days from the Commencement Date his detailed plan and/or construction drawings of his offices, stores, and warehouse that he proposes to construct or rent, including his proposals for water and power supply and sewage facilities. All buildings and facilities shall conform to the Employer's standards.

1.7 CONTRACTOR’S TRANSPORT
The Contractor shall make his own arrangements for the transport, where necessary, of his staff and workmen to and from the site of the works at his own expenses. No payment shall be made on this item, and such costs in this item are deemed to be covered in the unit rate.

1.8 TEMPORARY ACCESS ROAD
The Contractor shall construct and maintain the temporary access roads including temporary access bridges necessary for the construction of the Works and transportation of the materials. The access roads to the borrow pits and for constructing the canals and roads shall be constructed by rehabilitating and reinforcing the existing roads, where available. The access roads shall be constructed in such a manner that all of the temporary access roads and bridges ensure the passage of heavy equipment and trucks during the whole construction period. The Contractor shall also pay compensation to the owner(s) if he constructs the temporary access roads on privately owned land. To the possible extent the contractor should avoid agricultural lands and forest lands.

Not less than 14 days before he intends to start construction of any part of the temporary access roads, the Contractor shall submit to the Project Manager his detailed construction programme, and drawings of:
(a) the temporary access roads including temporary access bridges; and
(b) any other temporary works which he considers necessary for the proper execution of the Works.

The Contractor shall not start the construction of any temporary access road until the Project Manager’s approval thereto has been obtained. However, such approval shall not relieve the Contractor of any liability or obligation under the Contract.

The Contractor shall construct the temporary access roads and bridges in accordance with the approved drawings and construction programme and shall maintain and repair such roads so as to ensure the passage of heavy equipment and trucks throughout the construction period of the works, giving special attention to watering the access road(s), unless otherwise specified or directed by the Project Manager. On completion of the works, such as canal, drain, road, bridge, culvert, etc., he shall remove such access road and bridge from the site as directed by the Project Manager.

The public and village roads may also be used as temporary access road. The Contractor shall maintain and repair them to the satisfaction of the authorities concerned.

The Contractor shall facilitate the use of such roads by the public in a friendly cooperative manner.

All costs, including cost of land compensation, therefore incurred by the Contractor in complying with the requirements of this Sub-Clause shall be deemed to be included in the respective item rates in the Bill of Quantities. No separate payment for these items shall be made.
1.9 **BORROW AREA & QUARRIES**

The Project Manager shall have the power to disallow the method of construction and/or the use of any borrow/quarry area if, in his opinion, the stability and safety of the Works or any adjacent structure is endangered, or there is undue interference with the natural or artificial drainage, or the method or use of the area will promote undue erosion.

All areas susceptible to erosion shall be protected as soon as possible either by temporary or permanent drainage works. All necessary measures shall be taken to prevent concentration of surface water and to avoid erosion and scouring of slopes and other areas. Any newly formed channels shall be backfilled.

Borrow/quarries shall be located away from the population centres, drinking water intakes and drainage systems. The cutting of trees shall be minimised. Temporary ditches and/or settling basins shall be dug to prevent erosion. The undesirable ponding of water shall be prevented through temporary drains discharging into natural drainage channels.

No borrow pits shall be dug within 5m of the toe of the embankment, if their depth is less than 0.5m, and 10m, if their depth is more than 0.5 m; or within such a distance from the toe of the bank where a 4:1 hydraulic gradient line cuts the ground surface, whichever is more as per IS :4701-1982 pg.15.

Borrow pits shall not be more than 1m in depth and 25 m in length. A clear distance of 1m shall be left between the pits. The bed of borrow pits shall be left reasonably smooth and even.

Borrow pits shall be drained to avoid stagnation of water and the bottom level of borrow pits should be fixed with reference to the prevailing ground slope towards the nearest natural drainage course.

Borrow pits should be avoided within the forest areas.

Earthwork operations shall be strictly limited to the areas to be occupied by the permanent Works and approved borrow areas and quarries, unless otherwise permitted by the Project Manager. Due provision shall be made for temporary drainage. Erosion and/or instability and/or sediment deposition arising from earthwork operations not in accordance with the Specifications shall be made good immediately.

The Contractor shall obtain the permission of the Project Manager before opening up any borrows or quarries. Such borrow pits and quarries may be prohibited or restricted in dimensions and depth by the Project Manager where:

(i) they might affect the stability or safety of the Works or adjacent property;
(ii) they might interfere with natural or artificial drainage or irrigation;
(iii) they may be environmentally unsuitable.
(iv) the contractor should enter into an equitable agreement with landowner for borrow area redevelopment if any landowner requires and after completion of the borrow area the contractor obtains a “Satisfaction Letter “or “No – objection Letter” from the land owner on a stamp paper

At least 14 days before he intends to commence opening up any approved borrow pit or quarry, the Contractor shall submit to the Project Manager his intended method of working and restoration. These shall include but not be limited to:

(i) the location, design and method of construction of any access track;
(ii) the volume and nature of materials to be removed;
(iii) the sequence and method of excavation of materials;
(iv) measures for controlling runoff and sediment from the site during operations; and
(v) proposals for site restoration including approximate finished levels, drainage, erosion and sediment control, slope stabilisation and re-vegetation, including reinstatement of any access track.
The operation of borrow pits or borrow areas shall not be permitted until the method of working for that particular pit or area has been approved by the Project Manager in writing. Restoration shall be to the satisfaction of the Project Manager.

1.10 DISPOSAL OF CONSTRUCTION DEBRIS

Materials in excess of the requirements for permanent works and unsuitable materials shall be disposed of in locations and in the manner as agreed with the Project Manager. The locations of disposal sites shall be such as not to promote instability, destruction of properties and water supply systems. Exposed areas of such disposal sites shall be suitably dressed and be planted with suitable vegetation.

The Contractor shall plan his works in such a way that there is no spillage or seepage of petroleum products to the surface or sub-surface water.

1.11 CONSTRUCTION PROGRAM

Within ten (10) days from the Commencement Date the Contractor shall submit to the Project Manager for approval a complete and practicable construction programme showing the orderly performance of the Works. The Construction Programme shall show in detail the proposed method of operations, including purchase and delivery of materials and equipment, as well as the construction. The Construction Programme shall show in a bar chart each major item of the Works and the Temporary Works on separate horizontal lines, sequence of operation and the period required for the completion of each activity and preferably using Microsoft Project 2007 software. The Construction Programme shall, when approved by the Project Manager, become a part of the Contract.

In amplification, the particulars supplied by the Contractor with the programme shall include the following details:
(a) a statement giving the numbers and categories of supervisory and technical staff and skilled/unskilled labour to be employed on the Works;
(b) a list and type/details of the Contractor’s Equipment (including vehicles) which the Contractor proposes to employ on the Works, stating whether they are to be acquired from inside or outside India, including programmed dates for order and delivery;
(c) a list detailing the purchase and delivery of materials and Plant from both inside and outside India;
(d) details of the Contractor’s methods of working for all operations including construction by sequence. The programme shall also indicate the proposed temporary flow diversions and arrangements for de-watering illustrating the sequence of various critical stages of construction;
(e) a statement and outline layout giving the proposals for location of offices and stores at the Site; and
(f) details of the programme for the construction of the works from the Commencement Date, including a complete resource allocation showing the number of units and allotted times for each unit of the Contractor’s Equipment, Plant, materials and labour allocated for each part of the works.
(g) The programme shall show the start and completion dates of the various activities, in order to complete the entire project by the Intended Completion Date.
(h) No separate payment shall be made to the Contractor for complying with this Sub-Clause.
1.12 PROGRESS REPORTING AND REVIEW MEETINGS

1.12.1 Monthly Report
The Contractor shall furnish to the Project Manager, at the Contractor's own cost, at regular one (1) month intervals and in a form and number of copies determined by the Project Manager, the following:

(i) physical and financial progress for the preceding months and estimated progress for the report month;
(ii) completion schedules (target and actual) based on the approved Construction Programme;
(iii) estimated expenditures for the report month;
(iv) tabulation of construction equipment, listing the major items and pieces of equipment which were utilised for performance of the Works during the preceding month;
(v) tabulation of employees, showing the supervisory staff and the numbers of several classes of labourers employed by the Contractor in the preceding month;
(vi) purchase and expenditure report covering the Plant and materials furnished by the Contractor for the Works;
(vii) climatic conditions prevailing during the report month;
(viii) environmental and social measures carried out by the contractor; and
(ix) any report which may be specifically requested by the Employer and/or the Project Manager.

1.12.2 Final or Completion Report
Within 30 days from the Provisional Acceptance Date, the Contractor shall submit to the Project Manager a Completion Report in 30 copies. The Report should include:

• Inventory of executed works;
• Financial statement;
• Main issues encountered;
• List of the equipment and staff mobilized; and
• Recommendations.

The report should also include: as-built drawings of the various structures.

1.12.3 Site/Works Meetings
The Contractor shall attend all the Site/Work Meetings (periodical or exceptional) called by the Project Manager. A Minutes of Meeting should be prepared and jointly signed by the Contractor (or its representative) and the Project Manager.

1.12.4 Site Diary Book
The Contractor shall maintain a site diary book in which all the main activities in the site should be daily recorded including inventory of existing staff and equipment, works progress, incidents, executed tests and samples collection, visits and particular or exceptional events. The diary should be jointly signed by the Contractor’s representative and the Project Manager.

1.12.5 Audits by the Employer
The Contractor shall note that the Employer shall be entitled, at its discretion, to conduct audits in respect to:

(a) costs incurred in the event of termination; and
(b) any other costs that the Contractor claims from the Employer which are not specifically covered by the terms of the Contract.

The Contractor shall be obliged to keep accurate up-to-date accounts with records...
concerning the above items.

1.13  **PROGRESS PHOTOGRAPHS:**

The Contractor shall make all arrangements to provide a minimum of 20 monthly progress photographs by a digital camera in albums, but not pasted, showing the work progress and shall promptly supply four copies of such photographs, larger than 10 cm x 15 cm in size, of such portions of the works in progress and/or completed as may be directed by the Project Manager. Each print shall contain on its back the date and title of the view taken. The digital files of the photographs shall be the property of the Employer and no prints from those shall be supplied to any persons without the approval of the Project Manager. No payment on the account shall be made to the contractor.

1.14  **QUALITY ASSURANCE, CONTROL AND QUALITY MONITORING**

It shall be the responsibility of the Contractor to ensure the quality of the materials to be used, quality of works to be executed as well as the quality of finished product as per technical specification in accordance with Indian Standards.

Contractor shall establish and maintain field laboratory suitably placed inside the Project area (including suitable building, furniture and equipment) at his own cost and conduct different quality control test on construction material, process control test on construction & quality control monitoring test on finished products. He shall appoint qualified & experienced technical staff as per requirement to conduct tests. Equipment as necessary to conduct the tests shall be procured by the contractor. A list indicating some of the main equipment are given below for reference of the Contractors. The Contractor shall also procure other equipment, if necessary, to conduct tests specified for different items of work to the satisfaction of the Project Manager.

1. Portable Compressive strength Testing Machine 1 no.
2. Field density apparatus core cutter with dolly and steel rammer. 3 sets
3. Modified proctor density apparatus full unit. (For light compaction) 1 set.
4. Rapid Moisture meter 3 sets
5. Sample Extruder. 1 set
6. Steel Straight edge – 300mm long. 3 nos.
7. Flakiness gauge 3 nos.
8. Mixing tools such as mixing pan, spoon, trowel, spatula etc. 3 sets
9. Air tight container, small size for M.C. determination 40 nos.
10. Oven, thermostatically controlled to maintain a temperature 105 – 110\(^{0}\)C 1 no.
11. Steel tape 3mtr. 1 no.
12. Palette knife with blade 20cm long & 3cm wide. 1 set
13. Porcelain evaporating dish-15cm dia. 4 nos.
14. Stainless steelspatula 25 cm long 4 nos.
15. Aluminium dish with lid-5cm dia. 4 nos.
16. Enamel plate - 45cm x 45cm size 1 no.
17. Enamel plate - 20cm x 15cm size 1 no.
18. Glass plate 100 mm thick - 45cm x 45cm size 2 nos.
19. Ground glass -5mm thick -, 20cm x 15cm size 2 nos.
20. Brass rod of 3cm dia. & 10cm long 1 no.
21. Wash bottle- 1 lit capacity, 500ml capacity. 2 nos.
22. Frying pan 1 no.
23. Stove 1 no.
24. Grafting tool or spade & pick axe 3 nos. Each
25. G. I. Tray 3 nos.
26. Shallow tray 650 cm² 3 nos.
27. Quartering Trowel 2 nos.
28. (a) Steel tamping rod having 16mm dia. & 600 mm long with bullet end. 3 nos.
       (b) Steel tamping rod - 10mm dia. & 230mm long with bullet end. 1 no.
29. Slump test apparatus 3 nos.
30. Cube mould 150x150 x150mm. 54nos.
31. Pycnometer bottle 1 no.
32. Curing tank 1.6m x 0.8 m x 0.4 m 1 no.
33. (a) I.S Test Sieve with base and top lid (square hole perforated plate) 80mm,
       63mm, 40mm,31.5mm,25mm,20mm,16mm,12.5mm,10mm,6.3mm,
       4.75mm and pan. 3 sets.
       (b) I.S Test Sieves (fine mesh wire) 4.75mm, 2.36mm, 1.70mm, 1.18mm,
       600 micron, 300 micron, 150 micron, 75 micron and pan. 3 sets.
       (c) Test sieve with base & top lid - 37.5mm, 20mm, 19mm, 10mm,
       9.5mm, 4.75mm, 2mm, 1.18mm, 600 micron, 425 micron, 300 micron,
       150 micron, 20 micron, 10 micron, 3 micron, 2 micron. 1 set.
34. Hand operated sieve shaker for above sieves 1 no.
35. (a) Electronic Balance-10 Kg Capacity with 1.0gm least count. 1 no.
       (b) Electronic Balance 3Kg with 0.5gm least count 1 no.
       (c) Electronic Balance-2 Kg Capacity with 0.1gm least count. 1 no.
36. Consumables (As per actual requirement from time to time)
   a) Sieve brush
   b) Wire brush
   c) Sodium carbonate
   d) Sodium hexametaphosphate
   e) Kerosene
   f) Mercury
   g) Cotton waste
   h) Distilled water
   i) Carbide for rapid moisture meter
   j) Dry Soft absorbent cloth of size 75cm x 45cm
   k) Engine Oil

1.15 QUALITY ASSURANCE PLAN

The Contractor shall, within fourteen (14) days from the Commencement Date, submit a Quality Assurance Plan. The plan shall include methodology & sequence of operation, list of materials sources, Quality Assurance & Quality control procedure to be followed prior to commencement of work and during execution, testing schedule showing test to be conducted and their frequencies & testing of end product, with respect to procedure laid down in different Indian Standards for each item of work & internal organisation ensuring good quality of constructions works, procedures for supplying of suitable materials, procedures for verification of drawings and other items as required by the Project Manager. The Contractor shall implement the quality control procedures in compliance with the approved Quality Assurance Plan.

1.16 CONSTRUCTION SUPERVISION

Supervision of construction work will be done by the Project Manager and his site staff on a day-to-day basis and periodically by the concerned Superintending Engineer and Chief Engineer in charge of the Project.
1.17 MATERIALS AND SAMPLES

The Contractor shall submit to the Project Manager a list of all suppliers of manufactured items from whom he proposes to purchase, and the locations of quarries, material sources from which he proposes to extract material aggregates, stones, fill materials etc. If the contractor is purchasing the aggregates from the vendor he should obtain the material from the licensed quarry where the Orissa Pollution Control Board has given Consent for Establishment and Operation for the crusher. In addition the Contractor should enclose a copy of the Consent for establishment and operation as part of the Vendor approval. All materials and articles shall, whether specified or otherwise, be suitable for the use intended and shall be approved by the Project Manager. Samples of all materials or articles to be incorporated in the Works as may be called for by the Project Manager or his Representative shall be submitted as and when required for retention by the Project Manager’s Representative. Manufacturer’s test certificates shall be supplied in respect of cement, steel, pipes, etc.

The Contractor shall maintain a detailed record of all materials delivered to his stores or working areas, and shall make these records available to the Project Manager’s representative. All goods and materials used in the Permanent Works shall be new, unused, of the most recent or current models, and incorporate all recent improvements in design and materials unless provided otherwise in the Contract.

All materials and works rejected by the Project Manager’s representative shall be promptly removed from the site.

1.18 INSPECTION AND TESTS

All materials and goods furnished and works performed under these specifications shall be subject to the inspection of the Project Manager or his authorized representative to determine that they meet the requirements of these specifications. The Contractor shall notify the Project Manager, not less than 15 days in advance of the date and place that the materials will be available for inspection. Acceptance of materials or the waiving of inspection, thereof, shall not relieve the Contractor of the responsibility for furnishing materials and goods or performing works in accordance with the requirements of the Contract Documents.

The Contractor shall conduct different approval test in Government approved Testing Laboratories prior to utilisation in the work.

The Contractor shall be responsible for delivering all samples to the laboratory and for collecting the results. The original test certificates shall be presented to the Project Manager for his review and approval.

The Contractor shall conduct quality control test on construction material, process control test on construction & quality control monitoring test on finished products in Q.C Field Laboratory with respect to procedure & frequencies laid down in different Indian Standards for each item of work.

The Contractor shall maintain quality control test registers made out of approved test formats of all tests & abstract submitted to Project Manager regularly.

Contractor shall maintain guard file & document all test results of approval test of construction materials conducted in government approved Q.C. Testing laboratory, & abstract submitted to Project Manager regularly.

The Contractor shall facilitate inspection & verification of testing, documentation of test result to the Project Manager or his authorized representative (Asst. engineer, Junior Engineer & supporting testing staff) to ascertain, the work has been executed as per approved Technical Specification.

The Contractor shall facilitate State Quality Monitors (appointed by D.O.W.R) &
higher authorities of Project to inspect & conduct verification testing as and when required to ascertain the materials used in the work & the end products are of prescribed standards. The Contractor shall submit all the original quality control Test registers & guard file containing approval test results of materials to the Project Manager for record after completion of the work.

1.19 INTERFERENCE WITH EXISTING WORKS

The Contractor shall not interfere in any way with any existing works whether they are the property of the Employer or of a third party and whether the position of such works is indicated to the Contractor by the Project Manager or not, except where such interference is specifically described as part of the Works either in the Contract or in the Project Manager’s instructions.

The Contractor shall at his own expense provide and erect, to the approval of the Project Manager, such supports as may be required to protect efficiently all structures or works which may be endangered by the execution of the Works and he shall remove such supports on completion of the Works or otherwise take such permanent measures as may be required by the Project Manager to protect the structures or works.

The Contractor is to execute the Works in such a manner that he does not damage or interfere with existing services which are located in proximity to the Site. The Contractor shall be responsible for any damage or interference which may be caused to these services due to the execution of the Works and shall carry out all necessary repairs at his own expense and to the satisfaction of the Project Manager.

1.20 FIELD RECORDS AND AS-BUILT DRAWINGS

During the progress of the work, the Contractor shall maintain a continuous up-to-date copy and record of all drawings, specifications, supplementary data, latest revisions and field deviations from the drawings, if any, approved by the Project Manager.

As soon as any section of the Works has been completed the Contractor shall bring the construction drawings up to “As-Built” status incorporating all modifications, additions, alterations etc., which may have been made during the construction period. All “As-Built” drawings shall be subject to verification and approval by the Project Manager. Within the contractually stated period following the date of the issue of the Certificate of Completion for the Works or parts of the Works, the Contractor shall complete and submit one full set of such approved drawings together with one set of auto-positives to the Project Manager.

1.21 PROTECTION OF COMPLETED WORKS

The Contractor shall protect completed Works from damage from subsequent operations, from the weather or any other cause, including the naturally aggressive nature of the environment in which the works are to be constructed and make good any damage so arising until the work is fully completed and handed over to the Project Manager.

1.22 SIGNBOARDS

Notice boards shall be in Odia, Hindi and English and shall be displayed in suitable position on the Sites to show the Employers name together with the name of the Project and the names of the co-financer, Consultant and Contractor. The boards shall have a minimum overall size of 1.5m x 1m and shall be in a format to be provided by the Project Manager.
1.23 SAFETY MEAURES:

The contractor shall be responsible for ensuring throughout the contract period all the safety measures at site of work so as to prevent loss of life, property and damage of partially or completed works.

1.23.1 Safety Precautions

The Contractor shall comply with any safety instruction given by the Project Manager. In the performance of the Works, the Contractor shall exercise every reasonable precaution to protect persons or property from injury. The Contractor shall erect and maintain all necessary temporary fencing, barricades, barriers, signs and lights and provide fire alarm, fire extinguishing and fire-fighting services at strategic points on the Site. The Contractor shall adopt and enforce such rules and regulations as may be necessary, desirable or proper to safeguard the public and all persons engaged in the work and its supervision.  

1.23.2 Safety Officer

The Contractor shall constantly assign, during the progress of the Works, an employee qualified in safety, and familiar with the type of work being performed, whose assignment shall include initiation of measures for the protection of health and the prevention of accidents and who shall see, by personal inspection, that all safety rules and regulations are enforced. The Contractor shall hold regularly scheduled safety meetings at least once each month with his Project Managers, supervisors and foremen. When directed additional meetings will be held. The Contractor shall keep the Project Manager advised as to when these meetings are to be held and shall provide the Project Manager with a copy of the proposed agenda.

1.23.3 Safety Measures

The safety measures taken by Contractor shall include but shall not be limited to the following:

(a) Temporary Fencing – The Contractor shall erect, maintain and remove suitable and approved temporary fencing to enclose such areas of the Permanent Works and areas of land occupied by the Contractor within the Site as may be necessary to implement his obligations under the Contract, to the satisfaction of the Project Manager. Where any temporary fence has to be erected alongside a public road, footpath, etc., it shall be of the type required by and shall be erected to the satisfaction of the Government authority concerned.

(b) Lighting – The Contractor shall provide sufficient lighting in all places where work is in progress, such that:
   (i) Safe working conditions are provided both for the Contractor’s personnel, sub-contractor’s personnel and for personnel of the Project Manager;
   (ii) The Works can be constructed in complete compliance with the Contract; and
   (iii) A complete inspection of all Works in progress can be made by the Project Manager.

(c) The minimum service luminance on ground or working surfaces to be provided for the various operations or work areas shall be as directed by the Project Manager.

(d) The Contractor shall supply a suitable instrument to the Project Manager for measuring the intensity of illumination.

(e) All mobile equipment or plant used during night operations, as and when approved by the Project Manager, shall be equipped with sufficient lights and reflectors to ensure safe working conditions.
(f) Not less than fourteen (14) days before the start of night operations, the Contractor shall submit his proposals for lighting in the areas in which he proposes to work at night to the Project Manager. The Contractor shall modify the proposals if required by the Project Manager, and shall not begin operations at night until the proposals for lighting (in an amended form if required) have been approved.

(g) Approval of the Contractor’s proposals for lighting shall not relieve the Contractor of any of his liabilities or obligations under the Contract.

(h) Work in the vicinity of electrical equipment – in the interest of safety and security, the Contractor shall complete the erection of any safety fencing around electrical and mechanical apparatus by the time that the said apparatus is connected to any electricity supply.

(i) Explosives – in the use, handling and storage of explosives, the Contractor shall comply with the guidelines given in Section 3.4, under Earthworks of this Specification and with all statutory regulations of law. The Contractor’s attention is drawn to the fact that, depending on the nature of work in progress, the Project Manager may require the Contractor to discontinue the handling or use of explosives during the approach and progress of severe thunderstorms in which case all persons shall be removed from danger areas to a place of safety during such periods.

(j) Safety Instructions – the Contractor shall at his own cost supply and issue to his employees and those of his subcontractors and the staff of the Project Manager printed booklets, of pocket-size, on the scale of one per person, in English and in other languages used by his employees at Site, instructions based on good practice. Within sixty (60) days of the Project Manager’s written order to commence the Works at Site, proof copies of the booklet shall be submitted for approval before printing and amendments shall be made to the booklet to his entire satisfaction. The Contractor shall issue the booklet immediately after printing as required by this Clause and ensure that all employees are fully conversant with the instructions. Safety instructions shall deal with all safety including:

(i) Protective clothing, headgear and footwear;
(ii) Use of lifting equipment;
(iii) Use of drilling equipment;
(iv) Contract with and use of electrical equipment;
(v) Use and storage of explosives;
(vi) Compressed air;
(vii) Welding;
(viii) Routine for accidents or fires; and
(ix) Watchmen, warning notices and barriers.

The Contractor shall allow for 20 booklets for the use of the Project Manager.

(k) The Contractor shall provide for the Project Manager and Project Manager’s supervisory staff the protective clothing, headgear and footwear necessary for the proper discharge of their duties on Site.

(l) Accident Reports – the Contractor shall promptly report to the Project Manager, all accidents involving death or serious injury to staff or workmen, and furnish monthly
reports of all accidents to staff or workmen involving loss of time, giving such information as may be prescribed by the Project Manager.

(m) The Contractor shall provide all necessary signs for the works.
   (i) These shall include, but not be limited to:
     • use of sirens before blasting and a all-clear indication
     • standard road signs;
     • warning signs;
     • danger signs;
     • control signs;
     • safety signs; and
     • direction signs.
   (ii) Wording on all signs shall be in English and Odia and other approved languages. The size, colour, lettering and location of all signs will be subject to approval and attention shall be paid to international signs.
   (iii) The Contractor shall maintain all signs placed by him as well as those placed by the Employer.
   (iv) If the Project Manager considers that the system of signs provided by the Contractor is inadequate to ensure safety, or unsatisfactory in other respects, the Contractor shall add to, amend, or otherwise change the system to the satisfaction of the Project Manager.
   (v) The Contractor shall at his own cost make suitable replacement as directed by the Project Manager in case of loss or damage to any signs provided by the Contractor under this Sub-Clause.
   (vi) The Contractor shall at his own cost adopt such measures as the Project Manager may consider reasonable and necessary to minimize nuisance from dust, noise or other disturbance created while or in carrying out the Works.

Separate payment will not be made for complying with the provisions of this Clause and all costs included in the various rates in the priced Bill of Quantities.

1.24 FIRE PREVENTION:
1.25
The Contractor shall provide and maintain adequate fire-fighting equipment and take adequate fire precaution measures for the safety of all personnel, temporary and permanent works, and shall take action to prevent damage to or destruction by fire of trees, shrubs or grasses.

Separate payment will not be made for the provision of fire prevention measures.

1.25 FIRST AID & MEDICAL FACILITIES:
1.25.1 General
The Contractor shall in all respects be fully responsible for ensuring necessary first-aid services to his employees and employees of his subcontractors, including transport for injured personnel to hospital or other appropriate accommodation as and when required.
1.25.2 Staff
To enable the fulfilment of his obligations under this Clause, the Contractor shall engage qualified resident first-aid staff, and shall arrange for the treatment of casualties on the Site in first-aid units and for removal by ambulance of injured or site employees to hospitals or their homes.

Separate payment will not be made for first-aid and medical facilities provided by the Contractor for his employees and the employees of his subcontractors. The facility shall be also available for the use of staff of Project Manager.
Contractor with the help of local medical department should conduct AIDS awareness campaign for every six months to bring awareness to the labour employed by him.

1.26 PROTECTION OF REAL ESTATE

The Contractor shall control the movement of his crews and equipment on any right-of-way, including access routes approved by the Project Manager so as to minimise damage to crops and property and shall endeavour to avoid marring the lands. Ruts and scars shall be obliterated, damage to land shall be corrected and the land shall be restored as neatly as practicable to its original condition.

The Contractor shall be responsible directly to the Employer for any excessive or unnecessary damage to crops or lands resulting from the Contractor’s operations whether on lands adjacent to a right-of-way or on approved access roads, and deductions shall be made from payments due to the Contractor to cover the amount of such excessive or unnecessary damage as determined by the Project Manager.

No separate payment shall be made to the Contractor for complying with the stipulations of this Sub-Clause.

1.27 ENVIRONMENTAL PROTECTION WORKS

The Environment is defined as managing the surrounding area, including human and natural resources, to be affected by the execution and completion of the Works.

The Contractor shall take all precautions for safeguarding the environment during the course of the construction of the Works. He shall abide by all prevailing laws, rules and regulations governing pollution and environmental protection.

The Contractor shall prohibit employees from unauthorized use of explosives, poaching wildlife and cutting trees. The Contractor shall be responsible for the action of his employees.

Environmental protection works, among others, shall include:

Hazardous Materials
The Contractor shall not store hazardous materials near water surfaces. The Contractor shall provide protective clothing or appliances when it is necessary to use hazardous substances.

High concentration of airborne dust resulting in deposition and damage to crops and water resources shall be avoided. The Contractor shall take every precaution to control excessive noise resulting in disruption to wildlife and human populations.

Provision and Maintenance of Stores, and Equipment
Space allocated for storage of materials such as cement, gabion wire, reinforcing wire etc. shall in general be damp-free, rainproof and away from petroleum products storage.

Written information must be given to, and approval be taken from, the Project Manager regarding the proper establishment and maintenance of such stores. Failure to comply with the Project Manager’s instruction in respect of overall standards will lead to the reduction or withholding of payment.

Sanitation
The Contractor is to arrange for a high standard of sanitation to be maintained throughout his offices, stores, and warehouse, and the Works. Sanitary conveniences for the use of persons employed in the works shall be provided and maintained by the Contractor in accordance with the appropriate laws and regulations in force in India to the extent and in such a manner and at such places as may be approved by the Project Manager, and all persons connected with the works shall be obliged to use them.
Reinstatement of Environment
The Contractor shall arrange and execute works as well as related activities in such a way that environmental conditions are reinstated. He may be required to carry out filling, removal and disposal works, along with planting of grass and trees at identified locations to reinstate environment as directed by the Project Manager.

1.28 IMPLEMENTATION OF ENVIRONMENT MANAGEMENT PLAN
General
The role of Contractor is very important to ensure that the environmental and social impacts for implementation of the construction works are minimized, and that all aspects of the Environmental Management Action Plan (EMAP) are implemented as enclosed in the BOQ. The activities would be carried out in Consultation with Project Manager under the guidance of Environmental Expert to look after the implementation of EMP in all the Packages.

Pre-Construction/Early Construction Period Activities
The following environmental related activities are to be implemented during the pre-construction/construction (early part) periods:

- Contractor should apply to the State Pollution Control Board for the necessary statutory clearances required for the equipment like Concrete mixer / batching plants etc.
- Contractor should obtain all the vehicles fitness certificates which is operating in the project as well as Pollution under Control certificates for the vehicles he is using in the project
- Create a “sense” of environmental/safety awareness within all construction activities for all personnel to be employed by constant referral to environmental requirements, implications, and responsibilities.

Environmental Monitoring Programme

The contractor implements the Environmental Monitoring Program as per Environmental Management Plan (EMP) as mentioned in the EIA/ IEE.

1. The Contractor should obtain permission from the Project Manager to commence all the initial tests for monitoring (i.e. to assess the existing conditions before initiating the construction activity) and subsequent monitoring as suggested in the EMP
2. The Project Manager in consultation with the Environment Expert decides the locations/ testing schedule and fix the agency for carrying out the tests.
3. Environmental Monitoring includes testing of Ground water, Surface water, Silt and Soil.
   a) Ground water test should be conducted as per IS:10500: 1991 consisting of 34 parameters including 4 parameters of pesticide residue( Colour, odour, taste, turbidity, pH, total hardness, iron, chlorides, residual free chlorine, dissolved solids, calcium, copper, manganese, sulphate, nitrate, fluoride, phenolic compounds, mercury, cadmium, selenium,arsenic, cyanide, lead, zinc, anionic detergents, chromium, polyaromatic, hydrocarbons, mineral oil, pesticide residue (DDT, Endosulfan, Phorate, Carbofuran and monocrotophos), alkalinity, aluminium, Boron and E-coli.
   b) Surface water testing consisting of 37 parameters including 4 parameters of pesticide residue( Colour, odour, taste, turbidity, pH,Do, BOD, COD, total hardness, iron, chlorides, residual free chlorine, dissolved solids, calcium, copper, manganese, sulphate, nitrate, fluoride, phenolic compounds, mercury, cadmium, selenium,arsenic, cyanide, lead, zinc, anionic detergents, chromium, polyaromatic,
hydrocarbons, mineral oil, pesticide residue (DDT, Endosulfan, Phorate, Carbofuran and monocrotophos), alkalinity, aluminium, Boron and E-coli).

c) Silt and Soil testing includes 27 parameters with 4 pesticide residues (pH, EC, Organic Carbon, Texture, Phosphorous, Potassium, Sulphur, Calcium, Magnesium, Chromium, Lead, Cadmium, Fluoride, Nickel, Arsenic, Mercury, Boron, Iron, Manganese, Molybdenum, Zinc, Pesticide residue – DDT, Endosulfan, Phorate, Carbofuran and Monocrotophos)

4. The contractor will ensure he carries out the required tests and submit the test results to the Project Manager. The Contractor will carry out test from State Pollution Control Board Laboratory or its Approved laboratories, National Accredited Laboratory or Ministry of Environment and Forests recognised Laboratory.

5. Project Manager in Consultation with Environment Expert can request the Contractor to stop, modify or defer specific construction equipment, processes, etc., as necessary, that are deemed to have contributed significantly to monitoring readings in access of permissible environmental “safe” levels.

6. The Contractor should strictly adhere to the dust suppression methods as mentioned in the EMP

7. Implements the erosion control measures systematically as suggested in the EMP

Monitoring of Earthworks Activities

Most of the environmental problems related to the construction works are anticipated to be associated with the earthworks, particularly for the Quarries and Borrow Areas. Details regarding the guidelines and procedures adopted to minimize the environmental impacts of opening, operating and closing of quarries and borrow areas are presented in EMP and technical specifications.

Other environmental effects associated with the earthworks include the development of adequate temporary drainage to minimize detrimental effects (e.g. erosion) due to run-off, and safety

Environmental Safety

As mentioned in the specification in Section under safety

Monitoring of Contractor’s Facilities, Plant and Equipment

All issues related to negative environmental impacts of the Contractor’s Facilities, Plant and equipment are to be controlled through:

- The Contractor’s self-imposed Quality Assurance Plan

- Regular/periodic inspection of the Contractors Plant and Equipment and producing Fitness and “Pollution Under Control” certificates time to time.

1.29 CONSTRUCTION MATERIALS

The standard and specification of different construction Materials are given in detail in respective Sections of this specification. The contractor shall procure construction materials in confirmation to the required specification.
SECTION – (2)
SITE OF WORK

SECTION 2.1 SETTING OUT OF WORK

(A) Permanent bench marks/temporary bench marks fixed by the Project Manager at Project Site shall be referred by the Contractor for executing the Works. Temporary Bench Marks shall be set up at every 0.5 km. interval at convenient locations along the canal to serve as reference levels. The Contractor shall establish additional reference Bench Marks as may be needed at his own cost for facilitating the setting out and taking levels for measurement of work, with the approval of the Project Manager. The Bench Mark shall be marked on a concrete pillar 30 cm. (length) X 30cm. (breadth) X 75 cm. (depth) which shall be embedded 55 cm into firm ground and projecting 20 cm. above the ground. The Bench Mark pillar shall be constructed in plain cement concrete of M – 10. The pillar shall be well protected from being disturbed. The RL of bench mark shall be conspicuously carved and painted on the pillar.

(B) Before starting any work and during execution (if required), the contractor shall erect reference Bench Marks, reference lines and check profiles at convenient locations as per the direction of the Project Manager. The center line of the canal and the reference line for all alignments for demarcation purpose shall be laid by dug-belling on the ground. The reference line shall comprise the base line properly dug belled on the ground with the numbered concrete / masonry R. D. pillars suitably spaced.

(C) Centre line of the canal shall be marked by fixing pillars / stone at 30 M. intervals. Profiles of canal in filling and in moderate cutting shall be marked at 50 M. intervals in straight reaches and at 25 M. intervals in curves. A reference line shall also be marked on ground away from the outer edges of cutting and filling with pillars at suitable intervals for future reference.

To ensure correctness of execution, the edges of cutting, the outer toe lines of canal in filling should be marked by fixing pillars or pegs at suitable intervals or by dug belling.

(D) Initial level along cross section of canal at 15 m intervals shall be taken & recorded in officially issued Level Book of Project Manager. After completing the canal to the required section final level shall be taken & recorded in the Level Book.

(E) Cross section of canal shall be plotted with the initial level & designed canal section shall be plotted on it. The design profile shall be transferred to the ground or existing canal section.

(F) The check profiles shall be located 15 meter apart or longer as directed by the Project Manager to serve as a guide for execution of all slopes and steps to the elevations, and profile or profiles indicated in the approved drawings. All important levels and all reference points with respect to bench marks and reference lines shall be fixed and co-related by the contractor as per directions of the Project Manager.

(G) The zones of full cutting section, full filling section, partial cutting and filling sections shall be separated by conspicuous demarcation in the field.

The curves stipulated in construction drawings shall be carefully laid in the field by adopting approved method of curve layout. The curve shall be marked on the ground by fixing pegs at very close intervals and joining the peg-point by dug-belling to a suitable depth.

The locations of different structures indicated in construction drawing shall also be clearly marked on the ground along the alignment of the canal. The control structure locations of off-taking canals shall also be clearly demarcated, so that unnecessary excavation or filling at these locations can be avoided.

The spoil dumping zones shall clearly be demarcated in the field. These zones should be at least 2 m. beyond the location of catch water drains.
(H) To ensure accuracy in execution of cutting, the canal embankment, spoil banks and the structures, their layout shall be given in an appropriate manner with pegs and pillars, suitably placed in relation to outer dimensions of these elements.

(I) All materials and labour for setting out works mentioned in paragraph (A) to paragraph (F), as may be required at the various stages of the construction, shall be supplied by the Contractor at his own cost. The cost of such works shall be deemed to have been included in the cost of the items in BOQ.

SECTION 2.2 CLEARING AND GRUBBING

(A) CLEARING AND LEVELING SITE

The portion of the right-of-way where required for constructing the work under these specification shall be cleared of all trees, bushes, rubbish and other objectionable matter. Trees designated by the Project Manager shall not be cut and shall be protected from injury. Such cleared material shall be disposed off or removed from the site of work as approved by the Project Manager. The clearing operation shall be in accordance with clauses of I.S. 4701 – 1982 Indian Code of Practice for earth work in canals. Surface boulders either loose or partly embedded in the ground will have to be removed and stacked as directed.

(B) GRUBBING

The area described or shown on the relevant site plan shall be cleared of all obstructions, loose stones, non-required materials and rubbish of all kinds. All brushwood shall be cleared and the roots grubbed up. No trees shall be cut down and removed without the instructions of the Project Manager. Those which are cut down shall be grubbed up. The same remarks apply to jungle clearance. Trees to be preserved will be designated by the Project Manager.

The products of the clearing shall be stacked in such place and manner as may be ordered by Project Manager and the ground shall be left in perfectly clean condition; all products of the clearing shall be the property of Government and shall be disposed of as per the direction of Project Manager.

All holes or hollows, whether originally existing or produced by digging up rows shall be carefully filled up with earth, well rammed to the design density and leveled off, as directed.

(C) PREPARATION OF BED

Ant hills shall be completely dug out before earth work is started. In the absence of any separate contract schedule provision for removal or shrubs, loose stones and digging of ant hills, involved in the preparation of bed, the contract rate for earth work shall be deemed to include all the work to be done in accordance with this clause. In cases where the work of preparation or bed is rather extensive, the Project Manager will usually provide a separate schedule item for such preparation, but in the absence of such schedule provision, the contractor shall understand that his tender rate is inclusive of all such work without extra charge. The contractor shall therefore examine the site before tendering and provide for all items to be done under his earth work tender rate. Old bunds will be benched or sloped as directed by Project Manager before addition of earth, the benches being 500 mm. X 500 mm. unless other sizes are specified. The benches or slope shall be inspected by the Project Manager or engineer designated for the purpose and approved before new earth work is keyed into them.

(D) DISPOSAL OF CLEARED AND GRUBBED MATERIAL

The disposal of cleared and grubbed material shall be in accordance with clause 4.1.1 of I. S. 4701 – 1982 code of Practice for earth work on canals. The material to be disposed off shall be buried.
(E) PAYMENT

Separate payment will not be made for clearing of site and grubbing including disposal of the cleared and grubbed material required under the above paragraphs from (A) to (D). Similarly benching of earthwork on old surface will not be paid as separate items. The contractor shall include the cost thereof in the price bid in the bill of quantities of the contract for the relevant finished item of work for which clearing, grubbing and benching as mentioned in the above paragraphs are required.

SECTION 2.3: USE OF WATER FOR DUST ABATEMENT

The Contractor shall procure and apply water for dust abatement. The Contractor shall furnish all labour, materials and equipment and shall procure and apply water required for pre-wetting the areas under canal and embankment.

Water applied for dust abatement and pre-wetting of canal prism and adjacent areas will not be eligible for payment. The cost of procuring and applying water including all expenses for all means of conveying water to the point of use, their collection, usage, and all other incidental expenses will not be paid separately including creation of source of water and the cost shall be deemed to have been included in the concerned unit price bid in the bill of quantities of the contract for the relevant finished item of work for which water is required. So also the cost of procuring and applying water required for other items of the work as per BOQ shall be included in the price bid in the bill of quantities for the items of work for which the water is used.

SECTION 2.4 SITE DRAINAGE

The Contractor shall handle all flows from natural drainage channel intercepted by the work under these specifications, perform any additional excavation and grading for drainage as directed and provide and maintain any temporary construction required to bypass or otherwise cause the flows to be harmless to the work and property. When the temporary construction is no longer needed and prior to acceptance of the work the contractor shall remove the temporary construction and restore the site to its original condition as approved by the Project Manager.

In addition to cross drains, longitudinal drains may the considered necessary for proper drainage. The drainage system consisting of network of cross and longitudinal drainage system will be led into out fall drains to prevent stagnation of water at the place of construction. The drains shall be constructed to the section designed, and shall be either open or filled up with material to ensure free flow of water without clogging of the filled materials.

The cost of all works and materials required by this paragraph shall be included by the contractor in the unit prices quoted in the bill of quantities and no separate payment will be made for the same.

SECTION 2.5 MONSOON DAMAGES

Damages due to rain or flood either in cutting or in bank shall have to be made good by the contractor till the work is handed over to the department. The responsibility for desilting and making good the damages due to rain or flood rests with the contractor. No extra cost is payable for such operations and the contractor shall, therefore, have to take all necessary precautions to protect the work done during the construction period.
SECTION 2.6 KHARIF IRRIGATION

Water for kharif irrigation will be released in canal during construction period. The Contractor should plan such that his work should not interfere with Kharif irrigation. Before release of Kharif water, the Contractor should remove his materials/machineries from canal bed to safe levels. At the end of kharif season, before restart of work the Contractor shall clear silt and divert accumulated water from canal bed. No separated payment towards above operations will be made to the contractor, who shall include the cost thereof in the respective item rates of BOQ.

SECTION 2.7 REMOVAL OF SILT AND WATER

Accumulated silt and water in the canal and structures for the works partly done by the Contractor in current or previous seasons should be removed and no extra payment will be made, for such removal of silt and water. This unit rate of excavation is deemed to include cost for removal of such silt and water.

SECTION 2.8 PROCEDURE FOR MEASUREMENT

Measurement of Works will be recorded as per stipulations provided in Orissa Public Works Department Code Volume –II (OPWD Code, vol-II), APPENDIX-II and BIS Code No1200.

Before commencement of work, initial levels to indicate existing ground levels shall be taken at 15m. intervals longitudinally along the alignment of the canal. The level points transversely along the cross sections shall be maximum at 5 m. intervals in flat ground 1.5-2m. in undulating terrain. The cross sections shall be extended beyond the limit of work to a suitable distance and minimum 5 meters beyond the toe lines of slopes on both the sides. The intervals stipulated shall be made closer depending on the topography or any stipulation made by the Project Manager.

All initial levels shall be recorded in ink in authenticated level books issued by the Project Manager and shall be signed by the Junior Engineer / Assistant Engineer when he records the levels. The Assistant Engineers and Executive Engineers shall exercise checks strictly in accordance with the provisions of Orissa PWD Code.

The level shall be recorded in the presence of the contractor or his authorized agent. The contractor or his authorized agent shall sign each page of the level book / field book in token of acceptance. These cross sections shall form the basis of all future measurements and payments. Each dimension shall be measured to the nearest 0.01m. Areas shall be computed to nearest 0.01 sqm. volume shall be computed to nearest 0.01 cubic m. Actual construction work shall not be allowed to start unless the initial levels are recorded, signed and accepted by the Contractor.
SECTION – (3)
EARTH WORK

SECTION 3.1;   EARTH WORK – GENERAL

Drawing showing the typical section of the canal annexed to these specifications provides such details as would enable the contractor to execute the work in general conformity there-with under these specifications which have been prepared as definitely and in as much detail as possible with regard to design data presently available. These drawings will be supplemented by such additional, general and details drawings or directions as may be considered necessary or desirable as the work progresses. For all changes in approved drawing / design the recommendation of Superintending Engineer and approval of Chief Engineer will be essential. Where details shown on these drawings differ from the requirements of these specifications, the requirement of specifications shall govern. The contractor shall do no work without proper drawings. He shall check all drawings and specifications carefully and advise the Project Manager if any errors and omissions are discovered where upon the Project Manager will prepare and lodge such revised additional drawings and specifications as may be required to suit the stage of work. All such additional, general and detailed drawings whether original or revised lodged in the office of the Project Manager and signed by him for purpose of identification shall be open for inspection by the contractor under the same terms and conditions as provided in agreement.

All works of the contract shall be executed as per the specific and relevant clause / clauses of relevant I.S. code unless otherwise specified. Materials used should, confirm to the desired standards prescribed in the relevant codes. Wherever a para of I. S. code is cited in specification, it goes without saying that the latest revision of the specification subsequently, shall apply. For purpose of relevancy or otherwise of any provision of the I. S. code referred to, the decision of Project Manager shall be final and binding.

SECTION 3.2 –   EXCAVATION OF CANAL AND FOR STRUCTURES

3.2.1 EXCAVATION OF CANAL

(a) The excavation may be carried out manually or mechanically and as per specification drawing and direction of Project Manager.

(b) The excavation for canal in all kinds of soil shall be done according to the dimensions and grades shown on the drawing. Proud equivalent to thickness of the lining on sides and in bed on the underside of the lining shall be left unexcavated temporarily and the removal of this proud shall be done just before trimming and placement of lining.

(c) All areas to be excavated for canal sections shall be pre-wetted so that at the time of excavation moisture content shall be about optimum. However in case the excavated material from canal is not to be used for embankment, such pre-wetting is not necessary.

(e) The excavation shall be allowed to progress from the valley ends of the reach towards the ridge in conformity with the layout given. All useful earth from excavation shall be used for filling the banking section, with varying leads and with all lifts either manually or mechanically. Excavated materials which is not useful for banking or which is in excess after meeting the banking requirement of the reach shall be disposed as specified at Para 8.1 and 8.2 of I. S. Code 4701 – 1982 either by head lead or by mechanical means or by both in spoil bank or at any specified place with all lifts and with varying leads.

(f) The regradation for tail channel and approach channel for structures and diversion of drains / nallas shall be done according to the dimension and grade as shown on the drawings or as instructed by Project Manager.
Section 6 - Employer's Requirements

(g) The contractor shall not be entitled to any additional rate above the rates quoted in the schedule on account of the requirement for allowing additional time for drying, stock piling and rehandling the excavated material which have been deposited temporarily and stockpiled.

(h) When cutting on cross sloping ground the contractor shall cut a catch water drain on the higher side to prevent water from flowing down the cutting slope. No separate payment will be made for the work as the same is deemed to have included in the unit rate of excavation of soil.

3.2.1.1 EXCAVATION OF SOIL

Excavation of all kinds of soil shall comprise of all kinds of excavations in dry, wet, saturated or submerged conditions of soil such as ordinary soil, vegetable or organic soil, turf, sand, silt, slushy soil, loam, clay, mud, peat, black cotton soil, hard soil, loose or compact moorum, soft / stiff / heavy / hard shale or clay, stony earth, soil interspread with boulders up to 0.01 cum. in volume.

Excavation for canal shall confirm to provisions of relevant I. S. codes. Side slopes are to be provided as per the approved drawings, specification and provision of I. S. code.

3.2.1.2 OVER EXCAVATION:

The canal shall be excavated to exact designed section in all kinds of soil. No over excavation will be allowed in such reaches.

In the canal section where expansive type of soil such as CH type of soil is encountered and over which concrete lining cannot be directly laid, the canal prism shall be over excavated to the extent as directed by the Project Manager and such over excavated section shall be filled with suitable cohesive non-swelling (CNS) type of soil to be placed in uniformly compacted layers as directed by the Project Manager. The over excavation made in such strata, filling by suitable soil, watering and compacting, will be paid under respective items at the quoted rate.

3.2.1.3 DEWATERING TRENCHES AND WET EXCAVATION

Subsoil water met within canal excavation shall be diverted to nearby drain/nalla by cutting an open channel within the canal section to be excavated. When the drain/nalla bed is higher than the subsoil water level met with, pumping shall be resorted to for dewatering below the drain-nalla bed level.

No distinction shall be made as to whether the material being excavated is dry, moist, saturated or submerged. Care should be taken to discharge the drained water not to cause damage to works, crops or any other property. No separate payment shall be made for dewatering by pumping or by any other method.

3.2.1.4 MEASUREMENT FOR PAYMENT

The payment shall be made on volumetric basis for the quantities excavated to the lines and levels specified. The cross sections shall be taken initially before commencement of work as stipulated in earlier para. On completion of excavation, final cross sections shall be taken at the same points longitudinally and transversely. These cross sections shall be marked on the initial cross sections and the quantities between initial and final cross sections shall be worked out and paid.
SECTION 3.2.2 EXCAVATION FOR STRUCTURES

(A) GENERAL

Excavation for the foundation of structures shall be to the elevation shown on the drawings or as directed by the Project Manager. In so far as practicable the materials removed in excavation for structures shall be used for back fill and embankment.

(B) FOUNDATIONS FOR STRUCTURES

All trenches in soil other than rock or hard compact soil more than 1.5 M. deep, into which men enter shall be securely shored and strutted and timbered.

All trenches in soil soft or fissured rock or hard soil exceeding 2 M. in depth, into which men enter shall be securely shored and timbered.

Notwithstanding anything said above, it shall be understood that the need for shoring shall receive careful and frequent consideration even in trenches of less than 1.5 or 2 M. in depth (as the case may be). When there is doubt as to the safety of the work without shoring, no further excavation or other work shall be continued until adequate shoring is provided.

Where the sides of trenches are sloped but not to within 1.5 M. of the bottom, the vertical sides shall be shored and the shoring shall extend at least 30 Cm. above the vertical sides. When open spaced sheathing is used, a toe board shall be provided to prevent material rolling down the slope and falling into the part of the trench with vertical walls.

Shoring and timbering shall be carried along with the opening of a trench but when conditions permit protection work, such as sheet piling may be done before the excavation commences.

All loose stones, projecting clumps of earth, pockets of materials which might come down on the workers in the trench or any condition which is a hazard, shall be either removed or the excavated sides adequately braced and the trench suitably guarded. On steep slopes workmen shall not be permitted to work one above the other.

The contractor shall prepare the foundations at structure sites by methods which will provide firm foundation for the structures. The bottom and side slopes of common excavation upon or against which the structure is to be placed shall be finished to the prescribed dimensions and the surfaces, so prepared shall be moistened and tamped with suitable tools to form firm foundation upon or against which the structure is to be placed. The contractor shall prepare the foundation of the structures as shown on respective drawings. The horizontal foundation material beneath the required excavation shall be moistened if required and compacted in place.

If the Project Manager considers it necessary to consolidate the foundation strata by grouting cement slurry, then drilling and grouting or any other foundation treatment shall be done by the contractor as directed by the Project Manager and the payment will be as per the general contract document in respect of extra items. Densities of the compacted foundation materials and the testing thereof shall be in accordance with relevant I.S. specification.

Separate payment will not be made to the contractor for moistening and compacting the foundation of structures. The contractor shall include cost thereof in the price bid per cubic meter of the item of the bill of Quantities for foundation excavation.
When unsuitable material is encountered in the foundation for structure the Project Manager may direct additional excavation to remove the unsuitable materials. The additional excavation shall be refilled as follows. In excavation in soils, the over excavation shall be filled in by clean coarse sand and compacted.

If bad ground or loose soil is met with, the contractor, shall be responsible for reporting the fact to the Project Manager who shall issue such orders as may be necessary.

(C) OVER EXCAVATION

If at any point in common excavation the foundation material is excavated beyond the lines required to receive the structure, or if at any point in common excavation the natural foundation material is disturbed or loosened during the excavation process, it shall be compacted in place or where directed, it shall be removed and replaced as follows. In excavation in soils, the over excavation shall be filled in by clean coarse sand and compacted. Any and all excess excavation or over excavation performed by the contractor for any purpose or reason except for additional excavation as may be prescribed by the Project Manager and whether or not due to the fault of the contractor shall be at the expense of the contractor. **Filling for such excess excavation or over excavation shall be at the expense of the contractor.**

(D) DISPOSAL OF MATERIALS

All suitable materials removed in excavation of foundation or excavation of canal or as much thereof as may be needed as directed by the Project Manager shall be used in the construction of canal embankments, roadway embankments and for selected bedding material or for backfill around structure, within five km. distance from excavation site. If there is an excess of material in the excavation, it shall be used to strengthen the embankment on either side of the canal, deposited in low areas uphill of the canal to eliminate trapped drainage or otherwise wasted as directed by the Project Manager. The disposal of the excavated material shall be in accordance with clauses 8.1 and 8.2 of BIS 4701-1982.

(E) MEASUREMENT FOR PAYMENT

Foundation for structures will be measured for payment, for box cutting with **vertical sides of foundation dimensions.** The contractor will have to make his own arrangements for shoring, strutting provision of adequate slopes for the sides to prevent slips etc., and no separate charge will paid for any incidental charges arising either during excavation of foundation or construction of the structure.

The quantity for payment of excavation in soil and rock shall be arrived at by taking pre levels and finished levels at respective strata. Block levels will be taken at one meter or less intervals. The levels shall be plotted on a graph sheet and average levels arrived at for the purpose of determining the quantity of excavation. The contractor's signature in token of his acceptance shall be recorded in the cross section sheets. Final payment shall be based on levels only.

(F) PAYMENT

Payment for excavation for structures shall be made at the unit price per cubic meter bid. The rate for excavation for structures shall include the cost of all labour and materials for Coffer dam and other temporary construction, cost of all pumping and dewatering, cost of all other work necessary to maintain the excavation in good order during construction, cost of removing such temporary construction where required and shall include the cost of disposal of the excavated material.
SECTION 3.2.3 BACK FILL
3.2.3.1 BACKFILL AROUND STRUCTURES

(A) GENERAL
The item of the schedule for backfill around structures including pipe portions of structures includes all backfill required to be placed under these specifications.

(B) MATERIALS
The type of material used for backfill, the amount thereof and the manner of depositing the material shall be subject to approval of Project Manager. In so far as practicable back fill material shall be obtained from material removed in required excavations for structures. But when sufficient suitable material is not available from this source or from adjacent canal excavation, additional material shall be obtained from approved borrow areas. The borrow pit excavation shall be in accordance with clauses 9.1 to 9.3 of B.I.S. 4701-1982.

Where sand filling is specified, the sand shall be clean, free from admixture of foreign material and approved by the Project Manager before filling is commenced. Should there be a necessity to fill in a basement with sea sand, prior written approval of the Project Manager shall be obtained. Sand filling should be saturated with water before the construction is allowed to proceed.

Filling around structures shall have optimum moisture content and, well consolidated in layers of 15 Cm. by ramming with iron rammers and cut ends of crowbars. When filling reaches the finished level, the surface shall be saturated with water for at least 24 hours, allowed to dry and then rammed and consolidated to desired density in order to avoid any settlement at a later stage.

Except as otherwise provided below, backfill material to be compacted shall contain no stones larger than 80 millimeters in diameter. If the excavation for the foundations of the structure is in swelling soils, a layer of cohesive non-swelling soil conforming to B.I.S. 9451-1985 should be interposed between the swelling soil and the structure and compacted to at least 95 % standard proctor's density.

(C) PLACING BACKFILL

Back fill shall be placed to the lines and grades shown on the drawings as prescribed in this paragraph or as directed by the Project Manager.

The surface to receive the filling shall be first prepared free from all roots, vegetation or spoil and wetted.

All backfill shall be placed carefully and spread in uniform layers so that all spaces around rocks and clods will be filled. Backfill shall be brought up as uniformly as practicable on both sides of walls and all sides of structure to prevent unequal loading. Backfill shall be placed to about the same elevation on both sides of the pipe positions of the structures to prevent unequal loading and displacement of the pipe. Backfill required to be compacted shall be compacted in accordance with paragraph 3.2.3.2.

(D) STRUCTURES ON FILL

Where the original ground surface is below the base of a structure or below the bottom of pipe, all fill required for the structure foundation and all fill up to the bottom of the pipe shall be placed as compacted embankment. The embankment over the natural ground up to pipe bottom and over the pipe shall be laid in accordance with clauses 9.2.4, 9.2.5 and 9.2.6 of B.I.S. 783 code of practice for laying of concrete pipes.
(E) MEASUREMENT AND PAYMENT

The unit price bid in the bill of quantities for excavation of foundation of structure shall include cost of backfill around the structure up to ground level. No separate payment will be made for backfill of foundation.

Refill of excavation performed outside the established pay lines for excavation for structures shall be placed in the same manner specified for the adjacent backfill and such refill shall be placed at the expense of the contractor. The cost of backfill shall be included in the applicable price bid in the bill of quantities of contract for excavation of foundation of the structure for which backfill is required.

3.2.3.2 COMPACTING BACK FILL AROUND STRUCTURES

(A) GENERAL

Unless otherwise shown on the drawings backfill around structures shall be compacted. The compacting equipment shall be so selected as to give maximum safety to the structure. The compaction of backfill under or over the pipes shall be in accordance with clauses 9.2.4, 9.2.5 and 9.2.6 of I.S. 783. In the case of very high embankments, the embankments shall be built to an elevation above the top of the pipe equal to the external diameter of the pipe after which a trench shall be excavated and the pipe laid. When the backfill is placed above the pipe, the vertical surfaces of the trench above the top of the pipe shall not be more than 20 centimeters beyond the outside diameter of the pipe. After the pipe has been laid suitable backfill material shall be placed around the pipe and carefully compacted in layers, not more than 15 centimeters after compaction up to the top of the pipe. Thereafter, a loose fill of depth equal to external diameter, of the pipe shall be placed before further layers are added and compacted.

Compacted backfill should be placed in horizontal layers not exceeding 15 (Fifteen) centimeters after compaction.

Heavy stones shall neither be dropped on top of the pipe nor shall be allowed to roll down the side of the embankment against the pipe.

(B) MATERIAL AND COMPACTION

The material used for backfill to be compacted shall be selected material containing no stones larger than 80 millimeters or as approved by the Project Manager and obtained from required excavation or approved borrow pit.

3.2.3.3 MEASUREMENT AND PAYMENT

Payment for compacting backfill around structures will not be made as separate item and the unit price per Cubic meter bid therefore, in the bill of quantities for the excavation of foundation for structures is to include for compacting the backfill around the structure. The unit price bid in the bill of quantities for excavation of foundation for structure shall include the costs of furnishing water and moistening the material also.

Rate for cost of excavation of canal / excavation of foundation of structures will be paid as per BOQ in different types of classification of soil and rocks. The item rates include all costs for labour, material, T&P, machinery, equipment, consumables for the following operations.

1. Carrying out all necessary operations for setting out works, clearing, preparation of beds, removal of silt etc. described under section-2 of Technical
Specifications.

2. Excavation of canal / foundation of structures to design section with all operations described under section-3 and all operations for disposal of excavated materials within 5km range as described under section 3.3 & 3.2.2(D) including cost of dewatering, making drainage arrangement for disposal of water.

3. Cost of back filling and compaction around structures. In case of back filling with sand, the procurement cost of sand including royalties, watering & compaction of sand are included.

4. Construction of approach road, haul road, site illumination, construction of coffer dam till completion of the work and subsequent removal at appropriate time, and all mobilization and demobilization cost to complete the work.

5. Recording of photographs. Quality control works and tests. (excluding items specified in BOQ vide Bill-A).

6. Payment of all taxes, royalties, VAT etc.

7. Any other cost incidental to complete the items of work as per specification and direction of Project Manager.

8. Measurement & Payment will be made as per BOQ regardless of methods and type of equipment used for execution of the work.

SECTION 3.3 DISPOSAL OF MATERIAL

a. GENERAL

All suitable material removed in excavation or as much thereof as may be needed as determined by the Project Manager shall be used in the construction of canal embankments, roadway embankments and for selected bedding material or for back fill around structure. If there is an excess of material in the excavation for any reach, it shall be used to strengthen the embankment on either side of the canal, deposited in low areas uphill of the canal to eliminate trapped drainage or otherwise wasted as directed by the Project Manager. The disposal of an excavated material shall be in accordance with clauses 8.1 and 8.2 of I.S. 4701-1982.

When directed by the Project Manager excess material shall also be placed in low areas that may occur adjacent to bridge sites between the O&M Road ramps and the canal bank.

Material removed in excavation and not suitable or required for embankments, backfill or other required earth work, shall be deposited in waste banks on right of way owned by or controlled by the Government as directed by the Project Manager.

The soil obtained from canal cutting which is considered useful by the Project Manager shall be fully utilised for the formation of both the banks of the canal to the required profiles as shown in the drawings simultaneously with the excavation of the canal and without involving and re-handling of the earth. The soil not useful for the banks has to be thrown parallel to the bank and away from it as may be directed by the Project Manager during execution to form the spoil bank. In case of deep cutting the soil shall be so disposed off as not to result in unsightly heaps and shall be levelled and properly dressed. The top of both the finished banks shall slope away from the inner edge with a suitable gradient.
The useful rock obtained from the canal cutting shall not be mixed with other soils and shall be deposited on the outer slopes of the canal spoil bank in regular stacks. If the rock and the soil are mixed up while depositing at the spoil banks suitable deduction from the agreement rate as decided by the Project Manager shall be made which is binding on the contractor.

b. COST

The cost of disposing the excavated material shall be included in the unit price per cubic meter bid in the bill of quantities for excavation for canal.

SECTION 3.4 EMBANKMENT

3.4.1 PREPARATION OF SURFACES UNDER EMBANKMENTS

The preparation of surfaces under embankment shall be in accordance with clause 6.1 & 6.5 of I.S. 4701-1982.

Before commencing the work, the toe of the slope on each side of the Banks shall be lock-spitted (dog belled) and marked by pegs firmly driven into the ground at intervals of 15 meter, profiles made by bamboos, earth, or other convenient materials and strings shall be set up for the guidance of the workmen about 15 meters apart over straight reaches and about 7.5 meters apart at curves.

Except in areas of rock, the areas under canal embankments shall be pre-wet by sprinkling water before cleaning, grubbing or excavation operations or embankments construction begin. The moisture content shall be optimum to a depth of one meter below the original ground surface or to impervious material whichever is less, as directed by the Project Manager. Whenever possible all water shall be added uniformly in one application. Areas, on the sides of the canal banks upon which the Project Manager may direct spoil banks to be constructed will not require application of water.

The contractor is cautioned to control carefully the application of water and to check on the depth and amount of water penetration during application so as to avoid over watering, accumulation of water in depressions or excessive run off.

If at any location on embankment foundations, before and during embankment construction there is excessive moisture as determined by the Project Manager, steps shall be taken to reduce the moisture by excavating drains, by allowing adequate draining time or by any other approved means.

The contractor shall not be entitled for any additional allowance above the unit prices bid in the schedule on account of the requirement for excavating drains or allowing additional time for drying, delays or increased costs due to poor traffic ability on the embankment foundations or on the haul roads, reduced efficiency of the equipment the contractor elects to use or on account of any other operational difficulties caused by overweight wet embankment foundation or haul roads.

Where the ground surface under any embankment is not suitable as determined by the Project Manager for a foundation for the embankment, the contractor shall strip the area under the embankment of such unsuitable material to such depths as may be directed. The material so removed shall be disposed off as provided in paragraph 3.3. Separate payment for stripping unsuitable material under embankments shall not be made and the contractor should include this item under unit price rate for cubic meter bid in Bill of Quantities for excavation of canal.

Before beginning the construction of embankments the surface area of ground to be occupied shall be cleared of all roots and vegetable matter of any kind stripped to a suitable
depth. The stumps shall be pulled or otherwise removed, and the roots grubbed. The stumps and roots removed shall be suitably disposed off.

The depth to which top soil is to be removed shall be adequate to remove all perishable material and any soil which may become unstable on saturation or may interfere with development of proper bond between foundation and embankment. It is not necessary to remove all the soil containing fine hair like roots but only the rather heavy mat. The underline table may offer as a guide for lines for finding depth of stripping.

<table>
<thead>
<tr>
<th>Type of vegetable cover in the soil</th>
<th>depth of stripping</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Soil containing light grass cover</td>
<td>5.0 to 7.5 centimeters</td>
</tr>
<tr>
<td>2. Agricultural Lands</td>
<td>To bottom of ploughed zone 15.0 to 20.0 centimeters</td>
</tr>
</tbody>
</table>

The ground surface under all canal embankments excepting rock surface, where it is below the full supply level in the canal shall be scarified making open furrows not less than 20 centimeters deep below natural ground surface at intervals of not more than 1.0 (one) meter. However, where the ground surface is below the bed level of the canal the entire surface of the foundation of embankments shall be stripped to a depth of not less than 20 (Twenty) centimeters.

For **Raising, Widening & Strengthening of Existing Canal Embankment** the following additional operations has to be carried out.

After marking of slope profile on the existing canal embankment to ensure proper bonding, the side slope shall be benched (cut) to a depth of 0.30m & minimum width of 0.60m in steps where the slope is 1(v) : 4(h) and scarify the slope if the slope is flatter. The base soil sample be tested for OMC and MDD.

The bottom layer of canal embankment shall be pre-wetted by sprinkling water to reach OMC & compacted with suitable compacting equipment to achieve dry density equal to 95% of Proctor density.

**3.4.2 CONSTRUCTION OF EMBANKMENTS**

**a. GENERAL**

Canal embankment shall be constructed to top widths and side slopes as shown on the drawings duly providing 2.5% of height above the design height for settlement allowance in compacted embankment section where the minimum compaction efficiency is 95 % of proctors density & 3% of height above the design height for settlement allowance in compacted embankment section where the minimum compaction efficiency is 90 % of proctors density. The embankment shall be built to heights as directed above those shown on the drawings. The top of all the canal embankments shall be graded to be suitable for a road way in accordance with subparagraph.

Before commencing the construction work, initial levels of the ground on which banks are to be formed shall be taken. After completing the construction of embankment final cross section levels shall be taken and the volume shall be arrived at and payment shall be made to that quantity only.

From the materials deposited in embankments the cobbles, gravel and stones of size greater than 40 mm should be removed to ensure proper compaction.
In area where required excavation does not furnish suitable or adequate material for constructing embankments, material shall be obtained from areas where material in excess of that required to construct the adjacent embankment is available.

Where the original ground surface is below the grade of the canal and where construction of a fill below the bottom of the canal is prescribed such fill shall be placed as a compacted embankment. Where the original ground surface is below the base of a structure, the fill required to form a suitable foundation for the structure shall be placed as compacted embankment.

b. ROADS AND RAMPS

In conjunction with construction of canal embankments, the contractor shall construct operation and maintenance roads and earth ramps adjacent to the canal and structures where shown on the drawings. Suitable material from required excavation shall be placed as embankment for the roads and ramps. If sufficient material is not available from required excavation the Project Manager may direct excavation from borrow areas.

c. EMBANKMENTS NOT TO BE COMPACTED

Embankment not to be compacted shall be formed conforming to clause 6.6.1 to I.S 4701-1982. The material for these embankments shall have optimum moisture content before earth moving equipment is routed over the embankment. The embankments shall be built in layers not exceeding 30 (thirty) cm. in thickness. Embankments shall be built in approximately horizontal layers carried across the entire width of the embankments to the required slopes. Embankments shall not be widened with loose material dumped from the top. Embankments may be built by excavation and hauling equipment or by excavating machinery depositing the materials directly from the excavation. Embankments built by excavating and hauling equipment shall be made in horizontal layers and shall be kept as close to level as practicable. The travel over the embankments during construction shall be routed so as to distribute the compacting effect of the equipment to the best practicable advantage. Adequate settlement allowance shall have to be provided for un-compacted embankment as provided in para 3.5.8.

d. EMBANKMENT TO BE COMPACTED

The material used for compacted embankment shall be suitable materials as determined by the Project Manager and shall confirm to clause 6.4 of IS 4701-1982.

Before the materials for the 1st layer of embankment is placed, the foundation of the embankment shall be prepared as provided in paragraph 3.4.1. and shall be moistured and compacted in the manner hereinafter specified for each layer of compacted embankment to be placed thereon. The embankments shall be compacted to the elevation and to the top widths and side slopes shown on the drawings or prescribed by the Project Manager.

The layers shall be placed in rows approximately parallel to the axis of the bank. The base of embankment at every height is to be made to its full width of each zone as shown in the drawing plus offsets of not less than 0.45 metres beyond the finished profile on either side for compaction. **No payment will be made for the offsets or for the subsequent removal and unit price quoted for the banking is deemed to include this**, No additions will be allowed to the slope for full design section of the bank after the bank is raised. The embankment shall be compacted to minimum 95 % proctors density in case of new or extension of existing canal embankment where the extension width is more than 1.60m & minimum 90 % proctors density for minor canals where the extension width is less than 1.60m using pneumatic Tampers, frog rammers or vibratory plate compactor or power roller.
3.4.3 BORROW AREA.

3.4.3.1 GENERAL

(a) All materials required for the construction of embankment and backfill for cut-off trench and around the structures which are not available from canal excavation, excavation for structure or from excavation of other ancillary works shall be obtained from the borrow areas after approval by the Project Manager in consultation with field laboratory. The depth of cut in all borrow areas shall be designated by the Project Manager and the cuts shall be made up to such designated depths only. Shallow cut will be permitted in the borrow areas. Each approved borrow area shall be fully exploited before switching over to the next approved borrow area. Haphazard exploitation of borrow pits shall not be permitted. The type of equipment used and the operations in the excavation of materials in borrow areas shall be such as to produce the required uniformity of the mixture of materials for the embankment. The Contractor has to arrange/procure borrow areas at his own cost. No compensation whatsoever for change in limits and locations of the borrow areas and depth of cut for getting suitable earth shall be paid to the contractor. No borrow pits shall be dug within 5m of the toe of the embankment, if their depth is less than 0.5m, and 10m, if their depth is more than 0.5m; or within such a distance from the toe of the bank where a 4:1 hydraulic gradient line cuts the ground surface, whichever is more as per IS :4701-1982 page 15. Borrow pits shall be drained to avoid stagnation of water and the bottom level of borrow pits should be fixed with reference to the prevailing ground slope towards the nearest natural drainage course.

(b) Where earth is transported from canal or from borrow area for deposit in canal embankment or disposed off on stock piles, or waste banks, the leads shall be measured as horizontal distance between the vertical central lines of the pit cross-sections and the bank which is formed with the excavated earth.

3.4.3.2 PREPARATION OF BORROW AREAS

All areas required for borrowing earth for embankment shall be cleared of all tree stumps, roots, bushes, rubbish and other objectionable materials. Adequate lighting arrangement should be provided by the contractor.

Particular care shall be taken to exclude all organic matter from the materials to be placed in the embankment. All cleared organic materials shall be burnt to ashes or disposed of as directed. The cleared areas shall be maintained free of vegetable growth during the progress of the work. No payment shall be admissible for preparation of the borrow areas indicated above as this is deemed to have been included in unit bid price of earthwork in the bill of quantities.

3.4.3.3 STRIPPING OF BORROW AREAS.

Borrow areas shall be stripped of top soil, sod and any other objectionable materials to the required depth as directed by Project Manager. The work may be done manually or with suitable machine. Stripping operations shall be limited only to designated borrow areas. Materials from stripping shall be disposed of in exhausted borrow areas or in the approved adjacent areas as directed. No extra payment shall be admissible for stripping the borrow areas as this is deemed to have been included in the unit bid price for earthwork in the bill of quantities.
3.4.3.4 BORROW AREA WATERING / DEWATERING

(a) Borrow area watering shall be done by the contractor at his own cost wherever necessary preferably 48 hours in advance, so that materials may be carried with adequate moisture and in the manner specified by the Project Manager.

(b) The initial moisture content of the material in the borrow areas shall be estimated with the help of field laboratory tests. The optimum moisture content required for the material in any particular borrow area shall be obtained from the field laboratory. The additional moisture requirements as determined by the laboratory test shall be introduced into the borrow areas by watering well in advance of the excavation to ensure uniformity of moisture content. All care shall be taken to reduce excessive moisture in any of the locations of a borrow area before or during excavation to secure the materials with moisture content close to the optimum. To avoid formation of pools in the borrow areas during excavation operation, drainage ditches from borrow areas to suitable outlets shall be excavated, wherever necessary. Upon exhausting of all materials or abandoning the borrow areas, the pits shall be fully drained to ensure no ponding of water.

3.4.3.5 HAUL ROADS AND APPROACH ROADS.

Construction and maintenance of approach roads, and haulage roads will be the responsibility of the contractor. The Department will have full right of way to those roads for inspection purposes. Proper road sign as directed have to be provided for safety. For haulage of earth, the contractor shall construct ramps and haul roads of sufficient width along the shortest but most practicable route and shall maintain and illuminate them to a satisfactory manner. Watering of the haul road shall be done by the contractor as often as necessary to prevent raising of dust, formation of cuts and consequent deterioration of the surface. Whenever service roads meant for public road traverse through or run close to the borrow area, the contractor shall direct the excavation and haulage operation in such a manner as to ensure uninterrupted use of the service road and safety to the public. At the haul road and service road crossing, the contractor shall install necessary check gates and road signs.

No extra payment is admissible as this is deemed to have been included in the unit bid price for earthwork in the bill of quantities being contingent to the main work.

3.4.4 EARTHFILL MATERIAL.

Canal embankment shall be constructed to the top width and side slopes as shown on the drawings. Suitable excavated material available from the canal cutting, proud cutting, removal of ramps and excavation for structures shall be used for construction of banks.

If suitable and adequate material for constructing embankment is not available from excavations, the desired material shall be obtained from borrow area **arrange/procure by Contractor** for the purpose & approved by the Project Manager. Suitability of earth fill shall be decided by analysis of Laboratory test result of soil from canal cutting & borrow pits by Project Manager.

The following Laboratory test shall be conducted on soil obtained from canal excavation & from borrow pits for determination of suitability,

1. Grain size Analysis in accordance with IS 2720 part- 4
2. Liquid Limit & plastic limit in accordance with IS 2720 part- 5
The planning for execution should be such that all the useful excavated materials are utilised in embankment prior to utilisation of borrow earth from outside. The embankment earth shall be borrowed only after getting written instruction of the Project Manager.

Only suitable materials as per specification shall be excavated, loaded and conveyed to the point of placement in the embankment. Unsuitable material if conveyed shall be removed and disposed clear of the work site as directed by the Project Manager at the cost of the contractor.

3.4.5 PLACING EARTHFILL.

(a) The embankment shall be constructed with earth fill of required materials as per drawing and specification. The fill shall be free from lenses, pockets, streaks or layer of materials differing substantially in texture or gradation from the surrounding materials. The useful excavated materials shall be classified as ‘impervious’ and ‘semi pervious’ by the Project Manager. Care shall be taken to utilize the impervious materials towards the water side of the embankment and semi pervious materials towards outer zone of the embankment as per drawing.

(b) Construction of embankment shall begin at the toe of the fill and in no case shall embankment be widened by material dumped from the top. The material shall be placed in the earth fill in the continuous horizontal layers not more than 15 Cm. in thickness after being rolled as herein specified.

The thickness of the layer shall be adjusted by the Project Manager; if the contractor satisfies the Department that the particular type of compactors used by him give the required density by carrying out trial compaction and requisite tests. Initially the earth in the embankment fill shall be laid in a greater width than the designed section. Adequate extra width of about 0.45 M. on either side of the embankment shall be provided so that the earth fill, up to lines of the finished slopes, shall have the required compaction as per the drawing and specification. Such extra width shall be removed and utilized in the upper layers of embankment along with slope dressing, for which no additional payment shall be made as it is deemed to have been included in bid price of earthwork in embankment in the bill of quantities.

(c) No fresh layer shall be laid until the previous layer is properly watered and compacted as per the requirement. If in the opinion of the Project Manager, the surface of i.e. prepared foundation or the rolled surface of any layer of earth fill is too dry or smooth to bound properly with the layer of materials to be placed thereon, it shall be moistened or worked with harrow, scarifier or other suitable equipment in an approved manner to a sufficient depth to provide a satisfactory bonding surface before the next succeeding layer of earth fill materials is placed. If the rolled surface of any earth fill is found to be too wet for proper compaction of the layer of earth fill materials to be placed thereon, it shall be raked up and allowed to dry or be worked with harrow, scarifier or any other suitable equipment to reduce the moisture content to the required amount and then it shall be compacted before the next succeeding layer of earth fill materials is placed.

(d) The materials shall be deposited in rows parallel to the axis and spread in the uniform layers and clods shall be broken maximum up to 5 cm. The work of spreading and compaction shall be so adjusted as not to interfere with each other and in such a way that neither of the operations is held up because of non-completion of rolling and watering. The excavation and placing operation shall be such that the material when compacted shall be blended sufficiently to secure the best practicable degree of compaction, impermeability and stability. The surface of banking shall at all time of construction be maintained true to required cross section.
(e) During construction a small transverse slope from center towards edges should be given to avoid pools of water forming due to rains.

(f) When compacting the soil against the rock abutment or walls of masonry or concrete structures, the construction surface of the embankment shall be sloped away from the rock or masonry or concrete structures leaving a minimum distance of 0.6 M. and at an inclination of 3:1. If the foundation surface is too irregular to allow the use of large roller directly against the structure or rock out crop, the roller shall be used to compact the soil, as close to the structure or the out crop as possible and the portion of the embankment directly against the rock or the structure shall be compacted with pneumatic hand tampers in thin layers. The moisture content of the earth fill placed against the rock or the structure shall be slightly above the optimum to allow it to be compacted in to all irregularities of the rock and this shall be determined by the field laboratory. In placing the earth-fill under rock foundation, the foundation shall first be prepared as detailed earlier.

3.4.6 WEATHER CONDITIONS

Embankment materials shall be placed only when the weather conditions are satisfactory to permit accurate control of the moisture content in the embankment materials. Before closing work on embankment, in any continuous reach prior to setting of monsoon, the top surface shall be graded and rolled with a smooth wheeled roller to facilitate run off. Prior to resuming work, the top surface shall be scarified and moistened or allowed to dry as necessary and approved by the Project Manager for resumption.

The contractor shall provide suitable protection works to protect the slope from erosion due to rain water. No payment what-so-ever shall be made for providing such protection work and rectifying the monsoon damages.

3.4.7 MOISTURE CONTROL.

The water content of the earth fill material prior to and during compaction shall be distributed uniformly throughout each layer of materials and it shall be between -2% to +2% of the optimum moisture content. Moisture determination of soil as well as needle moisture determination of soil shall be carried out as per I.S. 2720-1983.

Laboratory investigations may impose some restriction on the lower limits of the practicable moisture contents on the basis of studies on consolidation characteristics of soil in embankment. Here-in-after, the term range of optimum practicable moisture content shall refer to the value as described above. As far as practicable, the material shall be brought to the proper moisture content in the borrow area before excavation. If additional moisture is required it shall be added preferably at the borrow area, and only in limited cases / extent, if required, on the embankment by sprinkling water before rolling of a layer. If more moisture is present than required, the material shall be spread and allowed to dry before starting rolling. Moisture control shall be strictly adhered to. The moisture content shall be relatively uniform throughout the layer of material. If necessary, ploughing, disc-harrowing or blending with other materials may have to be resorted to obtain uniform moisture distribution, if the moisture content is more or less than the range of optimum practicable moisture content, or if it is not uniformly distributed throughout the layer, rolling and adding of further layer shall be stopped. Further work shall be started again only when the above conditions are satisfied.
In order to have proper control of moisture content in the earth fill, no earth work shall be done during rainy days. No compensation shall be made to the contractor due to held up of work for rain or fog.

3.4.8 MEASUREMENT AND PAYMENT

The rate for construction of canal embankment with selected earth from borrow area shall include all costs for labour, material, T&P, machinery, equipment and consumables required for the followings:

1. Carrying out all necessary operations for setting out works, clearing, preparation of beds, removal of silt etc. described under section-2 of Technical Specifications.
2. Preparation of surface under embankment as specified under section-3.4.1 of the Specification, benching of old canal embankment and pre-wetting of canal prism.
3. Arrangement of borrow area and stripping of borrow area including watering and dewatering as per Sec.3.4.3 of the Specification.
4. Operations involved in construction of embankment as per Sec.3.4.2 of the Specification.
5. Construction and maintenance of approach road, haul road (including water sprinkling for dust suppression), site illumination, construction of coffer dam till completion of the work and subsequent removal at appropriate time, and all mobilization and demobilization cost to complete the above operations.
6. Settlement allowance provided as per Sec.3.5.8 of the specification.
7. Recording of photographs, quality control works and tests (excluding items specified in BOQ vide Bill-A).
8. Payment of all taxes, royalties, GST (as applicable from time to time) etc.
9. Any other incidental cost to complete the items of work as per specification and direction of Project Manager.
10. Measurement shall be limited to designed section & Payment shall be made as per BOQ regardless of methods and type of equipment used for execution of the work.
11. For all embankments, where turfing has been provided for slope protection, full payment for Earthwork shall be made only after completion of turfing. Until completion of turfing, 5% of earthwork quantity executed by the Contractor shall be with held.

SECTION 3.5 COMPACTING EARTH MATERIALS

3.5.1 GENERAL

Where compaction of earth materials are required, the materials shall be deposited in horizontal layers and compacted as specified in this paragraph. The excavation, placing moistening and compacting operations shall be such that the materials will be uniformly
compacted to the required density throughout the required section, and will be homogeneous, free from lenses, pockets, streaks, voids, laminations or other imperfections.

Having decided on the filling materials to be used standard compaction test in accordance with IS 2720 part-7 will be conducted in the Laboratory for determination of Optimum Moisture Content & Maximum Dry Density on the materials proposed for embankment to indicate best type of equipment to be used and the moisture content at which compaction should be done, thickness of layer and number of passes etc.

Since the canals of sub-projects of OIIAWMIP will be used for carrying water for Khariff Irrigation every year, all embankment shall be compacted by any approved method of compaction.

### 3.5.2 COMPACTING CLAY AND SILTY MATERIALS

Where compaction of earth materials containing appreciable amount of clay or silt is required the compaction shall be carried out in accordance with clause 6.6. of I.S. 4701-1982. The materials shall be deposited in horizontal layers. The thickness of each horizontal layer before compaction shall not be more than 25 centimeters (loose layer) and the layer shall be to full width of the embankment. The excavating and placing operation shall be such that the materials when compacted will be blended sufficiently to secure the highest practicable density and best impermeability and stability. If the surface of any compacted layer of earth fill is too dry or too smooth to bond properly with the layer of material to be placed thereon, it shall be moistened and/or scarified in an approved manner to provide a satisfactory bonding surface before the next succeeding layer is placed. All the rollers used on any one layer of fill shall be of the same type and same weight.

Prior to and during compaction operations, the embankment materials shall possess optimum moisture content as required in clause 6.6.4 of I.S. 4701 -1982. The embankment materials shall have optimum moisture content required for the purpose of compaction and this moisture content shall be fairly uniform throughout the layer. In so far as practicable the moistening of the material shall be performed at the site of excavation but such moistening shall be supplemented as required by sprinkling water at the site of compaction, if necessary. If the moisture content is greater than optimum for compaction, the compaction operations shall be delayed until such time as the material has dried to the optimum moisture content or to the level directed by Project Manager. The moisture content of soils shall be determined in accordance with I.S. 2720 (Part - III) 1982.

Where hand or power tampers are used to compact soils in confined areas such as under pipes and at the joints of bank connections with the structures, they shall be equipped with suitably shaped heads to obtain the required density.

The dry bulk density of the soil portion in compacted embankment materials shall be not less than 95% of the maximum dry bulk density at optimum moisture content obtained in accordance with I.S.2720 (Part - VII) 1980 Indian Code of Practice for determination of moisture content, dry density relation using light compaction in case of new or extension of existing canal embankment where the extension width is more than 1.60m. & minimum 90% of the maximum dry bulk density at optimum moisture content, for minor canals where the extension width is less than 1.60m.

The dry density of soil in field shall be determined in accordance with I.S. 2720 (Part - XXVIII) 1974. Indian Code of Practice for determination of dry density of soil in place by sand replacement or by I.S. 2720 (Part - XXIX) 1975 Indian Code of Practice for determination of dry density of soils in place by the core cutter method.
Moisture content of soil shall be determined in accordance with I.S. 2720 (Part - II) 1973 Indian Code of Practice for determination of moisture content.

The optimum moisture content is the moisture content that corresponds to the laboratory maximum dry density determined in accordance with I.S. 2720 (Part - VII) 1973.

The above compaction tests will be conducted by contractor in the presence of departmental officers and the contractor shall ensure compaction, till the Project Manager or his authorised representative is satisfied that the maximum dry density at optimum moisture content is obtained, and permits the laying of next layer.

