Irrigation Department
Government of Sindh, Pakistan

World Bank

SINDH BARRAGES IMPROVEMENT PROJECT

RFB No: PK-AFOF SBIP-494022-CW-RFB

Contract: SBIP/K2

Construction of Gauge Wells at Kotri Barrage

Bidding Documents

Volume 2
Specification

November 2026

Standard Procurement Document
Summary

Bidding Document: Request for Bids – Small Works (One-Envelope Bidding Process)

PART 1 – BIDDING PROCEDURES

VOLUME 0 – BIDDING PROCEDURES

Section I - Instructions to Bidders (ITB)

This Section provides information to help Bidders prepare their Bids. It is based on a one-envelope Bidding process. Information is also provided on the submission, opening, and evaluation of Bids and on the award of Contracts. **Section I contains provisions that are to be used without modification.**

Section II - Bid Data Sheet (BDS)

This Section includes of provisions that are specific to each procurement and that supplement Section I, Instructions to Bidders.

Section III - Evaluation and Qualification Criteria

This Section specifies the criteria to determine the Most Advantageous Bid.

Section IV - Bidding Forms

This Section includes the forms for the Bid submission, Bill of Quantities or Activity Schedule to be completed by the Bidder and submitted as part of its Bid.

Section V - Eligible Countries

This Section contains information regarding eligible countries.

Section VI - Fraud and Corruption

This section includes the Fraud and Corruption provisions which apply to this Bidding process.

VOLUME 1 – BILL OF QUANTITIES

PART 2 – WORKS' REQUIREMENTS (INCLUDED WITHIN VOLUMES 2 AND 3)

Section VII - Works' Requirements

This Section contains the Specification, the Drawings, and supplementary information that describe the Works to be procured. The Works' Requirements also include the environmental and social (ES) requirements (including requirements relating to Sexual Exploitation and Abuse (SEA) and Sexual Harassment (SH)) which are to be satisfied by the Contractor in executing the Works.

VOLUME 2 – SPECIFICATION

VOLUME 3 – DRAWINGS

PART 3 – CONDITIONS OF CONTRACT AND CONTRACT FORMS

VOLUME 4 – CONDITIONS OF CONTRACT AND CONTRACT FORMS

Section VIII - General Conditions of Contract (GCC)

This Section contains the general clauses to be applied in all contracts. **The text of the clauses in this Section shall not be modified.**

Section IX - Particular Conditions of Contract (PCC)

This Section consists the Particular Conditions of Contract which contains provisions specific to the contract. The contents of this Section modify or supplement the General Conditions and shall be prepared by the Employer.

Section X - Contract Forms

This Section contains the Letter of Acceptance, Contract Agreement and other relevant forms.

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1 Introduction

1.1 Abbreviations

The following abbreviations are used in this Specification:

Length	in	inch
	Ft, ft	foot
	RD	reduced distance (thousands of feet); 1 RD = 1000 ft; 5 RD = 1 canal mile
	mm	millimetre
	m	metre
	km	kilometre
Area	sq.ft, ft^2	square foot
	sq.mm, mm^2	square millimetre
	sq.cm, cm^2	square centimetre
Volume	cu.ft, ft^3	cubic foot
	cu.mm, mm^3	cubic millimetre
	cu.m, m^3	cubic metre
Discharge	cusec	cubic feet per second (ft3/s)
Mass	lb	pound
	kg	kilogram
	T	tonne = 1000 kg
Force	kN	kilonewton
Time	d	day
	Hr, hr	hour
	Sec, s	second
Other	dia	diameter
	nr	number
	°C	degree Celsius
	°F	degree Fahrenheit
	%	per cent
	±	plus or minus
	CESMP	Contractor's Environmental and Social Management Plan
	EBRD	European Bank for Reconstruction and Development
	EMP	Environmental Management Plan
	SEMP	Site Environmental Management Plan
	GC	General Conditions of Contract
	PC	Particular Conditions of Contract
	IFC	International Finance Corporation
	ICB	International Competitive Bidding
	WHO	World Health Organisation
	WSIP	Sindh Water Sector Improvement Project

1.2 Brief Description of Works

The scope of works for the contract SBIP/K2 is as follows:

- Construction of gauge wells on the off-taking canals of Kotri barrage

1.3 Canal Closure Period Dates

The annual closure period for the Fulleli, Pinyari, Kalri-Bhaghar Feeder, and Akram Wah canals usually runs from the 25th December to the 10th January.

The exact dates for the closure period will be notified to the Contractor by the Project Manager when they are announced by the Employer. Extended closure periods occur only by the direction of the Employer. Clause 1.34 of the Specification specifies the requirements for maintaining uninterrupted flows to the canals during the Works.

1.4 Mobilisation for Construction of the Works

The Contractor shall mobilise all resources as required for construction of Works according to the Contract Provisions. The major items of mobilisation are, but not limited to those listed and described in this Clause. The Contractor shall make his own assessment for provision and maintenance of mobilisation and demobilisation requirements and shall ensure their availability.

(a) Mobilisation of Contractor's Equipment to the Site

(b) Mobilisation of Contractor's personnel and labour at the Site

(c) Provision of camps, workshops, warehouses, shades, and storage yards required by the Contractor for the proper and sufficient execution of the Works

(d) Provision of such administrative and field offices, as the Contractor considers necessary for his organisation

(e) Preparation of approved Contractor's Environmental and Social Management Plan (CESMP - see Clause 1.27)

(f) Preparation of approved Health and Safety Plan (see Appendix C)

(g) Arrangements for supply of water for use in construction, including installation of the necessary wells, pumps, pipes, storage tanks, and suitable arrangements for the delivery of water at the various points of requirement.

(h) Maintenance of temporary site facilities provided by the Contractor for performance in connection with the Works.

(i) Demobilisation at the end of the Defects Notification Period.

1.5 Shipment of Contractor's Equipment and Equipment to Site

The Contractor shall be responsible for shipment and clearance of plant, equipment and machinery required for the execution of the Work to the specified Site within the specified time. In this regard the Contractor shall also be responsible for the payment of all applicable dues, taxes and customs duties.

1.6 Provision of Contractor's Camps

The Contractor shall provide adequate camps and associated facilities such as required for the proper and efficient progress of the Works. These camps are required in order to house all the Contractor's Employees, and also to include facilities for use of the Project Manager and Employer in accordance with Chapter 12. The Contractor shall provide cold food storage, food preparation and associated waste facilities as well as refectory for all employees. On the completion of the Works, the Contractor shall remove said camps and facilities with a follow up

reinstatement of the camp area. The Contractor shall be responsible for any damage caused by his labour to the surrounding environment and other utilities.

The Contractor shall submit to the Project Manager for approval, a layout plan for each camp, including construction and accommodation camps, before works begin to establish each camp. Layout plans for accommodation camps shall demonstrate compliance with the requirements of Clause 1.30 of this Specification.

The Contractor shall consult with local communities and make all reasonable efforts to mitigate their concerns before finalising the camp location.

1.7 Provision of Contractor's Workshops and Warehouses

The Contractor shall provide workshops, warehouses, shades, and storage yards required by the Contractor for the proper and sufficient execution of the Works.

The Contractor shall provide, maintain and operate temporary buildings such as his staff quarters, stores, workshops, labour camps and other temporary buildings necessary for the execution of the Works at the place the Employer will provide. If the contractor considers that the area provided by the Employer is not suitable or not large enough for establishing his site camp, site office or workshops and warehouses, then the contractor will arrange the land at his own risk and cost. The Contractor shall submit site plans and general particulars of the prescribed buildings to the Project Manager for his approval. The construction of the buildings shall not be started until the proposals have been approved by the Project Manager.

All workshops and storage areas shall be built on hard compacted ground with sufficient bunding and spill kits so as to prevent the loss or infiltration of leaked or spilt fluids into surrounding soils, ground water or water courses.

In locating storage areas, the Contractor shall avoid watercourses, drains and transport routes, ensure the area is not at risk of flooding, and where possible, locate storage areas close to the point of use. The Contractor shall prefer covered storage, and where this is not practicable, shall regularly sprinkle with water, stockpiles which have the potential to increase particulate matter in the locality. Where requested, a water spraying schedule shall be prepared by the Contractor and submitted to the Project Manager. The Contractor shall only use storage areas identified on his approved site layout plan. All excess materials, except earth stockpiles, shall be removed from the Site on completion of the Works.

1.8 Contractor's Power Supply

The Contractor shall make his own arrangements for electricity supply to the Contractor's office, his quarters, labour camp, workshop and stores and other temporary buildings.

1.9 Water Supply for Construction

The Contractor shall make his own arrangements for the supply of water for the purposes of the Works. The quality of the water shall be to the approval of the Project Manager and suitable for the purpose for which it is intended.

The Contractor's arrangements for supply of water for construction must not reduce the quantity or quality of local water resources where these are relied upon by people in the vicinity of the project for any purpose. The Contractor shall be prohibited from using ground water for use in construction, unless otherwise approved by the Project Manager.

Waste water shall be disposed of clear of the Site so as to cause no damage or complaint.

1.10 Maintenance of Site Facilities of Contractor

The Contractor shall arrange service for all of his mobilisation works, fixtures and equipment including provision of all water, electricity and sewerage and refuse disposal services, until the end of the Defects Notification Period. The Contractor shall replenish consumable items as and when required. At the end of Defects Notification Period, the Contractor shall remove his camp and facilities and reinstate the camp area.

1.11 Drawings and Specification

The Drawings at the date of the Letter of Acceptance show the Works to be carried out in sufficient detail for the Contractor to fully plan his activities. However, the Drawings issued with the Contract shall not be used to construct the Works, as revised versions of these Drawings will be issued to be used for the construction of the Works.

The Contractor shall check the Drawings and Specification carefully and advise the Project Manager, in writing, of any ambiguities, discrepancies, errors or omissions and a full instruction will be furnished to the Contractor should any ambiguities, discrepancies, errors or omissions be found. Although the Drawings are prepared to scale, work shall be based upon dimensions shown on the Drawings and not on dimensions scaled from the Drawings.

Drawings when read in conjunction with the Specification and instructions that may be issued from time to time by the Project Manager, will show sufficient dimensions, specific details and typical details to define the various features of the work, but the details necessary for the construction of any part of the Works may have to the deduced from several Drawings. Any additional drawings, which the Contractor requires to interpret how to construct the Works, shall be prepared by the Contractor.

The Project Manager may, from time to time, issue additional or revised Drawings to modify the Works.

1.12 Contractor’s Working Drawings and Shop Drawings

The Contractor shall prepare and submit to the Project Manager such working drawings and shop drawings as may be necessary to illustrate his proposed designs and method of working.

The Contractor shall note that during the course of the contract information will be given by the Project Manager in respect of individual structures to be constructed in accordance with issued drawings which show typical structures of the same form. The Contractor shall prepare from this information such working drawing as are required for the proper setting out and construction of such structures. Work shall not commence on an individual structure until the relevant working drawing has been approved by the Project Manager.

These working drawings and shop drawings shall:

a) be prepared to appropriate scales and include plans, elevations and sections;

b) consist of an electronic copy of the drawing (if available) in AutoCAD and PDF format, one print and one copy of design calculations, specification and parts catalogues;

c) be signed by a qualified engineer responsible for the design, checked and approved by the Contractor prior to submission;

d) Prior approval of the Project Manager shall be obtained for appointing the Contractor’s design engineer as well as the checking and approving engineer.

e) bear the title of the contract package.

Within 14 days of receiving such working drawing and shop drawings the Project Manager shall signify his approval or request modifications. The Contractor shall modify the designs and drawings, as may be required by the Project Manager.

The Works shall be constructed in accordance with the approved working drawings and shop drawings, and a copy of such drawings shall be kept on the Site at all times until the completion of the Works. All drawings on which changes are made, shall have the revisions clearly marked and dated.

Construction, fabrication or manufacture of any portion of the Works shall not commence until the design and drawings have been approved in writing by the Project Manager and thereafter no change shall be made to any drawings so approved without the permission of the Project Manager. Permission to make such changes shall be treated as a new submission under this Clause 1.12, and the requirements (a) through (d) above shall be met.

The approval of the working drawings and shop drawings by the Project Manager shall not in any way relieve the Contractor of his responsibilities under the Contract.

1.13 As Built Drawings

The Contractor shall prepare and submit one copy of as built drawings to the Project Manager for review as the works proceed. The Contractor shall modify the drawings, as may be required by the Project Manager. These drawing shall for the permanent record of the Employer and shall be in the form of soft and hard copies (black line/monochrome). Total number of prints shall be 10 (A3 size) along with one soft copy in AutoCAD and PDF format. The drawings shall be readable on A3 size for each drawing produced. The quality and format of these drawings shall be subject to the approval of the Project Manager. One set of the drawings shall be on archive quality drawing film.

1.14 Right to Change

When additional information regarding the geological formations, or other conditions becomes available as a result of excavation, testing, model studies, or exploratory work, the Project Manager may revise the Works to accommodate the newly disclosed conditions. The Contractor's Equipment shall be laid out and his operations shall be conducted so as to accommodate any such reasonable changes in the Works with no increase in cost to the Employer other than that due to changes in the measured quantities of the Works.

1.15 Datum of Levels

The levels shown on the Drawings refer to a system of bench marks previously established by the Irrigation Department based on a fixed datum level at Kotri Barrage. For the purpose of these Works the datum to be used shall be a bench mark for which the Project Manager will ascribe a value prior to the commencement of the Works.

1.16 Survey

From the bench mark specified in Clause 1.15 hereof, the Contractor shall check the levels of any existing temporary bench marks he proposes to use in setting-out the Works and shall establish additional bench marks such that no level is transferred more than 3000 feet without being transferred to a bench mark. Bench marks shall be numbered and their construction shall be to the approval of the Project Manager.

The Contractor shall supply to the Project Manager, in duplicate, maps and records in an approved form, giving details of the location (including coordinates) and level of each bench

mark used or established by the Contractor. Levels shall be transferred and ascribed to the bench mark within an accuracy of 0.25 √m inches, where m is the length in miles of the levelling circuit. Bench mark coordinates shall be determined to within an accuracy of 1 in 4000 of the length of the levelling circuit.

Where required, the Contractor shall submit to the Project Manager lists of original ground surface levels for the purpose of measurement of earthwork operations. The Contractor shall carry out a detailed topographical, bathymetric and structural measurement survey of the barrage left pocket, over the area identified on the Drawings.

The method of surveying shall be to the approval of the Project Manager. Field books and tabulated data shall he well maintained and made available to the Project Manager for inspection when ordered.

1.17 Programme

Before commencing the Works the Contractor shall submit to the Project Manager for his approval a programme including a Gantt chart prepared in MS Project software, showing the order in which he proposes to carry out the Works. This submittal shall be in accordance with the relevant clause within the General Conditions of Contract. The Contractor shall revise this programme as necessary to ensure completion of the Works within the time periods stated in the Contract. The Contractor shall also revise the programme whenever the previous programme is inconsistent with actual progress or with the Contractor's obligations. All revised and updated programmes shall be submitted to the Project Manager for his approval. The Contractor shall submit three hard copies, an electronic copy and one copy as a pdf file. The programme shall include the following details:

(i) details of the Contractor's methods of working and planned sequencing of works for all operations;

(ii) narrative statement giving the numbers and categories of supervisory and technical staff and skilled and unskilled labour to be employed on the Works;

(iii) a list and type details of major Contractor's Equipment (including vehicles) which the Contractor proposes to employ on the Works;

(iv) a statement giving the proposals for location or locations and sizes of base camps, accommodation, offices, workshops, stores and working areas.

Each Gant chart shall:

- be prepared using the critical path method
- show the assumed or actual Commencement Date
- show the start and finish date and float (if applicable) for each activity
- show the interdependencies between activities
- have each activity 'resource loaded' with labour, materials, equipment and be accompanied by print outs of planned and actual resource usage
- show the progress achieved on each activity
- show a clear critical path

The Contractor shall prepare and submit method statements in MS Word for approval by the Project Manager prior to starting any new activity or section of the Works, or at such other time that the Project Manager may reasonably require.

In the event that the Contractor's progress of work falls behind the approved programme through his own shortcomings, the Contractor shall provide an updated programming, detailing the delay and outlining how the Works will be expedited. This shall also detail how the

Employer shall have no financial burden resulting from the delay. This programme shall be subject to the Project Manager's approval, and until such time that the Contractor can provide an adequate programme, his progress shall be measured against the most recently approved programme.

1.18 Notice of Operations

The Contractor shall give full and complete written notice, including drawings and method statements, of all important operations to the Project Manager, 7 days in advance for activities shown on the Programme, else 30 days in advance, to enable the Project Manager to make such arrangements as the Project Manager may consider necessary for inspection and for any other purpose. The Contractor shall not start any important operation without the written approval of the Project Manager.

1.19 Working Hours

The Contractor shall plan his work on the basis of a six-day working week, and within the hours of 8:00 am and 5:00 pm and is deemed to have priced his work accordingly. Should the Contractor require additional working hours, or weekend working, he shall submit a request to the Project Manager for permission to work extended hours, giving full reasons for the requests. Approval to such requests will not be granted on a regular basis, but only in exceptional circumstances.

1.20 Staffing

The Contractor shall employ a full time, qualified Environmental Coordinator for the project who is conversant with national legislation related to the environment and with the World Bank's environmental safeguard policies.

The Contractor shall employ a full time, qualified Human Resource Officer for the project who is conversant with the Ministry of Labour and Manpower laws and their objectives related to:

(a) Formulation of a progressive and dynamic Labour and Manpower Policy;

(b) Human Resource Development, focus on education, training and skill development;

(c) Respect for human rights, gender balance, eradication of child and bonded labour;

(d) Promotion of dignity of labour;

(e) Promotion of social dialogue among the stake holders;

(f) Coordination with the Provincial Governments, International Labour Organisation (ILO) and other international agencies.

The Contractor shall employ a full time, qualified Community Liaison Officer for the project who is conversant with the World Bank's social safeguard policies and can address resettlement, consultation and stakeholder communication, grievances and other community liaison issues that arise according to the project action plans.

The Contractor shall employ a full time, qualified Health and Safety Officer for the project who is conversant with national legislation on occupational safety and work environments, and with the Ministry of Labour and Manpower and other ministry requirements and can manage and mitigate health and safety issues according to the Health and Safety Plan and the project action plans.

The Contractor shall provide sufficient staff with appropriate skills who are regularly available in Sindh Province for adequate management of environmental, social and community liaison issues.

The Contractor shall agree to not use any child labour or exploitative or forced labour. The Contractor shall not hire staff that are less than 18 years of age or have delivered a child within six preceding weeks (or as per labour legislation at time of works). The Contractor shall provide staff with information regarding their rights relating to hours of work, wages, overtime, compensation and provide a grievance mechanism for staff to raise work place concerns, and ensure third party employers do the same. The Contractor shall not discriminate against any staff candidate on the basis of gender, race, nationality, ethnic, social and indigenous origin, religion or belief, disability, age, or sexual orientation. The Contractor shall provide staff with notice of dismissal and severance payments as per national law. The Contractor shall provide employment opportunities to members of the local community.

