EXCELLENCE IN WATER CARE

BID DOCUMENT

VOLUME 2 OF 4
CIVIL WORKS: SCOPE OF WORKS & SITE INFORMATION

CIDB 9ME OR 9EP

DESCRIPTION:	**BID FOR THE UPGRADE/ REFURBISHMENT OF BIOFILTER MODULE (3) AT OLIFANTSFONTEIN WATER CARE WORKS (WCW): PHASE 1C**
PROJECT NO:	**ERW202009/TNDR-002**
COMPULSORY BRIEFING SESSION:	**11 FEBRUARY 2021 @ 11H00**
CLOSING DATE:	**05 MARCH 2021 @ 12H00**

FULL NAME OF BIDDER:
(Bidding Entity: cc, (Pty) Ltd,
JV, Sole Proprietor, etc.) : _____

CONTACT PERSON : _____

TEL NUMBER : _____

EMAIL : _____

CENTRAL SUPPLIER
DATABASE REG NO. : _____

BID AMOUNT (VAT INCLUSIVE) : _____

ERWAT STAMP

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2	Civil Works: -Scope of Works & Site Information
3	Mechanical and Electrical Works: Scope of Work and Site Information
4	Book (&CD) of Tender Drawings

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TENDER NO. ERW202009/TNDR-002

PART C3: SCOPE OF WORKS
CIVIL WORKS

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Note: The following Annexes form part of a CD bound into the document immediately after part C4 Site Information and are deemed to be part of C4:

Annex A – Geotechnical Investigation Report
Annex B – Environmental Management Plan

C3.1: DESCRIPTION OF THE WORKS

C3.1.1 EMPLOYER'S OBJECTIVES

The Employer's objective is to refurbish and/or rehabilitate certain treatment process units for the Module 3 plant at Olifantsfontein Water Care Works to improve its operational efficiency in order to meet the stipulated effluent discharge standards.

C3.1.2 OVERVIEW OF THE WORKS

Olifantsfontein Water Care works receives a combination of industrial and domestic sewage from Tembisa, certain suburbs in the north of Kempton Park, Ivory Park including Olifantsfontein, Midstream Estate Extension 2, Western and Southern parts of Chloorkop and Esselen Park Extension among others. The total influent is 105 Mℓ/d (ADWF) and is distributed equally to the existing 3 Modules at the plant by a system of weirs and sluice gates at the Head of works. Extraneous inflow at the Head of Works overflows to the emergency storage ponds, and then recycled back to the Head of Works during periods of low flows.

The existing Olifantsfontein Module 3 plant comprises a trickling filter plant and a conventional Activated Sludge plant.

The trickling filter plant has a design capacity of 16 Mℓ/d (ADWF) and comprises 6 No. x 12.5 m Diameter Dortmund Type Primary Settling Tanks, 6 No x 33.5 m Diameter Trickling Filters, 6 No x 12.5m Humus Tanks, 6 No x sludge digesters, Primary and humus sludge pumping stations and associated interlinking pipelines, channels and flow splitting boxes.

The Conventional Activated Sludge Plant comprises a mechanically scrapped primary settling tank, a primary sludge pumping station and an activated sludge reactor.

Module 3 is designed to treat approximately 35 Mℓ/d ADWF from the main head of works.

Presently, both the mechanically scraped Primary Settling Tank, including its sludge pumping station, and the trickling filter plant are not operational. Sewage is conveyed from the main head of works directly to the Activated Sludge Reactor.

The work to be carried under Phase 1C, in this contract, includes the rehabilitation of the biological treatment plant and refurbishment of certain mechanical and electrical equipment at the head of works and the activated sludge Reactor. The trickling filter plant is to be rehabilitated to allow re-routing of 16 Mℓ/d (ADWF) through the trickling filter plant. Recycling of the effluent to the Biofilters is introduced to increase the hydraulic loading on the Biofilters.

C3.1.3 EXTENT OF THE WORKS

All works shall be carried out in accordance with the Scope of Works, the Conditions of Contract and the Occupational Health and Safety Act 85 of 1993 and the Constructions Regulations of 2014.

The main work elements are best described below:

- A new sand trap & fat trap at the head of works for the incoming influent
- Rehabilitation of the old Dortmund Primary Settling Tanks and the associated influent concrete channels, distribution boxes, effluent channels and collection boxes;
- Replacement of the existing Dortmund Primary Settling Tanks influent pipes and sludge pipes with new HDPE pipes;

- Rehabilitation of the old primary sludge pumping station, the so-called the Old Digester Pump Station;
- Construction of a new rising main from the Old Digester Pump Station to the Digester division chamber
- Rehabilitation of the old Biofilter influent concrete channels, distribution boxes, siphon boxes, effluent channels and collection boxes;
- Replacement of the existing Biofilter influent pipes with new HDPE pipes;
- Construction of a new biofilter effluent recycle pumping station and the associated rising main to the main to the biofilter influent channel;
- Rehabilitation of the old Biofilter influent concrete channels, distribution box, effluent channels and collection boxes;
- Rehabilitation of the Humus tank influent concrete channels and distribution boxes;
- Rehabilitation of the humus tanks;
- Replacement of the existing humus tank influent pipes, effluent pipes and sludge pipes with new HDPE pipes;
- Rehabilitation of the humus sludge pumping station;
- Construction of the humus sludge rising main to the Old Digester Pump Station;
- Rehabilitation of the humus effluent recirculation pump station;
- Construction of a humus effluent recirculation rising main to the Biofilter influent channel
- Construction of a humus effluent pipe from the humus tanks to the existing outfall pipeline to the chlorine contact tank;
- Construction of meter chambers and associated pipework for the:
    - Old Digester Sludge P/S;
    - Humus Sludge P/S
    - Humus Effluent outfall to chlorine contact tank
    - RAS Pump Station for Clarifier No. 01
    - RAS Pump Station for Clarifier No. 02
    - BNR Inflow
    - Dortmund PST inflow
- Draining and Refurbishment of the Activated Sludge Reactor and removal of settled sludge;
- Rehabilitation of the sludge Digesters and;
- Rehabilitation of the sludge Drying Beds;
- Refurbishment and upgrades to the CoE pump station and rising main;
- Preparation of Commissioning Documentation and Staged Commissioning of the Biofilter Plant and of the Entire Module 3 Integration.

The detailed Scope of Work is set out as per the construction drawings and in the schedule of quantities.

The construction of the refurbishment and rehabilitation works has been implemented in stages to afford the Employer early beneficial use of part of the refurbished works. Details of the staged completion of the works required for beneficial use by the Employer are set out in C3.5.3 Management – Sequence of the Works and C5.14.1 of the Contract Data. It is envisaged that the following items of work will be completed by the commencement date of this contract.

- Construction of the main influent line, complete with the junction box and splitter box, to divert flow to Module 3 Works upstream of the Dortmund PST division chamber
- Packing and installation of the Cross-Flow Plastic Media in two Biofilters (the remaining biofilter work will be in progress during the implementation of this Contract).

All Work shall be performed in accordance with the General Conditions of Contract 2015, all relevant codes, details, specifications and the drawings.

The Tenderer is required to check these documents and drawings and the numbering of pages, which together form part of the Contract Document. The Tenderer shall satisfy himself that this Document is complete and if any pages are found to be missing, or duplicated, shall immediately request the Employer to rectify the discrepancy. No liability will be admitted by the Employer in respect of errors in the Tenderer's bid due to the foregoing.

C3.1.4 CONTRACTS INTERFACES

In addition to this contract, the Employer has awarded two other contracts at the same site namely

- Contract No ERW201902/TNDR-003 for the Refurbishment of Biological Trickling Filter Plant and minor civil and structural works on the six DPSTs and;
- Contract No ERW201912/TNDR-002 for The Supply and Delivery of Trickling Filter Plastic Packing Media To ERWAT's Olifantsfontein Water Care Works.

The scope of work under Contract No ERW201902/TNDR-003 includes the supply of the cross-flow plastic media for the first 2 Biofilters.

The assembling and placing of the cross-flow plastic media in the 4 No of Trickling filters supplied under Contract No ERW201912/TNDR-002 will be delayed pending the completion of the rehabilitation of the trickling filter influent pipelines to be completed under the current contract.

It is therefore possible that due to contract delays, all the three contracts may run concurrently at some point.

C3.1.5 LOCATION OF THE WORKS

Olifantsfontein Water Care Works (WCW) is located on Portion 34 of the farm Olifantsfontein 402JR, in the Ekurhuleni Metropolitan Municipal Area. The site is bounded by the Olifantspruit to the North and Kaalspruit to the South.

Access to the site is via Keramiek Street from the East.

The GPS Co-ordinates for the WCW are **25°56'24.49"S; 28°12'57.64"E**

Refer to the locality plan bound into this document.

C3.1.6 TEMPORARY WORKS

The temporary works required under this project may be as follows:

a) Supply, installation and maintenance of barricading / fencing around the construction site, including the pipeline trenches;

b) Design, supply and installation of shoring and / or bracing of trenches and excavation, where applicable, especially for existing structures;

c) Dewatering of trenches and excavations, if required;

d) Design, supply and installation of access scaffolding and lifting equipment, where applicable;

e) Design, supply and installation of formwork and support work;

f) Protection of existing services;

g) Temporary supply power, lighting and water as needed

h) Forced ventilation in confined spaces;

i) Any other temporary works as required from time to time in order to complete the Works

The above summary is not necessarily complete and shall not limit the work to be carried out.

C3.1.6.1 Excavation Support/Shoring Systems

Trenches and other excavations need to be barricaded in order to safeguard workers and to prevent unauthorised persons from entering or falling into them.

Excavations and trenches must be shored sufficiently to prevent persons being buried or trapped by a fall or dislodgement of material. Excavations adjacent to existing structures must be sufficiently shored to prevent any damage to such structures.

The Contractor must ensure that the necessary steps are taken to ensure the stability of any structure, pipeline, road or other service that is likely to be affected by his activities.

Barricading and shoring of excavations shall be the responsibility of the Contractor and for the purposes of this contract these measures are considered to be temporary works.

C3.1.7 EXISTING SERVICES

Items have been allowed in the Bills of Quantities for dealing with and protecting existing services where they are known.

The Contractor shall however ensure that prior to construction all the necessary Record Drawings for all services have been obtained and verified on site by the relevant Service Providers in his presence. The Contractor must request in writing the relevant official(s) to indicate the said services within 10 working days prior to commencement of work, after which the responsibility rests with the Service Department if the services are not indicated to the Contractor as requested.

The Contractor shall take whatever extra precautions are required to protect all existing services from damage during the period of the Contract. The Contractor shall make use of hand excavation to expose services. Any damage to existing services indicated by the relevant service providers or other damage as a result thereof, shall be for the Contractor's account.

All existing services shall be regarded as live and operational until otherwise advised by the responsible Service Provider or Official.

C3.1.8 SURVEY BEACONS AND BENCHMARKS

The Contractor shall be responsible for the preservation of all land survey, erf or other pegs, benchmarks and beacons. If damage or disturbance of any such pegs or beacons is caused by the operations of the Contractor or his subcontractors, the pegs are to be replaced by a Registered Land Surveyor at the cost of the Contractor. Benchmarks will be replaced by the Employer's Agent at the Contractor's expense.

Information regarding the position of all such pegs will be made available to the Contractor by the Employer's Agent on request.

The Contractor is to ensure that no spoil is placed over an erf peg or benchmarks and that these are adequately protected for the full duration of the Contract.

Where disturbances of boundary pegs is unavoidable due to excavation or other operations adjacent to the pegs, the Contractor shall advise the Employer's Agent or his Representative immediately, and agreement is to be reached that the disturbance of the peg is unavoidable and a strict record of such disturbed pegs is to be kept. Such pegs are to be replaced by a Registered Land Surveyor as described above and the Contractor is to submit proof of the cost of replacement of pegs. The Contractor will be reimbursed on a basis pro-rata to the total cost of peg replacement determined on completion of the Works.

C3.1.9 FEATURES REQUIRING SPECIAL ATTENTION

The Contractor is referred to SANS 1921: 2004: Construction and Management Requirement for Works Contracts, Part 1: General Engineering and Construction Works. These specifications shall be applicable to the contract under consideration and the Contractor shall comply with all requirements relevant to the project.

C3.1.9.1 Nature of Ground and Subsoil Conditions

The site is generally underlain by the chert-rich dolomite of the Monte Christo Formation of the Malmani subgroup. Incidences of sink hole formation and differential settlement have been reported on site. The Geotechnical Investigation report is attached to Annexure 5 of the document.

C3.1.9.2 Duration of the Works

The Works shall be completed in stages. Details of the Staged completion are set out in C3.5.3 and C1.1.1.14. and C5.14.1 of the Contract Data

C3.1.9.3 Work Within Demarcated Areas Only

The Contractor shall ensure that all his activities take place within the demarcated areas only. No work or activities may take place outside of the demarcated areas and any damage of whatsoever nature caused by the Contractor outside of the demarcated areas shall be the sole responsibility of the Contractor, who shall bear all and any associated costs.

C3.1.10 GUARANTEES

The Contractor shall be liable for, and shall guarantee, all work undertaken by him under the terms of the Contract and for the period of Defects Liability.

The Contractor shall accept and have full responsibility for the adequacy and compatibility of all items of plant and equipment required under this contract.

C3.1.11 SECURITY

The Contractor shall provide security watchmen for the contract as he deems fit at no extra cost to the Employer. This will include for all materials, temporary works and barricading. The Contractor must ensure that all his employees as well as the employees of his subcontractors are able to identify themselves as members of the construction team. The Contractor's rates will be deemed to allow for all related activities and equipment.

C3.2: ENGINEERING

C3.2.1 DESIGN SERVICES AND ACTIVITY MATRIX

Works designed by, per design stage:

Concept, feasibility and overall process	Employer
Basic engineering and detail layout to tender stage	Employer
Final design as approved for construction stage	Employer
Temporary works	Contractor
Final design of mechanical equipment electrical MCC's and cabling and control cabling and instrumentation for approval by the Employer	Contractor
Preparation of 'As-built' mark-up drawings	Contractor
Preparation of O&M manuals	Contractor
Approval of O&M Manuals	Employer
Preparation of 'Record' drawings	Employer

C3.2.2 EMPLOYER'S DESIGN

Prior to the closing of tenders, the design of the permanent works is the responsibility of the Employer's Agent. These designs and drawings may have to be amended to accommodate the specific requirements of the tendered mechanical equipment.

The hydraulic analysis of the system has been carried out by the Employer.

The conceptual mechanical, electrical and instrumentation design has been carried out by the Employer based on the hydraulic analyses.

C3.2.3 CONTRACTOR'S DESIGN

The Contractor is responsible for the design of all temporary works required for the construction of the permanent works to the approval of the Employer's Agent.

The Contractor is to be responsible for the layout of plant and equipment in the pump station/treatment works structures (should this/these differ from the Employer's proposed layout(s)) to suit the plant and equipment offered.

The Contractor is to be responsible for the design and detailed drawings of all of the mechanical, electrical and instrumentation plant and equipment to be supplied under this Contract.

The Contractor will be responsible for the design of all temporary works and all construction methods, including those for the tie-ins and interconnecting works and all coordination with the authorities and shoring and lateral support to excavations that may be required.

The Contractor will be responsible for the design of all temporary works required to protecting the existing anchor blocks on the existing pipelines.

The Contractor will be responsible for the preparation of method statements and for preparing designs for the removal, relocation and/or reconstruction of certain existing facilities on privately owned properties that will be affected by the construction of the new pipeline.

Note that, although all designs and drawings are subject to the approval of the Employer's Agent, this does not relieve the Contractor of his design responsibility nor accountability. The professional responsibility for such designs shall always remain with the Contractor and his design Engineer.

C3.2.4 DESIGN PROCEDURES

The successful Contractor shall be responsible for the design of all temporary works required for the successful completion of the Contract. Temporary works may include, but not be limited to:

- trench and excavation support/shoring,
- trench and excavation dewatering systems,
- support to existing structures and services,
- temporary access,
- formwork for concrete,
- temporary forced ventilation systems

The above description and listed items are not necessarily complete and shall not limit the design and execution of any other temporary work to be carried out.

All designs shall be in accordance with good engineering norms, standards and practices. Design calculations, information and assumptions on which designs are based shall be provided to the Employer's Agent if requested.

Note that, although all designs are subject to the approval by the Employer's Agent, this does not relieve the Contractor of his design responsibility nor accountability. The professional responsibility for such designs shall remain always with the Contractor and his design engineer.

The contractor shall take all statutory requirements, as well as the Site-Specific Health and Safety Specification and Basic Risk Assessment into consideration when designing the Temporary and Final Works.

The Contractor shall record, and transmit to the Employer's Agent, all construction data, to enable the Employer's Agent to compile 'As-Built' plans at the end of the contract.

The above summary is not necessarily complete and shall not limit the work to be carried out.

C3.2.5 DESIGN ASPECTS REQUIRING PARTICULAR ATTENTION

All design work for temporary and final works shall conform to recognised industry standards and norms. Design work shall be carried out by a competent person(s) qualified and experienced enough to undertake such design utilising adequate skills and knowledge to achieve the desired outcomes. Where required by legislation such persons shall be registered with the appropriate authorities such as the Engineering Council of South Africa (ECSA) or similar.

Formwork and support work shall be designed and signed off by a competent registered person.

C3.2.6 DRAWINGS

C3.2.6.1 Tender Drawings

Tender Drawings are provided in order to give an overview of the project. Any ambiguities shall be clarified by the Tenderer with the Employer's Agent prior to the submission of Tenders

The drawings that form part of the tender documents shall be used for tender purposes only.

The drawings issued for tender are set out in section C3.9 of the Scope of Works

Drawings for construction purposes will be issued to the appointed Contractor during the execution of the Contract.

C3.2.6.2 Construction Drawings

Construction drawings will, in terms of Clause 5.9 of the General Conditions of Contract (2015), be issued to the Contractor by the Employer's Agent on the commencement date and from time to time as required.

The successful Contractor will be supplied with three (3) sets of unreduced paper prints of each drawing free of charge. Any additional prints required will be for the account of the Contractor.

The Contractor shall conform in all aspects to the drawings and specifications and to any written instructions, which the Employer's Agent may provide him with during the Contract.

It is the Contractor's responsibility to ensure that work is carried out in accordance with the latest revision of the construction drawings.

Only figured dimensions may be used, and the drawings shall not be scaled unless the Contractor is so instructed by the Employer's Agent in writing. The Employer's Agent will upon written request provide any dimensions that may have been omitted from the drawings.

Should any differences or contradictions exist in the documents or dimensions used in the documents, the Contractor shall be responsible to obtain clarification thereof from the Employer's Agent. Such clarification shall be in writing and shall be final and binding.

Should the Contractor fail to seek clarification of any differences or contradictions, the Contractor shall be solely liable for any costs that may arise due to his failure in this regard.

C3.2.6.3 Record (as-built) Drawings

The Contractor shall mark up on drawings provided to him for this purpose the exact positions and details of all infrastructure, pipelines and the like constructed under the contract, as well as the details of all existing services found during the Contract. The marked-up drawings shall be handed to the Employer's Agent monthly as the work progresses.

The Certificate of Completion shall not be issued before the Employer's Agent is in receipt of all marked up drawings and other as-built information.

C3.2.7 CONSTRUCTION METHODS

Construction methods used shall be as environmentally friendly as possible. No construction methods that will result in long term or permanent damage to the surrounding natural environment shall be allowed.

Care shall be taken when mixing, transporting and placing concrete to avoid spillage and contamination of the soil.

All construction work shall be undertaken in accordance with the Occupational Health and Safety Act and its Construction Regulations, as well as the Environmental Management Plan.

Construction method statement shall be prepared and submitted by the Contractor to the Employer's Agent for review prior to any construction activity being undertaken.

C3.2.8 MATERIALS AND WORKMANSHIP

Workmanship throughout shall be executed according to the latest professional standards to the satisfaction of the Employer's Agent and particular care shall be taken to ensure a neat installation.

All plant, materials and work shall comply with the requirements of the applicable specification and shall be of best quality, new and unused, in good condition and complete.

The Contractor shall, when requested by the Employer's Agent to do so, submit samples of plant and materials for approval prior to commencing work.

Any plant, materials or work considered to be faulty, incorrectly installed, of inferior quality or badly fixed shall be repaired or replaced by the Contractor at his own cost, as ordered by the Employer's Agent.

The Contractor shall be held responsible for the correctness of all dimensions as set out.

The Employer's Agent will inspect the work from time to time during the progress of the work. Discrepancies will be pointed out to the Contractor and these shall be remedied at the Contractor's expense. Under no circumstances shall these inspections relieve the Contractor of any of his obligations or liabilities in terms of the Contract.

C3.2.9 ACCESS TO WORKS SITE

Access to the site is via existing streets. The Contractor shall maintain all access roads in good condition for the duration of the contract.

A payment item has been allowed in the preliminary and general section for maintenance of the access roads.

C3.3: PROCUREMENT

C3.3.1 PREFERENTIAL PROCUREMENT PROCEDURES

Tenders will be evaluated in terms of ERWAT's Supply Chain Management Policy.

C3.3.2 DEFINITIONS

For the purposes of the Scope of Works, the definitions given in the General Conditions of Contract for Construction Works (2015), the Standard Specifications and the Scope of Works, together with the following additional definitions, shall apply:

(a) **"*Contract*"** shall have the meaning assigned thereto in Clause 1.1.1.7 of the General Conditions of Contract for Construction Works (2015).

(b) **"*Contractor*"** shall have the meaning assigned thereto in Clause 1.1.1.9 of the General Conditions of Contract for Construction Works (2015).

(c) **"*Main Contract*"** shall mean the contract entered into between the Employer and the Contractor.

(d) **"*EME Subcontract*"** shall mean the contract entered into between the Contractor and an EE subcontractor.

(e) **"*EME Work Package*"** shall mean that portion of the Works that has been set aside for construction by an EME.

C3.3.3 SUBCONTRACTING

Should the Tenderer wish to employ Sub-Contractors for part of the works this is to be clearly indicated and the schedule in this document is to be completed to indicate the full names and addresses of all proposed Sub-Contractors for which approval of the Employer's Agent is sought, stating the section of the works that each will be handling.

Depending on the Contractor's CIDB class of registration with the CIDB, work may not be sub-contracted in any of the three primary disciplines, being civil, mechanical or electrical, to companies with Contractor designations and classes less than 6CE, 7ME or 5EP as appropriate.

Contractors may not sub-contract more than 25% of the contract value to another enterprise that does not have equal or higher B-BBEE status level, unless the intended sub-contractor is an EME that has the capability and ability to execute the sub-contract.

Selected Sub-contractors shall be chosen and appointed as follows:

The Employer will prepare a detailed scope of work and/or specification for work to be done or goods to be supplied by a Selected Sub-Contractor.

The Employer and the Contractor will compile a list of firms or persons acceptable to both and who will be invited by the Contractor to submit tenders for the requisite work to be carried out or goods to be supplied by Selected Sub-Contractors. When the tenders are received, they will be evaluated, and the Employer will then indicate which tender he requires the Contractor to accept and he will

advise the Contractor accordingly. The Contractor shall then accept that Tenderer and appoint him/her as a Selected Sub-Contractor.

The Contractor shall incorporate in the sub-contract provisions that:

In respect of the work carried out or the goods that are the subject of the sub-contract, the Selected Sub-Contractor undertakes to the Contractor mutatis mutandis the obligations and liabilities as are imposed upon the Contractor to the Employer in terms of the Contract, and holds the Contractor harmless from and indemnifies him against the same and in respect of all claims, demands, lawsuits, damages, costs, charges and expenses whatsoever arising out of or in connection therewith, or arising out of or in connection with any failure to perform such obligations or to fulfil such liabilities, and
The Selected Sub-Contractor shall also hold the Contractor harmless from and indemnify him against:

- Shortcomings in the sub-contract work if and where the work was designed by the Selected Sub-Contractor;
- Defects in the goods if and where the goods were manufactured and/or supplied by the Selected Sub-Contractor;
- Any negligence by the Selected Sub-Contractor, his/her Agents, workmen and servants;
- Any misuse by the Selected Sub-Contractor of any Constructional Plant, Temporary Works or materials provided by the Contractor for the purposes of the Contract; and
- Any claims as aforesaid.

Lightning Protection by a "Selected Sub-contractor"

It is intended that the lightning protection of the pump station building and the remote structure that is to house the telemetry equipment will be carried out by a selected sub-contractor under this Contract and a Provisional Sum has been included in the Bill of Quantities to cover the costs.

Cathodic Protection Installation by a "Selected Sub-contractor"

Details of the cathodic protection installations that are to be carried out on this project by a 'Selected Sub-contractor' to the Contractor under this Contract, will be carried out by a selected sub-contractor under this Contract and a Provisional Sum has been included in the Bill of Quantities to cover the costs.

As some of the CP design can only be carried out as field measurements are taken during the construction phase of the pipelines under this Contract, it is not possible to provide specific details in this document of the CP installations that will be required. The following data serves to indicate the scope of work that the 'selected sub-contractor' will be required to carry out.

<u>Cross Bonding:</u>

As the proposed pipelines is to cross, and is be laid in close proximity to, other existing steel pipelines, cross bonds will be installed between the various pipelines. Cross bonds usually comprise copper wires/cables welded at each end to the steel pipelines.

Continuity Bonding:

As it is essential to ensure that there is electrical continuity along the full length of the pipeline as it is being installed, electrical continuity bonds will have to be installed as the pipeline construction progresses. Electrical continuity bonds usually comprise copper wires/cables welded at each end to the steel pipelines at flanged and flexible coupled joints and also at flanges at air valve and scour valve installations. They are also required across insulating flanges and flow metering installations.

All work relating to permanent continuity bonding will be carried out by the "CP Selected Sub-Contractor" at the Employer's expense. All work associated with any temporary continuity bonding required to ensure that no section of pipeline is laid such that it is discontinuous from the main pipeline shall be carried out by the Contractor at no cost to the Employer. Temporary electrical continuity bonds shall comprise two parallel 120 square mm PVC coated stranded copper cables with ends securely clamped onto the ends of the steel pipes.

Monitoring Stations:

Monitoring stations may be required and are used for the ongoing testing of CP protection levels from an above ground point on the pipeline. These monitoring stations are usually small galvanized steel boxes placed within the pipeline servitude at regular intervals (normally 500 m apart), and have within them copper wire or cable connection to the pipeline and a stationary reference cell and a coupon.

Test Points:

Test points will be required and usually comprise stainless steel threaded rods installed into the concrete walls of a valve chambers at regular intervals along the pipeline route. Each rod is usually located above the external ground level of the chamber to allow CP personnel to do spot checks on the pipe's protection levels without having to open the valve chambers.

Transformer Rectifier Units (TRU):

Transformer rectifier units may be required and are used to generate DC power supplies to afford protection to the pipelines. These require an AC power supply from Eskom, an attachment to the pipeline, an appropriately sized ground bed, and a stationary reference electrode.

Should a Tenderer have any reason as to why they would not be prepared to enter into a sub-contact with any one of the abovementioned organizations or persons, he/she shall advise the Employer accordingly in their tender.

Environmental Rehabilitation by a "Selected Sub-contractor"

Whilst the Contractor will be required to carry out rehabilitation works as described and/or specified elsewhere in the document and/or to reinstate all areas affected by the works to conditions no worse than they were prior to the commencement of construction, the Contractor will be required to appoint a specialist environmental rehabilitation sub-contractor to carry out specific tasks such as:

- Soil sampling
- Pre-construction activities, including identification and creation of a nursery for the sensitive species within the construction site.
- Maintain the nursery until such time that the plant species are to be replanted.
- Ensuring that proper reinstatement and rehabilitation is undertaken along the pipeline route and all other sites including but not limited to spoil dump sites, the Contractor's camp site, staging areas and the pipe yard.

The present indications are that the Employer will require the Contractor under this Contract, to enter into a sub-contract with a specialist environmental firm who will, subject to agreement, become a "selected sub-contractor" to the Contractor under this Contract.

A Provisional Sum has been included in the Bill of Quantities to cover the cost of the work to be carried out by the selected sub- contractor.

C3.3.4 SCOPE OF MANDATORY SUBCONTRACT WORKS FOR EME'S

The following portions of work shall typically be subcontracted in accordance with the procedures described in this scope of work (Note: this list is not prescriptive, and the Contractor may subcontract any portion of the work, with the exception of water retaining concrete structures, to EME's).

- Bulk and trench excavations;
- Construction of pipelines up to 300mm diameter;
- Backfilling and reinstatement of pipelines;
- Construction of catch pits & manholes;
- Installation of kerbs and construction of concrete channels;
- Fixing of rebar;
- Trimming, top soiling, grassing and fencing;
- Installation of gabions and Reno mattresses;
- Construction of minor concrete structures;
- Paving

C3.3.5 EME SUBCONTRACTOR PROCUREMENT

It is a requirement of this contract that a minimum of 30% of the value of the Works (excluding Preliminary and General Items and specialised or imported mechanical equipment) shall be subcontracted to EME subcontractors in accordance with the subcontracting procedures referred to in this Scope of Work.
An EME is a micro or very small business as defined in the Schedule of the National Small Business Act 102 of 1996.

Selected EME subcontractors shall be EMEs based within the jurisdiction of the Ekurhuleni Metro Municipality.

Qualifying EMEs are required to have a valid Tax Clearance Certificate, be registered with the CIDB in a relevant category and be in good standing with the Compensation Commissioner.

The Contractor is free to select qualifying EMEs to be appointed by him on the Contract. EMEs shall be selected based firstly on the municipal ward in which the Olifantsfontein Water Care Works is located and the rest of Ekurhuleni Area.

C3.3.6 ENGAGEMENT OF EME SUBCONTRACTORS

The Main Contractor shall award and enter into the necessary subcontracts with the successful EMEs using the standard SAFCEC subcontract form of agreement, based on the accepted tender submissions. No deviations from the tender document shall be accepted by the Employer.

The Contractor shall ensure that EMEs are appointed timeously to avoid unnecessary delays to the programme.

C3.3.6.1 Sub-contracting by EME's

The Main contractor shall not permit appointed EME subcontractors to further subcontract on any other conditions than those applying in the project specification to subcontractors or EME subcontractors.

C3.3.6.2 Assistance to the Tenderers

The Contractor shall be responsible for ensuring that prospective EME tenderers fully comprehend the following:

- Implications of the liabilities and responsibilities inherent in the subcontract into which the tenderer proposes entering;
- implications of the tendered rates;
- scope and extent of the works included in the subcontract;
- proper procedures for the submission of the tender;
- procedures and basis on which tenders will be adjudicated and the subcontract awarded.

C3.3.6.3 Adjudication

a) The Contractor shall receive all tenders at a location identified by him, with all sealed tender submissions being placed in a proper tender box for this purpose.

b) All tenders received shall be evaluated by the person (Contracts Manager) mandated to act and sign on behalf of the Main Contractor.

c) The EME Committee shall have the right to interview any EME tenderer for the purpose of:

- Clarifying any aspect of the tender;
- Verifying the eligibility of the Tenderer;
- Querying abnormally high or low rates and prices, and
- Clarifying rates and prices, which are not in balance with other tendered rates and prices.

d) The correction of obvious errors shall be carried out in accordance with the requirements of the CIDB Conditions of Tender.

e) Adjudication of the tenders received will be made by the EME Committee. The Contractor shall be prepared to explain the process of adjudication to all Tenderers and motivate his method of award, as may be necessary. All unsuccessful and successful tenderers need to be notified in writing

C3.3.6.4 Award of Tenders

The Contractor must award the work to the successful EME Tenderer where after a subcontract agreement will be signed between the Contractor and the successful EME Tenderer using the standard SAFCEC subcontract form of agreement.

C3.3.7 ATTENDANCE ON EME SUBCONTRACTORS

The Contractor shall closely monitor all EME subcontracts to ensure compliance with the requirements of the Main Contract.

A payment item shall be provided in the schedule of quantities for the Main Contract through which the Main Contractor will be reimbursed for attendance on EME subcontracts. The following sub-items may be required:

- Subcontract procurement processes;
- Mark up on the actual cost of the subcontract works;
- Monitoring of the subcontract works;
- Allowance for payment of subcontractors within 7 days of submission of invoice.

The Contractor shall remain responsible for ensuring that the subcontracted portions of the Main Contract are completed in accordance with the contract drawings, specifications and approved programme.

C3.3.8 CONTRACTOR'S OBLIGATIONS TO SUBCONTRACTED EMEs

(1) **Dispute Avoidance and Resolution Procedures**

The Contractor shall at all times

(a) apply the terms and conditions of the subcontract fairly and justly, taking due cognisance of the level of sophistication and experience of the EME subcontractor concerned.

(b) issue reasonable warnings when any contravention of the terms of the subcontract has occurred or appears likely to occur. The Contractor shall give EMEs reasonable opportunity to avoid or make good any such contravention.

(c) closely manage and supervise all EME's and wherever feasible, give reasonable warning to EME's when any contravention of the terms of the subcontract has occurred or appears likely to occur. The Contractor shall whenever feasible, give the EME's reasonable opportunity to make good any such contravention or to avoid such contravention and shall render all reasonable assistance to the EME in this regard.

When taking any disciplinary actions or imposing any penalties provided for in the subcontract, the Contractor shall explain fully that such actions are in accordance with the conditions of subcontract.

Should any dispute arise between the Contractor and an EME, such dispute shall be resolved in accordance with the provisions of the subcontract.

(2) **Quality of Work and Performance of EME subcontractors**

Quality

The Contractor shall be fully liable for the quality of work done by the EME as if that work is done by the Main Contractor. All works are to be done according to the specifications and as specified in the tender document.

Performance

If, in the opinion of the Employer's Agent, an EME Subcontractor fails to comply with any of the criteria listed below, he/she shall issue a written warning to the Contractor stating all the areas of non-compliance.

(a) Acceptable standard of work as set out in the subcontract specifications.
(b) Progress in accordance with the time constraints in the subcontract.
(c) Site safety.
(d) Accommodation of traffic.

The circumstances that may warrant the issue of a written warning are, however, not limited to those listed above.

The EME Subcontractor shall have 14 days from the date of receipt of the letter of warning by the Contractor to address and rectify the issues raised by the Employer's Agent, with the exception of points (c) and (d), for which the reaction time shall be 24 hours. Failure to do so will be sufficient grounds for the Main Contractor to terminate the subcontract, provided that the Employer's Agent is satisfied that the Main Contractor has made every effort to correct the performance by the EME Subcontractor.

A copy of the letter of warning shall be forwarded to the Employer.

C3.3.9 MEASUREMENT AND PAYMENT FOR EME'S

Under the work packages set aside for EMEs, the EME shall be responsible for all labour, plant, equipment, tools, materials and any other incidentals that may be required to carry out the works in accordance with the specifications.

In cases where the EME is unable to have the above, then the Main Contractor will provide plant, equipment, tools, material and other items needed by the EME in order to implement his work and such contracts will be regarded as labour only sub-contractors. The cost and provisions for providing such plant, equipment, tools, material and other items shall be agreed in writing between the Main Contractor and the EME subcontractor.

The Contractor may provide a 10% advance payment (maximum R40,000) of the value of work allocated to EME's in order to ensure that EME's prepare all their documentation before commencement with work. This payment will cover items such as preparation of Health and Safety Plan, sending their staff for medicals, required PPE, etc.

EME's are to be invited to submit their payment certificates or claims fortnightly and are to be paid by the contractor within 7 days. Payment of EME's may not be delayed pending payment of the Contractor by the Employer.

No additional mark-up or costs will be payable to the Contractor for work described above other than the tendered mark-up rate as entered by the Contractor for the scheduled items.

C3.3.9.1 Retention

A five percent (5%) excluding VAT of the subcontract value will be deducted as retention on the EME, with half to be released on issue of the Certificate of Completion for the EME. The second half shall be released three months after the date of the Certificate of Completion.

C3.3.10 ISSUING OF COMPLETION CERTIFICATE

The Contractor shall, within 7 days of the completion of each subcontract completed in accordance with the provisions of this specification, issue free of charge to the EME a Certificate of Completion.

The format, layout and appearance of certificates issued shall be approved by the Employer's Agent, provided always that the certificates shall be respectable and presentable in accordance with the general standards of normal business practice. All certificates issued shall be co-signed by the Employer's Agent and a senior representative of the Contractor, who has been duly authorized thereto.

The Certificate of Completion shall provide the following information:

C3.3.10.1 Main Contract data:

(i) Contract title;
(ii) Contractor's full name and address;
(iii) Employer's Agent 's name and address;
(iv) Employer's name.

C3.3.10.2 Subcontract data:

(i) EME name and address;
(ii) Scope or extent of the subcontract works;
(iii) Value of the subcontract works;
(iv) Duration of the subcontract;
(v) Date of completion of the subcontract;
(vi) Description of the training undergone by the EME.

C3.3.11 ATTENDANCE ON EME SUBCONTRACTORS

The Contractor shall closely manage and supervise all EME's and shall manage, guide and assist each EME in all aspects of management, execution and completion of his subcontract. This shall typically include assistance with planning his works, sourcing and ordering of materials, labour relations, monthly measurements and invoicing procedures etc. The extent and level of such management, guidance and assistance, to be provided by the Contractor shall be commensurate with the expertise of relevant EME and shall be directed at enabling the EME's to achieve the successful execution and completion of the subcontract.

A payment item shall be provided in the schedule of quantities in the Main Contract, in which the Contractor will be reimbursed on the basis of a percentage of the value of the subcontracts awarded, for his attendance on the SMME subcontractors. This amount shall allow for:

- All costs incurred for advertising and adjudicating tenders, and for assistance afforded to prospective tenderers.
- All administrative, management and supervisory functions associated with the employment of the EME's.

The Contractor shall be required to appoint an EME Construction Manager who will be responsible to assist EME's as and when required. The EME Construction Manager's duties are specified in Clause PSA clause 5.14, repeated below

"PSA 5.14 EME CONSTRUCTION MANAGER

Assistance to the EME Subcontractors

The Contractor shall, in addition to the requirements of Clause 4.4 of the General Conditions of Contract for Construction Works (2015), guide, assist and mentor all eligible potential EME's wishing to submit tenders, in the proper completion and submission of their particular tenders, including advice and guidance on how to establish rates.

The Contractor shall employ on a full-time basis, a construction manager on the Contract who will manage the EME's and report on progress to the EME Committee. Such Construction Manager must be adequately experienced with EME work and the development thereof and will be subject to the approval of the Employer's Agent. The assistance rendered by the EME Construction Manager, shall inter alia:

a) Be given at a level and to the extent which is commensurate with the expertise and resources of the EME,

b) Be given in a manner which is neither prescriptive, dictatorial, nor coercive towards the EME;

c) Not be utilized by the Main Contractor to manipulate the rates and prices submitted, to his advantage, and

d) Be given in a manner which does not unfairly prejudice or favour any particular EME.

The EME Construction Manager will after the tendering process work with and manage the EME subcontractors throughout the Contract."

C3.3.12 CONTRACTOR'S LIABILITY

No provision or requirement set out in this specification shall be deemed to relieve the Contractor of any liability or obligation under the contract, and in accordance with the provisions of Clause 4.4 of the General Conditions of Contract for Construction Works (2015), the Contractor shall be fully liable for the acts, defaults and neglects of any EMEs, his agents or employees, as fully as if they were the acts, defaults and neglects of the Contractor, his agents or employees.

Claims for extension of time due to delays caused by EME's will not be entertained; the Main Contractor is to programme in his work factoring the use of EME's. Non-performance of EME's shall be dealt with in terms of the clause 10 in the SAFCEC subcontractor agreement.

C3.3.13 PENALTIES FOR NON-COMPLIANCE WITH EME SUBCONTRACTING

Should the Main Contractor do the work that is earmarked for sub-contracting to EME's the Main Contractor will be charged a penalty of 100% of value of any work he/she has done. The amount will be deducted from the monthly payment certificate.

C3.3.14 ATTENDANCE ON SUBCONTRACTORS

The Contractor shall remain responsible for providing the subcontracted portion of the works as if the work had not been subcontracted.

C3.4: CONSTRUCTION

C3.4.1 WORKS SPECIFICATION

C3.4.1.1 Applicable SANS 2001 or SANS 1200 Standards for Construction Works

The standard specifications on which this contract is based are the South African Bureau of Standards Standardised Specifications for Civil Engineering Construction SABS 1200 as listed in C3.6 of the Scope of Work. The various SANS specifications referred to in this document are listed in C3.6 and the Contractor is advised to obtain them from Standards South Africa (a division of SABS) in Pretoria.

The Standardised Specifications (SABS 1200) must be read in conjunction with the new SANS 1921 family of standards. In case of any discrepancy or conflict between the two, the SABS 1200 specification shall take precedence and shall govern.

Refer also to the Preface on interim situation until full suite of SANS 2001 Series of Specifications is available, on the first page of the Project Specification.

The term “project specifications” appearing in any of the SABS 1200 Standardised Specifications is deemed to be equivalent to the term “scope of work” in SANS Specifications.

The variations and additions to the standard specifications are prefixed PS and take precedence over the SABS Standardised Specification.

Where a particular specification is in conflict with either the variations and additions to standardized specifications or the SABS Standardised Specifications, the particular specifications shall take precedence.

C3.4.1.2 Applicable National and International Standards

Wherever possible items and materials for construction of the works shall comply with the relevant South African Bureau of Standards Specifications and with the British Standards where these are applicable in the absence of local standards.

The Contractor, when using materials conforming to a Standard Specification shall, if called upon, furnish the Employer’s Agent with certificates of tests showing that the materials do so conform.

Although not bound in nor issued with this document, for the purpose of this Contract the latest issues of the following Standard Specifications, applicable at the date of tender advertisement, shall apply:

SANS	719	Electric welded low carbon steel pipes for aqueous fluids (ordinary duties)
SANS	1123	Steel Pipe Flanges
SANS	1431	Weldable structural steels
SANS	1921-1: 2004	Construction and Management Requirements for Works Contracts, Part 1: General Engineering and Construction Works
	Part 1:	General Engineering and Construction Works;
	Part 2:	Accommodation of Traffic on Public Roads Occupied by the Contractor; and
	Part 6:	HIV/AIDS Awareness

SANS	10044	Welding
API	1104	Standard for welding pipelines and related facilities
AWWA	M11	Steel pipes - a guide for design and installation (Second edition)
BS	2633	Class 1 arc welding of ferritic steel pipework for carrying fluids
BS EN	10224	Non-alloy steel tubes and fittings for the conveyance of aqueous liquids including water for human consumption
BS EN	10025	Hot rolled products of structural steel
BS EN	1092	Flanges and their joints
BS EN	571	Non-destructive testing, penetrant testing
ISO	7005	Metallic flanges – steel flanges

BUILDING WORKS

SABS	0400	The applications of the national building regulations*
SABS	0412	Code of Practice for the Wiring of Premises*
SABS	1222	Enclosures for electrical equipment (Classified according to the degree of protection that the enclosures provide) *

ELECTRICAL, CONTROL AND INSTRUMENTATION

SANS	10142	Code of Practice for Wiring of premises as amended.

The standardised specifications (SABS 1200) must be read in conjunction with the new SANS 1921 family of standards. In case of any discrepancy or conflict between the two, the SABS 1200 specification shall take precedence and shall govern.

Refer also to the Preface on interim situation until full suite of SANS Series of Specifications is available, on the first page of the Standard Specification.

The term “project specifications” appearing in any of the SABS 1200 standardised specifications is deemed to be equivalent to the term “scope of work” in SANS Specifications.

C3.4.1.3 Particular / Generic Specifications

The Particular Specifications are included as C3.8 and take precedence over the Standard Specifications, but not over the Project Specifications.

C3.4.1.4 Certification by Recognised Bodies

Wherever possible items and materials for construction of the works shall comply with the relevant South African Bureau of Standards Specifications and with the British Standards where these are applicable in the absence of local standards.

The Contractor, when using materials conforming to a Standard Specification, shall if called upon furnish the Employer's Agent with certificates of tests showing that the materials do so conform.

C3.4.1.5 Agrément Certificates

The use of alternative materials, which may be fit for purpose and are subject to an Agrément certificate, may be considered providing the following are adhered to:

- A full copy of the Agrément certificate must be provided,
- The certificate must be currently active,
- All work must be done in accordance with the terms of a specific certificate for the product,
- Details of any and all variations approved by Agrément South Africa must be provided,
- Details of who will erect or install the product must be provided,

The decision as to whether alternative materials complying with the above requirements may be used will be at the sole discretion of the Employer's Agent.

C3.4.2 PLANT AND MATERIALS

C3.4.2.1 Plant and Materials Supplied by the Employer

The Employer shall not supply any plant for use on this contract. The Contractor shall provide all plant.

C3.4.2.2 Materials and Samples

Plant and materials that are to form part of the permanent works shall be required to conform to the specifications herein. Prior to acceptance of materials on the site the Contractor shall therefore submit for prior approval details of the proposed product and manufacturer, including brochures and technical information, and including typical quality test routines and validation certificates. Rejection and replacement of materials due to lack of prior approvals shall be at the Contractor's expense. Delay in ordering due to late submission of information to the Engineer shall be deemed to be a delay at the Contractor' own responsibility.

Certain materials are subject to inspection at the site of the manufacturer's works by an Independent Inspection Authority appointed by the Engineer. The Contractor shall be responsible to arrange the timely attendance of the Inspection Authority. Acceptance of materials on site shall be subject to the Engineer's approval and will generally not be granted in the absence of inadequate or missing Quality Assurance information and Material Data Sheets.

The storage of plant and materials on site is the Contractor's responsibility. The Contractor shall take adequate precautions to safeguard the plant and equipment and shall be liable to remedy any defects or replace any plant and equipment damaged in the course of transport, handling and storage and in the process of incorporation in the works and testing up to the point of acceptance of the works by the Employer.

C3.4.3 CONSTRUCTION EQUIPMENT

No construction equipment will be supplied by the Employer under this Contract. All construction equipment required for the completion of the works shall be provided by the Contractor.

Equipment to be used on site shall be well maintained and, if road going, in possession of valid roadworthy certificates. Leaking of fuel or lubricant, or excessive or objectionable noise, or exhaust emissions shall be adequate grounds for instruction to remove the plant from the site, which removal shall be done within 24 hours.

The Contractor shall be responsible for determining the load clearance limits existing at the time and ensuring that his construction equipment does not exceed such limits. Before moving any heavy construction traffic onto highways, roads and bridges, the Contractor shall make suitable arrangements with the appropriate government authorities and obtain their approval for the passage of such traffic.

The Contractor shall not travel tracked vehicles or plant on any bituminous sealed road surface. Only rubber tyre vehicles conforming to applicable load restrictions will be permitted to use bituminous sealed roads.

The Contractor shall take note of the work activities that are subject to mandatory Labour Intensive Construction Methods and shall make adequate allowance for hand tools and PPE sufficient to complete these work activities according to programme.

C3.4.4 EXISTING SERVICES

C3.4.4.1 Known Services

The positions of existing services, insofar as they are known, are shown on the drawings. The accuracy of the information relating to existing services, as shown on the drawings, is not guaranteed and the Contractor shall take this into account. There may also be services which are unknown or have inadvertently been left off the drawings, but the presence thereof can be reasonably determined or assumed on site.

Items have been allowed in the Bill of Quantities for dealing with and protecting services. In addition to the above, the Contractor shall carry out his own investigations and surveys to locate any services that may be affected by any of his construction activities.

The Contractor shall take whatever precautions are required to protect these services from damage during the period of the Contract.

C3.4.4.2 Treatment of Existing Services

The relevant authority or other service provider, as applicable, shall be contacted to assist the Contractor in the location of all existing services that cross the pipeline route.

Immediately after establishing on Site, the Contractor must open up all known services, where they will be affected by construction, by hand and using special equipment where necessary, under strict supervision and with diligent care. An item to provide for this is included in the Schedule of Quantities.

The Contractor, together with the Employer's Agent's Representative, shall measure and record the depth and level, and verify the type, position and dimensions of the exposed services. This must be done early during the contract period so that changes in design, which may become necessary, can be planned and arranged in good time. Any clashes with the proposed works shall be reported to the Employer's Agent well before any work commences.

No extensions of time will be considered by the Employer's Agent arising from the failure of the Contractor to comply with this clause. Damage to existing services must be made good by the Contractor.

Services exposed in any excavation shall be properly supported and protected from construction damage and vandalism by suitable shielding or other protective measures.

C3.4.4.3 Use of Detection Equipment

Where the presence of underground cables is suspected the Contractor shall use such methods as necessary, including cable or metal detectors, to prevent unnecessary damage and consequent delay and cost of repair.

C3.4.4.4 Damage to Services

Any known services damaged by the Contractor shall immediately be reported to the relevant service authority and to the Employer's Agent. The cost of repair of these services will be for the Contractor's account.

Known services include those services shown on the drawings as well as services not shown on the drawings but the presence of which can be reasonably expected or determined on site.

Should the Contractor be responsible for repairs to be carried out by an outside organisation, such costs will be recovered from the Contractor. This will be recovered from a monthly Payment Certificate if necessary.

Any unmarked or unknown services that may be damaged shall immediately be reported to the relevant service authority and to the Employer's Agent and/or his Representative. The repair cost for such services will not be the Contractors' responsibility.

In the event that the Contractor is requested to repair the damaged service, he shall submit the actual cost of repair with his next claim for payment and shall be paid the actual cost plus 10%.

Whenever it is necessary to disrupt essential services e.g. when excavating in the vicinity of a power line, the Contractor must liaise with all relevant authorities and the Employer's Agent to obtain approval for proposed activities and their programming.

C3.4.4.5 Connection to Existing Services

Fourteen (14) days written notice shall be given to the Employer's Agent and to the Employer of intention to connect to any existing service or structure. Such connection may only be undertaken once written approval is granted.

The time for connection of services will be of limited duration as the modules cannot be shut down for any length of time. Shutdowns will generally be limited to a maximum of 36 hours. This will require 24-hour continuous shift / overtime work by the Contractor to accommodate the requirements of the Employer.

Allowance for this must be made in the tendered rates as no additional payments shall be made in this regard.

C3.4.5 SITE ESTABLISHMENT

C3.4.5.1 Service and Facilities Provided by the Employer

C3.4.5.1.1 Source of Water Supply

Water for construction is available on site. The Contractor shall make his own arrangements with the authority and pay all installation charges for a water supply for his needs. To this end, the Contractor shall provide and make use of a metered connection at a position and in a manner agreed with the authority.

The Employer accepts no responsibility for the shortage of water due to any cause whatsoever, nor additional costs incurred by the Contractor as a result of such shortage.

The Contractor shall make himself thoroughly acquainted with the regulations relating to the use of water and shall take adequate measures to prevent the wastage of water.

The Contractor shall take note that no direct payment will be made for any costs incurred for the provision of a water supply point nor for the cost of water drawn. Payment for the aforementioned shall be deemed to be covered by the rates and prices tendered and paid for the various items of work included under the Contract.

C3.4.5.1.2 Source of Power Supply

Electrical power is available on site. The Contractor shall make his own arrangements with the authority and pay all installation charges for a power supply for his needs. To this end the Contractor shall provide and make use of a metered connection at a position and in a manner agreed with the authority.

The Employer accepts no responsibility for the interruption of the power supply due to any cause whatsoever, nor additional costs incurred by the Contractor as a result of such interruption.

No direct payment, other than provided for under the preliminary and general items, shall be made for any costs incurred for the provision of a power supply. The cost of supplying electrical power will be deemed to be covered by the relevant items.

C3.4.5.1.3 Location of Camp and Materials Storage Area

An area for a campsite and materials storage area is available. The Contractor may erect his site offices and materials storage depot within the demarcated boundaries of the area. The Contractor shall confine his camp and storage of materials to the areas designated.

The site and materials storage area shall always be kept in a clean, dry and tidy condition. Temporary buildings and fencing shall be neat and presentable, and the surrounding area shall, always, be kept in a neat, clean and orderly condition.

Under no circumstances may fires be made on site or naked flames be allowed. There are many sludge digesters on the site of the wastewater treatment works that produce explosive gas. Should this gas escape and be accidently ignited, the resulting explosion can cause extensive damage to property, very severe injuries and loss of life.

Scavenger-proof litter containers to be provided on site and paper and plastic packaging shall be collected daily and binned so that they cannot be blown onto the surrounding property.

Precautions to be taken against hydrocarbon spillage from heavy equipment such as compressors and generators, e.g. using sand or sawdust filled drip trays. If maintenance and refuelling activities take place in this area, adequate protection and clean-up mechanisms in the event of a spill must be in place. All contaminated material (including soil) to be disposed of at a registered waste site.

All toxic materials (cement, oil, petrol, diesel, etc.) used at or stored in the construction camps should always be very strictly controlled and secured against theft .

The Contractor shall not cut down or damage trees without the prior written permission of the Employer's Agent. If any vegetation is damaged or destroyed during the construction period, the damaged areas should be re-vegetated using indigenous plants that are native to this area.

On completion of the construction works, the area shall be re-instated to its original condition.

No persons, other than a night watchman, may overnight at the campsite.

C3.4.5.1.4 Disposal Site

All material cleared on the site, rubble, spoil and refuse shall be disposed of at an official waste disposal site approved by the Employer's Agent. Tenderers shall appraise themselves of the availability of the waste site and the rates charged. No additional payment shall be made for waste site charges, the cost of which shall be covered by the tendered rates.

C3.4.5.2 Facilities Provided by the Contractor

C3.4.5.2.1 Temporary Offices

A furnished office and covered car port of 6 x 6m are required for the Employer's Agent at the Contractor's main site camp.

Site meetings will be held in the Contractor's site office, which must be large enough for this purpose.

C3.4.5.2.2 Sanitary Facilities

The Contractor shall supply chemical or other suitable toilets for use by his workmen. The number of toilets shall be based on one toilet per fifteen personnel on site. Separate toilets shall be provided for males and females.

Toilets shall be positioned such that no member of the workforce is further than a maximum of 100m walking distance from a toilet. Under no circumstances may the toilets and ablution facilities at the wastewater treatment works be used by the Contractor and his staff.

Toilets shall be serviced regularly and maintained in a clean and hygienic state. Water shall be provided at each toilet for hand washing.

C3.4.5.2.3 Telecommunication Facilities

The Contractor is to provide his own telephone facilities on site. No telephone will be required for the use of the Engineer or his representative for the duration of the Contract. An item has been included in the Bill of Quantities to cover the costs of the Employer's Agent's Representative's cellular phone calls.

C3.4.5.2.4 Security

The Contractor shall provide security watchmen to safeguard the works, plant, personnel and materials for the contract, as he deems fit, at no extra cost to the Employer. The Contractor must ensure that all his employees as well as the employees of his Sub-contractors are able to identify themselves as members of the construction team.

C3.4.5.2.5 Disposal of Waste

The Contractor shall pay special attention to the management and disposal of all water on site from whatever source. It is essential that all completed works or parts thereof are kept dry and properly drained. Claims for any delay and for repair of damage caused to the works as a result of the Contractor's failure to properly manage rain and surface water, will not be considered.

The Contractor shall dispose of solid waste by burying it at the approved municipal dump yard or spoil site(s) that has (have) been approved for such use by the Local Municipality. Buried waste shall be covered up daily and the Contractor shall rehabilitate the site prior to practical completion. The Contractor shall dispose and cover up all surplus and unsuitable material in spoil areas that have been approved by the Local Municipality. He/she shall be responsible for all arrangements necessary to obtain access to such dump wards and spoil sites.

C3.4.5.2.6 Removal of Facilities on Completion

The Contractor shall remove all temporary offices and storage facilities, toilets, temporary water connections and the like on completion of the contract and leave the areas used in a neat and tidy condition free of any rubble, debris, oils spillage, concrete and the like.

C3.4.5.3 Other Facilities and Services

C3.4.5.3.1 Facilities for the Employer's Agent

The Contractor shall provide for the use of the Employer's Agent, maintain and service as required, the following facilities as specified in SANS 1200 A and AB and PSA and PSAB:

i) furnished office
ii) covered car port (6 x 6m)
iii) contract name board
iv) safety equipment
v) medical facilities
vi) survey equipment
vii) laptop computer and A3 printer

C3.4.5.3.2 Fax/Scanner Machine

The Contractor shall supply and maintain a fax/scanner machine in his site office for the duration of the contract, of which the Employer's Agent shall have the use of. Alternatively, he may provide a computer with email facilities coupled with an A3/A4 printer/Scanner.

An adequate supply of paper for the fax machine or printer must always be maintained.

C3.4.5.3.3 Site Instruction Book

A triplicate book for site instructions shall be supplied free of charge by the Contractor. The book shall be kept in the site office and be accessible to the Employer's Agent during normal working hours. The Contractor shall hand the book to the Employer's Agent at the end of the contract.

C3.4.5.3.4 Equipment for Determination of Labour-Intensive Excavation (Read with SANS 1921 - 5: 2004)

The Contractor shall provide and maintain in good condition a Dynamic Cone Penetrometer (DCP) and all associated equipment for the determination of areas for Labour-Intensive excavation methods as per PSDB5.4 and for the classification of excavated materials as per Annex B of SANS1921 Part 5.

C3.4.5.3.5 Site Establishment Completion

The Contractor's Establishment shall not be considered as being complete until such time as the facilities to be provided for the Engineer are fully in place. (Refer PSAA & PSAB)

C3.4.5.3.6 Establishment of Pipe Yards

The Contractor shall be responsible for the logistics of pipe deliveries for determining his/her storage requirements for pipes and the points of delivery, whether to the site camp, or along the pipeline routes. The Contractor shall secure adequate land for purposes of pipe delivery and storage and shall be responsible for any damages to pipes during the transport, offloading, storage and further handling of the pipes.

The location and size of a pipe yard(s) is at the Contractor's discretion. However, as a guide for site layout purposes, an average of 400 mm should be allowed between parallel pipes, the end to end gap between pipe stacks should be 5 m and the gap between pipes and the perimeter fence should be at least 6 m which includes the 5 m wide firebreak.
Steel pipes should be stored off the ground and secured from rolling using suitable dunnage, such as sandbags. Stacking of pipes should only be considered according to the manufacturer's recommendations.

To lessen the risk of fire damage the whole site where pipes are stored should be cleared of bushes and shrubs, subject to the Environmental Specification and Environmental Management Plan, and the grass on the site where pipes are stored to be cut to a height of no more than 25 mm and maintained at a height not exceeding 50 mm.

The Contractor shall provide the necessary supply of drinking water and ablution facilities at his pipe yard(s) and pipe storage areas for the use of the security guards and his employees.

C3.4.5.3.7 Storage and Laboratory Facilities

No storage facilities will be available or provided by the Employer and the Contractor is to make suitable arrangements to deliver materials as and when required for construction purposes and when called for by the Engineer, whether such call be issued on or after the delivery date offered by the Tenderer.

The Contractor shall arrange for process control testing to be undertaken by a Laboratory to be approved by the Engineer.

A Provisional Sum has been be allocated for in the Bill of Quantities for the Engineer's acceptance control testing.

C3.4.5.3.8 Security Services

The Contractor shall be responsible for any security services he deems necessary to safeguard his facilities, plant and equipment and personnel for the duration of the contract. An item has been allowed in the Bill of Quantities in this regard.

C3.4.5.3.9 Notice Boards

The Contractor shall supply, erect and maintain for the duration of the contract two (2) information boards providing the names and emergency contact details of the Contractor and the senior staff members responsible for the contract.

One notice board shall be erected at the entrance to the site and the other on the external wall of the site office, next to the door.

C3.4.6 SITE USAGE

The Contractor shall confine his activities to the site of the works and to the area allocated to him for his site offices and materials storage. The Contractor may not use or damage in any way any area that falls outside the boundaries of the site. Any area damaged by the Contractor outside the site boundaries shall be rehabilitated to the satisfaction of the Employer's Agent at the Contractor's expense.

All employees of the Contractor and his Sub-Contractors shall confine themselves to the construction site and area. Any employee found to be outside the construction area shall be immediately removed from site and shall not return for the duration of the construction period.

Under no circumstances shall any employee of the Contractor be allowed to enter any building or structure on the premises of the wastewater works other than to conduct work required under the contract.

C3.4.7 SURVEY CONTROL AND SETTING OUT OF THE WORKS

Survey pegs and reference marks shall be pointed out to the Contractor. The Contractor shall be solely responsible for the preservation of all land survey, erf or other pegs, benchmarks and beacons. If damage or disturbance of any such pegs or beacons is caused by the operations of the Contractor or his subcontractors, the pegs are to be replaced by a Registered Land Surveyor at the cost of the Contractor. Benchmarks will be replaced by the Employer's Agent at the Contractor's expense.

Information regarding the position of all such pegs will be made available to the Contractor by the Employer's Agent on request.

The Contractor is to ensure that no spoil is placed over any erf peg or benchmarks and that these are adequately protected for the full duration of the Contract.

Where disturbances of boundary or other pegs is unavoidable due to excavation or other operations adjacent to the pegs, the Contractor shall advise the Employer's Agent or his Representative immediately, and agreement is to be reached that the disturbance of the peg is unavoidable and a strict record of such disturbed pegs is to be kept.

Such pegs are to be replaced by a Registered Land Surveyor and the Contractor is to submit proof of the cost of replacement of pegs. The Contractor will be reimbursed on a basis for the total cost of pegs replaced on completion of the Works.

The Contractor is solely responsible for the setting out of the works and shall take all precautions to ensure the accuracy thereof. Any discrepancies in levels or setting out data provided to the Contractor in the form of drawings, specifications or by any other means shall be brought to the immediate attention of the Employer's Agent for clarification. Failure by the Contractor to seek

clarification from the Employer's Agent will result in the rejection of any claim for delays or costs and any work found to be incorrect in terms of setting out or level will be rejected at the contractor's cost.

Furthermore, the Contractor shall check the levels of all existing structures that the new works must connect to before commencing with construction. Any discrepancy in levels between the existing structures and the levels shown on the drawings must be brought to the Employer's Agent immediate attention. Failure to act in this regard shall result in the rejection of any claim for delays or costs by the Contractor due to level discrepancies.

C3.4.8 ALTERATIONS, ADDITIONS, EXTENSIONS AND MODIFICATIONS TO EXISTING WORKS

The Contractor shall satisfy himself within 14 days of moving onto site that the dimensional accuracy, alignment, levels and setting out of existing structures or components thereof are compatible with the proposed works and procedures. Any discrepancies shall immediately be brought to the attention of the Employer's Agent in writing where this is not the case.

Failure by the Contractor to timeously give written notice to the Employer's Agent in this regard shall result in any claim for additional time and / or costs being rejected.

New structures shall, as far as possible, match existing structures regarding type of materials and finishes. The Contractor shall provide the Employer's Agent with samples of bricks, blocks and other materials and finishes for approval at least 3 weeks prior to starting any work. Only once the Employer's Agent has given approval may the Contractor place orders for these materials.

C3.4.8.1 Protection of Existing Works

The Contractor shall take all necessary steps to ascertain the location of existing services before commencing any section of the works and shall exercise the greatest care when working in the vicinity of such services. No more than three weeks and not less than one week before commencing his operations in any area, the Contractor shall request in writing from the Employer's Agent the latest available drawings showing the location of services already installed. The Contractor will also be responsible for contacting the various service providers, arranging a meeting and verifying all known as well as possible unknown services on site.

The Contractor shall take all necessary steps to protect any existing works whatsoever against damage which may arise as a result of his operations on Site. The Contractor shall bear the cost of the repair of damage to any service, the possible existence of which could reasonably have been ascertained by him in good time.

Where the Contractor is responsible for damage for which repairs must be carried out by the Employer or an outside Authority, the costs of these repairs will be recovered by means of a deduction from the Contractor's monthly Payment Certificate. The Employer will attend to the payment of monies due to outside authorities, should the Contractor not make direct payment, to the outside authorities, timeously.

C3.4.9 PERMITS AND WAY LEAVES

The Contractor shall obtain the necessary approvals and shall be required to comply with the authorities, service providers, and landowners' / occupiers' requirements at all times.

The Contractor will be required to take cognisance of, and comply with, the general wayleave and 'permission to occupy' requirements of the authorities, service providers and landowners / occupiers during the construction of the works.

The Contractor will be required to confirm that permission has been granted and that the authorities, service providers, landowners/ occupiers and all affected parties have been informed of the Contractor's intentions before commencing with work on each property.

C3.4.10 QUALITY CONTROL

C3.4.10.1 Independent Quality Tests

An item for independent quality tests required by the Employer's Agent is included in the Schedule of Quantities.

C3.4.10.2 Test Cubes

Test cubes must be taken as required in terms of SANS 1200 for concrete works and tested according to specifications. A minimum of 3 test cubes per concrete cast shall be provided, irrespective of the volume of concrete cast.

C3.4.10.3 Hydraulic pressure tests

Hydraulic pressure tests will be carried out by the Contractor on all pipework and pipelines. Where the hydraulic testing cannot be performed for whatever reason, all pipework will be left exposed for a period of at least three (3) days under normal service conditions after which the work will be inspected by the Employer's Agent to determine the acceptability of the work. A standard hydrostatic test certificate will be completed for each hydrostatic test performed.

C3.4.11 ACCOMMODATION OF TRAFFIC AND ACCESS TO PROPERTIES

The Contractor shall ensure that all roads adjacent to or crossing the Site and which are affected by the Works and/or Temporary Works and by the Contractor's activities on site are kept in a safe condition for pedestrians and vehicular traffic.

Accommodation of vehicular and pedestrian traffic shall be performed in accordance with Sections D and DB of SABS 1200. The Contractor shall organise his work so as to reduce the inconvenience to traffic to a minimum, and no public road shall be completely closed without prior approval by the Employer's Agent and the relevant authority.

The Contractor shall provide and maintain in proper condition all necessary barricades, lights, warning signals and all direction signs necessary to enable traffic to follow the routes of diversion throughout their length. The Contractor shall provide flagmen at all deviations and/or obstructions.

All signs shall be in two languages as may be advised by the Employer and all traffic signs and control traffic shall be in accordance with the South African Road Traffic Signs Manual. The Contractor shall provide temporary bypasses where necessary to provide access for vehicular and pedestrian traffic.

C3.4.12 DEALING WITH WATER ON THE WORKS

Ground water may be encountered in excavations. The Contractor shall provide adequate measures in the form of well points, sumps, pumps, temporary pipework and all other necessary equipment and measures to remove water from the excavations to enable work to take place. Dewatering may be required 24 hours per day until such time as backfilling has been completed in order to prevent pipes from floating in the trenches.

Where necessary, the Contractor shall construct temporary drainage channels/berms to divert ground water from his excavation and excess water pumped out. No compensation for any variation of the actual conditions during construction from the data will be considered. Neither will additional compensation be considered for data omitted or inaccurately given. The rates tendered shall allow for the requirements of this clause and all incidentals.

C3.4.13 PROTECTION AGAINST FLOODING

The Contractor shall take the necessary temporary precautions to direct storm water away from his excavations. Severe thunderstorms accompanied by heavy rain are not uncommon, especially during the summer months.

See Sub-clause 1.3.11.1 of Section A of Part 3 and Sub-clause 3.2.4 of Section D of Part 2 of SANS 0120. The rates tendered shall allow for the requirements of this clause and all incidentals.

C3.4.14 DUST CONTROL

The Contractor shall apply water using a water tanker at regular intervals to access and construction roads where dust is causing a nuisance. The application rate should be sufficient to keep the routes dust free during the movement of construction equipment.

C3.4.15 DELIVERY OF MATERIALS

C3.4.15.1 Pipe Materials Supply

The Contractor will be responsible to manage all aspects of the pipe and fittings supply including (but not limited to):

- Ensuring that actual material supply will match his programme.
- Ensuring that the material supplied is according to the contract's specification and quality.
- Ensuring proper supply logistics and storage etc.
- Transporting pipes from a central delivery point to the point/s of installation, if necessary

Certain sections may not be accessible to delivery trucks. In this instance pipes and fittings will be offloaded and stockpiled at a designated point agreed with the Employer's Agent's Representative. The Contractor will then be responsible for transporting the pipes and fittings to their final positions.

The Contractor will be responsible for safe keeping and insurance of the pipes and fittings for the duration of the contract.

C3.4.15.2 Delivery of Pipes, Fittings and Materials

Pipe, fittings and material deliveries must be arranged to accommodate the construction programme.

(a) Delivery notes

All goods delivered to site must be accompanied by delivery notes/ waybills. These must be signed off at the time of delivery by the Contractor's representative as well as the Employer's Agent's representative

(b) Delivery scheduling

The pipe, fittings and materials delivery programme will be agreed with the Employer's Agent within 2 weeks of contract award. The programme shall be updated at 2 weekly intervals for the duration of the contract for which the materials are required.

Deliveries shall be planned to avoid creating congestion during peak traffic periods.

(c) Offloading

Offloading of the pipe, fittings and materials will be the responsibility of the Contractor, unless he arranges otherwise with his suppliers. The Contractor must ensure that he has the necessary labour, plant and equipment on site at the time of delivery to offload the pipe, fittings and materials. Any cost of delay in off-loading due to the Contractor not having the required plant and personnel available at the agreed time of delivery to off-load shall be for the Contractor's account.

(d) Inspection on delivery

The Employer's Agent and the Contractor must jointly inspect the pipe, fittings and materials at the time of delivery for damage. The pipe, fittings and materials must be delivered with the results of all specified tests, which must be handed to the Employer's Agent at the time of delivery.

The Contractor shall be responsible for any pipe, fittings and materials damaged during offloading, stacking and storage.

The Contractor and the Employer's Agent's Representative will sign the delivery notes acknowledging receipt of the pipe, fittings and materials. Any damages to the pipe, fittings or materials and any missing test results will be noted in writing at the time.

(e) Safeguarding of Pipes, Fittings and Materials

The Contractor will take delivery of the pipe, fittings and materials and confirm their compliance with specifications and that the pipes are undamaged at this stage. The Contractor shall then safeguard the pipe, fittings and materials against any damage during handling, stacking and storing, transporting, placing in position, laying, jointing, backfilling and testing.

C3.4.16 FEATURES REQUIRING SPECIAL ATTENTION

C3.4.16.1 Safety Regulations

Both the "Factories, Machinery and Building Work Act (Act 22 of 1941)" and the "Machinery and Occupational Health and Safety Act (Act 6 of 1983)" must wherever they appear in the SABS 1200 standardized specifications, be substituted by the "Occupational Health and Safety Act (Act 85 of 1995)".

C3.4.16.2 Health and Safety

Approval of the Contractor's Health and Safety Plan must be given before any work may commence on site. The H&S Plan must be kept on site and must be adhered to at all times.

The Site of the Works is a working wastewater treatment works. Special care should be taken to instruct workers of the potential health hazards likely to be encountered when working on such a Site. It must be particularly noted that toxic and/or explosive gases may be present and that special precautions must be taken in this regard.

No fires or naked flames shall be permitted at any time. Designated smoking areas shall be identified with the Employer and no person may smoke outside of the designated area.

Before using any cutting or other equipment that may produce sparks, the Contractor shall first ensure the absence of any explosive gases. If necessary forced ventilation shall be provided when the work is taking place. He shall also provide suitable screens around the work area to contain and prevent the spread of sparks.

Proper safe access must be provided to all structures and work areas. Loose ladders without handrails shall not be allowed.

The Contractor shall provide his staff and those of his subcontractors with appropriate Personal Protection Equipment (PPE) and shall ensure the use thereof.

Proper lifting equipment such as cranes, gantries or tripods with suitable block and tackle shall be provided to lift and place heavy equipment.

All construction work storage / storage areas and site office areas must, as far is practically possible, be securely demarcated / barricaded from the general access areas of the WWTW. These areas must be out of bounds to the Employer's staff and safe access routes to the normal work areas of the Employer's staff must be provided around or through the construction areas.

Where, due to the nature of the work, clear demarcation of construction areas vs operational WWTW areas is not possible, the Contractor shall issue the necessary personnel protection equipment to the Employer's staff. The Contractor shall enforce the use of this equipment in these overlapping construction areas. The Employer will be expected to enforce these requirements with their staff.