3.5.3 COMPACTING COHESIONLESS MATERIALS

Where compaction of cohesion less, free draining materials, such as sands and gravels is required, the materials shall be deposited in horizontal layers and compacted in accordance with I.S 4701-1982. The excavating and placing operation shall be such that the materials when compacted will be blended sufficiently to secure the best practicable degree of compaction and stability. Water shall be added to the materials as may be required to obtain the specified density by method of compaction being used.

The thickness of the embankment layer shall not exceed 25 centimeters (loose layer) before compaction and it should be spread over the full width of the embankment and compaction shall be done by tampers or crawler tractors or vibrating rollers. If the compaction is performed by Treads of crawler type tractor, surface vibrators or similar equipment the thickness of the layer before compaction shall not be more than 30 centimeters. If compaction is performed by internal vibrators the thickness of the layer shall not be more than the penetrating depth of the vibrator.

All compaction tests as indicated in Para 3.5.2 above shall be conducted in accordance with relevant I.S. Code of Practice. The relative density of the compacted material shall not be less than 70 % when tested in accordance with I.S. 2720 (Part - XIV) 1983 Indian Code of Practice for determination of density Index (relative density) of cohesion less soils.

3.5.4 COMPACTING COHESIONLESS MATERIALS CONTAINING CLAY AND SILT

This sub-paragraph applies only to cohesion less materials and not to cohesive materials. Cohesion less materials containing clay and silt may not be free draining. When compaction of cohesion less materials containing clay and silt is required, the materials shall be compacted to a dry density in accordance with either sub-paragraph (i) and (ii) below, using whichever test that results in higher dry density of the compacted material in the placement.

(i) Dry density determined using procedure enunciated in I.S. 2720 (Part - VII) 1965 (Indian Code of Practice for determination of moisture content dry density relation using light compaction):-Prior to and during compaction operation the material shall possess optimum moisture content as determined in accordance with clause 6.6.4 of I.S. 4701-1982 and the moisture content shall be uniform throughout each layer. Provided that the moisture content is ensured as required in clause 6.6.4 of I.S. 4701-1982, the dry density of the soil portion in the compacted material shall not be less than 95 % of the laboratory maximum soil dry density. The field dry density shall be determined in accordance with I.S. 2720 (Part - XXVIII) 1974 or I.S. 2720 (Part - XXIX) 1975.

(ii) Dry density using the relative density test as described in I.S. 2720 (Part - XIV) 1 983 Indian Code of Practice for determination of density Index (relative density) of cohesion less soils: - The relative density of the compacted material obtained shall be not less than 70 %, determined in accordance with I.S. 4701-1982, the moisture content shall be maintained as per clause 6.6.4 of I.S. 4701-1982.

3.5.5 ROLLERS AND OTHER COMPACTING EQUIPMENT

The earth compacting equipment may be used for compacting the soils as detailed in Appendix-C of IS-4701:1982:
The compacting equipment shall confirm to relevant Indian specification below:

2. Sheep Foot roller should conform to I.S. 4616-1968.
5. Vibratory roller should conform to I.S. 5500-1977.

The methods of compaction shall conform to clauses 7 of I.S. 4701-1995,

A. **Rolling:**

When each layer of material has been prepared to have the proper moisture content uniformly distributed throughout the material, it shall be compacted by passing the tamping roller. The exact number of passes for each layer to obtain specific density shall be designated by Field Laboratory tests and tests conducted on the borrowed material. The layers shall be compacted in strips over lapping not less than 0.6 M. Rolling shall commence at edges and progress towards center longitudinally. The rollers of loaded vehicles shall travel in a direction parallel to the axis of the canal. Turns should be made carefully to ensure uniform compaction. Rollers shall always be pulled.

3.5.6 **TAMPING**

Rollers will not be permitted to operate within one meter of concrete and masonry structures. In the following locations where compaction of the earth fill materials by means of roller is impracticable or undesirable the earth fill shall be specially compacted as specified further below.

(i) Portions of the earth fill in embankment adjacent to masonry structures and embankment foundations designated on the drawing as specially compacted earth fill.

(ii) Earth fill in embankment adjacent to steep abutments

(iii) Earth fill at specially designated locations.

Earth fill for tamping shall be spread in layers of not more than 10 (ten) cm in thickness when loose and shall be moistened to have the required moisture content, as specified. When each layer of materials has been conditioned to have the required moisture content, it shall be compacted to the specified density by special rollers, pneumatic/hand tampers or by other approved methods. The moisture control and compaction shall be equivalent to that obtained in the earth fill actually placed in the embankment in accordance with the specifications.

3.5.7 **TESTING**

Density tests shall be carried out after rolling to ascertain the state of compaction which should be measured in terms of dry density. Standard proctor density tests shall be carried out at regular intervals to account for variations in the borrow area material. Not less than three tests shall be conducted to indicate variation in the standard proctor density attained in the laboratory.

Density test shall be conducted from time to time at site to ascertain whether compaction is attained as specified. For every 300 cum of compacted earth fill for new or extension of existing canal bank of large width & 200 cum for minor Canals where extension of bank is of small width, at least one field density test (sample from three pits) shall be conducted. However,
minimum four density tests shall be made per day irrespective of quantity of earth work. In case the tests show that the specified densities are not attained, suitable action shall be taken either by moisture correction or by additional rolling, so as to obtain the specified density which shall be checked again by taking fresh tests at the same locations. The test locations should be so chosen as to represent the whole layer under test. Each layer should be tested for proper compaction before a fresh layer is allowed over it.

The density to be attained after compaction should be at least 95% of Proctor density pre-determined by Laboratory tests in case of new or extension of existing canal embankment where the extension width is more than 1.60m. & 90% of Proctor density for minor canals where the extension width is less than 1.60m.

3.5.8 SETTLEMENT ALLOWANCE:

During execution, the profile of each section is to be given keeping in view the extra earthwork necessary for settlement allowance, and after measurement of the final section, the settlement allowance is to be deducted from the final quantity as per guideline of Chief Engineer (D&R) vide his letter no. 6125 (WE), dated: 18.12.2001.

The Settlement Allowance as per above guideline are as under.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Type of compaction</th>
<th>Measurement taken before rainy season</th>
<th>Measurement taken after rainy season</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Compaction with HRR/ PRR not in OMC conditions. (a) Ordinary Soil</td>
<td>25%</td>
<td>10%</td>
<td>Whenever watering will be required, separate analysis will be made for payment.</td>
</tr>
</tbody>
</table>

In the mechanically compacted earth fill, settlement allowance of 2.5% of height for settlement allowance in compacted embankment section where the minimum compaction efficiency is 95% of proctor’s density & 3% of height in compacted embankment section where the minimum compaction efficiency is 90 % of proctor’s density should be provided.

Accordingly extra height should be provided taking the settlement into account. The base width of the embankment shall not be increased to maintain the design slopes indicated in the drawings for additional height as settlement allowance, but the following procedure shall be adopted.

Settlement allowance shall be calculated at various levels and the elevation including settlement allowance shall be derived keeping the embankment width at the designated levels unchanged. The edges of the embankment at the increased elevations (including settlement) when joined with the point where the slope has changed earlier below, shall give the slope to be adopted for construction.

3.5.9 SLOPE DRESSING

The slopes of particular reach of the canal which has been completed in the manner described earlier shall be dressed neatly to the designed line and grade. Extra earth work done at sides are to be dressed and reused in the embankment.

3.5.10 MEASUREMENT AND PAYMENTS

The costs of the compacting earth materials as described in this paragraph shall be paid in the price bid in the bill of quantities for watering and compacting earth work in canal embankment under these specifications. The unit rate of this item shall be for unit
volume of earth fill watered and compacted which includes all costs of labour, T&P, equipment, machinery and consumables for the following operations.
1. Compacting earth materials as per Sec.3.5 of specification.

2. Moisture control at borrow area and at placement site.

3. Testing and Quality Control operations.

4. Any other incidental expenditure to complete the item of work in finished shape as per the specification and direction of the Project Manager.

5. Measurement & Payment will be made as per BOQ regardless of methods and type of equipment used for execution of the work.

SECTION 3.6 SLOPE PROTECTION

3.6.1 ROUGH STONE DRY PACKING FOR APRONS AND REVETMENTS

1. The bed or slopes to receive the packing shall first be prepared as specified and passed by the Project Manager.

2. After bed/ slope preparation, filter materials such as sand/moorum and over this 40mm downwards coarse aggregate of such thickness as per approved drawing shall be provided. The quality of aggregate moorum/sand shall be as mentioned in other section of this specification.

3. The size of the stone to be used for dry stone revetment should be of approved size (usually not less than 225mm to 300mm in any direction) and usually not less than 40kg to 50kg weight per stone. The stone shall be perfectly sound, as regular in shape as possible free from cracks and decay and with their lengths equal to the thickness of the required apron or revetments and each stone shall not be less in size than 0.05 cubic meter unless otherwise specified. The smaller size stones required for filling in interstice and wedging shall only be supplied to the actual requirements for the work as defined in clause (4) below and shall not be used in 2 or 3 layers as a substitute for the full thickness stone specified in clause (3) below. The stone shall be obtained from the quarry specified.

4. The stones shall be laid closely in position on the prepared bed and firmly set with their broadest end downwards. The stones shall be laid breaking joint so far as possible in the direction of the flow of water. The stones are to be placed perpendicular to the finished surface i.e., perpendicular to the slope for revetments.

5. Interstices between adjacent stones shall be filled in with stones of the proper size, well driven in with crowbars to ensure tight packing and complete filling of all interstices. Such filling shall be carried on simultaneously with the placing in position of large stones and shall in no case be permitted to fall behind. The final wedging shall be done only after obtaining the orders of the Project Manager. The final wedging shall be done with the largest sized chip practicable, each chip being well driven home with a hammer so that no chip is possible of being picked up or removed by hand.

6. Profiles of strings and pegs are to be put up to ensure that the pitching is done true, straight and to the proper slope throughout and revetments are in all cases to be built up from the foot of the bund to be riveted. Care is necessary that a strong toe wall or other protection is always given to the revetment which protective measures shall be shown on the plans.
7. On completion, the surfaces presented by the apron or revetment shall be even throughout, free from irregularities to the required length, breadth and slope as specified or shown on the plans.

3.6.2 MEASUREMENT AND PAYMENT
Measurement and payment for rough stone dry packing for apron and revetment will be in the units of cubic meters.

The rate provided in BOQ for rough stone dry packing include all costs for labour, material, T & P, machineries equipment and consumables required for completing the following operations as per specification.

(a) Clearing and Preparation of Bed and Slope of Canal,
(b) Procurement of rough stone/ Laterite Stone, sand/moorum, course aggregate at work site.
(c) Laying of filter materials to approved thickness
(d) Laying of stone to approved thickness
(e) All taxes, royalties, GST (as applicable from time to time).
(f) Construction of approach road, haul road, site illumination, construction of coffer dam till completion of the work and subsequent removal at appropriate time, and all mobilization and demobilization cost to complete the above operations.
(g) Recording of photographs. Quality control works and tests. (excluding items specified in BOQ vide Bill-A).
(h) Any other incidental cost to complete the items of work as per specification and direction of Project Manager.

SECTION 3.7 TURFING
Slope protection of canal embankment will be done with turfing where stone packing is not provided the sequence of work is described below.

1) The slope to receive turfing shall first be prepared to proper line and passed by Project Manager.

2) Before the turf is laid, the slope shall be saturated with sprinkling of water. Care is to be taken to see that the soil particles on slope are not eroded or disturbed due to excessive application of water.

3) Over saturated slope grass sods is to be laid and compacted with a light wooden compactor in order to make the roots of grass in full contact with soil.

4) After the grass is laid and compacted, watering with water sprinkler is to be done repeating several times a day till survival of sods and development of green turf slope.

3.7.1 MEASUREMENT AND PAYMENT
The measurement of turfing will be recorded in sq met. of turf area after survival of sods and this includes all costs for labour, material, T & P machineries equipment and consumables required for completing a) Preparation of Slope b) Procurement of grass sods at work site c) laying and compacting grass d) watering till survival of sods e) Any other incidental expenditure to complete the work as per specification and direction of Project Manager.
SECTION (4)
CONCRETE WORKS

SECTION 4.1 CONCRETE IN STRUCTURES

4.1.1 GENERAL

The items in the BOQ for concrete in the structures includes all cast-in-place concrete in the structure.

Cast-in-place concrete for the structures shall confirm to the requirement of section 4.2. Pipe and fittings, miscellaneous metal work, mechanical and electrical equipment and other items forming a part of the structures are provided for elsewhere in these specification.

The structures shall be built to the lines, grades and dimensions shown on the drawings. The dimensions of each structure as shown on the drawings will be subject to such modifications as may be found necessary by the Project Manager to adopt the structure to the conditions disclosed by the excavation or to meet other conditions. Where the thickness of any portion of a concrete structure is variable it shall vary uniformly between the dimensions shown. Where necessary, as determined by the Project Manager, the contractor shall be furnished additional detail drawings of the structures to be constructed. The contractor will not be entitled to any additional allowances above the price bid in the bill of quantities by reason of the dimensions fixed by the Project Manager or by reasons of any modifications or extension of a minor character to adopt a structure at site, as determined by the Project Manager.

The cost of furnishing all materials and performing all work for installing timber, metal and other accessories for which specific price are not provided in the BOQ, shall be included in the applicable prices bid in the BOQ for the work to which such items are appurtenant.

SECTION 4.2 GENERAL CONCRETE REQUIREMENTS

4.2.1 COMPOSITION

A. GENERAL

Concrete shall be composed of cement, sand, coarse aggregate, water admixtures (if any) as specified and all well mixed in batching & mixing plant by weight or by concrete mixture by volume / weight and brought to the proper consistency. Batching plant shall conform to I.S code No. 4925. For works in which water tightness is required the specification in IS 3370 shall be applied.

MIXING

Concrete shall be mixed in a mechanical mixer and shall be as dense as possible, plastic enough to consolidate well and stiff enough to stay in place on the slopes. Mixing shall be continued until there is a uniform mixing of the materials and the concrete is uniform in colour and consistency. The time of mixing shall be as shown in IS 457.

B. NOMINAL MAXIMUM SIZE OF AGGREGATES

For sizes of aggregates IS 383 shall apply. The coarse aggregate to be used in concrete shall be as large as practicable, consistent with required strength, spacing of reinforcement and embedded items, and placement thickness. The size of the coarse aggregates to be used will be determined by the Project Manager and may vary incrementally according to the conditions encountered in each concrete placement. Nominal maximum size of aggregate for concrete in
structures and canal lining shall be as indicated in the relevant drawings appended to the contract documents. Smaller coarse aggregate than specified shall be used where in the opinion of the Project Manager that proper placement of concrete is impracticable with the size of the aggregate specified in the drawings.

C. MIX PROPORTIONS

Grades of concrete to be used shall be as per the specification in the approved drawing. The proportions of various ingredients to be used in the strength based concrete for different items of the work are to be determined from mix design. In volume proportion of concrete; the quantity of both cement and aggregate should be determined by volume. Water shall be either measured by volume in calibrate tanks or weighed. Batching plant shall conform I.S 4925. {Indian Standard Specification for batching and mixing plant). All measuring equipment shall be maintained in a clean serviceable condition and their accuracy periodically checked. The acceptance or rejection of concrete shall be as per the acceptance criteria laid down in clause 16 of I.S. 456-2000.

The net water cement ratio exclusive of water absorbed by the aggregate shall be sufficiently low to provide adequate durability in concrete. The water cement ratio for various grades of concrete shall be as determined and ordered by the Project Engineer.

D. CONSTITUENTS:

The slump of concrete at the placement shall be governed by IS: 456-2000:

If the specified slump is exceeded at the placement, the concrete is unacceptable. The Project Manager reserves the right to require lesser slump whenever concrete of such lesser slump can be consolidated readily into place by means of vibration specified by the Project Manager. To maintain concrete at proper consistency, the amount of water and sand batched for concrete shall be adjusted to compensate for any variation in the moisture content or grading of the aggregates as they enter the mixer. Addition of water to compensate for stiffening of the concrete after mixing but before placing will not be permitted. Uniformity in concrete consistency from batch to batch shall be maintained.

4.2.2 CONCRETE QUALITY CONTROL MEASURES AND CONCRETE QUALITY ASSURANCE TEST PROGRAMME

A. CONCRETE QUALITY CONTROL MEASURES

The contractor shall be responsible for providing quality concrete to ensure compliance of the contract requirements.

B. TESTS & FREQUENCY

1. MIX DESIGN

The contractor shall conduct Mix Design in government Testing Laboratory for different grade of concrete in accordance with I.S.10262 for each grade of concrete prior to commencement of work. The frequency of mix Design shall be for change of Material source & type & brand of cement.

2. WORKABILITY (SLUMP) TEST

The contractor shall conduct Workability (slump) test in accordance with I.S. 1199. The frequency of test shall be, one test for each structure site, daily/sift of concrete laying for each grade of concrete

3. CASTING OF CONCRETE CUBE & COMRESSIVE STRENGTH TEST

Making and curing concrete test specimens in the field, transporting to the laboratory and testing concrete specimen shall confirm to relevant clauses of I.S. 516.

Testing of concrete shall be carried out by the Contractor on representative samples taken at the site of laying concrete.
SAMPLING PROCEDURE AND FREQUENCY

A random sampling procedure shall be adopted to ensure that each concrete batch has a reasonable chance of being tested, i.e., the sampling should be spread over the entire period of concreting and should cover all mixing units.

The test procedures shall be in accordance with I.S. 1199 & minimum frequency of sampling of concrete of each grade shall be in accordance with the I.S. 456-2000. The details described, below.

For each Major Structure-site one set, - (6nos). 3nos for 7day & 3nos for 28days strength test. For minor structure- one set- 3nos, daily/sift of concrete laying for each grade of concrete

Up to 5 cum. – 1 set... up to 15 cum – 2 sets up to 30 cum. – 3 set up to 50 cum – 4 sets, above 50 cum – one additional sample for each additional 50 cum or part thereof.

TEST SPECIMEN

Three test specimens shall be made from each sample for testing at 28 days. Additional cubes may be required for various purposes, such as to determine the strength of concrete at 7 days or at the time of striking formwork, or to determine the duration of curing or to check the testing cubes cured by accelerated methods as described in I.S. 9013. The specimen shall be tested as described in I.S. 516.

TEST STRENGTH OF SAMPLES

a) The test strength of the sample shall be the average of three specimens. Individual variation shall not be more than 15 percent of the average as per clause 15.4 of I.S. 456 - 2000

b) Testing shall be carried out at the testing laboratories set up at the site or at any other laboratory that the Project Manager may decide upon and the results given thereby shall be considered as correct and authentic and acceptable to the Contractor.

ACCEPTANCE CRITERIA

Acceptance criteria will be as per clause 15, 16 and clause 17 of I.S. 456-2000.

4.2.3 CEMENT

A. QUALITY

Cement shall confirm to any of type, I.S. 269, I.S. 1489, I.S. 455, I.S. 8112 & I.S. 12269 out of all type of cement described in clause 5 of I.S. 456-2000 for the purposes of specifications. Cement used shall be with prior approval of the Project Manager.

The provisions of this paragraph apply to cement for use in cast-in-place concrete required under these specifications.

The contractor shall make his own arrangements for the procurement of cement to specifications required for the works. Transportation from the place of supplying to the batching plant shall be in any weather tight means which will protect the cement completely from exposure to moisture. Each shipment of bagged cement shall be stored separately so that it may readily be distinguished from other shipment and shall be stored in a dry enclosed area protected from moisture. Storage of materials shall be as described in I.S. 4082 (I.S.}
recommendation on stacking and storage of construction materials at site). To prevent under aging of bagged cement after delivery, the contractor shall use bags of cement in the chronological order in which they were delivered to the job site. All storage facilities shall be subject to approval of the Project Manager.

B. TESTS & FREQUENCY
   Cement shall be tested for the following parameters,

1. CONSISTENCY & SETTING TIME:
   The test procedure shall be in accordance with the I.S. 4031 part-4 & 5 & the frequency is one test per each type & brand of cement.

2. FINENESS:
   The test procedure shall be in accordance with the I.S. 4031 part-2 & the frequency is one test per each type & brand of cement.

3. SOUNDNESS
   The test procedure shall be in accordance with the I.S. 4031 part-3 & the frequency is one test per each type & brand of cement.

4. COMpressive strength:
   The test procedure shall be in accordance with the I.S. 4031 part-6 & the frequency is one test per each type & brand of cement.

4.2.4 ADMIXTURES
   The contractor shall use Air entraining agents & other admixtures as directed by the Project Manager. Admixtures shall be of uniform consistency and quality and shall be maintained at the job site at uniform strength of solution. Admixtures shall be batched separately in liquid form in containers capable of measuring at one time the full quantity of each admixture required for each batch. Chemical admixtures which harm the quality and strength of concrete shall not be used in the concrete.

   Admixtures to be used in concrete shall confirm to I.S. 9103-1979 Indian Standard Specifications for admixtures for concrete.

4.2.5 WATER
   The water used in making and curing of concrete, mortar and grout shall be free from objectionable quantities of silt, organic matter, injurious amounts of oils, acids, salts and other impurities etc. as per I.S. specification No. 456-2000.

4.2.6 SAND (FINE AGGREGATE)

A. GENERAL
   Sand shall be from approved sources of natural deposit and must be free from silt, organic impurities and other deleterious materials as per I.S. 383 & I.S. 2386.

   Sand as collected for concrete, shall have a uniform and stable moisture content. Determination of moisture content shall be made as frequently as possible, the frequency for a given job being determined by the Project Manager according to weather conditions, (I.S. 456 - 2000).

B. QUALITY
   Sand may be rejected if it fails to meet any of the following quality requirements.
The sand to be used shall have minimum specific gravity of 2.6

The sand as batched shall be well graded and when tested by means of standard sieves shall confirm to the limits given in I.S. 383 and shall be described as fine aggregates, grading zones I, II, III and IV. Sand complying with the requirements of any of the four grading zones is suitable for concrete. But, sand confirming to the requirements of grading zone - IV shall not be used for reinforced cement concrete work.

Sand shall be screened before use. If sand brought to site is not clean it must be washed clean in water. Fine draft sand or sea sand or sand containing saline impurities shall on no account to be used.

C. TESTS & FREQUENCY

1. SIEVE ANALYSIS

Sieve analysis shall be carried out in accordance with the I.S. 2386 part-I & the frequency is one test per each quarry (approval test), & one test in major structure site during construction.

2. SPECIFIC GRAVITY & WATER ABSORPTION

Specific Gravity & Water Absorption test shall be carried out in accordance with the I.S. 2386 part-III & the frequency is one test per each quarry.

3. SILT & CLAY CONTENT

Silt & Clay content test shall be carried out in accordance with the I.S. 2386 part-II & the frequency is one test per each quarry (approval test), & one test in major structure site during construction.

4. BULK DENSITY

Bulk density test shall be carried out in accordance with the I.S. 2386 part-III & the frequency is one test per each quarry for conversion of mix proportion by weight to by volume in absence of weigh batcher.

5. BULKAGE

Bulkage of sand shall be determined in accordance with the I.S. 2386 part-III for adjustment of volume of sand in volumetric conc mix. & the frequency is one test per day/sift.

4.2.7 COARSE AGGREGATE

A. GENERAL

For the purposes of these specifications, the term “Coarse Aggregate” designate clean well graded aggregate most of which is retained on 4.75 mm I.S. Sieve and containing only so much finer material as permitted for various types described under relevant clause of I.S. 383. Coarse Aggregate for concrete shall be furnished by the Contractor from the approved quarries.

B. QUALITY

The coarse aggregate shall consist of naturally occurring stones, and shall be hard, strong, durable, clear and free from veins and adherent coating, and free from injurious amounts
of disintegrated pieces, alkali, vegetable matter and other deleterious materials. Coarse aggregate will be rejected if it fails to meet any of the following requirements.

The abrasion value of Aggregates when tested in accordance with the method specified in I.S. 2386 (Part -IV) using Los-Angles machine shall not exceed 30% for Aggregates to be used in concrete for wearing surface and 50% for aggregate to be used in other concrete.

Aggregate crushing value, when determined in accordance with I.S. 2386 (Part - IV) 1 963 shall not exceed 45 % for aggregate used for concrete other than wearing surface and 30 % for wearing surfaces. As an alternative to the crushing strength test, aggregate impact value shall be found out with the method specified in I.S. 2386 (Part - IV) 1 963. The aggregate impact value shall not exceed 45 % by weight for aggregates used for concrete other than wearing surfaces, and 30 % by weight for concrete for wearing surfaces.

The coarse aggregate to be used for all concrete works shall pass a sodium-or magnesium sulphate accelerated soundness test specified in I.S. 2386 (Part - V) 1 963 and the average loss of weight after 5 cycles shall not exceed the limits specified in clause 3.6 of I.S. 383-1970.

The coarse aggregate shall have specific gravity of minimum 2.60.

The maximum quantity of deleterious materials in coarse aggregates shall not exceed the limits specified in Table I of I.S. 383-1 970 when tested in accordance with I.S. 2386-1 963.

C. TESTS & FREQUENCY

1. SIEVE ANALYSIS

Sieve analysis shall be carried out in accordance with the I.S. 2386 part-I & the frequency is one test per each quarry (approval test), & one test in major structure site during construction.

2. SPECIFIC GRAVITY & WATER ABSORPTION

Specific Gravity & Water Absorption test shall be carried out in accordance with the I.S. 2386 part-III & the frequency is one test per each quarry.

3. BULK DENSITY

Bulk density test shall be carried out in accordance with the I.S. 2386 part-III & the frequency is one test per each quarry for conversion of mix proportion by weight to by volume in absence of weigh batcher.

4. LOS-ANGLES ABRASION TEST

Los- Angles Abrasion test shall be carried out in accordance with the I.S. 2386 part-IV & the frequency is one test per each quarry for approval.

5. AGGREGATE CRUSHING STRENGTH TEST

Crushing Strength test shall be carried out in accordance with the I.S. 2386 part-IV & the frequency is one test per each quarry for approval.
6. **SOUNDNESS TEST**

Soundness test shall be carried out in accordance with the I.S. 2386 part-IV & the frequency is one test per each quarry for approval.

7. **FLAKINESS & ELONGATION INDEX TEST**

Flakiness & Elongation Index test shall be carried out in accordance with the I.S. 2386 part-I & the frequency is one test per each quarry (approval test), & one test in major structure site during construction.

**No separate payment will be made for tests of materials.** If sand and coarse aggregate are to be obtained from a deposit not previously tested and approved by the Project Manager, the contractor shall submit representative samples for pre-construction test for approval, well in advance before the sand and coarse aggregates are required for use. Each sample shall approximately consist of 100 Kg. of material. In addition to pre-construction tests, the approval of deposits, the Project Manager may test the aggregates for their suitability during their processing. The contractor shall provide such facilities as may be necessary for procuring representative samples free of cost at the aggregate processing plant and at the batch plant. Final compliance of aggregates will be based on the samples taken from the batch plant or mixing platform.

Use and development of any such deposit shall be subject to the approval by the Project Manager. Any royalties (seigniorage or other charges) required for materials taken from deposits either owned by the State Government or controlled by the Department of Mines and Geology, Government of India or owned by any other person shall be paid by the Contractor.

4.2.8 **BATCHING**

**(A) GENERAL**

The contractor shall notify the Project Manager 24 hours before batching concrete. Unless inspection is waived in each case, batching shall be performed only in the presence of an Engineer authorized by Project Manager.

The contractor shall provide, maintain and operate the equipment as required to accurately determine and control the prescribed amounts of the various materials entering the concrete mixers. The quantities of cement sand and each size of coarse aggregate entering each batch of concrete shall be determined by individual volume measurement or by weight as the case may be. Cement has to be weighed / measured in volume separately from the aggregates. Sand and coarse aggregate may be weighed with separate scales and hoppers.

The grading of aggregates shall be controlled by obtaining the coarse aggregate in different sizes and blending them in the right proportions, the different sizes being stacked in separate stock piles, the materials shall be stock piled a day before use. The grading of coarse and fine aggregates will be checked as frequently as directed by the Project Manager. Water shall be added by weight or measured by volume in calibrated tanks. The amount of added water shall be adjusted to compensate for any observed variations in the moisture contents. Determinations of moisture content in the aggregate shall be in accordance with I.S 2386 (Part - III) 1963 (Indian Standard Method of test for aggregate for concrete Part -111). The amount of surface water carried by aggregates will be determined in accordance with IS 456-1978.
4.2.9 MIXING
A. GENERAL

The concrete ingredients shall be thoroughly mixed in mechanical mixers designed to positively ensure uniform distribution of all the component materials. Mixing shall be done as per clause 9 of I.S 456-2000. The mixer should comply with I.S. 1791-1985 (I.S Specifications for batch type concrete mixers)

The concrete as discharge from the mixer, shall be uniform in composition and consistency from batch to batch. Workability shall be checked at frequent intervals as per I.S. 1199-1959. Mixers shall be examined regularly by the Project Manager or his authorised Engineer for changes in condition due to accumulation of hardened concrete or mortar or to wear of blades. The mixing shall be continued until there is a uniform in color and consistency and to the satisfaction of the Project Manager. If there is aggregation after unloading the concrete should be remixed.

4.2.10 TEMPERATURE OF CONCRETE

Fresh structural concrete and fresh canal lining concrete shall be placed at temperature of between 15° C to 30° C. During hot or cold weather, the concreting should be done as per the procedure set in I.S. 7861- (Part -D-1975 or I. S 7861 (Part – II).

The temperature of concrete at the batch plant shall be adjusted to assure that the specified concrete temperature is attained at the placement. The contractor shall not be entitled for any additional compensation due to the foregoing requirements.

4.2.11 FORM WORK

a) GENERAL

Form Work should confirm criteria stipulated in IS 456 and IS 14687.

Form shall be used wherever necessary, to confine the concrete and shaping it to the required lines. If a type of form does not consistently perform in an acceptable manner, as determined by the Project Manager, the type of form shall be changed and method of erection shall be modified by the Contractor subject to approval of the Project Manager.

Plumb and string lines shall be installed before, and maintained during concrete placement. Such lines shall be used by the Contractor’s personnel and by the Project Manager and shall be in sufficient number and properly installed as determined by the Project Manager. During concrete placement, the contractor shall continuously monitor plumb and string line, form positions and immediately correct deficiencies.

Forms shall have sufficient strength to withstand the pressure resulting from placement and vibration of the concrete and shall be maintained rigidly in position. Where form vibrators are to be used, forms shall be sufficiently rigid to effectively transmit energy from the form vibrators to the concrete, while not damaging or altering the positions of forms. Forms shall be sufficiently tight to prevent of loss of mortar from the concrete. Chamfer strips shall be placed to produce beveled edges on permanently exposed concrete surfaces. Interior angle of intersecting concrete surfaces and edges of construction joints shall not be beveled except where indicated on the drawings.
Suitable struts or stiffeners or ties shall be used for the form work wherever necessary. All supports shall be braced and cross braced into two directions. All splices and braces shall be secured by bolting unless specially intended otherwise. All struts shall be firmly supported against settlement and slipping, by suitable means as directed. All supports shall be cut square at both ends and firmly supported against settlement and slipping. When the form work is supported on soils, sleepers etc, shall be used to properly disperse the loads. In case, the supports rest on already, completed beam or slab, suitable props shall be provided under the latter.

b) The form work shall be of well-seasoned timber or steel. When timber forms are used, they shall be lined with M.S. Sheet or other suitable smooth faced non-absorbent materials as specified. Supports may be of timber or steel. Suitable wedges in pairs to facilitate adjustment and subsequent releasing of forms shall be provided preferably at the upper end of the supports. The details of the proposed form work and supports shall be submitted to the Project Manager and got approved before erection.

c) In case of columns, retaining walls or deep vertical component, the height of the column shall facilitate placement and compaction of concrete and suitable arrangement may be made for securing the forms to the already poured concrete for placing the subsequent lifts. No steel ties or wires used for securing this form work shall be left exposed of the face of the finished work.

d) Suitable inserts for blockouts for electrical and other service fixtures where necessary shall be provided in the required locations as specified.

e) Cleaning and oiling of Forms: - At the time the concrete is placed in forms, the surfaces of the forms shall be free from encrustations of mortar, grout or other foreign material. Before concrete is placed, the surface of the forms shall be oiled with commercial forms of oil.

Removal of Forms

The stripping of form work shall conform to relevant clause of I.S 456-2000. The Contractor shall be liable for damage and injury caused by removing forms before the concrete has gained sufficient strength. Forms on upper sloping faces of concrete such as forms on the water sides of warped transitions, shall be removed as soon as the concrete has attained sufficient stiffness to prevent sagging. Any needed repairs or treatment required on such slopping surfaces shall be performed at once and be followed immediately by the permitted curing.

To avoid injury appearance of concrete that might result from swelling of forms, wood forms for wall openings shall be loosened as soon as the loosening can be accomplished without damages to the concrete. Forms for the opening shall be constructed as to facilitate such loosening. Forms shall be removed with care so as to avoid injury to concrete and any concrete so damaged shall be repaired in accordance with paragraph 4.2.20.
g) **COST**

The cost of furnishing all materials and performing all work for constructing forms, including any necessary treatment or coating of forms will be paid at applicable prices bid in the schedule.

h) **MEASUREMENT AND PAYMENT**

The formwork will be measured in sq.m. of surface area of concrete surface to which forms are necessary.

Payment for formwork in BOQ includes 1) all costs for supplying labour, materials, T&P, machineries and consumables required for erecting the forms to line, level and plumb as per approved drawing and all such costs necessary for removing the forms after the concrete has hardened, 2) all other costs necessary for carrying out formwork operation mentioned in Sec.4.2.11 in preceding paragraphs, 3) All costs for carrying out repair of hardened concrete as per Clause 4.2.12(C&D), 4) any other incidental expenditure to complete the finished item of work as per specification and direction of Project Manager.

**4.2.12 TOLERANCES FOR CONCRETE CONSTRUCTIONS**

**A. GENERAL**

Tolerances are defined as allowable variations from specified lines, grades, and dimensions and as the allowable magnitude of the surface irregularities. Allowable variations from specified lines, grades and dimensions are listed as given under sub paragraph (b) below.

The intent of this paragraph is to establish tolerances that are consistent with modern construction practice that is governed by the effect that permissible variations may have upon a structure. The Project Manager reserves the right to diminish the tolerances set forth herein if such tolerances impair the structural action, operational function or architectural appearance of a structure or position thereof.

Concrete shall be within all stated tolerances even though more than one tolerance may be specified for a particular concrete structure. Provided that the specified variation for one element of the structure shall not apply when it will permit another element of the structure to exceed its alterable variation. Where tolerances are not specified for particular structure, tolerances shall be those specified for a similar work. As an exception to the general provisions, specific tolerances shown herein in connection with any dimension shall govern. The Contractor shall be responsible for finishing the concrete forms within the limits necessary to insure that the completed work will be within the tolerance limits specified. The defective work where the tolerance limit is exceeded shall be remedied in accordance with the provisions mentioned under “C.Concrete surface irregularities” in succeeding paragraphs.

**B. VARIATIONS FROM SPECIFIED LINES, GRADES AND DIMENSION**

Hardened concrete structure shall be checked by the contractor and will be subject to such inspection and measurement as needed to determine that the structures are within the tolerance specified in the table below.

Variation is defined as the distance between the actual position of the structure or any element of the structure and the specified position in plan for the structure or the particular
element. Plus or minus variations shown indicate a permitted actual position up or down and in or out from the specified position in plan. Variations not designated as plus or minus indicate the maximum deviation permitted between designated successive points on the completed element of construction.

Specified position in plan is defined as the lines, grade and dimensions described in those specifications or shown on the drawings or as otherwise prescribed by the Project Manager.

C. **TOLERANCES FOR CANAL STRUCTURES**

1. Deviations from specified dimensions of cross section of columns, beams, piers and slabs \([-6 \text{ mm to } +12 \text{ mm}]\)

   Deviations from dimensions of footing:
   a. Dimensions in plan = \((-12 \text{ mm to } +50 \text{ mm})\)
   b. Eccentricity = \((\pm 0.02 \text{ times width of footing})\) in the direction of deviation but not more than 50 mm.
   c. Thickness = \((\pm 0.05 \text{ times the specified thickness})\).

   Note: Tolerances apply to concrete dimensions only, but not for positioning of vertical reinforcing bars or dowels.

D. **CONCRETE SURFACE IRREGULARITIES**

a. **GENERAL**

   Bulges, depressions and offsets are defined as concrete surface irregularities. Concrete surface irregularities are classified as "abrupt" or "gradual" and are measured relative to the actual concrete surface

b. **ABRUPT SURFACE IRREGULARITIES**

   Abrupt surface Irregularities are defined herein as offsets such as those caused by misplaced or loose forms, loose knots in form, or other similar forming faults. Abrupt surface irregularities are measured using a straight edge held firmly against the concrete surface over the irregularity and the magnitude of the offset is determined by direct measurement.

c. **GRADUAL SURFACE IRREGULARITIES**

   Gradual surface irregularities are defined herein as bulges and depressions resulting in gradual changes on the concrete surface. Gradual surface irregularities are measured using a suitable template conforming to the design profile of the concrete surface being examined. The magnitude of the gradual surface irregularities is defined herein as measures of the rate of change in slopes of the concrete surface.

   The surface irregularities shall not exceed 6 mm for bottom slab and 12 mm for side slopes when tested with a straight edge of 1.5 meter in length.

   The magnitude of gradual surface irregularities on concrete shall be checked by the Contractor to ensure that the surfaces are within the specified tolerances. The Project Manager will also make such checks of hardened concrete surfaces as determined necessary to insure compliance with such specifications.
E. REPAIR OF HARDENED CONCRETE NOT WITHIN SPECIFIED TOLERANCES

Hardened concrete which is not within specified tolerances shall be repaired to bring it within those tolerances. Such repair shall be in accordance with paragraph 4.2.20 and shall be accomplished in a manner approved by the Project Manager. Concrete repair to bring concrete within the tolerances shall be done only after consultation with a representative of Project Manager regarding the method of repair. The Project Manager shall be notified as to the time when repair will be performed.

Concrete shall be finished in a manner which will result in concrete surface with a uniform appearance. Any rough projections can then be rubbed down and the whole surface brought to an even finish by rubbing with a wooden float using a mortar of one part cement by two parts of coarse sand as an abrasive, the mortar at the same time filling the voids. A neat cement wash shall than be applied to give a smooth surface. If the concrete has set hard, the fins and rough projections, if any, shall be removed by using carborandum brick or a paved grinding machine by chipping, before finishing off with the smoothing wash. If the work of chipping is not done with care or if the surface exposed after removal of the forms cannot be satisfactorily dealt with in this manner due to bad work or for other reasons, a coat of cement plaster of 1:2 of thickness as ordered by the Project Manager shall be applied.

No extra payment will be given for finishing concrete surface as instructed above in this clause.

F. PREVENTION OF REPEATED FAILURE TO MEET TOLERANCES

When concrete placements result in hardened concrete that does not meet the specified tolerances, the contractor shall submit to the Project Manager an outline of all prevention actions such as modification to form, modified procedure for setting screeds, and different finishing techniques to be implemented by the contractor to avoid repeated failure.

The Project Manager reserves the right to delay concrete placement until the contractor implements such preventive actions which are approved by the Project Manager.

4.2.13 REINFORCEMENT BARS

A. GENERAL

Reinforcing bars shall be placed in the concrete as shown in the approved drawings or as directed. For anchoring the concrete to the Hard rock contractor shall place the anchor rods to the spacing and depth shown in the drawings.

B. MATERIALS

Unless shown otherwise on the drawings the reinforcement to be used shall be High yield strength deformed bars of minimum grade Fe 415 TMT conforming to I.S 1786-1985 specification for high yield strength deformed steel bars and wire for concrete reinforcement.

C. PLACING

Reinforcement shall be bent and fixed in accordance with the procedure specified in I.S. 2502-1963 code of practice for bending and fixing of bars for concrete reinforcement.
reinforcement shall be placed and maintained in the position shown in the drawings. Splices shall be located where shown in the drawings, provided that the location of the splice may be altered subject to written approval of the Project Manager.

Subject to the written approval the Project Manager, the contractor may, for his convenience, splice bars at additional locations other than those shown on the drawings. All additional splices allowed shall be at the expense of the contractor.

Unless otherwise prescribed, placement dimensions shall be to the center line of the bars. Reinforcement will be inspected for compliance with requirement as to size, shape, length, splicing, position and amount after it has been placed, but before being embedded in concrete.

Before reinforcement is bent and fixed, the surface of the bars shall be cleaned of heavy flaky rust, loose scale, dirt grease or other foreign substances which in the opinion of the Project Manager are objectionable. Heavy flaky rust that can be removed by firm rubbing is considered objectionable.

As specified in clause 12 of I.S 456-2000 unless otherwise specified by the Project Manager, reinforcement shall be placed with the following tolerances.

a. For effective depth 200 mm or less = ± 10mm
b. For effective depth more than 200 mm = ± 15 mm

The cover in no case be reduced.

Reinforcement shall be securely held in position so that it will not be displaced during the placing of the concrete and special care shall be exercised to prevent any disturbances of the reinforcement in concrete that has already been placed. Welding of bars shall be done as directed by the Project Manager and in conformity with the requirements of I.S 456-1978.

Chairs, hangers, spacers and other supports for reinforcement shall be of concrete, metal or other approved material. Concrete cover shall be as shown on the drawings.

D. REINFORCEMENT DRAWINGS

The Project Manager shall supply drawings of reinforcement details and bar bending schedules for adoption.

E. MEASUREMENT AND PAYMENT

Measurement for payment of reinforcement bars will be based on the weight of the bars placed in the concrete in accordance with the drawings supplied by the Project Manager. The total weight of bars placed as reinforcement in concrete shall be arrived at by adding the products of lengths of each size and mass per meter (vide Table 1 and para 6.2.1 of IS 1786-1985) of that size of rod. Payment for furnishing and placing reinforcing bars will be made at the unit price bid in the bill of quantities for furnishing and placing reinforcement bars. Unit price shall include the cost of labour, materials T & P, machineries, equipment and consumables for completing the following items.

a) Cost of Procurement and transportation of reinforcement bars, and cleaning, straightening, cutting, bending, binding, tying, placing the grill, welding wherever required and securing the reinforcement grill in position as per approved drawing.
b) No separate payment will be made for lap length, splices, ties, chairs, spacers and binding wire used in the work.

c) All taxes, GST (as applicable from time to time), Royalties, excise duty.

d) Construction of approach road, haul road, site illumination, construction of coffer dam till completion of the work and subsequent removal at appropriate time, and all mobilization and demobilization cost to complete the above operations.

e) All testing and quality control works, recording of photographs.

f) Any other incidental cost to complete the items of work as per specification and direction of Project Manager.

4.2.14 DOWELS

The dowels shall be of same HYSD bars of grade Fe 415 conforming to I.S 1786-1985 as used for reinforcement.

Details for dowels shall be as shown on the drawings or as directed by the Project Manager. Dowels shall be placed in the concrete where shown on the drawings or where directed and will be inspected for compliance with requirements as to size, shape, length, position, and amount after they have been placed but before being covered by concrete.

Before the dowels are embedded in concrete, the surfaces of dowels be cleaned of all dirt, grease or other foreign substances which in the opinion of the Project Manager are objectionable.

The dowels shall be accurately placed and secured in position so that they will not be displaced during the placing of the concrete.

Measurement for payment of dowels will be made only on the weight of the dowels placed in the concrete in accordance with the drawings or as directed.

Payment for furnished and placing of dowels will be made at the unit price bid in the bill of quantities for furnishing and placing of reinforcing bars which unit price shall include the cost of furnishing all the materials and for placing the dowels as required.

4.2.15 PREPARATION FOR PLACING

A. GENERAL

No concrete shall be placed until all form work installation of items to be embedded and preparation of surface involved in the placement have been approved.

The contractor shall supply concrete placement checkout cards (Placement Register) satisfactory to the Project Manager and shall provide a water tight container for such cards at the convenient location near each individual concrete placement site. The cards shall list all the various work items for example "cleanup" and "embedded items" required prior to placement of concrete. After each work item for an individual placement has been completed that item on the cards shall be signed by contractor or his representative signifying completion of the required work. Engineer authorised by the Project Manager will inspect the work during and after
completion of each phase of the preparation and if the work is satisfactory will sign the check-out card (placement register)... Approval of preparation for placement will not be complete until the contractor or his representative and above authorised Engineer have approved by signature all applicable, items for the placement.

All surfaces of forms and embedded materials shall be free from curing compound, dried mortar from previous placements and other foreign substance before the adjacent or surrounding concrete placement is begun.

Prior to beginning concrete placement, the contractor shall make ready a sufficient number of properly operating vibrators and operators and shall have readily available additional vibrators to replace defective one during the progress of the placement. The Engineer's representative at the placement may delay the start of the concrete placement until the number of working vibrators available is acceptable.

B. FOUNDATION SURFACES

All surfaces upon or against which concrete is to be placed shall be free from frost, ice, water, mud and debris.

1. Rock surface shall be free from oil, objectionable coatings, and loose semi-detached and unsound fragments. Immediately prior to placement of concrete, surfaces of rock shall be washed with an air water jet and shall be brought to uniform surface dry condition.

2. Earth foundation surfaces, before placement of concrete, shall be wet to a depth of 15 cm or up to impermeable material whichever is less.

4.2.16 PLACING OF CONCRETE

A. GENERAL

The contractor shall notify the Project Manager before batching begins for placement of concrete. Placing shall be performed only in the presence of Project Manager's representative. Placement shall not begin until after preparations are complete and the concrete placement check out card has been signed by the contractor or his representative and the authorized representative of the Project Manager substantiating completion of all preparation for that placement.

B. TRANSPORTATION

The transportation of concrete shall conform to clause 13 of I.S 456-2000.

Concrete shall be deposited as near as practical to its final position. The use of Aluminum pipe or Aluminum chutes for delivery of concrete will not be permitted. Concrete buckets shall be capable of promptly discharging concrete of the specified mix design and the dumping mechanism shall be capable of discharging at one location, small portions of concrete from a full bucket.

C. PLACING

The placing of concrete shall be in accordance with relevant clause of I.S 456-2000.
Concrete shall not be placed in standing water except with written permission of the Project Manager and the method of placing shall be subject to approval. Concrete shall not be placed in running water and placed concrete shall not be subjected to running water until the concrete has hardened.

Concrete shall be deposited as nearly as practical in its final position and shall not be allowed to flow in such a manner that the lateral movement will cause segregation of the coarse aggregate from the concrete mass. Methods and equipment employed in depositing concrete in forms shall minimize clusters of coarse aggregates, clusters that occur shall be scattered before the concrete is vibrated.

Forms shall be constantly monitored and their position adjusted as necessary during concrete placement in accordance with paragraph 4.2.11 and 4.2.12.

All concrete except canal lining shall be placed in approximately horizontal layers. The depth of layers shall not exceed 45 cm. The Project Manager reserves the right to require lesser depths of layers where concrete cannot otherwise be placed and consolidated in accordance with the requirements of these specifications. All contraction joints which intersect exposed concrete surface shall be made level and straight to plumb except as shown otherwise on the drawings.

A cold joint is an unplanned joints resulting when a concrete surface hardens before the next batch is placed against it, cold joints would be allowed only in the event of equipment breakdown or other unavoidable prolonged interruption of continuous placing. If such unavoidable delays in placing occur which make it appear that unconsolidated concrete may harden to the extent that later vibration will not fully consolidate it, the contractor shall immediately consolidate such concrete to a stable and uniform slope. If delay of placement is then short enough to permit penetration of the underlying concrete placement shall resume with particular care being taken to thoroughly penetrate and re-vibrate the concrete surface placed before the delay. If concrete cannot be penetrated with vibrator, the cold joint shall be then treated as a construction joint.

Care shall be taken to prevent cold joints when placing concrete in any part of the work. The concrete placing rate shall ensure concrete is placed while the previously placed adjacent concrete is plastic so that the concrete can be made monolithic by normal use of vibrators / tamping.

Concrete shall not be placed in rain sufficiently heavy or prolonged to wash mortar from concrete. A cold joints may necessarily result from prolonged heavy rainfall.

The contractor shall not be entitled to any additional payment, over the unit price bid in the scheduled for concrete by reason of any limitation in the placing of concrete, required under the provisions of this paragraph.

CONSTRUCTION JOINTS

Joints shall confirm criteria specified in IS 456 and IS 11817.

When the work has to be resumed on a surface which has hardened, such surface shall be roughened. It shall then be swept clean & thoroughly wetted. For vertical joints neat cement slurry shall be applied on the surface before it is dry. For horizontal joints the surface shall be covered with a layer of mortar about 10 to 15 mm thick composed of cement and sand in the
same ratio as the cement and sand in concrete mix. This layer of cement slurry or mortar shall be freshly mixed and applied immediately before placing of the concrete.

Where the concrete has not fully hardened all imperfections shall be removed by scrubbing the wet surface with wire or bristle brushes, care being taken to avoid dislodgement of particles or aggregate. The surface shall be thoroughly wetted and all free water removed. The surface shall then be coated with neat cement slurry and fresh concrete laid.

**CONTRACTION JOINTS**

Contraction joints serve to provide for volumetric shrinkage of monolithic concrete and or movement between monolithic units at established joints, thus preventing formation of objectionable shrinkage cracks elsewhere in concrete. Prior to application of wax based curing compound to contraction joints, the surfaces of all joints shall be cleaned thoroughly of accretion of concrete or other foreign material by scraping, chipping or other means approved by the Project Manager. Water stops, reinforcing bars and other embedded items shall be free of curing compound when adjoining concrete is placed.

**D. COMPACTION**

The compaction of concrete shall conform to clause 13.3 of I.S 456-2000.

Concrete shall be consolidated by vibrators/ tampers. The vibrations shall be sufficient to remove all undesirable air voids from the concrete, including the air voids trapped against the forms. After consolidation, the concrete shall be free of rock pockets and honey comb areas and shall be closed against all surfaces of forms and embedded materials. All concrete shall be properly consolidated before it hardens.

Except as herein after provided, consolidation of all concrete shall be by immersion-type vibrators, immersion type vibrators shall be operated in nearly vertical position and the vibrating head shall penetrate and re-vibrate the concrete in the upper portion of the underlying layer. Care shall be exercised to avoid contact of the vibrating head with embedded items and with formed surfaces which will later be exposed to view. Concrete shall not be placed upon either plastic concrete until the previously placed concrete has been thoroughly consolidated.

Immersion type vibrators shall be operated at speeds of at least 7000 revolutions per minute when immersed in concrete. Form vibrators shall operate at speeds of at least 8000 revolutions per minute when being used to consolidate concrete. The Contractor shall immediately replace improperly operating vibrators with acceptable vibrators.

Form vibrators shall be used in conjunction with slip form lining machines to consolidate concrete in canal linings. Such vibrators shall be arranged for effective uniform consolidation of the concrete. The Project Manager or his representative may remove samples of the hardened concerns for testing and examination, and the Contractor shall repair, at no cost to the Government, concrete from which such samples are removed.

**4.2.17 FINISHES AND FINISHING**

The requirements for finishing of concrete surface shall be as specified in this paragraph, paragraph 4.2.11. and 4.2.12, or as otherwise indicated on the drawings. The contractor shall notify the Project Manager before finishing concrete. Unless inspection is waived, in each specific case, finishing of concrete shall be performed only when Project
Manager’s representative is present. Concrete surface will be tested by the Project Manager in accordance with paragraph 4.2.12 where necessary to determine whether the concrete surface is within the specified tolerances. Finished concrete which is not within the specified tolerances shall be repaired in accordance with paragraph 4.2.20.

Interior surface shall be sloped for drainage where shown on the drawings or as directed. Surfaces which will be exposed to the weather and which would normally be level, shall be sloped for drainage.

Floating may be performed by use of hand or power driven equipment. Floating shall be started as soon as the screeded surface has stiffened sufficiently and shall be the minimum necessary to produce a surface that is free from screened marks and is uniform in texture. Joints and edges shall be tooled where shown on the drawing or as directed.

After the surface of road way slabs of concrete bridges, have been wood floated, the surfaces shall be given a broom finish. The finish shall be applied when the water sheet has practically disappeared. The broom shall be drawn transversely across the pavement with adjacent strokes slightly overlapping. The brooming shall be completed before the concrete is in such condition that the surface will be torn or unduly roughened by the operation. The finished surfaces shall have a uniform appearance and shall be free of corrugations exceeding 1.5 millimeters in depth. Broom shall be of quality, size and construction be so operated as to produce a surface finish satisfactory to the Project Manager.

4.2.18 PROTECTION

The contractor shall protect all concrete against damage until final acceptance by the Project Manager.

When precipitation appears imminent, the contractor shall immediately make ready at the placement site all materials which may be required for protection of fresh concrete. The Project Manager may delay placement of concrete until adequate provisions for protection against weather are made.

All fresh concrete surfaces shall be protected from contamination and from foot traffic until the concrete has hardened. Hardened concrete surfaces which have to receive finish shall be protected against damage from foot traffic and the construction activity by covering with protective mats, plywood, or by other effective means. Method of protection shall be subject to approval by the Project Manager.

4.2.19 CURING

A. GENERAL

The curing is guided by Clause 13.5 of IS: 456-2000.

The contractor shall furnish all materials and perform all work required for curing concrete. All concrete including bed and sides of canal lining shall be cured by water curing.

The uniformed top surfaces of bridges decks shall be cured for 28 days with a damp sand cover or curing mat cover. The sand or curing mats shall not be kept so wet as to allow water to drain from them and stain other concrete. The sand or curing mats shall be removed after the expiry of the curing period.
All concrete surfaces shall be treated as specified to prevent loss of moisture from the concrete until the required curing period elapsed or until immediately prior to placement of other concrete or backfill against those surfaces. Only sufficient time to prepare construction joint surfaces and to bring them to a surface dry condition shall be allowed between discontinuance of curing and placement of adjacent concrete.

Forms shall be removed after the concrete has hardened sufficiently conforming to clause 11.3 of I.S 456-2000 to prevent structural collapse or other damage by careful form removal. Where required, repair of all minor surface imperfection shall be made immediately after form removal and prior to curing, minor surface repair shall be completed within 2 hours after form removal and shall be immediately followed by the initiation of curing by the applicable method specified herein. Concrete surfaces shall be kept continuously moist after form removal until initiation of curing.

B. MATERIALS

Concrete cured with water shall be kept wet for at least 28 days from the time the concrete has attained sufficient set to prevent detrimental efforts to the concrete surfaces. The concrete surfaces to be cured shall be kept wet covering them with water-saturated materials by using a system of perforated pipes, mechanical sprinklers or porous hose, or by other methods which will keep all surface continuously (not periodically) wet. All curing methods are subject to approval of Project Manager.

C. COST

The cost of furnishing all materials and performing all work for curing concrete shall be included in the price bid in the bill of quantities for the concrete on which the particular curing methods are required.

4.2.20 REPAIR OF CONCRETE

Concrete shall be repaired in accordance with clause 5.7 of I.S 3873-1978. Imperfections and irregularities on concrete surface shall be corrected in accordance with paragraph 4.2.12

TYPES OF REPAIR

Repairs to concrete surfaces and addition where required shall be made by cutting regular opening into the concrete and placing fresh concrete to the required lines. The chipped openings shall be sharp and shall not be less than 70 mm. in depth. The fresh concrete shall be reinforced and chipped and troweled to the surface of the openings. The concrete shall be placed in layers not more than 20 mm, in thickness after being completed each layer shall be compacted thoroughly. All exposed concrete surfaces shall be cleaned of impurities, lumps of mortar or grout and unsightly stains.

COST

The cost of furnishing all materials and performing all work required in the repair of concrete shall be borne by the contractor.

4.2.21 MEASUREMENT OF CONCRETE
Measurement for payment of concrete required to be placed directly upon or against surfaces of excavation will be made to the lines of construction as per approved drawing.

Measurement for payment of concrete will be made to the neat lines of structures constructed as shown on the approved drawings and prescribed in the specification. The unit of measurement will be cubic meter. In measuring concrete for payment, the volume of all opening, fixtures, embedded pipes and metal work, each of which is larger than 0.1 square meter in cross section will be deducted.

4.2.22 PAYMENT FOR CONCRETE

Concrete works of different grades and specifications are to be executed as per items of BOQ. The measurements for these items will be recorded in cubic meter basing on dimensions of concrete as per execution with reference to approved drawings. The item rates for different concrete items includes all costs for labour, material, T&P, machineries, equipment and consumables required for carrying out the following operations.

1. Carrying out all necessary operations for setting out works, clearing, preparation of beds, removal of silt etc. described under section-2 of Technical Specifications...

2. Laboratory testing of sample of aggregates, cement, water. (excluding items specified in BOQ vide Bill-A).

3. Procurement of fine aggregates, coarse aggregates, cement, admixtures and water at site of work. (Procurement cost of Reinforcement bars & placement are excluded)

4. Batching, mixing, laying of concrete, vibrating and curing as per Specifications.

5. Erection of gangways, scaffolding, chutes and dismantling the same after completion of work.

6. Construction of approach road, haul road, site illumination, construction of coffer dam till completion of the work and subsequent removal at appropriate time, and all mobilization and demobilization cost to complete the above operations.


8. Payment of all taxes, royalties, VAT etc.

9. Provision of contraction joints and provision for embedment of items as per approved drawings.

10. Cost of all safety precautions.

11. Any other incidental cost to complete the items of work as per specification and direction of Project Manager.

12. Measurement & Payment will be made as per BOQ regardless of methods and type of equipment used for execution of the work.
The cost of concrete used in (1) wasted concrete, (2) in replacement of damaged or defective concrete, (3) in extra concrete required as a result of over excavation, (4) in concrete placed by the contractor in excavations intentionally performed to facilitate the contractor's operations, and (5) Extra concrete due to tolerance in concrete finish shall be borne by the contractor. No extra payment shall be made to contractors for such additional quantity.

SECTION 4.3 SPECIAL REQUIREMENTS FOR CONCRETE STRUCTURES

4.3.1 P.V.C. STRIPS

The finished P.V.C. strips shall be manufactured with shapes conforming to dimensions shown on the drawings and shall be extruded from virgin, pigmented, plasticized P.V.C. The finished P.V.C. strip shall meet the requirement of Table I and II of I.S 9766-1981.

The P.V.C. water stops conforming to the above requirements shall be placed in the joints where shown in the drawings. The contractor shall furnish an I.S.I Test certificate for the P.V.C. he proposes to use. The unit price bid in the bill of quantities for this item shall include the cost of all materials and labour involved in the operations.

4.3.2 PLACEMENT OF KRAFT PAPER

The top surface of the masonry / concrete piers and abutments should be leveled and painted with brush, with asphaltic emulsion of 20/30 grade, such that the bearing surface is perfectly smooth and uniform. Over this surface, kraft paper of approved quality should be placed and the top painted with asphaltic emulsion of 20/30 grade. The unit price bid in the bill of quantities for this item shall include the cost of all materials and labour involved in the operations.

4.3.3 EMBEDMENT IN CONCRETE

In some of the locations of structures as shown on the relevant drawings a few conduits or openings shall have to be provided through RCC / PCC. Construction of the surface for either placement of concrete shall have to be suitably carried out so as to meet with the placement of such conduits or openings. No extra payment for such improvidence in construction shall be made.

4.4 PROVIDING & FIXING NP2/NP3 RCC PIPES WITH SPIGOT & SOCKET ENDS:

SUPPLY OF PIPES

Pipes shall be of specified diameter, non-pressure type conforming to IS 458. Maximum length of the pipe shall not be less than 2.5 m, or otherwise directed by the Project Manager. The Contractor shall order the pipes required for the work on the basis of the construction drawings supplied to him by the Project Manager. Pipe marked with the following information (A) Class of pipe, (B) Date of Manufacture, (C) Name of Manufactures or his trade mark or both, (D) IS Specification mark, shall only be accepted for work.

HANDLING AND LAYING OF PIPES

Work shall be done as per IS 783. Reasonable care shall be exercised in loading, transporting and unloading of concrete pipes. Handling shall be such as to avoid impact. All
pipes shall be inspected thoroughly before being laid. Broken or defective pipe shall not be used. Trench shall be of sufficient width to provide for free working space in minimum 30 cm. on either side of the pipe. Pipes shall be lowered into the trenches by use of standard appliance. Pipe shall be laid true to line and as specified on the construction drawings. Laying of pipes shall be along proposed grade of the slope. The socket ends of pipe shall face upstream. The connections of the pipes shall be jointed together in such a manner that these shall produce perfect even surface along the inside of the pipe.

JOINING PIPES

Semi flexible type spigot and joint as per IS 783 and as shown on the construction drawing shall be provided. The rubber sealing rings used in the joining shall confirm to IS: 382. A rubber ring shall be placed on the spigot which shall be forced into the socket of pipe already laid. This shall compress the rubber ring as it fills in to the annular space formed between the two surfaces of the spigot and socket so as to form a flexible and watertight joint. The recess at the end of pipes shall be filled with cement mortar 1:2. Every joint be kept wet for about 14 days.

BACK FILING IN TRENCHES

(A) Trenches shall be kept free from water until the material in the joints has hardened. Walking or working on the completed pipe shall not be permitted until the trench has been back filled to a height of at least 45 cm. over the pipe except as may be necessary for back filling and compaction.

(B) Trenches shall be backfilled after pipe has been laid subject to the condition that jointing material has hardened. Only selected materials shall be used for backfilling. Filling of the trench shall be carried out simultaneously on both sides of pipe in such a manner that unequal pressure does not occur.

MEASUREMENT & PAYMENT

Measurement for payment shall be on running meter basis on the pipe line laid including joints. The rate per pipe in bill of quantities shall include the cost of pipes including loading unloading, hauling, handling, storing, laying in position, cost of rubber rings, jointing and curing including back filling and other operations to complete the work as per the specification.
SECTION - (5)

CEMENT CONCRETE LINING

SECTION 5.1 SCOPE OF WORK

(a) (i) Canal lining shall be done with concrete paving and finishing machines, which will place, compact and finish the concrete lining in bed and slopes. Plain cement concrete of approved grade, with the maximum size of aggregate of 20 mm shall be laid on the bed and slopes of the canal sections as shown on relevant drawings. The thickness of lining shall be as per approved drawing.

(ii) Each concrete paving machine and associated support equipment utilized under this contract shall place canal lining at an average sustained rate of advancement of not less than 10 meters per hour. This minimum rate shall be obtained for paving operation on the side slopes and on the bottom of the canal while also meeting the requirements for lapsed time following trimming, consolidation of concrete, finishes, joints and other requirements specified therein.

(iii) The equipment and operation for foundation trimming, sub-grade preparation, concrete production, concrete delivery joint production, curing compound placement and other association activities supporting the placement of the canal lining shall be matched with the lining equipment capability so as not to impede the specified placement rate of lining operation. The overall equipment deployment shall be such as to ensure the completion of canal lining within the scheduled period specified in the contract.

(iv) The contractor can alternatively deploy longitudinally operating self-aligning slip form paver, with built in vibrator attached to the mould/forms so as to effectively compact and finish the concrete alternative to concrete paver finisher, and outlined in para (a) i above.

b) Near structures where fluming is involved, lining shall be provided for 15 m length on either side of structures as specified in the relevant drawings.

c) During the preparation of sub-grade for canal lining the proud earthwork shall be excavated and trimmed by machine for better progress and to achieve the designed profile of the sub-grade. This excavation for trimming for base preparation of lining shall be carried out immediately, prior to laying of the lining but in no case the time interval should exceed 3 days in normal weather and 2 days in adverse weather conditions.

d) The scope of work also includes the following.

i) Dewatering the canal section for preparing the base for lining and laying concrete lining,

ii) Providing steel safety ladders at required intervals or as directed.

iii) Providing necessary under drainage arrangements consisting of filter blanket of graded sand and pressure relief valves as per drawings.

(iv) Providing filter materials of approved quality as per design.

(v) Providing and fixing P.V.C. contraction joints forming water stops.
SECTION 5.2 CLEARING SITE

Area proposed for lining the canal as a whole shall have to be cleared of all objectionable materials, stumps, roots, bushes, and rubbish. Such materials, from clearing operation shall be disposed off away from the working area, clear of work site as per direction of the Project Manager. **The cost of clearing is deemed to be included in the item rates of lining in the contract and the Contractor shall not get any extra payment towards this operation.**

SECTION 5.3 PREPARATION OF SUB-GRADE FOR CONCRETE LINING

5.3.1 GENERAL

a) Provision of this paragraph shall apply to the preparation of sub-grade upon which concrete lining is to be placed.

b) The work of trimming the canal section up to the bottom of concrete lining/ bottom of filter materials to be provided as the case may be and preparing sub-grade for concrete lining includes removal of proud from the slope and bed of the canal. Wherever rock is over-excavated, the item of trimming and preparation of sub-grade includes filling the over-excavated portion with suitable semi pervious materials, watering and compaction and trimming up to bottom level of the concrete lining. Along the canal alignment the rain cuts on inner slope of the banks shall be filled up with approved excavated materials and shall be compacted adequately to required line and grade and level. The material required for filing the over excavation in rock and rain cuts, if not available during excavation in soils to be done under this item, shall be hauled from stockpiles or borrow area to be arranged by the Contractor and placed in position. **The cost of the works mentioned herein this item is deemed to be included in the item rates of concrete lining and the contractor shall not get any extra payment towards this operation.**

c) If at any point material has been excavated beyond the pay line required to receive the concrete lining, the excess excavation shall be refilled in horizontal layer with selected material moistened, if required, and compacted using rollers and slope compactors. Where placing and compacting bedding material is on a sloping foundation, the layers may be placed parallel to the surface of the foundation. If at any point the foundation material is disturbed or loosened during the excavation process or otherwise it shall be moistened, if required, and thoroughly compacted by tamping, rolling or by other approved methods to form firm foundations for placing the concrete lining.

d) If, at any place, placement of bedding material below the concrete lining is required, due care shall be taken by the contractor to wet the surfaces of excavation and embankment to a depth of 15 cm or to depth up to impermeable layer below, whichever is less, as per direction of the Project Manager.

e) In the canal section requiring bedding material below the concrete lining, due care shall be taken by the Contractor to place the bedding materials on scientifically approved surface adequately wet as described above, in layers not exceeding 15 cm in depth in a single operation and compacted till the bedding material attains a height where it can be trimmed to form a true and even surface upon which the concrete for lining is to be placed. Each layer of bedding material shall be moistened and thoroughly compacted.

f) All loose materials likely to be present at the end panel of existing lining adjacent to which lining is to be placed under these specifications shall be removed and all voids beneath
the existing lining shall be refilled and compacted thoroughly. No extra payment shall be made to the Contractor on this account.

g) Suitable material trimmed from the canal shall be judiciously utilised in canal embankment, road embankments or in back filling of the structures or used as a bed material as per direction of the Project Manager. The trimmed materials which cannot be utilised in proper place during one continuous operation shall be stock piled along the right of way where designated by the Project Manager.

h) In all the preparation of sub grade for concrete lining shall confirm to clauses 4.1, 4.2, 4.3, 4.4 and 4.5 of I.S 3873-1978 J Indian code of Practice for laying in situ cement concrete lining canal.)

5.3.2 TOLERANCE IN PREPARATION OF SUB-GRADE

Excavated profile provides the final base for lining and tolerance departure from lines shown on the drawings shall be as indicated here below:

- ± 20 mm on straight section
- ± 50 mm on tangents
- ± 100 mm on curves

Departure from levels shown on the drawings
- 20 mm

The above tolerances shall be negotiated gradually through smooth transition in a length of 50 m. and no over-run in concrete quantity shall be paid to the Contractor.

5.3.3 MEASUREMENT AND PAYMENT

The cost of the works mentioned in the item trimming the canal section and preparation of sub-grade is deemed to be included in the item rates of concrete lining and the contractor shall not get any extra payment towards this operation.

5.3.4 SELECTED BEDDING MATERIAL

The selected bedding material in the case of bed and sides of canal profile in normal soils shall be graded filter material compatible with sub grade materials and thoroughly compacted. In case of expansive soils, cohesive non swelling (CNS) soil will be used for bedding. The thickness of CNS layer shall be designed according to swelling pressure of soil or as directed by the Project Manager.

The loading, handling transporting and placing of the selected bedding material shall be subjected to approval and shall be such as will result in a uniform mixture of the material being placed without separation or segregation.

5.3.5 UNDER–DRAINAGE

For a lined canal where the ground water level is higher or likely to be higher than the water level inside the canal so as to cause damage by differential pressures on the lining or where the sub-grade is sufficiently impermeable to prevent free drainage of the underside of lining in case of rapid draw down condition, under drainage shall be provided with suitable pressure relief arrangements as indicated in the drawings or directed by the Project Manager.
(i) FILTER DRAINS

Wherever necessary longitudinal and/or transverse filter drains shall be laid in the concrete lining true to the canal grade as shown in the drawings or as directed by the Project Manager. The number of layers comprising the filter thickness of each layer and the materials to be used shall be as shown in the drawings. The filter material shall be clean, round well graded sand or coarse aggregate the requirements of grading of which shall be established in the field laboratory on the basis of a mechanical analysis of adjacent material. Particles of decomposed rock debris, rock, vegetable matter or the deleterious materials shall not be permitted in the filter. Before placing the filter the bed shall be prepared as specified in earlier paragraph.

The longitudinal drains shall be laid to the grade of the canal while the transverse drains in bed shall have a fall towards the center of the canal bed from the edges as shown in the drawing.

(ii). LOCAL FILTER

In addition to the above filler drains, local filters of the size and type as shown in the drawing shall be provided. The cost of these local filters shall be included in the unit prices bid for various types of pressure relief arrangements described below.

SECTION 5.4 MATERIALS

All materials including Cement, fine aggregate and coarse aggregate. Water, Admixture and Steel shall be as specified in Section 4.2.

SECTION 5.5. CAST-IN-PLACE CONCRETE LINING

5.5.1 GENERAL

The work shall generally conform to IS 3873. All concrete for lining shall be governed by IS: 456-2000. The concrete shall be of controlled grade with suitable admixtures of approved air entraining agents, using well graded aggregates with maximum size of aggregates of 20 mm. Ordinary Portland Cement or Portland Pozzolana/slag Cement shall be used. Design mix and actual cement level required shall be communicated from time to time to the Contractor in writing by the Project Manager.

5.5.2 BATCHING OF CONCRETE

Batching shall be done as per section 4.2.8

5.5.3 MIXING OF CONCRETE

Mixing shall be done as per section 4.2.9

5.5.4 TRANSPORTATION OF CONCRETE

a) Transportation shall be handled from the place of mixing to the place of final depositing as rapidly as practicable by use of equipment such as transit mixers which shall prevent initial setting, segregation or loss of any of the ingredients. It shall be transported and compacted in its final position within 30 minutes of its discharge from the mixer.
b) If segregation occurs during transport, the concrete shall be remixed before being placed, after observing the time requirements as above.

5.5.5 PLACING AND COMPACTION

a) Concrete shall be placed only in the presence of a duly authorized representative of the Project Manager. Concrete shall be placed and compacted before initial setting time and shall not be subsequently disturbed.

b) Placing of concrete shall not be started until all formwork, installation of parts to be embedded, if any, and preparation of surface upon which concrete is to be laid, have been completely inspected by the Project Manager. All absorptive surfaces against which concrete is to be laid shall be moistened adequately so that moisture shall not be withdrawn from freshly placed concrete. The surfaces, however, shall be free from standing water and mud.

c) Concrete shall be deposited in all cases as neatly as practicable directly from mechanized paver in its final position and shall not be caused to flow in a manner to permit segregation. Excessive separation of the coarse aggregate caused by allowing the concrete to fall freely from too great a height or at too great an angle from the vertical shall not be permitted and where such separation would otherwise occur the Contractor shall provide suitable means to convey the concrete without allowing such separation.

5.5.6 MECHANICAL PLACING

a) For efficient placing and finishing of the concrete lining on slopes and in bed, concrete lining machines such as slip form paver or concrete paver finisher of approved quality and design shall be used.

The equipment of operations for foundation trimming sub-grade preparation, concrete production, concrete delivery, joint production, curing compound placement and other associated activities supporting the placement of the canal lining shall be matched with the lining equipment capability so as not to impede the specified placement rate of each lining operation. The overall equipment deployment shall be such as to ensure the completion of canal lining within scheduled period specified in the contract.

Concrete canal lining shall be done in the canal prism as shown in the drawing. Mixing of concrete is to be done in a stationery or mobile weigh batching plant installed at suitable place / places and concrete is to be conveyed to work spot in transit mixers to be moved on canal banks and unloaded at site in the hopper of the paver. The concrete in bed and side is to be placed with mechanised paver finisher. The concrete from transit mixer is to be unloaded into hopper and conveyed to other bank, through side discharge conveyor then placed with paver in bed and side and vibrated. Joints will be done with Groove cutter attached to the paver. Panels shall be as per drawing or as directed by Project Manager. The above mechanised procedure is to be followed for side lining where slant length is 2.70 M. or above. In case where canal bed width is less than 2.00 M. and where bed lining is not possible to be-tackled with the above mechanised paver, concrete shall be laid by conventional method i.e. mixing by concrete mixtures and laying the concrete manually in alternative panels of 3 M. length as per drawing or as directed by Project Manager, duly using steel form work to the required thickness of concrete and vibrated with mechanical pan vibrators. The concrete for side lining, where the slant length is less than 2.70 M. shall be laid by using appropriate equipment with steel guided form work and vibrated by mechanical vibrator fitted to gantry. If the concrete is laid manually on slopes, compaction by suitable method, as approved by Project Manager shall be adopted.
b) Concrete when deposited shall unless otherwise specified have a placement temperature of not less than 15°C and not more than 32°C.

c) Concrete shall be so laid as to facilitate placing, vibrating, finishing and curing operations. The side lining concrete shall be screeded up the slope, while the concrete is being vibrated ahead of the screed. Concrete required for keys as shown on the drawings shall be laid integrally along with the side slope lining.

Alternatively, the Contractor can select to use longitudinally operating self-aligning, slip form machine with built in vibrators attached to the slip forms, so as to effectively compact and finish the slope and bed concrete lining.

5.5.7 FINISHING

The finishing in lining shall be in accordance with relevant Clause of I.S 3873-1978.

a) All exposed concrete surfaces shall be cleaned of impurities, lumps of mortar or grout and unsightly stains. The finished surface shall be even; smooth and free from pockets and equivalent to that obtainable by effective use of long handle steel trowel. Where the surface produced by lining machine meet the specified requirements, no further finishing operation shall be required. Surface irregularities, when tested with a straight edge of 1.5 meter length shall not exceed 6 mm in canal bed for bottom slab and 12 mm in that laid on side slopes.

b) The surface of concrete finished against form shall be smooth and be free from projections, honeycombing and other objectionable defects. Immediately on removal of forms, ridges or lips shall be removed and undesirable local bulging on exposed surfaces shall be remedied by tooling and rubbing.

c) Repairs to concrete surface and additions where required shall be made by cutting regular openings into the concrete and placing fresh concrete to the required lines, chopped openings shall be sharp and shall not be less than 75 mm in depth. The top portion of the side slopes of the canal lining extending 1-1/2 meter vertical below the top of the lining shall receive a nonkid, longitudinal brisk finish as approved by the Project Manager.

5.5.8 CURING

5.5.8.1 GENERAL

The concrete lining on slopes including curvatures portion at junction of slope and bed lining shall be cured with specifications given in section 4.2.19. The concrete lining in canal bed shall be cured with water in accordance with the specifications given in section 4.2.19. If water curing of lining in the canal bed is not carried out to the satisfaction of the Project Manager as per specifications, the Contractor shall be directed to switch over to liquid membrane forming curing compound for curing for which no extra payment shall be made to the Contractor.

All equipment, material etc, needed for curing and protection of concrete shall be at site and ready for installing before actual concreting begins. Detailed plans, methods and procedures of curing and protection of concrete lining shall be got approved in writing from the Project Manager sufficiently in advance of the actual concreting. The equipment and method proposed to be utilized shall be provided for adequate control and avoid interruption for damage to the work of other agencies.

The Precast slab for canal lining shall be cured by keeping them immersed in water for seven days and by sprinkling water for another 21 days with straw canvass, hessian or similar materials cover over slab.
5.5.8.3 WATER CURING

Unformed top surface of invert of the canal shall be kept continuously moist by covering it completely with wet burlap as soon as the concrete has hardened sufficiently. The burlap shall be kept continuously wet by spraying water for at least 12 hours. Thereafter curing by ponding shall be resorted to. Concrete to be cured with water shall be kept wet by ponding for at least 14 days. Water lost by evaporation shall be replenished periodically to keep the surfaces, continuously submerged under water. The period of 14 days specified above shall be increased to 21 days when pozzolana has been used in the concrete as part replacement of cement. The concrete in canal slope shall be cured by periodical wetting of covered burlap by sprinkling water on them so as to keep them always moist.

When the curing of concrete in the canal bed is not found satisfactory the Project Manager may ask the Contractor to resort to membrane curing without any extra cost to department.

SECTION 5.6 TESTING OF CONCRETE AND ACCEPTANCE OF WORK

5.6.1 GENERAL

Testing of concrete shall be carried out by the Contractor on representative samples taken at the site of laying the concrete in accordance with relevant clauses of I.S. 1119.

5.6.2 SAMPLING PROCEDURE AND FREQUENCY

a) Sampling Procedure: A random sampling procedure shall be adopted to ensure that each concrete batch has a reasonable chance of being tested, i.e. the sampling should be spread over the entire period of concreting and should cover all mixing units.

b) The test procedures shall be in accordance with I.S. 1199 & minimum frequency of sampling of concrete of each grade shall be in accordance with the I.S. 456-2000. The details described, below.

For each Major Structure-site one set, - (6nos). 3nos for 7day & 3nos for 28days strength test. For minor structure- one set- 3nos, daily/sift of concrete laying for each grade of concrete Up to 5 cum. – 1 set... up to 15 cum – 2 sets up to 30 cum. – 3 set up to 50 cum – 4 sets, above 50 cum – one additional sample for each additional 50 cum or part thereof.

5.6.3 TEST SPECIMEN

Three test specimens shall be made from each sample for testing at 28 days. Additional cubes may be required for various purposes, such as to determine the strength of concrete at 7 days or at the time of striking formwork, or to determine the duration of curing or to check the testing cubes cured by accelerated methods as described in I.S. 9013. The specimen shall be tested as described in I.S.516.

5.6.4 TEST STRENGTH OF SAMPLES

a) The test strength of the sample shall be the average of three specimens. Individual variation shall not be more than 15 percent of the average as per clause 15.4 of I.S. 456 - 2000.

b) Testing shall be carried out at the testing laboratories set up at the site or at any other laboratory that the Project Manager may decide upon and the results given thereby shall be considered as correct and authentic and acceptable to the Contractor.
5.6.5 ACCEPTANCE CRITERIA
Acceptance criteria will be as per clause 15, 16 and clause 17 of IS: 456-2000.

SECTION 5.7. TOLERANCE
The tolerances for concrete lining shall be as given below.

1. Departure from Established alignment: ± 20mm on straight reaches
± 50mm on partial curves on tangents.
2. Departure from Established grade: ± 20 mm

Any departure from alignment or grade shall be uniform and no corrections in assignment be
made in less than 50 m. No overrun in concrete quantity shall be paid to be Contractor.

SECTION 5.8. DEWATERING
In canal reaches where subsoil water is met with above the canal bed level, dewatering
shall be resorted to and continued during preparation of subgrades, providing under drainage
arrangement and placing of concrete for lining till such period, the concrete attains necessary
strength. No separate payment shall be made for dewatering operations, as the same is
deemed to have been included in rate of related item in Schedule of qualities.

SECTION 5.9 MEASUREMENT
Measurement for lining shall be made on square meter basis of the area of the lining
including key on both sides. To arrive at the quantity in cubic meter, the area thus measured
shall be multiplied with the thickness shown in the drawing and executed. The thickness of lining
shall be determined by setting of paver machine in relation to final subgrade on which lining is to
be laid. The thickness shall be cross checked by (i) volume of concrete placed and area
covered (ii) use of probe when concrete is being placed and (iii) curing. Any extra in quantity
of concrete in lining due to admissible tolerances, pockets and voids, over excavation of
sub-grade shall not be paid to the contractor.

SECTION 5.10 PAYMENT
The measurement of canal lining will be recorded in cubic meter volume.
The unit price shall include cost of labour, material, machineries T & P, equipment and
consumables required for the following items

1. Carrying out all necessary operations for setting out works, clearing, preparation
of beds, removal of silt etc. described under section-2 of Technical
Specifications...
2. Laboratory testing of sample of aggregates, cement, water and concrete.
(excluding items specified in BOQ vide Bill-A).
3. Procurement of fine aggregates, coarse aggregates, cement, admixtures and
water at site of work.
4. Batching, mixing, laying of concrete, vibrating and curing as per Specifications.
5. Erection of gangways, scaffolding, chutes and dismantling the same after
completion of work.
6. Construction of approach road, haul road, site illumination, construction of coffer
dam till completion of the work and subsequent removal at appropriate time, and
all mobilization and demobilization cost to complete the above operations.
7. Payment of all taxes, royalties, GST (as applicable from time to time) etc.
8. Provision of contraction joints and provision for embedment of items as per
approved drawings.
9. Cost of all safety precautions.
10. And any other incidental cost to complete the items of work as per specification
and direction of Project Manager.
11. Measurement & Payment will be made as per BOQ regardless of methods and
type of equipment used for execution of the work.
SECTION – (6)
CEMENT CONCRETE PILE

6.1. PILE FOUNDATIONS:
The Work shall consist of construction of Under-reamed piles for structures in accordance with the details shown on the drawing & conforming to the requirements of these specifications.

The method of installing the piles, including details of the equipment shall be submitted by the Contractor and got approved from the Project Manager.

Relevant details of proprietary system of piling shall be included in the bid documents.

The Contractor in his methods statement shall include the procedure for carrying out initial and routine tests of piles. The format for reporting test results shall be included in the methods statement.

6.1.1. UNDER REAMED PILES:

6.1.1.1. General:
At the time of filling his tender, the Contractor shall visit and inspect existing site to examine the nature of ground, type of soil levels etc. No claim or allowance what so ever shall be admissible on this account or on account of omissions in the levels or the description of the ground turning out to be different from what was shown on the drawings.

6.1.1.2. Setting Out:
The Contractor shall locate any lay out of the piles at his own cost or as per drawings and approval of the Project Manager. If any time during the progress of the work any error appear or arise in the position, levels, divergence and alignment of any part of the work, the Contractor on being required to do so by the Project Manager, shall at his own cost rectify errors to the satisfaction of the Project Manager. The Contractor shall carefully protect all bench mark pillars, sight rails and other things used in setting out.

6.1.1.3. Materials:

i. **Concrete:** The Concrete for pilling work shall be controlled as per specifications for the cement concrete and grade specified in the drawings.

ii. **Reinforcement:** The reinforcement for pilling work shall be as per specifications for the reinforcement bars provided in the section 4.2.13 of this document.

iii. **Bentonite:** Bentonite as brought to the site and prior to mixing shall be in accordance with the following specification.

   (a) A certificate is to be obtained by the Contractor from manufacture of the bentonite powder stating the manufacture’s consignment and the properties of consignment as determined by the manufacturer. The certificate shall be made available to the Project Manager on request.

   (b) The bentonite powder shall be mixed thoroughly with clean fresh water. The percentage of bentonite used to make the suspension shall be such as to maintain the stability of the excavation trench / bore.

   (c) Control tests to be carried out on the bentonite suspension using apparatus to determine:

      (A) The density
      (B) The Viscosity
      (C) The shear strength
      (D) The PH value of the freshly mixed bentonite.
The tests shall be carried out initially until consistent working pattern has been established.

1. Where the tests show consistent behavior some or all tests may be discontinued at the discretion of the Project Manager.

2. Prior to placing concrete, the Contractor shall ensure that contaminated bentonite suspension has not accumulated in the bottom of the trench to impair the free flow of concrete. The Contractor shall state the method of testing checking this item along with the tender and obtain approval of the Project Manager prior to commencement of the work.

3. The temperature of the water used in mixing bentonite suspension and of the suspension supplied to the trench excavation shall not be less than 5 degree centigrade.

4. During construction the level of the bentonite suspension in the trench shall be maintained within the depth of the guide walls and at a level not less than 10 M above the level of external standing water, if any.

5. In the event of the sudden loss of bentonite suspension, the trench shall be backfilled without delay and the instruction of the Project Manager shall be obtained on further course of action.

6. Where saline or chemically contaminated water is encountered, special measures shall be taken as directed by the Project Manager.

7. All reasonable steps shall be taken to prevent the spillage of bentonite suspension on the site away from the immediate vicinity of the wall. Discarded bentonite and suspension, which has been pumped from the trench, shall be immediately removed from the site.

6.1.1.4. Piling System:

a. These specifications cover only bored cast-in-situ under reamed piles.

b. Termination levels of piles shall be as shown in the drawings or as decided by the Project Manager during the progress of construction keeping in view the initial result.

c. In order to satisfy himself about the adequacy of the proposed length and anticipated safe load carrying capacity of the piles the Contractor shall examine the soil available at the site.

d. If the interpretation of load test indicates that the safe bearing capacity of the piles is less than the design working load, additional piles shall be provided.

e. The Contractor shall guarantees safe bearing capacity of all piles.

6.1.1.5. Construction Techniques:

(a) Safety of existing structure: The Contractor shall take every precaution to avoid damage to the existing structures in the vicinity as a result of construction of pile foundations. All claims arising out of damage to the existing structure due to the construction of piles shall be borne by contractor.