The Contractor shall comply with all Pakistan national, regional and local government labour and employment laws. In addition, the Contractor shall comply with the following international guidelines:

- International Finance Corporation (IFC): Policy and Performance Standards on Social and Environmental Sustainability (2012), in particular IFC Performance Standard 2 on Labour and Working Conditions;
- IFC General Environmental, Health and Safety (EHS) Guidelines, April 2007, as applicable;
- IFC Sector EHS Guidelines, as applicable;
- IFC and EBRD's guidance note on Workers' Accommodation: Processes and Standards (2009)
- IFC Labour Toolkit (2004);
- IFC Good Practice Notes on: Addressing Child Labour in the Workplace and Supply Chain (2002), HIV/AIDS in the Workplace (2002), Managing Retrenchment (2005), Non-Discrimination and Equal Opportunity (2006); and,
- ILO Labour Conventions, in particular the core labour conventions related to freedom of association and collective bargaining, elimination of forced and compulsory labour, elimination of discrimination in respect of employment and occupation, and abolition of child labour.

The Contractor shall include a plan for the recruitment and appointment of local staff within the CESMP (see Appendix B for further details).

1.21 Training

The Contractor shall prepare a training plan as part of the Contractor's Environmental and Social Management Plan (CESMP - as detailed in B) which provides all personnel with adequate information, instruction and training on environmental and social awareness, cultural sensitivity, health and safety, and skills to implement the method statements. Training activities shall be recorded and reported on monthly. The Contractor shall update the training plan annually.

The Contractor shall organise induction training for all staff. The Contractor shall not allow staff on site without having undergone induction training.

The Contractor shall ensure employees are trained in the proper use of equipment in their care to minimise the risk of accidents.

1.22 Code of Conduct

The Contractor shall develop a Code of Conduct within three months of the Commencement Date which outlines expectations regarding staff and:

(a) Proper use of Personal Protective Equipment (PPE) that has been provided;

(b) No poaching of illicit use of local natural resources;

(c) Discreet sexual behaviour that takes into consideration HIV / AIDS messages;

(d) Respect for the local community and its cultural norms;

(e) Presentation of professional behaviour and integrity when dealing with the public.

The Contractor shall ensure that each member of staff signs the Code of Conduct or provides a written explanation of why they have elected not to sign it.

1.23 Communication Strategy and Stakeholder Management

The Contractor shall establish a Communication Strategy detailing stakeholders and their information, disclosure, consultation and participation requirements. The Communication Strategy shall include the use of various media for providing information (for instance face to face meetings, leaflets, website and radio) and receiving comments (for instance telephone, face to face meetings, text and email).

The Contractor's Communication Strategy shall identify how the Contractor shall provide details regarding employment opportunities at mobilisation, and traffic management throughout the construction period, to the Employer for incorporation into the Employer's own communication strategy.

The Contractor shall establish a database for recording and tracking stakeholder complaints, accolades, comments and any responsive actions taken by the Contractor. A summary of the stakeholder comments shall be provided to the Project Manager on a fortnightly basis. The Contractor shall maintain a complaints register at the main camp office.

The Contractor shall provide key stakeholders with contact details for liaison regarding their own activities which interface with the project activities.

The Community Liaison Officer shall continually consult local communities, including a focus on women and girls, and shall provide advance notice to the community of the construction schedule.

1.24 Suppliers of Materials

Before ordering a material of any description intended for the Permanent Works, the Contractor shall submit for the approval of the Project Manager the name of the maker or supplier proposed and details of the place of origin and specification of the material. If requested by the Project Manager, the Contractor shall supply to the Project Manager for his retention a copy of any such order placed.

1.25 Natural Materials

The Contractor shall make all arrangements for the location, selection and processing of natural materials to comply with the Specification. The Contractor shall obtain any specific approvals and permission for the excavation/abstraction of all materials. Before commencement of any works or request for approval from the appropriate authority the Contractor shall submit to the

Project Manager full set of material and source information regarding the proposed location for approval. This information should be submitted to the Project Manager, well-in advance of commencement of working of the material. Approval of a source shall not imply that all the material in that source is approved.

1.26 Utilities

The Contractor shall locate on the site all utilities whether or not they are indicated on the Drawings and to make the necessary arrangements with the utilities authorities for any work in the vicinity of the utilities and or diversions of the utilities.

1.27 Contractor's Environmental and Social Management Plan

The Contractor shall prepare, and submit to the Project Manager, the Contractor's Environmental and Social Management Plan (CESMP). Further details on the CESMP are included in B. No Works shall be undertaken by the Contractor prior to the approval of this document.

All work executed by or on behalf of the Contractor in the performance of the Works shall be in accordance with the CESMP. Nothing included within the CESMP shall supersede the requirements of any of the Clauses of this Specification.

The supervision of the Contractor's compliance with the CESMP, as well as the Clauses of this specification which are relevant to social and environmental management, shall be subject to audits undertaken by the Employer and the Project Manager. Such audits will include a review of the Contractor's internal audit records including identified non-conformities and the effectiveness of the corrective action. The Contractor shall be provided with ten working days' notice prior to an audit being carried out.

On a day-to-day basis, the Contractor shall afford reasonable availability of staff and documentation for the Project Manager to assess implementation of the CESMP and the Clauses of this specification which are relevant to social and environmental management.

The contents and requirements of the CESMP are defined in Appendix B.

1.28 Environmental, Ecological and Social Monitoring

The Contractor shall nominate staff who shall be responsible for day to day monitoring of compliance with the environmental, ecological and social requirements of this specification as well as the requirements of the CESMP.

The Contractor shall produce a monthly report to the Employer, copied to the Project Manager, comprising a checklist of environmental, ecological and social actions required at each work site and their status on site. The report shall detail actions taken or proposed by the Contractor in response to any non-compliance identified by the Contractor, or identified and reported to the Contractor by the Project Manager, Employer or any of their representatives.

The Contractor's Environmental Coordinator shall be available to attend monthly meetings (when and where arranged by the Employer) to discuss environmental, ecological and social performance on Site. When instructed by the Employer or Engineer, any other member of the Contractor's staff shall be required to attend such meetings.

1.29 Safety

The Contractor shall prepare, and submit to the Project Manager, a project specific Health and Safety Plan. Further details on the Health and Safety Plan are included in Appendix C. No Works shall be undertaken by the Contractor prior to the approval of this document.

All work executed by or on behalf of the Contractor in the performance of the Works shall be in accordance with the approved Health and Safety Plan. The Contractor shall observe high standards of safety for workforce and machinery at all times and with regard to safety and shall, inter alia, comply with local laws and ensure strict adherence to the following:

(a) The Contractor shall take appropriate precautions where personnel are required to work in confined spaces and other hazardous areas, and to only permit employees to work in confined spaces or other hazardous areas when there are adequate and continuous communication links with colleagues equipped to provide emergency assistance.

(b) The Contractor shall protect men working in excavations from slips by the proper shoring or sloping of excavations, and prohibit individual employees from working unsupervised in excavations.

(c) The Contractor shall protect personnel from the moving parts of the machines by installing and maintaining proper guards.

(d) The Contractor shall not permit casual observers close to excavating operations.

(e) The Contractor shall provide adequate fencing around the working areas and excavations.

(f) The Contractor shall arrange for a PMDC registered doctor to service the site during the Works and be available at all times. The appointed doctor’s PMDC certificate shall be submitted to the Project Manager for approval.

(g) The Contractor shall prepare an emergency shutdown procedure and evacuation plan to cover all staff and affected members of the public in the event of any emergency incident (such as accident, fire, blast etc.), The Contractor shall ensure emergency access routes are signed and maintained and provide fire extinguishers throughout camps and work areas.

(h) The Contractor shall provide all necessary Personal Protective Equipment (PPE) to staff (including, but not limited to life jackets, safety harnesses, gloves, safety boots, hard hats, dust masks, ear protectors, safety goggles, personal protective clothing) and take all reasonable measures to enforce the use of such PPE by staff. Measures may include, but shall not be limited to awareness raising sessions, training sessions, and financial penalties for failure to use PPE.

(i) The Contractor shall prepare and submit accident reports to the Project Manager following any accident on site. The reports shall detail actions to be taken to reduce the risk of reoccurrence of the accident.

1.30 Facilities for Labour and Construction Camps

The Contractor's staff quarters and labour camps shall be provided with all necessary services for drainage, lighting, roads, paths, parking places, fencing, sanitation, cook-houses, fire prevention and fire-fighting equipment. All labour camps, workshops and storage areas shall be built on hard compacted ground with sufficient bunding and spill kits so as to prevent the loss or infiltration of leaked or spilt fluids into surrounding soils, ground water or water courses. Traffic signage shall be maintained in the camps.

The Contractor shall establish a drainage network, including end discharge, to drain storm water away from camps and settlements.

The Contractor's camps shall comply with the rules of the Pakistan Labour Camp Rules, 1960, issued by the Pakistan Health, Welfare and local Government Department and also the following benchmarks based on the "Workers' accommodation: processes and standards. A guidance note by IFC and the EBRD" (April 2009).

All solid waste will be collected and removed from camps and disposed in compliance with Clause 1.32.

1.30.1 General Living Facilities

Living facilities shall be located in areas not at risk of flooding or other natural hazards and within a reasonable distance from the worksite, to which safe, free transport is provided where required. The living facilities shall be built with adequate materials, kept in a good state of repair, clean and free from refuse.

The living accommodation, and immediate surrounding area, shall be provided with adequate drainage to avoid the accumulation of stagnant water.

Adequate ventilation, natural light and emergency lighting shall be provided. Windows shall provide a total opening area greater than 5% of the floor area of each room.

1.30.2 Drinking Water Supply

Access to a free, safe, readily available potable water source shall be provided at all times. Drinking water quality shall meet WHO standards and the Pakistan National Environmental Quality Standards. Prior to use, the Contractor shall arrange for tests on samples of each drinking water source from a laboratory approved by the Sindh Environmental Protection Agency. The results of these tests shall be submitted to the Project Manager. Testing of water supplies shall be repeated annually. Each supply of drinking water shall be conspicuously marked by an appropriate sign. All water storage tanks shall be covered to avoid the risk of contamination.

The Contractor's arrangements for supply of drinking water must not reduce the quantity or quality of local water resources where these are relied upon by people in the vicinity of the project for any purpose.

1.30.3 Room/Dormitory Facilities

Floors to rooms/dormitories shall be constructed from 6 inch thick, float finished concrete, or other similar solid, washable material. Rooms/dormitories shall be maintained to a liveable standard, and cleaned daily.

A minimum floor space of 4.5m² (48ft²) shall be provided per resident with a minimum ceiling height of 2.10m (6.9ft). Separate sleeping areas shall be provided for men and women except in the case of family accommodation.

A minimum spacing of 1m (3.3ft) shall be provided between beds and one bed should be provided per resident. The use of bunk beds shall be avoided. Each worker shall be provided with an appropriate mattress, pillow, cover, clean bedding and mosquito net. Bed linen shall be washed regularly and treated with repellents as necessary. A minimum of one cupboard per resident shall be provided for personal storage, with separate storage being provided for any clothing or Personal Protective Equipment required for staff to carry out the work assigned to them.

1.30.4 Sanitary Facilities

The Contractor shall provide and maintain hygienic, well lit and ventilated sanitary facilities. Sanitary facilities shall be provided within separate buildings in the vicinity of rooms/dormitories. Separate latrines and washing facilities shall be provided for males and females with total isolation by wall or by location. Female and male latrines shall be clearly distinguished in a language understood by those using them to avoid miscommunication,

Washing facilities, including showers, shall be provided at readily available places within the immediate vicinity of every latrine. Washing facilities shall include a supply of clean running water, soap or other suitable means of cleaning, and a hygienic means of drying.

A minimum of one hand-wash facility, one latrine and one shower shall be provided between every ten persons.

All sanitary facilities shall be built from easily cleanable material and shall be cleaned daily. Sanitary facilities shall be built so as to provide adequate privacy. All doors shall be lockable.

Treatment and disposal of sanitary waste is detailed in Clause 1.32 (Disposal of Waste).

1.30.5 Canteen, Cooking and Laundry Facilities

Canteen, cooking and laundry facilities shall be built from easily cleanable materials and kept in a clean and sanitary condition. All such facilities shall be cleaned daily.

Adequate facilities for washing and drying clothes shall be provided. When work clothes are to be in contact with hazardous or dangerous substances, special laundry facilities shall be provided.

Canteens shall have a minimum floor space of 1.25m² (13.5ft²) per worker using the canteen at any one time and shall be adequately furnished. As a minimum, tables, benches, individual cups and plates, and drinking water facilities shall be provided.

Kitchens and other areas used for food preparation shall promote good food hygiene and protect against contamination. Kitchens shall include raised, smooth, easily cleanable, non-toxic and non-corrosive surfaces for food preparation. All kitchen fittings shall be easy to move to promote easy cleaning. All kitchen floors, ceiling and wall surfaces shall be built from durable, non-absorbent, easy cleaning non-toxic material.

Adequate facilities for cleaning, disinfecting and storage of kitchen utensils shall be provided throughout the Contract period. Kitchens shall provide facilities to promote good personal hygiene, such as adequate handwash and hand drying facilities. Food waste and other refuse shall be adequately deposited in sealed containers and regularly removed from the kitchen.

Kitchens shall be sheltered and separated from living quarters. Walls next to cooking areas shall be fire resistant.

The Contractor shall provide sufficient fuel for cooking inside camps, so as to prevent the collection of firewood.

1.30.6 Standards for Nutrition and Food Safety

The WHO 5 keys to safer food process shall be implemented. Food shall be made available to workers and shall contain an appropriate level of nutritional value and take into account religious/cultural backgrounds. Food shall be prepared by cooks.

Suitable and sufficient facilities for cold storage of food shall be provided.

1.30.7 Medical Facilities

At least one first aid kit shall be provided and kept stocked at all times at each structure site, and an adequate number of staff shall be trained in first aid. A 24/7 first aid service shall be available in addition to services of a PMDC registered doctor, further discussed in Clause 1.44 hereof. Additional medical facilities should be provided where possible, such as nurse rooms.

1.30.8 Leisure, Social and Telecommunications Facilities

Basic collective social/rest/recreational spaces shall be provided. Workers shall be provided with dedicated spaces for religious observance if so warranted.

1.30.9 Emergency Evacuation

The Contractor shall include an evacuation procedure for the camp and work sites as part of the CESMP. The evacuation plan shall identify and include any public areas and members of public at risk from fire in the camp. Emergency access routes shall be signed and maintained. Emergency evacuation drills shall be held at least annually.

1.31 Hazardous Materials

The Contractor shall provide designated areas for the storage of materials, including wastes, which are hazardous to the environment or the safety of the Contractor's staff or general public. Hazardous material storage areas shall be provided with concrete floors, covered, provided with fire extinguishers and secured. Hazardous storage areas shall be secured and access shall be limited to staff having received adequate training. Hazardous material storage areas shall not be situated in areas immediately adjacent to a watercourse or at risk of flooding. The use of necessary PPE shall be enforced by the Contractor. The Contractor shall only use hazardous material storage areas identified on his approved site layout plan. Spill kits shall be provided at each hazardous material storage area. No hazardous materials shall be stored beyond designated areas.

Material Safety and Data Sheets (MSDS) for each material shall be kept on site.

The Contractor shall carryout weekly inspections of hazardous material storage areas and maintain documentation of such inspections. Hazardous material storage containers shall be stored with spaces between adjacent containers to facilitate these inspections.

The Contractor shall provide a concrete or masonry bund to the perimeter of hazardous material storage areas and generator platforms so as to prevent the loss or infiltration of leaked or spilt fluids into surrounding soils, ground water or water courses.

The Contractor shall mark fuel tanks and other hazardous material storage containers to identify their contents and hazard warnings. Fuel storage areas shall be provided with masonry or concrete secondary containment bunds with a capacity to contain 110% of the fuel stored within. The Contractor shall carryout daily inspections of fuel tanks and maintain documentation of such inspections.

Hazardous material including fuel shall be stored on ground at an elevation above the 1 in 50 year flood level.

1.32 Disposal of Waste

1.32.1 Waste Management

The Contractor shall separate domestic, sanitary, construction and hazardous waste and dispose of them using methods detailed below. All wastes shall be covered during transport. Disposal of inert waste materials shall be by burying, where burial of such materials is approved by the Project Manager; or by removal from the construction area.

The Contractor shall place domestic waste collection bins within camps sites at a radius of no greater than 100ft and enforce use by staff. The Contractor shall arrange for the regular emptying of these bins and disposal of waste (using methods discussed below) such that they are not overfilled at any time.

The Contractor shall aim to minimise construction waste by returning excess construction materials to the supplier, and by making use of local recycling facilities where available.

All worn out parts, equipment and empty containers must be removed from the Site, or to a proper storage location. Disposal of material by removal from the construction area shall be accomplished prior to the completion of any Works. All materials removed except trees, shall become the property of the Contractor.

All tree removal shall be carried out in accordance with the approved tree removal procedure discussed in Clause 1.39. All trees, tree roots and bushes not required by the Employer shall be burned or removed from the construction area by the Contractor.

1.32.2 Landfill

Landfills established by the Contractor shall be situated at least 300ft from any settlement in areas where the groundwater is low. A clay or geotextile lining shall be provided to landfills. Fencing shall be provided around landfill sites when in use. Sites shall be secured and unauthorised access prevented when in use. Following use, landfills shall be capped with a clay layer and covered with top soil to original ground level.

1.32.3 Burning

The Contractor shall not be permitted to burn waste.

1.32.4 Hazardous Waste

The Contractor shall pass hazardous waste to a Sindh EPA certified contractor for disposal. The Contractor’s proposed methodology for disposal of hazardous waste shall be included in the CESMP, including the ultimate disposal location.

Medical waste shall be classed as a hazardous waste, and stored and handled as a hazardous material. The Contractor shall arrange for the disposal of medical waste at a medical incinerator through a Sindh EPA certified contractor.

Unused concrete shall not be disposed into the river water.

1.32.5 Sanitary Waste

Treatment facilities for each sewerage system shall collect all sanitary waste and be capable of treating sewerage waste to the level required by the Pakistan National Environmental Quality Standards for Municipal and Liquid Industrial Effluents, before release, unless this is released to a Government approved municipal treatment system.

The location of treatment facilities shall be chosen such that surcharging of this system shall not result in contamination of water bodies, or else reasonable measures must be taken to prevent this.

The Contractor shall only be permitted to use a government approved municipal system if he can show, through annual testing and submittal of result to the Project Manager, that the release is within the limits for pre-treated waste water as per the Pakistan National Environmental Quality Standards and upon written consent of the operator of the system.

The Contractor's proposed methodology for the treatment and disposal of sanitary waste shall be included in the CESMP (see B). The methodology shall also include a maintenance plan for any treatment facilities and a plan for treatment and disposal of sludge from septic systems. Where the Contractor proposes the use of septic systems, the CESMP shall include designs or specifications demonstrating that the treatment rate of the system exceeds the loading rate.

The Contractor shall take reasonable steps to ensure that construction waste and sanitary wastes are not mixed.

1.32.6 Sediment Laden Construction Water

Sediment laden construction water shall be discharged into settling lagoons or tanks prior to final discharge.

1.32.7 Batching Plant Washout

Refer to section 7.24.

1.33 Disruption of Local Communities

The Contractor shall take all measures necessary to avoid nuisance and disruption to local communities. In particular the Contractor shall ensure no damage is done to crops, pasture or woodland and outside the area for which the Project Manager's approval for bush clearance has been given, that all irrigation supplies to such areas are maintained and that the Contractor's operations do not cause flooding or pollution hazards.