C3.4.16.3 Continuous Operation of the Wastewater Treatment Works

The existing wastewater treatment works shall always remain in operation and the Contractor shall allow full access to the existing works for the Employer's operational staff at all times. The Contractor shall programme his work taking these requirements into account.

Only during times of planned and agreed shutdowns may any portion of the WWTW be out of operation.

C3.4.16.4 Record Drawings

As the work progresses, the Contractor shall keep full sets of records of all the true levels, sizes and positions of structures as well as all amendments to and deviations from the drawings issue by the Employer's Agent from time to time. This information must be submitted monthly with the Contractor's claim for payment. A separate set of drawings will be issued to the Contractor for this purpose.

The completion certificate shall only be issued after the Employer's Agent has received a properly completed set of "record" drawings from the Contractor. No separate payment shall be made for this service as all costs related thereto shall be deemed to be included in the rates for the relevant items.

C3.4.16.5 Overhaul and Free Haul

No payment will be made for overhaul on this contract unless provision is made therefore in specific items. All haul inside the boundaries of the site is regarded as free haul. Rates for importation of materials from commercial sources will be deemed to include cost for haulage.

C3.4.16.6 Disposal of Spoil or Surplus Material

The Contractor is responsible to arrange for the necessary permission and to spoil all surplus and unsuitable material, as well as other objectionable material at a legal site of his choice. He shall be responsible for all arrangements necessary to obtain such spoil sites.

The cost of disposing of material shall not be paid separately. Disposal costs shall be deemed to be covered by the rates for all relevant items.

C3.4.16.7 Importation of Bedding and Backfill Material

The importation of suitable bedding and backfill material is the sole responsibility of the Contractor. All imported material shall be deemed to be from commercial sources and will be paid for in the rates tendered.

C3.4.16.8 Excavation Measurements

All excavations shall be measured nett as dimensioned on the drawings, unless otherwise agreed to in writing by the Employer's Agent. The rates tendered shall therefore include for any over break, additional haulage and disposal of over break, and filling of over break as specified.

C3.4.16.9 Inspection of Adjoining Properties and Structures

In order to establish a condition benchmark, all existing buildings, walls, fences, manholes, roads, etc. shall all be carefully inspected and photographed before any other work is commenced. This inspection will be used as the benchmark to evaluate any damage or reinstatement claims to these structures. These structures shall be left in an equal or better condition at the close of the contract.

C3.4.16.10 Deep Excavations and Trenches

The Contractor must ensure that enough precautions be taken to ensure that no unauthorized person or animals gain access to the excavations and to prevent, as far as is reasonably practicable, any person from being buried or trapped by a fall or dislodgement of material.

All shoring or bracing must be designed and certified by a competent person, approved and constructed in such a manner rendering it strong enough to support the sides of the excavation.

C3.4.16.11 Finishing and Tidying

On no account must rubble and spoil materials, other materials, equipment or unfinished operations be allowed to accumulate in such a manner as to unnecessarily impede the activities of the Contractor, other contractors or the Employer's staff.

Finishing and tidying must not simply be left until the end of the construction period. Should finishing and tidying lag behind, the Employer's Agent shall have the right to instruct the Contractor to stop work activities until such time as completed areas have been tidied. Such instruction shall not allow the Contractor to claim for extension of time and/or standing time and no claim for additional time or costs will be accepted.

The Contractor may, subject to prior agreement with the Employer's Agent and within reasonable limits, request that work in a particular area and/or work of a particular discipline, be inspected for partial completion. Partial completion shall not entitle the Contractor to Practical Completion of the partially completed work. A Certificate of Practical Completion shall only be issued once the entire Works has reached Practical Completion.

On completion of the Contract the Contractor shall ensure that all materials used in the construction of the temporary site office, workshop and storage yard are removed from Site. Waste material such as construction debris and soil contaminated with oil and fuel are to be disposed of at a suitable appropriately licenced waste disposal site. Proof of disposal shall be given to the Employer's Agent.

Prior to the Handover of the Site to the Employer, the Contractor and the Employer's Agent will conduct a post construction audit to determine if any additional measures are to be taken. The Completion Certificate will only be issued after this stage.

C3.5: MANAGEMENT

C3.5.1 MANAGEMENT OF THE WORKS

C3.5.1.1 Applicable SANS 1921 Specifications

The following SANS 1921 Construction and Management requirements for works standards and associated specification data are applicable:

SANS 1921-1 General Engineering and Construction Works

SANS 1921-2 Accommodation of Traffic on Public Roads

SANS 1921-5 Earthworks Activities Which are to be Performed by Hand

SANS 1921-6 HIV/AIDS Awareness

C3.5.1.2 Particular and Generic Specifications

The applicable Particular Specifications and Generic Specifications are included in section C3.8 of this specification.

C3.5.1.3 Specification Data

The specification data applicable to these SANS 1921 standards is as follows:

Standard	Clause	Essential Data
SANS 1921-1	4.1.7	The requirements for drawings, information and calculations for which the Contractor is to be responsible are detailed in the project specifications.
	4.2.1	The responsibility strategy assigned to the Contractor for the works is stategy A for civil engineering and building works and strategy B for the mechanical, electrical and instrumentation plant and equipment.
	4.2.2	The Structural Engineer for the permanent concrete structures is Royal HaskoningDHV.
	4.3.1	The planning, programme and method statements are to comply with the following: 1) The programme shall be prepared in bar (Gantt) chart form, preferably using a project management software tool such as *Microsoft Projects/Excel* and shall be issued to the Engineer in both hard copy and electronic format. The programme shall be structured to cover all items of work including all work to be done by sub-contractors and shall clearly indicate the critical path 2) The programme must clearly show the intermediate milestone dates to be achieved taking the indicative construction sequences into account. 3) The programme shall be updated whenever the circumstances of the work execution change and whenever instructed by the Engineer. Each revision of the programme shall be marked with a sequential revision number. The Contractor's programme shall be subject to approval by the Engineer. 4) Method statements shall be prepared by the Contractor for any procedures proposed by the Contractor for use in the contract as well as in accordance with the requirements of the project

Standard	Clause	Essential Data
		specifications.
	4.4	The Contractor will be solely responsible for the production of work that complies with the Specifications to the satisfaction of the Engineer. To this end it will be the full responsibility of the Contractor to institute an appropriate Quality Assurance (QA) system on site. The Contractor's QA system shall be open to audit by the Engineer to verify that adequate independent checks and tests are being carried out and to ensure that the Contractor's own control is sufficient to identify any possible quality problems which could cause a delay or failure.
SANS 1921-1		The Contractor shall ensure that efficient supervisory staff, the required transport, instruments, equipment and tools are available to control the quality of his own workmanship in accordance with his QA system. His attention is drawn to the fact that it is not the duty of the Engineer or the Engineer's Representative to act as foreman or surveyor.
	4.5	The Contractor will be required to verify the accuracy of all survey control provided on the drawings or in the form of beacons previously placed on the site. Prior to setting out, the Contractor shall also check the invert levels of all existing tie-in channels, manholes, pipes etc. against those provided on drawings and immediately report any inconsistencies to the Engineer in writing. The Contractor shall be held directly responsible for any errors in setting out of the works arising from use of the survey control or existing invert levels provided.
	4.5.1	It is important that, during construction, the Contractor checks all levels from time to time and satisfies himself as to their accuracy prior to placing of concrete as no concrete work will be accepted where tolerances have been exceeded, particularly where it interferes with the hydraulics of the flow through the works. The maintenance of gravelled temporary deviations and existing gravel roads used for construction shall include the watering of roads daily in the dry season for reduction of dust.
	4.6	An item has been included in the Bill of Quantities to cover all work associated with dealing with water.
	4.12.2	The samples of materials, workmanship and finishes that the Contractor is to provide and deliver to the Employer are: 1) Pipes and Jointing methods 2) Pipe coatings and corrosion protection of pipes and fittings 3) Pipe bedding materials 4) Concrete aggregate 5) Concrete sand 6) Reinforcing 7) Waterbar and other water retaining structures sealing materials The fabrication drawings that the Contractor is to provide and deliver to the Employer are those for the pipe specials, steel structures, ladders and any prefabricated items that the Contractor proposes to use in the permanent works.

Standard	Clause	Essential Data
	4.14.3	The office accommodation, equipment, accommodation for site meetings and other facilities for use by the Employer and his agents are: 1) Site offices as per SABS 1200 AB (refer PSAB). 2) Meeting room, minimum floor area 30 square metres. 3) Two covered parking bays. 4) Safety helmets, gumboots and other necessary safety equipment for the sole use of the Employer and his Agents 5) Survey equipment as per PSAB 4.2 6) No testing laboratory is required on site for use by the Engineer
	4.14.5	Toilet facilities are required for the Employer and his agents.
	4.14.6	The requirements for the provision and erection of sign boards are: 1) As per SABS 1200 AB and C4
SANS 1921-1	4.17.1	The requirements for the termination, diversion, or maintenance of existing services are: 1) Support in-situ of existing water mains up to and including DN 200 crossing pipe trench 2) Deviation of small diameter water house connection pipes and fittings. 3) Deviation and relocation of electrical power cables as domestic power connections – work is to be carried out by the responsible utility owner under the overall co-ordination of the Contractor. Provisional sums are provided for this purpose. 4) Temporary deviation and accommodation of traffic
	4.17.2	Where public services must be interrupted on account of the works, it shall be the Contractor's responsibility, in conjunction with the appropriate Authority to ensure that all users affected by the interruption are given due and sufficient notice of the date, time and duration of the interruption.
	4.17.3	Services which are known to exist on the site are: 1) Overhead telephone lines and electricity lines 2) Water pipelines 3) Stormwater pipes and catchpits 4) Roads and tracks 5) Box culverts and concrete causeways 6) Sewer pipelines The approximate positions of some of the known underground services, which may be affected by the Works, have not been shown on the drawings. The exact location or number or existence of these services cannot be guaranteed and the Contractor will be required to confirm the locations and status of all services with all service owners irrespective of whether they are shown on the drawing or not.

Standard	Clause	Essential Data
	4.17.4	The requirements for detection apparatus are: underground cable and pipe detectors during proving for pipe trench excavation. Where services are found the Engineer must be notified immediately so that a decision can be made regarding re-alignment, relocation or protection of said services. The Contractor shall on no account effect such adjustments without the prior consent of the Engineer
	4.17.5	If unknown services are found undamaged, they shall then be deemed to be known services with the provisions pertaining to known services becoming applicable.
	4.17.6	Where a service has been located and exposed, the Contractor shall take every care in ensuring that the excavation containing the service is barricaded and protected against collapse and that the service is adequately protected against damage. Should the existing service become damaged by the Contractor or any third party due to negligence on part of the Contractor, then the cost of its repair along with any consequential costs shall be borne by the Contractor.
	4.17.7	Existing known services or services that have been proved by the Contractor, which are damaged by the Contractor, shall be repaired by the service provider and all costs of the repair shall be borne by the Contractor.
SANS 1921-1	4.18	The safe conduct of the Works shall be a primary consideration and the entire Works shall be designed and carried out in conformity with all applicable statutory regulations and requirements and the Client's Health and Safety specification. Tenderers must price their tenders accordingly. • Particular attention is drawn to the following Acts and Regulations: • Occupational Health and Safety Act 1993 and Regulations; • Minerals Act, 1991 and Regulations; • The Explosives Act, 1956 as amended and Regulations. The Employer reserves the right to rectify any faults or conditions which could cause a safety hazard or endanger the lives of the Employer's personnel entering the Works. Any such rectification shall be at the Contractor's expense. All equipment and machines must be in a safe condition and registered as required by the Occupational Health and Safety Act. The Contractor shall submit written proof of payment of contribution in accordance with the Compensation for Occupational Injuries and Diseases Act (1993). The Employer's safety officer may at any time enter the premises or site to carry out safety inspections. The safety officer will notify the Contractor or his duly appointed representative of any safety hazards that he may find. The tendered rates and prices shall be deemed to include all costs of conforming to the requirements of the Act, and the Construction Regulations and the Employer's Health and Safety Specification. Should the Contractor fail to comply with the provisions of the Construction Regulations, he/she will be liable for penalties as provided in the Construction Regulations and in the Employer's Health and Safety Specification. .

Standard	Clause	Essential Data
SANS 1921-1		The site office area, pipe yard, the servitude/working strip and all other construction zones shall be fenced off to prevent unauthorized entry to the site. Gates shall be provided by the Contractor as required for construction access purposes. The Contractor shall be held responsible for the control of access at these gates at all times as well as to the worksite during removal and re-erection of fencing. No other opening in the fence shall be permitted and the Contractor shall be responsible for monitoring the fencing on a daily basis and repairing any such opening within the same day that it is detected. Notices in two official languages (English and isiZulu) shall be attached to the fence where appropriate to indicate that the site is for personnel employed on the Contract only and that unauthorised entry is forbidden. Notices should be attached to the perimeter fence indicating that the site is for personnel employed on the Contract only and not for unauthorised person. At nights and at weekends or holidays the site must be completely closed off to the public. It is the responsibility of the Contractor to ensure that the sites are closed off. All fencing and gates must be maintained until the work is complete. The temporary fencing shall comprise 2 m high Bonnox 4 x 4 Mesh fencing, Bonnox pattern 1972/4, with straining posts and straining wires as required and according to supplier's directions and with mesh spacing not exceeding 100mm in both the vertical and horizontal directions. Chevron tape shall be interwoven in a zig zag pattern from the top to the bottom of the fence thereby clearly marking off the working area. In proximity to residential areas the Employer's Agent may specify the addition of plastic square mesh to the temporary fencing, or equivalent method, to acts as a childproof barrier. The Contractor will be required to enable safe access for the Employer's operating staff to construction zones as and when required for the purpose of operating and maintaining the existing module 3 treatment plant. Similarly, the Contractor will need to accommodate safe access for the other service providers' operating staff to construction zones as and when required for the purpose of operating and maintaining the existing services. At weekends or holidays the site must be completely closed off to the public. It is the responsibility of the Contractor to ensure that the sites are closed off. Standard type farm gates can be used for access points and locked when the Contractor is not in attendance. All fencing and gates must be maintained until the work is complete and shall then be removed.

Standard	Clause	Variations
SANS 1921-1	4.1.10	Where reference is made to "SANS 2001", substitute with "SABS 1200"

Standard	Clause	Additional Clauses
SANS 1921-1	4.4	The Contractor is required to set up and maintain a Quality Management system and Quality Assurance process. The requirements are detailed elsewhere in this document.
	4.5	The Contractor is required to submit Method Statements for specific items of work as identified in this specification and wherever the Contractor proposes his own approach or method of working. In order to avoid delays to work Method Statements must be submitted well in advance of the proposed work (at least 10 working days or such suitable time as agreed with the Engineer's Representative) and are subject to the approval of the Engineer.
	4.6 (e)	The Contractor is to ensure that stormwater runoff or any groundwater seepage is controlled by means of temporary earthworks, cofferdams, pumping equipment, well-pointing, de-watering equipment etc. to keep the works free of water.
	4.6 (f)	Dealing with all water during construction from whatever source will include for by-pass arrangements for dealing with all possible flows whether or not the existing flow path is being interfered with during installation of pipework.
SANS 1921-1	4.7.4	No blasting will be permitted within 10 m of any structure, pipeline or service unless the Contractor can satisfy the Engineer that his proposed blasting methods and controls are such that no damage will be caused to the adjoining structure, pipeline or service. The Contractor will be required to provide equipment for and take vibro-recordings at no additional cost to the Employer.
	4.8.1	The Contractor shall be responsible for protection from damage to any structures or services that might be affected by the excavations or works.
	4.8.2	Notwithstanding whatsoever special construction methods, equipment or materials are used by the Contractor to protect the structure or service from damage, all work will be measured for payment on the assumption that normal excavation had been carried out and the Contractor shall therefore make allowance for the additional costs in his tendered rates.
	4.9.5	The provision of security for the Contractor's site establishment, plant and personnel at all times is the sole responsibility of the Contractor and no claims for payment for additional security measures taken during the contract will be entertained.

Standard	Clause	Variations
	4.9.6	The Contractor is to comply with the Environmental Management Plan and Employer's Environmental Management Specification included as a Particular Specification in Section C3.8.
	4.17.8	The Contractor shall so carry out all his operations as not to encroach on, or interfere with, trespass on, or damage adjoining land, buildings, properties, road structures, pipelines, places and things, in the vicinity of the Works and outside of the site boundary.

Standard	Clause	Essential Data
SANS 1921-2	4.3.2	The Contractor shall design all temporary culverts.

Standard	Clause	Variations
SANS 1921-2	4.3.2	**Variations** The Contractor shall be responsible for the design of all temporary deviations.

Standard	Clause	Essential Data
SANS 1921-5	4.2.1	The means of determination of method of Excavation (i.e. by hand or machine excavaton) shall be as per PSDB5.4.1. The depth of trenches which are to be excavated by hand is less than or equal to 1,5m and providing that the ground is stable.

Standard	Clause	Essential Data
SANS 1921-6	4.2.1 a)	A qualified service provider is one that appears on the list of recommended service providers, which is available from all regional offices of the Department of Public Works.
	4.2.1 a)	The HIV & AIDS awareness programme is to be repeated at 6 monthly intervals for the duration of the Contract (including the initial one at the start of the Contract).

Standard	Clause	Variations
SANS 1921-6	4.3.2	The HIV & AIDS Awareness Champion and the Employer's representative shall certify the report and schedule described in 4.3.1 whenever a claim for payment is issued to the Employer.

Standard	Clause	Additional Clauses
SANS 1921-6	4.1 f)	Appointing an HIV & AIDS Awareness Champion within 14 days of site handover from amongst the workers (which could include the Community Liaison Officer). The champion should be able to speak, read and write English, speak and understand the local languages spoken by the Workers and shall be on site at all stages of the construction period. The Contractor shall ensure that the Awareness Champion has been trained by the Service Provider on basic HIV & AIDS information, the support services available and has the necessary skills to handle questions regarding the HIV & AIDS programme in a sensitive and confidential manner.
		The Awareness Champion shall be responsible for: • Liaising with the Service Provider to assist in organising awareness workshops • Filling condom dispensers and monitoring condom distribution • Handing out information booklets • Placing and maintaining posters
	4.1 g)	Provide information about the names of the closest service providers to be displayed on a poster of size not smaller than A2.
	4.2.3 c)	Understand and communicate the purpose of voluntary HIV & AIDS testing and counselling.
	4.2.3 d)	Recognise the importance of caring for people living with HIV & AIDS and be familiar with the various treatments available, including treatment of opportunistic infections.
	4.2.3 e)	Understand and communicate the rights and responsibilities of those living with HIV & AIDS in the workplace and the importance of non-discrimination.

Standard	Clause	Additional Clauses
	5	**Sanctions** In the event that the Contractor fails to satisfy the requirements of this specification, the Employer may apply sanctions which include the rejection of claims for payment as being incomplete or the withholding of completion certificates (interim or final).

C3.5.2 PLANNING AND PROGRAMMING

C3.5.2.1 Preliminary Programme

The Tenderer shall include with his tender a preliminary programme on the prescribed form to be completed by all Tenderers. The programme shall be in the form of a simplified bar chart with sufficient details to show clearly how the works will be performed within the time for completion as stated in the Contract Data.

In drawing up his programme, the tenderer is to consider the following:

The Contractor shall allow time for co-ordination of piping tie-ins to the existing system. The Contractor shall be deemed to have allowed fully in his tendered rates and prices as well as in his programme for all possible delays due to normal adverse weather conditions and special non-working days as specified in the Special Conditions of Contract, in the Project Specifications and in the Contract Data.

C3.5.2.2 Construction Programme (GCC 2015 Clause 5.6)

For the purpose of this clause, "construction programme" means the Programme of the Works to be submitted in terms of Clause 5.6 of the General Conditions of Contract 2015 and used to plan and organise the work.

On award of the Contract, the successful Contractor is to prepare a full construction programme, in accordance with the requirements of C3.5.3 Management – Sequence of the Works and C5.14.1 of the Contract Data. The programme is to show all activities and highlight which are critical path activities. With reference to GCC 2015 Clause 5.6.1 the Initial Programme must be provided prior to commencement of the works. Adjusted Programmes of Works may be required from time to time as stated in GCC 2015 Clause 5.6.1.

In addition to the Construction programme, when directed, the Contractor shall promptly furnish a detailed sub-programme of the construction programme for sections of the Permanent Works.

C3.5.2.3 Software Application for Programming

The construction programme shall be prepared using Excel Format (*.xls/.xlsx) or Projects Format (*.mpp) and showing at least the minimum detail as described in Clause C3.5.3 of the Standard Conditions of Contract.

C3.5.3 SEQUENCE OF THE WORKS

The Contractor can choose his own sequence of construction, bearing in mind the requirements for Staged Practical Completion as set out in C5.14.1 of the Contract Data. However, the Contractor must practice progressive reinstatement and remediation in line with the Particular Specification for Environmental Management and EMP.

The draining and cleaning of the Biological Nutrient Reactor, for which a provisional sum has been allowed for in the BoQ, can only take place once the biological treatment plant (PST's, Biofilter and Humus Tanks and associated pipework, channels and pumps) has been commissioned and the BNR can be bypassed so that module 3 can continue to operate with minimal disruption. The draining and refurbishment of the BNR will need to be co-ordinated with the plant works operators.

On no account will spoil, rubble, materials, equipment or unfinished operations be allowed to

accumulate in such a manner as to unnecessarily impede the activities of others or impact on the environment. In the event of this occurring, the Employer shall have the right to withhold payment for as long as may be necessary in respect of the relevant Works in the areas concerned without prejudicing the rights of others to institute claims against the Contractor on the grounds of unnecessary obstruction.

Finishing and tidying must not be deferred to the end of the Contract. All finishing and tidying shall be carried out to the best advantage of the project as a whole and in close co-operation with other parties and residents.

C3.5.4 COMMUNITY LIAISON OFFICER

The Employer will provide the services of a Community Liaison Officer (CLO) for the duration of the Contract.

The primary role of the CLO will be liaison and facilitation of communication which shall include inter alia:

- Assist in all aspects related to the recruitment of local Labour, and advise them of their rights
- Act as liaison between the Contractor and community on the application of Labour Intensive Construction Methods as set out in this document
- Act as a source of information for the community and the Ward Councilors on issues related to the Contract
- Liaise with a Project Committee, as anticipated in the EMP, for community representation
- Keep the Contractor advised on community issues
- Keep the Contractor advised on any issues pertaining to local security (where applicable)
- Assist in setting up any meetings/negotiations with affected parties
- Keep a diary and record details of Labour/community issues that may arise
- Monitor and report on general Health and Safety issues on site
- Assist in HIV/AIDS awareness programmes
- Attend contract site meetings and report on labour/community issues

The CLO shall have no authority to issue any instructions to the Contractor. The CLO shall be neutral to all parties and endeavour to remain impartial should any conflict arise.

Responsibility for identifying a pool of suitable labour shall rest with the CLO, although the Contractor shall have the right to choose from the pool. The Contractor (and Sub-contractors) shall have the right to determine the total number of labourers required at any one time, which may vary throughout the contract.

The Contractor shall have the right to replace labour that is not performing adequately and the replacement of any labourer shall be done in conjunction with the CLO.

Local labour employed on the contract shall be paid in accordance with the Civil Engineering Industry minimum wage rate for EPWP contracts and all statutory conditions of employment shall be met.

C3.5.5 METHODS & PROCEDURES

C3.5.5.1 Management & Disposal of Water (Read with SANS 1921 - 1: 2004 Clause 4.6)

The Contractor shall pay special attention to the management and disposal of water and Stormwater on the site. It is essential that all completed works or parts thereof are kept dry and properly drained. Claims for delay and for repair of damage caused to the works as a result of the Contractor's failure to properly manage rain and surface water, will not be considered.

C3.5.5.2 Disposal of Spoil or Surplus Material (Read with SANS 1921 - 1: 2004 Clause 4.10)

The Contractor will be responsible for the disposal of material and making all arrangements in connection therewith. The Contractor shall dispose of all surplus and unsuitable excavated material in designated spoil areas.

C3.5.5.3 Length of Trenches not Backfilled and not Rehabilitated

The recommended maximum length of open trenches at any one time is 400m in order to limit the safety risk to surrounding communities.

In areas immediately adjoined by residential properties the Contractor will not be permitted to excavate any new pipe trenches once the maximum limit for open trench in a particular area has been reached, without the permission of the Environmental Control Officer. A maximum of three working fronts for pipelaying will be permitted.

C3.5.5.4 Length of Pipeline not Pressure Tested

The maximum length of pipeline which is not pressure tested that will be allowed at any given time during construction is 2000 m. The Contractor will not be permitted to excavate any new pipe trenches once the maximum limit for "un-pressure tested" pipeline has been reached unless otherwise authorised by the Engineer.

C3.5.5.5 Determination of Method of Excavation

Trenches for pipelines shall be excavated by either mechanical means or by hand, determined as follows:

Trial holes of minimum dimensions 1,0 x 1,0 m shall be excavated by hand along all pipeline routes at 50 m intervals ahead of the Contractor's programme. The trial holes shall be 1 m deep or less if intermediate or hard rock material is encountered. An item has been included in the Schedule of Quantities to cover this work.

If intermediate or hard rock material is encountered in the top 1 m of excavation at such trial holes, then excavation may be deemed to be carried out by mechanical means, the length of such excavation determined based on other trial hole findings.

If soft material only is encountered at such trial holes, then excavation may be deemed to be carried out by hand up to a maximum depth of 1,5m, the length of such excavation determined based on other trial hole findings. The consistency of the material shall be determined as per Table 1 of SANS 1921-Part 5 and the Classification of excavated material shall be as per Annex B of SANS 1921-Part 5 (Tables B.1 & B.2).

If intermediate or hard rock material is encountered in those stretches set aside for hand excavation on the basis of the trial hole findings, then the Contractor may be allowed to remove the intermediate or hard rock material by mechanical or whatever means, the rate for which is to include for backfilling and re-excavating (if necessary).

C3.5.5.6 Determination of Haul Distances

The Contractor shall be responsible to plan his work and logistics to minimise his costs of haul of imported materials and spoil. No payment will be made for overhaul on this contract unless provision is made for in specific items.

C3.5.6 QUALITY MANAGEMENT

C3.5.6.1 Quality Assurance (QA)

Tenderers shall submit, together with their tenders, an assessment report on their QA and Quality Control (QC) system issued by an independent Quality Assurance Authority. The inspection on which the assessment report is based shall have taken place not more than 12 months prior to the closing date for this tender.

In the event that a tenderer does not have a QA system, then sufficient information shall be submitted with the tender to demonstrate the Contractor's ability to prepare and implement a QA system that has been prepared in conjunction with an independent Quality Assurance Authority so that it will achieve the objective of full compliance with the requirements of the contract.

The Contractor will be solely responsible for the production of work that complies with the drawings and specifications to the satisfaction of the Employer's Agent. To this end it will be the responsibility of the Contractor to institute an appropriate ISO 9001 type Quality Assurance (QA) system for the contract which shall make provision for method statements for all activities. The Contractor’s QA System shall include quality management objectives, policies, organisation structure (organogram that includes the qualifications and number of years of relevant experience of the named persons), procedures, method statements and work instructions that comply with the requirements of ISO 9001.

The proposed QA system shall be agreed with the Employer's Agent prior to commencement of any work on site. The Contractor's QA system will be subject to an audit by the Employer’s Agent on a regular basis but not exceeding three monthly intervals to verify that adequate inspection, checks and tests are being carried out and to ensure that the Contractor's own control and record keeping is sufficient to identify any possible quality issues that could cause a delay or failure.

The approval of a QA system by the Employer's Agent will not exempt the Contractor from compliance with any of the specifications and/or the quality requirements prescribed in, or implied by, the tender documents. Monitoring by the Employer's Agent and/or the Employer's Agent's Representative may be done at any time on any material or construction process.

The Contractor shall ensure that a sufficient number of appropriately qualified, trained and experienced supervisory staff and the required transport, instruments, equipment and tools are available to control the quality of his/her own workmanship in accordance with his/her QA system. Attention is drawn to the fact that it is not the duty of the Employer's Agent or the Employer's Agent's Representative to act as supervisor, foreman, surveyor or QC manager.

Responsibility for compliance with this sub-clause, and all associated costs, shall rest with the Contractor and will be deemed to be included in the tendered rates.

C3.5.6.2 Quality Control Plan

The Contractor shall, within 20 days from the commencement date, submit an overall Quality Control Plan (QCP) for the project. The QCP shall indicate how the QA System will apply to the specific requirements of the Contract to ensure compliance with the requirements of the specifications. The QCP shall be subject to approval by the Employer's Agent.

Individual QCPs shall be prepared by the Contractor and/or his/her subcontractors for each group of activities. These shall include Method Statements including plant, construction equipment, materials or services required, as applicable, to achieve compliance with the drawings and the specifications. The relevant QCP for each activity shall be submitted to the Employer's Agent's Representative for approval and for the inclusion of his/her construction monitoring activities at least two weeks in advance of any construction of the permanent works commencing unless agreed to otherwise by the EAR and recorded in a site instruction.

The following surveillance requirements shall be included in each QCP for review and/or comment by the Employer's Agent or his/her Representative.

Record (Rec): The Contractor shall prepare documentary evidence for every construction activity and statistical analysis of the data to be retained, generally in the form of QC forms but other appropriate documentation may apply, and copies shall be sent to the Employer's Agent's Representative.

Witness (W): The Employer's Agent or his/her Representative requires notification to enable witnessing of an activity. The notice period shall be agreed (generally not less than 48 hours) and will depend on the nature and location of the activity and shall be reviewed from time to time. QC forms for tests that have been witnessed shall be signed in the field as having been “witnessed only” by the Employer's Agent or the Representative who witnessed the test.

Verification (V): The Employer's Agent or his/her Representative will not necessarily be present during the activity or to witness all subsequent QC testing but documentary evidence to permit verification of compliance with the requirements is to be generated, retained and presented to the Employer's Agent's Representative for signature as part of on-going verification that QC is being carried out and that the results of each test as recorded on the QC sheets meet the requirements of the specification.

Hold (H): The Contractor may not proceed with such an activity until the preceding activity has complied with the specified requirements and the EAR or the EAR’s Representative has been given the QC sheets and verified that the information recorded by the Contractor complies with the specification. Documentary evidence shall be retained in accordance with the agreed QA system.

Random (Ran): Construction monitoring by random inspection. Random construction monitoring may be carried out at any stage of the activity or during the preparation for the activity. Documentary evidence shall be retained in accordance with the agreed QA system.

C3.5.6.3 Categorizations of QCPs

The following categories shall apply in determining the requirements for a Quality Control Plan:

Category	Clarification	Quality Control Plan
Critical	A component, group of components, structure, the failure of which to comply with the specifications may affect the short or long term performance of the Works or which it is a part and /or will cause a detrimental environmental impact, and/or may result in hazardous or unsafe conditions.	Required for all components.
Major	A component, group of components, structure, element of a structure or facility, other than categorized as 'Critical', the failure of which to comply with the specifications may compromise the performance of the works of which it is a part, result in increased maintenance and/or impact negatively on the quality of the Works.	As determined by the Contractor and subject to approval of the Employer's Agent.
Minor	All items other than those categorised as 'Critical' or 'Major' and which are visible and capable of rectification during routine inspections.	As determined by the Contractor

C3.5.6.4 Laboratory Testing

The Contractor shall arrange for all tests required for process control to be done by a laboratory acceptable and subject to approval by the Employer's Agent.

The Contractor may establish his/her own laboratory on site or he/she may employ the services of an independent commercial laboratory.

Whatever method is used, the Contractor must submit the results of tests carried out on materials and workmanship at the end of every shift for verification by the Employer's Agent's Representative. Unless otherwise stated, the costs of all of these tests will be deemed to be included in the relevant tendered rates and no additional payment will be made for such testing as the case may be.

C3.5.6.5 Verification (Acceptance Control)

The process control test results submitted by the Contractor for his own approval of materials and workmanship may be used by the Employer's Agent's Representative for verification (process control). However, before verifying any work, the Employer's Agent's Representative may require further control tests to be carried out by a laboratory of his/her choice. The cost of such additional tests will be paid for, but tests that failed to confirm compliance with the specifications, will be for the account of the Contractor.

C3.5.6.6 Quality Management Audit

The Contractor shall carry out periodic assessments of the adherence to the QA system and the QCPs by senior qualified staff who are not normally employed on the Site. The Employer's Agent and/or his/her Representative shall be invited to attend at the Contractor's periodic assessments meeting and be afforded the opportunity to view and comment on the report on the implementation of the QA system at the site.

C3.5.6.7 Corrective Action

Failure to conform to the specified requirements will result in the issue by the Employer's Agent's Representative of a Corrective Action Request typically in the form of, or under cover of, a Site Instruction. Failure to rectify the deficiencies covered by a Corrective Action Request within the period stated will result in the Employer's Agent invoking the provisions of GCC (2015) Clause 7.6.3 – Removal of Improper Work and Materials.

C3.5.6.8 Quality Assurance Enhancement

Should the Contractor or any of the proposed sub-contractors not comply with Sub-Clause C3.5.4.1 at the time of tender, a Contract may be awarded subject to a written undertaking to enhance his own and/or Sub-Contractor's quality assurance system to the satisfaction of the Employer's Agent before commencement of the contract.

C3.5.6.9 Quality Assurance Staff

The Contractor shall satisfy the Employer's Agent that a quality specialist together with sufficient and suitably qualified staff will be assigned to control the quality of the material used by each sub-contractor engaged in the supply of critical and major components and sub-assemblies.

C3.5.6.10 Employer's Agent's Quality Assurance Representative/Inspector

The Employer's Agent may elect to appoint an independent quality assurance representative(s) to act in a surveillance capacity on his behalf for all or part of the Contract.

The Employer's Agent's Quality Assurance Representative will be a selected Sub-Contractor and will be paid by the Contractor under this Contract for all tests passed by the Inspector and certified by the Employer's Agent. The Inspector will not act as the quality controller for the Contractor or his Sub-Contractors and accordingly any tests failing inspection will be for the account of the Contractor. Similarly, the costs of all inspections arising following any failed tests will be for the account of the Contractor.

C3.5.6.11 Sub-Letting

All enquiries made, and contracts placed by the Contractor for critical components shall require that sub-contractors comply with the requirements of the preceding sub-clauses. Responsibility for and all associated costs of compliance shall rest with the Contractor. In instances where ISO 9001 is not applicable, Tenderers must indicate what equivalent alternative Code of Practice is being implemented.

C3.5.6.12 Disqualification

Tenderers who do not include the formally documented statements called for in Sub-Clause C3.5.6.1 and who do not respond in terms of Sub-Clause C3.5.6.2 above may be disqualified.

C3.5.7 Testing (Read with SANS 1921 – 1: 2004 clause 4.11)

C3.5.7.1 Process control

The Contractor shall arrange for all tests required for process control to be done by a laboratory acceptable to, and approved by, the Employer's Agent.

The Contractor may establish his/her own laboratory on site, or he/she may employ the services of an independent commercial laboratory. Whatever method is used, the Contractor must submit the results of tests carried out on materials and workmanship when submitting work for acceptance by the Employer's Agent. The costs of these tests shall be deemed to be included in the relevant rates and no additional payment will be made for the testing required.

C3.5.7.2 Acceptance control

The process control test results submitted by the Contractor for approval of materials and workmanship may be used by the Employer's Agent for acceptance control. However, before accepting any work, the Employer's Agent may have further control tests carried out by a laboratory of his/her choice. The cost of such additional tests will be covered by a provisional sum provided in the schedule of quantities, but the cost of any tests that failed to confirm compliance with the specifications, will be for the account of the Contractor.

C3.5.7.3 Performance Tests

On completion of erection and installation the Contractor must carry out the following tests, where applicable, in addition to any other tests which may be specified elsewhere:

Before Commissioning
Tests for correct alignment of all equipment.
Tests for correct direction of rotation of motors.
Tests for watertightness, where applicable.
Test for correct operation of control gear and equipment.

Before Taking Over
Check all rotating or moving equipment for correct and smooth operation.
Check and calibrate all items of plant for correct delivery and power consumption.
Check all controls for correct operation and functioning.
Check accuracy of measurements in conjunction with the Employer's Agent against known operating conditions such as emptying a sump, pumped flow of known values, etc. For certain of these tests, the Contractor will have to make temporary recording facilities available for the instrument/meters.

During Defects Liability Period
Check all equipment for correct operation and functioning.
Check accuracy of measurement of all meters, as detailed above.

The entire cost of providing all test equipment must be borne by the Contractor, and an adequate allowance for such tests must be made in the tendered price for commissioning, testing and adjusting which is included in the Bill of Quantities where applicable.

C3.5.8 MANAGEMENT OF THE ENVIRONMENT

(Read with SANS 1921-1: 2004 clause 4.19, the Environment Particular Specification and the Environmental Management Plan

The Contractor shall pay special attention to the following:

(a) Clearing of Vegetation

The Contractor shall not destroy, remove or clear trees, timber or shrub to any extent greater than that approved. The Contractor shall not carry out any activity outside the areas defined for clearing unless otherwise approved by the Environmental Control Officer.

(b) Soil Erosion

The quality of topsoil in stockpiles will be maintained by measures including minimising contamination from other materials, minimizing stockpiling periods and prevention of soil erosion by surface runoff or wind. Monitoring for erosion and soil erosion risk will be undertaken regularly to ensure that any erosion that occurs is mitigated as soon as possible.

(c) Risk of Faunal Injury and Death

The trenches will be kept open for the minimum period necessary to undertake the works. Temporary fencing or barriers will be placed along the trenches in all populated areas and in areas that are likely to be used as crossing points along the corridor.

(d) Pollution Prevention

With particular regard to Sanitation, Solid Waste Facilities, Fuels, Hazardous Substances and other Liquid Pollutants as elaborated in the Particular Specification for Environmental Management.

(e) Rehabilitation

The Contractor is to ensure that the site and its surrounds are rehabilitated to the condition in which they were prior to commencement of construction activities.

(f) Working in watercourses

Cofferdams shall be constructed around trenched areas in watercourses using sealed plastic bags filled with sand and means of conveyance must be provided for the flow of water to bypass the excavation. The flow of rivers is not to be restricted.

C3.5.9 ACCOMMODATION OF TRAFFIC ON PUBLIC ROADS OCCUPIED BY THE CONTRACTOR (Read with SANS 1921 – 1: 2004 clause 4.13 and SANS 1921 – 2: 2004)

C3.5.9.1 General

The Contractor will be responsible for the safe and easy passage of public traffic past and on sections of roads of which he/she has occupation or where work has to be done near traffic.

Accommodation of traffic, where applicable shall comply with SANS 1921-2: 2004: Construction and Management Requirements for Works Contracts, Part 2: Accommodation of Traffic on Public Roads occupied by the Contractor. The Contractor shall obtain this specification from Standards South Africa if accommodation of traffic will be involved on any part of the construction works.

C3.5.9.2 Basic Requirements

The travelling public shall have the right of way on public roads, and the Contractor shall make use of approved methods to control the movement of his equipment and vehicles so as not to constitute a hazard on the road.

The Contractor shall ensure that all road signs, barricades, delineators, flagmen and speed controls are effective, and that courtesy is extended to the public at all times.

Failure to maintain road signs, warning signs or flicker lights, etc, in a good condition shall constitute ample reason for the Engineer to suspend the work until the road signs, etc, have been repaired to his satisfaction.

The Contractor may not commence constructional activities affecting existing roads before adequate provision has been made to accommodate traffic in accordance with the requirements of this document and the South African Road Traffic Signs Manual.

The Contractor shall design, construct and maintain all temporary access and haul roads to the various working areas. The Contractor shall construct and maintain all temporary drainage works necessary for temporary deviations.

The Contractor shall provide and grant access to persons whose properties fall within or adjoin the area in which he/she is working.

C3.5.9.3 Traffic Safety Officer

Where warranted by traffic conditions on or near the site, the Contractor shall nominate a suitable member of his/her staff as at Traffic Safety Officer to be responsible for the arrangement and maintenance of all the measures for the accommodation of traffic for the duration of the project. Duties of the Traffic Safety Officer shall be as set out in SANS 1921 Part 2 and shall also be in compliance with the Occupational Health and Safety Act No 85 of 1993 and the Construction Regulations 2014, including the Particular Safety Specification.

C3.5.10 ACCREDITED SKILLS TRAINING

Apart from the Contractor's own in-task training of his workforce it is the intention of the Employer that Accredited On-Site Skills Training will also be provided under this contract. Candidates for On-Site Skills Training will be identified by the community from individuals who are undergoing, or who have undergone, training at an Accredited Training Providers for skills and learnership. This list will be reviewed by the Employer prior to notifying the Contractor in writing of the names of candidates to be accepted for Accredited Skills Training. The Contractor shall employ such candidates according to his full and normal conditions of employment for unskilled labour for the duration of training. The ISD shall appoint an Accredited Skills Training Facilitator subject to the Employer's approval who will conduct the training, which will take place adjacent to the worksite in a suitable area to be provided by the Contractor for the purpose of training and set aside for that purpose. The Contractor shall be required to provide an office space for theoretical instruction as well as construction materials for practical training.

It is intended that Skills Training will be provided in any or all of the following disciplines:

- Trench Excavation and Supervision;
- Pipelaying;
- Steel Fixing;
- Formwork and Concreting;
- Basic Construction Hand;

- Finishing Hand;
- Task Based Labour Administration
- Understanding the Scope of Works and Engineer's Specifications;
- Labour Recruitment and Management;
- Contractor's Responsibilities and Requirements;
- Payroll Management and Implementation;
- Basic Tender and Contract Pricing
- Community Liaison and Facilitation

The Contractor shall provide the workspace and office space for training and shall pay the training candidates at the normal rate of pay for unskilled labour for the duration of the training. The Contractor shall also pay the fees and charges of the accredited trainer according to the agreed scale. The cost of Accredited On-Site Training is an item in the Bill of Quantities and the cost is to be reclaimed by the Contractor via the Payment Certificate.

Upon completion of the training by the Contractor the employment shall terminate and the Contractor shall not be obliged to keep the trained personnel in his employ. However, he may re-employ candidates on an individual basis by mutual agreement.

Apart from the Contractor's own in-task training of his workforce it is the intention of the Employer that Accredited On-Site Skills Training will also be provided under this contract. The Contractor has management responsibilities in this regard and this Accredited On-Site Skills Training is further described in Particular Specification PT. A payment item is included in the Bill of Quantities where the costs of providing this training will be recovered by the Contractor. The item shall be deemed to cover all the Contractor's costs in relation to provision of training as outlined in this section and in Particular Specification PT

C3.5.11 RECORDING OF WEATHER

The Contractor shall be permitted to take his own rainfall measurements on site subject to the Engineer's approval, but access to the measuring gauge(s) shall be under the Engineer's control. The Contractor is to provide and install all the necessary equipment for accurately measuring the rainfall as well as to provide, erect and maintain a security fence plus gate, padlock and keys at each measuring station, all at his own cost.

C3.5.12 KEY PERSONNEL

The Contractor's Key Personnel for this contract shall be the Contracts Director, Contracts Manager, Contracts Site Agent, Health & Safety Officer, Site Supervisor, Engineer, Technician and Foreman.

C3.5.13 MANAGEMENT MEETINGS

The Contractor and such other persons as may be nominated by the Engineer shall be required to attend periodic site meetings, the date and place for which will be set by the Engineer in consultation with the Employer and Contractor.

The main purpose of the site meetings will be to review and discuss progress and programme, and all persons attending the site meetings must be empowered to act on behalf of the organisations they represent.

C3.5.14 FORMS FOR CORRECT ADMINISTRATION

C3.5.14.1 Report on Employment Generation

The Contractor shall provide to the Engineer, monthly, in an EPWP reporting template form approved by the Engineer, a detailed breakdown of his personnel (Contractor's staff and labour such as skilled and semi-skilled) days worked, and those of any Sub-contractors employed at the Site to conform with EPWP reporting requirements.

The breakdown shall also include details of the following:

employee name and ID number

gender and age group

job category, with skill classification, or speciality;

job title;

number of employees in each job category or with that job title;

trainees in each job category;

classification of employees by origin (local/imported)

Daily register

Proof of Payment

Payment Certificate will not be honoured if the Project is not Reporting on the EPWP

C3.5.14.2 Contractual

Payment Certificate must be accompanied with the EPWP monthly report template.

C3.5.15 ELECTRONIC PAYMENTS

Payment of employees by electronic funds transfer will be permitted provided that the bank or financial institution that is proposed for the transfer of funds is adequately represented in City of Ekurhuleni, including the provision of ATM facilities.

C3.5.16 DAILY RECORDS

The Contractor is to provide a triplicate site diary book, which is to be kept on site, for the purpose of keeping daily records in respect of work performed on the site and all significant events. The Engineer's Representative will keep the top copy on his records and the Contractor will take the middle copy and the third copy will remain in the site diary book which will be kept on site for the duration of the Contract. Standing time details, disruptions, plant on site, etc to be clearly documented. Lack of such information will lead to disqualification of the claims should claims arise.

C3.5.17 BONDS ABD GUARANTEES

Requirements for a Performance Bond are indicated in section T.2. The original bond document will be retained by the Employer and will be released in accordance with Clause 6.2 of GCC 2015.

C3.5.18 PAYMENT CERTIFICATES

The Contractor shall submit invoices at monthly intervals in terms of Clause 6.10.1 of GCC 2015 in respect of works completed during the preceding period and materials on site. The work shall be measured according to the format of the Bill of Quantities and measurements should be taken together with the Employer's Agent's Representative and are subject to agreement as to the status of work completed. The Contractor will submit his invoice, together with invoices and other supporting documentation to the Engineer in terms of GCC 2015 Clause 6.10.2. The Engineer will process the Contractor's invoice within 7 days of receipt (refer GCC 2015 Clause 6.10.3 & 6.10.4) to produce a Payment Certificate and will deliver this to the Employer.

The Payment Certificate will be scrutinised by the Employer prior to payment within 30 days of receipt of the Certificate from the Employer's Agent, provided that the date of submission is such as to comply with the Employer's payment cycle as notified to the Contractor. The Contractor must ensure that, allowing for the time allowed for processing Certificates by the Engineer, his invoice is submitted in good time to allow for the payment cycle to be met.

The Contractor's tendered rates for the relevant items in the Bill of Quantities shall include full compensation for all possible additional costs which may arise from this, and no claims for extra payment due to inconvenience as a result of the modus operandi will be considered.

C3.5.19 PERMITS

The Employer requires no special permits for the Contractor's personnel other than those required by the statutory authorities. This includes, but is not necessarily limited to, Work and Residence permits for non-South African nationals, Blasting Certificate for the use of explosives and permits from the Department of Energy and Mineral Affairs in respect of mining and exploitation of natural resources including sand and aggregates.

C3.5.20 PROOF OF COMPLIANCE WITH THE LAW

The Contractor is referred to the Returnable Schedules in Section T.2. The Contractor shall be required to maintain evidence of the continued validity of all aspects to which he has witnessed compliance at the time of submission of his tender, as well as any permits required by nature of his operation. The Contractor will be deemed to have granted the Employer the right of inspection of such documentation in the possession of the Contractor at any time as well as to make his own independent investigations where necessary.

C3.5.21 INSURANCE PROVIDED BY THE EMPLOYER

The Employer is not providing Principal Controlled Insurance for the works that are the subject of this contract.

C3.5.22 HEALTH AND SAFETY

C3.5.22.1 Health and Safety Requirements and Procedures

This clause shall be read in conjunction with the Health and Safety Specification. Anything set out in connection with the Safety Act in this document is supplementary to and in no way replaces, alters or supersedes the provisions of the Occupational Health and Safety Act 1993 (Act 85 of 1993) and the Constructional Regulations 2014, which shall be complied with at all times.

a) in terms of the provisions of Section 37(2) of the *Occupational Health and Safety Amendment Act*, 1993 (Act 85 of 1993), hereinafter referred to as the Act, the following arrangements and procedures shall apply between the Contractor and the Employer to ensure compliance by the Contractor with the provisions of the Act:

(i) The Contractor undertakes to acquaint the appropriate officials and employees of the Contractor with all relevant provisions of the Act and the Regulations promulgated in terms of the Act.

(ii) The Contractor undertakes that all relevant duties, obligations and prohibitions imposed in terms of the Act and Regulations on the Contractor will be fully complied with.

(iii) The Contractor accepts sole liability for such due compliance with the relevant duties, obligations and prohibitions imposed by the Act and Regulations and expressly absolves the Employer from himself being obliged to comply with any of the aforesaid duties, obligations and prohibitions, with the exception of such duties, obligations and prohibitions expressly assigned to the Employer in terms of the Act and its associated Regulations.

(iv) The Contractor agrees that any duly authorised officials of the Employer shall be entitled, although not obliged, to take such steps as may be necessary to monitor that the Contractor has conformed to his undertakings as described in paragraphs (i) and (ii) above, which steps may include, but will not be limited to, the right to inspect any appropriate site or premises occupied by the Contractor, or any appropriate records or safety plans held by the Contractor.

(v) The Contractor shall be obliged to report forthwith to the Employer and Employer's Agent any investigation, complaint or criminal charge which may arise as a consequence of the provisions of the Act and Regulations, pursuant to work performed in terms of this Contract, and shall, on written demand, provide full details in writing, to the Employer and Employer's Agent, of such investigation, complaint or criminal charge.

(vi) The Contractor shall furthermore, in compliance with Constructional Regulations 2014 to the Act acquaint himself with the requirements of the Employer's Health and Safety Specification as laid down in Regulation 4(1)(a) of the Construction Regulation 2014, and prepare a suitably and sufficiently documented health and safety plan as contemplated in Regulation 5(1) of the Construction Regulation 2014 for approval by the Employer or his assigned agent. The Contractor's Health and Safety Plan and Risk Assessment shall be submitted to the Employer for approval within fourteen (14) days of the Commencement Date and shall be implemented and maintained from the commencement of the works.

(vii) The Contractor shall always be responsible for full compliance with the approved plan as well as with the Construction Regulations and no extension of time will be considered for delays due to non-compliance with the abovementioned plan or regulations.

(viii) The Employer, or his assigned agent, reserves the right to conduct periodic audits, as contemplated in the Construction Regulations 2014, to monitor that the Contractor is compliant in respect of his obligations. Failure by the Contractor to comply with the requirements of these Regulations shall entitle the Employer's Agent, at the request of the Employer or his agent, to suspend all or any part of the Works, with no recourse whatsoever by the Contractor for any damages incurred as a result of such suspension, until such time that the Employer or his agents are satisfied that the issues in which the Contractor has been in default have been rectified.

(ix) The proposed type of work, materials to be used and potential hazards likely to be encountered on this contract are detailed in Section C3.3: Construction, the Bill of Quantities, the Drawings, and in the Employers' Health and Safety Specification *(Regulation 4(1) of the Construction Regulations 2014).*

Payment items are included in the Bill of Quantities to cover the Contractor's cost for compliance with the OHS Act and the abovementioned regulations.

C3.5.22.2 Health and Safety Specifications and Plans to be Submitted at Tender Stage

C3.5.22.2.1 Employer's Health and Safety Specification

The Employer's Health and Safety Specification form part of the Scope of Works.

C3.5.22.2.2 Tenderer's Health and Safety Plan

The successful Tenderer shall, on receipt of notification that he has been awarded the contract, submit without delay his own documented Health and Safety Plan for the execution of the work under the contract. His Health and Safety Plan must at least cover the following:

(i) a proper risk assessment of the works, risk items, work methods and procedures in terms of Regulations 9;

(ii) pro-active identification of potential hazards and unsafe working conditions;

(iii) provision of a safe working environment and equipment;

(iv) statements of methods to ensure the health and safety of subcontractors, employees and visitors to the site, including safety training in hazards and risk areas (Regulation 7);

(v) monitoring health and safety on the site of works on a regular basis, and keeping of records and registers as provided for in the Construction Regulations;

(vi) details of the Construction Supervisor, the Construction Safety Officers and other competent persons he intends to appoint for the construction works in terms of Regulation 8 and other applicable regulations; and

(vii) details of methods to ensure that his Health and Safety Plan is carried out effectively in accordance with the Construction Regulations 2014.

The Contractor's Health and Safety Plan will be subject to approval by the Employer, or amendment if necessary, before commencement of construction work. The Contractor will not be allowed to commence work, or his work will be suspended if he had already commenced work, before he has obtained the Employer's written approval of his Health and Safety Plan.

Time lost due to delayed commencement or suspension of the work as a result of the Contractor's failure to obtain approval for his safety plan, shall not be used as a reason to claim for extension of time or standing time and related costs

C3.5.22.3 Cost of Compliance with the OHSA Construction Regulations

The rates and prices tendered by the Contractor shall be deemed to include all costs for conforming to the requirements of the Act, the Construction Regulations and the Employer's Health and Safety Specification as applicable to this contract. Should the Contractor fail to comply with the provisions of the Construction Regulations, he will be liable for penalties as provided in the Construction Regulations and in the Employer's Health and Safety Specification.

Items that may qualify for remuneration will be specified in the Safety Specifications included or in the Project specifications.

C3.5.22.4 Protection of the Public and Employer's Staff

The Contractor shall at all times ensure that his operations do not endanger any member of the public and the Employer's staff.

The Contractor shall take special precautions to prevent non-authorised access to any dangerous areas on the works by means of temporary barricades and / or fencing.

C3.5.22.5 First Aid and Site Safety

The Contractor shall be the responsible party on Site to ensure that the Occupational Health and Safety Act 1993 (Act 85 of 1993) including the Constructional Regulations 2014 and any other statutory obligations on safety are strictly adhered to and administered. The Employer shall not be held liable for safety on Site or anywhere else where the Contractor is active. The Contractor shall complete a "Contractor's Legal Delegation Statement" which is bound into this document.

The Contractor may be working in confined spaces where toxic and/or explosive gasses may accumulate, deep trenches and excavations, and shall especially be required to observe those sections of the Act and Regulations which deal with working in such conditions. The Contractor shall ensure that the following list of personnel protective equipment is in general use as a minimum:

- Safety harnesses for working in confined spaces, near to water and at heights.
- Where work is carried out over water, workers shall be provided with, and wear flotation equipment. Lifesaving equipment shall be provided to these areas.
- Hard hats where required.
- Leather gloves for cut resistance as required.
- Ear muffs or ear plugs for noise from machines.
- Appropriate eye protection when any cutting, grinding or welding is undertaken, and in dusty conditions.
- Overalls for body protection.
- Reflective safety vests.
- Safety shoes for foot protection.

Self-contained breathing apparatus (SCBA) shall be provided as necessary.

Ladders for access and escape from excavations and trenches shall be placed at the regulated minimum distances and shall be maintained in a good and safe state at all times.

Anything set out in connection with the Safety Act in this document is supplementary to and in no way replaces, alters or supersedes the provisions of the Occupational Health and Safety Act 1993 (Act 85 of 1993) and Constructional Regulations 2014, which shall be complied with at all times.

C3.5.22.6 Expected Health and Safety Risks

Listed below are, which may not be all, the expected health and safety related risks that may be encountered during the contract duration. The Contractor shall identify and prepare assessments for all risks he is likely to encounter in the execution of the contract before commencing with any work.

Further assessments shall be prepared as and when required for any other risks identified during the construction phase before work involving such risks is undertaken.

- Working at an existing wastewater treatment works with the potential of contracting hepatitis or other diseases;
- Presence of toxic sewer gases and other dangerous and/or explosive gases such as methane;
- Working in deep trenches and other excavations in potentially unstable and/or wet ground conditions;
- Working at heights;
- Working in close proximity to operating machinery that starts and stops automatically;
- Existing services including water pipes, sewer pipes and electrical cables;
- Working with electrical power tools;
- Working with pneumatic tools;
- Excessive noise levels;
- Working with welding and other electrical equipment;
- Working close to and/or over water;
- Working with or in proximity to laser or oxyacetylene or other types of steel cutting, burning or drilling equipment;
- Working in confined spaces inside pipes when welding and lining the pipe;
- Working with or in close proximity to epoxies and other paint and coating materials;
- Working with cement and other hazardous materials;
- Water in excavations;
- Operating construction plant and equipment;
- Lifting, loading and placing of heavy materials and other weights;
- Excessive noise levels;
- Bright light from welding and other steel working activities;
- Moving construction plant and vehicles on the Site;
- Potential of flooding should heavy rain occur;
- Venomous snakes on the Site

C3.5.22.7 Barricades and Lighting

The Contractor shall comply in all aspects with the requirements of the Occupational Health and Safety Act (Act 85 of 1993) and the Constructional Regulations 2014.

The work will be carried out at an operating wastewater treatment works staffed 24 hours per day. The Contractor shall erect and maintain for the duration of the contract adequate barricades in the form of fencing, or other approved methods, to prevent access to the Site, and in particular any excavations, by unauthorised persons.

Trench excavations for pipelines shall be barricaded on both sides along the entire length of open trench. Where trenches are excavated within road reserves and where it may be reasonably expected that vehicular traffic may be encountered in areas outside of road reserves, the Contractor shall provide, maintain and keep lit between sunset and sunrise, warning lamps placed at regular intervals not exceeding 50m along the length of open trench on the side facing the street or direction from which traffic may reasonably be expected.

The Contractor shall, in connection with the Works, provide and maintain all signs, signboards, lights, barriers, barricades, fencing and watching when and where

(a) specified in or reasonably to be inferred from the Contract, or

(b) required by any competent statutory or other authority, or

(c) required by the Employer's Agent and/or Employer for the protection of the Works or for the safety or convenience of the public or others;

C3.5.22.8 Health and Safety Plan

The Health and Safety Plan shall be based on the following principles:

- Proper risk assessments of the construction work;
- Pro-active identification of potential health hazards and unsafe working conditions;
- Informing and training of employees in hazards and risks;
- Provision of a safe working environment and safety equipment;
- Ensuring the health and safety of subcontractors through their health and safety plans;
- Monitoring the health and safety on the construction works on a continuous basis;
- Employing only competent, registered health and safety officials.

C3.5.22.9 Proof of Compliance with the Law

The Works shall be constructed in accordance with the relevant Government Acts and Regulations and in particular "The Occupational and Health and Safety (Act No. 85 of 1993) and the Construction Regulations 2014".

All apparatus and material supplied, and all work carried out shall comply in all respects with the Act.

The Contractor must comply with the requirements of the Act and inform his employees and Sub-contractors regarding regulations, safety requirements, inspections, etc.

The specific health and safety conditions imposed by the Employer (refer the OHASA Agreement under "Forms to be completed after award of Tender" in Volume 1 of the Tender Document) also apply and take precedence where in conflict with the Occupational Health and Safety Act. This Agreement must be signed upon award of the Tender.

The Contractor exempts both the Employer and the Employer's Agent for the safety of his work on the Site. The Contractor assumes the responsibility in terms of Section 16(1) of the Occupational Health and Safety Act. If the Contractor delegates any duty in terms of Section 16(2), a copy of each written delegation shall immediately be handed to the Employer's Agent.

By accepting the Contract, the Contractor warrants that all his and his Sub-contractor's workmen are covered in terms of the Compensation for Occupational Injuries and Diseases Act (Act No. 130 of 1993), which cover shall remain in force whilst any workman is present on the Site.

C3.5.23 ENVIRONMENTAL MANAGEMENT

C3.5.23.1 Environment Management Plan

The Contractor shall comply fully with all provisions of the environmental plan. During the duration of the contract, the Contractor may be required to take specific measures not covered by the EMP to protect the environment.

The Contractor shall prior to the commencement of any construction prepare and submit a comprehensive Construction Environmental Management Plan (CEMP), which should address the management and monitoring of environmental impacts related to this contract, for approval by the Employer's Agent.

The CEMP shall clearly demonstrate how the Contractor intends mitigating damage to the environment, as a result of their construction activities.

The Contractor will further be required to appoint a competent Environmental Liaison Officer (ELO), who will be responsible for monitoring the Contractor's operations on site, as well as compliance with regard to the EMP, CEMP and associated legislation.

Further, the ECO will submit his/her Environmental Audits at monthly site meetings, for discussion by all role players.

No additional payment will be made in this regard, other than those preliminary and general items scheduled.

C3.5.23.2 Methods and Procedures

The following, together with the Construction Environmental Management Programme, shall be applied regarding the operation and maintenance of the site:

- Before setting up any construction work camp or stockpile site for equipment, the Contractor must liaise with the Employer's Agent, ECO and the relevant landowner and reach agreement regarding the location, layout and demarcation of any camp to be established, including any compensation to be paid to the landowner;
- All equipment and materials, particularly potentially hazardous substances, shall be securely stored in lockable structures and all reasonable steps taken to prevent theft or use by unauthorized personnel;
- The site shall always be kept in a neat and tidy condition. Papers and packaging shall be binned and removed from site and waste stockpiles shall be properly demarcated and the waste removed at regular intervals and disposed of at a registered waste disposal site.
- Natural vegetation shall not be damaged unnecessarily, and the working areas of the site be kept to the minimum reasonably possible for construction. An environmental awareness training programme for the construction staff should be implemented by the Contractor/sub-contractor(s) and all workers made aware of the recommended mitigation measures to be implemented.
- No wild animals (birds, snakes, lizards, game, etc.), domestic stock or indigenous plants are to be disturbed unnecessarily in any way by the construction activities or by the construction staff.
- All topsoil (containing indigenous plant seeds, rootstock, etc.) removed – that may be required in future rehabilitation – should be carefully stockpiled for later rehabilitation.

- Measures need to be taken to ensure that contamination from the work camp and lay-down site does not pollute adjacent areas. This should include the diversion of natural run-off away from the works and the containment thereof in drainage retention areas, where applicable.
- Water from dewatering operations shall be disposed of so as not to return to the working area nor to cause damage or erosion to surrounding areas.
- Dust from stockpiles and access roads shall be controlled by watering.
- Precautions need to be taken against oil spillage from heavy equipment through the use of sand or sawdust drip trays. All material (including soil) contaminated with hydrocarbons should be disposed of as hazardous waste at a registered waste disposal site.
- Any object of historical interest that may be uncovered in the course of the works shall immediately be protected and reported to the Employer's Agent for further action. There is a legal requirement to report any archaeological site of cultural significance to the National Monuments Council, according to the National Heritage Act (Act No. 25 of 1999).
- The Contractor shall check and supervise his own work and the work of his sub-contractors to ensure that all work is carried out in accordance with the EMP.
- Sources of imported material shall be listed and approved by the ECO and shall be free of weeds, seeds of alien plants, litter and contaminants;
- No hazardous substances may be disposed of on site;
- The storage of flammable liquids and substances should strictly comply with specifications;
- Adequate fire-fighting equipment must be readily available at the materials storage and dispensing areas;
- Adequate precautions shall be provided to prevent spillage during the filling of any tank with flammable and hazardous liquids and during the dispensing of the contents;
- The site shall at all times be kept in a neat and tidy condition – papers and packaging shall be disposed of into scavenger- and weatherproof bins and the waste removed at regular intervals;
- Wherever possible, materials used or generated by construction shall be recycled;
- Provision shall be made for employee facilities including shelter, toilets, washing and eating facilities;
- Sanitation facilities supplied by the Contractor for the workers shall be maintained in a hygienic state and serviced regularly;
- Contaminated water, run-off and/or effluent should be prevented from discharging into the groundwater, any water course, drain or sea and should be contained and disposed of at a site approved by the Employer's Agent and Local Authority;
- Water from dewatering operations shall be disposed of so as not to return to the working area nor to cause damage or erosion to surrounding areas;
- Dust shall be minimized as far as reasonably possible and controlled by watering;
- Natural vegetation shall not be damaged unnecessarily and the working areas of the site and along the pipelines shall be kept to the minimum reasonable possible for construction;
- The Contractor should manage and minimize any noise generated on site so as not to disturb nearby residents;
- Final audit: On completion of the works, but before the construction site is handed back to the Employer, a thorough environmental inspection or audit impacted by the construction activities shall be carried out and any 'problematic' or damaged areas shall be made good or rehabilitated to the satisfaction of all parties.

C3.5.23.3 Fires and Burning of Vegetation

Under no circumstances whatsoever may fires be lit anywhere on the site of the Works.

C3.5.23.4 Preservation of Flora and Fauna and Soil Conservation

The Contractor shall :

a. take all precautions to prevent:

   i) any damage to trees, shrubs and the surrounding natural environment,

   ii) fires,

   iii) loss or injury to domestic or wild animals from any lands used or occupied by the Contractor

b. refrain from destroying, removing or clearing trees, timber and scrub to any extent greater than is absolutely necessary for the execution of the contract

c. ensure that no vegetation, trees or shrubs outside the site boundaries are disturbed, damaged or destroyed. A penalty of R2,000 per incident may be charged to the Contractor,

d. take care to cause the minimum disturbance to the fauna and flora,

e. take measures as to ensure that his employees are aware of and abide by all laws and restrictions governing the hunting, disturbing, capturing or destroying of animals and birds in the vicinity of the camp or the Works or the taking of fish from any water; and

f. prohibit all firearms from the site and temporary camps.

C3.5.23.5 Protection of Trees, Shrubs and Surrounding Environment

The Contractor shall ensure that no trees, shrubs or the surrounding natural environment outside the site boundaries are disturbed, damaged or destroyed.

A penalty of R2,000 per tree or shrub damaged or destroyed or for damage to the natural surrounding environment may be charged to the Contractor. The Employer's Agent shall have the right to permanently exclude any person from the site who causes any damage to the natural environment.

C3.5.23.6 Prevention of Poaching

The Contractor shall ensure that none of his employees partake in any poaching activities of any nature during the duration of the contract.

Any person caught poaching shall be banned from the site of the Works and shall be prosecuted under the relevant laws.

The Contractor shall be liable for a fine of R5,000 for the first incidence of poaching committed by any of his employees, whether the employee is prosecuted or not. The fine shall double for each and every incident thereafter up to a maximum of R20,000 per incidence. Repeated incidents may be considered as cause for cancellation of the contract in terms of Clause 9.2.1.3.6 of the GCC 2015.

C3.5.24 LEGISLATION

C3.5.24.1 Changes in legislation

Reference in the General Conditions of Contract and in any other standard document forming part of this contract to legislation which has been amended or superseded by other legislation since the most recent publication of such standard document, shall be deemed to be a reference to the amended or replacement legislation.

Such amendment or replaced legislation shall be applicable during the Contract Period, provided the amendment or replacement occurred more than 28 days prior to the closing date for tenders, in terms of Clause 6.8.4 of the GCC 2015, as amended in Part 1 of the Contract Data.

C3.5.24.2 The Occupational Health and Safety Act

The Contractor shall be required to comply with the latest revision of the *Occupational Health and Safety Act, 1993, the Construction Regulations 2014 as promulgated in the Government Gazette No. 37305 of 07 February 2014* and any subsequent amendments thereto. Non-compliance with these regulations in any way whatsoever will be adequate reason for suspension of the Works.

The proposed type of work, materials to be used and hazards likely to be encountered on this Contract are detailed in the Scope of Work, Pricing Instructions and Drawings.

The Contractor shall, in terms of Sub-clause 5(1) provide a comprehensive health and safety plan, detailing his proposed compliance with the Regulations, for approval by the Employer.

C3.6: SPECIFICATION DATA

SECTION	DESCRIPTION	PAGE Nº
C3.6.1	LIST OF APPLICABLE STANDARDIZED SPECIFICATIONS	73
C3.6.2	VARIATIONS AND ADDITIONAL CLAUSES TO THE APPLICABLE STANDARDIZED SPECIFICATIONS	74

The Specification Data gives amendments and additions to the specifications that are listed in the List of Applicable Specifications. Clause headings are prefixed by the letters "PS" followed by alphabetic and numeric characters which identify the specification and main clause of the applicable specification. Where the Specification Data sub-clause is an addition and there is no appropriate clause in the applicable specification to which to link it, a new clause number is given following the last clause number used in the specification. New clauses are followed by an asterisk (*).

Should any requirement of the Specification Data conflict with any requirement of the specifications listed, the requirement of the Specification Data shall prevail.

Where the context requires, words importing the singular also include the plural and vice versa, and words importing the masculine gender also include the feminine and neuter.

C3.6.1 LIST OF APPLICABLE STANDARDIZED SPECIFICATIONS

SABS	1200 A	General
SABS	1200 AB	Engineer’s Office
SABS	1200 C	Site Clearance
SABS	1200 DA	Earthworks
SABS	1200 DB	Earthworks (Pipe Trenches)
SABS	1200 DM	Earthworks (Roads, Subgrade)
SABS	1200 G	Concrete (Structural)
SABS	1200 HA	Structural Steelwork (Sundry Items)
SABS	1200 HB	CLADDING AND SHEETING
SABS	1200 HC	CLADDING AND SHEETING
SABS	1200 L	Medium-pressure Pipelines
SABS	1200 LB	Bedding (Pipes)
SABS	1200 LD	Sewer (Pipes)
SABS	1200 LE	Stormwater Drainage

Preface on Interim Situation until full suite of SANS Series Specifications are Available

The Bill of Quantities is based on the SABS 1200 system of specifications and measurement.

Where SANS specifications are available, these have been incorporated into the “Contract” section of this document.

Where overlapping specifications from the SANS 2001 series of specifications occur the appropriate SABS 1200 specifications have been incorporated into the Project Specifications.

In such cases, the requirements of the SABS 1200 specifications shall prevail over the requirements of the SANS specification(s).

The payment clauses in the Bill of Quantities are based on the SABS 1200 series of specifications for consistency and the Tenderer is required to ensure that he has priced all of the requirements pertaining to the SABS specifications.

C3.6.2 VARIATIONS AND ADDITIONAL CLAUSES TO THE APPLICABLE STANDARDIZED SPECIFICATIONS

INTRODUCTION

In certain clauses the standard, standardised and particular specifications allow a choice to be specified in the project specifications between alternative materials or methods of construction and for additional requirements to be specified to suit a particular contract. Details of such alternative or additional requirements applicable to this contract are contained in this part of the project specifications. It also contains additional specifications required for this particular Contract.

The number of each clause and each payment item in this part of the project specifications consists of the prefix PS followed by a number corresponding to the number of the relevant clause or payment item in the standard specifications. The number of a new clause or payment item, which does not form part of a clause or a payment item in the standard specifications and which is included here, is also prefixed by PS, but followed by a new number which follows on the last clause or item number used in the relevant section of the standard specifications.

STATUS

In the event of any discrepancy between a part or parts of the Section C3.1 to C3.5 and the Standardized or Particular Specifications, Section C3.1 to C3.5 shall take precedence. In the event of a discrepancy between the Specifications, (including Sections C3.1 to C3.6), the Bill of Quantities, and the drawings, the drawings take precedence, thereafter the Bill of Quantities. In all events, the discrepancy shall be brought to the attention of the Employer's Agent before the execution of the work under the relevant item.

In addition to the Standard Project Specifications the following Particular Specifications shall apply to this Contract and are bound in hereafter.

C3.7: PROJECT SPECIFICATIONS

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PSA : GENERAL
(Applicable to SABS 1200 A – 1986)

PSA 3 MATERIALS

PSA 3.1 Quality and Samples

Add to the Sub-Clause:

No used or recycled material may be used in the Works unless expressly authorised by the Engineer.

Materials specified as being to the approval of a Standard Bureau shall bear the official mark of the appropriate standard.

Samples of concrete aggregates are to be delivered to an approved laboratory.

PSA 4 PLANT

PSA 4.2 Contractor's Office, Stores & Services (Refer SANS 1921-1 Clause 4.14)

Add to the Sub-Clause:

Neither housing nor shelters are available for the Contractor's employees, and the Contractor shall make his own arrangements to house his employees and transport them to site.

The site camp will be made available by the employer (fenced, meeting room, Engineer Representative's office, two parking bay for the Engineer Representative and his assistance and the Contractor's office). The Contractor must not cut down or damage any trees nor make any excavation without the written permission of the Engineer and will be required to restore the site to its original condition on completion of the works.