(b) Bore holes: Boreholes shall be made by any standard method. The Contractor shall submit along with the tender a description of the equipment and the method of the boring he proposes to use for checking and approval by the Project Manager.
(c) If high water table is encountered causing instability of the bores, boring and under reaming shall be carried out using a suitable fluid such as bentonites slurry. Normal spiral or modified augers having arrangements to avoid back suction shall be used.

6.1.1.6. Placing of Concrete:
(a) The boreholes shall be cleaned of all soil cutting and sediments before placing concrete.
(b) Concrete shall be placed through a funnel so as to fill the entire volume of borehole without formation of voids. Mechanical vibrators shall not be used.
(c) Under-water concreting shall be carried out by displacement method and a Tromie pipe of diameter of not less than 15 cm having suitable protective arrangement at the lower end may be used.
(d) The minimum pile stem diameter under water concreting shall be 25 cm.
(e) The volume of concrete placed shall be observed in the case of first few piles. The average figure thus obtained shall be used to check possible under variations in the volume in the subsequent piles. In case of significant variations, the contractor shall investigate the possible causes to the complete satisfaction of the Project Manager whose decision in this regard will be final and binding on the Contractor.
(f) When using the bentonite slurry technique, utmost care shall be taken to avoid mixing of slurry with concrete. In any case the method of concentrating shall be subject to the approval of the Project Manager.

6.1.1.7. Finish Pile Heads
(a) The top of the piles shall be brought up above the specified cut off level by at least 50 cm to permit all the laitance and weak concrete to be removed and to ensure that the pile can be properly keyed into the pile cap by a minimum of 5 cm. This additional concrete shall not however be paid extra.
(b) The reinforcement in the pile shall be exposed for a length of at least 50 times the diameter of the Tor steel used or as specified in the drawings beyond the theoretical point of cut off of the pile to permit to be adequately bended into the pile cap.

6.1.1.8. Control of Alignment and tolerances
(a) Errors in setting out shall not exceed 12 mm, measured horizontally from the centre of the piles.
(b) If the piles are not found to be in the exact position or out of plumb by more than 1% or if they are found to be skew or defective in any other manner, they shall be rejected and the decision of the Project Manager shall be final and binding in this regard.

6.1.1.9. Defective Piles:
The Project Manager shall have full authority to reject any pile at the time of chipping of excess concrete to bring the head to the cut off level, in case it is found that:-
I) Diameter of the pile at the cut off level is smaller than the diameter specified.
II) Location of the pile is outside the limitations prescribed in these specifications.
III) Concrete at the cut off level is of below specification.
IV) Diameter of bars, spacing, shapes or lengths of piles reinforcement do not conform to details given in the drawings or the reinforcement cage is disfigured, distorted, displaced or otherwise damaged in any manner.
V) Anchorage length of the reinforcement bars at the cut of level is inadequate. The Contractor shall make good the piles, pull out the piles or provide new piles in place of the rejected piles at his own cost and without any additional cost to the client even if the pile had been accepted at the time of boring. The final acceptance of all piles shall be made after the pile head has been brought to the cut off level, all reinforcement requires to be embodied in pile cap exposed and after all measurement have been completed vis a vis the layout of the piles.

6.1.1.10 Load Tests:

(a) **Testing procedure:** The Contractor, along with his tender, shall submit a description of his procedure for carrying out load tests. The Project Manager reserves the right to demand a modification of the test procedure proposed by the Contractor at no extra cost.

(b) **Number of initial test pile:** To determine the safe load of a pile or group of piles the structure as per IS: 2911 (part -IV) no payment shall be made for initial test piles and its testing. The contractor shall include in his rate his expenditure towards initial load test piles and initial load testing.

(c) **Routine Load Test:** Routine test shall be conducted on 2% of the total number of piles. The contractor shall include in his rate his expenditure towards load tests.

(d) **Equipment:** The Contractor shall provide all necessary equipment for applying specified vertical load on the top of the piles and for measuring the settlement of the pile.

(e) **Loading device:** The device for giving the vertical load shall be suitable to avoid impact, lateral forces, titling etc. and shall have an arrangement for gradual application of load and for readings at close intervals. The load shall be in the form of suitable kenledge.

(f) **Apparatus for measuring settlement:** The apparatus for measuring settlement shall consist of a dial gauge permitting a reading of 0.02 mm accuracy. The dial gauge shall be fixed to the datum bar whose ends rest upon non-moveable supports. The supports for datum bar with reference to which the settlement of the pile would be measured shall be at least 5 d away, clear from piles, “d” being the diameter of the piles.

(g) **Loading Procedure:** The head of the pile shall be at the cut off level and shall be capped in such a manner as to prepare a horizontal place – bearing surface. The maximum test load shall be twice the anticipated working load on the pile. Alternative loading and unloading shall be carried out for 25, 50, 75, 100, 150, 175, 200 percent of the anticipated safe test load. Settlement and time shall be recorded in the beginning and end of loading and also for at least 2 hours after completion of each loading and unloading.

(h) **Sustained loading:** The maximum test load of twice the anticipated working load on the pile shall be applied in increments of 25, 50, 75, 100, 150, 175, 200 percent of the anticipated working load. Settlement reading shall be taken to the accuracy of 0.02 mm before and after the application of each new load increment. Additional load shall not be applied until the rate of settlement under the preview increments is less than 0.02 mm per hour or 2 hours have elapsed whichever occurs first. When loading has been
completed, the full test load shall remain on the pile for 24 hours or for a longer period if the necessity is there or if indicated by the rate of the settlement of the pile and settlement reading shall be taken during and at the end of the period. During the unloading of the pile, the rebound shall be measured when the load remaining on the pile amount to 75, 50, 25 and 0% of the full test load with decrements of load released at not less than half hour intervals and with measurement of the rebound being made immediately before and after each decrement. The final rebound shall be recorded 24 hours after the entire test load has been removed.

(i) **Reports:** The contractor shall submit the report of the load test, which shall include the following information.

I) A description of the soil condition at the location of each test pile.

II) A description of the pile and its boring record including boring time, rate, types of soil strata encountered and the stability of the sides, density of the bentonites used and any other relevant data.

III) A tabulation of the loads and settlement readings during the loading and unloading of the pile.

IV) Time load settlement curves.

V) Remarks concerning unusual occurrences if any during boring or loading of piles.

### 6.1.1.11. Interpretation of Test Results:

(a) All test results and piling records shall be submitted to the Project Manager in duplicate for his confirmation.

(b) Test results shall generally be interpreted as per relevant Indian Standard Code of practice. The Project Manager may refer the test results to the design cell for their opinion and decision.

### 6.2 Measurement:

(a) The length of the pile shall be measured in running meter from the theoretical cut off point of the pile to its termination level.

(b) The length of the empty boring shall be measured in running meter from the top of existing ground level at the time of starting of the particular pile to top of the theoretical point of cut off of the particular pile.

### 6.3 PAYMENT

The item of BOQ provides unit rates for payment which includes all costs for labour, material, T & P machineries, equipment and consumables required for carrying out the following items.

1) **Cleaning of Surface Area,**

2) **Procurement of all materials at work site,**
3) Boring hole to required depth,
4) Providing and tying of reinforcement cage for the Pile.
5) Mixing and laying of concrete of required grade as per approved drawing,
6) Curing,
6) Construction of initial load test Pile,
7) Conducting initial load testing,
8) Conducting routine load test on working piles,
9) Construction of approach road, haul road, site illumination, construction of coffer dam till completion of the work and subsequent removal at appropriate time, and all mobilization and demobilization cost to complete the work.
10) Payment of all taxes, royalties, GST (as applicable from time to time) etc.
11) Any other cost incidental to complete the items of work as per specification and direction of Project Manager.
SECTION – (7)
PLASTERING AND POINTING

SECTION 7.1 MATERIALS
7.1.1. SAND FOR MORTAR FOR PLASTERING AND POINTING

A. GENERAL

Sand for preparation of Mortar for plastering and pointing shall conform to the gradation, as per I.S 1542-1977.

The procurement of sand for usage for plastering and pointing shall confirm to the specifications given paragraph 4.2.6.

B. COST

The cost of procurement of sand for mortar for plastering and pointing will not be measured for payment and shall be included in the unit price per cu. metre bid in the relevant item of work in the bill of quantities for which this sand is required.

7.1.2 CEMENT

Ordinary Portland cement conforming to I.S 269-1976 shall normally be used for preparation of mortar for plastering, pointing and for masonry work. In the event of non-availability of ordinary Portland cement, Portland Pozzolana cement conforming to IS 1489-1976 may be used with the approval of Project Manager.

7.1.3 WATER

The Specification and condition specified for procurement of water in paragraph 4.2.5 shall be applicable here also.

SECTION 7.2 MORTAR

7.2.1 PREPARATION OF MORTAR FOR PLASTERING WORK

The cement mortar used in plastering work shall be as per specifications of approved drawings.

The other specifications and conditions enunciated in paragraph 6.2.1 shall apply for the mortar for plastering work also.

7.2.2 PREPARATION OF MORTAR FOR POINTING

The cement mortar used in pointing work shall be cement mortar mix 1:4 (One cement four sand by volume).

The other specifications and conditions enunciated in paragraph 6.2 shall apply for this mortar for pointing work also.

SECTION 7.3 PLASTERING WITH CEMENT MORTAR
7.3.1 PREPARATION OF SURFACE

The roughening of the background improves the bond of plaster. All joints shall be thoroughly raked. After roughening the surface, care shall be taken to moisten the surface sufficiently before plastering as otherwise freshly exposed surface may tend to absorb considerable amount of water from the plaster. The surface shall be wetted evenly before applying the plaster. Care shall be taken to see that the surface is not too dry as this may cause lack of adhesion or excessive suction of water from the plaster. A fog spray may be used for this work. As far possible, the plaster work shall not be done under hot sun.

7.3.2 LAYING OF PLASTERING WITH CEMENT MORTAR 12 MM. THICK.

The mortar used for plastering shall be stiff enough to cling and hold when laid. To ensure even thickness and true surface, plaster shall be applied in patches of 150 mm x 150 mm of the required 12 mm thickness at not more than 2 metres intervals horizontally and vertically over the entire surface to serve as guides. The surface of these guides shall be truly in the plane of the finished plaster surface and truly in plumb. The mortar shall then be applied to the surface to be plastered between the guides with a trowel. Each trowel full of mortar shall overlap and sufficient pressure shall be used to force it into thorough contact with the surface. On relatively smooth surfaces, the mortar shall be dashed on with the trowel to ensure adequate bond. The mortar shall be applied to a thickness slightly more than that specified, using a string, stretched out between the guides. This shall then be brought to a true surface by working with a long wooden float with small motion. The surface shall be periodically checked with a string stretched across it. Finally the surface shall be rendered smooth with a small wooden float, over working shall be avoided. All corners, edges and junctions shall be brought truly to a line with any necessary rounding and chambering.

If it is necessary to suspend the work at the end of the day, it shall be left in a clean horizontal or vertical line not nearer than 150 millimeters from any corner or edges or on parapet tops or on coping etc. When recommencing the work, the edges of the old work shall be scraped clean and treated with cement slurry before the new plaster is laid adjacent to it. After the first coat is done it shall be kept undisturbed for the next 24 hours and thereafter kept moist and not to be permitted to dry until the final rendering is applied.

After the plaster has sufficiently hardened cement slurry with cream like consistency shall be applied as thinly and evenly and rubbed to a fine condition.

The finished surface shall be cured with water for a minimum period of 14 days.

Should the mortar crack or perish, the plastering shall be removed and redone at the contractor's expense or should contractor fail to cure the work to the satisfaction or the Project Manager the later may cure the work at the risk and cost of the Contractor.

All portions which sound hallow when tapped or found to be soft or otherwise defective shall be cut out in regular shape and redone as directed by the Project Manager at the contractor's expense.

SECTION 7.4 POINTING TO C.R. MASONRY/ LATERITE MASONRY WITH CEMENT MORTAR

7.4.1 PREPARATION OF SURFACE

The joints in the masonry shall be raked out to a depth not less than the width of the joint or as directed when the mortar is green. Joints shall be brushed clean of dust and loose
particles with a stiff brush. The area shall then be washed and the joint thoroughly wetted before pointing is commenced.

7.4.2 FLUSH POINTING WITH CEMENT MORTAR FOR COURSED RUBBLE/LATERITE MASONRY

The pointing to be done shall be flush pointing with cement mortar. The mortar shall be pressed into the raked out joints according to the type of pointing required. The mortar shall not be spread over the corners, edges or surface of the masonry. The pointing shall then be finished as detailed below. The mortar shall be finished off flush and level with the edges of the stones, so as to give a smooth appearance. The edges shall be neatly trimmed with a trowel and a straight edge. When finished the mortar pointing shall be restricted to the width of the joints and all superfluous mortar shall be removed with a trowel. The work shall be executed as rapidly as possible (and not again touched after it has begun to set) and kept wet for a minimum period of 14 days thereafter. The pointing shall also be cured for 14 days.

SECTION 7.5 MEASUREMENT

The measurement of plastering and pointing shall be in units of square meters and it shall be paid at the relevant unit price bid per square meters of plastering / pointing in the bill of quantities.

SECTION 7.6 PAYMENT

The item of BOQ provides unit rates for payment of plastering which includes all costs for labour, material, T & P machineries, equipment and consumables required for carrying out the following items.

1) Cleaning of Surface Area
2) Procurement of all materials at work site
3) Mixing and laying of plaster as per approved drawing and curing.
4) Construction of approach road, haul road, site illumination, construction of coffer dam till completion of the work and subsequent removal at appropriate time, and all mobilization and demobilization cost to complete the work.
5) Payment of all taxes, royalties, GST (as applicable from time to time) etc.
6) Any other cost incidental to complete the items of work as per specification and direction of Project Manager.
SECTION 8

ROAD WORK

SECTION 8.1 GENERAL

1. Road shall be constructed to the lines, level and grade with sand and moorum fill having desired parameters of density cohesion, etc. so as to ensure the designed stability and performances of the whole road. The Quality Control Organization of the project may carry out requisite test for the suitability of construction materials well in advance and the contractor shall ensure that only approved materials are brought to place of fill and used for construction of Road.

2. The Contractor shall submit sequence of operation which he proposes to follow to the Project Manager and shall obtain approval to it prior to commencing work and shall adhere to the agreed sequence after modification if any by the Project Manager.

3. The methods and plants and equipment to be used by Contractor is subject to approval by the Project manager.

4. Placing of the layers for the road portion programmed for construction in the season shall be continuous and approximately horizontal. In case the whole length of road is not constructed simultaneously, the incomplete end of the road shall be kept at slope not steeper than 1 in 4.

5. No materials shall be placed in any section of the road until the road seat for that section has been dewatered, suitably prepared and approved by the Project Manager. All portions of excavation made for test pits or other sub-surface investigations, all holes, hollows, and all other existing cavities found within the area to be covered and which extend below the established lines of excavation for road seats, shall be filled with suitable earth fill of the corresponding zone of the road and suitably compacted.

6. Pools of water shall not be permitted in the foundation for road and such water shall be drained and cleared prior to placing the first layer of road materials.

7. The contractor shall construct and maintain good diversion in case the existing communication are disturbed. Precautionary measures such as night lamp, danger facing signals, diversion signals etc. shall be provided by the contractor at his cost to avoid accidents on the communication lines because of contracts activities.

8. Proper care shall be taken to avoid any interference with or damage to works of other areas of work such as water supply, sewerage, electricity etc.

9. The Contractor shall at all-time carry out work in a manner creating least interference to the traffic during execution. The Contractor shall provide and maintain during execution a passage for traffic either along or as part of existing way under construction or a separate diversion road at his own cost.

10. Quality of all materials should be approved by Project Manager prior to collection at site. If any materials brought to site is found inferior and rejected shall be removed from site immediately by the Contractor at his own cost.

11. Construction traffic shall not be allowed to use the newly prepared surface without prior permission from Project Manager. Any damage arising out of such use shall however be made good by the Contractor at his own cost.

12. All measurements unless otherwise indicated shall be recorded / computed to the following limit
   (i) Length and breadth –0.01 m.
   (ii) Height, depth or thickness of earthwork, Sub base and base course-5mm.
   (iii) Areas - 0.01 sqm.
(iv) Cubic content - 0.01 cum.

13. Works rejected by the Project Manager on ground of poor quality or workmanship shall be dismantled and redone by the Contractor at his own cost.

14. Complete stacking of materials like sand, moorum, H.G. chips as per requirement shall be carried out in 2Km. length before spreading. The collection shall always commence at one end and be carried continuously towards the other unless the Project Manager directs otherwise.

SECTION 8.2 SETTING OUT OF THE WORK:

1. Before starting any work and during execution (if required) the contractor shall erect reference Bench Marks, reference lines and check profiles at convenient locations as per the direction of the Engineer- In-Charge. The center line of the road and the reference line for all alignments for demarcation purpose shall be laid by properly dug-belling on the ground.

2. The Check profiles shall be located at 30M apart or closer as directed by the Project Manager so as to ensure execution of all slopes, steps and elevations, to the profile as indicated in the approved drawings. All important levels and all control points with respect to Bench Marks and reference lines shall be fixed and co-related by the Project Manager.

3. To ensure correctness of execution the edges of cutting, the lines of the road and those of spoil bank shall be marked carefully with pegs at close intervals. The pegs shall then be connected by stretching string from peg to peg and dug belling into ground along the strings. The lines so connected shall be corrected whenever necessary to provide a stream lined plan of the features. Special care shall be taken at curves to ensure uniform curvature of the alignment. The layout of the structures shall have to be given in appropriate manner with pegs & pillars.

4. All materials and labour for setting out works including construction of reference Bench Marks, reference lines check profiles and surveys, as may be required at various stages of the construction, shall be supplied by the contractor at his own cost. The cost of such works shall be deemed to have been included in the costs of items for road work in schedule.

SECTION 8.3 PREPARATION OF SITE

8.3.1 CLEARING THE SITE

(a) The contractor shall clear of all tree stumps, bushes, roots, brushwood, rubbish of all kinds, loose stones and all other objectionable materials in the entire area required for setting out. The ownership of all the useful materials so removed from clearing site and or excavation shall rest with the department. The roots of the trees shall be grubbed to full depth. The contractor shall dispose off all such materials as directed by the Project Manager.

(b) No separate payment will be made to the contractor for complying the requirements of clearing the site and all cost shall be deemed to have been included in the rates quoted in schedule for the items.

8.3.2 RECORDING OF CROSS SECTION

Initial cross sections shall be taken at every 30 m interval or closer depending on nature of the ground upto sufficient distance outside the limit if work. Levels on these cross
sections shall be taken at 5 m. or closer intervals as directed by the Project Manager and recorded in the field and level books in the presence of the contractor or his authorised agent who shall sign the field book/level book in the token of acceptance. These cross sections shall form the basis of all future measurements and payments.

SECTION 8.4 FOUNDATION PREPARATION

1. SOIL FOUNDATION

Soil foundation under the seat of road shall be scarified and loosened by means of a plough or other means to a depth of about 15 cm to 20 cm to the satisfaction of the Project Manager. Roots and other debris turned up during scarifying shall be removed from entire foundation area for the fill. Before placing of fill materials, the stripped surface of the road is to be initially compacted. The first layer of fill for the road shall be of depth of 10 cm to 15 cm and shall be carefully placed, ensuring uniform compaction and a satisfactory intimate bond between the foundation soil and fill materials. Heavy rubber type rollers or vibratory rollers may be used for compaction. Power Road Rollers shall be used for compaction of impervious soil and preferably vibratory type roller shall be used for compaction of all other soil.

Separate payment shall not be made for preparation of foundation as above and it shall be deemed to have been included in the unit rate quoted for respective item of road.

SECTION 8.5 BORROW AREA

1. GENERAL

All materials required for the construction of road shall be obtained from borrow areas duly approved by the Project Manager. The contractor has to arrange borrow area for necessary testing and approval of Project Manager to borrow sandy soil, sand & moorum. Borrow pits shall be operated so as not to disfigure/disturb the appearance of any part of the work or any other property.

2. PREPARATION / STRIPPING OF BORROW AREA

All areas required for borrowing sand / sandy soil / moorum for road shall be cleared of all tree stumps, roots, bushes, rubbish and other objectionable materials. Borrow areas shall be stripped of top soil, and any other objectionable materials to the required depth as directed by the Project Manager. The work may be done manually or with suitable machine. Stripping operations shall be limited only to designated borrow areas. Materials from stripping shall be disposed of in exhausted borrow areas or in the approved adjacent areas as directed. Particular care shall be taken to exclude all organic matter from the materials. The cleared areas shall be maintained free of vegetable growth during the progress of the work.

No extra payment shall be admissible for preparation and stripping the borrow area as this is deemed to have been included in the unit bid price.

3. HAUL ROADS AND APPROACH ROADS

Construction and maintenance of approach roads and haulage roads will be the responsibility of the contractor. The department will have full right of way to those roads for inspection purposes. Proper road sign as directed have to be provided for safety. For haulage of road materials, the contractor shall construct ramps and haul roads of sufficient width along
the shortest but most practical route and shall maintain and illuminate them to a satisfactory manner. Watering of the haul road shall be done by the contractor as often as necessary to prevent raising of dust, formation of cuts and consequent deterioration of the surface. Whenever service roads meant for public thorough fare traverse through or run close to the borrow areas, the contractor shall direct his excavation and haulage operation in such manner as to ensure uninterrupted use of the service road and safety to the public. At the haul road and the service road crossing, the contractor shall install necessary check gates and road signs.

No extra payment for haul road and approach road is admissible as this is deemed to have been included in the unit bid price for the earth work item being contingent to the main work.

WEATHER CONDITIONS: Road materials shall be placed only when the weather conditions are satisfactory to permit accurate control of the moisture content in the road materials. Before closing work on road, the top surface shall be graded and rolled with a smooth wheeled roller to facilitate run off. Prior to resuming work, the top surface shall be scarified and moistened or allowed to dry as necessary and approved by the Project Manager for resumption. The contractor shall provide suitable protection works to protect the slope from erosion due to rainwater. No payment whatsoever shall be made for providing such protection work and rectifying of monsoon damages.

4. WATERING

Adequate watering to the sand fills are to be done to facilitate proper compaction. Similarly water content to moorum is to be controlled for proper compaction. No compensation will be made to the contractor due to held up of work for rain, fog and moisture content in the working process.

SECTION 8.6 COMPACTATION

GENERAL

(a) Having decided on the filling materials to be used, standard compaction test shall be made on the materials proposed for road to indicate broadly which are the most suitable type of equipment to be used and the moisture content at which compaction should be undertaken and also to determine the effects of soil moisture content, thickness of layer and number of passes.

(b) Having decided on the thickness of layer and range of moisture contents, tests should be made with different types of equipments available and the required number of passes should also be determined.

(c) In all this work, the state of compaction should be measured in terms of dry density.

(d) Density tests if felt necessary by Project Manager shall be made after rolling. Standard proctor density test shall be carried out at regular intervals to account for variations in the borrow area materials as well as that in situ excavated materials.

(e) The contractor shall supply all materials labour machinery and equipment at his cost for the work.

(f) No extra payment shall be made for compaction operations as this shall be deemed to have been included in the price bid in schedule of Quantities for the respective item of work.

1. ROLLING

When each layer of materials has been prepared so as to have the proper moisture content uniformly distributed throughout the materials it shall be compacted by passing the vibrating roller or P. R .R . The exact number of passes for each layer to obtain specified density shall be designed by the field laboratory after necessary test. The layers shall be compacted in strips
overlapping not less than 0.6 m. Rolling shall commence at edges and progress towards center longitudinally. The rollers of loaded vehicle shall travel in a direction parallel to the axis of the road. Turns shall be made carefully to ensure uniform compaction. Rollers shall always be pulled. Density tests shall be made after rolling and dry density attained shall satisfy the compaction standards specified in relevant I.S. Codes.

2. COMPACTION OF COHESIONLESS MATERIALS

Where compaction of cohesion less free draining materials such as sand and gravel is required, the materials shall be deposited in horizontal layers and compacted to the relative density specified. The excavation and placing operations shall be such that the materials when compacted shall be blended sufficiently to secure the highest practicable unit weight and best stability. Water shall be added to the materials as may be required to obtain the specified density by method of compaction being used. The thickness of the horizontal layers after compaction shall not be more than 10 cm, if compaction is performed by tampers and not more than 15cm, if by rollers.

3. DRESSING OF SLOPES

The slopes of road shall be neatly dressed to lines and grade as shown on the drawing as the placing of fill progress, compaction shall extend over the full width of the road and materials in slopes shall be compacted as for the rest of the road. To ensure proper compaction of the edges, the cross section of the fill during construction shall be kept wider as directed by the Project Manager and cross section shall be dressed to the designed requirement after compaction for which no extra payment shall be made as it is deemed to have been included in unit bid price for item of schedule of Quantities. Materials used to fill depression shall be of same type as used in the road and shall be thoroughly compacted and bonded to the original surface. Slopes shall be maintained until final completion and acceptance. Any material that is lost by rains, weathering or other causes shall be replaced at the cost of the contractor till completion of the works and taking over by the department.

4. SETTLEMENT ALLOWANCES

(i) In the fill road, settlement allowances of 2% will be provided. Accordingly extraheight shall be provided but payment for design height will be made. The base width of the road will not be increased to maintain the design slopes indicated in the drawing for the additional height as settlement allowances, but the following procedure will be adopted. Settlement allowances will be calculated at various levels where the slopes is to be changed and the elevations including settlement allowances will be derived keeping the road widths of the designed levels unchanged. The edges of road at the increased elevations (including settlement) when joined with the point where the slope has changed earlier bellow, shall give the slope to be adopted for constructions.

(ii) If the road is raised in more than one season, provision for settlement shall be made in the last season's construction as described above.

SECTION 8.7 MEASUREMENT AND PAYMENT

(a) All works shall be measured by levels.
(b) For payments the level books, field books, the cross section sheets and calculations sheets shall be treated as adjuncts to the measurement books. The
quantities between the levels taken after stripping and cross sectional levels taken after construction of consolidated road will be recorded for payment. It shall be clearly understood that construction of road to extra width/height for settlement allowance as specified earlier will not include for payment. The measurement will be limited to the design section.

(c) Final measurement and levels shall be taken at the cross sections of the completed compacted bank design section after the slopes dressed to ensure that work is completed as shown in the drawing plus settlement allowances.

SECTION 8.8 RATE FOR PAYMENT

The Unit rate for different items for Construction of road shall include all costs for labour, materials, tools and plants, machinery, excavation, transportation and incidental operations required for carrying out and completing the item of work in accordance with the specification, drawing and as directed by the Project Manager including all costs for (i) Site clearance (ii) Setting out works (iii) Marking out, providing and forming model section with strings and stakes as may be considered necessary by the Project Manager to guide the contractor in road construction (iv) compacting the original ground including preparation of seat under road (v) Scarifying and benching etc. (vi) Clearing trees stumps and bushes, stripping of the borrow area up to required depth including cost of arranging borrow area (vii) Maintaining borrow area free from vegetation growth, drainage arrangement and moisture control including watering (viii) Loading, conveyance from designated borrow area, unloading and spreading of suitable materials including rehandling (ix) Construction and maintenance of approach roads and haul roads, site illumination and borrow area illumination (x) Cutting and trimming as specified in dressing of slopes (xi) Restricted working near sites of structures (xii) Settlement allowance (xiii) Spreading in thinner layers at required places (xiv) Compaction with suitable compactors (xv) Removal of materials like bushes, roots, sods, other perishable materials and pebbles etc. from the fill materials (xvi) Providing labour for recording of levels and testing charge for testing of samples (xvii) All drainage and dewatering as required (xviii) The section of all work to be maintained in good order during execution and also in rainy season (xix) All safety measures.(xx) All taxes, royalties of materials (xxi) any other incidental expenditure to complete the work including mobilization and demobilization as per drawing, specification and direction of Project Manager.

SECTION 8.9 MATERIALS

8.9.1 MOORUM AND SAND

The moorum shall have plasticity index not less than 6 as determined in accordance with I.S. 2720. It shall be free from all rubbish, dust and organic materials as well as clods of clay / black cotton soil. The moorum should be granular and gritty.

Sand shall consist of hard, dense, durable and uncoated siliceous gritty materials. Sand to be used shall be natural as obtained from river bed from specified quarries. It shall be free from all rubbish, dust and organic materials as well as clods of earth loam and other deleterious substances.
8.9.2 STONE AGGREGATE

(a) METAL

The hard granite crusher broken stone metal shall be obtained from quarries containing hard, tough, sound, durable stone of close texture, free from decay and weathering. Pieces of the stone shall be angular and roughly cubical in shape. Round, elongated or flaky materials shall be rejected. The size of the metal shall be well graded as per specification.

(b) Sample metals, collected from the quarries shall be got tested by the Contractor at his cost in the laboratory. The test results shall conform to the standard requirement laid down for metal to be used for this work.

(c) The physical requirement for standard size metal shall conform to the test results as per IS: 2386.

(d) The grading requirement of coarse aggregates shall confirm to IRC specification.

8.9.3 CHIPS

Stone chips shall consist of regular fragments of clean hard, tough and durable rock of uniform quality throughout by crushing granite rock, and shall be free of elongated and flaky pieces, soft and disintegrated materials, and vegetable or deleterious matter. They shall satisfy the physical requirements set-forth as under.

<table>
<thead>
<tr>
<th>Test</th>
<th>IS for Test Method</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) Los Angels Abrasion value</td>
<td>IS:2386 (Part-IV)</td>
<td>35% Maximum</td>
</tr>
<tr>
<td>(ii) Aggregate impact value</td>
<td>-do-</td>
<td>30% Maximum</td>
</tr>
<tr>
<td>(iii) Flakiness index</td>
<td>IS:2385 (Part-I)</td>
<td>30% Maximum</td>
</tr>
<tr>
<td>(iv) Stripping value</td>
<td>IS:624</td>
<td>25% Maximum</td>
</tr>
<tr>
<td>(v) Water Absorption</td>
<td>IS:3386 (Part-III)</td>
<td>2% Maximum</td>
</tr>
</tbody>
</table>

Size of stone chips shall be as under:

(i) For premix carpet 20mm to 12mm size: Passing 20mm sieve and retained on 10 mm sieve.

(ii) For precoated seal coat 6mm and downgraded size: passing 10mm sieve and retained on 2.36mm sieve.

(iii) Samples of stone chips collected from the quarries shall be got tested by the Contractor at his cost in laboratory. The test results shall confirm to the standard requirement as per BIS.

(iv) Control on quality of material will be exercised by the Project Manager by carrying out the following tests at frequencies shown against each.

Type of construction material Test Frequency: Chips for carpet

i) Aggregate impact value - One test per 100 M³ of aggregate and seal coat.

ii) Flakiness index of aggregate – 1 test per 100 M³ of aggregate.

iii) Stripping value and water absorption - initially, one set of 3 representative absorption test of aggregates from specimens for each source of supply. Subsequently when warranted by changes in the quality of aggregates.

iv) Grading of aggregates - One test for 100 M³ of aggregates.
8.9.4 MEASUREMENTS:

The materials such as sand, moorum, and crusher broken granite metals are to be separately stacked at approved stack yard beyond trafficable berm in standard stacks of 1.5mX1.5mX1m. Accounting deduction of voids, each such stack is to be measured and paid as 1 cum.

8.9.5 PAYMENT:

Rate for collection of materials under item provides all costs for labour, material, T&P, machineries, excavation, transportation and incidental operations required for carrying out and completing the items of work with specification and includes all costs for 1) selection and permission for quarry operation, 2) all required tests for selection of materials as per BIS / IRC / MORTH, 3) Quarry operation and procurement of approved materials at approved stack yard and stacking, 4) Royalties of material and all other taxes pertaining to the operations, 5) storage charge and watch & ward of materials and machineries, 6) all wastages during operations, 7) all safety operations, 8) insurance and compensation of labour, 9) any other incidental expenditure to complete the finished item of work.

8.9.6 BITUMEN

Bitumen of 80/100 grade conforming to BIS as approved by the Project Manager, in writing shall be utilized in the work. Procurement of the bitumen will be made by the Contractor at his own cost from reputed manufacturers on approval by the Project Manager. The contractor is to produce test certificate to be issued by manufacturer for each consignment separately.

SECTION 8.10 CONSTRUCTION PROCEDURE

8.10.1 SUB-BASE BELOW PAVEMENT

(i) Moorum and sand stacked separately shall be conveyed and mixed properly to make an admixture of moorum and sand in proportion as per direction of Project Manager.

(ii) The formation after excavation or trimming shall be dressed to required camber and grade.

(iii) The admixture of moorum shall be spread in subbase and also side shoulders in layers not exceeding 15cm. in thickness and should be adequately watered.

(iv) Immediately following spreading of moorum admixture rolling will be started with three wheeled roller of 8 to 10 tones capacity or equivalent vibratory roller. The rolling shall begin from edges and then progress gradually to center, parallel to the center line of the road and over lapping uniformly each preceding rear wheel track by one half width and shall continue until the entire area of the course has been rolled by the rear wheel. In case of super-elevated portions rolling shall proceed from inner edge to the outer edge. Rolling to continue till the admixture of moorum is thoroughly keyed. During rolling sprinkling of water is to be done as required for a dense compacted mix layer.

(v) The rolled surface to be checked transversely and longitudinally and any irregularities, ruts and soft yielding places be corrected by loosening surface, adding or removing amount of admixture moorum and rolling entire surface to confirm desired grade and camber of 1 in 50 (not flater than 1 in 72).

(vi)
8.10.2 I.R.C. GRADE-I AND I.R.C. GRADE-III METALING

A) SPREADING OF COARSE AGGREGATE

i) I.R.C. Grade-III metal (size 40mm to 25mm) shall satisfy criteria described under sub-head criteria "materials" in preceding paragraph.

ii) Stacking for Gr.-III shall be done after the spreading of Gr.-I metal.

iii) The surface to receive I.R.C. Gr-I or Gr.-III water bound macadam course (metaling) shall be made free from dust and other extraneous material.

iv) The respective grade metals shall be spread uniformly to achieve compacted nominal thickness of 11.5cm and 10 cm for I.R.C. Grade-1 and I.R.C Grade-III metaling respectively.

v) The spreading shall be done from stacks along the side of the roadways or approved stock yards. In no case shall aggregates be dumped in heaps directly on the surface prepared for the metaling nor shall hauling over un-compact ed or partially completed base be permitted. No segregation of large or fine particles shall be allowed. The surface of the aggregates shall be carefully checked with Templates and all high or low spots remedied by removing or adding aggregates as may be required by hand packing the same to proper grade and camber.

vi) The bunds of earth or moorum one on either side shall be made along the outer edge of metaling prior to or simultaneously with spreading of metal. In addition where ever required turf edging are to be provided. These bunds and turf edging are required to prevent loose metal from spreading out beyond width of road to be metalled. No extra payment will be made for the bunding or turf edging as the same are deemed to be included in the unit rate of respective items.

vii) The course aggregate shall normally be spread more than 3 days in advance of the subsequent operation.

viii) Spreading of metal shall proceed only 200m. in advance of rolling operation.

B) CONSOLIDATION

(a) Immediately following the spreading of the coarse aggregates, rolling shall be started with three wheeled power roller of 8 to 10 ton capacity or equivalent vibratory roller. The weight of the roller shall depend upon the type of the aggregate and shall be as indicated by Project Manager.

(b) Except on super elevated portions where the rolling shall proceed from inner edge to outer, rolling shall begin from the edges gradually progressing towards the center. First the edge/edges shall be compacted with roller moving forward and backward. The roller shall then move inwards parallel to the center line of the road, in successive passes uniformly lapping preceding tracks by at least one half wheel width.

(c) Rolling shall continue until the aggregate is thoroughly keyed and the creeping of the aggregate ahead of the roller is no longer visible. During, rolling slight sprinkling of water may be done, if necessary. Rolling shall not be done when the sub-grade is soft or yielding or when it causes a wave like
motion in the sub-grade or sub-base course.

(d) The rolled surface shall be checked transversely and longitudinally with Templates and any irregularities corrected by loosening the surface, addition or removing necessary amounts of aggregates and re-rolling till the entire surface conforms to desired camber and grade. In no case shall use of screenings be permitted to make up depression.

(e) Moorum as blinding material shall be applied, successively in two or more thin layers at a slow and uniform rate. After each application, the surface shall be copiously sprinkled with water, the resulting slurry swept in with hand brooms or mechanical brooms to fill the voids properly, and rolled, during which water shall be applied to the wheels of the rollers, if necessary to wash down the blinding materials sticking to them. These operations shall continue until the resulting slurry after filling the voids, forms a wave ahead of the wheels of the moving roller.

(f) After final compaction of water bound macadam course, the road shall be allowed to dry overnight. Next morning hungry spots shall be filled with screenings or binding materials as directed, lightly sprinkled with water, if necessary & rolled. No traffic shall be allowed on the road until the macadam has set. The Project Manager shall have the discretion to stop hauling traffic from using the completed water bound macadam course if in his opinion it would cause damage to the surface.

(g) Material which crushed excessively during compaction or becomes segregated shall be removed & replaced with suitable aggregate.

(h) It shall be ensured that shoulders are built up simultaneously along with water bound macadam courses.

C) CONSUMPTION OF MATERIALS

1.2 Consumption of material for specified thickness of pavement in case of both I.R.C. Gr.I and I.R.C. Gr. III metaling shall be as follows:

<table>
<thead>
<tr>
<th>ITEM OF WORK</th>
<th>I.R.C. Gr.I</th>
<th>I.R.C. Gr.111</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over all (Nominal) thickness of layer</td>
<td>115 mm.</td>
<td>100 mm.</td>
</tr>
<tr>
<td>laid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compacted thickness</td>
<td>90 mm</td>
<td>75mm.</td>
</tr>
<tr>
<td>Consumption of metal</td>
<td>0.115 cum/sqm</td>
<td>0.100 cum/sqm</td>
</tr>
<tr>
<td>Consumption of moorum as blinding</td>
<td>0.028 cum/sqm</td>
<td>0.025cum/sqm</td>
</tr>
<tr>
<td>material.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Quantity of metal and moorum is after deduction of void from stacked measurement.

8.10.3 MEASUREMENT:
Spreading of admixture of moorum and sand or Gr-I & Gr-III metals are to be measured on level sections as indicated vide clause 8.7 in preceding paragraph. The volume quantities of different items calculated from level sections are to tally with the corresponding stack measurement quantities computed vide items of BOQ respectively.

8.10.4 PAYMENT:
Rate for conveying from stacks and spreading different items as per of BOQ provides all costs for labour, T&P, machineries, transportation and incidental expenditure required.
for carrying out and completing the items of work with specifications and includes all costs of labour, materials, machineries T&P, equipment and consumables for (a) operations described under Cl.8.10.1 & 8.10.2 of preceding paragraphs for conveying from stacks and spreading moorum sand admixture / metal IRC Gr-I / metal IRC Gr-III, compaction and watering (b) cost of road diversion and road signaling & safety precautions (c) cost of procurement / storage and application of water and any other incidental expenditure required to complete the finished item of work.

8.10.5 PREMIX CARPET AND SEAL COAT
(a) This work shall consist of laying an open graded carpet of 25mm thickness in a single course and 6mm thick pre-coated seal coat composed of suitable small sized aggregate premixed with bituminous binder on a previously prepared approved base.

(b) The quality and grading of materials shall satisfy provisions under sub-head materials.

(c) Carpet shall not be laid during rainy weather or when the base course is damp or wet and when the atmospheric temperature under shade is $160^\circ$ C or below.

(d) The underlying base on which the bituminous carpet is to be laid shall be scraped with wire brushes, swept clean with brooms and finally dust removed with sacks as found necessary.

(e) Tack Coat
This work shall consist of application of a single coat of low viscosity bituminous material to under lying road surface duly cleaned preparatory to bituminous construction. The temperature of bitumen at the time of application shall be in the range of $160^\circ$ to $175^\circ$C. Bitumen shall be heated to the temperature appropriate to the grade of bitumen used and approved by the Project Manager. The rate of spread in terms of straight run bitumen shall be 1kg per sq.m. area for untreated water bound macadam surface. The binder shall be applied uniformly with the aid of sprayers. The tack coat shall be applied just ahead of bituminous construction.

(f) Mixing
Bitumen Mixers of approved type shall be used for fixing aggregates with the bituminous binder. The binder shall be heated to the temperature raising from $150^\circ$C to $175^\circ$C as approved by the Project Manager, avoiding local over-heating and ensuring a continuous supply. Aggregates shall be dry before they are placed in the mixer. After about 15 seconds of dry mixing the heated binder shall be distributed over the aggregates at the rate specified. Kerosene to an extent of 4% to 6% of asphalt shall be provided by the Contractor according to the requirement at his cost. Mixing of binder with chips shall be continued until all chips are uniformly coated with the bitumen and a homogeneous mixture is obtained. The mix shall be immediately transported from the mixer to the point of use in suitable vehicles. The vehicles employed for transport shall be clean and be covered over in transit, if so directed by the Project Manager.

(g) Spreading
The mix shall be spread on the road surface with rakes to the required thickness and camber, or distributed evenly with the help of a drag spreader, without any undue loss of time. The camber shall be checked by means of camber boards and inequalities evened out to prepare the surface to specified line, grade and camber.

(h) Rolling
As soon as sufficient length of bituminous material has been laid, rolling shall commence. When the roller has passed over the whole area once, any high spots or depressions that become apparent shall be corrected by removing or adding premixed materials. The rolling will be done
with a set of 8 to 10 tons three wheel tandem rollers or equivalent suitable pneumatic roller as approved by Project Manager. The roller speed will not be exceeding 5km. per hour. The roller wheels shall be kept damp to prevent the mix from adhering to them but in no case shall lubricating oil be used for this purpose. Rolling shall commence longitudinally from the edges and progress towards the center except that in super-elevated portion, it shall progress from lower to upper edge parallel to the center line of the pavement. The roller should proceed on the fresh material with rear or fixed wheel leading so as to minimize the pushing of the mix and each pass of the roller uniformly over laps not less than one third of the track made in the proceeding pass. Rolling shall continue until the entire surface has been rolled and all the roller marks eliminated. The contractor shall provide necessary labour for keeping the roller wheels damp during rolling so as to prevent the premix from adhering to the wheels and being picked up. The edges along and transverse of the carpet laid and compacted earlier shall be cut to their full depth so as to expose fresh surface which shall be painted with a thin surface coat of appropriate bitumen before the new mix is placed against.

(i)  Seal Coat
Pre coated seal coat of approved thickness shall be applied immediately after laying of the bituminous course of carpet. Before application the surface shall be cleaned free of any dust or other extraneous matter. Mixing of chips and bitumen, laying the mix to proper thickness and rolling will be done similar to procedure for premix carpet described above. Blinding of rolled asphalt surface with course clean sand at the rate of 0.003 cum per Sq.m. of road surface area shall be done by the contractor at his own cost as the same is included in the unit price. Traffic may be allowed only after final rolling when the premix material has cooled down to surrounding temperature.

Consumption of Material

<table>
<thead>
<tr>
<th>Material</th>
<th>Consumption/ Sqm of road surface area</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. 20mm thick premix carpet</td>
<td></td>
</tr>
<tr>
<td>1) 20mm to 12mm size H.G. chips</td>
<td></td>
</tr>
<tr>
<td>Nominal 20mm</td>
<td>0.015 Cum</td>
</tr>
<tr>
<td>-do- 10mm</td>
<td>0.008 Cum</td>
</tr>
<tr>
<td>Total</td>
<td>0.023 Cum 0.023 Cum</td>
</tr>
<tr>
<td>2) Bitumen – 80/100 grade</td>
<td></td>
</tr>
<tr>
<td>Tack coat</td>
<td>0.907 Kg.</td>
</tr>
<tr>
<td>Pre-coating chips</td>
<td>1.270 Kg.</td>
</tr>
<tr>
<td>Misc. and Wastage</td>
<td>0.091 Kg.</td>
</tr>
<tr>
<td>Total</td>
<td>2.268 Kg. 2.268 Kg</td>
</tr>
<tr>
<td>B. 6mm thick pre-coated seal coat.</td>
<td></td>
</tr>
<tr>
<td>1) 6mm and downgraded H.G. chips</td>
<td>0.006 Cum</td>
</tr>
<tr>
<td>2) Bitumen – 80/100 grade</td>
<td></td>
</tr>
<tr>
<td>Pre-coating chips</td>
<td>0.680 Kg.</td>
</tr>
<tr>
<td>Misc. and Wastage</td>
<td>0.010 Kg.</td>
</tr>
<tr>
<td>Total</td>
<td>0.690 Kg. 0.690 Kg.</td>
</tr>
<tr>
<td>3) Sand (for blinding)</td>
<td>0.003 Cum</td>
</tr>
</tbody>
</table>

(i)  The shoulders or berms on either side of the pavement over the embankment to be constructed with rolled moorum layer in conformity with the lines, grades and cross...
sections as per approved drawing and as directed by the Project Manager..

(ii) Moorum shall be conveyed from the road side heaps or from stockyard and spread on the prepared base to lines and grade.

(iii) Rolling will be done with 8 to 10 tons capacity three wheeled rollers as per similar procedure laid for sub-base.

8.10.6 ROAD DIVERSION

(a) The Contractor shall Construct and maintain the road diversion for the traffic with necessary sign boards working signal during construction period as approved by the Project Manager at his own cost.

(b) The Contractor shall take all necessary measures for the safety of traffic during construction and provide, direct and maintain such barricades including sign, marking, light and flagmen as may be required by the Project Manager for the information and protection of traffic approaching and passing through the section of the road under construction. Before taking up any construction, phased program for the Control of traffic on the road shall be drawn up in consultation with the Project Manager.

8.10.7 MEASUREMENT

Measurement of pre-mix carpet and seal coat are to be taken on carpet area and payment shall be made in sqm basis.

8.10.8 PAYMENT:

Rate for providing and placing pre-mix carpet / seal coat provides all costs for labour, material, T&P, machineries, equipment, transportation, storage, watch & ward and other incidental operations required for completing the items of works with specifications and includes all costs for (a) selection and permission for quarry operation, (b) conducting required tests for quarry materials, (c) Quarry operation and collection of approved materials at quarry site, loading into and transportation of materials and unloading and stacking at work sites, (d) royalties & other taxes of material, (e) cost of procurement, transportation, storage and all taxes of bitumen, (f) providing tack coat, (g) mixing bitumen with aggregates mechanically, transporting the mix and spreading on the approved surface, (h) rolling with power roller including watering and cost of water, (i) providing blindage with coarse sand including cost, transportation, royalties and storage of sand, (j) construction of diversion and all safety precautions, insurance and compensation charges, (k) any other incidental expenditure to complete the item in finished shape.
SECTION – 9
GATES AND HOIST FOR CROSS REGULATORS, HEAD REGULATOR & ESCAPE

GENERAL

SECTION 9.1 SCOPE OF WORK
The Scope of the work covers the following items of work.
(a) Manufacturing and supplying including painting (field and workshop both), transport, erection, testing and commissioning of vertical gates of Head Regulators, Cross Regulators and Escapes, with suitable hoisting arrangements.
(b) The scope of work also covers manufacture, transport, supply and erection of all the anchorages including first stage and second stage embedded parts required to be embedded in the first stage / second stage concrete for above gates. The scope of work also includes providing 2nd stage cement concrete of approved grade in block outs as per approved manufacturing drawings.

9.2 The scope of work also covers proper storing of all components, sub-assemblies, electromechanical parts etc. of the items to be furnished under this tender and keeping them in safe custody till they are taken over by the owner in the final installed form.

9.3 The Bidder shall furnish at his own expense all the materials, consumables, tools, plants, equipment, machinery etc. and labour and supervision required for carrying out manufacture / fabrication, transportation, supply installation, painting (both field and shop), testing and commissioning of the above mentioned components and equipment of the gates and hoists as per the conditions and specifications, in these tender documents and as per drawings as may be approved by the Project Manager. The Bidder shall also carry out at his own expense all the preliminary and enabling works and all other incidental works such as establishing a field workshop and stores, furnishing and installing erection aids, cranes if necessary, scaffoldings, ladders, temporary bracings and supports etc. complete as required to facilitate execution of work and shall also carry out at his own expense all other operation covered under the meaning and intent of conditions and specifications in the tender documents. The cost tendered by the Bidder for the above items shall be deemed to be inclusive of all expenses required to be incurred by him for executing the work.

SECTION 9.4 APPLICABLE B.I.S. CODES:
All materials & methods and procedures for the work of design, manufacture, transport, supply and installation shall conform to latest edition Indian Standard Specification and other publication listed below unless otherwise specified.

IS: 210   Cast Iron
IS: 305   Aluminium Bronze Ingots & Castings
IS: 318   Leaded Tin Bronze Ingots & Casting
IS: 434, IS: 693, IS: 2982 Cables and Conductors
IS: 456   Code of Practice for Plain and Reinforced Concrete
IS: 800   Code of Practice for General Construction in Steel.
IS: 808(Part – 1) Dimensions for Hot Rolled Steel Beams M.B. Series.
IS: 808(Part – II) Dimensions for Hot Rolled Steel Column Series.
IS: 808(Part – III) Dimensions for Hot Rolled Steel Beams, Channel and Angle Section Channel MC and MCP Series.
IS: 808(Part – V) Dimensions for Hot Rolled Steel Sections Equal Leg Angles
IS: 815   Classification and coding of covered Electrodes for Metal Arc Welding of Structural steel.
IS: 816   Code of Practice for Use of Metal Arc Welding for General Construction in Mild Steel.
IS: 817 Code of Practice for Training and testing of Metal Arc Welders.
IS: 961 High Tensile Structural Steel
IS: 1028, IS: 1458 Bronze Bushing
IS: 1363 (Part – II) Hexagon Head Bolts, Screws and Nuts of product Grade C Part - I-Hexagon Head (Size Range M 5 to M 36).
IS: 1363 (Part – III) Hexagon Head Bolts, Screws and Nuts of Product Grade C Part-3 Hexagon Nuts (Size Range M 5 to M 36).
IS: 1364 (Part-II) Specification for Hexagon Head Bolts, Screws and Nuts of Product Grade A and Part – II Hexagon Head Bolts (Size Range M 3 to M 36).
IS: 1365, IS: 2389 Threaded Fasteners
IS: 1367 (Part – I) Technical Supply conditions for Threaded Steel Fasteners Part-I Surface Discontinuities on Bolt, Screws and studs.
IS: 1599 Method for Bend Test for Steel Products other than Strip, Wire and Tube.
IS: 1653 Conduits
IS: 1875 Specification for Carbon Steel Billets, Blooms, Stabs and Bars for forging.
IS: 1893 Criteria for Earthquake Resistant Design of structures.
IS: 2048, 2091, 2092 Key ways and Keys
IS: 2062 Specification for weld-able structural steel.
IS: 2266; IS: 2365 Steel wire ropes for general Engineering purpose.
IS: 2513, 5932, 5933, 5692, 5669 Ball and roller bearings
IS: 2644 High Tensile Steel Castings.
IS: 2709 Guide for selection of Fits.
IS: 3073 Assessment of surface roughness.
IS: 3640 Specification for Hexagon fit bolts.
IS: 3681, 4058, 4460, 4702, 4715 Gears
IS: 3757 for high strength structural bolts.
IS: 4218 (Part-I) ISO Metric Screw Threads Part-I Basic and design Profiles.
IS: 4218 (Part-II) ISO Metric Screw Threads Part-II-Diameter Pitch Combinations.
IS: 4218 (Part-IV) ISO Metric Screw Threads Part-IV-Tolerancing system.
IS: 4218 (Part-V) ISO Metric Screw Threads Part-V-Tolerancing system.
IS: 4460 Spur and Helical Gears
IS: 4622 Fixed wheel gates structural design-recommendations
IS: 5530 Code of procedure for repair and rectification of steel castings by metal Arc welding process.
IS: 5620 Recommendations for structural design criteria for low head slide gates.
IS: 5897 Specification for Aluminum and Aluminum alloy welding rods.
IS: 6623 Specification for High Strength structural nuts.
IS: 6639 Specification for Hexagon Bolts for steel structures.
IS: 6649 Specification for Hardened and Tempered Washes for High Strength Structural Bolts and nuts.
IS: 6938 Design for rope drum and chain hoists for hydraulic gates – Code of practice.
IS: 7205 Safety code for erection of structural steel.
IS: 7215 Tolerances for fabrication of steel structure.
IS: 7310 (Part-I) Approval Tests for Welders working to approved welding procedures – Part-I – Fusion welding of steel.
IS: 7718 (Part-I) Recommendations for inspection, testing and maintenance of fixed wheel and slide gate-part-I – Inspection. Testing and assembly at the manufacturing stage.
IS: 7718 (Part-III) Recommendations for inspection, testing and maintenance of fixed wheel and slide gate – Part-III- Inspection and testing at the erection. 
IS: 7718 (Part-III) Recommendations for inspection, testing and maintenance of fixed wheel and slide gate – Part-III- after erection.
IS: 8500 Weldable structure steel (Medium & High strength qualities)
IS: 9595 Recommendations of metal Arc welding of carbon and carbon manganese steels.
IS: 9954 Pictorial surface preparation standard for painting of seal surface.
IS: 11228 Recommendations for design of screw hoists for Hydraulic gates.
IS: 11855 General Requirements for Rubber seals for Hydraulic gates.

The above list is only indicative & in no way complete or exhaustive. Any other materials necessary as per approved drawings have to be procured and used by the bidder within quoted rates.
SECTION 9.5 TECHNICAL PROVISION FOR CROSS REGULATOR / HEAD REGULATOR/ESCAPE GATES

The materials shall conform to the specifications as mentioned in the approved drawings and as per direction of the Project Manager. The bidder shall go through the approved drawings thoroughly and bring to notice of the Project Manager immediately of any discrepancy or deficiency before taking up fabrication. The Project Manager shall not be responsible if any problem arises due to discrepancy in the drawings noticed during or after fabrication. The bidder shall be fully responsible for smooth operating of the gates under all conditions. The gates shall be capable of being operative at any opening under all conditions of unbalanced operations and shall be free from vibrations at all conditions of gate operation. The leakage through the gates shall not exceed the permissible limits.

SECTION 9.6 METAL WORK, FABRICATION AND MACHINE WORK:

9.6.1 General workmanship.

All fabrication work under the contract shall be done in accordance with the specifications and works shall be performed and completed in a thorough workman like manner as per the practice in manufacture and fabrication of materials of the type covered by the specification. The work, shall in all cases, be of the highest quality and carefully performed to the specification of the Project Manager. All materials and workmanship furnished by the Bidder be free from injurious defect. He shall replace free of cost to the Project Manager, any defect in material or workmanship noticed during erection and shall bear all cost of the modification in the field of any defect for which he is responsible. Workmanship shall conform to the latest standards, laid down in Indian Standard specification.

All members shall be free of twists, bends or other deformations and all surfaces that will be in contact shall be thoroughly cleaned before assembling. Parts shall be adjusted to line and fit and shall be firmly bolted or otherwise held securely together so that surfaces are in close contact before drilling, reaming or welding is commenced.

If weight limitations and transport clearances do not permit anchorages and miscellaneous embedded parts, they shall be fabricated into sub-assemblies. The Bidder shall submit a drawing showing the sub-assemblies into which he proposes to fabricate the gates, anchorages, miscellaneous assemblies and embedded parts and hoists for transporting them to site.

Plates with laminations discovered during cutting, welding or at any other time shall be rejected. Minor surface imperfections can be repaired wherever possible with the prior approval of the Project Manager. Materials not supplied or workmanship not performed in accordance with the approved drawings and / or with the specifications shall be rejected and replaced.

All parts of the gates, hoists shall be fabricated in accordance with the specifications and approved drawing. The Bidder shall take special care in fabrication of the parts affecting strength, rigidity and water tightness of the gates. The seal bases shall be finished after the plates have been welded to the skin plate and the finished surfaces of the seal bases shall be in the same plane within the tolerances as specified elsewhere.

9.6.2 FITS AND TOLERANCE

Fits used for difference components shall be according to the best modern shop practice. Due consideration shall be given to the special nature of function of the parts and to the corresponding accuracy required to secure proper operation. The fits shall be in accordance with the Indian Standard “Guide for the Selection of the Fits (First Revision) IS: 2709.”
9.6.3 SCREW THREADS
The threads for bolts and nuts shall have metric threads of International Standards Organisation and conforming to Indian Standards “ISO Metric Screw Threads Diameter Pitch Combination IS: 4218 Part.II.

9.6.4 MACHINE FINISH

The type of finish, unless otherwise specified shall be that most suitable for the part to which it applies and shall be smooth, average or rough as defined under Indian Standard “Assessment of Surface Roughness (With Amendment No.1 to 3) IS:3073. A smooth finish (Three Delta, that is 0.20 to 0.8 micrometers) will be required for all surfaces in sliding / rolling contact, an average or commercial finish (Two Delta, that is 1.6 to 6.3 micrometers) for surfaces in contact where a tight joint is required and a rough finish (Single Delta, that is 12.5 to 25 micrometers) for all other machined surfaces which are not in contact, but which require finished for dimensional accuracy.

9.6.5 FABRICATION OF STRUCTURAL STEEL:

9.6.5.1 The structural steel work for the equipment covered by the specifications shall confirm to the requirements of “Reamed work and shall conform to the following requirements unless otherwise called for in these specifications.

9.6.5.2 STRAIGHTENING
Before being laid off or worked in any manner, structural materials shall be straight without twist, bends or kinks and if straightening is necessary, it shall be done by methods that will not injure or mark the materials. Heating or hammering shall not be permitted. All steel surfaces to be welded shall be cleared of dirt, rust and mill scale prior to fabrication.

9.6.5.3 SHEARING, CHIPPING AND GAS CUTTING:
Shearing, chipping and gas cutting shall be done carefully by torch or by arc and all portions of the work which shall be exposed to view shall present a neat appearance. Gas cutting shall be mechanically controlled. Re-entrant cuts and copes in beams and channels shall be filled before cutting.

9.6.5.4 PLANNING OR FINISHING EDGES:
Planning or finishing of the sheared or cut edges of plates or rolled shapes shall not be required except otherwise specified for welded edges or as shown on the Bidder’s drawings, approved by the Project Manager.

9.6.5.5 WELDED EDGES:
The edges of plates or shapes to be joined by welding shall be properly formed to suit the selected type of welding. Sheared edges of plates and shapes to be jointed by welding shall machined or chipped to sound metal before welding.

9.6.5.6 BENT PLATES AND SHAPES
Where bending of plates or forming shapes is required, these shall be bent to the proper curvature by cold forming. Heating and hammering to correct curvature shall not be permitted.

9.6.5.7 DRILLING AND REAMING:
Holes shall be accurately located drilled and reamed perpendicular to the face of the member and if necessary a template shall be used. Holes in material 20mm, or less in thickness shall be sub-punched or sub-drilled before assembly and reamed to full size during assembly. Holes in materials more than 20mm in thickness shall be sub-drilled 3mm. smaller than the normal diameter of the rivet of bolt before assembly and reamed to full size during assembly.
Counter boring shall be done carefully to meet the requirements for clearance and fill the weld studs. Anchor bolt holes shall be punched or drilled out to full size. All holes shall be made by the following methods.

1) **Punching.**

Punching of holes to full size shall not be permitted. For sub-punching, the diameter of the punch shall be 4.5mm smaller than the nominal diameter of the bolt used and the diameter of the punch shall not be more than 2.50mm larger than the diameter of punch. All holes shall be clean cut without any burn or ragged edges or burrs.

2) **Drilling and reaming**

For sub-drilling, the diameter of the drill shall be 3mm. smaller than the nominal diameter of bolt used except where tapping is required for tight fit bolts. Ribbed bolts or dowel are to be used full size drilled or reamed holes shall not be less than 1.5mm nor more than 2.5mm larger than nominal diameter of the bolt used. Holes for ribbed bolts shall be drilled or reamed to 1.5mm less than the diameter of the ribbed shunk of the bolts to ensure a tight fit. Reaming of sub-punched or sub-drilled holes shall be done with machines after assembly. The templates shall be used when assembled reaming is impracticable. Tapped holes shall be drilled to the proper diameter for the tap used and shall be tapped carefully so that the threads will be continuous, smoothly cut and free from imperfections.

**9.6.5.8 ACCURACY OF PUNCHING, DRILLING AND REAMING :**

1) Before assembly :-

The accuracy of all holes shall be such that during assembly, a cylindrical pin 3mm. less in diameter than the normal size of the holes shall be entered perpendicular to the face of the member.

2) During assembly :-

The accuracy of reaming and drilling during assembly shall be such that not less than 85 percent of any group of continuous holes in the same plane shall show no offset greater than 0.5mm. between adjacent thickness of materials, unless a greater degree of accuracy is called for on the drawings approved by the Project Manager or in these specifications.

**9.6.5.9 WELDED STUDS:**

Welded studs wherever used shall be welded in place with automatic end-welding guns. Templates of sufficient thickness to afford good alignment shall be used to accurately locate the studs during the welding cycle and to locate matching holes in other materials. Bushing shall be used for template holes, if necessary to ensure angular alignment of the studs and location, accuracy required for proper fit of parts to be assembled.

**9.6.6 PATTERNS:**

The price bid shall include the cost of all necessary pattern. Patterns shall remain the property of the Bidder. While making patterns, care shall be taken to avoid sharp corners or abrupt changes in cross section and ample fillets shall be used. The Bidder shall provide pattern thickness as will conform to his standard foundry practice and as may be necessary to ensure that all metal thickness of the finished castings shall be in accordance with the dimensions shown on the Bidder’s drawings approved by the Project Manager.
9.6.7 WELDINGS:
9.6.7.1 PREPARATION FOR WELDING:

Members to be joined by welding shall be cut accurate to size, and where required shall be rolled or pressed to the proper curvature in accordance with the dimensions shown on the Project Manager’s drawings. The edges of the member to be joined by welding shall be sheared, flame cut or machined to suit the required type of welding and to allow through penetration. The cut surface shall expose sound metal, free from laminations, surface defects caused by shearing or flame cutting operations and other injurious defect. The surfaces of plates to be welded shall be free from rust, grease and other foreign matter for a distance of at least 50mm, back from the edge of the weld. In assembling and during welding the components parts of built up members shall be held in place with sufficient and proper clamps or other adequate means to keep all parts in proper position.

9.6.7.2 WELDING TECHNIQUE:

All welding shall be performed by electric arc process using coated electrodes or other means whereby the atmosphere is excluded from the molten metal and where applicable, automatic machines with correct precision control shall be used. After being deposited, the weld shall be cleaned of slag or flux and shall show uniform section, smoothness of weld metal, feature edges without overlap and free from porosity and clinkers. Visual inspection at the edges and ends of welding shall indicate good fusion with the base metal. When weld metal is deposited in successive layers, each layer except the last shall be peened moderately with a tool before the next layer is applied. Particular care shall be taken in aligning and separating the edges of members to be joined by butt welding, so that complete penetration and fusion at the bottom of the joint shall be ensured. All pin holes, cracks and other defects shall be repaired by chipping or grading the defects to sound metal and re-welding. Where fillet welds are used, the member shall fit closely and shall be held together during welding. The welding rods used for manual welding shall be of heavily coated type and shall be suitable for all position welding where required. While welding precaution shall be taken to minimize stresses due to expansion and contraction and distortion due to heat by using the proper sequence in welding i.e., by peening the welds while hot or by other satisfactory methods.

Rectification of distortions by blows after welding shall not be permitted. Welds shall not be primer coated until they have been inspected and approved by the Project Manager. The welding shall conform to Indian Standard “Code of practice for use of Metal Arc welding for general construction in mild steel IS: 816. All skin plate welds shall be continuous and water tight and shall develop the full strength of plate. The electrodes shall conform to the “Indian Standard Specifications for covered Electrodes for Metal Arc welding of structural steel for welding products other than sheets and for welding sheets (Part-I and II) IS: 814.

The Bidder shall prepare shop and field welding procedure including stress relieving and preheat requirements and shall submit this procedure to the Project Manager for approval. The procedure shall be in accordance with the best modern welding practice and shall be such as to minimize residual stresses and distortion of the finished members of the structure. Approval of any procedure, however, shall not relieve the Bidder of the sole responsibility for producing a finished product meeting all requirements of these specifications. Welds in contact with rubber seal shall be ground flush, all corners and corner welds in contact with rubber seal shall be rounded.

9.6.7.3 APPROVAL TEST OF WELDING PROCESS:

Specification of the welding procedure that are proposed to be used shall be established and recorded and a copy of such procedure, specifications together with certified copies of reports of results of tests made in accordance with the procedure specifications shall be furnished by the

9.6.7.4 QUALIFICATION OF WELDERS:

All welders assigned to the work shall have passed qualification test for welders. If at any time, work of the welder appears to be questionable, such welder shall be required to pass additional qualification test conforming to Indian Standard “Code of Practice for Training and Testing of metal Arc welders “ IS:817 and Indian Standard “Approval test for welding procedure part-I Fusion welding of steel IS: 7307 (Part-I).

9.6.8 CASTINGS:

All castings shall be true to pattern and thickness of the metal shall not vary at any point by more than 1.5mm from that shown on the drawings approved by the Project Manager. Care shall be taken in the foundry to cool the castings properly so that they shall not warp or twist. No casting will be accepted if it is warped and/or twisted to such extent that machined surface can not be properly finished to the dimensions shown in the Bidder’s drawings approved by the Project Manager, or require so much metal to be removed as to leave the thickness of the metal less than that shown in the Bidder’s drawings approved by the Project Manager by more than 1.5mm. All castings shall be free from cracks, large or injurious blow holes or sand holes and other blemishes. They shall have workman like finish, inside angles having proper billets and unfinished edges of bases, ribs and similar parts being neatly cast with rounded corners.

The cast parts shall be homogeneous and free from non-metallic inclusions. An excessive concentration of impurities or a separation of the alloy element in the critical point of cast part shall be sufficient cause for rejection.

The surface which are not machined and which will be exposed after their final installation shall be such that grinding at the site is not required before painting.

Repairs of major defects in castings shall not be allowed, but if the strength and machinability of the casting can be ensured, the castings shall be rectified by welding with the prior approval of the Project Manager. All castings shall be welded, if required, in accordance with the procedure laid down in Indian Standards “Code of Procedure for Repair and Rectification of Steel Castings by Metal Arc welding process IS: 5530. All such castings in the area of repairs shall be re-examined as directed by and to the satisfaction of the Project Manager.

9.6.9 FORGINGS:

All forgings shall be supplied in the as forged and normalized condition. They shall be sound and free from scales, cracks, crevices or any other flaws that can be detrimental to their use.

All forgings shall be suitably heat treated as required under specified method. Finished surfaces of all forgings shall be smooth and free from tool marks.

9.6.10 ERECTION OF BOLTS, NUTS, WASHERS AND OTHER FASTENERS:

Erection of bolts, washers and other fasteners shall be furnished in the amount of 15 percent the bolts, nuts, washers and other fasteners whichever is greater, in excess of the nominal nature of each size and length required for complete installation of equipment.

Bolts in tension shall have net section at root of thread 15 percent in excess of the net section required in tension.

9.6.11 WASTAGE OF STEEL

There shall be some wastage of steel section and plates during fabrication & cutting losses. It is the responsibility of the Bidder for minimizing such losses & the cost of such lost steel shall be deemed to have been included in the Bid price. Bidders also shall not be compensated for the wastage of steel.
SECTION 9.7 CLEANING, SURFACE PREPARATION AND PAINTING:

9.7.1 GENERAL

The Bidder shall furnish, prepare and supply all materials for cleaning surface preparation and painting of metal work as hereinafter specified. The cost of furnishing, preparing and supplying all materials which are required for cleaning, surface preparation, painting and coating operations including supply of all labour, tools and equipment shall be included in the rate quoted.

9.7.2 CLEANING AND SURFACE PREPARATION:
9.7.2.1 Cleaning of different components

(i) Gate Leaves/Hoist and Hoist bridges:
All the surface (except non-ferrous surface and machined mating ferrous surface) of the gate leaves for the gates, hoist & hoist bridges etc. shall be cleaned and prepared for painting in accordance with the “METHOD –A specified vide section 9.7.2.2.1 below.

(ii) Embedded parts:
The surface (except non-ferrous surface and machined matting ferrous surface) of all the embedded parts for all the gates shall be cleaned and prepared for painting as under.
All the exterior ferrous surfaces of the embedded parts which are to come in contact with concrete shall be cleaned by the “METHOD-B” specified vide section 9.7.2.2.2 below.
The ferrous unfinished surfaces of the embedded parts which will be exposed to water or atmosphere shall be cleaned and prepared for painting in accordance with the “METHOD –A” specified vide section 9.7.2.2.1 below.

(iii) All the exterior surfaces of the hoist and heads including non-matting finished surfaces and unfinished surfaces of hoist stems, coupling and stem retaining device shall be cleaned and prepared by the “METHOD-A” specified vide section 9.7.2.2.1 below.

(iv) The ferrous surfaces of the pipes and other fittings for the surfaces of hoist support frames and girders, ladders, hand railings, grating etc. shall be cleaned and prepared by the “METHOD – B” specified vide section 9.7.2.2.2 below.

(v) The exposed external surfaces of the bought out components like gear boxes, worm reducers etc. which are shop coated by their respective manufacturers shall be cleaned by suitable means in a manner which will avoid any damage to the components. The damaged portion (if any) of the shop coat on such items shall be repaired.

(vi) Any other metal work not specifically mentioned in the foregoing paras (i) to (v) above but which requires painting shall be cleaned and prepared for painting as directed by the Project Manager.

9.7.2.2 METHOD-A AND METHOD-B
9.7.2.2.1 The METHOD-A shall be as under :-

The weld surfaces shall be de-slagged and weld splatters, burrs and other objectionable surface irregularities shall be removed carefully. All rust, mill scale and other foreign substances shall be removed from the surfaces by scrapping, chipping, vigorous wire brushing, blasting or other effective means. Care shall be taken to avoid excessive brushings of steel. All oil, grease, dirt and all other contaminants shall then be removed by the use of clean mineral spirits, xylol or white gasoline and clean wiping materials.

9.7.2.2.2 METHOD-B: In case rust forms of the surfaces become otherwise contaminated in the interval between cleaning and painting, re-cleaning shall be carried out by the same method as herein above specified for the respective items. Surfaces of stainless steel, Nickel, Bronze and machined surfaces adjacent to metal work being cleaned or painted shall be protected by masking tape or by other suitable means during the cleaning and painting operation.
9.7.3 PAINT MATERIALS AND PAINTING :

9.7.3.1 GATE LEAF :

All the surfaces (except non-ferrous surfaces and machined mating ferrous surface) of the gate leaves for all the gates shall be after cleaning as per section 9.7.2.2.1 above, applied with 1(one) coat of Epoxy Base Primer followed by 2(two) coats of COAL TAR EPOXY. The Epoxy Base Primer and coal tar epoxy paint shall generally conform to the particular given in the relevant IS Codes or as directed by the Project Manager. The first coat of the Epoxy Base Primer shall be applied within 4 hours of cleaning. The dry filling thickness (DFT) of each coat of zinc rich primer shall be at-least 50 microns. The dry filling thickness (DFT) of each coat of coal tar epoxy paint shall be at-least 100 microns.

9.7.3.2 EMBEDDED PARTS :

The surfaces (except non-ferrous surface and machined mating ferrous surfaces) of all the embedded parts for all the gates after cleaning as per the relevant foregoing para shall be coated as under:

i) All the exterior ferrous surfaces of the embedded parts which are to come in contact with concrete shall be given 2(Two) coats of cement wash mixed with 5% potassium dichromat. The first coat shall be applied immediately after cleaning and second immediately before pouring concrete.

ii) The ferrous, unfinished surfaces of the embedded parts (except stainless steel) which will be exposed to water or atmosphere shall be painted with the same paint materials (viz. Epoxy Base Primer and Coal tar epoxy paint) and coated in same manner as specified for the gate leaves vide foregoing section 9.7.3.1.

9.7.3.3 HOISTS AND OTHER PARTS

i) All the exterior surfaces of the hoist stem (screw hoist) machined mating finished surfaces shall be given one coat of Epoxy Base Primer at a coverage rate of approximately 6 square meters per liter. This shall be followed by two coats of alluminium paint of suitable grade at a coverage rate at 5 square meter per liter per coat, without thinning. The hoist stems, couplings and stem retaining device shall be given four or more coats of red lead priming paint to achieve a total dry film thickness of 0.15 mm.

ii) Miscellaneous items such as hoist support frames and girders, control cabinets, ladders hand railings, gratings etc. shall be given 2 coats of Alkyd priming paint or machinery grade paint or Aluminum paint as directed by the Project Manager. The exterior surfaces of the bought out items like electric motors, gear boxes etc. which are shop coated by the manufacturer shall be given one additional coat of the same paint as original shop coat or one coat of Alkyd priming paint or machinery paint or Aluminum paint as directed by the Project Manager.

9.7.3.4 APPLICATION PROCEDURE :

a) Painting shall not be done when the ambient temperature is less than 10 degrees C and when relative humidity is more than 80%.

b) Primer coats shall be applied without any time lag after the cleaning and surface preparation as per clause 9.7 above and care shall be taken to ensure that paint is not applied to damp surface.

c) Painting shall be discontinued during rain and dust storm and shall not commence until the surfaces are perfectly dry and clean.
d) Welds and adjacent parent metal shall not be painted or touched up prior to de-slagging inspection and approval.

e) All materials shall be in a thoroughly mixed conditions at time of application and shall not be thinned unless otherwise specified. When paint is applied by spraying, suitable means should be provided to prevent segregation during the painting operation.

f) Any warming of the paint materials shall be performed by means of hot water bath and except as specifically provided. Paints shall not be heated to a temperature higher than 38°C.

g) Each coat of paint shall completely and uniformly cover the surface and shall be free from runs and sags. Each coat shall be allowed to dry or harden sufficiently as per manufacturers recommendations before the next coat is applied.

h) The detail application procedure indicating method of preparing and applying etc. shall be evolved in consultation with the paint manufacturer which shall be followed by the Bidder.

i) Surface to be painted that will be inaccessible after installation shall be completely painted as per schedule prior to installation.

9.7.5 REPAIR AND PROTECTION OF COATINGS:

Metal work that has been shop painted or field painted should be handled with care so as to preserve the coatings in best practicable condition. Before proceedings with a fresh coat the Bidder shall clean and repair all areas of the previous coat which are defective or damaged. Previous coat on the areas where the coating is loose, weakly bonded blistered or otherwise defective shall be removed to clean metal by scrapping, chipping, power wire brushing or other effective means. Areas thus prepared shall be cleaned of all dust, dirt and other contaminations using clean rags and clean solvent. These surfaces shall then be repainted in accordance with the painting schedule. Hair line cracks or areas where the thickness of coating is less than specified but which are otherwise damaged shall be cleaned of all dust and other contaminations if any, and shall be recoated with additional paint to build the coating to specified DFT. All repaired areas of paint will be required to pass acceptance tests performed by the Engineer. The cost of cleaning and painting of damaged and defective areas shall be borne by the Bidder.

9.7.6 INSPECTION OF PAINT MATERIALS AND ACCEPTANCE TEST FOR PAINT COATINGS:

The Bidder shall use the paint materials made by reputed manufacturers whose paint have been successfully used on the under-water high head gates of other comparable hydro project in India. The particulars of the paint product intended to be used and name of the manufacturers shall be furnished to the Project Manager for approval prior to making any use of any paint materials in the works.

All paint and coating materials shall be made available for sampling at least 30 days prior to use and no paint or coating materials shall be used until they have been tested and/or approved by the Project Manager.

So far as practicable as determined by the Project Manager, the Bidder shall make arrangements with the Government for inspection of paint material at the factory of the Bidder. The Bidder shall provide facility and assistance as required for procuring representative test samples which will be taken by the Project Manager. With all materials, the Bidder shall furnish detailed information regarding specification. The replacement of the paint materials and expenses incurred for this replacement, if the analysis discloses anomalies, shall be borne by the Bidder and no payment on this account will be made to him. Preparation of the paint
materials used and their labeling shall comply with the rules applicable. The safety rules required during their application shall be strictly observed. Before starting on work, the Bidder shall submit reference metallic test plates of size 200X300X2mm. These test plates shall be prepared according to the specifications and shall receive the specified paint materials with the exact utilization shades selected and specified number of coats. Upon completion, the coating appearance shall be in accordance with the specification and the test plates supplied. The Bidder shall check thickness of coats both during application of paint and finally after their completion. The Project Manager shall check thickness of coats after their drying time in a number of areas of 1m² representing together 20% of the total surface of the coating. Within each area of 1m² the Project Manager will select 8 elementary surfaces of 100cm² each for paint coat application when 10 consecutive measurement of thickness will be affected. The average of measurement over 100cm² each shall not be smaller by more than 10% of the specified thickness. If, over 100cm² these tolerances are not met with, the coating thickness will be measured on two more adjacent elementary surfaces. The Bidder shall have to bring up the thickness of the coating wherever it is recognized to be insufficient. The thickness measuring unit shall be calibrated and cross checked by both the Project Manager and the Bidder.

SECTION 9.8 SHOP TESTS AND INSPECTIONS:

9.8.1 GENERAL

All materials and components of the equipment offered under the specifications shall be tested by the Bidder prior to fabrication. After fabrication the equipment shall be assembled in the shop and shop tests shall be performed by the Bidder to ensure accuracy in fabrication and workmanship. The Bidder shall carry out such tests as may be required by the Project Manager in order to determine that the gates, hoist will fulfill the functions for which they have been designed. The Bidder shall be responsible for all modifications and adjustments required for the work as a result of such tests. The test shall be repeated, if necessary, until they are successfully carried out to the satisfaction of the Project Manager.

9.8.2 TESTS OF MATERIALS:

All materials, supplied parts and assemblies thereof being used in the work to be done under these specifications shall be of tested quality and all works performed shall be subjected to rigid inspection and no article or material or supply shall be dispatched until all tests analysis and sub-inspection have been completed and certified copies of reports of results and analysis have been accepted by the Project Manager.

9.8.3 SHOP ASSEMBLY AND TESTS

9.8.3.1 GENERAL:

The gates hoists along with hoist bridge shall be completely assembled in the shop for inspection and to ensure that all parts to be connected are fitted properly and that all the dimensions, clearances and tolerances called for in these specifications and / or shown in the drawings of Project Manager are obtained. Any template or layout plates required to ensure correct matching of holes in connecting parts for erection shall be furnished by the Bidder to the Project Manager. The gates and the hoists shall be assembled in a vertical / inclined position to ensure proper alignment and holes for field connections shall be carefully drilled or reamed while the gates are being shop assembled. The gates shall be shop assembled as considered necessary to check fabrication and all parts shall be carefully match marked to facilitate erection at site.
9.8.4 INTERCHANGEABILITY
Where possible all similar items and removable parts of similar equipment of gates, hoists and their embedded parts shall be interchangeable with each other.

SECTION 9.9 TRANSPORTATION AND STORAGE
9.9.1 GENERAL

All the components to be furnished against items of BOQ and all the spare parts as may be ordered by the Project Manager shall be transported by the Bidder as per the requirements stated below. The Bidder shall be also responsible for proper storage of the above mentioned components (till the acceptance of the final installed forms) at his field store or field workshop near project site. The land for establishing the field store / workshop is the responsibility of the Bidder for which no extra cost will be paid.

9.9.2 TRANSPORT
i) All the components shall be transported (including loading and unloading) by the Bidder from his workshop or any other place of their manufacturer as the case may be to the said field store / workshop near project site. The transport of the fabricated components from workshop to the said field shall be done after all shop tests are completed and after obtaining clearance from the Project Manager. Such clearance given by the Project Manager shall not be construed as acceptance of any components and the same shall in no way absolve the bidder of his responsibility for satisfactory performance of the equipment or any office obligations under this contract. It shall be ensured that respective components are transported and brought to project site sufficiently in advance of the program for their erection.

ii) The Bidder shall be responsible for any damage or loss in transport as well as for all claims to accident if any occurs in transporting the components. The necessary transit insurance for the equipment up to destination shall be the responsibility of the Bidder and insurance cost shall be borne by the Bidder.

iii) Disassembly for dispatch
After completion of required shop assembly shop tests and inspection the equipment shall be disassembled into minimum no. of sub-assemblies convenient for transport and storage without damage to any parts of the equipment to the satisfaction of the Project Manager.

iv) Unit marking, match marking and transportation designation
Each part of the cross regulator, head regulator and escape gates and their respective parts, hoists etc. which is to be transported as a separate piece shall be marked to show the unit of which it is a part and match marked to show its relative position in the unit to facilitate assembly in the field. Unit marks and match marks shall be made with heavy steel stamps and paints. Each piece sub-assembly or package transported separately shall be labeled or tagged with transportation designation consisting of the specification number and the mark number of such piece or the no. of parts grouped in such sub-assemblies or contained in package.

v) Weighing, packing and preparation of transportation
All assemblies or parts shall be packed by the bidder in a secured manner in boxes or crates and adequate skids and lifting slings provided where necessary. All protruding pieces or long slender parts shall be adequately protected from damage. All exposed finished surfaces of the equipment shall be adequately protected from abrasion. All packing shall be allowed for easy removal and checking at sites. Special precautions shall be taken to prevent rusting of steel and iron parts during transit. The methods proposed to be adopted for protection against moisture shall be subject to the prior approval of the Project Manager. The bidder shall provide an wooden blocking to prevent deflection and vibration of all parts of the gates and hoists during transport handling and storage. All opening shall be covered and all parts shall be tightly coated with a rust preventing compound as specified. Rubber seal shall be dismantled after shop
assembly and shall be transported separately. They shall be rapped and boxed to protect them from any element which would adversely affect their size, shape or physical properties before their field assembly to the gates. The gates, hoists shall be prepared for transportation so as to permit minimum amount of field assembly.

All projecting plates etc. shall be kept in shape in timber or angles bolted to them. All straight bars and plates except small pieces shall be transported in convenient bundles, temporarily bolted or bound together. All slender pieces shall be adequately supported and blocked. All bolts, nuts, washers, plates under 0.3m. and generally such small article as may be selected shall be tacked in a strong case and made secure for transportation to site. All bolts and nuts of different sizes shall be packed in separate bags each having a label indicating the contents of the bag. All packing shall become property of the Project Manager.

All oils shall be drip drained from hoists and all connection for piping and valves shall be metal plugged or otherwise closed watertight and dust tight to the satisfaction of the Project Manager.

vi) MANUFACTURERS’ NAME PLATE

The Bidder shall be permitted to attach a metal plate indicating his name, address etc. on equipment at suitable locations approved by the Project Manager. Cast lettering except pattern number will not be permitted on any of the casting. Suitable name plates shall be provided in the controlled cabinets and other locations where necessary. The name plates shall be made of laminated material suitable for engraving, shall be opaque and consist of black lettering over white background or white lettering over black background. All the name plates shall be in English language.

vii) Each case or packing shall be clearly marked with name of work and the items to which the contents pertain and shall contain a packing list which will also include similar details. Copies of the packing list shall also be sent to the Project Manager by registered post for record.

viii) Maintenance and Operation Instructions

One set of the following manuals in English shall be furnished by the Bidder along with the respective equipment at the time of transport.

1) Technical and design data
2) General description of main components
3) Operating instructions.
   a) General
   b) Specific (Dealing with any useful features of safety precautions)
4) Maintenance and repair instructions
5) Lubrications
6) Materials and part identification list
7) Adjustments
8) Two sets of drawings as-built and
9) List of all special tools required to follow correctly the servicing procedure along with a set of such tools.

After the final approval, the bidder shall complete the submitted documents in order to constitute 6 complete approved sets of maintenance and operation instructions. All these instructions shall be written in English.

9.9.3 All the fabricated components shall be in the custody of the Bidder for work under this tender till they are taken over by the Project Manager in final installed form. These components shall be stored on suitable platforms and shall be supported in a manner which
will not cause damage / distortions or bending due to their own or superimposed weight. All components shall be protected from all sides against rusting or any other deterioration which may affect their performance. The machined parts and other precision components of hoists and sills etc. shall be stored in go-down or a closed shade with proper locking arrangement as directed by the Project Manager.

The Bidder should make all arrangements at his own cost for establishing his field store / workshop. All other facilities and arrangements required for storage of the components in the above stated manner and for proper watch and word of the component while in storage shall be provided by the Bidder at his own expenses. In case of any bending, deformations or any other injury occurs during storages, transportations and handlings before and during installations they shall be rectified to the satisfaction of and in a manner specified by the Project Manager, without any extra cost. Decision of the Project Manager shall be final and binding.

9.9.4 Notwithstanding anything stated in these clauses, the Bidder shall be entirely responsible for loss, damage or depreciation of stores during transport, handling, storage or installations. Separate payment shall not be made for transport and storage of the equipment as per the requirements of these specifications and all costs for the same shall be deemed to have included in the rates tendered for in the items of BOQ.

SECTION 9.10 INSTALLATION, TESTING AND COMMISSIONING

9.10.1 GENERAL:

1) The items covered under the scope of the work also covers installations, operational trials and commissioning of the various equipment and components to be furnished under this contract. The Bidder shall carry out installations, testing, operational trials etc. as per the requirements of contract specifications and conditions of approved drawings and as directed by the Project Manager. He shall ensure that all equipment and components furnished by him under this contract are properly installed, tested and commissioned and shall be wholly responsible for the satisfactory performance of the same.

2) Not less than 45 days prior to commencing any erection the Bidder shall submit to the Project Manager:
   a) Detailed program of erection prepared in accordance with relevant provision in these tender documents. He shall also indicate the methods and procedures intended for transport, handling and installing the equipment and components to be furnished under this contract.
   b) Erection drawings indicating the identification of the components and their relative positions, field welds and connections and any other relevant details.