The Contractor shall note that the marginal bunds, spurs, guide bunds and canal inspection and non-inspection paths are used by the Employer's staff for operation, inspection and maintenance purposes. The contactor shall allow for continued use of these by the Employer during the construction of the Works.

The Employer permits public access to parts of the marginal bunds, spurs, guide bunds and canal inspection and non-inspection paths. The Contractor shall allow for the continued public use of these where permitted by the Employer.

The Contractor shall ensure that road and pedestrian access across the River and any canal is maintained at all locations where existing crossings are present or in a reasonable location close to the existing crossing.

The Contractor shall ensure that Works do not prevent continued public access to any mosque or school.

The Contractor shall not allow migrant labourers to enter local villages other than in the course of their official duties.

The Contractor shall provide at least one staff member at each site who is fluent in the local language and able to communicate with the local community.

The Contractor shall comply with national guidelines on noise levels, carryout noise monitoring in the event of complaint by local community and implement noise reduction measures, such as temporary noise barriers, where noise levels exceed national guidelines.

1.34 Maintenance of Existing Irrigation Flows

Except during the closure period, the Contractor shall not interrupt the irrigation flows to the four active off-taking canals at Kotri Barrage that are essential for the growing of crops, taking into account the time of year, without the recorded and witnessed consent of the Employer.

1.35 Traffic Management

All construction operations shall be coordinated to result in the least practicable delay of traffic. The Contractor shall maintain all existing roads in a traffic worthy condition, ensure the maintenance of uninterrupted movement of traffic and repair any damage to local roads. Where partial road closure is required and approved by the Project Manager, one way traffic shall be maintained and traffic speeds restricted to 10 miles per hour. The Contractor shall provide flagmen, warning signs and barricades. Flag men shall be provided where haul routes cross and meet public roads.

Road closure shall not be permitted; except when authorised by the Project Manager and National / Local Highways Authority. In the event of any approved road closure, the Contractor shall place sign boards on the road to advertise the closure at least seven days in advance. The Contractor shall also identify and sign suitable diversions for the duration of the road closure. The Contractor shall be responsible for the maintenance of such diversions. All road closures shall be completed during non-peak hours of traffic flow.

The Contractor shall take all reasonable precautions and efforts to remove mud from public roads where this is as a result of operations. Ruts and scars on public roads resulting from the Contractor’s operations shall be repaired promptly.

Vehicle traffic through communities will be avoided as far as possible, and low speeds shall be maintained if they pass through communities. Warning signs shall also be provided by the Contractor where haul routes pass adjacent to settlements. Prior to the movement of large plant, the Contractor shall inform any communities who live or conduct their business along or adjacent to the proposed route of this plant.

The Contractor shall not move plant outside of the working hours given in Clause 1.19. Vehicles shall not be operated between sunset and sunrise, other than on public roads or in an emergency. The Contractor shall limit the speed of his vehicles and plant to 30km/hr on haul routes. National speed limits shall be observed on public roads. All plant and vehicles when not in use shall be parked in designated areas as identified in the layout plan. The Contractor shall ensure that all drivers of vehicles hold a valid license. The use of horns is prohibited near settlements.

The Contractor shall fit audible alarms which activate automatically when vehicles reverse, or else provide a banksmen.

The Contractor shall ensure that the deliveries of loose material to site, and transport of loose material through the site, are covered during transportation. The Contractor shall make provision for the off road queuing of delivery vehicles in the layout plan, and not allow delivery vehicles to queue, load, or unload on public roads so far as is practicable.

The Contractor shall provide a project specific Traffic Management Plan within the CESMP, as detailed in Appendix B.

1.36 Archaeological Findings

The Contractor shall not trespass, excavate in or otherwise disturb graveyards whether shown on Drawings or not. In the case of unidentified graveyards or burial sites, the Contractor shall immediately cease works in the vicinity and notify the Project Manager in writing. The Project Manager shall make such design changes as required.

The Contractor shall erect fencing around any graveyards existing within the site and prohibit access to these areas by his staff.

There are no known cultural or archaeological heritage sites within the project area. However, the Contractor shall develop a procedure for “chance finds” in accordance with the Environmental and Social Assessment and World Bank OP 4.11.

1.37 Temporary use of Land

The Contractor shall be responsible for arranging the temporary use of privately owned or leased land where required for the completion of the Works. The Contractor shall enter into written, signed and witnessed agreements with the land owners, or lease holders, for the use of their land.

The Contractor will not use any areas subjected to anti-encroachment drive for temporary use, transportation, materials dumping or storage or any other activity related to civil works

1.38 Landscape Preservation

The Contractor shall exercise care to preserve the natural landscape and shall conduct his construction operations so as to prevent any unnecessary destruction, scarring or defacing of the natural surroundings in the vicinity of the work. Except where clearing is required for permanent works, for approved construction roads and for excavation operations, all trees, native shrubbery, vegetation, fences and walls shall be preserved and protected from damage which may be caused by the Contractor's construction and restoration operations and equipment. Movement of crews and equipment over routes provided for access to the work shall be performed in a manner to minimise damage to grazing land, crops or property.

Prior to commencement of Works, including site clearance, the Contractor shall take, and make available on request to the Project Manager or Employer until the end of the Defects Notification Period, photographs of the undisturbed site.

1.39 Removal of Trees

1.39.1 Scope of Work

The work consists of removal of trees of 6 inches girth or larger along with their stumps and roots to a depth to ensure complete removal of roots and stumps and their disposal as instructed by the Project Manager. The disposal of cut trees shall be as per the tree removal procedure outlined below.

Refer to Clause 4.2 for requirements relating to the removal of trees with a girth less than 6 inches.

1.39.2 Tree Marking

The Contractor shall clearly mark each tree that is required to be removed with a cross on all four sides using a highly visible paint. The marking shall be located at approximately 4.5 feet from the base of the tree.

1.39.3 Tree Inventory

The Contractor shall prepare an inventory of all trees to be cut. The inventory shall include the following details:

- Reference number
- Location
- Species
- Girth
- Approximate height

1.39.4 Approval

The Contractor shall obtain written approval from the Project Manager before any trees are cut. The Project Manager shall only approve tree cutting where a complete tree inventory has been submitted to the Project Manager detailing all trees included in the request. A joint visit between the Project Manager and the Contractor (or their representatives) may be required to verify the inventory prior to approval.

1.39.5 Tree Cutting

Once the Contractor receives approval from the Project Manager he can proceed to cut the sanctioned trees and shall store all cut section with a girth greater than 6 inches in a designated, secure storage area as directed by the Project Manager. The Contractor shall mark each cut section of tree with a unique reference number that corresponds to a reference number given on the tree inventory.

The Contractor shall maintain the tree inventory to include the number of cut sections of each tree and storage details of each section removed from site. The tree inventory shall be kept up-to-date and available to the Project Manager at all times.

The felling of a tree which houses an active nest of eggs shall be prohibited.

1.39.6 Tree Handover

The Contractor shall inform the Employer via the Project Manager when a batch of trees is ready for handover.

The Employer shall visit the tree storage area to review the inventory of trees to be handed over. The Employer shall only assume responsibility of each batch of trees and arrange for their transportation from the storage area following signing of the agreed tree inventory and handover record by the Contractor and the Employer.

1.39.7 Compensatory Tree Plantation

The Contractor shall plant five trees for every single tree cut. Planted trees shall be saplings of native trees and the Contractor shall be responsible for aftercare until the end of the defects notification period, but for a period of no less than one year. The Contractor shall replace any newly planted tree that does not survive during the period for aftercare.

1.40 Pollution

1.40.1 Water

The Contractor shall comply with applicable regulations concerning the control and abatement of water pollution as follows:

- The Contractor's construction activities shall be performed by methods that will prevent entrance or accidental spillage, of solid matter, contaminants, debris and other objectionable pollutants and wastes into flowing streams, flowing or dry watercourses, lakes and underground water sources.
- Vehicle washing areas shall not discharge directly or indirectly to any drain, groundwater or surface water body. In the case that vehicle washout drains to a settling tank adequate lining shall be provided so as to fully impede any seepage from the tank, and proper disposal of the washout shall be arranged.
- The Contractor will provide suitable sanitary facilities for the use of his personnel.
- National water quality standards shall not be exceeded.

1.40.2 Ground

The Contractor shall confine contaminants immediately following a land based spill and clear contaminants using absorbent material. Contaminated soils and contaminated absorbent material shall be collected for treatment and disposal through Sindh EPA certified contractors.

1.41 Grazing of Livestock

The Contractor shall provide reasonable care by hiring watchmen to ensure that livestock are not allowed within the Site.

1.42 Wildlife

The Contractor shall fully cooperate and assist as necessary with any protection plans developed by state authorities to avoid damage to or disturbance of wildlife.

The Contractor and all staff are prohibited from hunting, poaching, fishing and trapping fauna.

1.43 Security

The Contractor shall provide appropriate security personnel (police /military or private security guards) and enclosures to prevent unauthorized entry to the Site and the camp areas. Entrances to Site and camps shall be monitored and restricted by the Contractor. The Contractor shall issue his staff with identity cards showing their association to the project. Armed security personnel shall be retained by the Contractor for travelling to selected project locations. Sindhi speaking staff shall be available at all active work sites to communicate with the local community. The Contractor shall coordinate with the Police and Rangers on matters of security and shall formalise an internal and external communication mechanism.

1.44 Medical Facilities

A Pakistan Medical and Dental Council (PMDC) registered doctor / paramedic shall be available in accordance with Clause 1.29 hereof and adequately equipped and properly staffed portable first aid stations and dispensaries shall be provided by the Contractor at the camp, to administer first aid treatment at any time required and free of charge to all persons on the Site, including personnel of the Project Manager and the Employer. The nature, number and location of facilities furnished and the Contractor's staff for administering first-aid treatment shall, as a minimum, meet the requirements of the Health Service of the Government of Pakistan. The dispensary shall be stocked with appropriate medicines for likely incidents, diseases and ailments to occur on site, and restocked as necessary.

The Contractor shall arrange for the doctor/paramedic to visit the camp on, at least, a weekly basis.

The Contractor shall monitor labourers health, safety and hygiene for the entire construction period.

1.45 Operation of Plant and Vehicles

1.45.1 Maintenance

The Contractor shall be responsible for servicing all plant according to manufacturer's requirements. He shall ensure plant operators carryout daily checks for fuel and oil leaks, and that any such leaks are fixed immediately. The Contractor shall ensure that all acoustic guards, silencers, covers and doors provided on plant are retained in place during operation, and shall regularly monitor noise emissions from plant and vehicles against the Pakistan National Environmental Quality Standards.

1.45.2 Refuelling of Plant

The Contractor shall only carryout refuelling of plant over a concrete pad surrounded with bunding or over portable drip trays so as to prevent the loss or infiltration of leaked or spilt fuel into surrounding soils, ground water or water courses. Spilt fuel shall be reused or disposed of as hazardous waste. The Contractor shall provide spill kits at refuelling points.

1.45.3 Wash Down

The Contractor shall wash down plant and vehicles in designated areas only. Such areas shall be identified in the Contractor's camp layout plan and provided with a concrete base and means for the collection of wash down water, separation of oil and other contaminants and their disposal as hazardous waste to prevent infiltration of contaminants into surrounding soils, ground water or water courses. The Contractor is prohibited from using groundwater for the wash down of plant.

1.45.4 Air Emissions

The Contractor shall provide vehicles which do not exceed national guidelines on ambient air quality or the following International Finance Corporation limits:

- Particulate matter: 100 mg/Nm^3
- Sulphur dioxide: 3% sulphur
- Nitrogen oxides: 1,460 mg/Nm^3

1.45.5 Passengers

The Contractor shall ensure that no passengers are carried in or on site machinery unless it is purposely designed to carry passengers. No passengers shall be carried in the cabs of tractors, dozers, excavators or cranes or in the back of lorries, pick-ups or dump trucks.

1.46 Generators

The Contractor shall provide generators and generator stacks which meet guidelines given in Table 1.1.2 and Annex 1.1.3 respectively of the Environmental, Health, and Safety Guidelines, General EHS Guidelines: Environmental, Air Emissions and Ambient Air Quality, published by the International Finance Corporation (2007). Generators shall be routinely inspected and maintained by the Contractor and emissions shall not exceed national emission standards. Canopies shall be provided to generators for noise control.

2 The Site and Working Constraints

2.1 Site Location

Kotri Barrage is located on the Indus River between Jamshoro and Hyderabad in Sindh Province. It is the third of three barrages on the Indus River within the Province of Sindh.

The Site is as defined on the Drawings.

2.2 The Site

The Site shall be that area as defined in Clause 1.1 (aa) of the Conditions of Contract and as stated below.

The Site is shown on the Drawings.

Within the areas which may from time to time be defined as the Site, the Contractor shall carry out and perform the construction of the Works, and subject to the approval of the Project Manager, will be permitted to construct temporary road ways, camps, buildings and temporary works which may be required for the construction of the Works at the site. If the Contractor wishes to use other land for construction of camps or for any other contract purposes, the Contractor shall make all necessary arrangements with the owner thereof and shall bear all rentals or other costs connected therein.

The Employer shall give the Contractor possession of the Site, when the Project Manager's instruction to commence work is given.

The Contractor shall maintain the Site in a neat, tidy and healthy condition and free from accumulation of waste or rubbish. The site should comply with good health and safety standards at all times and as per the minimum conditions set out in the CESMP.

2.3 Access to the Works

Right of way for access to the Works from existing roads shall be provided by the Contractor through his own arrangements. The Contractor shall make his own investigations of the condition of available public or private roads and of clearance, restrictions, bridge load limits and other limitation that affect or may affect transportation and ingress and egress at the job sites, and shall bear all responsibilities in that respect.

Before the commencement of any part of the Works the Contractor shall make temporary access tracks including all necessary temporary diversions and bridge works to the part of the Site concerned, both for the Contractor's own access and for the maintenance of public access, all to the approval of the Project Manager. The Contractor shall maintain such access tracks in a condition suitable for the safe and easy passage of Contractor's Equipment, vehicles, and pedestrians until these tracks are no longer required for the purposes of the Works. Other contractors may use such access. The Contractor shall also provide and maintain temporary drainage and shall divert and reinstate permanent drainage systems.

The width of new access tracks established by the Contractor shall be no greater than 10 ft. The use of existing access tracks should be preferred where appropriate. The Contract shall not remove dense vegetation, trees or stands of *Acacia nilotica* or *Tamarix sp* in order to make a temporary access track unless approved by the Project Manager.

The Contractor shall make a record to be agreed by the Project Manager of the condition of the surfaces of any private lands or any public cultivated or maintained lands over which access for the Site lies before use for access and he shall keep such surfaces in a reasonable state of cleanliness and repair. On the termination of the Contractor's use of such access he shall restore the surfaces to a condition at least equal to that found before his first entry on them.

The Contractor shall implement continuous dust suppression measures, such as water sprinkling, on access roads where project traffic activates dust. Where requested, a water spraying schedule shall be prepared by the Contractor and submitted to the Project Manager.

2.4 Haul Routes

The hauling of materials and other hauling and transportation over public highways, roads and bridges shall be in compliance with local regulations. Where haul routes cross public highways or roads, the Contractor shall provide barricades, flagmen and other necessary precautions for safety.

The Contractor shall plan haulage routes to take advantage of existing established tracks. Where new haul routes are to be established, these shall follow the contours of natural topography to reduce earthworks along these routes. The width of new haul routes established by the Contractor shall be no greater than 10 ft. The Contract shall not remove dense vegetation, trees or stands of *Acacia nilotica* or *Tamarix sp* in order to establish haul routes.

The Contractor shall implement continuous dust suppression measures, such as water sprinkling, on haul routes where project traffic activates dust. Where requested, a water spraying schedule shall be prepared by the Contractor and submitted to the Project Manager.

The movement of plant or vehicles shall be prohibited between sunset and sunrise, except on public roads, or in case of emergency.

2.5 Damage to River, Canal and Drain Banks and Operating Roads

The Contractor shall limit his loads, speeds, and hauling operations over the existing roads so as to minimise damage to other existing facilities. Ruts and scars resulting from the Contractor's operations shall be repaired and any damage to drain, canal or river embankments shall be promptly corrected.

2.6 Clearance of Site

The Contractor shall clear the Site to the extent required by the Project Manager for checking setting-out. The Contractor shall also clear the parts of the Site to be occupied by the Works of all vegetation and artificial obstructions.

The Contractor shall fill and make good with appropriate material those cavities and losses of soil which result from clearing for setting-out as specified in this Clause. The material arising from such clearance shall be removed from the Site and disposed of by the Contractor.

The Contractor shall make periodic clearance of vegetation as is necessary to preserve the amenity and appearance of the neighbourhood of the Site.

3 Materials and Workmanship

3.1 Sampling and Testing

(i) The Contractor shall keep records of all the tests he conducts in compliance with the Specification or as required by the Project Manager and shall submit copies of the results of such tests to the Project Manager.

(ii) The Contractor shall not use for his own purpose any testing equipment supplied for the Project Manager's laboratory unless expressly permitted to do so by the Project Manager.

(iii) Samples required for tests in the Project Manager's laboratory, or in a laboratory approved by the Project Manager, shall be supplied and delivered by the Contractor in appropriate containers, suitably packed and labelled.

(iv) The Contractor shall supply, install and service the equipment specified in the Contract for use in the Project Manager's laboratory to the extent order by the Project Manager.

(v) Tests in the Project Manager's laboratory shall be carried out by the staff of the Project Manager or the laboratory technician supplied by the Contractor in accordance with Clause **Error! Reference source not found.** hereof under the direction of the Project Manager.

(vi) Tests required by the Project Manager may be carried out at the Project Manager's laboratory or a laboratory approved by the Project Manager. Tests carried out in the Project Manager's laboratory shall be made using the equipment supplied under the Contract and no additional payment will be made for carrying out the tests. Where specified or ordered by the Project Manager, the Contractor will arrange for additional tests to be carried out at a laboratory approved by the Project Manager. If at any time a test cannot be carried out in the Project Manager's laboratory due to a malfunction of the laboratory equipment maintained by the Contractor the test shall be carried out in an approved laboratory at the Contractor's expense. The Contractor shall maintain the equipment supplied under the Contract in full working order and - shall hand over the same in this condition to the Employer at the end of the Defects Notification Period or at such earlier time as the Employer may require. The Contractor shall also supply and maintain such number of sample containers for the tests as is necessary to meet the requirements of the Project Manager's testing program.

3.2 Testing Plan

Before the commencement of work at site the Contractor shall submit a testing plan indicating methods, standards, frequency of tests for the approval of the Project Manager. The testing plan may be revised with the permission of the Project Manager when required.

The testing plan shall also include all tests to be performed as specified in all the Chapters of the Specification unless otherwise stated.

3.3 Equipment for the Project Manager's Laboratory

If ordered, the Contractor shall provide and maintain all the equipment and materials required to carry out the following tests. ASTM and AASHTO Standards may also be used by the Contractor with the approval of the Project Manager.

(a) Soil Testing (the numbers given in brackets refer to the tests as specified in BS 1377:1990):

(i) Determination of moisture comment (IA)

(ii) Determination of liquid limit (2A)

(iii) Determination of plastic limit (3)

(iv) Determination of plasticity index (4)

(v) Determination of linear shrinkage (5)

(vi) Determination of specific gravity of soil particles (6A or 6B)

(vii) Determination of particle size distribution (down to sieve size 200) (7A)

(viii) Determination of particle size distribution (fine grained soils) (7D)

(ix) Determination of sulphate content of soil and groundwater (9) and (10)

(x) Determination of dry density/moisture content relationship (12)

(xi) Determination of dry density of soil on the Site (I5B), ASTM D1556, and D 1558.