On completion of the Works or as soon as the Contractor's facilities are no longer required the Contractor shall remove such facilities and clear away all surface indications of their presence.

PSA 5 CONSTRUCTION

PSA 5.1.2 Preservation and Replacement of Beacons and Pegs subject to the Land Survey Act (Refer SANS 1921 - 1 Clause 4.15)

Add to the Sub-Clause :

The Engineer will arrange for any pegs that are missing to be replaced at the Contractor's expense.

All survey reference marks shall be clearly marked and protected by the erection of three fencing standards.

All plot boundary pegs shall be painted and marked with fencing droppers.

PSA 5.4 Protection of Overhead and Underground Services (Refer SANS 1921-1 Clause 4.17)

Delete title and substitute the following :

Protection of Visible and Underground Services (Sub-Clause 5.4).

PSA 5.6 Pollution

Add to the Sub-Clause :

The Contractor shall take all reasonable measures to minimise any dust nuisance, noise, pollution of streams and inconvenience to or interference with the public or others arising out of the execution of the Works.

PSA 5.7 Safety (Refer SANS 1921-1 Clause 4.18)

Add to the Sub-Clause :

All work and particularly work carried out in the proximity of buildings, bridges, tanks or other structures shall be carried out in conformance with the regulations framed under the Occupational Health and Safety Act, 1993 and the Minerals Act, Act 50 of 1991, including shoring where necessary, to ensure the safety of structures that are at risk. This clause shall be read in conjunction with the particular specification for health and safety.

The Contractor shall enter into an agreement on Occupational Health and Safety as per the pro forma bound into this document.

The Contractor shall make available for the duration of the contract safety helmets, gumboots and any other necessary safety equipment for sole use by the Engineer and his representative(s).

PSA 5.9 Protection of Structures (new sub-clause)

Where work is carried out in the proximity of buildings, bridges, buried services, tanks, wall or other structures, the Contractor shall take all necessary precautions required in terms of the regulations framed under the Occupational Health and Safety Act, (Act Nº 85 of 1993) to ensure the safety of structures and services that are at risk.

PSA 6 TOLERANCES

PSA 6.2 Degrees of Accuracy

Add to the Sub-Clause :

Generally, Degree of Accuracy II shall be applicable to the whole of the Works, unless specified otherwise (refer specifically to PSD 6 and PSG 6).

PSA 8 MEASUREMENT AND PAYMENT

PSA 8.2.1 Fixed-Charge and Value-Related Items

Add to the Sub-Clause :

The amount, if any, by which the sum of the fixed-charge and value-related items exceeds three percent of the net total tendered amount (excluding allowances for contingencies and price escalation) shall be regarded for payment purposes as time-related items and will be paid in accordance with Clause 8.2.2. (refer to Clause C2.1 (e) of the Pricing Instructions)

PSA 8.2.2 Time-related Items (refer to Clause C2.1 (e) of the Pricing Instructions)

Add to the Sub-Clause :

Notwithstanding the provisions of Sub-Clause 8.2.2, an approved extension of time will not qualify the Contractor to receive any payment for that portion of fixed charge and value-related items which has become regarded as "time-related" items in terms of PSA 8.2.1 above.

PSA 8.4.2.2 Temporary Works – Dealing with Water on Works

Add to the Sub-Clause :

The sum in PSA 8.4.2.2 (h) shall cover the cost of providing, operating and maintaining the necessary equipment and other temporary works for dealing with groundwater in trenches and excavations.

PSA 8.5 Sums stated provisionally by the Engineer

Add the following new subclauses to A 8.5:

PSA 8.5(c) Community Liaison Officer

In addition to the requirements of clause 8.4.3 of SANS 1200 A, the Contractor shall allow for a Community Liaison Officer for the duration of the Contract. A provisional sum is included in the Schedule of Quantities for the payment of a C.L.O. Provision is also made in the Schedule of Quantities for the Contractor to include a mark-up on the amounts paid.

PSA 8.5(d) Skills training

In addition to the requirements of Clause 8.4.3 of SANS 1200 A the Contractor shall allow for skills training by an accredited trainer to be approved by the Engineer of some of the local labourers who will be employed on site. A provisional sum is included in the Schedule of Quantities for the payment for skill training. Provision is also made in the Schedule of Quantities for the Contractor to include a mark-up on the amounts paid.

PSA 8.8.2 Dealing with Traffic (to be read in conjunction with SANS 1921 – Part 2)

Add the following to A 8.8.2:

This item shall include for the supply, erection and maintenance of all temporary road signs and delineators and for flagmen that may be required, in terms of the South African Road Traffic Signs Manual, for any and all road crossings and work within the road reserve for the full duration of the work within the road reserve. All road signs and delineators shall be new.

The tendered sum for the accommodation of traffic shall include full compensation for all items necessary for such accommodation and the construction and maintenance of bypasses including existing roads used as bypasses during the construction period. It shall also include full compensation for traffic control, the provision of traffic signs, (where necessary), communications equipment required to regulate traffic, for the construction of any necessary temporary drainage works, for the maintenance of all drainage works, arranging the moving of services and subsequent reinstatement thereof, attending to traffic problems and complying with the requirements of the Road Traffic Ordinance and the relevant local authorities.

Payments shall be made in equal monthly instalments from the date of commencement of such work to the end of the contract period.

PSAB : ENGINEER'S OFFICE
(Applicable to SABS 1200 AB - 1986)

PSAB 2 INTERPRETATIONS

PSAB 2.1(b) Supporting Specifications

Delete the Sub-Clause and substitute the following :

SABS 1200 A

PSAB 2.3 Definitions

Delete the first two lines and substitute the following :

For the purposes of this specification the definitions given in SABS 1200 A shall apply:

PSAB 3 MATERIALS

PSAB 3.1 Nameboards

In the 3rd line delete “South African Institution of Civil Engineers” and substitute with “Consulting Engineers South Africa”.

In the 4th line add “and the logo and name of the Municipal Infrastructure Grant” before the words “and the names and titles....”

PSAB 3.2 Office Building(s)

Delete the first sentence and substitute the following:

Where required, the Contractor shall furnish one temporary office for the sole use of the Engineer and his staff. The office is situated at the specified Contractor’s offices.

Add to the Sub-Clause :

In addition to the furnishings listed under sub-items (a) to (i), the following shall be provided and properly maintained :

(a) If power is to be used by the Contractor on site :

electrical installation is to include a light and one 15A plug point plus an adequately sized air conditioning unit (for heating and cooling) or, alternatively, one 2000 W electric heater and one 375 mm diameter electric fan.

or

(b) If power is unlikely to be available on site:

one gas operated light and one gas operated heater plus an adequate supply of gas.

(c) one refrigerator of at least 100 litre capacity

(d) one kettle of at least 2 litre capacity

(e) one tea set comprising six cups and saucers, six teaspoons, one teapot, one sugar bowl and one milk jug

(f) covered parking for two vehicles

(g) two “Barhold” or similar wall mounted racks each with 6 clamps suitable for hanging A0 sized drawings

(h) one large meeting table

(i) ten additional chairs

PSAB 4 PLANT

PSAB 4.1 Telephone

The Contractor shall not be required to provide a telephone for the sole use of the Engineer or his Representative.

PSAB 4.2 Survey Equipment (New Sub-Clause)

The Contractor shall provide the following survey equipment on the Site from the commencement to the completion of the Works :

- One theodolite capable of reading to six seconds of arc and tripod
- One automatic level and tripod
- One levelling staff (4 m long, 1 cm gradations)
- One staff angle bubble
- One metal change-point for levelling
- One spirit level (one metre long)
- Two steel-tipped ranging rods each 2,5 m long
- One 25 m stilon tape
- One 5 m steel tape
- One hammer (2 kg)
- Steel pegs in sufficient quantities as required

The above equipment may be shared by arrangement between the Contractor and the Engineer or his representative on Site. The Contractor shall maintain the equipment in good working order and keep it clean until the completion of the Works. The Contractor shall keep the equipment continuously insured against any loss, damage, or breakage and he shall indemnify the Engineer and the Employer against any claims in this regard. Upon completion of the Works the survey equipment as listed above shall revert to the Contractor.

PSAB 5 CONSTRUCTION

PSAB 5.2 Engineer's Office (Refer SANS 1921-1 Clause 4.14)

Add to the Sub-Clause:

The toilet facilities provided for the sole use of the Engineer or his representative(s) shall include hand washing facilities and shall be maintained in a hygienic and sanitary condition and shall be removed on completion of the Works. The facilities provided shall conform to the local health authority's requirements as applicable and the Contractor shall pay all sanitary fees and charges.

PSAB 5.5 Survey Assistants

Delete the first sentence and substitute the following :

The Contractor shall make available to the Engineer two suitably trained labourers for use on and about the site on survey and other work directed by the Engineer at all reasonable times.

PSAB 8 MEASUREMENT AND PAYMENT

PSAB 8.1 Scheduled Items

Delete the first sentence and substitute the following:

Items will be scheduled in terms of Sub-Clauses 8.3.2 & 8.4.2 of SABS1200 A.

PSAB 8.2.1 Fixed and Time-related Charges

Delete the first sentence and substitute the following:

The terms of Sub-Clause 8.2 of SABS 120 AA shall apply.

Add to the Sub-Clause:

The Tenderer is to include, under the Time-Related Charges, a Prime Cost Sum of R300,00 per week for a period of time equal to the Time for Completion of the Contract to cover the cost of the Resident Engineer's telephone calls and internet access.

PSAB 8.2.2 (a) Laboratory Testing

It is not an express condition of this contract that the Contractor need erect a laboratory.

A provisional sum is included in the Scheduled of Quantities for the payment of the acceptance control testing (by a commercial laboratory) solely for use by the Engineer.

Provision is also made in the Schedule of Quantities for the Contractor to include a mark-up on the amounts paid.

PSC: SITE CLEARANCE
(Applicable to SABS 1200 C – 1980 As Amended 1982)

Note: Particular Specification PI: Employer's Environmental Management Specification for Environmental Management of construction projects, and Particular Specification

PSC 3 MATERIALS

PSC 3.1 Disposal of Material

Add to the Sub-clause:

Material obtained from clearing must be disposed of off-site by the Contractor at his expense. Disposal of combustible material by burning will not be permitted. The Contractor will be held responsible for observing the by-laws and regulations of the relevant local authority and for any injury to persons and damage to property caused by any fire starting on site, in his camp, or a fire started for any reason by his employees, regardless of whether such injury or damage is the direct or indirect result of such fire.

PSC 5 CONSTRUCTION

PSC 5.2.3.2 Individual Trees

Delete the second sentence of the Sub-Clause and substitute the following:

The amount of the penalty payable by the Contractor for the removal or damage by him of a tree designated for preservation shall be as stated in the Employer's Environmental Management Specification and/or Environmental Management Plan (EMP).

PSC 5.3 Clearing

Add the following new Sub-Clauses:

PSC 5.3.1 Fences (New Sub-Clause)

Where the pipeline route crosses an existing fence, a section of fencing not exceeding 10,0m in length may be removed temporarily during construction and thereafter reinstated to a condition not worse than the original as soon as the pipeline has been installed and backfilled in the immediate vicinity of the crossing. For the period while the existing fence is dismantled, the Contractor shall erect, at the end of each day's operations, a temporary fence to close the gap in the existing fence.

PSC 5.3.2 Demarcation & Fencing of Pipeline Servitudes (New Sub-Clause)

Demarcation of the pipeline construction servitude will be by means of wooden stakes. These stakes will be at least 1m high, painted white and placed at least every 30m on either side of the linear feature, in all areas where works are occurring. The stakes shall be moved as required as the project progresses.

PSC 5.3.3 Fencing of Pipeline Servitudes in Populated Areas (New Sub-Clause)

In populated areas and where directed by the Engineer the Contractor shall also supply, install and maintain temporary fencing on both sides of the working area (servitude) and around the perimeter of all agreed additional working areas during construction for prevention of unauthorised access and shall remove on completion of the works. The fencing shall comprise 2m high Bonnox 4 x 4 Mesh fencing, Bonnox pattern 1972/4, with straining posts and straining wires as required and according to supplier's directions and with mesh spacing not exceeding 100mm in both the vertical and horizontal directions. Chevron tape shall be interwoven in a zig zag pattern from the top to the bottom of the fence thereby clearly marking off the working area.

Gates shall be provided by the Contractor at all points as required for construction access purposes. The Contractor shall be held responsible for the control of access at these gates at all times as well as to the worksite during removal and re-erection of fencing. No other opening in the fence shall be permitted and the Contractor shall be responsible for monitoring the fencing on a daily basis and repairing any such opening within the same day that it is detected. Notices in two official languages (English and isiZulu) shall be attached to the fence where appropriate to indicate that the site is for personnel employed on the Contract only and that unauthorised entry is forbidden.

PSC 5.4 Grubbing

In the fourth line delete “200mm” and substitute 300mm.

PSC 5.6 Conservation of Topsoil

Add to the Sub-Clause:

All topsoil shall be conserved for later use by stockpiling, clear of the working area.

PSC 5.8 Demolition of Structures

Add the following new Sub-Clauses:

PSC 5.8.1 Removal and Re-Erection of Structures

Where the Contractor is directed to dismantle structures to facilitate construction and thereafter to re-erect the same structures, the structure shall be erected at the same location, or such other location as may be required by the owner within the same property, using the same or similar materials as those set aside when removing the structure. The acceptance of the work by the Engineer and certification for payment shall be subject to the Contractor submitting to the Engineer documentary evidence of the owner’s satisfaction that the re-erected structure, the over-riding consideration being that it shall be in a condition no worst than that pertaining prior to its removal.

The tendered rates shall include for the provision of a detailed photographic and written record of the structures before dismantling commences and following re-erection.

PSC 5.8.2 Demolition of Building Structures

Where the Contractor is directed to demolish structures, the Contractor shall provide a Method Statement for the approval of the Engineer. Entering upon the premises for the purpose of the demolition shall not commence before the Contractor has received a release form, duly authorised by representatives of the Employer and the Engineer, in which any special conditions applicable to the demolition are documented.

PSC 8 MEASUREMENT AND PAYMENT

PSC 8.2 Scheduled Items

PSC 8.2.9 Transport Materials and debris to unspecified sites and dump

Delete the sub-clause and substitute:

The cost of cartage to the unspecified disposal site(s) shall not be paid separately and shall be deemed to be included in the Contractor’s rates for site clearance.

PSC 8.2.10 Remove Topsoil to a Nominal Depth of 150 mm and Stockpile

Delete from the sub-clause heading the words: 'to a Nominal Depth of 150 mm'

Add to the Sub-Clause:

The topsoil, where approved by the Engineer, shall be conserved for later use by stockpiling clear of the working area.

PSC 8.2.11 Fences (New Sub-Clause)

Separate payment will be made for dealing with fences in the manner specified in PSC 5.3.1 above as scheduled.

PSC 8.2.12 Demarcation Staking (New Sub-Clause)

Payment will be made per linear metre in the manner specified in PSC 5.3.2 above and removal on completion of the works.

PSC 8.2.13 Fencing of Pipeline Servitudes in Populated Areas (New Sub-Clause)

Payment will be made per linear metre of temporary fencing installed in the manner specified in PSC 5.3.3 above, and the rate shall include for maintaining such fencing in good condition, including daily surveillance and repair, throughout the duration of construction and removal on completion of the works.

PSC 8.2.14 Removal and Re-Erection of Structures (New Sub-Clause)

A Provisional Sum has been included for the removal and re-erection of structures within pipeline route servitudes.

Separate payment will be made for removing and re-erecting structures in the manner specified in PSC 5.8.1 above as scheduled and including for the costs of photographic and written records.

PSDA : EARTHWORKS (SMALL WORKS)
(Applicable to SABS 1200 DA – 1988 (as amended 1990))

PSDA 2 INTERPRETATIONS

PSDA 2.3 DEFINITIONS

DELETE THE SENTENCE FOLLOWING THE WORDS "Restricted excavation." *AND REPLACE WITH*:

"An excavation so restricted in area or width as to preclude removal of material by excavating machinery used for bulk excavation measured in terms of Subclause 8.3.1(b). Restricted excavation may be carried out by smaller machinery or by hand, as selected by the Contractor. The extent of restricted excavation shall be as scheduled and/or shown on the drawings; all other excavation shall be regarded as bulk excavation."

PSDA 3 MATERIALS

PSDA 3.1 CLASSIFICATION FOR EXCAVATION PURPOSES

PSDA 3.1.1 Method of Classifying

DELETE THE FIRST PARAGRAPH AND REPLACE WITH:

"The Contractor may use any method he chooses to excavate, subject to the requirements of the project specifications, but his chosen method of excavation shall not determine the classification of the excavation."

PSDA 3.2 EMBANKMENTS AND BACKFILL

PSDA 3.2.1 General

ADD THE FOLLOWING:

“Embankment material shall be compacted to 90% modified AASHTO density.”

ADD NEW SUBCLAUSE:

“PSDA 3.3 EMBANKMENTS

Sufficient material arising from excavations for structures, foundations, footings and the like and which is suitable for forming embankments and backfilling against finished structures shall be temporarily stockpiled in the vicinity of the structures. All other material from the excavations shall be disposed of as directed by the Engineer."

PSDA 4 PLANT

ADD NEW SUBCLAUSES:

“PSDA 4.3 COMPACTION PLANT

Where plant is used for applying the dynamic load, controlling the moisture content and grading or mixing, the plant shall be capable of achieving the compaction specified using the material available for the construction of the Works.

PSDA 4.4 RESTRICTION ON USE OF PLANT

Where the Contractor finds it impractical to use mechanical plant for excavation or to complete portions of the work due to restrictions caused by difficult access or the presence of existing structures, pipelines or services shown on the tender drawings, the Contractor shall satisfy himself as to the alternative requirements when entering rates against the appropriate items in the Bill of Quantities as no claim for extra payment based on the inability to use plant in such circumstances will be considered.

PSDA 4.5 VIBRATION LOADINGS FROM USE OF PLANT

The onus will be on the Contractor, when proposing to use heavy plant or equipment to complete work in close proximity to existing structures, pipelines or services, to determine the effect of the vibration loading from the plant or equipment on the supporting ground or foundation and the structure, pipeline or service and take all necessary steps to ensure that the stability or integrity of the element concerned is not compromised by the particular selection and use of plant or equipment.

Any damages caused to existing elements directly or indirectly arising out of the use of plant and equipment in close proximity shall be made good, to the satisfaction of the Engineer by the Contractor at his own expense."

PSDA 5 CONSTRUCTION

PSDA 5.1 PRECAUTIONS

PSDA 5.1.1 Safety

PSDA 5.1.1.1 Barricading and lighting (Refer SANS 1921-1 Clause 4.18.2 and 4.18.3)

DELETE THE SUBCLAUSE AND REPLACE WITH:

"Without limiting any obligation which the Contractor may have in terms of any Act, Ordinance or other legislation, the Contractor shall ensure that all excavations which are accessible to the public or which are adjacent to a public road or thoroughfare, or by which the safety of persons may be endangered are protected as set out in the General Safety Regulations of the Occupational Health and Safety Act, 1993 and that watchmen are employed to ensure that barricades, barriers and lights are effective at all times.

Trench excavations shall be protected by means of at least two horizontal double sided ‘red/white’ chevron tapes approved by the Engineer. The tapes shall be stretched tightly between supports along both sides and ends of the excavation at levels approximately 0,45 m and 1,12 m above the ground. The supports shall consist of poles or iron standards securely planted in solid ground at not more than 10 m centres so as to enclose the spoil and the excavations.

Bridges for vehicles and/or pedestrians shall be provided along the route of the work as and where may be considered necessary by the Engineer. They shall consist of a number of suitably sized steel plates laid across open excavated trenches. They shall be protected on each side by a stout two rail timber safety barrier, at least 1 m high, consisting of 150 x 75 mm timber verticals set firmly into the ground, 75 mm x 50 mm rails securely fastened to them. At least 4 lamps or reflective markers must be provided at each crossing.

Where construction is in, or across, public roads the barricades or barriers and temporary road signs shall be erected. All such signs and positioning thereof shall comply with the requirements set out in Road Signs Note 13 read in conjunction with the SA Road Traffic Signs Manual."

PSDA 5.1.1.2 Safeguarding of excavations (Refer SANS 1921-1 Clause 4.18.3)

IN SUBCLAUSE (a) *DELETE THE WORDS* "Machinery and Occupational Safety Act" *IN THE THIRD AND FOURTH LINES AND REPLACE WITH* "regulations to the Occupational Health and Safety Act, 1993."

PSDA 5.1.1.3 Explosives (Refer SANS 1921-1 Clause 4.7)

ADD NEW SUBSUBCLAUSES:

"(a) Notwithstanding Subclause 5.1.1.3, the Engineer shall be notified at least 48 hours beforehand of the Contractor's intention to use explosives on site.

It shall be incumbent on the Contractor to make himself aware of the restrictions to blasting imposed by electric transmission or telephonic lines and other similar services. Where the presence and location of electric transmission or telephonic lines, etc, are known or are shown on the Engineer's drawing at tender stage; the Contractor must make allowance in his rates and programmes for restrictions and delays which may result from restrictions imposed by the authorities.

(b) Generally, the Contractor will be permitted to use explosives for breaking up rock and hard material during excavations, for demolishing existing structures and for such other purposes where it may normally be required, subject to the following conditions:

(i) The Engineer or Inspector of Explosives shall have the power to prohibit the use of explosives in cases where in his opinion, the risk of injury or damage to persons, property or adjoining structures is too high. Such action by the Engineer shall not entitle the Contractor to any additional payment for having to resort to other less economical methods of construction unless otherwise provided in the Contract Data or Bill of Quantities.

(ii) Should blasting be necessary, the Contractor shall take every precaution to protect the Works and persons, animals and property in the vicinity of the site. The Contractor will be held responsible for any injury or damage caused by any blasting operations and shall make good such damage at his own expense.

(iii) The requirements for the Explosives Regulations Act (Act 26 of 1956) and the requirements of the Inspector of Explosives shall be complied with. In addition, where applicable, the requirements of Chapter 9 of the Regulations published in terms of the Mines and Works Act (Act 27 of 1956) and the requirements of the Government Mining Engineer shall be complied with.

(iv) A copy of each blasting permit issued to workmen, and of each permit issued to the Contractor to cover the purchase, storage and transport of explosives, shall be handed to the Engineer. The Contractor shall grant the Engineer access to all records maintained for the Inspector of Explosives or the Government Mining Engineer, as the case may be.

(v) Before any blasting is undertaken, the Contractor, together with the Engineer shall examine and measure up any buildings, houses or structures in the vicinity of the proposed blasting and establish and record together with the owners thereof the extent of cracking or damage that may exist before commencement of blasting operations. It is advised that a photographic record will be required of neighbouring

structures before blasting commences. These structures will be pointed out by the Engineer. It shall be the responsibility of the Contractor to make good at his own expense any further damage to such houses, buildings or structures which is a result of the blasting.

(vi) Where there is reasonable danger of damage to power and telephone lines or any other property, the Contractor shall suitably adapt his methods of blasting, the size of the charges and use adequate protective measures such as cover blasting in order to limit the risk of damage as far as possible.

(vii) When blasting to specified profiles, the Contractor shall so arrange the holes and charges that the resulting exposed surfaces are as sound as the nature of the material permits. The Contractor shall make good at his own expense any additional excavation necessitated by the shattering of rock in excess of any overbreak allowance specified in the Specification Data or in any other specification or given on a drawing."

ADD NEW SUBCLAUSES:

"PSDA 5.1.1.4 Limitations for Blasting

(a) Approval of methods and keeping of records

No blasting work may be carried out prior to the Engineer's approval being given in writing.

Prior to starting any drilling for the first section of blasting, the Contractor shall submit for approval to the Engineer, details of the proposed overall methods of blasting that will be used on site, including spacing, depth and pattern of holes, charging levels (kg/m^3), spacing and positioning of relays, method of blast initiation, precautions to prevent 'fly rock', maximum charge per relay, traffic arrangements during blasting, and any other details he may consider relevant. These details shall be submitted in writing and supported with sketches at least 7 days before the commencement of drilling and blasting.

The Engineer will evaluate these details in relation to the given limitations and prior to giving his approval, will indicate to the Contractor any changes that may possibly be needed to comply with the limitations.

For all subsequent blasts, the Contractor shall, at least 24 hours beforehand, notify the Engineer of the intention to blast and at the same time shall note if any changes will be made relative to the approved method.

The Engineer reserves the right to order the Contractor to modify his method of drilling and blasting, or to employ reduced blasting, without thereby invalidating the Contract. The Contractor shall have no claim for extra payment, over and above his tendered rates, due to his being ordered to use such a different method of drilling or blasting or reduced charges, regardless of any prior approval by the Engineer of any previous method.

After every blast, the Contractor shall, within 24 hours, submit to the Engineer details of the actual total mass of explosives used, the approximate volume of material loosened and the maximum simultaneous mass of explosives detonated (maximum charge per relay).

Notwithstanding any approval given by the Engineer, the Contractor shall at all times be responsible for the safety of the Works, persons, animals and property in the vicinity of the Site during blasting operations.

(b) Vibrations

Blasting vibrations are caused by the transmission of the shock wave from the explosion charge through the material being blasted. This shock wave could cause damage to structures in the vicinity of the blasting if the vibrations are not limited to acceptable levels. Damage to structures is closely associated with peak particle velocity of the ground vibrations in the vicinity of the structure. Advisable maximum levels for peak particle velocity are given in Table 2.

Table 2: Maximum Particle Velocities (Vibration)

MAXIMUM PEAK PARTICLE VELOCITY (mm/s)	EFFECT ON PEOPLE AND BUILDINGS
0,5	Threshold of human perception unlikely to cause damage of any type
5	Limit for blasting adjacent to historical monuments
25	Limit for blasting near private dwellings in order to reduce disturbance to residents to a minimum
50	Limit for blasting adjacent to residential structures on good foundations
84	Limit for property owned by concern doing the blasting (i.e. minor plaster cracks acceptable)
120	Recommended maximum level for blasting adjacent to sturdy reinforced concrete structures

The peak particle velocity V is related to the distance D from the blast and the maximum mass of explosive E instantaneously detonated (maximum charge per relay) by the general equation:

$$V = \left(\frac{k}{D}\right)^{m} x\ E^{n}$$

where k, m and n are constants for a particular set of circumstances. V is in mm/s, D is in metres and E is in kilograms. Experimentation has shown that n = 0,5 but k and m have to be determined for each site by means of vibration measurements. However, blasting can be safely conducted without vibration measurements or expert advice if the following relationship is used:

$$V = \left(\frac{1150}{D}\right)\ x\ E^{0.5}$$

which gives the maximum charge levels for V = 50 mm/s listed in Table 3.

Table 3: Maximum Charge Levels

MINIMUM DISTANCE FROM NEAREST BLAST HOLE STRUCTURE (m)	MAXIMUM CHARGE MASS PER RELAY (kg)
10	0,19
20	0,76
30	1,7
40	3,0
50	4,7
60	6,8
70	9,3
80	12,1
90	15,3
100	18,9

Only detonating relays of at least 20 milliseconds delay interval shall be used.

The above relationship can be used to calculate charge mass for other velocity limits. However, if higher charge levels have to be used for practical reasons, expert advice and possibly vibration measurements will be required.

Notwithstanding the above blasting limits, the Contractor shall at all times be responsible for the safety of the Works, person, animals and property in the vicinity of the Site during blasting operations.

PSDA 5.1.1.5 Negligence

The Contractor shall be liable for all damages to services caused as a result of the Contractor's negligence."

PSDA 5.1.2 Protection of Structures

ADD TO THE SUBCLAUSE:

"Protection will be required for every building structure that encroaches within the pipeline servitude as shown on the drawings. Payment items are provided in respect of each of these structures for the protection of the structure and the tendered rates will be deemed to include for all costs associated with working within a restricted working width.

During the site clearance operations, the Contractor shall notify the Engineer of any structure that is not included in the scheduled items in the Bill of Quantities for protection or for demolition but that in his judgment requires protection under Clause PSDA 5.1.2. After due investigation the Engineer will consider the Contractor's proposal regarding the protection or demolition of the structure."

PSDA 5.1.3 Existing Services (Refer SANS 1921-1 Clause 4.17)

ADD TO THE SUBCLAUSE:

"All existing services on the site may not be shown on the Drawings or be visible on the site. The Engineer may order excavation by hand in order to search for and expose services. An item has been included in the Bill of Quantities to cover the cost of such work if so ordered by the Engineer.

Where a service is damaged because of the Contractor's negligence, he shall be liable for the costs involved in the repair of the service and any other costs consequent upon the interruption of the damaged services."

PSDA 5.1.4 Stormwater and Groundwater

DELETE THE THIRD SENTENCE AND REPLACE WITH:

"Except where the use of tremies has been approved, foundation excavations for structures shall be kept free of water at all times until they have been inspected and approved and the concrete substructures, together with their related superstructures, have been completed."

PSDA 5.1.5 Excessive Pollution (Refer SANS 1921-1 Clause 4.19)

ADD THE WORDS "noise and", *BEFORE THE WORD* "dust" *IN THE SECOND LINE*.

PSDA 5.1.6 Excavated Material not to Endanger or Interfere (Refer SANS 1921-1 Clause 4.10)

DELETE THE SENTENCE: "If the necessity ……..will be borne by the Employer."

DELETE THE LAST SENTENCE AND REPLACE WITH:

"All material that is unsuitable or not required for backfilling (surplus material) shall be disposed of as described in C.3.5.5.2. No additional payment will be made for these activities."

PSDA 5.1.8 Road Traffic Control

DELETE FROM THE THIRD AND FOURTH LINES, THE WORDS "and such barricades and warning lights as are ordered" *AND ADD TO THE SUBCLAUSE*:

"An item has been included in the Bill of Quantities to cover the relevant costs."

PSDA 5.2 METHODS AND PROCEDURES

PSDA 5.2.1 Site Preparation

DELETE THE LAST SENTENCE AND REPLACE WITH:

"Material so removed shall be disposed of by the Contractor to Sites designated by the Engineer."

PSDA 5.2.2 Excavation (Refer SANS 1921-1 Clause 4.10)

ADD THE FOLLOWING TO SUBCLAUSE (d):

"In order to minimize potential differential settlement of the shallow foundations for the proposed new works in relation to existing or new valve chambers or undermining of the existing structures, it may be necessary to carry out ground improvement.

Once excavation to the base of the existing structure has taken place, a Dynamic Cone Penetration Test (DCP) shall be carried out to a minimum depth of 1 m to ascertain the necessity or otherwise to carry out the ground improvement. DCP results of ≥ 5 blows per 100 mm are deemed to indicate the presence of stiff clays.

Where stiff clays are encountered in the 1 m zone below the existing structure, it is recommended that the clay is immediately blinded with a lean mix of concrete and construction proceeds on the basis of a 'raft' type foundation / base slab supporting the sidewalls of the new structure.

If the clays are soft or loose sand is encountered, vertical lightweight trench sheeting is to be vibrated or driven down as close as possible to the existing foundations for a distance of at least 1,0 to 1,2 m below founding level.

The base area shall then be over-excavated, both vertically and horizontally, and the material shall be replaced with well compacted granular material (G6 minimum). The surface shall be blinded with a lean concrete mix after removal of the trench sheeting, following which the base slab to support the sidewalls shall be cast."

DELETE PARAGRAPH (f) *OF THE SUBCLAUSE AND REPLACE WITH*:

"(f) Borrow pits where and when ordered shall be so maintained that they do not become a danger to persons and livestock. The necessary access shall be constructed to each site. Topsoil and overburden shall be stockpiled temporarily and, on completion of the work, returned to and spread over the area of the borrow pit in such a manner that the sides are graded 1:2 and the floor is self-draining, or otherwise as directed. Any access constructed by the Contractor shall be scarified and the area reinstated.

ADD THE FOLLOWING SUBSUBCLAUSES:

"(h) Where outside shuttering is ordered by the Engineer, the excavations shall be carried out for an extra width of not more than 600 mm all around the structure, measured from the base of the face to be shuttered, to allow for the shuttering to be fixed, this extra excavation and refilling where necessary is to be measured and paid for under quantities allowed for this purpose in the Bill of Quantities. Outside shuttering shall be used for the construction of all major structures unless ordered otherwise by the Engineer.

(i) Where permanent concrete is to be placed against an excavated face, the excavation shall be trimmed to ensure that there is no projection greater than 20 mm protruding into the excavation profile.

(j) The Contractor shall not spoil, waste or stockpile excavated material without approval."

PSDA 5.2.3 Placing

PSDA 5.2.3.1 Embankments

IN THE THIRTEENTH LINE DELETE "600 mm" AND REPLACE WITH "300 mm"

IN THE SIXTEENTH LINE DELETE "300 mm" AND REPLACE WITH "150 mm"

DELETE THE NINETEENTH LINE AND REPLACE WITH THE FOLLOWING:

"Each layer shall be compacted to achieve 90% modified AASHTO density except where indicated otherwise on the Drawings."

PSDA 5.2.3.2 Restricted backfill and compaction at structures

DELETE THE EIGHTH AND NINTH LINES AND REPLACE WITH:

"not exceeding 250 mm and compacted by means of mechanical tampers to achieve a 90% modified AASHTO density except where indicated otherwise on the Drawings."

PSDA 5.2.5 Finishing

PSDA 5.2.5.2 Topsoiling

DELETE THE CONTENTS OF SUBCLAUSE 5.2.5.2 AND REPLACE WITH THE FOLLOWING:

"Where scheduled, topsoil shall be placed on all surfaces and on embankments and shall be lightly compacted by wheeled vehicles or by tamping, and trimmed neatly to the required lines grades and levels. The final thickness of topsoil after compaction shall be at least 200 mm. Prior to topsoiling, the surfaces to be topsoiled shall be prepared by pulling horizontal ruts into the soil with the tines of a front-end loader or other suitable method to retard erosion of the topsoil."

PSDA 5.2.6.1 Freehaul

DELETE THE CONTENTS OF SUBCLAUSE 5.2.6.1 AND REPLACE WITH THE FOLLOWING:

"All haul will be regarded as freehaul. No overhaul will be paid under this contract."

PSDA 5.2.6.2 Overhaul

DELETE THE SUBCLAUSE.

PSDA 6 TOLERANCES

PSDA 6.2 PERMISSIBLE DEVIATIONS

ADD THE FOLLOWING PERMISSIBLE DEVIATIONS FOR WORK TO DEGREE OF ACCURACY II:

"

6.2(a)	1 2 3 4	 From direction of slope Between 1/100 and 1/300 1/400 and flatter	± 300 mm ± 100 mm ± 50 mm Nil 10% 5%
6.2(b)	1 2 3 4		± 35 mm ± 50 mm ± 50 mm ± 15 mm
6.2(c)	1	Read '-2% + 1%' in place of ' ± 2%'	

"

ADD NEW SUBCLAUSE:

"**PSDA 6.3 EXCAVATION BY MECHANICAL MEANS**

Where bulk excavation is carried out by earthmoving equipment, such excavation will only be allowed to within a level of 300 mm, or less as ordered by the Engineer, above the general level to which the ground has to be reduced, the balance of the bulk excavation being carried out by hand or by other means approved by the Engineer."

PSDA 7 TESTING

ADD NEW SUBCLAUSES:

"**PSDA 7.4 DELAY FOR INSPECTION AND TESTING FOUNDATIONS**

In the case of the structure(s) listed hereunder, the prices quoted in the Bill of Quantities and the programmed time for carrying out foundation excavations shall include for up to seven days delay to permit the Engineer to carry out tests or to get an expert opinion on the exposed foundation, should he consider these to be necessary. No claim for standing time or other extra cost for such delay will be accepted by the Engineer, neither will an extension of time be granted, except where the delay exceeds 7 days.

The structure(s) to which this Subclause applies is as follows:
Biofilter Recycle Pumping Station.
Various meter chambers

PSDA 7.5 TESTS FOR THE CONTRACTOR'S ACCOUNT

The Contractor shall make arrangements with a soils testing laboratory to undertake the following tests and to pass the test results to the Engineer. The costs of such tests shall be included in the rates tendered for the appropriate item in the Bill of Quantities.

(a) Material imported from outside the Contract Site as working surfaces, subgrade improvement or for fill material

One CBR and indicator test per 200 m^3 of compacted material brought on to site, (river sand will normally be exempted from this requirement). A sample and one CBR and indictor test of the material proposed for importation shall be submitted to the Engineer for approval prior to the commencement of importation.

(b) Fill material in place

One density and moisture content test per 100 m^3 of compacted fill.

(c) Compacted subgrade or finished level

One density and moisture content test per 200 m^2 of compacted surface area. Should any of the above density tests fail to comply with the specified requirements, the Contractor shall at his own expense remedy the failure and submit a new test to the Engineer.

PSDA 7.6 DETERMINATION OF COMPACTION

Determination of the standard of compaction achieved shall be carried out in accordance with Standard methods of testing road construction materials published by the Department of Transport Division of National Roads, Publication TMH.1.

PSDA 7.7 TESTS AT THE EMPLOYER'S REQUEST

Where CBR, indicator tests and the like are required on materials from within the Contract Site the Contractor shall also make arrangements with a soils testing laboratory to undertake these tests, the costs of which have been allowed for in the Bill of Quantities as a Provisional Sum. Payment for such tests will be per sample tested and reported to the Engineer. "

PSDA 8 MEASUREMENT AND PAYMENT

PSDA 8.1 BASIC PRINCIPLES

PSDA 8.1.1 *DELETE THE THIRD LINE OF THE FIRST SENTENCE AND REPLACE WITH*:

"material in backfilling, forming embankments, etc., including any necessary additional offloading, stock-piling and reloading and the cost of disposal of any"

IN THE SEVENTH LINE DELETE "Drawing DA-2" AND REPLACE WITH "Fig DA-2"

ADD TO THE SUBCLAUSE:

"Unavoidable over-excavation for structures located in boulder formation will be measured and paid for up to a maximum of 600 mm in Class A boulder formation and 300 mm in the case of Class B boulder formation, as applicable, as measured beyond the required outline of the structure and at right angles to it."

PSDA 8.1.2 *DELETE THE FIRST LINE OF THE FIRST SENTENCE AND REPLACE WITH:*

"Excavations which are required to be backfilled, or partially backfilled, will be measured as if taken out"

DELETE THE FIFTH AND SIXTH LINES AND REPLACE WITH:

"other such structures, the volume will be measured from the finished outline of the concrete, or the blinding to the concrete (as the case may be), as shown on the Drawings."

PSDA 8.1.3 *DELETE THE THIRD LINE AND REPLACE WITH*:

"will be measured as part of the bulk excavation or restricted excavation, as applicable".

PSDA 8.3 SCHEDULED ITEMS

PSDA 8.3.1 Excavation

(a) Remove topsoil to nominal depth, 150 mm, stockpile and maintain

ADD TO THE SUBCLAUSE:

"Where removal to greater depths is ordered, the area measured for payment will unless otherwise scheduled, be increased pro rata to the average increase in depth".

(b) Excavate in all materials and use for embankment or backfill or dispose, as ordered

REPLACE "Drawing DA-1" *IN THE THIRD LINE WITH* "Fig DA-1".
DELETE THE THIRD LINE OF THE SECOND SENTENCE AND REPLACE WITH:

"-ation, offloading to stockpile, stockpiling and reloading as may be necessary, spreading or backfilling, compacting and watering"

(c) Extra-over for

REPLACE "Drawing DA-1" IN THE LAST LINE WITH "Fig DA-1".

PSDA 8.3.2 Restricted Excavation

(a) Excavate for restricted foundations, footings and trenches in all materials and use for backfill or embankment or dispose

REPLACE "Drawing DA-2" *IN THE FOURTH LINE WITH* "Fig DA-2".

(b) Extra-over for

ADD TO THE SUBCLAUSE:

"(3) boulder excavation Class A .....Unit: m^3

(4) boulder excavation Class B .....Unit: m^3

DELETE THE LAST TWO LINES AND REPLACE WITH:

(a) above for any portion of the excavated material that is classified as intermediate, hard rock, boulder Class A or boulder Class B as applicable."

PSDA 8.3.3 Overhaul

DELETE THE SUBCLAUSE AND REPLACE WITH:

"(a) Overhaul (provisional) .....Unit m^3.km

Overhaul is applicable only when the appropriate information set out in 5.2.6.1(b) was not available to the Contractor at the tendering stage.
Volumes will be computed from designated dimensions. No allowance will be made for bulking.
Overhaul distances will be measured to the nearest 0,1 km from the limit of the freehaul range, in one direction only, by the shortest practical route."

PSDA 8.3.4 Importation of Materials from Commercial Sources or from Borrow Pits

DELETE THE LAST FIVE LINES.

ADD THE FOLLOWING SUBITEMS:

"(a) For Embankment Construction **.....**Unit: m^3

The rate shall cover the cost of royalties (if any) and acquiring suitable material, loading, transporting with freehaul distance, unloading, spreading in layers not exceeding 150 mm thick, watering, compacting to 90% Mod AASHTO density, trimming slopes of embankment to required outline all in accordance with the Specifications. The rate shall also include for carrying out density testing and the disposal of any surplus material.

(b) For Backfilling around Structures .....Unit: m^3

The rate shall cover the cost of royalties (if any) and acquiring suitable material, loading, transporting with freehaul distance, unloading, spreading in layers not exceeding 150 mm thick, watering, compacting to 90% Mod AASHTO density, trimming upper surfaces to the required outline all in accordance with the Specifications."

ADD THE FOLLOWING ITEMS IN SUBCLAUSE 8.3:

"PSDA 8.3.9 Additional Compaction.....Unit: m^3

Where so scheduled additional compaction over that required to achieve 90% Mod AASHTO density in order to achieve the scheduled higher density shall be paid for by the volume so compacted.

The rate shall include for all additional plant, labour and materials necessary to achieve the additional compaction scheduled.

PSDA 8.3.10 Survey of Surrounding Structures before Blasting ..... Unit: Sum

The rate shall cover the cost to examine and measure up any buildings, houses or structures in the vicinity of the proposed blasting and establish and record together with the owners thereof the extent of cracking or damage that may exist before commencement of blasting operations. The rate shall cover the cost of providing a photographic record of neighbouring structures before blasting commences.

PSDA 8.3.11 Protection of Structures: Buildings .....Unit: Sum or No

The rates shall cover the cost of examining and measuring up any buildings, houses or structures that encroach within the pipeline servitude and establishing and recording, together with the owners thereof, the general condition and/or damage that may exist before commencement of blasting operations, including the cost of providing a photographic record, the costs of reduced working width, and the costs of any special working methods required to protect the structure throughout the course of the nearby construction work. This shall include, where required, but is not necessarily limited to, the use of shoring or lateral trench support and the placing of barriers to demarcate restricted working area in the vicinity of the structure.

PSDB : EARTHWORKS (Pipe Trenches)
(Applicable to SABS 1200 DB - 1989)

PSDB 3 MATERIALS

PSDB 3.1 CLASSES OF EXCAVATION

ADD TO SUBCLAUSE:

"Notwithstanding the provisions of Subclause 3.1, the materials excavated other than hard rock shall not be classified for purposes of measurement and payment. The unit rate for excavation shall cover excavation in all materials other than hard rock and where scheduled separately boulders classes A and B (as specified in SABS 1200 DA Subclauses 3.1.2(d) and 3.1.2(e)."

PSDB 3.3 SELECTED GRANULAR MATERIAL

ADD TO SUBCLAUSE:

"The requirements for bedding material (padding) for steel pipes is given in PSLB 3.3."

PSDB 3.4 SELECTED FILL MATERIAL

DELETE THE SENTENCE "The requirements ..... shall apply." *AND REPLACE WITH*:

"All material up to the underside of backfill shall be measured as selected granular. The requirements for bedding material (padding) for steel pipes is given in PSLB 3.3."

PSDB 3.5 BACKFILL MATERIAL

IN THE THIRD LINE OF SUBSUBCLAUSE (a) *DELETE* "150 mm" *AND REPLACE WITH* "100 mm".

IN THE SECOND LINE OF SUBSUBCLAUSE (b) *DELETE* "PI not exceeding 12" *AND REPLACE WITH* "PI not exceeding 6."

ADD THE FOLLOWING NEW SUBSUBCLAUSE (c):

"(c) Cement Stabilised Backfill

Where scheduled, or directed by the Engineer, backfill shall be stabilised with 5% cement by mass. The backfill material shall have a plasticity index not exceeding 10 and all material must pass through a sieve of aperture size not exceeding that specified in SABS 1200 LB, Subclause 3.2, as amended.

The dry materials shall first be mixed in a concrete mixer, thereafter sufficient water is to be added to produce the stiffest consistency available for placing and compacting with vibrators."

PSDB 3.6 MATERIALS FOR REINSTATEMENT OF ROADS AND PAVED AREAS

DELETE THE SUBCLAUSE AND REPLACE WITH:

"Material used in the reinstatement of roadways shall fall into the following relevant categories:

(a) Foundation material recovered from the excavation of trenches across existing roadways which, if so instructed by the Engineer, shall be set aside and re-used as sub-base material.

(b) New material which shall conform to the requirements of:
   (i) Clause 3.2.1 of SABS 1200 ME for the Subbase
   (ii) Clauses 3.2 and 3.3 of SABS 1200 MF for the Base course
   (iii) Clause 3.2.2 of SABS 1200 ME for the Gravel Wearing Course
   (iv) Clause 3 of SABS 1200 MH for the asphalt surfacing."

PSDB 3.7 SELECTION

DELETE THE SECOND SENTENCE AND REPLACE WITH:

"The Contractor is not required to use selective methods of excavating but shall, if so instructed by the Engineer, screen or otherwise treat excavated material in order to produce material suitable for the bedding cradle or the bedding blanket."

PSDB 4 PLANT

PSDB 4.1 EXCAVATION EQUIPMENT

IN THE FIRST LINE DELETE "The Contractor" *AND REPLACE WITH*: "In sections deemed to be suitable for excavation by mechanical means, the Contractor"

ADD TO THE SUBCLAUSE:

"Should any portion of a pipe trench exceed the specified depth, the Contractor will be held responsible for any additional costs which may arise as a result of such over-excavation. Concrete filling or imported compacted fill may be ordered by the Engineer to be placed below the bottom of the trench."

PSDB 5 CONSTRUCTION

PSDB 5.2 MINIMUM BASE WIDTHS

ADD TO THE SUBCLAUSE:

"Trench sides shall be as near vertical as possible in order to minimise the quantity of backfill material required and to avoid possible difficulties where pipelines have to be installed parallel to existing services, fences, hedges, etc and to minimise the loading on the pipe.

The base width for trenches for cables, ducts and unbedded flexible continuous piping, of external diameter less than 125 mm laid at a depth not exceeding 1,5 m, shall be equal to the external diameter of the cable, duct or pipe, plus a side allowance of 200 mm on either side."

PSDB 5.4 EXCAVATION

ADD TO THE SUBCLAUSE:

"Except where otherwise specified, trenches shall be of such depth as to result in a minimum cover over the pipes of 800 mm except at road-crossings where the minimum cover over the pipes shall be 1 000 mm.

Where the pipe trench crosses surfaced roads the Contractor shall neatly cut two parallel grooves into and through the 'black top' before excavating between the grooves. The grooves are to be set back at least 200 mm from the edge of the excavation face to prevent ravelling of the cut edge. The cost of this operation, where not scheduled separately, will be held to be covered in the general rates for excavation."

PSDB 5.5 TRENCH BOTTOM

ADD TO THE SUBCLAUSE:

"In waterlogged conditions and/or where so instructed by the Engineer a 200 mm thick layer (See PSLB 5.2.5) of imported single sized stone (19 mm size unless otherwise instructed by the Engineer) with a geofabric filter surround ('Bidim' Grade A4 or similar approved) shall be constructed under the bedding layer specified for the pipes."

ADD THE FOLLOWING NEW SUBCLAUSE:

"PSDB 5.5.1 Jointing Holes

Jointing holes shall be cut of sufficient length and depth to allow for the proper making or bolting of pipe joints and to ensure that joint collars or sleeves do not rest on the trench bottoms. After the pipework has been inspected, tested and approved by the Engineer, the jointing holes shall be refilled with selected soft material free from stone (padding materials as specified under PSLB in the case of coated steel pipes) and then rammed to provide a continuous uniform support for the pipework. No specific payment will be made for forming and refilling holes, the cost of which is deemed to be included in the tendered rates."

PSDB 5.6 BACKFILLING

PSDB 5.6.1 General

ADD TO THE SUBCLAUSE:

"Notwithstanding the requirements of Subclauses 5.6.1 and 5.6.6, no pipe joint or pipe fitting shall be covered by either blanket or backfill material prior to the successful completion of the visual inspection and pressure testing of the relevant section of the pipeline.

All backfilling shall be carried out by hand and the Contractor must price his tender accordingly. No mechanical plant shall be used in backfilling without prior written consent of the Engineer."

PSDB 5.6.2 Material for Backfilling

DELETE FOURTH, FIFTH AND SIXTH LINES AND REPLACE WITH:

"Hard rock material shall not be used for, or incorporated into, the backfill above the bedding layers without the Engineer's approval."

PSDB 5.6.3 Disposal of Soft Excavation Material

ADD TO THE SUBCLAUSE:

"Surplus material or unsuitable material shall be disposed of offsite by the Contractor."

PSDB 5.6.4 Disposal of Intermediate and Hard Rock Material

ADD TO THE SUBCLAUSE:

"Surplus intermediate and hard rock material from trench excavations shall be disposed of off site by the Contractor."

PSDB 5.6.8 Transport for Earthworks for Trenches

DELETE THE SUBCLAUSE AND REPLACE WITH:

"The requirements of Subclause 5.2.6 of SABS 1200 DA as amended and as applicable shall apply."

PSDB 5.7 COMPACTION

PSDB 5.7.2 Areas subject to Traffic Loads

ADD AT THE END OF THE SUBCLAUSE:

"for an extent of 2 m on either side of the carriage-way at each crossing."

PSDB 5.9 REINSTATEMENT OF SURFACES

PSDB 5.9.4 Bitumen Roads, Subbase and Base

ADD TO THE SUBCLAUSE:

"Each Tenderer is required to make provision in his/her tender for allowances to cover the costs of reinstating all surfaces, inclusive of all layers to their conditions pertaining before the commencement of construction.

Items have been included in the Bill of Quantities to cover the reinstatement of certain surfaces (grassed lawns, concrete and/or asphalted/gravel driveways and/or roads) and for payment purposes, the area of those specific surfaces shall be calculated from the product of the length of the trench and the specified trench width plus 400 mm (refer PSDB 5.4)."

PSDB 8 MEASUREMENT AND PAYMENT

PSDB 8.1 BASIC PRINCIPLES

DELETE SUBCLAUSE 8.1.4 AND REPLACE WITH:

"Except that the volume will be computed as specified in 8.2.3, the requirements of Subclause 5.2.6.1 (Freehaul) of SABS 1200 DA as amended and as relevant, shall apply to freehaul.

No additional payment will be made for excavating and backfilling bell (fox) holes as the cost of that work will be deemed to be included in the rates for trenching."

PSDB 8.3 SCHEDULED ITEMS

PSDB 8.3.2 Excavation

(a) Excavate in all materials for trenches, backfill, compact and dispose of surplus material

IN THE SECOND SENTENCE DELETE "1,0 m" *AND REPLACE WITH* "as scheduled in the Bill of Quantities"

(b) Extra-over item (a) above for

ADD THE FOLLOWING SUBITEMS:

"(3) Hand excavation and backfill only where ordered by the Engineer .....Unit : m^3

(4) Backfill stabilised with 5% cement where directed by the Engineer .....Unit : m^3

(5) Boulder excavation Class A .....Unit : m^3

(6) Boulder excavation Class B .....Unit : m^3"

The tendered rates for (4) above shall include full compensation for selecting, mixing, backfilling and compacting of the stabilised material to 90% of modified AASHTO density.

Measurement of extra over for (5) and (6) above will not apply to any length of trench in soft material more than 2 m long. Surplus boulder material from trench excavation shall where applicable, be disposed of to the designated spoil areas except where shown otherwise on the drawings."

PSDB 8.3.3 Excavation Ancillaries

PSDB 8.3.3.1 Make up deficiency in backfill materials (provisional)

ADD TO THE SUBCLAUSE:

"Payment for imported, graded stone laid under pipelines in accordance with PSDB 5.5 shall be paid for under either Subclause 8.3.3.1(c) or as scheduled."

PSDB 8.3.3.4 Overhaul

DELETE THE SUBCLAUSE AND REPLACE WITH:

"All haul will be regarded as free haul."

PSDB 8.3.5 Existing Services that Intersect or Adjoin a Pipe Trench

ADD TO THE END OF THE SUBCLAUSE:

"(v) all work involved in locating the service by hand excavation

(vi) notifying and attending upon the owner of the service

(vii) supporting and protecting the service while the pipeline is installed, inspected, tested and backfilled."

PSDM EARTHWORKS (ROADS, SUBGRADE) (SABS 1200 DM)

PSDM 1 SCOPE

This specification shall also apply to earthworks under paved areas.

PSDM 5 CONSTRUCTION

PSDM 5.2 Methods and Procedures

PSDM 5.2.2 Cut and Borrow

Minimum excavation should be required. The road prism or area under paving must be graded with any localised high or low points levelled or filled so as to present a smooth surface without abrupt changes in elevation or grade. The levelled prism shall be watered and compacted to achieve 90% MOD AASHTO density (100% for sand).

Any localised soft spots shall be excavated to the extents agreed with the Engineer and filled with G5 material compacted to 90% MOD AASHTO density.

PSDM 6 TOLERANCES

PSDM 6.3 Selected Layer

The permissible deviations from designated levels under paved areas shall be +0 -15

PSDM 7 TESTING

PSDM 72 Process Control

A minimum of 1 test per $10m^2$ under paved areas is required. Areas smaller than $10m^2$ shall have a minimum of one test per such area.

In Table 1 Column 3 and Column 4 change the area or volume to which one test is applied, and the number of tests per lot, to the following:

Column 3	Column 4
$100m^3$	2
$200m^2$	2
$150m^2$	2
$100m^2$	1
$250m^2$	2

PSG: CONCRETE (STRUCTURAL)
(Applicable to SABS 1200 G - 1982)

PSG 2 INTERPRETATIONS

PSG 2.4 EXPLANATION OF TERMS

PSG 2.4.3 Joints

DELETE THE FOURTH SENTENCE AND REPLACE WITH:

"The Engineer may order further joints prior to the commencement of casting the relevant concrete wherein they are situated. Such joints will become 'designated joints' and will be paid for in terms of Subclause 8.5, or as may be otherwise agreed. However, should the Contractor require further joints to suit his own purposes he shall first obtain the approval of the Engineer. Such further joints may then be constructed but these will not be 'designated joints' nor will they be paid for."

PSG 3 MATERIALS

PSG 3.2 CEMENT

PSG 3.2.1 Applicable Specifications

ADD TO THE SUBCLAUSE:

"The standard cement specifications SABS 471, SABS 626, SABS 831 and SABS 1466, referred to in clause 3.3, have been withdrawn and are replaced by the new SANS 50197-1 and -2: Common Cements, and SANS 50413-1 and -2: Masonry Cement. These specifications will be applicable to this Contract, and the descriptions and types of cements specified, will be based on the designations as defined in these specifications.

Unless agreed to otherwise by the Engineer, the cement used on the Works shall be Ordinary Portland Cement (OPC) or PC15 (or equivalent in terms of SABS ENV 197-1; i.e. CEM I, CEM II A-S, CEM II A-V, CEM II B-S or CEM II B-V)."

PSG 3.2.2 Alternative Types of Cement

ADD TO THE SUBCLAUSE:

"Pulverised Fly Ash (PFA) used on the works shall be from an approved source and shall comply with the requirements of SANS 50450-1 & 2.

Ground granulated blast furnace slag used on the works shall be from an approved source and shall comply with the requirements of SANS 55167-1 & 2."

PSG 3.2.3 Storage of Cement

ADD TO THE SUBCLAUSE:

"Cement and PFA shall be stored in a closed structure or container and shall not be kept in storage for longer than two months without the Engineer's permission."

PSG 3.4 AGGREGATES

PSG 3.4.1 Applicable Specifications

ADD TO THE SUBCLAUSE:

"Sand from a source selected by the Contractor and approved by the Engineer after testing by the Contractor will be used under this Contract."

PSG 3.4.2 Use of Plums

ADD TO THE SUBCLAUSE:

"The use of plums will be permitted only in mass concrete fill if agreed to by the Engineer."

ADD NEW SUBCLAUSE:

"PSG 3.4.4 Dolomitic Aggregates

Where scheduled, aggregates for structural concrete shall be of dolomitic origin. The quantity of insoluble matter in respect of concrete made with aggregates of dolomitic origin, determined according to the method described in SABS 677, Appendix C, shall not be more than 15%."

PSG 4 PLANT

PSG 4.5 FORMWORK

PSG 4.5.1 Design

ADD TO THE SUBCLAUSE:

"The Contractor shall arrange for a Professional Engineer to design and sign the drawings for the formwork (including all supports) to be used for suspended slabs and roofs."

PSG 4.5.2 Finish

DELETE THE CONTENTS OF THIS SUBCLAUSE AND REPLACE WITH:

"The quality of the finished surfaces of the concrete shall be as scheduled or as shown on the drawings."

PSG 4.5.3 Ties

ADD TO THE SUBCLAUSE:

"After removal of ties, all ferrules are to be drilled out of the concrete to provide an oversized reamed hole free of all remnants of the ferrule and blown out to remove all dust and other loose material.

The surface of the hole is to be primed by well wetting with a cement/SBR latex slurry and the hole filled by caulking with a cementitious mortar consisting of 1 part cement to 2 parts concrete sand by volume, well mixed with sufficient clean water to obtain the required consistency. This grout is to be well tamped into the hole to completely fill same and provide a dense, void-free plug. The surface is to be trowelled to finish flush with the surrounding area."

PSG 5 CONSTRUCTION

PSG 5.1 REINFORCEMENT

PSG 5.1.2 Fixing

DELETE FROM THE EIGHTH AND NINTH LINES THE FOLLOWING:

"or, if permitted by the Engineer, by welding".

PSG 5.2 FORMWORK

PSG 5.2.5 Removal of Formwork

ADD TO SUBSUBCLAUSE 5.2.5.2:

"Where test cubes to determine stripping times are not made, the minimum periods, which shall elapse between the time of the placing of the concrete and the time of removal of the forms shall, unless otherwise agreed with the Engineer, be in accordance with the table hereunder, where each day covers a full 24 hour period. The following table 2 supersedes table 2 in SABS 1200 G.

Table 2: Removal of Formwork (Minimum stripping time in days (24 h))

	CEM I		CEM II/A & CEM II/ B (MAX 29% EXTENDER)		CEMII/B (30-35% EXTENDER)	
Type of Structural Member or Formwork	**Normal weather (Above 15° C)***	**Cold weather (Below 5° C)***	**Normal weather (Above 15° C)***	**Cold weather (Below 5° C)***	**Normal weather (Above 15° C)***	**Cold weather (Below 5° C)***
Beam sides, wall or unloaded columns	1	2	2	4	2	6
Slabs, with props left underneath	4	7	5	8	6	10
Beam soffits, props left in place	7	12	8	14	10	17
Removal of slab props	10	17	10	17	12	21
Removal of beam props	14	21	14	21	18	28

*Average daily temperature of the atmosphere adjacent to the concrete as measured by a maximum and minimum thermometer. When the average daily temperature is between 5°C and 15°C the minimum stripping times shall be interpolated from the table.

The table assumes that the member concerned is not subjected to any heavy construction loads and that the total force to be supported is not more than half the design load. Where heavier loads are to be carried, no stripping of soffits shall be permitted until the concrete has attained its full strength. Any days during which the average temperature was below 2°c shall be completely disregarded.

In the case of walls and columns the stripping times shall be determined by means of cube test results in the first instance, so as to ensure that no damage is caused to the structures by removing formwork."

ADD TO SUBSUBCLAUSE 5.2.5.5:

"Special attention is to be paid to the repair and sealing of shutter-ties in all water retaining concrete to ensure watertightness."

PSG 5.3 HOLES, CHASES, AND FIXING BLOCKS

ADD TO THE SUBCLAUSE:

"Fixing blocks for the attachment of fixtures may be embedded in concrete provided that the strength or any other desirable feature (such as appearance) is not, in the opinion of the Engineer, impaired thereby."

PSG 5.5 CONCRETE

PSG 5.5.1 QUALITY

PSG 5.5.1.2 Consistency

DELETE THE CONTENTS OF PARAGRAPH (b) AND REPLACE WITH:

"(b) by the Engineer in respect of prescribed mix and strength concrete, or"

PSG 5.5.1.5 Durability

ADD TO THE SUBCLAUSE:

"The exposure conditions at the site of the Works are to be considered as being severe."

PSG 5.5.1.6 Prescribed mix concrete

DELETE THE FOURTH TO TENTH LINES INCLUSIVE FROM THE SUBCLAUSE AND REPLACE WITH THE FOLLOWING:

"The grades of prescribed mix concrete are designated 15/19 and 10/40 and are composed of cement, sand and stone, as specified hereinbefore, proportioned as follows:

Prescribed Grade	Size of Stone (mm)	Cement (kg)	Sand (m^3)	Stone (m^3)
15/19	19	50	0,130	0,160
10/40	37,5	50	0,160	0,225

While the proportion of cement to the combined quantity of sand and stone must remain constant for each grade of concrete, as set out above, the relative proportions of sand and stone are to be adjusted, if required by the Engineer, so as to obtain the most suitable consistency of concrete, due allowance being made for the bulking of sand due to moisture.

The addition of water shall be regulated by the use of properly calibrated containers, only sufficient water shall be added, as in the opinion of the Engineer, to afford a workable mix.

The fine and coarse aggregates approved for use in strength concrete as specified in Subclause 5.5.1.7 are to be used for prescribed concrete mixes Grades 20/19 and 15/19."

PSG 5.5.1.7 Strength concrete

DELETE THE SUBCLAUSE AND REPLACE WITH THE FOLLOWING:

"There shall be two grades of strength concrete used on the works designated Grades 35/19, 25/19, and composed of cementitious material, sand and stone as specified hereinbefore.

The use of concrete admixtures (plasticisers, retarders, accelerators, etc) shall not be permitted.

(a) Grade 35/19 Concrete for Water Retaining Structures

For Grade 35/19 concrete Ordinary Portland Cement (OPC) and Pulverised Fly Ash (PFA) shall be blended together such that the combined cementitious material comprises 70% OPC and 30% PFA by mass.

The minimum content of combined cementitious material shall be not less than 360 kg and not more than 450 kg per cubic metre of concrete and the minimum cement/water ratio shall be 2,0.

The characteristic cube strength at 28 days shall be not less than 35 MPa.

The concrete mixes for the abovementioned grades of strength concrete are to be designed by an approved laboratory. At least six weeks before placing any concrete on the works the Contractor shall supply and deliver to the laboratory, at his own cost, samples of the aggregates he proposed to use in the concrete mixes. The Contractor shall include in his tender for all the fees and charges levied by the laboratory and all other costs incurred in designing and adjusting the strength concrete mixes."

ADD NEW SUBCLAUSES:

"PSG 5.5.1.8 No-Fines concrete

No-fines concrete shall be composed of cement and coarse aggregate only, the fine aggregate being omitted from the mix. The proportions of the cement and stone shall be one part by volume of cement to eight parts by volume of stone.

The stone shall comply with the grading requirements of 19 mm single-sized crushed stone to Table 7 of SABS 1083.

Only sufficient water shall be added to the mix to produce a smooth grout to completely cover each and every particle of aggregate.

Proportions may be varied on site with the approval (or to the direction) of the Engineer to obtain a more satisfactory result. The upper surface of the no-fines is to be finished off with a wood float to provide a smooth working surface while adding just sufficient dry mix mortar (1 to 8) to close the upper surface of the voids in order to prevent ingress of foreign matter into the interstices.

Mixing shall be carried out in a mechanical batching plant and the hopper shall first be charged with the aggregate to which a small quantity of water has been added to moisten the aggregate particles. The cement shall then be added followed by the remainder of the water.

The no-fines concrete shall be placed within 20 minutes of having been mixed and shall be rodded and hand-tamped into position. The use of vibrators will not be permitted.

No traffic shall be permitted to traverse the surface of the no-fines concrete during the three days following upon placing and then only over planks or boards placed for that purpose.

PSG.5.5.1.9 Temperature of concrete

The temperature of the concrete delivered to site from a batch plant or a concrete supplier shall be measured prior to placing and shall be within the range 10°c and 30°c. Concrete which has a temperature outside of that range shall be rejected and shall not be placed in the structure."

PSG 5.5.2 Batching

PSG 5.5.2.3 Aggregates

ADD TO THE SUBCLAUSE:

"Batching is to be by mass using an approved type of weigh-batching plant."

PSG 5.5.3 Mixing

PSG 5.5.3.2 Ready-mixed concrete

DELETE THE FIRST *SENTENCE AND REPLACE WITH THE FOLLOWING*:

"Concrete produced at a central facility, other than at the site of the Works, shall not be accepted for use in the Works except with the prior and express approval of the Engineer. When such approval has been given the Engineer will then decide whether or not to accept the test results obtained by the facility concerned.

The use of concrete from a ready-mixed concrete facility shall be permitted subject to the following provisos:

- The facility shall be accredited as being compliant with the requirements of the ISO 9001-2000 standard.
- The concrete batching plant shall be inspected by the Engineer for compliance with SABS specifications and his approval must be obtained in writing before commencement of the concrete works.
- Before any ready-mixed concrete is used on the works, the Contractor shall furnish the Engineer with a copy of his letter to the supplier in which was specified:
  - (I) the type of cement(s);
  - (ii) the nominal maximum sizes of aggregates;
  - (iii) the cement / water ratios;
  - (iv) the required compressive strengths;
  - (v) the required slump at the time and place of delivery; and
  - (vi) the type of additive - documentary evidence proving the suitability of the additive for use in the concrete, particularly in the grade 35/19 water retaining concrete, shall be given to the Engineer for his prior approval.

The following shall be specified in the Contractor's contract/order with the ready-mixed concrete supplier and a copy of the relevant documentation shall be given to the Engineer's Representative:

- A maximum delivery period of 90 minutes from the time water is added to the concrete mix to the actual completion of the discharge of concrete on site shall be permitted. The discharge period (including placing the concrete) shall not exceed 30 minutes.

- The concrete slump of every truckload shall be measured on delivery to site as soon as discharge commences and it shall comply with Clause SABS 1200 G 5.5.1.2 prior to any concrete from that truck being placed. No additional water may be added to the mix after it has left the batching plant without the written approval of the Engineer's Representative. Under no circumstances shall the cement/water ratio for concrete in water retaining structures be less than 2,0.
- A detailed computer printout of the constituents of the concrete mix from the batching plant is to be handed over to and retained by the Engineer's Representative on site on arrival (i.e. truck registration, mix proportions and the time water was added to the mix). The masses of the concrete constituents of each truck shall be checked against that of those submitted with the trial mix, subject to the batching accuracy as specified in SABS 0100-2: 1992. The arrival time of each truck on site and the time that the concrete discharge is completed shall also be recorded by the Engineer's Representative. Dedicated truck drivers shall be used, where possible, for the delivery of the concrete to site.
- When required the Contractor shall satisfy the Engineer that acceptable alternative means of supplying concrete have been arranged and can be brought into operation in the event of disruption in the supply of concrete. In this regard, the Engineer may require that the alternative means of supply shall commence if the disruption in the supply of ready-mixed concrete has lasted for a period of 1½ hours.
- The use of ready-mixed concrete will in no way relieve the Contractor of any of his obligations for providing concrete that complies with the specifications."

PSG 5.5.5 Placing

DELETE SUBCLAUSE 5.5.5.5 AND REPLACE WITH THE FOLLOWING:

"Dropping concrete freely will only be permitted if the Engineer is satisfied that this is the only practical method of placing."

DELETE SUBCLAUSE 5.5.5.9 AND REPLACE WITH THE FOLLOWING:

"The placing of concrete by pumping will not be permitted."

ADD NEW SUBSUBCLAUSES:

"PSG 5.5.5.10 Continuous walls

In the case of continuous walls, these are to be cast in lifts of such height that each lift can be poured uninterruptedly in one continuous operation over the entire perimeter of the wall. No vertical or inclined construction joints of any kind will be permitted in continuous walls unless they have been specifically ordered or authorised by the Engineer. The placing of concrete shall commence at convenient points on the perimeter of the wall and shall proceed both ways simultaneously so that fresh concrete meets fresh concrete. Any rest pauses, such as for meals, shall be avoided as far as possible, and the Contractor may be required by the Engineer to make the operation continuous by working in shifts. A workable arrangement must be made before each concreting operation commences.

PSG 5.5.5.11 Blinding layer

Beneath all structural grades of concrete, or elsewhere if so ordered by the Engineer or shown on drawings, the bottom of the excavation is to be covered by a blinding layer (screed) in Grade 15/19 concrete to a depth of 75 mm or 50 mm as shown on the drawings, to prevent disturbance of the ground and to serve as an even, clean and accurately positioned working floor for setting steel and placing foundation concrete. This blinding layer shall be laid immediately after excavations have been taken out, trimmed to the required depths and have been inspected and approved by the Engineer.

PSG 5.5.5.12 Under-drainage layer

Quantities have been included in the Bills of Quantities for the placing of a 75 mm thick no-fines concrete under-drainage layer between the top of the blinding layer and the underside of certain structural concrete floors."

PSG 5.5.7 Construction Joints

IN SUBSUBCLAUSE 5.5.7.3 DELETE PARAGRAPHS (a), (b), (c) AND (d) *AND REPLACE WITH:*

"PSG 5.5.7.3 Surface preparation of joints

(a) All horizontal and vertical construction joints shall be cleaned of all dirt and loose particles and shall be prepared to the satisfaction of the Engineer. Formed keys shall be provided if shown on the drawings or if instructed by the Engineer. All intersections of construction joints with concrete surfaces which will be exposed to view shall be made straight and level or plumb and shall be constructed to the details shown on the drawings.

(b) The Contractor is to provide a compressor with suitable oil traps in the air delivery hoses on site for the whole period during which concreting is in progress, and this must be available for cleaning concrete faces prior to placing fresh concrete or pouring joints.

(c) 'Blowing off' may generally be carried out on horizontal surfaces but under special circumstances approved by the Engineer it may also be carried out on vertical surfaces. The surface concrete to be prepared shall be between 4 hours and 8 hours old after completion of placing and shall be blown off using a mixture of air and water under a pressure of at least 500 kPa or by using a high pressure water jet until all dirt, laitance, etc is removed and particles of clean coarse aggregate are exposed sufficiently to produce a rough surface. Any loose particles of coarse aggregate shall also be removed. The success of this method of preparation depends on selecting the correct time (dependent on the type of cement, atmospheric conditions, etc) so that the concrete has set to just the necessary degree of hardness. The operation may therefore require to be undertaken outside normal working hours and at night. When the surfaces are at least 12 hours old any remaining loose fine aggregate particles shall be washed off.

(d) 'Scabbling', which refers to removal of all surface laitance plus roughening the concrete surface with pneumatic picks in order to expose the coarse aggregate in a uniform pattern, may be carried out on both horizontal and vertical surfaces. The surfaces to be prepared in this manner shall be at least 12 hours old after placing the concrete. At least 35% of the roughened surface area shall consist of exposed coarse aggregate.

(e) All surfaces prepared either by 'blowing-off' or by 'scabbling' shall be kept continuously wet until the next lift of fresh concrete is to be placed against them, the minimum time being 12 hours.

(f) The use of approved wet-to-dry epoxy resin concrete adhesive, mixed and applied strictly in accordance with the manufacturer's instructions, may be permitted in the formation of concrete joints at surfaces where the concrete is older than 7 days."

ADD THE FOLLOWING SUBSUBCLAUSES:

"PSG 5.5.7.4 Placing fresh concrete at joints

(a) Vertical construction joint surfaces, as instructed by the Engineer, shall be either:

(i) smooth, clean and kept damp for at least 24 hours before placing fresh concrete against them, or

(ii) scabbled, clean and damp as specified above.