3) The Bidder for the work under this tender shall fully co-operate and work in close co-ordination with the bidder for construction of other related works of the project and other appurtenant work.

4) The Bidder shall at his own expense provide to install bracings and temporary supports, fixtures etc. necessary for safe transport, handling, erection and testing of the various components and equipment to be furnished under this contract. The platforms, scaffoldings, false works, erection aids, and other facilities required for accurate installation and inspection and testing of the equipment and components supplied shall also be provided by the Bidder at his own expense.

5) The reference lines, center lines of openings and labels having relations to completed civil structures shall have to be established on site by the Bidder so as to facilitate
installation at proper locations. Installation in the field shall be done by bolting and/or electric arc welding, or by any combination of these as shown on the approved drawings or described in these specifications and the bidder shall be prepared to perform this class of work. The requirements “Welding”, “Bolting” etc. stipulated under relevant foregoing clauses shall apply to all welding, bolting etc. performed during installation.

6) The Bidder shall keep posted at the project site his one senior qualified engineer and foreman having adequate experience in fabrication and installation of gates and hoists and mechanical equipment. The Bidders’ crew for the work shall also be experienced in the type of work involved under this contract.

9.10.2 EMBEDDED PARTS AND GATES

1) All the embedded parts, gates and hoists shall be accurately assembled and installed in lines, levels and plumbs as shown on the approved installation drawings and as directed by the Project Manager. All match marks shall be followed carefully, while installing these parts members shall not be over stressed. Hammering that will injure or distort the members will not be permitted. Bearing surfaces and surfaces to be in permanent contact shall be carefully cleaned before the members are assembled or installed. The work shall be performed duly adhering to the tolerance stipulated.

2) The Bidder shall furnish erection gauge with each type of gate and the same shall be used to check the alignment of gate frame for required tolerances. The anchor bolts shall be located accurately and shall be held rigidly in position while the concrete in the structure is being placed. Frames and guides shall be placed in position and be adjusted accurately to exact position and alignment by means of adjusting nuts and turn buckles on the anchor bolts or by means of erection beams. Exceptional care shall be taken to ensure that all frames and guides are installed such that the gate sealing surface of each frame is even and true and lies in a true plane and that bearing surfaces of the tracks and gate guide on each frame lies in the same plane, so that, when slide gates are installed the gate seal and seats will bear evenly without leakage, all these operations being to the satisfaction of the Project Manager.

3) After the second stage embedded parts are erected, aligned and secured properly and rigidly by the Bidder, the bidder shall provide and place 2nd stage concrete for their embedment after all necessary field trials or as directed by Project Manager. It is to be insured by the Bidder that the gates are operational to the design requirements after 2nd stage concreting. The Bidder shall provide and fix all necessary dressings, supports etc. and ensure that 2nd stage embedded parts are not damaged or their alignment is not disturbed due to the placement of 2nd stage concrete.

4) Unless otherwise directed by the Project Manager the gate leaves shall not be inserted before curing of the 2nd stage concrete. Sealing strips and seals shall be cut accurately to the required length and shall be attached to the gates as shown on the approved drawings or as directed. The Bidder shall locate carefully holes to be drilled in the sealing strips. The seal clamps shall be used as templates for drilling holes in the rubber seals where required. At joints, the end of the seals shall be cut so as to butt evenly. All gates shall be raised and lowered several times and all adjustments shall be made to the satisfaction of the Project Manager. Each set of gate shall be tested for satisfactory operation and leakage by lowering and raising the same in their respective grooves.
SECTION 9.11 INSPECTION:
The inspection of all gates and their accessories, shall be carried out in accordance with Indian Standard recommendations for inspection, testing and maintenance of fixed wheels and slide gates part-II, inspection and testing at the time of erection part-III – IS:7718.

9.11.1 INSPECTION AT THE TIME OF INSTALLATION:

1. It shall be ensured that sill beam is correctly positioned in level and location.
2. The parts to be embedded, i.e., track plates, guides, seal, seats shall be checked when all these parts are in final position from bottom to top of the groove. Check shall be carried out both in location and levels, with respect to sill beams already established in position. Each part shall be checked first individually and thereafter relatively to other parts.
3. The track plates and seal seats shall be in true alignment. The alignment of track plates and seal seats shall be checked at 300mm. intervals from bottom to top side of the gate / stop log opening. Alternatively, diagonal checking or any other satisfactory method can be adopted for checking the alignment.
4. After checking the track plates and seal seats on both sides it shall be ensured that they are in their respective planes.
5. Guide and guide shoes shall be checked for true location and alignment first individually and then relatively.
6. Groove corner protection angles shall be checked for true location and alignment.
7. The following critical dimensions shall be checked at intervals 300mm from bottom to top of the groove for embedded parts.
   (a) Center to center distance of track plates.
   (b) Center to center distance of side seal seats.
   (c) Face to face distance of guides.
   (d) Face to track plates to face of side seal seat and
   (e) Face of track plate to center line of guide.
8. Eccentricity provided to gate for its fine adjustment in the grooves, shall not be accounted for while erecting parts to be embedded.
9. The groove concreting shall be done only after satisfying all these details including field trial and keeping proper record thereof. Recheck of alignment of embedded parts shall be done after concreting.
10. It shall be ensured that there is offset of joints while extending the embedded parts.
11. All the gates shall be inspected on site before lowering them in the respective grooves. Overall dimensions shall be checked to ensure that the respective gates match correctly in the respective grooves.
12. The following critical dimensions shall be checked at an interval of at least 300mm, wherever applicable for gate.
   (a) Centre to center distance between thrust pad treads.
   (b) Centre to center distance between side seals / bases.
   (c) Face to face distance between guide shoes / rollers.
   (d) Face of seal base to pad treads and
   (e) Centre line of guide shoes / roller to pad tread in zero position.
13. Seals and seal base shall be checked to ensure that they are coplanar. All pads shall be adjusted to ensure that pad treads are in proper alignment.
14. Seal bolts shall be tightened adequately and uniformly.
15. To check the effectiveness of seal, actual seal interference shall be compared with that provided in the design.
16. It shall be ensured that installation of the various parts of the hoisting arrangements along with gates has been done to specified locations and alignment, particularly in respect of correct positioning and attachment of stem of the gates as well as hoists.

17. Connections like shaft couplings, connection of stem rods to the gates and hoists, connection of stem links, connection of hoist components to the base shall be checked.

18. It shall be ensured that intermediate supports for the stem rods are provided at the required levels and permit free movement of stem rod for the entire gate travel.

19. It shall be ensured that electric installations have been properly earthed.

20. The hoists provided for the operation of the gates shall be independently tested when not connected to the gates to ensure satisfactory workings. The hoists shall be kept running for a sufficient period so as to ensure independent working. Bearings shall be checked to ensure that there is no undue friction.

9.11.2 INSPECTION AFTER INSTALLATION At an appropriate stage (as decided by the Project Manager) after installation of respective gates the bidder shall give field tests as directed in these specifications. The bidder shall at his own expenses make all arrangements and provide all necessary equipment, materials, tools, tackles and labour necessary for carrying out the said field tests. The inspection after installation shall cover following points and any other point considered necessary by the Project Manager.

1. Drain holes of the components of the gates shall be so checked that they do not get clubbed with silt causing accumulation of water in the horizontal girders.

2. Inspection of gates shall be carried out to detect defects, if any, after erection and when the canal is full. The gate shall be operated up and down several times to make sure that they function well, without vibrations.

3. Inspection, after erection shall consist of visual inspection of exposed surfaces of embedded parts, sill beams, seal seats, gate leaves, hoisting equipment, hoist supporting structures and checking of important dimensions. In case of inaccessible parts necessary inspection shall be carried out with the help of arrangements to be provided by the bidder at his expense.

4. Inspection shall be carried out for connection, for structures, gate, tightness of all fittings, soundness of the welds, leakage through gates, lubrication of all bearings, guide shoes, machineries and equipment, wear and tear, corrosion, sealing, pitting of all metal work and machineries (soundness of metal).

SECTION 9.12 FIELD TESTS:

9.12.1 Field tests shall be for all the gates and shall include

1. Operational tests in dry.

2. Operation steps with stipulated full supply level, and

3. Leakage tests.

The tests will be repeated, if necessary, until they are successfully carried out to the satisfaction of the Project Manager.

i) Operation tests in dry

Operational tests in dry will be carried out after completion of erection. The tests will include at least 2 complete traverses from the maximum raised position to the full seated position. All adjustments, clearances etc. shall be checked and adjusted by the bidder for proper operation.

ii) Operational tests with full supply level

These tests will simulate the actual operating conditions as early as possible. At least one complete traverse shall be made from the fully closed position to the normal raised position as follows:-
a) When the gates are closed, raise the gates to their normally opened position and
b) Lower the gates to the fully closed positions.

iii) Leakage Tests
Leakage tests will be carried out with the gates lowered unto the sill. Before the observation
for leakage, the gates will be raised and lowered suitably in order to dislodge any debris it
might have been lodged in the side and bottom seals. The leakage then shall be measured
and it shall not be more than the amount specified in the relevant code. The tests shall be
repeated if necessary, until they are successfully carried out to the satisfaction of the Project
Manager. Leakage tests and operation tests will be carried out at the convenience of the
Project Manager after completion of other portions of the work and when the canal is at full
supply level. However, the Project Manager will have the right to carry out such tests when
the canal is at a level lower than the full supply level. The Project Manager shall also have
the right to carry out the leakage tests by jetting water at 1.5 times the normal working
pressure on the sealing position from bottom to top.

9.12.2 The bidder, without claiming any extra cost or compensation, shall carry out all
adjustments, modifications, which in the opinion of the Project Manager based on the above
mentioned field tests are necessary to ensure satisfactory performance of the equipment
furnished under this contract.

SECTION 9.13 MEASUREMENT
The measurement of gates will be recorded on sq.m of gate opening.

SECTION 9.14 PAYMENT:
Rate for manufacturing, transporting and erecting screw, gear, shutter and vertical
shutter etc. under items of BOQ includes cost of
  a) all materials, labour, T&P, machineries, equipment and consumables for
     manufacturing / fabricating, testing, transporting to work sites, storing of materials at
     site and erecting screw gear shutter / vertical lift fix wheel shutter along with sill
     beams, guides, seals, hoists, hoisting platforms, gear box and all other accessories for
     head regulator / cross regulator / escapes including all incidental items to complete the
     work.
  b) Cost of all materials, labour, machineries, consumables required for
     manufacturing / fabricating, transporting to work site, storing at work site and fixing in
     position the embedded parts in concrete as per design and specification,
  c) Cost of all material, labour, T&P, machineries for supplying and laying 2nd stage
     concrete of specified grade as per IS specification
  d) All cost including GST (as applicable from time to time), excise duty, sale tax,
     royalties, storage charges, insurance charges and other taxes of material, labour, T&P,
     machineries and consumables for painting the gates and of finished work in vogue and
     that may be imposed or revised by the Government from time to time
  e) Any other incidental expenditure to complete the work as per the specification
     and direction of the Project Manager.
SECTION - 10
REHABILITATION AND REPAIR WORKS

SECTION 10.1 General

Repairing of different types of works is required after a long period of service, to restore the strength, flexibility, durability and characteristics of the original work. Depending on the level of the damage, the type of the components, works can be repaired and/or rehabilitated, or upgraded by different methods. It is of paramount importance to realize that in all repair works the instructions of the Project Manager shall be followed. All soil, turf, gravel, stone, timber and other materials obtained in the excavation and clearing of the site of the Works shall belong to the Employer and shall not be removed from the Works or sold without the consent of the Project Manager. The Contractor may use for the construction of the Works any of the materials excavated, which the Project Manager may determine to be fit for such use.

SECTION 10.2 Requirement for Repairs
The Contractor shall ensure that certain requirements are satisfied for the repair works to be executed efficiently. The following requirements are necessary for the proper execution of the works:

- Adequacy of tools and equipments used.
- Safety measures taken to avoid unnecessary damage to the existing structures.
- Sequence and methodology of work adopted.
- Suitability of materials used and quality of workmanship.

10.2.1 Tools and Equipment for dismantling old structure:
In repairing the damaged works, the Contractor shall use simple hand tools, light devices and if necessary, mechanical means as may be required and approved by the Project Manager to avoid damages to existing structures and its surroundings. Damaged parts shall be removed with care to avoid causing vibrations and movements of the works under repair that may cause a threat to the existing structures or its surroundings. Use of explosives shall not be allowed.

10.2.2 Safety Measures
The Contractor shall explore the Site conditions and identify the nature and scope of the works under this Contract, its limitations and risks. The procedures and measures to be adopted in carrying out the repair works and handing over the site clean and neat shall be decided in consultation with the Project Manager. The provisions of clauses in earlier sections of this Specification shall apply in regard to safety measures needed for this kind of work. Temporary supports, scaffolding and all required shall be provided by the Contractor at his own cost to carry out the works efficiently and safely and finish the same in good condition. The Contractor shall safely dispose of all refuse matter within the haul distance as directed by Project Manager.

10.2.3 Sequence of Works
The Contractor shall strictly follow the adopted procedures and accepted practices related to the methodology of works and sequential execution of the different activities pertaining to repair works. Repair works shall have the following sequential stages:

- Cleaning and Clearing the area.
- Removal of the damaged parts.
- Application of the appropriate repair technique in the right sequential order.
- Restoration of work to its original condition.

The method of work, and sequence of implementing the works under repair shall be finalised by the Project Manager and shall be strictly followed by the Contractor. No permission shall be given to the Contractor to proceed from one stage of work to the next, unless the previous work is inspected and accepted by the Project Manager.
10.2.4 Materials and Workmanship
The Contractor shall furnish all materials and supplies and complete works required for repair works under this Contract in accordance with this Specification described herein and referred to elsewhere in the Specifications.

SECTION 10.3 Repair Works
In carrying out repair works the contractor shall use the most efficient method that is suitable to remedy a specific damage. Damaged works can be upgraded, rehabilitated and repaired by the following repairing techniques:
- Removal and Replacement of the damaged parts.
- Jacketing.
- Injection

The location, extent and type of major repair works are indicated on the Drawings. The contractor shall resort to the appropriate type of repair technique shown on the Drawings and shall strictly follow the procedures stipulated in the specifications to carry out the works under this item as described in the Bill of Quantities.

10.3.1 Removal and Replacement of Damaged Parts
When the concrete / masonry is heavily damaged, the steel reinforcement is exposed, abraded or completely rusted, and/or the concrete is crushed, total removal and replacement of the damaged parts must be carried out. If only repair is required, the original cross-section size will be maintained. If strengthening is necessary, the area of the original cross section may increase; damaged and loose concrete must be removed, new reinforcement inserted and welded to existing sound reinforcement and new ties be placed. Special attention must be paid to achieve good bond between new and old concrete.

In carrying out repair work in concrete, the Contractor shall follow the stages explained below:

1- The Contractor shall refer to the Drawings to identify the type of repair and extent of the works involved. The lines, levels and alignment of the works under repair shall be followed strictly from the Drawings and shall be consistent and in harmony with those of the existing works. The Contractor shall carry out needed survey works to establish the correct grades, cross sections, center line and alignment of the works.

2- The Contractor shall demolish and chip away the damaged parts of the concrete. Chipping away the concrete surface shall be done to the levels required to remove the damaged, rusted reinforcement. The Contractor shall remove the damaged steel parts and ties and replace them with new ones of the same diameter or higher.

3- The existing sound steel parts and ties shall be cleaned from rust by use of mechanical steel brushes or sand gun.

4- The new reinforcement and ties shall be welded to the existing sound reinforcement and ties to restore the reinforcement level to its original condition before the damage as per the direction of Project Manager.

5- Prior to concreting, the rough surface shall be cleaned from dust and loose materials and shall be treated with suitable and approved bonding epoxy resin glue paint (NITOBOND or equivalent) to achieve bond between the old and new works. Applying cement mortar on the surface may be used as another option as per approval of the Project Manager.

6- Formwork for the concrete shall be placed to restore the shape, lines and dimensions as shown on the Drawings. Formwork shall comply with the relevant clauses in earlier sections.

7- Concrete of specified grade shall be laid/poured in the formwork to produce the required dimension. Concrete shall comply with the requirements of clauses in section-4 of the Specifications.
When rendering and/or repair work is required along existing masonry structure all loose stones and defective joints shall be thoroughly raked out and cleaned back to expose a sound base for application of the repair work. All such exposures shall be inspected by the Project Manager. The Contractor shall not commence any repair work before the Project Manager’s approval is obtained. The stone and mortar mix used for remedial works should be consistent with the general clauses of the Specifications described earlier and also with the general colour and appearance of the existing structure.

The procedure to be followed by the Contractor for cracking repair shall be as follows:
- Clean out all cracks with water. Remove old mortar from any masonry joints and clean the joints.
- Deposits in cracks can be easily removed by compressed air.
- The contractor shall fill the cracks with mortar and finally fill the joints with mortar to replace the old mortar that has been removed from the joints.
- Then the mortar shall be trowelled smoothly after the cracks have been filled, and the joints treated.
- The Contractor shall remove all loose stones and rack defective joints using compressed air or a water spray, hammer and chisel. The Contractor shall clean all cavities defective joints of old mortar to establish a sound base for formation of the new repair works.

The surface under repair shall be moistened with spray water, and the Contractor shall place a new mortar bed to receive the masonry stones, and shall also apply fresh mortar to the joints between the new stones and the old ones, and filling all space available, compacting with a suitable tamping tools. The joints shall be smoothened with suitable tool. The joints width shall be within 10 – 20mm.

10.3.2 Jacketing in Concrete work
Jacketing should be applied in cases of heavily damaged concrete works or in cases of insufficient strength of concrete elements. Jacketing may be used for strengthening purposes of the concrete structures, although it can also be used for repairing. Jacketing can be performed by adding reinforced concrete, steel profiles (angles and straps) or steel encasement.

In carrying out this type of repair technique, the contractor shall follow the procedures set below:
1. Same procedure as in 1 of 10.3.1
2. The Contractor shall remove the loose concrete and chip away the concrete cover manually or with suitable mechanical equipment under the supervision of the Project Manager without damaging portion of the structure in good condition.
3. For protecting the edges where required, M.S. angles of suitable size (not less than 50X50X5) shall then be fixed in position by welding them to exposed reinforcement with due care to achieve the correct finished lines as per the drawing. Formwork shall be placed as required confirming to the design profile complying to the requirement of relevant clauses of section-4 of the specification. The concrete and steel surface shall then be cleaned properly and a layer of suitable grade of Epoxy resin adhesive shall be applied, and concrete of suitable grade poured. The concrete to be used for repair shall be of at least one grade higher than the old concrete.

10.3.3 Jacketing in Masonry work
For major repair works, where excessive stones is required to be removed, many repair operations are involved; strengthening the wall by steel jacketing; reconstruction of the damaged portion of the wall; filling the cavities inside the wall by grouting. The Contractor shall proceed as follows as per the direction of Project Manager:
- Prior to commencement of repair works, the Contractor shall make necessary arrangements to ensure the stability and safety of the structure under repair and its surroundings and the safety of all persons working at the Site whether employed by him or not.
- The Contractor shall rack the joints, repair/remove the surface boulders and prepare surface to accommodate the new works.
- Vertical reinforced steel wire mesh comprising welded steel wire fabric shall be put in position close to the wall by 12/16 mm dia anchors fixed in masonry at 75 to 100 cm apart. Form work shall be placed in position along with arrangement of edge protection as specified under section 10.3.1 of this specification and concreting done.

10.3.4 Injection
Resin or cement grout injections are to be applied only for works with slight cracks, without damaging concrete or reinforcement.

SECTION 10.4 Grouting in Masonry
Where felt necessary the old and distressed masonry works shall be grouted. After completion of the works in the manner described in section 10.3.2 above, a number of holes are drilled in the masonry wall at the rate of 1 holes per square meter taking care to drill the hole centrally. First water is injected in order to wash the wall inside and to improve the cohesion between the grouted mixture and the wall elements. Then cement grout and (1 cement; 1 water) shall be grouted at low pressure of 1 to 2kg/cm² in the holes. In most cases the pressure needed for grouting can be obtained by gravity flow of the grout from supper elevated tanks.

SECTION 10.5 MEASUREMENT AND PAYMENT
Recording of measurements for rehabilitation works are similar to the measurement of different items like concrete, masonry, centering, shuttering, reinforcement and plastering / pointing etc. Similarly, payment will be made at the rates provided for different items of work in the BOQ. The dismentaling items required for execution of rehabilitation work will be measured under Item of BOQ. The payment for the items includes all cost for labour, materials, T & P, Machinery, equipment and consumables required for carrying out the following operations.

1) Cleaning of surface area.
2) Carrying out dismantling work as per the instruction of Project Manager.
3) Removing dismantled debries away from work site and stacking useful materials for reuse.
4) Laboratory testing of sample of aggregates, cement, water, (excluding items specified in BOQ vide Bill-A).
5) Procurement of fine aggregates, coarse aggregates, cement, admixtures, water and all other materials at site of work. (Procurement cost of Reinforcement bars & placement are excluded )
6) Batching, mixing, laying of concrete, vibrating and curing as per Specifications.
7) Erection of gangways, scaffolding, chutes and dismantling the same after completion of work.
8) Construction of approach road, haul road, site illumination, construction of coffer dam till completion of the work and subsequent removal at appropriate time, and all mobilization and demobilization cost to complete the above operations.
9) Recording of photographs. Quality control works.(excluding items specified in BOQ vide Bill-A).
10) Payment of all taxes, royalties, GST etc.
11) Cost of all safety precautions.
12) Any other incidental cost to complete the items of work as per specification and direction of Project Manager.
Drawings

1. Index Map
2. Sample VRB
3. Sample Cross Section
CROSS SECTION OF OPEN TRENCH

M15 A20

M15 A20

M15 A20

M15 A40

SAND

150

300

75

150

150
Section of Guard Wall

Laterite stone
MASONARY

800 MM THICK P.C.C. M-15
(LA-40)

0.15m thick sand filling

3000mm

1500

100

800

P.C.C. M-15 - A-20

Jr. Engineer
Byree Irrg. Section

Asst. Engineer
Chandikhole Irrg. Section

Asst. Executive Engineer
Chandikhole Irrg. Sub-Divn.

Executive Engineer
Jaraka Irrigation Divn.
Supplementary Information
Regarding Works to Be Procured

List of Structures to be repaired in PKG-HLC-14

1. Repair / Renovation of outlets – 5 nos. VRB-10 nos, CD- 1 no.
   and tail cluster has been proposed.
2. Other structures as directed by the Project Manager.
## Personnel Requirements

Using Form PER-1 and PER-2 in Section 4 (Bidding Forms), the Bidder must demonstrate that it has personnel who meet the following requirements:

<table>
<thead>
<tr>
<th>No.</th>
<th>Position</th>
<th>Total Work Experience [years]</th>
<th>Experience In Similar Work [years]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chief Construction Manager</td>
<td>5years</td>
<td>4years</td>
</tr>
<tr>
<td>2</td>
<td>Construction Manager (Structures)</td>
<td>4years</td>
<td>3years</td>
</tr>
<tr>
<td>3</td>
<td>Quality Control Assistant</td>
<td>4years</td>
<td>3years</td>
</tr>
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</table>
Equipment Requirements

Using Form EQU in Section 4 (Bidding Forms), the Bidder must demonstrate that it has the key equipment listed below:

<table>
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<tr>
<th>No.</th>
<th>Equipment Type and Characteristics</th>
<th>Minimum Number Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Excavators</td>
<td>2 Nos</td>
</tr>
<tr>
<td>2</td>
<td>Dumper/Tipper</td>
<td>3 Nos.</td>
</tr>
<tr>
<td>3</td>
<td>Concrete Mixer</td>
<td>4 Nos.</td>
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Section 7 - General Conditions of Contract

Department of Water Resources, Government of Odisha
[Name of Employer]

Package No: - CW-NCB-HLC-14
[Name of Contract]
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General Conditions of Contract

A. General

1. Definitions

1.1 Boldface type is used to identify defined terms.

(a) The **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.

(b) The **Activity Schedule** is a schedule of the activities comprising the construction, installation, testing, and commissioning of the Works in a lump sum contract. It includes a lump sum price for each activity, which is used for valuations and for assessing the effects of Variations and Compensation Events.

(c) The **Adjudicator** is the person appointed jointly by the Employer and the Contractor to resolve disputes in the first instance, as provided for in GCC 29.1[Appointment of Adjudicator] hereunder.

(d) **Bank** means the financing institutions named in the **Particular Conditions of Contract (PCC)**.

(e) **Bill of Quantities** means the priced and completed Bill of Quantities forming part of the Bid.

(f) **Compensation Events** are those defined in GCC 51.1[Compensation Events]hereunder.

(g) The **Completion Date** is the date of completion of the Works as certified by the Project Manager, in accordance with GCC 69.1 [Completion].

(h) The **Contract** is the Contract between the Employer and the Contractor to execute, complete, and maintain the Works. It consists of the documents listed in GCC 2.3 below.

(i) The **Contractor** is the party whose Bid to carry out the Works has been accepted by the Employer.

(j) The **Contractor’s Bid** is the completed bidding document submitted by the Contractor to the Employer.

(k) The **Contract Price** is the Accepted Contract Amount stated in the Letter of Acceptance and thereafter as adjusted in accordance with the Contract.

(l) **Days** are calendar days; months are calendar months.

(m) **Dayworks** are varied work inputs subject to payment on a time basis for the Contractor’s employees and Equipment, in addition to payments for associated Materials and Plant.

(n) A **Defect** is any part of the Works not completed in accordance with the Contract.

(o) The **Defects Liability Certificate** is the certificate issued by the Project Manager upon correction of defects by the Contractor.

(p) The **Defects Liability Period** is the period calculated from the Completion Date where the Contractor remains responsible for remedying defects.

(q) **Drawings** include calculations and other information provided or approved by the Project Manager for the execution of the Contract.

(r) The **Employer** is the party who employs the Contractor to carry out the Works, as specified in the PCC.

(s) **Equipment** is the Contractor’s machinery and vehicles brought temporarily to the Site to construct the Works.
(t) **Force Majeure** means an exceptional event or circumstance: which is beyond a Party’s control; which such Party could not reasonably have provided against before entering into the Contract; which, having arisen, such Party could not reasonably have avoided or overcome; and, which is not substantially attributable to the other Party.

(u) **In writing or written** means hand-written, type-written, printed or electronically made, and resulting in a permanent record.

(v) The **Initial Contract Price** is the Contract Price listed in the Employer's Letter of Acceptance.

(w) The **Intended Completion Date** is the date on which it is intended that the Contractor shall complete the Works. The Intended Completion Date is specified in the PCC. The Intended Completion Date may be revised only by the Project Manager by issuing an extension of time or an acceleration order.

(x) **Letter of Acceptance** means the formal acceptance by the Employer of the Bid and denotes the formation of the Contract at the date of acceptance.

(y) **Materials** are all supplies, including consumables, used by the Contractor for incorporation in the Works.

(z) **Party** means the Employer or the Contractor, as the context requires.

(aa) **PCC** means Particular Conditions of Contract.

(bb) **Plant** is any integral part of the Works that shall have a mechanical, electrical, chemical, or biological function.

(cc) The **Project Manager** is the person named in the PCC (or any other competent person appointed by the Employer and notified to the Contractor, to act in replacement of the Project Manager) who is responsible for supervising the execution of the Works and administering the Contract.

(dd) **Retention Money** means the aggregate of all monies retained by the Employer pursuant to GCC 55.1 [Retention].

(ee) **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.

(ff) The **Site** is the area defined as such in the PCC.

(gg) **Site Investigation Reports** are those that were included in the bidding documents and are factual and interpretative reports about the surface and subsurface conditions at the Site.

(hh) **Specification** means the Specification of the Works included in the Contract and any modification or addition made or approved by the Project Manager.

(ii) The **Start Date** is given in the PCC. It is the latest date when the Contractor shall commence execution of the Works. It does not necessarily coincide with any of the Site Possession Dates.

(jj) A **Subcontractor** is a person or corporate body who has a Contract with the Contractor to carry out a part of the work in the Contract, which includes work on the Site.

(kk) **Temporary Works** are works designed, constructed, installed, and removed by the Contractor that are needed for construction or installation of the Works.


2. Interpretation

2.1 In interpreting these GCC, singular also means plural, male also means female or neuter, and the other way around. Headings have no significance. Words have their normal meaning under the language of the Contract unless specifically defined. The Project Manager shall provide instructions clarifying queries about these GCC.

2.2 If sectional completion is specified in the PCC, references in the GCC to the Works, the Completion Date, and the Intended Completion Date apply to any Section of the Works (other than references to the Completion Date and Intended Completion Date for the whole of the Works).

2.3 The documents forming the Contract shall be interpreted in the following order of priority:

(a) Contract Agreement,
(b) Letter of Acceptance,
(c) Letter of Bid,
(d) Particular Conditions of Contract,
(e) the List of Eligible Countries that was specified in Section 5 of the bidding document,
(f) General Conditions of Contract,
(g) Specifications,
(h) Drawings,
(i) Completed Activity Schedules or Bill of Quantities, and
(j) any other document listed in the PCC as forming part of the Contract.

3. Language and Law

3.1 The language of the Contract and the law governing the Contract are stated in the PCC.

3.2 Throughout the execution of the Contract, the Contractor shall comply with the import of goods and services prohibitions in the Employer's country when

(a) 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 from, or any payments to, a particular country, person, or entity. Where the borrower's country prohibits payments to a particular firm or for particular goods by such an act of compliance, that firm may be excluded.

4. Contract Agreement

4.1 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 attached Contract forms in Section 8. 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.
5. Assignment 5.1 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 favor of a bank or financial institution, assign its right to any moneys due, or to become due, under the Contract.

6. Care and Supply of Documents 6.1 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.

6.2 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.

6.3 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.

6.4 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.

7. Confidential Details 7.1 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 the Contractor’s compliance with the Contract and allow its proper implementation.

7.2 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.

7.3 Notwithstanding the above, the Contractor may furnish to its Subcontractor(s) such documents, data and other information it receives from the Employer to the extent required for the Subcontractor(s) to perform its work under the Contract, in which event the Contractor shall obtain from such Subcontractor(s) an undertaking of confidentiality similar to that imposed on the Contractor under this Clause.

8. Compliance with Laws 8.1 The Contractor shall, in performing the Contract, comply with applicable Laws.
8.2 Unless otherwise stated in the Particular Conditions,

(a) the Employer shall acquire and pay for all permits, approvals, and/or licenses from all local, state, or national government authorities or public service undertakings in the [Employer’s Country or country where the Site is located] which (i) such authorities or undertakings require the Employer to obtain in the Employer’s name, and (ii) are necessary for the execution of the Contract, including those required for the performance by both the Contractor and the Employer of their respective obligations under the Contract;

(b) the Contractor shall acquire and pay for all permits, approvals, and/or licenses from all local, state, or national government authorities or public service undertakings in the [Employer’s Country or country where the Site is located] which such authorities or undertakings require the Contractor to obtain in its name and which are necessary for the performance of the Contract, including, without limitation, visas for the Contractor’s and Subcontractor’s personnel and entry permits for all imported Contractor’s Equipment. The Contractor shall acquire all other permits, approvals, and/or licenses that are not the responsibility of the Employer under Subclause 8.2(a) hereof and that are necessary for the performance of the Contract. The Contractor shall indemnify and hold harmless the Employer from and against any and all liabilities, damages, claims, fines, penalties, and expenses of whatever nature arising or resulting from the violation of such laws by the Employer or its personnel, including the Subcontractors and their personnel, but without prejudice to Sub clause 8.1 hereof.

9. Joint and Several Liability

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

10. Project Manager’s Decisions

10.1 Except where otherwise specifically stated, the Project Manager shall decide contractual matters between the Employer and the Contractor in the role representing the Employer.

11. Delegation

11.1 The Project Manager may delegate any of his duties and responsibilities to other people, except to the Adjudicator, after notifying the Contractor, and may cancel any delegation after notifying the Contractor.

12. Communications

12.1 Communications between parties that are referred to in the Conditions shall be effective only when in writing. A notice shall be effective only when it is delivered.

13. Subcontracting

13.1 The Contractor may subcontract with the approval of the Project Manager, but may not assign the Contract without the approval of the Employer in writing. Subcontracting shall not alter the Contractor’s obligations.
14. Other Contractors
14.1 The Contractor shall cooperate and share the Site with other contractors, public authorities, utilities, and the Employer between the dates given in the Schedule of Other Contractors, as referred to in the PCC. The Contractor shall also provide facilities and services for them as described in the Schedule. The Employer may modify the Schedule of Other Contractors, and shall notify the Contractor of any such modification.

15. Personnel and Equipment
15.1 The Contractor shall employ the key personnel and use the equipment identified in its Bid to carry out the functions stated in the Schedule or other personnel and equipment approved by the Project Manager. The Project Manager shall approve any proposed replacement of key personnel and equipment only if their relevant qualifications or characteristics are substantially equal to or better than those proposed in the Bid.

15.2 If the Project Manager asks the Contractor to remove a person who is a member of the Contractor’s staff or work force, stating the reasons, the Contractor shall ensure that the person leaves the Site within 7 days and has no further connection with the work in the Contract.

15.3 If the Employer, Project Manager, or Contractor determines, that any employee of the Contractor be determined to have engaged in corrupt, fraudulent, collusive, coercive, or other prohibited practices during the execution of the Works, then that employee shall be removed in accordance with Clause 15.2 above.

16. Employer's and Contractor's Risks
16.1 The Employer carries the risks which this Contract states are Employer’s risks, and the Contractor carries the risks which this Contract states are Contractor's risks.

17. Employer's Risks
17.1 From the Start Date until the Defects Liability Certificate has been issued, the following are Employer’s risks:
   (a) The risk of personal injury, death, or loss of or damage to property (excluding the Works, Plant, Materials, and Equipment), which are due to
      (i) use or occupation of the Site by the Works or for the purpose of the Works, which is the unavoidable result of the Works, or
      (ii) negligence, breach of statutory duty, or interference with any legal right by the Employer or by any person employed by or contracted to him except the Contractor.
   (b) The risk of damage to the Works, Plant, Materials, and Equipment to the extent that it is due to a fault of the Employer or in the Employer’s design, or due to war or radioactive contamination directly affecting the country where the Works are to be executed.

17.2 From the Completion Date until the Defects Liability Certificate has been issued, the risk of loss of or damage to the Works, Plant, and Materials is an Employer’s risk except loss or damage due to
   (a) a Defect which existed on the Completion Date,
   (b) an event occurring before the Completion Date, which was not
itself an Employer’s risk, or
(c) the activities of the Contractor on the Site after the Completion Date.

18. Contractor’s Risks
18.1 From the Starting Date until the Defects Liability Certificate has been issued, the risks of personal injury, death, and loss of or damage to property (including, without limitation, the Works, Plant, Materials, and Equipment) which are not Employer’s risks, are Contractor’s risks.

19. Insurance
19.1 The Contractor shall provide, in the joint names of the Employer and the Contractor, insurance cover from the Start Date to the end of the Defects Liability Period, in the amounts and deductibles stated in the PCC for the following events, which are due to the Contractor’s risks:
   (a) loss of or damage to the Works, Plant, and Materials;
   (b) loss of or damage to Equipment;
   (c) loss of or damage to property (except the Works, Plant, Materials, and Equipment) in connection with the Contract; and
   (d) personal injury or death.
19.2 Policies and certificates for insurance shall be delivered by the Contractor to the Project Manager for the Project Manager’s approval before the Start Date. All such insurance shall provide for compensation to be payable in the types and proportions of currencies required to rectify the loss or damage incurred.
19.3 If the Contractor does not provide any of the policies and certificates required, the Employer may effect the insurance, which the Contractor should have provided and recover the premiums the Employer has paid from payments otherwise due to the Contractor or, if no payment is due, the payment of the premiums shall be a debt due.
19.4 Alterations to the terms of an insurance shall not be made without the approval of the Project Manager.
19.5 Both parties shall comply with any conditions of the insurance policies.

20. Site Investigation Reports
20.1 The Contractor, in preparing the Bid, shall rely on any Site Investigation Reports referred to in the PCC, supplemented by any information available to the Contractor.

21. Contractor to Construct the Works
21.1 The Contractor shall construct and install the Works in accordance with the Specifications and Drawings.

22. The Works to Be Completed by the Intended Completion Date
22.1 The Contractor may commence execution of the Works on the Start Date and shall carry out the Works in accordance with the Program submitted by the Contractor, as updated with the approval of the Project Manager, and complete them by the Intended Completion Date.

23. Designs by Contractor and Approval by the Project Manager
23.1 The Contractor shall carry out design to the extent specified in the PCC. The Contractor shall promptly submit to the Employer all designs prepared by him. Within 14 days of receipt, the Employer shall notify any comments. The Contractor shall not construct any element of the permanent work designed by him within 14 days after the design has
been submitted to the Employer or where the design for that element has been rejected. Design that has been rejected shall be promptly amended and resubmitted. The Contractor shall resubmit all designs commented on, taking these comments into account as necessary.

23.2 The Contractor shall submit Specifications and Drawings showing the proposed Temporary Works to the Project Manager, who is to approve them if they comply with the Specifications and Drawings.

23.3 The Contractor shall be responsible for design of Temporary Works.

23.4 The Project Manager’s approval shall not alter the Contractor’s responsibility for design of the Temporary Works.

23.5 The Contractor shall obtain approval of third parties to the design of the Temporary Works, where required.

23.6 All Drawings prepared by the Contractor for the execution of the temporary or permanent Works, are subject to prior approval by the Project Manager before this use.

24. Safety

24.1 The Contractor shall be responsible for the safety of all activities on the Site.

25. Discoveries

25.1 Anything of historical or other interest or of significant value unexpectedly discovered on the Site shall be the property of the Employer. The Contractor shall notify the Project Manager of such discoveries and carry out the Project Manager’s instructions for dealing with them.

26. Possession of the Site

26.1 The Employer shall give possession of all parts of the Site to the Contractor. If possession of a part is not given by the date stated in the PCC, the Employer shall be deemed to have delayed the start of the relevant activities, and this shall be a Compensation Event.

27. Access to the Site

27.1 The Contractor shall allow the Project Manager and any person authorized by the Project Manager access to the Site and to any place where work in connection with the Contract is being carried out or is intended to be carried out.

28. Instructions, Inspections, and Audits

28.1 The Contractor shall carry out all instructions of the Project Manager, which comply with the applicable laws where the Site is located.

28.2 The Contractor shall keep, and shall make all reasonable efforts to cause its Subcontractors and subconsultants to keep accurate and systematic accounts and records in respect of the Works in such form and details as will clearly identify relevant time changes and costs.

28.3 The Contractor shall permit ADB to inspect the Contractor’s accounts, records, and other documents relating to the submission of bids and contract performance and to have them audited by auditors appointed by ADB. The Contractor shall maintain all documents and records related to the Contract for a period of three (3) years after completion of the Works. The Contractor shall provide any documents necessary for the investigation of allegations of fraud, collusion, coercion, or corruption and require its employees or agents with knowledge of the Contract to respond to questions from ADB.
29. Appointment of the Adjudicator

29.1 The Adjudicator shall be appointed jointly by the Employer and the Contractor, at the time of the Employer’s issuance of the Letter of Acceptance. If, in the Letter of Acceptance, the Employer does not agree on the appointment of the Adjudicator, the Employer will request the Appointing Authority designated in the PCC, to appoint the Adjudicator within 14 days of receipt of such request.

29.2 Should the Adjudicator resign or die, or should the Employer and the Contractor agree that the Adjudicator is not functioning in accordance with the provisions of the Contract, a new Adjudicator shall be jointly appointed by the Employer and the Contractor. In case of disagreement between the Employer and the Contractor, within 30 days, the Adjudicator shall be designated by the Appointing Authority at the request of either party, within 14 days of receipt of such request.

30. Procedure for Disputes

30.1 If the Contractor believes that a decision taken by the Project Manager was either outside the authority given to the Project Manager by the Contract or that the decision was wrongly taken, the decision shall be referred to the Adjudicator within 14 days of the notification of the Project Manager’s decision.

30.2 The Adjudicator shall give a decision in writing within 28 days of receipt of a notification of a dispute.

30.3 The Adjudicator shall be paid by the hour at the rate specified in the PCC, together with reimbursable expenses of the types specified in the PCC, and the cost shall be divided equally between the Employer and the Contractor, whatever decision is reached by the Adjudicator. Either party may refer a decision of the Adjudicator to an Arbitrator within 28 days of the Adjudicator’s written decision. If neither party refers the dispute to arbitration within the above 28 days, the Adjudicator’s decision shall be final and binding.

30.4 The arbitration shall be conducted in accordance with the arbitration procedures published by the institution named and in the place specified in the PCC.

B. Staff and Labor

31. Forced Labor

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

32. Child Labor

32.1 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 national laws 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.

33. Workers’ Organizations

33.1 In countries where national law recognizes workers’ rights to form and to join workers’ organizations of their choosing without interference and to bargain collectively, the Contractor shall comply with national law. Where national law substantially restricts workers’ organizations, 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 national law is silent, the Contractor shall not discourage the Contractor’s Personnel from forming or joining workers’ organizations 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 organizations and bargain collectively. The Contractor shall engage with such workers representatives. Worker organizations are expected to fairly represent the workers in the workforce.

34. Nondiscrimination and Equal Opportunity

34.1 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 national law provides for non-discrimination in employment, the Contractor shall comply with national law. When national laws are silent on nondiscrimination in employment, the Contractor shall meet this Subclause’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.

C. Time Control

35. Program

35.1 Within the time stated in the PCC, after the date of the Letter of Acceptance, the Contractor shall submit to the Project Manager for approval a Program showing the general methods, arrangements, order, and timing for all the activities in the Works. In the case of a lump sum contract, the activities in the Program shall be consistent with those in the Activity Schedule.

35.2 An update of the Program shall be a program showing the actual progress achieved on each activity and the effect of the progress achieved on the timing of the remaining work, including any changes to the sequence of the activities.

35.3 The Contractor shall submit to the Project Manager for approval an updated Program at intervals no longer than the period stated in the PCC. If the Contractor does not submit an updated Program within this period, the Project Manager may withhold the amount stated in the PCC from the next payment certificate and continue to withhold this amount until the next payment after the date on which the overdue Program has been submitted. In the case of a lump sum contract, the Contractor shall provide an updated Activity Schedule within 14 days of being instructed to do by the Project Manager.
35.4 The Project Manager’s approval of the Program shall not alter the Contractor’s obligations. The Contractor may revise the Program and submit it to the Project Manager again at any time. A revised Program shall show the effect of Variations and Compensation Events.

36. Extension of the Intended Completion Date

36.1 The Project Manager shall extend the Intended Completion Date if a Compensation Event occurs or a Variation is issued which makes it impossible for Completion to be achieved by the Intended Completion Date without the Contractor taking steps to accelerate the remaining work, which would cause the Contractor to incur additional cost.

36.2 The Project Manager shall decide whether and by how much to extend the Intended Completion Date within 21 days of the Contractor asking the Project Manager for a decision upon the effect of a Compensation Event or Variation and submitting full supporting information. If the Contractor has failed to give early warning of a delay or has failed to cooperate in dealing with a delay, the delay by this failure shall not be considered in assessing the new Intended Completion Date.

37. Acceleration

37.1 When the Employer wants the Contractor to finish before the Intended Completion Date, the Project Manager shall obtain priced proposals for achieving the necessary acceleration from the Contractor. If the Employer accepts these proposals, the Intended Completion Date shall be adjusted accordingly and confirmed by both the Employer and the Contractor.

37.2 If the Contractor’s priced proposals for an acceleration are accepted by the Employer, they are incorporated in the Contract Price and treated as a Variation.

38. Delays Ordered by the Project Manager

38.1 The Project Manager may instruct the Contractor to delay the start or progress of any activity within the Works.

39. Management Meetings

39.1 Either the Project Manager or the Contractor may require the other to attend a management meeting. The business of a management meeting shall be to review the plans for remaining work and to deal with matters raised in accordance with the early warning procedure.

39.2 The Project Manager shall record the business of management meetings and provide copies of the record to those attending the meeting and to the Employer. The responsibility of the parties for actions to be taken shall be decided by the Project Manager either at the management meeting or after the management meeting and stated in writing to all who attended the meeting.

40. Early Warning

40.1 The Contractor shall warn the Project Manager at the earliest opportunity of specific likely future events or circumstances that may adversely affect the quality of the work, increase the Contract Price, or delay the execution of the Works. The Project Manager may require the Contractor to provide an estimate of the expected effect of the future event or circumstance on the Contract Price and Completion Date. The estimate shall be provided by the Contractor as soon as reasonably possible.

40.2 The Contractor shall cooperate with the Project Manager in making and considering proposals for how the effect of such an event or circumstance can be avoided or reduced by anyone involved in the work and in carrying out any resulting instruction of the Project Manager.
D.  Quality Control

41.  Identifying Defects 41.1 The Project Manager shall check the Contractor’s work and notify the Contractor of any Defects that are found. Such checking shall not affect the Contractor’s responsibilities. The Project Manager may instruct the Contractor to search for a Defect and to uncover and test any work that the Project Manager considers may have a Defect.

42.  Tests 42.1 If the Project Manager instructs the Contractor to carry out a test not specified in the Specification to check whether any work has a Defect and the test shows that it does, the Contractor shall pay for the test and any samples. If there is no Defect, the test shall be a Compensation Event.

43.  Correction of Defects 43.1 The Project Manager shall give notice to the Contractor of any Defects before the end of the Defects Liability Period, which begins at Completion, and is defined in the PCC. The Defects Liability Period shall be extended for as long as Defects remain to be corrected.

43.2 Every time notice of a Defect is given, the Contractor shall correct the notified Defect within the length of time specified by the Project Manager’s notice.

44.  Uncorrected Defects 44.1 If the Contractor has not corrected a Defect within the time specified in the Project Manager’s notice, the Project Manager shall assess the cost of having the Defect corrected, and the Contractor shall pay this amount.

E.  Cost Control

45.  Contract Price 45.1 In the case of an admeasurement contract, the Bill of Quantities shall contain priced items for the Works to be performed by the Contractor. The Bill of Quantities is used to calculate the Contract Price. The Contractor will be paid for the quantity of the work accomplished at the rate in the Bill of Quantities for each item.

45.2 In the case of a lump sum contract, the Activity Schedule shall contain the priced activities for the Works to be performed by the Contractor. The Activity Schedule is used to monitor and control the performance of activities on which basis the Contractor will be paid. If payment for Materials on Site shall be made separately, the Contractor shall show delivery of Materials to the Site separately on the Activity Schedule.

46.  Changes in the Contract Price 46.1 In the case of an admeasurement contract:

(a) If the final quantity of the work done differs from the quantity in the Bill of Quantities for the particular item by more than 25%, provided the change exceeds 1% of the Initial Contract Price, the Project Manager shall adjust the rate to allow for the change.

(b) The Project Manager shall not adjust rates from changes in quantities if thereby the Initial Contract Price is exceeded by more than 15%, except with the prior approval of the Employer.
(c) If requested by the Project Manager, the Contractor shall provide the Project Manager with a detailed cost breakdown of any rate in the Bill of Quantities.

46.2 In the case of a lump sum contract, the Activity Schedule shall be amended by the Contractor to accommodate changes of Program or method of working made at the Contractor's own discretion. Prices in the Activity Schedule shall not be altered when the Contractor makes such changes to the Activity Schedule.

47. Variations

47.1 All Variations shall be included in updated Programs, and, in the case of a lump sum contract, also in the Activity Schedule, produced by the Contractor.

47.2 The Contractor shall provide the Project Manager with a quotation for carrying out the Variation when requested to do so by the Project Manager. The Project Manager shall assess the quotation, which shall be given within seven (7) days of the request or within any longer period stated by the Project Manager and before the Variation is ordered.

47.3 If the Contractor's quotation is unreasonable, the Project Manager may order the Variation and make a change to the Contract Price, which shall be based on the Project Manager's own forecast of the effects of the Variation on the Contractor's costs.

47.4 If the Project Manager decides that the urgency of varying the work would prevent a quotation being given and considered without delaying the work, no quotation shall be given and the Variation shall be treated as a Compensation Event.

47.5 The Contractor shall not be entitled to additional payment for costs that could have been avoided by giving early warning.

47.6 In the case of an admeasurement contract, if the work in the Variation corresponds to an item description in the Bill of Quantities and if, in the opinion of the Project Manager, the quantity of work above the limit stated in GCC46.1 [Changes in the Contract Price] or the timing of its execution do not cause the cost per unit of quantity to change, the rate in the Bill of Quantities shall be used to calculate the value of the Variation. If the cost per unit of quantity changes, or if the nature or timing of the work in the Variation does not correspond with items in the Bill of Quantities, the quotation by the Contractor shall be in the form of new rates for the relevant items of work.

48. Cash Flow Forecasts

48.1 When the Program, or, in the case of a lump sum contract, the Activity Schedule, is updated, the Contractor shall provide the Project Manager with an updated cash flow forecast. The cash flow forecast shall include different currencies, as defined in the Contract, converted as necessary using the Contract exchange rates.

49. Payment Certificates

49.1 The Contractor shall submit to the Project Manager monthly statements of the estimated value of the work executed less the cumulative amount certified previously.
49.2 The Project Manager shall check the Contractor’s monthly statement and certify the amount to be paid to the Contractor.

49.3 The value of work executed shall be determined by the Project Manager.

49.4 The value of work executed shall comprise,

(a) in the case of an admeasurement contract, the value of the quantities of work in the Bill of Quantities that have been completed; or

(b) in the case of a lump sum contract, the value of work executed shall comprise the value of completed activities in the Activity Schedule.

49.5 The value of work executed shall include the valuation of Variations and Compensation Events.

49.6 The Project Manager may exclude any item certified in a previous certificate or reduce the proportion of any item previously certified in any certificate in the light of later information.

50. Payments

50.1 Payments shall be adjusted for deductions for advance payments and retention. The Employer shall pay the Contractor the amounts certified by the Project Manager within 28 days of the date of each certificate. If the Employer makes a late payment, the Contractor shall be paid interest on the late payment in the next payment. Interest shall be calculated from the date by which the payment should have been made up to the date when the late payment is made at the prevailing rate of interest for commercial borrowing for each of the currencies in which payments are made.

50.2 If an amount certified is increased in a later certificate or as a result of an award by the Adjudicator or an Arbitrator, the Contractor shall be paid interest upon the delayed payment as set out in this clause. Interest shall be calculated from the date upon which the increased amount would have been certified in the absence of dispute.

50.3 Unless otherwise stated, all payments and deductions shall be paid or charged in the proportions of currencies comprising the Contract Price.

50.4 Items of the Works for which no rate or price has been entered in shall not be paid for by the Employer and shall be deemed covered by other rates and prices in the Contract.

51. Compensation Events

51.1 The following shall be Compensation Events:

(a) The Employer does not give access to a part of the Site by the Site Possession Date pursuant to GCC 26.1 [Possession of the Site].

(b) The Employer modifies the Schedule of Other Contractors in a way that affects the work of the Contractor under the Contract.
(c) The Project Manager orders a delay or does not issue Drawings, Specifications, or instructions required for execution of the Works on time.

(d) The Project Manager instructs the Contractor to uncover or to carry out additional tests upon work, which is then found to have no Defects.

(e) The Project Manager unreasonably does not approve a subcontract to be let.

(f) Ground conditions are substantially more adverse than could reasonably have been assumed before issuance of the Letter of Acceptance from the information issued to Bidders (including the Site Investigation Reports), from information available publicly and from a visual inspection of the Site.

(g) The Project Manager gives an instruction for dealing with an unforeseen condition, caused by the Employer, or additional work required for safety or other reasons.

(h) Other contractors, public authorities, utilities, or the Employer does not work within the dates and other constraints stated in the Contract, and they cause delay or extra cost to the Contractor.

(i) The advance payment is delayed.

(j) The effects on the Contractor of any of the Employer’s Risks.

(k) The Project Manager unreasonably delays issuing a Certificate of Completion.

51.2 If a Compensation Event would cause additional cost or would prevent the work being completed before the Intended Completion Date, the Contract Price shall be increased and/or the Intended Completion Date shall be extended. The Project Manager shall decide whether and by how much the Contract Price shall be increased and whether and by how much the Intended Completion Date shall be extended.

51.3 As soon as information demonstrating the effect of each Compensation Event upon the Contractor’s forecast cost has been provided by the Contractor, it shall be assessed by the Project Manager, and the Contract Price shall be adjusted accordingly. If the Contractor’s forecast is deemed unreasonable, the Project Manager shall adjust the Contract Price based on the Project Manager’s own forecast. The Project Manager shall assume that the Contractor shall react competently and promptly to the event.

51.4 The Contractor shall not be entitled to compensation to the extent that the Employer’s interests are adversely affected by the Contractor’s not having given early warning or not having cooperated with the Project Manager.

52. Tax

52.1 The Project Manager shall adjust the Contract Price if taxes, duties, and other levies are changed between the date 28 days before the submission of bids for the Contract and the date of the last Completion certificate. The adjustment shall be the change in the amount of tax payable by the Contractor, provided such changes are not already reflected in the Contract Price or are a result of GCC 54.1 [Price
53. Currencies

53.1 Where payments are made in currencies other than the currency of the Employer’s country specified in the PCC, the exchange rates used for calculating the amounts to be paid shall be the exchange rates stated in the Contractor’s Bid.

54. Price Adjustment

54.1 Prices shall be adjusted for fluctuations in the cost of inputs only if provided for in the PCC. If so provided, the amounts certified in each payment certificate, before deducting for Advance Payment, shall be adjusted by applying the respective price adjustment factor to the payment amounts due in each currency. A separate formula of the type indicated below applies to each Contract currency:

\[ P_c = A_c + B_c I_m/c/I_o \]

where:

- \( P_c \) is the adjustment factor for the portion of the Contract Price payable in a specific currency “c.”
- \( A_c \) and \( B_c \) are coefficients specified in the PCC, representing the nonadjustable and adjustable portions, respectively, of the Contract Price payable in that specific currency “c;” and
- \( I_m/c \) is a consolidated index prevailing at the end of the month being invoiced and \( I_o \) is the same consolidated index prevailing 28 days before Bid opening for inputs payable; both in the specific currency “c.”

54.2 If the value of the index is changed after it has been used in a calculation, the calculation shall be corrected and an adjustment made in the next payment certificate. The index value shall be deemed to take account of all changes in cost due to fluctuations in costs.

55. Retention

55.1 The Employer shall retain from each payment due to the Contractor the proportion stated in the PCC until Completion of the whole of the Works.

55.2 Upon the issue of a Certificate of Completion of the Works by the Project Manager, in accordance with GCC 69.1 [Completion], half the total amount retained shall be repaid to the Contractor and half when the Defects Liability Period has passed and the Project Manager has certified that all Defects notified by the Project Manager to the Contractor before the end of this period have been corrected. The Contractor may substitute retention money with an “on demand” bank guarantee.

56. Liquidated Damages

56.1 The Contractor shall pay liquidated damages to the Employer at the rate per day stated in the PCC for each day that the Completion Date is later than the Intended Completion Date. The total amount of

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The sum of the two coefficients \( A_c \) and \( B_c \) should be 1 (one) in the formula for each currency. Normally, both coefficients shall be the same in the formulas for all currencies, since coefficient \( A_c \) for the nonadjustable portion of the payments, is a very approximate figure (usually 0.10 ~ 0.20) to take account of fixed cost elements or other nonadjustable components. The sum of the adjustments for each currency is added to the Contract Price.
liquidated damages shall not exceed the amount defined in the PCC. The Employer may deduct liquidated damages from payments due to the Contractor. Payment of liquidated damages shall not affect the Contractor’s liabilities.

56.2 If the Intended Completion Date is extended after liquidated damages have been paid, the Project Manager shall correct any overpayment of liquidated damages by the Contractor by adjusting the next payment certificate. The Contractor shall be paid interest on the overpayment, calculated from the date of payment to the date of repayment, at the rates specified in GCC 50.1 [Payments].

57. Bonus
57.1 The Contractor shall be paid a Bonus calculated at the rate per calendar day stated in the PCC for each day (less any days for which the Contractor is paid for acceleration) that the Completion is earlier than the Intended Completion Date. The Project Manager shall certify that the Works are complete, although they may not be due to be complete.

58. Advance Payment
58.1 The Employer shall make advance payment to the Contractor of the amounts stated in the PCC by the date stated in the PCC, against provision by the Contractor of an unconditional bank guarantee in a form and by a bank acceptable to the Employer in amounts and currencies equal to the advance payment. The guarantee shall remain effective until the advance payment has been repaid, but the amount of the guarantee shall be progressively reduced by the amounts repaid by the Contractor. Interest shall not be charged on the advance payment.

58.2 The Contractor is to use the advance payment only to pay for Equipment, Plant, Materials, and mobilization expenses required specifically for execution of the Contract. The Contractor shall demonstrate that advance payment has been used in this way by supplying copies of invoices or other documents to the Project Manager.

58.3 The advance payment shall be repaid by deducting proportionate amounts from payments otherwise due to the Contractor, following the schedule of completed percentages of the Works on a payment basis. No account shall be taken of the advance payment or its repayment in assessing valuations of work done, Variations, price adjustments, Compensation Events, Bonuses, or Liquidated Damages.

59. Securities
59.1 The Performance Security shall be provided to the Employer no later than the date specified in the Letter of Acceptance and shall be issued in an amount specified in the PCC, by a bank acceptable to the Employer, and denominated in the types and proportions of the currencies in which the Contract Price is payable. The Performance Security shall be valid until a date 28 days from the date of issue of the Certificate of Completion in the case of a bank guarantee.

60. Dayworks
60.1 If applicable, the Dayworks rates in the Contractor’s Bid shall be used for small additional amounts of work only when the Project Manager has given written instructions in advance for additional work to be paid for in that way.

60.2 All work to be paid for as Dayworks shall be recorded by the Contractor on forms approved by the Project Manager. Each
completed form shall be verified and signed by the Project Manager within 2 days of the work being done.

60.3 The Contractor shall be paid for Dayworks subject to obtaining signed Dayworks forms.

61. Cost of Repairs

61.1 Loss or damage to the Works or Materials to be incorporated in the Works between the Start Date and the end of the Defects Correction periods shall be remedied by the Contractor at the Contractor’s cost if the loss or damage arises from the Contractor’s acts or omissions.

F. Force Majeure

62. Definition of Force Majeure

62.1 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.

62.2 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:

(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;

(c) riot, commotion, disorder, strike or lockout by persons other than the Contractor’s Personnel;

(d) munitions of war, explosive materials, ionizing 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

(e) natural catastrophes such as earthquake, hurricane, typhoon or volcanic activity.

63. Notice of Force Majeure

63.1 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.

63.2 The Party shall, having given notice, be excused performance of its obligations for so long as such Force Majeure prevents it from performing them.
63.3 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.

64. Duty to Minimize Delay

64.1 Each Party shall at all times use all reasonable endeavours to minimize any delay in the performance of the Contract as a result of Force Majeure.

64.2 A Party shall give notice to the other Party when it ceases to be affected by the Force Majeure.

65. Consequences of Force Majeure

65.1 If the Contractor is prevented from performing its substantial obligations under the Contract by Force Majeure of which notice has been given under GCC Subclause 63 [Notice of Force Majeure], and suffers delay and/or incurs Cost by reason of such Force Majeure, the Contractor shall be entitled subject to GCC Subclause 30.1 [Procedure for Disputes] to

(a) an extension of time for any such delay, if completion is or will be delayed, under GCC Subclause 36 [Extension of the Intended Completion Date]; and

(b) if the event or circumstance is of the kind described in subparagraphs (a) to (d) of GCC Subclause 62.2 [Definition of Force Majeure] and, in the case of subparagraphs (b) to (d), 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 GCC Subclause 19 [Insurance].

65.2 After receiving this notice, the Project Manager shall proceed in accordance with GCC Subclause 10 [Project Manager's Decisions] to agree or determine these matters.

66. Force Majeure Affecting Subcontractor

66.1 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 nonperformance or entitle him to relief under this Clause.

67. Optional Termination, Payment and Release

67.1 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 GCC Subclause 63 [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 GCC Subclause 73.5 [Termination].

67.2 Upon such termination, the Project Manager 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 Costs 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 labor employed wholly in connection with the Works at the date of termination.

68. Release from Performance

68.1 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 fulfill 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 GCC Subclause 67 [Optional Termination, Payment and Release] if the Contract had been terminated under GCC Subclause 67.

G. Finishing the Contract

69. Completion

69.1 The Contractor shall request the Project Manager to issue a certificate of Completion of the Works, and the Project Manager shall do so upon deciding that the work is completed.

70. Taking Over

70.1 The Employer shall take over the Site and the Works within 7 days of the Project Manager’s issuing a certificate of Completion.

71. Final Account

71.1 The Contractor shall supply the Project Manager with a detailed account of the total amount that the Contractor considers payable under the Contract before the end of the Defects Liability Period. The Project Manager shall issue a Defects Liability Certificate and certify any final payment that is due to the Contractor within 56 days of receiving the Contractor’s account if it is correct and complete. If it is not, the Project Manager shall issue within 56 days a schedule that states the scope of the corrections or additions that are necessary. If the Final Account is still unsatisfactory after it has been resubmitted,
the Project Manager shall decide on the amount payable to the Contractor and issue a payment certificate.

72. Operating and Maintenance Manuals

72.1 If “as built” Drawings and/or operating and maintenance manuals are required, the Contractor shall supply them by the dates stated in the PCC.

72.2 If the Contractor does not supply the Drawings and/or manuals by the dates stated in the PCC pursuant to GCC 72.1, or they do not receive the Project Manager’s approval, the Project Manager shall withhold the amount stated in the PCC from payments due to the Contractor.

73. Termination

73.1 The Employer or the Contractor may terminate the Contract if the other party causes a fundamental breach of the Contract.

73.2 Fundamental breaches of Contract shall include, but shall not be limited to, the following:

(a) the Contractor stops work for 28 days when no stoppage of work is shown on the current Program and the stoppage has not been authorized by the Project Manager;

(b) the Project Manager instructs the Contractor to delay the progress of the Works, and the instruction is not withdrawn within 28 days;

(c) the Employer or the Contractor is made bankrupt or goes into liquidation other than for a reconstruction or amalgamation;

(d) a payment certified by the Project Manager is not paid by the Employer to the Contractor within 84 days of the date of the Project Manager’s certificate;

(e) the Project Manager gives Notice that failure to correct a particular Defect is a fundamental breach of Contract and the Contractor fails to correct it within a reasonable period of time determined by the Project Manager;

(f) the Project Manager gives two consecutive Notices to update the Program and accelerate the works to ensure compliance with GCC Subclause 22.1 [The Works to be Completed by the Intended Completion Date] and the Contractor fails to update the Program and demonstrate acceleration of the works within a reasonable period of time determined by the Project Manager;

(g) the Contractor does not maintain a Security, which is required;

(h) the Contractor has delayed the completion of the Works by the number of days for which the maximum amount of liquidated damages can be paid, as defined in the PCC; and

(i) if the Contractor, in the judgment of the Employer has engaged in corrupt or fraudulent practices in competing for or in executing the Contract, pursuant to GCC 74.1 [Fraud and Corruption].

73.3 When either party to the Contract gives notice of a breach of Contract to the Project Manager for a cause other than those listed under GCC 73.2 above, the Project Manager shall decide whether the breach is fundamental or not.

73.4 Notwithstanding the above, the Employer may terminate the Contract for convenience.
73.5 If the Contract is terminated, the Contractor shall stop work immediately, make the Site safe and secure, and leave the Site as soon as reasonably possible.

74. Fraud and Corruption

74.1 ADB’s Anticorruption Policy requires that 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, the 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 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; and

(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 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.

75. Payment upon Termination

75.1 If the Contract is terminated because of a fundamental breach of Contract by the Contractor, the Project Manager shall issue a certificate for the value of the work done and Materials ordered less advance payments received up to the date of the issue of the certificate and less the percentage to apply to the value of the work not completed, as indicated in the PCC. Additional Liquidated Damages shall not apply. If the total amount due to the Employer exceeds any payment due to the Contractor, the difference shall be a debt payable to the Employer.

75.2 If the Contract is terminated for the Employer’s convenience or because of a fundamental breach of Contract by the Employer, the Project Manager shall issue a certificate for the value of the work done, Materials ordered, the reasonable cost of removal of Equipment, repatriation of the Contractor’s personnel employed solely on the Works, and the Contractor’s costs of protecting and securing the Works, and less advance payments received up to the date of the certificate.

76. Property

76.1 All Materials on the Site, Plant, Equipment, Temporary Works, and Works shall be deemed to be the property of the Employer if the Contract is terminated because of the Contractor’s default.

77. Release from Performance

77.1 If the Contract is frustrated by the outbreak of war or by any other event entirely outside the control of either the Employer or the Contractor, the Project Manager shall certify that the Contract has been frustrated. The Contractor shall make the Site safe and stop work as quickly as possible after receiving this certificate and shall be paid for all work carried out before receiving it and for any work carried out afterward to which a commitment was made.

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2 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 which 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.
78. Suspension of ADB Loan or Credit

78.1 In the event that ADB suspends the Loan or Credit to the Employer, from which part of the payments to the Contractor are being made,

(a) the Employer is obligated to notify the Contractor, with copy to the Project Manager, of such suspension within 7 days of having received ADB’s suspension notice.

(b) if the Contractor has not received sums due it within the 28 days for payment provided for in GCC50.1 [Payments], the Contractor may immediately issue a 14-day termination notice.

79. Eligibility

79.1 The Contractor shall have the nationality of an eligible country as specified in Section 5 [Eligible Countries] of the bidding document. The Contractor shall be deemed to have the nationality of a country if the Contractor is a citizen or is constituted, or incorporated, 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.

79.2 The materials, equipment, and services to be supplied under the Contract shall have their origin in eligible source countries as specified in Section 5 [Eligible Countries] of the bidding document and all expenditures under the Contract will be limited to such materials, equipment, and services. At the Employer’s request, the Contractor may be required to provide evidence of the origin of materials, equipment, and services.

79.3 For purposes of GCC 79.2, “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.
Section 8 - Particular Conditions of Contract

The following Particular Conditions of Contract shall supplement the GCC. Whenever there is a conflict, the provisions herein shall prevail over those in the GCC.
## Particular Conditions of Contract

### A. General

<table>
<thead>
<tr>
<th>GCC 1.1 (d)</th>
<th>The financing institutions is Asian Development Bank (ADB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GCC 1.1 (r)</td>
<td>The Employer is Department of Water Resources, Government of Odisha</td>
</tr>
<tr>
<td>GCC 1.1 (w)</td>
<td>The Intended Completion Date for the whole of the Works shall be <strong>twelve (12) calendar months</strong> from the Start date.</td>
</tr>
<tr>
<td>GCC 1.1 (cc)</td>
<td>The Project Manager is the Executive Engineer, Jaraka Irrigation Division, At/P.O- Jaraka, Dist:- Jajpur.</td>
</tr>
<tr>
<td>GCC 1.1 (ff)</td>
<td>The site is located near Badamangalpur, Kapileswarpur, Baligaria, Sanaraipada, Allarpur, Mirjapur &amp; Arangabad of HLC Range-I canal and is defined in Index map.</td>
</tr>
<tr>
<td>GCC 1.1 (ii)</td>
<td>The Start Date shall be fifteen (15) days from the date of issue of letter to commence the work.</td>
</tr>
</tbody>
</table>
| GCC 1.1 (mm) | The Works consist of: -  
- Raising & strengthening of canal banks of as per approved LS & DS.  
- Renovation of outlets. VRB, CD, fall, lining, field channel and tail cluster has been proposed.  
- Other structures as directed by the Project Manager. |
| GCC 2.2 | Sectional Completions are: Not applicable |
| GCC 2.3(j) | The following documents also form part of the Contract: Initial Environmental Examination (IEE), HLC Canal System and associated Environmental Management Plan (EMP), integral to the IEE, attached hereto as Appendix 1. |
| GCC 3.1 | The language of the contract is English  
The law that applies to the Contract is the law of State of Odisha, India |
| GCC 11.1 | The Project Manager may delegate any of his duties and responsibilities. |
| GCC 14.1 | Schedule of other contractors: None |
### GCC 19.1
The minimum insurance amounts and deductibles shall be:

(a) for loss or damage to the Works, Plant and Materials: Amount fixed by insurance company for 5% of the Contract Price.

(b) for loss or damage to Equipment: Amount fixed by insurance company for 5% of the Contract Price.

(c) for loss or damage to property (except the Works, Plant, Materials, and Equipment) in connection with Contract; Amount fixed by insurance company for 2% of the Contract Price.

(d) for personal injury or death:
   (i) of the Contractor’s employees: Insurance coverage of Rs. 2.00 lakhs
   (ii) of other people: Insurance coverage of Rs. 2.00 lakhs

### GCC 20.1
Site Investigation Reports are: Available with the Executive Engineer, Jaraka Irrigation Division, At/P.O- Jaraka, Dist: Jajpur

### GCC 23.1
The following shall be designed by the Contractor: All temporary works

### GCC 26.1
The Site Possession Date(s) shall be: Within 7(Seven) days of signing of Contract

### GCC 29.1
Appointing Authority for the Adjudicator: President, Institution of Engineers, Odisha State center, Bhubaneswar, Odisha, India.

### GCC 30.3
The Adjudicator shall be paid by the hour at the rate of: INR 1000
The reimbursable expenses are: Expenses on site visits, Stationeries and computer consumables.

### GCC 30.4
Institution whose arbitration procedures shall be used:

(a) **Contracts with foreign contractors:**
   
   International arbitration shall be conducted in accordance with the rules of__________________________If no rules have been specified, then Rules of the Singapore International Arbitration Centre (SIAC) shall apply.

   Arbitration shall be administered by__________________________If no institution has been specified, then SIAC shall be the institution to administer the arbitration.

   The place of arbitration shall be: the place of the institution administering the arbitration.

(b) **Contracts with domestic contractors:**

   Arbitration shall be conducted in accordance with the laws of the Employer's country.

### C. Time Control

### GCC 35.1
The Contractor shall submit for approval a Program for the Works within ten (10) days from the date of the Letter of Acceptance.

### GCC 35.3
The period between Program updates is sixty (60) days
The amount to be withheld for late submission of an updated Program is INR one lakh (100,000) only.

D. Quality Control

GCC 43.1 The Defects Liability Period is: Twelve (12) months.

E. Cost Control

GCC 53.1 The currency of the Employer’s country is: Indian Rupees (INR)

GCC 54.1 Prices quoted by successful Bidder shall be subject to adjustment during the Contract execution.

The prices quoted by the successful Bidder shall be subject to adjustment during performance of contract.

The Contract is subject to price adjustment in accordance with GCC Clause 54, and the following procedure shall apply.

The contract price shall be adjusted for increase or decrease in rates and price of Labour, Cement, Steel, Bitumen, Pipes, POL & other material component is subject to price adjustment in accordance with the following principles and procedures as per formula given below:

**(A)(i) REIMBURSEMENT/RECOVERY DUE TO VARIATION IN PRICES OF MATERIALS OTHER THAN (STEEL, CEMENT, BITUMEN, PIPES & P.O.L.),**

If during the progress of the work the price of any material (excluding the cost of steel, cement & bitumen & P.O.L.) incorporated in the work (not being materials supplied from the Engineer-in-Charge’s store) in accordance with clause there of increases or decreases as a result of increase or decrease in the Average wholesale price index (all commodities), and the contractor there upon necessarily and properly pays in respect of that materials incorporated in the work such increased or decreased price, then he shall be entitled to reimbursement or liable to refund, quarterly as the case may be, such an amount as shall be equivalent to the plus or minus difference of 85% in between the Average wholesale Price Index (all commodities) which is operating for the quarter under consideration and that operated for the quarter in which the bid was received (last date of receipt), as per the formula indicated below provided that the work has been carried out within the stipulated time or extension thereof as are not attributable to him. If penalty is levied for delayed completion of the work, the contractor shall not be eligible to get price escalation on the above materials on the value of works executed during the extended period.

This clause will be applicable to the contracts where original stipulated period of completion is more than 18 months.

In the situation where the period of completion is initially stipulated the agreement as less than 18(eighteen) months but subsequently the completion period has been validly extended on the ground that the delay in completion is not attributable to the contractor and in the result the total period including the extended period stands more than 18(eighteen) months or more, price escalation for other materials is admissible only for the remaining period excluding 18(eighteen) months there from.

**Formula to calculate the increase or decrease in the price of materials:**

Price adjustment for increase or decrease in cost of materials other than cement, steel, bitumen, pipes and POL procured by the contractor shall be paid in
accordance with the following formula.

\[ V_m = 0.85 \times P_m / 100 \times R \times (M_i - M_o) / M_o \]

\( V_m \) = Increase or decrease in the cost of work during the quarter under consideration due to changes in rates of materials other than cement, steel, bitumen, pipes and POL.

\( R \) = Value of work done during the quarter under consideration excluding the work executed under extra items if any at prevailing schedule of rate/derived rates.

\( M_o \) = The all India Wholesale Price Index (all commodities) prevailed during the quarter of last date of receipt of the bids (as published by the Economic Advisor to Govt. of India, Ministry of Industry and Commerce, New Delhi).

\( M_i \) = The average Wholesale Price index (all commodities) for the quarter under consideration.

\( P_m \) = Percentage of material component (other than cement, steel, bitumen, pipes and POL) of the work, as indicated in clause (d) below.

(A)(ii): REIMBURSEMENT/RECOVERY OF DIFFERENTIAL COST DUE TO VARIATION IN PRICES OF PRINCIPAL MATERIALS (STEEL, CEMENT, BITUMEN AND PIPES NOT ISSUED BY DEPARTMENT) AFTER SUBMISSION OF TENDER:

If after submission of tender, the prices of Steel, Cement, Bitumen and Pipes (not being supplied by the department) increases/decreases beyond the price(s) prevailing at the time of the last date for submission of tenders including extension for the work, the contractor shall be eligible to get differential cost due to such hike on the value of works executed during the stipulated period and during the extended period when the reason of delay in completion of the work is not attributable to the Contractor. If penalty is levied for delayed completion of the work, the Contractor shall not be eligible to get price variation on the above materials on the value of works executed during the extended period.

Reimbursement in case of differential cost due to increase in prices of cement, steel, bitumen and pipes are to be made by the Executive Engineer with prior approval of tender accepting authority subject to following conditions:

1) Contractors have to submit the vouchers showing procurement of different materials from authorised dealers for the said works.

2) Differential cost will be allowed only for the works which are progressed as per the approved work programme/revised work programme duly approved by the Engineer-in-charge.

Recovery in case of decrease in prices of cement, steel, bitumen and pipes shall be made by concerned Executive Engineer from the Contractor immediately.

The increase/decrease in prices of cement, steel, Bitumen and Pipes for reimbursement/recovery shall be determined as follows:

a) Adjustment towards differential cost of Cement

\[ V_c = (C_i - C_o) / C_o \times \text{Actual quantity of cement utilized in the work during the quarter under consideration} \times \text{base price of cement as prevailing on the last stipulated date of tender including extension, if any.} \]

\( V_c \) = Differential cost of cement i.e. amount of increase or decrease in rupees to be paid or recovered.

\( C_i \) = All India Wholesale Price index for cement for the quarter under consideration as published by Economic Advisor, Govt. of India, Ministry of Industry and Commerce, New Delhi.

\( C_o \) = All India Wholesale Price index (as published by Economic Advisor, Govt. of India, Ministry of Industry and Commerce, New Delhi) for cement as prevailing on the last stipulated date of receipt of tender.
b) Adjustment towards differential cost of Steel

\[ V_s = (S_i - S_o) \times \text{Actual quantity of steel utilized in the work during the quarter under consideration.} \]

- \( V_s \) = Differential cost of steel i.e. amount of increase or decrease in rupees to be paid or recovered.
- \( S_i \) = Cost of Steel as prevailed during the period under consideration as fixed by Steel Authority of India.
- \( S_o \) = Base price of Steel prevailing as on last date of submission of tender including extension, if any.

c) Adjustment towards differential cost of bitumen:

\[ V_b = (B_i - B_0) \times \text{Actual quantity of Bitumen utilized in the work during the quarter under consideration.} \]

- \( V_b \) = Differential cost of Bitumen i.e. amount of increase or decrease in rupees to be paid or recovered.
- \( B_i \) = Average cost of Bitumen prevailed during the period under consideration as fixed by IOCL / BPCL / HPCL.
- \( B_0 \) = Base price of bitumen as prevailing on the last stipulated date of receipt of tender including extension, if any.

d) Adjustment towards differential cost of Pipes:

\[ V_p = 0.85 \times \frac{P_p}{100} \times \frac{R (P_i - P_o)}{P_o} \]

- \( V_p \) = Differential cost of pipe i.e. amount of increase or decrease in rupees to be paid or recovered during the quarter under consideration.
- \( P_p \) = Percentage of pipe component of the works as indicated in the clause (D).
- \( R \) = Value of work done during the quarter under consideration excluding the value of work executed under extra items, if any, at prevailing schedule of rates or derived rate.
- \( P_i \) = All India Wholesale price index for the period under consideration as published by Economic Adviser, Govt. of India, Ministry of Industry and Commerce, New Delhi, for the type of pipe under consideration.
- \( P_o \) = All India Wholesale price index (as published by Economic Adviser, Govt. of India, Ministry of Industry and Commerce New Delhi) as on last stipulated date of receipt of tender including extension, if any, for the type of pipe under consideration.

(B): REIMBURSEMENT / REFUND DUE TO STATUTORY RISE IN COST OF MINIMUM WAGES BY GOVERNMENT:

If after submission of the tender, the wages of labour increases or decreases as a direct result of the coming into force of any fresh law, or statutory rule or order beyond the wages prevailing at the time of the last date of submission of tenders including extension, the contractors shall be eligible to get escalation due to such hike on the value of works executed during the stipulated period and during the validity extended period when the delay in completion is not attributable to the contractor. If penalty is levied for delayed completion of the work, the contractor shall not be eligible to get escalation on labour on the value of works executed during the extended period.

The contractor shall, within a reasonable time of his becoming aware of any alteration in the price of any such wages of labour, give notice thereof to the Engineer-in-charge stating that the same is given pursuant to this condition together with all information relating thereto which he may be in a position to supply. Engineer-in-charge may call books of account and other relevant documents from the contractor to satisfy himself about responsibility of increase in prices of wages and actual payment thereof. For this purpose, the labour component of the work executed during period under consideration shall be the percentage (as specified in table below) of the value of work done during that period and the increase / decrease in labour shall be considered on the cost of
minimum daily wages of any unskilled Labourer, fixed by the Government of Odisha under Minimum wages act.

**The composition for escalation for Labour shall be worked as per the formula given below:**

\[ V_i = 0.85 \times \frac{P_i}{100} \times R \times \frac{(L_i-L_0)}{L_0} \]

\( V_i \) = Increase or decrease in the cost of work during the quarter under consideration due to changes in rates of minimum wages.

\( R \) = Value of work done during the quarter under consideration excluding the work executed under extra items if any at prevailing schedule of rate / derived rates.

\( L_0 \) = The minimum wages for Labour as notified by State Government, as prevailing on the last stipulated date of receipt of tender including extension, if any

\( L_i \) = The minimum wages for Labour as notified by State Government, as prevailing on the last date of quarter previous to the one under consideration. In respect of the justified period extended, the minimum wage prevailing on the last date of quarter previous to the quarter pertaining to stipulated date of completion or the minimum wage prevailing on the last date of the quarter previous to the one under consideration, whichever is less, shall be considered.

\( P_i \) = Percentage of labour component of the work, as indicated in the clause (D).

**C): REIMBURSEMENT / REFUND DUE TO VARIATION IN PRICES OF P.O.L**

Similarly, if during the progress of work, the prices of Diesel, Petrol, Oil and Lubricants increases or decreases as a result of the price fixed thereof by the Government of India and the contractor thereupon necessarily and properly pays such increased or decreased price towards Diesel, Petrol, Oil and Lubricants used in the execution of the work, then he shall be entitled to reimbursement of liable to refund, quarterly, as the case may be such an amount as shall be equivalent to the plus or minus difference of 85% in between the price of P.O.L. which is operating for the quarter under consideration and that operated for the quarter of last date of receipt of bids as per the formula indicated below provided that the work has been carried out within the stipulated time or extension thereof as are not attributable to him. If penalty is levied for delayed completion of the work, the contractor shall not be eligible to get price escalation on POL on the value of works executed during the extended period.

**Formula to calculate the increase or decrease in the price of P.O.L.**

\[ V_f = 0.85 \times \frac{P_f}{100} \times R \times \frac{(F_i-F_0)}{F_0} \]

\( V_f \) = Increase or decrease in the cost of work during the quarter under consideration due to changes in rates for P.O.L.

\( P_f \) = Percentage of P.O.L. component of the work, as indicated in clause – (D) below.

\( R \) = Value of work done during the quarter under consideration excluding the work executed under extra items if any at prevailing schedule of rate / derived rates.

\( F_i \) = All India Whole sale price index for fuel, oil and lubricant (High Speed Diesel) for the quarter under consideration as published by Economic Adviser, Govt. of India, Ministry of Industry and Commerce, New Delhi. In respect of the justified period extended, the rates prevailing at the time of stipulated date of completion or the prevailing rates of the period under consideration, whichever is less, shall be considered.

\( F_0 \) = All India Whole sale price index for Fuel, Oil and lubricant (High Speed Diesel) as prevailing on the last stipulated date of receipt of tender including extension, if any.
(D): The following percentage will govern the price adjustment for the entire contract for different types of works as applicable given in the following table:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Category of Works</th>
<th>Percentage Table</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Labour (P_l)</td>
</tr>
<tr>
<td>1.</td>
<td>R&amp;B Works (% of component)</td>
<td>Road works</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bridge work</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Building Works</td>
</tr>
<tr>
<td>2.</td>
<td>Irrigation Works (% of component)</td>
<td>Structural Work</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Earth, Canal, Embankment Work</td>
</tr>
<tr>
<td>3.</td>
<td>P.H. Work (% of component)</td>
<td>Structural Work</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pipeline Work</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sewer Line</td>
</tr>
</tbody>
</table>

*Note:* Further break up may be worked out considering the consumption of Cement, Steel, Bitumen and Pipe in the concerned works for the period under consideration.

(E): APPLICATION OF ESCALATION CLAUSE:

(i) The Contractor shall for the purpose of availing reimbursement / refund of differential cost of steel, bitumen, cement, pipe, POL and wages, keep such books of account and other documents as are necessary to show that the amount of increase claimed or reduction available and shall allow inspection of the same by a duly authorized representative of Government and further, shall at the request of the Engineer-in-Charge, furnish documents to be verified in such a manner as the Engineer-in-Charge may require any document and information kept. The contractor shall within a reasonable time of 15 days of his becoming aware of any alteration in the price of such material, wages of labour and/or price of POL give notice thereof to the Engineer-in-Charge stating that the same is given pursuant to this condition along with information relating thereto which he may be in a position to supply.

(ii) The compensation for escalation shall be worked out at quarterly intervals and shall be with respect to the cost of work done as per bills paid during the three calendar months of the said quarter. The first such payment shall be made at the end of three months after the months excluding the month in which tender was accepted and thereafter at three months interval. At the end of completion of the work, the last period for payment might become less than 3 months depending on the actual date of completion.
| GCC 55.1 | The proportion of payments retained is: 6% from each bill |
| GCC 56.1 | The liquidated damages for the whole of the Works are 0.1% of the final Contract Price per day. The maximum amount of liquidated damages for the whole of the Works is 10% of the final Contract Price |
| GCC 57.1 | The Bonus for the whole of the Works is 0.33% of the total contract price per day. The maximum amount of Bonus for the whole of the Works is 2% of the final Contract Price |
| GCC 58.1 | The Advance Payments shall be 10% of the Contract Price and shall be paid to the Contractor no later than 30 days from signing of the Contract |
| GCC 58.3 | Repayment of the Advance Payments shall be: 15% from each payment certificate |
| GCC 59.1 | The Performance Security amount is 5% of the Contract Price |

**G. Finishing the Contract**

| GCC 72.1 | The date by which operating and maintenance manuals are required is within one month of completion of the structure. The date by which “as built” drawings are required is Within one month of completion of the structure or a canal |
| GCC 72.2 | The amount to be withheld for failing to produce “as built” drawings and/or operating and maintenance manuals by the date required in GCC 72.1 is INR 1.0 million (INR 1,000,000) |
| GCC 73.2 (h) | The maximum number of days is: one hundred (100) |
| GCC 75.1 | The percentage to apply to the value of the work not completed, representing the Employer’s additional cost for completing the Works, is 10% |
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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Performance Security ................................................................................................................................... 9-5
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Letter of Acceptance

--- on letterhead paper of the employer ---

........ 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 numbers and words 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.

[Choose one of the following statements:]

We accept that _______________________[insert the name of adjudicator proposed by the bidder] be appointed as the Adjudicator.

[or]

We do not accept that _______________________[insert the name of adjudicator proposed by the bidder] be appointed as the Adjudicator, and by sending a copy of this Letter of Acceptance to _______________________[insert name of the appointing authority], the Appointing Authority, we are hereby requesting such Authority to appoint the Adjudicator in accordance with GCC 29.1.

Authorized Signature: ..........................................................................................................................

Name and Title of Signatory: ..................................................................................................................

Name of Agency: .................................................................................................................................