(xii) Modified Proctor Test ASTM D1557 T-180.

(b) Concrete Testing (the part number refers to the tests or procedures specified in BS 1881):

(i) Slump test - Part 102: 1983

(ii) Making and curing test cubes -Parts 108:1983 and 111:1983

(iii) Compressive strength test – Part 116:1983

(c) Fine and Coarse Aggregate Testing (the part, section and paragraph numbers refer to the tests specified in BS 812):

(i) Flakiness Index -Part 105: Section 105.J:1989

(ii) Elongation Index - Part 105: Section 105.2: 1990

(iii) Particle size and grading - Part 103: Section 103.1: 1'985

(iv) Silt content by field settling test - Part 103: Section 103.2: 1989

(v) Chloride content - Part 117:1988

(vi) Aggregate moisture Content - Part 109:1990.

3.4 Concrete Sampling and Testing

The Contractor shall provide samples of concrete and its constituent materials either for testing by himself or on behalf of the Project Manager or for testing at the Project Manager's or a laboratory approved by the Project Manager. Samples may also be taken by the Project Manager for testing at the Project Manager's laboratory or a laboratory approved by the Project Manager. Concrete test cubes, which shall be made in accordance with BS 1881, shall be deemed to be samples for the purpose of this Clause. All sampling of constituent materials shall be carried out in accordance with the provisions of the appropriate British Standard, and all sampling of fresh and hardened concrete shall be carried out in accordance with the Provisions of BS 1881 unless such provision is at variance with the Specification hereof.

Details of such samples shall be recorded by the Contractor and passed to the Project Manager. The Project Manager will make available to the Contractor the results of each test carried out on the samples provided.

The tests which the Contractor is required to undertake himself, on behalf of the Project Manager, are those to be carried out on fresh concrete at the place of final deposit, or elsewhere in the Site as directed by the Project Manager.

The Contractor shall also test aggregates for moisture content and so determine the water / cement ratio of the fresh concrete. Determinations of water / cement ratio shall be carried out as required by the Project Manager and the results and calculations submitted to him.

The Contractor shall until the end of the Defects Notification Period (or such earlier date as directed by the Project Manager) supply, service and operate the necessary apparatus for sampling concrete and its constituent materials in accordance with the requirements and for slump tests on fresh concrete as described above.

Sampling of fresh concrete for concrete test cubes shall be carried out, whenever possible, at the place of deposition in the Works. From each such sample three (3) such cubes shall be made. Each cube shall be marked indelibly for identification when it is in the mould. After retention at the place where they are made for 24 hours, the cubes shall be delivered to the Project Manager's laboratory for removal from their moulds, curing and testing. Moulds shall be returned to the Contractor for re-use. Sampling fresh concrete for such cubes shall be carried out by the Contractor in accordance with a sampling plan approved by the Project Manager in accordance with the following principles.

The frequency of sampling for each class of concrete from each batching centre in each active day to be at a rate of:

(a) one sample from one batch of every 10 batches: or

(b) one sample per-350 cubic feet of concrete; or

(c) one sample,

Whichever involves the greatest number of samples.

When more than 700 cubic feet from one batching centre is placed in one location in one day, the rate of sampling may be decreased, with the approval of the Project Manager, to one sample from one batch of every 20 batches or one sample per 700 cubic feet of concrete, whichever involves the greatest number of samples. The actual rate of sampling may vary to the approval of the Project Manager according to the random selection of batches to be sampled and shall be increased when ordered by the Project Manager in appropriate circumstances.

In addition to his other duties in connection with the sampling and testing of concrete, the Contractor shall provide the instruments for, and record the temperatures of the concrete and concrete materials, as required by the Project Manager, and copies of such records shall be supplied to the Project Manager.

3.5 Sampling

The Contractor shall provide for the approval of the Project Manager samples of all construction materials and manufactured items required for the Permanent Works specified herein and in all Chapters of the Specifications, if ordered. All samples rejected by the Project Manager shall be removed forthwith from the Site. All approved items shall be stored on the Site by the Project Manager with assistance of Contractor for the duration of the Works under conditions which will prevent deterioration of the approved sample. Any materials or manufactured items

subsequently delivered to the Site for incorporation in the Permanent Works shall be at least equal to the approved sample.

3.6 Records

The Contractor shall keep full and proper weekly records of the operation, production and progress of each item of Contractor's Equipment, including details of the ground and conditions of working and shall copy such records to the Project Manager on a regular basis.

3.7 Quality of Materials

All materials, fixtures, fittings, and supplies furnished by the Contractor shall be new and unused, of standard first-grade quality and of the best workmanship and design. No inferior or low grade materials, supplies or articles will be either approved or accepted.

Prior to procurement, the Contractor shall furnish to the Project Manager, for his approval, the names of the manufacturers of all equipment and materials which he contemplates incorporating in the Works. With this information the Contractor shall also furnish such pertinent information as to capacities, efficiencies and sizes, and such other information as may be required by the Project Manager. Samples of materials shall be submitted to the Project Manager for approval when so directed. Equipment, materials, supplies and articles installed or used without the Project Manager's approval shall be at the risk of subsequent rejection.

3.8 Standards and Specifications

Except where otherwise specified all materials and workmanship shall conform with the requirements of the relevant British Standards and British Standard Codes of Practice hereinafter referred to as latest BS or CP issued by the British Standards Institution. Other equivalent National or International Standard Specifications may be substituted at the sole discretion of the Project Manager or as may have been agreed in the Contract. A list of the relevant standards is included as A to this specification. Where relevant BS and CP now quote metric units only, these are to be interpreted, if so required, as the nearest equivalent imperial (foot / pound) unit.

The Contractor shall obtain and keep on Site at least one copy of each BS, CP or other approved Standard and reference work which is referred to in these Specifications, and of each other Standard which applies to materials which are being supplied to, or workmanship executed on, the Works. If the Project Manager is in possession of any Standard, further copies may not be required, as the Project Manager shall determine. These Standards and reference works shall be supplied to the Project Manager within 40 days of the Project Manager's instruction.

If the Contractor, at any time and for any reason, wishes to deviate from the above standards or desires to use material or equipment not covered by the above standards, he shall state the exact nature of the changes, the reason for making the change and shall submit complete specifications of the materials and equipment to the Project Manager for approval.

3.9 Inspection and Tests

All equipment and materials furnished under these Specification and all work performed in connection therewith will be subject to rigid inspection by the Project Manager. Inspection at the manufacturer's plant will be made to determine that the equipment and materials meet the requirements of these Specifications. The Contractor shall notify the Project Manager not less than 14 days in advance of the date and place that the equipment or materials will be available for inspection. No equipment or material shall be transported until inspection by the Project

Manager at the manufacturer's plant has been made and final drawings have been furnished by the Contractor and accepted by the Project Manager. Acceptance of equipment and materials or the waiving of inspection thereof shall in no way relieve the Contractor of the responsibility for furnishing equipment and materials meeting the requirements of the Specification.

4 Earthworks

4.1 Scope of Work

Earth works consists of all necessary work for excavation and placing in embankment or back fill or disposal by dumping of earth or other material from or to the Site or adjacent thereto or from borrow areas, including excavation from structures, trenches and backfilling, removal of unsuitable material, formation of canal or river banks, widening, desilting of canal or river, clearing, grubbing, selective removal of trees, removal of existing obstructions within the reservation width in accordance with these specifications and in conformity with lines, grades, sections and dimensions shown in the Drawings or as instructed by the Project Manager.

4.2 Jungle Clearance

4.2.1 General

Jungle is defined as any weeds, reeds, long grass, pann grass, bushes, hedges, trees of girth less than six inches, undergrowth or the like which may affect the visibility and access along the berms, inspection and non-inspection paths. Jungle wherever it occurs with the Site will be cleared only where ordered by the Project Manager.

The trees shall not be felled without prior written authorisation of the Project Manager. The Contractor shall generally remove Jungle, which is visible above the ground including roots. The Jungle shall not be set on fire without the written permission of the Project Manager.

Jungle clearance shall be limited to the extent required for the execution of the works.

4.2.2 Scarifying Ground Surface

Where fill in embankments is to be compacted, the surface of the ground under the embankment shall be scarified to a depth of 6 inches, insuring that all clods are broken and material is carefully spread so as to provide a satisfactory bond between grounds and fill. The moisture content of the scarified surface shall be carefully controlled either by natural drying or by wetting with a fine spray. If for any reason, progress in compacting the fill is interrupted for a significant time, the surface of the fill material shall be scarified before compaction continues.

4.2.3 Removal of Trees

The work consist of removal of trees of girth less than six inches and stumps along with their roots to a depth to ensure complete removal of roots and stumps and their disposal as instructed by the Project Manager. Removal of trees shall be in accordance with Clause 1.39.

4.3 Earthworks

The Contractor shall make excavations in any material and any conditions for the Works and shall dispose of the excavated materials all as specified, shown on the Drawings, and instructed by the Project Manager.

4.4 Commencing Earthworks - Notice and Approval

The Contractor shall give the Project Manager at least twenty eight days written notice of his intention to commence earthworks on any part of the Site. A full work plan and methodology detailing how the Contractor plans to carry out the earthworks shall be provided along with the

factual site investigation report and the aforementioned written notice. The earthworks shall not be commenced until the Contractor has received written approval from the Project Manager.

The Contractor shall prepare a plan of earthworks operation for each particular part of the Works to be constructed at any one time, detailing the location and programme of excavation in channels and structures, of placing the fill in embankments, necessary supports for excavations, etc.

Any approval given by the Project Manager to the Contractor's method of working will not relieve the Contractor of his responsibility to meet the requirements the Specification set out herein.

4.5 Earthworks to Lines and Levels

The whole of the earthworks for the several parts of the Works shall be carried out to the dimensions and the levels shown on the Drawings or to such other dimensions and levels as may be ordered by the Project Manager, and conforming to the specified tolerances. Dimensions, which are based on, or related to, ground levels or chainages, shall be referred to the Project Manager before commencing earthworks at any locations

For the purpose of the Specification the term ground level shall refer to the original profile before the start of earthwork operations.

The base of embankments and the limits of the borrow pits shall be marked by trenches before the earth work is commenced, and the side slopes shall be constructed using batter boards. The batter boards shall be made with a ledge at the correct angle of the slopes including shrinkage allowance so that in conjunction with a mason’s level, the slope can be tested at any time during the work. When the embankment is raised to within 2 feet of the top, the top width shall be laid out in line and level with two stakes every 100 feet having the required height marked thereon.

4.6 Site Preparation

The surface of any old banks or mound which is not to be removed but covered with a raised embankment shall be thoroughly loosened and stepped or benched in 6 inch steps over the whole area to be covered by the new bank. The new work should be properly keyed into the old as per Clause 4.2.2.

The site shall always be prepared for a length of not less than 500 feet in advance of the earth work.

4.7 Excavation of Unsound Material

(i) If any unsound material occurs in the bed or sides of a channel, in foundations, or below embankments, the Contractor shall remove and dispose of it. Unsound material shall include roots, organic matter, mud, gypsum, surface layers of boulders, cobbles and gravel, and deleterious substances. Unless otherwise specified or ordered by the Project Manager, the Contractor shall fill the voids so formed, with concrete class D for structures, with compacted fill, not less than 95% of dry density as determined by AASHTO T180 or equivalent, for channels and embankments, and with approved granular material for embankment pitching.

If the Contractor encounters any material, which in his opinion may be unsound, he shall immediately inform the Project Manager who will instruct the Contractor in writing as to whether or not the material is to be treated as unsound.

(ii) The above notwithstanding, where the Drawings show the placing of earthworks on vegetation existing prior to commencement of earthwork operations at any location, such

vegetation shall not be considered to be unsound material except to the extent that the vegetation, or its roots etc, is deemed by the Project Manager to be unsuitable.

(iii) The provisions of Sub-Clause (i) hereof, notwithstanding, where the Drawings show excavation below the line of future embankments in order to remove roots of reeds, etc. the material so excavated shall be classed as unsound if comprising roots, organic matter or mud.

4.8 Slips and Falls

The Contractor shall exercise the greatest possible care and take all necessary precautions to prevent slips and falls of material from the sides of the excavation and embankments.

In the event of slips and falls accrue, the Contractor shall make good all earthworks and associated works and execute any requisite modifications of the Works, as directed by the Project Manager.

4.9 Fill

Fill means selected suitable material placed in embankment above original ground level. Selection shall, inter alia, be such as to exclude material of particle size specified or approved by the Project Manager. Notwithstanding other provisions of the specifications all suitable sandy, silty and clayey earth material will be accepted in the fill, as specified below. Where the channel excavation at any section does not furnish sufficient suitable material for embankments, the material shall be taken from designated borrow areas as approved by the Project Manager.

4.9.1 Approved Material for Compacted Fill and Backfill

The material for compacted fill shall comply with the following requirements:

- Material classified as A-4, A-5, A-6 or A-7 according to AASHTO M 145, or as otherwise approved by the Project Manager, shall be suitable for use as compacted fill
- All suitable material from excavation shall be dry and free of vegetation.
- The surface of the embankment including the crest and slopes shall be covered with a minimum of one foot of clay material.

4.9.2 Special Compaction of Fill or Backfill

Specially compacted fill or backfill shall consist of approved material spread and compacted in layers approximately horizontal and of uniform thickness with a slight outward slope and of a compacted depth not exceeding 6 inches. The moisture content of the soil shall be carefully controlled either by natural drying or wetting with a fine spray.

The compaction shall be carried out by mechanical rollers, rammers, vibrators or other approved Contractor’s Equipment so as to produce a dry density not less than 90%of the maximum dry density as determined by ASTM D-1557 for embankments and material placed above structural foundation level, and not less than 95% of the maximum dry density for material placed below structural foundation level, as determined by ASTM D-1557.

The Contractor shall exercise careful control of the moisture content of the fill material prior to and during compaction such that it lies within a range of values established to the approval of the Project Manager during the trials specified in Clause 4.9.3 herein and is suitable for the fill material and the method of compaction adopted.

4.9.3 Preliminary Trials for Specially Compacted Fill

At least one month before commencing special compaction of the fill in the Works, the Contractor shall submit to the Project Manager details of the method and Contractor's Equipment proposed to be used, and shall make trials on Site. The Contractor shall make such tests of the materials before and after compaction as the Project Manager considers necessary, both of the trials and of the Works, to ascertain that the degree of compaction specified is attained.

Any approval given by the Project Manager to the Contractor's method of working will not relieve the Contractor of his responsibility to meet the requirements of Clause 4.9.2 hereof.

4.10 Allowances for Settlement

The Contractor shall make due allowance for the effects of consolidation, including the settlement of fill and compacted fill, such that the levels, widths and dimensions of the finished surfaces at the end of the Defects Notification Period are in accordance with the Specification.

4.11 Borrow Areas

Borrow areas shall be established between the left and right marginal bunds. No private or agricultural land shall be used for the establishment of borrow areas. The Contractor is responsible for determining the ownership of land required for borrow areas and shall submit such records to the Project Manager. Refer to section 1.37 for further details of temporary use of land.

The Contractor shall place material at point of use or within vehicle for haulage directly following excavation and shall not double handle material.

Initial establishment of new borrow areas shall avoid faunal breeding seasons. Removal of protected flora during the establishment of borrow areas is prohibited. The Contractor shall take and record photographs of the pre-construction baseline and post-works condition of each separate borrow area.

All borrow activities shall be completed between the hours of 6am and 6pm.

4.12 Method of Excavation

The Contractor shall submit his proposed method of excavation to the Project Manager for his written approval, in accordance with Clause 4.4.

4.13 Working Space

Excavation shall be carried out to such minimum dimensions as will permit, proper support of the sides of the excavation, the erection of shuttering, placing of concrete and fill, including compaction, and any other construction operation.

4.14 Pipeline Excavation Formation

Excavations for pipelines shall follow the lines and levels shown on the Drawings and instructed by the Project Manager. Curves, where necessary, shall not involve angular deviations at any pipe joint greater than those recommended by the manufacturer and approved by the Project Manager.

Properly painted sight rails and boning rods of predetermined measurement shall be supplied and shall be used to ensure the excavation is to true and even gradient.

Whether excavations for pipelines are constructed with vertical, sloping, or stepped sides, that portion of the excavation which extends from the formation to a level not less than 1 foot above the pipe when laid in its correct position shall be formed with vertical sides unless otherwise specified or ordered by the Project Manager.

4.15 Backfill and Fill

Backfill means selected material obtained from that excavated for the structure and replaced below original ground level. Selection shall be as for fill as specified in Clauses 4.9 and 4.11. All backfill and fill above original ground level at or adjacent to structures shall be compacted in accordance with Clause 4.9.2 or as directed by the Project Manager.

4.16 Test on Formation Level

On reaching the level for hand trimming specified below in Clause 4.19, the Project Manager may order in-situ or other tests as specified to determine the nature and strength of the soil.

4.17 Structure Foundations

Not used

4.18 Over-excavation

The extent of excavations shall be the minimum practicable in the opinion of the Project Manager for the construction of the Works.

Any excavation for structures beyond the limits specified or ordered shall be filled by the Contractor at his own expense with concrete of the same class as the concrete in the foundation or with gravel backing material or with specially compacted fill as the Project Manager may require. Except with the written approval of the Project Manager, work on each approved length shall be completed before work on any new length is commenced.

4.19 Hand Trimming at Formation Level

Where the formation level of any excavation is to receive concrete or backfill, the final 6 inches of the excavation shall be trimmed by hand, or such other method as may be approved or ordered by the Project Manager, after removal of any slurry and immediately before the placing of concrete or backfill.

4.20 Protection of the Works

The Contractor's proposals for protecting the Works from damage by flooding or otherwise shall be submitted to the Project Manager for approval. Such submission shall not in any way absolve the Contractor from responsibility for any damage, which may be incurred subsequently.

The Contractor shall repair any damage to the Works caused by flood water / sub-surface water or failure of any part of the protection works undertaken by him, as directed by the Project Manager.

4.21 Disposal of Excavated Material

Excavated material shall be reused as fill material or disposed of on barren land.

4.22 Haulage of Excavated Material

Excavator operators shall be trained to reduce the drop height from excavator to truck.

5 Care and Handling of Water including Dewatering

5.1 General

The Employer does not guarantee or describe completely the conditions which may be encountered in performing the specified work. Ground water, surface runoff and sub-surface water may be encountered during construction of the Works.

5.2 Scope of Work

The work to be done under care and handling of water, including dewatering for construction of the Works, consists of, but will not be limited to the following:

a) Protecting the Works from damage by rains, surface runoff and sub-surface water.

b) Dewatering foundations of structures including other areas required for the Works and care of water to maintain all foundations, excavations and surfaces dry and free of water as required for proper construction of the works.

5.3 Protection of Works

The Contractor shall construct and maintain all required temporary diversion and protective works as may be required to protect the Works from rains, surface runoff, sub-surface water, if any, as is necessary for their proper construction in accordance with the Specifications. After having served their purpose, all cofferdams or other temporary protection works shall be removed or levelled and graded so as not to interfere in any way with the operation and usefulness of the completed Works.