(b) Horizontal construction joint surfaces shall be 'scabbled' or 'blown off', cleaned and kept continuously wet as specified above before fresh concrete is placed over them. Immediately before placing the fresh concrete, the damp surface of the set concrete shall be evenly coated (by brushing or brooming) with a layer of cement mortar between 10 mm and 15 mm thick. The water/cement ratio and the cement/sand ratio of this mortar shall be the same as that of the fresh concrete to be placed and the mortar shall be producing by leaving the coarse aggregate fraction out of a batch of the fresh concrete. Coating with mortar is to be done in stages immediately before areas of set concrete are covered with fresh concrete, so that no mortar is exposed for longer than one hour after mixing, or less if the mortar has become dry or has started to set before being covered with fresh concrete. Any dried out mortar shall be removed and, after cleaning the surface, shall be replaced with fresh mortar.

(c) No fresh concrete shall be placed on the top surface of concrete which is laterally restrained (e.g. by formwork or by in-situ earth) while the top layer of concrete is between 3 hours and 12 hours old after mixing. No fresh concrete shall be placed on top of the concrete with an unrestrained lateral surface while the top layer of concrete is between 2 hours and 12 hours old after mixing.

PSG 5.7.7.5 Concrete casting sequence

All concrete shall be cast in such a manner as to cause the least possible time lapse between casting of adjacent sections. Four weeks prior to commencement of construction of a structure the Contractor shall submit to the Engineer for approval the casting sequence he intends using."

PSG 5.5.8 Curing and Protection

ADD TO THE SUBCLAUSE:

"Notwithstanding the methods of curing itemised under (a) to (e) of the Subclause, the floors, walls and slabs of all water-retaining structures shall be cured by method (c) continuous spraying or 'microjetting' and shall be subject to continuous spray curing for a minimum period of 10 days."

DELETE SUBCLAUSE (e) *IN ITS ENTIRETY, AS THE USE OF CURING COMPOUNDS WILL NOT BE PERMITTED.*

PSG 5.5.9 Adverse Weather Conditions

DELETE THE FIRST TWO SENTENCES OF SUBCLAUSE 5.5.9.2 AND REPLACE WITH:

"When concrete operations are being carried out at ambient temperatures in excess of 32°C, the Contractor shall apply the relevant recommendations for hot weather concreting set out in American Concrete Institute publication ACI 305R-77 "Recommended practice for hot weather concreting".

PSG 5.5.10 Concrete Surfaces

ADD TO SUBCLAUSE 5.5.10.1:

"Concrete surfaces that require special treatment before or after the striking of forms and the treatment to be given thereto are as detailed in the Bill of Quantities."

ADD TO SUBCLAUSE 5.5.10.2:

"The unformed surfaces that require to be wood-floated or steel-floated or which are to receive other special treatment as well as the degree of accuracy, if this is not Degree of Accuracy II, are as detailed in the Bill of Quantities."

PSG 5.5.11 Watertight Concrete

ADD AT THE END OF THE SECOND *LINE, AFTER* "construction joints,":

"and shutter tie positions"

ADD TO THE SUBCLAUSE:

"The following structures are to be subject to water-tightness tests:

- Biofilter Recycle Pumping Station
- Fat, Oil & Grease Trap Structures

No vertical, horizontal, or inclined construction joints of any kind will be permitted in the perimeter walls of the Biofilter Recycle Pump station unless these have been specially ordered or authorised by the Engineer."

ADD THE NEW SUBSUBCLAUSES:

"PSG 5.5.11.1 Concrete for water retaining structures

Grade 35/19 concrete, as scheduled, shall be used for the construction of all water retaining structures.

PSG 5.5.11.2 Pipes and conduits embedded in concrete

Except with the approval of the Engineer no pipes other than those shown on the drawings shall be embedded in the concrete."

PSG 5.5.12 Concrete in Wet Ground

DELETE THE CONTENTS OF THE SUBCLAUSE AND REPLACE WITH:

"The design for the structures to be built in wet ground makes full allowance for the conditions likely to be encountered on Site. The documents and drawings indicate what is required to be built. However, the Contractor shall be fully responsible for keeping the excavations free from water whilst the construction work is being carried out. The methods by which he proposes to achieve this shall be approved by the Engineer before being implemented. The cost of dewatering shall be included in the tendered rates for the construction work and no separate payment shall be made for such dewatering throughout the construction period."

PSG 5.5.13 Grouting

ADD TO THE SUBCLAUSE:

"Grouting shall be done to the instruction of the Engineer using materials of suitable consistency as follows. Unless otherwise directed, grouting mixtures shall consist of one part cement to two parts concrete sand by volume, well mixed and with sufficient water added to obtain the required consistency. Where recesses to be filled are of appreciable dimensions, the Engineer may direct the Contractor to replace a proportion of sand with fine stone to reduce shrinkage. The Engineer may also require the Contractor to use non-shrink or other additives in grouting mixtures where these are allowed for in the Bill of Quantities."

ADD NEW SUBSUBCLAUSES:

"PSG 5.5.13.1 Liquid grout

Where liquid grout is required for bolt holes, etc, water shall be added in such quantity that, when the material is thoroughly mixed and stirred, it shall flow readily so as to fill all recesses and air spaces in the work to be grouted. Before grouting any section of the work with liquid grout, the surfaces to receive grout shall first be thoroughly cleaned and flushed with water. The grout shall then be introduced in such a manner as to fill effectively all recesses. When the grout has set the surface of the work shall be finished off flush and smooth with cement mortar.

PSG 5.5.13.2 Grouting of pipes/specials through walls

Where entry holes for pipes/specials have been provided in the walls, the Contractor shall be responsible for the grouting in of such pipes/specials regardless of whether or not these have been supplied by himself.

Before commencing the positioning in holes of any pipes/specials the Contractor shall:

(a) remove all shuttering and boxing remaining in the holes;

(b) make any alterations required to the position and shape of the holes and reinforcing steel (lacing bars, etc) in the holes

(c) thoroughly clean and scabble the sides of the holes so as to obtain satisfactory bond surface for the new concrete (including the post-forming of "frogs" where longitudinal forces are to be restrained by the concrete); and

(d) free all surfaces of the pipes/specials of all coatings, and thoroughly scrape and clean the pipes/specials.

After accurately positioning the pipes/specials in the respective holes, the Contractor shall fix the pipes/specials in a suitable manner to prevent movement.

Immediately prior to grouting being carried out by the placing of mortar and concrete around the pipes, the surface of existing concrete shall be saturated with water. All surplus water shall be removed and the surface covered with a layer, approximately 12 mm thick, of mortar consisting of 3 parts concrete sand and 1 part cement.

The concrete ingredients shall be mixed and placed as dry as possible to obtain a dense, waterproof concrete. Where a watertight seal is required, the concrete shall be carefully worked around the puddle flange, if any, and the pipe barrel or body of the special, and shall be vibrated in layers so as to obviate any falling away from pipe/special surfaces of the concrete already placed. A spare vibrator with an independent power source shall be kept in readiness to ensure continuity of placing in the event of the breakdown of the duty vibrator.

Smooth formwork that has been suitably strengthened for use with a vibrator shall be provided for facing the concrete around each pipe/special.

When set, the grouting must form a dense, homogeneous and waterproof mass.

PSG 5.5.13.3 Dry-packed grout

When dry-packed grout is specified, under baseplates, etc, only sufficient water shall be added to make the mixture ball when squeezed in the hand. Before any grouting is done with dry caulking, the surfaces between which the caulking is to be placed, shall first be thoroughly cleaned and flushed with water. All surplus visible water shall be wiped or blown away and the dry caulking shall be forcefully rammed or hammered into place using suitable tools. Exposed surfaces shall be finished off neatly with a trowel and extensive exposed areas shall be covered with wet sacking and kept damp for at least 24 hours.

Where additives are required for grouting operations, these shall be brought on to site in the manufacturer's unopened containers and used strictly in accordance with the manufacturer's instructions which the Contractor shall not fail to obtain. If necessary, the Engineer may require the Contractor to undertake preliminary tests to check the behaviour of proprietary additives under the conditions pertaining on the site.

PSG 5.5.13.4 Epoxy grout (Epoxy mortar type only)

The manufacturer's instructions shall be observed when an epoxy grout is used."

ADD NEW SUBCLAUSES:

"PSG 5.5.16 Cement Mortar

Where cement mortar is specified for filling around pipes, etc, water shall be added to obtain a firm paste which can be worked with a trowel but is not fluid. Surfaces to receive mortar shall be well wetted and excess water allowed to drain, or be removed. The mortar shall be worked into place with a trowel or tamping rod, exposed surfaces floated off and covered with wet hessian for 24 hours and allowed to harden without disturbance.

PSG 5.5.17 Joints *(Refer also to Particular Specification: PUB included under Section 3.8 Particular Specifications)*

The specific requirements pertaining to joints are described in the Sub clauses below.

PSG 5.5.17.1 Joint filler materials

Joint formers for use in joints shall be approved by the Engineer and shall comply with the requirements of Particular Specification PUB. Furthermore it shall be highly resilient (the resiliency shall not be less than 90% recovery after compression to half original thickness), capable of giving effective support to sealing compounds in movement joints, and able to withstand permanent immersion in water without disintegration.

The minimum required specifications are:

(a) Elongation at break point : 98%

(b) Tensile strength at 70% : 782 kPa

(c) Tear strength of width : 5,4 N/mm

The joint filler shall be securely fixed in position to avoid distortion or displacement while concreting operations are in progress.

PSG 5.5.17.2 Waterstops

Polyvinyl chloride (PVC) and/or rubber waterstops shall be approved by the Engineer and shall comply with the requirements of Particular Specification PUB. Furthermore, the minimum elongation at break point shall be 360% at 25°C. The waterstops shall be of the size and shapes shown on the drawings and as scheduled. Prior to use, all waterstops shall be carefully stored to avoid damage or contamination by oil, grease, weather, and in particular, by the sun.

PSG 5.5.17.3 Joint sealants

The joint sealant shall be approved by the Engineer and shall comply with the requirements of Particular Specification PUB. It shall be two component polyurethane complying with SANS 110 and the cured material shall have the following properties:

(a) A service temperature range of –50°C to +80°C

(b) It shall not flow

(c) Hardness shall be ± 25 Shore A (by method 6.12.2.1 of SANS 110)

(d) Movement must never exceed 25% of neutral width of joint

(e) adhesion to the specified surface shall be such that failure takes place within the material and not at the contact face

(f) It shall not be affected by sewage, water, dilute acids and alkalis, fats, vegetable oils and petroleum products

(g) It shall be extremely resistant to atmospheric oxidation

(h) Surface preparation: Before the joint sealer is applied, the surfaces of the joint shall be thoroughly cleaned and primed in accordance with the manufacturer's instructions.

(i) Approval: Before any joint sealers are applied, approval by the Engineer in writing shall be obtained. The material shall be applied strictly in accordance with the manufacturer's instructions and any cleaners or primers applied as required.

PSG 5.5.17.4 Joints with Waterstops

Where shown on the Drawings, joints shall be formed in concrete work embodying waterstops embedded in the concrete. It is essential that the waterstops are held securely during concreting by using suitable shuttering and a clamping device for holding the waterstop in position, nailing not being permitted except through the lugs provided for the purpose. The concrete adjacent to the waterstop shall be carefully placed and compacted to avoid honeycombing and to ensure full contact between the water-stop and the adjacent concrete.

After one half of the waterstop has been set into concrete and before the concreting of the succeeding section is commenced, the faces of the concrete against which the succeeding section is about to be cast shall be thoroughly cleaned by brushing with a wire brush, care being taken not to damage the waterstop.

PSG 5.5.17.5 Movement joints

Joint recesses to receive sealing compound are to be formed to the dimensions and shapes indicated on the Drawings. These recesses are to be formed with rough sides and so shuttered that the shuttering can be removed without any timber having to be left in the recesses. Shuttering shall be left in the joints until the joints are ready for priming and filling with sealant. After the removal of the shutters, joints shall be cleaned by mechanically operated wire brushes and all dust removed.

PSG 5.5.17.6 Sealing joints

The sealing of the expansion joints is to be carried out by the Contractor under the supervision of a representative of the specialist firm supplying the sealing compounds and materials. The Contractor is to be responsible for supplying these approved materials, transporting them to site, storing and using them as required, and providing all labour, tools, equipment and everything necessary to prime and fill the joints.

Before priming and sealing, the joints are to be thoroughly cleaned and dried out by a method approved by the Engineer.

No sealing of joint recesses is to be carried out until at least 21 days after the adjacent concrete has been cast.

Every care shall be exercised by the Contractor to ensure that the work shall be carried out in accordance with the requirements of this Specification and in strict conformity with any special instructions given by the manufacturers for the proper use and treatment of the sealing materials provided by them.

All internal joints in the floors and the external joints in the roof shall be sealed either with an approved sealant or alternatively, if instructed by the Engineer, with a 190 mm wide bandage joint system.

The concrete surface onto which the bandage is to be laid must be sound, dry and dust free and must be fully cured and free from curing compound. The concrete surfaces on either side of joints shall be finished smooth and level and free from all dirt, dust, laitance, loose material and irregularities with no vertical misalignment between each side of the joint to be sealed. Any portions that are not so finished shall be ground down at the Contractor's expense. The bandage is to be installed strictly in accordance with the manufacturer's instructions and adhered to the concrete surfaces so as to form a permanently watertight joint.

Payment for the construction joints shall be measured per linear metre for the various types of construction joints. The rate shall include for all shuttering at the joints, scabbling of the concrete surface and the supply and installation of either an approved sealant or a bandage system including everything necessary to achieve the objective of a watertight joint.

PSG 5.5.18 Anchors to Pipelines

Concrete pipeline anchors at horizontal bends, vertical bends and on steep slopes shall be constructed where directed by the Engineer in accordance with type drawings to be supplied. Bolts, clamping straps and reinforcement shall be provided as directed.

In general, anchors will be provided at all horizontal bends in flexibly coupled pipelines and at such vertical bends as the Engineer may decide. Details of the anchors will be supplied by the Engineer.

PSG 5.5.19 Manhole Covers and Frames

The rates are to include for setting the covers into concrete with the upper edge 10 mm above the concrete level to prevent the entry of rainwater where installed in positions exposed to rain; and set into concrete so as to be flush with either the concrete surface or the finished granolithic surface as required where installed within roofed buildings. The rates are also to include for the thorough cleaning and painting of all exposed portions with two coats of approved epoxy tar paint after setting into concrete work, in particular the exposed underside of the cover and the frame.

PSG 5.5.20 Screeding floor(s)

Where screeding has been scheduled or is indicated on the drawings, a 50 mm thick screed comprising 3:1 sand cement mortar is to be placed on the floor. The floor surface shall have previously been chipped and roughened to ensure a proper bond. Immediately before applying the screed the surface shall be flushed with clean water and coated with cement grout."

PSG 6 TOLERANCES

PSG 6.2 PERMISSIBLE DEVIATIONS

PSG 6.2.3 Specified PDs

ADD TO THE SUBCLAUSE:

"Except for the special smooth finish described in PSG 5 above, where applicable, the Contractor shall work within the limits of the permissible deviations laid down for Degree of Accuracy II with the following modifications:

(a) Reinforcement (Subclause 6.2.3 (a))

When fixing reinforcement to any element of the reinforced concrete structures, the Contractor shall work within the limits of the permissible deviations laid down for Degree of Accuracy I.

(b) Foundations (Subclause 6.2.3(c))

Position on plan	$\pm$ 20 mm
Surface level	$\pm$ 20 mm

(c) Above foundations (Subclause 6.2.3(d))

Position on plan	$\pm$ 10 mm
Surface level	$\pm$ 5 mm."

PSG 7 TESTS

PSG 7.1 FACILITIES AND FREQUENCY OF SAMPLING

PSG 7.1.2 Frequency of Sampling

DELETE SUBCLAUSE 7.1.2.2 AND REPLACE WITH:

"The Contractor shall provide, as a minimum, the following number of sets of three standard metric 150 mm metal cube moulds for the volume of concrete to be poured as set out in the table below:

Frequency of compressive strength tests:

Volume of pour (m^3)	Number of sets
0 – 25	2
26 – 50	4
51 – 100	6
101 – 200	8
> 201	10 (or as instructed by the Engineer)

A maximum of 50% of these sets of concrete cubes will be crushed when they are 7 days old and the remainder when they are 28 days old.

All test cubes shall be made and cured on site, under the supervision of the Engineer's Representative, in accordance with SABS Method 861-3.

All cubes shall be transported to the nominated laboratory between 7:30 and 11:00 on the last working day prior to the date of test. Only the results from this laboratory will be considered and will be the sole basis on which concrete is accepted or rejected.

The Contractor shall provide sufficient extra cube moulds as so required for his own purposes."

PSG 7.2 TESTING

PSG 7.2.3 Laboratory Testing

ADD TO THE SUBCLAUSE:

"The Contractor will be liable for all costs incurred in making structural concrete cubes and having these tested."

ADD NEW SUBCLAUSES:

"PSG 7.2.5 Testing Grouting Procedure

SABS 10120-3: Part 2 Section G page 9, Subclause PSG 9.10 shall be applicable where relevant.

PSG 7.2.6 Watertightness Tests

Before the structure is tested for watertightness it is to be thoroughly cleaned, swept and brushed to remove all dirt, grit and rubbish and washed down with clean water. Channels and pipes are to be cleaned and inspected before.

The cost of the water required for cleaning will be for the Contractor's account.

Unless otherwise ordered by the Engineer, all water containing structures shall be tested for watertightness. Each structure shall be filled, in four stages, at a uniform rate to the next 2 m increment in 24 hours, to top water level unless it is obvious that some appreciable leak has developed and that a test is not possible.

After each stage, the water level is to be established and recorded by means of a hook gauge to be provided by the Contractor, and thereafter, is to be measured and recorded by the Engineer, in relation to a fixed bench mark, each successive 24 hours for 2 days in the case of the first three stages and 7 days at TWL and the results graphed so as to establish the progressive rate of absorption and leakage. During the test period, the total permissible drop in level after allowing for evaporation if applicable, is not to exceed 1/800th (0,125%) of the average water depth of the tank or 10 mm, whichever is the greater. Should the structure not satisfy the test, then, after the completion of the remedial work, it should be refilled and if necessary, left for a further stabilising period; a further test of 7 days duration should then be undertaken in accordance with the specification. If the rate of leakage at any stage exceeds the specified amount (plus an allowance for evaporation if the structure is unroofed) at the end of seven days and there is no prospect, in the opinion of the Engineer, of the rate of leakage becoming as low as that, he shall have the right to deem the water containing structure to be not watertight, and to notify the Contractor accordingly,

who shall forthwith take such steps, at his own expense and to the approval of the Engineer, as may be considered necessary to achieve watertightness, other than plastering the floor and inside walls. In the event of the steps taken by the Contractor proving ineffective in reducing the rate of drop in water level over a period of 7 days to less than specified amount (plus an allowance for evaporation if the structure is unroofed) the Engineer shall have the right, if he considers there is no prospect of the leakage taking up in a reasonable period to the rate stated, to order the Contractor to carry out at his own expense, approved steps, on completion of which the Contractor shall again clean out and test in the manner specified and at his own expense.

Notwithstanding the fact that a structure may have passed the test described in the aforementioned paragraph, it will not be accepted if there are any leaks or damp spots on any exterior surface. Any such defects shall be sealed and repaired in a manner and to a standard acceptable to the Engineer.

Backfilling around the water retaining structures may only commence after successful completion of the watertightness testing.

Watertightness of the concrete roof(s) shall be tested by the continuous sprinkling of water over the roof with approved sprinklers so that a film of water is maintained on the surface of the slab for not less than 6 hours. The roof shall be considered watertight if there are no damp patches visible on the underside after 48 hours of sprinkling or ponding. The roof insulation covering shall be completed as soon as possible after satisfactory testing.

In order to minimise the risk of the Works not being watertight, the Contractor shall take the greatest precaution during construction to prevent the occurrences of possible sources of leakage, and in this respect it is emphasised that:

(a) as far as possible concreting should be carried out in one continuous operation, preferably alternating the direction of pour so that a cold joint does not occur at the end of pouring a lift.

(b) where such continuous operation is not possible, proper bond of concrete must be secured;

(c) while setting, concrete shall be suitably protected from the direct heat of the sun and shall be kept moist for at least 10 days.

In the event of leakage being evident at any time during the Defects Liability Period the Engineer, before issuing his Final Certificate may call for further rectification and testing as already described, if he considers such to be necessary, and will have the right to withhold this Certificate until he considers the work to be satisfactory."

PSG 7.3 ACCEPTANCE CRITERIA FOR STRENGTH CONCRETE

DELETE SUBCLAUSES 7.3.1 AND 7.3.2 AND REPLACE WITH:

"PSG 7.3.1 Criteria for Three Valid Test Results

The only basis on which concrete strength will be accepted or rejected is on the 28-day cube strength obtained from cubes crushed at the nominated laboratory. In order to obtain accurate results, the Contractor must strictly comply with all the concrete test methods specified in SABS Method 863.

Acceptance criteria for concrete strength:

Acceptance Category	Strength C_S = Average minimum strength for 3 cubes at 28 days (MPa)
Characteristic concrete strength for water retaining structures	35
Full acceptance	$C_S \geq 37$
Conditional acceptable	$37 > C_S \geq 33$
Rejection	$33 > C_S$

The descriptions given in the “acceptance category” column above shall have the following meanings:

Full Acceptance: Concrete shall be accepted, subject to the concrete meeting the durability and cover acceptance criteria.

Conditional Acceptance: Concrete shall be accepted with a warning that construction methods should be examined to improve the strength. A financial penalty of up to R75/m3 will be applied on a pro rata sliding scale for all concrete poured where the average strength (for 3 cubes at 28 days) test results fall within the conditional acceptable range.

Rejection: At the discretion of the Engineer, the concrete shall be removed and replaced at the expense of the Contractor.

Core Holes: That test cores shall be drilled from the concrete and tested in accordance with SANS Method 5865 to determine the estimated actual strength and the estimated potential strength of the concrete.

If the results of the core tests show that the concrete meets the test requirements, the structure shall be accepted. If the cores tests show that the concrete does not meet the strength requirements, an appropriate full-scale load test, as determined by the Engineer, may be applied on the structural element with the defective concrete.

If load tests are, in the opinion of the Engineer, impracticable, or where the portions of the structure subjected to such test fail to pass the test specified, the Contractor will be required to strengthen or replace those elements of the structure at his own cost.

Repair of the core hole will be carried out by thoroughly wetting and filling the hole with a stiff mix of an expanding cementitious grout (Sika Grout G.P. or similar approved). An external slurry coat (0.25 x 0.25 m) of a polymer modified cementitious coating (Sika Top-Seal 107 or similar approved) is to be applied over the exposed surface of the repaired core hole.

An item has been included in the Bill of Quantities for the making good of core holes as directed by the Engineer.

The cost of these tests will be borne by the Employer if the results are equal to or exceed the Specified Full Acceptance Value. The Contractor will pay for the tests if the results fall within or below the conditional acceptance range."

ADD NEW SUBCLAUSES:

"PSG 7.3.6 Concrete Cover Below Specified Value

Acceptance criteria for concrete cover:

Acceptance Category	Concrete Cover (mm) (for specified cover of 50 mm)
Full acceptance	$70 > C_d \geq 50$
Conditional acceptance	$50 \geq C_d > 45$
Acceptance with remedial measures	$45 \geq C_d > 40$
Rejection	$C_d < 40$, $C_d > 70$

The descriptions given in the "Acceptance Categories" column above shall have the following meanings:

Full acceptance: Concrete shall be accepted, subject to the concrete meeting the strength and durability criteria.

Conditional acceptance: Concrete will be accepted with a warning that construction methods should be examined to improve the cover. A financial penalty of up to R15/m^2 will be applied on a pro rata sliding scale for each structural element where the average test results fall within the conditional acceptable range.

Acceptance with remedial measures: Concrete will be accepted if the Contractor undertakes remedial work at his expense, as approved by the Engineer, to improve the durability of the concrete to the criterion described as 'full acceptance'.

Rejection: At the discretion of the Engineer, the concrete shall be removed and replaced at the Contractor's cost.

Where the Engineer or his/her Representative has reason to doubt that the concrete cover to the reinforcement is not in accordance with the requirements of clause 5.1.3, the cover shall be tested with a cover meter. If necessary, the Engineer or his representative shall then indicate to the Contractor where he must expose the reinforcement to prove the depth of cover.

Repairs to exposed reinforcement shall be carried out using a bonding agent and anti-corrosion coating (Sika Top Armatec 110 EpoCem or similar approved) followed by filling the void with a epoxy cement repair mortar (Sikadur 45 EpoCem or similar approved). An external slurry coat (0.25 x 0.25 m) of a polymer modified cementitious coating (Sika Top-Seal 107 or similar approved) is to be applied over the exposed surface of the repaired void.

An item has been included in the Bill of Quantities for the making good of voids as directed by the Engineer.

The cost of these tests will be borne by the Employer if the results are equal to or exceed the Specified Full Acceptance Value. The Contractor will pay for the tests if the results fall within or below the conditional acceptance range.

PSG 7.3.7 Durability Index Tests

To ensure that the concrete has been placed, compacted and cured correctly, a number of tests will be carried out by a nominated laboratory on the concrete after curing has been completed i.e. 26 to 30 days after placing of the concrete.

(a) a set of four 68 mm diameter cores, 75 mm in length will be drilled at each test location through the concrete layer between the outermost layer of steel reinforcement and the exposed outer surface of the concrete element when the concrete has reached 28 days of age. A 15 mm thick slice will then be cut from outer surface and discarded. A 30 mm thick slice will be cut from the new surface extending inwards towards the reinforcement and tested for:
(i) oxygen permeability (tested in the ballim apparatus),
(ii)water sorptivity, and
(iii)chloride conductivity.

The positions at which the cores will be extracted will be indicated by the Engineer.

The oxygen permeability and water sorptivity, and chloride conductivity test procedures shall be carried out in accordance with the following references to papers prepared by MG Alexander, Y Ballim and JR Machechnie of the University of Cape Town:

(1) Guide to the use of durability indexes for achieving durability in concrete structures. (Research Monograph No 2).

(2) Rapid chloride conductivity testing of concrete. (Research Monograph No 3.)

(3) Concrete durability index testing manual. (research Monograph No 4.)

(b) the depth of concrete cover achieved will be measured to ensure that the specified values have been achieved.

Repair of the core hole will be carried out by thoroughly wetting and filling the hole with a stiff mix of an expanding cementitious grout (sika grout g.p. or similar approved). An external slurry coat (0,25 x 0,25 m) of a polymer modified cementitious coating (sika top-seal 107 or similar approved) is to be applied over the exposed surface of the repaired core hole.

An item has been included in the Bill of Quantities for the making good of core holes as directed by the Engineer.

The cost of these tests will be borne by the Employer if the results are equal to or exceed the Specified Full Acceptance Value. The Contractor will pay for the tests if the results fall within or below the conditional acceptance range.

Acceptance criteria for durability testing of structural elements

Acceptance Category	Oxygen permeability index (log scale)	Water sorptivity (mm/h)	Chloride Conductivity
Full acceptance	$O_p \geq 9.15$	$W_s \leq 8$	$C_c \leq 0.75$
Conditional acceptance	$9.15 \geq O_p > 9.0$	$8 < W_s \leq 12$	$0.75 < C_c \leq 1.50$
Acceptance with remedial measures	$9.0 \geq O_p > 8.75$	$12 < W_s \leq 15$	$1.50 < C_c \leq 2.50$
Rejection	$O_p < 8.75$	$W_s > 15$	$C_c > 2.50$

The descriptions given in the "Acceptance Categories" column above shall have the following meanings:

Full acceptance:	Concrete shall be accepted, subject to the concrete meeting the strength and cover criteria.
Conditional acceptance:	Concrete will be accepted with a warning that construction methods should be examined to improve the durability. A financial penalty of up to R75/m^3 will be applied on a pro rata sliding scale for each structural element where the average test results fall within the conditional acceptable range.
Acceptance with remedial measures:	Concrete will be accepted if the Contractor undertakes remedial work at his expense, as approved by the Engineer to improve the durability of the concrete to the criterion described as 'full acceptance.'
Rejection:	At the discretion of the Engineer, the concrete shall be removed and replaced at the expense of the Contractor.

PSG 7.3.8 Costs of Tests

The costs of all tests required by the Engineer or his/her representative shall be borne by the employer except that costs of tests as set out hereunder shall be borne by the Contractor:

(a) preliminary tests on materials and of mix proportions

(b) all tests as may be made necessary by reason of the provisions of clause 7.3.5.

(c) such tests, including concrete coring and load tests, durability and cover tests, as may in the opinion of the Engineer be made necessary by failure on the part of the Contractor to meet the requirements of this specification.

Notwithstanding Clause 7.6.3 of the General Condition of Contract (Removal of improper work and materials) and Clause 7.7.1 of GCC 2015 (Contractor to search), the onus will be on the Contractor to prove to the Engineer the limit of the concrete for which the cover and durability values fall below the Specified Full Acceptance Values as set out above, and the cost of this searching is to be included in the Contractor's rates for concrete."

PSG 8 MEASUREMENT AND PAYMENT

PSG 8.1 MEASUREMENT AND RATES

PSG 8.1.1 Formwork

ADD TO SUBCLAUSE 8.1.1.6:

"The rate shall also include for all labour, tools and material necessary for the preparation and effective sealing of shutter-tie positions in order to affect watertightness of these areas, as required."

PSG 8.1.2 Reinforcement

DELETE THE SECOND PARAGRAPH OF SUBSUBCLAUSE 8.1.2.2(a) AND REPLACE WITH THE FOLLOWING:

"The quantities (or percentages) of all other sizes of steel bars that are scheduled may be subject to variations and the contract prices for these will be fixed regardless of the magnitude of such variations (if any)."

PSG 8.1.3 Concrete

DELETE SUBSUBCLAUSE 8.1.3.1(b) AND REPLACE WITH THE FOLLOWING:

"The scheduled rate for overbreak in hard rock excavation to structures shall include, inter alia, for the excavation of material, cleaning, washing and brushing with grout and for refilling with Grade 10/19 concrete together with all necessary shuttering and including the additional thickness of 50 mm to the concrete in lieu of blinding on horizontal floors. The Contractor is to make his own estimate of the extent of overbreak. The Contractor will not be paid for overbreak in intermediate or soft material."

ADD TO SUBCLAUSE 8.1.3.2:

"(e) No fines concrete drainage layers."

IN SUBSUBCLAUSE 8.1.3.3(a), *DELETE THE WORDS* "and curing" *IN THE FOURTH LINE.*

ADD TO SUBCLAUSE 8.1.3.3:

"(e) Separate items shall be scheduled for curing of various concrete elements."

PSG 8.4 SCHEDULED CONCRETE ITEMS

"PSG 8.4.7 Concrete Complete with Formwork.....Unit: m³

Separate items, where so required, have been included in the Bill of Quantities for concrete complete with formwork for each particular grade of concrete or for structural units of similar size and shape, or for both. The unit rates shall cover the cost of the provision of concrete (made with Ordinary Portland Cement unless otherwise so scheduled), mixing, testing, placing, compacting, the forming of stop-ends and unforeseen construction joints, striking off or levelling as applicable, and curing and repairing where necessary, together with the cost of all parts of formwork in contact with the concrete and the necessary bearers, struts, and other supports, plus the layout and plant necessary to erect and strike such formwork.

PSG 8.4.8 Concrete Curing .....Unit: m³

Separate items, where so required, have been included in the Bill of Quantities for curing exposed concrete faces. The unit rates shall cover the cost of the provision of all labour, materials and equipment required for the method selected for the curing of bases, surface beds, floors, walls and roof panels."

ADD NEW PAYMENT ITEMS:

"PSG 8.9 grouting of pipes/specials through walls or slabs .....Unit: m³

Items, where so required, have been included in the Bill of Quantities for the grouting of pipes and specials through box-outs or broken out openings in walls or slabs. The rates shall include for all necessary labour, plant and materials required to carry out the work described in PSG 5.5.13 and for finishing to the required quality.

PSG 8.10 casting of pipes/specials through walls or slabs .....Unit: m³

Items, where so required, have been included in the Bill of Quantities for the casting of pipes or specials through walls or slabs. The rates shall include for all labour, plant and materials to make the necessary modifications to formwork to allow the pipe or special to be cast in, the positioning of the pipe or special and for finishing the concrete surface to the required quality around the pipe or special at the end of the concreting operation.

PSG 8.11 JOINTS .....Unit: m³

The measurement and payment for joints will be made per unit length of each type and size of completed joint including sand blasting, cutting, cleaning, dust removal, all formwork as necessary, waterstops, fillers, sealants, bandages, etc.

Separate items shall also be scheduled for joints identical in elevation but which may be curved or straight in plan.

The prices shall include for the provision of all labour, plant and material (including waste) necessary for the completion of the joint."

PSHA : STRUCTURAL STEELWORK (SUNDRY ITEMS)
(Applicable to SABS 1200 HA - 1990)

PSHA 3 MATERIALS

PSHA 3.1 STRUCTURAL STEEL

DELETE THE CONTENTS OF THE SUBCLAUSE AND REPLACE WITH:

"Except where scheduled to the contrary or shown on the drawings, the grade of steel to be used in the manufacture of the following shall be that grade normally supplied by reputable manufacturers approved by the Engineer for the following items:

(a) Roof cladding
(b) Handrailing systems
(c) Open grid flooring systems
(d) Steel plate flooring
(e) Steel windows, doors and frames
(f) Stair treads (but excluding supporting steelwork)

All structural steelwork which shall include ladders, safety cages and platforms, shall be manufactured from 350 W grade steel in conformity with SABS 50025 Part 1 to 6, except where shown to the contrary on the drawings or in the Bill of Quantities.

All stainless steel shall be Grade 304, except where shown to the contrary on the drawings or in the Bill of Quantities and shall be fully pickled and passivated prior to installation.

Grade 3Cr12 steel shall be used where scheduled or shown on the drawings and shall be fully pickled and passivated prior to installation."

PSHA 5 CONSTRUCTION

PSHA 5.1 DRAWINGS AND SHOP DETAILS

PSHA 5.1.2 Shop Details

ADD TO THE SUBCLAUSE:

“The Contractor shall prepare his own shop details based on the dimensions and details given on the drawings and will be required to submit his shop details to the Engineer at least 3 weeks prior to fabrication. Written consent must be obtained from the Engineer, prior to commencing fabrication. The Contractor is still responsible for ensuring that the shop details are dimensionally correct.”

PSHA 5.2 FABRICATION AND ASSEMBLY

PSHA 5.2.6 Handrails

ADD TO THE SUBCLAUSE:

“Handrailings shall be of tubular construction in Grade 304 stainless steel or galvanised mild steel as scheduled and be of an approved proprietary make.

Hand and knee rails shall be not less than 32 mm O.D. (wall thickness not less than 1,6 mm) and the height of the handrails (centre) shall be 1 000 mm above walk-way level, with knee rails located approximately midway between.

Stanchions shall be not less than 44 mm O.D. (wall thickness not less than 1,6 mm) and shall have ball type or spun and flared connectors to suit horizontal or angled handrailing as required. The base plates shall not be less than 8 mm thick.

In general all bends in the hand and knee railing shall be 140 mm radius. Handrails shall be either side or top mounted and shall be fastened with stainless steel nuts, bolts and washers.

Spacing between stanchions shall be determined by site conditions but in no case shall it exceed 1 800 mm c/c. At bends, stanchions shall be provided on either side at a distance of 300 mm from mid-bend.

Finished handrailing shall be true to line and level and connections shall be securely fixed by means of 2 No. stainless steel pins, finished flush on each side of the joints (to the approval of the Engineer).

All ends shall have closures joining the hand and knee railing.

The rate quoted per metre shall include for the supply and installation of the handrail, knee rail, portion of a stanchion, footing, holding down bolts and nuts and shall be inclusive of all cutting, mitring, welding, grinding and waste. Stainless steel components shall be fully pickled and passivated prior to installation."

PSHA 5.2.7 Ladders

ADD TO THE SUBCLAUSE:

"Stairs and ladders shall be provided in accordance with the details shown on the drawings and/or as scheduled."

PSHA 5.2.8 Open Grid Floors

ADD TO THE SUBCLAUSE:

"Open grid steel flooring shall be cut and framed to the required panel shapes and sizes all in accordance with the details shown on the drawings and/or as scheduled."

PSHA 5.2.10 Protective Treatment

ADD TO THE SUBCLAUSE:

"All mild steel components shall be hot-dip galvanised after fabrication except where shown to the contrary on the drawings or in the Bill of Quantities. Hot-dip galvanising shall conform to SANS 121 for heavy duty coatings or equivalent. Screwed and socketed tubing shall be galvanised in compliance with BS 1387. Galvanised malleable cast iron fittings shall comply with SANS 14.

Where painting is called for, it shall comply with the requirements of SABS 1200 HC, as amended by PSHC."

ADD NEW SUBCLAUSES:

"PSHA 5.2.11 Penstock Gates, Frames and Operating Gear

Metal gates and frames shall be provided in compliance with the requirements shown on the drawings or stated in the Bill of Quantities. Frames may be cast directly into position or set into previously prepared grooves and grouted up. Care shall be taken to maintain the correct alignment of the frame during concreting.

PSHA 5.2.12 Pipe Clamps and Brackets and/or Supports

Clamps and brackets around pipes and supports under pipes and valves shall be constructed to the details shown on the drawings and shall be provided with all necessary bolts for fixing to concrete.

Where pipes and valves are supported inside concrete chambers on fabricated steel pipe supports, a layer of 6 mm thick GP rubber sheet (Shore hardness 65) shall be attached to the top surface of the steel support by contact adhesive prior to receiving the pipe or valve to be supported. The rubber is to extend 20 mm beyond the edges of the plate."

PSHA 5.3 ERECTION AND INSTALLATION

PSHA 5.3.6 Grouting

ADD TO THE SUBCLAUSE:

"The Contractor shall be fully responsible for all grouting work under this Contract."

PSHA 6TOLERANCES

PSHA 6.1 FABRICATION AND ASSEMBLY TOLERANCE

PSHA 6.1.3 Other Tolerances

ADD TO THE SUBCLAUSE:

"The accuracy of erection shall be the Degree of Accuracy II as tabulated, but amended as follows:

In items (d)(1) and (d)(2) of the table the Degree of Accuracy delete '$\pm$ 5' and replace with '$\pm$ 3'."

PSHA 7 TESTING

PSHA 7.1 TEST CERTIFICATES

DELETE THE PART SENTENCE "in terms of the project specification" *FROM THE WORDING OF THE SUBCLAUSE AND ADD THE WORDS* "when so requested by the former" *AT THE END OF THE SENTENCE*.

PSHA 8 MEASUREMENT AND PAYMENT

PSHA 8.3 SCHEDULED ITEMS

ADD THE FOLLOWING INTRODUCTION APPLICABLE TO THE SUBSEQUENT SUBCLAUSES:

"The tendered rates shall cover the cost of preparing shop details (where applicable), the supply of all materials, fabrication, process control, loading, transporting to Site, off-loading, erection (unless separately included), setting into concrete or brickwork and grouting in. They shall also include for the supply of all nuts, bolts, holding down bolts, washers, rivets, cutting to waste, all temporary bracing, templates and shuttering necessary for installing, transporting and erecting.

Where the scheduled items for steelwork include corrosion protection, then the price stated shall also include for such protection as specified in SABS 1200 HC, as amended by PSHC. Similarly, the materials and corrosion protection for nuts, bolts, washers etc shall match the steelwork ordered.

Where the requirements of the above introduction conflict with the requirements of Subclauses 8.3.1 to 8.3.6 inclusive the requirements of the introduction shall take precedence."

PSHB : CLADDING AND SHEETING
(Applicable to SABS 1200 HB – 1985)

PSHB 3 MATERIALS

PSHB 3.2 STEEL SHEETING

PSHB 3.2.2 Pre-painted Galvanised Steel Sheeting

ADD TO THE SUBCLAUSE:

"Where indicated on the drawings roof sheeting and/or side cladding, with the IBR pattern shall be of approved manufacture and be pre-painted to the specified colour, shall be supplied and installed. The requisite flashings, gable end closures, ridge pieces and other compatible accessories shall be supplied by the same sheeting manufacturer.

The roof sheeting and side cladding shall, unless otherwise specified or scheduled, be 0,58 mm thick Z275 galvanised steel with a 'Chromadek' finish on one side. Roof flashings, gable ends, ridge pieces and other accessories shall also be 0,58 mm thick Z275 galvanised steel with a 'Chromadek' finish on one side.

Installation shall be in accordance with the manufacturer's details and the finished product shall be entirely weatherproof."

PSHB 3.4 FC SHEETING

DELETE THE SUBCLAUSE AND REPLACE WITH:

"PSHB 3.4 TRANSLUCENT SHEETING

Where indicated on the drawings glass fibre reinforced polyester or polycarbonate translucent roof sheeting as manufactured by "Modek Fibreglass Sheeting" or similar approved shall be supplied and installed. All such sheeting material shall comply with SABS 1150 and shall be 85% translucent. Both sides of the sheeting shall have the gel coat applied."

ADD NEW SUBCLAUSE:

PSHB 5 CONSTRUCTION

PSHB 5.5 INSTALLATION OF SHEETING

PSHB 5.5.1 General

ADD TO THE SUBCLAUSE:

"The roof sheeting shall be supplied and installed in the longest lengths available in order to minimise the number of end laps. Narrow flutes shall be outermost, with single flute side laps laid facing away from the prevailing driving rain. All sheets shall be secured to the purlins set generally at 1 500 mm centres utilising the fasteners and fixing methods recommended by the manufacturer. Main fasteners shall be positioned in the crown of the second and fourth narrow flutes, i.e. two fasteners per sheet per purlin. Sidelaps shall be secured with fasteners spaced equally between purlins and at centres not exceeding 750 mm. 15 mm of the broad flute of all roof sheets shall be turned up through 45 degrees at the apex to form a dam and turned down through 10 degrees at the eaves to form a drip.

The vertical cladding shall be fixed in long lengths, broad flutes outermost, with single flute sidelaps fixed facing away from the prevailing wind. All sheets shall be secured to the grids set generally at 1500 mm centres utilising the fasteners and fixing methods recommended by the manufacturer. Main fasteners shall be positioned in the bottom of the first and third narrow flutes, i.e. two fasteners per sheet per girder. Sidelaps shall be secured with fasteners spaced equally between girders and at centres not exceeding 750 mm. Every care must be taken during construction to ensure that sheeting is kept clean from plaster droppings and any staining of sheeting by any other means.

Any sheeting that is defective or on which then paint coating has been damaged, shall, at the discretion of the Engineer be removed and replaced by the Contractor at his own expense. If by doing so any good work is affected, this work will also have to be replaced at the Contractor's expense."

ADD NEW SUBCLAUSE:

PSHB 5.8.1 Fixing to Eyelets

Where eyelets are welded to structural steel members or anchored in concrete with PVC-sheathed threads, to the satisfaction of the Engineer they shall consist of 20 mm closed circular rings manufactured from a 3 mm mild steel round bar and shall be spaced apart at not more than 250 mm.

The reinforced edge of each sheet shall be tied to the eyelets with a UV-resistant nylon thread of not less than 200 kg breaking strain with double knots that shall be sealed by heat treatment to prevent self-loosening due to the effects of the temperature. Heat treatment of knots shall consist of applying a heated object to the knot long enough to ensure fusion between threads without adversely affecting its strength.

PSHB 5.8.2 Fixing Around Thin Structural Members

Where fixing to a structural member with a circular profile and with a cross-sectional circumference of less than 300 mm, the edge of the sheet shall be wrapped around the member and heat treated to effect bonding along a continuous edge with the rest of the sheet.

PSHB 5.8.3 Fixing of Continuous Sheet over the Top of a Supporting Structural Element

Fixing of a continuous sheet over the top of a supporting structural element shall not be permitted, in order to allow for uniform movement due to temperature expansion and contraction of single sheets or sets of jointed sheets without warping. Only edges of sheets may be fixed to structural members.

Notwithstanding the requirements specified in the above paragraph, the Engineer may require that a supporting structural element be fixed to the top where excessive sagging of shade cloth/netting becomes apparent at high ambient temperatures, and then only at certain points and in a manner which shall not adversely affect the aesthetic appearance.

All shade cloth/netting shall thus be primarily spanned from outer edge to outer edge at a maximum tension which shall not exceed the maximum working tension and other working properties of the shade netting during periods of maximum contraction."

PSHC: CORROSION PROTECTION OF STRUCTURAL STEEL
(Applicable to SABS 1200 HC - 1988)

PSHC 5 CONSTRUCTION (EXECUTION OF WORK)

PSHC 5.3 DRESSING AND REPAIRS DURING FABRICATION

ADD TO THE SUBCLAUSE:

"Edges shall be ground to a smooth radius of at least 1 mm unless otherwise indicated. Weld beads with a surface irregularity exceeding 3 mm in height or with sharp crests less than 2 mm radius shall be ground back to a smooth profile."

PSHC 5.4 PREPARATION FOR COATING

PSHC 5.4.1 General

ADD TO THE SUBCLAUSE:

"Surface preparation prior to painting shall be carried out at the steelwork manufacturer's works.

The final treatment for surface preparation prior to galvanising shall be carried out at the galvaniser's works."

PSHC 5.4.3 Methods of Preparation

PSHC 5.4.3.1 Abrasive blast cleaning

(a) General

ADD TO SUBCLAUSE:

"The standard of blast cleaning required is Sa 2,5 in accordance with ISO 8501-1 to achieve an angular profile of 50 – 75 µm.

The surface profile after blasting shall be in accordance with the paint manufacturer's requirements for the particular paint system being used."

(b) Dry abrasive blast cleaning

ADD TO SUBCLAUSE:

"The blast cleaning media shall not be recycled."

(c) Wet abrasive blast cleaning

REPLACE THE "(b)" IN THE HEADING OF THIS SUBSUBCLAUSE WITH A "(c)" AS INDICATED ABOVE.

ADD AT THE END OF SUBCLAUSE (c):

"Wet abrasive blast cleaning shall be used to remove soluble salts from steelwork where so specified hereunder, or shown on the drawings."

PSHC 5.4.3.2 Cleaning by hand or with power tools

ADD TO THE SUBCLAUSE:

"Cleaning by hand or power tools, where permitted or ordered by the Engineer, shall be to (ST3 - ISO 8501 – 1: 1988) to attain a bright metal finish."

PSHC 5.7 COATING SYSTEM

REPLACE THE HEADING OF THIS SUBCLAUSE WITH THE FOLLOWING:

"PSHC 5.7 COATING SYSTEM FOR NEW STEELWORK"

ADD TO THE SUBCLAUSE:

"The coating systems to be applied under this Contract shall be carried out strictly in accordance with the manufacturers' instructions which written instructions shall be obtained by the Contractor and a copy handed to the Engineer's Representative prior to commencing painting operations.

The paint systems shown in Subclauses 5.7.1 and 5.7.2 and 5.7.3 below are considered to be acceptable but other similar approved paint systems may be used."

ADD NEW SUBCLAUSES:

"PSHC 5.7.1 Painting System No 1

For structural steelwork coastal regions - exterior work:

Kansai Plascon	**DFT (µm)**
Plascozinc	75
Plascochem HB	
Intermediate PVL 101	70
Plascochem 4000	
Series PVL 4000	35
	180

PSHC 5.7.2 Painting System No 2

For structural steelwork coastal regions - interior work:

Kansai Plascon	**DFT (µm)**	**Kansai Plascon**	**DFT (µm)**
Degrease with		Degrease with	-
Aquasolv GR 1	-	Aquasolv GR 1	
Zinc phosphate Primer		Zinc phosphate Primer	60
PP 50	60	PP 50	
Alkyd undercoat		Alkyd undercoat	35
UC 1	35	UC 1	
Enamel	30	Enamel	30
	125		125"

PSHC 5.7.3 Painting System No 3

For overcoating galvanised work:

Kansai Plascon	**DFT (µm)**
Prepare surface cleaner GIC	-
Galvogrip metal Primer GIP1	30
Universal undercoat UC1	30
Super Universal Gloss Enamel G Range	25
	85

PSHC 5.7.4 Alternative Paint Systems

Specifications for alternative paint systems shall be obtained by the Contractor from other approved manufacturers and submitted to the Engineer for consideration and approval."

PSHC 5.8 APPLICATION OF PAINTING COATINGS

ADD TO THE SUBCLAUSE:

"No application of paint shall be carried out before the paint manufacturer has approved the firm of applicators and the plant to be used, except where instructed to the contrary by the Engineer.

Where applicable, the range of temperature, outside the range of +5 ^{o}C to 35 ^{o}C, within which paint may be applied, shall be that range which the Contractor shall obtain in writing from the manufacturer of the paint.

The embedded lengths of irremovable fasteners which penetrate deeper than 75 mm from the concrete face may be left as base metal. The remaining portion shall comply with the paint system specified for the adjacent steelwork.

Surfaces which will become inaccessible for coating after fabrication or erection shall be given the full paint treatment specified plus one further top coat prior to the surfaces becoming inaccessible.

Generally the paint system shall be applied at the factory and damage to the system caused during transport or erection shall be repaired on Site after erection has been completed."

PSHC 5.9 APPLICATION OF METAL COATINGS (HOT-DIP GALVANIZING, METAL SPRAYING)

ADD TO THE SUBCLAUSE:

"The grade of HDG (hot-dipped galvanizing) required shall be carried out in accordance with SANS 121:2011, and shall be that for heavy duty coatings. This shall be applicable to all metalwork where HDG is called for either on the drawings or in the Bill of Quantities."

PSHC 7 TESTING

PSHC 7.1 TESTING BY THE CONTRACTOR

DELETE SUBCLAUSE (d) *AS TESTS ARE NOT REQUIRED TO BE CARRIED OUT AFTER THE APPLICATION OF EACH INTERMEDIATE COAT.*

ADD TO SUBCLAUSE (e):

“Test results are required after completion of the painting system, and the results shall be submitted to the Engineer.”

PSHC 7.3 TESTS, INSTRUMENTS, METHODS AND CRITERIA

PSHC 7.3.8 Dry Film Thickness

DELETE THE FIRST SENTENCE OF THE SUBCLAUSE AND REPLACE WITH:

"DFT measurements and frequency of readings shall be in accordance with SANS 2808."

PSHC 8 MEASUREMENT AND PAYMENT

PSHC 8.1 PRINCIPLES

PSHC 8.1.1 Units

ADD TO THE SUBCLAUSE:

"Separate payment for corrosion protection of structural steel shall only be made when so scheduled in the Bill of Quantities.

When not so scheduled the cost of the corrosion protection work shall be deemed to be included in the rate tendered for the structural steelwork."

PSL: MEDIUM-PRESSURE PIPELINES
(Applicable to SABS 1200 L – 1983)

PSL 2 INTERPRETATIONS

PSL 3 MATERIALS

PSL 3.1 GENERAL

ADD TO THE SUBCLAUSE:

"The types of pipe materials to be supplied and installed by the Contractor under this Contract are:

- Steel
- HDPE
- PVC
- Concrete

PSL 3.2 AC PIPES AND SPECIALS

DELETE THE SUBCLAUSE IN ITS ENTIRETY.

PSL 3.4 STEEL PIPES, FITTINGS AND SPECIALS

PSL 3.4.1 General

ADD TO THE SUBCLAUSE:

"All steel pipes, fittings and specials supplied by the Contractor under this Contract shall be to the dimensions and details shown on the drawings or as scheduled in the Bill of Quantities.

Steel pipes DN 200 and smaller shall be hot-dipped galvanised. Steel pipes larger than DN 200 and up to and including DN 500 shall have either flanged or belled and plain ends (spigot and socket) suitable for field fillet welding, as scheduled. Steel pipes greater than DN 500 shall have either flanged or plain ends prepared for field welding as scheduled.

Steel pipes DN 150 and smaller shall be API seamless Schedule 40 pipe.

Steel pipes DN 200 and larger shall be manufactured in accordance with SANS 719 and have a wall thickness of 6 mm unless otherwise shown on the drawings or stated in the Bill of Quantities.

All hand welding shall be carried out by suitably coded welders.

PSL 3.4.2 Pipes of Nominal Bore up to 150 mm

DELETE:
"shall be of medium class, shall be screwed, and shall comply with the applicable requirements of SABS 62"

AND REPLACE WITH

"shall be API seamless Schedule 40 pipe with plain ends, and be galvanised,"

PSL 3.4.3 Pipes of Nominal Bore over 150 mm

DELETE THE SUBCLAUSE IN ITS ENTIRETY.

PSL 3.4.4 Fittings and Specials

ADD TO THE SUBCLAUSE:

"All steel bends, fittings and specials shall be manufactured from straight pipe specified elsewhere unless otherwise stated in the Bill of Quantities.

All steel bends, fittings and specials shall be fabricated to the dimensions and details shown on the drawings and/or described in the Bill of Quantities.

The sides of taper pieces shall diverge at an angle of not more than 11° to each other.

Individual steel bends, fittings and specials up to and including DN 200 shall be hot-dip galvanised to heavy duty grade in accordance with SABS 121:2000 after fabrication. Where a hot-dipped galvanised fitting is to be welded to a coated and lined pipe, the galvanising is to be abraded off prior to welding. The external coating at the welded joint is to be primed and coated with an approved anti-corrosion system.

Bends, fittings, and specials larger than DN 200 shall have the internal lining and external coating made continuous ('made good') as specified elsewhere for welded joints on coated and lined steel pipes.

Steel bends shall generally be of the segmented type except where otherwise stated or shown on the drawings.

The Contractor will be responsible for the provision of strengthening webs, crotch plates, gussets, etc as may be necessary to prevent excessive deflection or deformation of fittings and specials when subjected to hydraulic pressure tests, and the tendered rates for the work will be deemed to include for the provision of this reinforcing

Steel bends shall be fabricated in accordance with the Table below.

Deflection Angle	
Up to and including 3°	One pipe end scarfed on site
Exceeding 3° and up to and including 9°	Mitre cut (two pipe ends scarfed on site)
Exceeding 9º but less than 15º	2 segment bend
15º and larger but less than 45º	3 segment bend
45º and larger but less than 60º	4 segment bend
60º and larger but less than 75º	5 segment bend
75º and larger but less than 90º	6 segment bend

All flanged bends, fittings and specials shall be hydraulically tested at the fabricator's premises to the same pressure that they will be subjected to during the hydraulic testing of the completed pipeline. No visible signs of leakage will be permitted."

ADD NEW SUBCLAUSES:

PSL 3.4.6 Puddle Collars and Anchoring Flanges

Puddle collars and anchoring flanges used as pipe anchorages shall be of the same dimensions as corresponding flanges but those cast into concrete walls are to be undrilled. The collar/flange shall be capable of transmitting a longitudinal force 33% greater than the internal hydraulic pressure to be applied when testing, multiplied by the area of the bore and, under that condition, the stress in the material shall not exceed its yield stress.

Where puddle collars are shown on the drawings as being 20 mm thick, those collars are not required to transmit thrust, their purpose being to assist with the waterproofing of the concrete chambers by increasing the path that ground water might have to take to enter the chambers.

Where polyethylene pipes are cast into concrete structures, they shall be specially prepared and adapted by positioning a custom-made tight-fitting natural rubber sealing sleeve around the circumference of the pipe and in the case of structured-wall pipe creating shear keys through removing small segments of the outer wall. The rubber seal shall be 10 mm thick and 200 mm wide or 80% of the width of the wall and shall be 60 to 65 shore hardness, with a vulcanised joint. It shall be stretched over the pipe circumference to ensure a tight fit.

PSL 3.4.7 Closure Pipes

Closure pipes, which are to be cut on site to the exact lengths, shall have the diametrical tolerances specified for the pipe ends applied over the full length of the pipe. Closure pipes shall be supplied in standard lengths.

PSL 3.7 OTHER TYPES OF PIPE

PSL 3.7.1 uPVC Pipes

DELETE THE SUBCLAUSE AND REPLACE WITH THE FOLLOWING:

"The following standards are applicable to **Unplasticised Polyvinyl Chloride (PVC-U)** pipes and fittings:

- SANS 791 - Unplasticised poly(vinyl chloride) (PVC-U) sewer and drain pipes and pipe fittings
- SANS 966-1 - Components of pressure pipe systems Part 1: Unplasticised polyvinyl chloride (PVC-U) pressure pipe systems
- SANS/ISO 967 - Unplasticised polyvinyl chloride (PVC-U) soil, waste and vent pipes and pipe fittings
- SANS/ISO 21138 - Plastic piping systems of Unplasticised polyvinyl chloride (PVC-U) for non-pressure underground drainage and sewerage – structured wall piping systems etc.
- SANS/ISO 1601 - Structured wall pipes and fittings of Unplasticised polyvinyl chloride (PVC-U) for buried drainage and sewerage systems:

The following standards are applicable to **Modified Polyvinyl Chloride (PVC-M)** "High impact resistance, Optimum balance between strength and ductility" pipes and fittings:

- SANS/ISO 966 Part 2 - Components of pressure pipe systems Part 2: Modified poly(vinyl chloride)(PVC-M) pressure pipe systems
- SANS 1283 - Modified poly(vinyl chloride) (PVC-M) pressure pipe and couplings for cold water services in underground mining

The following standard is applicable to **Bi-oriented Polyvinyl Chloride (PVC-O)** – "Improved mechanical & physical properties during manufacturing process; higher resistance to shock, punch and crack propagation":

- SANS/ISO 16422 - Pipes and joints made of oriented Unplasticised Polyvinyl chloride (PVC-O) for the conveyance of water under pressure.

The following standard is applicable to flexible **PVC Pressure Hose**:

- SANS 1086 Amendment 1 - Flexible polyvinyl chloride (PVC) pressure hose:

All PVC pressure and non-pressure pipes and fittings shall be free of all traces of heavy metal stabilisers and shall comply with the relevant SANS standard for that particular product, according to the class specified and/or indicated on the drawings and/or in the Bill of Quantities.

All pipe lengths shall bear the date and time of production, the SANS standard and the logo of a certification authority accredited by SANAS (currently SABS and SATAS) to carry out product conformance certifications according to the relevant SANS standard on a particular product at regular intervals as per the product standard. Pipes and fittings which do not carry the above mentioned markings e.g. small components, fittings, seals, etc. will only be accepted if the manufacturer is in possession of a valid certificate from a certification authority for those particular items.

Copies of the following documents shall be submitted to the Employer's Agent for verification prior to the commencement of manufacture:

- A Quality Assurance plan dealing with all aspects of the materials and manufacturing processes.
- A certificate of conformance of the polymer(s) to be used.
- Valid current product certificates issued by a certification authority.
- Factory audits shall be routinely be carried out by an independent organisation.
- The latest three factory audit reports conducted by an external independent organisation and confirmed by that organisation that at least one of the three audits was an unannounced audit i.e. that the manufacturer had not been advised in advance as to when the audits were to take place.
- The laboratory analyses of representative samples selected by, and taken at random by, the auditing organisation and/or a quality monitoring body, and analysed/tested by an external independent laboratory.

The Employer reserves the right to refer some or all of the aforementioned documents to a third party for comment and/or verification and, in the event of there being a non-compliance, pipes or fittings from that manufacturer will be not be acceptable."

PSL 3.7.2 Polyethylene Pipes

DELETE THE SUBCLAUSE AND REPLACE WITH THE FOLLOWING:

"The following standards are applicable to High Density Polyethylene (HDPE) pipes and fittings:

- SANS/ISO 4427 - Plastics piping systems – Polyethylene (PE) pipes and fittings for water supply.
- SANS/ISO 4437 Metric Series - Buried polyethylene pipes (PE) for the supply of gaseous fuels.
- SANS/ISO 8772 - Plastics piping systems for non-pressure underground drainage and sewerage – Polyethylene (PE).
- SANS/ISO 21307 - Plastics pipes and fittings – butt fusion jointing procedures for polyethylene (PE) pipes and fittings.
- PR EN 13476-1 & ISO 9969 - PE Structured Wall Sewer Pipes (Note that all pipes must be spigoted and socketed with a rubber seal):

All HDPE pressure and non-pressure pipes and fittings shall comply with the relevant SANS standard for that particular product; according to the class specified and/or indicated in the Bill of Quantities.

All pipe lengths shall bear the date and time of production, SANS standard and logo of any certification authority accredited by SANAS (currently SABS and SATAS) to do product conformance certifications according to the relevant SANS standard on a particular pipe or fitting at regular intervals as per the product standard. Pipes and fittings which do not carry the above mentioned markings e.g. small components, fittings, seals, etc. will only be accepted if the manufacturer is in possession of a valid certificate from a certification authority for that particular item.

The use of PE 80 and PE 63 in the manufacturing of polyethylene pipes and fittings is not permitted. Only virgin PE100 polymer from a recognised supplier may be used except that, in accordance with SANS 4427, the addition of regrind material is permitted provided it is from the manufacturer's own material. Preference will be given to manufacturers who do not use regrind material.

Copies of the following documents shall be submitted to the Employer's Agent for verification prior to the commencement of manufacture:

- A Quality Assurance plan dealing with all aspects of the materials and manufacturing processes.
- A certificate of conformance of the polymer(s) to be used.
- Valid current product certificates issued by a certification authority.
- Factory audits shall be routinely be carried out by an independent organisation.
- The latest three factory audit reports conducted by and external independent organisation and confirmed by that organisation that at least one of the three audits was an unannounced audit i.e. that the manufacturer had not been advised in advance as to when the audits were to take place.
- The laboratory analyses of representative samples selected by, and taken at random by, the auditing organisation and/or a quality monitoring body, and analysed/tested by an external independent laboratory.

The Employer reserves the right to refer some or all of the aforementioned documents to a third party for comment and/or verification and, in the event of there being a non-compliance, pipes or fittings from that manufacturer will be not be acceptable."

PSL 3.8 JOINTING MATERIALS

PSL 3.8.2 Flexible Couplings

DELETE SUBCLAUSE 3.8.2.1 AND REPLACE WITH THE FOLLOWING:

"Where ordered, steel flexible couplings shall be of the 'Viking Johnson'/'Klamflex'/'Aqualok/'Rexus' or similar approved type without central registers, each comprising one centre collar, two special flanges, two rubber rings and hot-dipped galvanised mild steel bolts.

Steel flexible couplings shall be assembled strictly in accordance with the manufacturer's instructions and all bolts shall be torqued to the value recommended by the manufacturer. On completion of hydraulic pressure testing of the installation, the entire joint shall be protected as described in Clause PSL 3.9.3.6.

The tendered prices for laying and jointing shall include for the supply of all necessary materials, plant and labour to complete the joint.

Flexible couplings shall conform generally to BS 10311: 2005 for slip-on type couplings and shall be of approved manufacture. They shall be capable of being tightened and released without damaging or improperly distorting the rubber seating rings and shall be designed to prevent the rubber rings being blown out under pressure or sucked in under vacuum.

Each coupling shall be capable of withstanding the test pressure applicable to the pipes with which they are to be used without exceeding a stress in the steel of 67% of the yield point.

Mild steel couplings shall be protected by an approved solvent-free epoxy (SFE) system such as 'Nordcoat 1' or similar approved system and applied within 4 hours of abrasive blast cleaning the metal surfaces of the coupling in accordance with ISO 8501-1 Grade Sa 2,5. Nuts, bolts and washers shall be hot-dipped galvanised. The plain end of the pipe shall be properly prepared, and in the case of steel pipes before corrosion protection, so as to accept the flexible coupling.

Adaptor couplings and anchoring adaptor joints shall comply with the above specification for flexible couplings and be of a similar design, but one end shall be flanged to enable connection of plain ended pipes to flanged joints. The adaptor joints shall be complete with bolts and nuts for connecting the flanged joint to the anchoring flange situated generally 300 mm to 400 mm from the plain end of pipe. All bolts, nuts and washers shall be hot-dipped galvanised. In order to anchor the plain ended pipe to the flanged joint all of the bolts for the flanged joint shall pass though the anchoring flange and shall be fitted with nuts and washers at the flanged joint and on either side of the anchoring flange."

PSL 3.8.3 Flanges and Accessories

ADD NEW SUBCLAUSE:

"PSL 3.8.3.1 Bolted connections

All flanges, gaskets, bolts, nuts, washers and other appurtenances required for the execution of the work under this Contract shall be supplied and installed by the Contractor and shall comply with the following:

- The dimensions and drillings of flanges shall comply with the requirements of SANS 1123 Tables 1600 unless otherwise shown on the drawings and/or in the Bill of Quantities.
- Flanges cut from steel plate shall have flat faces.
- No machining needs be carried out on the back face provided that face is sufficiently flat to ensure square bedding of the bolt heads and nuts and provided that all weld reinforcement is removed.
- The faces of flanges that are in contact with gaskets shall be masked and shall not be painted or coated. The mating flange shall then receive one coat of an approved rust inhibitor. Care shall be exercised to ensure that after the application of all coatings there are no runs or drips on the mating surfaces of the flanges and that the flange profiling is clearly visible over the entire face. Excessive coating build up in flange bolt holes that could snag bolts will not be permitted.
- Flanged joints shall be connected with the specified bolts, nuts and washers all of which shall be supplied by the Contractor.
- All bolts, tie-bolts, nuts and washers shall be galvanised to SANS 121: 2011 and shall comply with the relevant requirements of SANS 1700.
- The length of each bolt shall be such that after the bolt has been tightened, the end of the bolt shall project beyond the outer face of the nut. In the case of joints that will remain visible, the projection shall not be more than two threads. Tie-bolts on restrained/anchoring couplings shall be fitted with 'backing nuts' and washers.
- Each flanged joint shall be fitted with an approved and suitably rated gasket and sealed watertight such that there will be no visible sign of leakage under the specified factory and field test pressures and under the in-service working conditions (pressures).
- All bolts shall be tightened in a predetermined pattern with opposing bolts being tightened sequentially. When all bolts are tight, each bolt shall be torqued to the required/recommended torque in a predetermined pattern with opposing bolts being tightened sequentially.
- All bolt threads shall be liberally coated with 'Copper slip' or similar approved compound prior to assembly. Upon completion, bolt heads, washers and nuts shall be wrapped with the 'Denso Mastic Blanket System' comprising of a priming solution, mastic blanket, petrolatum tape and lay-flat sheeting as described in elsewhere."

PSL 3.8.4 Loose Flanges

ADD TO THE SUBCLAUSE:

"Flange jointing material, when installed in the complete pipeline, shall be capable of withstanding transient pressures of up to the specified field test pressure. Under this condition no damage shall be caused or leakage occur through the joint. Bolts and nuts shall be galvanised to SANS 121 and shall comply with the relevant requirements of SANS 1700 where applicable."

PSL 3.8.5 Insulating Flanged Joints

Where required, suitably rated insulating flanged kits shall be supplied, installed and tested such that the flanged joints will be electrically discontinuous and will withstand the hydraulic field tests without leaking.

The flange insulating sets shall be supplied complete. Each set must include an insulating gasket, insulating sleeves, two insulating washers and two machined steel washers per bolt, and an explosion proof spark gap. The entire insulating flanged joint shall be proved to be electrically discontinuous on completion of the project.

After the assembly of the joint and successful hydraulic pressure testing, the entire insulating flange shall be wrapped circumferentially with a white PVC backed polymer modified bituminous tape 1,5 to 2,0 mm thick with a minimum 25 mm overlap.

The insulating sets must be suitable for use with standard flat or raised face flanges as stated in the Project Specification.

An insulating flange consists of an insulating gasket, bolt sleeves and washers, appropriated sized steel bolts and washers and a voltage-limiting device for protection of the insulating materials.

The insulating gasket located between flanges is to be in accordance with the following table. The internal diameter of the pipe and the gasket shall be equal in all instances.

Field Test Pressure (MPa)	**Nominal Pipe Diameter (mm)**	**Insulating Gasket Material**
< 2,5	All Diameters	3,2 mm thick High Density Polyethylene to PEH Hostalen GM 5010 Specification, full face gasket in one piece
=> 2,5 < 4,6	All Diameters	3,2 mm thick High Density Polyethylene to PEH Hostalen GM 5020 SA Specification, full face gasket in one piece
=> 2,5 < 4,6	< 1 200	3,2 mm thick Fabric Reinforced Phenolic (Tested to BS 5102 Appendices A-M Type III) full faced gasket in one piece with neoprene or nitrile rubber faces 0,8mm thick
> 4,6	=< 1 200	3,2 mm thick Fabric Reinforced Phenolic (Tested to BS 5102 Appendices A-M Type III) full faced gasket with not more than 2 only factory made lap joints, with neoprene or nitrile rubber faces 0,8 mm thick
=> 4,6	> 1 200	3,2 mm thick Fabric Reinforced Phenolic (Tested to BS 5102 Appendices A-M Type III) full faced gasket in one piece with a aramid and glass fibre with nitrile rubber binder full faced gasket to BS 7531 on each side.

Notwithstanding the gasket types tabulated above the Contractor will be responsible for ensuring watertight joints shall therefore ensure that the gaskets used are suitable for the specified pressures. The insulating sleeves for each bolt shall be a minimum 1 mm thick glass fibre reinforced polyester or heat shrink insulation type ITCS Polyolefin sleeving with sealant. The total length of sleeves is to be 2 to 3 mm less than the length between inside faces of steel washers. The insulating sleeves shall fit completely inside the insulating washers and extend partially inside the steel washers.

Two insulating washers for each bolt shall be 3 mm thick fabric reinforced phenolic resin with outer diameter the same as that of machined steel washer. The internal diameter to be a sliding fit over outer diameter of insulating sleeve.

The diameter and thickness of the steel washers are to be machined in accordance with the tolerances for Grade A in SANS 1700-4-3.

Bolts and nuts shall comply with the requirements of SANS 1700-5-1. Stud bolts may only be used where it is not possible to through bolt. Tolerances shall be in accordance with Grade A in SANS 1700-4-1. The next smaller size bolt diameter shall be selected for installation in standard drilled flanges to accommodate the insulating sleeves and the "property class" shall be 8.8 as per SANS1700-5-1 i.e. the material of the bolts and nuts material shall be high tensile steel with a tensile strength of 800 MPa.

An explosion proof spark gap, type Dehn EX-FS (120kA) or similar approved shall be installed across the flange faces. The mild steel mounting brackets holding the spark gap are to be hot dip galvanised and of suitable dimensions to suit the flange bolt.

PSL 3.9 CORROSION PROTECTION

PSL 3.9.2 Steel Pipes

PSL 3.9.2.2 Steel pipes of nominal bore over 150 mm

DELETE THE SUBCLAUSE AND REPLACE WITH:

"PSL 3.9.2.2 Steel pipes of nominal bore over 300mm

Steel pipes shall be coated and lined as scheduled and/or as shown on the drawings. Linings and coatings shall comply with the following Particular Specifications as applicable:

PVA Cement Mortar Lining of Steel Pipes
PVC Fusion Bonded Medium Density Polyethylene Coating of Steel Pipes

The supply and application of coatings and linings are not scheduled separately in the Bill of Quantities and payment for the costs of meeting the requirements of these specifications which include for the provision of all labour, plant, materials and testing necessary to carry out the complete lining and making good, etc shall be included in the rates tendered for the supplying, laying and bedding of the pipeline as per Subclauses 8.2.1 and 8.2.2 of SABS 1200 L."

PSL 3.9.3 Protection against corrosion

ADD NEW SUBSUBCLAUSES:

"PSL 3.9.3.1 Preparation of steel surfaces for repairs and/or reinstatement of internal lining and/or external coating

The following method is applicable to the preparation of exposed steel surfaces prior to the carrying out of any repair procedure to internal linings and/or to external coatings. This specification is applicable to all steel surfaces that have been stripped of its corrosion protection layer, internally or externally, as a result of the manufacturing of specials, construction activities or pipe laying, welding and/or damages caused by handling or latent defects in application.