Attachment: Contract Agreement
Contract Agreement

THIS AGREEMENT made the . . . . . . day 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 Letters of Technical Bid and Price Bid,
   (d) the Particular Conditions of Contract,
   (e) the List of Eligible Countries that was specified in Section 5 of the bidding document,
   (f) the General Conditions of Contract,
   (g) the Specification,
   (h) the Drawings,
   (i) the Completed Activity Schedules or Bill of Quantities, and
   (j) any other documents shall be added here.\textsuperscript{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.

\textsuperscript{1} Tables of Adjustment Data may be added if the contract provides for price adjustment (see GCC 54.1).
Signed by ............................................................
for and on behalf of the Employer
in the presence of:
Witness, Name, Signature, Address, Date

Signed by ............................................................
for and on behalf the Contractor
in the presence of:
Witness, Name, Signature, Address, Date
Performance Security

Bank's name, and address of issuing branch or office\(^1\)

Beneficiary: ........................................ Name and address of 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 figures\(^2\) . . . . . ( . . . . amount in words . . . . ) 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, except that subparagraph (ii) of Sub-article 20(a) is hereby excluded.\(^4\)

Seal of Bank and Signature(s)

-- Note to Bidder --

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. If the bank 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.

\(^3\) 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

Beneficiary: .................................................. Name and address of 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 figures . . . . ( . . . . amount in words . . . . ) 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 figures . . . .
( . . . . amount in words . . . . ) 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 eighty percent (80%) of the Contract Price has been
certified for payment, or on the . . . day of . . . . . . . . . . . , . . . . . . . . . . . . . . , 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).

Seal of Bank and Signature(s)

Note to Bidder

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.”

---

Department of Water Resources (DoWR)
Project Management Unit (PMU)

Orissa Integrated Irrigated Agriculture and Water Management Investment Programme (OIIAWMIP)
(ADB Loan No. 2444 and OFID Loan No. 1251-P)

HLC Range-1 Subproject
(Tranche-2 Preparation)

Initial Environmental Examination (IEE)
& Public Consultation Report
(compliant with ADB Safeguard Policy Statement 2009)

August 2014

assisted by
Institutional Strengthening and Project Management Consultants (ISPMC)

Hydrosult, Division of SNC- Lavalin Inc.
in association with
This “IEE & Public Consultation Report” for the proposed HLC Range-1 Subproject is intended to comply with the prerequisites for Preparation of Tranche-2 subproject of the OIIAWIMP.

This document, initially drafted during OIIAWIMP (Project 1, Tranche-1) preparations, is updated and revised to comply with ADB’s Safeguard Policy Statement 2009. This Report supersedes the Report on IEE & Public Consultation prepared for the proposed Subproject under ADB TA - 4814-INDIA during May 2008 by STUP Consultants and as well as draft report prepared during June 2012 and subsequent comments made during 10 July 2014. The necessary comments and suggestions given by ADB were incorporated.

A tabular guidance on the responses and compliance with the above mentioned ADB comments/requirements is presented on the following pages.

This Report supersedes the Report on IEE & Public Consultation prepared for the proposed Subproject under ADB TA - 4814-INDIA during May 2008 by STUP Consultants.

August 2014
ISPMC

(“Compliance to ADB Comments Dated 10th July 2014” table to follow this page)
## Compliance to ADB Comments Dated 10 July 2014 for HLC Range -1 Sub Project

<table>
<thead>
<tr>
<th>Reference</th>
<th>Comment Number</th>
<th>ADBs Comments</th>
<th>EAs Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive Summary, Pg IEE HLC R 1</td>
<td>NMA 1</td>
<td>Please make the same changes discussed for Macchagaon for ex summary, introduction, policy, description, on environment, information disclosure, GRM... My detailed comments provided in this document are limited to chapter III, V and VIII.</td>
<td>Incorporated with necessary changes details as below:</td>
</tr>
<tr>
<td>Executive Summary</td>
<td></td>
<td></td>
<td>Incorporated all the abbreviation and a list of abbreviations enclosed in the contents refer Pg. i to viii</td>
</tr>
<tr>
<td>Chapter – I Introduction</td>
<td></td>
<td></td>
<td>Minor changes made in Para 2 last 3 rd line and Para3 with last three lines, and para 6</td>
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<tr>
<td>Chapter – II Policy</td>
<td></td>
<td></td>
<td>Para 12 some text deleted as suggested, Para 22 OSG replaced with Government of Odisha</td>
</tr>
<tr>
<td>Chapter - III</td>
<td></td>
<td></td>
<td>Para 53, minor correction Table 3 disty made to Distributary and Para 109 last bullet revised</td>
</tr>
<tr>
<td>Chapter IV</td>
<td></td>
<td></td>
<td>Updated with latest available base line information refer revised Table 7,11,12,13,17,18,24,25,26,27,29 and Figures 4 &amp; 5. Para 150, 180, 213, 214</td>
</tr>
<tr>
<td>Para K) Section 169, Pg 31</td>
<td>NMA 2</td>
<td>What is doab?, can you give a footnote giving the meaning?</td>
<td>Incorporated in the foot note refer para 150</td>
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<tr>
<td>Para F,Section 273, Pg 53</td>
<td>NMA 3</td>
<td>Are they being compensated under the resettlement plan?</td>
<td>Reference to RP plan made refer revised para 226 bullet 1 and para 226 bullet 2; Pg. 55</td>
</tr>
<tr>
<td>Para2 (H), Section1 (286),Pg 58</td>
<td>NMA 4</td>
<td>Please check the numbering.</td>
<td>Revised Para 232, pg. 57</td>
</tr>
<tr>
<td>Para 2 (H), Section1</td>
<td>NMA 5</td>
<td>Please describe what those means are.</td>
<td>Necessary formatting carried refer Para 239 Pg. 60</td>
</tr>
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</table>

Necessary formatting carried refer Para 239 Pg. 60.
<table>
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<th>Reference Number</th>
<th>ADBs Comments</th>
<th>EAs Response</th>
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<tr>
<td>(289), Pg 59</td>
<td></td>
<td>Machhagaon and formatting carried out</td>
</tr>
<tr>
<td>Para 5 Section 298, Pg 59</td>
<td>Please check numbering</td>
<td>Rectified refer revised para 248 bullets; Pg. 62</td>
</tr>
<tr>
<td>Para 6 Section 301, Pg 61</td>
<td>Numbering</td>
<td>Rectified refer revised para 254 bullets, pg. 63</td>
</tr>
<tr>
<td>Para 8, Section 305, Pg 62</td>
<td>Please cross refer to the resettlement plan which identifies the compensation for such parties.</td>
<td>Incorporated refer revised Para 258 bullet 3 Pg. 63</td>
</tr>
<tr>
<td>Para 5, Section 314, Pg 64</td>
<td>Please check the numbering.</td>
<td>Revised Para refer Para 261, 263, 264, and 269</td>
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<tr>
<td>Chapter VI</td>
<td></td>
<td>Revised Para 271, , 280, 281, 282, Pg. 72</td>
</tr>
<tr>
<td>Chapter VII</td>
<td>Incorporated Para 283 with environmental officer and elaboration of NGO, Para 285 last 3 lines</td>
<td></td>
</tr>
<tr>
<td>CHAPERT VIII</td>
<td></td>
<td>Revised Para 292, 293, 294, 295, , 300, 304, 305, Table 36 item 2, 5 and Table 37 item 1, 4</td>
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<tr>
<td>Table 38, Pg 85</td>
<td>Please note the reference.</td>
<td>Incorporated Table 38 item 2</td>
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<tr>
<td>Table 42, Pg 101</td>
<td>Check Numbering</td>
<td>Revised Table 42 item 1, 3, 4</td>
</tr>
<tr>
<td>Table 43, Pg 104</td>
<td>Please identify who is responsible for this</td>
<td>Revised para 309, 312, 315</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Revised Table 45 and Para 315 and 322</td>
</tr>
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List of Abbreviations

$  US. Dollar
%  Percentage
ADB  Asian Development Bank
C  Centigrade
CAD  Command Area Development
CCA  Cultural Command Area
CFO  Consent for Operation
CFE  Consent for Establishment
CPCB  Central Pollution Control Board
CTA  Component Technical Assistance
Cu.mecs  Cubic meters
D.S.L  Dead Storage Level
DFO  Divisional Forest Officer
DG  Diesel Generator
DOWR  Department of Water Resources
DPR  Detailed Project Report
Dy.SIO  Deputy Sub project Implementation Officer
E  East
EARF  Environmental Assessment & Review Framework
EC  Environmental Clearance
EHS  Environment, Health and Safety
EIA  Environment Impact Assessment
EMP  Environmental Management Plan
ERM  Extension, Renovation and Modernization
FB  Foot Bridge
FGD  Focus Group Discussion
F.R.L  Full Reservoir Level
Ft  Feet
GoI  Government of India
ha  Hectares
Ham  Hectare Meter
HMP  Hot Mix plant
HR  Head Regulator
IEE  Initial Environmental Examination
IND  India
IS  Indian Standard
ISPM  Institutional Strengthening and Project Management
IUCN  International Union for Conservation of Nature and Natural Resources
IWRM  Integrated Water Resources Management
KM/ km/ Km  Kilo meters
KVA  Kilo - Volt - ampere
l  Litres
LA  Land Acquisition
LAA  Land Acquisition Act
M  Meters
M³ / cu.m  Cubic Metre
MFF  Multi-tranche Financing Facility
MFI  Multilateral Financing Institutions
Mg  Milligrams
mm  Millimetres
MoEF Ministry of Environment & Forests
N North
NAAQS National Ambient Air Quality Standards
NABET National Accreditation Board for Education and Training
NABL National Accreditation Board for Testing and Calibration Laboratory
NBSS National Bureau of Soil Survey
NBSS&LUP National Bureau of Soil Survey and Landuse Planning
NGO Non Governmental Organisation
NIC National Informatics Centre
NRRP National Rehabilitation and Resettlement Policy
NWP National Water Policy
O&M Operation and Maintenance
OIIAWMIP Orissa Integrated Irrigated Agriculture and Water Management Investment Program
OM Operation Manual
O&M Operation and Maintenance
OP Operational Policies
OSPCB Odisha State Pollution Control Board
PA Protected Areas
PF Protected Forest
PIM Participatory Irrigation Management
PMU Project Management Unit
PP Pani Panchayat
PPE / PPG Personnel Protective Equipments / Personnel Protective Gears
PPME Project Performance Monitoring and Evaluation
PPTA Project Planning and Technical Assistance
PRR Powered Road Roller
PUC Pollution under Control Certificate
RD Reduced Distance
REA Rapid Environmental Assessment
RF Reserved Forest
RoW Right of Way
RPM Respirable Particulate Matter
R & R Resettlement & Rehabilitation
SC Schedule Caste
Sec Seconds
SIO’s Sub-Project Implementation Officers
SOI Survey of India
SPCB State Pollution Control Board
SPS Safeguard Policy Statement
ST Schedule Tribes
SRC Special Relief Commissioner
WMM Wet Mix Macadam
WUAs Water Users Association
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EXECUTIVE SUMMARY

1. PROJECT BACKGROUND

i. The "Orissa Integrated Irrigated Agriculture and Water Management Investment Program" (OIIAWMIP) is an initiative by the Department of Water Resources (DoWR) of the Government of Odisha. It is intended to undertake the improvement of irrigation service delivery with PP empowerment and to enhance the productivity and sustainability of irrigated agriculture, thereby contributing to rural poverty reduction by increasing rural economic growth in the four northern river basins (Brahmani, Baitarani, Burhabalanga, and Subrenerekha river basins) and a part of Mahanadi Delta areas. The Government of Odisha had obtained a multi-tranche financing facility (MFF) loan from the Asian Development Bank (ADB), titled MFF No. 0022 and Loan No. 2444, India (IND.). The loan includes funds for upgrading or undertaking extension, renovation and modernisation (ERM) work in 6 major, 9 medium and 4 creek irrigation projects.

ii. The "Orissa Integrated Irrigated Agriculture and Water Management Investment Program" (OIIAWMIP) is classified as Category B according to the Environment Policy (2002) of the Asian Development Bank (ADB). Initial environmental examinations (IEEs) were undertaken for two major and three medium irrigation schemes, and two sample community-based minor lift irrigation schemes during the Project Planning and Technical Assistance (PPTA) stage; IEEs for four major and 2 medium were prepared during the Component Technical Assistance (CTA) stage. An environmental assessment and review framework (EARF) was also prepared during the PPTA stage, to guide the environmental assessment of further subprojects. HLC Range -1 is one of the subprojects included in the CTA for preparation of IEEs. The present report deals with the Initial Environmental Examination Report for the HLC Range -1 subproject, as per the new ADB Safeguard Policy Statement (SPS), June, 2009.

2. EXTENT OF THE IEE STUDY

iii. The IEE is normally part of the Appraisal Report. However, for the HLC Range -1 Subproject, an IEE was prepared during CTA period. This report has been prepared on the basis of site visits and the completion of ADB’s Rapid Environmental Assessment (REA) Checklist and updated to meet the requirements of ADBs SPS 2009.

3. METHODOLOGY

iv. The general methodology adopted to accomplish the Initial Environmental Examination includes:

   - Review of legal and statutory requirements;
   - Review of feasibility study;
   - Preliminary reconnaissance to identity environmentally sensitive issues relating to the subproject and baseline conditions;
   - Collection of Primary and secondary data;
   - Stakeholders Consultations;
   - Identify and assess the potential impacts of the subproject on the base line conditions and recommend mitigation measures to offset the identified adverse impacts;
   - Formulate Environmental Management Plan including review of Institutional set up and
4. DESCRIPTION OF THE PROJECT

v. The HLC Range -1 major irrigation sub-project is one of the sub-projects that have been proposed under the OIIAWMIP. The HLC Range -1 irrigation sub-project is in the lower Mahanadi river basin. The 53.094 kilo meters (km) HLC-R-1 contour canal off-takes from the left bank of the Birupa Barrage at Cuttack (20°30’52” N, 85°55’17” E), and terminates at Jenapur on the right bank of Brahmani. HLC Range-1 was designed as a navigation canal in the mid-19th Century, linking the Mahanadi river at Cuttack to the Brahmani river at Jenapur. These were relatively stable points of the rivers, being at the head of the Delta. Canals off-taking from the navigation canal were built to irrigation the command area, mostly to the north-east of the main (navigation) canal. Three canals off-take from the Mahanadi-Birupa pond: (i) HLC-1 on the left bank of the Birupa; (ii) Kendrapara on the left bank of the Mahanadi; and (iii) Taladanda on the right bank of the Mahanadi. The barrages are in reasonable condition and no works on these are included in the subproject.

vi. HLC R-1 and other early irrigation developments to safeguard against famine are collectively known as the Mahanadi Delta Stage-I Project. With construction of Hirakud reservoir in 1946-1957 in the Mahanadi middle basin, additional perennial water became available. Irrigation scheme coverage was extended into Puri district in developments collectively known as the Mahanadi Delta Stage-II Project. The High Level Canal Range-1 irrigation subproject is in the lower Mahanadi river basin. The canal commands a gross area (GCA) of 17,295 hectares, and had an original cultivable command area (CCA) of 14,700 ha now reduced by urbanization and other developments to about 13,790 ha. It covers parts of four Blocks: Tangi-Chowdwar Mahanga and Salepur Blocks of Cuttack district covering an area of 5800 ha and Badachana and Dharmasal Blocks in Jajpur district covering 8200 ha. The original CCA was 14,000 ha but this has gradually declined as agriculture land was used for urban and commercial purposes. The current CCA is estimated at 13,790 ha. Presently it’s irrigating 6200 ha fully, 2000 ha partially and 3,700 ha of area is deprived as per the DPR October 2011, DoWR.

vii. The HLC Range -1 scheme benefits 317 villages approx. covering 3 blocks of Cuttack district and 2 blocks of Jajpur district with 32 Pani Panchayats (PPs).

viii. The sub-project distribution system consist of 1 no.s of main canal, 4 no.s of distributaries, 33 no.s of minors and 28 no.s of sub-minors.

(i)

5. SCOPE OF WORK

ix. The Initial Environment Examination (IEE) has been prepared for HLC Range -1 subproject which covers:

• The difficulties inherent in operating and maintaining the existing system, coupled with no major rehabilitation or upgrading since original construction, has resulted in most of the command area getting little irrigation water. So, rehabilitation of HLC Range -1 canal is absolutely necessary for economic up-liftment of villagers of HLC Range -1 district of Odisha.

• Renovation and modernization of the canal system by regulators, without increasing the command area. This entails the restoration back to the designed command area,
without extending and widening the canal systems, and minimizing the losses by repairing the existing structures, and if necessary, the construction of additional structures as per the field requirement

- Bringing the canals to the original design section and providing necessary lining or guard walls as necessity and site conditions in the vulnerable reaches of the main canal and upstream and downstream of structures,
  - Remodeling of existing Hydraulic control structures for improved flow control and flow measurement in the main canal and distributaries.
  - Construction of new super passages and repair of existing escapes and aqueducts to avoid water logging and properly designing drainage inlets to minimize entry of sediment into the canals.
  - Providing additional new bridges and repairing the existing ones for improved access across canals.
  - Renovating the outlets of the main canal, distributaries, minor and sub-minors.
  - Improving the service banks a provision for improvement of service road is built within the sub-project, the approx length of 20.520 km will be improved under the subproject.
  - Providing some tube wells along the entire length main canal and its distribution system was kept to provide water during canal closure period.

6. ENVIRONMENTAL CATEGORY OF THE PROJECT

This sub-project is also classified as "Category B" as per Environmental Guidelines for Asian Development Bank’s Safeguard Policy Statement, 2009. This project is one of the sub-projects of the CTA, which were prepared earlier. This sub-project does not have any major environmentally sensitive issues within the existing project area. There are no wildlife sanctuaries or national parks, eco-sensitive zones, protected monuments, endangered or exotic species of plants are present in the region. Although expansion and modernization of existing sub-projects (Irrigation / River valley) may involve Ministry of Environment and Forest (MoEF) clearance, the present sub-project does not extend to an additional command areas; hence, no clearance is required. Since the project components include mainly renovation works, with no extension and widening of the canal system, the impact on natural resources is negligible, temporary and mitigable.

7. PROJECT ALTERNATIVES

The project has little or no scope for alternatives in terms of locations, as it is an existing project and the scope of the present project is to improve the performance of an existing system without increasing the command and to cater to the needs of the people. The originally designed areas will be improved, through the rehabilitation of sections of the canals and by modernizing the system with regulators, minimizing the losses by repairing structures and constructing additional structures as per requirements. The investment costs are largely for the rehabilitation and upgrading of the existing systems. As the original design appears to be adequate, alternative solutions for rehabilitation are not foreseen at this time.
8. CLEARANCES REQUIRED FOR THE SUBPROJECT

xii. After reviewing the various applicable environmental acts and statutes, as applicable to Government of India, Govt. of Odisha and ADB some of the clearances that are to be obtained by SIO / Contractor are:

- **Permission from State Forest Department**: There are some trees that exist on the canal embankments to the possible extent trees would be saved if tree cutting is necessary, they require permission from State, **Divisional Forest Officer** (DFO) for cutting before commencement of the civil work.

- **Consent from Orissa State Pollution Control Board** - All the construction contractors should obtain consent under the water and air act from Odisha State pollution control board before commencement of construction work for the plant and machinery (Hot Mix, **Wet Mix Macadam** (WMM), Batching, Crusher, Diesel Generator greater than 15 **kilo-volt-ampere** (KVA) they establish for the projector if they are procuring from the vendor, the contractor should ensure that the vendors has the requisite consents from the **State Pollution Control Board of Odisha** (OSPCB). The list of crushers falling under Regional Office Cuttack (Cuttack, Jagatsingpur, Kendrapara and HLC Range -1) whose consents has been issued by OSPCB, Cuttack as on November 2011 (information shared) is enclosed as Annexure-2

- **Permissions from Department of Mines and Geology**:
  
i. Contractor would obtain permission for transporting the soil from the Department of Mines and Geology or local bodies as applicable, along with the mutual agreement with the land owner in case of private lands.
  
ii. Contractor would obtain permission for extracting boulders before quarrying; if the extraction of the boulder is being procured from the existing quarry/supplier, it shall be ensured that, the requisite license/lease has been obtained from the concerned Authority.
  
iii. Contractor would obtain permission for extracting sand before quarrying; if the extraction of boulder is being procured from the existing quarry/supplier, it shall be ensured that the requisite license/lease has been obtained from the concerned Authority.

- **Permission from Commissioner of Explosives** - If the Contractor stores diesel or stores blasting materials he has to obtain permission or if procuring or executing through vendors he must ensure that the vendor has obtained permission.

- **Permission from District Health Officer** - Contractor would obtain permission for establishing labour camps.

- **Pollution under Control Certificates** - Vehicles and machineries engaged in the construction of the project will comply with the Motors Vehicle act and will be required to obtain pollution under control certificate.

- **Clearance of Encroachments** - There are some encroachments which need to be addressed as per R & R policy of the government, **Sub project Implementation Officer** (SIO; Superintendent Engineer for Major sub project and Executive Engineer for medium sub project), DoWR should ensure there won't be any issues pertaining to the resettlement before handing over the site to the contractor.

9. BASELINE ENVIRONMENTAL STATUS

xiii. The baseline environmental overview is as follows:
a. **Topography** - The elevation in the project command area varies from 12 to 20 meters (m); the slope is varying from north – eastwards. There are small hillocks in the command area and several nullahs draining into the Bada Genguti, Kelua and then Brahmani rivers. The nullahs have insufficient capacity to drain storm water, HLC range -1 being contour canal, railway lines, national highways and road embankments hinder drainage flows to some extent.

b. **Climate**. The average annual rainfall for the period 2004 to 2014 in the sub project blocks is 1634mm out of maximum rainfall occurs from south –west monsoon between June to November i.e. 1483 mm is received during monsoon, around 76 mm during pre-monsoon months of February to May. Temperature varies with minimums ranging from 12°C (centigrade) to 16°C and maximums from 34°C to 44°C.

c. **Geology & Soils** - The oldest rocks found in the study area are khondalities, charnockites and granite gneiss. Khondalities are mainly found Tigira block of Cuttack district Jajpur district and Gneiss are found in the north of Mahanadi basin from Narsingpur to T. The soils in the subproject command is in upper Mahanadi deltaic plain and sediments were deposited under fluvial influence, the soil are classified as clay loam, lateritic, sandy loam, alluvial loam, coastal alluvial loam and mixed red and black soils. The subproject falls under earthquake risk zone III i.e. moderate damage risk zone and the tail end portion under earthquake risk zone – II i.e. Low damage risk zone.

d. **Landuse** - HLC Range -1 canal mainly passes through the agricultural lands, at places it crosses small nallas, highways, roads, railway line and passes adjacent to the settlements in certain sections of the canals. The available existing acquired land for the canal i.e. Right Of Way (ROW) for the main canal ranges from 70 to 120 m i.e. 35 to 60 m on either side of the canal centre. For distributaries the available ROW is ranging from 36 to 40 m covering both sides of the canal; for minors the available ROW is approx. 26 m covering both the sides of the canal and for sub-minors the available ROW is around 16m (both sides of the canal) No additional land acquisition is required.

e. **Agro-climatic condition** - The HLC Range -1 subproject falls in the North-Eastern Coastal Plain” Agro-Climatic Zone of Odisha. The district is primarily an agricultural district but even large scale industrial units are present in Cuttack and Jajpur and huge number of stone crushers are located in the Jajpur district.

f. **Water Resources** - The water quality of the HLC Range -1 subproject is not monitored. The water quality for Mahanadi river shows that the water quality of Class C or even deteriorates further by not meeting Class C also near the vicinities of the HLC Range -1 town due to the release of untreated effluents from the Cuttack town ship.

g. **Biodiversity** - The forest cover of the HLC Range -1 project districts i.e. Cuttack and Jajpur is very less, only 787 square kilometres (sq.km) and 725 sq.km out of which demarcated protected forest is around 101 sq.km in Cuttack district and 299 sq.km in Jajpur district. There are no reserved or protected forest in the subproject area. There are no endangered plants in the subproject area the dominant tree species are Anogeissus latifolia, Azadiracta indica, Albizia lebbeck, Buchanania lanjan, Butea monosperma etc., There are no endangered fauna in the subproject area, the fauna found in the area are pea foul, red jungle fowl, red spur fowl, black patridge, grey horn bill, green pigeon and ducks all under least concern category of red data book. There are no government notified core habitations like elephant reserves or sanctuaries with in the area of influence of the project area.
h. **Demography** - The sub project area is covered in three blocks of Cuttack district and 2% and Schedule Tribes (ST) population of blocks of Jajpur district. The subproject covered blocks have a population of 881525 with a Schedule Caste (SC) population of 19.8% and ST population of 6% There are 214 benefited villages with approx. 49,805 beneficiaries.01 % as per 2001 census.

10. **ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES:**

xiv. The potential positive and negative impacts were identified in relation to design, construction and operation for the proposed renovation works. The negative environmental impacts, both direct and indirect, associated with the project location and mitigative measures, and the impacts arising due to the construction phase of the project will be temporary and short term in nature.

xv. The direct and short term impacts concern the implementation stage of the ERM works which can be mitigable with environmental management Plan (EMP) implementation. Mitigation reduce measures have been developed to reduce all negative impacts to acceptable levels. Special measures like dust suppression measures, traffic management and safety measures for workers have been addressed in the EMP.

11. **INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION**

xvi. In the most recent notification of the Ministry of Environment and Forests of 14 September 2006, (referred to in section III E of this IEE) modernization of irrigation projects does not require Public Consultation. However, Public Consultation and Information Disclosure is an essential element of the ADB Safeguard Policy Statement 2009, and included in the internal project procedures. The process of stakeholder, public consultation as well as outcome of consultations and information disclosure adopted for the subproject have been developed.

xvii. The subproject stake holders of the project include:

- Project benefitted communities or stakeholders or Pani Panchayat members,
- Institutional stake holders such as Pollution Control Board (PCB), government institutions like Water Resource Department, State Pollution Control Board, etc.,

xviii. House hold survey for 240 households in Solara, Champapur, Birol, Jaganathpurl, Bharatpur, Brahanapada, Paikerapur, Sabo, Sardola, Mirjapur, Gothamuhanpatna and Narendrapur covering head, middle and tail villages. And the focus group discussions (FGDs) were held at Birol, Champapur, Gangudia- Bharatpur and Jaganathpur villages. The consultation and discussions were held with groups of beneficiaries during initial field visits and the preparation of feasibility studies for the core sub-projects. During these discussions, the scheme was discussed with groups of beneficiaries, typically 10 to 20 persons in size, and their views sought on key issues including (i) anticipated effects of the proposed scheme improvement, (ii) the extent and nature of changes in land use that may occur with improved supplies of irrigation water (iii) presence of any sites of archaeological or cultural importance (iv) land stability in the around the existing scheme and (v) potential land use conflicts. No serious concerns were raised by villagers during these discussions. Focus group discussion for individual village and household surveys were conducted in selected villages to understand the present problem of irrigation system.

xix. The Institutional stake holders that were consulted were: State Pollution Control Board, Regional Office, and Cuttack. The feedback and suggestions obtained from the departments were used in screening the subproject and planning the activities.
xx. Summary findings of Consultation sessions with benefited communities are:

- Villagers will cooperate in all aspects for implementation of the prestigious project
- Non availability of the canal water during construction work- villagers requested planning of construction work during lien period when irrigation water not much required
- They will accommodate the short term impacts during construction phase
- They need real help from government side for regular testing of agricultural soil and irrigation water
- Introduction of organic manure, bio-fertilizer and vermicompost will be required. Farmers have no knowledge on beneficial effect of utilization of bio-fertilizer
- Environmental awareness program will be required for non use of banned pesticide as well as personal safety during application of pesticide
- Minimization of conflict among water users through PP intervention
- Solving of drainage problem at water logging area

12. GRIEVANCE REDRESS MECHANISM

xxi. The grievance mechanism for the subproject has been developed and discussed in the IEE report.

13. ENVIRONMENTAL MANAGEMENT PLAN (EMP)

xxii. An EMP is mandatory and consists of the following features: (i) Institutional Arrangement required for the subproject; (ii) staffing requirement for EMP implementation; (iii) Reporting System and the responsibilities of different institutions involved in EMP implementation (iv) Environmental Monitoring plan with the check list of anticipated impacts and suggested mitigation measures and the responsibility of different institutions and also stages of implementation (v) Suggesting Environmental monitoring plan with showing locations of monitoring, frequency and stage of monitoring; (vi) performance indicators for the subproject (vii) Environmental Monitoring and Management Costs and (viii) Capacity building requirements.

14. RECOMMENDATION

xxiii. Recommends the subproject to be rated Category B for the following reasons: (i) There are no significant adverse impacts associated with this project in the local environmental condition due to construction and operation of the project. Instead the project is expected to improve irrigation facilities and enhance economic growth of the area; (ii) Increased irrigation will also help in planting of more trees thereby increasing the environmental conditions of the area adding to the greenery and general aesthetics of the area; (iii) The indirect benefits of the project will be lowered levels of out migration as the communities will have more opportunity of securing income from within the village; (iv) There will be growth in living standard of people, which will encourage proper education, social awareness, health facility and prosperity amongst the people; (v) The IEE clearly states in its findings that there will be no significant impact in the local environmental condition due to construction and operation of the project and preference shall be given to the local labour for carrying out the work.

xxiv. Any impact associated with the project activities will be minor in nature and will be restricted. Adequate safety, dust suppression measures and traffic management need
to be taken up by the contractor while executing the construction works canal crosses nullahs and roads and the road is on the river embankment, there are many VRBs across this canal to access country side. Clearing of weeds and grasses involving community and awareness raising about the impacts of weeds during operation phase will enhance system efficiency. Scope for increased levels in ground water increase in soil salinity, increased levels of insecticides and pesticides might be some of the impacts need to be monitored during project operation. Increased ground water level is a beneficial impact and hence no mitigation measures are recommended. It is suggested that local villagers should be educated through pani panchayat about rational use of water, chemical fertilizers and pesticides to reduce soil salinity and protect surface and ground water quality.

15. CONCLUSION

xxv. The IEE has assessed potential environmental impacts associated with the subproject. There are no adverse impacts that are significant and complex in nature expected from implementation of this subproject.

xxvi. The subproject is expected to improve the existing degraded irrigation infrastructure and will be put to beneficial use to the society. This will boost agriculture growth in the area and will bring prosperity to the region.

xxvii. The potential adverse impacts are minimal as no additional land is required, and the impacts that may arise with construction can be mitigated through following standard working procedures with adequate safety and dust suppression measures and monitoring for the works carried out by the Contractor and WUAs and implementing the suggested EMP measures

xxviii. By improving the irrigation infrastructure economic disparity between head end and tail end users will be reduced.

xxix. IEE assessment confirmed the subproject Category B classification and will not require detailed EIA to be undertaken except obtaining required permits and certification as suggested in the IEE report.
I. INTRODUCTION

A. Overview

1. The Asian Development Bank (ADB) has agreed with national and state governments to fund the project in Odisha, which will include support for irrigated agriculture development and integrated water resources management with a loan of $189 million in the form of a sector loan to utilize multi-tranche financing facility (MFF). The Government of India is promoting state-level sector reforms through its National Water Policy (NWP) 1987 and 2002, which advocates PIM and IWRM to promote and sustain more efficient water use.

2. To support the process, in the late 1990s, the Government of Odisha has started gradually developed the policy, planning and institutional basis for the irrigation and water resources. Specific steps taken include (i) promulgation of the State Water Policy and State Water Plan adopting Participatory Irrigation Management (PIM) and Integrated Water Resources Management (IWRM) principles, (ii) establishment of a legal framework for water users associations (WUAs), (iii) substantial increase in the water tariff and O&M financing, and (iv) capacity strengthening of the Department of Water Resources (DoWR).

3. As an effort towards attaining these objectives had applied for MFF No. 0022 and Loan No 2444 IND and as a result has started “Orissa Integrated Irrigated Agriculture and Water Management Investment Program (OIIAWMIP) to be implemented under different tranches. The project has a wider objective to improve the irrigation service delivery with Pani Panchayat (PP) empowerment to enhance the productivity and sustainability of irrigated agriculture, thereby contributing to rural poverty reduction by increasing rural economic growth and reduce poverty in the four northern river basins (Brahmani, Baitarani, Burhabalanga, and Subrenerekha river basins) and a part of Mahanadi Delta areas. The executing agency is the Department of Water Resources (DoWR). The DoWR, Odisha will be the implementing agency and the projects are operated through a Project Management Unit (PMU), and the works will be outsourced to private contractors selected under National Competitive Bidding.

4. The project will assist in preparation of operation plans and procedures and an improved canal operation PME system to provide canal managers with (minimal) data. Assistance for O&M, and regular training, will continue during and after system ERM to facilitate adoption of improved procedures by both the DoWR managers and Pani Panchayts (PPs).

5. The major components of the OIIAWMP include:
   - the rehabilitation of irrigation systems within five major river basins, namely the Subernarekha, Burhabalang, Mahanadi, Baitarani and Brahmani covering a total area of 300,407 ha;
   - supporting the practical implementation of integrated water resources management using a river basin approach;
   - strengthening the capacity of irrigation water delivery agencies;
   - promoting participatory irrigation management through water user association;
   - Supporting improvements in the quality of and access to agricultural support services.
6. The HLC Range -1 schemes benefits 317 villages approx. covering 3 blocks of Cuttack district and 2 blocks of Jajpur district with 32 Pani Panchayats (PPs). There are a number of government welfare schemes operating in the project villages. Some are run by Government Cooperative Agencies for the benefit of the vulnerable groups. The schemes are Antodaya Annapurna Yojna, *Indira Avas Yojana* (IAY), Old Age Pension and Widow Allowance. General awareness about these welfare schemes is high. Only very few non-government organisations (NGOs) and Community based organizations are operational in the scheme area.

B. Purpose of the Report

7. HLC Range -1 canal irrigation system is one of the sub-projects to be funded under Tranche -2. The rehabilitation and resectioning of an existing major canal irrigation scheme: HLC Range -1 located in Cuttack and Jajpur districts are being considered. The Initial Environmental Examination (IEE) report investigates the environmental impacts based on the preliminary design and estimates. It is mandatory that the sub-project considered for implementation complies with all relevant environmental requirements of the Government of India, the State Government of Odisha, and ADB’s safeguard Policy Statement (SPS) 2009. The Environment Impact Assessment (EIA) Notification of 2006, Govt. of India is the basis for environmental assessment. The expansion and modernization of existing projects or activities listed in the Schedule to this notification with addition of capacity beyond the limits specified for the concerned sector, project or activities which cross the threshold limits given in the Schedule, after expansion or modernization require environmental clearance. As this sub-project involves renovation of the existing canals to its original designed capacity, repair of existing structures and construction of some new additional structures (Village Road Bridges, Bathing ghats etc) are involved in the project without increase in the command areas or no new canal are proposed, so doesn’t require any environmental clearances.

C. The Study Methodology

8. The IEE was prepared based on the detailed screening and analysis of all environmental parameters, field visits to the project site to assess the present condition of the system and level of intervention required. The data to establish baseline environmental status of the project was collected from various secondary sources like published literature, reports, official web sites and meeting with the key personnel. Public consultation was undertaken at four villages in the project area. The villages were selected in such a way that they were chosen to be representative of the head, middle and tail end of the project to get views of the project affected community. An environmental management plan was suggested to mitigate the adverse impacts of the project.

D. Project Location

9. The High Level Canal Range-1 irrigation subproject is in the lower Mahanadi river basin. The 53.094km HLCR-1 contour canal offtakes from the left bank of the Birupa Barrage at Cuttack (20°30’52” N, 85°55’17” E), and terminates at Jenapur on the right bank of Brahmani. The canal commands a gross area (GCA) of 17,295 ha, and had an original cultivable command area (CCA) of 14,700ha now reduced by urbanization and other developments to about 13,790 ha. It covers parts of four Blocks: Tangi-Chowdwar Mahanga and Salepur Blocks of Cuttack district covering an area of 5800 Ha and Badachana and Dharmasal Blocks in Jajpur district covering 8200 ha. Figure 1 shows the subproject’s location and the index map is enclosed as *Annexure -1*. 
Orissa Integrated Irrigated Agriculture & Water Management Investment Program (OIIAWMIP)

Figure 1 shows the subproject's location
10. In line with the ADB’s SPS 2009, the IEE report has 10 chapters. The details are as:

1. **Executive Summary**: The section deals briefly with the critical facts, significant findings and recommendations.

2. **Chapter 1: Introduction** This chapter describes with overview of the project, purpose of the report, study methodology and project location

3. **Chapter 2: Policy, Legal and Administrative Frame work for Environment Management** chapter provides environmental management and protection policies, regulations as per the Ministry of Environment, Govt. of India, Govt. of Odisha and ADB environmental policies and the required clearance for the subproject.

4. **Chapter -3: Description** This chapter briefly describes the present condition of the various structures under the *HLC Range -1 Canal System* irrigation project and a description of the proposed engineering recommendations.

5. **Chapter 4: Description of the Environment**. The section includes baseline conditions for the physical and natural environment, socio economic and demographic profile of the project area. The data presented in the report is gathered from secondary sources.

6. **Chapter 5: Anticipated Environmental Impacts and Mitigation Measures** Chapter describes the extent of the impacts of the project activity on the existing environment. The focus of section is on the adverse impacts however the beneficial impacts are also reported in this chapter.

7. **Chapter 6: The Information Disclosure, Consultation and Participation** chapter gives information on consultation, stages and levels of consultation process and findings of the public consultation conducted in six villages as part of the project.

8. **Chapter 7 Grievance Redress Mechanism** Chapter provides the proposed mechanism for grievances.

9. **Chapter 8: Environmental Management Plan** Chapter describes the measures recommended for mitigating the adverse impacts arising out of the project. This chapter also emphasizes on the roles and responsibilities, regular monitoring activities, supervision and reporting of monitoring of various environmental components during different phases of the project.

10. **Chapter 9** Gives findings and recommendations of the IEE study.

11. **Chapter 10** includes the conclusion of the IEE study.
II. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK FOR ENVIRONMENTAL MANAGEMENT

11. The environmental management and protection policies, regulations and administrative framework governing the project are reviewed in this section. The review includes sector-specific environmental policies and regulations of the Government of India, State Govt of Odisha, ADB’s Safeguard Policy Statement, June, 2009, and the administrative framework of various agencies, such as the Ministry of Environment and Forest (MoEF), the Pollution Control Boards and other bodies associated with the implementation of the proposed subproject.

A) Mandatory Requirements (Funding Agency)

1 Asian Development Bank’s Safeguard Policy Statement (June 2009)

12. The following are the requirements under Asian Development Bank’s safeguard policy.

2 Environment Categorization

13. ADB uses a classification system to reflect the significance of a project’s potential environmental impacts. A project’s category is determined by the category of its most environmentally sensitive component, including direct, indirect, cumulative, and induced impacts in the project’s area of influence. Each proposed project is scrutinized as to its type, location, scale, and sensitivity and the magnitude of its potential environmental impacts. Projects are assigned to one of the following four categories based on the Operations Manual Section F1 and Operational Procedures (OP) March 2010:

Category A: Projects with potential for significant adverse environmental impacts which are irreversible, diverse, or unprecedented. An environmental impact assessment (EIA) is required to address significant impacts.

Category B: Projects judged to have some adverse environmental impacts, but of a lesser degree and or significance than those of category A projects. An initial environmental examination (IEE) is required to determine whether or not significant environmental impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report.

Category C: Projects unlikely to have adverse environmental impacts. No EIA or “IEE is required, although environmental implications are still reviewed.

Category F1: Projects are classified as category F1, if they involve a credit line through a financial intermediary. The financial intermediary must apply on environmental management system; otherwise all subprojects will result in insignificant impacts.

3 Environmental Management Plan

14. It addresses the potential impacts and risks identified through the process of environmental assessment and the level of details and complexity of the EMP. It identifies impacts and risks and the priority measures and actions that will commensurate with the project.
4 Public Disclosure

16. The IEE summary will be translated into local language and disclosed to Water Users Association (WUA) level. The copy of the full IEE will be available with subproject Implementation Office (SIO) and Project Management Unit (PMU) and will be made available for the stakeholders as and when asked for. A copy of the IEE Summary will be disclosed through the DOWR website and in ADB website as well.

B. Mandatory Requirements (National)

5 Environmental Regulatory and Policy Framework for Subproject Selection

17. The environmental regulations of the Government of India have laid out various policy guidelines, acts and regulations pertaining to the sustenance of environment. The acts that are applicable to this project are summarized in the sections below.

6 Constitutional Provisions

18. The Constitution of India, in Article 48, of Directive Principles of the State, states that “the state shall endeavour to protect and improve the environment and to safeguard forests and wildlife of the country”. Further Article 51-A (g), of fundamental duties, emphasizes that, “It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures”. These two provisions of the constitution are the guiding principles for the environmental legislation in India.

19. The Government of India has laid down various policy guidelines, regulations, acts and legislations pertaining to the sustainability and protection of the environment and its various components. The statutory requirements for the proposed subproject are discussed briefly in the following paragraphs.


20. The Environmental (Protection) Act, 1986 is the umbrella legislation providing for the protection of the environment in the country. This act provides the Environment (Protection) Rules, which were formulated in 1986. The Environmental Impact Assessment Notification, 1994 and the various amendments thereto have been notified under this act. The Ministry of Environment and Forests (MoEF) has enacted a new notification under the Environmental Protection Act, 1986 related to environmental clearance (EC) of the developmental projects with effect from September 14, 2006.

21. According to this notification, developmental projects are classified as category A and Category B based on their size, nature, location and possible environmental impacts. All the projects included in Category A require environmental clearance from the MoEF, Government of India. The list of projects or activities requiring environmental clearance and their categorization is given in the schedule of this notification. According to this notification, expansion and modernization of existing projects or activities listed in the schedule to this notification with addition of capacity beyond the limits specified for the concerned sector, project or activities which cross the threshold limits given in the Schedule after expansion or modernization requires environmental clearance.
22. During discussions held with officials of the department of environment and forests Government of Odisha (GOO). The state department of environment (DOEn) is of the view that new irrigation projects encompassing a command area less than 500 ha need not require EC. In view of this all the new major, medium and minor projects that are likely to increase the command area more than 500 ha and will need an EC from the SEIAA and projects whose command area increases equal to or more than 10,000 ha will need an EC from the central government.

23. This HLC Range -1 sub-project is an existing major project where renovation of existing canals to its original designed capacity, repair of existing structures and construction of new additional structures like village bridges, bathing ghats etc are involved in the project activities. Since no new canals and no additional command area is being increased under this sub-project so doesn’t require environmental clearance as per the provisions of EIA notification 2006.

8 The Water and Air (Prevention and Control of Pollution) Acts

24. The Water (Prevention and Control of Pollution) Act, 1974 resulted in the establishment of the Central and State level Pollution Control Boards, (CPCB and SPCB) whose responsibilities include managing water quality and effluent standards, as well as monitoring water quality, prosecuting offenders and issuing licenses for the construction and operation of developmental projects requiring water as a resource. The Air (Prevention and Control of Pollution) Act, 1981, empowers the SPCBs to enforce air quality standards set by the CPCB.

25. During the construction phase of the project, if plants like concrete mixing plants, hot mix plants, crushers, diesel generators etc are installed, will require consent {consent for establishment (CFE) and consent for Operation (CFO)} from the Odisha State Pollution Control Board(OSPCB) pursuant to the Water (Prevention and Control of pollution) Act of 1974, The Water Cess Act of 1977 and the Air (Prevention and Control of Pollution) Act of 1981.

26. This consent will be taken by the construction contractor. If the contractor is procuring the material from the vendors, he must ensure that the vendor’s have consent from the OSPCB. This would be applicable to all the major, medium and minor sub projects of this loan programme.

9 The Hazardous Waste (Management and Handling) Rules, 1989

27. The Central Government formulated these rules under the Environment (Protection) Act, 1986. Under Section 7 of these rules it is required that the operator or occupier of a facility dealing with hazardous waste ensures that hazardous waste is packaged in a suitable manner for storage and transport and that the labeling and packaging shall be easily visible and be able to withstand physical conditions and climatic factors.

28. Bituminous and other materials used in construction are considered as hazardous in nature. Section 9 of these Rules also requires that in case of an accident during transportation of hazardous wastes, the operator or occupier of a facility shall immediately report to the SPCB in the prescribed form. This statute applies to the contractor’s if they are involved, in handling (including storing) and transshipment of hazardous bituminous materials during construction or black topping of the project dam roads.

10 The Forest (Conservation) Act, 1980

29. The Forest (Conservation) Act, 1980 pertains to the cases of diversion of forest area for non-forestry use. The forest management rules, 2003 provide the guidelines for conversion of forest land for non-forest purposes. According to these rules the
process of obtaining forest clearance under the new amendment varies with the legal status of the forestland to be diverted. There are two types of forests namely, reserved and protected, whose forest land can be diverted for non forest purposes. Reserved Forest (RF) is an area notified under the provisions of the Indian Forest Act or the State Forest Acts, with a full degree of protection. In Reserved Forest, all activities are prohibited unless permitted. Protected Forest (PF) is an area notified under the provisions of Indian Forest Act or the State Forest Acts with a limited degree of protection. In Protected Forests all activities are permitted unless prohibited through a government notification. It also restricts felling of trees and regulates diversion of forestland for non-forest use.

a. In the case of Reserved Forest
   (i) If the area of forests to be cleared or diverted exceeds 40 ha then prior permission will be granted by MoEF, GOI, New Delhi.
   (ii) If the area of forest to be cleared or diverted is between ‘5 to 40’ ha, then the case would be put to the state advisory committee for consideration. The committee after studying the case will make its recommendation to the MoEF, GOI for formal approval.
   (iii) If the area of forest to be cleared or diverted is below or equal to 5 ha, then the MoEF regional office is empowered to give the approval.
   (iv) If the area to be clear-felled has a forest density of more than 40%, permission to undertake any work is needed from the Central Government, irrespective of the area to be cleared.

b. In the case of Protected Forest
30. The MoEF regional office is empowered to accord Forest clearance for an area up to 5 hectares, which is to be cleared.

The procedure for getting the forest clearance is as follows:
   (i) The user agency will submit an application to the District Forests Officer (DFO) seeking conversion of forest land for non forests purpose.
   (ii) The DFO will scrutinise the application and forward it to the state conservator of forests (CFO) with his recommendations.
   (iii) The state forest department will estimate the cost of compensatory afforestation as twice the cost of area likely to be submerged/ acquired and suggest the user agency to deposit this amount to the state forests department.
   (iv) The state forests department will also identify the land for compensatory afforestation and submit the application along with a compensatory afforestation plan to the Secretary MoEF, Government of India.
   (v) The expert committee scrutinizes the application and state government’s proposal for compensatory afforestation. If required, the committee will also under take site visits.
   (vi) The committee accords approval provided the application and compensatory afforestation proposals are satisfactory
   (vii) The state government submits the compliance report stating the status of implementation of compensatory afforestation plan and conditions given in MoEF’s first stage clearance.
   (viii) After review of the compliance report MoEF accords formal forest clearance.
31. This sub-project is an existing project without any forest areas, so doesn’t require any forest clearance. However, there are some trees on the canal embankments i.e. within ROW if any tree need to cut under unavoidable situation, then SIO should obtain permission for tree cutting from State Forest Department.

11 The Wild Life (Protection) Act, 1972

The Wildlife (Protection) Act, 1972 has allowed the government to establish a number of National Parks and Sanctuaries over the past 25 years, to protect and conserve the flora and fauna of the state. The act will be applicable to this project if the command area of any sub-project encroach any National Park or Sanctuary which houses habitats of wild animals. The wildlife sanctuaries and national parks in the river basins under consideration are given in Table 5 below. This sub projects identified for tranche -2 funding do not fall within these Protected Areas (Pas).

Table 1 List of National Parks and Sanctuaries in OIIAWMP Area

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of the Protected Area (PA)</th>
<th>Area Sq. km.</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Parks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Bhitarkanika</td>
<td>145.00</td>
</tr>
<tr>
<td>2.</td>
<td>Similipal</td>
<td>845.70</td>
</tr>
<tr>
<td>Sanctuaries</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Bhitarkanika</td>
<td>672.00</td>
</tr>
<tr>
<td>2.</td>
<td>Similipal</td>
<td>2200.00</td>
</tr>
<tr>
<td>3.</td>
<td>Satakosia Gorge</td>
<td>795.52</td>
</tr>
<tr>
<td>4.</td>
<td>Hadagarh</td>
<td>191.06</td>
</tr>
<tr>
<td>5.</td>
<td>Khalasuni</td>
<td>116.00</td>
</tr>
<tr>
<td>6.</td>
<td>Kuldiha</td>
<td>272.75</td>
</tr>
<tr>
<td>7.</td>
<td>Gahirmatha (Marine)</td>
<td>1435.00</td>
</tr>
</tbody>
</table>


32. No wildlife Sanctuaries or Protected areas are present within or near the sub-project area.

12 The Motor Vehicles Act, 1988

33. In 1988, the Indian Motor Vehicles Act empowered the State Transport Authority (usually the Road Transport Office) to enforce standards for vehicular pollution and prevention control. The authority also checks emission standards of registered vehicles, collects road taxes, and issues licenses. In August 1997, the Pollution Under Control Certificate (PUC) programme was launched in an attempt to crack down on the vehicular emissions in the States. Since this act is applicable for all states, this will be applicable for this project.

34. All the vehicles that will be used in construction of the subprojects will have to comply with the PUC norms set down under this act.

13 The Ancient Monuments and Archaeological Sites and Remains Act, 1958

35. According to this Act, the area within the radii of 100 meters (m) and 300m from the “protected property” are designated as a “protected area” and “controlled area” respectively. No development activity (including building, mining, excavating, blasting) is permitted in the “protected area” and development activities likely to damage the protected property are not permitted in the “controlled area”, without prior permission of the Archaeological Survey of India (ASI), if the site/remains/monuments are protected by ASI. The likely subprojects command area does not have any protected
property and therefore, this act will not be applicable for the project. However, there may be a possibility that artifacts of coins, structures, fabrics or any other archaeological relics may be identified during the construction phase. If such a situation would arise this Act would then apply. However, in case of chance finds, the contractors will be required to follow a protocol; as defined in the Environmental Management Plan.

14 Land Acquisition and Resettlement & Rehabilitation:

36. The following acts and policies would be applicable to the sub-projects under OIIAWMIP.

a) Land Acquisition Act, 1894 (LAA-1894)

37. In India, compensation for land acquisition (LA) and resettlement assistance for project-affected people is governed by the Land Acquisition Act (LAA), 1894 which has been amended from time to time. Under the Land Acquisition Act of 1894, compensation is paid only to the legal titleholders and does not provide any compensation package to the non-titleholders like encroachers, squatters etc. LAA, as amended in 1984 provides the legal framework for land acquisition for a public purpose in India. It enables the State Government to acquire private lands for a public purpose, and seeks to ensure that no person is deprived of land except under the Act.

b) National Rehabilitation and Resettlement Policy, 2007 (NRRP-2007)

38. The National Rehabilitation and Resettlement Policy, 2007 (NRRP-2007) was adopted by the Government of India in 31st October, 2007 to address development-induced resettlement issues. The policy provides for the basic minimum requirements, and all projects leading to involuntary displacement of people must address the rehabilitation and resettlement issues comprehensively. The State Governments, Public Sector Undertakings or agencies, and other requiring bodies shall be at liberty to put in place greater benefit levels than those prescribed in the NRRP-2007. The principles of this policy may also apply to the rehabilitation and resettlement of persons involuntarily displaced permanently due to any other reason.

c) The Orissa Resettlement and Rehabilitation Policy, 2006

39. The State Government of Odisha in 2006 have framed and adopted a comprehensive resettlement and rehabilitation policy named “The Orissa Resettlement and Rehabilitation Policy, 2006” in order to ensure sustained development through a participatory and transparent process. It shall apply to all those projects, for which acquisition of private land under Land Acquisition Act, 1894 or under any other law’s for the time being in force or proclamation inviting objections in case of Government land is notified. This shall also be applicable to all projects for which land is acquired through negotiation under the provisions of this Policy.

d) Involuntary Resettlement Policy of Asian Development Bank

40. The Safeguard Policy Statement (2009) of Asian Development Bank’s (ADB) is being followed for preparing this resettlement plan. The main objectives of the ADB policy include:

- to avoid involuntary resettlement wherever possible;
- to minimize involuntary resettlement by exploring project and design alternatives;
to enhance, or at least restore, the livelihoods of all affected persons in real terms relative to pre-project levels; and to improve the standards of living of the affected poor and other vulnerable groups

41. This sub-project HLC Range -1 doesn’t require any land acquisition but there are some encroachments which would be surveyed and addressed separately in the Resettlement Report.

15 Public Liability Insurance Act, 1991
42. This Act provides for public liability insurance for the purpose of providing immediate relief to the persons affected by an accident occurring while handling any hazardous substance and for matters connected therewith or incidental thereto. The transportation of hazardous substances by vehicle use is also included. This statute would apply on the implementers of the Project.

16 Central Pollution Control Board (CPCB)
43. It is a statutory authority attached to the MoEF located at New Delhi. The main responsibilities of CPCB include the planning and implementation of water and air pollution programmes; advising the Central Government on water and air pollution programmes; setting air and water standards and co-ordinating with the SPCBs.

17 Odisha State Pollution Control Board (OSPCB)
44. The OSPCB is the government agency responsible for ensuring the compliance to relevant standards related to discharges in the environment. The activities of the OSPCB include, planning and executing state level air and water quality initiatives; advising the state government on air, water and industry issues; establishing standards based on National Minimum standards and enforcing and monitoring of all activities within the state under the Air Act, the Water Act and the Cess Act.

18 Applicability of International Environmental Agreements
45. In addition, international conventions such as the International Union for Conservation of Nature and Natural Resources¹ (IUCN), Convention on Migratory Species of Wild Animals (CMS)² and Ramsar Convention on Wetlands of International Importance³ are applicable for selection and screening of sub-projects under restricted / sensitive areas. India is a party to these conventions

19 Odisha State Legislations and Acts and Other relevant Guidelines/ Standards
46. Over and above, the project also gives due importance to the Indian standards, norms, guidelines and management procedures related to canal or irrigation projects such as IS 4701 reaffirmed 1995 i.e. Code of Practice for Earth work on canals and IS 4839 (part -1)1992, etc.

47. The Government of India in the Ministry of Labour & Employment have enacted the Building and Other Construction Workers (Regulation of Employment and Conditions of Service of the Buildings and other Construction Workers and to provide their safety, health and welfare measures. To enforce the same the Government of Odisha has formulated rules namely the Orissa Building and other Construction Workers

¹ The IUCN provides Red List of Threatened Species which provides comprehensive information on the global conservation status of plants and animal species. The IUCN Red List is applicable for assessing global risk of extinction for species world over. The objective of the list is to highlight and convey the need for species conservation issues to public, policy makers and researchers

² CMS also known as Bonn Convention, recognized that states must be the protectors of migratory species that live within or pass through their national jurisdictions, and aim to conserve terrestrial, marine and avian migratory species through out their ranges. Migratory species threatened with extinction are listed on the Appendix I of the Convention. The signatories have to strive towards protecting these species.

³ The convention on Wetlands of International importance (Ramsar Convention) provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources, As per this there are 25 designated wetlands in India, Chilka in Orissa is one among them
(Regulation of Employment and conditions of Service) Rules, 2002. As per the act, Government has to deposit 1% cess of the cost approved as per the tendered notification. The amount needs to be deducted from the bill at the time of making payment to the contractor.

48. According to the Child Labour Act, children at the age of 14 to 18 years, if employed, shall not be engaged in hazardous working conditions.

49. The constitution of India has provisions for ensuring the health and wellbeing of all employees need to be protected and the state has the duty to ensure protection. For this sub-project, the mitigation measures were based on the World Bank Environmental, Health and Safety (EHS) Guidelines.

20 Orissa minor mineral concession Rules 1990 amended 2004

50. As per the act, no person shall undertake any quarrying operations for the purpose of extraction, collection and/or removal of minor minerals except under and in accordance with terms and conditions of the quarry lease, permit and/or auction sale, various rules which are important and relevant to the project activities are stated below:

- Extraction, collection, and/or removal of minor minerals by a person from his own land for normal agricultural operations or other bonafide domestic consumptions shall not be construed as quarrying operations.

- The government may have restrictions in granting a quarry lease; for an area up to 5 Ha, the permit and lease should be obtained from Tahasildhar, Revenue Department, Govt. of Odisha and above 5 Ha, from the Sub-Collector, and in the case of Forest Lands, it should be from Divisional Forest Officer and for the Minor minerals other than those specified in item I(1) of Schedule III, regardless of location, from the Mining Officer and Deputy Director of Mines, Department of Steel & Mines.

- Chapter II section 14 sub. Section 8 states the conditions of quarry lease; it states that the lease shall not carry on or be allowed to be carried out at any point within a distance of: (a). One hundred meters from any railway line, national highway, state highway or any reservoir; or (b) within a distance of 50 meters from any tank, canal, road (other than National or State highways) except under and under in accordance with the permission of the Collector.

- Section 21 and 23 states lessee shall ensure major erosion and observe all such environmental safeguards as provided in the act and in case of granite quarry, proper reclamation should be done with plantation.

- It also states if the land leased out is a private land, the lessee shall pay a reasonable compensation, as agreed upon between the lessee and the owner of the land.

- It also states that the depth of quarry below the surface shall not exceed six meters.

C. Clearances required for the subproject

51. After reviewing the various applicable environmental acts and statutes, as applicable to Government of India, Govt. of Orissa and ADB some of the clearances that are to be obtained by SIO/Contractor are:

- **Permission from State Forest Department** - There are some trees that exist on the canal embankments to the possible extent trees would be saved if tree cutting is necessary, they require permission from State DFO for cutting before commencement of the civil work.

- **Consent from Odisha State Pollution Control Board** - All the construction contractors should obtain consent under the water and air act from Odisha State pollution control
board before commencement of construction work for the plant and machinery (Hot Mix, WMM, Batching, Crusher, Diesel Generator greater than 15 KVA) they establish for the projector if they are procuring from the vendor, the contractor should ensure that the vendors has the requisite consents from the State Pollution Control Board of Odisha. The list of crushers falling under Regional Office Cuttack (Cuttack, Jagatsingpur, Kendrapara and Jajpur) whose consents has been issued by OSPCB, Cuttack as on November 2011 (information shared) is enclosed as Annexure-2.

- **Permissions from Department of Mines and Geology**:  
  iv. Contractor would obtain permission for transporting the soil from the Department of Mines and Geology or local bodies as applicable, along with the mutual agreement with the land owner in case of private lands.  
  v. Contractor would obtain permission for extracting boulders before quarrying; if the extraction of the boulder is being procured from the existing quarry/supplier, it shall be ensured that, the requisite license/lease has been obtained from the concerned Authority.  
  vi. Contractor would obtain permission for extracting sand before quarrying; if the extraction of boulder is being procured from the existing quarry/supplier, it shall be ensured that the requisite license/lease has been obtained from the concerned Authority.

- **Permission from Commissioner of Explosives** - If the Contractor stores diesel or stores blasting materials he has to obtain permission or if procuring or executing through vendors he must ensure that the vendor has obtained permission.

- **Permission from District Health Officer** - Contractor would obtain permission for establishing labour camps.

- **Pollution under Control Certificates** - Vehicles and machineries engaged in the construction of the project will comply with the Motors Vehicle act and will be required to obtain pollution under control certificate.

- **Clearance of Encroachments** - There are very few encroachments which need to be addressed as per R & R policy of the government, SIO, DoWR should ensure there won’t be any issues pertaining to the resettlement before handing over the site to the contractor.
III. PROJECT DESCRIPTION

A. Type and need of the Project

52. The High Level Canal Range-1 irrigation subproject is in the lower Mahanadi river basin, and forms part of the Delta Stage 1 development comprising over 180,000ha through major canal systems (Taladanda, Machhagan, High Level Canal-1 and Kendrapara) with supply from Mahanadi and Birupa barrage.

53. The 53.094km HLCR-1 contour canal offtakes from the left bank of the Birupa Barrage at Cuttack (20°30'52" N, 85°55'17" E), and terminates at Jenapur on the right bank of Brahmani. The canal commands a gross area (GCA) of 17,295 ha, and had an original culturable command area (CCA) of 14,700ha now reduced by urbanization and other developments to about 13,790 ha. It covers parts of four Blocks: Tangi-Chowdwar Mahanga and Salepur Blocks of Cuttack district covering an area of 5800 Ha and Badachana and Dharmasal Blocks in Jajpur district covering 8200 ha.

54. The subproject was originally built to facilitate boat / small ship navigation between the Brahmani and Mahanadi, as well as to for irrigation.

55. National Highway (NH) 5 (Cuttack to Kolkata) bisects the command area from north to south, and the main railway line passes along the western boundary. NH 5A and NH 42 pass across the scheme from east to west.

56. The canal and canal structures of the High Level Canal Range –having been constructed 100 years ago require to be modified. In some cases the carrying capacities of the canals have decreased due to silting or slipping of banks as a result of poor maintenance. The old canal system has not been renovated since long except some minor repair out of O & M grant. Poor maintenance of banks has resulted in heavy seepage through banks, causing a higher rate of transmission losses.

57. As the distribution system is to be handed over to W.U.A. the condition of the canal system must be in a complete healthy condition as envisaged under rule.

58. The structures in the canal system are also in a bad state and they require repair and reconstruction. Some of these structures are in so bad condition that they are to be completely dismantled and reconstructed. In some cases new structures such as falls, outlets, CDs etc. are to be constructed.

B. Category of the project

59. This project does not have any major environmentally sensitive issues. There are no reserved forest, wild life sanctuaries, eco-sensitive zones, protected monuments, endangered or exotic species of plants or animals in the region. There is no rehabilitation and resettlement of people. Hence this project is classified as category B as per ADB’s Safeguard Policy Statement 2009.

C. Scope of work

60. The difficulties inherent in operating and maintaining the existing system, coupled with no major rehabilitation or upgrading since original construction, has resulted in most of the command area getting little irrigation water.
D. Description of the subproject - Scheme Development History

61. HLC Range-1 was designed as a navigation canal in the mid-19th Century, linking the Mahanadi river at Cuttack to the Brahmani river at Jenapur. These were relatively stable points of the rivers, being at the head of the Delta. Canals off-taking from the navigation canal were built to irrigate the command area, mostly to the north-east of the main (navigation) canal.

62. HLC R-1 and other early irrigation developments to safeguard against famine are collectively known as the Mahanadi Delta Stage-I Project. With construction of Hirakud reservoir in 1946-1957 in the Mahanadi middle basin, additional perennial water became available. Irrigation scheme coverage was extended into Puri district in developments collectively known as the Mahanadi Delta Stage-II Project.

63. Navigation use declined leaving a main canal conveying silt-laden water for irrigation. Maintenance of lock gates ceased and they fell into despair. However the irrigation infrastructure has been maintained with modest improvements over the years.

64. The original CCA was 14,000ha but this has gradually declined as agriculture land became used for urban and commercial purposes. The current CCA is estimated at 13,790 ha. Presently its irrigating 6200 ha fully, 2000 ha partially and 3,700 ha of area is deprived as per the DPR October 2011, DoWR.

65. Irrigation canal water supplements rainfall. In Kharif most (90%) of the command area receives canal water and paddy is the dominant crop. Follow-on Rabi crops, dominated by pulses, oilseeds and vegetables rely heavily on soil moisture available following harvest of the paddy crop, and, for vegetables, pumping of groundwater.

66. Subproject infrastructure includes:

67.  
   - Birupa barrage complex
   - HLC Range-1 canal system comprising of the main canal, four distributaries and minor and sub-minors
   - Associated canal infrastructure including service roads, bridges, regulators and cross drainage structures
   - Watercourses and field channels
   - Drainage system: mostly existing nullahs and rivers.
   - Flood embankments.

1. Mahanadi Barrage Complex

68. The river bifurcates into two about 4km downstream of the Munduli barrage, at Naraj: (i) Mahanadi; and (ii) Kathjori. The Mahanadi further divides into the Mahanadi and the Birupa rivers. These three principal branches of the Mahanadi sub-divide into numerous branches forming an extensive fertile delta of about 9,000 km².

69. Three barrages across these main river branches form a common pond for off taking canals. The barrage across the Kathjori just upstream of Cuttack city is the Kathjori or Naraj barrage. This barrage was built in 1998-2004 replacing a low weir structure, to control flow division between the Kathjori and Mahanadi. The Mahanadi and Birupa barrages are near the downstream end of Cuttack, across the Mahandi and Birupa rivers respectively. The Mahanadi is by far the largest of the three barrages with 95

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4 The Kathjori had been capturing 60-70% of the flow, and this was increasing with a risk of insufficient flow to the Mahanadi.
bays, compared with 46 bays for Naraj and just 15 for Birupa. About 4.5km upstream of Naraj is the Munduli barrage over the Mahanadi diverting water to the right bank Puri canal (part of the Delta Stage II development).

70. Three canals offtake from the Mahanadi-Birupa pond: (i) HLC-1 on the left bank of the Birupa; (ii) Kendrapara on the left bank of the Mahanadi; and (iii) Taladanda on the right bank of the Mahanadi. The barrages are in reasonable condition and no works on these are included in the subproject.

2. Description of the Canal System and scope of Work

i. General

71. The High Level Canal Range-1 irrigation subproject is in the lower Mahanadi river basin. The 53.094km long HLC Range-1 canal offtakes from the left bank of the Birupa pond just upstream of Birupa barrage. This canal system consists of 4 distributaries, 11 minors and 11 sub-minor canals. Salient features of the canal system are tabulated in Table 2 below and the schematic line diagram showing the distribution system is shown in Annexure 3.

72. Table 2  HLC Range-1 Scheme

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Original Command area</td>
<td>13,790 ha</td>
</tr>
<tr>
<td>2</td>
<td>Revised (2008) command area</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Revised Design Discharge (2008)</td>
<td>17.94Cumecs</td>
</tr>
<tr>
<td>4</td>
<td>Length of Main canal</td>
<td>53.094km</td>
</tr>
<tr>
<td>5</td>
<td>Distributary Canals off taking from Main canal</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Minors off taking from Main canal</td>
<td>11</td>
</tr>
<tr>
<td>7</td>
<td>Sub-minors off taking from Main canal</td>
<td>11</td>
</tr>
<tr>
<td>8</td>
<td>Outlets off taking from main canal</td>
<td>90</td>
</tr>
<tr>
<td>9</td>
<td>No. of locks (cross regulator cum fall) along main canal</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>No. of Escapes</td>
<td>5</td>
</tr>
<tr>
<td>11</td>
<td>Total number of outlets in command area</td>
<td>1,047</td>
</tr>
<tr>
<td>12</td>
<td>Average command area per outlet</td>
<td>13.0</td>
</tr>
</tbody>
</table>

ii. Weirs

73. There is one weir cum fall at Imamnagar at RD 41.072 km of HLC Range -1. The cistern of the weir cum fall are built with laterite stone masonry covered with cement concrete. The cistern is in damaged condition requiring replacement with RCC. Even the downstream protection works are also in damaged condition needs replacement. The body wall as well wings are made of masonry, these are damaged requiring repair and plastering.

iii. Classification of Canals under OIIAWMIP

74. Classification of canals in accordance to discharge is necessary because: (i) the works and O&M of main, branch & distributary canals will remain the responsibility of the DoWR; While (ii) O &M of minors and sub-minor system will become responsibility of the PPs in accordance with the PIM Act, 2002 and Rules, 2003. Canal classification adopted under the OIIAWMIP is in Table 3.

---

5 Based on DoWR classification of canals by discharge: (i) Main / Branch: >10m3/s; (ii) Distributary: 1-10m3/s; (iii) Minor 0.2-1m3/s; (iv) Sub-minor / watercourse: 0.008-0.2m3/s; and (v) field channel <0.008m3/s.
### Table 3 - Showing Canal Categorization

<table>
<thead>
<tr>
<th>No</th>
<th>Name of Canal</th>
<th>Category of Canal</th>
<th>Discharge (m³/s)</th>
<th>Typical Command Area (ha)</th>
<th>O&amp;M Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Varies: Main/ Branch/ Distributary</td>
<td>Main Canal/ Branch Canal</td>
<td>&gt;10</td>
<td>15,000 to 40,000</td>
<td>DoWR (Appex and Distributary Level PPs)</td>
</tr>
<tr>
<td>2</td>
<td>Main System Infrastructure: O &amp; M DoWR</td>
<td>Distributary</td>
<td>1.0 – 10.0</td>
<td>1,500 to 15,000</td>
<td></td>
</tr>
</tbody>
</table>

**Minor System Infrastructure: O & M (WUAs)**

| 3  | Distributary/ Minor/ Sub-minor/ Water courses | Minor       | 0.2 – 1.0       | 250 to 1,500 | PP Irrigator Group                     |
| 4  | Sub-minor/ Water Course                   | Sub-minor/ Water Course | 0.04 – 0.20 | 40 - 250 (Chak) |                                           |

**On-farm System Infrastructure: O & M by PP (Irrigator Group)**

( Field system only to be developed if desired by PP for warabundi)

| 5  | CAD / Field Channels | Field Channels | 0.030-0.040 | 30 – 40 (Chak / Sub-Chak) | PP Irrigator Group                     |
| 6  | Lateral Channel      | Lateral Channel | 0.010 – 0.030 | 2 to 8 (Sub-Chak) | Farmers                                 |

75. In the sub-project as per the above classification it has 1nos of main canal, 4 nos of distributaries, 40 no.s of minors and 115 no.s of sub-minors.

### 3. Land use and Right of Way (ROW) of the canal system

76. HLC Range -1 canal mainly passes through the agricultural lands, at places it crosses small nallas, highways, roads, railway line and passes adjacent to the settlements in certain sections of the canals.

77. The available existing acquired land for the canal i.e. Right Of Way (ROW) for the main canal ranges from 70 to 120 m (i.e. 35 to 60 m on either side of the canal centre). For distributaries the available ROW is ranging from 36 to 40 m (covering both sides of the canal); for minors the available ROW is approx. 26 m (covering both the sides of the canal) and for sub-minors the available ROW is around 16m (both sides of the canal). No additional land acquisition is required. Resectioning of the main canal has been proposed under this sub-project, the L.S and D.S has been approved by the Chief Engineer Design, Research and Quality Control, Bhubaneswar on 17-05-2011 for main canal. The typical cross section of the main at RD 11.610 km proposed for resectioning is shown in Figure 2.

![Figure 2 Typical cross section of the main at RD 11.610 km](image-url)
4. HLC Range -1 Main Canal

78. The canal is unlined along its entire length. From the head regulator at Birupa the canal flows north-northeast. At about RD 42.0km the canal curves and flows north-northwest parallel to the Brahmani. From RD 42.0km the canal’s right embankment is also the Brahmani’s flood embankment.

79. From the original design statement the discharge capacity at the head was 18.63 m³/s. The current design statement indicates a required discharge at the head regulator of 17.33m³/s and a design discharge of 17.46m³/s.

80. The adopted bed width meeting navigation requirements was 21.95m through out except in three laterite stone reaches, where the width was reduced to 10.67m and single boat passage.

81. The 53.094km main canal is essentially a contour canal with little slope along most of its length.

82. An earthen service road allows vehicle inspections of the main canal.

83. Due to the sluggish flow velocities in the canal and low sediment transport weed and water hyacinth growth / spread is a major problem.

5. Main Canal Structures

84. Existing main canal structures are tabulated and described below Table 4 .

Table 4  Main Canal Structures

<table>
<thead>
<tr>
<th>No</th>
<th>Type of structure</th>
<th>No. of structures as per inventory</th>
<th>No. of structures to be repaired</th>
<th>No of new structures to be constructed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cross Regulators</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Escapes</td>
<td>4</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>Aqueducts</td>
<td>11</td>
<td>11</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>Super-passages</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Head regulators</td>
<td>27</td>
<td>27</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>Village Road Bridges</td>
<td>15</td>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>Direct Outlets</td>
<td>89</td>
<td>39</td>
<td>50</td>
</tr>
</tbody>
</table>

a) Main Canal Weir cum Cross Regulators

85. The head regulator at Birupa barrage comprises of 3 vertical lift gates (10.0m by 4.10m) with hoisting arrangements. The design pond level is 21.20m and the FSL of canal is 20.67m giving a driving head of 0.53m. The pond level is often maintained at 21.30m increasing the driving head. Flow under the gates is always submerged. It is in good conditions requiring no repair.

86. There is only one cross regulator cum weir cum fall at 41.072km, at the old Immam nagar lock which requires repair.

87. There is also a dysfunctional lock at the tail at RD 53.09km at Jenapur where boats / ships used to enter the canal from the Brahmani. Since dysfunctional lock no repairs proposed.
b) Head Regulators
88. There are 27 head regulators along the main canal for the four distributaries, 11 minors and 11 sub-minors. Most are gated structures but with operating systems removed / welded in place to prevent tampering. Gate openings are infrequently adjusted. All the structures require repairs.

c) Escape
89. There are four numbers of escapes in the main canal at RD 1.200; 15.969; 334.210 and 43.320 kms. Escapes, particularly the Kadei escape at RD 15.969km, allow drainage inflows at the inlets to leave the canal ensuring against over topping / canal breaching. They have damaged over a period requiring repairs like wing wall plastering, wearing coat, parapet wall construction.

d) Cross Drainage Structures
i) Aqueduct
90. There are 11 aqueducts along the main canal allowing drainage flows to pass under the canal at RD 1.26; 4.33; 10.49; 13.53; 22.41; 26.59;30.00;34.58;38.12;42.27 and 48.22km which are damaged and leakages are present requires treatment and repair. The HLCR-1 main canal following the contour impedes natural drainage. Following rainfall water accumulates at RD 1.26km and RD 4.33km due to inadequate cross drainage.

ii) Cross drainage siphons
91. There are three cross drainage siphons at RD 2.0km, 4.6km and 17.9km.

iii) Drainage Inlets and Super passages
92. Where levels do not permit drainage flows to pass under the main canal, drainage inlets are provided allowing runoff from the west to enter the canal. The main inlets are at 6.7km (Alarpur); 15.02km; 15.778km; 15.98km and 20.562km. So to overcome the drainage problem four new super passages have been considered in the design at RD 6.70; 15.778; 20.56; and 28.70 as a replacement of inlets.

a) Village Road Bridges
93. There are 15 village road bridges across the main canal which requires minor repairs. In addition to accommodate the villagers demand 5 additional new VRBs have been proposed at RD 5.92; 29.00; 33.10; 39.35 and 50.00 km.

b) Direct Field Outlets
94. There are eighty nine direct field outlets along the main canal, out of thirty nine are proposed minor repairs and fifty are replacement and reconstruction of the existing outlets.

6. Distributaries, Minors and Sub-minors
95. The classification of canal according to discharge is tabulated in Table 3 above. PPs will take over O&M responsibility for minor canals, and Distributary level PPs will be set up for the distributaries.

96. Observing this classification there are four distributaries (Table 5), 11 minors and 11 sub-minors offtaking from the main canal, plus 90 direct offtakes to watercourses / fields.
Table 5 HLC-1 Distributaries

<table>
<thead>
<tr>
<th>Distributary Name</th>
<th>R.D (km)</th>
<th>Design CCA (ha)</th>
<th>Design discharge (m3/s)</th>
<th>FSD at Head of canal (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disty no -1</td>
<td>0.490</td>
<td>2,462</td>
<td>2.58</td>
<td>0.98</td>
</tr>
<tr>
<td>Disty No -6</td>
<td>19.700</td>
<td>1,359</td>
<td>1.43</td>
<td>0.83</td>
</tr>
<tr>
<td>Disty No -7 1/4</td>
<td>22.714</td>
<td>1,145</td>
<td>1.20</td>
<td>0.70</td>
</tr>
<tr>
<td>Disty No - 14</td>
<td>39.460</td>
<td>1,615</td>
<td>1.69</td>
<td>1.06</td>
</tr>
</tbody>
</table>

97. Distributary 1 follows the Birupa river for much of its length, and supplies an elongated command between the Birupa river and the Chotta Gengui nullah. It is the longest of the four distributaries as well has having the largest command area.

98. Distributary 14 is the second largest of the four distributaries, offtakes near the tail of the scheme and irrigates an elongated command between the Brahmani (Kelua) river and the Sagria nullah.

7. Distribution System Structures

99. Distribution system structures are mostly masonry constructions in need of repair or replacement or new construction (Table 6). Data are tabulated below. The schematic line diagram showing the canal system is enclosed as Annexure -2.

<table>
<thead>
<tr>
<th>Type of Structure</th>
<th>As per inventory</th>
<th>To be Repaired</th>
<th>Reconstruction / New construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR</td>
<td>56</td>
<td>52</td>
<td>14</td>
</tr>
<tr>
<td>VRB</td>
<td>103</td>
<td>103</td>
<td>27</td>
</tr>
<tr>
<td>Fall</td>
<td>29</td>
<td>29</td>
<td>0</td>
</tr>
<tr>
<td>Aquaduct</td>
<td>11</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>CS</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>DS</td>
<td>83</td>
<td>31</td>
<td>52</td>
</tr>
<tr>
<td>Escape</td>
<td>4</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>CR</td>
<td>84</td>
<td>23</td>
<td>61</td>
</tr>
<tr>
<td>Outlet</td>
<td>1047</td>
<td>478</td>
<td>569</td>
</tr>
</tbody>
</table>

a) Flow Measurement

100. There are no flow measurement structures along the main canal. Flows are estimated at the head regulator at Birupa based on gate openings. However with submerged flows measurements are not accurate. Also section office staff measure flows at a few locations, sometimes by surface velocity measurements. Data are recorded in ledgers on site but not routinely processed. So to have a proper data 44 measuring devices are proposed covering 21 distributaries and one minor. The numbers are varying from between the distribution system.

8. Earth work and Turfing

101. Earth work in the main canal, distributaries, minors and sub-minors would be carried out for resection of the canals. Most of the canal sections have eroded over
period resulting in under section due to rain cuts and failure of slopes in many places, and breaches occur at peak supply condition hence it is necessary to strengthen the canal banks to its design section. This involves filling of the earth material, the approx. quantities required in the main canal 1.38 lakh cum and for distributaries, minors and sub-minors it requires approx 5.30 lakh cum.

102. The canal system uptake from the barrage in the deltaic region and the river carries a lot of silt in the rainy season and erosion of the canals banks is taking place both depositing in the canal bed over the years resulting in increased bed level and reducing the flow. So in order to bring back the canal to its design bed level requires desilting and cutting of canal bed. The approximate quantity of cutting would be around 5.68 lakh cum in the main canal & for distributary, minor and sub-, minor’s approx. 2.95 lakhs cum. The 40 % of cutting quantity shall be reused in the filling material in the main canal and distributary system.

103. Provision for compaction of the main canals has been built under the project by Powered Road Roller (PRR) and the ordinary compaction (HRR) to be done in distributaries, minor and sub-minors.

104. In the sections of the canal where earth work has been completed a provision for turfing has been made.

9. Lining and Guard walls

105. In the vulnerable reaches of the main canal, distributaries and upstream and downstream of structure locations a provision for lining and guard walls is built within the project.

10. Bathing Ghats

106. Under the sub-project 25 existing bathing ghats which are damaged are going to be renovated or repaired as part of the project activities.

12. Service roads

107. The canal service roads which are primarily meant for movement of inspection vehicles are now only the means for transporting agricultural products and materials like seeds, fertilizer, pesticides and agricultural implements. So a provision for improvement of service road is built within the sub-project, the approx length of 20.520 km in the canal system will be improved under the subproject by black topping. To improve the connectivity in the area by improving the existing roads from right service bank to Sub-division section and colony road at Byree, Chandikhol, Jenapur and Kaima to a length of 1.850 km.

13. Drilling of bore wells

108. A provision for drilling 50 number of tube wells along the entire of length of main canal and its distribution system was kept to provide water during canal closure period.

14. Construction Materials

109. The below are the list of provisional construction materials that the Contractor may need to procure for the sub-project. The preliminary estimate provides a
provision to approximate carriage and conveyance of materials i.e. lead distance involved are given below and the quarry map showing the locations are shown in Annexure -4.

- Cement shall be procured from an approx. distance of 35 km i.e. Jagatpur.
- Steel shall be procured from an approx. distance of 35 km i.e. Jagatpur.
- Wood (shuttering and centering) shall be procured from an approx. distance of 35km i.e. Jagatpur.
- Granite products would be procured from the quarry Baghua the lead provided is 25 kms. In addition the tentative list of approved crushers (State Pollution Control Board) available within the lead distance are as:
  - Tapti Tie-up Pvt. Ltd., At: Barada & Dankari, PO – Mahisara, Dist: Jajpur
  - RSS Infrastructure Projects Ltd., At Dankari., P.O. Mahisara, Dist: Jajpur
  - Chitra Builders (P) Ltd., Plot . No- D-7, At: Ranasinghabati Tahasil-Dharmasala, Dist: Jajpur
  - Anand Exports (Crusher unit), Nimpalli, Golagaon, Jajpur
  - Rout Stone Crushers, At. Godisahi, Cuttack
- Morum / Gravel shall be procured from Neulpur– 19 km away.
- Sand shall be procured from a distance of 20 km from river Baitarani ghat
- Bricks shall be procured from a distance of 35 km from Jagatpur
- Hume pipe shall be procured from a distance of 5 km from Chandikhol
- Laterite stone shall be procured from a distance of 25 km from Chhatia
- Bitumen shall be procured from a distance of 40 km from OIIC.

- Earth may be procured by the contractor from private lands; the estimate has a provision for hiring earth from private lands. The contractor before commencement of works shall identify the borrow areas and take approval from the SIO. The EMP for the subproject stipulates the criteria of selection for borrow areas to avoid any damage to the environment. Contractor would try to procure earth within lead of 5 km length of the canal system in small quantities.

15. Disposal of Debris & Spoil

110. The material generated from dismantling old structures would be reused to the possible extent. Any materials like wood or iron would be taken in to the surplus stock of Water Resources Department and auctioned by the competent authority.

111. The generated cutting material suitable for the filling would be utilized to the possible extent. The remaining material generated will be tested for suitability and necessary material testing shall be carried out and it shall be utilized in the left spoil banks of the existing canal and in the low lying sections of the canal bank with in the available ROW after toe line. In some sections of the canal RD 14.545 and 28.7 km have low lying government land available adjacent to main canal which can be utilized for disposal. However, if any additional material is generated it would be disposed by identifying a suitable places like old borrow areas, quarry sites and low lying govt. land by taking appropriate permission from the SIO and competent authority. The silt shall be tested for heavy metals and pesticide residues also before disposal and some quantities can be distributed to the adjacent farmers by involving PP..

16. Access roads

112. The sub-project is well connected with the road net work, The NH-5 runs almost in parallel to the canal. The NH- 42 crosses the canal at RD 4.000 km of main canal
and express highway (Paradeep to Duburi) at RD 33.100km, in addition other district roads like Tangi to Haripur, Chatia to kalakaka and Jarka to Imamnagar. In addition the canal embankment serves as a service road for the villagers of the command area. These roads can be utilized for transporting the material to the project site. However, the access service roads shall be maintained if necessary by the contractor while transporting the material.

17. Plantation

113. To increase the aesthetic value of the area and also to compensate any tree loss that may arise due to unavoidable tree cutting, the subproject is built with a provision for 3750 trees plantation in the area i.e. along the canal system.

a) Existing Drainage System in the project area

114. The scheme is bounded by the Birupa and Bada Genguti rivers to the east and the Brahmani and Kelua rivers to the north. Within the command area drainage is mostly by four major natural drainage nullah systems: (i) the Chotta Genguti system in the southern and central parts of the command area comprising the Chotta Genguit nullah and feeder nullahs including the Hadua Jori, Baisi Jori, Padua Jori, Sorisa Jori and Rasul Jori drainage cuts; and (ii) the Sagria Nullah system in the northern part of the command area; and (iii & iv) the Kumaria and Matgunjar in the north-west of the command area. Of these the Chotta Genguti system is the largest and most important followed by the Sagria system.

115. All four drainage systems drain northwest to the Keular and Brahmani rivers. To some extent they have been improved, with cross drainage structures, drainage cuts / prism excavation. Sluice gated outfall structures are not provided but could be useful to prevent backup of flows when the Brahmani is in flood.

116. Canal, road and rail embankment cross drainage structures are insufficient at some locations impeding drainage cross flows and causing localized congestions.

117. Low-lying land comprises about 42% (5,791ha) of the command area, and parts are susceptible to drainage congestion following heavy rainfall, particularly heavy rainfall towards the end of Kharif when water tables are high. Typically about 3,000 ha is waterlogged each year.

b) Flood Embankments

118. There are flood embankments along the rivers and major nullahs maintained by the concerned Divisions and Sub-divisions. These comprise stone-protected earthen embankments.

119. Along the tail portion of the main canal, downstream of about RD 43km, the canal runs close to the Brahmani and at places the right canal embankment and river protection embankment merge. Similarly distributary No 1 runs along the Birupa river in its upper reaches, and along the Genguti in its tail reaches.

18. Implementation Arrangement

120. Procurement of civil works for the sub-project related to main canal, distributaries and minors shall be divided into different contract packages and tendered. Water Resources Department through PMU in consultation through the concerned C.E’s/
S.E/E.Es as per the provisions of OPWD code and in line with ADBs procurement policy shall call for tenders and through national competitive bidding, different contractors shall be selected and they will be executing the civil works under the supervision of respective Subproject Implementing Officers (SIOs).

121. For sub-minors execution of civil work shall be carried out by different Water Users Associations (PPs) of the respective subproject through an agreement between SIO / Executive Engineer of the respective sub-project.