5.4 Plans to be approved by the Project Manager

Prior to the beginning of construction of any protection or diversion work, the Contractor shall submit for the approval of the Project Manager his proposed plan for such protection and diversion works, being wholly in accordance with Clause 1.33 hereof. The plan may be placed in operation upon its approval. Nothing in the Contract shall relieve the Contractor from full responsibility for the adequacy of the protection and diversion works. The Contractor shall repair any damage to the foundations, or any other part of the works caused by flood water / sub-surface water or failure of any part of the protection works undertaken by him, as directed by the Project Manager.

5.5 Handling Water and Dewatering Foundations

The Contractor shall maintain the areas and the foundations of structures and embankment and other structures, where ever applicable, free from water. The Contractor's methods of dewatering the foundations shall always be subject to the approval of the Project Manager. The dewatering shall be accomplished in a manner that will;

a) Maintain stability of excavated slopes;

b) Keep foundations dry for proper construction by lowering sub-soil water 3 feet lower than the lowest excavated levels;

c) Ensure proper compaction and bonding of earth fill material when placed;

d) Facilitate placing of concrete; and

e) Establish water table before the start of work and maintain below the foundation level and record the levels of water table during the construction and inspection period.

6 Dismantling, Demolition, Repair and Refixing

6.1 General

The work includes dismantling stated in Clause 6.2 herein. The work also includes the repair and re-fixing as instructed by the Project Manager.

6.2 Works included in Dismantling

Dismantling shall include, but will not be limited to, the following:

- demolition of structures to be completely removed;
- removing cement or lime plaster;
- demolition of protection works to be completely removed;
- dismantling carefully a part of a structure without causing damage to the part of the structure to be retained as a part of the new structure;
- protecting structures or parts of the same structure from damage during dismantling operations;
- disposing of the waste materials to the approved fenced waste pile; and

6.3 Masonry and Concrete Works

Dismantling of masonry and concrete as required to be carried out to existing structures which are to be partially preserved shall be undertaken using pickaxes and crowbars by manual labour and mechanical hammers, equipment or any other methods up to the lines and levels, as shown on the Drawings and as instructed by the Project Manager. Any damage caused to the Works during the dismantling operations shall be repaired or replaced by the Contractor. Dismantled material shall be stacked or disposed of within reservation width and as instructed by the Project Manager.

6.4 Removal and Reuse

Pre-cast concrete blocks, stone, bricks and other materials which the Project Manager instructs for reuse shall be removed safely using mechanical equipment, if necessary, and stored in a nearby place as directed by the Project Manager. The removed material shall be cleaned and reused at locations as directed. Steel and wood shall be stacked item-wise in Employer's stores irrespective of whether it will be re-used or not, as instructed by the Project Manager. All steel nails shall be removed from timber immediately upon dismantling.

7 Concrete

7.1 Scope of Work

The work shall consist of furnishing, placing, curing, finishing, including transport of cement, concrete, various type of cement, water, fine and coarse aggregate in accordance with requirements in these specifications, and conforming to lines, grades and typical sections shown on the Drawings or as instructed by the Project Manager.

7.2 Cement

The cement used in the Works shall be Ordinary Portland Cement (OPC) complying with BS EN 197-1: 2000, or Sulphate Resisting Cement (SRC) complying with BS 4027.

The Contractor shall supply samples of cement, when requested by the Project Manager, both from the Contractor's store on Site and from the place of manufacture.

The Contractor shall supply the manufacturer's test certificate for each consignment of cement received at the Site. He shall maintain a record available for inspection by the Project Manager of the locations of concrete made from each consignment.

7.3 Aggregates

Aggregates for concrete shall comply with BS 882 at the time of use. Aggregates which are likely to cause alkali aggregate reaction in the concrete shall not be used.

Fine aggregate shall consist of natural sand. The Project Manager will permit the addition of suitable crushed rock fine aggregate, as necessary, to the natural sand where in his opinion it is impracticable to obtain the required grading of the combined aggregates other than by such addition. The maximum quantities of clay, silt and fine dust shall, in any event, not exceed 3 percent by weight as determined by the test given in Clause 7.2.4 of BS 812, Part 1:1975.

Coarse aggregate shall comply with the requirements in Table 4 of BS 882:1983 for graded aggregate to the nominal maximum size specified for the appropriate class of concrete.

The aggregate shall be such that concrete, when made and tested in accordance with Building Research Station Digest 35 (2nd series), shall not show a drying shrinkage greater than 0.065 percent.

Immediately after commencement of the Works the Contractor shall supply and deliver samples of proposed aggregates for testing at a laboratory approved by the Project Manager. If the material in the samples passes the specified tests for quality the Project Manager will give approval to the source of aggregates proposed by the Contractor.

Alternatively, and subject to the approval of the circumstances by the Project Manager, the Contractor may submit test certificates in respect of the proposed aggregates from an independent laboratory.

Unless otherwise specified, separate fine aggregate and 0.78” nominal maximum size coarse aggregate shall be used. When 1.57” nominal maximum size coarse aggregate is specified or approved it shall be a separate grading additional to the 0.78” aggregate added at the time of batching the concrete ingredients.

The Contractor shall supply samples of aggregates when required by the Project Manager (the samples shall be taken in accordance with BS 812) at a frequency at least once every six months at each source of each grading approved by the Project Manager.

7.4 Water

The water used for making and curing concrete shall be from a source approved by the Project Manager and at the time of use shall be free from objectionable quantities of silt, organic matter, alkali salts or other polluting matter in any quantity which:

(a) Affects the initial setting time of the cement by more than 30 minutes or reduces the compressive strength of test cubes by more than 20% when tested in accordance with BS 3148;

(b) Prevents the achievements of the specified test cube strengths at 28 days for the appropriate class of concrete;

(c) produces discoloration or efflorescence on the surface of the hardened concrete;

(d) Aggravates or promotes an "alkali-aggregate" reaction.

Inorganic matter in solution shall not exceed 500 parts per million by weight and in suspension shall not exceed 30 parts per million by weight.

The Contractor shall make regular tests of the water taken from the points of delivery into the other ingredients of concrete and mortar in a pattern and at a frequency approved by the Project Manager and shall furnish the Project Manager with two copies of each test result.

7.5 Additives

Concrete shall be made from cement, aggregates and water as specified. No other ingredient shall be mixed with the concrete or mortar without the Project Manager's approval.

If the Project Manager approves the use of retarding or workability agents this use shall be subject to the following conditions:

(a) No reduction of testing plan mean strength compared with additive-free concrete of the same class;

(b) No reduction of cement content prescribed;

(c) No corrosive effect on reinforcement steel;

(d) No alkali-aggregate reaction promoted; and

(e) Dosage and admixture strictly in accordance with the manufacturer's instructions in respect of the specific conditions obtaining. Dosage to be by approved dispenser.

The Contractor may use a retarder to facilitate the preparation of construction joints, subject to the approval of the Project Manager to the composition of the retarder and its method of application.

7.6 Chemicals in Materials

The total sulphate content, whether as gypsum or more soluble salts, of concrete ingredients when measured as SO_3 shall together not exceed 4.0 percent of the weight of cement in the concrete.

The chloride content of concrete ingredients when measured as Cl shall together not exceed 0.2 percent of the weight of cement in the concrete.

7.7 Storage of Materials

The Contractor's arrangements for storing and handling the materials for concrete shall be to the approval of the Project Manager. Such arrangements shall be directed towards preventing the deterioration, adulteration or segregation of the various materials and ingredients thereof and shall ensure the ready identification and orderly use of consignments of cement.

7.8 Formwork

Formwork shall be constructed to obtain the required profiles and surface textures of the structures and be such that it remains rigid during the placing and setting of the concrete.

It shall be fixed in accurate alignment and to the true shape and dimensions of the Works shown on the Drawings or ordered by the Project Manager.

A method of support which would result in holes extending the whole width from face to face of concrete which forms part of the Works shall not be permitted.

No plugs, bolts, wire ties, holdfasts or any other appliance whatsoever, for the purpose of supporting the formwork or reinforcement, shall be fixed permanently into the structure so that they have less cover than the reinforcement or in any way impair the strength or appearance of the work, nor shall they be placed in such a manner that damage to work would result in the removal of the same at the time of striking the formwork.

Unless otherwise approved, top formwork shall be provided for concrete upper surfaces where the slope exceeds one vertical in three horizontal.

Except where otherwise specified, formwork for concrete faces which will remain exposed in the Works, shall be "face formwork", which is to say that it shall be such as will prevent the loss of any ingredients from the concrete and will produce a dense smooth concrete surface without discontinuities of line, texture or appearance. Face formwork shall be prepared from suitably thick partal.

Except where otherwise specified, formwork for concrete faces which will remain hidden in the Works, shall be "back formwork", which is to say that it shall be such as will prevent the loss of any ingredient from the concrete and will produce a dense concrete surface.

Unless otherwise shown on the Drawings, exposed concrete edges shall be formed with a chamfer measuring 1 inch by 1 inch.

Kickers shall be provided for all walls as indicated on the drawings or instructed by the Project Manager.

Before each concreting operation is commenced, formwork shall be carefully examined and cleaned.

All formwork in contact with concrete shall be treated with an approved composition before each usage to prevent adhesion of the concrete. Such composition shall be carefully applied in such a manner that there is no contamination of the reinforcement or previously placed concrete by the composition.

When so instructed the Contractor shall submit his proposed design and details of formwork for the Project Manager's approval.

Formwork shall only be removed with the permission of the Project Manager, and the work of removing it after the receipt of such permission shall be carried out under the personal supervision of a competent foreman, Great care shall be exercised during the removal to avoid shocks to, or reversal of stress, in the concrete.

Props supporting beams and slabs shall remain in place for a minimum of 14 days or until the 28-day design strength has been achieved whichever is longer. Additional cubes over and above those specified in Clause 7.11 may be required for this purpose.

7.9 Classes of Concrete

The concrete used in the Permanent Works shall be of the class shown on the Drawings or ordered by the Project Manager. Characteristics of the classes of concrete which may be used are given in Table 7.1 and Table 7.2.

Except where otherwise specified, the concrete ingredients, manufacture, testing and workmanship shall conform with the requirements of BS 8110 : 1997 and BS 5328 : 1997.

The water : cement ratios referred to in the Specification are the ratios by weight of free water to cement in the mix and are based on the aggregates being in a saturated surface-dry condition.

The Contractor shall not commence concreting in the Permanent Works until a trial mix design for the class of concrete required has been approved by the Project Manager pursuant to Clause 7.10 hereof.

Adjustments to the concrete mix proportions will only be made if, in the opinion of the Project Manager, such adjustments are necessary.

The Contractor shall not alter the mix proportions nor the source of supply of any of the ingredients without having previously obtained the approval of the Project Manager.

Table 7.1: Concrete Classification

Class	Grade	Cement Type	Maximum aggregate size (mm)	Workability	Mean strength (N/mm2)	Minimum strength (N/mm2)
AA	45	OPC	20	Medium	48	42
A	35	OPC	40	Medium	38	32
A1	35	SRC	20	High	38	32
A2	35	OPC	20	High	38	32
B	30	OPC	20	Medium	33	27
B1	30	SRC	20	High	33	27
C	25	OPC	20	High	28	22
C1	25	OPC	40	Medium	28	22
D	17.5	OPC	40	Medium	17	13
E	8	OPC	40	High	8	7
E1	8	OPC	20	High	8	7
BS	25	SRC	20	High	28	22
CS	25	SRC	40	Medium	28	22

Note: High workability: slump 100 to 150 mm (4 to 6 inches).

Medium workability: slump 50 to 100 mm (2 to 4 inches).

Concrete classes shall be as shown on the Drawings and generally used as indicated below:

AA Prestressed concrete

A Reinforced concrete – hydraulic structures

B Reinforced concrete - thin sections

C Reinforced concrete – general use

C1 Reinforced concrete - general use

D Mass concrete

E Blinding, infill

BS Reinforced concrete – thin sections in contact with the ground or drainage water

CS Reinforced concrete – general use and mass concrete in contact with the ground or drainage water

7.10 Designed Mix Concrete

Some characteristics required of concrete produced to design mixes are given in Table 7.2

The Contractor shall determine to the approval of the Project Manager the actual proportions of ingredients for each class of concrete. Unless otherwise agreed by the Project Manager and except where not consistent with this Specification, such determination shall be in accordance with the recommendations of BS 5328: 1997 and BS 8110 : 1997 : Part 1.

Table 7.2: Designed Mix Concrete

Class	Minimum cement content (kg/m3 of concrete)	Maximum water : cement ratio	Trial mean strength (N/mm2)
AA	500	0.45	57.5
A	410	0.45	46.5
A1	395	0.45	46.5
A2	395	0.45	46.5
B	320	0.55	41.5
B1	305	0.55	41.5
C	290	0.50	36.5
C1	275	0.50	36.5
D	220	0.55	21.5
E	170	-	10.0
E1	170	-	10.0
BS	330	0.45	36.5
CS	330	0.45	36.5

The Contractor shall make trial mixes for each class of concrete using the same type of Contractor's Equipment and the same materials as are proposed for the Permanent Works. The Contractor shall give 24 hours' notice of such trials to enable the Project Manager to attend. For each trial mix, three separate batches of concrete shall be made. From each batch of concrete, three 6 inch (150 mm) concrete cubes shall be made by the Contractor and will be tested by the Project Manager at 28 days all in accordance with BS 1881 : 1983. A trial mix design will be approved by the Project Manager. The specified characteristic compressive strength for the minimum individual and the minimum mean of specified consecutive test results are derived from BS 8500-1:2002, BS 8500-2:2002, BS EN 206-1:2000.

7.11 Compliance with Strength Requirements

Of the three cubes made from each sample of fresh concrete in accordance with Clause 7.10, of the specification one will be crushed at 7 days and the other two at 28 days. The average of the 28 days strengths will be taken as the test result. Compliance with the specified strength requirements shall always be judged on the results of tests taken at 28 days.

Concrete shall be considered to have failed to comply with the Specifications;

(a) if a test result is less than the testing plan minimum specified for that class of concrete, in which case the concrete which it represents shall be broken out and removed by the Contractor when ordered

(b) if the average of four consecutive test results for that class / grade of concrete shall have failed to exceed the testing plan mean strength as specified in which case no further concrete of that class shall be placed in the Works until the Contractor shall have discovered the cause of such failure and rectified it.

7.12 Control and Mixing Ingredients

The Contractor shall proportion the ingredients of each batch of concrete accurately by weight. The water shall be added to the aggregates and cement in a mechanical batch mixer; it shall not exceed the amount specified in Table 7.2hereof and shall otherwise be the minimum amount necessary consistent with complete compaction. The device for measuring the water shall show accurately the weight required having regard to the moisture content of the aggregate and shall be so designed that the water supply will be stopped automatically when the correct quantity has been discharged into the mix. The concrete ingredients shall then be mixed thoroughly.

7.13 Truck Mixed Concrete

Truck mixed concrete may be used with the prior approval of the Project Manager provided that it complies with the Specification and with BS 5328, and that the water for the mix is added at the Site adjacent to the point of final deposit. Truck mixers shall comply with BS 4251. The manufacturer's data listed in Appendix B of BS 4251 shall be submitted to the Project Manager for approval if requested.

7.14 Preparation of Surfaces for Concreting

Concrete surfaces in construction joints shall be treated carefully to expose the aggregate over the full section and to leave a sound irregular clean surface free from laitance by scabbling, wire-brushing, washing with water and air under pressure or other approved means. Immediately before the fresh concrete is to be placed, the set concrete shall be dampened, without excessive water remaining.

7.15 Transportation, Placing and Compaction of the Concrete

The concrete shall be handled so that at the point of deposition it is of the specified quality and consistency, nothing having been added to it or lost from it since leaving the mixer, and segregation of the concrete ingredients is avoided. Any concrete which has stiffened to a degree where proper placement cannot be assured should be wasted and no payment will be made to the Contractor for such wastage.

The Contractor shall obtain the approval of the Project Manager to his proposed arrangements before commencing concreting. Concrete shall only be placed in the presence of the Project Manager.

The Contractor shall regard the compaction of the concrete as a work of fundamental importance and shall produce a watertight concrete of maximum density compatible with the approved mix. Compaction shall be assisted by the use of mechanical vibrators of the immersion type but shall not involve the vibration of reinforcement or formwork except that vibration of formwork may be allowed in the case of pre-cast concrete with the approval of the Project Manager.

The number and type of vibrators available for use during each period of concreting shall be to the approval of the Project Manager, which will not be given if sufficient standby vibrators are not readily available in good working order.

7.16 Construction Joints

Construction joints shall be watertight. They shall be formed in straight lines with rigid shuttering perpendicular to the principal line of stress and as far as practicable at points of least shear. They shall be the plain butt type unless otherwise specified or approved and 20 mm x 20 mm grout checks shall be used to form straight edges between pours. Where wall pours or columns are continuous with slabs, they shall be defined by a minimum 100 mm high kicker that is poured with the slab. It is not acceptable to pour these separately from the slab.

Before placing new concrete against that which has already set, the latter shall be treated carefully to expose the aggregate over the full section and to leave a sound irregular clean surface free from laitance.

Where not shown on the Drawings, the details and positions of construction joints shall be submitted to the Project Manager for approval before any concreting takes place. They shall be located so that, in conjunction with the programme for concreting, the effects of shrinkage and temperature are minimised. Where long lengths or large areas of work are to be concreted and where in the opinion of the Project Manager it is practicable, the Contractor shall so arrange his programme of construction that concrete is two weeks old before new concrete is placed against it.

7.17 Surface Finishes

The classes of finish required for concrete surfaces, both those formed against formwork and those unformed (i.e. horizontal or sloping surface finished without the use of formwork) and the maximum tolerances on true position, dimension and shape of the completed work which will normally be permitted and accepted by the Project Manager are described in the following Clauses 7.18 to 7.20.

No treatment to the finished concrete other than that specified in the class of finish shall be carried out unless an instruction to do so is given by the Project Manager.

The faces of all concrete shall be left sound, solid and to the class of finish specified. If the Project Manager should decide to allow minor defects to be rectified rather than have the whole lift removed then voids shall be properly opened out and repaired with cement sand mortar and projections shall be ground off.

The finish of the surface of blinding concrete shall be matched to the requirement to bond with or to be free from the subsequently placed concrete.

7.18 Classes of Formed Surfaces

Unless shown otherwise on the Drawings formed concrete surfaces shall comply with one of the classes of finish described below.

Class F1

This finish is for surfaces against which backfill or further concrete will be placed or which will remain hidden. Formwork shall be such as will prevent the loss of any ingredients from the concrete and will produce a dense concrete surface.

Class F2

This finish is for all surfaces that will remain exposed in the Works unless otherwise shown on the Drawings. Formwork shall be such as will prevent the loss of any ingredients from the concrete and will produce a dense smooth concrete surface without discontinuities of line, texture or appearance. The surface shall be free from surface pitting but other minor defects shall be remedied by methods approved by the Project Manager.

Class F3

This finish is for all surfaces in contact with flowing water. Formwork shall be such as will produce a surface that is smooth, true and accurately formed to the required lines and levels and free from all lips, pitting, excrescences, etc. If considered necessary by the Project Manager, the hardened faces shall be ground down to produce the desired finish.

Where a surface is partly hidden and partly exposed the finish appropriate to the exposed surface shall extend 1.5 ft (500 mm) below the level of exposure.