(a) Degreasing

All bare metal surfaces shall be degreased in order to remove grease and oil from the pipe surface as a first step in the preparation process i.e. before grit blasting and/or power brushing starts. Degreasing shall be carried out using an approved water-based solvent degreaser such as that

complying with SANS 1216 or, for use in enclosed systems, with SANS 1365. The surface shall then be cleaned with potable water and left to dry completely before the next step is taken.

(b) Grit Blasting – Internal Lining Repair

Grit blasting of bare metal surfaces shall take place after degreasing of the area. The finished grit blasted surface shall be to Sa 2,5 of ISO 8501-1 with a 75 micron angular profile.

Transition areas from epoxy internal lining, to bare metal which has been grit blasted, shall be smooth without rough edges or flaking appearances.

All grit blasting within the pipe line that is under construction, shall be performed by way of a "vacuum blast" process in order to limit the generation of dust. Grit blasting shall, under all circumstances, be carried out using equipment suitable for the size of the work to be undertaken. Damp hessian sacking or other suitable material is to be temporarily fixed around the pipe on both sides of the work areas to prevent damage to the adjoining pipe coating/lining.

All residual dust and debris shall be removed.

The Contractor shall provide the Engineer with a method statement for approval for each type/location of grit blasting, before work commences.

(c) Power Brush – External Coating Repair

Power brushing of bare metal surface shall take place after degreasing of the area as specified. The area that has been power brushed shall be free from rust, laitance, dust, oil or other deleterious matter before the application of primer. Any areas in the region where power brushing took place shall be free from signs of disbonding of lining and/or coating, once power brushed. The surface finish, once power brushing has been completed, shall conform to minimum St 2 standard.

PSL 3.9.3.2 Preparation, mixing and application of epoxy compounds

When mixing two part epoxies the base and activator shall be mixed in accordance with the manufacturer's instructions. Mixing in the original container will only be permitted by means of methods that ensure full integration of different parts of the compound into a homogeneous compound with the characteristics as intended by the manufacturer. The different parts of the compound shall not be diluted. Mixing shall only be allowed with full batches and reduction of volumes from mixing packs by means of weight or volume measurement, which will result in smaller portions to be mixed, will not be allowed. In the application of the epoxy the following shall be strictly in compliance with the manufacturer's instructions:

- Method of application (Type of brush or roller.)
- Over coating time.
- Temperature range for application.
- Method of mixing base and activator.
- Number of coats to achieve the specified thickness.
- Safety aspects e.g. Eye and hand protection, ventilation, fire precautions, etc.
- Note that roller and brush applicators shall be replaced once the product application expiry time has been reached on any specific applicator tool.

Uncured epoxy must be regarded as being toxic and shall be handled in accordance with the manufacturer's instructions. Adequate lighting and ventilation shall be provided whilst working within the pipeline.

Only solvent free epoxy repair kits shall be utilised to repair the internal linings of the pipe line. This specification refers to 'two part epoxy' as an epoxy repair kit which consists of a base and an activator approved by the Engineer and could be products similar to 'Denso ST100', 'Sigma SF 523', 'Nordcoat 1', etc.

The Contractor's tendered rates for the laying of the pipe shall be deemed to include for all the repairs and make-goods that have to be effected in order to deliver a serviceable and acceptable pipe line. (This excludes such repairs as instructed by the Engineer as a result of manufacturing defects, if any).

Two part epoxy may only be applied on steel surfaces prepared as specified in PSL 3.9.3.1.

PSL 3.9.3.3 Making good of cement mortar lining at welded joints

All cement mortar lined pipes that are supplied by the Contractor under this Contract shall have their cement mortar lining stopping between 50 mm and 75 mm from each plain end and from each belled or plain end and it shall be 'chamfered' by 15 degrees to provide a positive dove-tail joint for the cement mortar repair plug after field butt welding to another pipe.

When cement mortar lined straight steel pipes are cut, the cement mortar lining shall be cut back between 50 mm and 75 mm from the cut end of the pipe and "chamfered" by approximately 15 degrees to provide a positive dove-tail joint for the cement mortar repair plug after butt welding.

The surfaces shall be prepared as specified in PSL 3.9.3.1 save that grit blasting will not be necessary.

Cement mortar is to be used for the make-good of the internal cement mortar linings. The design mix for the mortar shall be prepared by an approved laboratory it being envisaged that it will comprise cement and plaster sand in a ratio of around 1:1,5 with a maximum water/cement ration by mass of 0,36 and including a small quantity of a styrene-butadene rubber latex additive to improve adhesion and flexibility. The cost of the mix design(s) will be for the account of the Contractor.

The ends of the cement mortar and the prepared surfaces of the steel surfaces shall be primed with a rubber latex solution after which the cement mortar lining shall be made continuous. Where internal access to the pipe is possible the joint filling shall be done manually. In the case of spigot and socket (plain and belled end) pipes where access to the inside of the pipe is not possible, a 50 mm wide by 20 mm thick band of cement mortar shall be applied internally on the steel adjacent to the cement mortar lining. The plain end of the adjoining pipe shall then be pushed into the bellmouth (or into the external sleeve when there is no bellmouth) in such a way that the cement mortar band is compressed and makes contact with the transverse face of the cement mortar lining of both pipes. The excess material that is squeezed into the bore of the pipes shall be removed by drawing a suitably sized pig across the joint. The pig that is used shall be such as to render an even and smooth finish to the cement mortar at the joint. The timing of when the pig is pulled through is critical and shall be carefully controlled.

PSL 3.9.3.5 External corrosion protection of factory welded joints and coating repairs

All factory coated steel pipes shall be supplied with the external coating cut back 100 mm from each pipe end. Where pipes are cut, either on site, or for the purpose of fabricating bends, fittings and specials, the pipe coating shall be cut back 100 mm from the intended cut area before the pipe is cut. Damp hessian sacking or other suitable material shall be temporarily fixed around the pipe to prevent damage to the pipe coating during welding operations. Once welding is complete, and all weld splatter and burnt coating has been removed, the welded pipe joints shall be wrapped in the following manner.

The following specification is based on 'Denso' products and systems. Alternative products and procedures may be proposed by the Contractor and, if approved by the Engineer, they may be used. Irrespective of which products are approved by the Engineer and used by the Contractor, all procedures shall be carried out strictly in accordance with the Contractor's method statements which must conform to the product manufacturer's recommendations.

A fundamental outcome is a sound and continuous coating that is free from wrinkles and that does not have any entrapped air pockets or any air bubbles.

(a) Surface Preparation

The bare metal shall be cleaned and wire brushed to minimum St 2 standard and degreased with white spirit. The adjacent pipe coating shall be cleaned to a minimum of 300 mm either side of the joint and the edges 'feathered' to achieve a tapered transition over a distance of 100 mm. The sound, parent coating surface shall be roughened with sandpaper over an area 250 mm either side of the joint.

(b) Priming

The entire pipe and coating surface over a length of 250 mm on either side of the joint shall be primed using 'Denso Primer D' (or equivalent approved). Care must be taken to obtain a thin even film with no runs or sags. The primer shall be allowed to cure until 'tack dry' before the application of the tape commences. Priming may only be carried out on those areas that are wrapped that same day. If primed areas are left overnight, those areas shall be re-primed before wrapping.

(c) Profiling Tape

A 1,5 mm thick x 50 mm wide 'Denso Mastic Sealing Tape' (or equivalent approved) shall be applied to the full circumference of the weld bead in accordance with the manufacturer's specifications. Care shall be taken to ensure a smooth profile and to avoid air bubbles being trapped beneath the tape. (Note: The profiling tape may be omitted at the discretion of the Engineer. Tenderers shall nonetheless allow for the profiling tape in their tendered rates).

(d) Tape Wrapping

The joint shall then be wrapped (minimum 55% overlap) with 'Denso Ultraflex 1250' tape starting at the roughened section (250 mm from the welded joint) in accordance with the manufacturer's requirements to create a 500 mm wide wrapping, centred over the welded joint. A 100% overlap is required on the first and last revolutions of the tape wrapping operation. It is important that tension in the tape be released when the wrapping of the last half circumference of the pipe. The Contractor shall ensure that the wrapping overlaps or covers a minimum of 150 mm of the pipe coating. A secondary or outer tape wrap layer of 'Denso MDP 032' is then applied over the first layer with a 55% tape overlap.

PSL 3.9.3.6 External corrosion protection of shop-fabricated pipe bends and fittings

The external coating of shop fabricated bends and fittings shall be carried out as follows:

- Where a substantial part of the external coating on the parent pipe is intact, the coating repairs/make good shall be carried out in accordance with PSL 3.9.3.5, or
- Where black (uncoated pipe has been used), the coating shall be carried out with an approved solvent-free epoxy (SFE) system such as 'Nordcoat 1' or similar approved system, or
- Where only a relatively small proportion of the external coating on the parent pipe remains, all of the remaining coating shall be removed and the entire bend/fitting shall be coated with an approved solvent-free epoxy (SFE) system such as 'Nordcoat 1' or similar approved system.

All crotch plates and wrappers/collars shall be coated an approved solvent-free epoxy (SFE) system such as 'Nordcoat 1' or similar approved system.

After application of the SFE coatings to the crotch plates and collars/wrappers, approved mastic (refer PSL 3.9.3.8) shall be placed in all crevices that may become moisture traps.

No additional payment will be made for any of this work as the costs are deemed to be included in the scheduled rates for pipelaying.

PSL 3.9.3.7 External corrosion protection of site-fabricated pipe bends and fittings

"The coating repairs/make good shall be carried out in accordance with PSL 3.9.3.5.

PSL 3.9.3.8 Corrosion protection of flanges and flexible adaptor/anchoring joints

All flanges and flexible joints and adaptor/anchoring joints and their associated bolts, nuts and washers, shall, notwithstanding that the flexible and adaptor/anchoring joints shall be epoxy coated as specified elsewhere, be protected as described below.

(Note: This specification is based on a 'Denso' system. Alternative products may be used, subject to approval by the Engineer.)

(a) Surface Preparation

The entire surface area of the flange/adaptor/anchoring joint, and its bolts, nuts and washers, up to not less than 250 mm either side of the joint, shall be cleaned of all dirt and other deleterious matter. The cleaned area, up to 200 mm either side of the flange/adaptor/anchoring joint, shall then be wire brushed.

(b) Priming

The cleaned flange/adaptor/anchoring joint, bolts, nuts, washers and the adjoining 200 mm length either side shall be primed with 'Denso Priming Solution', or if moisture is present, with 'Denso S105 Paste'.

(c) Application of Mastic Blankets

Narrow strips cut from 'Denso Mastic Blanket' shall be applied to the flange/ adaptor/anchoring joint to achieve a smooth profile with a 50 mm splayed fillet being formed at the joint/pipe interface. Care shall be taken, particularly at bolts, to avoid the formation of air pockets. Complete 'Denso Mastic Blankets' shall then be applied (mastic side down) to the flange/adaptor/anchoring joint until the flange/adaptor/anchoring joint is completely enveloped.

The blanket shall be overlapped at least 50 mm and shall extend at least 150 mm along the pipe barrel on each side of the flange/adaptor/anchoring joint. The ends of the blanket shall be bound to the barrel of the pipe on each end with 100 mm wide 'Denso Tape'. The 'Denso Tape' overlaps shall be 50 mm and shall extend 100 mm onto the blanket and 150 mm onto the pipe barrel.

(d) Application of Protective Sheeting

The entire flange/adaptor/anchoring joint shall then be wrapped with 350 micron polyethylene sheeting which shall end 400 mm beyond the joint. The protective sheeting shall be secured to the pipe barrel and along the seam with 48 mm wide 'Denso Adhesive Tape'.

PSL 3.9.3.9 Coating of permanently exposed pipes/fittings

All steel pipes which are permanently exposed shall, in addition to the specified corrosion protection at flange/adaptor/anchoring joints, be protected with the 'Denso Acrylic Pipeline Tape (Steelcoat 500)' system or similar approved UV resistant coating. The pipe surface shall be prepared and the coating applied in strict accordance with the manufacturer's instructions.

(a) Surface Preparation

The pipe surface to be wrapped shall be cleaned of dirt, grime, grease and other deleterious matter, using white spirit if necessary and then allowed to dry thoroughly.

(b) Priming

'Denso Primer D' shall be applied to the prepared surfaces at a nominal coverage rate of 8 m² per litre. Care shall be taken to obtain an even film with no runs or sags. Only those areas that are to be wrapped the same day shall be primed. If primed areas are to be left overnight, these areas shall be re-primed before wrapping.

(c) Tape Wrapping

The joint shall be spirally wrapped (minimum 55% overlap) with 'Denso Acrylic Tape' (or approved equivalent) in accordance with the manufacturer's requirements such that the start and end points are located at buried sections of the pipe, before it daylights. A 100% overlap is required on the first and last revolutions of the tape wrapping operation. It is important that tension in the tape be released when the wrapping of the last half circumference of the pipe.

(d) Final Coating

One coat of 'Densoflex Fire Retardant' shall be applied to the exposed pipe at a nominal application rate of 3 m² per litre.

PSL 3.9.3.10 Repair of cement mortar lining

All repairs procedures shall be subject to the prior approval of the Engineer. Generally, a crack shall be ground out using a mechanical grinder down to the steel wall to form a 'dove-tail' groove with a minimum width of 8 mm. Care shall be taken not to grind any of the steel pipe wall. The groove shall be rendered free of laitance, dust, oil, grease, fractured aggregate and other deleterious matter. The steel pipe wall internal surface shall be rendered free of rust and other deleterious matter by wire brushing (apply white spirit, if necessary). The groove shall be filled with 'Epidermix 338' (or equivalent approved), mixed and applied in accordance with the manufacturer's instructions.

PSL 3.9.3.11 Repair of FBMDPE coating

All damaged and blistered FBMDPE coating caused by welding or other mechanical means shall be removed back to sound coating by mechanical grinding or other approved means.

The exposed steel surface shall be power wire brushed to remove dirt, scale, rust and other foreign matter to a surface profile equivalent to a Class St 2 finish. Weld spatter shall be removed by chipping or grinding to a smooth surface flush with the surrounding steel. Welds shall have a smooth contour free from sharp edges, protrusions and undercut. Sharp edges and protrusions shall be removed by grinding to a smooth radius of curvature of not less than 3 mm.

Degreasing of the exposed steel surface shall be done in terms of Clause PSL 3.9.3.1.

The surrounding sound FBMDPE surface shall be feathered from steel surface to maximum thickness and then abraded to a distance of 100 mm beyond the defective area. The abrasion shall be carried out with clean emery paper of 80 to 100 mesh so as to produce a suitably rough surface profile without causing the removal of excessive amounts of protective material.

Virgin Sintakote powder is to be melted into the defect to ensure proper mechanical bonding with the steel surface and chemical bonding with the existing Sintakote. The melting of the virgin material shall be such that melting is not effected with an open flame. The melted powder shall be shaped with a hot spatula to form a smooth surface over the repair area.

As an alternative to the use of powder, the repair may be carried out in accordance with Clause PSL 3.9.3.5

Under no circumstances will patching of damaged areas by means of pieces of tape wrap, be allowed.

PSL 3.9.3.12 Corrosion protection of valves and & flexible and flanged joints

Every buried cast iron/steel coupling, joint, flange, and valve, where scheduled, shall be protected by the following 'Denso' or equal approved anti-corrosion system.

After the pipework has been satisfactorily tested (and bonded at the couplings for electrical continuity, if applicable) the exposed portion of the coupling, joint or flange and the unsheathed portions of the pipes at the joint and the bodies of all buried valves shall be covered with an approved petroleum based mastic/cloth system applied strictly in accordance with the manufacturer's instructions and then covered with two layers of approved adhesive PVC tape. The external sheathing system, which shall be to the approval of the Engineer, shall be carried out as follows:

All loose dirt, rust, mill scale and flaking paint shall be removed by wire brushing all exposed metal surfaces. An approved priming solution shall be applied by brush with care being taken to ensure all exposed metal surfaces are coated.

'Denso', 'Corromastic' or equal approved mastic shall be packed around the joint and/or valve body to form an even contour for the application of tape. A fillet shall be formed between the flange and the pipe barrel/valve body and, in the case of flexible couplings, mastic shall be packed around the bolts to a height of 3 mm above the bolts. Care shall be taken to ensure that no air is entrapped.

A layer of impregnated tape/cloth shall be spirally applied with a minimum overlap of 50 mm. All air pockets shall be removed.

A 10 mm thick layer of mastic shall then be packed on top of the tape and a second layer of impregnated tape/cloth shall be spirally applied with a minimum overlap of 25 mm. The tape layer shall commence and terminate at least 100 mm over the pipe sheathing on either side of the joint. The surface shall then be smoothed off and all air pockets shall be removed.

An overwrap consisting of two separate layers of approved, 300 micron thick adhesive PVC tape shall be spirally applied with a minimum of 25 mm overlap and with at least two laps over the untreated sheathing on either side of the joint.

The whole sheathed area of the joint shall be subjected to holiday detection and, if proved sound and approved by the Engineer, it shall be covered with 'padding' sand.

PSL 3.10 VALVES

DELETE THE SUBCLAUSE AND REPLACE WITH:

"Valves supplied under this Contract shall comply with the requirements of Particular Specification PVH: Valves which covers Gate Valves, Resilient Seal Valves, Butterfly Valves, Reflux valves and Air Valves

PSL 3.11 MANHOLES AND SURFACE BOXES

PSL 3.11.1 Bricks

DELETE THE FIRST SENTENCE AND REPLACE WITH:

"Bricks for manholes and surface boxes shall be engineering bricks type FBXE45 or better, with a water absorption not exceeding 7% and complying with the applicable requirements of SANS 227."

PSL 3.11.5 Manhole Covers and Frames

DELETE SUBCLAUSE 3.11.5.1 AND REPLACE WITH:

"Manhole covers shall comply with SANS 558 for the types shown on the drawings and/or scheduled in the Bill of Quantities."

ADD NEW SUBCLAUSES:

"PSL 3.11.7 Sand

Sand used for mortar (general purpose) and for plaster (external) shall comply with the applicable requirements of SANS 1090.

PSL 3.11.8 Cement

The cement used on the Works shall be Portland cement complying with the requirements of SANS 50197-1 and -2: Common Cements."

PSL 4 PLANT

ADD NEW SUBCLAUSES:

"PSL 4.4 PACKING

Goods should be suitably packed in such manner as to ensure safe and efficient transport by road or rail, and the Contractor shall include in his prices for whatever packing may be necessary in this respect. Small items, particularly liable to damage or loss in transit, should be crated. All crates and packing material shall, after use, become the property of the Employer, unless distinctly specified otherwise, or if returnable, shall be so at the Contractor's expense.

PSL 4.5 ADVICE NOTES AND INVOICES

The Contractor shall submit one copy of every advice note in respect of each individual consignment, quoting the Contract Number, the truck or vehicle number, item numbers and a brief description of the articles so consigned. The advice note shall be lodged with the Engineer's Representative on Site at least two days before the arrival of the goods.

PSL 4.6 DELIVERY AND ACCEPTANCE

The material to be supplied under this Contract shall be consigned and delivered to approved areas adjacent to the pipeline route, or to an approved storage area if not required for immediate use."

PSL 5 CONSTRUCTION

PSL 5.1 LAYING

PSL 5.1.1 General

ADD TO THE SUBCLAUSE:

"The Contractor shall be responsible for clearing the areas required for pipe storage that shall include the removal of rock, stones and all combustible material. He/she shall also be responsible for maintaining the area in a clean and tidy condition for the duration of the Contract.

Upon delivery of the pipes, fittings, specials and valves, these will be inspected jointly by the Engineer's Representative and the Contractor. Any items found to be damaged shall be returned to the factory for repair or replacement, in which case the costs of additional transport, repair or replacement shall be borne by the Contractor, if the pipes were supplied by the Contractor and not by the Employer.

The Contractor shall be held fully responsible for the care and safety of all pipes and fittings, etc, on site, and shall bear the cost of all renewals, which may be necessary to make good losses, damages or breakages. Furthermore, he shall be fully responsible for handling and re-loading material at the storage areas and for transporting and off-loading of all such materials to the Site of the Works.

Before commencing pipelaying, the Contractor shall properly distribute pipes, fittings and specials, along the trenches. Valves and couplings shall not be distributed until they are actually required for laying in their designed position.

All HDPE pipe installations (in trenches or trenchless) shall be carried out by an IFPA (The Installation and Fabrication Plastics Pipe Association) member who shall provide the necessary training to their employees to ensure IFPA standards are maintained. Employees involved with the welding operations shall have a (minimum) certificate of competence at NQF Level 2 (in accordance to SANS 10268.) All bends on HDPE pipes shall comply with SANS 6269.

All pipe installers involved with the installation procedures with HDPE pipes must submit a valid IFPA membership certificate to the Employer's Agent prior to commencement of work on site."

PSL 5.1.2 Damage

ADD TO THE SUBCLAUSE:

"The Contractor shall be responsible for protecting pipes fittings and valves from grass fires at all times and shall keep grass cut short in the vicinity of all unlaid pipework items.

Should trenches be inundated by water, there is a risk of movement of the pipes by flotation. The Contractor shall ensure that trenches are not flooded by stormwater and that pipes laid in the trench are backfilled as soon as possible after laying, except at joints made with couplings or flanges which must be kept visible until the pipeline has been satisfactorily tested.

Steel pipes with welded joints may, after all specified testing and corrosion protection has been satisfactorily completed and with prior approval from the Engineer, be backfilled at the same time as backfilling the pipeline.

Should movement of the pipes occur, the Contractor shall remove the pipes from the trench and thoroughly clean and relay the pipes. This work shall be carried out at the Contractor's expense."

PSL 5.1.3 Keeping Pipelines Clean

ADD TO THE SUBCLAUSE:

"The Contractor shall take all of the steps necessary to prevent flooding of the Works and hence ensure that all work is carried out in the dry, and that the ingress of dirt and or dirty water into the pipes is prevented. The ends of all laid pipes shall be closed at all time when work is not being carried out."

ADD NEW SUBSUBCLAUSES:

"PSL 5.1.3.1 Cleaning pipe internals

The Contractor shall ensure that all pipe work is installed internally free of any contaminants. All traces of dirty water, slag, splatter, swarf, cuttings, coupons, welding rod ends, grinding dust, dirt and other debris shall be removed from the inside of the pipe as it is installed.

The Contractor's attention is drawn to the need to take great care to protect internal epoxy linings. To this end, a rubber mat shall be provided for walking on inside the pipe. On steep slopes, the mat shall be restrained from sliding down the pipe. Care shall also be taken on steep slopes to restrain equipment and hand tools from sliding down the pipe during construction.

The relevant safety procedures shall be followed when entering pipes.

The Contractor shall ensure that all dust, grit and powder that accumulates in the pipe as a result of grit blasting for the repair of internal linings, be removed from the pipe in an acceptable manner before the internal lining repairs are carried out.

Once the lining repair has been completed, cleaned off and inspected, that specific section of the pipe shall be blocked off to prevent any further access by workers.

The Contractor shall take note that flushing of the completed pipeline may not be allowed after construction has been completed and therefore clean house keeping practices shall be required under all circumstances during construction. The tendered rates for pipe laying shall include for the clean house keeping practices required.

Each section of the pipeline shall be internally inspected and passed by the Engineer once construction has been completed. If the pipework is not satisfactory, the Contractor shall re-clean the pipe at his own expense until the pipe is passed clean. The Engineer reserves the right to utilize cameras or any other means to inspect inaccessible areas.

PSL 5.1.3.2 Cleaning of valves and fittings

All flanges, valves, fittings and equipment may only be installed in pipe work after they have been thoroughly cleaned. Flange faces shall be checked for damage before being incorporated into the permanent works and any damage shall be reported to the Engineer."

PSL 5.1.4 Depths and Cover

DELETE SUBCLAUSE 5.1.4.1 AND REPLACE WITH THE FOLLOWING:

"Unless otherwise shown on the drawings or scheduled in the Bills of Quantities or ordered, the depth of excavation for trenches for medium-pressure pipelines shall be such that the cover to finished ground level over the laid pipe shall not exceed 1,0 m."

DELETE FROM THE THIRD AND FOURTH LINES OF SUBCLAUSE 5.1.4.2:

"(e.g. the deflection shall not exceed 1,5° per joint in the case of AC pipes:)"

ADD NEW SUBCLAUSES:

PSL 5.1.5 Pipe Supports

Temporary pipe supports may be used to assist setting up and assembly. However, it is preferred that permanent pipe supports are installed as soon as possible to minimize double handling and/or omission during construction.

Permanent pipe supports shall be constructed as indicated on the drawings or as directed on site.

Before testing, all permanent supports shall be complete and all temporary supports removed, unless otherwise agreed by the Engineer.

PSL 5.1.6 End Caps

The Contractor shall, at the end of each days work, fit end caps to the open ends of the pipeline under construction. The end caps shall be manufactured in such a manner that it can be fitted to seal off the pipeline to the extent that it is totally dust and water proof. The end cap must be able to withstand a pressure of 5 m head of water externally when fitted.

End caps shall be maintained during non-working periods.

The tendered rates for the laying of pipes shall be deemed to include for the supply, fitment, and maintenance of the end caps.

PSL 5.1.7 Marker Posts

Pre-cast concrete marker posts as shown on the drawings and painted white in colour shall be set at all horizontal direction changes and where otherwise indicated by the Engineer.

The standard marker post rate shall include the supply and erection of painted, inscribed posts. The rate shall be inclusive of erection and shall include for all necessary excavation, mass concrete footing and formwork."

PSL 5.2 JOINTING METHODS

PSL 5.2.2 Flanges (Steel Pipelines)

IN THE HEADING DELETE "**(Steel Pipelines)**"

ADD TO THE SUBCLAUSE:

"Before being brought together, the ends of the pipes, fittings, couplings and flanges shall be inspected and cleaned to ensure that all parts forming the joint are undamaged and clean.
When jointing flanges, the faces shall be cleaned thoroughly and, cut properly to size, shall be inserted immediately before bringing the two flanges together. Before closing the joints, the flanges shall be parallel to each other, with all bolts inserted in the bolt holes. After the fittings have thus been aligned and well supported, the joint shall be bolted up to a uniform tightness using torque wrenches to achieve the required compression *force on the gasket.*

Gaskets for flanged joints shall be of aramid and glass fibre with nitrile rubber binder to BS 7531, and shall be suitable for the specified pressures with a minimum thickness of 3 mm. Inside bolt circle gaskets should be used for flat face flange connections and ring gaskets for raised face flange connections.

If and where full face gaskets are used, the jointing material shall be flush with, or protrude beyond, the outer circumference of the flange. On completion of the joint, the flanges and bolts shall be protected as described in Clause PSL 3.9.3.8."

PSL 5.2.3 Welding (Steel) Pipelines of Diameter 600 mm or greater)

ADD TO THE SUBCLAUSE:

Records of which welds were carried out by each individual welder as well as non-destructive testing results shall be submitted to the Engineer monthly. Should there be repetitive or serious defects, this information shall be forwarded to the Engineer immediately."

"PSL 5.2.5 Cut Pipes

Cut pipes shall be used where required as closure lengths. The cut ends shall be dressed square and to a smooth even finish and prepared for butt welding preparation which shall not be inferior to that of the ends of uncut pipes. The finished dimensions of ends cut on site shall be within the tolerances applicable to the ends of the particular types of pipe to be laid. The cost of cutting and trimming of pipes shall be included in the rates tendered for laying and jointing pipes."

PSL 5.3 SETTING OF VALVES, SPECIALS, AND FITTINGS

ADD TO THE SUBCLAUSE:

"Valves shall be set correctly in the positions indicated and supported on concrete stools or steel supports as detailed, except where not so required by the Engineer. Valve spindle guide brackets and stays where provided shall be secured into position against concrete work and set and carefully adjusted in order to give true vertical alignment of the spindle."

PSL 5.4 CONCRETE CASING

IN THE FIRST AND SECOND LINES DELETE "a strength 15 MPa/37,5 mm or such other strength as scheduled" AND REPLACE WITH: "concrete grade 20/19".

PSL 5.5 ANCHOR/THRUST BLOCKS AND PEDESTALS

IN THE FOURTH LINE DELETE "15 MPa/37,5 mm" *AND REPLACE WITH* "20/19"

ADD TO THE SUBCLAUSE:

"Steel pipelines that are to be continuously welded or flanged, do not require anchor/thrust blocks at tees, bends, terminal valves and end caps."

PSL 5.6 VALVE AND HYDRANT CHAMBERS

PSL 5.6.1 General

DELETE THE REFERENCES TO DRAWINGS L1, L2 AND L3 AND REPLACE WITH "drawings issued by the Engineer".

PSL 5.6.2 Construction of Chambers

DELETE THE REFERENCES TO DRAWINGS L1, L2 AND L3 AND REPLACE WITH "drawings issued by the Engineer".

PSL 6 TOLERANCES

PSL 6.3 ALIGNMENT (PLAN AND LEVEL)

DELETE THE THIRD AND FOURTH LINES AND REPLACE WITH:

"of the pipeline, shall be $\pm$ 50 mm or $\pm$ 10% of the nominal diameter of the pipe, whichever is the larger, and the permissible deviation per pipe length shall be +/- 20 mm."

DELETE THE SIXTH (LAST) LINE AND REPLACE WITH:

"$\pm$ 25 mm or $\pm$ 5% of the nominal diameter of the pipe, whichever is the larger, provided that there shall be no reversal of the pipeline gradient."

PSL 7 TESTING

PSL 7.3 STANDARD HYDRAULIC PIPE TEST

ADD THE FOLLOWING PREAMBLE:

"Water used for one filling of the pipeline for hydraulic testing, one filling for disinfection and one filling after draining the disinfection water shall be provided by the Employer free of charge. Additional water used due to dirty water in the pipe and/or due to unsuccessful hydraulic tests shall be charged at the Employer's bulk rate per kilolitre that is charged to their bulk consumers. Filling of the pipeline for hydraulic testing shall be carried out slowly to enable air to escape and under the direction of the Engineer.

PSL 7.3.1 Test Pressure and Time of Test

ADD TO THE SUBCLAUSE:

"The pipeline shall be subjected to a field test pressure as shown on the drawings.

The sections in which the pipeline will be tested will be at the discretion of the Contractor, except that the pipeline shall not be tested in sections exceeding a maximum allowable length of 2 000 m unless otherwise agreed by the Engineer and also taking cognisance of the requirements of Clause C3.5.17 of the project specifications. The Contractor shall make due allowance in the construction programme and in the tendered rates for the entire testing operation including for the provision of temporary end stops (flanges or bullnoses) and any other costs incurred associated with testing the pipeline in intermediate sections. Once all intermediate sections have been successfully tested, the untested sections, if any, between the ends of the tested sections shall be visually inspected under a pressure as detailed on the drawings.

The pipe shall not be tested until the associated structural concrete for anchorage has cured for 28 days or until such concrete has attained the specified design strength. Once filled, the pipe shall be left for 24 hours to permit maximum saturation of cement mortar linings.

The section to be tested shall be pressurised to the specified pressure and left for 24 hours, during which period, the pressure drop (if any) and the quantity of water required to be pumped in to restore the test pressure shall be measured and recorded. In addition, all flexible and flanged joints shall be visually inspected and there shall be no sign of leakage.

The permissible leakage for welded and flanged steel pipelines is zero (0) litres.

At all times when there is water in the pipeline, and particularly during filling, testing and draining of the pipeline, all air valves shall be in operation and their individual isolating valves shall be open."

PSL 7.3.1.2 *DELETE SUBCLAUSE* 7.3.1.2.

PSL 7.3.1.3 *DELETE SUBCLAUSE* 7.3.1.3.

PSL 7.3.1.4 *DELETE SUBCLAUSE* 7.3.1.4.

PSL 7.3.3 Permissible Leakage Rates

DELETE THE TITLE OF THE SUBCLAUSE AND REPLACE WITH THE FOLLOWING:

"PSL 7.3.3 Permissible Make-up Water"

ADD ADDITIONAL PARAGRAPH TO THE SUBCLAUSE AS FOLLOWS:

"(c) Welded steel pipelines ..... Nil"

ADD NEW SUBCLAUSES:

"PSL 7.3.4 Initial Filling of Pipeline

The entire process for filling the pipeline at any time during testing or disinfection shall be carried out under the supervision of the Engineer and will also be monitored by the Engineer and/or the Employer's personnel. Under no circumstances shall the Contractor be allowed to carry out filling of the pipeline without the supervision of the Engineer, neither shall he/she permit any other persons to carry out such filling without the written permission of the Engineer.

Any damage to the pipeline caused by non-compliance with this Subclause shall be rectified at the Contractor's expense.

PSL 7.3.5 Connections After Testing

The connections of the new pipework to the existing pipework shall only be carried out after the pipeline testing has been completed and accepted by the Engineer. For this reason, testing shall be carried out against a blank flange or bullnose end cap at these locations.

PSL 7.3.6 Remedial Measures

In the event that a pipe section fails a test, the Contractor shall carry out all remedial measures necessary to obtain a successful test of each individual section and the entire pipeline, at his/her own expense. Such remedial measures shall in no way compromise the original pipeline specifications.

PSL 7.3.7 Draining of the Pipeline

The pipeline may have to be drained to carry out remedial measures and it must be drained before the disinfection process commences. The pipeline shall be drained via the scour valves in a manner that does not cause erosion of the streambeds or negatively impact on the environment in any way. All such drainage of the pipeline shall be carried out under the supervision of the Engineer's Representative."

ADD NEW SUBCLAUSES:

"PSL 7.6 COMMISSIONING

The pipeline shall be considered to have been commissioned and practically complete once all the associated structures are sufficiently complete to carry out their structural and hydraulic function and the hydraulic test and disinfection of the entire pipeline has been successfully completed.

PSL 7.7 WATER TIGHTNESS TEST FOR CHAMBERS

On completion of each concrete valve chamber, and prior to completion of the backfilling around the chamber, a watertightness test shall be undertaken by the Contractor. This shall be carried out by excavating a trench approximately 0,5 m deep around the periphery of the chamber and continuously (for at least 4 hours) maintaining it full of water. Should there be any noticeable leaks into the chamber, the Contractor shall carry out at his/her own expense whatever measures are necessary to waterproof the chamber to the Engineer's satisfaction."

PSL 8 MEASUREMENT AND PAYMENT

PSL 8.2 SCHEDULED ITEMS

"PSL 8.2.1 Manufacture, supply, deliver, transport, lay, and bed pipes complete ..... Unit: m or No

PSL 8.2.1.2 Welded Joints and Fabricated Bends:

(a) Extra over 8.2.1 for welded joints: ..... Unit: No

(b) Extra over 8.2.1 for skew cutting and forming bend up to and including 3^0 ..... Unit: No

(c) Extra over 8.2.1 for mitre cutting of two pipe ends and forming bend over 3^0 but less than 9^0..... Unit: No

The rates shall cover the cost of cutting, forming, and bevelling the ends of the pipes at the joint, all welding, testing and forming joint holes in all materials and for completion of the internal and external corrosion protection at the joints.

PSL 8.2.1.3 Cutting Pipes:

Extra over 8.2.1 for cutting pipe as closure…….…….. ..... Unit: No

Payment will only be made where shown on the drawings or where instructed by the Engineer's Representative. No payment shall, however, be made for cutting pipes to suit the installation of bends, fittings, and valves that are shown on the drawings.

PSL 8.2.15 Special Wrapping in Corrosive Soil

REPLACE THE ITEM WITH THE FOLLOWING:

"**PSL 8.2.15 Corrosion Protection.....Unit:…**

The costs of making good the internal linings and external coatings on all butt welded and fillet welded joints on the pipeline shall be included in the tendered rates for pipelaying."

ADD THE FOLLOWING NEW ITEMS:

"PSL 8.2.16 Cutting into and Connecting to Existing Pipeline ..... Unit: Sum

The rate for cutting into and connecting to existing pipelines shall cover the cost of exposing the existing pipeline, making arrangements with the Employer's staff to temporarily shut off the existing pipeline whilst effecting the connection, cleaning and preparing the pipe for cutting, cutting, dealing with all water (including that from possible leaking valves), preparing the pipe ends for jointing, welding/jointing and connecting the new pipework, making good internal linings and external coatings, re-commissioning the pipeline, and including all temporary supports, bedding and backfilling.

PSL 8.2.17 External corrosion protection to valves, flexible joints, anchored flexible joints & flanged joints complete as specified in PSL 3.9.3.12 ..... Unit: No

Separate items are scheduled for each item by pipe nominal diameter.

In the case of valves, the rate shall include for protection of the whole of the valve body, all flanges integral to the valve, the connecting flanges to the valve i.e. including the two flanges of the pipework connected to either side of the valve, and the packing of mastic (without tape or sheathing) over the gland adjusting bolts and nuts.

PSL 8.2.18 Allowance for the conveyance of water to and along the pipeline for scouring and pressure testing ..... Unit: Sum

The rate shall include for conveying all water required from the available source stated in PSL 7.3 above and for the cost of purchasing all water in excess of the quantity prescribed in PSL 7.3.

PSL 8.2.19 Hydraulic pressure test of the pipeline ..... Unit: Sum

The rate shall cover all costs of achieving a satisfactory hydraulic test and, in particular of compliance with PSL 7.3 above.

PSLB - BEDDING (PIPES)
(Applicable to SABS 1200 LB - 1983)

PSLB 2 INTERPRETATIONS

PSLB 2.3 DEFINITIONS

IN THE DEFINITION OF “main fill” *DELETE* "150 mm" *IN THE SECOND LINE AND REPLACE WITH* "300 mm".

PSLB 3 MATERIALS

PSLB 3.1 SELECTED GRANULAR MATERIAL

IN THE SECOND LINE DELETE "19 mm" *AND REPLACE WITH* "10 mm".

ADD TO THE SUBCLAUSE:

"Where scheduled and/or shown on the drawings, bedding material (padding) as specified in PSLB 3.3 shall be used in place of selected granular material."

PSLB 3.2 SELECTED FILL MATERIAL

ADD TO THE SUBCLAUSE:

"Where scheduled and/or shown on the drawings, bedding material (padding) as specified in PSLB 3.3 shall be used in place of selected fill material."

PSLB 3.3 BEDDING

ADD TO THE SUBCLAUSE:

"All PVC and HDPE pipes and fittings and steel pipes and fittings greater than DN500 are deemed to be flexible pipes.

Where scheduled or shown on the drawings, bedding (selected granular and selected fill material) shall be fine sand or fine non-cohesive soil, carefully selected, with maximum particle size of 5 mm and which shall not cake nor form lumps when drying. Material complying with the above requirements may also be referred to in this document as ‘padding’. Samples of bedding (padding) material shall be submitted by the Contractor to the Engineer for approval well in advance of construction. Only after the Contractor has received written approval from the Engineer, may he/she proceed with placing bedding (padding) material as selected granular and/or selected fill material.

No sharp-edged stones shall be allowed to come into contact with the pipes or fittings. Joint holes (pockets) shall be provided in the trench bottom and bedding, at each pipe joint to facilitate jointing and/or welding, and no extra payment will be made for forming or filling the joint holes (pockets) with padding material.

All padding material used for the cradle beneath and surrounding the coated steel pipes shall comply with the following requirements:

GRADING ANALYSIS RANGE	
SIEVE SIZE (mm)	**PERCENTAGE PASSING**
6,7	98 to 100
4,76	85 to 100
2,36	55 to 95
1,18	30 to 75
0,60	20 to 50
0,425	16 to 38
0,30	13 to 27
0,15	5 to 18
0,075	0 to 12

The material shall be free of organic matter and shall have a compatibility factor of not more than 0,4. The material should be classified as silty to fine sand having a stiffness ratio of not less than 5,0 MPa. Furthermore, the origin of the materials should, preferably, be river transported since it is preferable that the larger grains (3,0 to 4,8 mm in size) be rounded and not sharp and angular.

The Contractor will be required to carry out his/her own quality control testing of the material to ensure that it meets the padding sand requirements and complies with this specification at all times. At least one grading analysis shall be carried out for every 100 lineal metres of bedding placed. The results of these tests shall be forwarded to the Engineer within 24 hours of completion of the test. Should the material not comply with the specification, the Contractor shall remove and replace it with approved material at his/her own cost.

Depending on the actual material supplied by the Contractor, the moisture content may be critical to enable satisfactory placing and compaction and the Contractor will be deemed to have allowed in his tendered rate for any and all adjustments required to the moisture content of the padding material at all times.

Where applicable, items have been provided in the Bill of Quantities for the provision of approved bedding material from approved Commercial or other approved off-site sources for padding sand.

No extra payment shall be made for forming or filling joint holes/bell holes/fox holes (pockets)."

PSLB 3.4 SELECTION

PSLB 3.4.1 Suitable Material Available from Trench Excavation

DELETE THE CONTENTS OF THE SUBCLAUSE AND REPLACE WITH THE FOLLOWING:

"The excavation of a pipe trench shall comply with the requirements of Subclause 5.4 of SANS 1200 DB and the provisions of Subclause 3.7 of SANS 1200 DB (in terms of which, for the purposes of providing bedding materials, the Contractor is not required to use selective methods of excavating) shall apply. Nevertheless, the Contractor shall take every reasonable precaution to avoid burying or contaminating material that is suitable and is required for bedding or covering the pipeline. If, in the opinion of the Engineer, bedding material can be produced from the excavated material, the Contractor shall, if so ordered by the Engineer, screen or otherwise treat (as scheduled) the excavated material in order to produce material suitable for bedding (see also Subclause PSLB 8.2.1)."

PSLB 5 CONSTRUCTION

PLSB 5.1 GENERAL

PSLB 5.1.2 Details of Bedding

ADD TO THE SUBCLAUSE:

"The pipelines shall be laid on the class of bedding indicated in the Bill of Quantities and/or on the drawings."

ADD NEW SUBCLAUSE:

"PSLB 5.1.2.1 Stone drainage layer beneath bedding

Where indicated on the drawings, or as otherwise indicated by the Engineer, a 200 mm thick layer of 19 mm stone shall be placed beneath the bedding layer to act as a drainage channel for excessive groundwater. This layer shall be wrapped in approved geofabric and provided with outlet pipes if and where required or indicated by the Engineer's Representative."

PSLB 5.1.4 Compacting

DELETE THE SECOND LINE AND REPLACE WITH:

"top of the pipeline) shall be 93% mod AASHTO."

ADD TO THE SUBCLAUSE:

"Steps will have to be taken by the Contractor to ensure that flexible pipes do not deform excessively in cross-section during and after construction and backfilling operations. The maximum deflection which will be acceptable at any stage during or after construction is 2% of the pipe diameter horizontally or vertically. The Contractor will be required to provide the necessary apparatus and to monitor deflection during construction.

Pipe deformations will only be maintained within the specified tolerances by correct backfilling practice. No heavy compaction equipment will be permitted for compaction of any pipe bedding, only pneumatic or hand rammers being acceptable. To this end, and to achieve the 93% compaction specified, it is required that the bedding material be brought up evenly on either side of the pipe. The use of complete saturation of the material as a method of achieving the specified compaction may, subject to the Engineer's approval, be used. However, in this regard, Contractors are advised that the presence of excessive quantities of water in the pipe trench could lead to flotation of the pipe.

Prior to the commencement of pipe laying the Contractor shall be required to submit, to the Engineer, for his approval, his proposed methods of placing, and compacting methods which he proposes to implement in order to ensure compliance with the specification."

ADD NEW SUBCLAUSE:

"PSLB 5.1.5 Testing

All flexible and flanged joints shall be left exposed with a minimum of 300 mm clearance around the bottom of the pipe during hydraulic pressure testing of the pipe to facilitate inspection."

PSLB 5.2 PLACING AND COMPACTING OF RIGID PIPES

AND NEW SUBCLAUSE:

"PSLB 5.2.5 Stone Bedding

In areas where waterlogged conditions exist or where ordered by the Engineer, special drains consisting of a 200 mm thickness (See PSDB 5.5) of single sized stone with a geofabric filter surround ('Bidim' Grade A4 or similar approved) extending the full width of the trench shall be provided below the bedding to the pipes. The excavation for these drains shall be measured in cubic metres at the contract rate applying to unsuitable excavation below the bottom of the trench. The stone filling shall be paid for per cubic metre and the geofabric filter shall be paid for per square metre. All measurements in this connection shall be to a width equal to the base widths and depths ordered."

PSLB 5.3 PLACING AND COMPACTING FLEXIBLE PIPES

(a) Bedding Cradle

DELETE THE CONTENTS OF THIS SUBCLAUSE AND REPLACE WITH THE FOLLOWING:

"The pipes shall be bedded on a minimum 100 mm thick layer of compacted granular bedding material on which a 50 mm thick layer of uncompacted granular bedding material has been placed and spread. Loose granular bedding material lying next to the pipe shall be placed into the haunch area and compacted with suitable hand tools (covered with rubber to prevent damage to the pipe coating), and additional selected granular material shall be added and compacted in layers up to the mid point of the pipe diameter in the vertical plane. The remainder of the bedding i.e. the selected fill blanket, shall be placed in layers up the sides of the pipe, each layer being compacted until a level of 300 mm above the crown of the pipe is reached.

All bell holes (fox holes) shall be filled with bedding material."

(b) Selected Fill Blanket

DELETE "200 mm" *FROM THE TITLE AS SHOWN ABOVE*.

PSLB 6 TOLERANCES

PSLB 6.1 MOISTURE CONTENT AND DENSITY

ADD TO THE SUBCLAUSE:

"The permissible deviations applicable shall be those for Degree of Accuracy II class of work."

PSLB 8 MEASUREMENT AND PAYMENT

PSLB 8.1 PRINCIPLES

PSLB 8.1.3 Volume of Bedding Materials

ADD TO THE SUBCLAUSE:

"(c) The volume of bedding material shall be measured net i.e. the volume of the pipe is to be deducted.

(d) No additional payment shall be made for bedding material placed in bell (fox) holes."

PSLB 8.1.5 Disposal of Displaced Material

DELETE THE CONTENTS OF THIS SUBCLAUSE AND REPLACE WITH:

"Material displaced by the pipeline and by imported material from sources other than trench excavation, shall be disposed of by the Contractor at an approved site(s). No haulage shall be paid."

PSLB 8.1.6 Freehaul

DELETE THE CONTENTS OF THIS SUBCLAUSE AND REPLACE WITH:

"All haul shall be regarded as free haul. No overhaul shall be paid for under this Contract."

PSLB 8.2 SCHEDULED ITEMS

PSLB 8.2.1 Provision of Bedding from Trench Excavation

DELETE THE SUBCLAUSE AND REPLACE WITH THE FOLLOWING:

"PSLB 8.2.1 Provision of Bedding from Trench Excavation:

(a) Without the need for screening:

(i) Selected granular material.....Unit : m^3

The rates shall cover the cost of acquiring, from any point along the trench excavation as may be selected by the Engineer, bedding that complies with the relevant requirements of the specification, of delivering it to points alongside the trench spaced to suit the Contractor's methods of working, of making good any backfill deficiency from points where backfill has been acquired, and of disposing of displaced material.

(b) Including for screening:

(i) Selected granular material.....Unit : m^3

The rates shall cover the cost of screening or otherwise treating excavated material, at any point along the trench excavation as may be selected by the Engineer, in order to produce bedding that complies with the relevant specification, delivering it to points alongside the trench, spaced to suit the Contractor's methods of working, of making good any backfill deficiency there may be from points where screened backfill material has been acquired, and of disposing of displaced material."

PSLB 8.2.2 Supply Only of Bedding by Importation

DELETE THE SUBCLAUSE AND REPLACE WITH THE FOLLOWING:

"PSLB 8.2.2 Provision of Bedding by Importation:

(a) Including for screening and/or other treatment:

(i) Selected granular material.....Unit : m^3

(ii) Padding sand to specified bedding dimensions.....Unit : m^3

The rates shall cover the cost of acquiring, loading, transporting, off-loading, screening or otherwise treating excavated material in order to produce bedding that complies with the relevant specification, delivering it to points alongside the trench spaced to suit the Contractor's methods of working and of disposing of displaced material.

NOTE: The rate for the supply and laying of pipelines covers the cost of handling the bedding material from alongside the trench, placing it under the pipeline, forming joint holes and completing the bedding around and over the pipeline."

PSLB 8.2.3 Concrete Bedding Cradle

ADD THE FOLLOWING PARAGRAPH TO THE SUBCLAUSE:

"All concrete bedding to pipes will require formwork. The rate for concrete bedding shall include for the supply, installation and stripping of all formwork."

PSLB 8.2.4 Encasing of Pipes in Concrete

DELETE THE FIFTH AND SIXTH LINES AND REPLACE WITH THE FOLLOWING:

"encasing the pipe in concrete 150 mm thick each side of the pipe and to 150 mm above the crown of the pipe including the cost of formwork, (if any), etc. and the cost of formwork to form stop ends on either side of collars, couplings, joints, etc if instructed by the Engineer."

ADD TO THE SUBCLAUSE:

"The rate for concrete encasing shall include for the supply, installation and stripping of all formwork."

PSLB 8.2.5 Overhaul of Material for Bedding Cradle and Selected Fill Blanket

DELETE THE SUBCLAUSE.

ADD NEW SUBITEM:

"PSLB 8.2.6 Drainage Layer:

(a) Stone filling .....Unit : m^2

(b) Geofabric filter material (Bidim Grade A4 or similar) .....Unit : m^2

Supply and place beneath pipe, 150 mm crushed stone layer as ground water drainage layer. The excavation for these drains shall be measured in cubic metres at the tendered rate applying to unsuitable excavation below the bottom of the trench (SABS 1200 DB 8.3.2 c).

The rate for stone filling shall be per cubic metre of stone fill, measured according to a width equal to the base widths and depths ordered.

Supply and installation of geofabric filter material (BIDIM Grade A4 or similar) around stone. The rate shall be per square metre of geofabric to enclose the stone material, measured net according to a width equal to the base widths and depths ordered."

PSLD: SEWERS
(Applicable to SABS 1200 LD - 1982)

PSLD 2 INTERPRETATION

PSLD 2.4 ADDITIONAL ABBREVIATIONS

ADD TO THE SUBCLAUSE:

"HDPE : High density polyethylene **"**

PSLD 3 MATERIALS

PSLD 3.1 PIPES, FITTINGS AND PIPE JOINTS

PSLD 3.1.2 Reinforced Concrete Pipes

IN THE THIRD LINE, DELETE "dolomitic" *AND REPLACE WITH* "silicious".

PSLD 3.1.3 AC Pipes

DELETE THE SUBCLAUSE IN ITS ENTIRETY.

ADD NEW SUBCLAUSE:

"PSLD 3.1.8 Polyethylene Pipes

HDPE pipes and fittings shall comply with SABS ISO 4427 and shall be manufactured from PE 100 or PE 80 material (solid wall pipes) and PE 80 material (structured wall pipes)."

PSLD 3.4 BEDDING

ADD TO THE SUBCLAUSE:

"Bedding of sewers shall be of the Class(es) shown on the drawings or as directed on site."

PSLD 3.5 MANHOLES, CHAMBERS, ETC

PSLD 3.5.2 Precast Concrete Sections

ADD TO THE SUBCLAUSE:

"Sectional spun-concrete cylinders shall be manufactured from dolomitic aggregate.

Joints between wall sections shall be sealed with an approved plasticised butyl rubber compound."

PSLD 3.5.6 Mortar

DELETE THE CONTENTS OF THIS SUBCLAUSE AND REPLACE WITH THE FOLLOWING:

"Mortar for brickwork and, where so ordered by the Engineer, for external plasterwork to manholes shall be composed of one part of cement to four parts of clean pit sand. Mortar for the internal plasterwork to manholes and to the benching within manholes shall be composed of one part of cement to three parts of dolomitic sand."

PSLD 3.5.8 Manhole Covers and Frames

ADD TO THE FIRST PARAGRAPH OF THE SUBCLAUSE:

"After installation, all exposed portions of the cast iron cover and frame shall be thoroughly cleaned and painted with two coats of epoxy tar, with particular attention being paid to the painting of the underside of the covers and frames.

Precast concrete manhole covers and frames shall comply with the applicable requirements of SANS 1294 and to the details shown on the drawings. The precast concrete lid cover shall be so designed as to withstand a point load, as specified in Clause 7.1.2 of SANS 1294, in the centre of the lid of 50 kN for light duty covers and 100 kN for heavy duty covers."

PSLD 3.6 MARKER POSTS

DELETE THE SUBCLAUSE AND REPLACE WITH:

"PSLD 3.6 MARKER BLOCKS

A concrete marker block shall be provided to define the position of each sewer connection where there is no manhole. It shall comprise a Grade 20/19 concrete block, 300 x 300 x 300 mm deep, set into the ground in a position adjacent to the connection on the boundary and set off therefrom by a distance of 1,0 m in the two horizontal orthogonal directions, except where shown otherwise on the drawings. The surface of the block shall be set proud of the natural ground level by a height not exceeding 50 mm and it shall be trowelled to a smooth finish with a steel trowel and inscribed with two direction arrows and the depth of the connection in metres, correct to the nearest one-tenth of a metre.

Precast or in-situ blocks may be provided. If the Contractor should elect to provide precast blocks, the rate should include for bedding these in a sand layer 50 mm thick laid on the bottom of the excavation.

Connection marker blocks are to be set on private property, except where site conditions dictate otherwise. In such cases the approval of the Engineer is to be obtained for an alternative position before the commencement of the relevant excavation.

In all cases the position and inscription of the connection markers shall be checked by the Engineer prior to the backfilling of the trench.

Connection marker blocks will be measured by number. The rate entered for marker blocks in the Bill of Quantities shall include for all excavation, concrete work, shuttering, setting accurately in position, bedding in sand if relevant, accuracy of recording depth, clarity of inscription and all labour, material and plant necessary to complete the work."

PSLD 5 CONSTRUCTION

PSLD 5.1 TRENCH BOTTOM

ADD NEW SUBCLAUSE:

"PSLD 5.1.1 Trial Section

Notwithstanding the requirements of Subclause 5.2, the Contractor shall, prior to the construction of any sewers, prepare and lay a trial section for inspection by the Engineer. The trial section shall be at least 30 m long and shall include at least two adjacent completed manholes and a property connection. Such trial section shall be approved by the Engineer before authority is granted to proceed with the laying of any further sections."

PSLD 5.2 LAYING AND BEDDING

PSLD 5.2.3 Method

ADD TO THE SUBCLAUSE:

"Where pipes are to be installed below the water table their buoyancy (particularly that of structured-wall HDPE pipes) shall be considered. These pipes shall be securely anchored against flotation and lateral displacement during laying. The method used to secure these pipes during this activity is left entirely to the discretion of the Contractor and he is to make due allowance in his rates for pipelaying for any extra costs accruing from his precautions."

PSLD 5.2.4 Cutting

ADD TO THE SUBCLAUSE:

"The following requirements shall be met when pipes are to be cut to the required length.

(a) The cut end shall be equal to a manufactured end in all respects.
(b) Suitable apparatus for the cutting of pipes shall be used.
(c) The chiselling of pipe ends shall not be permitted."

ADD NEW SUBCLAUSE:

"PSLD 5.2.6 Jointing

HDPE pipework on this contract shall be jointed by the following methods (and approved by the manufacturer) where indicated on the drawings or elsewhere described or as instructed by the Engineer.

(a) Structured wall pipes up to and including 800 mm internal diameter:

(i) "water-tight" socket and rubber seal.
(ii) in-situ welding.
(iii) flexible/stepped couplings.

(b) Structured wall pipes over 800 mm internal diameter and all solid wall pipes:

(i) in-situ welding.
(ii) flexible/stepped couplings.

(c) Welding

All welding shall be heated tool butt welding (HS) in accordance with SANS 10268. Welding (and the pipe manufacturer's instructions) shall be carried out only by welders certified under the Thermoplastics Welding Institute of South Africa (TWISA) or the Plastics Federation of South Africa.

The following standards shall apply:

SANS 10270	–	Welding of Thermoplastics - Approval of Welding procedures
SANS 10268 Part 1	–	Welding of Thermoplastics Welding Processes, Part 1" Heated-tool welding (Butt-welding)
SANS 10268 Part 4	–	Welding of Thermoplastics Welding Processes, Part 4: Hot-gas extrusion welding

SANS 10286 Part 10	–	Welding of Thermoplastics Welding Processes, Part 10: Weld defects
SANS 6269	–	Welding of Thermoplastics - Test Methods for welded Joints
ISO 12176 Part 1	–	Plastic pipes and fittings - Equipment for fusion jointing polyethylene systems, Part 1: Butt Fusion
SANS 10269	–	Welding of thermoplastics - Testing & Approval of Welders
DIN 16963 Part 1	–	4 (Fabricated Fittings – PE-HD Systems)

(d) Couplings

All flexible/stepped couplings shall be as Aqualok Stepfit (as manufactured by Rare Pipe Specials) or similar and approved and to the following minimum specifications:

Centre sleeve/body and endings	Rolled steel to SANS 50025 - Part 2 to 6 Grade 350W
Bolts, nuts and washers	Low carbon unalloyed steel to BS970 Part 1 Grade 070M20 electro-galvanised
Gaskets	EPDM compound to SANS 974-1 1986/ ISO 4633 : 1983
Coatings (sleeve/body and endings)	Fusion-bonded epoxy to SANS 1217 : 2011 minimum 300 microns externally

(e) Corrosion Protection

Each steel coupling shall be suitably protected by an approved anti-corrosion system in accordance with the requirements of Clause PSL 3.9.3.8 after installation and testing and tenderers shall include for this aspect in the pricing of the elements."

PSLD 5.4 CONNECTIONS TO MANHOLES

ADD TO THE SUBCLAUSE:

"Where polyethylene pipes are cast into concrete structures, they shall be specially prepared and adapted by positioning a custom-made tight-fitting natural rubber, sealing sleeve around the circumference of the pipe. The rubber seal shall be 10 mm thick and shall be 60 - 65 shore hardness, with a vulcanised joint. It shall need to stretch over the pipe circumference to ensure a tight fit.

The rates tendered for the construction of manholes shall include for whatever additional costs there may be over and above the tendered rates for the supply, lay, joint, bed and test of the short lengths of pipes cast into the manhole walls."

PSLD 5.6 MANHOLES, INSPECTION CHAMBERS, ETC

PSLD 5.6.5 Precast Concrete Manholes

IN THE FIRST SENTENCE DELETE "Drawing LD-5" *AND REPLACE WITH* "the drawings"

ADD TO THE SUBCLAUSE:

"Where sewers are laid before the relevant roads are constructed, all the manholes in the road reserve shall have three layers of spacer slabs. This will facilitate the lowering (or raising) of the manhole covers to suit the future roadway and sidewalk levels."

PSLD 5.7 CONCRETE CASING TO PIPES

ADD TO THE SUBCLAUSE:

"Where concrete casing is ordered by the Engineer, it shall be of grade 20/19 concrete with a minimum thickness of 150 mm above top of the pipe."

PSLD 5.9 CONNECTING SEWERS

PSLD 5.9.1 Location and Details

ADD TO THE SUBCLAUSE:

"Typical details of connecting sewers (house connections) are shown on the drawings accompanying this contract.

House connections shall be laid in 100 mm diameter piping. A 45° plain junction shall be built into the sewer at the point directed by the Engineer, and the connection shall start from the branch of this junction with a 45° bend and be continued up to the boundary line of the property at such grade as may be directed by the Engineer, the branch of the junction and the bend tilted at the same grade. Where the trunk sewer is laid inside the erf boundary, an end cap is to be provided on the 100 mm diameter branch of the access junction and no additional 100 mm diameter pipes shall be laid for that particular erf connection.

Where there is a difference in level between the invert of the main sewer and the private drain at the property line, the connection to the main sewer shall be made by means of a ramp. If the difference in levels is less than 1,2 m an inclined ramp shall be built using two 45° bends. If the difference in level is over 1,2 m a vertical ramp with a 45° junction and bend fixed at a suitable level to take the house connection, the vertical pipe being continued to within 450 mm of the ground surface and sealed with a stopper plug.

In those cases where connections will be effected at manholes, a branch channel shall be formed in the manhole floor and the connection taken off therefrom. Where there is no difference in level between the house connection and the main sewer, the connection shall be continued to the property line in the same manner as described above but without the initial bend. Where there is a difference in level, a ramp shall be formed of the required height in the same manner as shown on the drawing. Each house connection shall be plugged off with a stopper plug."

PSLD 5.9.2 Marker Posts

DELETE "Marker Posts" *AND REPLACE WITH* "Marker Blocks".

PSLD 5.9.3 Recording Location

DELETE THE LAST SENTENCE AND REPLACE WITH:

"The records shall be handed to the Engineer, in a form acceptable to the Engineer, at the time when the Contractor claims payment for the relevant work."

PSLD 6 TOLERANCES

PSLD 6.1 GENERAL

ADD TO THE SUBCLAUSE:

"Notwithstanding the tolerances specified in Subclauses 6.2 and 6.3, all pipes, irrespective of diameter, shall be laid to the following tolerances:

(a) Level of pipe invert: within 10 mm of the level shown on the drawings, i.e. ±10 mm

(b) Location of pipe centreline on plan: within 20 mm of the location shown on the drawings or designated by the Engineer, i.e. ±20 mm"

PSLD 7 TESTING

PSLD 7.1 GENERAL

DELETE SUBCLAUSE 7.1.4 AND REPLACE WITH:

"The pipework shall be tested in sections as practical and as arranged between the Contractor and the Engineer or his/her Representative.

The sewer, and the house connections along its length, shall be tested simultaneously between manholes or chambers, as applicable. The house connections and the section of the sewer under test shall be suitably 'plugged' at the open ends using plugs or stoppers which have been braced adequately."

PSLD 7.2 TESTS AND ACCEPTANCE/REJECTION CRITERIA

PSLD 7.2.2 Water Test

DELETE THE CONTENTS OF THIS SUBCLAUSE AND REPLACE WITH THE FOLLOWING:

"The Water Test shall not be acceptable under this Contract."

PSLD 7.2.6 Watertightness of Manholes

ADD TO THE SUBCLAUSE:

"Wherever practicable, after each manhole has been inspected and approved by the Engineer, it shall be tested in his presence or in the presence of his authorised representative, in the following manner:

All sewer inlets and outlets to and from the manhole shall be closed with expanding plugs or other apparatus. Water shall then be introduced into the manhole up to a level 25 mm below the underside of the roof slab. The water level shall be maintained for not less than one hour or such longer period as may be necessary to accurately record the rate of leakage, if any. Careful and accurate records shall be kept at frequent and regular intervals of the variation in the level of the water in the manhole and of the quantity of water added so that the rate of leakage may be properly determined. In the event of the rate of leakage exceeding 1,25 litre per hour per metre of depth of manhole, or in the event of any weakness, defect or fracture or visible signs of leakage occurring in the manhole under test, the Engineer shall have the right to order the test to be discontinued. The Contractor shall thereupon, at his own expense, search for and rectify any weakness or defect in the manhole. Such work or rectification shall consist of repair or replacement or both. The manhole shall thereafter be refilled with water and retested in the manner specified. This process shall be repeated until a satisfactory test is obtained.

Alternatively, manholes may be tested by thoroughly saturating the ground in the immediate vicinity of each manhole by excavating a shallow trench around the manhole and filling the trench with water. If after maintaining the water level in the shallow trench for two hours, the internal faces of the manhole and benching show no signs of dampness or leakage, the manhole shall be deemed to have passed the watertightness test.

The Contractor shall be paid for the hydraulic testing of manholes at the rate per manhole to be quoted by him in the Bill of Quantities. The Contractor's prices for the hydraulic testing of manholes shall include for all arrangements for the supply of water for testing, the cost of water so used where the water is not obtained free of cost from the Employer, for any necessary rectification work and re-testing and for all labour, plant and materials required to carry out the specified tests."

PSLD 8 MEASUREMENT AND PAYMENT

PSLD 8.2 SCHEDULED ITEMS

PSLD 8.2.5 Inspection Chambers, etc

DELETE THE FIRST AND SECOND LINES OF THE SUBCLAUSE AND REPLACE WITH:

"Separate items shall be scheduled for manholes, backdrops and inspection chambers, etc. of each type and of each depth (measured from top of cover to invert) in increments of 0,5 m."

PSLE STORMWATER (SABS 1200 LE)

PSLE 3 MATERIALS

PSLE 3.4.1 Bricks

Delete the first sentence and replace with the following:

"Bricks used in stormwater structures shall be:

Burnt clay engineering bricks, having a normal compressive strength of 28 MPa, and complying with the requirements of SANS 227."

PSLE 5 CONSTRUCTION

PSLE 5.2.2 Pipe Culverts

Add the following:

"Pipes with ogee joints, where they pass under roads and also on curved pipelines in verges, shall be wrapped with two layers of Hessian soaked in cementitious grout. The wrapping shall be 400 mm wide and placed centrally over each joint.

Unless otherwise stated in the Bill of Quantities or indicated on the drawings, pipes with ogee joints shall be used.

Butt-ended pipes will not be permitted.

Lifting holes should be suitably closed off to prevent the ingress of soil."

PSLE 5.5.6 Benching

Delete:

"… granolithic plaster …"

And replace by the following:

"… concrete topping consisting of a 1:2:3 cement, sand and 7 mm stone mix by weight. The sand proportion may be varied between 1,5 and 2,5 to obtain ideal workability."

PSLE 5.8* Pipes into Manholes / Catchpits

"Pipes may protrude up to 300 mm into a manhole / catchpit. This relaxation will only be permitted if the pipe does not have to be cut. The 'dead space' formed at the end of a manhole is to be suitably benched off to prevent the collection of silt and rubbish."

PSLE 5.9* "As-Built" Details

"The Contractor shall submit "As-Built" levels, distances between manholes and the grades of pipelines for which he requires payment, at the time he submits his monthly payment claim. A sample form can be obtained from the Engineer or his representative."

PSLE 8 MEASUREMENT AND PAYMENT

PSLE 8.2.8 Supply and Install Manholes, Catchpits, etc.

Delete the words:

"… but excluding excavation and backfilling, which will be measured separately."

And replace with the following:

"… including dealing with any excavation in all materials (including disposal of surplus) which is additional to that measured under the item for pipe trench excavation (see Sub-clause 8.2.3 of SANS 1200DB)."

Add the following sub clause to LE 8.2.8 :

d) Extra-over for construction of new manholes or catch pits on existing pipelines ..... Unit : No

The rate shall include for the additional cost of providing all plant, labour and materials to cut the existing pipe, dealing with water, working around the existing pipe and making good.

PSLE 8.2.14* Breaking Into Existing Manholes …….…….…….…….…….…….…. Unit : No

"The rate shall include for all labour and materials required for breaking into the existing structure, cutting to size and laying of pipes, reinstatement and / or new benching – where ordered by the Engineer – making good around the pipe with an approved repair material, and including all necessary reinstatement around the structure on completion of the connection."

C3.8: PARTICULAR SPECIFICATIONS

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PQA: BRICKWORK, BLOCKWORK AND PLASTERING

(Supplementary to SABS 1200 – 1986)

PQA 1 BRICKS AND BLOCKS

PQA 1.1 Burnt Clay Masonry Units

Solid clay masonry units (bricks) shall be of nominal dimensions 222 x 106 x 73 mm, shall comply with SANS 227 and conform to the types scheduled, as selected from the following:

	Nominal Compressive Strength	Max Water Absorption
FBX - face brick extra	17,0 Mpa	10%
FBS - face brick standard	17,0 MPa	12%
NFP - non facing to be plastered	10,5 MPa	15%
NFX - non facing extra for damp conditions	14,0 MPa	15%

Engineering bricks shall carry the suffix ‘E’ and the compressive strength in MPa and shall be of one or more of the following types as scheduled:

	Max Water Absorption
FBXE 45 the best engineering brick	7%
FBSE 30 a good engineering brick	8%
NFXE 14 the lowest acceptable category	10%

Sample bricks shall be taken at random by the Employer’s Agent, should he consider tests to be necessary. These tests shall normally comprise an inspection for defects, a compressive strength test and a water absorption test. Should any deficiencies become apparent after testing in accordance with SANS 227, the Employer’s Agent shall have the right to reject the complete consignment.

PQA 1.2 Concrete Masonry Units

Concrete masonry units (blocks) shall comply with SANS 1215 and shall be either solid or hollow as called for in the Bill of Quantities or shown on the drawings.

The preferred dimensions of units, where not otherwise called for, are as follows:

Solid Units		222 x 106 x 73 mm
	or	190 x 90 x 90 mm
Hollow Units		390 x 90 x 190 mm
	or	390 x 190 x 190 mm

Preferred size when used in conjunction with clay bricks:

FU	-	Face Units	the nearest matching size to the clay bricks
FUA	-	Face units aesthetic	being used, especially in regard to height in order to suit brick courses

The nominal compressive strength of solid units or hollow blocks shall be at least 14 MPa except where shown otherwise on the drawings or the Bill of Quantities. The alternative strengths shall be either 7 or 21 MPa (3,5 MPa strength is not acceptable).

Masonry units manufactured with aggregates which contain slag, clinker or burnt clay brick shall not be used unless prior approval has been obtained from the Employer's Agent.

The average drying shrinkage of units shall not exceed 0,06% and the average expansion on rewetting shall not exceed 0,02% in excess of the actual drying shrinkage obtained from manufacturer's tests.

Sample units shall be taken at random by the Employer's Agent, should he consider that tests are necessary to satisfy himself that there are no deficiencies in any consignment. Should deficiencies occur when tested in accordance with SANS 1215, the complete consignment may be rejected.

PQA 2 BONDING OF BRICKWORK AND BLOCKWORK

PQA 2.1 Brickwork Bonds

Brickwork shall be laid in the following bonds, except where shown otherwise on the drawing or scheduled to the contrary:

Brickwork	230 mm thick	English bond
Brickwork	280 mm thick to cavity walls	Stretcher bond
Brickwork	350 mm thick below damp proof course	English bond

Cavity brickwork shall include wall ties which connect the inner and outer skins of the wall. The ties shall be galvanised and of approved pattern, fixed along every fifth course at spacings not exceeding 600 mm, with alternate rows staggered.

PQA 2.2 Blockwork Bonds

Bonding of blockwork shall be carried out in full compliance with SANS 10145.

PQA 3 BRICKLAYING AND BLOCKLAYING

PQA 3.1 Laying Clay Bricks

Brickwork shall be well and regularly bonded, with no false headers and none but whole bricks, except where legitimately required as closers. All bricks must be thoroughly wetted before laying and each brick is to be pressed into its bed so as to squeeze out superfluous mortar and give a finished joint generally 10 mm thick, but in no case shall it exceed 12 mm thickness. All joints, both horizontal and vertical, notwithstanding any trade custom to the contrary, are to be filled solid with mortar for their full width and depth, each course being flushed with mortar, worked well down into all vertical joints before the succeeding course is laid. All brickwork shall be built true and plumb with the perpends vertically in line.

Horizontal and vertical joints shall be rounded, square or flush pointed as required by the Employer's Agent. All joints of facework shall be pointed flush. Walls to be plastered shall have the joints raked out to a depth of 6 mm to form a key for the plaster.

Bricklaying is to be carried out uniformly so that no part of the work shall be in advance of any other part by more than six courses, unless otherwise authorised by the Employer's Agent. In the latter case, the work is to be stepped back as toothing will generally not be allowed.

The cavity in cavity walls shall be kept free from mortar droppings and movable boards of the appropriate widths shall be used for that purpose. Vertical joints in the outside leaf on the course immediately above the damp proof course shall be raked out every fifth brick to drain the cavity. Around the periphery of all built-in frames the cavities shall be closed with interior brickwork.

PQA 3.2 Laying Concrete Blocks

Concrete blocks shall be laid in compliance with Code of Practice SANS 10145.

Blocks shall not be wetted prior to laying in a wall and the moisture control at the time of laying shall comply with Table 2 of that Code of Practice. The drying shrinkage of the blocks to be laid shall be available to the Employer's Agent in the form of a directive from the manufacturer of each type of masonry unit. The average annual humidity shall likewise be made available to the Employer's Agent.