19. On farm Development Works (OFD)

122. The on farm development works include watercourses, field channels and field drains. In the traditional system of irrigation the responsibility of distribution system ends at outlet. So distribution of water beyond the outlets remains the responsibility of the farmers. OFD works under Jajpur sub-project command area had been contemplated to be taken up separately insteps by Command Area Development (CAD) wing of Water Resources Department separately in consultation with the farmers of the concerned WUAs. The CAD water management activities will be funded by the OSG through the centrally sponsored program (CSP) for CAD works without availing OIIAWMIP funds.
IV. DESCRIPTION OF THE ENVIRONMENT

123. The baseline environmental status of the project area is described in this section.

A) Physical Resources

i. Climate

a) Climatic Zone

124. The HLC-1 command area is within two agro-climatic zones, the ‘North Eastern Coastal Plain’ (Jajpur district) and ‘East and South Eastern Coastal Plain’ (Cuttack district). The ‘North Eastern Coastal Plain’ agro-climatic zone is characterised by a moist sub-humid climate, with mean annual rainfall of 1,568 mm, mean summer maximum of 36°C and mean winter minimum of 14.8°C. The ‘East and South Eastern Coastal Plain’ agro-climatic zone is characterised by hot and humid climate, with mean annual rainfall of 1,577 mm, mean summer maximum of 39°C and mean winter minimum of 11.5°C.

125. The Agricultural Technology Management Agency (ATMA) of respective districts supported by the Institute of Management of Agricultural Extension (IMAGE), Bhubaneswar and in consultation with scientists of OUAT, Bhubaneswar is identifying the prevailing Agro-Eco-Situations (AES) in districts based on altitude, soil type, rainfall, irrigation, topography and existing farming practices so as to develop Strategic Research and Extension Plan for the districts.

b) Rainfall

126. Rainfall from the southwest monsoon occurs from mid-June to October. Rainfall data for the sub-project covered blocks in Cuttack & Jajpur for the last 10 years from 2004 to 2014 (Table 7) show an average annual rainfall ranging from 1505mm to 1869mm. Approx the rainfall is around 1,483mm in Kharif (June to November) and just 76mm in Rabi (December to May) varies from block to block.

Table 7 Monthly Rainfall, sub project covered Block (in mm)

<table>
<thead>
<tr>
<th>Year</th>
<th>Mahanga</th>
<th>Salepur</th>
<th>Tangi</th>
<th>Bada chana</th>
<th>Dharmasala</th>
</tr>
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<tbody>
<tr>
<td>2004</td>
<td>1928</td>
<td>1217</td>
<td>1469</td>
<td>1355</td>
<td>1800</td>
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<tr>
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<td>1729</td>
<td>1422</td>
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</tr>
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<td>1900</td>
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</tr>
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<td>1592</td>
</tr>
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</tr>
<tr>
<td>2011</td>
<td>1448</td>
<td>1612</td>
<td>1493</td>
<td>879</td>
<td>1479</td>
</tr>
<tr>
<td>2012</td>
<td>1037</td>
<td>1489</td>
<td>853</td>
<td>1502</td>
<td>1200</td>
</tr>
<tr>
<td>2013</td>
<td>1397</td>
<td>1288</td>
<td>3149</td>
<td>1816</td>
<td>1751</td>
</tr>
<tr>
<td>Average</td>
<td>1869.4</td>
<td>1525.5</td>
<td>1830.4</td>
<td>1505.3</td>
<td>1637.7</td>
</tr>
</tbody>
</table>

IEE HLC Range 1 25373
127. The average number of rainfall days is 75 per annum, varying from 91 days in 1998 to just 61 days in 2006. During the monsoon months, the average number of rainfall days is 63, varying from 75 to just 48 days (1993-2006 data). Average number of rainfall days during the pre-monsoon months from February to May is 9, varying from 13 to just 4 days.

128. From 1965 – 2012 Odisha experienced nearly 17 droughts. This is in part due to low rainfall in these years, but also due to the erratic nature of rainfall within a year. For example in the 2000 drought year monsoon rainfall was 755mm (58% of the average of 1304 mm) but monthly deviations were June 260 mm (126%), July 172mm (55%), August 180 mm (48%), September 64 mm (28%), October 79 mm (43%). The rainfall pattern caused crop loss and depressed yields. Out of 52 years only 13 years have been normal years, this almost puts the state with a 75% probability of being visited by natural calamity of any kind as per status of agriculture in Odisha, Directorate of Agriculture, Odisha.

129. Rainfall in the command area can be intense, leading to extensive flooding in low-lying areas mostly adjacent to the nullahs, particularly if water tables are high and paddy fields already ponded at the onset of the rainstorm.

c) Temperature and Humidity

130. Temperature varies with minimums ranging from 12°C to 16°C and maximums from 34°C to 44°C. Relative humidity varies from 67% in summer to 90% during the monsoon Table 8..

Table 8 Mean Monthly Temperatures and Relative Humidity, Cuttack District

<table>
<thead>
<tr>
<th>Month</th>
<th>Average Temperatures</th>
<th>Relative Humidity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Max °C</td>
<td>Min °C</td>
</tr>
<tr>
<td>January</td>
<td>34</td>
<td>16</td>
</tr>
<tr>
<td>February</td>
<td>38</td>
<td>19</td>
</tr>
<tr>
<td>March</td>
<td>41</td>
<td>23</td>
</tr>
<tr>
<td>April</td>
<td>43</td>
<td>26</td>
</tr>
<tr>
<td>May</td>
<td>44</td>
<td>27</td>
</tr>
<tr>
<td>June</td>
<td>43</td>
<td>26</td>
</tr>
<tr>
<td>July</td>
<td>38</td>
<td>26</td>
</tr>
<tr>
<td>August</td>
<td>39</td>
<td>37</td>
</tr>
<tr>
<td>September</td>
<td>41</td>
<td>26</td>
</tr>
<tr>
<td>October</td>
<td>37</td>
<td>24</td>
</tr>
<tr>
<td>November</td>
<td>36</td>
<td>20</td>
</tr>
<tr>
<td>December</td>
<td>34</td>
<td>17</td>
</tr>
</tbody>
</table>

Source: DoWR, and PPTA calculations

d) Evaporation

131. Class A pan evaporation data is available at Cuttack meteorological station and has been used to estimate crop water requirements. Rainfall and evaporation is shown on the figure 3 below. Evaporation is well above rainfall during Rabi, and the reverse in Kharif.
20. Physiographic, Soils, Geology and Land use

e) Physiography

132. The command area slope north-eastwards averages about 1 in 4,000, with an elevation of about 20m near the head to about 12m near the tail. There are small hillocks in the command area and several *nullahs* draining into the Bada Genguti, Kelua and then Brahmani rivers.

133. These *nullahs* have insufficient capacity to drain storm water. Also the main HLC-1 contour canal, and railway, national highway and road embankments hinder drainage flows. Drainage water accumulates in low-lying land, particularly towards the end of Kharif.

134. Table 9 shows the area of high, middle and low land in the area, a weighted average, based on the area by Block, for the HLC-1 subproject area. The command has about 21% of high land, 37% of medium land and 42% of low land. Generally lighter, sandy soils are found in the high and medium land, whilst low land consists of heavier, impermeable, clays, but with higher moisture retention.

<table>
<thead>
<tr>
<th>Block</th>
<th>Area ('000 ha)</th>
<th>High (%)</th>
<th>Medium (%)</th>
<th>Low (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tangi-Choudwar</td>
<td>19</td>
<td>15.8</td>
<td>31.6</td>
<td>52.6</td>
</tr>
<tr>
<td>Mahanga</td>
<td>13</td>
<td>7.7</td>
<td>53.8</td>
<td>38.5</td>
</tr>
<tr>
<td>Badachana</td>
<td>17</td>
<td>17.6</td>
<td>47.1</td>
<td>35.3</td>
</tr>
<tr>
<td>Dharmasala</td>
<td>19</td>
<td>36.8</td>
<td>26.3</td>
<td>36.8</td>
</tr>
<tr>
<td>HLC-1 Command</td>
<td>14</td>
<td>20.7</td>
<td>37.0</td>
<td>42.2</td>
</tr>
</tbody>
</table>

Source: “A Profile on Agriculture in Odisha-2006”, Published by the DA&FP, Odisha

135. Land elevation controls the feasible cropping patterns. High and medium land permits short and medium duration high yielding varieties of paddy, vegetable crops and maize in the Kharif season, and light and medium duty commercial crops in Rabi. Land preparation and planting of paddy rice requires substantial pre-irrigation.

136. Low-lying lands account for 42% of the command area, allow early planting of long duration Kharif paddy rice, both transplanted and broadcast, and can to some extent rely on rainfall for land preparation/planting. During Rabi farmers with low lands near *nullahs* and natural water bodies grow summer rice and vegetables and can pump water from the *nullahs*. Taking advantage of high clay content many farmers
retain as much water as possible from the last Kharif irrigation and sow black gram about one week before harvest of rice paddy. Others wait until after harvest of the Kharif rice paddy until the moisture content drops to allow tillage, and sow green gram after ploughing. Both black gram and green gram crops mature with available soil moisture. Rain coinciding with flowering increases yields.

137. Limited canal water limits high value cropping in high and medium lands, 58% of the command area. Farmers can grow rice paddy of 100 to 110 days duration in the developed high lands and up to 135 days duration in the medium lands; the high lands become free in October and the medium lands in October-November for commercial Rabi crops. High and medium land that have coarse soils cannot grow crops on residual moisture, and go fallow after rice paddy unless irrigation is available.

f) Soils

138. The subproject is in the upper Mahanadi deltaic plain and sediments were deposited under fluvial influence. The soils in command area have been classified as clay loam, lateritic, sandy loam, alluvial loam, coastal alluvial loam and mixed red and black soils.

139. The soils in the region are permeable to moderately permeable. Availability of organic nitrogen is medium, phosphorous (in some cases it was low) and potassium is medium, see Error! Reference source not found.10. Most soils are acidic and need treatment to obtain maximum productivity from groundnut, some vegetables, potato and sugarcane. The soils are suitable for most of the commercial and economically important crops.

Table 10 Soil Reaction and Nutrient Availability in Subproject Area

<table>
<thead>
<tr>
<th>Soil reaction (% of area)</th>
<th>Nutrient availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acid 97</td>
<td>Neutral 3</td>
</tr>
</tbody>
</table>

Source: Mitra, G.N et al: Macro and Micro Nutrient Soils of Odisha. Published by IFFCO, December 2002

140. The District Agriculture Office is encouraging farmers to test their soils to determine fertilizer requirements for different crops. Farmers are interested in soil testing and 940 tests were undertaken in the subproject Blocks in 2006-7 and soil health cards issued to the farmers. The OSG has made soil testing facilities available in every Block from 2006, in addition to the district and state soil testing laboratories that are equipped for larger numbers of samples and more complex tests. Presently one soil testing kit has been supplied to each Junior Agriculture Officer.

141.

g) Geology

142. The oldest rocks found in the study area are Khondalites, Charnockites and Granite Gneiss. Khondalites is mainly found in Jajpur while the Granite Gneiss are found in the north of Mahanadi basin from Narsinghpur to Tigira block of Cuttack District.

143.

h) Land Use

144. Land use pattern of Cuttack and Jajpur district is shown in Table 11 and Figures 4 and 5.
Table 11: Land Use Pattern in Cuttack and Jajpur District

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Land Use</th>
<th>Cuttack District</th>
<th>Jajpur District</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Area in '000 Ha.</td>
<td>Area in '000 Ha.</td>
</tr>
<tr>
<td>1.</td>
<td>Net Sown Area</td>
<td>140</td>
<td>136</td>
</tr>
<tr>
<td></td>
<td></td>
<td>35.62</td>
<td>47.05</td>
</tr>
<tr>
<td>2.</td>
<td>Barren and unculturable land</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.54</td>
<td>1.73</td>
</tr>
<tr>
<td>3.</td>
<td>Land put to Non Agricultural Land</td>
<td>83</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td></td>
<td>21.12</td>
<td>17.65</td>
</tr>
<tr>
<td>4.</td>
<td>Forest</td>
<td>79</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td></td>
<td>20.10</td>
<td>24.91</td>
</tr>
<tr>
<td>5.</td>
<td>Permanent Pastures</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.8</td>
<td>1.38</td>
</tr>
<tr>
<td>6.</td>
<td>Culturable Waste</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.54</td>
<td>1.38</td>
</tr>
<tr>
<td>7.</td>
<td>Other Fallow</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.25</td>
<td>1.73</td>
</tr>
<tr>
<td>8.</td>
<td>Current Fallow</td>
<td>48</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12.2</td>
<td>3.11</td>
</tr>
<tr>
<td>9.</td>
<td>Miscellaneous Tree &amp; Gooves</td>
<td>11</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.8</td>
<td>1.38</td>
</tr>
<tr>
<td></td>
<td><strong>Total Geographical Area</strong></td>
<td>393</td>
<td>289</td>
</tr>
<tr>
<td></td>
<td><strong>Area, %</strong></td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

(Source: Odisha Agricultural statistics 2011 -2012, Directorate of agriculture & Food Production, Odisha)

Figure 4: Land Use Pattern in Cuttack District
145. Land use pattern of 5 blocks through which HLC R-1 canal passing is given in Table 12. It is noted from the table that agriculture is the major land use within the blocks.

### Table 12 Land Use Pattern in different Sub Project Covered by blocks of Cuttack and Jajpur District

<table>
<thead>
<tr>
<th>Sl No</th>
<th>Category</th>
<th>Cuttack District</th>
<th>Jajpur District</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mahanga</td>
<td>Tangi</td>
</tr>
<tr>
<td>1</td>
<td>Forest Area</td>
<td>---</td>
<td>1538</td>
</tr>
<tr>
<td>2</td>
<td>Misc. Tree crops &amp; groves not included in net area sown</td>
<td>435</td>
<td>450</td>
</tr>
<tr>
<td>3</td>
<td>Permanent pasture and other grazing lands</td>
<td>574</td>
<td>1590</td>
</tr>
<tr>
<td>4</td>
<td>Culturable waste</td>
<td>446</td>
<td>3927</td>
</tr>
<tr>
<td>5</td>
<td>Land put to non-agricultural uses</td>
<td>4270</td>
<td>4622</td>
</tr>
<tr>
<td>6</td>
<td>Barren and non-cultivable land</td>
<td>537</td>
<td>1794</td>
</tr>
<tr>
<td>7</td>
<td>Current fallows</td>
<td>677</td>
<td>2784</td>
</tr>
<tr>
<td>8</td>
<td>Old fallows</td>
<td>592</td>
<td>2098</td>
</tr>
<tr>
<td>9</td>
<td>Net Area sown</td>
<td>13047</td>
<td>13475</td>
</tr>
</tbody>
</table>


### i) Ambient Air Quality

146. The Central Pollution Control Board and State Pollution Control Board maintain database on the ambient air quality of the state. However, such database is limited to major cities/urban centres and some selected industrial areas. No secondary data is available for the project districts particularly representing the rural areas.

147. Along the proposed canal construction proposals, neither there is any industrial activity nor significant vehicular traffic contributing to air pollution. Therefore the ambient air quality is expected to be within the National Ambient Air Quality Standards (NAAQS) for all parameters (oxides of nitrogen, oxides of sulphur, carbon monoxide, hydrocarbon, benzene, carbon monoxide) excepting the dust or particulate matter. The occasional vehicular movement on unpaved roads lead to formation of dust clouds over short periods. The airborne dust increases the concentration of both the Suspended Particulate Matter (SPM) and Respirable Particulate Matter (RPM< 10 micron) beyond the limits of the NAAQS.

### j) Earthquake Zone / Sensitivity

148. The Bureau of Indian Standards has categorised the entire India into 5 seismic zones depending upon the degree of proneness to earthquakes. The Zone I signify lesser degree while Zone V is of highest order. The northern and southern most parts of Odisha are classified as Zone I and remaining parts of the state are classified under Zone II & Zone III. The subproject majority of the region falls under earthquake risk
zone –III (Moderate Damage Risk Zone) and tail portion under earthquake risk zone – II (Low damage risk zone) Figure 6.

k) Regional Drainage

Area to the East of High Level Canal Range – I Doab- IV- Jajpur and Cuttack dist.

150. A short description of the drainage system in this doab is given below. This doab lies between the HLC Range – I and Birupa river. The GCA and CCA of this doab 6 is 23,000 ha and 14,000 ha respectively. This doab gets irrigation from the HLC Range – I. There are 4 nos. of drainage system in this doab.

151. Chhota genguti system- This system is the largest drainage system of the doab with a total drainage area of 45000 ha. The main drain in Chhohagenguti drain is 72 km long and it outfalls into the Badagenguti river. There are 20 nos. secondary drain in this system with a total length of 104 kms. There are no field drains existing in the doab. For better drainage clearance it is proposed to construct a new link drains. The main outfall drain and secondary drains are proposed to be renovated to their required desired section and grade wherever necessary. It is proposed to provide control structures at the end of the outfall drain at the end of secondary drains to facilitate drainage clearance from the doab.

152. Sagadia system- This system consists of the outfall drain in Sagadia drain with its secondary drain (5 nos.) and drain an area about 9730 ha. in the doab before out falling to river Brahmani. The length of the outfall drain is 21 km and the total length of secondary drains is 13 kms. There are no field drains existing in the system. It is proposed to construct the link drains freshly and to bring the existing outfall drain and the secondary drains to their designed carrying capacities.

153. To have a control the drainage clearance for improvement in the drainage conditions, it is proposed to have control structures at the outfall drain itself and its secondary drains at their outfalling point.

154. Matagunjar system- This system consists of the main drain Mataginjar and its 3 nos. secondary drains. The total drainage area of the system is 11,580 ha. The drain outfalls into river Brahmani after flowing for a length of 21 km. Total length of secondary drains is 22 kms. As there are no of field drains existing it is proposed to

---

6 Island or land inbetween two rivers
construct them a new. It is also proposed to bring the outfall drain and secondary drains to their drainage designed sections for better clearance.

155. Control structures are proposed to be provided at the end of the main drain and the secondary drains so as to prevent entry in river flood into the doab and to improve the hydraulic capacity of the drain.

156. Kumaria system – This is under large system with total drainage area of 17900 ha. The main drain is 33 km long and outfalls into Brahmani river. It has 5 nos. of secondary drains whose total length is 30 km. There are no field drains existing in this system. So it is proposed to construct them afresh. The main drain and its secondary drains are proposed to be renovated so as to bring them to their designed sections for smooth and easy drainage clearance. Control structures are proposed to be provided on the main drain and the secondary drains at their out falling point in order to regulate the drainage congestion and for improved drainage conditions within the doab.

L) Flood condition of Mahanadi , Brahmani and Baitarani Basin

157. The Mahanadi delta experiences frequent major floods, particularly when flood levels are exacerbated by storm surges increasing sea levels. The construction of Hirakud reservoir in 1957 moderates peak flows in the delta and also allows flows to be accurately gauged and flood warnings issued.

158. More or less in alternate years flood condition is recorded by concerned department. Table 13 below indicates flood status of the project area of Odisha.

Table 13 List of Past flood and area damaged by Flood in Mahanadi basin

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Year and month</th>
<th>Rivers</th>
<th>Affected Dist./ Area under project area</th>
<th>Loss/Damage Reported</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>1960 (August)</td>
<td>Mahanadi, Brahmani and Baitarani</td>
<td>Cuttack, Not available</td>
<td>Average 6 lakh acre of cropped area damaged</td>
</tr>
<tr>
<td>2</td>
<td>1961 (Sept)</td>
<td>Mahanadi, Brahmani and Baitarani</td>
<td>Cuttack, Not available</td>
<td>Average 0.48 lakh acre of cropped area damaged</td>
</tr>
<tr>
<td>3</td>
<td>1964 (July- Aug)</td>
<td>Mahanadi, Brahmani and Baitarani</td>
<td>Cuttack, Dhenkanal, Sambalpur</td>
<td>Average 1.35 lakh acre of cropped area damaged</td>
</tr>
<tr>
<td>4</td>
<td>1971 (July- Oct.)</td>
<td>Mahanadi, Brahmani and Baitarani</td>
<td>Cuttack, Sundergarh</td>
<td>8 75</td>
</tr>
<tr>
<td>5</td>
<td>1974 (August)</td>
<td>Mahanadi, Brahmani and Baitarani</td>
<td>Cuttack, Dhenkanal</td>
<td>Not available</td>
</tr>
<tr>
<td>6</td>
<td>1980 (Sept.)</td>
<td>Mahanadi, Brahmani and Baitarani</td>
<td>Cuttack, Dhenkanal</td>
<td>16 3300</td>
</tr>
<tr>
<td>7</td>
<td>1982 (Aug-Sept.)</td>
<td>Mahanadi</td>
<td>Cuttack, Dhenkanal</td>
<td>32 6500</td>
</tr>
<tr>
<td>8</td>
<td>1984</td>
<td>Mahanadi, Cuttack,</td>
<td>7 0</td>
<td>Average 1 lakh</td>
</tr>
<tr>
<td>Sr. No.</td>
<td>Year and month</td>
<td>Rivers</td>
<td>Affected Dist./ Area under project area</td>
<td>Loss/Damage Reported</td>
</tr>
<tr>
<td>---------</td>
<td>----------------</td>
<td>--------</td>
<td>----------------------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td></td>
<td>(June – Sept.)</td>
<td>Brahmani and Baitarani</td>
<td>Dhenkanal</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>1985 (Aug-Sept.)</td>
<td>Mahanadi, Brahmani and Baitarani</td>
<td>Cuttack</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Average 0.33 lakh ha. of cropped area damaged</td>
</tr>
<tr>
<td>10</td>
<td>1986</td>
<td>Mahanadi</td>
<td>Cuttack, Dhenkanal</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Average 0.24 lakh ha. of cropped area damaged</td>
</tr>
<tr>
<td>11</td>
<td>1991 (July-August)</td>
<td>Mahanadi, Brahmani and Baitarani</td>
<td>Cuttack, Dhenkanal</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Average 1.3 lakh ha. of cropped area damaged</td>
</tr>
<tr>
<td>12</td>
<td>1992 (June-August)</td>
<td>Mahanadi</td>
<td>Cuttack, Dhenkanal</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Average 0.8 lakh ha. of cropped area damaged</td>
</tr>
<tr>
<td>13</td>
<td>1994 (July-September)</td>
<td>Mahanadi, Brahmani</td>
<td>Cuttack, Jajpur, Jagatsinghpur, Kendrapara, Sundergarh</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Average 2.5 lakh ha. of cropped area damaged</td>
</tr>
<tr>
<td>14</td>
<td>1995 (May-November)</td>
<td>Mahanadi</td>
<td>Cuttack, Dhenkanal, Jagatsinghpur, Jajpur, Kendrapara, Sundergarh</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Average 3.5 lakh ha. of cropped area damaged</td>
</tr>
<tr>
<td>15</td>
<td>1997 (June &amp; August)</td>
<td>Mahanadi</td>
<td>Cuttack, Dhenkanal, Jagatsinghpur, Jajpur, Kendrapara, Sundergarh</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Average 1.8 lakh ha. of cropped area damaged</td>
</tr>
<tr>
<td>16</td>
<td>1999 (July-August)</td>
<td>Mahanadi, Brahmani, Baitarani</td>
<td>Cuttack, Jagatsinghpur, Kendrapara, Jajpur</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Average 0.8 lakh ha. of cropped area damaged</td>
</tr>
<tr>
<td>17</td>
<td>2001 (July-August)</td>
<td>Mahanadi, Brahmani</td>
<td>Cuttack, Dhenkanal, Jagatsinghpur, Kendrapara, Jajpur, Jagatsingpur, Kendrapara, Sundergarh</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Average 2 lakh ha. of cropped area damaged</td>
</tr>
<tr>
<td>18</td>
<td>2003 (July-October)</td>
<td>Mahanadi, Baitarani</td>
<td>Cuttack, Jajpur, Jagatsinghpur, Kendrapara</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Average 0.8 lakh ha. of cropped area damaged</td>
</tr>
<tr>
<td>19</td>
<td>2006 (July-August)</td>
<td>Mahanadi, Brahmani, Baitarani</td>
<td>Cuttack, Dhenkanal, Jagatsinghpur, Kendrapara, Jajpur, Jagatsingpur, Kendrapara</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Average 0.6 lakh ha. of cropped area damaged</td>
</tr>
<tr>
<td>20</td>
<td>2007 (July-Aug – Sept)</td>
<td>Subarnarekha, Angul, Balasore</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>2008 (Jun)</td>
<td>Subarnarekha, Angul, Balasore,</td>
<td></td>
<td>110</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>258155 houses</td>
</tr>
<tr>
<td>Sr. No.</td>
<td>Year and month</td>
<td>Rivers</td>
<td>Affected Dist./ Area under project area</td>
<td>Loss/Damage Reported</td>
</tr>
<tr>
<td>---------</td>
<td>----------------</td>
<td>--------</td>
<td>----------------------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Average Human</td>
</tr>
<tr>
<td>23</td>
<td>2010( Aug.)</td>
<td></td>
<td>Kalahandi, Nabarangpur, Koraput, Boudh, Rayagada, Malkangiri</td>
<td>14</td>
</tr>
<tr>
<td>24</td>
<td>2011( June, Aug, Sept)</td>
<td>Subarnarekha, Jalaka, Mahanadi, Brahman, Baitarani, Budhabalanga.</td>
<td>Angul, Balasore,Bargarh , Bhadrakh, Boudh, Cuttack, Deogarh, Dhenkanal, Jagatsinghpur, Jajpur, Jharsuguda, Kendrapara, keonjhar, Khurda, Mayurbhanj, Nayagarh, Nuapada, Puri, Sambalpur, Subarnapur, Sundargarh.</td>
<td>82</td>
</tr>
<tr>
<td>25</td>
<td>2012( Aug. &amp; Nov.)</td>
<td></td>
<td>Khorha, Khandhamal,Nayagarh,Kalahandi &amp; Ganjam.</td>
<td>3</td>
</tr>
<tr>
<td>26</td>
<td>2013( June, Aug, Sept)</td>
<td>Baitarani</td>
<td>Kalahandi</td>
<td>70</td>
</tr>
</tbody>
</table>
Table 14 Drainage Area of Mahanadi River by State

<table>
<thead>
<tr>
<th>State</th>
<th>Area of Drainage £km²£</th>
<th>% of Total Basin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Madhya Pradesh &amp; Chhatishgarh</td>
<td>75,136</td>
<td>53.2</td>
</tr>
<tr>
<td>Maharastra</td>
<td>238</td>
<td>0.2</td>
</tr>
<tr>
<td>Jharkand</td>
<td>132</td>
<td>0.1</td>
</tr>
<tr>
<td>Odisha</td>
<td>65,628</td>
<td>46.5</td>
</tr>
<tr>
<td>Total</td>
<td>141,134</td>
<td>100%</td>
</tr>
</tbody>
</table>

The Hirakud dam reservoir in Sambalpur district, north-west Odisha provides the only major storage of Mahanadi river flow. The dam was constructed in 1948-1957. The dam intercepts 83,400 km² of the Mahanadi catchment and has 4,823 MCM of storage. Water is released to irrigate over 260,000 ha in 4 districts and 251,000 ha in the Mahanadi delta\(^7\), and for power generation, local water supply and flood protection of 9,500 ha.

\(^7\) Data are sourced from the “3rd Spiral Study Report of Mahanadi Basin Plan (Volume-I)”, Department of Water Resources, Government of Orissa, 2001
161. The Mahanadi deposits silt as it loses energy within the delta. Evidence of siltation is visible in the low-lying island formations and the braiding river channels within the flood embankments. Sediment accretion in the Mahanadi impedes drainage northwards from the command area.

b) Mahanadi River Flows

162. Due to low elevation, flat slopes and storm surges about a third of the Mahanadi Basin area suffers flooding and drainage congestion. Storm surges\(^8\) in the 1999 super cyclone were estimated in excess of 6-7m. Flood levels and protection embankments along rivers and nullahs are closely monitored during the monsoon. To reduce risk of damage to command areas the DoWR will shortly implement the Flood Master Plan (Raising and Strengthening Embankments).

163. Hourly river flows are automatically recorded and transmitted\(^9\) in real time to the Central Water Commission (CWC) at Hirakud, Bhubaneswar and Delhi. No major tributaries join the river downstream of Naraj and those data are therefore adopted as the inflows to Mahanadi barrage.

164. Annual peak flows measured at Naraj are shown below. In recent years there have been several large flood events, in particular: 1994-95, 2001-02 and 2003-04 with 10-day flood volumes of 1,450,360ham (16,790m\(^3\)/s), 1,222,220ham (14,150m\(^3\)/s) and 1,011,460ham (11,710m\(^3\)/s), respectively. The annual average flood for this period was 510,020ham (5,900m\(^3\)/s). The design flood for the Mahanadi barrage is 15,300m\(^3\)/s.

Figure 7 Annual Flows at Naraj (000HaM), 1969-2006

165. Decadal (10-day) average flow volumes are shown below. Flows increase rapidly in July with the onset of monsoon. The slight downward trend in early August may indicate conservation at Hirakud dam. The decadal average flood peak is slightly greater than 600,000ham (6,940m\(^3\)/s). Floods recession occurs from September to November and base flows from January to June are about 24,000ham (280m\(^3\)/s).

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\(^8\) Information provided in “Orissa State Water Plan (Annexures)”, Orissa Water Planning Organization, Department of Water Resources, 2004

\(^9\) The information is conveyed to DoWR Bhubaneswar via CWC and DoWR at Burla
166. Base flows coincide with peak irrigation water requirements for Rabi (and early summer) cultivation and for Kharif pre-irrigation.

c. Water Users

167. Main river water use is for irrigation, industry and domestic water supply, with irrigation by far the largest user. In addition there is a minimal environment requirement.

168. The irrigation systems offtaking at the Mahanadi and adjacent Birupa barrages are: Birupa-Genguti, HLC-I, Kendrapara, Taladanda, Machhagan and MCII. Command areas are tabulated below.

Table 15 Irrigation Systems supplied from Mahanadi Barrage Complex

<table>
<thead>
<tr>
<th>Nr</th>
<th>Canal System</th>
<th>Offtaking From</th>
<th>CCA (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HLC-1 Birupa barrage, left bank</td>
<td></td>
<td>14,000</td>
</tr>
<tr>
<td>2</td>
<td>Kendrapada (including Pattamundai)</td>
<td>Mahanadi barrage, left bank (Pattamundai canal offtakes from Kendrapada at bifurcation at RD )</td>
<td>80,152</td>
</tr>
<tr>
<td>3</td>
<td>MCIIP</td>
<td>Kendrapada</td>
<td>15,342</td>
</tr>
<tr>
<td>4</td>
<td>Birupa Genguti</td>
<td>Kendrapada (Pattamundai)</td>
<td>3,400</td>
</tr>
<tr>
<td>5</td>
<td>Taladanda</td>
<td>Mahanadi barrage (right bank)</td>
<td>32,684</td>
</tr>
<tr>
<td>6</td>
<td>Machhagan</td>
<td>Talandanda canal at Biribati bifurcation, RD 11.75km</td>
<td>35,000</td>
</tr>
</tbody>
</table>

Total: 180,578

169. These six systems are supplied by three canals offtaking from the Mahandadi – Birupa pond: (i) Taladanda; (ii) Kendrapara; and (iii) HLC-1. Daily flow data to each of these systems has been processed to determine monthly and seasonal volumes supplied in from 2001 to 2006.
170. Kharif diversions over the combined command area of 180,578ha varied from 0.61m to 0.99m and averaged 0.81m, while Rabi diversions varied from just 0.04m to 0.22m and averaged 0.14m. Including for rainfall average supplies were 2.59m in Kharif and 0.32m in Rabi.

171. The large quantities of water supplied in Kharif greatly exceed paddy evaporation requirements (0.6m), and recharge groundwater as well as leaving the scheme command areas draining through nullahs and rivers to the sea. In Rabi evapotranspiration exceeds supply, residual moisture cropping dominates and water tables decline.

172. Current industrial utilization as reported by DoWR is 3m$^3$/s with a further 3 having been requested. Domestic water supply requirements for Cuttack with its urban population of 641,000 in 2005$^{10}$ and for a per capita supply of 150 l/d plus 30% for losses$^{11}$ Indicates a water requirement of 1.6m$^3$/s. Other downstream cities (Bhubaneswar) also draw water from rivers to some extent. In total a combined flow for urban and industrial users of 22.5m$^3$/s has been adopted for water balance (see below), about 3 times the current requirement.

173. Minimum environmental flows comprising a base flow of 50m$^3$/s plus 30% of river flow is adopted for water balance. This flow is for both the Mahanadi delta downstream of Mahanadi barrage as well as for the Kathjori river oftaking at Naraj$^{12}$. The Kathjori contributes fresh water to Chilika Lake through its two branches, Bhargavi and Daya.

d. River Water Balance

174. River water balance for the Mahanadi barrage complex has been carried out using data from December 2000 to May 2006 primarily to determine surplus Rabi water available for diversion from the Mahanadi (& Birupa) pond.

175. The surplus water is given by: (i) inflows measured upstream of Naraj at the railway crossing over the Mahanadi; less (ii) current canal diversions; environmental requirements and urban / industrial requirements. Monthly data are summarized by season below.

<table>
<thead>
<tr>
<th>Year &amp; Season</th>
<th>Seasonal Inflows at Naraj (Mm$^3$)</th>
<th>Delta (m)</th>
<th>Seasonal Canal Diversions (Mm$^3$)</th>
<th>Delta (m)</th>
<th>Seasonal Urban &amp; Industrial Flow (Mm$^3$)</th>
<th>(%</th>
<th>Seasonal Environmental Flow (Mm$^3$)</th>
<th>(%)</th>
<th>Seasonal Surplus (Mm$^3$)</th>
<th>Delta (m)</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001 Rabi</td>
<td>3,569</td>
<td>1.98</td>
<td>81</td>
<td>0.04</td>
<td>350</td>
<td>9.8%</td>
<td>1,848</td>
<td>51.8%</td>
<td>1,290</td>
<td>0.71</td>
<td>36.1%</td>
</tr>
<tr>
<td></td>
<td>115,376</td>
<td>63.89</td>
<td>1,324</td>
<td>0.73</td>
<td>350</td>
<td>0.3%</td>
<td>35,388</td>
<td>30.7%</td>
<td>78,314</td>
<td>43.37</td>
<td>67.9%</td>
</tr>
<tr>
<td>2002 Rabi</td>
<td>6,855</td>
<td>3.80</td>
<td>392</td>
<td>0.22</td>
<td>350</td>
<td>5.1%</td>
<td>2,834</td>
<td>41.3%</td>
<td>3,279</td>
<td>1.82</td>
<td>47.8%</td>
</tr>
<tr>
<td></td>
<td>31,755</td>
<td>17.59</td>
<td>1,729</td>
<td>0.96</td>
<td>350</td>
<td>1.1%</td>
<td>10,304</td>
<td>32.4%</td>
<td>19,372</td>
<td>10.73</td>
<td>61.0%</td>
</tr>
<tr>
<td>2003 Rabi</td>
<td>3,639</td>
<td>2.02</td>
<td>337</td>
<td>0.19</td>
<td>350</td>
<td>9.6%</td>
<td>1,869</td>
<td>51.4%</td>
<td>1,083</td>
<td>0.60</td>
<td>29.8%</td>
</tr>
<tr>
<td></td>
<td>93,318</td>
<td>51.68</td>
<td>1,109</td>
<td>0.61</td>
<td>350</td>
<td>1.2%</td>
<td>28,773</td>
<td>30.8%</td>
<td>63,086</td>
<td>34.94</td>
<td>67.6%</td>
</tr>
<tr>
<td>2004 Rabi</td>
<td>7,828</td>
<td>4.33</td>
<td>297</td>
<td>0.16</td>
<td>350</td>
<td>3.8%</td>
<td>3,126</td>
<td>39.9%</td>
<td>4,055</td>
<td>2.25</td>
<td>51.8%</td>
</tr>
<tr>
<td></td>
<td>48,090</td>
<td>26.63</td>
<td>1,785</td>
<td>0.99</td>
<td>350</td>
<td>3.7%</td>
<td>15,205</td>
<td>31.6%</td>
<td>30,750</td>
<td>17.03</td>
<td>63.9%</td>
</tr>
<tr>
<td>2005 Rabi</td>
<td>4,020</td>
<td>2.23</td>
<td>221</td>
<td>0.12</td>
<td>350</td>
<td>5.5%</td>
<td>1,983</td>
<td>49.3%</td>
<td>1,466</td>
<td>0.81</td>
<td>36.5%</td>
</tr>
</tbody>
</table>

$^{10}$ Population census data
$^{11}$ Orissa State Water Plan, 2004
$^{12}$ Component of OWRCP and commissioned in 2006
<table>
<thead>
<tr>
<th>Year &amp; Season</th>
<th>Seasonal Inflows at Naraj (Mm³)</th>
<th>Seasonal Canal Diversions (Mm³)</th>
<th>Seasonal Urban &amp; Industrial Environment Flow (Mm³)</th>
<th>Seasonal Surplus (Mm³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kharif</td>
<td>66,764</td>
<td>36.97</td>
<td>1,392</td>
<td>350 0.5%</td>
</tr>
<tr>
<td>2006 Rabi</td>
<td>5,654</td>
<td>3.13</td>
<td>240</td>
<td>350 6.2%</td>
</tr>
<tr>
<td>Avg Rabi</td>
<td>5,261</td>
<td>2.91</td>
<td>261</td>
<td>350 6.7%</td>
</tr>
<tr>
<td>Kharif</td>
<td>71,061</td>
<td>39.35</td>
<td>1,468</td>
<td>350 0.5%</td>
</tr>
</tbody>
</table>

Notes:
1. Seasonal canal diversions are measured canal diversions.
2. Urban and industrial requirements adopt a constant flow of 22.5m³/s.
3. Environmental flows made up of a base flow of 50m³/s plus 30% of Mahanadi pond inflows at Naraj.

176. There are large surplus volumes in Kharif. Canal diversions and industrial and urban demand are almost negligible by comparison. To facilitate comparison volumes are expressed as deltas (depths) over the command area of the offtaking canals, i.e. volumes over 180,578ha. In Kharif seasonal inflow at Naraj equates to a delta of 39.3m, of which just 0.81m (2.1%) is diverted. Future urban and industrial demand is 0.5%, while environmental flows are 31.1%. The Kharif surplus equates to a delta of 26.1m (66.3% of inflow).

177. In Rabi seasonal inflow at Naraj equates to a delta of 2.9m, of which just 0.14m (5.0%) is diverted. Future urban and industrial demand is 6.7%, while environmental flows are 44.8%. The Rabi surplus equates to a delta of 1.27m (43.6% of inflow).

Figure 9 Mahanadi Pond Canal Diversions, River Inflows and Surplus

178. Currently the surplus passes over the Naraj barrage (60-70%) with most of the balance passing over the Mahanadi barrage. Relatively small flows pass over the Birupa barrage.

179. The water balance indicates scope to considerable increase diversions from the Mahanadi pond with current storage provided by Hirakud reservoirs.
e. Surface Water Quality

180. Studies\(^{13}\) indicate the Mahanadi river water it is not directly potable, except in its middle reach. Pollution is from municipal wastewater and from large industries including fertilizer and paper mills. The Prevention and Control of Pollution Act, 1974 and subsequent amendments governs water quality management.

181. The State Pollution Control Board has established 9 river monitoring stations. Seasonal observations are made of pH, BOD, DO and TC. Other parameters such as Am-N, EC, SAR and B are observed annually.

182. Water quality date for the Mahanadi and the Kathjori, which offtakes from the Mahanadi just upstream of Cuttack city, show that water quality deteriorates as it passes through the city (Table 17 & 18). This is due to discharge of untreated effluent from the city into the river. Upstream of Cuttack, the river water confirms to Class C quality and is potable with conventional treatment following by disinfection. Downstream, in the Mahanadi it sometimes confirms to Class C, while downstream in the Kathjori it does not.

Table 17 River Water Quality U/S and D/S of Cuttack- Mahanadi basin

<table>
<thead>
<tr>
<th>Sl. no</th>
<th>Location</th>
<th>year</th>
<th>Annual average values</th>
<th>Designated Class</th>
<th>Existing Class</th>
<th>Source of Pollution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>pH</td>
<td>DO mg/l</td>
<td>BOD mg/l</td>
<td>TC MPN /100 ml</td>
</tr>
<tr>
<td>1</td>
<td>Mahanadi River - U/S of Cuttack (NWMP)</td>
<td>2007</td>
<td>7.6</td>
<td>7.8</td>
<td>2.62</td>
<td>13.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2008</td>
<td>7.6</td>
<td>7.9</td>
<td>1.2</td>
<td>13.95</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2009</td>
<td>7.7</td>
<td>8</td>
<td>1</td>
<td>13.35</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2010</td>
<td>7.8</td>
<td>7.8</td>
<td>1.25</td>
<td>44.47</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2011</td>
<td>8</td>
<td>8</td>
<td>1.4</td>
<td>1038 (330-17000)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2012</td>
<td>8</td>
<td>8.2</td>
<td>1.5</td>
<td>3256 (470-11000)</td>
</tr>
<tr>
<td>2</td>
<td>Kathajori River U/S of Cuttack (Board Station)</td>
<td>2007</td>
<td>7.7</td>
<td>7.8</td>
<td>1.1</td>
<td>13.29</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2008</td>
<td>7.6</td>
<td>7.9</td>
<td>1.2</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2009</td>
<td>7.8</td>
<td>8</td>
<td>1</td>
<td>13.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2010</td>
<td>9.8</td>
<td>7.8</td>
<td>1.2</td>
<td>11.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2011</td>
<td>8.1</td>
<td>7.9</td>
<td>1.8</td>
<td>1222(390-17000)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2012</td>
<td>7.8</td>
<td>4.1</td>
<td>8.2</td>
<td>69333(21000-160000)</td>
</tr>
<tr>
<td>3</td>
<td>Mahanadi River- Cuttack FDS (Board Station)</td>
<td>2007</td>
<td>7.62</td>
<td>5.8</td>
<td>1.7</td>
<td>48.16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2008</td>
<td>8.8</td>
<td>7.8</td>
<td>1.5</td>
<td>76</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2009</td>
<td>8.2</td>
<td>8.7</td>
<td>1.4</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2010</td>
<td>7.85</td>
<td>5.2</td>
<td>1.6</td>
<td>61</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2011</td>
<td>8.1</td>
<td>7</td>
<td>1.9</td>
<td>14925 (1100-92000)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2012</td>
<td>8.1</td>
<td>7.7</td>
<td>2</td>
<td>24517 (92000-54000)</td>
</tr>
<tr>
<td>4</td>
<td>Mahanadi</td>
<td>2007</td>
<td>7.7</td>
<td>7.4</td>
<td>2.25</td>
<td>322.2</td>
</tr>
</tbody>
</table>

\(^{13}\) University College of Engineering, Burla and School of Life Science, Burla
<table>
<thead>
<tr>
<th>Sl. no</th>
<th>Location</th>
<th>year</th>
<th>Annual average values</th>
<th>Designated Class</th>
<th>Existing Class</th>
<th>Source of Pollution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>pH</td>
<td>DO mg/l</td>
<td>BOD mg/l</td>
<td>TC MPN /100 ml</td>
</tr>
<tr>
<td>1</td>
<td>River -D/s of Cuttack (NWMP)</td>
<td>2008</td>
<td>7.9</td>
<td>7.65</td>
<td>2.1</td>
<td>262.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2009</td>
<td>7.8</td>
<td>7.75</td>
<td>2.2</td>
<td>170</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2010</td>
<td>7.8</td>
<td>7.3</td>
<td>2.15</td>
<td>176.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2011</td>
<td>8</td>
<td>7.3</td>
<td>2.5</td>
<td>35675(2200-1600000)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2012</td>
<td>8</td>
<td>7.7</td>
<td>2.5</td>
<td>55417 (2400-160000)</td>
</tr>
<tr>
<td>2</td>
<td>Kathajori River D/S of Cuttack (NWMP)</td>
<td>2007</td>
<td>7.9</td>
<td>7</td>
<td>3.7</td>
<td>1051</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2008</td>
<td>7.8</td>
<td>7</td>
<td>3.72</td>
<td>1297</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2009</td>
<td>8.1</td>
<td>7.45</td>
<td>3.6</td>
<td>882</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2010</td>
<td>7.6</td>
<td>6.8</td>
<td>3.6</td>
<td>1110</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2011</td>
<td>8</td>
<td>7.4</td>
<td>3.1</td>
<td>66088(8400-160000)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2012</td>
<td>8</td>
<td>7.7</td>
<td>2.5</td>
<td>55417 (2400-160000)</td>
</tr>
<tr>
<td>3</td>
<td>Mahanadi Mahanadi - Birupa Downstream</td>
<td>2007</td>
<td>7.8</td>
<td>7.75</td>
<td>1.2</td>
<td>24.25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2008</td>
<td>7.6</td>
<td>7.8</td>
<td>2.8</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2009</td>
<td>8</td>
<td>7.7</td>
<td>0.7</td>
<td>20.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2010</td>
<td>8.1</td>
<td>7.5</td>
<td>1.6</td>
<td>21.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2011</td>
<td>7.9</td>
<td>7.3</td>
<td>1.6</td>
<td>5445 (940-170000)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2012</td>
<td>8</td>
<td>7.7</td>
<td>2.5</td>
<td>55417 (2400-160000)</td>
</tr>
</tbody>
</table>

**CLASS C WATER QUALITY CRITERIA (IS-2296-1982)**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>6.5-8.5</th>
<th>4 and above</th>
<th>3 and less</th>
<th>5,000 or less</th>
<th>Drinking water sources with conventional treatment followed by disinfection</th>
</tr>
</thead>
</table>

(Source: Water Quality of Major Rivers Of Odisha during 2007-2010, State Pollution Control Board Odisha 2013 & www.OSPCBoard.org)

**Table 18 Biomonitoring of River Mahanadi**

**Table 12 Biomonitoring of River Mahanadi**

<table>
<thead>
<tr>
<th>Station</th>
<th>Year</th>
<th>Annual average values</th>
<th>Designated Class</th>
<th>Existing Biological Water Quality Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cuttack D/s</td>
<td>2007</td>
<td>5.4 (4.8-6.0)</td>
<td>0.33 (0.30-0.36)</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>2008</td>
<td>5.0</td>
<td>0.48</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>2009</td>
<td>5.6 (5.5-5.6)</td>
<td>0.46 (0.43-0.51)</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>2010</td>
<td>5.2 (4.0-5.8)</td>
<td>0.55 (0.42-0.70)</td>
<td>C</td>
</tr>
<tr>
<td>Kathajodi D/s</td>
<td>2007</td>
<td>5.43 (4.5-6.0)</td>
<td>0.36 (0.32-0.39)</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>2008</td>
<td>5.2 (4.5-5.7)</td>
<td>0.4 (0.38-0.45)</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>2009</td>
<td>5.7 (5.4-5.7)</td>
<td>0.47 (0.45-0.50)</td>
<td>C</td>
</tr>
</tbody>
</table>
183. In India, the Central Pollution Control Board (CPCB) has developed a concept of designated best use and classified water based on the surface water quality (IS: 2296-1992) into five classes i.e. A – E (Table 19). The different classes are: A- Drinking Water Source without conventional treatment but after disinfection; B- Outdoor bathing (Organised); C- Drinking water source after conventional treatment and disinfection; D- Propagation of Wild life and Fisheries and E -Irrigation, Industrial Cooling, Controlled Waste disposal.

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Parameters</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>pH</td>
<td>6.5-8.5</td>
<td>6.5-8.5</td>
<td>6.5-8.5</td>
<td>6.0</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Colour, Hazen unit, max</td>
<td>10</td>
<td>300</td>
<td>300</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Total Dissolved Solid, mg/l, max</td>
<td>500</td>
<td></td>
<td>1500</td>
<td></td>
<td>2100</td>
</tr>
<tr>
<td>5</td>
<td>Free Ammonia (as N), mg/l, max</td>
<td></td>
<td>-</td>
<td>-</td>
<td>1.2</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>Sulphate (as SO4), mg/l, max</td>
<td>400</td>
<td></td>
<td>400</td>
<td></td>
<td>1000</td>
</tr>
<tr>
<td>7</td>
<td>Total Hardness as CaCO3</td>
<td>Not specified</td>
<td>Not specified</td>
<td>Not specified</td>
<td>Not specified</td>
<td>Not specified</td>
</tr>
<tr>
<td>8</td>
<td>Total Alkalinity as CaCO3</td>
<td>Not specified</td>
<td>Not specified</td>
<td>Not specified</td>
<td>Not specified</td>
<td>Not specified</td>
</tr>
<tr>
<td>9</td>
<td>Lead(as Pb) mg/l, max</td>
<td>0.1</td>
<td></td>
<td>0.1</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>10</td>
<td>Dissolved Oxygen, mg/l, max</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>11</td>
<td>BOD, mg/l, min</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>12</td>
<td>COD</td>
<td>Not specified</td>
<td>Not specified</td>
<td>Not specified</td>
<td>Not specified</td>
<td>Not specified</td>
</tr>
</tbody>
</table>

Note:
A- Drinking water source without conventional treatment but after disinfection.
B- Outdoors bathing
C- Drinking water source with conventional treatment followed by disinfection.
D- Propagation of wildlife, fisheries.
E- Irrigation, Industrial cooling, controlled, controlling waste disposal

184. The HLC-1 obtains water from the left bank of the barrage pond at Cuttack and may be contaminated to some extent.
f. Ground Water Resources and Quality

g. Ground Water Resources

185. Groundwater information by the Groundwater Estimation Committee (GEC), published by the Directorate of Groundwater Survey and Investigation, DoWR14, is disaggregated by district and block. The Cuttack and Jajpur districts, including the Pattamundai command, comprises semi-consolidated lower Precambrian metamorphosed rock or consolidated Precambrian intrusive and extrusive lavas and traps. The area is suitable for extraction of groundwater by dug wells. Groundwater has less than 500ppm dissolved solids. There are local variations in groundwater availability.

186. The 2004 State Water Plan gives the annual fresh groundwater resource for each of the 314 blocks in the 30 districts of Odisha. Parts of the coastal districts are affected by saline groundwater to different extents and care is required not to disturb these saline aquifers. While in parts of Jajpur district saline water overlies freshwater, this is not the case for any of the blocks in HLC-1.

187. Extrapolating from block data15 on the basis of area, there are about 409 dugwells in the command area (149ha), 81 shallow tubewells (117ha), 21 deep tubewells (241ha), and 132 surface lift pumps (1,438ha) in the subproject command. The surface lift pumps abstract water from nullahs, rivers and ponds. The total potential area irrigated by pumping is 1,945ha, 14% of the command area.

188. Annual groundwater resource (estimated in 1999) and groundwater use (estimated in 2004) for the four blocks is tabulated below. Total resource is about 36,845ham, while total utilization is about 6,326ha, 17.7%. However utilization varies between blocks, from 7-26%.

189. Groundwater use is dominated by pumping for agriculture (73%), following by domestic use (23%).

Table 20: Ground Water Resource Utilization by Block

<table>
<thead>
<tr>
<th>Block</th>
<th>Groundwater resources Assessed 1999</th>
<th>Annual Ground Water Draft as on 31.03.04</th>
<th>Utilization</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Agriculture</td>
<td>Domestic use</td>
<td>Industrial use</td>
</tr>
<tr>
<td>Badachana</td>
<td>6,820</td>
<td>1,278</td>
<td>435</td>
</tr>
<tr>
<td>Dharmasala</td>
<td>9,523</td>
<td>1,854</td>
<td>413</td>
</tr>
<tr>
<td>Mahanga</td>
<td>12,313</td>
<td>1,272</td>
<td>340</td>
</tr>
<tr>
<td>Tangi Choudwar</td>
<td>8,189</td>
<td>230</td>
<td>296</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>36,845</strong></td>
<td>(73%)</td>
<td><strong>1,484</strong></td>
</tr>
<tr>
<td></td>
<td><strong>6,326</strong></td>
<td></td>
<td><strong>17.7%</strong></td>
</tr>
</tbody>
</table>

Source: Directorate of Ground Water Odisha Bhubaneswar.

190. Average depths to groundwater depend on elevation and proximity to drainage nullahs, rivers or canals. For higher lying land depths typically vary from 3-6m below ground level, while for lower lying land depths vary from 1-3m. The seasonal fluctuation is about 2-3m. Depths to the water table are plotted below for three tube wells and one dug well in Cuttack block.

---

10 Ground Water Resources of Orissa (Approved by the study group), Department of Water Resources, Bhubaneswar, Orissa, December 2001.
15 3rd Minor Irrigation Census, Directorate of Economics and Statistics, Orissa 2001-02
h. Ground Water Quality

191. The State Pollution Control Board, Odisha is monitoring the ground water quality of Cuttack city at 15 different locations under Central pollution Control Board sponsored National Water Management Project. The observed values are reported in Table 21 below. It is observed that conductivity and nitrate concentration are within the limits stipulated in Indian drinking water standards. The low conductivity in Cuttack shows that the ground water is not affected by saline water intrusion as Cuttack is away from the sea coast.

Table 21: Ground Water Characteristics of Cuttack

<table>
<thead>
<tr>
<th>SI No</th>
<th>Station</th>
<th>pH</th>
<th>Conductance µS/cm</th>
<th>NO₃(mg/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>April</td>
<td>Oct</td>
<td>April</td>
</tr>
<tr>
<td>1</td>
<td>Jagatpur Industrial Area</td>
<td>6.4</td>
<td>6.9</td>
<td>345</td>
</tr>
<tr>
<td>2</td>
<td>Madhupatna Kalyan Nagar Area</td>
<td>6.9</td>
<td>7.0</td>
<td>250</td>
</tr>
<tr>
<td>3</td>
<td>Bidanasi-Tulsipur Area</td>
<td>6.8</td>
<td>6.6</td>
<td>180</td>
</tr>
<tr>
<td>4</td>
<td>Badambadi Area</td>
<td>7.0</td>
<td>7.5</td>
<td>289</td>
</tr>
<tr>
<td>5</td>
<td>Ranihat-Mangalabag Area</td>
<td>6.9</td>
<td>7.2</td>
<td>163</td>
</tr>
</tbody>
</table>

Source: Annual Report, SPCB, Odisha, 2005-2006

i. Ecological Resources

21. Fisheries

192. Mahanadi estuaries have large fishery resources. The present marine fish resource of the district is 34,576 tones which are captured from 11 fish landing centers. The important fish species are shrimp, hilsa and Bombay Duck. Out of the total marine fishes, 16,405 tons are marketed to different states and 1,730 tons are converted into dry fish. There is not much fishing activity in HLC range 1 canal but
The presence of fishes has been reported. The fresh water fishes of Mahanadi basin are given in Table 22 below.

Table 22: Common Fresh Water Fishes of Mahanadi Basin

<table>
<thead>
<tr>
<th>Sr No.</th>
<th>Local Names</th>
<th>Latin Names</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Balia</td>
<td>Wallagonia attu</td>
</tr>
<tr>
<td>2</td>
<td>Baligarda</td>
<td>Glossogabius giziris</td>
</tr>
<tr>
<td>3</td>
<td>Bhakur</td>
<td>Catla catla</td>
</tr>
<tr>
<td>4</td>
<td>Chengu</td>
<td>Ophicaphalus gachus</td>
</tr>
<tr>
<td>5</td>
<td>Chitala</td>
<td>Notoptorus chitala</td>
</tr>
<tr>
<td>6</td>
<td>Dandkhiri</td>
<td>Esomus dandrica</td>
</tr>
<tr>
<td>7</td>
<td>Gadsi</td>
<td>Ophioapnetatus</td>
</tr>
<tr>
<td>8</td>
<td>Illlishi</td>
<td>Itilisa ilisa</td>
</tr>
<tr>
<td>9</td>
<td>Jalanga</td>
<td>Panga sisus</td>
</tr>
<tr>
<td>10</td>
<td>Jallah</td>
<td>Chelaargentea</td>
</tr>
<tr>
<td>11</td>
<td>Kantia</td>
<td>Myotous carasistus</td>
</tr>
<tr>
<td>12</td>
<td>Kerandi</td>
<td>Barbus ambasis</td>
</tr>
<tr>
<td>13</td>
<td>Mangura</td>
<td>Clarias batrachus</td>
</tr>
<tr>
<td>14</td>
<td>Mirakali</td>
<td>Amblypharyngodon mola</td>
</tr>
<tr>
<td>15</td>
<td>Neuli</td>
<td>Gobioperterus ohund</td>
</tr>
<tr>
<td>16</td>
<td>Pohale (chuna)</td>
<td>Cirrhina reba</td>
</tr>
<tr>
<td>17</td>
<td>Pohale (dhanga)</td>
<td>Labeo bata</td>
</tr>
<tr>
<td>18</td>
<td>Pabatata</td>
<td>Callichrous bimaculatus</td>
</tr>
<tr>
<td>19</td>
<td>Phali</td>
<td>Notopterus notpterus</td>
</tr>
<tr>
<td>20</td>
<td>Rohi</td>
<td>Labeo rohita</td>
</tr>
<tr>
<td>21</td>
<td>Serana</td>
<td>Barbus serana</td>
</tr>
<tr>
<td>22</td>
<td>Seula</td>
<td>Ophiocephalus striatus</td>
</tr>
<tr>
<td>23</td>
<td>Singi</td>
<td>Heteropnaustec fossilis</td>
</tr>
<tr>
<td>24</td>
<td>Todi</td>
<td>Mastacembelus armatus</td>
</tr>
</tbody>
</table>

(Source: Environmental issues and concerns relating to basin planning activity of Mahanadi basin, 2001)

22. Flora and Fauna

During discussion with local forest officials and through public consultation with local people it was learned that there are no rare and endangered plant or animal species in the project area. The command area of HLC R-1 canal falls in the cultivated plains area. The area is endowed with rich faunal habitats. The Table 23 shows fauna of the study area.

Table 23: Subproject Fauna with IUCN Status

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Common name</th>
<th>Scientific name</th>
<th>ICUN conservation status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pea fowl</td>
<td>Pavo cristatus</td>
<td>LC</td>
</tr>
<tr>
<td></td>
<td>Red Jungle fowl</td>
<td>Gallus gallus</td>
<td>LC</td>
</tr>
<tr>
<td></td>
<td>Red Spur fowl</td>
<td>Galloperdix spadicea</td>
<td>LC</td>
</tr>
<tr>
<td></td>
<td>Black Partridge</td>
<td>Melanoperdix nige</td>
<td>LC</td>
</tr>
<tr>
<td></td>
<td>Grey Horn Bill</td>
<td>Ocyceros birostris</td>
<td>LC</td>
</tr>
<tr>
<td></td>
<td>Green Pigeon</td>
<td>Treron sphenura</td>
<td>LC</td>
</tr>
<tr>
<td></td>
<td>Ducks</td>
<td>Anas platyrhinos</td>
<td>LC</td>
</tr>
</tbody>
</table>
195. Major tree species under avenue plantation in the project area includes Anogeissus latifolia, Azadirachta indica (Neem), Albizia lebbeck (Chakunda), Buchanania lanzan (Chiranji), Butea monosperma (Palas), Ficus bengalensis (Bat), Careya arborea, Cassia fistula (Sonaru), Dalbergia Latifolia (Sishu), Mangifera indica (Aam), Diospyros melanoxylon (Kendu), Madhuca Indica (Mohua), Phyllanthus emblica (Amla), Scleichera oleosa (Kusum), Samecarpus anacardium (Bhalia), Semaruba glauca, Shorea robusta (Sal), Syzygium Cummini (Jamum), Tectona grandis (Segun), Terminalia arjuna (Arjun), Terminalia bellerica (Bahera), Terminalia chebula, Wrightia arborea, Zizyphus Oenoplia.

(ii) Similarly, important medicinal plants found in the project area are chandan (Santalum album), bija (Pterocarpus marsupium), rohini (Ssoyimida fabrifuga), fanfana, (Oroxylon indicum), kamalagudi (Malotus philipinensis), patuli (Pterospermum swave), chandeigodi (Vitex peduncularis), bidanga (Embelia ribes), modafal (Helioteres isora), bumpipali (Piper longum), karpura haldi (Curtuma aromatic), iswari (Aristolochea indica), bridha daruka (Aarneya durvula) etc. No endangered plant species are noticed in the study area.

196. 23. Forest

197. Forest cover in Cuttack district is high as compared to 37.33 percent of the total forest cover area in the state. There are five types of forests found in both the districts mainly reserve forest, demarcated protected forest, unclassified forest, UDPF and other type of forests. Details of forest cover in the district are given in Table 24. However there is no forest in the HLC Range 1 command area.

Table 24: Forest cover in Cuttack and Jajpur District

<table>
<thead>
<tr>
<th>Sl No</th>
<th>Type of Forest</th>
<th>Cuttack(Area in Sq.Km)</th>
<th>Jajpur(Area in Sq. Km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Reserve Forest</td>
<td>522.39</td>
<td>6.35</td>
</tr>
<tr>
<td>2</td>
<td>Demarcated protected Forest</td>
<td>103.68</td>
<td>299.32</td>
</tr>
<tr>
<td>3</td>
<td>Un Classified Forest</td>
<td>0.45</td>
<td>0.01</td>
</tr>
<tr>
<td>4</td>
<td>Un demarcated Forests</td>
<td>0.0</td>
<td>-----</td>
</tr>
<tr>
<td>5</td>
<td>Other Forests</td>
<td>163.65</td>
<td>419.59</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>787.90</td>
<td>725.27</td>
</tr>
</tbody>
</table>

(Source: District Statistical Handbook 2009,, Cuttack and Jajpur)

j. Economic Development

24. Industries

198. The small scale industries sector has grown steadily over the past few years in Cuttack district and has helped in upliftment of economy in the area. The category wise Small Scale Industries (SSI) units set up in the Cuttack district below in Table 25. District has always attracted private investors due to its conducive industrial atmosphere. In the large and medium sector the proposed investment against the pipeline units is around 11458 crores. The same figure may cross around 12000 crores if the proposed micro & small Enterprises are taken into consideration.
Table 25: Small Scale Industries in Cuttack District

<table>
<thead>
<tr>
<th>S I No</th>
<th>Category</th>
<th>No.of units</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Food &amp; Allied</td>
<td>1807</td>
</tr>
<tr>
<td>2</td>
<td>Electrical &amp; Electronics</td>
<td>482</td>
</tr>
<tr>
<td>3</td>
<td>Chemical based</td>
<td>210</td>
</tr>
<tr>
<td>4</td>
<td>Engineering &amp; Metal based</td>
<td>1865</td>
</tr>
<tr>
<td>5</td>
<td>Forest &amp; Wood based</td>
<td>1078</td>
</tr>
<tr>
<td>6</td>
<td>Glass &amp; ceramics</td>
<td>689</td>
</tr>
<tr>
<td>7</td>
<td>Textile based</td>
<td>190</td>
</tr>
<tr>
<td>8</td>
<td>Leather units</td>
<td>572</td>
</tr>
<tr>
<td>9</td>
<td>paper</td>
<td>249</td>
</tr>
<tr>
<td>10</td>
<td>Rubber &amp; plastic</td>
<td>1193</td>
</tr>
<tr>
<td>11</td>
<td>Repairing &amp; Servicing</td>
<td>1702</td>
</tr>
<tr>
<td>12</td>
<td>Miscellaneous</td>
<td>2286</td>
</tr>
<tr>
<td>13</td>
<td>Total</td>
<td>12323</td>
</tr>
</tbody>
</table>

(Source: www.cuttack.nic.in)

199. In addition to this there are many large and medium industries in Cuttack district.

200. There are 10 large scale industrial unit at Jajpur district and huge numbers of stone crusher (251 nos.) located in the district.

201. Proposed Air Separation unit factory by British Oxygen which will come up at Kalinga Nagar in Jajpur district. It will produce 1800 tons of oxygen daily. It will need 15 acres of land and will invest 838 crores. The bulk of the investment will be made in the phase-II development of its stainless steel plant of Jindal in Jajpur, Odisha.

202. MESCO Steel Group plans to invest $2.8 billion (over Rs 1,000 crore) to expand its existing steel making capacity and set up a green-field project at Kalinga nagar that would together take its total capacity to 6.5 million tonnes per annum. MESCO, which owns Mideast Integrated Steel Ltd (MISL), would enhance its existing pig iron plant here into a 3.5 million tonnes steel plant with an investment of $1.2 billion.

203. The small scale industries sector has also grown steadily over the past few years in Jajpur district and has helped in upliftment of economy in the area. The category wise Small Scale Industries (SSI) units set up in the Jajpur district is given below in Table 26.

Table 26: Small Scale, Cottage and Handloom Industries in Jajpur District

<table>
<thead>
<tr>
<th>Type of Industry</th>
<th>Numbers</th>
<th>Capital Investment (Rs.in Lakh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Scale</td>
<td>292</td>
<td>671.53</td>
</tr>
<tr>
<td>Cottage</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Handloom</td>
<td>935</td>
<td>NA</td>
</tr>
</tbody>
</table>

(Source: District Statistical Handbook of Jajpur, 2009)
25. Transportation

204. Cuttack is connected by National Highway NH-5 and runs through the district for 85.75 km and connects Cuttack to important cities like Baripada and Baleshwar. This district is also well connected with the National Highway No. 5A, comprising a running length within the district of 77 km. Apart from the national and state highway, major district road runs for 461.50 km within the state, reaching all corner of the district.

205. Jajpur district is well connected by road & rail. The existing length of highways and roads are given in Table 27 below.

Table 27: Length of Highways and Roads

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Category</th>
<th>Cuttack District</th>
<th>Jajpur District</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>National Highways</td>
<td>64</td>
<td>154</td>
</tr>
<tr>
<td>2</td>
<td>State Highways</td>
<td>118</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Major District Roads</td>
<td>316</td>
<td>135</td>
</tr>
<tr>
<td>4</td>
<td>Other District Roads</td>
<td>443</td>
<td>325</td>
</tr>
<tr>
<td>5</td>
<td>Village Roads</td>
<td>1275</td>
<td>1130</td>
</tr>
<tr>
<td>6</td>
<td>Forest Roads</td>
<td>204</td>
<td>43</td>
</tr>
<tr>
<td>7</td>
<td>Gram Panchayat roads</td>
<td></td>
<td>2850</td>
</tr>
</tbody>
</table>

( Source: District Statistical Handbook, 2009, Cuttack & Jajpur)

K. Agricultural and Mineral Development

206. Cuttack is divided into three agro-climatic zone viz. a) marshy strip of Bay of Bengal. This low land impregnated with salt and unsuitable for cultivation, b) Alluvial plains forming the delta of Mahanadi River, c) Hilly regions which are sterile land covered with bamboos and scrub jungles. Agriculture constitutes the main source of rural livelihood and incomes. Rice and Paddy is the main food crop grown in this area.

207. The command area conditions are suited for paddy rice, pulses (green gram and black gram), oil seeds (groundnut, mustard, sunflower), maize, jute, sugarcane, vegetables (onion, potato, brassica) and spice crops (Chilli pepper, garlic), which are part of the current cropping pattern. Potential viable new or expanded crops include: certified seeds, vegetables (capsicum) seasonal flowers, potato, onion, spices, sweet corn, baby corn and sugarcane. These require improved irrigation supplies (in June) to allow earlier sowing and harvesting of paddy.

208. Groundnut is mostly cropped with available moisture after harvest of paddy in October-November. With irrigation farmers can grow groundnut in December-January. Sesame is mostly grown with residual moisture. Where irrigation water is available sesame is grown after potato and vegetables as a third crop. The state department of agriculture has tried to introduce sunflower as a Rabi oilseed crop. The crop has economic potential and private companies will procure the produce. Wheat was historically grown successfully in the area but current wheat cropping is negligible. The availability of subsidised wheat from the Public Distribution System removed farmers’ incentive.

209. The current and proposed cropping patterns are based on discussions with the farming community, PP functionaries and local officials of state agriculture and water resources departments considering the constraints and opportunities, agro-climate, soil, water availability, past cropping patterns and market demand. Block level crop area data for 2006-2007 for the four subproject Blocks were weighted by the area in
the subproject to provide current cropping patterns. These indicate a high current Rabi cropping intensity (84%), mostly pulses, oilseeds and vegetables.

Table 28: Current and Proposed Cropping Pattern

<table>
<thead>
<tr>
<th>Crop</th>
<th>Current Area (2006-2007)</th>
<th>Area with project (full development)</th>
<th>Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Percent of Command Area</td>
<td>Area (ha)</td>
<td>Percent of Command Area</td>
</tr>
<tr>
<td>Paddy</td>
<td>78.2</td>
<td>10,784</td>
<td>78.3</td>
</tr>
<tr>
<td>Vegetables</td>
<td>11.5</td>
<td>1,586</td>
<td>13.1</td>
</tr>
<tr>
<td>Spices</td>
<td>1.6</td>
<td>221</td>
<td>2.0</td>
</tr>
<tr>
<td>Maize</td>
<td>0.5</td>
<td>69</td>
<td>0.7</td>
</tr>
<tr>
<td>Fibre</td>
<td>1.5</td>
<td>207</td>
<td>1.1</td>
</tr>
<tr>
<td>Pulses</td>
<td>1.5</td>
<td>207</td>
<td>0.9</td>
</tr>
<tr>
<td>Others</td>
<td>0.1</td>
<td>15</td>
<td>0.2</td>
</tr>
<tr>
<td>Total Kharif</td>
<td>94.9</td>
<td>13,088</td>
<td>96.2</td>
</tr>
<tr>
<td>Hybrid Paddy</td>
<td>1.1</td>
<td>152</td>
<td>2.2</td>
</tr>
<tr>
<td>Vegetables</td>
<td>17.5</td>
<td>2,413</td>
<td>21.8</td>
</tr>
<tr>
<td>Pulses</td>
<td>49.1</td>
<td>6,771</td>
<td>47.1</td>
</tr>
<tr>
<td>Oilseed</td>
<td>15.6</td>
<td>2,151</td>
<td>20.3</td>
</tr>
<tr>
<td>Spices</td>
<td>0.4</td>
<td>50</td>
<td>1.5</td>
</tr>
<tr>
<td>Fodder</td>
<td>0.0</td>
<td>0</td>
<td>0.7</td>
</tr>
<tr>
<td>Others</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total Rabi</td>
<td>83.7</td>
<td>11,537</td>
<td>93.5</td>
</tr>
<tr>
<td>Sugar cane</td>
<td>1.3</td>
<td>182</td>
<td>1.5</td>
</tr>
<tr>
<td>Annual Total</td>
<td>179.9</td>
<td>24,807</td>
<td>191.2</td>
</tr>
</tbody>
</table>

(Source: Harmonised data from District Agricultural Strategy Committee Meeting 2007-08, Reports from local AEOs, Survey results and DoWR officials and Consultants’ estimate)

210. At Cuttack district few fireclay mines (9 nos.) are in operation.

211. Jajpur is famous for chromite mine. Number of working mines, area covered and production output are shown in Table 29 below.

Table 29: Working mines, area and production

<table>
<thead>
<tr>
<th>Sl no</th>
<th>Name of the Ore</th>
<th>No of Working Mines</th>
<th>Area Covered (in ha)</th>
<th>Production-output (In 000 MT)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Cuttack District</td>
</tr>
<tr>
<td>1</td>
<td>Fire Clay</td>
<td>9</td>
<td>953.21</td>
<td>76.69</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Jajpur District</td>
</tr>
<tr>
<td>1</td>
<td>Chromite</td>
<td>14</td>
<td>4112</td>
<td>2646.57</td>
</tr>
<tr>
<td>2</td>
<td>Iron one</td>
<td>1</td>
<td>190.20</td>
<td>1593.55</td>
</tr>
<tr>
<td>3</td>
<td>Quartzite</td>
<td>1</td>
<td>406</td>
<td>231</td>
</tr>
<tr>
<td>4</td>
<td>Pyroxenite</td>
<td>1</td>
<td>2.3</td>
<td>15.25</td>
</tr>
<tr>
<td>5</td>
<td>Total</td>
<td>17</td>
<td>4710.5</td>
<td>4486.37</td>
</tr>
</tbody>
</table>
L. Social and Cultural Resources Population and Communities

212. Demographic Status i.e total population of Cuttack district is 2,341,000 out of which 1888423 is the rural population and 736047 is the urban population, which constitutes about 27.41% of urban population. The population of schedule cast is 498633 and schedule tribe is 93745. A detail of demographic structure of the Cuttack district is given in Table 30.

Table 30: Demographic Pattern of Cuttack District

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Population</td>
<td>2624470</td>
</tr>
<tr>
<td>Rural Population</td>
<td>1888423</td>
</tr>
<tr>
<td>Urban Population</td>
<td>736047</td>
</tr>
<tr>
<td>SC Population</td>
<td>498633</td>
</tr>
<tr>
<td>ST Population</td>
<td>93745</td>
</tr>
<tr>
<td>Percentage of Urban Population to Total Population</td>
<td>28.0</td>
</tr>
<tr>
<td>Number of females per Thousand Male</td>
<td>940</td>
</tr>
<tr>
<td>Population density per sq.km</td>
<td>667</td>
</tr>
<tr>
<td>Decennial growth rate percentage</td>
<td>12.1</td>
</tr>
</tbody>
</table>

(Source: Census 2011)

213. Total population of Jajpur district is 1,624,000 out of which 1827192 is the rural population and 1692095 and 135057 is the urban population. The population of schedule cast is 433387 and schedule tribe is 151432. A detail of demographic structure of the Jajpur district is given in Table 31.

Table 31: Demographic Pattern of Jajpur District

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Population</td>
<td>1827192</td>
</tr>
<tr>
<td>Rural Population</td>
<td>1692095</td>
</tr>
<tr>
<td>Urban Population</td>
<td>135057</td>
</tr>
<tr>
<td>SC Population</td>
<td>433387</td>
</tr>
<tr>
<td>ST Population</td>
<td>151432</td>
</tr>
<tr>
<td>Percentage of Urban Population to Total Population</td>
<td>7.39%</td>
</tr>
<tr>
<td>Number of females per Thousand Male</td>
<td>972</td>
</tr>
<tr>
<td>Population density per sq.km</td>
<td>630</td>
</tr>
<tr>
<td>Decennial growth rate percentage</td>
<td>12.43</td>
</tr>
</tbody>
</table>

(Source: Source: Census 2011)

214. The command area is spread over 3 blocks of Cuttack district, and 2 blocks of Jajpur district, the total number of villages approx. covered under the command area are 317 villages with a total number of approx. beneficiaries 58,715 covering an area of 13,790 Ha. The population details of the blocks covered under the project is given in Table 32.
Table 32: Population details of the blocks covered under the project

<table>
<thead>
<tr>
<th>S.no</th>
<th>Name of the Block and district</th>
<th>Total Population</th>
<th>SC Population</th>
<th>ST Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mahanga, Cuttack district</td>
<td>163321</td>
<td>34757</td>
<td>728</td>
</tr>
<tr>
<td>2</td>
<td>Salipur, Cuttack district</td>
<td>174692</td>
<td>43515</td>
<td>4003</td>
</tr>
<tr>
<td>3</td>
<td>Tangi, Cuttack district</td>
<td>141838</td>
<td>22011</td>
<td>16153</td>
</tr>
<tr>
<td>4</td>
<td>Barachana, Jajpur district</td>
<td>206129</td>
<td>36338</td>
<td>16459</td>
</tr>
<tr>
<td>5</td>
<td>Dharmasala, Jajpur district</td>
<td>195545</td>
<td>37655</td>
<td>15696</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>881525</td>
<td>174276</td>
<td>53039</td>
</tr>
</tbody>
</table>

(Source: 2001 census, District Handbook, Cuttack and Jajpur districts)

215. The sub-project covered blocks have around 881525 total populations of which SC population is around 19.8% and ST population is around 6.01% as per 2001 census.

26. Places of Historical, Archeological and Religious Significance

216. Cuttack city houses the Barabati Fort, a nine storey palace of the Ganga dynasty lies on the bank of Mahanadi River. Qadam-I-Rasool, a sacred shrine for Muslims is situated in the centre of Cuttack city and Netaji Seva Sadan, a birth place of Netaji Subhash Chandra Bose is located in Oriya bazaar of town.

217. Banki, Bhattarika, Chhapachikana, Dhaobaleswar, Kukudiapada, Kukudanga, Nimal, Niali Madhab, Paramhansa and Simhanath are religious places in Cuttack District.

218. From time immoral Jajpur has been identical with Viraja or Viraja Khetra. The place sacred to Viraja, the symbol of Sakti(Power) on one side and Verah, the symbol of Brahma or Purusha on the other side is one of the traditional Pancha khetras in Odisha dedicated to Brahmansical Pancha Khetras. As a seat of ancient culture and a holy shrine for Hindus it was once studded with scores of ancient stone temples as in the temple town of Bhubaneswar. But it witnessed and bore the brunt of the vandalism of the invaders from the North, who destroyed the temples and palaces. But in and around the surviving temples and the temples built after the mass destruction we come across a large number of sculptures ranging in date from the 4th century, which not only stand as the milestone of art and architecture of the place but also provide us with ample materials to reconstruct a cultural history of Odisha.

219. A new political situation developed with the rise of the Bhaumakaras in 736 AD. The Bhaumaker empire extended from the Ganges in the North to the Mahendra mountain on the south. The Bhaumas ruled over two centuries with their capital at Guheswar Patak in Viraja Khetra. Khijinga Mandal of the Bhaumas comprised modern Mayurbhanja, eastern part of Keonjhar, some portion of Dhenkanal and the modern Jajpur and Bhadrak districts. Though a great deal of geographical political and social changes have taken place since, the cultural tie of the regions is still conspicuous as the people of the region still perform their social functions and rituals.
in accordance with Viraja Panjika approved by the learned astrologers and scholars (Pundits) of Jajpur. Broadly speaking Odisha was mainly divided into two cultural units the one centering round Viraja khetra and the other round Shrikhetra. As in Puri there was also the Mukti Mandap and Pundit Sava at Jajpur and the ruins still bear testimony to it.

220. The important religious and tourist places at Jajpur are mentioned below.

CHHATIA: situated at a distance of 25kms from Cuttack, Chhatia is famous for lord Jagannath temple

CHANDIKHOL: Chandikhol, which is at a distance of 40kms from Cuttack, is an attractive picnic spot with natural springs and sceneries.

MAHABINAYAK: at a distance of 2 kms from Chandikhol to the west, is situated the Mahabinayak. The tourists can enjoy its natural surroundings and the temples of Lord Binayak.

LALITGIRI, RATNAGIRI & UDAYAGIRI: the three Boudh Vhars are at a distance of 70kms from Cuttack. The famous buddhist complex is said to be ancient seat of puspagiri, the buddhist university of 7th century AD. Recently a statue of emperor Ashok is being discovered form Langudi hill.
V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

i. General

221. The positive and negative impacts associated with this project are described in this chapter. The impacts associated during the construction phase of the project will be temporary and short term in nature. During the operation phase, impacts associated may have longer term effects. For purposes of this IEE report the environmental impacts in the study area have been discussed during the construction and operation phase of the project. Identification of these impacts is followed by recommendations of appropriate cost effective mitigation measures. These impacts along with the mitigation measures are given in the following sections.

ii. Subproject Activities

222. In HLC range-1, priority for infrastructure works is as follows:

(i) Ensure safety of irrigation system by strengthening canal banks where required and carrying out essential repairs to structures.
(ii) Improved hydraulic performance of: (i) the main; (ii) the four distributaries; and finally (iii) minors and sub-minors, checking for prism / trapezoidal shape and stability and remodeling with removal of accumulated silt, weed and water hyacinth. Remodeling for distribution canals should be using regime principals. For the main canal the flat slopes and non-available headloss except at the Imam-nagar regulator / fall makes this impossible / too expensive.
(iii) Repair of existing structures and construction of new structures
(iv) Hydraulic control structures for improved flow control and flow measurement, for example at the head of the main canal (just downstream of the head regulator at Birupa pond) and at the heads of distributaries and minor canals taking off from the main canal.
(v) Reconstruction of existing bridges and construction of new bridges for improved access over canals.
(vi) Resectioning of distributaries, minors and sub-minor canal systems and selective lining of distributary and minor canals in fill and / or head reach sections.
(vii) Improved access along main canal by upgrading inspection roads, and provision of inspection roads along the four distributaries.
(viii) Repair of outlets and provision of new outlets
(ix) Provision of drilling for new tube wells along the canal system

27. Subproject Activities during construction phase

- The cistern of weir cum falls are built with latraite stone masonry covered with cement concrete are damaged and needs replacement with RCC structures, replacement of damaged down stream protection works and repair of wing walls etc
- Remove silt and resection of canal of the main canal, distributaries, minors and sub-minors.
- In reaches 1-5 with little spare capacity remodeling to restore design sections is proposed, with sediment, weed and hyacinth removed. Reaches 6, 7 and 8 have substantial spare capacity and prism remodeling is not justified, particularly for Reach 8

---

16 Water hyacinth once removed must be dried and burnt to prevent further spread.
17 Flume measuring structure would require a headloss of about 0.4m at 20m3/s for free flow. For a pond operating level of 21.20m this only leaves 0.13m for the head regulator. This would require gate openings for all three gates of about 0.7m, which is feasible. Furthermore the pond is often operated at 21.3m, increasing headloss available.
downstream of the Imam-nagar cross regulator / fall at RD 41.072km where little land is commanded (just 578ha, 4.2%). During desilting weeds should be removed, however weed and hyacinth growth dried and burnt (with diesel if partially dried) for these three reaches

- Canal embankments are out of shape, particularly the left embankment where effected by drainage inflows. These need to be remodeled to restore freeboard, bank top widths and required back slopes for stability.
- The canal structures should be rehabilitated with new gates and gauges, facilitating easy operation and more accurate flow measurement. 70% of existing structures can be retained and modified, with the balance being demolished and replaced with new structures.
- Field channel headwalls are damaged and at a few locations the pipes need replacement.
- Rehabilitation works will include addressing leakage between the aqueduct trough and wing walls; cleaning, repairing and re-pointing masonry work, and placement of a new concrete skin in the bed. In some locations wing walls need to be extended, and lining provided about 25m upstream and downstream of the trough.
- Need for lining in bed and slope especially in the tail end of the main canal from from RD 22.95 to 55 km to avoid weed growth if paucity of funds under ADB, additional funding need to be explored by the SIO.
- Drilling of tube wells along the canal system

223. Rehabilitation works for the structures are summarized below in Table 33

Table 33: Structure Rehabilitation Works for Main Canal Distributaries, Minors & Sub-minors

<table>
<thead>
<tr>
<th>Category of Structure</th>
<th>As per Inventory</th>
<th>To be Repaired</th>
<th>New Structures</th>
</tr>
</thead>
<tbody>
<tr>
<td>HR</td>
<td>56</td>
<td>52</td>
<td>14</td>
</tr>
<tr>
<td>VRB</td>
<td>103</td>
<td>103</td>
<td>27</td>
</tr>
<tr>
<td>Fall</td>
<td>29</td>
<td>29</td>
<td>0</td>
</tr>
<tr>
<td>Aqueduct</td>
<td>11</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>CS</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>DS</td>
<td>83</td>
<td>31</td>
<td>52</td>
</tr>
<tr>
<td>Escape</td>
<td>4</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>CR</td>
<td>84</td>
<td>23</td>
<td>61</td>
</tr>
<tr>
<td>CR Cum Escape</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>VRB cum Fall</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>VRB Cum CR</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sup. Passage</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Outlet</td>
<td>1047</td>
<td>478</td>
<td>569</td>
</tr>
</tbody>
</table>

28. Subproject Activities during operation phase

- Maintenance of water availability
- Maintenance of canal through desilting operation and deweeding
- Maintain drainage system of agricultural field
E. Possible Environmental Impact and Mitigation Measures

224. The proposed project will have impacts on the environmental in different phases:
   - Due to Project Location
   - During site selection and design phase
   - During the construction phase which are temporary or short-term in nature
   - During operation phase which will have long term impacts

F. Impact due to Project Location

225. The environmental issues that may arise due to the present project location are minimal:
   - As per the resettlement plan (RP) the sub project would not entail land acquisition as existing right of way (ROW) is sufficient. However the project would entail loss of assets and livelihood of people settled (non title holders) on either side of the existing embankment. As per the RP prepared during July & August 2013 shows encroachments totals to 124 units (out of which 79 are residential and 45 commercial) in between RD 0 to 10 km and 178 units (out of which 85 residential and 93 commercial) in between RD 10 to 53 km of the canal system for more details kindly refer RP plan for HLC Range 1.

   - However, some details of the encroachments which were noticed during the preliminary environmental survey are also detailed here: in the main canal at (RD 2.07; 22.o093; 24.552; 28.687; 33.00; 41.07; 47.091; 48.22; 48.595; 50.00 and 53.00 km) Distributary no.1 (RD 4.20; 11.6; 25.80; 29.2 km); Disty no-1C (RD 1.9 to 2.6 km) Disty No. 2 (1.2 to 1.8 km); Disty -5 (RD 6.199; 8.199; 8.510; and 8.717 km) Disty. No 5A (RD 3.60 km); Disty no 6A-1 (RD 0.060); Disty No. 12A (RD 0.950 km) Distry No. 14 (RD 5.30; 10.30 and 11.973 km) Disty -16 (RD 0.650 km); Sendapur minor (RD 0.120 km) and Derabara sub-minor (RD 1.20 and 2.0 km); Pattapur sub minor (RD 0.4 to 0.90 km) within the ROW and some illegal cultivation outside toe line within the ROW of the canal are present.

   - No forest land is involved so no impact but some trees are found on the embankment which may get affected.