7.19 Classes of Unformed Surfaces

Unless shown otherwise on the Drawings unformed concrete surfaces shall comply with one of the classes of finish described below.

Class U1

This finish is for surfaces of roads or of foundations, beds, slabs, and structural members to be covered by backfill, and for exposed surfaces of paving where a superior finish is not required. It is also the first stage for finishes U2 and U3. The finish shall be similar to that left by a vibrated hardwood board, 2 inches (50 mm thick), when used for screeding concrete to its proper level and profile immediately after deposition.

Class U2

This finish is for all exposed unformed (or un-shuttered) surfaces in the Works unless otherwise shown on the Drawings and as an intermediate stage for a U3 finish. The surface shall be floated with a wood float to a smooth finish free from screed marks. The floating shall be executed so as not to bring excess laitance of the material to the surface.

Class U3

This finish is for all unformed (or un-shuttered) surfaces in contact with flowing water and shall be achieved by floating with a steel trowel to a fine open surface finish. The fine open surface shall be obtained by first screeding and floating the concrete to a Class U2 finish then leaving it until the concrete has stiffened and the film of moisture has disappeared. Floating shall then be applied with a steel float to produce a ‘glossy’ surface without bringing excess laitance of fine material to the surface. Whenever necessary a properly constructed overhead cover shall be erected before the work is commenced to prevent the finished surface from being marred by raindrops or dripping water.

Except at movement joints, concrete surfaces which are to be covered by further concrete or mortar shall be prepared in accordance with Clause 7.14.

7.20 Tolerances in Finished Work

The irregularities in formed and unformed surface for the various classes of finish shall be within the target limits shown in Table 7.3.

Table 7.3: Maximum Irregularities in Formed and Unformed Surfaces

	Tolerance (inches) Type of finish					
	Formed			Unformed		
Type of irregularity	F1	Max. allowed F2	F3	U1	Max. allowed U2	U3
Departure from alignment and grade shown on the Drawings	+1 -1/2	±1/2	±1/2	±1/2	±1/4	±1/4
Variations in cross-sectional dimensions (1)	+1/2 -1/4	+1/2 -1/4	+1/2 -1/4	-	-	-
Deviation from template in long dimensions (2)	±1/2	±1/2	±1/4	±1/2	±1/4	±1/4
Abrupt (3)	±1/2	±1/4	±1/8	±1/2	±1/4	±1/8

In Table 7.3 the numbers in brackets under the type of irregularity are defined below.

1) The cross-sectional dimensions of structural members such as walls, columns, beams, etc, where, for structural reasons it is necessary to keep the tolerances within closer limits than those for alignment and grade.

2) Gradual irregularities caused by misalignment of formwork from the dimensions shown on the Drawings and measured from a 10 ft (3 m) long template.

3) Offsets and fins caused by displaced or misplaced formwork sheathing, lining or supports, by loose knots in forms or by otherwise defective form material, and abrupt surface irregularities in unformed surfaces.

If irregularities exceed the target the Contractor shall take the necessary steps to bring subsequent work within the target. If, however, the irregularities exceed the maximum allowable shown in the table, the structure, member or section of a member of the structure may be rejected by the Project Manager.

The Contractor should note that the tolerances are for the completed work and the formwork, etc. used should be constructed and erected to a considerably higher standard of accuracy.

7.21 Concreting in Unfavourable Weather

The Contractor shall not place concrete:

(a) During heavy rain or dust storms; or

(b) When the air temperature is more than 43 degrees C.

When the air temperature exceeds 30 degrees C the Contractor shall not place concrete without the approval of the Project Manager and without taking such precautions as may be required to keep the temperature of the concrete during mixing and setting below 38 degrees C, for example, by keeping the concrete materials and formwork shaded from the sun and the aggregates and shutters sprayed with water.

Concrete shall not be poured against formwork, which is hotter than 30 degrees C without the approval of the Project Manager.

7.22 Curing Concrete

Until it has thoroughly hardened, concrete shall be protected from the harmful effect of wind, sun, temperature and variations of temperature, premature loading or deflection or impact, and aggressive groundwater.

Unless otherwise approved by the Project Manager, all concrete shall be cured by water curing. Concrete cured with water shall be kept wet for at least 7 consecutive days immediately following placement of the concrete, by covering with water saturated material, or by a system of perforated pipes, mechanical sprinklers, or porous hose, or by any other approved method which will keep all surfaces to be cured continuously (not periodically) wet. Water used for curing shall meet the requirements of these specifications for water used for mixing concrete.

7.23 Precast Concrete

Unless otherwise specified or approved all precast work shall be of Class ‘C’ concrete.

Each mould for concrete work, which is specified or approved by the Project Manager to be precast shall have a different embossed or recessed identification mark in a position to the approval of the Project Manager.

Each precast unit shall be indelibly marked with the date of casting and after the mould is removed shall not be disturbed for 28 days thereafter.

Each precast unit shall, where required, be provided with lifting eyes and holes located to the approval of the Project Manager so as to avoid unsafe stresses during handling.

If the Contractor proposes precasting concrete which is not specified or described as precast work, the Contractor shall provide such additional reinforcement as may be necessary, that handling will not give rise to unsafe stresses.

7.24 Use of Batching Plants

The Contractor shall collect and treat any washout from concrete batching plants, or other plant used to mix or transport concrete, to within the limits of the National Environmental Quality Standards for industrial effluent. Treatment will include, as necessary, flow and load equalisation with pH adjustment and sedimentation of suspended solids using settling basins or clarifiers. The Contractor’s proposed methodology for treatment of bathing plant washout shall be included in his Pollution Plan as part of the CESMP.

The Contractor shall employ dust suppression methods, for example water sprinkling, on uncovered stockpiles of loose materials as necessary to prevent the generation of dust from these materials. Where requested, a water spraying schedule shall be prepared by the Contractor and submitted to the Project Manager. The distance between batching plants and storage areas shall be minimised.

Batching plants shall only be operated during the Working Hours defined in Clause 1.19.

Where emissions of Particulate Matter from batching plant exceed the limits given in Clause 1.45.4, the Contractor shall employ reduction methods detailed in Annex 1.1.2 of the General Environmental, Health and Safety Guidelines, prepared by the International Finance Corporation.

8 Reinforcement

8.1 General

The work consists of furnishing transportation, storage, cutting, fabrication, bending and placing steel reinforcement and welded wire fabric in concrete structures or elsewhere at any elevation as shown on the drawing or/and as directed by the Project Manager for a complete job.

8.2 Materials

Reinforcing bars, shall conform to the requirements of ASTM A-615 Gr. 60 for deformed hot rolled new stock billet steel bars and shall have a minimum yield strength of not less than 60,000 psi (414 MPa)

Reinforcement shall be free from all loose or flaky rust and mill scale, or coating including ice, and any other substance that would reduce or destroy the bond. Reduced section steel reinforcement shall not be used.

The Project Manager shall have the right to witness routine testing of steel reinforcing bars at the manufacturer's workshop. When required by the Project Manager, the Contractor shall take samples from the reinforcing steel bars delivered to the site and shall arrange for the samples to be tested by an approved testing agency. Test certificates from the agency shall be submitted to the Project Manager.

The Contractor shall submit certificates of compliance from the manufacturer stating that the supplied reinforcement conforms to the specifications. In addition, wherever and as directed by the Project Manager, conformance of the supplied reinforcing bars with the specifications shall be demonstrated by the Contractor through laboratory tests, in accordance with the relevant standards.

8.3 Storage of Reinforcing Bars

The Contractor shall stack separately and label different types of reinforcement for positive identification of the manufacturer, size and productive run or other number, which relates to the last certificates furnished by the manufacturer. All reinforcement shall be stored under cover on wooden or concrete supports at least 6 inches above the ground.

8.4 Placing Reinforcing Bars

The reinforcing bars shall conform to the requirements shown on the reinforcement Drawings. The steel bars shall be securely and accurately fixed in position as shown on the drawings using approved spacer blocks or chairs. All interconnection of bars shall be secured with soft wire, the ends turned into the body of the concrete.

Splices shall be located where shown on the Drawings. The location of splices may be altered subject to the written approval of the Project Manager.

Splice lengths shall be according to ACI 318 requirements or as shown on the Drawings. All additional splices allowed for the convenience of the Contractor shall be at the expense of the Contractor and with prior written approval of the Project Manager.

Bars shall be cut and bent in accordance with ACI 315, bending shall be carried out slowly at a steady even pressure without jerking or heating.

Unless otherwise prescribed, placement dimensions shall be to the centreline of the bars. Reinforcement will be inspected for compliance with requirements as to size, shape, length, splicing, position, and amount after it has been placed.

Reinforcement shall be accurately placed to meet the following tolerances:

A. The amount of concrete covering reinforcement shall not deviate from that specified by more than 1/4 inch if the cover specified is more than 2½ inches, nor by more than 1/8 inch if the cover specified is 2½ inches or less.

B. The spacing of reinforcing bars shall not deviate from the required spacing by more than 1/2 inch and the total number of bars shall be as shown on the Drawings.

Reinforcement shall be secured in position so that it will not be displaced during the placing of the concrete, and special care shall be exercised to prevent any disturbance of the reinforcement in concrete that has already been placed. Bars shall not be field bent to the extent of permanent set, nor straightened, except as approved by the Project Manager or shown on the Drawings. Bars bent without approval shall be replaced to conform to the Drawings. Welding or tack welding of reinforcing bars will not be permitted except where approved by the Project Manager. Chairs, hangers, spacers, and other supports for reinforcement shall be of concrete, metal or other approved material. Where portions of such supports will be exposed on finished concrete surfaces, the exposed portion of the supports shall be galvanized or made of corrosion-resistant material. Unless otherwise shown on the Drawings, reinforcement in structures shall be so placed that there will be a clear distance of at least 1inch between the reinforcement and any anchor bolts, form ties, or other embedded metalwork. Concrete spacer blocks shall be of the same strength as the pour in question and shall be compacted and cured in accordance with Chapter 7. The Contractor shall provide for the immediate availability of competent steel fixers and carpenters during the whole period of any concrete placement.

8.5 Reinforcement Drawings to be prepared by the Contractor

The Contractor shall prepare and submit reinforcement detail drawings for review and approval, including bar-placing drawings, bar bending diagrams, and bar bending schedules, in accordance with the following provisions:

The Contractor's reinforcement detail drawings shall be prepared from reinforcement design drawings issued by the Project Manager. These shall be submitted, in one (1) soft and four (4) A1 size, at least 60 days before scheduled concrete placement for all structures.

The Contractor's reinforcement detail drawings shall be prepared following the recommendations established by the American Concrete Institute's "Manual of Standard Practice for Detailing Reinforced Concrete Structures" (ACI 318-latest) unless otherwise shown on the reinforcement design drawings.

The Contractor's detailed reinforcement drawings shall clearly show necessary details such as quantities, shapes, lengths, sizes, and weights of the bars and laps, for checking the bars during placement and for use in establishing payment quantities.

The Contractor's reinforcement detail drawings shall be clean, legible, and accurate and checked by the Contractor before submittal. Acceptable reinforcement detail drawings will be reviewed by the Project Manager for adequacy of general design and controlling dimensions. Errors, omissions, or corrections will be marked on the print, and one print of each drawing will be returned to the Contractor for correction. The Contractor shall make all necessary corrections shown on the returned prints, and resubmit the corrected drawings as before. Such review and approval shall not relieve the Contractor of his responsibility for the correctness of details or for conformance with the requirements of these Specifications.

9 Movement Joints

9.1 Waterstops

Not used

9.2 Joint Fillers

The Contractor shall supply and fix pre-moulded joint fillers in all expansion joints and where shown on the Drawings. Unless otherwise specified, the joint filler shall be of resin or bituminous bonded cork. The filler shall be obtained from a manufacturer approved by the Project Manager and shall be stored and fixed in accordance with the manufacturer's instructions. The joint filler of the thickness specified shall be cut to shape and fixed to fill the whole space between the concrete faces of the joint which is not otherwise filled by waterstop and joint sealer. Abutting pieces shall be placed in close contact and the joints covered on each side to prevent the passage of cement grout.

The Contractor shall supply the manufacturer's test certificate for each consignment of joint filler delivered to Site and shall, in addition, supply to the Project Manager sufficient numbers of each consignment for confirmatory tests to be carried out in accordance with the appropriate standard test procedure, if ordered.

The filler shall comply with United States Federal Specification HH-F-341e Type II Class B for the resin bonded cork and HH-F-341e Type I Class B for the bituminous bonded cork.

The filler shall also comply with the American Society for Testing and Materials Specification as follows:

(a) For resin bonded cork - specification ASTM D 1752 - 67 Type II

(b) For bituminous bonded cork - specification ASTM D 1751 -73

9.3 Dowel Bars

Where dowel bars are to be provided through movement joints they shall be of mild steel plain round bars with sawn cut ends and complying with BS 4449.

In expansion joints the part of the bar to be free to move shall be encased in a rigid PVC or metal sleeve and fitted with a compressible cap of joint filler material or other material approved by the Project Manager. The free end of the dowel bar shall be coated with an approved bitumen bond breaking compound. The diameter of the sleeve shall be the minimum necessary to allow free sliding movement of the bar after concreting.

In expansion joints care shall be taken during fixing and subsequent paving of concrete to ensure that the bars are correctly aligned with the direction of movement of the completed structure.

9.4 Joint Sealers – General

The Contractor shall construct recesses at expansion and contraction joints on both faces of the concrete work except on the underside of continuously supported work and on faces backfilled with earth.

The recesses shall be accurately formed to the lines and dimensions shown on the Drawings or where not shown on the drawings or specified elsewhere shall be to minimum dimensions recommended by the manufacturer.

The Contractor shall prepare the surfaces of the recess and shall supply a joint sealer and fill or caulk the recess completely with it.

Unless otherwise shown on the Drawings or ordered by the Project Manager, the joint sealer shall be a hot poured rubber/bitumen compound for horizontal joints, and a bituminous putty for sloping, vertical and soffit joints.

Where shown on the Drawings, or ordered by the Project Manager, an elastomeric two-part polysulphide sealer shall be used. Joint sealers and the requisite priming materials shall be obtained from manufacturers approved by the Project Manager and shall be used in accordance with the manufacturer's instructions. The application of joint sealer shall not be commenced without the Contractor having first obtained the approval of the Project Manager.

The Contractor shall supply the manufacturer's test certificate for each consignment of each type of joint sealer delivered to Site and shall, in addition, supply to the Project Manager sufficient numbers of each type and consignment for confirmatory tests to be carried out in accordance with the appropriate test procedure, if ordered.

9.5 Bituminous Sealer

The hot poured rubber/bitumen compound for sealing horizontal joints shall comply with BS 2499 : 1993 for type AI. For sloping, vertical and soffit joints, a bituminous putty shall be supplied which shall not slump in a vertical joint 25mm wide and 25mm deep at a temperature of 80°C.

9.6 Polysulphide Sealer

The elastomeric two-part polysulphide sealer shall comply with BS 4254 : 1983.

In conjunction with this type of sealer an approved bond breaker such as a self-adhesive polyethylene strip shall be positioned against the exposed edge of the joint filler prior to application of the joint sealer. The bond breaker shall be resistant to attack from any primer used to bond the polysulphide sealer to the concrete.

9.7 Bitumen Coated Joints

Where the Drawings show a layer of bituminous paint between concrete faces, the Contractor shall clean and dry the face to which the bitumen is to be applied and shall then paint the bitumen on in two separate applications. The bitumen shall be a straight run bitumen, grade 40/50 penetration, or other approved by the Project Manager.

10 Reinforced Concrete Pipes and Pipe Culverts

10.1 General

This work shall consist of the construction, reconstruction or repair of culverts and hydraulic structures in accordance with these specifications, and in conformity with the line, grades and dimensions shown on the Drawings or ordered by the Project Manager.

The work shall include the furnishing and laying of the pipe, and the construction of such joints and connection to other pipes, catch basins, or other structures as may be required to complete the work as shown on the Drawings or as required by the Project Manager.

The work shall also include the removal and disposal of existing culverts and structures except such portions as may be required or permitted by the Project Manager to be left in place.

The Project Manager reserves the right to inspect and test the pipe after its delivery to work. Injurious defects revealed subsequent to acceptance of pipe and prior to its installation in the work shall be cause for rejection.

The Contractor shall not order and deliver the pipes for any work until the Project Manager has approved a list of sizes and lengths.

The pipelines referred to in this Chapter are those having a maximum working pressure of less than 10 ft head of water and shall include all pipe formed culverts, conduits, underpasses etc.

10.2 Materials and Design Criteria

Low pressure pipelines in structures have been designed assuming that pre-cast concrete pipes and pre-cast reinforced concrete pipes are used as shown in the Drawings or as instructed by the Project Manager. However the Project Manager may approve alternative systems, the details of which shall be submitted to the Project Manager well in advance of any intended use. Such alternatives might include an equivalent in PVC pipe and cast in-situ pipe culverts using inflatable moulds. No alternative system, which is likely to have a shorter useful life than pre-cast concrete pipes will be permitted.

Unless otherwise specified on the Drawings, joints in low pressure or gravity pipelines shall be flexible.

10.3 Reinforcement

Each line of reinforcement shall be assembled into a cage, which shall contain sufficient longitudinal bars or members extending through the barrel of the pipe to maintain the reinforcement rigidly in exact shape and correct position within the form. If the splices are not welded, the reinforcement shall be lapped not less than 30 diameter for bars and 40 diameter for cold-drawn wire. If welded, the member at either a welded splice or intersection shall develop a tensile strength of not less than 60,000 psi or as approved by the Project Manager. The spacing centres of adjacent rings of the circumferential reinforcement (pitch) shall not exceed 4 inches. The circumferential reinforcement shall be located midway between the inner and outer surfaces of the pipe within a tolerance of + 2 inches.

10.4 Concrete Pipes and Fittings

(1) Concrete pipes and fittings shall comply with BS 5911.

(2) The cement used in the manufacture of the pipes shall be Sulphate Resisting Cement unless otherwise stated in the Drawings or ordered by the Project Manager.

(3) No admixtures shall be included in the concrete without the written approval of the Project Manager.

(4) If the pipes are to be supplied by a manufacturer, the Contractor shall produce to the Project Manager for his approval, prior to any order for such pipes being made, confirmation from such proposed manufacturer that he can supply pipes of the required sizes, which will conform to the Specification.

(5) During the course of manufacture, the Contractor shall supply the Project Manager with certificates from the manufacturer as required under Clause 24 of BS 5911. Tests shall be made, for witness by the Project Manager, unless otherwise ordered by him, all in accordance with BS 5911.

(6) If the pipes are to be manufactured by the Contractor himself he shall obtain the equipment for pipe making from a reputable manufacturer whom he will have made aware of the requirements of this Specification and who will have undertaken that his plant, if his instructions are followed, will provide pipes which will comply with this Specification. The Contractor shall have satisfied himself that he will be able to comply with the instructions of the manufacturer with the materials available and under the conditions prevailing at the Site. The Contractor shall provide all details in respect of manufacturer of pies to the Project Manager for his approval prior to commencement of casting and these details shall include his proposals for the fabrication and placing in position of reinforcement cages where these are to be used. The Contactor shall provide the equipment for testing and test samples in accordance with BS 5911, and the Project Manager will apply the rules in respect of acceptance or rejection as set out therein.