Blocks shall be laid on a full bedding of mortar. All joints are to be nominally 10 mm thick and both vertical and horizontal joints shall be completely filled. Blocks shall be laid with the thicker shell face outermost. They shall be laid in stretcher bond with the horizontal distance between vertical joints in adjacent course equal to at least one quarter of the length of the block. All blockwork shall be built true and plumb with the perpends vertically in line.

Control joints shall be formed at spacings indicated in Table 3, should joints not be detailed on the drawings. The spacing is a function of the vertical spacing of the horizontal reinforcement.

Corners and other work where the blocks are necessarily laid to a higher level than the general progress of work, shall be stepped back and not raised above the level of the remaining blockwork by more than one metre.

Blocks below damp proof course level shall be concrete-filled using concrete having the same mix proportions as the concrete in the strip foundations. The concrete shall be struck off flush at damp proof course level.

Horizontal reinforcement shall be placed at 600 mm vertical spacings unless shown otherwise on the drawings and bond beams shall be incorporated in the structure as shown on the drawings.

Fire resistance ratings as shown in Table 4 of the Code of Practice shall be adhered to, if required by the drawings.

PQA 4 LOUVRE VENTS AND AIR FILTERS

Where indicated on the drawings or ordered by the Employer's Agent, openings for louvre vents shall be formed through walls, and approved vents shall be built in or installed in the opening and neatly finished off.

Where indicated on the drawings, openings shall be formed through walls for air filters and the filters, supplied by an approved manufacturer, shall be jointed together to form panels as shown on the drawings and fitted in accordance with the manufacturer's instructions.

PQA 5 BUILDING IN PIPES, FRAMES, STEELWORK ETC

All window and door frames and wall vents are to be set up and built-in as the brickwork proceeds. Window and door frames are to be set, bedded and pointed in 4:1 sand cement mortar and the tendered unit rates are to include for any cutting and fitting of brickwork and for making good thereafter. The unit rates are also to include for attending to windows, doors and vents etc, in order to leave them in perfect

working order. The Contractor will be held liable for the repair of any damage done to such items during progress of the work.

Where pipes, frames, brackets or other such parts pass through or have to be set into brickwork, the bricks shall be carefully cut and fitted around the parts so as to maintain regularity of courses and uniformity of joints, the shaped bricks being bedded and pointed to conform to the surrounding brickwork. Where such parts have to be set into position after brickwork is built, holes shall be left wherever possible, in preference to cutting out bricks, and the work shall be subsequently made good in the manner described.

PQA 6 DAMP PROOFING

PQA 6.1 Damp Proof Course

Where indicated on the drawings, and at window sills, a damp proof course is to be embedded into the work, consisting of a SABS approved bituminous sheeting of mass not less than 1,3 kg/m^2 or PVC sheeting of 0,375 mm thickness laid over the full width of the wall, lapped and sealed at all joints. Where shown on the drawings, the damp proof course is to be stepped up one course of brickwork in the inner skin. Proper returns are to be made at all door frames.

Damp proof courses in blockwork shall be laid strictly in accordance with Subclause 5.3.6 of SANS 10145 at all places indicated in that Code or Practice.

PQA 6.2 Underfloor Waterproofing

Underfloor waterproofing membranes, where called for, shall be of approved 250 micron thick PVC sheeting lapped to a minimum of 200 mm at all joints.

PQA 6.3 Waterproofing Blockwork Faces

Where the external faces of blockwork are not to be plastered, they shall be treated with an approved waterproof coating applied in accordance with the manufacturer's instructions.

PQA 7 WINDOW SILLS

Window sills shall be constructed as shown on the drawings, including items such as damp proof course and expanded metal reinforcement, where called for.

PQA 8 PRECAST CONCRETE LINTELS

Precast concrete lintels over doors and windows shall be E-type, supplied by an approved manufacturer and suitable for the thickness of the walls being constructed. Shoring of soffits of lintels shall be fixed on spans exceeding 2,5 m and left in place for as long as the Employer's Agent considers necessary. The length of lintels shall be such as to give at least 200 mm of bearing at each end.

PQA 9 EXTRACTION FANS

Where indicated on the drawings, openings shall be formed through walls for extraction fans. The required fans, complete with bird proof weather cowls, shall be supplied and fitted therein by an approved specialist firm. Making good around the fan unit shall be carried out by the Contractor.

PQA 10 WALL CHASING

Where directed by the Employer's Agent, the Contractor shall chase brickwork to accommodate electrical conduits. Such chasing shall precede plastering or rendering and on no account shall the plastering or rendering be commenced until the conduits have been installed. The rates for chasing shall include for making good the brickwork after the conduit has been fixed.

In the case of unplastered concrete walls, electrical conduits shall either be cast into the concrete during pouring or shall be surface mounted as indicated on the drawings or in the Bill of Quantities.

Chasing in masonry units shall be carried out in compliance with SANS 10145 and, where possible, as directed by the Employer's Agent, shall be cut prior to laying the blocks.

PQA 11 CEMENT MORTAR

PQA 11.1 Mortar for Brickwork

Sand for mortar shall comply with SANS 1090 and be well graded from 5 mm down in accordance with Table 1. Sand shall not contain an excess of dust or fine material. Cement shall be Portland cement Type CEM.I 42,5 to SABS.ENV 197-1.

Cement mortar shall be in the proportion 1 part Portland cement to 4 parts sieved sand in the case of face brickwork, and 1 part cement to 5 parts sand for all other brickwork.

PQA 11.2 Mortar for Blockwork

Mortars to be used for blocklaying are to be in accordance with either Classes I, II or III as specified in SANS 0145, Subclause 3.2.3 as called for in the Bill of Quantities or on the drawings. Should no specific strength be specified then Class II, mortar having a compressive strength of 5 MPa at 28 days shall be used. The mortar mix shall be 170 ℓ of sand to 50 kg of Portland cement 42,5 and shall be used in conjunction with an approved mortar plasticiser conforming to BS EN 934-3: 2009+A1: 2012.

Alternatively, 50 kg of an approved masonry cement (supplied by a reputable manufacturer) may be used in lieu of 50 kg of Portland cement in the mix to give the same 28 day strength as required under the previous paragraph, but in that case no mortar plasticiser is to be used.

PQA 12 REINFORCEMENT

PQA 12.1 Reinforcement to Brickwork

Brickforce mesh or similar approved welded mesh supplied in rolls shall be built into brickwork where specified or shown on the drawings.

Reinforcement to brickwork shall comprise galvanised welded mesh as called for on the drawings supplied in rolls. The mesh shall be of suitable width to suit the brickwork thickness and the minimum cover from any external face shall be at least 10 mm. Reinforcement is to be built in every third course except where shown otherwise on the drawings. Except where shown to the contrary on the drawings, galvanised steel strips of dimensions 1 360 mm long x 40 mm wide x 1,6 mm thick shall be used to tie brickwork into concrete columns at every fourth course.

PQA 12.2 Reinforcement to Blockwork

Reinforcement to blockwork shall comprise galvanised welded mesh supplied in rolls. The mesh shall be of suitable width to suit the blockwork thickness and the minimum cover from any external face shall be at least 20 mm. The number of courses where reinforcement is to be built in shall be at 600 mm (maximum) vertical spaces, except where shown otherwise on the drawings.

PQA 13 HOOP IRON TIES AND ANCHORS

Galvanised hoop iron ties shall be provided for securing roof timbers to brick walls and shall be built-in to a vertical depth of not less than six courses of brickwork with bottom ends bent square to form an anchor. The upper ends shall project at least 450 mm above the brickwork for attachment to roof timberwork.

Anchoring of roofs and floors in blockwork shall be carried out in accordance with SANS 10145 except where shown otherwise on the drawings.

PQA 14 PLASTERING

Plastering shall be composed of one part Portland cement 42,5 plus one tenth part lime to four parts fine plaster sand from an approved source. An equivalent mortar comprising other cementitious materials may be approved by the Employer's Agent, after testing. Plaster shall be applied to walls in one coat 12 mm thick and well worked into brickwork or blockwork joints, which shall have been previously raked out to form a key. The surface of the work shall be finally smoothed with a wooden float or steel trowel, as may be called for, depending upon the nature of the surface required. Angles and edges are to be carefully plumbed or levelled, as the case may be, and corners shall be arris rounded.

In the case of plastering to concrete work, the surface of the concrete shall first be hacked sufficiently to afford proper bond and the plaster applied as a thin skimming coat, or coats. V-joints shall be formed at the junction of concrete and brickwork. Plaster adhesive supplied by a reputable manufacturer may be used on the concrete faces in lieu of hacking, subject to prior approval by the Employer's Agent.

Where scheduled or shown on the drawings, the external faces of brickwork, blockwork and/or concrete shall be cement mortar plastered.

Should any plaster show signs of cracking, blowing or other defects at any time before or during the Defects Liability Period, the defective work shall either be stripped and re-plastered or locally repaired by the Contractor, all at his own expense, as directed by the Employer's Agent. The defective areas shall be cut out to a rectangular shape unless otherwise permitted, with edges undercut to form a key and the joint carefully smoothed off flush with the surrounding plaster. Plasterwork should in all cases be commenced at the top and proceed downwards and every care must be taken to prevent staining of face brickwork and other finished parts with plaster droppings. Such droppings shall not be allowed to harden, but shall be cleaned off continuously as plastering proceeds. Plaster droppings in sumps must be removed to the satisfaction of the Employer's Agent. Plastering must be carried out from ceiling to floor and from wall to wall without any breaks in the plastered surface.

PQA 15 PAYMENT FOR BRICKWORK

PQA 15.1 Brickwork ..... Unit: m²

Payment for brickwork will be made by area of finished brickwork of the various wall thicknesses and types as scheduled, measured in elevation.

Prices shall be inclusive of the supply of all materials, plant and labour necessary for completing the work, including the supply and building in of wire ties, all plumbing of corners and faces, lining, levelling, forming reveals and openings, cutting where necessary but not specially scheduled. The measurement of the work will be taken net with window and door openings deducted, but no deductions from the measurements will be made for lintels, air bricks, pipes up to and including 150 mm diameter or fittings up to 150 mm square built into the work. Small openings of area up to 0,05 m² will not be deducted.

Items for brickwork are scheduled separately for reinforced and unreinforced brickwork, except for small areas of reinforced brickwork over openings, windows and doors etc, which are deemed to be included in the rate for unreinforced brickwork.

PQA 15.2 Louvre vents ..... Unit: No

Payment for louvre vents and air filters will be made by number supplied and installed.

PQA 15.3 Building in window frames, door frames, pipes, Steelwork, etc. ..... Unit: No

Payment for building in window frames, door frames, pipes, steelwork etc shall be paid separately for each type and size as scheduled.

PQA 15.4 Damp proof course ..... Unit: m²

Payment for damp proof course will be made by the net area of each size supplied and installed. No payment will be made for overlaps, etc.

PQA 15.5 Lintels ..... Unit: m

Payment for lintels will be made by length installed.

PQA 15.6 Extraction fans ..... Unit: No

Payment for extraction fans will be made by number supplied and installed. The tendered rate shall include for forming the necessary openings through the walls.

PQA 15.7 Chases in brickwork ..... Unit: m

Payment for chases in brickwork for electric conduits will be made per linear metre of chase cut.

PQA 15.8 Hoop iron ties ..... Unit: No

Payment for hoop iron ties will be made by number supplied and installed.

PQA 15.9 Brickforce brick reinforcement ..... Unit: m

Payment for Brickforce brick reinforcement will be made for each different wall thickness.

PQA 16 PAYMENT FOR BLOCKWORK

PQA 16.1 Blockwork .....Unit: m²

Payment for blockwork will be made by area of finished blockwork of various thicknesses and types, measured in elevation.

Prices shall be inclusive of the provision of all materials, plant and labour necessary for completing the work, including the building in of wire ties, all plumbing of corners and faces, lining, levelling, forming reveals and openings, cutting where necessary and plastering where specified. The measurement of the work will be taken nett with window and door openings deducted, but no deductions from the measurements will be made for lintels, air bricks, pipes up to and including 150 mm diameter or fittings up to 150 mm square built into the work. Small openings of areas up to 0,05 m² will not be deducted.

PQA 16.2 Infilling of blockwork with concrete .....Unit: m²

Payment for infilling of blockwork with concrete shall be extra over the payment item PQA 16.1 above, for various thickness and types, measured in elevation. The rate shall include the provision of expanded metal mesh where indicated.

PQA 16.3 Brickforce brick reinforcement .....Unit: m

Payment for Brickforce brick reinforcement will be made for each different wall thickness.

PQA 16.4 Waterproof coating of external faces .....Unit: m²

Payment for waterproof coating of external faces shall be by the surface area actually treated.

PQA 17 PAYMENT FOR PLASTERING

PQA 17.1 Plastered finish to walls. .....Unit: m²

Payment for plastered finish to walls will be made by area of finished plaster, measured in elevation, for each surface finish specified. Prices shall be inclusive of the provision of all materials, plant and labour necessary for carrying out the plastering work, including the plumbing of corners and faces and forming reveals and openings. The measurement of the work will be taken net with window and door openings deducted. Small openings of areas up to 0,05 m² will not be deducted.

PQB: FLOOR FINISHES AND WALL TILING

(Supplementary to SABS 1200 – 1986)

PQB 1 GRANOLITHIC FLOOR SCREEDS

PQB 1.1 Materials

Granolithic screed shall consist of one part Portland cement Type CEM.I 42,5 to SABS.ENV 197-142,5, one part sand and two parts 5 mm stone chippings, thoroughly mixed as for concrete and applied to the surface of the underlying concrete in a layer not less than 20 mm thick, levelled or graded and trowelled to a smooth uniform surface. Granolithic shall be either untinted or tinted, as called for in the Bill of Quantities.

PQB 1.2 Laying

The laying of the granolithic finish shall be in full compliance with the relevant clauses of SANS 10109 Part 2. To ensure thorough bond, the granolithic should, where possible, be applied before the concrete below has become properly set and preferably while it is still green, and every precaution must be taken to keep the concrete damp and clean until the granolithic is placed. If this is not possible, then the underlying concrete must be chipped or otherwise roughened to the satisfaction of the Employer's Agent, flushed with clean water and then coated with cement grout before the granolithic is laid.

Granolithic paving is to be V-jointed in squares of approximately 1,25 metres side length, the V-joint being formed while the surface is still soft.

Where floor cables are not covered by chequered plate or other steel flooring, cable ducts in the floor shall be filled with clean river sand to a depth of 70 mm from the finished granolithic level after all cables are in position and have been tested and approved. A 50 mm thick layer of Grade 20 concrete shall be placed on top of the sand, which in turn shall be covered with granolithic screed. V-joints shall be formed at both sides of all cable ducts, the joints being accurately positioned.

V-joints are to be formed in straight lines and extend to 75% of the full depth of the granolithic layer.

The screed shall be finished with its upper surface perfectly smooth and continuous without voids or float marks.

Where shown or directed by the Employer's Agent, 100 mm high granolithic skirtings are to be formed. They shall include rounded top edges, and radiused corners and a 38 mm radius coving at junctions with the floor. The tendered rates shall include for forming all internal and external mitres, returns, stopped ends, etc, all finished smooth with a steel trowel. At steps a sloping skirting shall be formed, 100 mm high above the noses of the steps. Where ordered, the tread risers and sides of steps, shall also receive a granolithic finish and at the edge of steps and slabs rounded nosing and reeded treads shall be provided. A sunk and weathered threshold shall be provided in the granolithic at all doors.

The risers and treads of stairs shall also receive a granolithic finish and the treads shall be reeded and the front edges are to have a rounded nosing.

PQB 2 FLOOR SCREEDS

Floor screeds shall comply with all of the requirements set out above for "Granolithic Floor Screeds" save that the mix shall not contain any stone chippings and shall comprise four parts sand to one part Portland cement Type CEM.I 42,5 to SABS.ENV 197-142,5 and be of 25 mm average thickness and minimum of 20 mm thick, except where otherwise scheduled or shown on the drawings.

PQB 3 VINYL (PVC) FLOOR TILING

PQB 3.1 General

Where indicated on the drawings or scheduled in the Bill of Quantities, vinyl (PVC) semi-flexible floor tiles or sheeting shall be supplied and installed.

PQB 3.2 Materials

The tiles/sheeting shall comply with SANS 581: 2007 and shall receive the prior approval of the Employer's Agent. Unless otherwise indicated, the tiles shall be 300 x 300 mm and the tiles/sheeting shall be 2,5 mm thick. The vinyl flooring shall be of an approved colour chosen from the manufacturer's standard range. Vinyl cove skirtings shall be of similar quality and colour to the floor tiles and 70 mm in height unless otherwise stated. Where sheeting is called for, it shall be welded at all joints and to the skirting.

PQB 3.3 Laying and Fixing

Floors to receive vinyl tiles/sheeting shall be covered with a mortar screed comprising four parts sand to one part Portland cement 42,5 and of 25 mm average thickness and minimum of 20 mm thick, except where laid on an unbonded damp-proof membrane, in which case the screed shall be 50 mm thick. The screed shall be finished with its upper surface perfectly level and continuous without voids or float marks. The screed materials and methods of laying shall be in full compliance with SANS 10109 Part 2. The screed shall be at least 7 days old and perfectly dry, to the satisfaction of the Employer's Agent, prior to laying the vinyl tiles. The underlaying concrete shall be thoroughly cleaned to the Employer's Agent's satisfaction prior to laying the screed.

The tiles shall be laid strictly in accordance with the manufacturer's instructions onto the screed using the recommended adhesive. This adhesive shall be spread with a Vee notched trowel 1,5 x 1,5 x 1,5 mm triangular notches at 4 mm centres. The coverage of adhesive shall be between 5,0 and 5,5 m^2 per litre. After laying, the tiles are to be rolled with a suitable roller to ensure complete adhesion. The floor tiles shall be cut where required and neatly fitted against adjoining walls, floors, thresholds, etc. Vinyl skirtings shall be close fitted to floors and walls, butted and end jointed, neatly mitred at internal angles and dressed around external angles, and fixed with adhesive as for the flooring.

Finished floors and skirtings shall be protected from damage during the progress of the remaining work, and at completion shall be cleaned and handed over in a perfect condition. The work shall be carried out by skilled workmen experienced in laying this type of floor finish.

PQB 4 TEXTILE FLOOR COVERING

PQB 4.1 Materials

Textile floor coverings shall be of the type shown on the drawings or scheduled in the Bill of Quantities, and shall include an underlay where called for, and laid in full compliance with SANS 10186.

Skirtings shall comprise standard meranti hardwood skirting mitred at all corners and joints and fixed with steel nails.

PQB 4.2 Substrate

The substrate on which textile floor coverings are to be laid shall be as shown on the drawings, and where textile floor coverings are laid on a concrete screed, the screed shall comply with Clause PQB 3.3 above.

PQB 5 INTERFACE BETWEEN DIFFERENT FLOOR FINISHES

At junctions of differing floor finishings, a 25 x 3 mm brass strip with a 3 mm wide top edge flush with the adjoining finishings shall be supplied and installed.

At each external door, a 25 x 3 mm brass strip with a 3 mm wide top edge flush with the internal surface shall be supplied and installed so as to create a vertical step 6 mm high in line with the inner face of the opening outwards door(s).

PQB 6 WALL TILING

PQB 6.1 Tiles for Interior Work

Glazed ceramic tiles and fittings shall comply with the requirements of SANS 22 and, unless otherwise called for on the drawings or Bill of Quantities, shall be white, size 150 x 150 mm and 6,5 mm thick.

PQB 6.2 Fixing of Tiles

The tiles shall be fixed to previously sand/cement rendered walls with an approved cementitious tile adhesive. Horizontal and vertical joints in the tiling shall be continuous and be at least 2 mm wide. After fixing and setting for at least 12 hours, the joints shall be filled in completely with an approved white cement grout. Tiles shall not be soaked in water before fixing except where recommended by the tile manufacturer. The finished work shall be thoroughly cleaned off after grouting is completed.

Unless otherwise specified, the wall tiling shall project approximately 4 mm beyond the face of adjoining plaster with all exposed edges finished with glazed edge tiles.

Tiling shall be returned into reveals of openings and onto window sills, and shall be butted at internal angles and provided with glazed edged tiles to external angles, unless otherwise specified. All necessary cutting of tiles shall be properly performed.

Unless otherwise specified on drawings, tiles are to be fixed outwards from the centre of the walls and upwards from approx 140 mm above the floor, with cut tiles at the extremities of the wall face and floor areas. Exposed external edges must be finished with a full glazed edge tile. The 140 mm of height below the bottom tiles shall be filled in with the same type of tile cut to fit where no special skirting tile is scheduled or shown on the drawings.

Provision must be made for any pipework or protrusions through the walls. Tiles must be finished off around the protrusion and take the necessary shape to accommodate any pipework, etc.

Joints around such protrusions are to be similar in width to joints in the rest of the tiling, unless the Employer's Agent instructs otherwise.

Expansion joints for wall tiles, unless otherwise specified by the manufacturers, are to be provided in areas that are in excess of 6,0 metres, measured horizontally along the floor and 3,0 metres, measured vertically along the wall, or as indicated on drawings. These joints are to have a maximum width of 4 mm and be filled with white silicone.

PQB 7 MEASUREMENT AND PAYMENT

PQB 7.1 Payment for Granolithic finish

PQB 7.1.1 Granolithic finish ..... Unit: m²

Payment for granolithic finish shall be by area of finished surface irrespective of whether it is horizontal, vertical (except for skirting) or on the slope. The price shall include for all the work specified, including treating the underlying concrete surface.

PQB 7.1.2 Granolithic skirting ..... Unit: m

Payment for granolithic skirting shall be per linear metre of completed skirting, for each height scheduled. Price shall be inclusive of the provision of all materials, plant and labour necessary to complete the granolithic work and for any material which is wasted.

PQB 7.1.3 Extra over Item PQB 7.1.2 for rounded nosing and reeded treads on stairs ..... Unit: m

PQB 7.2 Payment for Vinyl Floor Tiling/Sheeting

PQB 7.2.1 Vinyl flooring ..... Unit: m²

Payment for vinyl flooring shall be per net area of completed floor surface. The rate shall include for all the work specified above including the cement mortar screed and the preparation of the surface of the concrete structural floor.

PQB 7.2.2 Skirting ..... Unit : m²

Payment for skirting shall be by length of the completed skirting of each height scheduled.

Prices shall be inclusive of the provision of all materials, plant and labour necessary to complete the required work and for all cutting and waste.

PQB 7.3 Payment for Textile Floor Coverings

PQB 7.3.1 Textile floor coverings ..... Unit : m²

Payment for textile floor coverings shall be per net area of completed floor surface. The rate shall include for all work specified, including the preparation of the structural surface, the cement mortar screed, the underlay where called for and the laying of the textile floor covering.

PQB 7.3.2 Skirting ..... Unit : m

Payment for skirting shall be by length of completed skirting for each height scheduled.

Prices shall be inclusive of the provision of all materials, plant and labour necessary to complete the required work and for all cutting and waste.

PQB 7.4 Payment for interface between different floor finishes

PQB 7.4.1 Brass strips..... Unit : m

Payment for the brass strips shall be by length and shall be inclusive of the provision of all materials, plant and labour necessary to complete the required work and for all cutting and waste.

PQB 7.5 Payment for Wall Tiling

PQB 7.5.1 Tiling..... Unit : m²

Payment for tiling will be by area of completed tiling including exposed tiled ledges, window and door returns, etc but the area of window and door openings will be excluded.

PQB 7.5.2 Expansion joints ..... Unit : m

Expansion joints will be paid for separately per linear metre.

PQB 7.5.3 Supply and installation of toilet roll holders and soap dishes..... Unit: No

PQB 7.5.4 Skirting ..... Unit: m

Payment for skirting will be measured separately by length only if and where a special skirting tile is called for.

Tendered rates shall include for the provision of all materials, including all special tiles, eg stair treads, skirting tiles, external and internal angle tiles and cover base skirting tiles, and for all labour and plant necessary to complete the work shown on the drawings or scheduled and for all cutting and waste.

PQD: STEEL DOORS AND WINDOWS

(Supplementary to SABS 1200 – 1986)

PQD 1 STEEL DOORS AND FRAMES

PQD 1.1 Pressed Steel Door Frames

Pressed steel door frames shall be of welded one piece construction or of an approved knock-down type for assembly on site, and constructed of mild steel sheet, pressed or rolled to the required shapes.

Frames for walls one brick thick shall have a single rebate profile and the frame material shall be at least 1,6 mm thick. All other frames, unless otherwise specified, shall be double rebated and manufactured from metal at least 1,6 mm thick.

Frames shall be of widths required to suit the thickness of walls into which they are to be built, and shall be fitted with suitable tie-bars and braces at bottom, and lugs for building in three to each jamb of frames without fanlights, and four to each jamb of frames with fanlights. Where fanlights are shown over doors, the frame shall be fitted with transoms of pressed or rolled steel sheet as above rebated for fanlights and for doors if required and shall have a nominal thickness of at least 1,6 mm thick metal. The rebates in frames and transoms for doors and fanlights shall be of widths required to suit the thickness of doors and fanlights.

Frames shall have holes as and where required for screws for fixing fanlight openers, keeps of spring catches, etc. Where fanlights are shown to be fixed into frames, the frames shall be holed and tapped in the rebates suitable for screws for fixing the top centres.

Frames for single doors shall be fitted with an approved chromium plated, or stainless steel (unless otherwise specified) adjustable striking plate keep, boxed in at the back of the frame with a sheet metal box welded on, and not less than two rubber buffers.

All welding shall be cleaned off smooth and flush on exposed surfaces and frames shall be cleaned and primed as described for steel windows, before leaving the manufacturer's works.

PQD 1.2 Steel Doors, Sidelights and Fanlights

PQD 1.2.1 General Requirements

Steel doors shall comply with the requirements of SANS 727, constructed from mild steel sheet of at least 1,6 mm thick metal.

All doors, sidelights and fanlights shall, in addition, comply with the following requirements:

(a) Suitable weather bars shall be provided to render external doors, etc, perfectly watertight.

(b) Frames of doors, etc. where fixed to concrete columns, beams, etc, shall be provided with suitable lugs for fixing to plugs in the concrete at same spacing as the standard fixing lugs.

(c) Doors, sidelights, fanlights and components, except where specified to be hot dip galvanised, shall be cleaned and primed as described below.

Door, sidelights and fanlights unless otherwise shown, shall be of "one piece" construction, but where shown to be in two or more "one piece" units, the units shall be coupled together with standard coupling mullions and/or transoms.

Bottom openings in doors and sidelights shall be fitted with kicking plates of one thickness of 1,6 mm thick mild steel sheet fixed with metal beads.

Frames for outward opening doors shall be fitted at the bottom with sills of door framing section (stepped sills) and frames for inward opening doors with metal ties, welded to frames, for embedding in thresholds (flush sills).

After doors, sidelights and fanlights have been built in and before being glazed, they shall be checked for alignment, adjusted as necessary, and left in a satisfactory state and in good working order.

PQD 1.2.2 Stock Doors Units

Stock doors, sidelights and fanlights shall be of the type scheduled or shown on the drawings. The doors shall be constructed of not less than 33 mm universal steel sections, and sidelights and fanlights of 25 mm sections as described for windows.

Each leaf of a double door and each single door shall be hung on three steel hinges having brass pins. Hinges shall be of the parliament type where frames are set back from wall faces and where doors are shown to fold back against these faces.

Fanlights shall be hung and fitted as described for steel windows.

PQD 1.2.3 Purpose Made Door Units

Purpose made doors, sidelights and fanlights shall be as described in 1.2.2 above but constructed to the forms and sizes shown on the drawings. Unless otherwise specified, the doors shall be of not less than 33 mm universal sections and the sidelights and fanlights to standard 25 mm sections.

PQD 2 STEEL WINDOWS

PQD 2.1 Materials

Stock residential and industrial type steel windows shall comply with the requirements of SANS 727, and all other types shall comply with the constructional and other requirements of the above specification wherever applicable. All windows shall, in addition, comply with the following additional and/or amended requirements, viz:

(a) Suitable weather bars shall be provided to the bottom of inward opening and vertically pivot hung ventilators and also to the bottom of all outward opening ventilators where they occur above other ventilators and elsewhere as may be required to render the windows perfectly watertight.
(b) Frames for windows where fixed to concrete columns, beams, etc, shall be provided with suitable lugs for fixing to plugs in the concrete, or with holes for screwing to plugs in the concrete, all at the same spacing as the standard fixing lugs.
(c) Windows and components, except where specified to be hot dip galvanised, shall, before leaving the manufacturer's works, be cleaned by acid pickling, rinsing and drying, as laid down in SANS 10064, or by other approved means, to remove all scale, rust, grease, oil and foreign matter, and then primed with an approved red oxide zinc chromate primer applied by dipping or by means of spray guns.

Ventilators hung at one side to open outwards for windows above ground floors and not accessible for cleaning from an adjoining opening ventilator in the same window or from verandahs, balconies and the like, shall be hung on projecting hinges.

Windows, unless otherwise specified, shall be of one piece construction but where shown to be in two or more "one piece" units, the units shall be coupled together with standard coupling mullions and/or transoms.

Windows shall be fitted with brass handles, stays, catches and other fittings as later described. Those for windows constructed of universal sections shall have a polished finish, whereas all other windows shall have a tumbled finish. The fittings shall be fixed in such a way as to be removable after the windows are glazed.

After the windows have been built in, but before being glazed in accordance with Particular Specification: PQE Glazing, they shall be checked for alignment, adjusted as necessary, and left in a satisfactory state and in good working order.

PQD 2.2 Construction

The various type of windows shall be constructed as follows:

(a) Stock Residential Type Windows:

Stock residential windows shall be of the types shown on drawings, constructed of standard 25 mm steel sections with metal not less than 3 mm thick.

Side hung ventilators shall be hung on steel hinges having brass pins, and shall each be fitted with a casement fastener and sliding stay.

Top hung ventilators shall be hung on hinges as above, and shall each be fitted with combined fanlight stay and fastener size 200 mm for one pane high ventilator and size 250 mm for two panes with ventilators.

Bottom hung ventilators shall be hung on hinges as above, and shall each be fitted with approved concealed friction side arms and a spring catch and keep.

Pivot hung ventilators shall be hung on friction pivots and shall each be fitted with a spring catch and keep.

Projected out ventilators shall slide on approved spring loaded brass shoes, sliding in the channels of the fixed frame, and shall be balanced on steel arms, pivoted at ends and housed within the vertical frames; ventilators shall each be fitted with an approved casement fastener at the bottom.

(b) Purpose Made Residential Type Windows:

Purpose made residential type windows shall be as described in (a) above, but constructed to the forms and sizes shown on the drawings.

(c) Stock Industrial Type Windows:

Stock industrial type windows shall be of the types shown on the drawings, constructed with main frames of not less than 33 mm steel sections with metal not less than 3 mm thick, and with ventilators of standard 25 mm sections with metal not less than 3 mm thick.

Pivot hung ventilators shall be hung on friction pivots and shall each be fitted with a spring catch and keep.

Bottom hung ventilators shall be hung on steel hinges having brass pins, and shall each be fitted with approved concealed friction arms and a spring catch and keep.

(d) Purpose Made Industrial Type Windows:

Purpose made industrial type windows shall be as described in (c) above, but constructed to the forms and sizes shown on drawings.

PQD 3 MEASUREMENT AND PAYMENT

PQD 3.1 Steel doors and frames

PQD 3.1.1 Door units ..... Unit: No

Door units shall be supplied and installed complete with frame, hinge, locks and bolts as scheduled or detailed on the drawings. Each size and type shall be measured separately.

PQD 3.2 Steel windows

PQD 3.2.1 Window units ..... Unit: No

Window units shall be supplied and installed complete as specified, scheduled and detailed on the drawings, excluding glazing which is measured separately. Payment will be by number for each type and size.

The tendered rates shall include for the provision for all materials (including fastenings, hinges and ironmongery) except where scheduled separately, and for all labour and plant required to build the windows into the structures

PQE: GLAZING
(Supplementary to SABS 1200 – 1986)

PQE 1 GLAZING

PQE 1.1 Glass Material

Glass panes, not exceeding 0,65 m² surface area, shall be cut from 3 mm thick best quality clear float glass.

Glass exceeding 0,65 m² and up to 1,0 m² surface area of glass pane, shall be cut from 4 mm thick best quality clear float glass.

Panes larger than 0,66 m² shall be glazed with approved laminated safety glass at least 5 mm thick. Where scheduled or shown on the drawings, laminated glass is to have a solar barrier of the specified UV reduction factor.

PQE 1.2 Fixing of Glass Panes

Steel and wooden window frames shall be primed with an approved wood (or metal) primer before glazing is commenced.

Each pane of glass is to be well bedded at both back and front with putty and sprigged or otherwise mechanically located in the window frames. All putty shall be carefully trimmed and cleaned off and finished to neat straight lines. The finished surface of the putty is to be allowed to partly dry and then painted - usually after a few days of applying the putty - the actual timing of the painting will depend on the putty used and the prevailing site conditions.

Glazing putting shall be in accordance with SANS 680, suitable for use with metal or wooden window frames as appropriate and, shall be of the self-setting type.

PQE 1.3 Payment for Glazing

PQE 1.3.1 Glazing .....Unit: No

Glazing will be measured and paid for separately (except where otherwise scheduled) and will be deemed to include all costs associated with the glazing. Measurement will be based on the overall area of the window glazed irrespective of the number of individual panes and without deduction for glazing bars.

PQH: PAINTING

(Supplementary to SABS 1200 – 1986)

PQH 1 SCOPE

This specification covers the normal work required for small to medium size buildings. It does not cover the painting of steelwork (which is covered by SANS 1200 HC as amended by PSHC), but does include painting of galvanised iron for roof sheeting, gutters, downpipes, etc.

This specification should be adhered to, but as the formulation of paints is subject to continual modification, the specification for a particular material may be amended, should the paint manufacturer recommend an improvement thereto and provided such amendment receives the prior approval of the Employer's Agent.

A change of specification purely to reduce costs by using less suitable materials will not be acceptable.

PQH 2 MATERIALS

PQH 2.1 General

All materials which are to be used for painting under this Contract shall be from the same approved manufacturer (except in special cases which have had prior approval from the Employer's Agent) and shall be supplied in unopened containers. Thinning will be permitted only in conformity with the applicable manufacturer's recommendations.

The approved manufacturer of the paints shall be either Plascon or Dulux or as selected by the Contractor. Other manufacturer's products may be used, subject to them being approved by the Employer's Agent prior to any orders being placed.

The paint systems to be applied shall be the applicable of the systems itemised hereunder.

PQH 2.2 Approved Materials

The following materials, as supplied by the selected paint manufacturer, are approved for use under this Contract.

	Applicable Clauses	Kansai Plascon References	Dulux References
Pre-paint treatment:			
Bonding liquid	3.4.1	CVI.14	5147198
Knotting for timber	3.1	PK.2	-
Wood stopping	3.1	BS	-
Porous surface sealer	3.1	CVI 14	-
Primers for:			
Acrylic coat filler	3.2.1	PP 500	5147618
Plaster (alkali resistant)	3.2.1	UC.56	5147200
Hardboard	3.2.2	UC 56	-
Softwood timber	3.2.2	UC.2	5147196
Galvanised iron	3.5.1 3.5.2	G.I.P.	5147204
Aluminium	3.5.3	SNS 1	-

	Applicable Clauses	Kansai Plascon References	Dulux References
Water-Based Paint Systems:			
PVA emulsion	3.2.1	EPL	5147037
Acrylic PVA	3.3.1	PEM 600	5147037
Texture coating	3.3.2	FLX	5147080
Acrylic roof paint	3.4.1	TRP	5147005
Oil-Based Paint Systems:			
Universal undercoat	3.2.2, 3.3.3, 3.5.2	UC.1	5147206
Stain for wood	3.2.3	W 1	5147400
Alloyed roof paint	3.5.1	AW 255	-
Gloss enamel	3.2.2, 3.3.3, 3.5.2	G - Range	5147208
Interior varnishes:			
wood-gloss matt	3.2.3 3.2.3	X.33 X.44	5147426 5147430
Exterior varnishes:			
wood-gloss matts	3.3.4 3.3.4	-PNW - Gloss -PNW - Suede	5147422 -

PQH 3 APPLICATION

PQH 3.1 Surface Preparation

All surfaces to be painted must be thoroughly degreased, clean and dry prior to commencement of painting. The local environs are to be free from dust whilst painting is in progress.

Ironmongery and fittings not to be painted shall either be removed and subsequently replaced or, be suitably masked to prevent paint spots or streaks adhering to the surfaces.

All cracks are to be filled with the paint manufacturer's recommended filler suitable for the purpose and for the location (i.e. interior or exterior work). After drying, the filler is to be rubbed down to a smooth surface, flush with the adjacent surfaces.

Porous surfaces must be sealed in accordance with the paint manufacturer's recommendations. Timber work shall be knotted and stopped as necessary prior to commencing painting. All surface preparation shall be in accordance with the paint manufacturer's specifications.

PQH 3.2 Painting Interior Surfaces

PQH 3.2.1 PVA Emulsion System

3.2.1.1	Cement plaster, & concrete	Apply one coat of acrylic filler coat followed by two coats of PVA emulsion paint
3.2.1.2	Gypsum plaster, hardwall plaster & gypsum board	Apply one coat of alkali resistant primer followed by two coats of PVA emulsion paint
3.2.1.3	Hardboard	Apply one coat hardboard primer followed by two coats of PVA emulsion paint

PQH 3.2.2 Gloss Enamel System

3.2.2.1	Cement plaster, gypsum plaster hardwall plaster & gypsum board	Apply one coat of alkali resistant primer followed by one coat universal undercoat and one coat of gloss enamel
3.2.2.2	Hardboard	Apply one coat hardboard primer followed by one coat of universal undercoat and one coat of gloss enamel
3.2.2.3	Softwood timber	Apply one coat of oil based wood primer followed by one coat of universal undercoat and one coat of gloss enamel

PQH 3.2.3 Stain and Varnish System

3.2.3.1	Softwood timber	Apply one coat of stain followed by two coats of varnish (matt or gloss as ordered)
3.2.3.2	Hardwood timber	Apply two coats of varnish (matt or gloss as ordered)

PQH 3.3 Painting Exterior Surfaces

PQH 3.3.1 Acrylic PVA System

3.3.1.1	Cement plaster, & concrete	Apply one coat of acrylic filler coat followed by two coats of acrylic PVA paint
3.3.1.2	Asbestos board	Apply one coat of undercoat followed by two coats of acrylic PVA paint

PQH 3.3.2 Texture Coating System

Cement plaster & concrete:	Apply two coats of texture coating paint

PQH 3.3.3 Gloss Enamel System

Cement plaster:	As per 3.2.2.1 for interior surfaces
Softwood timber:	As per 3.2.2.3 for interior surfaces

PQH 3.3.4 Varnish System

Hardwood:	Apply two coats of ultra violet resistant varnish (matt or gloss as ordered)

PQH 3.4 To Roof Areas (Other than Galvanised Iron)

PQH 3.4.1 Acrylic PVA System

Cement and clay tiles:	Apply one coat of bonding liquid followed by two coats of acrylic emulsion roof paint

PQH 3.5 To Non Ferrous Metal Surfaces

PQH 3.5.1 Galvanised Iron Roofs

Apply one coat G.I metal primer followed by one coat micaceous iron ore roof paint

PQH 3.5.2 Galvanised Iron Tubes etc

Apply one coat G.I metal primer followed by one coat universal undercoat and one coat gloss enamel

PQH 3.5.3 Aluminium Surfaces

Apply one coat of aluminium primer followed by one coat of universal undercoat and one coat of gloss enamel.

PQH 4 MEASUREMENT AND PAYMENT

PQH 4.1 Provision of all materials, plant and labour necessary to prepare surfaces and complete painting work as specified:.....Unit: m²

Measurement and payment for paintwork will not be made separately, except where so scheduled in the Bill of Quantities. In the latter case, the prices tendered are to cover for the provision of all materials, plant and labour necessary to prepare the surfaces and complete the work as specified. Payment will be made by lump sum for the entire painting work, or by individual sum for each unit scheduled, or by area.

PQH 4.2 Painting of windows .....Unit: m²

Painting of windows will be measured as the overall size of the window frame with both sides being measured and with no deductions

PQI: ROOF COVERINGS (Other than thatch)

(Supplementary to SABS 1200 – 1986)

PQI 1 STEEL SHEET ROOF COVERINGS

For steel sheet roof coverings refer to Specification SANS 1200 HB Cladding and Sheeting and the amendments thereto in PS HB.

PQI 2 CEMENT ROOFING SLATE COVERINGS

Cement roofing slates shall be of the texture, size and colour shown on the drawings or scheduled, and manufactured by Everite Building Products or other equally approved manufacturer.

Care shall be taken to avoid damage by dropping or rough handling, this being especially important to the edges and the surface coating.

Roofing slates must be stored under cover, clear of the ground on suitable timber supports. The maximum height of stored materials must not exceed 25 bundles (10 slates per bundle). Snips must be used to remove the bundle strapping (on no account must straps be levered off).

PQI 3 CONCRETE TILE ROOF COVERINGS

PQI 3.1 General

Concrete roof tiles shall be of the texture, size and colour shown on the drawings or scheduled. The tiles are to be of the interlocking type and shall be laid with underlaying sheeting as required by the drawings. Generally tiles with an underlay may be laid to a flatter pitch (minimum 17,5°) than those without (minimum 26°).

PQI 3.2 Materials

Concrete roof tiles shall be manufactured in accordance with SANS 542 and be supplied by an approved manufacturer to the type, size and colour called for on the drawings or in the Bill of Quantities. Approved manufacturers are Marley Roofing (Pty) Ltd, Coverland and Watson Tile and Concrete. Other manufacturer's products may be acceptable but are subject to approval by the Employer's Agent.

Fittings and accessories shown on the drawings or scheduled are to be supplied by the same manufacturer from his standard range, where applicable.

Purpose-made fittings shall be approved by the tile manufacturer for use with his products and shall conform with the requirements shown on the drawings. Such purpose-made fittings shall be ordered by the Contractor sufficiently early to ensure delivery to suit his roof construction programme.

PQI 3.3 Construction of Concrete Tiled or Cement Slate Roofing

PQI 3.3.1 Safety

The laying of roof coverings shall be carried out only by workmen approved by the Contractor and who have had previous experience of such work. No other person, except those authorised for supervision and inspection, shall be permitted either onto the roof area being constructed or onto the floor vertically below that area at any time until such work has been completed. The Contractor shall be responsible for ensuring full adherence to the Occupation Health & Safety Act whilst construction of the roofing is being carried out.

No unfastened materials shall be left on the roof at any time, to avoid any possible dislodgement by wind or other natural force over which the Contractor has no control.

PQI 3.3.2 Laying Operations

In addition to complying with the aforesaid safety requirements, the laying of concrete tiles and cement slates and the associated fittings and accessories shall be carried out fully in accordance with the manufacturer's specifications. A copy of such specifications shall be available on site at all times.

Where underlay sheeting is called for, it shall have the SABS mark and must be laid in accordance with the drawings with sufficient overlap at all joins. Care must be taken to avoid cutting or tearing the underlay during subsequent operations and no rubbish or debris shall be left between the top of the sheeting and the underside of the tiles/slates.

Handling concrete tiles and cement slates and the fittings and accessories shall at all times be such as to cause no damage to the products and such handling methods shall be to the manufacturer's approval.

Walking on complete sections of the roof shall be permitted only in accordance with the tile/slate manufacturer's recommendations.

PQI 4 TESTING ROOFS FOR WEATHERTIGHTNESS

After laying operations have been completed, the Employer's Agent shall have the right to test the roof for tightness against penetration by rain or other weather condition by any means he considers necessary to simulate natural conditions. Should any part of the roofing be shown to be defective due to faulty workmanship or the use of sub-standard materials, the Contractor shall repair such defective parts as his own cost. The repairs shall be of the extent necessary to satisfy the Employer's Agent that the roof is weathertight.

PQI 5 PAYMENT FOR ROOF COVERINGS

PQI 5.1 Roof coverings ..... **Unit: m²**

Payment for roof coverings will be made for the exposed surface area of the finished roof where ancillaries are measured separately.

PQI 5.2 Ancillaries, such as flashing, ridging, ventilator openings, etc. ..... Unit: m/No

Payment for ancillaries such as flashing, ridging, ventilator openings, etc where scheduled separately, will be paid for by length or number of each item concerned.

PQI 5.3 Roof coverings with all ancillaries..... Unit: m²/Sum

Payment for roof coverings, where scheduled complete with all ancillaries as shown on the drawings, will be made either by roof surface area or by lump sum (small roofs only).

PQI 5.4 Weather testing..... Unit: Sum

Payment for weather testing of completed roof shall be made if such tests are ordered by the Employer's Agent and the roof is thereby proved to be weathertight. No payment for testing will be made should the roof be found to be defective. Payment, where called for by the foregoing shall be made at a lump sum mutually agreed by the Employer's Agent and Contractor.

The tendered rates shall cover for the supply, delivery, storage and handling of all materials, including waste, plant and labour necessary for the complete construction of the roof covering in accordance with the drawings.

PRD: DEMOLITION OF CONCRETE

(Supplementary to SABS 1200 – 1986)

PRD 1 SCOPE

This specification covers the demolition of concrete structures and/or portions of concrete structures together with the removal of the demolished material to the specified disposal area.

PRD 2 INTERPRETATIONS

PRD 2.1 Definitions

PRD 2.1.1 Concrete structures shall include all types of concrete including mass concrete, reinforced concrete, prestressed concrete and pneumatically applied concrete.

PRD 2.1.2 Demolition

The breaking down of concrete to the required outline and into separate, manageable and disposable sizes with no repair work to be undertaken. Where necessary, reinforcement shall be trimmed back in both the material left in place and in the material to be carted to disposal areas.

PRD 2.1.3 Removal

The breaking away of material from an existing concrete structure to expose sound concrete surfaces and/or reinforcement.

PRD 3 MATERIALS

Materials to be used in the demolition process shall be handled, stored and used strictly in accordance with the manufacturer's instructions.

PRD 4 PLANT

PRD 4.1 General

The plant and equipment to be used for the demolition of entire concrete structures or for portions of concrete structures shall be suitable for the particular application, based on proven and acceptable methods.

The proposed method of working shall, where so required, be demonstrated on a representative test section selected by the Employer's Agent.

PRD 4.2 Temporary Work and Safety

The Contractor shall provide suitable and safe temporary structures, including debris collection and removal chutes, as well as bins. Protection screens shall be provided, at each location of concrete demolition operations.

Any temporary propping required by the Employer's Agent for safety purposes shall be securely fixed in position and be subject to the approval of the Employer's Agent, prior to carrying out any stage of the work.

All work shall be carried out in full compliance with the Occupational Health and Safety Act No 85 of 1993 as well as to the approval of the Local Authority.

PRD 5 CONSTRUCTION

PRD 5.1 Access to Structures

The access to each structure to be demolished shall be completed prior to the commencement of demolition or removal work.

PRD 5.2 Programme

The demolition programme shall be in accordance with the drawings and any written instructions issued by the Employer's Agent.

PRD 5.3 Demolition of Structures

The demolition of structures, or major portions of a structure, shall be carried out in a manner that will ensure that no damage is caused to adjacent structures or structural members. The demolition activities shall not contaminate the surrounding environment making it unfit for normal activities, except at times and for durations approved by the Employer's Agent.

The Contractor shall ensure that nuisances associated with his work are minimised by taking appropriate precautions that shall be subject to the approval of the Employer's Agent. Nuisances include *inter alia*: noise, dust, flying fragments, heat, vibration and fumes.

Demolition shall be carried out without the use of explosives, (except where otherwise approved by the Employer's Agent) and in compliance with all relevant health and safety regulations.

PRD 5.4 Removal of Concrete

The Employer's Agent shall clearly mark or define the extent of the concrete to be removed. The marked outline shall be cut at least 10 mm deep into the concrete by the Contractor before commencing the associated removal work.

The concrete to be removed may be either the full depth and width of the member or a surface area removed to a prescribed depth, as shown on the drawings or ordered by the Employer's Agent.

Reinforcement to concrete which is not to be removed shall be cut back to lines as detailed on the drawings. The method used shall be selected by the Contractor and be subject to the approval of the Employer's Agent prior to commencing such activity.

Methods of demolition and/or removal that do not damage the structure or strength of the remaining sound concrete shall be used. Thermal cutting shall not be used closer than 100 mm from the outline marked on the structure or as indicated on the drawings. The remaining concrete shall be removed using appropriate mechanical means.

Where a concrete member is subsequently to be extended or partially replaced, the concrete around the reinforcement bars shall be removed to expose the bars to the extent required by the Employer's Agent. Care shall be taken to avoid reducing the strength of the bars to be exposed.

The equipment to be used for cutting back concrete to such contact surfaces shall be such as to avoid cracking the structure which is to remain in place. No reduction of bond between reinforcement and existing concrete will be tolerated.

PRD 5.5 Removal of Embedded Steelwork

Steel, or other metal, sections embedded in concrete structures shall be carefully removed, where so required, without damaging the structural concrete. Suitable tools, subject to the approval of the Employer's Agent shall be used for this work.

PRD 5.6 Surface Preparation for Contact Surfaces

The required concrete contact surfaces shall be cut to a plane and even surface with exposed faces perpendicular to the horizontal face or side faces as applicable.

All loose and shattered concrete, as well as foreign material such as oil, paint, grease, etc shall be removed from the contact surfaces. The contact surfaces thus prepared shall be cleaned by water jetting or other methods subject to the approval of the Employer's Agent and, in the case where the new concrete will not be cast against the surface within 3 days, shall be protected with plastic sheeting.

PRD 5.7 Drilling Holes into or though Concrete

Prior to drilling into or through concrete members a non-destructive survey shall be carried out by the Contractor in conjunction with the Employer's Agent over areas outlined by the Employer's Agent in order to locate existing reinforcement steel. The located bar positions shall be clearly marked, and using this information, final positions for drilling will be determined by the Employer's Agent.

PRD 6 TOLERANCES

The maximum deviation from the required line, level or dimensions indicated on the drawings shall be 25 mm, unless otherwise approved by the Employer's Agent.

PRD 7 TESTING

Should the Employer's Agent require the Contractor to demonstrate the suitability of the equipment and method he proposes to use for demolition work, the Employer's Agent will specify where such a demonstration shall be carried out and the Contractor shall comply with such requirements. No payment will be made for any such demonstration.

PRD 8 MEASUREMENT AND PAYMENT

PRD 8.1 Demolition of Concrete .....Unit: m^3

The unit of measurement shall be the volume of concrete to be demolished, measured in its original position prior to demolition.

The tendered rates shall include full compensation for the provision of all materials, plant, labour, screening and protective measures that are required to demolish the concrete and to load, transport and dump the concrete segments and rubble at the nearest approved dumping area.

PRD 8.2 Cutting Back of Concrete to a New Surface .....Unit: m^3

The unit of measurement shall be the volume of concrete to be removed, as measured in its original position prior to cutting back operations.

The tendered rates shall include full compensation for the provision of all materials, plant, labour, screening and protective measures, that are required to cut back the concrete and reinforcement to the profile shown on the drawings and to load, transport and dump the spoil material at the nearest approved dumping area.

PRD 8.3 Removal of Concrete to Expose Reinforcement.....Unit: m^3

The unit of measurement shall be the volume of concrete removed, measured in its original position on a structural member.

The tendered rate shall include full compensation for the provision of all labour, materials, screening and protective measures, equipment, plant, etc that is required to cut back the concrete and expose reinforcement to the profile shown and to load, transport and dump the material at the nearest approved dumping area.

PRD 8.4 Removal of Surface Concrete .....**Unit: m^2**

The unit of measurement shall be the area of concrete of specified thickness that is removed, measured in its original position of a structural member.

The tendered rate shall include full compensation for the provision of all labour, materials, screening and protective measures, equipment, plant, etc, that is required for the removal of the surface concrete to the profile shown or specified including the exposure of reinforcement bars, and to load, transport and dump the material at the nearest approved dumping area.

PRD 8.5 Removal of Metal Sections Embedded in Concrete.....Unit: No or Sum

The unit of measurement shall be the number of metal sections removed.

The tendered rate shall include full compensation for the provision of all labour, material, screening and protective measures, plant and equipment required for the removal of embedment grout or concrete surrounding the metal section by means of chiselling, cutting or grinding, the removal of the metal section stub and disposal of all rubble at a suitable waste site, and the cleaning of the pocket as specified.

PRD 8.6 Drilling or Coring of Holes through Concrete Members ..... Unit: No

The unit of measurement shall be the number of holes of specified type and size drilled or cored into or through a concrete member.

The tendered rate shall include full compensation for the provision of all labour, protective measures, plant or equipment required for the execution of work, including the provision of fixings, power cabling, etc and the disposal of resultant rubble at the nearest approved dumping area.

PUB: JOINTS IN HYDRAULIC STRUCTURES

(Supplementary to SABS 1200 – 1986)

PUB 1 SCOPE

This specification covers the requirements for watertight expansion, contraction, and construction joints in water retaining and water excluding concrete structures. Should there be any discrepancy between the requirements of the specification and the drawings, the requirements of the drawings shall prevail.

PUB 2 MATERIALS

PUB 2.1 General

All joint materials shall be subject to the approval of the Employer's Agent prior to their use. A written recommendation regarding the suitability of the materials that the Contractor proposes to use shall be obtained from the manufacturer by the Contractor and submitted to the Employer's Agent at the time of requesting approval for the use of such materials.

All the materials required for each separate jointing system shall be obtained from the same manufacturer, except where other specific manufacturer's products are called for on the drawings, or scheduled.

The types of liquid to be retained within, or excluded from, the structures included under this Contract, are as follows:

- Potable water treated with chlorine
- Potable water treated with ozone
- Raw river water
- Raw sewage
- Aerobic sewage sludges
- Anaerobic sewage sludges
- Sewage effluent

PUB 2.2 Joint Filler Materials

PUB 2.2.1 Expanded Polyethylene Fillers

The material shall comprise a semi-rigid, closed cell expanded polyethylene sheet suitable for use in movement joints in water/sewage retaining structures and water excluding structures.

The material shall be rot-proof, resistant to biological attack, non-absorbent, ultraviolet stabilised and non-toxic when used for potable water applications. The last quality is not required for use with sewage systems. The material shall also be able to withstand the maximum hydraulic head which may be applied at the joint.

Suitable approved materials are not limited to but include:

(a) For hydraulic heads up to 3 m:
"Jointex" manufactured by Sondor Industries Ltd
"Hydrocell" manufactured by Fosroc (Pty) Ltd

(b) For hydraulic heads over 3 m up to 15 m:
"Aquajoint SPX 120" manufactured by Sondor Industries Ltd
"Hydrocell" manufactured by Fosroc (Pty) Ltd

PUB 2.3 Waterstops

PUB 2.3.1 PVC Waterstops

PVC waterstops shall be manufactured from new materials (regenerated PVC is not acceptable) and shall be of the sections shown on the drawings and/or scheduled in the Bill of Quantities. The sections detailed may vary from being a complex section of large surface area which offers a difficult path for possible leakage water, to a surface-mounted waterstop. The waterstops shall be manufactured with fixing lugs, an eyeletted edge or nailing flange.

Suitable approved materials are not limited to but include the following that are manufactured by Fosroc (Pty) Ltd:

(a) Large Surface Area Type

(i) "Supercast Hydrofoil" sections with centre bulb from 150 mm up to 330 mm wide for use in expansion, contraction and construction joints.

(ii) Heavy duty "Hydrofoil" sections 250 mm wide for use where large volumes of concrete are being placed or where the lift is high in deep shutters.

(b) Surface Mounted Waterstops

(i) "Supercast Rearguard S" with central hollow box from 150 mm up to 250 mm wide for use in expansion joints.

PUB 2.3.2 Rubber Waterstops

Rubber waterstops shall be manufactured from a high grade rubber compound to give the characteristics of flexibility and longevity. They shall be of the sections detailed on the drawings and may be of the plain dumbell type or the centre bulb type.

Suitable approved materials are not limited to but include the following that are manufactured by Fosroc (Pty) Ltd:

(a) Plain Dumbell Type

Two section profiles, 150 mm and 230 mm wide are available and are suitable for contraction joints where no shear movement is possible but otherwise high movement is expected.

(b) Centrebulb Type

Four profiles from 115 mm to 355 mm wide are available and are suitable for contraction and expansion joints where high movement is expected.

PUB 2.3.3 Swellable Hydrophilic Waterstops

Water swellable waterstops shall be manufactured from high performance synthetic elastomer strips with the swelling action resulting from the strips coming into contact with water. They shall have an unrestrained volumetric expansion of not less than 170% and must not deteriorate under prolonged wet/dry cycling.

The strips shall be of the sizes shown on the drawings and fastened to the concrete with the manufacturer's recommended adhesive. Fosroc (Pty) Ltd manufactures a material, supplied in strips referenced "Supercast SW20 or SW10". "SW20" is 10 x 20 mm in cross-section whilst "SW10" is 5 x 10 mm. This material is suitable for construction and contraction joints but is not suitable for expansion joints.

The swellable waterstop is particularly suitable for joints formed under difficult conditions, as well as for pipe entries. The maximum hydrostatic pressure resistance of this product is 50 m head of water.

"Supercast SW" swellable waterstops may be used in conjunction with the same manufacturer's rearguard waterstop.

PUB 2.3.4 Other Manufacturer's Waterstops

Waterstops manufactured by other specialist manufacturers may be used where they are of similar specification, provided prior approval is obtained from the Employer's Agent in compliance with Clause PUB 2.3 above.

PUB 2.4 Joint Sealant Materials

PUB 2.4.1 General

Before ordering any joint sealant materials the Contractor shall obtain, and submit to the Employer's Agent for his approval, written evidence from the manufacturer that the proposed materials are suitable for their required purpose(s).

All materials shall be insoluble in water and not deteriorate if subjected to any chemical action or biological attack when in contact with the liquids listed in Clause PUB 2.2 above.

PUB 2.4.2 Elastomeric Sealants

PUB 2.4.2.1 Polysulphide Sealants (Not suitable for sewage uses)

Polysulphide sealants shall be manganese cured and lead free and shall be used with the primer and bondbreaker as may be required to comply with the manufacturer's specifications.

A suitable sealant is "Thioflex 600" manufactured by Fosroc (Pty) Ltd but subject to meeting the requirements of Clause PUB 2.4.1 above, and subject to the joint dimensions being within the limits laid down by the sealant manufacturer.

PUB 2.4.2.2 Polyurethane Sealants

Polyurethane sealants may be either one component or two component materials. Suitable materials, but subject to Clause PUB 2.4.1 above, are as follows:

(a) One component:
- "Sikaflex 1a" for a wide variety of applications
- "Sikaflex 11FC" for low movement joints
- "Sikaflex 35SL" with high abrasion and weathering resistance.

(b) Two components:
- "Expoflex 800" for a wide variety of applications
-

"Sikaflex" materials are manufactured by Sika (Pty) Ltd and "Expoflex" by Fosroc (Pty) Ltd.

PUB 2.5 Bandage Joint Systems

PUB 2.5.1 General

Proprietary bandage joint waterproofing systems shall conform in all respects to the manufacturer's specifications and a written recommendation is to be obtained by the Contractor from the manufacturer with regard to the suitability of the material for the specific application.

Bandage systems are particularly useful for remedial purposes in water retaining structures.

PUB 2.5.2 Fosroc Bandage Material

A suitable bandage material supplied by Fosroc (Pty) Ltd is "Expoband" but the complete joint comprises:

"Expoband" bandage
"Expoband" adhesive
"Thioflex 600" joint sealant
"Hydrocell" joint filler
"Famguard strap" (may be omitted)

PUB 2.5.3 Sika Bandage System

A suitable bandage material supplied by Sika (Pty) Ltd is "Sikadur-Combiflex" and the complete joint comprises:

A suitable joint filler
"Sikadur 31" (2 layers)
"Combiflex" hypalon sheeting
Masking strip

PUB 3 CONSTRUCTION

PUB 3.1 Joint with Waterstops

Where shown on the drawings, joints shall be formed in concrete work embodying waterstops within the concrete. Such waterstops shall provide a continuous watertight membrane made from strip welded in accordance with the manufacturer's instructions.

It is essential that the waterstops are held securely during concreting by using split wooden shuttering and a clamping device; nailing is not permitted except through the lugs where such are provided for that purpose. The concrete around the waterstop shall be carefully placed and compacted to avoid honeycombing and to ensure full contact between the waterstop and the concrete around the embedded periphery to the seal.

After one half of the waterstop has been set into concrete, the faces of the concrete against which the succeeding section is to be cast shall be thoroughly cleaned by brushing with a wire brush, care being taken not to damage the waterstop.

PUB 3.2 Placing Filler Material

Where scheduled and/or shown on the drawings, filler material shall be placed against concrete work or shuttering and held firmly in position to prevent distortion or displacement while adjacent concrete is being placed. Adhesives, as recommended by the manufacturer of the filler material, shall be used where necessary for this purpose.

PUB 3.3 Sliding Joints

Sliding joints are to be formed where shown on the drawings. The upper concrete surfaces forming the sliding joints, whilst still green, are to be sprinkled with cement and brought to a hard smooth and level finish by trowelling the concrete with a steel trowel. When thoroughly set and dry, these surfaces are to receive one priming coat and two finishing coats of an approved bituminous solution prior to the upper concrete being cast thereon.

PUB 3.4 Joints with Recesses

Joint recesses provided for sealants are to be formed to the dimensions and shapes indicated on the drawings by suitable shuttering which can be removed without any timber having to be left in the recesses. Shuttering shall however be left in place until the joints are ready for cleaning, priming and filling with sealant. Joints shall be thoroughly cleaned and all dust removed.

PUB 3.5 Cutting Joint Recesses

Whilst cutting of recesses will not normally be permitted, should the Employer's Agent so agree in particular situations, the recesses for expansion and contraction joints may be cut into the concrete after concreting has been completed. Such cutting, to accurately achieve the joint dimensions, shall be carried out immediately prior to the filling of the joints with sealant. Great care shall be taken to ensure that no dust or other loose material remains in the recess. All such material shall be removed in the same manner as specified in the previous clause.

PUB 3.6 Sealing Joints with Recesses

The sealing of expansion and contraction joints is to be carried out by the Contractor under the supervision of a representative from the manufacturer of the sealant material. The Contractor is to be responsible for supplying approved materials, transporting them to site, storing and using them as required, and providing all labour, tools and all other apparatus necessary to prime and fill the joints.

The sealing of joints is to be carried out precisely in accordance with the instructions previously obtained from the manufacturer, or in accordance with his representative's requirements should these differ from the written instructions.

No sealing of joint recesses is to be carried out until at least 21 days after the adjacent concrete has been cast.

PUB 4 MEASUREMENT AND PAYMENT

For measurement and payment items for joints refer to PSG.

PVA: CEMENT MORTAR LINING OF STEEL PIPES

(Supplementary to SABS 1200 – 1986)

PVA 1 SCOPE

The specification covers the requirements for the lining of steel pipes and fittings with cement mortar either in the factory or in-situ. It covers the basic materials to be used, the quality, manufacture, curing, tolerances and testing of the completed linings.

Unless otherwise specified, all steel pipes, fittings, and specials with a cement mortar lining shall be lined generally in accordance with the requirements of the Australian Standard ASW 1281:2001 but more particularly, in accordance with the requirements of this specification which take preference over ASW 1281:2001.

PVA 2 DEFINITIONS

Approved Laboratory: A laboratory suitably equipped and staffed for the purposes of concrete testing.

AWWA: American Water Works Association.

PVA 3 MATERIALS

PVA 3.1 Cement

Unless agreed to otherwise by the Employer's Agent, the cement used on the works shall be either Type Cem 1, Type Cem II A-S, CEM II A-V, CEM II B-S or Cem II B-V.

PVA 3.2 Storage of Cementitious Material

Cement shall not be kept in storage before use for more than 4 weeks without the Employer's Agent's permission.

PVA 3.3 Water

Water used for cement mortar lining shall be free from injurious amounts of acids, alkalis, organic matter and other substances that may impair the strength or durability of the lining.

PVA 3.4 Aggregates

The aggregate for cement mortar linings shall be specially graded washed silica sand complying with the grading requirements of SANS 1090 Table 1 Column 3. Special care must be taken during storage to prevent contamination by wind blown seeds and grasses. The aggregate stockpile shall be kept covered at all times when cement mortar is not being produced.

The batching plant shall be such that the cement, aggregate and water can be mixed to an accuracy of 2% of the mass required. All mortar shall be mixed in suitable mortar mixers. Hand mixing will not be permitted.

The Contractor is to deliver a sufficient quantity of proposed aggregates to an approved laboratory in order that suitability tests may be carried out by that laboratory. The aggregate selected by them as being the most suitable shall be used throughout the Contract. The provision of samples and the testing thereof shall be for the account of the Contractor. All test results are to be submitted to the Employer's Agent within 4 weeks of the commencement date of the Contract.

To ensure consistency of the aggregate, further samples shall be submitted by the Contractor to an approved laboratory from time to time throughout the Contract as may be required by the Employer's Agent.

PVA 3.5 Mortar

The Contractor shall also arrange for the design and testing of mortar mixes (using the recommended aggregate) by the laboratory and submit the results obtained to the Employer's Agent for his approval.

The lining of pipes and/or specials shall not commence before the proposed mortar mix has been approved by the Employer's Agent in writing.

Fly ash may not be added.

The total content of cementitious materials shall not be less than 600 kg/m^3 of mortar.

The total water content of the mortar mix shall be the minimum required to produce a suitable consistency for application of the lining but subject to a maximum water:cement ratio of 0,45:1 by mass.

At least six cubes shall be made for each mix used for pipe lining, three shall be tested by the Contractor after 7 days of curing and the other three cubes after 28 days. Test results shall be submitted to the Employer's Agent.

The minimum compressive strength to be achieved by the mortar shall be 17 MPa after 7 days and 31 MPa after 28 days.

PVA 4 PLANT

PVA 4.1 Batching and Mixing Plant

The batching plant shall be such that the masses of each ingredient, namely cement, aggregate and water can be measured to within a tolerance of +2% to - 2% of the mass required.

All mortar shall be mixed in suitable mortar mixers, each mix being of not less than two minutes duration. Hand mixing will not be permitted.

To ensure consistency of the aggregate, further samples shall be submitted by the Contractor to an approved laboratory from time to time as may be required by the Employer's Agent throughout the duration of lining application.

PVA 5 APPLICATION OF LINING

PVA 5.1 Surface Preparation

The internal surfaces which are to be lined shall be prepared as follows:

(a) Weld spatter, loose rust, mill scale and any other loosely adhering material shall be removed by chipping, scraping or other mechanical means.

(b) Deposits of grease, oil, bitumen and similar contaminants shall be removed by scraping and cleaning with a suitable non-toxic solvent.

(c) The standard of preparation to be achieved shall be at least to ISO 8501-1, Grade Sa 1.

(d) Any residual dust or debris on the pipe surface shall be removed by brushing immediately prior to applying the lining.

PVA 5.2 Factory Applied Lining

The application of linings at the factory or at a site yard shall comply with the requirement of the relevant portions of ASW 1281:2001 except as may be amended by the requirements of this specification.

PVA 5.2.1 Application by Rotating the Pipes

As soon as possible after cleaning the surfaces (maximum of 12 h) the pipes shall have the lining applied thereto.

Each pipe pre-loaded in one operation with the calculated quantity of material to complete the entire lining shall be rotated in a suitable machine. The speed of rotation shall initially be that required to produce a uniform distribution of lining material over the full length and circumference of the pipe. When this has been achieved, the speed shall be increased to the maximum possible (consistent with pipe stability in the lining machine) in order to compact the lining.

Arrangements to be made by the lining applicator:

(a) To ensure circularity of the pipe and the thickness of the lining at each end by the provision of of temporary steel end rings

(b) to drain off surplus water emerging from the lining during compaction without causing damage to the surface of the lining

(c) to produce a smooth finish to the lining trowelling or other means.

PVA 5.2.2 Application by Machine Spraying and Trowelling

This method of application shall be carried out by spraying and trowelling the lining material using a machine that travels through each pipeline from one end to the other.

Where this system is used, it is essential to observe the following requirements:

(a) The mortar shall be applied with sufficient force to compact the lining as it is placed.

(b) The spray nozzles shall be equidistant from the pipe centre-line to achieve uniform lining thickness around the periphery.

(c) The speed of forward travel by the spraying machine must be at a uniform rate to prevent the formation of corrugations in the pipe wall. The rate shall be that necessary to apply the required lining thickness and produce the trowelled surface finish in one pass.

(d) The blades of the drag trowel shall be kept clean and in good condition to prevent the formation of longitudinal score marks in the pipe wall. Particular attention shall be paid to the area where trowelling blades overlap each other.

(e) It is recommended that the mortar be applied in a maximum of 20 m lengths, by forming appropriate joints in the lining, to limit the extent of the contractor's risk of any catastrophic failure of the newly applied mortar. The contractor is at liberty to form joints at closer centres to further limit this risk.

PVA 5.3 In-Situ Applied Lining

The application of cement mortar linings in-situ shall comply with the requirements of Section 8 of the American Water Works Association standard AWWA C 602, except as may be amended by the requirements of this specification.

The requirements of PVA 5.2.2 above, also apply to in-situ applied linings.

PVA 5.4 Methods of Application to Fittings and Specials

Where it is not possible to line fittings and specials by machine due to their shape and/or size the lining shall be applied manually. The work shall be carried out carefully and expertly in order to achieve the same density and quality of finish as the machine placed linings.

For fittings and specials DN 600 or greater, pre-cleaned reinforcement mesh shall be tack welded to the inside of the pipe after completing the surface preparation.

The mesh shall comprise 2,5 mm diameter wire at 100 mm centres in one direction and 50 mm centres in the other direction and the mesh shall not be in contact with the pipe wall except at the tack welds.

PVA 5.5 Thickness of Lining

The thickness of the applied lining shall be as follows:

Pipe Diameter	Thickness of Lining (mm)		
	Nominal	Minimum	Maximum
DN 150 up to DN 300	8	6	11
over DN 300 up to DN 600	12	10	16
over DN 600 up to DN 1 300	16	12	20
Over DN 1 300	19	15	22

PVA 5.6 Length of Lining

Pipes with flanged ends shall be lined for the full length of pipe and shall have the lining ends slightly tapered to prevent them touching when the pipes are jointed.

Pipes to be jointed with flexible couplings shall be lined for the full length of pipe and the lining shall finish square with the end of the pipe.

For pipes that are to be butt welded in-situ, the lining shall terminate 50 mm back from the end of each pipe and shall be chamfered at approximately 85° to the pipe wall. This will form a dovetail joint in the pipeline suitable for in-situ making good the lining after welding is completed.

For pipes that are to be sleeve or "belled-end" jointed and fillet welded, the spigot end shall be lined up to the end of the pipe and finished off square to the pipe, whilst the sleeve end shall have the lining finished approximately 30 mm from the end of the sleeve with a chamfer at 85° to the pipe wall.

Where unlined pipes are to be lined in-situ after welding, joints should be formed in the lining at the recommended maximum spacing or closer. Joints formed in the lining shall be 80 mm wide and shall be chamfered at approximately 85° to the pipe wall to form a dovetail joint in the mortar suitable for in-situ making good the lining.

PVA 5.7 Surface Finish of Lining

The surface finish required for the lining is that which will give an effective roughness by the Colebrook-White formula of k = 0,13 mm or less for the entire completed pipeline including joint losses. This will be checked in the field after completion of the pipeline at the Employer's Agent's discretion.

Should the roughness be such that it does not achieve the foregoing requirement, and the Employer's Agent is satisfied that pipe jointing has been properly carried out by the pipelayers, a reduction in payment for the pipes up to a maximum of 20% of the total value of the internal lining to the pipes will be applied.