   - No archaeological, monumental, and cultural sites are present along the ROW except few temples with in ROW

   - Utilities like electric poles / line are noticed on the canal embankment either passing adjacent or at places crossing the canal mostly in main canal, distributaries (Disty. No-1(Poles and Transformers -4), Disty No.2, Disty. No-3; Disty. No-4; Disty no-5; 5A; 6; 6A; 7A; 71/4; 71/4A; 71/2; 8; 9; 11; 12; 12A; 13; 14; 141/2; 16; and 17), Sendhapur minor and sub –minors (Talabana; Derabara; Bhuban; Patapur and Bhabilo)

226. The mitigation measures proposed are:
   - Contractor will ensure proper planning and take necessary precaution while executing the works in consultation with the PP members and local people
   - DoWR with the help of ISPMC Resettlement Specialist survey and a detailed RP plan has been prepared, RP implementation cost will be borne by the executing agency (EA) and the livelihood assistance cost will be borne out of the OIIAWMIP loan fund for RP implementation. The proposed RP budget works out to Rs. 28,58,861 ($52,942) for the canal section from RD 0 to 10 km and Rs. 55,45,893 (US$102,702) for the canal section from RD 10 to 53Km) for more details refer Resettlement Plan for HLC Range -1, prepared and submitted to ADB during July and August 2013.
• During the survey SIO along with the survey team and Design Engineers shall identify the number of trees likely to get affected and to the possible should avoid tree cutting.
• During survey and design the SIO staff shall identity the electric poles in consultation with the design team that need to be shifted some may be obstruction while working

G. Impacts due to Planning & Design Phase

227. The planning phase will include further detailed topographic and geotechnical surveys and hydrological assessments which will provide information for the detailed design of the scheme. As such impacts during this planning phase may be limited to erroneous or inadequate field assessments and data interpretation. These impacts could manifest themselves in the following manner:

• Incorrect survey in order to align / resection of canal. This may result in errors in the alignment and change in the section
• Incorrect hydrological assessment of flood magnitude, drainage problem resulting in under-design of conveyance system, leading to hydraulic/structural failure;
• Incorrect and insufficient geotechnical survey which does not adequately taken into account the geology of the area may result in structural failure.
• Designing of canals to suit the additional command area that are converted to agricultural lands from forest and grazing lands etc.,
• Reconstruction and repair of CD structures to avoid drainage and water logging conditions in the command area.
• Some large girth trees present on the embankment may get effected or may require tree cutting
• Utilities like electric poles / electric lines were found within the ROW on the canal embankment
• No Archaeological sites are within the project area but while excavation work chance find protocol would be used.
• Identification of potential sites or locations for drilling tube wells
• Adequate provision for weed removal especially water hyacinth

228. The mitigation measures proposed would include:
• Thorough hydrological assessment using all available background data and making use of flood simulation software to better estimate optimum design flows. This is to be conducted as the starting point to the design process and will be checked and verified in accordance with project quality assurance procedures;
• A geotechnical survey, topographic survey and a soil survey particularly along the axis of the canal side should be conducted at the beginning of the design process to reduce the risk of costly design revisions during construction, or worse the failure of a scheme due to a design based on erroneous parameters;
• The design should be checked in accordance with project quality assurance and quality control procedures.
• Proper designing of the minor and sub-minors would be carried out keeping in view of the additional carrying capacity to support the increased command areas without affecting the tail end users.
• During project planning proper drainage arrangements shall be planned in consultation with the drainage division. As part of the improvement to the drainage problem within the command, four new super passages have also been considered in the design at RD 6.70; 15.778; 20.56; and 28.70 as a replacement of inlets to avoid water logging of the command area. In addition there are 11 aqueducts along the main canal allowing
Orissa Integrated Irrigated Agriculture & Water Management Investment Program (OIIAWMIP)

drainage flows to pass under the canal at RD 1.26, 4.33; 10.49; 13.53; 22.41; 26.59; 30.00; 34.58; 38.12; 42.27 and 48.22 km which are damaged and are having leakages at present requires treatment and repair to overcome the drainage problem.

- Some large girth trees present on the canal embankment may require removal or tree cutting. During survey and design SIO staff along with survey team and in consultation with design engineers shall identify the number of trees that may get affected. To the possible extent tree cutting shall be avoided, if any tree shall be be removed from the ROW before commencement of actual work it shall be done in consultation and with the permission of State Forest Department. Stacking, transport and storage of wood shall be done as per the relevant norms. All efforts shall be made to preserve the trees to the possible extent.

- Utilities like electric poles lines existing with in ROW may be damaged while widening or strengthening the canal embankment or may cause hindrance to the movement of construction equipment, the SIO in consultation with design team should identify the need for shifting such poles, if they need to be relocated proper planning and contingency for shifting need to be planned by the SIO in consultation with the PMU

- Tube wells locations shall be away from dumps, refuse piles, storage facilities, fuel storage areas, seepage pits, pit toilets, septic tanks, surface water bodies, drains, field fertilized with dung.

H. Impact during Construction Phase

229. Most of the impacts during construction phase are temporary or short term in nature and can be mitigated by using appropriate methods. Impacts during construction phase has been assessed under the following aspects:

230. 
- Pre-construction activities like selection of Camps, Borrow areas, Quarry etc
- Construction Method
- Source of materials and process of procurement of material like earth from borrow areas, Quarry areas, mining of sand
- Transportation of construction materials used in the construction
- Storage of materials
- Work site maintenance and
- Labour related issues like their shelter, facilities etc

231. Most of the impacts during construction phase are temporary or short term in nature and can be mitigated by using appropriate methods.

i. Construction Method

232. Rehabilitation and resection of the existing canal system will involve earth moving equipment like excavators, rollers, tippers, tractors, concrete mixers, vibrators, dozers, etc and stripping and leveling of borrow areas etc. Materials will be brought through trucks and offloaded and lifted through manually (head load) where the approach roads in the minors and sub minors are narrow. Excavation and manual digging and cutting would be involved. The excess material would be disposed off within the low lying areas of right of way.

ii. Sources of Materials

233. The approximate quantities of different materials as identified by SIO staff as part of preliminary estimate is shown in Table 33.
### Table 34: Showing the Approximate quantities of Material required for the sub-project

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Materials</th>
<th>Approx. Estimated Quantities in cum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Moorum</td>
<td>18537.45</td>
</tr>
<tr>
<td>2</td>
<td>Sand</td>
<td>15132.69</td>
</tr>
<tr>
<td>3</td>
<td>Stone Boulders</td>
<td>8814.39</td>
</tr>
<tr>
<td>4</td>
<td>Steel</td>
<td>57.288 MT</td>
</tr>
<tr>
<td>5</td>
<td>Granite Material (IRC G I, III)</td>
<td>21834.86</td>
</tr>
<tr>
<td>6</td>
<td>Granite metal chips</td>
<td>45297.13</td>
</tr>
<tr>
<td>7</td>
<td>cement</td>
<td>8279.539 MT</td>
</tr>
<tr>
<td>8</td>
<td>Laterite stone</td>
<td>1692</td>
</tr>
</tbody>
</table>

### iii. Pre construction activities by the contractor

234. After finalizing the contract before the contractor commence his work the Contractor along with the SIO staff shall identify

- Potential sites for work camps, stockpiles, storage areas and disposal sites with the help of SIO staff and takes the approval of the SIO manager.
- Potential locations for sources of borrow areas, quarry and other materials if any required and take the prior approval of the SIO Manager.

235. The mitigation measures proposed are:

a) Camp
- Contractor shall avoid establishment of camp/plant in forest areas.
- Contractor shall prioritize areas within or nearest possible vacant space within the subproject without affecting property, forest, vegetation, drinking water sources and away from the water bodies and the canal system.
- All construction plants shall be sited sufficiently away from the settlements and agricultural operations or any commercial establishments. Such plants shall be located at least 100m away from the nearest dwelling preferably in the downwind direction.
- The Contractor shall submit a detailed layout plan for all such plant sites established and approved by the SIO manager.
- If any contractor has to establish crushers, hot mix plants and batching plants shall comply with the requirements of the relevant emission control legislations. Consent for Establishment and Operation from state pollution control board Odisha shall be obtained before establishment and operation and a copy to be submitted to the SIO Manager.
- Arrangements to control dust pollution through provision of wind screen, water sprinklers and dust extraction systems shall have to be provided at all such sites (plants).

b) Borrow areas
- If earth material is required or need to procure from borrow pits.
- Finalisation of borrow areas for earth and all logistic arrangements as well as compliance to environmental requirements, as applicable shall be the sole responsibility of the Contractor.
- Contractor shall identify the potential borrow areas and take permission from SIO manager before operating any borrow areas.
- Contractor shall identify the potential borrow areas and take permission from SIO manager before operating any borrow areas. Earth material should be taken from barren land or selected borrow area during lean period as per IS Code 1498 after taking approval from SIO Manager. The criteria of selection is as follows:
Selection Criteria of Borrow areas is as follows: IS 4701: 1982

- No borrow pits shall be dug within 5m of the toe of the embankment, if the depth of the borrow pit is less than 0.5m it shall be after 5m of the toe of the embankment and if the pit depth shall be more than 0.5m it shall be 10m of the toe of the embankment or within such a distance from the toe of the bank where a 4:1 hydraulic gradient line cuts the ground surface, which ever more.
- Borrow pits shall not be more than 1m in depth and 25 m in length.
- A clear distance of 1m shall be left between the pits
- The bed of borrow pits shall be left reasonably smooth and even.
- Contractor shall not be permitted to lift any material from the forest areas.
- The Contractor shall not start borrowing earth from selected borrow area until the mutual agreement is signed between landowner and Contractor. Copy of the document shall be submitted to SIO manager.
- The Contractor in addition to the established practices, rules and regulation will also consider following criteria before finalizing the locations.
  - The borrow area should not be located in agriculture field unless unavoidable i.e. barren land is not available.
  - The borrow pits should not be located along the roads.
  - The loss of productive and agricultural land should be minimum.
  - The loss of vegetation is almost nil or minimum.
  - Sufficient quality of soil is available.
    - The Contractor will ensure the availability of suitable earth. The Contractor shall obtain representative samples from each of the identified borrow areas and have these tested at the site laboratory following a testing programme as approved by the concerned Engineer. It shall be ensured that the fill material compacted to the required density.
- The Contractor after award of the contract may identify the potential private lands for borrow areas and he will take the approval for the borrow areas after testing the suitability and enter into mutual agreement with the land owners. As per the contractual conditions Contractor will arrange sites for borrow areas by making an agreement with the land owner, and he will also ensure to take the necessary permission for operating these borrow areas. The necessary royalty would be deducted by the SIO staff from the Contractor. Contractor would try to procure earth within a lead of 5 Km of the canal system in small quantities.
- Planning of haul roads for accessing borrow areas shall be undertaken during this stage. The haul roads shall be routed to avoid agricultural areas as well as forest areas as far as possible and shall use the existing village roads wherever possible.
  - **The rehabilitation of the borrow areas shall be done by the contractors as per the need of the land owners**

C) Quarry areas

- The Contractor shall finalize the quarry for procurement of construction materials after assessment of the availability of sufficient materials, quality and other logistic arrangements.
- A preliminary survey has been carried out by the SIO and identified the quarry as shown in Annexure -4.
- If extraction shall be done, prioritize sites already permitted by the Mining or concerned department,
- Contractor shall purchase materials and finalize vendors who have valid permissions. The list of potential crusher who has valid license from State Pollution Control board, Odisha is enclosed for reference as Annexure 2.
- If other sites are necessary and the contractor want to use, let the contractor obtain necessary permission from the concerned regulatory authority and inform SIO Manager.
- The contractor shall avoid all forest areas for quarrying
d. Sand

- The sand shall be procured from identified (by SIO) sand mines as far as possible. If Contractor wishes to procure from other sources he shall obtain the lease agreement of the supplier.

236. Most of the impacts during construction phase are temporary or short term in nature and can be mitigated by using appropriate methods.

1. Impact on Land Use:

237. The land acquisition will be not required for the said major irrigation project. No major adverse impact is expected on the living conditions of the inhabitants. Storage of construction materials and silt at construction sites may temporarily change local land use status. The disposal of debris and silt shall be done properly.

238. The mitigation measures proposed are:

239. The Contractor while working in main canal, distributaries and minors and WUAs while working in sub-minors shall follow the below:

- Construction materials / silt should be stored properly and proper appropriate measures shall be taken while disposing the debris and silt.
- To the possible extent the materials like stone and other reusable materials shall be utilized in the construction.
- The iron and wood if any generated shall be taken into the surplus stock and the scrap shall be auctioned as per the procedures of Odisha Water Resources Department.
- The suitable material generated from cutting shall be used in the filling after material testing and obtaining necessary approval from the SIO. The remaining unsuitable material shall be disposed on the left side of the main canal after the toe line within the ROW and also in the adjacent suitable available land along the canal after obtaining necessary permission from the competent authority.

2. Impact of soil – soil erosion and siltation:

240. Soil erosion will take place during earthworks, such as filling and cutting for re-sectioning of the canals and disposal of cutting earth in the spoil bank. The impact will be localized, short-term and minor. These activities will be conducted in the dry season. Mitigating and safeguarding measures to prevent excessive dust will be taken up by the contractor. Further safeguards associated with on-site activity and clean-up will be incorporated into the procurement documents.

241. The mitigation measures proposed are:

242. The Contractor while working in main canal, distributaries and minors and WUAs while working in sub-minors shall follow the below:

- Confirming excavations operations and slope stabilization work during the dry season only and use of silt traps.
- Careful construction planning for surface protection particularly before monsoon season.
- Earth material and selection of Borrow area as per IS code 1498 1970 reaffirmed 1970.
- Earthworks operations shall be strictly limited to the areas to be occupied by the permanent Works and approved borrow areas and quarries, unless otherwise
permitted by the Project Manager. Due provision shall be made for temporary drainage. Erosion and/or instability and/or sediment deposition arising from earthwork operations not in accordance with the Specifications shall be made good immediately.

- The Contractor shall obtain the permission of the Project Manager before opening up any borrow or quarries. Such borrow pits and quarries may be prohibited or restricted in dimensions and depth by the Project Manager where:
  
  - they might affect the stability or safety of the Works or adjacent property;
  - they might interfere with natural or artificial drainage or irrigation;
  - they may be environmentally unsuitable.
  - the contractor should enter into an equitable agreement with landowner for borrow area redevelopment if any landowner requires and after completion of the borrow area the contractor obtains a “Satisfaction Letter” or “No objection Letter” from the land owner on a stamp paper

- At least 14 days before he intends to commence opening up any approved borrow pit or quarry, the Contractor shall submit to the Project Manager his intended method of working and restoration. These shall include but not be limited to:

(i) the location, design and method of construction of any access track;
(ii) the volume and nature of materials to be removed;
(iii) the sequence and method of excavation of materials; and
(iv) measures for controlling runoff and sediment from the site during operations; and

- Proposals for site restoration including approximate finished levels, drainage, erosion and sediment control, slope stabilisation and re-vegetation, including reinstatement of any access track.

- The operation of borrow pits or borrow areas shall not be permitted until the method of working for that particular pit or area has been approved by the Project Manager in writing. Restoration shall be to the satisfaction of the Project Manager.

- Soil erosion will take place during earthworks, such as filling and cutting for re-sectioning of the canals. The impact will be localized, short-term and minor. These activities will be conducted in the dry season. Mitigating and safeguarding measures to prevent excessive dust will be taken up by the contractor such as sprinkling of water. Further safeguards associated with on-site activity and clean-up will be incorporated into the procurement documents.

- The rehabilitation of the borrow areas shall be done by the contractor as per the land owners requirements.

3. Impact on Access Roads and Haulage Roads

243. Deterioration in quality of roads and damage to some of the existing bridges on the canal anticipated while transporting the materials

244. The mitigation measures proposed are:
245. The Contractor while working in main canal, distributaries and minors and WUAs while working in sub-minors shall follow the below:

- Limited construction period, careful planning on the movement of vehicles and restrictions on construction workers movement and adequate monitoring shall be carried out by the contractor
- At project site –in distributaries 22 bridge are in poor shape, therefore proposed for reconstruction, the contractor shall avoid all such bridges (Disty. No. 5- RD0.67; 5.529;
6.199 and 7.199; Disty %a- RD 0.40; 2.89km; Disty -6A – RD 6.468; 7.443km; Disty -6A-1 – RD 0.24; 0.67; Disty 71/4 – RD 0.57; 4.04km; Disty- 8 RD 0.165; 0.655; Disty -9- RD 0.72km; Disty. 11 RD – 0.347; 0.768km; Disty. 12 – RD 2.175km; Disty 12 A- RD 0.90 km; Disty – 141/2 – RD 0.285; Disty no. 16 RD 1.153 and Disty . no 17 0.795 km) while transporting the materials.

- All existing roads used by vehicles of the contractor or any of his suppliers of material shall maintain during construction period. Clear any materials dropped by the vehicles on the access roads.

4. **Impact on Water Quality:**

246. Water used in construction process is not in the large quantities. Thus impact on water quantity is negligible.

(iii) Other minor impacts,
- Inadequate drainage in the temporary camp site resulting poor sanitation condition and surface and ground water pollution and promote breeding of mosquitoes.
- Contamination of ground and surface water due to inappropriate disposal of spoil materials, debris and waste
- Contamination of water due to fuels and lubricants and construction waste waters

247. The mitigation measures proposed are:

248. The Contractor while working in main canal, distributaries and minors and WUAs while working in sub-minors shall follow the below:

- Proper disposal/reuse of construction spoils and silt generated from desilting operation considering environmental safeguard
- Arrangement to drain out wastewater from construction site should be planned as per the site conditions i.e. along the natural gradients. The Contractors are hiring buildings for Camp as these are scattered works. If Contractor establishes any Camp he shall ensure adequate drainage and sanitation at the site.
- The contractor shall procure the fuel from the nearest authorized outlets, if any minor storage if he has to make he shall ensure he doesn't contaminate the area.
- Contractor shall avoid oil spillages etc.,
- Contractor shall not wash his vehicles in the canals
- Contractor shall ensure or install equipment in such a way that the waste water doesn’t enter the canal during monsoon season.

5. **Impact on Air Quality:**

249. Deterioration of air quality would be mainly due to fugitive dust emission from construction activities, and gaseous emissions from construction equipment and vehicular movements. These impacts would be short term in nature and limited to the project site and construction phase only.

250. The mitigation measures proposed are:

251. The Contractor while working in main canal, distributaries and minors and WUAs while working in sub-minors shall follow the below:

- Contractor shall ensure trucks carrying soil, sand and stone will be duly covered to avoid spilling.
- Contractor shall ensure adequate dust suppression measures such as regular sprinkling of water especially at the time of construction along the village corridor will be undertaken. Contractor shall ensure that all construction equipments and vehicles are in good working condition, properly tuned and maintained to keep emissions within permissible limits.
6. Impact on Noise Level:

252. The construction phase will see the operation of only light construction machinery, which is known to emit sounds with moderate decibel (dB). Temporary impacts in the immediate vicinity of project site may occur due to noise generated from construction activities superimposed with existing vehicular noise. The magnitude of impact will depend upon specific types of equipment to be used, the construction methods employed and scheduling of the work. The construction noise will be intermittent and of short duration and mostly during day time.

253. The mitigation measures proposed are:

254. The Contractor while working in main canal, distributaries and minors and WUAs while working in sub-minors shall follow the below:

- In order to reduce these impacts it will be ensured that all construction equipment and vehicles used in construction shall strictly conform to the MoEF / CPCB standards.
- All vehicles exceeding the limits shall be fitted with exhaust silencers.
- Regular servicing of all construction vehicles and machinery shall be done regularly and during servicing the effectiveness of exhaust silencers shall be checked.
- All the construction sites within in 150m of the nearest habitation, noisy construction work such as crushing, operation of DG sets and any high noise construction equipments shall be stopped during night time between 10.00pm and 6.00 am.
- Working hours of the construction activities around sensitive areas like schools / hospitals upt a distance of 100m shall be restricted.

7. Impact on Biological Environment:

255. The project site does not include any rare or endangered species of plant and animals. Thus, no impacts on rare / endangered species are envisaged due to site operations. The increased irrigation facilities in the area will actually enhance the environmental conditions resulting in more greenery. There is also a possibility of planting more trees by farmers due to the easy availability of water. Only few canal side trees will be felled during construction phase.

256. The mitigation measures proposed are:

257. The Contractor while working in main canal, distributaries and minors and WUAs while working in sub-minors shall follow the below:

- The sub-project has provision for planting around 3000 trees along the canal banks against the tree loss if any.
- Plantation of indigenous tree species along the irrigation canal compensates loss of flora.
- The survival of trees needs to be monitored by the WUAs and SIO staff.

8. Impact on Social Environment

258. Most of the social impacts related to development of irrigation project are positive. Some of the impacts and mitigation measures are as follows:

(v)

- The sub project is to be implemented on a community participative basis, with full consultation during the planning and design process.
- Most impacts pertaining to the establishment of the proposed scheme are positive in nature, the soils in the area will become more stable and the area will have a source of irrigation and farm use water, which has a positive impact on the agriculture of the area, thereby enhancing farm incomes.
- The subproject doesn’t entail any land acquisition as existing RoW is sufficient, however, some the sub project would entail loss of assets and livelihood of people.
settled (non–title holders) on either side of the existing canal embankments. The assets loss or encroachments are 124 units (79 residential and 93 commercial) for the canal section RD 0 to 10 km and 178 units (85 residential and 45 commercial) for the canal section RD 10 to 53 km as per the Resettlement Plan of HLC Range -1 prepared during July & August 2013. The proposed RP budget is Rs. 28,58,861 (US$ 52,942) for the canal section RD 0 to 10 km and Rs. 55,45,893 (US$ 102,703), the RP implementation cost will be borne by the executing agency and the Livelihood Assistance cost will be borne out of OIIAWMIP loan fund.

- During the construction phase, there may be an influx of migrant skilled and unskilled workers in the project area. This will be restricted to the construction phase of the project. Efforts will be made to recruit local workers from the area as a priority to create employment opportunities and provide a sense of well being among local people as well as social compatibility among the people.
- Labour/construction camps will be sited based on consultation with local communities with the priority of causing the least disruption to the residents and the surrounding environment. Transport routes for materials to the site, given the proximity of the residents houses etc. will also be selected with community consultation such that minimal disturbance will be made to residents. Given the proximity of the houses to the entry road to the site, the final selection of the entry route to the site for construction purposes will need to be carefully monitored for impacts during the construction period.
- The location of key infrastructure under the Main Contract is located at a distance from the communities, therefore the camp sites are unlikely to cause disturbance to the communities.
- For construction activities undertaken close to communities, movement of construction equipment, vehicles and personnel will be restricted to within work areas, to avoid noise disturbance.
- For construction activities undertaken close to communities, movement of construction equipment, vehicles and personnel will be regulated to avoid traffic jams and noise.
- After completion of all construction activities, excess construction material and debris, is should be removed from the site and disposed of in the low lying areas within ROW.

9. Occupational Health and Safety

259. The potential impacts of occupational hazards are minor due to handling of cement and working in excavations. Few canals (Disty no – 5A, 5, 6A, 71/4A, 71/4; 9; 10, 11, 12; 13; 14) crosses National highway -5 so while working at these places safety requirement is most important. These impacts can be mitigated through proper safety measures. The Construction contractor will be required to

- Develop and implement site specific safety and health plan which include measures like: (a) proper safety measures while working at VRB’s (b) ensuring all workers are provided with and use of Personal Protective Equipments (PPE); (c) contractor ensuring all workers follow the documented procedures and providing health and safety training to the workers
- Providing first aid kits at the work sites at all times
- Providing insurance including medical coverage for workers
- Providing basic amenities like drinking water, clean eating areas, sanitation etc
- Safety and security of the work sites etc
- Providing proper lighting arrangement while working in the nights
- Moving equipment and vehicles equipped with back alarms or flag men
- Maintaining equipment properly and ensuring the workers are not exposed to noise high noise level and use of hearing protection etc if required should be enforced
PROVIDING APPROPRIATE SIGN BOARDS WHILE EXCAVATION / CONSTRUCTION WORK AND PROVIDING PROPER BARRIACDES FOR PREVENTING PEOPLE AND ANIMALS.

10. Community Health and Safety

260. Most sections of the canals are passing through crop lands except few locations canal passes adjacent to the residential localities and canal bank serve as an access road in the areas. So construction contractor should ensure the materials he dumps or equipments he installs will not obstruct the movement of local people. If necessary he will ensure proper safety measures in the areas and take dust suppression measures adequately to prevent dust pollution etc.

261. The section of the canal pass have electric poles along the canal or some times electric lines cross across the canal so the Contractors and WUAs while working shall ensure all precautions and prevent any danger from electrical line or equipments and ensures that they doesn't cause any inconvenience to the people. The SIO shall identify the electric poles / lines that may hinder the movement people and machines during construction and SIO shall request the local electricity department for shifting such poles/ lines by depositing the required shifting charges from the department contingency funds

262. The contractor Camp can cause some temporary disturbance to the surrounding areas if established near the residential areas, so care should be taken while identifying the areas and ensure the place is not polluted due to the storage of oils/ fuels used for construction. While storing fuel the contractor should follow approved practices of storing fuels and train the staff in handling and recovering the materials. Provide proper lighting, sanitation and drinking water facilities for the workers and staff. If the contractor constructs any temporary structures he will follow the approved practices and clear the site and handover to the concerned and take a no –objection or satisfaction letter.

11. Impact on Archaeological sites during excavation

• No Archaeological sites are within the project area but while excavation work chance find protocol would be used.

• While excavating or dismantling any structure if any fossils, coins, articles of value / antiquity and remains of archaeological interest discovered on the site shall be the property of the Government and shall be dealt with as per the provisions of the relevant legislation

• The Contractor shall take reasonable precautions to prevent his workmen or any other persons from damaging or removing any such articles, if any articles found shall be brought to the notice of SIO and Environment Specialist and shall seek the direction of Archaeological Survey of India (ASI) before contractor recommencing the work

G. Operation Phase Impact

1. Impact on Irrigation Water Quality and Quantity

263. Periodic testing of water for chemical and biological properties will help in establishing a database on water quality. This will help in taking planning decision and remedial measures for any adverse impacts on the water quality. The result of the testing if disseminated to the pani panchayats would help in bringing awareness to the local people. Weed removal should be done regularly and community should be made aware of the causes of weed growth and washing of domestic animals and letting
domestic sewage into the canal should be checked with help of pani panchayats. If proper water planning not done with PP there could lead to conflicts within the WUAs. Hence WUA, Apex committee and Distibutary committees shall be involved in the water planning and distribution.

2. Impact on canal system due to weeds

264. Fast multiplying weeds like water hyacinth reduces or impairs flow of water and reduces water availability and damages structures and increases mosquitoes if unchecked. So regular deweeding and checking of weeds by mechanical means or by usage of herbicides if necessary. Pani Panchayat members including community members shall be made aware and encouraged to prepare compost / vermi compost etc. The State Agriculture Policy 2013 emphasizes on the provision of assistance for organic farming i.e. provision of subsidy for establishing vermi compost units, so linkages shall be established with the local agriculture department.

3. Impact on the aesthetics

265. After completion of works, replanting of economically and aesthetically important plants can be ensured along the canal. Greening of the area may offset the ecological effects of the clearing and felling of any trees during construction phase. So monitoring of trees and their survival planted along the canal shall be ensured.

4. Impact due to non-maintenance

266. The responsibility of maintaining main canal, distributaries likes with the SIO staff and minor and sub-minors with WUAs. The responsibilities of PP are as:

- Removal of silt and proper up keeping off minor/ sub-minor/ water courses / field channels and field drains
- Repair and maintenance of inspection path and service roads
- Removal of grass, shrubs and bushes from the canal embankment and canal beds
- Repair and maintenance of all structures in the distribution system handed over for operation and maintenance.
- Restoration of banks – earthwork
- Repairs to lining, painting, plastering and replacing damage portions to structures etc.

5. Soil modification

267. Agriculture practiced by beneficiary farmers will intensify as a result of infrastructure improvements. The nature and extent of improvements will be influenced by agriculture extension. The changes in agriculture practices may result in soil modifications, including increased susceptibility to slumping, reduced nutrient status and impaired structure if the organic matter content is not maintained. These can be mitigated by including sustainable land use practices in the agriculture extension component. These include (i) continued use of traditional terrace construction and management of water flows, (ii) the use of deep rooting grasses and shrubs to further strengthen bunds and terrace walls, and (iii) promotion of continued use of organic based practices like use of bio-fertilizers.

6. Soil and water contamination due to agrochemicals

268. The intensification of agriculture may also result in increased use of agrochemicals including mineral fertilizers and pesticides, which may result in soil and water contamination. Although the use of agrochemical is currently far less than the...
level applied in productive agriculture systems, these need to be carefully monitored, and mitigated through agriculture extension that promotes (i) optimum, informed use of mineral fertilizers in combination with organic manure, (ii) promotion of the concept of integrated pest management, focusing on cost effective and environmentally friendly or benign pest management techniques; and (iii) emphatic discouragement of the use of persistent and banned pesticides.

7. Biodiversity

269. Introduction of high yielding varieties (HYV) if any in the sub project area at the expense of traditional low yielding varieties might affect the agricultural biodiversity of the area. These can be mitigated by establishing linkages with local agriculture department on (i) awareness raising through the agriculture extension component and through training and support to WUAs of the importance of maintaining diversity of farming practices and local landscape, (ii) promoting under the agriculture extension component the maintenance of variety of production of both cash and subsistence crops and (iii) promoting under the agriculture extension component the use of indigenous multi-purpose trees for soil protection, watershed management and cash crop production.

270. The renovation and modernization of this project will have beneficial impacts in terms of improved irrigation and road facilities in the area that increase overall agriculture production and improved economic conditions of the area.
VI. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

A. General

271. Consultation, participation and disclosure was an integral part of environmental assessment process. Stakeholders were consulted about the proposed project. It helped in identification of needs of the local population that is likely to be benefited. Aiming at promotion of public understanding and fruitful solutions of developmental problems such as local needs of farmers and problem and prospect associated with irrigation facilities, various sections of community people and other stakeholders were consulted during household survey as well as through focus group discussions. It was attended by local farmers, gram panchyat members and engineers from DOWR.

272. Discussions were held with groups of beneficiaries during initial field visits and the preparation of feasibility studies for the core sub-projects. During these discussions, the scheme was discussed with groups of beneficiaries, typically 10 to 20 persons in size, and their views sought on key issues including (i) anticipated effects of the proposed scheme improvement, (ii) the extent and nature of changes in land use that may occur with improved supplies of irrigation water (iii) presence of any sites of archaeological or cultural importance (iv) land stability in the around the existing scheme and (v) potential land use conflicts. No serious concerns were raised by villagers during these discussions. Villagers anticipated higher yields of existing crops as well as the ability to produce a greater range of crops, including cash crops, as well marketable surpluses that would increase cash incomes.

273. The consultations were carried during initial IEE report preparation and also during revised IEE updation. The list of villagers met during focus group discussion is given in Annexure 5 & 8 The findings of focus group discussion for individual village are given in Annexure 6 & 7. The key person met and sources of data are given in bibliography that is given in Annexure 9. Household surveys are also conducted in selected villages to understand the present problem of irrigation system.

B. Survey

(i) Household Surveys

274. In order to access the existing environment and likely impacts on irrigation, a house hold survey for 240 households in Solara, Champapur, Birol, Jaganathpur, Bharatpur, Brahmanpada, Paikerapur, Sabo, Sardola, Mirzapur, Gothamuhanapatna and Narendrapur covering head, middle and tail part of village was carried out with the help of local NGO. A common approach is to interview a representative sample of affected people and ask a predefined set of questions, with a response recoded in a standard form. Survey was conducted for sample population that consisted equal representation of gender, age and economic status. Survey also ensured equal distribution of higher and backward cast groups.

275. Points as emerged from household survey is given below,

1. Majority (85%) of the villagers have not heard any thing about the proposed project

2. Majority of the people interviewed during house hold survey feel that the proposed project will be beneficial for their economic upliftment. Those villagers have no agricultural land expressed that they may not be benefited from the project
3. A main source of the drinking water is tube well. In 98% cases as per villager perception quality of drinking water is good for consumption. Only in Pikerapur area few villagers express that salinity problem of the drinking water
4. There is no dust and gaseous emission problem in villages as there is no industry nearby.
5. Local people very much interested to involve in the project as labour. Only few villagers from Jaganathpur are not interested to participate in the project as labour. The villagers have no objection on migration of labour during construction.
6. Most of the villagers (92%) feel that during construction time generated dust and noise may not be a problem
7. Villagers mentioned that there is no big tree along the minor canal. No forest area exist nearby
8. 50 % of the villagers of Birol indicate that they catch fishes from canal. They express that fish population is very less in canal water.
9. Farmers generally used Gromour, DAP, urea, potash as fertilizer without testing the soil
10. 85% of the farmers disclose that they utilise pesticide for control of pest. In 35% cases farmers have not taken any precaution during application of pesticide.
11. 20% cases villagers reported flooding of agricultural land particularly during monsoon.
12. There is field drainage problem (50% cases) during heavy rainfall. As such no salinity problem of the land.
13. Majority of villagers inform that they have no conflict on use of water for irrigation

ii. Focused Group Discussions

276. Focus group discussions (FGDs) were used as an effective tool in the public participation process. The FGDs were held at Birol, Champapur, Gangudia- Bharatpur and Jaganathpur covering head, middle and tail part of village with the help of local NGO active in environmental field to understand the implication of the project impacts on various groups, especially those with a distinct degree of vulnerability.

277. Issues discussed with the village community are regarding environmental aspects are given below.
- Awareness and extent of the project and development components
- Benefits of Project for the economic and social Upliftment of Community
- Labour availability in the Project area or requirement of outside labour involvement
- Sources of water for the villager and quality of available water
- Overall dependency on canal system
- Local disturbances due to Project Construction Work
- Necessity of tree felling, requirement and responsibility for the maintenance of canal bund plantation
- Views on disposal of debris and desilted soil from canal
- Water logging and drainage problem if any
- Forest and sensitive area nearby the project site
 ➢ Movement of wild animal if any within the village  
 ➢ Use of fertilizer, manure, pesticide and bio-fertilizer  
 ➢ Precaution during application of pesticide  
 ➢ Soil salinity problem  
 ➢ Necessity of testing of water and soil.

D. Issues and Action Plan

278. On the basis of FGD some action plan is being recommended for fulfilment of villager demands and issues and mitigation of short term impacts.

Table 35: Major Issues of the Public Consultation

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Key Issues/Demands</th>
<th>Perception of village community</th>
<th>Action to be Taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Awareness of the project – including coverage area</td>
<td>People were not much aware of this project and felt that rehabilitation work for HLC Range 1 major irrigation project will bring prosperity to the village.</td>
<td>Project should be consider for detail design program and to be finalize for funding</td>
</tr>
<tr>
<td>2</td>
<td>Presence of any forest, wild life or any sensitive / unique environmental components nearby the project area</td>
<td>As per the villagers there are no special environmental components nearby. No forest and sensitive locations in and around HLC Range 1 command area</td>
<td>Points are noted</td>
</tr>
<tr>
<td>3</td>
<td>Presence of historical/ cultural sites</td>
<td>As per the villagers there are no special historical/ cultural site</td>
<td>Points are noted</td>
</tr>
<tr>
<td>4</td>
<td>Occurrence of flood</td>
<td>Occurrence of flood noted during heavy rainfall</td>
<td>Proper designing of drainage outlet will be absolutely required during detail designing</td>
</tr>
<tr>
<td>5</td>
<td>Drainage problem – canal water seepage</td>
<td>Water logging and drainage problem exist at few places</td>
<td>Water logging not from seepage only during flooding. Proper drainage arrangement needed</td>
</tr>
<tr>
<td>6</td>
<td>Salinity problem</td>
<td>As per villagers there is no salinity problem of the area.</td>
<td>Points are noted</td>
</tr>
<tr>
<td>7</td>
<td>Testing of soil and water</td>
<td>Generally soil and water not tested</td>
<td>Routine testing of agricultural soil and irrigation water will be essential as per EMP. Provision of soil testing at block level is absolutely necessary. Responsibly may be given to pani panchyat</td>
</tr>
<tr>
<td>8</td>
<td>Cultivation practices during Kharif and Rabi seasons</td>
<td>At present people are cultivating paddy as Kharif crop People like to cultivate economically rewarding crops like ground nut, spices, potato and vegetables in the farms after</td>
<td>Ensure sufficient available water in entire command area during Rabi season by said irrigation scheme</td>
</tr>
<tr>
<td>Sr. No.</td>
<td>Key Issues/Demands</td>
<td>Perception of village community</td>
<td>Action to be Taken</td>
</tr>
<tr>
<td>--------</td>
<td>-----------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>9</td>
<td>Use of fertilizer and pesticides for cultivation of crops</td>
<td>Cultivators used chemical fertilizer like DAP, urea, super phosphate and potassic fertilizer without testing of soil. Use of organic manure, bio-fertilizer are not common. Farmers used pesticides like Phorate, Dimecron, Themate etc. some of them are banned due to long persistence in soil.</td>
<td>Pesticides those have long residual persistence in soil should be banned and close monitoring from agricultural extension side will be required. Before application of chemical fertilizers soil testing will be required to maintain good productive soil health.</td>
</tr>
<tr>
<td>10</td>
<td>Safety aspects during spraying/ application of pesticide</td>
<td>Generally no safety precaution taken up during application of pesticide.</td>
<td>Safety precaution like use of noise mask/ cloth and hand gloves will be suggested through awareness program.</td>
</tr>
<tr>
<td>11</td>
<td>Occurrence of pesticide contamination of surface water and contamination of fish</td>
<td>Contamination of surface water through pesticide leaching and that causing fish death is very rare.</td>
<td>Application of organic fertilizer (that have binding characteristics), bio-fertilizer and non use of banned pesticide are necessary.</td>
</tr>
<tr>
<td>12</td>
<td>Availability of labour during construction time</td>
<td>The farmers agreed to involve in project implementation as labour for excavation and earth work. Availability of labour may be a problem during intense cropping season particularly at head part.</td>
<td>If labour available from beneficiary village no need to bring construction worker from outside. Further community consultation will be required before starting of work.</td>
</tr>
<tr>
<td>13</td>
<td>Access road to project site</td>
<td>Access road to project site (particularly at minor canal side) is either old or non existence. Villagers said if required they will help for construction of temporary road.</td>
<td>Engineering design will be required for transportation of construction material.</td>
</tr>
<tr>
<td>14</td>
<td>Setting up worker camp site within the village</td>
<td>Places available within the village.</td>
<td>Point is noted for further consultation just before setting up workers camp. In most of the areas setting up of labour camp is not necessary since local labour will work at project site.</td>
</tr>
<tr>
<td>15</td>
<td>Dust and noise pollution and disturbances during construction work</td>
<td>May not be a problem for short duration impact due to transporting of materials and villagers will accommodate the impact within their community.</td>
<td>Stringent control measures will be adopted as per EMP. Carefully controlled and continuously implementing soil wetting will be done.</td>
</tr>
<tr>
<td>Sr. No.</td>
<td>Key Issues/Demands</td>
<td>Perception of village community</td>
<td>Action to be Taken</td>
</tr>
<tr>
<td>---------</td>
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</tr>
<tr>
<td>16</td>
<td>Safety of residents during construction phase and plying of vehicle for construction activities</td>
<td>As per the opinion of villagers, since transportation of construction material is minimum it may not be a problem in lieu of implementation of said beneficial and highly needed project</td>
<td>Application of safety measures as per EMP</td>
</tr>
<tr>
<td>17</td>
<td>Conflict among beneficiaries down stream users</td>
<td>Rarely conflict may result among the user but that get solved through Pani Panchyat meeting</td>
<td>Point noted</td>
</tr>
<tr>
<td>18</td>
<td>Enhancement of other facilities</td>
<td>Requirement of sufficient and quality drinking water since water quality in few villages not as per potable water standard</td>
<td>Points are noted and to be addressed in feasibility report</td>
</tr>
<tr>
<td>19</td>
<td>Non availability of canal water during construction</td>
<td>Farmers (particularly head area where irrigation water available) agreed to sacrifice one productive season due to closure of canal during construction Farmers requested that project authority should consider lien period for construction work</td>
<td>In implementation schedule EMP should be consulted</td>
</tr>
</tbody>
</table>

279. The main points that emerge from public consultation are:
- Villagers will cooperate in all aspects for implementation of the prestigious project
- They will accommodate the short term impacts during construction phase
- They need real help from government side for regular testing of agricultural soil and irrigation water
- Environmental awareness program will be required for non use of banned pesticide as well as personal safety during application of pesticide
- Non availability of the canal water during construction work- villagers requested planning of construction work during lien period when irrigation water not much required
- Introduction of organic manure, bio-fertilizer and vermicompost will be required. Farmers have no knowledge on beneficial effect of utilization of bio-fertilizer
- Minimization of conflict among water users through PP intervention
- Solving of drainage problem at water logging area

280. The approach adopted for the Project ensures that all sub-projects are community driven. Design and implementation involves the groups potentially influenced by the schemes, ensuring a very high level of public awareness and involvement at each stage. The IEEs will be made available at the SIO office and consultation with the stake holders will be carried out during construction phase also. The PP will be informed about the project achievement and will made aware of the environmental issues during consultation. In accordance with the main issues identified in the project implementation in the Project Completion Report (PCR), essential elements incorporated into procedures for the Project include (i) understanding the project during the planning phase, (ii) physical and financial contributions during the construction phase, and (iii) taking ownership for operation, maintenance and management of the irrigation systems after construction.

E. Future Consultation and Disclosure

281. During construction period also consultations will be carried out with affected persons, stakeholders. Small meetings with the Pani Panchayat members and
farmers and other vulnerable communities including women will be consulted to address any issues related to the proposed construction. The findings would be presented in the monitoring reports that would be submitted to ADB. The brief executive summary of the IEE would be translated into local language and it would be made available to local people at SIO office.

282. As per the ADB SPS 2009, for Environment Category “B” subprojects, the following documents will be submitted to ADB for disclosure on ADB’s website.

- Draft IEE
- Final IEE
- A new or updated IEE and corrective action plan prepared during project implementation, if any, and
- Environmental Monitoring reports
VII. GRIEVANCE REDRESS MECHANISMS

283. A joint social and environmental redress mechanism will be implemented under the Project. The Grievance Redressal Committee will be constituted at PMU level comprising of the Project Director, Resettlement Officer, Environmental Officer, representative from local non-government organisation (NGOs), elected representative from Panchayat, elected representative from Pani Panchayat representatives of affected persons including vulnerable groups and women in the committee. It is proposed GRC will meet regularly (at least once a month) on a prefixed date. All the grievances of the people will be reviewed and resolved within 6 weeks of the date of submission. Through public consultations and disclosure, the APs will be informed that they have a right to grievance redress. The APs can call upon the support of the NGO to assist them in presenting their grievances or queries to GRC.

284. Grievances and suggestions from local and affected people may come-up related to inappropriate implementation of the project and components of EMP. Grievance re-dress mechanism shall be translated in Odia language and posted to the respective village/Panchayat office by Contractor on behalf of the OIAWMIP at least 6 weeks prior to commencement of construction works.

285. The expected range of grievances to be handled through this mechanism will encompass but not limited to the following: i) nuisance from noise will be resolved within 6 weeks from the date of receipt, dust, borrow earth, disposal of spoil and temporary blocking of access; ii) contamination of receiving water from runoff iii) emissions from increase vehicular traffic and stationary sources like hot mix plant, WMM etc., iv) conflict between local residents and migrant workers; v) ownership of vegetation for clearing; and vi) damage compensation. These issues will be addressed through acknowledgement, evaluation and corrective action and response approach. Grievances from public or stakeholders concerning the project and EMP implementation will be received by the concerned Executive Engineer (SIO Manager) of the sub-project. The Executive Engineer shall refer the application to PD, PMU who with the help of Construction Management Specialist, Quality Control and Assurance Specialist and Environment specialist of ISPMC then assess the grievances/suggestions and if they are found to be genuine and acceptable, shall be moved to GRC and they will be resolved within 6 weeks from the date of receipt. In site the Contractor shall provide a sign board notifying the contact details of the GRC.

286. This mechanism is non-judicial in nature and does not preclude the affected people coursing their grievances to the courts. The corrective action will be started as per the action plan indicated to the stakeholder. The action taken and the outcome shall form a part of half yearly report to ADB.
VIII. ENVIRONMENTAL MANAGEMENT PLAN

1. General

287. This chapter describes the Environmental Management and Monitoring Plan (EMP) to mitigate the likely adverse impacts arising from this project. This chapter also provides institutional requirements and environmental monitoring plans required to effectively implement the environmental mitigation measures into the project.

2. Institutional Arrangement

288. The Figure 12 shows the organization structure of the DoWR for the OIIAWMIP project.

(Note: EIC – Engineer in Chief; C.E – Chief Engineer; S.E - Superintendent Engineer; E.E – Executive Engineer; A.E – Assistant Engineer; J.E – Junior Engineer; CAD – Command Area Development; O & M – Operation & Maintenance; D.D – Deputy Director; PPSU – Pani Panchayat Support unit; ISPMC- Institutional Strengthening and Project Management Consultants)

Figure 11 Organization structure of the DoWR for the OIIAWMIP project
The key agencies involved in implementation of EMP are:

289. DoWR is the Executing Agency for OIIAWMIP. The DoWR has been reorganized to constitute a Command Area Development and Participatory Irrigation Management Directorate (CAD&PIM Directorate) for more effectively integrating irrigation system management and on-farm development through participation of the Pani Panchayats. The Project is being implemented through the existing setup technically headed by EIC. Special Secretary, DoWR has been designated as the Engineer-in-Chief for OIIAWMIP. Special Secretary, DoWR will advise and guide on overall implementation matters including PIM-CAD.

290. A Project Management Unit (PMU) has been established within the CAD&PIM Directorate with a Project Director of the rank of Chief Engineer operating under the overall guidance of Additional Secretary cum Director CAD - PIM with the overall responsibility of program implementation. Chief Engineer cum Project Director, PMU will exercise the powers vested by the OPWD code for execution of all civil works. At the field level Sub-project Implementation Offices (SIO) have been formed to implement the program. For Major irrigation sub-projects the concerned Superintending Engineer is the Sub-project manager and the concerned Executive Engineer is the Sub-project manager for Medium irrigation Sub-projects. The Sub-Project Manager, who is a Superintending Engineer (SE) for major irrigation systems and an EE for medium schemes, will manage the Technical Cell as well as monitor and guide the CAD and PP Support Cells for effective integration and coordination of the sub-project activities, under the support and guidance of PMU, EIC (P&D), and ISPM Consultants provided through regular PMU-SIO meetings.

291. DoWR for effective implementation of Tranche-2 sub-projects under OIIAWMIP proposes to create one Circle, four Divisions, 12 Sub-Divisions under the Chief Engineer – cum – Project Director, PMU.

Circle: One Superintending Engineer S.E will be in charge of circle office. He will be responsible for the managing the Technical Cell as well as monitor and guide the CAD and PP Support Cells for effective integration and coordination of the sub-project activities.

Division: Under each division one Executive Engineer (E.E) will be in charge of the division for, processing tender and bid documents executing the works, check measurement etc. He will ensure the quality of the ongoing works etc.

Sub-Division: Under each sub-division Assistant Engineer / Asst. Executive Engineer shall be in charge of the sub-division office. He will be supported by field functionaries like Junior Engineer and other field for execution, check measurement, monitoring the works and ensuring the quality of the work.

292. The Junior Engineer at the field level will be responsible for day to day environmental monitoring and the overall supervision and responsibility of EMP implementation will be with the concerned SIO (S.E for Major sub project and E.E for medium sub project).

3. Institutional Strengthening and Project Management Consultants (ISPMC)

The ISPMC will have an Environment Specialist, Resettlement Specialist and Indigenous group Specialist who will support the PMU in advising and monitoring the EMP measures with help of SIO Staff and WUAs. The ISPMC will assist in reviewing
all the contractors' monthly environmental reports submitted by Contractors through SIO in consultation with PMU. They will assist the PMU in preparing environmental monitoring reports and other reports like preparation of IEEs, RP and social assessment reports.

4. Responsible for carrying out monitoring measures - Staffing Requirements

293. As per the revised Environmental Assessment and Review Framework (EARF) prepared for the project it states that “PMU will be responsible to undertake to undertake (i) environmental screening at subproject identification stage; (ii) preparation of IEEs/EIAs at subproject appraisal stage; and (iii) environmental management and mitigation during subproject implementation and operational stage. At appraisal, IEEs /EIAs will be done with the engagement of consulting firms who would be guided by the project environmental specialist. Environmental management and mitigation will be undertaken by the construction contractors during construction phase under the supervision of the designated staff in the subproject management offices (SIOs) and monitored by PMU environmental cell. The consultants mobilized for institutional strengthening and project management will also be entrusted to provide necessary capacity development of the DOWR engineers and SIO (S.E for major sub project and E.E for medium subproject) in terms of environmental planning and management”.

294. In lieu of not forming Environmental cell in the PMU, the following arrangement is proposed. The PMU / SIO of DoWR assisted by the WUAs, and the Institutional Strengthening and Project Management Consultants (ISPMC) will be guiding the implementation of the EMP. During project works the responsibility to implement environmental mitigation and safeguards shall be primarily on the Contractor for main canal, distributaries and minors and monitored by the SIO (S.E for major sub project and E.E for medium subproject). The field level Junior Engineer shall be made responsible for monitoring the EMP activities of the Contractors on a day to day basis. The field level Junior Engineer shall be made responsible for the monitoring the EMP activities of the Contractors. The SIO staff and WUAs with the help of ISPMC, Environment Specialist will monitor the EMP implementation of the Contractor.

295. While the implementation of sub-minors shall be on WUAs and monitored by SIO. Pani Panchayat Support Unit (PPSU) is the state level apex agency who is responsible for strengthening the PP activities. Under PPSU one Environmental Monitoring Specialist was recruited to provide capacity building of the PPs. He may be made responsible for the monitoring of WUAs along with SIO staff and these will work under the overall guidance of ISPMC. The WUAs will end up leading O&M responsibilities with the help of Environmental Monitoring Specialist of PPSU, CAD unit.

296. The current structure of DoWR indicates that they have no environmental management system. The WUAs will end up leading O&M responsibilities. Neither DOWR nor the WUAs are currently in a position to assume EMP responsibility. Their institutional capabilities and capacities will have to be developed and strengthened under the Project.

297. So for effective monitoring there is a need to designate or made in charge one Junior Engineer (Technical / Works) from each sub-project to look into the environmental aspects, he may be named as “Environmental Co-coordinator” who would be working under the guidance of National Environment Specialist- ISPMC in addition to his regular duties. The Environmental Co-coordinators would be trained time to time; this will ensure proper and systematic environmental monitoring and
ensuring timely compliances from the contractors. In addition Junior Engineer (O&M) would also be trained along with the Junior Engineer (Technical / Works) who will monitor after the completion of works i.e. during “Operation and Maintenance Period”.

298. To make environmental monitoring integral in to the system and since the projects are of larger scale there is a need for systematic and continuous monitoring. To ensure systematic monitoring the ISPMC had developed formats presented in Annexure-.10 & 10a. The format has to be filled up and submitted by the Contractor / WUAs to SIO staff on a monthly basis. The Contractors / WUAs and SIO shall be trained for filling up the format during the project period.

299. As per the Technical Specification for construction of civil works of ADB assisted schemes, DoWR, Odisha Section – 6 Clause – 1.23 – Sub – Clause 1.23.1& 1.23.3 Contractors shall be designate as “Safety Officers” and he shall also be made responsible for environmental issues and he shall be named as an “Environmental Co-ordinator” from the Contractors side and he shall also be trained on the environmental issues.

5. Reporting System or Responsible for Reporting

300. Reporting system suggested under this project is three tier systems:

- Reporting of the Contractor and WUAs to the SIO staff. (For the civil works implemented by Contractors monitoring shall be done SIO with the help of ISPMC and for the civil works carried out by WUAs monitoring shall be done by SIO with the help of PPSU Environmental Monitoring Specialist).
- Reporting of ISPMC, Environment Specialist after evaluating the contractor reports and evaluating the indicators at PMU level (The reports submitted by Contractors shall be evaluated by ISPMC Environment Specialist and feedback provided to SIO and PMU); In addition, ISPMC, Resettlement Specialist for resettlement issues and Vulnerable Group Specialist responsible for preparing Indigenous People Development Plan (IPDP) and for any social related issues.
- PMU reporting to ADB and PMU shall submit annual environmental monitoring report to ADB

301. Environmental monitoring suggested involves regular checking of the parameters suggested in the environmental management plan to ascertain the mitigation measures are achieved as the work progress. It provides the necessary feedback and midcourse corrections for project management to keep the program to achieve the expected outputs.

302. The reporting system starts with the construction Contractor who is the main executor of the implementation activities. The Contractor will report on a monthly basis to SIO staff as per the check list provided in the Annexure10 to the Junior Engineer. He on the basis of daily visits to the site and observations evaluates and submit to the SIO manager. This will form the basis for evaluating the Contractor on the implementation process.

303. For the works executed by Pani Panchayat or WUAs similar simplified reporting system is proposed, the PPs have to complete a check list Annexure 10a and submit to the SIO staff, the Environment Monitoring Specialist recruited under PPSU, CAD unit will evaluate on a monthly basis and submit to the PMU and ISPMC.
304. The Environment Specialist, ISPMC during period visits spot checks the sites and evaluates the monthly reports submitted by the Junior Engineer and PPSU Environmental Monitoring Specialist and on this basis brief quarterly reports would be prepared and submitted to the PMU and on a yearly basis a detailed report with corrective action plans would be prepared.

305. The PMU will submit the annual reports prepared during the construction phase to the ADB. The PMU in the monthly meetings should discuss the implementation of EMP with the SIO staff and ISPMC and suggest remedial measures to the contractor.

6. Environmental Mitigation Plan

306. An Environmental Management and Monitoring Plan (EMP) is key to ensure a safe and clean environment. The desired results from the environmental mitigation measures proposed in the project can only be obtained with a management plan to assure its proper implementation & function. The EMP outlines the plans for the proper implementation of mitigation measures to reduce the adverse impacts arising out of the project activities. The EMP has been prepared addressing issues such as:

- Mitigation measures for abatement of adverse impacts caused during the construction and operation stage;
- Details of management plans;
- Institutional set up identified/recommended for implementation of the EMP;
- Post project environmental monitoring programme to be undertaken;

7. Expenditures for environmental protection measures and budget for EMP

307. The major impacts due to different project activities and their mitigation measures have been identified in Chapter 5. The environmental parameters checklist for the anticipated impacts and suggested mitigation measures with implementation and supervision responsibility during Pre construction Table 36 and 37; Pre construction activity for the works executed by contractor Table 38, Construction phase for the works executed by contractor Table 39; Preconstruction activities for the works executed by WUAs Table 40 and Construction phase for the works executed by WUAs Table 41 and Operation & maintenance phases Table 42 for the HLC Range - 1subproject is shown below:
<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Field / Activity</th>
<th>Anticipated Impact</th>
<th>Recommended Mitigation Measure</th>
<th>IEE Responsibility</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Land Acquisition</td>
<td>Not likely to cause specific environmental problems as long as steps are made to select sites which are not located in protected/inhabited areas etc</td>
<td>No land acquisition is involved only existing ROW is being used</td>
<td>SIO</td>
<td>PMU</td>
</tr>
<tr>
<td>2</td>
<td>Encroachments</td>
<td>As per the resettlement plan (RP) the sub-project would not entail land acquisition as existing right of way (ROW) is sufficient. However the project would entail loss of assets and livelihood of people settled (non title holders) on either side of the existing embankment. As per the RP prepared during July &amp; August 2013 shows encroachments totals to 124 units (out of which 79 are residential and 45 commercial) in RD 0 to 10km and 178 units (out of which 85 residential and 93 commercial for more details kindly refer RP plan for HLC Range 1) There are some encroachments main canal (Main canal RD 2.07; 22.093; 24.552; 28.687; 33.00; 41.07; 47.091; 48.22; 48.595; 50.00 and 53.00km); Distributary no.1 (RD 4.20; 11.6; 25.80; 29.2 km); Disty no-1C (RD 1.9 to 2.6 km); Disty No. 2 (1.2 to 1.8km); Disty -5 (RD 6.199; 8.199; 8.510 and 8.717 km) Disty. No 5A (RD 3.60km); Disty no 6A-1 (RD 0.060); Disty No. 12A (RD 0.950 km) Distry.No. 14 (RD 5.30; 10.30 and 11.973 km) Disty -16 (RD 0.650 km); Sendapur minor (RD 0.120 km) and Derabara sub-minor (RD 1.20 and 2.0 km); Pattapur sub-minor (RD 0.4 to 0.90 km) were found within the ROW may get affected. Encroachments in the form of fencing or cultivation after toe line with in the ROW may get affected.</td>
<td>Demarcation of ROW need to be done before commencement of the work by the SIO in the presence of PP members. As per the report there are 900 number of encroachments which include residential, commercial as well as common property resources. The cut of date for enumeration survey for encroachment as per RP report was from March to April 2013 The proposed RP budget was to Rs. 28,58,861 ($ 52,942) for the canal section from RD 0 to 10 km and Rs. 55,45,893 (US$102,702) for the canal section from RD 10 to 53Km) for more details refer Resettlement Plan for HLC Range 1 prepared and submitted to ADB during July and August 2013. RP implementation cost shall borne by the executing agency and the Livelihood Assistance cost will be borne out of OIIAWMIP loan fund for RP implementation. All resettlement issues shall be undertaken as per the provisions of R&amp; R policy before construction stage</td>
<td>SIO</td>
<td>PMU &amp; ISPMC R &amp; R Specialist</td>
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<td>Sl. No</td>
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<td>3</td>
<td>Tree cutting</td>
<td>Removal of trees planted on the embankment with in the ROW</td>
<td>To the possible extent the design should reduce or avoid tree cutting. If any trees need to be removed from the ROW before actual commencement of work, it shall be done with permission from the State Forest Department. Stacking, transport and storage of wood shall be done as per the relevant norm. All efforts shall be made to preserve trees including evaluation of minor designs, adjustmentment / alternatives to save trees to the possible extent.</td>
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<tr>
<td>5</td>
<td>Utilities</td>
<td>Electric poles/ electric lines passing adjacent to the canal or crosses the canal(Disty. No-1(Poles and Transformers -4), Disty No.2, Disty. No-3; Disty.No.4; Disty no-5; 5A; 6; 6A; 7A; 71/4; 71/4A; 71/2; 8; 9; 11; 12; 12A; 13; 14; 141/2; 16; and 17), Sendhapur minor and sub –minors (Talabana ; Derabara; Bhuban; Patapur and Bhabilo) within the ROW may be damaged or some need to be shifted</td>
<td>SIO should identify the electric poles which may be a hinderance as per the designs. During survey and detailed estimate a contingency plan for shifting if necessary should be done and the utilities need to be shifted if necessary with the appropriate permission from the electricity department as per the provisions</td>
<td></td>
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<tr>
<td>5</td>
<td>Canal weeds</td>
<td>noticed in the silted portions of the canal</td>
<td>Reduced water flow and delayed water supply</td>
<td>Provision for removal of weeds during resectioning and PP members may be encouraged to prepare vermi compost with the weeds. SIO shall establish linkage with the agriculture department for establishment of vermic-compost units</td>
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**Remarks**

- √: Indicates the measure is recommended for implementation
- SIO: SIO PMU & ISPMC
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<th>Sl. No</th>
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<th>IEE Responsibility</th>
<th>Remarks</th>
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<tr>
<td>6</td>
<td>Religious and community structures</td>
<td>three temples at RD 9.34; 11.834; and 39.12 and Disty no-1 RD 29.2km of the main canal were found with in the ROW any be affected.</td>
<td>The religious structures shall not be affected to the possible extent, the designs shall accommodate, if necessary if the temples need to be relocated this shall be done in consultation with the local people and religious leaders.</td>
<td>SIO</td>
<td>PMU&amp; ISPMC</td>
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### Table 37: Environmental Parameters Checklist for anticipated impacts and Mitigation Measures for HLC Range -1 Sub-project - Pre Construction Activity (Impacts During Design and Survey) - Environmental Mitigation Plan

<table>
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<tr>
<th>Sl. No</th>
<th>Field / Activity</th>
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<th>Recommended Mitigation Measure</th>
<th>IEE</th>
<th>Responsibility</th>
<th>Remarks</th>
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<tr>
<td>1</td>
<td>Trees cutting</td>
<td>Change in Aesthetic value</td>
<td>During detailed, the SIO with the help of survey team and in consultation with Design Engineers shall assess the number of trees that may likely to affect due to the designs. If some trees may be required to be cut to the possible extent trees cut would be minimized Some part of the Project budget shall be consider for tree-planting activities wherever places available along the canal / distributaries. <strong>The proposed tentative budget is shown in Table 45</strong> species suitable to the area need to be selected in consultation with horticultural department. This would also have the added value of employing water conservation methodologies and thus increased sustainability of the system and stability of canal slope.</td>
<td>√</td>
<td>SIO staff with the help of survey team &amp; Contractor PMU, Design Engineer, ISPMC</td>
<td>Some trees are noted on the canal embankment.</td>
</tr>
<tr>
<td>2</td>
<td>Utilities</td>
<td>Electric poles/ electric lines (Disty. No-1(Poles and Transformers -4), Disty No.2, Disty No-3, Disty.No.4; Disty no-5; 5A; 6; 6A; 7A; 71/4; 71/4A; 71/2; 8; 9; 11; 12; 12A; 13; 14; 141/2; 16; and 17), Sendhapur minor and sub-minors (Talabana; Derabara; Bhuban; Patapur and Bhabilo) within the ROW may be damaged or some need to be shifted.</td>
<td>The number of electric poles that need to be shifted shall be identified, if necessary to be shifted SIO shall include some contingency plan for shifting in consultation with the electricity department.</td>
<td>√</td>
<td>SIO Staff PMU and Design Engineer, ISPMC</td>
<td></td>
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*IEE HLC Range 1*
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<tr>
<th>Sl. No</th>
<th>Field / Activity</th>
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<th>Remarks</th>
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<tbody>
<tr>
<td>3</td>
<td>Impact on productivity due to water stagnation after irrigation</td>
<td>Due to drainage problem in few locations – impact on productivity.</td>
<td>During project planning proper drainage arrangement also should be planned. To avoid water logging and as part of the improvement to the drainage problem within the command, four new super passages have also been considered in the design at RD 6.70; 15.778; 20.56; and 28.70 as a replacement of inlets to avoid water logging of the command area. In addition there are 11 aqueducts along the main canal allowing drainage flows to pass under the canal at RD 1.26, 4.33; 10.49; 13.53; 22.41; 26.59; 30.00; 34.58; 38.12; 42.27 and 48.22 km which are damaged and leakages are proposed for repair and treatment.</td>
<td>√</td>
<td>SIO staff with the help of survey team, PMU, Design engineer, ISPMC</td>
</tr>
<tr>
<td>4</td>
<td>Proposed Tube well Drilling</td>
<td>Scope for changes in ground water</td>
<td>A preliminary need assessment and identification of potential sites for the proposed drilling based on the people need to be carried out. The sites or locations identified shall be away from dumps, refuse piles, storage facilities, pit toilets, fields fertilized with dung, septic tanks, drains, away from flooding areas. Identify the locations which are socially acceptable. Care shall be taken not to locate the tube wells adjacent to the existing tube wells, the distance between two tube wells proposed shall be as per the Odisha State Ground water department rules. Odisha state ground water department should be consulted for the proposed depth and precautions while drilling and suitability of the proposed site for quantity and quality before finalisation of the drilling site by the SIO.</td>
<td>√</td>
<td>SIO Staff, PMU</td>
</tr>
</tbody>
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Table 38: Environmental Parameters  Checklist for anticipated impacts and Mitigation Measures for HLC Range -1 Sub-project (Main canal, Distributaries and Minors executed by Contractors) - Pre Construction Activity (Construction Contractor) - Environmental Mitigation Plan

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<th>Sl. No</th>
<th>Field / Activity</th>
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<th>IEE Responsibility</th>
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<tbody>
<tr>
<td>1</td>
<td>Establishment of Camp / Plants</td>
<td>Disruption to traffic flow and sensitive receptors and change landuse aswell as aesthetic value of area</td>
<td>Contractor shall avoid establishment of camp / plant in forest areas. Contractor shall prioritize areas with in or nearest possible vacant space within the subproject without affecting property, forest, vegetation, drinking water sources and away from the water bodies and the canal system. All construction plants shall be sited suitably away from the settlements and agricultural operations or any commercial establishments. Such plants shall be located at least 100m away from the nearest dwelling preferably in the downwind direction. The Contractor shall submit a detailed layout plan for all such plant sites establish and approved by the SIO manager. Arrangements to control dust pollution through provision of wind screen, water sprinklers and dust extraction systems shall have to be provided at all such sites. If any contractor has to establish crushers, hot mix plants and batching plants shall comply with the requirements of the relevant emission control legislations. Consent for Establishment and Operation from state pollution control board Odisha shall be obtained before establishment and operation and a copy to be submitted to the SIO Manager.</td>
<td>√ Contractor</td>
<td>SIO Staff, PMU and ISPMC</td>
</tr>
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<td>Sl. No</td>
<td>Field / Activity</td>
<td>Anticipated Impact</td>
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<td>2</td>
<td>Sources of Materials</td>
<td>Borrow areas- extraction of materials like earth etc., can disrupt natural drainage, vegetation and resulting in accelerated erosion and leading to water stagnation, ponding and pollution</td>
<td>Finalisation of borrow areas for earth and all logistic arrangements as well as compliance to environmental requirements, as applicable shall be the sole responsibility of the Contractor. <strong>Selection Criteria of Borrow areas is as follows:</strong> Contractor shall identify the potential borrow areas and take permission from SIO manager before operating any borrow areas. The Contractor shall not start borrowing earth from selected borrow area until the mutual agreement is signed between landowner and Contractor. Copy of the document shall be submitted to SIO manager. The Contractor in addition to the established practices, rules and regulation will also consider following criteria before finalizing the locations. 1) The borrow area should not be located in agriculture field unless unavoidable i.e. barren land is not available. 2) The borrow pits should not be located along the roads. 3) The loss of productive and agricultural land should be minimum. 4) The loss of vegetation is almost nil or minimum. 5) Sufficient quality of soil is available. 6) The Contractor will ensure the availability of suitable earth. The Contractor shall obtain representative samples form each of the identified borrow areas and have these tested at the site laboratory following a testing programme as approved by the concerned Engineer. It shall be ensured that the fill material compacted to the required density. Planning of haul roads for accessing borrow areas shall be undertaken during this stage. The haul roads shall be routed to avoid a gicultural areas as well as forest areas as far as possible and shall use the existing village roads wherever possible.</td>
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<td>Sl. No</td>
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<tr>
<td>1</td>
<td>Quarry areas-Extraction of materials like earth etc., can disrupt natural drainage, vegetation and resulting in accelerated erosion and leading to water stagnation, ponding and pollution</td>
<td>The Contractor shall finalize the quarry for procurement of construction materials after assessment of the availability of sufficient materials, quality and other logistic arrangements. A preliminary survey has been carried out by the SIO and identified the quarry as shown in Annexure -----. If extraction shall be done, prioritize sites already permitted by the Mining or concerned department. Contractor shall purchase materials and finalize vendors who have valid permissions. The list of potential crusher who has valid license from State Pollution Control board, Odisha is enclosed for reference as Annexure 2. If other sites are necessary and the contractor want to use, let the contractor obtain necessary permission from the concerned regulatory authority and inform SIO Manager.</td>
<td>√</td>
<td>Contractor SIO Staff and PMU ISPMC</td>
<td></td>
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<tr>
<td>2</td>
<td>Sand</td>
<td>The sand shall be procured from identified (by SIO) sand mines as far as possible. If Contractor wishes to procure from other sources he shall obtain the lease agreement of the supplier</td>
<td>√</td>
<td>Contractor SIO Staff and PMU ISPMC</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Drilling of tube wells</td>
<td>Possibility of drilling tube wells in a near distance and change in water quality</td>
<td>The contractor along with SIO staff should locate all the potential sites proposed for drilling and initiate drilling as per the provisions of the contract.</td>
<td>√</td>
<td>Contractor SIO Staff and PMU ISPMC</td>
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<td>Sl. No</td>
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<tr>
<td>1</td>
<td>Inadequate monitoring during construction stages</td>
<td>Potential damages to system likely to be maximised as a result of neglect on part of contractor.</td>
<td>Contractor to execute works in accordance with standard Contract Specification. Provision of site supervisory staff to ensure quality control and adherence to contract requirements. Monthly progress reporting and recording of community complaints/ objections, Issues to be resolved jointly with Project (SIO), PMU and ISPMC.</td>
<td>Contractor SIO Staff, PMU and ISPMC</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Tube well drilling</td>
<td>Scope for contamination of water</td>
<td>The Contractor after tube well drilling shall purge and decontaminate before it is put to use. Tube well shall be sealed and its pedestal shall be sealed properly to avoid mixing of impurities mixing with ground water. A concrete pad around the tube well may be constructed.</td>
<td>Contractor SIO Staff, PMU and ISPMC</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Site clearance - Clearing and grubbing</td>
<td>Damage to existing vegetation</td>
<td>If any vegetation shall be removed from construction site / zone it shall be carried out such that damage to the surrounding vegetation other than identified vegetation proposed for clearing is minimal. Only ground cover/ shrubs that impinge directly at the work site shall be removed prior approval from SIO staff and in consultation with Environment Specialist.</td>
<td>Contractor SIO Staff, PMU and ISPMC</td>
<td></td>
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<tr>
<td>4</td>
<td>Disposal of debris from dismantling structures and spoil</td>
<td>Scope for contamination of soil and blockage of natural drains and pollution of ground water by dumping of construction spoils</td>
<td>To the possible extent the materials like stone and other reusable materials shall be utilized in the construction. The iron and wood generated if any would be disposed off as a surplus stock and scrap shall be auctioned as per the procedures of Odisha Water Resources Department.</td>
<td>Contractor SIO Staff, PMU and ISPMC</td>
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## Orissa Integrated Irrigated Agriculture & Water Management Investment Program (OIIAWMIP)

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<tr>
<td>5</td>
<td>Disposal of canal silt</td>
<td>Affect agricultural land / forest land and change in land use for stacking of silt</td>
<td><strong>The generated cutting material from the canal, the suitable material shall be used in the filling after material testing and obtaining necessary approval from the SIO. The remaining material based on the suitability shall be disposed on the left side of the main canal after toe line within the ROW and also in the adjacent low lying government land available along the main canal after obtaining necessary permission from the competent authority. However, if any excess found shall be disposed off in old borrow areas, quarries, low lying government areas etc after taking appropriate permission from SIO staff if available in excess after testing for pesticide and heavy metals it can be distributed to farmers for using in agricultural fields. If the silt is found to be contaminated then it should not be distributed to farmers however the contractor with the help of SIO shall identify low lying waste lands or play grounds and disposed off in that area and some plantation can be made on this area.</strong></td>
<td>Contractor SIO Staff, PMU ISPMC</td>
<td>Before disposal of silt chemical testing shall be carried out.</td>
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<tr>
<td>6</td>
<td>Stripping, Stocking and Damage to top agricultural soil due to earth work</td>
<td>Loss of productive soil and plant nutrients – impact on production</td>
<td><strong>Before beginning the construction of embankments the surface area of ground to be occupied shall be cleared of all roots and vegetable matter and stripped to a suitable depth as per IS: 4701-1982 (i) Depth of stripping 5.0 to 7.5 cm for soil containing light grass cover (ii) Depth upto bottom of ploughed zone usually 15.0 to 22.5 cm in agricultural land. Top soil may be preserved and reused in turfing activities if possible in borrow areas bunds or if excess shall be distributed to farmers for using in the agricultural lands Project activities shall be carried out during lean period and non-monsoon period for minimizing loss.</strong></td>
<td>Contractor SIO Staff, PMU ISPMC</td>
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<td>7</td>
<td>Earth from Borrow areas for construction</td>
<td>Loss of productive soil and plant nutrients – impact on production</td>
<td>Contractor shall not be permitted to borrow areas in forest areas. Contractor shall identify location of borrow areas and get approval from SIO staff and in consultation ISPMC. Earth material should be taken from barren land or selected borrow area during lean period as per IS Code 1498 after taking approval from SIO Manager. Borrow areas should be dug as per IS code :4701 and prior approval from the competent authorities must be taken before execution and mutual agreement with the land owners should be taken by the contractor and ensure the borrow areas should not have any environmental issues like water logging etc. Borrow areas should be avoided in agricultural areas as well as forest areas. Required permission should be obtained from the authorized person as stipulated in the Orissa state minor minerals act and if operating in private lands mutual agreement and no objection certificate need to be produced to SIO by the contractor.</td>
<td>√ Contractor SIO staff, PMU and ISPMC</td>
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<td>8</td>
<td>Quarry operation</td>
<td>Can disrupt natural drainage, vegetation and results in accelerated erosion</td>
<td>The contractor shall obtain materials from approved quarries only after the consent of Department of mines and Geology and District Administration. If any crusher need to be established it shall be done after obtaining proper consents for establishment and operation from the statutory agencies. All the materials purchased shall be from the approved vendors.</td>
<td>√ Contractor SIO staff, PMU and ISPMC</td>
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<td>9</td>
<td>Storage of Construction materials like sand, stone etc</td>
<td>Storage of construction materials may temporary change local land use</td>
<td>Temporary impact – materials should be stored properly avoiding agricultural lands.</td>
<td>√ Contractor SIO staff, PMU and ISPMC</td>
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<td>10</td>
<td>Use of access roads and Transporting of Construction materials and Haul Road Management</td>
<td>Deterioration in quality of road condition and damage of forest cart roads within the forest areas</td>
<td>Limited construction period, careful planning, restrictions on construction workers movements, adequate monitoring. At project sites in the distributaries 22 bridges are in very poor condition, therefore proposed for reconstruction, the contractor shall avoid all such bridge (Disty No. 5- RD 0.67; 5.529; 6.199 and 7.199; Disty %a- RD 0.40; 2.89km; Disty -6A – RD 6.468; 7.443km; Disty -6A1 – RD 0.24; 0.67; Disty 71/4 – RD 0.57; 4.04km; Disty- 8 RD 0.165; 0.655; Disty -9- RD 0.72km; Disty. 11 RD – 0.347; 0.768km; Disty. 12 – RD 2.175km; Disty 12 A- RD 0.90 km; Disty – 14/2 – RD 0.285; Disty no. 16 RD 1.153 and Disty . no 17 0.795 km) while transporting the materials). All existing roads used by vehicles of the contractor or any of his suppliers of material shall maintain properly during construction period and clear any materials dropped by the vehicles.</td>
<td>Contractor</td>
<td>SIO staff, PMU and ISPMC</td>
</tr>
<tr>
<td>11</td>
<td>Transporting of materials and operation of equipment</td>
<td>Dust pollution – nuisances and health hazards to travellers / neighbours / workers</td>
<td>Contractor shall cover vehicles while transporting materials. Careful planning to minimize and offset losses. Construction practices in accordance with Specification, community consultation prior to detailed design and adequate monitoring shall be carried out. Temporary impact on air quality shall be mitigated by using water sprinklers. Trucks carrying dirt, earth material, sand and metal to and from construction site, should be limited and wetted to prevent material being spilled on public roads. Necessary protection has to be taken to meet relevant emission standards for all construction machinery and vehicle, maintaining construction equipment in good condition and servicing diesel engines for reduction of emissions. The contractor shall ensure all the vehicles, equipments and machinery used for construction are well maintained and confirm that emissions levels comply with the relevant statutory requirements of CPCB and Motor Vehicle Rules</td>
<td>Contractor</td>
<td>SIO staff, PMU and ISPMC</td>
</tr>
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<td>Sl. No</td>
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<td>12</td>
<td>Noise from vehicles, plants and equipments and Vibration hazards</td>
<td>Nuisances to travelers/ workers and neighbors if increase in sound levels – health hazard</td>
<td>All construction plants and equipment used in construction shall strictly conform to the MoEF / CPCB noise standards. All vehicles and equipment used in construction shall be fitted with exhaust silencers. Regular servicing of all construction vehicles and machinery shall be done regularly and during servicing the effectiveness of exhaust silencers shall be checked. All the construction sites with in 150m of the nearest habitation, noisy construction work such as crushing, operation of DG sets and any high noise construction equipment shall be stopped during night time between 10.00 pm and 6.00 am. Working hours of the construction activities around sensitive areas like schools / hospitals upto a distance of 100m shall be restricted.</td>
<td>Contractor SIO staff, PMU and ISPMC</td>
<td></td>
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<tr>
<td>13</td>
<td>Contamination of water due to fuel and lubricants and construction waters</td>
<td>Water pollution from fuel and lubricants</td>
<td>The contractor shall procure fuel from the nearest outlet if any minor storage if he does he shall ensure the land is not contaminated. Contractor shall avoid oil spillage etc. Contractor shall not wash his vehicle in the canals Contractor shall ensure or install equipment in such a way that the waste water doesn’t enter the canal during monsoon period.</td>
<td>Contractor SIO staff, PMU and ISPMC</td>
<td></td>
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<tr>
<td>14</td>
<td>Interference with existing road network and traffic, blockage of access ways Restriction on movements of communities</td>
<td>Disruption of services and land uses and settlements adjacent to the canal. Road in some sections runs parallel to canals.</td>
<td>Close consultation with community during planning and design stages necessary, since houses of local villagers located away from the canal – few canals (Disty no – 5A, 5, 6A, 71/4A, 71/4; 9; 10, 11, 12; 13; 14) crosses National highway -5 so while working at these places safety requirement is most important, construction implementation in accordance with specification, prior agreement with community on alignment of access roads and irrigation infrastructure, and monitoring. Contractor shall if necessary prepare a traffic management plan in consultation with the local police and ensure adequate safety measure.</td>
<td>Contractor SIO staff, PMU and ISPMC</td>
<td></td>
</tr>
<tr>
<td>Sl. No</td>
<td>Field / Activity</td>
<td>Anticipated Impact</td>
<td>Recommended Mitigation Measure</td>
<td>IEE Responsibility</td>
<td>Supervision</td>
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<td>15</td>
<td>Soil Erosion and Siltation</td>
<td>Degraded embankments, damage to soil and general land value. Increased sedimentation build-up and clogging of surrounding waterways.</td>
<td>Employment of stringent construction practices and monitoring Confirming excavations operations and slope stabilisation work during the dry season only and compaction in main canal by powered road roller and vibratory roller and in the distributaries, minors and sub-minors by ordinary compaction Careful construction planning for surface protection particularly before monsoon season and provision of turfing and plantation. Plantation can be taken up on the canal embankments with the available funds under plantation and also with the other ongoing schemes of Govt. Odisha like social forestry programmes etc</td>
<td>Contractor</td>
<td>SIO staff, PMU and ISPMC</td>
</tr>
<tr>
<td>16</td>
<td>Stocking materials or Blockage of natural drainage with materials</td>
<td>Damage to natural drainage patterns Presently natural Drains are dominant with weeds</td>
<td>Assessment of existing drainage channels during construction stages. Contractor to maintain natural drainage, stipulate in Contract Specification. Provision of site supervision during construction implementation.</td>
<td>Contractor</td>
<td>SIO Staff, PMU and ISPMC</td>
</tr>
<tr>
<td>17</td>
<td>Personnel Safety Measures for Labour</td>
<td>Workers health would get affected</td>
<td>Contractor shall provide the necessary personnel Protective Equipment (PPE) like foot wear, gloves, protective goggles and eye –shields etc for workers employed in concrete, crushers, welders and bitumen work Ear plugs to workers exposed to loud noise and workers working in crushers etc if the contractor establishes such sites The contractor shall comply with all the regulations regarding safe scaffoldiing, ladders, working platforms, excavations and safe emans of entry and engress The contractor shall not employ any person below age of 14 years for any work and no pregnant women. The contractor shall comply with all the relevant provisions of the Orissa Buidlings and other Construction Workers (Regulations of Employment and conditions of service) Rules 2002 and shall also comply with the precautions as required for ensuring the safety of thw workmen as per International Labour Organisation (ILO) Convention No 62 as far as thse are applicable to this contract.</td>
<td>Contractor</td>
<td>SIO Staff, PMU and ISPMC</td>
</tr>
<tr>
<td>Sl. No</td>
<td>Field / Activity</td>
<td>Anticipated Impact</td>
<td>Recommended Mitigation Measure</td>
<td>IEE Responsibility</td>
<td>Remarks</td>
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<td>18</td>
<td>Traffic and Safety</td>
<td>Disruption of services and may lead to accidents</td>
<td>The contractor shall take all necessary measures for maintaining the traffic during construction and erect safety barricades, safety ribbons and safety boards including sign boards, flags and other measures as per the requirement</td>
<td>Contractor</td>
<td>Staff, PMU and ISPMC</td>
</tr>
<tr>
<td>19</td>
<td>Protection of public and workers health and safety</td>
<td>Loss of public / workers health status</td>
<td>Project staff to provide basic health and safety trainings to all construction workers and providing periodic health check ups and AIDS awareness camps</td>
<td>Contractor</td>
<td>Staff, PMU and ISPMC</td>
</tr>
<tr>
<td>20</td>
<td>Risk from Electric Poles / lines and electrical equipments</td>
<td>Scope for electric socks and electrocution hazard</td>
<td>While giving level or marking workers should ensure they take preventive measures while working with electric lines. The contractor shall take all required precautions to prevent danger from electrical equipment and ensures that he doesn’t place or stack any material that may cause danger or inconvenience to any person or public. All machines and equipments and lighting used will be as per the IS standards and shall maintain proper without any defects.</td>
<td>Contractor</td>
<td>Staff, PMU and ISPMC</td>
</tr>
<tr>
<td>21</td>
<td>Damage to different flora / fauna habitats</td>
<td>Along the canal side few trees are present during renovation work those trees will be felled and workers might damage the trees for fuel wood or hunting of animals</td>
<td>Close consultation with community prior to detailed design to identify important flora/fauna habitats. Careful planning of infrastructure alignment prior to construction/ implementation. Stipulate in Conditions of Contract and provision of site supervision. Plantation of trees along the irrigation canal compensate loss of flora. Contractor shall take reasonable precaution to prevent his workers from damaging any flora or fauna of the area including fishing or hunting of any animals in the area. If by chance if the contractor sights any animal (wild) the contractor shall inform the SIO staff and Environment Specialist and need to be reported to the State Forest Department immediately and shall take appropriate steps / measures in consultation with Forest Department Officials.</td>
<td>Contractor</td>
<td>Staff, PMU and ISPMC</td>
</tr>
<tr>
<td>Sl. No</td>
<td>Field / Activity</td>
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<td>22</td>
<td>Temporary closure of irrigation system</td>
<td>Non availability of irrigation water and impact on production and livelihood of farmers</td>
<td>Consultation with local Water Users Associations members or Panu Panchayt members before closing the canal. The construction activities will be scheduled after Kharif crop period only. Proper information shall be given to the farmers.</td>
<td>Contractor</td>
<td>SIO Staff, PMU and ISPMC</td>
</tr>
<tr>
<td>23</td>
<td>Digging activity - Chance found Archaeological property</td>
<td>By Chance if any Archaeological property is found while digging</td>
<td>While excavating or dismantling any structure if any fossils, coins, articles of value / antiquity and remains of archaeological interest discovered on the site shall be the property of the Government and shall be dealt with as per the provisions of the relevant legislation. The Contractor shall take reasonable precautions to prevent his workmen or any other persons from damaging or removing any such articles, if any articles found shall be brought to the notice of SIO and Environment Specialist and shall seek the direction of Archaeological Survey of India (ASI) before recommencing the work.</td>
<td>Contractor</td>
<td>SIO Staff, PMU and ISPMC</td>
</tr>
<tr>
<td>24</td>
<td>Provision of Basic Amenities and proper accommodation</td>
<td>Scope for providing improper accommodation and basic amenities to workers</td>
<td>The Contractor shall provide the basic accommodation as per the provisions of the Orissa Building and Construction Workers Rules. The location and layout of the labour camps shall be provided to the SIO staff and take his approval. The Contractor will ensure all the basic amenities like provision of drinking water at work site and camps and proper sanitation facilities and arrangement for eating the food. The drinking water he provides shall be as per the IS 10,500.</td>
<td>Contractor</td>
<td>SIO Staff, PMU and ISPMC</td>
</tr>
<tr>
<td>25</td>
<td>Clearing of site before monsoon and Demobilization of contractor</td>
<td>Scope for not clearing materials from the site especially cutting materials from the canal bed and materials used for construction</td>
<td>The Contractor shall ensure that he clears all the unwanted materials from the canal bed which may affect or obstruct after releasing the water into canal. In the tube wells drilled areas pits if any removed shall be refilled. All excess materials and debris shall be cleared.</td>
<td>Contractor</td>
<td>SIO Staff, PMU and ISPMC</td>
</tr>
<tr>
<td>Sl. No</td>
<td>Field / Activity</td>
<td>Anticipated Impact</td>
<td>Recommended Mitigation Measure</td>
<td>IEE Significant Impact</td>
<td>Responsibility Implementation</td>
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<td>26</td>
<td>Tree plantation</td>
<td>Scope for wrong species selection and not able to survive</td>
<td>SIO shall consult horticultural department before selecting the tree species that would be planted along the canal. Appropriate distance shall be maintained and Regular maintenance shall be carried out.</td>
<td>√</td>
<td>SIO staff</td>
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## Table 40: Environmental Parameters Checklist for anticipated impacts and Mitigation Measures for HLC Range -1 Sub-project (Sub Minors executed by WUAS) – Pre construction Activity - Environmental Mitigation Plan