10.5 Joints for Concrete Pipes and Fittings

(1) Unless otherwise specified or ordered, joints for concrete pipes, bends and junctions shall be of the flexible spigot and socket type as specified in Clause 17 of BS 5911 incorporating rubber gaskets complying with BS 2494 all to the approval of the Project Manager. Unless otherwise shown on the Drawings or approved by the Project Manager, joints shall be at not less frequent intervals than 6 feet. In the event of substitution of standards for the manufacture of pipes, the Contractor shall satisfy himself, inter alia, that the rubber gaskets he proposes to use fit the spigots and sockets he has been permitted to adopt and that the physical properties of the gaskets are suitable for their installation and use under the conditions prevailing on the Site.

(2) Where ordinary ogee or rebated-type joints for concrete pipes, bends and junctions are specified or ordered by the Project Manager, they shall comply with BS 5911, Part 3. Except where such pipes are shown on the Drawings as open jointed, cement mortar shall be used to seal the joints.

(3) Where it is made up into cages, they shall be sufficiently rigid to enable them to be handled without damage. Bends cast in-situ shall be formed in a continuous operation; joints other than with adjacent sections of pipeline shall not be permitted. The concrete dimensions, reinforcement and internal surface finish shall be such as will give a bend of strength and internal dimensions, shape and smoothness at least equal to that required for pipe bends in BS 5911.

10.6 Bends in Pipelines

Where it is required to form a bend in a pipeline of more than 11 degrees, either a pre-cast pipe bend which meets the requirements of BS 5911 : 2002 shall be placed, or the bend shall be cast in situ in reinforced concrete forming rigid, watertight junctions with the adjacent straight pipes. If the bend is cast in situ, the concrete dimensions, reinforcement and internal surface finish shall be such as will give a bend of strength and internal dimensions, shape and smoothness at least equal to that required for pipe bends in BS 5911 : 2002.

10.7 Transportation and Handling of Pipes and Fittings

Any vehicle on which pipes are to be transported shall have a body of such length that the pipes do not overhang. Large pipes are to be placed on cradles and the loads properly secured during transport. The pipes are to be handled in accordance with the manufacturer's recommendations.

Wide non-abrasive or other approved slings shall be used and all hooks and dogs and other metal devices shall be well padded and steadying ropes used. Any equipment which in the opinion of the Project Manager may damage the pipes or their coating shall not be used. Hooks engaging on the inner wall surfaces at pipe ends shall not be used.

Under no circumstances are pipes to be dropped or allowed to strike one another, rolled freely or dragged along the ground.

Pipe ends shall be protected during transport to and around the Site and during handling.

The timber or skids used to support the pipe prior to lowering into the trench shall be properly padded with sufficient bags stuffed with sand or straw for the purpose of protecting any coating. Alternatively, the pipe may be supported alongside the trench on mounds of sand. Any injury to protective coating, from any cause, must be repaired before the pipes are tested. Every precaution shall be taken to prevent foreign material from entering the pipes or fittings. During laying operations, no debris, tools, cloth or other material shall be placed in the pipe. Pipes and fittings shall be lowered into the trench with equipment suitable for the weight of the pipes and fittings, and shall be carefully cleaned before jointing.

10.8 Inspection of Pipes and Fittings

Each pipe and fitting shall be carefully brushed out and examined for soundness, before incorporation in the Works. Damaged pipes which in the opinion of the Project Manager cannot be satisfactorily repaired shall be rejected.

10.9 Bedding

Pipes including bends shall be laid in standard bedding or in reinforced concrete, mass concrete or granular bedding as shown on the Drawings or as ordered by the Project Manager in accordance with the Specification and at least to the minimum dimensions shown on the Drawings.

Standard bedding shall be used where no other bedding is specified and where there is no risk of rock, boulders and irregular hard spots occurring beneath the pipe barrel. Standard bedding shall consist of careful hand preparation and compaction of the trench bottom to the level of the underside of the pipe barrel to a smooth and regular surface free from all rocks and stones greater than 1 inch size.

Where pipes are to be laid in a bedding of granular material, the granular material shall be evenly spread over the full width of the formation and carefully compacted up to the level of the

underside of the pipe barrel to a minimum thickness of 6 inches, or one sixth of the external diameter of the pipe barrel, whichever is the larger. In rock or mixed soils containing rock bands, boulders or other irregular hard spots, the thickness of granular material beneath the pipe barrel shall be not less than 8 inches or one quarter of the external diameter of the pipe barrel, whichever is the larger. The thickness of granular material generally shall be such that in no case does a pipe socket or sleeve rest on the excavated formation.

10.10 Concrete Blinding

Where pipes are to be laid in a concrete bedding, a blinding layer of concrete Class D shall be laid evenly over the full width of the formation to a minimum thickness as shown on the Drawings and accurately to the required gradient of the finished pipeline.

The layer of blinding concrete shall be allowed to set for at least 12 hours before pipelaying commences.

10.11 Pipelaying – General

Each pipe immediately before being laid shall be carefully brushed out and examined for soundness.

Unless otherwise shown on the Drawings pipelines shall be straight and each pipe shall be laid accurately within the following tolerances to the lines and levels shown on the Drawings or ordered by the Project Manager:

Table 10.1: Pipelaying Tolerances

Nominal Internal Diameter	Tolerance in Line or Level (inches)
Up to 30 inches	0.5
Over 30 inches	1.0

Provided always that there shall be no reverse gradient on any pipe or on the line as a whole.

Properly painted sight rails shall be supplied and erected and used with boning rods of predetermined measurement for the boning in of individual pipes to the correct alignment. The sight rails shall be situated vertically above the line or pipe or immediately adjacent thereto, and there shall at no time be less than three sight rails in position on each length of pipe under construction to any one gradient.

10.12 Pipelaying in Standard Bedding

Sufficient space shall be made in the trench bed to allow each pipe joint to be made, tested and inspected. The pipe shall then be laid and covered to a depth of 1 ft above the crown of the pipe, leaving the joints exposed. Selected excavated material shall be used with particle size not exceeding 1 inch. The material shall be evenly placed and compacted in layers not exceeding 4 inch thickness after compaction. Hand controlled vibrators or such other means as approved by the Project Manager shall be used. Special care shall be taken to fill under the sides of pipes to ensure full contact with the barrel of the pipe.

After the pipeline has passed the test before completion of backfilling, the holes left at exposed joints shall be carefully filled and compacted with material as specified above. The remainder of the pipe trench shall then be filled in with the excavated material with particle size not exceeding 4 inches. Trenches must be overfilled to allow for settlement.

10.13 Pipelaying in Granular Material

Where pipes are to be laid in a bedding of granular material, they shall be laid on the bed prepared as specified in Clause 10.9. Sufficient space shall be made in the granular material to enable the joints to be made, tested and inspected, but the Contractor shall ensure that at least three-quarters of each pipe length is fully supported at all times.

The pipe joints shall be protected to prevent granular material or fill entering the space between the pipe spigot and the socket. Such protection may take the form of a twist of yarn lightly pressed into the annular space or other equal protection approved by the Project Manager.

After the pipeline has been approved by the Project Manager, the trench shall be carefully filled to the level of the horizontal diameter of the pipe barrel with granular material. This filling shall be carefully compacted by a method approved by the Project Manager so as not to disturb the pipes or joints.

Special care shall be taken to fill under the sides of pipes to ensure full contact with the barrel of the pipe.

After the pipeline has passed the preliminary test the joint holes shall be carefully filled with granular material and then backfilling shall proceed with selected excavated material with particle-size not exceeding 4 inches and as specified in Clause 4.9.2 of the Specification.

The pipe shall then be covered to a depth of 12 inches above the crown of the pipe, using selected excavated material with particle-size not exceeding 1 inch. The material shall be evenly placed and compacted in layers not exceeding 4 inch thickness after compaction. Hand controlled vibrators or other such means as approved by the Project Manager shall be used.

Trenches must be overfilled to allow for settlement.

Where ordered by the Project Manager, the granular bedding and fill to the excavation shall be interrupted by a clay or other approved impermeable barrier.

10.14 Pipe laying in Concrete Bed

Where pipes are to be laid in a concrete bed, the concrete blinding layer specified in Clause 10.10 shall first be washed clean. The pipe to be laid shall be firmly supported to true line and gradient on pre-cast concrete blocks and separated from them by a 1 inch thick saturated softwood or other approved flexible packing. The blinding concrete shall then be thoroughly washed down and reinforcement, if any, and concrete shall be carefully placed and compacted thereon until the appropriate profile shown on the Drawings for the required concrete bed has been obtained in such manner as not to disturb the pipes or joints. The concrete shall be placed against vertical shutters or to the full width of the trench. The concrete class shall be Class A for all reinforced concrete bedding and for pipe diameters less than 30 inches on mass concrete bedding. Class B concrete shall be used for all other pipe diameters on mass concrete bedding.

Before placing the concrete bed, a thickness of bituminous joint filler as specified, or other approved filler, shall be shaped and placed at every pipe joint to prevent concrete entering the pipe joint and to interrupt the concrete bed across its full section. The thickness of the joint filler shall be:

a) 0.5 inch for pipes up to and including 3 ft nominal diameter; and

b) 0.75 inch for pipes over 3 ft nominal diameter

After placing and fixing the reinforcement, if any, the concrete shall be placed and compacted evenly to within 1 inch of the underside of the pipe barrel over the full width of the excavation or

between rigid shutters to the required minimum width of the bedding. The concrete shall then be placed on one side of the pipe only and carefully worked under the pipe until all voids are filled and the pipe is firmly supported on the concrete. The remainder of the concrete shall then be placed to bring up the level of the concrete equally on each side of the pipe.

After the pipeline has satisfied the preliminary test as specified in Clause 10.15 and after the concrete has been cured as specified for not less than 24 hours, the remainder of the excavation shall be refilled.

The pipe shall be covered to a depth of 1 ft above the crown of the pipe, using selected excavated material with particle size not exceeding 1 inch. The material shall be evenly placed and compacted in layers not exceeding 4 inch thickness after compaction. Hand controlled vibrators or other such means as approved by the Project Manager shall be used. Backfilling shall then continue with selected excavated material with particle size not exceeding 4 inches and as specified in Clause 4.9.2 herein.

Trenches must be overfilled to allow for settlement.

10.15Testing Pipelines

Pipelines shall be subjected to preliminary tests and tests on completion. The preliminary test shall be an air water test as specified below. The test on completion shall be a water test as specified below. The preliminary test shall be made after the pipeline length to be tested has been laid and jointed, but before completing the filling of the excavation or placing the concrete surround or bed, as the case may be. The test on completion shall be made after the pipeline excavation for the length under test has been filled. All fittings required for temporarily closing the openings in pipelines to be tested shall be properly designed for the purpose and shall be adequately strutted to withstand the pressure specified. All apparatus required by the Project Manager for measuring and maintaining pressures and levels shall be supplied, fixed and maintained by the Contractor to the approval of the Project Manager. A record shall be kept to the approval of the Project Manager of all tests made and of their results.

Any length of pipeline for which the Project Manager requires test shall not be considered complete until it has satisfied the test on completion in the presence of the Project Manager.

a) The air test shall be conducted as follows:

The pipelines shall be thoroughly wetted for the length under test. Air or smoke shall be pumped into the pipeline under test until a pressure equal to 4 inches of water is indicated in a graduated ‘U’ type gauge. After a period of 5 minutes without any further pumping, this pressure shall not have fallen below 3 inches.

b) The water test shall be conducted as follows:

The pipeline under test shall be filled with water from a header tank at the lower end, air being released through a valve at the upper end until the pipeline is completely full of water. After a period approved by the Project Manager for absorption by the pipe material, water shall be added until the head over the soffit of the pipeline is 4 ft at its highest point, but not more than 20 ft at its lowest point. The water level in the header tank shall be marked. At the end of thirty minutes the amount of water necessary to bring the level in the header tank up to the original mark shall not exceed 0.07 gallons per hour per 100 ft of pipeline per half-inch of nominal internal diameter of pipe.

For pipelines of nominal internal diameter more than 2 ft, subject to the agreement of the Project Manager (which will not be unreasonably withheld) the test on completion as specified may be substituted by a visual inspection by the Project Manager of the internal surfaces of the pipeline

for apparent defects together with a hydraulic test of the joints. The hydraulic test of the joints shall be performed using apparatus approved by the Project Manager. The test pressure shall be twice the maximum pressure specified above for the test on completion, and the duration of the test shall be not less than 5 minutes. The test will be considered satisfactory if the loss of water is not greater than 0.0006 gallons per hour per inch of internal diameter per joint.

11 Brickwork and Plasterwork

11.1 General

All bricks shall be new and of the best quality of their respective kinds. They shall be clean, hard, sound and well burnt, equal in size, straight and sharp in the arises and shall be obtained from manufacturers approved by the Project Manager. Samples of ten bricks from each consignment of 20,000 bricks or less are to be submitted to the Project Manager for his approval and every consignment delivered to the Works shall be equal in quality to the approved samples retained by the Project Manager.

Bricks delivered to and within the Site, shall be unloaded by hand and not tipped.

11.2 Cement Mortar for Brickwork

Unless otherwise ordered cement mortar for brickwork shall consist of one part of Cement to four parts of sand by volume mixed with just sufficient water to make it workable.

11.3 Sand

Sand shall be as specified in the Chapter of ‘Concrete’.

11.4 Cement

Cement shall be as specified in the Chapter of ‘Concrete’.

11.5 Laying

Brickwork shall be laid in English Bond unless otherwise specified. Bricks shall be laid to true line and level courses and to the dimensions shown on the Drawings or instructed by the Project Manager. The bricks shall be thoroughly soaked in clean water for at least one hour before use and before continuing partly completed work. The exposed bed joint shall be likewise soaked. The new work should be kept wet during construction and for ten days after completion. The joints shall generally be not more than 0.25 inch in the beds and 0.50 inch at the ends or such other dimensions as may be agreed by the Project Manager and the whole joint shall be completely filled with the same mortar.

Brickwork shall be carried up in a uniform manner and no one portion carried more than 3 ft above another, the ends being racked not toothed.

For roads, where indicated on the Drawings the bricks on the edge shall be laid with their width parallel and joints at right angle to the centre line of the road, the soil beneath the bricks should be well rammed and brought to proper level. The edging shall be made with bricks laid on either side of the carriageway.

The dimensions of the brick to be provided for road and brick work (masonry) shall be 4.5” (thick), 3” (wide) and 9” (long) and 9 inches x 4 3/8 inches x 2 11/16 inches or 228.6 mm x 111.12 mm x 68.26 mm respectively.

11.5.1 Compressive Strength

The compressive strength of brick shall not be less than 2000 lbs per square inch.

11.5.2 Water Absorption

This test shall be carried out in the following manner:

The weights of samples of bricks are taken:

- when dry at room temperature
- after immersion in water at room temperature for 24 hours and
- after boiling in water for 5 hours and cooling in water overnight. In each case the weight of water absorbed is expressed as percentage of the corresponding weight of dry bricks. Water absorption by dry weight of an average first class brick varies from 10 to 15 per cent and that of a second class brick varies from 15 to 25 per cent.

11.6 Cement Plaster

The cement plaster shall consist of one part cement to three parts of sand by volume. Cement plaster shall be applied in two coats to give a total thickness of 19 mm and 12.5 mm (0.75 and 0.5 inches), as instructed by the Project Manager. The undercoat shall be thoroughly scratched and brought to a true surface before application of the topcoat.

The top coat shall be finished to a true and even surface with a wood float. Corners shall be finished true, vertical, even and carried out at the same time as adjacent wall surfaces. All brickwork shall be cured as it is constructed and for not less than 10 days.

12 Project Requirements

12.1 Meetings and Reports

Approved representatives of the Contractor shall attend formal meetings at the office of the Project Manager on Site or in Hyderabad and Karachi, when called upon, for the purposes of contract administration. Such meetings, unless otherwise agreed, shall not be more frequent than once per month or as instructed by Engineer. The Contractor shall also attend daily and weekly meetings at the Site when called upon by the Project Manager.

12.2 Employer's / Engineer's Office (Furnished)

The Contractor, if ordered, shall provide fully serviced, secure furnished office accommodation as directed by the Project Manager for the exclusive use of the Employer / Engineer and his staff.

All accommodation shall be provided with air conditioners, ceiling fans, utilities including water supply, electricity, sanitary, gas, telephone and 20 MBps broadband wi-fi internet facility. These facilities shall be connected to mains supply and any fees payable to the respected suppliers shall be the responsibility of the Contractor. These facilities shall be made available and maintained for the duration of the contract up to the end of the Defects Notification Period of all the works.

12.3 PPE for the Project Manager and Employer

The Contractor shall provide following personal protective equipment (PPE) and clothing and any other articles necessary for the safety of the Project Manager's / Employer's staff and visitors:

(1) Overalls and protective aprons
(2) Protective headgear - safety helmets, wide brimmed hats to protect against the sun
(3) Safety boots or shoes
(4) Safety glasses or goggles
(5) Hand gloves
(6) Respirators and masks
(7) Earmuffs and earpieces

12.4 Water, Electricity, Gas and Communication

The Contractor shall provide for the colony a continuous supply of utilities and drinking water (WHO standards), electricity, gas, 20Mbs wi-fi internet and telephone to the Project Manager's offices up to the end of the Defect Notification Period.

12.5 Assistance to the Project Manager

The Contractor shall supply continuously, the labour required by the Project Manager to assist him in checking the setting out of the Works, in measuring the works, as messengers in connection with the Works, general labour in connection with the operation and maintenance of the Project Manager's office, and also watchman, or watchmen as required, over the Project Manager's offices and equipment.

12.6 Correspondence

All correspondence to the Employer and to the Project Manager originating from the Contractor shall be in English and in searchable pdf format.

Appendices

A. Standards

B. Contractor’s Environmental and Social Management Plan

C. Health and Safety Plan

D. Furniture, Fittings and Equipment

A. Standards

The Contractor shall supply standards, the publications, stated herein, but not limited to the list when ordered by the Project Manager. All amendments to each Standard (Published by the British Standards Institution) shall be included.

A.1 British Standards

BS 4:	Part 1: Structural steel sections, Specification for rolled sections.
BS 21	Specification for pipe threads for tubes and fittings where pressure-tight joints are made on the treads.
BS 302:	Parts 1 & 5: Standard steel wire ropes.
BS410	Specification for test sieves.
BS 443	Specification for testing zinc coatings on steel wire and for quality requirements.
BS 486	Specification for asbestos-cement pressure pipes and joints.
BS 534	Specification for steel pipes, joints and specials for water and sewage.
BS 709	Methods of destructive testing fusion welded joints and weld metal in steel.
BS 812	Testing aggregates.
BS 882	Specification for aggregates from natural sources for concrete.
BS 903	Physical testing of rubber. Parts A1, A, A3, A4, A5, A6, A19 & A6.
BS 1052	Specification for mild steel wire for general engineering purposes.
BS 1199&1200	Specification for building sands from natural sources.
BS 1377	Methods of test for soils for civil engineering purposes.
BS 1387	Specification for screwed and socketed steel tubes and tubular and for plan end steel tubes suitable for welding or for screwing to BS 21 pipe threads.
BS 1471	Specification for wrought aluminium and aluminium alloys for general engineering purposes; place, sheet and strip
BS 1722	Part 1: Specification for chain-link fences.
BS 1853	Tubular fluorescent lamps for general lighting service.
BS 1881	Testing Concrete
BS 2494	Specification for elastomeric seals for joints in pipe-work and pipelines.
BS 2499	Hot applied joint sealant systems for concrete pavements.
BS 3083	Specification for hot-dip zinc coated and hot-dip aluminium / zinc corrugated steel sheets for general purposes.
BS 3100	Specification for cast steel for general engineering purposes.