The finished surface shall be free of excessive laitance, the maximum acceptable thickness being 10% of the total lining thickness or 1,25 mm whichever is the lesser. Mortar projections exceeding 1,5 mm in height shall be removed by rubbng with a carborundum block or in exceptional circumstances by grinding after the lining is fully cured.

PVA 5.8 Curing of Lining

Curing of the lining shall be carried out by keeping the surface continuously moist for a period of at least 7 days and thereafter cured in air for a further 7 days.

Curing shall be done by temporarily covering the end of each pipe with plastic material which has one hole of about 50 mm diameter cut therein at the centre. A shallow pond shall then be made over the full length of each pipe and topped up as necessary. No pipe shall be moved during the 14 days curing period from the date of lining the pipe except where authorised to the contrary by the Employer's Agent.

No accelerated curing by steam or other means will be permitted.

PVA 5.9 Repair of Defective Lining

Defective cement mortar lining shall be that which has not bonded to the inner wall of the steel pipe or cement mortar lining which has failed to pass the tests specified under PVA 7 below, except for those items which may be accepted by the Employer's Agent.

All defective lining shall be removed and the surrounding area chipped back to where the lining is firmly bonded to the steel pipe wall or to the limits called for by the Employer's Agent whichever is the lesser. The edges of the chipped back area shall be sloped at an angle of 85° normal to the pipewall with the slope being in the direction to give a dovetailed key for the replacement lining. The pipe surface shall be thoroughly cleaned immediately prior to commencing the repair.

The pipe surface over the area to be repaired shall be given a coat of neat cement grout and the fresh mortar mix placed by hand thereupon whilst the grout is still wet. The mortar mix shall be of the mix and consistency specified for the pipe lining. The application shall fill all voids at the edges and shall be finished to the thickness of the surrounding lining. The repaired areas shall be cured with water and shall remain wetted continuously for a period of at least 7 days from the time of completion of each repair.

PVA 5.10 Protection of Lining During Transport

Every pipe, fitting and special shall be fitted with suitable end closures as a precautionary measure against damage being caused to the lining material. The end closures shall be capable of preventing the ingress of dirt and at the same time allow air to ventilate through the pipework which they protect. They shall be secured in such a manner that they cannot be dislodged or damaged by normal pipe handling operations.

PVA 6 TOLERANCES

The tolerances permitted on the thickness of concrete linings shall be those tabulated under PVA 5.5 above.

The tolerance permissible on the length of linings for butt welded pipes shall be ±3 mm at each end of the pipe.

PVA 7 INSPECTION AND TESTING

PVA 7.1 Linings Applied at Factory or Yard

The following inspections and tests shall be carried out by the Contractor on the lining of all pipes, fittings and specials. The Contractor shall provide all necessary equipment, labour and materials to carry out all tests specified above. He/she shall also make arrangements to have all the laboratory tests carried out at either a laboratory on site provided by him or alternatively at an independent approved laboratory. All test results shall be submitted in duplicate to the Employer's Agent.

The Contractor shall also provide all reasonable facilities to enable an inspector, if so appointed by the Employer, to witness any or all the specified tests and to record the results. The inspector shall have the power to stop delivery of any item from the place of application of the lining and report his findings to the Employer's Agent who shall then decide what action to take. No claims for delays caused to the Contractor, or for costs incurred by him as a consequence of failure to pass any test specified for the linings, will be considered by the Employer's Agent.

PVA 7.1.1 Visual Inspection

A visual inspection of linings will be carried out not earlier than 21 days after application of the lining. The lining, when inspected using strong light, shall present a smooth steel floated appearance and shall have no projections exceeding a height of 1,5 mm above the surrounding lining surface within a radius of 100 mm from the projection. The lining shall not be corrugated in appearance. Some cracking and crazing will be tolerated provided the average crack width does not exceed 0,5 mm with a crack length not exceeding 300 mm.

Cracks which a probe of 1,5 mm diameter can penetrate to a depth of 50% of the specified minimum lining thickness will not be acceptable and shall be repaired in accordance with the relevant specification included hereunder.

PVA 7.1.2 Lining Thickness

The thickness of lining shall be measured by a suitable electronic device which has been precalibrated to the satisfaction of the Employer's Agent.

Four readings shall be taken equally spread around the circumference of each and every lined pipe at six places, namely at each end of the pipe and at distances of 1,3 m and 3,5 m in from each end of each pipe up to 9,5 m long. An additional set of four readings shall be taken at approximately midway along each pipe which is in excess of 9,5 m long.

Special apparatus is to be provided for use in pipes smaller than 550 mm internal diameter where entry for inspection is not possible.

A total of eight thickness readings shall be taken for each and every fitting and special as applicable.

PVA 7.1.4 Water Absorption

A sample of lining 150 x 150 mm shall be cut from every 50th pipe (with a minimum of three samples for each of the diameters) which has been lined. These lining samples shall be used for water absorption tests. The samples shall be oven dried at 100° C until no further loss of mass occurs. When cooled the dry mass shall be determined, following which the samples shall be immersed in clean water for 24 hours and the saturated mass determined. Should the saturated mass exceed the dry mass by more than 6% the linings of the batch of pipes may be rejected.

PVA 7.1.5 Strength of Lining

Six 150 mm size cubes shall be prepared, cured and tested in accordance with SANS Method 863 from one batch of mortar selected at random from each day's lining production. Three cubes shall be tested after 7 days and the other three after 28 days. Should any one of the cubes fail to reach the minimum specified compression strength given under PVA 3.5 above, the Employer's Agent shall decide what action to take, but should two or more cubes fail, all pipe linings applied from that day's output shall be rejected.

PVA 7.2 Linings Applied In-Situ (Pipes 550 mm internal diameter or less)

The following inspections and tests shall be carried out along pipelines of less than 550 mm internal diameter, where the lining has been carried out in-situ. Inspection and testing of lining in pipes which are 550 mm bore and larger shall be carried out in accordance with the requirements of PLA 7.1 above.

PVA 7.2.1 Inspection by Camera

A trolley mounted camera shall be so arranged to take photographs of the entire lining periphery at approximately 15 m centres throughout the length of the applied lining.

All records, processed film and photographs shall become the property of the Employer but shall initially be handed to the Employer's Agent.

Repeat exposures shall be made where the quality of the original does not show the lining clearly and completely. Additional exposures may be ordered by the Employer's Agent where a lining defect is suspected. Should the defect exist the additional costs will be payable by the Contractor but should there be no non-acceptable defect then the additional costs will be reimbursed to the Contractor by the Employer.

PVA 7.2.2 Crack Measurement

Crack measurements will be estimated from the photographic evidence produced under PLA 7.2.1 above.

PVA 7.2.3 Lining Thickness

The lining thickness shall be measured in sets of four, spaced equally around the lining periphery at the following places:

(a) At each end of the pipe at each and every access point along the lined pipe
(b) At 1,0 m into the pipe from each access point
(c) At 2,0 m into the pipe from each access point

PVA 8 MEASUREMENT AND PAYMENT

PVA 8.1 Linings.....Unit: m or No

Where the application of linings is scheduled separately in the Bill of Quantities, payment will be made per length of completed lining in the case of pipes and by number in the case of fittings and specials.

The rate shall include for the provision of all labour, plant and materials necessary to carry out the complete lining in full compliance with this Specification, including for forming and making good joints in the lining, all testing and analyses and all repairs where they required, as well as for any additional transportation over that required for delivery of the steel pipes, fittings and specials to Site.

Where no separate item is scheduled for the application of the lining, the costs of complying with this specification shall be included in the rates tendered for supplying, laying and bedding of the pipeline as per SABS 1200L Sub-Clause 8.

PVA 8.2 Payment for Inspection and Testing

Should additional expenditure be incurred by the Employer's inspector, due to any failure of the prescribed tests, then such additional expenditure shall be reimbursed to the Employer by the Contractor.

PVC: FUSION-BONDED MEDIUM DENSITY POLYETHYLENE COATING OF STEEL PIPES

(Supplementary to SABS 1200 – 1986)

PVC 1 QUALITY ASSURANCE

A detailed Quality Control Procedure shall be prepared by the Contractor and approved by the Employer's Agent prior to any work commencing.

PVC 2 SURFACE PREPARATION

PVC 2.1 Preparation of Pipe Surfaces

The surfaces of all pipes and fittings that are to be coated shall, prior to the application of any coating be prepared in accordance with the following requirements.

Pipes shall be in rust condition A to C of Swedish Standard SIS 05 5900. Pipes in rust condition D are not acceptable.

Weld splatter shall be removed by chipping or grinding to a smooth surface flush with the surrounding steel surface. Weld seams shall have a smooth contour, free from sharp edges, protrusions and undercuts. Sharp edges and protrusions shall be removed by grinding to a smooth radius of curvature of not less than 3 mm. Pipes shall be in rust condition A to C of Swedish Standard SIS 05 5900. Pipes in rust condition D are not acceptable.

PVC 2.2 Degreasing

Pipes shall be grease free prior to the application of a coating or lining. In the event that degreasing is required, pipes shall be degreased by the use of a water based solvent degreaser such as that complying with SANS 1216 - Solvent Emulsion or, for use in enclosed systems, with SANS 1365.

Pipes shall be thoroughly washed with clean potable water to remove all residues. The surface shall be water break free. The pipe shall then be allowed to dry.

PVC 2.3 Blast Cleaning

Abrasive material used for blast cleaning shall be free from oil or grease, as shall be the compressed air used in air blast cleaning.

The surface of the pipe to be coated shall be blast cleaned by centrifugal or air blast cleaning methods, then vacuum cleaned or blown off to achieve the following standards:

- Cleanliness shall be equal to Sa 2,5 of ISO 8501-1 when tested in accordance with SANS 5772:2004.
- The profile produced by blast cleaning shall be angular and shall have an average peak to valley height of 60 to 100 microns, when tested in accordance with SANS 5772: 2004.
- Hackles shall be removed with coarse abrasive paper.
- Residual dust and debris shall not exceed 0,2% when tested in accordance with SANS 8502-3.
- Water-soluble salts shall not exceed 100 mg/m^2 at any point when tested with the Weber-Reilly reagent.

- Any laminations revealed by blast cleaning shall be ground out and re-blast cleaned to meet the above requirements. If grinding penetrates the steel to a depth greater than 3,5% of the nominal wall thickness, the pipe will be rejected.
- The pipe surface shall not be contaminated by oil, grease or other harmful contaminant.

PVC 2.4 Cut Back of Coated Pipe

The blast cleaned surface shall be stopped off or cut back by suitable masking which shall not contaminate the cleaned surface. Cut-backs shall comply with the requirements as set out in the table below:

Cut-Back of Coatings		
Pipe End	**Cut-Back (mm)**	**Comment**
Pipe ends prepared for field butt welding	100	All coatings to be mitred or feathered to prevent air entrapment in the joint coating system.
Pipe ends prepared for flexible joint couplings	Various	The coating shall be cut back a sufficient distance to accommodate a standard coupling for the particular diameter of pipe.
“Belled" and plain ended pipe ends prepared for fillet welding	100	The cut back shall be measured from either side of the (field) external fillet weld position when the spigot is fully inserted into the “belled" end.

PVC 2.5 Handling of Cleaned Pipe

After cleaning, the pipe surface shall not be contaminated in any way. Operators shall wear clean gloves and all surfaces in contact with the pipe surface shall be clean and free from oil, grease, grit, dirt and other contamination.

PVC 2.6 Protection of Pipe Ends on Pipes with Cut-Back

Before delivery cut backs of each pipe for field welds shall be coated with an approved rust inhibitor. This inhibitor shall be "Sigmaweld 120" or similar approved and shall provide corrosion protection for up to 6 months and shall enable good cutting and welding properties). Plain ended pipes (to be joined by flexible couplings) are to be coated with an approved rust inhibitor for a distance of 100 mm from the pipe-ends on the inside and the outside of each pipe. Careful attention must be paid to ensuring the pipe ends are also completely covered. The inhibitor used must be compatible with both the lining and the coating.

PVC 3 FBMDP COATING

PVC 3.1 General

The coating shall be applied in accordance with the requirements of the Australian Standard Specification AS 4321-1955 entitled “Fusion-bonded Medium Density Polyethylene Coating and Lining for Pipes and Fittings” subject to the amendments in PVC 2.2 below.

PVC 3.2 Amendments to AS 4321-1955

PVC 3.2.1 AS 5.1 Preparation of Surface

DELETE THE CONTENTS OF SUBCLAUSE 5.1 AND REPLACE WITH:

"Surface preparation shall be in accordance with PVC 2 above."

PVC 3.2.2 AS 8.1 Repairs

DELETE THE LAST SENTENCE OF SUBCLAUSE 8.1 AND REPLACE WITH:

"Damaged areas that pass the continuity test need not be repaired provided that the coating or lining thickness is equal to or greater than the thickness specified in Table 1 of AS 4321-1995. Generally, no more than three repairs will be allowed per 9,5 m length of pipe and the area of a single repair is not to exceed 0,01 square m. If the area of a single repair does exceed 0,01 square m the pipe will be rejected. Repairs may be undertaken in accordance with Clause 8 of AS 4321 for the following methods of repair: Fusion bond; Heat shrink sleeve or Hot gas welding. A wrapping system may also be used if applied as detailed hereunder.

Repairs with Tape

When repairs are permissible the repairs shall be made using a repair system comprising (1) a polymer bitumen primer ("Denso Primer D" or equivalent approved), (2) an inner seal of modified rubber bitumen sealing tape ("Denso Mastic Sealing Tape" or equivalent approved) and (3) an outer protective layer of acrylic coated/modified bitumen adhesive pipeline tape ("Denso Acrylic Pipeline Tape" or equivalent approved) is to be applied with a 50% overlap, ensuring that it is placed 50 mm wider all round than the inner repair tape. The outer protective tape is to be wrapped around the entire pipe.

Pinholes

At each pinhole detected by the electrical test, the surrounding area shall be abraded to at least a minimum area of 175 mm by 175 mm around the hole. The abrasion shall be carried out (with clean emery paper of 80 to 100 mesh) around the repair so as to provide a suitable rough surface profile without causing the removal or excessive amounts of coating material. The repair area is to be feathered into the surrounding sound coating. Debris and other deleterious matter are to be removed by means of a clean rag moistened with Cleaning Solvent. The primer is applied and once it has dried the prepared surface is covered with a patch of modified rubber bitumen sealing tape ("Denso Mastic Sealing Tape" or equivalent approved) of size 150 mm by 150 mm. The bond is to be free of air bubbles and smoothed out by hand or using an aluminium fluted roller. Finally, acrylic bitumen adhesive pipeline tape ("Denso Acrylic Pipeline Tape" or equivalent approved) is to be applied with a 50% overlap, ensuring that it is placed 50 mm wider all round than the inner repair tape.

Larger Damaged Areas

The edges of the damaged coating must be chamfered back to remove all potential void areas. The primer and modified bitumen rubber are applied as for pinholes but the modified bitumen rubber tape is pre-cut and applied with 55% overlap Finally acrylic bitumen adhesive pipeline tape ("Denso Acrylic Pipeline Tape" or equivalent approved) is to be applied with a 50% overlap, ensuring that it is placed 50 mm wider all round than the inner repair tape.

Weld beads are repaired with suitable lengths of the above size tapes. When covering weld beads, the centre portion of the square must make contact first. Smooth the tape out with an outward direction to remove all entrapped air."

PVC 3.2.3 AS 11 Storage, Handling, Transport and Marking

ADD TO SUBCLAUSE 11:

"Clause 1.5 of this specification entitled "Plant and Rigging for the handling and delivery of Pipe and Specials".

PVC 4 MEASUREMENT AND PAYMENT

PVC 4.1 Coatings .....Unit: m or No

Where the application of coatings is scheduled separately in the Bill of Quantities, payment will be made per length of completed lining in the case of pipes and by number in the case of fittings and specials.

The rate shall include for the provision of all labour, plant and materials necessary to carry out the complete lining in full compliance with this Specification, including for forming and making good joints in the lining, all testing and analyses and all repairs where they are required, as well as for any additional transportation over that required for delivery of the steel pipes, fittings and specials to Site.

Where no separate item is scheduled for the application of the coating, the costs of complying with this specification shall be included in the rates tendered for supplying, laying and bedding of the pipeline as per SABS 1200L Subclause 8.

PVC 4.2 Payment for Inspection and Testing

Should additional expenditure be incurred by the Employer's inspector, due to any failure of the prescribed tests, then such additional expenditure shall be reimbursed to the Employer by the Contractor.

PVH: WEDGE GATE, RESILIENT SEAL, CHECK (REFLUX), BUTTERFLY AND AIR VALVES

(Supplementary to SABS 1200 – 1986)

PVH 1 SCOPE

This specification covers the materials, manufacturing and testing requirements for wedge gate, resilient seal, check (reflux), butterfly and air valves for use in water and wastewater installations.

The supply, delivery, installation and field testing of valves is dealt with in PSL / the relevant sections of the standard specification / the project specification.

PVH 2 INTERPRETATIONS

PVH 2.1 Supporting Specifications

The following form part of this specification:

(a) SANS 664-1: 2011 - Wedge Gate and Resilient Seal Valves for Waterworks: Part 1: General

(b) SANS 664-2: 2011 - Wedge Gate and Resilient Seal Valves for Waterworks: Part 2: Wedge Gate Valves

(c) SANS 664-3: 2011 - Wedge Gate and Resilient Seal Valves for Waterworks: Part 3: Resilient Seal Valves

(d) SANS 191: 2015 - Cast Steel Gate Valves

(e) SANS 1849: 2008 - Butterfly Valves for General Purposes

(f) SANS 1551-1: 2008 - Check Valves (flanged and wafer types): Part 1: PN Series (DN 40 to DN 600 with PN up to 2 500 kPa)

(g) SANS 1551-2: 2007 - Check Valves (flanged and wafer types): Part 2: Class Series (DN 40 to DN 600 with PN up to 4 200 kPa)

Where there is conflict, the requirements contained in this specification shall take precedence over the above-mentioned SANS specifications.

PVH 2.2 Abbreviations

EPDM	Ethylene Propylene Diene Monomer (M-class) rubber
DN	Nominal Diameter
PN	Nominal Pressure - pressure rating
NBR	Nitrile rubber
QCP	Quality Control Plan

PVH 3 MATERIALS, WORKMANSHIP AND CONSTRUCTION

PVH 3.1 General

The types, sizes, end connections, and pressure ratings of the valves required are as scheduled in the Bills of Quantities.

Unless specifically stated otherwise, all valves are to be suitable for use in terminal positions.

Technical Data Sheets are included in the Returnable Schedules section of the tender document to enable Tenderers to provide specific details of the valves offered.

PVH 3.2 Quality Verification

The valve manufacturer shall have in place, and shall fully comply with, a certified SANS 9001 integrated quality system that is applicable to the valve design, manufacturing, testing, and coating and lining processes.

A QCP shall be prepared by the manufacturer well in advance of commencement of manufacture and submitted to the Employer's Agent for his/her consideration and amendment as deemed necessary and shall thereafter be updated and adhered to by the manufacturer.

PVH 3.3 Corrosion Protection

PVH 3.3.1 General

All valves shall be coated externally and lined internally as specified hereunder.

Coating and lining materials shall be suitable for use on potable water systems. The cured materials shall be chemically unaffected by free chlorine or chloramine in water in concentrations up to 10 mg/ℓ and to ozone concentration up to 5 mg/ℓ in water and by fluids with a pH ranging from 4 to 10.

The coating and lining of valves shall be carried out at the factory prior to the dispatch of the valves.

Non-ferrous metal or stainless steel surfaces must not be painted.

PVH 3.3.2 Substrate Condition

All surfaces to be coated shall be free of all weld splatter, slag and loose scale.

PVH 3.3.3 Surface Preparation

All cast iron and steel surfaces of every valve shall be prepared for painting to a thoroughly clean condition, free of all grease and deleterious matter.

Surfaces shall be degreased by the use of a water-free solvent degreaser such as that complies with SANS 1344 or, for use in enclosed systems, with SANS 1365.

After complete removal of oil or grease contamination, the valve shall be thoroughly washed with clean potable water to remove all residues. The surface shall be water break free. The valve shall then be allowed to dry.

PVH 3.3.4 Blast Cleaning

Abrasive materials used for blast cleaning shall be free from oil or grease, as shall be the compressed air used in air blast cleaning.

Surfaces shall be blast cleaned by air blast cleaning methods, then vacuum cleaned or blown off to achieve a standard equal to Sa3 of Swedish Standard SIS 05 5900 when tested in accordance with SANS 5767.

The profile produced by blast cleaning shall be angular and shall have an average peak to valley height of 60 to 100 microns, when tested in accordance with SANS 5772. Hackles shall be removed with coarse abrasive paper.

Residual dust and debris shall not exceed 0,2% when tested in accordance with SANS 5769. Water soluble salts shall not exceed 100 mg/m^2 at any point when tested with the Weber-Reilly Reagent.

Any laminations revealed by blast cleaning shall be ground out and re-blasted. If grinding penetrates the body to a depth greater than 8% of the nominal wall thickness the valve shall be rejected.

PVH 3.3.5 Handling of Cleaned Valve

After cleaning, the surfaces shall not be contaminated in any way. Operators shall wear clean gloves and all surfaces in contact with the valve surface shall be clean and free from oil, grease, grit, dirt and other contamination.

PVH 3.3.6 Coating and Lining Materials

The materials shall comply with SANS 1217 Type 1A for solvent borne chemically cured epoxies. The product used shall be approved by a recognised national body (SABS or similar) as suitable for use on potable water systems. The cured material shall be chemically unaffected by free chlorine or chloramine in water in concentrations up to 10mg/ℓ and to ozone concentration up to 5mg/ℓ in water and by pH ranging from 4 to 10.

A total minimum dry film thickness of 250 µm that is to be pinhole free over the entire painted surface shall be achieved.

Coating and lining repairs shall be carried out using repair systems that comply with the specified performance requirements and shall be compatible with the coating and lining materials. The Contractor shall submit proof to the Employer's Agent from the suppliers of the lining and coating suppliers to this effect.

The mating face of flanges shall be masked and left uncoated. All runs or drips of epoxy shall be removed from the mating faces of the flanges and the flange profiling shall be clearly visible over the entire flange face.

The mating face shall receive one coat of an approved polymer based, waterborne rust inhibitor.

Care shall be exercised to ensure that after application of all coatings there are no runs or drips and that the flange profiling is clearly visible over the entire flange face.

Excessive coating build up in flange bolt holes that could snag bolts will not be permitted.

PVH 3.3.7 Valve Seating Areas

In the case of valves with resilient seals, attention shall be given to the thickness and integrity of the coating in the areas where the gate is to operate.

PVH 3.3.8 Inspection

Low voltage, wet sponge detection of pinholes is to be conducted on all coated surfaces of the valves. There shall be no defects in the coatings and linings when tested in accordance with ASTM D5162. The finished coating to be smooth and glossy, free from pinholes, excessive runs, sags, “orange peel” finish, occlusions and other visible defects.

PVH 3.4 Local Content –

The Department of Trade and Industry has, in terms of Regulation 9 (2) of the Procurement Regulations 2011, stipulated the *"minimum threshold for valves products and actuators for local production and content"* the details of which are set out in the National Treasury instruction that became effective from 3 March 2014. These requirements must be complied with.

PVH 4 WEDGE GATE VALVES (SANS 664 Part 1 & Part 2)

With reference to Annex A.1 to SANS 664-1: 2011 - Wedge Gate and Resilient Seal Valves for Waterworks: Part 1: General:

(a) The sizes, pressure ratings end connections, and other specific details of the valves required are as scheduled in the Bills of Quantities.

(b) The method(s) of operation of the valves shall be as stated in Table A below.

(c) The direction of turning the spindle to close the valve shall be as shown in Table A below.

(d) The valves shall be provided with a means for repacking the gland whilst the valve is under pressure.

(e) The flange details are given in Table A below.

(f) Flanges are to be either flat faced or raised face as shown in Table A below. The backs of each flange shall be spot faced over areas large enough to accommodate every washer and nut.

(g) All flanges are to be drilled with the holes off horizontal and vertical centrelines.

(h) Hexagon-head bolts shall comply with the requirements of SANS 1700-5-1.

(i) All valves shall be double flanged unless otherwise scheduled in the Bills of Quantities

(j) Unless stated in Table A below, no position indicators are required.

(k) Unless stated in Table A below, no identification plates are required.

(l) Test certificates are required and shall be submitted to the Employer’s Agent.

(m) The Employer reserves the right to arrange for inspections and/or witnessing of the manufacture and/or testing and/or coating and lining of the valves. Full details shall be prescribed in the QCP - refer PVH 3.2 above.

(n) The body ends of the valves need not be sealed.

(o) Unless otherwise stated in Table A below, the coating system specified in PVH 3.3 above is applicable.

With reference to Annex A.2 to SANS 664-1: 2011 - Wedge Gate and Resilient Seal Valves for Waterworks: Part 1: General:

The requirements shall be agreed and documented in a QCP - refer PVH 3.2 above.

With reference to Annex A to SANS 664-2: 2011 - Wedge Gate and Resilient Seal Valves for Waterworks: Part 2: Wedge Gate Valves:

(a) The type of trim shall be 'Type 3 - Standard' as shown in Table 1 - Trim Materials

(b) Trim rings shall be pinned into the body. Trim rings secured by pressing are not permitted. Bonding liquids are not acceptable as the primary means of securing trim rings.

(c) Working pressures of valves are not normally given as they may vary significantly.

(d) Shoes and channel guides of non-corrosive material, namely bronze, are required for valves:

- DN 150 or larger with differential pressures of 500 kPa or higher,
- Installed where the valve is at an angle to the vertical,
- Whenever gearing or an actuator is installed.

(e) Seat leakages in accordance with Table 2 are permissible.

4.1 Testing

Notwithstanding the requirements of SANS 664-1: 2011, the test pressure requirements are as follows:

All wedge gate valves DN 300 and larger shall be subjected to:

(a) An open end gate strength test of 1,5 times the 'Pressure Rating' of the valve on both sides of the gate. Drop tightness (gate leakage) in respect of this gate strength test is not required but shall comply with the requirements of SANS 664.

(b) A body test of 2,0 times the 'Pressure Rating' of the valve.

Table A - Wedge Gate Valves

SANS 664-1		PN 10	PN16	PN25	PN40
Annex A.1 b)	Operation	Valve cap / hand wheel / actuator	Valve cap / hand wheel / actuator	Valve cap / hand wheel / actuator	Valve cap / hand wheel / actuator
Annex A.1 c)	Direction of closing	Anti-clockwise *	Anti-clockwise *	Anti-clockwise *	Anti-clockwise *
Annex A.1 e)	Flanges	SANS 1123: Table 1000 **	SANS 1123: Table 1600 **	SANS 1123: Table 2500 **	SANS 1123: Table 4000 **
Annex A.1 f)	Flange faces	Flat face ***	Flat face ***	Flat face ***	Flat face ***

PVH 5 CAST STEEL GATE VALVES (SANS 191)

With reference to Annex A to SANS 191:2015 - Cast Steel Gate Valves:

(a) The sizes, pressure ratings end connections, and other specific details of the valves required are as scheduled in the Bills of Quantities.

(b) The direction of turning the spindle to close the valve shall be as shown in Table B below.

(c) The valves shall be equipped with hand wheels unless stated otherwise in the Table B below.

(d) The sizes of the valves are as scheduled in the Bills of Quantities.

(e) The design of the guides of all valves, irrespective of size, shall be such that the valves can be installed in any position.

(f) The quality and strength of the cast steel shall be suitable for purpose. Spindles shall be of stainless steel. Seats shall be gunmetal. Trim rings shall be pinned into the body. Trim rings secured by pressing are not permitted. Bonding liquids are not acceptable as the primary means of securing trim rings.

(g) All valves shall be double flanged. Flanges shall be as shown in Table B below.

(h) The backs of each flange shall be spot faced over areas large enough to accommodate every washer and nut. All flanges are to be drilled with the holes off horizontal and vertical centrelines.

PHV 5.1 Testing

Notwithstanding the requirements of SANS 191:2015, the test pressure requirements are as follows:

All cast steel gate valves DN 300 and larger shall be subjected to:

(a) An open end gate strength test of 1,5 times the 'Pressure Rating' of the valve on both sides of the gate. Drop tightness in respect of this gate strength test is not required but shall comply with the requirements of SANS 191.

(b) A body test of 2,0 times the 'Pressure Rating' of the valve.

Table B - Cast Steel Gate Valves

SANS 191		PN25	PN40
Annex A b)	Direction of closing	Anti-clockwise *	Anti-clockwise *
Annex A c)	Operation	Valve cap / hand wheel / actuator	Valve cap / hand wheel / actuator
Annex A g)	Flanges	SANS 1123: Table 2500 **	SANS: 1123 Table 4000 **
Annex A g)	Flange faces	Raised face ***	Raised face ***

PVH 6 RESILIENT SEAL VALVES (RSV's) (SANS 664 Part 1 & Part 3)

With reference to Annex A to SANS 664-3:2011 - Resilient Seal Valves:

(a) The medium passing though the valves will be that shown in Table C below.

(b) The gate shall be fully encapsulated with EPDM or NBR rubber.

In addition to the relevant requirements of SANS 664, RSV's shall have the following minimum requirements:

- The valves shall be PN 16 with non-rising spindles.
- The body, bonnet and gate shall be manufactured from spheroidal graphite or ductile iron.
- The spindle shall be manufactured from Grade 304 stainless steel or EN57 steel.
- All valves shall be double flanged. Flange details are given in Table C below.
- The backs of each flange shall be spot faced over areas large enough to accommodate every washer and nut. All flanges are to be drilled with the holes off horizontal and vertical centrelines.

- The face to face dimensions of flanged valves shall be in accordance with SANS 664-1: 2011 Table 1, Column 2, short pattern.
- The direction of turning the spindle to close the valve shall be as shown in Table C below.
- The spindle seal shall comprise multiple O-rings incorporated in the valve bonnet.
- Unless otherwise stated in Table C below, the coating system specified in PVH 3.3 above is applicable.

The use of studs and Allen-type screws to fasten the bonnet will be acceptable subject to the following:

- All bolts shall be of stainless steel or hot dip galvanised, and shall be suitable for operation with a normal hexagonal “Allen Key”.
- The bolting system shall be counter sunk, and the bolt cavities shall be filled and covered with a waterproof wax resin or an approved equivalent in order to prevent the ingress of dirt.
- The bonnet gasket shall prevent leakage or seepage and must withstand the body test pressure of the valve.
- Gates must be capable of being replaced without removing the valve body from the installation.

PHV 6.1 Testing

Notwithstanding the requirements of SANS 664-3:2011, the test pressure requirements are as follows:

All resilient seal gate valves DN 300 and larger shall be subjected to:

(a) An open end gate strength test of 1,5 times the 'Pressure Rating' of the valve on both sides of the gate. Drop tightness in respect of this gate strength test is not required but shall comply with the requirements of SANS 664.

(b) A body test of 2,0 times the 'Pressure Rating' of the valve.

Table C - Resilient Seal Valves

SANS 664-3		**PN16**
Annex A a)	Medium to pass through the valve	Raw water/ potable water/raw sewage/ treated wastewater / activated sludge/other???
Direction of closing		Anti-clockwise *
Flanges		SANS 1123: Table 1600 **
Flange faces		Flat face ***
Operation		Valve cap / hand wheel

PVH 7 CHECK VALVES (FLANGED AND WAFER TYPES) - PN SERIES (SANS 1551 Part 1)

With reference to Annex A.1 to SANS 1551-1: 2008 - Check Valves (Flanged and Wafer Type):

(a) The rating of the valves shall be as scheduled in the Bills of Quantities.

(b) Door return springs are not permitted.

(c) Unless otherwise stated in Table D below, the coating system specified in PVH 3.3 above is applicable.

(d) The sizes of the valves are as scheduled in the Bills of Quantities.

(e) Valves with a nominal bore greater than 600 mm must be of the double door or multi-door type and, if so shown in Table D below, shall be fitted with an integral valved bypass. In other respects they must be in accordance with the specifications for the single door type. A suitable arrow indicating the flow direction through the valve shall be cast onto the body of the valve.

(f) All valve flanges shall have bolt holes unless otherwise indicated in Table D below.

(g) All valves shall be double flanged. Flange details are given in Table D below. The backs of each flange shall be spot faced over areas large enough to accommodate every washer and nut. All flanges are to be drilled with the holes off horizontal and vertical centrelines.

(h) Unless stated in Table D below, no identification plates are required.

With reference to Annex A.2 to SANS 1551-1: 2008 - Check Valves (Flanged and Wafer Type):

(a) None of the valves will be used at temperatures that exceed 120 0C.

(b) The materials shall be suitable for purpose and shall be agreed and documented in a QCP which is to be approved by the Employer's Agent before manufacture commences.

(c) The valve trim materials shall be suitable for purpose and shall be agreed and documented in the QCP - refer PVH 3.2 above.

(d) Door seat rings shall be fixed with non-corrosive fixing screws.

(e) The maximum permissible leakage rate shall be as stated in column 2 of Table 1 and Table 2 for metal seated and resilient seated valves respectively.

(f) No defects are acceptable unless accepted in writing by the Employer's Agent or the Employer's Agent's inspector, who is duly authorised in writing to approve defects and the method of repair.

(g) Unless otherwise stated in Table D below, the coating system specified in PVH 3.3 above is applicable.

(h) The face-to-face dimensions shall be suitable for the proposed installation and shall be agreed and documented in the QCP, which is to be approved by the Employer's Agent before manufacture commences - refer PVH 3.2 above.

(i) The dimensions "A" and "E" are to be agreed and recorded in a QCP prior to commencement of manufacture of the valves.

(j) Unless otherwise stated in Table D below, no additional features are required

(k) All flanged check valves shall have an access cover.

(l) Unless otherwise stated in Table D below, bolt holes shall be drilled and not tapped.

(m) None of the valves will be used at temperatures exceeding 50 ºC.

(n) Unless stated in Table D below, no identification plates are required.

(o) The symbols shown in 7.2.2 are to be used.

PHV 7.1 Testing

Notwithstanding the requirements of SANS 1551-1:2008, the test pressure requirements are as follows:

All PN Series check valves DN 300 and larger shall be subjected to:

(a) An open end gate strength test of 1,5 times the 'Pressure Rating' of the valve on both sides of the gate. Drop tightness in respect of this gate strength test is not required but shall comply with the requirements of SANS 1551.

(b) A body test of 2,0 times the 'Pressure Rating' of the valve.

Table D - Check Valves - PN Series

SANS 1551-1		PN10	PN16	PN25
Annex A.1 g)	Flanges	SANS 1123: Table 1000 *	SANS 1123: Table 1600 *	SANS 1123: Table 2500 *
Annex A.1 g)	Flange faces	Flat face **	Flat face **	Flat face **

PVH 8 CHECK VALVES (FLANGED AND WAFER TYPES) - CLASS SERIES

With reference to Annex A.1 to SANS 1551-2:2007 - Check Valves:

(a) The rating of the valves shall be as scheduled in the Bills of Quantities.

(b) Door return springs are not permitted.

(c) Unless otherwise stated in Table E below, the coating system specified in PVH 3.3 above is applicable.

(d) The sizes of the valves are as scheduled in the Bills of Quantities.

(e) Valves with a nominal bore greater than 600 mm must be of the double door or multi-door type and if so shown in Table E below, shall be fitted with an integral, valved bypass. In other respects they must be in accordance with the specifications for the single door type. A suitable arrow indicating the flow direction through the valve shall be cast onto the body of the valve.

(f) All valve flanges shall have bolt holes unless otherwise indicated in Table E below.

(g) All flanged valves shall be double flanged. Flange details are given in Table E below. The backs of each flange shall be spot faced over areas large enough to accommodate every washer and nut. All flanges are to be drilled with the holes off horizontal and vertical centrelines.

(h) Unless otherwise stated in Table E below, no identification plates are required.

With reference to Annex A.2 to SANS 1551-2: 2007 - Check Valves:

(a) The body and door materials shall be suitable for purpose and shall be agreed and documented in a QCP - refer PVH 3.2 above.

(b) Valve trim materials shall be suitable for purpose and shall be agreed and documented in a QCP - refer PVH 3.2 above.

(c) Door seat rings shall be fixed with non-corrosive fixing screws.

(d) The maximum permissible leakage rate shall be as stated in column 2 of Table 1 and Table 2 for metal seated and resilient seated valves respectively.

(e) No defects are acceptable unless accepted in writing by the Employer's Agent or the Employer's Agent's inspector who is duly authorised in writing to approve defects and the method of repair of those defects.

(f) Flange faces shall be fully machined and, unless otherwise stated in Table E below, "O" ring joint faces are not required

(g) Unless stated in Table E below, the finish of the gasket contact surface shall be as described in 4.4.3.

(h) Unless otherwise stated in the Table E below, the coating system specified in PVH 3.3 above is applicable.

(i) The dimensions "A" and "E" shall be agreed and recorded in a QCP prior to commencement of manufacture of the valves.

(j) Unless otherwise stated in Table E below, no additional features are required

(k) All flanged valves shall have an access cover.

(l) The finish of the flange face shall be as agreed and recorded in a QCP prior to commencement of manufacture of the valves - refer PVH 3.2 above.

(m) Unless otherwise stated in Table E below, bolt holes shall be drilled and not tapped.

(n) None of the valves will be used at temperatures exceeding 50 0C.

(o) Unless stated in the Table E below, no identification plates are required.

(p) The symbols shown in 7.2.2 are to be used.

PVH 8.1 Testing

Notwithstanding the requirements of SANS 1551-2:2007, the test pressure requirements are as follows:

All Class Series check valves DN 300 and larger shall be subjected to:

(a) An open end gate strength test of 1,5 times the 'Pressure Rating' of the valve on both sides of the gate. Drop tightness in respect of this gate strength test is not required but shall comply with the requirements of SANS 1551.

(b) A body test of 2,0 times the 'Pressure Rating' of the valve.

Table E - Check Valves - Class Series

SANS 1551-2		**Class 600**	**Class 900**	**Class 1500**	**Class 2500**
Annex A.1 g)	Flanges	SANS 1123: Table 1000 *	SANS 1123: Table 1600 *	SANS 1123: Table 2500 *	SANS 1123: Table 4000 *
Annex A.1 g)	Flange faces	Flat face **	Flat face **	Flat face **	Flat face **

PVH 9 CHECK VALVES (TILTING DISC TYPE)

(a) The sizes and ratings of the valves shall be as scheduled in the Bills of Quantities.

(b) Door return springs are not permitted.

(c) The tilting disc shall be hinged off-centre with the shaft located in a long bush at each end and with a small amount of lateral clearance to enable the disc and body to align and seal on closure.

(d) The valve shall have an external lever arm with an adjustable counterweight - the lever arm shall be on the side of the valve stated in Table F below when viewed in the direction of flow.

(e) The face-to-face dimensions shall be suitable for the proposed installation and shall be agreed and documented in the QCP - refer PVH 3.2 above.

(f) All valves shall be double flanged. Flange details are given in Table F below. The backs of each flange shall be spot faced over areas large enough to accommodate every washer and nut. All flanges are to be drilled with the holes off horizontal and vertical centrelines.

(g) The valve trim materials shall be stainless steel with the seat ring welded in and with a fine machined conical seat face.

(h) The disc shall have an aerofoil shape that is convex toward the pressure side and shall have a fine machined conical seat face.

(i) Notwithstanding the foregoing, all materials shall be suitable for purpose and shall be agreed and documented in a QCP - refer PVH 3.2 above.

(j) Unless otherwise stated in Table F below, the coating system specified in PVH 3.3 above is applicable.

(k) No defects are acceptable unless accepted in writing by the Employer's Agent or the Employer's Agent's inspector, who is duly authorised in writing to approve defects and the method of repair.

(l) Unless otherwise stated in Table F below, no additional features are required

(m) Unless stated in Table F below, no identification plates are required.

Table F - Check Valves - Tilting Disc Type

		PN10	**PN16**	**PN25**	**PN40**
d)	Position of extension arm and counterweight	Left / right hand side when viewed in the direction of flow	Left / right hand side when viewed in the direction of flow	Left / right hand side when viewed in the direction of flow	Left / right hand side when viewed in the direction of flow
f)	Flanges	SANS 1123: Table 1000 *	SANS 1123: Table 1600 *	SANS 1123: Table 2500 *	SANS 1123: Table 2500 *
f)	Flange faces	Flat face **	Flat face **	Flat face **	

PVH 10 BUTTERFLY VALVES

With reference to Annex A.1 to SANS 1849:2008 - Butterfly Valves:

(a) The types of valves required are as scheduled in the Bills of Quantities.

(b) The nominal sizes (DN) of the valves are as shown in the Bill of Quantities and on the Technical Data Sheet(s).

(c) The nominal pressures (PN) of the valves are as scheduled in the Bills of Quantities.

(d) None of the valves will operate at a temperature above 50 ºC.

(e) Flange details are given in Table G below. The backs of each flange shall be spot faced over areas large enough to accommodate every washer and nut. All flanges are to be drilled with the holes off horizontal and vertical centrelines.

(f) The face to face dimension of the valves shall be in accordance with Table 5 unless as agreed and recorded in a QCP - refer PVH 3.2 above.

(g) The service application shall be "tight shut-off" as per 4.6.1 a).

(h) Wafer lugged valves shall have drilled though holes unless otherwise stated in Table F below

(i) Tapping connections shall be in the side of the valve opposite to the operator end of the shaft.

(j) Support feet shall be provided for valves greater than DN 400.

(k) The service differential pressure shall be the 'Nominal Pressure PN' rating of the valve.

(l) The operating devices shall be as stated in the Table G below.

(m) The direction of turning the spindle to close the valve shall be as shown in Table F below.

(n) Details of the actuators required, if any, are given in PVN Valve Actuators.

(o) The locking mechanism is not required to provide for an intermediate position.

(p) The valve body and disc materials shall be ductile iron unless otherwise agreed and recorded in a QCP prior to commencement of manufacture of the valves.

(q) The leakage rate for low leakage valves shall be rate D.

(r) Valves will not be used for regulating purposes.

(s) A test certificate is required for every valve.

(t) Unless otherwise stated in Table G below, the coating system specified in PVH 3.3 above is applicable.

(u) All valves shall have their jointing surfaces protected during transit and storage.

(v) All valves shall have their body ends sealed to exclude foreign matter during transit and storage.

(w) Each valve shall have a manufacturer's certificate.

With reference to Annex A.2 to SANS 1849:2008 - Butterfly Valves:

(a) This specification does not deal with "other types of valves, shouldered, socketed, etc."

(b) The design and function of position indicators shall be as agreed and recorded in a QCP - refer PVH 3.2 above.

(c) The maximum allowable leakage rate shall be agreed and recorded in a QCP prior to commencement of manufacture of the valves.

In addition to the requirements of SANS 1849:2008, all valves shall comply with the following minimum requirements:

1) Valves shall be of the "tight shut off type" and the water seals shall be of the resilient seal type.

2) All stainless steel components shall be Grade 316 stainless steel unless the design of the valve warrants a higher strength, high chrome, steel.

3) Hubs for shaft bearing housings shall form an integral part of the valve body.

4) Valves bodies shall have adjustable mechanical stops to prevent over travel of the valve disc in the open or closed position.

5) Valves shall have the configurations shown in Table G below.

6) For PN 10 and PN 16 valves, the resilient, synthetic rubber EPDM or Nitrile seal shall preferably be easily replaceable (not bonded), and shall entirely cover the inside of the body overlapping over the sides to form the seal between the body and matching pipework. The liner shall be keyed to the body with annular groves in the bore of the valve to minimise distortion of the material. However, a fully bonded seal is acceptable, in which case, the seal should be bonded onto a phenolic backing ring to facilitate replacement of the seal. In the event that the valves that are offered are fully bonded without a backing ring, the valve manufacturer will be required to guarantee that they are able to re-line their valves in RSA.

7) For PN 25 and PN 40 valves, the resilient, synthetic rubber EPDM or Nitrile seal shall be fixed to the disc with Grade 316 stainless steel retaining rings protected against galvanic corrosion in accordance with PVH 3.3 above. The recess for the retaining ring in the blade or body shall be coated as specified or the seal face shall be assembled with a coat of wet solvent free epoxy having been applied. Seal retaining screws shall not be recessed but have a hexagonal or Allen key bolt head and spring washer underneath to ensure that water seepage does not occur into the screw area. The seal assembly should be done with the use of "Anti-seize" to ensure ease of removal and further prevent water seepage and corrosion.

8) Notwithstanding the foregoing, if stated in Table G below, the disc seal and seat on PN 25 and/or PN 40 valves shall be stainless steel and, as the seals need to be carefully matched, the manufacturer shall supply a complete spare set including fixings and the costs shall be included in the tendered rate quoted for the valve. Furthermore, the valve manufacturer will be required to confirm that a facility to recondition the valve exists in RSA.

9) The design shall be such as to allow the disc to seal drop-tight to the liner, so that there is no ingress of fluid to the shaft area.

10) The seat shall be sufficiently wide to permit at least 10 mm "lead" distance on each side for the resilient seal.

11) The resilient seal shall be "non-stick" and shall be stable and not deteriorate under conditions of continuous submersion in chlorinated potable water.

12) The valve seal and seat shall be replaceable without dismantling the valve - not applicable to PN 10 and PN 16 valves that may have bonded seals.

13) Discs shall be a single casting of a hydrofoil section with a smooth continuous surface. The maximum combined stresses in the disc shall not exceed 20% of the minimum yield stress of the material used when the specified unbalanced pressure is applied on either of the two sides.

14) Shafts may either be continuous or of a stub-shaft configuration. In the case of stub shafts, they must extend into the disc hub for a distance of at least 1,5 times the diameter of the shaft and they shall not protrude from the disc hub i.e. the shaft shall not be exposed.

15) Shafts may be either round or hexagonal in cross section. The disc shall be attached to the shaft by means of a 'square drive' or spline or key. No allowance shall be made on dowel pins or taper pins to transmit torque. The connection of the disc to the shaft shall be capable of transmitting a shaft torque equivalent to at least 75% of the design torsional strength of the shaft. Dowel and taper pins that may be required to prevent lateral movement shall be mechanically secured.

16) Shafts shall be fabricated from high strength, high grade, stainless steel and be located in self-lubricating sleeve type bearings/bronze bushes. Each valve shall be fitted with at least one adjustable thrust bearing set to hold the disc securely concentric with the body or seat.

17) Shafts shall be located inside the disc and not be in contact with the water.

18) Shaft sealing shall be achieved with two replaceable O-rings at each end of the shaft and, where applicable, the rubber lining is to be moulded along the stem.

19) Each valve shall be equipped with an operating lever, or a gearbox with a handwheel, or an actuator as stated in Table G below.

20) Each valve shall be so protected as to minimise the possibility of damage during transit and storage. All valves shall be individually crated.

21) The valves will be installed with their shafts horizontal and the valve operating spindle, vertical. The direction of opening shall be such that the bottom of the disc moves in a downstream direction.

22) The 'handing' of the valves shall be as shown in Table G below.

PHV 10.1 Testing

Notwithstanding the requirements of SANS 1849:2008, the test pressure requirements are as follows:

(a) All valves shall be subjected to an open end gate strength test of 1,5 times the 'Pressure Rating' of the valve on both sides of the gate. Drop tightness in respect of this gate strength test is not required but shall comply with the requirements of SANS 1849.

(b) All valves shall be subject to a body test of 2,0 times the 'Pressure Rating' of the valve.

PVH 10.2 GEARBOXES (For Butterfly Valves)

Where required and/or where specified, all gearboxes on butterfly valves shall comply with the following:

(a) Gearboxes shall be side mounted and of the spur/worm type capable of being manually operated, by one person under the maximum unbalanced working pressure whilst applying a torque of no more than 120 Nm.

(b) Shear pins shall be fitted to gearboxes in order to provide overload protection.

(c) Water must not be able to leak past the main shaft and enter the actuator.

(d) Disc position indicators shall be fitted to the gearbox and shall clearly indicate the fully open and closed positions.

(e) A suitable arrow indicating the preferred flow direction through the valve, where such preference is applicable, shall be cast onto the body of the valve and, where applicable, the inappropriate arrow ground off.

(f) The gearbox shall be fitted to the right hand side or left hand side of the valve when viewed from the upstream side as stated in Table G below.

(g) The handwheel shall be of appropriate size and the direction of rotation of the operating hand wheel to close the valve shall be as stated in Table G below.

(h) Gearboxes shall be coated in accordance with the coating specification for its associated valve.

Table G - Butterfly Valves

SANS 1849		**PN10**	**PN16**	**PN25**	**PN40**
Annex A.1 e)	Flanges	SANS 1123: Table 1000 **	SANS 1123: Table 1600 **	SANS 1123: Table 2500 **	SANS 1123: Table 4000 **
Annex A.1 e)	Flange faces	Flat face ***	Flat face ***	Flat face ***	Flat face ***
Annex A.1 l)	Operating device	Lever / hand wheel / actuator	Lever / hand wheel / actuator	Lever / hand wheel / actuator	Lever / hand wheel / actuator
PVH 10 - 6)	ve configuration		Double eccentric	Double eccentric	Triple eccentric
PVH 10 - 7), 8), and 9)	pe of seal	DM or Nitrile ****	EPDM or Nitrile or metal ****	EPDM or Nitrile or metal ****	EPDM or Nitrile or metal ****
PVH 10.2 g)	Direction of closing	Anti-clockwise *	Anti-clockwise *	Anti-clockwise *	Anti-clockwise*

PVH 11 AIR VALVES

PVH 11.1 Design and Performance

The design and performance characteristics of the air valves must have been tested and approved by the Council for Scientific and Industrial Research (CSIR) or other similar testing authority.
Valves shall be capable of discharging high volumes of air through the large orifice under positive line pressure filling conditions and shall be capable of letting in high volumes of air under negative pressure conditions. In addition, the valve shall be capable of releasing small quantities of dis-entrained air at all line pressures up to the rated working pressure of the valve.
Air valves shall not exhibit the characteristics of dynamic closure in both the exhaust and vacuum mode. The valves shall be dual acting and suitably sized to enable the following without creating shock or pressure surges in the pipeline:

- Unrestricted intake of air under negative (sub atmospheric) pressure
- Unrestricted discharge of air under pressurised air pressure conditions and,
- Slow discharge of air that may come out of solution when the space beneath the air valve is full of water under pressure

The primary intake/discharge orifice shall be equivalent in cross-sectional area to the nominal diameter of the air valve. The discharge/intake port shall be protected by a non-corrosive screen or shield that shall not impair the discharge characteristics of the valve.

Discharge of pressurised air shall be controlled by the seating and unseating of a small orifice nozzle which shall only open in the presence of air and shall not leak under normal operating conditions.

The valve construction shall be proportioned with regard to the inherent material strengths such that excessive deformation or damage of any kind or leaks do not occur when the air valve is subjected to twice its rated pressure.

Valves shall react immediately to negative pipeline pressure in order to prevent the formation of unacceptably high negative pressure conditions.

During air discharge conditions, the large orifice shall close at a differential pressure across the large orifice of between 4 and 6 kPa in order to minimize transient pressure effects. The design shall enable air to continue to be released once the large orifice has closed under such conditions. This may be achieved by means of a secondary orifice or other approved manner. A slow closing characteristic is an important feature so as to sudden rate of change of velocity which will result in a pressure spine and concomitant surges in the pipeline

The valve shall seal drop tight, without the use of a mechanical spring device, at all line pressures from 10 kPa up to 1,5 times the rated working pressure of the valve.

The valve floats and seals shall require minimal maintenance and it shall be possible to carry out such maintenance without removing the valve.

Provision shall be made for the installation of a 6 mm stainless nipple and ball valve for the fitting of pressure gauges for testing purposes. The stainless steel nipple shall extend through the body to cover all the threads.

Unless otherwise stated in Table H below, all ferrous components shall be treated as specified in PVH 3.3 above.

All stainless steel components shall be painted with “Everbond” or similar material applied in accordance with the manufacturer's instructions, the purpose of which is to disguise the stainless steel to minimise the risk of theft.

All air valves shall be supplied with a copy of the relevant factory test certificates that reflect the test pressure and valve serial number. Original factory test certificates together with a copy of the QCP referred to in PVH 3.2 above, shall be issued for each valve.

Flange details are given in Table H below. The backs of each flange shall be spot faced over areas large enough to accommodate every washer and nut. All flanges are to be drilled with the holes off horizontal and vertical centrelines.

PVH 11.2 Testing

Each valve shall be tested at the factory as follows:

(a) Body Test - The valve shall be filled with water and a pressure equivalent to twice the 'Pressure Rating' shall be applied for at least 5 minutes. There shall be no visible signs of leakage during the test.

(b) Low Head Leak Test - The pressure shall be reduced to 50 kPa and maintained for at least 5 minutes. There shall be no loss of water from the valve during the test. Steadily lower the pressure further to ascertain at what pressure seepage begins and record that pressure.

(c) Drop Test - One valve taken at random from each batch of ten small orifice and double orifice air valves (or less) shall be subjected to a “drop test”. The valve shall be filled with water and pressurised to above the working pressure and isolated from the test rig by closure of an isolating valve. A chamber in the test rig immediately prior to the isolating valve must be filled with compressed air at a pressure equal to that being maintained in the air release valve. The isolating valve is then opened so as to allow the air to rise in the air release valve without the pressure dropping lower than 2 - 3 bar above rated working pressure of the air release valve. The “Drop Test” is then carried out by slowly bleeding off the pressure through a suitable cock until the float drops away from the orifice to allow discharge. Failure of the air release valve to function in the manner described will be reason for rejection.

Table H - Air Valves

	PN10	**PN16**	**PN25**	**PN40**
Flanges	SANS 1123: Table 1000 *	SANS 1123: Table 1600 *	SANS 1123: Table 2500 *	SANS 1123: Table 4000 *
Flange faces	Flat face **	Flat face **	Flat face **	Flat face **

PVH 12 VALVE ACTUATORS

Valve actuators, if scheduled, shall comply with the requirements of Particular Specification PVK and shall be manually operated or power operated as scheduled in the Bills of Quantities.

PVH 13 DRAWINGS

The valve manufacturer shall provide fully dimensioned drawings for each type and size of valve and actuator. Drawings must be provided in .pdf and in a CAD format as required by the Employer’s Agent.

PVH 14 INSPECTION

An inspector may be appointed by the Employer to witness the hydraulic and other testing of valves and/or to inspect valves prior to their release for delivery to site. Where an independent inspector is appointed, the test and/or inspection certificates must be signed by the supplier and the inspector.

The following procedure shall be employed for the inspection of all valves:

(a) All valves will be subject to inspection at their place of manufacture or assembly or, where not manufactured or assembled locally, at the valve supplier.

(b) Inspection may be carried out by the Employer's Agent or a third party appointed by or on behalf of the Employer.

(c) Where valves are provided with corrosion protective coatings, provision must be made for the prepared surfaces to be inspected by the Employer's Agent or his representative prior to the application of any coatings or linings.

(d) Provision must be made for all valves to be subjected to inspection and testing following application of corrosion protection coatings and prior to release from the factory for delivery to site.

(e) Tests on the coatings and linings may include visual inspection, dry film tests and wet sponge "holiday" detection tests at the Employer's Agent's discretion.

PVH 15 MEASUREMENT AND PAYMENT

The method of measurement and payment for valves is dealt with in PSL the Project Specification

PUC: CORROSION PROTECTION

1. CORROSION PROTECTION: APPLICATION AND CONTROL

Painting contractor

Surface preparation and coating application shall be carried out by experienced industrial painting contractors who are fully equipped and staffed to do such work in their own covered premises strictly in accordance with the paint manufacturer's recommendations. Before proceeding with the corrosion protection coatings, the Contractor shall submit the name of the painting sub-contractor for approval by the Engineer.

Site work

Surface preparation and coating application shall not be done on Site except for minor repairs, for application of the final aesthetic coat, where specifically called for or where permitted by the Engineer in writing.

Systems to be used

Systems: The corrosion protection systems to be used on the plant and equipment will usually be specified for the equipment, but if not, the Contractor shall recommend a suitable system for approval by the Engineer. If doubt exists as to the system or colour to be used, the Engineer's requirements must be ascertained.

Alternative systems: Alternative systems superior to those specified may be used if approved in writing by the Engineer.

All items to be painted: Except where otherwise specified, all metal surfaces shall be painted. This includes hot-dip galvanized items and metal-sprayed coatings. In the latter case the paint shall be in the form of a sealer. Details of approved painting systems to be used are given below.

Coating appearance: After installation on Site the finished paintwork must be neat, smooth, of uniform colour and to the approval of the Engineer.

316 Stainless steel: It is not usually necessary to paint 316 stainless steel. If corrosion of 316 stainless steel does occur, and depending on the appearance or extent of the problem, the Engineer may call for pickling, electro-cleaning, painting or replacement of the item at no additional cost. Painting may however be required if contaminated or stained surfaces cannot be properly cleaned or where stitch welding has been approved.

Quality control of coating application

Inspection: The Contractor shall arrange for the coating application on fabricated steelwork to be inspected throughout by the Engineer. The Engineer may approve inspections by an independent competent person (hereinafter called the Inspector) appointed by and at the cost of the Contractor.
Inspection report: A written report of the inspections, prepared by the Inspector and signed by both the Inspector and the Contractor, shall be submitted for appraisal by the Engineer before delivery of the equipment to Site.

Inspector qualifications: Inspectors appointed by the Contractor shall hold an appropriate qualification from either the CISA, the SAIW or the SAQCC.

Identification of items: Every item to be coated shall be identified by a welded or hard-stamped code. Records shall be maintained for each item.

2. CORROSION PROTECTION: SURFACE PREPARATION

Imperfections

Welding shall be free of blowholes and all welding flux removed. All weld spatter, sharp edges and other imperfections shall be removed prior to abrasive blasting. Prior to painting, weld beads with a surface irregularity exceeding 3 mm or with sharp crests having a radius less than 2 mm shall be ground. (Weld grinding must not, however, be performed on stainless steel). Areas to be painted shall be free of crevices. If the Engineer has permitted stitch welding, crevices shall be filled with a compatible sealing compound after the priming coat has been applied.

Abrasive blasting

Before coating all surfaces shall be properly degreased and abrasive blast cleaned to an SA3 finish with a 40-65 µm surface profile to Swedish Standard SIS 055900 of 1967. The abrasive shall comply with paragraph 4.3.3 of SANS 064 and shall be free from all traces of oil, grease, foreign matter and corrosive contaminants such as chlorides, etc. The prepared surface shall be given the first coat of the painting system within 4 hours after cleaning.
In instances where stainless steel and 3CR12 are to be painted, the surface shall be suitably abrasive blasted prior to primer application.

Between coats

Between coats or with previously painted surfaces in good condition, all traces of oils, greases, soluble salts and corrosive air borne contaminants shall be thoroughly washed from the surface to be painted using a detergent type cleaning agent, rinsed and dried. The previous coat shall then immediately be lightly sanded or otherwise prepared as recommended by the paint manufacturer, wiped clean, dried and painted. Solvents are not acceptable as a surface cleaning agent.

Hot-dip galvanized surfaces

Hot-dip galvanized surfaces to be painted shall be free from white rust and shall be cleaned with approved water based galvanizing cleaner using non metallic abrasive pads until a "water break free" surface is obtained. The surface shall then be thoroughly rinsed with clean potable water to remove all residues and dried immediately prior to painting. Where necessary to obtain adhesion a sweep blast of the surface shall be done after cleaning.

3. CORROSION PROTECTION: METAL COATINGS

General

Fabrication of items to be protected by metal coatings shall be in accordance with SANS ISO 14713.

Hot-dip galvanizing

Standard: Hot-dip galvanizing shall be done in accordance with SANS 121 (ISO 1461:1999) Hot-dip Galvanized Coatings on Fabricated Iron and Steel Articles.

Thickness: Coatings shall be to the thicknesses detailed in the Standard.

Passivation: Hot-dip galvanized material which is to remain unpainted shall be passivated as specified in SANS 121. Items to be painted after hot-dip galvanizing shall be air dried and not passivated.

White rust: Hot-dip galvanized material shall be substantially free from white rust when it is erected on site. Stacking and storing shall at all times be done in a manner to prevent white rust forming.

Repair: Damage to hot-dip galvanizing caused by welding, grinding, etc. is not acceptable. The repair to hot-dip galvanizing damaged by handling or transport shall be done by cleaning the area and applying 3 coats of a zinc rich primer giving a dry film thickness of at least 100 µm and containing at least 94 % zinc in the dried film. If the opinion of the Engineer is that damage is excessive, such items will be rejected by the Engineer and shall be replaced by the Contractor at his own expense.

Welding: Welding after hot-dip galvanizing is not acceptable.

Test certificate: The Contractor shall supply a galvanizer's guarantee or test certificate prior to installation.

Sprayed metal coatings

Standard: Sprayed metal coatings shall be done in accordance with SANS 1391: Standard Specification for Thermally Sprayed Metal Coatings as amended below. The statements below apply to Part 1 of SANS 1391.

Symbols: The type symbol described in Table 1 of the Standard shall be used to specify material and thickness requirements; i.e. AL for aluminium, Zn for zinc, followed by the minimum average thickness in microns.

Thickness: The minimum coating thickness for both Aluminium and Zinc shall be 150 µm.

Thickness testing procedure: The procedure laid down in Clauses 4.2.1.3 a (1) or b (1) of SANS 1391: Part 1 for the determination of the coating thickness shall not be regarded as sufficient. The thickness shall be **checked on every surface plane** at points not more than 300 mm apart for small articles and 500 mm for large articles, e.g. angles shall be checked along all 4 surfaces, channels along all 6 surfaces, pipes in 4 planes etc. The minus tolerance on thickness in isolated areas shall also not exceed -10% and such low areas shall not be larger than 50 mm in diameter.

Period between preparation and coating: For the purpose of Clause 3.3 of SANS 1391: Part 1, the time between preparation and coating shall be shortened from 4 hours to 2 hours at any application area closer than 10 km from the coast.

Sealing: Unless otherwise specified, all metal coatings shall be sealed immediately after metal-spraying using a suitable pre-treatment wash primer followed by coats of low viscosity sealant until absorption is complete.

This shall be followed by a suitable top coat system to give a smooth final finish. The various coatings used shall be as specified or, if not specified, shall be selected by the Contractor to suit the duty and submitted to the Engineer for approval. The final coat shall normally be applied on site after installation. Colours shall be as specified or as agreed with the Engineer. Depending on the particular application, the following systems are acceptable:

System 1

C1. Application of micaceous oxide pigmented polyamide cured epoxy to achieve a dry film thickness of 60 to 80 µm; (Sigmarite Sealer, or equivalent);

C2. One coat of solvent borne modified acrylic coating to achieve a dry film thickness of 70 µm; (Sigma Topacryl coating, or equivalent); and

C3. One coat of solvent borne modified acrylic finish to a dry film thickness of 30-45 µm; (Sigma Topacryl finish, or equivalent).

System 2

C4. Application of one coat of two component epoxy primer to a dry film thickness of 40 µm; (Intergard 269, Chemrite Carboline Rustbond Penetrating Sealer, or equivalent);

C5. Application of one intermediate coat chemical resistant vinyl copolymer to a minimum dry film thickness of 70 µm; and

C6. Application of one coat of vinyl copolymer chemical resistant enamel to a minimum dry film thickness of 40 µm.

System 3

C7. Application of one coat of two component epoxy primer to a dry film thickness of 40 µm; (Chemrite Carboline Rustbond Penetrating Sealer, Intergard 269, or equivalent); and

C8. Application of two coats of polyurethane enamel (twin pack) to a minimum combined dry film thickness of 70 µm.

4. CORROSION PROTECTION: PAINT COATINGS

Paint selection

Paint quality: Paint shall be of best quality, of approved manufacture and brand and comply with the requirements of the relevant SANS or BS specifications.

Compatibility: To avoid incompatibility between paint coats due to variations in formulation, the different coats in any one paint system shall be provided by the same manufacturer.

Confirmation of suitability: Contractors shall obtain confirmation from their paint suppliers that, when using their paints, the systems specified are technically correct and suitable for the application and the material being coated.

Paint application

Surface preparation: All surfaces shall be properly prepared as specified in Clause "Corrosion Protection: Surface Preparation".

Painting: Paints shall be applied strictly in accordance with the manufacturer's instructions by tradesmen skilled in this class of work. Thinning of paint shall only be allowed for spray application and the manufacturer's recommended thinners shall be used.

Coating of hidden areas: Areas which will be inaccessible after erection and surfaces resting on floors shall receive the full paint system prior to erection. Mating or contact surfaces shall be prepared and primed and be brought together while the paint is still wet.

Items encased in concrete: Metal to be encased in concrete shall be painted externally up to 30 mm inside the concrete section, leaving the remainder bare so as to facilitate bonding with the concrete.

Crevices: Crevices will not be permitted. Where unavoidable crevices are accepted by the Engineer, such crevices shall be filled with a compatible filler after application of the priming coat.

Protection of machined surfaces: Where painting of machined surfaces is not possible or advisable, these surfaces shall be coated with an approved proprietary anti-corrosion compound giving 12 months protection under operating conditions. Shaft ends and machined mating or mounting surfaces or pads shall be so coated and shall not be painted.

Coating thickness: The dry film thickness shall be measured using a non-destructive thickness gauge such as the "Mikrotest" or equivalent and shall comply with the Specification.

Repair: Painted areas damaged during transportation, erection or any means whatever shall be repaired as follows - Rusted spots shall be removed and cleaned by means of a wire brush or emery paper to a bright metal finish and the surrounding paint which is still intact shall be feathered for a distance of 50 mm beyond the damaged area. Spot priming and repair shall consist of all the coats previously applied and shall overlap the undamaged area.

Protection on site: Proper and adequate use of cover sheets and other means shall be made to protect the existing paintwork from damage and from metal dust and sparks when welding, grinding, and wire brushing on site. Similarly effective steps shall be taken to prevent spillage or splashing or other damage to floors, walls and equipment when painting on site and any damage or mess caused shall be corrected at the Contractor's cost.

Final coat: The final external coat/s shall always be applied on site after installation except for System A/1, where all coats shall be applied by a specialist applicator at his premises. A professional, smooth finish with a uniform colour is required.

Final colour code – general

The final colour code shall be as follows:

PIPEWORK

CONTENTS OF PIPE	BASIC COLOUR	COLOUR OF INDICATOR		
		1 BAND	2 BANDS	3 BANDS
AIR				
Compressed, Power	Arctic Blue (F28)		-	-
Aeration	Arctic Blue (F28)	Canary Yellow (C61)	-	-
Instrument	Arctic Blue (F28)	Salmon Pink (A40)	-	-
Vacuum	Arctic Blue (F28)	Primrose (C67)	-	-
Lime Transfer	Arctic Blue (F28)	Crimson (A03)	-	-
Blower	Arctic Blue (F28)	Verdigris Green (E22)	-	-
CHEMICALS				
Aluminium Sulphate	Jacaranda (F18)	Verdigris Green (E22)	-	-
Sodium Aluminate	Jacaranda (F18)	Crimson (A03)	-	-
Ferric Sulphate	Jacaranda (F18)	Canary Yellow (C61)	-	-
Lime (dry powder)	Jacaranda (F18)	Salmon Pink (A40)	-	-
Activated Carbon	Jacaranda (F18)	Light Stone (C37)	-	-
Polyelectrolyte	Jacaranda (F18)	Cloud White (G80)	-	-

CONTENTS OF PIPE	BASIC COLOUR	COLOUR OF INDICATOR		
		1 BAND	2 BANDS	3 BANDS
GASSES - (other than air); liquefied or gaseous				
Butane, Propane	Light Stone (C37)	-	-	-
Ammonia	Light Stone (C37)	Ultramarine (F09)	-	-
Blast furnace	Light Stone (C37)	Crimson (A03)	-	-
Carbon Dioxide	Light Stone (C37)	Light Brunswick Green (H07)	-	-
Coke Oven	Light Stone (C37)	Light Grey (G29)	-	-
Producer	Light Stone (C37)	Verdigris Green (E22)	-	-
Chlorine, Hypoclorite	Light Stone (C37)	Canary Yellow (C61)	-	-
WATER				
Cold Drinkable	Brilliant Green (H10)	Cornflower (F29)	-	-
Hot Drinkable	Brilliant Green (H10)	Crimson (A03)	Cornflower (F29)	-
Boiler Feed (Distilled)	Brilliant Green (H10)	Crimson (A03)	Cloud White (G80)	Crimson (A03)
Boiler Feed (Demineralised)	Brilliant Green (H10)	Cloud White (G80)	-	-
Industrial, Raw	Brilliant Green (H10)	Golden Yellow (B49)	-	-
Reclaimed	Brilliant Green (H10)	Jacaranda (F18)	-	-
Backwash	Brilliant Green (H10)	Light Stone (C37)	-	-
Desludge	Brilliant Green (H10)	Canary Yellow (C61)	-	-
Stove Circulating	Brilliant Green (H10)	Salmon Pink (A40)	-	-
Hydraulic Power	Brilliant Green (H10)	Terra Cotta (A10)	-	-
Final Treated Effluent	Aquamarine (E67)	-	-	-
Interchange, Stage	Drakensberg Green (H36)	-	-	-
Raw Sewage	Olive Green (H05)	-	-	-
Sea Water	Light Brunswick Green (H07)	-	-	-
Primary Sludge	Dark Brown (B03)	-	-	-
Waste Activated Sludge	Light Brown (B15)	-	-	-
Digested Sludge	Light Brown (B15)	Light Olive Green (H21)	-	-
Pasteurised Sludge	Light Brown (B15)	Cloud White (G80)	-	-

CONTENTS OF PIPE	BASIC COLOUR	COLOUR OF INDICATOR		
OIL				
Diesel Fuel	Golden Brown (B13)	Cloud White (G80)	-	-
Hydraulic Power	Golden Brown (B13)	Salmon Pink (A40)	-	-
Lubricating	Golden Brown (B13)	Verdigris Green (E22)	-	-
Transformer	Golden Brown (B13)	Crimson (A03)	-	-
Paraffin	Golden Brown (B13)	Arctic Blue (F28)	-	-

PLANT AND EQUIPMENT	
EQUIPMENT	**COLOUR CODE**
FIRE FIGHTING	
Equipment and Pipework	Signal Red (A11)
ELECTRICAL	
Distribution Boards, Switchgear, Terminal Boxes and Conduits	Light Orange (B26)
Emergency Stop	Signal Red (A11)
MACHINE GUARDS	
Inside	Light Orange (B26)
Outside	Colour of Machine
Protruding Shafts, Exposed Gear Wheels and Rotating Parts	Light Orange (B26)
OVERHEAD TRAVELLING CRANE	
Final colour	Golden Yellow (B49)
HANDRAILS	
Horizontal Rails and Chains	Golden Yellow (B49)
Stanchions	Black
Protrusion, Sides of Ramps	Black and Yellow Diagonal Stripes
GENERAL	
Scour Pipes	Deep Buff (B24)
Valves	Basic colour of pipeline
WORKSHOP FLOOR DEMARCATION	
Demarcation Lines	Golden Yellow (B49)
Working Areas	Pastel Grey (G54)
No Parking, No Storage	Golden Yellow (B49)
Aisles and Walkways	Brilliant Green (H10)
Storage Area	Terracotta (A10)
Urethane based paint is to be used for concrete surfaces. Traffic paint is to be used for tarred surfaces	

Exception:

Items made of 316 or 316L stainless steel may be left unpainted provided the surface is of uniform self-colour without blemishes, rust, marks or stains. If blemished the surfaces must either be painted or cleaned by pickling and/or electro-cleaning (not grinding or other mechanical means).

Painting systems

Definition of terms

The abbreviation "d.f.t." used in this Specification shall mean dry film thickness given in microns and, except where otherwise specified is the minimum (not average) thickness permissible.

System A/1

Three coats of a low solvent, high solids, polyamine/amide cured, epoxy (twin pack) to a minimum thickness of 350 µm.

Notes:

The coating shall undergo holiday detection over the full surface in accordance with SANS 1217. This test shall be done by an inspector holding an appropriate qualification from either the CISA, the SAIW or the SAQCC.