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Field / Activity</th>
<th>Anticipated Impact</th>
<th>Recommended Mitigation Measure</th>
<th>IEE Responsibility</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sources of Materials</td>
<td>Extraction of materials like earth etc., can disrupt natural drainage, vegetation and resulting in accelerated erosion and leading to water stagnation, ponding and pollution</td>
<td>WUAs shall identify the potential borrow areas and take appropriate permission from the regulating agencies and shall enter into mutual agreements with the land owners. WUAS shall obtain SIO manager permission before operating any borrow areas. Selection Criteria of Borrow areas is as follows: IS 4701: 1982 No borrow pits shall be dug within 5m of the toe of the embankment, if the depth of the borrow pit is less than 0.5m it shall be after 5m of the toe of the embankment and if the pit depth shall be more than 0.5m it shall be 10m of the toe of the embankment or within such a distance from the toe of the bank where a 4:1 hydraulic gradient line cuts the ground surface, which ever more. Borrow pits shall not be more than 1m in depth and 25 m in length. A clear distance of 1m shall be left between the pits. The bed of borrow pits shall be left reasonably smooth and even. WUAs shall not be permitted to lift any materials from the forest areas. WUAs shall purchase materials and finalize vendors who have valid permissions in consultation with SIO staff.</td>
<td>√</td>
<td>PP/ WUAs SIO Staff and PMU ISPMC</td>
</tr>
</tbody>
</table>
Table 41: Environmental Parameters   Checklist for anticipated impacts and Mitigation Measures for HLC Range -1 Sub-project (Sub Minors executed by WUAS) –Construction Phase - Environmental Mitigation Plan

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Field / Activity</th>
<th>Anticipated Impact</th>
<th>Recommended Mitigation Measure</th>
<th>IEE Responsibility</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Inadequate monitoring during construction stages</td>
<td>Potential damages to system likely to be maximised as a result of neglect on part of contractor.</td>
<td>WUAs to execute works in accordance with standard Contract Specification.</td>
<td>√</td>
<td>PP/ WUAs SIO Staff, PMU and ISPMC</td>
</tr>
<tr>
<td>2</td>
<td>Site clearance – Clearing and grubbing</td>
<td>Damage to existing vegetation</td>
<td>If any vegetation shall be removed from construction site / zone before commencement of construction shall be carried out such that damage to the surrounding vegetation other than identified vegetation proposed for clearing is minimal. Only ground cover/ shrubs that impinge directly at the work site shall be removed prior approval from SIO staff and in consultation with Environment Specialist.</td>
<td>√</td>
<td>PP/ WUAs SIO Staff, PMU and ISPMC</td>
</tr>
<tr>
<td>3</td>
<td>Disposal of debris from dismantling structures and spoil</td>
<td>Scope for contamination of soil and blockage of natural drains and pollution of ground water by dumping of construction spoils</td>
<td>To the possible extent the materials like stone and other reusable materials shall be utilized in the construction. The iron and wood generated if any would be disposed off as a dead stock and scrap shall be auctioned as per the procedures of Odisha Water Resources Department.</td>
<td>√</td>
<td>PP/ WUAs SIO Staff, PMU PPSU and ISPMC</td>
</tr>
<tr>
<td>4</td>
<td>Disposal of canal silt</td>
<td>Affect agricultural land and change in land use for stacking of silt</td>
<td>The sub-minors shall generated very low quantities of cutting material if any generates material suitable for filling shall be utilized to the possible extent. The remaining materials shall be utilized in filling in the low lying sections the canal bank within the available ROW. If available in excess after testing for pesticide and heavy metals it can be distributed to farmers for using in agricultural fields.</td>
<td>√</td>
<td>PP/ WUAs SIO Staff, PMU PPSU and ISPMC</td>
</tr>
</tbody>
</table>

**Remarks:** Before disposal of silt chemical testing will be required.
<table>
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<tr>
<th>Sl. No</th>
<th>Field / Activity</th>
<th>Anticipated Impact</th>
<th>Recommended Mitigation Measure</th>
<th>IEE Responsibility</th>
<th>Remarks</th>
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<tr>
<td>5</td>
<td>Stripping, Stocking and Damage to top agricultural soil due to earth work</td>
<td>Loss of productive soil and plant nutrients – impact on production</td>
<td>Before beginning the construction of embankments the surface area of ground to be occupied shall be cleared of all roots and vegetable matter and stripped to a suitable depth as per IS: 4701 - 1982 &lt;br&gt; (i) Depth of stripping 5.0 to 7.5 cm for soil containing light grass cover &lt;br&gt; (ii) Depth upto to bottom of ploughed zone usually 15.0 to 22.5 cm in agricultural land. &lt;br&gt; Top soil may be preserved and resued in turfing activities if possible in borrow areas bunds or if excess shall be distributed to farmers for using in the agricultural lands &lt;br&gt; Project activities shall be carried out during lean period and non-monsoon period for minimizing loss.</td>
<td>√</td>
<td>PP/ WUAs</td>
</tr>
<tr>
<td>6</td>
<td>Earth from Borrow areas for construction</td>
<td>Loss of productive soil and plant nutrients – impact on production</td>
<td>WUAs shall identify location of borrow areas and get approval from SIO staff and in consultation ISPMC. &lt;br&gt; Earth material should be taken from barren land or selected borrow area during lean period as per IS Code 1498 after taking approval from SIO Manager. &lt;br&gt; Borrow areas should be dug as per IS code 4701 and prior approval from the competent authorities must be taken before execution and mutual agreement with the land owners should be taken by the contractor and ensure the borrow areas should not have any environmental issues like water logging etc. &lt;br&gt; Borrow areas should be avoided in agricultural areas as well as forest areas. &lt;br&gt; Required permission should be obtained from the authorized person as stipulated in the Orissa state minor minerals act and if operating in private lands mutual agreement and no objection certificate need to be produced to SIO by the contractor.</td>
<td>√</td>
<td>PP/ WUAs</td>
</tr>
<tr>
<td>7</td>
<td>Quarry operation</td>
<td>Can disrupt natural drainage, vegetation and results in accelerated erosion</td>
<td>The WUAS shall obtain materials from approved quarries only. &lt;br&gt; All the materials purchased shall be from the approved vendors.</td>
<td>√</td>
<td>PP/ WUAs</td>
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<td>Sl. No</td>
<td>Field / Activity</td>
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<tr>
<td>8</td>
<td>Storage of Construction materials like sand, stone etc</td>
<td>Storage of construction materials may temporarily change local land use</td>
<td>Temporary impact – materials should be stored properly avoiding agricultural lands in consultation with local people</td>
<td>√</td>
<td>PP/ WUAs SIO, PMU, PPSU, and ISPMC. Only rehabilitation on work no change in land use</td>
</tr>
<tr>
<td>9</td>
<td>Use of access roads and Transporting of Construction materials and Haul Road Management</td>
<td>Deterioration in quality of road condition</td>
<td>Limited construction period and small quantities of materials involved, so care need to be taken and if any damages the WUAs shall maintain</td>
<td>√</td>
<td>PP/ WUAs SIO, PMU, PPSU, and ISPMC.</td>
</tr>
<tr>
<td>10</td>
<td>Interference with existing road network and traffic, blockage of access ways. Restriction on movements of communities</td>
<td>Disruption of services and land uses</td>
<td>Close consultation with community during planning and design stages necessary. Since local communities are involved they will take precautions in protecting the interest and safety of the people living around. Construction implementation in accordance with specification, prior agreement with community on alignment of access roads and irrigation infrastructure, and monitoring</td>
<td>√</td>
<td>PP/ WUAs SIO, PMU, PPSU, and ISPMC.</td>
</tr>
<tr>
<td>11</td>
<td>Soil Erosion and Siltation</td>
<td>Degraded embankments, damage to soil and general land value. Increased sedimentation build-up and clogging of surrounding waterways.</td>
<td>Employment of stringent construction practices and monitoring Confirming excavations operations and slope stabilisation work during the dry season Careful construction planning for surface protection particularly before monsoon season and provision of turfing and plantation</td>
<td>√</td>
<td>PP/ WUAs SIO, PMU, PPSU, and ISPMC.</td>
</tr>
<tr>
<td>12</td>
<td>Stocking materials or Blockage of natural drainage with materials</td>
<td>Damage to natural drainage patterns Presently natural Drains are with weeds</td>
<td>Assessment of existing drainage channels during construction stages. WUAs to maintain natural drainage, stipulate in Contract Specification. Provision of site supervision during construction implementation.</td>
<td>√</td>
<td>PP/ WUAs SIO, PMU, PPSU, and ISPMC. Co-ordination with CADA division recommended</td>
</tr>
<tr>
<td>Sl. No</td>
<td>Field / Activity</td>
<td>Anticipated Impact</td>
<td>Recommended Mitigation Measure</td>
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<tr>
<td>13</td>
<td>Protection of public and workers health and safety</td>
<td>Loss of public / workers health status</td>
<td>Awareness to workers / staff to provide basic health and safety trainings to all construction workers</td>
<td>√</td>
<td>PPSU Staff, PMU PPSU and ISPMC</td>
</tr>
<tr>
<td>14</td>
<td>Risk from Electric Poles / lines and electrical equipments</td>
<td>Scope for electric socks and electrocution hazard</td>
<td>While giving level or marking workers should ensure they take preventive measures while working with electric lines. The WUAs shall take all required precautions to prevent danger from electrical equipments and ensures that he doesn’t place or stack any material that may cause danger or inconvenience to any person or public</td>
<td>√</td>
<td>PP/ WUAs Staff, PMU PPSU and ISPMC</td>
</tr>
<tr>
<td>15</td>
<td>Damage to different flora/fauna habitats</td>
<td>Along the canal side few trees are present during renovation work those trees will be felled and workers might damage the trees for fuel wood or hunting of animals</td>
<td>WUAS shall take reasonable precaution to prevent his workers from damaging any flora or fauna of the area including fishig or hunting of any animals in the area. If by chance if the WUAS sights any animal (wild) the WUAs shall inform the SIO staff and Environment Specialist and need to be reported to the State Forest Department immediately and shall take appropriate steps / measures in consultation with Forest Department Officials</td>
<td>√</td>
<td>PP/ WUAs SIO Staff, PMU PPSU and ISPMC Canal RD - through RF and .....through village forest</td>
</tr>
<tr>
<td>16</td>
<td>Digging activity - Chance found Archaeological property</td>
<td>By Chance if any Archaeological property is found while digging</td>
<td>While excavating or dismantling any structure if any fossils, coins, articles of value / antiquity and remains of archaeological interest discovered on the site shall be the property of the Government and shall be dealt with as per the provisions of the relevant legislation The WUAs shall take reasonable precautions to prevent his workmen or any other persons from damaging or removing any such articles, if any articles found shall be brought to the notice of SIO and Environment Specialist and shall seek the direction of Archaeological Survey of India (ASI) before WUAs recommencing the work</td>
<td>√</td>
<td>PP/ WUAs SIO Staff, PMU PPSU and ISPMC</td>
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<td>Sl. No</td>
<td>Field / Activity</td>
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<td>No Significant Impact</td>
<td>Significant Impact</td>
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<td>Minor</td>
<td>Moderate</td>
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<tr>
<td>17</td>
<td>Clearing of site before monsoon and Demobilization of contractor</td>
<td>Scope for not clearing materials from the site especially cutting materials from the canal bed and materials used for construction</td>
<td>The WUAs shall ensure that he clears all the unwanted materials from the canal bed which may effect or obstruct after releasing the water into canal</td>
<td>√</td>
<td>WUAs</td>
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Table 42: Environmental Parameters Checklist for anticipated impacts and Mitigation Measures for HLC Range - Sub-project – Operation and Maintenance Phase - Environmental Mitigation Plan

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<tr>
<th>Sl. No</th>
<th>Field / Activity</th>
<th>Anticipated Impact</th>
<th>Recommended Mitigation Measure</th>
<th>IEE</th>
<th>Responsibility</th>
<th>Remarks</th>
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<td></td>
<td>No Significant Impact</td>
<td>Significant Impact</td>
<td>Implementation</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Minor</td>
<td>Moderate</td>
<td>Major</td>
</tr>
<tr>
<td>1</td>
<td>Overall Environmental problem</td>
<td>Competent O&amp;M plus monitoring necessary.</td>
<td>Monitoring of irrigation water quality and soil quality will be required during operation phase for maintaining best productive environment. The proposed sampling locations, parameters to be monitored and frequency are provided in Table 43 and proposed buget and stage of testing is provided in Table 45 of this chapter.</td>
<td>√</td>
<td>WUAs &amp; SIO staff</td>
<td>PMU and PPSU Env. Monitoring Specialist</td>
</tr>
<tr>
<td>2</td>
<td>Impact on canal system due weeds growth</td>
<td>Fast multiply water hyacinth reduces or impairs flow of water and reduces water availability, damages structures and becomes habitat of mosquitoes</td>
<td>Regular deweeding and checking of weeds by mechanical means or by usage of herbicides if necessary. Involving community and PP members in undertaking regular cleaning and encouraging the PP to prepare compost with the help of agriculture department.</td>
<td>√</td>
<td>WUAs &amp; SIO staff</td>
<td>PMU and PPSU Env. Monitoring Specialist</td>
</tr>
<tr>
<td>Sl. No</td>
<td>Field / Activity</td>
<td>Anticipated Impact</td>
<td>Recommended Mitigation Measure</td>
<td>IEE Responsibility</td>
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<td>3</td>
<td>Impact due to non-maintenance</td>
<td>Damages to the earthwork due to raincuts, damage to the structures etc</td>
<td>The responsibility of maintaining main canal, distributaries lies with the SIO staff and minor and sub-minors with WUAs. The responsibilities of PP are as: Removal of silt and proper up keeping off minor/ sub-minor/ water courses / field channels and field drains Repair and maintenance of inspection path and service roads Removal of grass, shrubs and bushes from the canal embankment and canal beds Repair and maintenance of all structures in the distribution system handed over for operation and maintenance. Restoration of banks – earthwork Repairs to lining, painting, plastering and replacing damage portions to structures etc.</td>
<td>WUAs &amp; SIO staff</td>
<td>PMU and PPSU Env. Monitoring Specialist</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Non Restoration of aesthetics after construction activity overall ecological impact.</td>
<td>Ecological unbalancing</td>
<td>Monitoring of survival of tree planted along the canal. The SIO with the help of contractor / local Forest Department / Horticulture Department shall monitor the survival. After completion of works, replanting of economically and aesthetically important plants can be ensured along the canal area. Greening of this area may offset the ecological effects of the clearing and felling of trees during the construction phase. Further in course of time the population of avian fauna may go up and enhance the biological diversity.</td>
<td>Contractor / WUAs &amp; SIO staff / Local Forest Department / Horticulture Department</td>
<td>PMU and PPSU Env. Monitoring Specialist</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Modification of soil practices</td>
<td>The changes in agriculture practices may result in soil modifications, including increased susceptibility to slumping, reduced nutrient status and impaired structure if the organic matter content is not maintained.</td>
<td>Continued use of deep rooting grasses and shrubs to further strengthen bunds and terrace walls, and promotion of continued use of organic based practices – use of bio fertilizer and vermi-compost.</td>
<td>WUAs &amp; SIO staff and agriculture dept</td>
<td>PMU and PPSU Env. Monitoring Specialist</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Soil and water contamination due to agrochemicals</td>
<td>Increased use of agrochemicals including mineral fertilizers and pesticides, which may result in soil and water contamination.</td>
<td>Optimum utilization of chemical fertilizer and discourage utilization of long persistence and banned pesticide Use of bio fertilizer and vermi-compost to minimize contamination Post project water quality both surface and ground water, silt and soil shall be monitored for the pollutants</td>
<td>WUAs &amp; SIO staff and agriculture dept</td>
<td>PMU and PPSU Env. Monitoring Specialist</td>
<td>Presently use of bio-fertilizer and organic manure is limited</td>
</tr>
<tr>
<td>Sl. No</td>
<td>Field / Activity</td>
<td>Anticipated Impact</td>
<td>Recommended Mitigation Measure</td>
<td>IEE</td>
<td>Responsibility</td>
<td>Supervision</td>
</tr>
<tr>
<td>-------</td>
<td>------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------</td>
<td>-----</td>
<td>----------------</td>
<td>-------------</td>
</tr>
<tr>
<td>7</td>
<td>Impact on biodiversity</td>
<td>Biodiversity may be affected by increased specialized mono-cropping, use of agrochemicals, introduction of alien (invasive) species, introduction of high yielding varieties (HYV).</td>
<td>Awareness raising through the agriculture extension component and promoting under the agriculture extension component the use of indigenous multi-purpose trees for soil protection, watershed management and cash crop production, optimum use of agrochemical</td>
<td>No Significant Impact</td>
<td>Supervision</td>
<td>WUAs &amp; PPSU</td>
</tr>
</tbody>
</table>
8. Environmental Monitoring Plan

Environmental Monitoring is an essential component of any developmental project, it is an integral part of any environmental assessment process. Any intervention in the form of development shall have complex-inter relationships between people, natural resources, biotic and other forces resulting in a new environment. So it is essential to monitor critical environmental parameters in the pre-post project scenario, during and post project scenario. The monitoring program includes environmental parameters, description of sampling stations, frequency of monitoring, applicable standards, responsible parties is shown in Table 43 and the parameters suggested for monitoring ground water, surface water, silt and soil is presented in Annexure 11, 11a &b.

The monitoring can be carried out by (i) PMU outsourcing to a Laboratory for all the subprojects, or (ii) SIO outsourcing to a laboratory directly. The suggested parameters, description of sampling locations and different stages of monitoring required along with suggested frequency is shown in Table 35.

The environmental monitoring during the different phases of the subproject implementation can be carried out by a recognized laboratory (i.e approved by State Pollution Control Board, Odisha or National Accreditation Board for Testing and Calibration Laboratory (NABL) or National Accreditation Board for Education and Training (NABET) or any Ministry of Environment and Forests (MoEF) recognized laboratory.
<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Parameter to be monitored</th>
<th>Parameter / Indicators</th>
<th>Location</th>
<th>Responsibility</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pre-Construction Stage (Baseline data)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Ground water (IS: 10,600)</td>
<td>Physico, chemical, bacteriological parameters. Total of 34 parameters including 4 pesticide residue as per IS: 10,600:1991 details in Annexure 10</td>
<td>preferably from the newly drilled tube wells under the project (6 locations)</td>
<td>SIO/Laboratory</td>
<td>Once before start of the project for baseline data</td>
</tr>
<tr>
<td>2</td>
<td>Surface water (IS: 2296: 1992)</td>
<td>Physico, chemical, bacteriological parameters. Total 39 parameter including 4 pesticide residue as per IS: 2296: 1992, details in Annexure 10a</td>
<td>Barrage and canal water (6 locations)</td>
<td>SIO/Laboratory</td>
<td>Once before start of the project for baseline data</td>
</tr>
<tr>
<td>3</td>
<td>Silt</td>
<td>Physico-chemical, micro and macro nutrients and pesticide residue. Total 27 parameters including 4 pesticide residue details in Annexure 10b</td>
<td>Silt from Canal (6 locations)</td>
<td>SIO/Laboratory</td>
<td>Once before start of the project for baseline data</td>
</tr>
<tr>
<td>4</td>
<td>Soil</td>
<td>Physico-chemical, micro and macro nutrients and pesticide residue. Total 27 parameters including 4 pesticide residue details in Annexure 10b</td>
<td>(Soils from canal Adjacent - agricultural fields and preferably water logged areas) (6 locations)</td>
<td>SIO/Laboratory</td>
<td>Once before start of the project for baseline data</td>
</tr>
<tr>
<td><strong>Construction Stage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Ground water (IS: 10,600)</td>
<td>Physico, chemical, bacteriological parameters. Total of 34 parameters including 4 pesticide residue as per IS: 10,600:1991 details in Annexure 10</td>
<td>preferably from the newly drilled tube wells under the project (6 locations)</td>
<td>SIO/Laboratory</td>
<td>Twice a year for the construction of 3 years</td>
</tr>
<tr>
<td>2</td>
<td>Surface water (IS: 2296: 1992)</td>
<td>Physico, chemical, bacteriological parameters. Total 39 parameter including 4 pesticide residue as per IS: 2296: 1992, details in Annexure 10a</td>
<td>Barrage and canal water (6 locations)</td>
<td>SIO/Laboratory</td>
<td>Twice a year for the construction of 3 years</td>
</tr>
<tr>
<td>3</td>
<td>Silt</td>
<td>Physico-chemical, micro and macro nutrients and pesticide residue. Total 27 parameters including 4 pesticide residue details in Annexure 10b</td>
<td>Silt from Canal (6 locations)</td>
<td>SIO/Laboratory</td>
<td>Twice a year for the construction of 3 years</td>
</tr>
<tr>
<td>4</td>
<td>Soil</td>
<td>Physico-chemical, micro and macro nutrients and pesticide residue. Total 27 parameters including 4 pesticide residue details in Annexure 10b</td>
<td>(Soils from canal Adjacent - agricultural fields and preferably water logged areas)</td>
<td>SIO/Laboratory</td>
<td>Once in a year times during construction period of 3 yrs</td>
</tr>
</tbody>
</table>
### Orissa Integrated Irrigated Agriculture & Water Management Investment Program (OIIAWMIP)

<table>
<thead>
<tr>
<th>Operation &amp; Maintenance Phase (Post Project)</th>
<th>6 Dust Monitoring</th>
<th>Visual Observation</th>
<th>Entire Project Corridor</th>
<th>SIO</th>
<th>Daily</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Noise Observation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operation &amp; Maintenance Phase (Post Project)</th>
<th>6 Dust Monitoring</th>
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<th>Entire Project Corridor</th>
<th>SIO</th>
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<tbody>
<tr>
<td>6 Noise Observation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operation &amp; Maintenance Phase (Post Project)</th>
<th>6 Dust Monitoring</th>
<th>Visual Observation</th>
<th>Entire Project Corridor</th>
<th>SIO</th>
<th>Daily</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Noise Observation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operation &amp; Maintenance Phase (Post Project)</th>
<th>6 Dust Monitoring</th>
<th>Visual Observation</th>
<th>Entire Project Corridor</th>
<th>SIO</th>
<th>Daily</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Noise Observation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Operation & Maintenance Phase (Post Project)

<table>
<thead>
<tr>
<th>No.</th>
<th>Activity</th>
<th>Description</th>
<th>Sampling Location</th>
<th>Sampling Frequency</th>
<th>Location for Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Groundwater (IS: 10,600)</td>
<td>Physico-chemical, bacteriological parameters. Total of 34 parameters including 4 pesticide residue as per IS: 10,600:1991 details in Annexure 10</td>
<td>preferably from the newly drilled tube wells under the project</td>
<td>SIO/Laboratory</td>
<td>Once after completion of works</td>
</tr>
<tr>
<td>2</td>
<td>Surface water (IS: 2296: 1992)</td>
<td>Physico-chemical, bacteriological parameters. Total 39 parameter including 4 pesticide residue as per IS: 2296: 1992, details in Annexure 10a</td>
<td>Barrage and canal water (6 locations)</td>
<td>SIO/Laboratory</td>
<td>Once after completion of works</td>
</tr>
<tr>
<td>3</td>
<td>Silt</td>
<td>Physico-chemical, micro and macro nutrients and pesticide residue. Total 27 parameters including 4 pesticide residue details in</td>
<td>Silt from Canal (6 locations)</td>
<td>SIO/Laboratory</td>
<td>Once after completion of works</td>
</tr>
<tr>
<td>4</td>
<td>Soil</td>
<td>Physico-chemical, micro and macro nutrients and pesticide residue. Total 27 parameters including 4 pesticide residue details in</td>
<td>(Soils from canal adjacent - agricultural fields and preferably water logged areas) (6 locations)</td>
<td>SIO/Laboratory</td>
<td>Once after completion of works</td>
</tr>
</tbody>
</table>

HLC Range-1 sub project Locations for monitoring: (1.) Barrage /R (2.) Main canal 15.778km, (3) RD 53.09km (4) Distributary 5 RD 6.5 km and (5) Distributary 16 RD 1.800
9. **Performance Indicators:**

311. The monitoring programme constitutes performance indicators (Table 44) and necessary budgetary provisions.

### Table 44: Showing the Performance Indicators

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Indicator</th>
<th>Description of the item</th>
<th>Stage</th>
<th>Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Statutory Clearance</td>
<td>Obtaining CFE &amp; CFO - Statutory requirement from regulatory bodies</td>
<td>Pre construction and construction</td>
<td>Contractor</td>
</tr>
<tr>
<td>2</td>
<td>Borrow area</td>
<td>No. of Borrow areas identified and verified No. of sites redevelopment and no-objection certificate produced after handing over site</td>
<td>Pre and Post Construction</td>
<td>Contractor</td>
</tr>
<tr>
<td>3</td>
<td>Quarry</td>
<td>No. of Quarry sites identified and verified No. of sites redevelopment and no-objection certificate produced after handing over site</td>
<td>Pre and Post Construction</td>
<td>Contractor</td>
</tr>
<tr>
<td>4</td>
<td>Disposal sites</td>
<td>Quantity of Debris and Spoil disposed off</td>
<td>Construction and Post Construction</td>
<td>Contractor</td>
</tr>
<tr>
<td>5</td>
<td>Dust Control</td>
<td>No. of times watering carried out</td>
<td>Construction period</td>
<td>Contractor</td>
</tr>
<tr>
<td>6</td>
<td>Encroachments</td>
<td>No. of Encroachments identified No. of encroachers and squatters rehabilitated as per RAP provisions</td>
<td>Pre and Post Construction</td>
<td>SIO</td>
</tr>
<tr>
<td>7</td>
<td>Environmental monitoring</td>
<td>No. of times testing( Ground water, Surface water, Silt and Soil) carried out during construction and operation</td>
<td>Pre, Construction and Post Construction</td>
<td>Contractor /SIO</td>
</tr>
<tr>
<td>8</td>
<td>Use of PPE</td>
<td>No. of work sites provided with PPE</td>
<td>Construction</td>
<td>Contractor</td>
</tr>
<tr>
<td>9</td>
<td>Usage of safety measures and sign boards</td>
<td>No. of sites safety arrangements made and sign boards installed</td>
<td>Construction</td>
<td>Contractor</td>
</tr>
<tr>
<td>10</td>
<td>Turfing</td>
<td>Length of turfing carried out</td>
<td>Construction and post construction</td>
<td>Contractor</td>
</tr>
<tr>
<td>11</td>
<td>Plantation</td>
<td>No. of trees cut and no. of trees planted</td>
<td>Construction and Post Construction</td>
<td>Contractor and SIO</td>
</tr>
<tr>
<td>12</td>
<td>Health camps</td>
<td>No. of medical and health camps including AIDS awareness camps conducted</td>
<td>Construction</td>
<td>Contractor</td>
</tr>
</tbody>
</table>
10. **Environmental Management and Monitoring Plan (EMMP) Costs**

312. Most of the mitigation measures require the Construction Contractors to adopt good site practice, which should be part of their normal regular procedures, so there are unlikely to be major costs associated with compliance. In addition to this, any costs of mitigation by the construction contractors or SIO are included in the budgets for the civil works. All the environmental costs like dust suppression (sprinkling of water), borrow area rehabilitation, haulage road maintenance, safety etc are all inclusive under overheads of item rates as per revised schedule of rates, Govt. of Odisha.

313. Environmental monitoring will be integrated into the Project performance monitoring and evaluation (PPME) system. The majority of activities involved are translating actions suggested in the EMP to be implemented by the Construction Contractor and WUAs. The implementation period stipulated for the sub-projects are three years of construction phase and three years of post construction phase is suggested for environmental monitoring. The environmental monitoring suggested here is developed keeping in view of the needs of the Department of Water Resources as suggested in the EARF. The DoWR want to monitor surface water and ground water to assess the impacts of upstream urbanization and industrialization and it also want to monitor level of deterioration of water quality due to increased use of fertilizers and pesticides within and outside the command area. In addition the department wants to assess contaminants in the silt and soil in the command area. So the SIO, DoWR will be responsible for the implementation of environmental monitoring (Surface water, Ground water, Soil and Silt testing).

314. The monitoring shall be carried out by recognized laboratories (i.e., laboratories approved by State Pollution Control Board, Odisha, or National Accreditation Board for Testing and Calibration Laboratory (NABL) or (National Accreditation Board for Education and Training (NABET) or any Ministry of Environment and Forests (MoEF) recognized laboratory).

315. The impacts arising out of the construction are minimal and the responsibility of implementation of the EMP mainly lies with the Contractor monitored by SIO staff. In addition to environmental safeguards taken up the contractor the physical environmental monitoring shall be carried out by the SIO/PMU. The total physical environmental monitoring and management cost for the sub-project covering three years of Construction phase and Pre & post construction stage are shown in Table 45.

### Table 45: Showing Physical Environmental Monitoring Cost

<table>
<thead>
<tr>
<th>Environmental Parameter</th>
<th>Suggested No. of locations</th>
<th>Frequency and period of monitoring</th>
<th>Unit rate in Rs</th>
<th>Total cost in Rs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre - construction period monitoring (baseline data) before commencement of civil works</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface water</td>
<td>6</td>
<td>6x1 (6)</td>
<td>10,000</td>
<td>60,000</td>
</tr>
<tr>
<td>Ground water</td>
<td>6</td>
<td>6x1(6)</td>
<td>10,000</td>
<td>60,000</td>
</tr>
<tr>
<td>Silt</td>
<td>6</td>
<td>6x1(6)</td>
<td>12,500</td>
<td>75,000</td>
</tr>
<tr>
<td>Soil</td>
<td>6</td>
<td>6x1(6)</td>
<td>12,500</td>
<td>75,000</td>
</tr>
<tr>
<td>Sub-total</td>
<td></td>
<td></td>
<td></td>
<td>270000</td>
</tr>
<tr>
<td>Construction Phase</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface water</td>
<td>6</td>
<td>6x2x3(36)</td>
<td>10,000</td>
<td>360000</td>
</tr>
<tr>
<td>Ground water</td>
<td>6</td>
<td>6x2x3(36)</td>
<td>10,000</td>
<td>360000</td>
</tr>
<tr>
<td>Silt</td>
<td>6</td>
<td>6x2x3(36)</td>
<td>12,500</td>
<td>450000</td>
</tr>
<tr>
<td>Soil</td>
<td>6</td>
<td>6x1x3(18)</td>
<td>12,500</td>
<td>225000</td>
</tr>
<tr>
<td>Sub-total</td>
<td></td>
<td></td>
<td></td>
<td>13,95,000</td>
</tr>
</tbody>
</table>

**Operation and Maintenance phase – Post construction**

| Surface water | 6 | 6x1(6) | 10,000 | 60,000 |
| Ground water | 6 | 6x1(6) | 10,000 | 60,000 |
| Silt | 6 | 6x1(6) | 12,500 | 75,000 |
| Soil | 6 | 6x1(6) | 12,500 | 75,000 |
| Sub-total | | | | 270000 |
| Grand Total | | | | 19,35,000 |

| Cost of Plantation | 3000 | 1200 / plant with 3 yrs maintenance cost | 36,00,000 |

11. Environmental Training

316.  The basic requirement of the environmental training is to strengthen the knowledge of PMU/ SIO, DoWR and WUAs on environmental aspects.

12. Strengthening Environmental Knowledge & Management Capability

317.  The capacity and skills of the DoWR to carry out environmental management of irrigated agriculture schemes will need to be developed to be responsive and proactive to the needs and perceptions of environmental management in their jurisdictions during and following Project completion. The institutional strengthening of environmental management will be blended within the activities. The focus will be on building the capacity and capability of the SIO, DoWR to assume their responsibilities in carrying out REAs, IEEs and implementing EMPs. The organizational framework in the DoWR for this to occur will be establishment of new environmental division as per EARF.

318.  Awareness raising will initially socialize the environmental assessment and EMP procedures among the project stakeholders. In addition meetings, seminars and some short courses will be organized to raise awareness within the DoWR. ISPM Environmental consultant during the field visits will also give on-field training on the implementation of EMP to the Contractor staff and SIO staff by the ISPMC and WUAs with the help of PPSU – Environmental Monitoring Specialist. In addition training programs would be conducted to the Contractor staff and SIO staff, DoWR by the ISPMC and for WUAs by the PPSU – Environmental Monitoring Specialist with the available funds of the PMU under training. The list of appropriate training module and 46.

319.  Participatory Mechanisms are the building blocks for the success of the Project. Besides the DoWR and WUAs, the community needs to get involved in developing the foundation of future environmental management of irrigated agriculture in the State. Results of Environmental monitoring carried out during construction would be disseminated to WUA / PP members for raising awareness through PPSU Environmental Monitoring specialist and these would be built into the PPME System Participatory Environmental Monitoring guidelines shall be developed with the assistance of the environmental monitoring specialists of PPSU through the PIM Component for use by DoWR and WUA staff during construction and O&M. Lessons learned from past environmental management initiatives will be used to reinforce public participation as an essential aspect to instill a sense of ownership and stewardship among all stakeholders that will be involved in
environmental management and the use of resources. Measures to involve active participation of the community will be included to help ensure more effective and appropriate management, since the stakeholders (those using the resources) can become involved in a voluntary way in some of the basic monitoring (e.g., soil erosion point sources) and regulating various activities under the EMP.

320. An environmental monitoring programme is important as it provides useful information and helps to i) assist in detecting the development of any unwanted environmental situation, and thus, provides opportunities for adopting appropriate control measures, and ii) evaluate the performance and effectiveness of mitigation measures proposed in the EMP and suggest improvements in management plan, if required.

Table 46: Proposed Training Module for Capacity Building of SIO and WUAs

<table>
<thead>
<tr>
<th>Item No</th>
<th>Training Type</th>
<th>Item/ subject of Training</th>
<th>Target Group</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Orientation Training</td>
<td>Need for Initial Environmental Examination Report and Overview of important Environmental Regulation and frame work to the project Applicable statutory Environmental Clearances – by the SIO staff and Contractor</td>
<td>PMU, SIO staff, PPSU staff, Contractors and WUAs while executing construction of minors</td>
<td>Pre-Construction</td>
</tr>
<tr>
<td>2</td>
<td>Training on Environmental &amp; Safety Aspects Relevant to Construction</td>
<td>1. Environmental &amp; Safety Aspects Relevant to Construction Environmental obligations as per Contract Clauses and technical specification (covering issues and impacts related to Borrow areas, Quarries, Aggregates, Top soil usage, Disposal of construction debris, handling of hazardous materials and dust suppression measures) Safety measures and usage of PPE’s during construction 2. Implementation of Environmental Monitoring Plans Importance of EMP and parameters to be monitored Parameters for Environmental Monitoring (Surface water, Ground Water, Silt and Soil) Precautions to be taken while sampling Monitoring frequency</td>
<td>PMU, SIO staff, PPSU staff, Contractors and WUAs while executing construction of minors</td>
<td>Twice during Construction period</td>
</tr>
</tbody>
</table>
13. Training Budget

321. The approximate cost involved under training is shown in Table 47.

Table 47: Showing the training budget

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Training Details</th>
<th>Unit rate</th>
<th>Frequency</th>
<th>Total cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Orientation training on the EMP implementation to SIO Staff and Contractors for a group 40 to 50 people</td>
<td>Rs. 25,000</td>
<td>4 times during project period</td>
<td>Rs.1,00,000</td>
</tr>
<tr>
<td>2</td>
<td>Orientation training on the EMP implementation to SIO Staff and Contractors for a group 40 to 50 people</td>
<td>Rs. 25,000</td>
<td>4 times during project period</td>
<td>Rs.1,00,000</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>2,00,000</strong></td>
</tr>
</tbody>
</table>

14. Environmental monitoring reporting

322. The environmental reporting system has been discussed in detail under section E of this Chapter. The contractors and WUAs shall submit monthly report to the SIO as provided in Annexure 9 and 9a of this report. The summary of status of EMP implementation shall be provided by PMU to ADB periodically through Quarterly Progress Report (QPR). PMU shall also submit Environmental Monitoring Report describing the status of EMP implementation in detail to ADB on an annual basis for Category “B” projects.
IX. FINDINGS AND RECOMMENDATIONS

323. There are no significant adverse impacts associated with this project. Instead the project is expected to improve irrigation facilities and enhance economic growth of the area. Increased irrigation will also help in planting of more trees thereby increasing the environmental conditions of the area adding to the greenery and general aesthetics of the area. The indirect benefits of the project will be lowered levels of out migration as the communities will have more opportunity of securing income from within the village. There will be growth in living standard of people, which will encourage proper education, social awareness, health facility and prosperity amongst the people.

324. The IEE clearly states in its findings that there will be no significant impact in the local environmental condition due to construction and operation of the project only adequate safety, dust suppression measures and traffic management need to be taken up by the contractor while executing the construction works. Any Issues related to encroachments need to be addressed as per the R & R policy. Regular weed removal or provision of lining in the reaches where water hyacinth is dominant (some portion of head and tail end portion) would improve the system efficiency. Any impact associated with the project activities will be minor in nature and will be restricted only during the construction phase of the project. Increased levels in ground water, increase in soil salinity, increased levels of insecticides and pesticides are some of the major impacts during project operation. Increased ground water level is a beneficial impact and hence no mitigation measures are recommended. It is suggested that local villagers should be educated through pani panchayat about rational use of water, chemical fertilizers and pesticides to reduce soil salinity and protect surface and ground water quality.
X. CONCLUSION

325. There are no adverse impacts expected from this project. The project is expected to improve the existing derelict irrigation infrastructure and will be put to beneficial use to the society. This will boost agriculture growth in the area and will bring prosperity to the region. By improving the irrigation infrastructure issues like water logging, economic disparity between head end and tail end users will be reduced. The project has already been assessed as category “B” as per ADB’s environmental category, the project and will not require any environmental clearance as no additional land is covered for irrigation under this project.
ANNEXURE
INDEX MAP SHOWING HLC RANGE-I SUB-PROJECT LOCATION
LIST OF ODISHA STATE POLLUTION CONTROL BOARD APPROVED CRUSHERS

List of the Stone Crusher Obtained Permission For Trial Run
(List mentioned by Regional Office, Cuttack, Odisha Pollution Control Board
As on November 2011)

1. Tapti Tie-up Pvt. Ltd.,
   At : Barada & Dankari,
   PO – Mahisara
   Dist: Jajpur

2. ARSS Infrastructure Projects Ltd.,
   At Dankari.
   P.O. Mahisara
   Dist: Jajpur

3. Chitra Builders (P) Ltd., Plot . No- D-7
   At: Ranasinghabati Tahasil- Dharmasala
   Dist: Jajpur

4. Anand Exports ( Crusher unit)
   Nimpalli,
   Golagaon
   Jajpur

5. Rout Stone Crushers
   At. Godisahi
   Cuttack

(Note: List collected from Regional office, SPCB by author)
ANNEXURE 4

QUARRY MAP OF H.L.C. RANGE-I

LIST OF QUARRY

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Material</th>
<th>Quarry</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Limestone</td>
<td>Nuapara</td>
</tr>
<tr>
<td>2</td>
<td>Sand</td>
<td>Brahman Ghat</td>
</tr>
<tr>
<td>3</td>
<td>Stone Product</td>
<td>Bagha</td>
</tr>
<tr>
<td>4</td>
<td>Building Stone</td>
<td>Jagtapur</td>
</tr>
<tr>
<td>5</td>
<td>Nuts Pipe</td>
<td>Chaudlabal</td>
</tr>
<tr>
<td>6</td>
<td>Laterite Stone</td>
<td>Chhatala</td>
</tr>
<tr>
<td>7</td>
<td>Blumen</td>
<td>CHC, Cuttack</td>
</tr>
</tbody>
</table>

REFERENCE:

1. MAJOR CANAL
2. DISTRIBUTION
3. MAIN, SUB-MAIN
4. ROAD
5. RAIL
6. ACREAGE AREA (8000 Hects.)
7. PARTIAL IRRIGATION (2500 Hects.)
8. TETRAEDRICAL AREA (1300 Hects.)

IEE HLC Range 1 119
## ANNEXURE 5

### VILLAGERS PRESENT DURING PUBLIC CONSULTATION- HLC RANGE 1

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Name</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mr. G.C. Sawain</td>
<td>Junior Engineer, Water Resource Dept.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mr. K. C. Behera</td>
<td>Junior Engineer, Water Resource Dept.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mr. Rajkishor Das</td>
<td>Farmer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mr. Bharat Shethi</td>
<td>Farmer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mr. Surendra Kr. Sethi</td>
<td>Farmer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mr. Ghanashyam Behera</td>
<td>Farmer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mr. Lingaraj Barik</td>
<td>Farmer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mr. Harekrishna Dey</td>
<td>Farmer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mr. Chandrakanta Kunthia</td>
<td>Farmer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mr. Amulya Kr. Das</td>
<td>Farmer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mr. Umesh Raut</td>
<td>Farmer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mr. Jadunath Behera</td>
<td>Farmer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mr. Ghanashyam Behera</td>
<td>Farmer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mr. Lingaraj Barik</td>
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<tr>
<td></td>
<td></td>
<td>Mr. Harekrishna Dey</td>
<td>Farmer</td>
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<tr>
<td></td>
<td></td>
<td>Mr. Chandrakanta Kunthia</td>
<td>Farmer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mr. Amulya Kr. Das</td>
<td>Farmer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mr. Umesh Raut</td>
<td>Farmer</td>
</tr>
<tr>
<td></td>
<td>Champapur (Middle part)</td>
<td>Mr. H. K. Ojha</td>
<td>Junior Engineer, Water Resource Dept.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mr. K. C. Behera</td>
<td>Junior Engineer, Water Resource Dept.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mr. G.C. Sawain</td>
<td>Junior Engineer, Water Resource Dept.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mr. Dilip Raut</td>
<td>Treasurer, Pani Panchyat 2</td>
</tr>
<tr>
<td></td>
<td>Champapur (Middle part)</td>
<td>Mr. Ishwar Lenka</td>
<td>Farmer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mr. Bajo Behera</td>
<td>Farmer</td>
</tr>
<tr>
<td></td>
<td>Champapur (Middle part)</td>
<td>Mr. Raj Krishna Raut</td>
<td>Farmer</td>
</tr>
<tr>
<td></td>
<td>Champapur (Middle part)</td>
<td>Mr. Gandharba Raut</td>
<td>Farmer</td>
</tr>
<tr>
<td></td>
<td>Champapur (Middle part)</td>
<td>Mr. Golokh Behera</td>
<td>Farmer</td>
</tr>
<tr>
<td></td>
<td>Champapur (Middle part)</td>
<td>Mr. Promad Kr. Raut</td>
<td>Farmer</td>
</tr>
<tr>
<td></td>
<td>Champapur (Middle part)</td>
<td>Mr. Motruguna Sahoo</td>
<td>Farmer</td>
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<td></td>
<td>Champapur (Middle part)</td>
<td>Mr. Adikandha Raut</td>
<td>Farmer</td>
</tr>
<tr>
<td></td>
<td>Champapur (Middle part)</td>
<td>Mr. Subhash Raut</td>
<td>Farmer</td>
</tr>
<tr>
<td></td>
<td>Champapur (Middle part)</td>
<td>Mr. Hirod Samal</td>
<td>Panchayat member, Farmer</td>
</tr>
<tr>
<td></td>
<td>Bharatpur- Gangudia (Tail part)</td>
<td>Mr. H. K. Ojha</td>
<td>Junior Engineer, Water Resource Dept.</td>
</tr>
<tr>
<td></td>
<td>Bharatpur- Gangudia (Tail part)</td>
<td>Mr. K. C. Behera</td>
<td>Junior Engineer, Water Resource Dept.</td>
</tr>
<tr>
<td></td>
<td>Bharatpur- Gangudia (Tail part)</td>
<td>Mr. Golobdhana Raut</td>
<td>Farmer</td>
</tr>
<tr>
<td></td>
<td>Bharatpur- Gangudia (Tail part)</td>
<td>Mr. Pranakrishna Patra</td>
<td>Farmer</td>
</tr>
<tr>
<td></td>
<td>Bharatpur- Gangudia (Tail part)</td>
<td>Mr. Sahadeb Parida</td>
<td>Farmer</td>
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<td></td>
<td>Bharatpur- Gangudia (Tail part)</td>
<td>Mr. Sanjay Kr. Sahoo</td>
<td>Farmer</td>
</tr>
<tr>
<td></td>
<td>Bharatpur- Gangudia (Tail part)</td>
<td>Mr. Jagabandhu Raut</td>
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<td>Bharatpur- Gangudia (Tail part)</td>
<td>Mr. Chakradhar Raut</td>
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<td>Bharatpur- Gangudia (Tail part)</td>
<td>Mr. Prankrishna Parida</td>
<td>Farmer</td>
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<td>Bharatpur- Gangudia (Tail part)</td>
<td>Mr. Dharendra Sahoo</td>
<td>Farmer</td>
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<td></td>
<td>Bharatpur- Gangudia (Tail part)</td>
<td>Mr. Mritunjoy Swain</td>
<td>Farmer</td>
</tr>
<tr>
<td>Date</td>
<td>Location</td>
<td>Name</td>
<td>Status</td>
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<td></td>
<td>Mr. K. C. Behera</td>
<td>Junior Engineer, Water Resource Dept.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mr. Basudeb Raut</td>
<td>Farmer</td>
</tr>
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<td></td>
<td></td>
<td>Mr. Ramakanta Malik</td>
<td>Farmer</td>
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<td></td>
<td></td>
<td>Mr. Dullar Swain</td>
<td>Farmer</td>
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<td></td>
<td>Mr. Sarat Das</td>
<td>Farmer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mr. Gobinda Nayak</td>
<td>Farmer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mr. Nirod Biswal</td>
<td>Farmer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mr. Dibakar Sahoo</td>
<td>Farmer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mr. Chintamoni Bej</td>
<td>Farmer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mr. Rasha Bihari Nayak</td>
<td>Farmer</td>
</tr>
</tbody>
</table>
# Findings of Focus Group Discussion

Table – A (6) 1: Findings of Focus Group Discussion Birol

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Issues Raised</th>
<th>Discussions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Community Awareness About the Project</td>
<td>50% of the villagers have no knowledge on the project and some of them are aware of the project through the socio-economic team of ADB TA consultant. Officer of irrigation department also informed them.</td>
</tr>
<tr>
<td>2.</td>
<td>Benefits of Project for the Upliftment of Community</td>
<td>Villagers express that due to accumulation of silt in canal, bank of the canal get submerged during monsoon and that resulting water logging. So as per the villagers opinion the rehabilitation project would benefited them two ways – 1. non submergence of agricultural land nearby the canal after removal of canal silt and 2. get enough water for irrigation and that uplift their socio economic condition</td>
</tr>
<tr>
<td>3.</td>
<td>Labour Participation in the Project</td>
<td>Most of the villagers show their interest to participate in the project as labour force.</td>
</tr>
<tr>
<td>4.</td>
<td>Source of Water for the Village</td>
<td>Villagers indicate that they drink tube well or dug well water. But number of public tube wells are limited</td>
</tr>
<tr>
<td>5.</td>
<td>Quality of Water for basic need</td>
<td>At present quality of dug well water not good. No as such salinity problem. Villagers express that after canal renovation work quality of water may improve.</td>
</tr>
<tr>
<td>6.</td>
<td>In what way villagers depend on canal water</td>
<td>Other than irrigation villagers use canal water for bathing, cloth and utensils washing and cattle washing</td>
</tr>
<tr>
<td>7.</td>
<td>Disturbances due to Project Construction Work</td>
<td>People have no objection on disturbances that will be created during construction work and they will bear the disturbances for bigger interest</td>
</tr>
<tr>
<td>8.</td>
<td>Presence of trees – tree felling requirement</td>
<td>No big trees along minor canal. Along main canal few medium to big girth trees like Palm, Jamun, Owe, Kadam and Chakunda present and that need to be fell during construction</td>
</tr>
<tr>
<td>9.</td>
<td>Responsibility for the Maintenance of Canal Bund Plantation</td>
<td>Villagers agreed to take responsibility for maintaining canal bund plantation</td>
</tr>
<tr>
<td>10.</td>
<td>Sustainable Disposal of Debris in</td>
<td>Villagers felt that the debris should be used for</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>Lowland strengthening canal bund and also can be used for road construction and filling up low laying area</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Water Logging in the Village Area-drainage and flooding problem if any</strong></td>
<td><strong>Water logging problem and poor drainage condition exist</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Forest in Nearby Village</strong></td>
<td><strong>No forest exist</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Sensitive Archeological / historical site</strong></td>
<td><strong>No as such</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Movement of Wild Animals Through Village</strong></td>
<td><strong>No wildlife movement through village only domestic animal noted</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Disposal of canal silt</strong></td>
<td><strong>As per the villager canal silt can be used in canal bund. Villager of the project area told that desilted soil can also be disposed in a low land</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Use of fertilizer, pesticide and biofertilizer</strong></td>
<td><strong>Use of fertilizer like Urea, DAP, Gromour and potash is common. Application of bio –fertilizer not common. Use of manure like cow dung is very common. Among the pesticides farmers normally use Demecron, Phorate and Metasite.</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Precaution taken during application of pesticide</strong></td>
<td><strong>Generally no precaution taken during application of liquid and solid pesticide. Few villagers mention that they occasionally use cloth for covering their nose during application of pesticide</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Incidence of fertilizer and pesticide toxicity</strong></td>
<td><strong>No as such incidence</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Salinity problem of land</strong></td>
<td><strong>No as such salinity problem in the project area</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Testing of water and soil</strong></td>
<td><strong>No testing have been done for water and soil</strong></td>
<td></td>
</tr>
</tbody>
</table>
Table – A(6) 2: Findings of Focus Group Discussion Champapur

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Issues Raised</th>
<th>Discussions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Community Awareness About the Project</td>
<td>Villagers have knowledge on the project through the socio-economic team of ADB TA consultant. Officer of irrigation department also informed them.</td>
</tr>
<tr>
<td>2</td>
<td>Benefits of Project for the Upliftment of Community</td>
<td>Villagers express that the rehabilitation project would benefit them since at present most of the branch canal in middle part dried up. Mainly farmers cultivated paddy. In few cases they tried mung during rabi</td>
</tr>
<tr>
<td>3</td>
<td>Labour Participation in the Project</td>
<td>Villagers express that up to September chances to get labour for the project is less. After that (from September) most of the farmers can associate in the project as labour force.</td>
</tr>
<tr>
<td>4</td>
<td>Source of Water for the Village</td>
<td>Villagers indicate that they drink tube well or dug well water. But number of public tube wells are limited.</td>
</tr>
<tr>
<td>5</td>
<td>Quality of Water for basic need</td>
<td>At present quality of water not good.</td>
</tr>
<tr>
<td>6</td>
<td>In what way villagers depend on canal water</td>
<td>Villagers only use canal water for irrigation if available.</td>
</tr>
<tr>
<td>7</td>
<td>Disturbances due to Project Construction Work</td>
<td>People have no objection on disturbances that will be created during construction work and they will bear the disturbances for beneficial project.</td>
</tr>
<tr>
<td>8</td>
<td>Presence of trees – tree felling requirement</td>
<td>No big trees along minor canal. Only few medium girth trees like Palm, Jamun and Chakunda noted.</td>
</tr>
<tr>
<td>9</td>
<td>Responsibility for the Maintenance of Canal Bund Plantation</td>
<td>Villagers along with the PP members would like to maintain canal bund plantation.</td>
</tr>
<tr>
<td>10</td>
<td>Sustainable Disposal of Debris in Lowland</td>
<td>Villagers felt that the debris should be used for strengthening canal bund and also can be used for road construction and filling up low land. Some villagers express that mosquitoes may be controlled by filling up low land near canal.</td>
</tr>
<tr>
<td>11</td>
<td>Water Logging in the Village Area-drainage and flooding problem if any</td>
<td>No as such drainage and flooding problem in village.</td>
</tr>
<tr>
<td>12</td>
<td>Forest in Nearby Village</td>
<td>No forest exist</td>
</tr>
<tr>
<td>13</td>
<td>Sensitive Archeological / historical site</td>
<td>No as such</td>
</tr>
<tr>
<td>14</td>
<td>Movement of Wild Animals Through Village</td>
<td>No wildlife movement through village only domestic animal noted.</td>
</tr>
<tr>
<td>15</td>
<td>Disposal of canal silt</td>
<td>As per the villager canal silt can be used in</td>
</tr>
</tbody>
</table>
canal bund. Villager of the project area told that desilted soil can also be disposed in a low land and it is totally depends on the land owner.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>16. Use of fertilizer, pesticide and biofertilizer</td>
<td>Use of fertilizer like Urea, DAP, Gromour and potash is common. Application of bio-fertilizer not reported Among the pesticides farmers normally use Demecron, Phorate</td>
</tr>
<tr>
<td>17. Precaution taken during application of pesticide</td>
<td>Generally no precaution taken during application of liquid and solid pesticide. Few farmers express that they use gloves during application of pesticide</td>
</tr>
<tr>
<td>18. Incidence of fertilizer and pesticide toxicity</td>
<td>No as such incidence</td>
</tr>
<tr>
<td>19. Salinity problem of land</td>
<td>No as such salinity problem in the project area</td>
</tr>
<tr>
<td>20. Testing of water and soil</td>
<td>No testing have been done for water and soil</td>
</tr>
</tbody>
</table>
### Table – A(6) 3: Findings of Focus Group Discussion Gangudia- Bharatpur

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Issues Raised</th>
<th>Discussions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Community Awareness About the Project</td>
<td>Villagers have little knowledge on the project and some of them are aware of the project through the socio-economic team of ADB TA consultant.</td>
</tr>
<tr>
<td>2</td>
<td>Benefits of Project for the Upliftment of Community</td>
<td>Villagers express that the rehabilitation project would benefited them since at present all the branch canal in tail part dried up. Farmers only produce paddy.</td>
</tr>
<tr>
<td>3</td>
<td>Labour Participation in the Project</td>
<td>Villagers assured that no outside labour will be required, sufficient labour available for project work.</td>
</tr>
<tr>
<td>4</td>
<td>Source of Water for the Village</td>
<td>People have their own tube well/ dug well for drinking purpose.</td>
</tr>
<tr>
<td>5</td>
<td>Quality of Water for basic need</td>
<td>At present quality of water good.</td>
</tr>
<tr>
<td>6</td>
<td>In what way villagers depend on canal water</td>
<td>Villagers only use canal water for irrigation if available.</td>
</tr>
<tr>
<td>7</td>
<td>Disturbances due to Project Construction Work</td>
<td>People have no objection on disturbances (dust and noises) that they would have experience during construction work.</td>
</tr>
<tr>
<td>8</td>
<td>Presence of trees – tree felling requirement</td>
<td>No big trees along minor canal. Along main canal few big trees need to be fell.</td>
</tr>
<tr>
<td>9</td>
<td>Responsibility for the Maintenance of Canal Bund Plantation</td>
<td>Villagers along with the FP members would like to maintain canal bund plantation.</td>
</tr>
<tr>
<td>10</td>
<td>Sustainable Disposal of Debris in Lowland</td>
<td>Villagers felt that the debris should be used for strengthening canal bund and also can be used for canal side road construction.</td>
</tr>
<tr>
<td>11</td>
<td>Water Logging in the Village Area-drainage and flooding problem if any</td>
<td>No as such drainage problem in village. After heavy rainfall water logging is reported at few of the locations.</td>
</tr>
<tr>
<td>12</td>
<td>Forest in Nearby Village</td>
<td>No forest exist.</td>
</tr>
<tr>
<td>13</td>
<td>Sensitive Archeological / historical site</td>
<td>No as such.</td>
</tr>
<tr>
<td>14</td>
<td>Movement of Wild Animals Through Village</td>
<td>No wildlife movement through village only domestic animal noted.</td>
</tr>
<tr>
<td>15</td>
<td>Disposal of canal silt</td>
<td>As per the villager canal silt can be used in canal bund. Villager of the project area told that desilted soil can also be disposed in a low land.</td>
</tr>
<tr>
<td>16</td>
<td>Use of fertilizer, pesticide and biofertilizer</td>
<td>Use of fertilizer like Urea, DAP, Gromour and potash is common. Application of bio-fertilizer not done. Among the pesticides farmers normally use Demecron, Phorate, Danadar.</td>
</tr>
</tbody>
</table>
### Orissa Integrated Irrigated Agriculture & Water Management Investment Program (OIIAWMIP)

<table>
<thead>
<tr>
<th></th>
<th>Precaution taken during application of pesticide</th>
<th>Generally no precaution taken during application of liquid and solid pesticide. But few villagers express that they use cloth for protection of eye and nose</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>Incidence of fertilizer and pesticide toxicity</td>
<td>No fish death or pond contamination reported</td>
</tr>
<tr>
<td>18</td>
<td>Salinity problem of land</td>
<td>No as such salinity problem in the project area</td>
</tr>
<tr>
<td>19</td>
<td>Testing of water and soil</td>
<td>No testing have been done for water and soil</td>
</tr>
<tr>
<td>20</td>
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### Table – A(6) 4: Findings of Focus Group Discussion Jaganathpur

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Issues Raised</th>
<th>Discussions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Community Awareness About the Project</td>
<td>Most of the villagers have no knowledge on the project and villagers indicates that no government official inform them about the project</td>
</tr>
<tr>
<td>2</td>
<td>Benefits of Project for the Upliftment of Community</td>
<td>In 90% cases villagers express that the rehabilitation project would benefited them since at present most of the branch canal in middle part dried up only rainfed paddy production taken up, generally no Rabi crop</td>
</tr>
<tr>
<td>3</td>
<td>Labour Participation in the Project</td>
<td>There is some conflict among villagers – few villagers interested to work as labour but majority of villages disagreed to work as labour</td>
</tr>
<tr>
<td>4</td>
<td>Source of Water for the Village</td>
<td>People have their own tube well for drinking purpose</td>
</tr>
<tr>
<td>5</td>
<td>Quality of Water for basic need</td>
<td>At present quality of water good.</td>
</tr>
<tr>
<td>6</td>
<td>In what way villagers depend on canal water</td>
<td>Villagers use canal water for irrigation. When water available they also use canal water for washing of utensils, cattle washing and bathing</td>
</tr>
<tr>
<td>7</td>
<td>Disturbances due to Project Construction Work</td>
<td>People have no objection on disturbances that will be occurred during construction work and they will bear the disturbances for beneficial project</td>
</tr>
<tr>
<td>8</td>
<td>Presence of trees – tree felling requirement</td>
<td>No big trees along minor canal.</td>
</tr>
<tr>
<td>9</td>
<td>Responsibility for the Maintenance of Canal Bund Plantation</td>
<td>Villagers along with the PP members would like to maintain canal bund plantation</td>
</tr>
<tr>
<td>10</td>
<td>Sustainable Disposal of Debris in Lowland</td>
<td>Villagers felt that the debris should be used for strengthening canal bund and also can be used for filling up low land</td>
</tr>
<tr>
<td>11</td>
<td>Water Logging in the Village Area -drainage and flooding problem if any</td>
<td>There is field drainage problem</td>
</tr>
<tr>
<td>12</td>
<td>Forest in Nearby Village</td>
<td>No forest exist</td>
</tr>
<tr>
<td>13</td>
<td>Sensitive Archeological / historical site</td>
<td>No as such</td>
</tr>
<tr>
<td>14</td>
<td>Movement of Wild Animals Through Village</td>
<td>No wildlife movement through village only domestic animal noted</td>
</tr>
<tr>
<td>15</td>
<td>Disposal of canal silt</td>
<td>As per the villager canal silt can be used in canal bund. Villager of the project area told that desilted soil can also be disposed in a low land</td>
</tr>
<tr>
<td>16</td>
<td>Use of fertilizer, pesticide and biofertilizer</td>
<td>Use of fertilizer like Urea, DAP, Gromour and potash is common. Application of bio –fertilizer negligible</td>
</tr>
</tbody>
</table>
Among the pesticides farmers normally use Demecron, Phorate, Danadar.

<table>
<thead>
<tr>
<th></th>
<th>17. Precaution taken during application of pesticide</th>
<th>Generally no precaution taken during application of liquid and solid pesticide. Few farmers informed that they use gloves and cloth for protection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>18. Incidence of fertilizer and pesticide toxicity</td>
<td>No as such incidence of contamination from pesticide</td>
</tr>
<tr>
<td></td>
<td>19. Salinity problem of land</td>
<td>No as such salinity problem in the project area</td>
</tr>
<tr>
<td></td>
<td>20. Testing of water and soil</td>
<td>No testing have been done for water and soil</td>
</tr>
</tbody>
</table>
A consultation or a focused group discussion was carried out on 23rd December 2011 at Chandikhol village by inviting members of the Pani Panchayat and other farmers. The presidents and secretaries of Pani Panchayat and some farmers were present for the interaction. The representatives were from Pani Panchayat No. 3, 7, 8, 10, 11, 12, 18, 20 and 22. The list of participants is enclosed as Annexure -10a. The SIO staff and Mr. Barik SDO of the sub-project was present. The PPSU – Environment Monitoring Specialist was also present in the meeting. The problems or issues raised by different PP members are summarized below:

- Canal HR defective, shutter was not installed properly
- At the tail end the design of canal not proper canal passes through lower level and ayacut at a higher level
- Seepage and percolation high from the canals
- Guard walls damaged
- Empowerment of Pani Panchayat and involvement of PP members during construction of main canal is needed to ensure better quality of works by the contractor
- Water not reaching in the tail end of the villages due to high siltation and weed growth
- Heavy siltation of the canal
- Structures are damaged
- Embankments damaged and outlets are damaged and require additional outlets
- Pitching at places damaged
- Repair of VRB and additional VRB needed
- Repair of sub-minors and minor need to be done through PP not by contract

These were some the issues connected to the main canal as well as minor and sub-minor. While enquiring about the water quality they said the water quality is good except heavy weeds in the tail end portion of the canal. While enquiring about the encroachments they said very few structures at places are present and PP said they can be removed easily. PP requested for the demarcation of canal ROW as they observe the canal side cutting land has been encroached and that is blocking the drainage also. They said canal water is good for agriculture they do not have any health issues however they said they are using ground water for drinking.

The farmers are using mostly inorganic fertilizers and pesticides, they said they tried some organics composting etc but could not get timely support from the agriculture department. They said there are no forest or wild life habitats near the project site.

Over all the PP members expressed happiness over the proposed work and they are worried due the delay in undertaking the works. They said some labour available within the village they can be utilized and if additional labour need they said they do not have objection for the outside labour. The PP suggested the implementation of minor and sub-minor has to be undertaken by PP only not by contractor. However overall they are ready to co-operate during the work and ready to bear temporary closure of canal and disturbances during the construction.
## LIST OF PARTICIPANTS

**ANNEXURE - 10A**

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of Participant</th>
<th>Designation</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Suresh Kumar Mehera</td>
<td>Secretary</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Bhuban Kumar Jena</td>
<td>Secretary</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Anil Kumar Sahu</td>
<td>Secretary</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Prafulla Kumar Majar</td>
<td>Member</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Baburam Mehera</td>
<td>Member</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Mahendra Sahu</td>
<td>Member</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Pratap Kumar Majar</td>
<td>Member</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Babulal Majar</td>
<td>Member</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Ramchandra Mehera</td>
<td>Member</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Ramchandra Mehera</td>
<td>Member</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Ananda Bihary</td>
<td>Member</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Ramchandra Mehera</td>
<td>Member</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Ramchandra Mehera</td>
<td>Member</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Ananda Bihary</td>
<td>Member</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Nabin Kr. Majar</td>
<td>Member</td>
<td></td>
</tr>
</tbody>
</table>
A. List of persons consulted

1. Mr. N. Mahapatra, Director, Water Resources Dept., Govt. of Odisha
2. Mr. G. Maharana, SDO, Water Resources Dept., Govt. of Odisha
3. Mr., G.C. Sawain, Junior Engineer, Water Resources Dept., Govt. of Odisha
4. Mr. H. K. Ojha, JE, Water Resources Dept., Govt. of Odisha
5. Mr. K. C. Behera, JE, Water Resources Dept., Govt. of Odisha
6. Mr. B. K. Misra, Member Secretary, Odisha State Pollution Control Board
7. Mr. B. N. Bhol, Environmental Engineer, Odisha State Pollution Control Board

B. List of data sources

3. District Census data book of Odisha
8. Official website for Cuttack District (www.cuttack.nic.in)
9. Official website for Jajpur District (www.jajpur.nic.in)
10. Official Website of Ministry of Environment and Forest (www.envfor.nic.in)
12. Annual Report 2005-06 State Pollution Control Board, Odisha
13. Champion and Seth (1968) Classification of forest type of India


Annexure 10

ENVIRONMENTAL MONITORING – CHECK LIST - CONTRACTORS
(To be filled by the Contractor)

Monthly Report

<table>
<thead>
<tr>
<th>Package Description</th>
<th>Reporting Month: …………….</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Contract Package</td>
<td></td>
</tr>
<tr>
<td>1.2 Name of the Contractor</td>
<td></td>
</tr>
<tr>
<td>1.3 Name of the Sub-project</td>
<td></td>
</tr>
<tr>
<td>1.4 Work Completed for the Month</td>
<td>Earth work/ Concrete work/ Masonry / Others Specify</td>
</tr>
<tr>
<td>Earth Work -Filling</td>
<td>Qty....... Loc.......</td>
</tr>
<tr>
<td>Earth Work -Cutting</td>
<td>Qty....... Loc.......</td>
</tr>
<tr>
<td>Concrete work</td>
<td>Qty....... Loc.......</td>
</tr>
<tr>
<td>Lining</td>
<td>Qty....... Loc.......</td>
</tr>
<tr>
<td>Turfing</td>
<td>Qty....... Loc.......</td>
</tr>
<tr>
<td>Service Road</td>
<td>Qty....... Loc.......</td>
</tr>
</tbody>
</table>

II. Establishment of Contractors’ Camp

1. Usage of Camp: Plant / Machines / Labour
   1.1 If Plant: Crusher unit / HMP / WMM / Any Other
   If material purchased from Vendor: Name of the Vendor
   1.2 If Machinery stocking: Yes / No

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Type of Machinery in Operation</th>
<th>Number</th>
<th>Fitness / PCB certificate obtained</th>
<th>Remarks - Repair under taken at camp / sent to Garage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Paver</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Rollers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Excavators</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Dumpers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Vehicles ( Tractors/ Trucks)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Others</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1.3 If Labour

<table>
<thead>
<tr>
<th>S.No</th>
<th>Particulars</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>i</td>
<td>Total Number of Labourers employed?</td>
<td></td>
</tr>
<tr>
<td>ii</td>
<td>Number of Male labourers?</td>
<td></td>
</tr>
<tr>
<td>iii</td>
<td>Number of female labourers?</td>
<td></td>
</tr>
<tr>
<td>iv</td>
<td>Number of local labourers?</td>
<td></td>
</tr>
<tr>
<td>v</td>
<td>Name the village from where the labour come from?</td>
<td></td>
</tr>
<tr>
<td>vi</td>
<td>Number of migrant labourers?</td>
<td></td>
</tr>
<tr>
<td>vii</td>
<td>Number of dwelling units in the camp?</td>
<td></td>
</tr>
</tbody>
</table>
Orissa Integrated Irrigated Agriculture & Water Management Investment Program (OIIAWMIP)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>ix</td>
<td>Water Supply provided?</td>
<td></td>
</tr>
<tr>
<td>x</td>
<td>Drinking water supply provided?</td>
<td>Tube well/ Open Well/ Tanker/ etc</td>
</tr>
<tr>
<td>xi</td>
<td>Number of Toilets provided?</td>
<td></td>
</tr>
<tr>
<td>xii</td>
<td>Type of Toilet?</td>
<td>Leach pit / Soak Pit / Septic tank</td>
</tr>
<tr>
<td>xii</td>
<td>Number of Bath rooms provided?</td>
<td></td>
</tr>
<tr>
<td>xiii</td>
<td>Are Separate Bath rooms provided for women?</td>
<td>Yes / No</td>
</tr>
<tr>
<td>xiv</td>
<td>Washing plat forms provided?</td>
<td></td>
</tr>
<tr>
<td>xv</td>
<td>Drainage facility provided?</td>
<td></td>
</tr>
<tr>
<td>xvi</td>
<td>Crèche facility provided?</td>
<td></td>
</tr>
<tr>
<td>xvii</td>
<td>Availability of Health centre?</td>
<td>Nearest</td>
</tr>
<tr>
<td>xviii</td>
<td>First Aid Facility Available?</td>
<td></td>
</tr>
<tr>
<td>xix</td>
<td>Health Camp / HIV awareness conducted?</td>
<td>Yes / No</td>
</tr>
<tr>
<td>xx</td>
<td>Fuel used in the Camp?</td>
<td>Fire wood/ Kerosene/ LPG</td>
</tr>
<tr>
<td>xxi</td>
<td>Does the Camp has Workshop for Repair?</td>
<td>Yes / No</td>
</tr>
<tr>
<td>xii</td>
<td>Any Oil Spill taking Place?</td>
<td>Yes / No</td>
</tr>
<tr>
<td>xxiii</td>
<td>Oil / Grease traps / solid plat forms provided?</td>
<td>Yes / No</td>
</tr>
</tbody>
</table>

1.4 Storage of Fuel  Temporary/ Permanent
1.5 Type of Fuel Stored?  HSD/ Petrol
1.5.1 License Obtained?  Yes/ NO
1.6 Any Blasting Material Stored?  Yes/ NO
1.6.1. License Obtained?  Yes/ NO

III. Borrow Area Management
1. No. of Borrow Area approved?
2. No. of Borrow Area Rehabilitated/ Re-developed?
3. Permission Obtained for Borrow areas  Private - land Owner / Govt. Land – Panchayat /Revenue

(Note: Attach Copies of Permission Letter)
4. Details of Borrow Areas

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>B.A. - 1</th>
<th>B.A. - 2</th>
<th>B.A. - 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>Capacity of the Borrow Area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.2</td>
<td>Percentage of the capacity exhausted</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.3</td>
<td>Total quantity of the Earth Excavated (in cum.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.4</td>
<td>Quantity of Top Soil Removed from the Borrow Area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.5</td>
<td>Location of stored top Soil that was removed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.6</td>
<td>Quantity of Top Soil Stored at the beginning of the month</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.7</td>
<td>Quantity of Top Soil utilized at the end of</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
the month

4.8 Location(s) where Top Soil has been utilized (Specify on a Location Plan)

IV. Haulage Road

<table>
<thead>
<tr>
<th>Existing Road/ Temp Road Created</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Maintenance of Haulage Road done?</td>
</tr>
<tr>
<td>2. Dust Suppression Measures taken?</td>
</tr>
</tbody>
</table>

V. Quarries Under Operation

Yes / No

<table>
<thead>
<tr>
<th>If Yes, Number of Quarries in Use and locations?</th>
</tr>
</thead>
<tbody>
<tr>
<td>If No, Name of Vendor, the material Purchased and SPCB Certificate of Vendor to be Enclosed?</td>
</tr>
<tr>
<td>Are the Vehicles used for Supplying material covered?</td>
</tr>
</tbody>
</table>

VI. Erosion Control Measures:

Silt Traps/ Construction in Lean Season / Compaction Taken up

VII. Dump Sites:

Identified - Yes / No

Low lying areas Used - Yes / No

Disposal Sites – identified - Yes / No

VIII Storage of Material:

Adj. to Canal / ROW/ etc

1. Blockage of Natural drains | Yes / No |

IX Dust Control Measure:

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Dust Control Devices</th>
<th>Dust control devices are available. – Yes/ N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sprinkling of Water</td>
<td>Sprinkling of water carried out. Yes/ No</td>
</tr>
<tr>
<td>2</td>
<td>Cover on the vehicles</td>
<td>Yes/ No</td>
</tr>
<tr>
<td>3</td>
<td>Cover on stack materials</td>
<td>Yes/ No</td>
</tr>
</tbody>
</table>

X. Noise Control Measure:

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Measure</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Machines establishes in Habitation</td>
<td>Yes / No</td>
</tr>
<tr>
<td>2</td>
<td>Away from Habitations</td>
<td>Yes / No</td>
</tr>
<tr>
<td>3</td>
<td>Machines Sent for Maintenance regularly</td>
<td>Yes / No</td>
</tr>
</tbody>
</table>

XI. Safety Measures Taken:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Whether first aid post established at site?</td>
<td>Yes/No</td>
</tr>
<tr>
<td>2</td>
<td>Whether safety helmets given to all workmen at site?</td>
<td>Yes/No</td>
</tr>
<tr>
<td>3</td>
<td>Whether safety belts / ribbons used at work site</td>
<td>Yes/No</td>
</tr>
<tr>
<td>4</td>
<td>Whether gum boots, tarring unfits, spectacles etc. given to person handling bitumen?</td>
<td>Yes/No</td>
</tr>
</tbody>
</table>

**XII. Environmental Monitoring Details**

<table>
<thead>
<tr>
<th>Sl.No</th>
<th>Type of Test</th>
<th>No. of Locations</th>
<th>Date of Test last conducted</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ground Water</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Surface Water</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Silt</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Soil</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Signature of the Contractor / Representative
Name of the Contractor
Date

Signature of the SIO Staff
Name of the SIO Staff
Date Verified
ENVIRONMENTAL MONITORING - CHECK LIST - WUA
(To be filled by the WUAs)

Monthly Report

<table>
<thead>
<tr>
<th>I. Package Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Contract Package</td>
</tr>
<tr>
<td>1.2 Name of the WUA</td>
</tr>
<tr>
<td>1.3 Name of the Sub-project</td>
</tr>
<tr>
<td>1.4 Work Completed for the Month</td>
</tr>
<tr>
<td>Earth Work - Filling</td>
</tr>
<tr>
<td>Earth Work - Cutting</td>
</tr>
<tr>
<td>Concrete work</td>
</tr>
<tr>
<td>Lining</td>
</tr>
<tr>
<td>Turfing</td>
</tr>
<tr>
<td>Service Road</td>
</tr>
</tbody>
</table>

II Material purchased from Vendor Ye Yes / No
Granite Yes / No
Sand Yes / No
Morrum Yes / No
Details of the Vendor
Labour Employed Yes / No

<table>
<thead>
<tr>
<th>S.No</th>
<th>Particulars</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
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</tr>
<tr>
<td>iv</td>
<td>Number of local labourers?</td>
<td></td>
</tr>
<tr>
<td>v</td>
<td>Name the village from where the labour comes from?</td>
<td></td>
</tr>
</tbody>
</table>

V. Storage of Fuel Ye Yes / No

VI. Borrow Area Management

4. No. of Borrow Area approved?
5. No. of Borrow Area Rehabilitated/ Re-developed?
6. Permission Obtained for Borrow areas Private - land Owner / Govt. Land – Panchayat /Revenue

(Note: Attach Copies of Permission Letter)
### 4. Details of Borrow Areas

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<th>B.A. - 2</th>
<th>B.A. - 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>Capacity of the Borrow Area</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>4.2</td>
<td>Percentage of the capacity exhausted</td>
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<tr>
<td>4.3</td>
<td>Total quantity of the Earth Excavated (in cum.)</td>
<td></td>
<td></td>
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<tr>
<td>4.4</td>
<td>Quantity of Top Soil Removed from the Borrow Area</td>
<td></td>
<td></td>
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<tr>
<td>4.5</td>
<td>Location of stored top Soil that was removed</td>
<td></td>
<td></td>
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<td>4.6</td>
<td>Quantity of Top Soil Stored at the beginning of the month</td>
<td></td>
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<tr>
<td>4.7</td>
<td>Quantity of Top Soil utilized at the end of the month</td>
<td></td>
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<td>4.8</td>
<td>Location(s) where Top Soil has been utilized (Specify on a Location Plan)</td>
<td></td>
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</table>

#### VII. Haulage Road
- Existing Road / Temp Road Created
  3. Maintenance of Haulage Road done? Yes / No
  4. Dust Suppression Measures taken? Yes / No

#### VIII. Quarries Under Operation
- Yes / No
  4. If Yes, Number of Quarries in Use and locations?
  5. If No, Name of Vendor, the material Purchased and SPCB Certificate of Vendor to be Enclosed?
  6. Are the Vehicles used for Supplying material covered? Yes / No

#### IX. Dump Sites:
- Identified - Yes / No
  Low lying areas Used - Yes / No
  Disposal Sites – identified - Yes / No

#### X. Storage of Material:
- Adj. to Canal / ROW / etc

#### XI. Blockage of Natural drains
- Yes / No

#### XII. Dust Control Measure:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Dust Control Devices</th>
<th>Dust control devices are available. – Yes / No</th>
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<tbody>
<tr>
<td>1</td>
<td>Sprinkling of Water</td>
<td>Sprinkling of water carried out. Yes / No</td>
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<tr>
<td>2</td>
<td>Cover on the vehicles</td>
<td>Yes / No</td>
</tr>
<tr>
<td>3</td>
<td>Cover on stack materials</td>
<td>Yes / No</td>
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Noise Control Measure:

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<th>Measure</th>
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<td>1</td>
<td>Machines establishes in Habitation</td>
<td>Yes / No</td>
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<tr>
<td>2</td>
<td>Away from Habitations</td>
<td>Yes / No</td>
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<tr>
<td>3</td>
<td>Machines Sent for Maintenance regularly</td>
<td>Yes / No</td>
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XIII. Safety Measures Taken:

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<th>Description</th>
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<tbody>
<tr>
<td>1</td>
<td>Whether first aid post established at site?</td>
<td>Yes/No</td>
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<tr>
<td>2</td>
<td>Whether safety helmets given to all workmen at site?</td>
<td>Yes/No</td>
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<tr>
<td>3</td>
<td>Whether safety belts / ribbons used at work site</td>
<td>Yes/No</td>
</tr>
<tr>
<td>4</td>
<td>Whether gum boots, tarring unfits, spectacles etc. given to person handling bitumen?</td>
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XIV. Environmental Monitoring Details

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<thead>
<tr>
<th>Sl.No</th>
<th>Type of Test</th>
<th>No. of Locations</th>
<th>Date of Test last conducted</th>
<th>Remarks</th>
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<td>1</td>
<td>Ground Water</td>
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<td>2</td>
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<tr>
<td>3</td>
<td>Silt</td>
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<tr>
<td>4</td>
<td>Soil</td>
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Signature of the WUAs Representative

Name of the WUA

Date

Signature of the SIO Staff

Name of the SIO Staff

Date Verified
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<th>Essential Characteristics</th>
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<td>pH Value</td>
<td>pH Value</td>
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<td>2</td>
<td>Odour</td>
<td>Turbidity NTU, Max</td>
<td>Turbidity NTU, Max</td>
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<tr>
<td>3</td>
<td>Taste</td>
<td>pH Value</td>
<td>pH Value</td>
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<tr>
<td>4</td>
<td>Total hardness (as CaCO3) mg/L, Max</td>
<td>pH Value</td>
<td>pH Value</td>
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<tr>
<td>5</td>
<td>Iron (as Fe) mg/L, Max</td>
<td>pH Value</td>
<td>pH Value</td>
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<td>6</td>
<td>Chlorides (as Cl) mg/L, Max</td>
<td>pH Value</td>
<td>pH Value</td>
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<tr>
<td>7</td>
<td>Residual, free chlorine mg/L, Max</td>
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<td>pH Value</td>
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<td>Desirable Characteristics</td>
<td>Dissolved solids mg/L, Max</td>
<td>Dissolved solids mg/L, Max</td>
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<td>Calcium (as Ca) mg/L, Max</td>
<td>Calcium (as Ca) mg/L, Max</td>
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<td>Copper (as Cu) mg/L, Max</td>
<td>Copper (as Cu) mg/L, Max</td>
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<td>Iron (as Fe) mg/L, Max</td>
<td>Iron (as Fe) mg/L, Max</td>
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<tr>
<td>13</td>
<td>Sulphate (as SO4) mg/L, Max</td>
<td>Chlorides (as Cl) mg/L, Max</td>
<td>Chlorides (as Cl) mg/L, Max</td>
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<td>Nitrate (as NO3) mg/L</td>
<td>Nitrate (as NO3) mg/L</td>
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<td>15</td>
<td>Fluoride (as F) mg/L, Max</td>
<td>Fluoride (as F) mg/L, Max</td>
<td>Fluoride (as F) mg/L, Max</td>
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<tr>
<td>16</td>
<td>Phenolic compounds (as C6H5OH) mg/L, Max</td>
<td>Chlorides (as Cl) mg/L, Max</td>
<td>Chlorides (as Cl) mg/L, Max</td>
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<td>Mercury (as Hg) mg/L, Max</td>
<td>Mercury (as Hg) mg/L, Max</td>
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<td>Cadmium (as Cd) mg/L, Max</td>
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<td>Selenium (as Se) mg/L, Max</td>
<td>Selenium (as Se) mg/L, Max</td>
<td>Selenium (as Se) mg/L, Max</td>
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<td>Arsenic (as As) mg/L, Max</td>
<td>Arsenic (as As) mg/L, Max</td>
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<td>Cyanide (as CN) mg/L, Max</td>
<td>Cyanide (as CN) mg/L, Max</td>
<td>Cyanide (as CN) mg/L, Max</td>
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<tr>
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<td>Lead (as Pb) mg/L, Max</td>
<td>Lead (as Pb) mg/L, Max</td>
<td>Lead (as Pb) mg/L, Max</td>
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<td>23</td>
<td>Zinc (as Zn) mg/L, Max</td>
<td>Zinc (as Zn) mg/L, Max</td>
<td>Zinc (as Zn) mg/L, Max</td>
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<tr>
<td>24</td>
<td>Anionic Detergents (as MBAS) mg/L, Max</td>
<td>Sulphate (as SO4) mg/L, Max</td>
<td>Sulphate (as SO4) mg/L, Max</td>
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<tr>
<td>25</td>
<td>Chromium (as Cr 6+) mg/L, Max</td>
<td>Anionic Detergents (as MBAS) mg/L, Max</td>
<td>Anionic Detergents (as MBAS) mg/L, Max</td>
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<tr>
<td>26</td>
<td>Polynuclear aromatic hydrocarbons (as PAH) g/L, max</td>
<td>Chromium (as Cr 6+) mg/L, Max</td>
<td>Chromium (as Cr 6+) mg/L, Max</td>
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<td>Mineral Oil mg/L, Max</td>
<td>Polynuclear aromatic hydrocarbons (as PAH) g/L, max</td>
<td>Polynuclear aromatic hydrocarbons (as PAH) g/L, max</td>
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<td>Pesticides mg/L, Max</td>
<td>Radioactive materials</td>
<td>Radioactive materials</td>
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<tr>
<td>29</td>
<td>DDT/ Endosulphan/ phorate/ carbofuran/ monocrotophos</td>
<td>Radioactive materials</td>
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<td>Alkalinity mg/L, Max</td>
<td>a). Alpha emitters Bq/L, Max</td>
<td>a). Alpha emitters Bq/L, Max</td>
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<td>Boron, mg/L, Max</td>
<td>b). Beta emitters Bq/L, Max</td>
<td>b). Beta emitters Bq/L, Max</td>
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<td>E-coli</td>
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<td>Alumina (as Al) mg/L, Max</td>
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# Annexure 11a

**PARAMETERS FOR SURFACE WATER ANALYSIS AS PER IS : 2296:1992**

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<th>Sl.No</th>
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<tr>
<td>1</td>
<td>Dissolved Oxygen (DO) mg/l, min</td>
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<tr>
<td>2</td>
<td>Biochemical Oxygen demand (BOD) mg/l, max</td>
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<tr>
<td>3</td>
<td>Total coliform organisms MPN/100ml, max</td>
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<td>4</td>
<td>pH value</td>
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<td>5</td>
<td>Colour, Hazen units, max.</td>
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<td>6</td>
<td>Odour</td>
</tr>
<tr>
<td>7</td>
<td>Taste</td>
</tr>
<tr>
<td>8</td>
<td>Total dissolved solids, mg/l, max.</td>
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<tr>
<td>9</td>
<td>Total hardness (as CaCO₃), mg/l, max.</td>
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<td>10</td>
<td>Calcium hardness (as CaCO₃), mg/l, max.</td>
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<td>Magnesium hardness (as CaCO₃), mg/l, max.</td>
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<td>Copper (as Cu), mg/l, max.</td>
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<tr>
<td>13</td>
<td>Iron (as Fe), mg/l, max.</td>
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<tr>
<td>14</td>
<td>Manganese (as Mn), mg/l, max.</td>
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<tr>
<td>15</td>
<td>Chlorides (as Cu), mg/l, max.</td>
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<td>Sulphates (as SO₄), mg/l, max.</td>
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<td>Nitrates (as NO₃), mg/l, max.</td>
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<td>18</td>
<td>Fluorides (as F), mg/l, max.</td>
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<td>Phenolic compounds (as C₂H₅OH), mg/l, max.</td>
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<td>Mercury (as Hg), mg/l, max.</td>
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<td>Cadmium (as Cd), mg/l, max.</td>
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<td>Selenium (as Se), mg/l, max.</td>
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<td>Arsenic (as As), mg/l, max.</td>
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<td>Cyanide (as Pb), mg/l, max.</td>
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<td>Lead (as Pb), mg/l, max.</td>
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<td>Zinc (as Zn), mg/l, max.</td>
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<td>Chromium (as Cr⁶⁺), mg/l, max.</td>
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<td>Barium (as Ba), mg/l, max.</td>
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<td>Free Ammonia (as N), mg/l, max.</td>
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<td>Electrical conductivity, micromhos/cm, max</td>
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<td>Sodium absorption ratio, max</td>
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<td>DDE</td>
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<td>Phorate</td>
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<td>Sodium as Na %</td>
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<td>Residual Sodium Carbonate (RSC)</td>
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## PARAMETERS FOR SOIL / SILT ANALYSIS

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<td>Monocrotophos</td>
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