BS 3148	Methods of test for water for making concrete (including notes on the suitability of the water).
BS 3382	Specification for electroplated coating on threaded components.
BS 3416	Specification for bitumen-based coatings for cold application, suitable for use in contact with potable water.
BS 3505	Specification for unplasticized polyvinyl chloride (PVC-U) pressure pipes for cold potable water.
BS 3680	Measurement of liquid flow in open channels, Parts 1, 3A, 3C, 3D, 8A, 8B, 10B, 10C and 10D.
BS 4027	Specification for sulphate-resisting Portland cement.
BS 4072	Wood preservation by means of copper/chromium/arsenic compositions.
BS 4254	Specification for two parts polysulphide-based sealants.
BS 4395	Specification for high strength friction grip bolts and associated nut and washers for structural engineering.
BS 4449	Specification for carbon steel bars for the reinforcement of concrete
BS 4466	Specification for scheduling, dimensioning, bending and cutting of steel reinforcement for concrete.
BS 4482	Specification for cold reduced steel wire for the reinforcement of concrete.
BS 4483	Specification for steel fabric for the reinforcement of concrete.
BS 4504	Circular flanges for pipes, valves and fittings (PN designated)
BS 4550	Methods of testing cement
BS 4604	Specification for the use of high strength friction grip bolts in structural steel work, Metric series.
BS 4660	Specification for unplasticized polyvinyl chloride (PVC-U) Pipes and fittings of nominal sizes 110 and 160 for below ground gravity drainage and sewerage.
BS 4251	Truck mixed Concrete
BS 2494	Rubber Gasket
BS 4848	Parts 1 & 4: Hot-rolled structural steel sections.
BS 4872:	Part 1: Specification for approval testing of welders when welding procedure approval is not required.
BS 4987	Coated macadam for roads and other paved areas.
BS 5135	Specification for arc-welding of carbon and carbon manganese steels.
BS 5328	Concrete
BS 5390	Code of practice for stone masonry.
BS 5400:	Part 6: Steel, concrete and composite bridges. Specification for materials and workmanship, steel.

BS 5481	Specification for unplasticized PVC Pipe and fittings for gravity sewers.
BS 5493	Code of practice for protective coating of iron and steel structures against corrosion.
BS 5628	Code of practice for use of masonry.
BS 5911	Part 100: Precast concrete pipes, fittings and ancillary products, Specification for unreinforced and reinforced pipes and fittings with flexible joints.
BS 5930	Code of practice for site investigations
BS 6073	Precast concrete masonry units.
BS 6150	Code of practice for painting of buildings
BS 6323	Specification for seamless and welded steel tubes for automobile, mechanical and general engineering purposes.
BS 7079	Preparation of steel substrates before application of paints and related products. Part 0, A1, A1 Supplement 1, C1, C2, C3, C4, E3 & E4.
BS 7613	Specification for hot rolled quenched and tempered weld-able structural steel plates.
BS 7668	Specification for weld-able structural steels. Hot finished structural below sections in weather resistant steels.
BS 5911	Concrete pipes and filling
BS 8004	Code of practice for foundations
BS 8110	Part 1: Structural use of concrete. Code of practice for design and construction

A.2 BS European Standards

(Published by the British Standards Institution)

BS EN 197	Specification for Ordinary Portland Cement
BS EN 499	Welding consumables, Covered electrodes for manual metal are welding of non alloy and fire grained steels. Classification
BS EN 10029	Specification for tolerances on dimensions, shape and mass for hot rolled steel plates 3 mm thick and above.
BS EN 10113	Hot rolled products in weld-able fine grain structural steels, Part 1 to 3
BS EN 10155	Structural steel with improved atmospheric corrosion resistance. Technical delivery conditions
BS EN 10210-I	Hot finished structural below sections of non-alloy and fine grained steels. Technical delivery requirements.

A.3 American Standards

ASTM D-412	Test for rubber properties in tension
ASTM D-1117	Tear Strength of Fabrics

ASTM D-1600-81	Abbreviations of terms relating to plastics
ASTM D-1682	Tensile Strength/Elongation of Fabrics
ASTM D-1751	Preformed Expansion joint filters for concrete paving and structural construction (non-extruding and resilient bituminous types)
ASTM D-1752	Preformed sponge rubber and cork expansion joint filters for concrete paving and structural constructions
ASTM D-1777	Thickness of Yarn and Fabrics
ASTM D-1784	Right Polyvinyl Chloride compounds

A.4 United States Federal Specification

HH-F	341e	Joints Filters

A.5 Pakistan Public Works Department (PWD) Specification

Pakistan PWD	Specifications for Building and Road Works (1973)

A.6 Miscellaneous

Building Research Station, UK (January 1991)	Digest	357: Shrinkage of natural aggregates in concrete
US Bureau Reclamation		Earth manual
Department of Environment, UK		Analysis of raw, portable and waste waters, 1972

B. Contractor's Environmental and Social Management Plan

B.1 General

The Contractor's Environmental and Social Management Plan must demonstrate compliance with this specification as well as the Environmental Code of Practices and Environmental and Social Management Plan for Sindh Barrages Improvement Project.

The general objectives of the environmental and social management for the implementation of the Works are:

(a) Implementation of measures to prevent or reduce negative impacts to acceptable levels or to enhance environmental and social conditions in the project.

(b) Implementation of measures to deal with environmental and social risks that arise during implementation and Defects Notification Period.

(c) Implementation of measures that ensure that the environmental and social actions are in phase with engineering and other project activities throughout implementation.

(d) Supervising and monitoring of significant issues during installation and operation.

Wherever stated within this document that any information or documentation shall be provided or submitted by the Contractor to the Employer and copied to the Project Manager.

The Employer and the Project Manager may nominate representatives to act on behalf of them for the provisions of this document. In such case, the Contractor shall liaise and make the necessary coordination with such nominated representatives for the fulfilment of his requirements under this document.

The Contractor shall prepare and implement the Contractor's Environmental and Social Management Plan (CESMP) setting out:

- a clear statement of environmental and social policy to be adopted for the Works
- details of specific actions and mitigations to be implemented on site to prevent or reduce the environmental and social impact of the Works
- details of proposed internal monitoring actions to ensure implementation of mitigations, and
- details of the administrative framework under which the plan shall be implemented.

The Contractor shall not commence any Works until the CESMP is approved by the Project Manager.

B.2 Contents of the CESMP

The CESMP shall be divided into the following chapters.

B.2.1 Organisational Framework

The Contractor shall provide details of his organisational framework, in particular the designation of a senior manager to take overall responsibility and the designation of the following positions:

- Environmental Coordinator

- Human Resource Officer
- Community Liaison Officer
- Health and Safety Officer
- Safety Supervisor

The Contractor shall provide Curriculum Vitae for staff appointed to the positions above. The Contractor shall also include an organogram within the CESMP showing the managerial position of the staff members within the Contractor's team and detailing the superiors to whom they report and subordinates who they shall control to ensure the day-to-day implementation of the CESMP. The Contractor shall demonstrate in the CESMP that he has allocated sufficient personnel to achieve the objectives and actions detailed in other sections of the CESMP.

B.2.2 Construction Camp Management Plan

The CESMP shall include a construction camp management plan on the basis of Environmental Code of Practice 16. The plan shall include layout plans for all construction and labour camp(s). All layout plans shall include the following details:

- Camp location
- Camp boundary
- Work areas
- Accommodation areas
- Kitchens and dining areas
- Sanitary facilities (including toilets and washrooms/showers)
- Location of sanitary treatment facilities and discharges
- Waste facilities
- Location of landfills
- Generators
- Batching plants (if applicable)
- Storage areas (including hazardous material storage areas)
- Fuel tanks
- Water supply
- Plant and vehicle parking
- Measures taken to segregate pedestrian and vehicle routes
- Evacuation routes and emergency exits
- Drainage
- Refuelling points
- Plant wash down points

B.2.3 Traffic Management Plan

The Contractor shall include a traffic management plan within the CESMP on the basis of Environmental Code of Practice 15 and which includes the following details:

- Access routes for deliveries to and from the main camp
- Queuing points for delivery vehicles
- Loading/unloading points for deliveries and Contractors plant and vehicles at the construction camp
- Access routes around the Site for transfer of materials and personnel
- Proposed access/haul routes identifying which shall utilise existing track and which are to be constructed
- Locations and details of warning signs to be erected on public roads
- Locations where banksmen shall be provided (if required)

The traffic management plan shall be discussed with the Sindh Irrigation Department and authorities responsible for roads and traffic prior to submitting the CESMP to the Project Manager.

B.2.4 Erosion, Sediment and Drainage Control Plan

The Contractor shall include an erosion, sediment and drainage control plan on the basis of Environmental Code of Practices 4, 6 and 8.

B.2.5 Pollution Prevention and Control Plan

The Contractor shall include a pollution prevention and control plan within the CESMP on the basis of Environmental Code of Practices 1, 2,10, 11 and the World Bank EHS Guidelines (2007). This plan shall also include the following details:

- Actions to be taken to prevent the spill of contaminants on site
- Actions to be taken in the event of land and water based minor and major pollution events, including materials/equipment to be permanently based on site, regularly maintained and to be used during a pollution event

B.2.6 Waste Disposal and Effluent Management Plan

The Contractor shall include a waste disposal and effluent management plan within the CESMP on the basis of Environmental Code of Practices 1, 2 16 and the World Bank EHS Guidelines (2007). This plan shall also include the following details:

- Method of treatment and disposal of sanitary wastes. Where the Contractor proposes the use of septic tanks, he must include the designs or specifications of the system demonstrating that the treatment rate exceeds the loading rate and the methodology for treatment/disposal of the sludge
- Proposed method for disposal of hazardous waste as per requirement of Clause 1.32.4
- Proposed method for treatment of concrete batching plant washout water (if applicable), to include as necessary, flow and load equalisation, pH adjustment and sedimentation using settling basins or clarifiers
- Procedures for the collection and disposal of wastes, including domestic and construction waste

B.2.7 Borrow Area Management and Restoration Plan

The Contractor shall include a borrow area management and restoration plan within the CESMP on the basis of Environmental Code of Practices 5, 6 ,8 9 and 10. This Plan will aim at minimizing the environmental and social impacts during borrowing activities and restoring as much as possible the original natural situation of these sites by various measures (such as refill, levelling or smoothening). Restoration methodologies will be included in the Plan.

B.2.8 Protection of Gas Pipeline Plan

The CESMP shall include a plan to ensure the proposed rehabilitation works won't damage the gas pipeline, along with precautionary measures to be taken. The Contractor shall also submit this to the Sui Southern Gas Pipeline Company for the review and approval.

B.2.9 Drinking Water Supply and Sanitation Plan

The Contractor shall include a drinking water supply and sanitation plan within the CESMP on the basis of Environmental Code of Practice 3 which shall detail measures to ensure no shortages and/or contamination of local water supplies.

B.2.10 Management Plan for Protection of Flora and Fauna

The CESMP shall include a management plan for the protection of flora and fauna on the basis of Environmental Code of practices 12, 13 and 14 to address impact on dolphins.

B.2.11 Fuel and Hazardous Substances Management Plan

The CESMP shall include a fuel and hazardous substances management plan on the basis of Environmental Code of Practice 2 and in accordance with the standard operating procedures, relevant guidelines, and where applicable, material safety data sheets. The Plan will include the procedures for handling oils and chemical spills.

B.2.12 Instream Construction Works Management Plan

The CESMP shall include an Instream Construction Works Management Plan to address the environmental concerns associated with use of motor boats, barge mounted equipment and in-river temporary works. The plan will address risk of spills, collision with dolphins, safety of construction workers as well as the other potential risks identified in the Environmental and Social Assessment Report and its addendum.

B.2.13 Emergency Plan

The Contractor shall include an emergency plan within the CESMP which includes the following details:

- Measures for fire prevention and fire fighting
- Indicators on site (for example, heavy rainfall) that shall prompt the shutdown of specified areas of work
- Procedure for shutdown of site, including transfer of plant, materials and personnel to safe areas (for example in the event of a flood)
- Procedures for working safely near to or in water, including use of boats and other water based plant and equipment
- Identification of public areas at risk from fire within camps or workshops.
- Emergency evacuation procedure for staff and members of the public likely to be impacted by emergency event on site (for example, fire, blast)

B.2.14 Training Plan

The Contractor shall include a training plan within the CESMP which details the programme for the delivery of training, demonstrating training shall be carried out initially at induction of staff and repeated intermittently throughout the project, to cover the subjects included in the following table.

Training Subjects for Inclusion in Contractors Training Plan

Subject	Target Audience
Handling, use & disposal of hazardous material	Construction workers with authorised access to hazardous material storage areas and required to use hazardous material during their works
Waste Management	All staff (construction and camp staff)
Efficient & safe driving practices, including road & vehicle restrictions	Mandatory for all drivers & mobile plant operators
Actions to be taken in the event of major or minor pollution event on land	All construction staff
Pollution prevention: Best practice	All staff

Subject	Target Audience
Health & Safety: Safe way to work & hazard awareness, including working on or close to water	All construction staff
Health & Safety: Safe use of plant & equipment, including water based plant and equipment	Operators of plant & equipment
Health & Safety: Working at height	All construction staff
Health & Safety: Use of PPE	All construction staff
Emergency procedures and evacuation	All staff
Fire fighting	All staff
Site inductions, including requirements under the Environmental Management Plan	All staff
Culturally sensitive awareness raising on HIV/AIDS and the spread of sexually transmitted diseases. Awareness raising on risks, prevention and available treatment of vector-borne diseases	All staff
Cultural sensitivities of the local population	On induction of all migrant staff

B.2.15 Monitoring Plan

The Contractor shall include details of the proposed environmental, ecological and social monitoring procedures, to ensure the construction site is operating satisfactorily and that problems are being dealt with promptly. This shall include the following:

- Checklists for day to day monitoring of compliance with environmental, ecological and social requirements of this specification and the CESMP.
- Details of the records to be kept to demonstrate compliance with environmental, ecological and social requirements of this specification and the CESMP
- A plan for day-to-day monitoring of the site and identification of staff responsible for this
- Proposed actions to be taken to correct non-compliances noted by the Contractor
- Internal reporting channels for non-compliances
- The format of a monthly report to be submitted to the Employer and Engineer which reviews the Contractors own compliance with the environmental, ecological and social requirements of this specification and the CESMP and identifies any problems
- A formalised mechanism to audit the effectiveness of the CESMP

B.2.16 Communication and Local Recruitment Plan

The CESMP shall include a Communication and Local Recruitment Plan, in compliance with clause 1.23 of this specification. The Plan shall demonstrate how the Contractor will communicate with local community leaders, provide details regarding employment opportunities at mobilization, and traffic management throughout the construction period. The contractor's communication plan should define a process for receiving, recording and responding to complaints and also monitoring of the success of any responsive action taken to prevent the escalation of any conflicts. The plan will be prepared in compliance with communication strategy provided in the Social Management Framework for this project[1].

The Contractor's Local Recruitment Plan shall demonstrate how the Contractor shall maximise the recruitment of local staff to the maximum extent possible. The Plan shall provide a methodology for the advertisement of local employment opportunities, including spatial extent, medium, timing and frequency of advertisements, as well as the number and nature of the job opportunities to be advertised. Mediums shall include SMS, television, radio and newspapers.

[1] Freely available on the World Bank website

The Plan shall include a target for the number of local population employed as a percentage of the Contractor's total workforce.

B.3 Contractor's Responsibilities

The Contractor shall:

- Produce and implement the CESMP;
- Monitoring their own compliance with environmental and social requirements of this specification and the CESMP;
- Co-operate with the Project Manager and the Employer or their nominated representatives;
- Provide the Project Manager and Employer with access to records of the environmental management programme for the purposes of an audit, every six months.
- Produce a monthly report to the Employer, copied to the Project Manager, which reviews the Contractors own compliance with the environmental and social requirements of this specification and the CESMP and identifies any problems. The report shall detail actions taken or proposed by the Contractor in response to any non-compliance identified by the Contractor, or identified and reported to the Contractor by the Project Manager, Employer or any of their representatives.

C. Health and Safety Plan

C.1 General

The Contractor's Health and Safety Plan must demonstrate compliance with this specification as well as the World Bank Group EHS Guidelines (2007), Environmental Code of Practices and the Environmental and Social Management for Sindh Barrages Improvement Project (SBIP).

The Contractor shall prepare a site specific health and safety plan that includes or addresses the following topics:

C.1.1 Description of Project

- Project description and programme details;
- Details of the Employer, designers, the Project Manager, the Contractor and other contractors;
- Extent and location of existing records and plans.

C.1.2 Communication and Management of the Work

- Management structure, responsibilities (to include sub contractors), supervision and reporting scheme;
- Health and safety goals for the project and arrangements for monitoring and review of health and safety performance;
- Identification of potential hazards relevant to the proposed works and the Contractor's chosen methodology, which may include, but not necessarily limited to the following:
- Safety risks:
  - services, including temporary electrical installations;
  - working in confined spaces;
  - preventing falls;
  - working near water;
  - work with or near fragile materials;
  - control of lifting operations;
  - dealing with services (water, electricity and gas);
  - the maintenance of Contractor's Equipment;
  - poor ground conditions;
  - traffic routes and segregation of vehicles and pedestrians;
  - storage of hazardous materials;
  - dealing with existing unstable structures;
  - accommodating adjacent land use;
  - other significant safety risks.
- Health risks:
  - removal of asbestos;
  - dealing with contaminated land;
  - manual handling;
  - use of hazardous substances;
  - reducing noise and vibration; and
  - other significant health risks.

- Proposed measures to reduce the risk of occurrence of hazards identified in (c) above, including identification of personal protective equipment requirements;
- Measures, which are specific and relevant to the proposed works and the Contractor's chosen methodology, to meet the requirements of the 'Environmental, Health, and Safety (EHS) Guidelines, General EHS Guidelines: Occupational Health and Safety' as issued by the International Finance Corporation (April 2007).
- Arrangements for:
  - appointment of a qualified safety officer;
  - appointment of a doctor/paramedic registered with the PMDC;
  - provision of personal protective equipment;
  - measures to enforce the use of personal protective equipment
  - regular liaison between parties on site including meetings of the safety committee;
  - consultation with the workforce; the exchange of design information between the Employer, designers, the Project Manager, the Contractor and other contractors on site.
  - handling design changes during the project;
  - the selection and control of sub-contractors;
  - the exchange of health and safety information between parties;
  - security, site induction and on site training for workers and supervisors;
  - medical examinations, welfare facilities, first aid and emergency facilities;
  - the production and approval of risk assessments and method statements;
- System for the reporting and investigating accidents and incidents including near misses and a template for an accident report to be submitted to the Project Manager and Employer following an accident;
- A plan for emergency transfer of Contractor's staff on site, or any member of the public who may be injured by the Contractor's activities, to suitable medical facilities in the event of a serious accident, including details of transport and medical treatment en-route.
- Site rules;
- Fire and emergency procedures;
- Site security.

C.1.3 Health and Safety File

- Layout and format;
- Arrangements for collection and gathering of information;
- Storage of information.