When applied to hot-dip galvanized surfaces, a suitable epoxy primer shall be used after careful surface preparation before applying this system.

This system shall be applied by a specialist applicator prior to delivery to site with particular attention to the required interval between coats.

The first and third coats shall be a different colour to the second coat.

Applied to:

Items subject to immersion and/or wet abrasion; e.g. screw pumps, clarifier rotating arms, scum boxes and weirs, pipework, chutes, tanks, etc.

System A/2

System A/1, plus ..... d.f.t = 350 µm

Coat wash primer to SANS 723 ..... d.f.t = 40 µm

..... Total d.f.t = 390 µm

System A/3

2 Coats of a micaceous iron oxide pigmented polyamine/ amide

cured epoxy sealer/coating (twin pack) with d.f.t = 60 µm per coat. ..... **Total d.f.t = 120 µm**

Notes:

Use Sigmarite Sealer, or equivalent.

Applied to Hot dry applications up to 200ºC.

System A/4

3 Coats of a micaceous iron oxide pigmented polyamine/amide

cured epoxy sealer/coating (twin pack) with a d.f.t = 80 µm per coat. ..... **Total d.f.t = 240 µm**

Notes:

Use Sigmarite Sealer, or equivalent.

Applied to Immersed applications in potable water up to 100 ºC.

System A/5

2 or 3 coats polyamine/amide cured coaltar epoxy..... **Total d.f.t. = 400 µm**

Notes:

Where paints are available in different colours, each coat shall be a different colour.

System B/1

1 Coat aluminium filled epoxy (twin pack).....d.f.t. = 125 µm

1 Coat polyurethane enamel (twin pack).....d.f.t. = 40 µm

..... Total d.f.t. = 165 µm

Application a maintenance coat over weathered coatings on steel.

Notes:

Surface preparation shall include, as a minimum, removal of all loose mill scale, non-adherent rust and loose paint prior to wire brushing and degreasing and shall be in accordance with an appropriate internationally accepted standard such as the Steel Structures Painting Council of the USA or that of the Swedish Standards Institute's St standards.

System B/2

1 Coat HB epoxy primer.....d.f.t. = 100 µm

2 Coats polyurethane enamel (twin pack).....d.f.t. = 60 µm

..... Total d.f.t. = 160 µm

Applied to motors, gearboxes, cast iron components, steel fabrications, etc.

System C/1

1 Coat inorganic zinc silicate.....d.f.t. = 75 µm

1 Coat high build modified acrylic coating.....d.f.t. = 75 µm

1 Coat modified acrylic finish to approved colour .....d.f.t. = 30 µm

..... Total d.f.t. = 180 µm

Notes:

The primer must be factory applied. The intermediate and final coats may be applied on Site.

Particular care shall be taken to obtain the recommended anchor pattern during abrasive blasting and to achieve the required primer thickness on all surfaces in one coat.

The primer shall be tested for full cure before applying the subsequent coats.

This system shall not be used for items subject to immersion.

Intermediate coat shall be Sigma Topacryl, or equivalent.

Top coat shall be Sigma Topacryl Finish, or equivalent.

Applied to heavy fabricated steel items requiring a primer which travels well and/or can be left for an extended period before overcoating.

System C/2

1 Coat inorganic zinc silicate..... d.f.t. = 75 µm

1 Coat epoxy tie coat..... d.f.t. = 75 µm

1 Coat polyurethane enamel (twin pack)..... d.f.t. = 40 µm

..... Total d.f.t. = 190 µm

Notes:

The complete system must be factory applied and touch ups will be required on Site.

The primer shall be tested for full cure before applying the subsequent coats.

This system shall not be used for items subject to immersion.

Applied to:

Heavy fabricated steel items requiring a hard, high gloss colour finish - e.g. bridges, tanks, non-immersed piping, structural steel, etc.

System C/3

1 Coat inorganic zinc silicate..... d.f.t = 75 µm

1 Coat modified silicone heat resisting coating suitable for 200 ºC ..... d.f.t = 75 µm

..... Total d.f.t = 150 µm

Notes:

Particular care shall be taken to obtain the recommended anchor pattern during abrasive blasting and to achieve the required primer thickness on all surfaces in one coat.

The primer must be factory applied.

The primer shall be tested for full cure before applying the subsequent coat.

A tie coat suitable for 200ºC shall be included between the primer and top coat if so recommended by the paint manufacturer.

The top coat must cure at ambient temperatures.

Applied to:

Steel and cast iron items on dry heat applications with temperatures up to 200ºC continuous.

System C/4

3 coats modified silicon ..... **Total d.f.t = 120 µm**

Notes:

Steel and cast iron items on dry heat applications with temperatures up to 540ºC continuous.

System D/1

Hot dip galvanize to SANS 121 (ISO 1461), then after preparation by chemical cleaners or sweep blasting in accordance with Hot Dip Galvanizers Association Code of Practice for Surface Preparation and Application of Organic Coatings (HDGASA 01-1990).

1 Coat epoxy primer..... d.f.t = 35-40 µm

1 Coat epoxy intermediate with MIO (micaceous iron oxide) ..... d.f.t = 100-120 µm

1 Final coat of polyurethane sealer..... d.f.t = 30-40 µm

Total d.f.t. = 160-200 µm

Applied to:

C9. • Hot dip galvanized steel pipes, handrails and stanchions, guards, steelwork, etc. in very aggressive areas

System D/2

Hot dip galvanize to SANS 121 (ISO 1461), then after preparation by chemical cleaners or sweep blasting in accordance with Hot Dip Galvanizers Association Code of Practice for Surface Preparation and Application of Organic Coatings (HDGASA 01-1990).

1 Coat epoxy primer ..... d.f.t = 35-40 µm

2 Final coat of polyurethane sealer ..... d.f.t = 60-80 µm

Total d.f.t. = 95-120 µm

Applied to:

C10. • Hot dip galvanized steel pipes, handrails and stanchions, guards, steelwork, etc. in aggressive areas

System D/3

Hot dip galvanize to SANS 121 (ISO 1461), then after preparation by chemical cleaners or sweep blasting in accordance with Hot Dip Galvanizers Association Code of Practice for Surface Preparation and Application of Organic Coatings (HDGASA 01-1990).

1 Coat epoxy primer ..... d.f.t = 35-40 µm

1 Final coat of polyurethane sealer ..... d.f.t = 30-40 µm

Total d.f.t. = 65-80 µm

Applied to:

C11. • Hot dip galvanized steel pipes, handrails and stanchions, guards, steelwork, etc. in less aggressive areas

System E/1

1 coat wash primer to SANS 723 ..... d.f.t = 10 µm
1 coat zinc chromate primer to SANS 679 Type 1 ..... d.f.t = 40 µm

1 coat universal undercoat to SANS 681 ..... d.f.t = 35 µm

2 coats silicone urethane gloss enamel top coat to colour code. ..... d.f.t = 70 µm

..... Total d.f.t = 155 µm

Notes:

If the specified dry film thickness of the zinc chromate primer of 40 µm is not achieved with one coat, an additional coat shall be applied.

The paints used shall be suitable for internal and external use.

An alternative priming and undercoat system of superior corrosion resistance may be used.

System E/2

1 Coat phenolic based primer ..... d.f.t = 20 µm

1 Coat universal undercoat to SANS 681 ..... d.f.t = 35 µm

2 Coats machinery enamel ..... d.f.t = 50 µm

..... Total d.f.t = 105 µm

Notes:

The paints shall be suitable for internal and external use.

The paints selected shall not be damaged by oil spillage or grease and shall be reasonably chemical resistant.

System E/3

1 coat zinc chromate self-etching wash primer to SANS 723 max ..... d.f.t = 10 μm
1 coat zinc chromate primer to SANS 679 Type 1 ..... d.f.t = 40 μm
1 coat universal undercoat to SANS 681 ..... d.f.t = 35 μm
2 coats single pack urethane gloss enamel ..... d.f.t = 60 μm

..... Total d.f.t = 145 μm

Notes:

All paints shall be suitable for internal and external use.

If the specified dry film thickness of the zinc chromate primer of 40 μm is not achieved with one coat, an additional coat shall be applied.

System E/4

1 Coat water borne vinyl based primer; Dulux Corrocote 3 or equiv. ..... d.f.t = 40 μm
2 Coats Acrylic Semi Gloss top coats; Amercoat 234 or equivalent ..... d.f.t = 100 μm

..... Total d.f.t = 140 μm

Applied to:

General use on hot-dip galvanized surfaces.

System E/5

1 Coat twin pack epoxy zinc chromate primer ..... d.f.t = 30 μm
2 Coats acrylic semi gloss coats; Amercoat 234 or equal approved ..... d.f.t = 100 μm

..... Total d.f.t = 130 μm

System E/6

1 Coat epoxy strontium chromate primer ..... d.f.t = 25 μm
2 Coats Dulux Silthane Gloss enamel ..... d.f.t = 60 μm

..... Total d.f.t = 85 μm

Note:

The paints used for this system must be suitable for a continuous operating temperature of 120ºC or higher.

System F

1 Coat vinyl copolymer polyester ..... **Total d.f.t = 100 μm**

Applied to steel floor grating.

System - Fusion Bonded Epoxy

This is a water resistant, non-toxic and non-tainting, fusion bonded epoxy pipe coating in accordance with SANS 1217. The material used shall be of Type 2; i.e. a thermosetting powder-coating material. The finished coating shall have a thickness of 300 μm and no reading shall be less than 200 μm.

Note:

The Contractor shall execute holiday detection over the full surface in accordance with SANS 1217.

The items to be coated shall be prepared in accordance with Clause 4.1.1 of the SANS 1217 and, in particular, shall have edges ground to a radius of curvature of at least 3 mm.

The surfaces to be coated shall be prepared in accordance with Clause 4.1.2 of SANS 1217 and, in particular, shall be blasted to a preparation grade of Sa 3.

Pre-heating is needed to achieve the required coating thickness.

Applied to immersed objects, cast iron valve bodies, pipework, etc.

System – Hot-Applied Thermoplastic

This is a synthetic thermoplastic polyamide, Rilsan or equivalent, which shall be applied by dipping the hot object into a fluidised bed of the polymer. The coating shall be executed in accordance with the supplier's recommendations. The finished coating shall have a thickness of 300 μm and no reading shall be less than 200 μm.

PZA: CLEANING OF SEWERS

(Supplementary to SABS 1200 – 1986)

PZA 1 SCOPE

This specification covers the clearing and cleaning of blocked or partially blocked sewer pipes and manholes.

PZA 2 DEFINITIONS

"Sewer" or **"sewer pipe"** is a gravity pipeline between two manholes.
"Route" or **"sewer route"** is a series of consecutive sewers/sewer pipes.

PZA 3 PLANT

For the duration of the Contract, the Contractor shall have on site:

- Sufficient plant and equipment and personnel, plant and equipment to carry out mechanical rodding and cleaning of sewer pipes.
- At least one high pressure jetting machine with all associated support personnel, plant and equipment.

PZA 4 CLEANING USING HIGH PRESSURE JETTING EQUIPMENT

The Employer's Agent's Representative will inspect all manholes and decide which sewer pipes require cleaning.

Before using a high pressure jetting machine, the Contractor must confirm that the sewer pipes that are to be jetted are not clay pipes. Clay sewers are to be cleaned using mechanical methods.

The cleaning of the sewers is to be carried out in a systematic manner with cleaning of a pipe only commencing once all lines feeding into that pipe have been passed as cleaned.

Sewer pipes and manholes shall be cleared of blockages and other debris/detritus by high pressure water jetting methods using potable water.

The jetting equipment to be utilised must be suitable for cleaning sewers and shall be provided with appropriate delivery hoses and cleaning nozzles and operated by experienced personnel. The working pressure for sewer pipes up to 300 mm diameter shall be between 80 and 100 bar and for larger diameter sewer pipes between 200 and 250 bar.

The minimum water delivery rate shall be 160 litres per minute for the 200 to 250 bar machine and 100 litres per minute for the 80 to 100 bar machine. The equipment must be mobile and compact to facilitate access to all of the site of works. The Employer's Agent's Representative shall have the right to require the Contractor to regularly test the effectiveness of jetting equipment at no additional cost to the Employer.

Before commencing with water jetting and cleaning of sewers, it may be necessary to clear blockages first to induce liquid flow. For this purpose rodding and mechanical cleaning equipment will be required.

High pressure water jetting of pipes shall be undertaken in the following manner. The route to be cleared is to be agreed with the Employer's Agent's Representative. All routes upstream of the route to be cleared must have been passed as cleared by the Employer's Agent's Representative. Jetting

shall start at the downstream end of the route. The first (lower) sewer pipe between manholes must be jetted until the bulk of the silt has been removed. The jetting shall then be carried out of the next (second lowest) length of sewer between manholes from the downstream end of the route. This process shall be continued until the top (highest) end of the route is reached. In this way the bulk of the silt will be cleared moving from the downstream (lower) end of the route up to the upstream (upper) of the route.

While progressing upstream, most of the silt moved from one sewer pipe will be trapped at the downstream manhole of that sewer pipe. However, a certain amount will be carried past the trap and deposited in the downstream sewer pipe. For this reason, the final cleaning and pulling of the "pig" to confirm that the pipes are clean, shall be undertaken starting at the upstream end of the sewer route and progressing in a downstream direction to the lowest end of the route.

A sewer pipe will only be considered cleared and cleaned once it has been inspected and passed by the Employer's Agent or his/her Representative.

Debris and foreign material dislodged from sewer pipes during the cleaning process must be trapped at the downstream manhole of the section of sewer pipe being cleaned and shall be removed and disposed of to an approved spoil site. Whilst jetting, the Contractor shall have a silt trap in place at all times in the manhole at the downstream end of the section of sewer being cleaned. The silt trap shall be of a circular shape and the same diameter as the pipe being cleaned. The bottom half of the circle shall be solid plate and the top half open. Attached to the bottom half shall be a 300 mm long half cylinder that is to lie in and match the invert of the channel in the manhole. The silt trap shall be fitted with a handle for easy removal.

Silt and other debris caught against the trap must be removed from time to time as it builds up.

At the upstream manhole of the sewer pipe being jetted, the entrance to the pipe must, at all times, be equipped with a screen with 25 mm openings. This is to prevent material and other large foreign objects entering the pipe and becoming tangled with the jetting hose and nozzle. This screen must be cleared as often as required to prevent blockages.

Pipes and manholes will be deemed adequately cleaned only after all silt build-up, obstructions, and all foreign materials have been removed and the Contractor has proven to the satisfaction of the Employer's Agent by means of a clear pass of the jetting equipment and by a clear pass of a suitably sized "pig" through the length of sewer being checked, that no further silt or debris can be removed by further jetting or clearing operations. The "pig" is to have a solid rim the external diameter of which is 80 mm less than the internal diameter of the pipe to be cleaned. A suitable rubber wiper/ squeegee that protrudes a further 25 mm all the way around the solid rim must be fixed to the rim. The length of the solid rim is to be at least 1,2 times the pipe diameter so as to prevent the rim rotating. On larger diameter pipes, a space frame to support two narrow solid rims at a spacing of 1,2 times the pipe diameter should be used. Inside the rim there must be sufficient opening to permit sewage to flow through it while it is being pulled through the pipe. A rope must be attached to both ends of the "pig" to permit extraction in either direction.

As an alternative to pulling a "pig" where flow is low enough to permit blocking the line for a short period, the line may be inspected using mirrors to confirm that it is clear. The Contractor may submit any alternative form of "pig" or method of proving the pipe is clean to the Employer's Agent for approval.

The Contractor must take care not to damage the sewerage system during the clearing and cleaning process. If any damage in the opinion of the Employer's Agent is caused to the existing sewerage system as a result of the Contractor's negligence, this damage shall be repaired by the Contractor at his own expense.

PZA 5 MEASUREMENT AND PAYMENT

PZA 5.1 Cleaning Sewer Pipes and Manholes:

(a) Cleaning of up to DN 350. sewer using mechanical means. ..... Unit: m

(b) Extra over for levels of silting greater than 20% of the pipe diameter. ..... Unit: m

(c) Cleaning of up to DN400. sewer using high pressure jet cleaning. ..... Unit: m

(d) Extra over for levels of silting greater than 20% of the pipe diameter. ..... Unit: m

(e) Cleaning of manholes, irrespective of internal dimensions using high pressure jet cleaning. ..... Unit: No

Separate items will be scheduled for cleaning sewers using high pressure jetting and mechanical methods.

The rate shall cover all costs of the provision of labour and equipment, access to the site, providing water and water storage facilities, cleaning pipes, the trapping and removal of silt, dislodged debris and foreign objects and disposal thereof to the approved disposal site. The rate shall also cover measures required to accommodate normal sewer flows.

No distinction shall be made between the number of blockages in a particular sewer pipe.

An extra over rate shall apply for levels of silting greater then 20% of the pipe diameter. The level of silting shall be determined by calculation from the volume of silt removed at the downstream manhole during the desilting operation.

The rate tendered shall be per metre length of pipe including manholes. Separate items shall be scheduled for different pipe diameters.

One third of the tendered rate will be certified for payment when the Contractor has completed the initial cleaning of the pipe starting at the downstream end of the route and finishing at the upstream end of the route. The remaining two thirds of the tendered rate will be paid after the "pig" has been pulled through on the final cleaning run and the route has been inspected and approved as having been satisfactorily cleaned by the Employer's Agent's Representative.

PZC: CLOSED CIRCUIT TELEVISION (CCTV) INSPECTION OF SEWERS

(Supplementary to SABS 1200 – 1986)

PZC 1 SCOPE

This specification covers the Closed Circuit Television (CCTV) camera inspection of existing sewer pipelines on site

PZC 2 CLOSED CIRCUIT CAMERA INSPECTIONS

PZC 2.1 Inspection Equipment for Mainline Sewers

The CCTV camera inspections shall be undertaken using a tractorised CCTV pipe inspection camera system.

The camera system shall be capable of overlaying text onto the recorded video image of the pipe in such a way as to identify the pipe. Overlay must include the time, date, suburb, street, pipe number and continuously updated meterage and GPS coordinates of vehicle position at start of inspection. The overlay must also be capable of being removed from the screen.

The camera system must be capable of measuring the slope of the pipe being inspected. The instantaneous angle must be filtered and is to be displayed on the screen and recorded on the video. Raw inclinometer data is also to be stored for downloading to the database for the purpose of pipe profiling. The camera system must be capable of down-loading to a database, no less than three readings per metre of pipe inspected.

The camera shall be transported through the pipe on a tractor system to allow for smooth transportation of the camera through the pipe. The tractor shall be controllable at various speeds in forward and reverse and must be able to operate in pipes from 100 mm and greater. The tractor speed shall, however, not exceed 0,5 metres per second.

No “push-pull” camera system will be deemed acceptable, as the recorded image is “jerky” and difficult to interpret and no inclinometer data can be collected.

The camera mounted on the tractor shall be mounted in such a manner as to transport the camera within 10% of the centre of the pipe.

The camera system shall provide for complete condition assessment and lighting to illuminate the pipe sufficiently to allow for the detection of cracks and other structural defects in the pipe. The lighting shall be of such a nature that the natural colour of the pipe is recorded (black & white will not be acceptable).

The camera system’s linear meterage system shall be capable of being reset to zero at the start inspection manhole.

The camera system distance measurement shall be better than 1% accuracy and all measurements shall be made from manhole centre to manhole centre.

The camera systems used by the Contractor shall be pan and rotatable and shall include radiosonde tracking on the surface if requested by the Employer’s Agent to determine lateral positions.

The equipment shall be capable of “Task handling” in order to control and log, in the correct order, the defect as found in the pipe and recorded. All defects are to be reported at the distance that they occur, but defects are to be graded only after the camera has passed the defect in question.

PZC 2.2 Lateral Inspections

The camera system shall be capable not only of locating lateral consumer connections on the main sewer pipeline, but also be capable of inspecting these connections to the same standard and specification as for the main sewer pipeline.

The camera system shall be capable of inspecting the connections from the cleaning eye down toward the main sewer pipeline and shall be able to inspect the lateral from the main sewer pipeline up towards the erf boundary and extending into the erf by at least 25 metres without any open excavation being made.

The camera equipment shall be able to negotiate typical multiple bend radii in Clay or PVC piping of diameters of 100 mm and larger.

The Contractor's camera equipment shall have the ability of tracking the camera's progress.

The Contractor's camera equipment must be capable of being tracked in X, Y and Z on the surface by means of radiosonde or similar technology.

Cameras used for lateral inspections must be fully pan and rotate-able, incorporating "right side up" technology.

PZC 2.3 Road Safety

The inspection unit shall be provided with one amber-flashing beacon, which shall comply with and be operated in accordance with the Road Vehicle Lighting Regulations.

Road signs and cones shall be carried at all time and displayed in accordance with Safety Regulations.

The Contractor is to ensure that his staff has bright coloured overalls with the Company name and fluorescent over jackets. These shall be worn at all times to provide safe working conditions in road reserves.

PZC 2.4 Sewer Health and Safety Equipment

At the time of tender, the Contractor shall provide proof of trained and certified staff who can use the health and safety equipment.

The Contractor shall have the following health and safety equipment in his possession while carrying out CCTV camera inspections:

Oxygen deficiency and gas detector apparatus per unit, regularly serviced and operable.

Fresh air breathing apparatus – face mask and demand value, 10-minute compressed air supply.

Approved vertical lift full safety harness.

Personal equipment per operative:

- Safety helmet
- Safety boots
- Sewer wading boots
- Disposal protective gloves

Adequately sized First Aid Kit suitable for the number of operatives per unit.

Facilities for washing to include:

- Soft soap
- Disinfectant
- Potable water

Radio equipment and cellular phone for on site communication.

Fire extinguisher.

PZC 3 Video Recordings

(a) All video material shall be recorded on digital mediums and shall be of a DVD format compatible with Power DVD 4. All recordings shall for 5 seconds at the start of the inspection, have superimposed the video recording, the GPS coordinates of the vehicle's position at the start of the inspection.

(b) The DVD's shall contain the video material, daily diaries as generated on site, and other relevant data pertaining to the inspection of the sewers.

(c) DVD's are to be labelled with the following information:

- Local Authority name
- Contact number
- DVD number
- Suburb
- Contractors name
- Sub-catchment
- Streets inspected
- Date and time

(d) At the time of tender, the Contractor shall provide a recording of at least 50 m of sewer filmed with the equipment intended for use on this Contract for approval by the Employer's Agent.

(e) The above-mentioned DVD shall include pdb files and thematic maps as proof of the Contractor's ability to comply with the tender requirements.

PZC 4 Reports

(a) No reports will be manually generated by the Contractor. All reporting will take place in an automated electronic format from the inspection database.

(b) The minimum requirement for submission of inspection reports for each payment section of the works shall include:

(i) The ability to provide colour copies of the printed inspection report on request.

(ii) DVD or CD recording of the complete CCTV inspection.

(iii) 1 CD, including electronic media comprising of an electronic copy of the inspection report and a PIC database ("pdb") file of all inspection information for electronic importing of the CCTV data to PICdata and the resultant representation of the CCTV data on GIS.

(iv) Status quo report detailing all rehabilitation requirements and statistical data relevant to the project area.

(v) Thematic Maps.

(c) The condition assessment and CCTV camera inspection of the sewer system will include reporting on both the sewer pipeline and manholes within the sections inspected, with the following minimum data being required:

PZC 4.1 Manhole Inspection Report:

(a) Manhole number (to correspond with numbering manhole numbering indicated on the GIS as provided by the Employer's Agent:

(b) Suburb

(c) Street Name

(d) Stand Number

(e) Manhole type

(f) Manhole cover type

(g) Manhole depth from the rim to the base of the pipe

(h) Manhole benching condition

(i) Shaft condition

(j) Number and type of steps

(k) General manhole condition assessment

(l) GPS co-ordinates of vehicle position at start inspection

PZC 4.2 Sewer Pipeline Inspection Report:

(a) Pipe number

(b) Operator name

(c) Time and date

(d) Start and end manhole numbers

(e) Pipe material and type

(f) Pipe position

(g) Pipe diameter

(h) Inclinometer data

(i) Defects reported and graded to a standard acceptable to the client

(j) Lateral identification including stand numbers

(k) Digital images of all lateral connection points to the main sewer pipeline, taken with a tilted camera looking into the connection from within the main sewer pipeline where ever possible

(l) Digital images of severe and critical defects

(m) GIS representation of CCTV inspections and data

(n) End inspection data

The report must be structured in such a manner so that inspection data is grouped and presented sequentially with all information relating to a specific sewer section being grouped together for ease of reference and interpretation.

Lateral consumer connections are to be dealt with as individual pipes and will assume a unique ID. The Contractor will be responsible for the identification and numbering of these pipes. The inspection of lateral connections from the connection point on the main sewer pipeline towards the erf boundary and beyond will only be done on instruction of the Employer's Agent.

The complete sewer inspection, including the lateral consumer connection inspections must result in a "pdb" file format, being created for electronic importing of the CCTV data to PIC data and the resultant representation of the CCTV data on GIS.

Electronic media must be in the form of a CD / DVD and must include not only the pipe data, but the digital images, as well as a thematic map indicating the pipes completed in that payment period, as well as complete copies of all reports generated.

All meterage measured by the camera must be from manhole centre to manhole centre starting at zero from the centre of the start manhole. Each inspection must be registered from a manhole, ie the Contractor may not inspect from one manhole through an intermediate manhole to another manhole without entering the intermediate manhole's data.

PZC 5 CLEANING

(a) If the Contractor's camera is able to pass through a sewer line from manhole to manhole, the sewer shall be considered to be clean and it would not require cleaning.

(b) Only if the Contractor's camera is not able to pass through a specific manhole or section of sewer, and only if instructed to do so by the Employer's Agent, shall the Contractor proceed with cleaning operations of the specific manhole or sewer section in accordance with particular specification PB.

PZC 6 MEASUREMENT AND PAYMENT

PZC 6.1 Site Establishment ..... Unit: Sum

The unit of measurement for establishing site for the CCTV camera inspection crews shall be Sum.

The rate is to include for all costs involved in establishing crews to carry out the CCTV survey for the duration of the contract and shall be paid pro rata to progress.

PZC 6.2 CCTV Camera Inspections ..... Unit: m

The unit of measurement for CCTV inspection work shall be linear metre (m).

The rate is to include for all costs involved in condition assessment of the sewer pipeline, transport, equipment, labour, accommodation of personnel, logging and mapping defects and lateral consumer connections as well as condition assessment of manholes encountered along the way, all to the set standards and criteria of the specification.

Payment for camera work will be subject to the success of the camera negotiating the sewer pipeline from manhole centre to manhole centre and subject to the submitted CCTV data meeting the criteria as set out in this specification. If the Contractor's camera is not able to pass through a sewer pipeline section, payment for the CCTV inspection will be made only for the portion of sewer pipe inspected.

PZC 6.3 Lateral Connections..... Unit: No

The unit of measurement for inspections of lateral connections shall be Number (No.) and an extra over per linear metre of the consumer connections inspected.

PZC 6.4 Plugging of Sewers..... Unit: No

The unit of measurement for plugging of sewers during CCTV camera inspections shall be Number (No.) and be an extra over per linear metre of sewer pipes inspected. The rate is to include for all plant, labour and equipment associated with plugging of the sewer pipes.

PZC 6.5 Over-Pumping of Sewer Flows..... Unit: h

The unit of measurement for over-pumping of sewer flows during CCTV camera inspections shall be Hours (h) and be an extra over per linear metre of sewer pipes inspected. The rate is to include for all plant, labour and equipment.

PYA: MEMBRANE LINING OF EARTH DAMS

(Supplementary to SABS 1200 – 1986)

PYA 1 SCOPE

This specification, when read together with SANS 10125:2011 - The Installation of Flexible Membrane Linings in Earth Embankment Reservoirs, covers the requirements for the supply, and installation of a geomembrane lining to the floor and sloping sides of an earth dam or reservoir as shown on the drawings.

PYA 2 MATERIALS

PYA 2.1 Membrane Lining

The geomembrane lining material shall be High Density Polyethylene sheeting complying with the requirements of SANS 1526: 2003 (Table 1 Sheeting Type 2) unless those requirements are exceeded by the Contractor's own specification for this type and size of lining installation. In that case, the sheeting shall comply with the latter in accordance with the minimum test values and with the methods of test all as given in the Contractor's literature submitted with the successful tender and subsequently approved by the Employer's Agent.

The lining material is to be 1 mm thick and is to be supplied to site.

As the geomembrane is to be exposed to ultraviolet light during its service life, only the use of UV stabilised HDPE membranes will be permitted.

The nominal length of the sheets is to be agreed prior to commencement of manufacture. The sheet lengths shall be as long as possible and the total length of welds in the lining installation shall not exceed the minimum possible length of welds by more than 5%. If more welds have been performed due to patching than in the opinion of the Employer's Agent or his Representative is acceptable, an instruction may be given to replace excessively patched sheets with new ones at the expense of the Contractor.

Tenderers shall submit the following information with their tenders:

(a) A full specification for the proposed geomembrane.

(b) Details of the proposed joining systems to be employed, either at the factory or on site, as applicable.

(c) A programme of quality assurance and quality control which is to be implemented during the fabrication and installation stages. Preference will be given to geomembrane lining systems that require a minimum of site welding by judicious design and the use of the largest possible prefabricated panels.

PYA 2.2 Geotextile Backing

A non-woven geotextile fabric is to be installed between the geomembrane and the prepared sand surface, or above the geomembranes as a protective layer, where so shown on the drawings. The geotextile is to be joined with an overlap of at least 300 mm that is securely fastened to prevent any movement or slipping. The geotextile supplied should have unit mass at least equal to that stated in the relevant item of the Bill of Quantities and a full specification of the geotextile offered must be included with the Tender.

PYA 2.3 Colour of Membrane

The colour of the geomembrane shall be black with a black extruded weld (in the case of extrusion fusion welded sheets).

PYA 2.4 Bolts and Fasteners

All nuts, bolts and washers shall be manufactured from Grade 304 stainless steel and shall comply with the requirements of SANS 1700 or SANS 1143 as applicable.

PYA 2.5 Sand Underlayer

Sand used in the sand underlayer shall be clean fine sand with not more than 15% material passing the 0,075 mm sieve and 100% passing the 2 mm sieve. The sand shall be free of roots and vegetal matter.

PYA 3 CONSTRUCTION

PYA 3.1 Preparation of Concrete Surfaces

All surfaces to be lined shall be smooth and must adequately support the geomembrane over the whole area. Transitions must be gradual and there shall be no projections which may jeopardise the integrity of the lining. The surface to be lined must be thoroughly cleaned to be free from all loose material, oil, grease, dirt and any other chemicals which may be detrimental to the geomembrane.

PYA 3.2 Preparation of Compacted Fill Surfaces

The Contractor shall ensure that the area to be lined is free of all protrusions, stones, roots, vegetation, organic matter and other materials which may be detrimental to the performance of the lining. A maximum particle size of 3 mm shall not be exceeded. Where called for, a sand underlayer and/or geotextile layer shall be installed prior to the installation of the geomembrane.

The fill material to the slopes and floor must be compacted to at least 98% of modified AASHTO density.

Before lining commences, the surfaces shall be dry and approved by the Employer's Agent as being ready for lining.

PYA 3.3 Placing the Geotextile and Geomembrane

Care shall be taken to anchor the geotextile and geomembrane at all times against wind and against sliding down the sloping sides of the dam/reservoir.

PYA 3.4 Joining of Geomembrane Sheets

Prior to joining, the surfaces to be joined shall be thoroughly cleaned and all dust and foreign matter removed.

The geomembrane sheets shall be welded together where necessary using a technique that produces a homogeneous joint which is at least as strong as the parent material when tested in both shear and direct tension configurations.

The geomembrane shall meet all the physical and mechanical characteristics and properties as published by the supplier.

PYA 3.5 Make-Off Arrangements

The design, supply and construction/installation of all make-offs of the geomembrane around pipes and on and to the structural elements shall be the responsibility of the Contractor. The designs provided by the Employer's Agent shall be subject to approval of the material geomembrane manufacturer and the Contractor, as applicable, prior to commencement of work. Such approval must be given to the Employer's Agent in writing.

PYA 4 TOLERANCES

Before installation of the lining commences, the Contractor shall ensure that the earthworks are within the degree of accuracy specified elsewhere for such work.

PYA 5 Watertightness Tests

Unless otherwise ordered by the Employer's Agent, the lining shall be tested for watertightness in the following manner:

After the initial filling of the dam, the water level shall be monitored on a daily basis for a period of not less than 30 days. When the rate of seepage from the basin has stabilised a seven-day watertightness test shall be carried out. A floating control tank of not less than 0,5 m^2 surface area shall be provided in an area protected from waves for the purposes of determining the evaporation loss from the dam and/or the quantity of rainfall. The design of the control tank shall be submitted for approval to the Employer's Agent, who may order such changes to the design as he deems necessary.

The water level shall be recorded using a calibrated sight glass connected to the outlet pipe via a suitable pressure hose.

The maximum permissible drop in water level, after adjustment for evaporation, shall not exceed 4 mm/day over a seven-day period.

If, at the end of the test period, the permissible drop in water level is still exceeded and, in the opinion of the Employer's Agent there is no prospect of the rate of leakage reducing to that specified, the Employer's Agent will deem the structure as being not watertight.

In that case the Contractor will then be required to implement further steps (which are to be approved by the Employer's Agent) at his expense to ensure the dam does not leak faster than the maximum acceptable rate.

In the event of leakage being evident at any time during the Defects Liability Period, the Employer's Agent, before issuing the Final Certificate for the Works, may call for further rectification and testing as described above should he consider such to be necessary. No payment will be made for such additional rectification work and testing thereof.

PYA 6 GUARANTEE

The installed lining membrane and all joints in the membrane and/or any structures passing through it shall be guaranteed by the Contractor to be free from defects in material and workmanship for a period of twenty years commencing on the date of the Employer's Agent's certification of final completion of the works. In the event of remedial work being necessary (apart from those necessitated by circumstances beyond the Contractor's control), the Contractor shall be responsible for carrying out these repairs at his own cost, provided that the cost to the Contractor shall not exceed

the original cost of the lining less one-twentieth (1/20) part thereof for each year during which the guarantee has been in force.

Where the supply and installation of the lining is executed by a Subcontractor, the Subcontractor shall provide a full and separate guarantee to the Contractor (with copy to the Employer's Agent), in addition to that provided by the Contractor. The Contractor's guarantee shall be in favour of the Employer, and shall be subject to the approval of the Employer's Agent.

The Contractor shall submit draft guarantees from both himself and his sub-contractor within 4 weeks of the award of the Contract and these shall be signed and become effective within 8 weeks of the commencement date of the Contract.

PYA 7 MEASUREMENT AND PAYMENT

PYA 7.1 Place Sand Underlayer .....Unit: m²

Separate items are scheduled for each source of the sand material and where screening is required.

The rates shall include for the cost of providing the sand from excavations on site or from a commercial source as scheduled, screening where called for, placing to the specified thickness and compacting the layer with a plate compactor and smoothing the surface.

PYA 7.2 Supply and Install Geotextile .....Unit: m²

Measurement will be based on the net area of geotextile installed in accordance with the details shown on the drawings. The rate is to include allowances for overlaps at joints and all cutting and waste.

Separate items are scheduled for each type of geotextile.

PYA 7.3 Supply and Install Membrane .....Unit: m²

The basis of measurement will be the net area of geomembrane installed excluding that portion in the anchor trench at the top and bottom of the embankment as defined on the drawings. The rate is to include for the material in the anchor trenches and for all jointing required and for allowances for overlaps at joints and all cutting and waste.

No reduction of area will be made for any pipework protruding through the geomembrane. Separate items in the Bill of Quantities are included for each type, thickness and position of the geomembrane to be installed. The rate shall cover the cost of supply, delivery, installation, testing and any necessary repairs of the complete geomembrane including for surface preparation, anchoring of the geomembrane on the slopes during installation.

PYA 7.4 Make-Offs.....Unit: No or m

Separate items are scheduled for the make-offs to each type of structure and each item of pipework. The rates shall include for supplying and casting in the clamping frame and bolts, supplying and installing the gaskets and completing the work to effect a watertight make-off.

Separate payment will be made for the supply and installation of the heavy duty geomembrane and geotextile used at the make-offs, but the cost of adhesive used in attaching the geofabric structures or pipework shall be included in the rate for the make-off.

PEM: ENVIRONMENTAL MANAGEMENT SPECIFICATION

A) DEFINITIONS

For the purposes of this Specification the definitions and abbreviations given in the applicable specifications listed in 2.1 and the following definitions shall apply:

Environment means the surroundings within which humans exist and that are made up of -

i) the land, water and atmosphere of the earth;

ii) micro-organisms, plant and animal life;

iii) any part or combination of i) and ii) and the interrelationships among and between them; and

iv) the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

Potentially hazardous substance is a substance that, in the reasonable opinion of the Engineer, can have a deleterious effect on the environment.

Method Statement: a written submission by the Contractor to the Engineer in response to the Specification or a request by the Engineer, setting out the plant, materials, labour and method the Contractor proposes using to carry out an activity, identified by the relevant specification or the Engineer when requesting the Method Statement, in such detail that the Engineer is enabled to assess whether the Contractor's proposal is in accordance with the Specifications and/or will produce results in accordance with the Specifications.

The Method Statement shall cover applicable details with regard to:

- construction procedures,
- materials and equipment to be used,
- getting the equipment to and from site,
- how the equipment/ material will be moved while on site,
- how and where material will be stored,
- the containment (or action to be taken if containment is not possible) of leaks or spills of any liquid or material that may occur,
- timing and location of activities,
- compliance/ non-compliance with the Specifications and
- any other information deemed necessary by the Engineer.

Reasonable means, unless the context indicates otherwise, reasonable in the opinion of the Engineer after he has consulted with a person, not an employee of the Employer, suitably experienced in "environmental implementation plans" and "environmental management plans" (both as defined in Act No 107,1998).

Solid waste means all solid waste, including construction debris, chemical waste, excess cement/ concrete, wrapping materials, timber, tins and cans, drums, wire, nails, food and domestic waste (e.g. plastic packets and wrappers).

Contract means the General Conditions of Contract and Special Conditions, Specifications, Drawings, Tender, written records of matters agreed after the submission of the Contractor's tender, Letter of Acceptance and Agreement, together with other documents which the parties have agreed in writing shall form part of the Contract and such amendments or additions to the Contract as may be agreed in writing between the parties.

Contaminated water means water contaminated by the Contractor's activities, *e.g.* concrete water and runoff from plant/ personnel wash areas.

B) MATERIALS

Materials Handling, Use and Storage

The Contractor shall ensure that any delivery drivers are informed of all procedures and restrictions (including "no go" areas) required to comply with the Specifications. The Contractor shall ensure that these delivery drivers are supervised during off loading, by someone with an adequate understanding of the requirements of the Specifications.

Materials shall be appropriately secured to ensure safe passage between destinations. Loads including, but not limited to sand, fine vegetation, refuse, paper and cement, shall have appropriate cover to prevent them spilling from the vehicle during transit. The Contractor shall be responsible for any clean-up resulting from the failure by his employees or suppliers to properly secure transported materials.

All manufactured and/ or imported material shall be stored within the Contractor's camp, and, if so required by the Project Specification, out of the rain. All lay down areas outside of the construction camp shall be subject to the Engineer's approval, which shall not unreasonably be withheld.

Hazardous Substances

Hazardous chemical substances (as defined in the Regulations for Hazardous Chemical Substances) used during construction shall be stored in secondary containers. The relevant Material Safety Data Sheets (MSDS) shall be available on Site. Procedures detailed in the MSDS's shall be followed in the event of an emergency situation.

Hazardous and non-hazardous materials shall be separated at site and disposed of in a manner approved by the Engineer.

Sludge is regarded as a hazardous substance and shall be disposed of into the primary sludge sump at a controlled rate so as not to overload the sump and pumping systems.

C) CONSTRUCTION

Method Statements

Any Method Statement required by the Engineer or the Project Specification shall be produced within such reasonable time as the Engineer shall specify or as required by the Project Specification. The Contractor shall not commence the activity until the Method Statement has been approved and shall, except in the case of emergency activities, allow a period of two weeks for approval of the Method Statement by the Engineer. Such approval shall not unreasonably be withheld.

The Engineer may require changes to a Method Statement if the proposal does not comply with the specification or if, in the reasonable opinion of the Engineer, the proposal may result in, or carries a greater than reasonable risk of, damage to the environment in excess of that permitted by the Specifications.

Approved Method Statements shall be readily available on the site and shall be communicated to all relevant personnel. The Contractor shall carry out the Works in accordance with the approved Method Statement.

Approval of the Method Statement shall not absolve the Contractor from any of his obligations or responsibilities in terms of the Contract.

Site Division

The Contractor shall restrict all his activities, materials, equipment and personnel to within the designated areas as specified by the engineer.

Site Structures

All site establishment components (as well as equipment) shall be positioned to limit visual intrusion on neighbours and the size of area disturbed. The type and colour of roofing and cladding materials to the Contractor's temporary structures shall be selected to reduce reflection.

Security

The contractor’s camp areas shall be fenced with a minimum 1.8 metre high secure fence for the duration of the construction period.

Security guards shall control access to camp areas and to vehicular access routes to the construction site at all times during the construction phase.

Fences shall be checked regularly for breaches and be repaired as necessary.

Strict stock control systems shall be enforced in storage areas, particularly where chemicals, explosives and other potentially dangerous materials are being stored. Checking of stock quantities shall be undertaken immediately prior to contract progress meetings and findings shall be reported at the meetings.

Transportation of Labour

Labour should be transported to and from the site in vehicles, where possible, arranged by the Contractor to discourage loitering in adjacent areas and possible increase in crime or disturbance. Unsocial activities such as unauthorised consumption or illegal selling of alcohol on the site shall be banned and any persons found to be engaged in such activities shall be removed from site for the duration of the contract and may have criminal action taken against them.

Informal Settlements

No labour other than essential personnel required for stand-by situations and security shall be housed on the site. Measures shall be put in place, in consultation with the local authority, to prevent squatting on the site and in areas immediately adjacent to the site.

Lighting

The placement of light sources within the construction site and camp areas must be carefully planned so as to avoid causing a nuisance to residents.

Eating Areas

The Contractor shall designate an eating area for his employees. The Contractor shall provide bins with lids in this area. The waste may be temporarily stored on Site in a central waste area that is weatherproof and scavenger-proof, and which the Engineer has approved.

Any cooking on Site shall be done on well-maintained gas cookers with fire extinguishers present.

Ablution Facilities

Washing, whether of the person or of personal effects and acts of excretion and urination are strictly prohibited other than at the facilities provided.

The Contractor shall ensure that no spillage occurs when the toilets are cleaned or emptied and that the contents are properly stored and removed from Site. Discharge of waste from toilets into the environment or works, and burial of waste is strictly prohibited.

Lights

The Contractor shall ensure that any lighting installed on the site for his activities does not interfere with road traffic or cause a reasonably avoidable disturbance to the surrounding community or other users of the area.

"No go" Areas

If so required by the Project Specification, certain areas shall be "no go" areas. The Contractor shall ensure that, insofar as he has the authority, no person, machinery, equipment or material enters the "no go" areas at any time.

Solid Waste Management

No on-site burying or dumping of any waste materials, vegetation, litter or refuse shall occur. The Contractor shall provide sufficient bins with lids on Site to store the solid waste produced on a daily basis. Bins shall not be allowed to become overfull and shall be emptied a minimum of once daily. The waste may be temporarily stored on Site in a central waste area that is weatherproof and scavenger-proof, and which the Engineer has approved.

All solid waste shall be disposed of off-site at a registered landfill site. The Contractor shall supply the Engineer with a certificate of disposal.

Emergency Procedures

The Contractor's procedures for the following emergencies shall include:

i) Fire

The Contractor shall advise the relevant authority of a fire as soon as one starts and shall not wait until he can no longer control it. The Contractor shall ensure that his employees are aware of the procedure to be followed in the event of a fire.

ii) Accidental leaks and spillages

The Contractor shall ensure that his employees are aware of the procedure to be followed for dealing with spills and leaks, which shall include notifying the Engineer and the relevant authorities. The Contractor shall ensure that the necessary materials and equipment for dealing with spills and leaks is available on Site at all times. Treatment and remediation of the spill areas shall be undertaken to the reasonable satisfaction of the Engineer.

In the event of a hydrocarbon spill, the source of the spillage shall be isolated, and the spillage contained. The area shall be cordoned off and secured. The Contractor shall ensure that there is always a supply of absorbent material readily available to absorb/ breakdown and where possible be designed to encapsulate minor hydrocarbon spillage. The quantity of such materials shall be able to handle a minimum of 200 ℓ of hydrocarbon liquid spill.

Fire Control

No fires may be lit on site. Any fires that occur shall be reported to the Engineer immediately.

Smoking shall only be allowed in designated smoking areas. Smoking shall not be permitted in those areas where it is a fire hazard. Such areas shall include the workshop and fuel storage areas, close proximity to sludge digesters and any areas where the vegetation or other material is such as to make liable the rapid spread of an initial flame. In terms of the Atmospheric Pollution Prevention Act (No. 45 of 1965), burning is not permitted as a disposal method.

The Contractor shall appoint a Fire Officer who shall be responsible for ensuring immediate and appropriate actions in the event of a fire and shall ensure that employees are aware of the procedure to be followed. The Contractor shall forward the name of the Fire Officer to the Engineer for his approval.

The Contractor shall ensure that there is basic fire-fighting equipment available on Site at all times. This shall include at least rubber beaters and at least one fire extinguisher of the appropriate type when welding or other “hot” activities are undertaken.

Noise

The Contractor shall limit noise levels (e.g. install and maintain silencers on machinery). The provisions of SABS 1200A Subclause 4.1 regarding "built-up areas" shall apply to all areas within audible distance of residents whether in urban, peri-urban or rural areas.

Appropriate directional and intensity settings are to be maintained on all hooters and sirens.

No amplified music shall be allowed on Site. The use of radios, tape recorders, compact disc players, television sets etc shall not be permitted unless the volume is kept sufficiently low as to avoid any intrusion on members of the public within range. The Contractor shall not use sound amplification equipment on Site unless in emergency situations.

Construction activities generating output levels of 85 dB (A) or more, in residential areas, shall be confined to the hour’s 08h00 to 17h00 Mondays to Fridays.

Blasting, pneumatic rock drills or other noisy activities should take place during normal working hours. The community should be notified prior to any planned activities that will be unusually noisy. These activities could include, but are not limited to, blasting and the use of pneumatic rock drills.

Noise suppression measures must be applied to all construction equipment. Construction equipment must be kept in good working order, and where appropriate fitted with silencers which are to be kept in good working order. Should the vehicles or equipment not be in good working order, the Contractor may be instructed to remove the offending vehicle or machinery from site.

Should complaints regarding noise levels be received, as a result of construction activities on the site, these shall be recorded by the ELO, and if the associated operation is programmed to occur over an extended period of longer than two days, then the offending machinery or vehicle shall be identified and remedial measures implemented.

The Contractor shall take measures to discourage labourers from loitering in the area and causing noise disturbance. Where possible labour shall be transported to and from the site by the Contractor or his Sub Contractors by the Contractors own transport.

Access Routes/ Haul Roads

On the Site, and, if so required by the Project Specification, within such distance of the Site as may be stated, the Contractor shall control the movement of all vehicles and plant including that of his suppliers so that they remain on designated routes, are distributed so as not to cause an undue concentration of traffic and that all relevant laws are complied with. In addition such vehicles and plant shall be so routed and operated as to minimise disruption to regular users of the routes not on the Site. On and within 500m of the Site, the vehicles of the Contractor and his suppliers shall not exceed a speed of 45 km/hr.

Safety

Telephone numbers of emergency services, including the local firefighting service, shall be posted conspicuously in the Contractor's office near the telephone.

No firearms are permitted on Site.

Protection of Natural Features

The Contractor shall not deface, paint, damage or mark any natural features (e.g. rock formations) situated in or around the Site for survey or other purposes unless agreed beforehand with the Engineer. Any features affected by the Contractor in contravention of this clause shall be restored/ rehabilitated to the satisfaction of the Engineer.

Within 500m of the Site the Contractor shall not permit his employees to make use of any natural water sources (e.g. springs, streams, open water bodies) for the purposes of swimming, personal washing and the washing of machinery or clothes.

Protection of Flora and Fauna

Except to the extent necessary for the carrying out of the Works, flora shall not be removed, damaged or disturbed nor shall any vegetation be planted without authorisation.

Trapping, poisoning and/ or shooting of animals is strictly prohibited. No domestic pets or livestock are permitted on Site.

Where the use of herbicides, pesticides and other poisonous substances has been specified, they shall be stored, handled and applied with due regard to their potential harmful effects.

The Contractor will follow previously mentioned management guidelines Section 3.1.4 regarding the avoidance of soil degradation.

Construction and delivery vehicles shall only use established roads when transporting items to/from site.

The contractor shall be limited to a maximum working corridor of 5 metres wide through areas of crop, grassland and areas of indigenous vegetation.

The Engineer may instruct that any ecologically valuable plant species, found on site and likely to be disturbed by construction operations shall be removed by suitably qualified personnel (horticulturist) to a location within the alignment area to be instructed by the Engineer.

No plants or animals will be allowed to be caught, collected and consumed on site or removed from site by the Contractor or his personnel or sub-contractors. Any individual caught collecting plant or animal species shall be removed from the site for the duration of the contract and criminal proceedings may be pursued.

The Main Contractor shall be held responsible for all infringements of this condition and a penalty of R1000.00 shall be charged for each infringement. An infringement shall be deemed to have occurred for each trap found, each person caught hunting, each animal caught and each plant harvested.

Fires and collection of firewood will not be permitted on or adjacent to site.

Sanitation and Ablution Facilities

Adequate sanitation and ablution facilities must be provided for construction workers to avoid the use of the open space and water courses as toilets or washing facilities. Toilets and ablution facilities shall be connected to the municipal sewer, as far as possible. Chemical latrines, if used, shall be emptied regularly by a responsible contractor with knowledge of proper sanitation disposal procedures.

In addition, food preparation areas shall be provided with adequate washing facilities and food refuse shall be stored in sealed refuse bins which shall be removed from site at least twice weekly, to prevent the attraction of vermin.

The Contractor shall take steps to ensure that littering by construction workers does not occur and persons shall be employed on the site to collect litter from the site and immediate surroundings.

Skip waste containers shall be maintained on site. These shall be kept covered and arrangements made for them to be collected regularly from site by an appropriate contractor.

Storage of Materials

The Contractor will maintain storage of all potentially polluting materials, and shall undertake potentially polluting operations as far away as practically possible from areas of indigenous vegetation, topsoil/subsoil stockpiles and watercourses. The Contractor will ensure that additional supervisory time is spent to monitor such works. Such materials/operations include (but are not limited to):

- batching, storing of cement, concrete and mortar;
- petrol, oil and chemical storage and transfer;
- washing, ablution and toilet facilities;
- plant storage

All oils and lubricants which are unopened shall be stored in the workshop store on site. Used oils/lubricants will be put into drums and recycled. The Main Contractor will be responsible for ensuring that these used oils/lubricants are not disposed of by dumping pouring on open ground or down drains or in water courses. The main contractor shall ensure that contractors purchasing these materials understand the liability under which they must operate. The Environmental Liaison Officer will be responsible for reporting the storage/use of any other potentially harmful materials to DWAF.

The Environmental Liaison Officer will be responsible for ensuring that potentially harmful materials are properly stored in a dry, secure environment, with concrete or sealed flooring and a means of preventing unauthorized entry. The Environmental Liaison Officer will further ensure that materials storage facilities are cleaned/maintained on a regular basis, and that leaking containers are disposed of in a manner which allows no spillage onto the bare soil. The management of such storage facilities and means of securing them shall be agreed.

No washing of construction vehicles and plant will be allowed on site other than wheel washing. No detergents or chemicals will be used for wheel washing.

Machinery and plant shall keep as far away from watercourses as possible. No washing of vehicles/ plant in natural watercourses shall be allowed.

Aesthetics

The Contractor shall take reasonable measures to ensure that construction activities do not have an unreasonable impact on the aesthetics of the area.

Community Relations

If so required by the Project Specification, the Contractor shall erect and maintain information boards in the position, quantity, design and dimensions specified. Such boards shall include contact details for complaints by members of the public in accordance with details provided by the Engineer.

The Contractor shall keep a "Complaints Register" on Site. The Register shall contain all contact details of the person who made the complaint, and information regarding the complaint itself.

Unskilled and semi-skilled labour should be recruited from the local communities. Recruitment will take place through formal procurement procedure that includes a positive policy towards the employment of members of previously disadvantaged communities.

Where appropriate, the contractor will undertake training of unskilled and semi-skilled labour.

Where appropriate, labour intensive construction methods should be utilised to maximise the potential number of employment opportunities.

No selling or consuming of alcohol shall be permitted on site and any person found importing alcohol, drugs or illegal substances, shall be removed from the site for the duration of the contract and criminal action may be taken.

Temporary site closure

If the Site is closed for a period exceeding one week, the Contractor in consultation with the Engineer shall carry out the checklist procedure required by the Project Specification.

D) PLANT

Fuel (petrol and diesel) and Oil

Fuel may be stored on site and the fuel storage area shall be located at the workshop or a fuel storage depot located within the construction camp. The Contractor shall ensure that all liquid fuels (petrol and diesel) are stored in tanks with lids, which are kept firmly shut or in bowsers. The tanks/ bowsers shall be situated on a smooth impermeable surface (plastic or concrete) base with an earth bund (plastic must have sand on top to prevent damage and perishing). The impermeable lining shall extend to the crest of the bund and the volume inside the bund shall be 110% of the total capacity of all the storage tanks/ bowsers. The bunded area shall be covered.

Only empty and externally clean tanks may be stored on the bare ground. All empty and externally dirty tanks shall be stored on an area where the ground has been protected. If fuel is dispensed from 200 litre drums, the proper dispensing equipment shall be used, and the drum shall not be tipped in order to dispense fuel. The dispensing mechanism of the fuel storage tank shall be stored in a waterproof container when not in use.

The Contractor shall prevent unauthorised access into the fuel storage area. No smoking shall be allowed within the vicinity of the fuel storage area. The Contractor shall ensure that there is adequate fire-fighting equipment at the fuel stores.

Where reasonably practical, plant shall be refuelled at the depot or at the workshop as applicable. If it is not reasonably practical then the surface under the refuelling area shall be protected against pollution to the reasonable satisfaction of the Engineer prior to any refuelling activities. The Contractor shall ensure that there is always a supply of absorbent material readily available to absorb/breakdown and where possible be designed to encapsulate minor hydrocarbon spillage. The quantity of such materials shall be able to handle a minimum of 200ℓ of hydrocarbon liquid spill. This material must be approved by the Engineer prior to any refuelling or maintenance activities.

Contaminated Water

The Contractor shall set up a contaminated water management system, which shall include collection facilities to be used to prevent pollution, as well as suitable methods of disposal of contaminated water.

The Contractor shall prevent discharge water contaminated with any pollutants, such as cements, concrete, lime, chemicals and fuels, into the works or into any drainage line, stream, river or other wetland. The Contractor shall not discharge the water used in cleaning the equipment into the works.

The Engineer's approval will be required prior to the discharge of contaminated water to a Municipal sewer system.

The Contractor shall notify the Engineer immediately of any pollution incidents on Site.

Grout Batching Area

Grout shall be mixed in the proper plant. All cement-contaminated water resulting from batching of grout shall be disposed of via the wastewater management system, and shall not be discharged into a water course.

Workshop, Equipment Maintenance and Storage

Where practical, all maintenance of equipment and vehicles on Site shall be performed in the workshop. If it is necessary to do maintenance outside of the workshop area, the Contractor shall obtain the approval of the Engineer prior to commencing activities.

The Contractor shall ensure that in his workshop and other plant maintenance facilities, including those areas where, after obtaining the Engineer's approval, the Contractor carries out emergency plant maintenance, there is no contamination of the soil or vegetation. The workshop shall have a smooth impermeable (concrete or thick plastic covered with sand) floor. The floor shall be bunded and sloped towards an oil trap or sump to contain any spillages of substances (e.g. oil). When servicing equipment, drip trays shall be used to collect the waste oil and other lubricants. Drip trays shall also be provided in construction areas for stationary plant (such as compressors) and for "parked" plant (such as scrapers, loaders, vehicles).

All vehicles and equipment shall be kept in good working order and serviced regularly. Leaking equipment shall be repaired immediately or removed from the Site. When servicing or refuelling equipment, drip trays shall be used to collect the waste oil and other lubricants.

The washing of equipment shall be restricted to urgent or preventative maintenance requirements only. All washing shall be undertaken in the workshop or maintenance areas, and these areas must be equipped with a suitable impermeable floor and sump/oil trap. The use of detergents for washing shall be restricted to low phosphate and nitrate containing, low sudsing-type detergents.

Dust

The Contractor shall take all reasonable measures to minimise the generation of dust as a result of construction activities to the satisfaction of the Engineer. Appropriate dust suppression measures, e.g. dampening with water, shall be used when dust generation is unavoidable, particularly during prolonged periods of dry weather in summer.

During high wind conditions, the Contractor shall comply with the Engineer instructions regarding dust-damping measures. The Engineer may request the temporary cessation of all construction activities were wind speeds are unacceptably high, and until such time as wind speeds return to acceptable levels.

The Contractor will dampen all exposed soil surfaces including; access roads, works areas and camp areas with a water bowser or sprinklers, as necessary to minimise dust problems. Mitigation will be especially significant during extended dry periods or due to particular operations such as soil stripping, blasting or excavation at which times damping down shall take place on a continual basis.

The Contractor will commence rehabilitation of exposed soil surfaces as soon as practical after completion of earthworks. This includes the grassing of any cut and fill soil slopes immediately on completion of earthworks.

The regular maintenance of plant and machinery will be undertaken to ensure that gaseous emissions are minimised. The Contractor shall ensure that his Sub Contractors comply with this condition. Any offending machinery or plant may be instructed to be removed from site.

Cooking will only be permitted in designated areas by approved vendors. Only gas operated cookers will be permitted. All food preparation areas shall be operated to hygienic standards and shall be regularly inspected by the Environmental Liaison Officer.
The Contractor must further ensure that any grass or weed vegetation left in a natural state and adjacent to cooking areas shall be cut to prevent fires, especially during the dry months.

Blasting shall be carried out in accordance with legislation using optimal and not excessive quantities of explosives. The manufacturers recommended mitigation measures shall be applied, such as blankets and watering down of surfaces. Blasting shall only occur on calm days. All explosive material, if retained on site, shall be stored in a secure and separately designated area. If any rock removal is found to be necessary within 500 metres of any existing buildings, alternative methods of rock removal shall be considered.

Existing vegetation will assist in screening the site, control dust and help prevent soil erosion.

Areas of indigenous vegetation shall be fenced off during construction as instructed by the engineer.

All existing vegetation on and adjacent to the pipe alignment shall be retained.

Should it become necessary to undertake bush clearance, all areas of clearance and removal of individual trees shall only be undertaken after approval by the engineer, who shall inspect the area of proposed clearance with the ECO. Should the contractor not comply with this condition a penalty of R1000.00 shall be imposed on him for each area of shrub / herbaceous vegetation or each individual tree removed without approval. The contractor shall also be responsible for immediate rehabilitation of the area affected to the satisfaction of the engineer and at his own cost.

E) FINES FOR NON COMPLIANCE WITH THIS ENVIRONMENTAL MANAGEMENT PLAN.

Fines will be issued for the transgressions listed below. Fines may be issued per incident at the discretion of the Engineer. Such fines will be issued in addition to any remedial costs incurred as a result of non-compliance with the environmental specifications. The Engineer will inform the Contractor of the contravention and the amount of the fine, and will deduct the amount from monies due under the Contract.

Fines for the activities detailed below, will be imposed by the Engineer on the Contractor and/or his Sub-contractors.

a.	Any employee's, vehicles, plant, or thing related to the Contractors operations operating within the designated boundaries of a "no-go" area.	R	5 000
b.	Any vehicle driving in excess of designated speed limits.	R	1 000
c.	Employees walking, any vehicle being driven, and items of plant or materials being parked or stored outside the demarcated boundaries of the site.	R	2 000
d.	Persistent and un-repaired oil leaks from machinery.	R	3 000
e.	Persistent failure to monitor and empty drip trays timeously.	R	1 000
f.	The use of inappropriate methods for refuelling.	R	1 000
g.	Litter on site associated with construction activities.	R	1 000
h.	Deliberate lighting of illegal fires on site.	R	5 000
i.	Any employee eating meals on site, outside of the defined eating area.	R	1 000
j.	Employees not making use of the site ablution facilities.	R	1 000
k.	Failure to implement specified noise controls.	R	1 000
l.	Failure to empty waste bins on a regular basis.	R	1 000
m.	Inadequate dust control.	R	3 000
n.	A spillage, pollution, fire or any damage to on-site flora or any wetland or river resulting from negligence on the part of the Contractor.	R	10 000
o.	The use of inappropriate handling and disposal methods for the sludge and effluent.	R	5 000
p.	An individual littering on the site	R	20
q.	An individual making an illegal fire on site	R	200
r.	An individual performing an ablution anywhere other than in a toilet	R	20
s.	An individual eating a meal outside of the defined eating area	R	20

For each subsequent similar offence the fine shall be doubled in value to a maximum value of R30,000.

The Engineer shall be the judge as to what constitutes a transgression in terms of this clause, subject to the provisions of Clause 60(1) of the General Conditions of Contract. In the event that transgressions continue the Contractors attention is drawn to the provisions of Sub-clause 58(1)(b)(vi) of the General Conditions of Contract under which the Engineer may cancel the Contract.

F) ENVIRONMENTAL MANAGEMENT COMPLIANCE

Environmental Officers

The Contractor shall appoint an Environmental Liaison Officer (ELO) for the duration of the construction period. The ELO shall be a senior member of the construction team and have overall environmental management responsibilities on the site.

The ELO is to monitor the activities of the Main Contractor and any subcontractors, and is to ensure that mitigation measures contained in this document are adhered to. The ELO is to liaise with the Environmental Control Officer (ECO) on a regular basis so as to inform the ECO of the adherence to and effectiveness of the prescribed management measures. The ECO shall be appointed the Employer. Any new, or amendments to existing, mitigation measures to address areas of concern notified by the ECO are to be acted on as necessary by the Contractor.

EMP Compliance Monitoring and Audits

The Environmental Liaison Officer will conduct regular monitoring of the Construction Phase to ensure compliance with this EMP and keep records of such monitoring. The results of this monitoring will be reported to the Contractor, the Employer, the Engineer and the ECO in the form of a compliance monitoring report which must be submitted monthly during the Construction Phase. The ELO shall also keep records of non-compliance and how this was rectified, and this must be reported to the Contractor, the Employer, the Engineer, the ECO and the Environmental Committee in order that they can follow up if necessary.

Environmental Audits will be undertaken by the ECO and the ELO on a monthly basis during the Construction Phase. The results of these audits will be included in EMP Compliance Reports to be submitted to the Department of Agriculture and Environmental Affairs (DAEA). DAEA, through their Inspectorate will also be involved in monitoring procedures as necessary.

EMP Compliance

The EMP will be considered an extension of the Conditions of Approval as set forth by DAEA. Non-compliance with the EMP will constitute non-compliance with said Conditions.

The EMP will be made binding on all contractors operating on the site and will be included within the Contractual Clauses. According to the DAEA Standard Conditions for EIA Approval, non-compliance with, or any deviation from, the conditions set out in the document constitutes a failure in compliance with the approval. Such failure in compliance will be dealt with in terms of Sections 29, 30, and 31 of the Environment Conservation Act (Act No. 73 of 1989), as well as any other appropriate legal mechanisms.

It should be noted that in terms of the Environment Conservation Act, those responsible for Environmental Damage (in this case the Contractor) must pay the repair costs both to the environment and human health and the preventative measures to reduce or prevent further pollution and / or environmental damage (The polluter pays principle).

Tolerances

Environmental management is concerned not only with the final results of the Contractor's operations to carry out the Works but also with the control of how those operations are carried out. Tolerance with respect to environmental matters applies not only to the finished product but also to the standard of the day-to-day operations required to complete the Works.

It is thus required that the Contractor shall comply with the environmental requirements on an ongoing basis and any failure on his part to do so will entitle the Engineer to certify the imposition of a fine subject to the conditions in the Pro Forma: Protection of the Environment and the details set out in the Project Specification.

ENVIRONMENTAL PROTECTION DECLARATION

Employer : ERWAT
Contract No : ERW202009/TNDR-002

UPGRADE/ REFURBISHMENT OF BIOFILTER MODULE (3) AT OLIFANTSFONTEIN WATER CARE WORKS (WWCW): PHASE 1C

The Contractor will not be given right of access to the Site until this form has been signed

I/ we,.....{Contractor} record as follows:

1. I/ we, the undersigned, do hereby declare that I/ we am/ are aware of the increasing requirement by society that construction activities shall be carried out with due regard to their impact on the environment.

2. In view of this requirement of society and a corresponding requirement by the Employer with regard to this Contract, I/ we will, in addition to complying with the letter of the terms of the Contract dealing with protection of the environment, also take into consideration the spirit of such requirements and will, in selecting appropriate employees, plant, materials and methods of construction, in-so-far as I/ we have the choice, include in the analysis not only the technical and economic (both financial and with regard to time) aspects but also the impact on the environment of the options. In this regard, I/ we recognised and accept the need to a Tender by the “precautionary principle” which aims to ensure the protection of the environment by the adoption of the most environmentally sensitive construction approach in the face of uncertainty with regard to the environmental implications of construction.

3. I/ we acknowledge and accept the right of the Employer to deduct, should he so wish, from any amounts due to me/ us, such amounts (hereinafter referred to as fines) as the Engineer shall certify as being warranted in view of my/ our failure to comply with the terms of the Contract dealing with protection of the environment, subject to the following:

Pro-forma

3.1 The Engineer may impose such fine only –

3.1.1 if he is reasonably satisfied of my/ our failure to comply with the terms of the Contract dealing with protection of the environment
3.1.2 if he is reasonably satisfied that it is necessary to impose such fine in order to achieve future compliance
3.1.3 after he has consulted with a person suitably experienced in "environmental implementation plans" and "environmental management plans" (both as defined in Act No 107,1998) as to whether there has been a failure to comply with a terms of the Contract dealing with protection of the environment and as to a reasonable amount of the fine.

3.2 The Engineer, in determining the amount of such fine, shall take into account *inter alia*, the nature of the offence, the seriousness of its impact on the environment, the degree of prior compliance/non-compliance, the extent of the Contractor's overall compliance with environmental protection requirements and, in particular, the extent to which he considers it necessary to impose a sanction in order to eliminate/reduce future occurrences

3.3 The Engineer shall, with respect to any fine imposed, provide me/ us with a written statement giving details of the offence, the facts on which the Engineer has based his assessment and the terms of the Contract (by reference to the specific clause) which has been contravened.

3.4 At the sole discretion of the Engineer, the Engineer may at any time before one month after the issue of the Certificate of Completion (for the last completed portion of the Works should there be more than one), reverse all or some, in whole or in part, of previously imposed fine and shall include such reversed payment in a subsequent Payment Certificate.

3.5 The sum total of all fines retained by the Employer after the processing of any Payment Certificate issued up to one month after the issue of the Certificate of Completion referred to above, shall, within one month be paid by the Employer to a charity mutually agreed upon by the Contractor and the Employer, failing which agreement, as determined by the Engineer following consultation with the two parties.

Signed ..... Date.....
CONTRACTOR

Witnesses:

……

……

C3.9: LIST OF TENDER DRAWINGS

The drawings listed below are attached in order to give an overview of the project. Any ambiguities shall be clarified by the Tenderer with the Engineer prior to the submission of Tenders.

The drawings that form part of the tender documents shall be used for tender purposes only.

Drawing Number	Description
MD4696-RHD-CZ-SR-DR-CX-2000	General Layout
MD4696-RHD-CZ-SR-DR-CX-2001	Pipe Replacement Layout Plan
MD4696-RHD-CZ-SR-DR-CX-2002	New Construction Layout Plan
MD4696-RHD-CZ-SR-DR-CX-2006	Biofilter Recycle Pump Station
MD4696-RHD-PF-TH3-DR-CX-2012	Humus Effluent Rising Main Plan and Long Section
MD4696-RHD-PF-TH3-DR-CX-2013	Humus Sludge Recycle Rising Main Plan and Long Section Sheet 1
MD4696-RHD-PL-TH3-DR-CX-2014	Humus Sludge Recycle Rising Main plan and Long Section Sheet 2
MD4696-RHD-PL-TS3-DR-CX-2017	Old Digester Pump Station Rising Main (Sheet 1)
MD4696-RHD-PL-DA-DR-CX-2018	Old Digester Rising Main 1 Pipe Replacement Plan and Long Section (Sheet 2)
MD4696-RHD-PL-DA-DR-CX-2019	Old Digester Rising Main 2 Pipe Replacement Plan and Long Section
MD4696-RHD-PL-DA-DR-CX-2020	Old Digester Rising Main 3 Pipe Replacement Plan and Long Section
MD4696-RHD-PF-TS3-DR-CX-2052	DPST Feed Pipe 1 Plan and Long Section
MD4696-RHD-PF-TS3-DR-CX-2053	DPST Feed Pipe 2 Plan and Long Section
MD4696-RHD-PF-TS3-DR-CX-2054	DPST Feed Pipe 3 Plan and Long Section
MD4696-RHD-PF-TS3-DR-CX-2055	DPST Feed Pipe 4 Plan and Long Section
MD4696-RHD-PF-TS3-DR-CX-2056	DPST Feed Pipe 5 Plan and Long Section
MD4696-RHD-PF-TS3-DR-CX-2057	DPST Feed Pipe 6 Plan and Long Section
MD4696-RHD-PF-BF3-DR-CX-2059	Siphon Box Feed Pipe 1 Plan and Long Section
MD4696-RHD-PF-BF3-DR-CX-2060	Siphon Box Feed Pipe 2 Plan and Long Section
MD4696-RHD-PF-BF3-DR-CX-2061	Siphon Box Feed Pipe 3 Plan and Long Section
MD4696-RHD-PF-BF3-DR-CX-2062	Biofilter Feed Pipe 1 Plan and Long Section
MD4696-RHD-PF-BF3-DR-CX-2063	Biofilter Feed Pipe 2 Plan and Long Section
MD4696-RHD-PF-BF3-DR-CX-2064	Biofilter Feed Pipe 3 Plan and Long Section
MD4696-RHD-PF-BF3-DR-CX-2065	Biofilter Feed Pipe 4 Plan and Long Section
MD4696-RHD-PF-BF3-DR-CX-2066	Biofilter Feed Pipe 5 Plan and Long Section
MD4696-RHD-PF-BF3-DR-CX-2067	Biofilter Feed Pipe 6 Plan and Long Section

Drawing Number	Description
MD4696-RHD-PF-TH3-DR-CX-2068	Humus Tank Feed Pipe 1 Plan and Long Section
MD4696-RHD-PF-TH3-DR-CX-2069	Humus Tank Feed Pipe 2 Plan and Long Section
MD4696-RHD-PF-TH3-DR-CX-2070	Humus Tank Feed Pipe 3 Plan and Long Section
MD4696-RHD-PF-TH3-DR-CX-2071	Humus Tank Feed Pipe 4 Plan and Long Section
MD4696-RHD-PF-TH3-DR-CX-2072	Humus Tank Feed Pipe 5 Plan and Long Section
MD4696-RHD-PF-TH3-DR-CX-2073	Humus Tank Feed Pipe 6 Plan and Long Section
MD4696-RHD-PL-TS3-DR-CX-2074	DPST Sludge Pipe 1 Replacement
MD4696-RHD-PL-TS3-DR-CX-2075	DPST Sludge Pipe 2 Replacement
MD4696-RHD-PL-TH3-DR-CX-2076	Humus Sludge Pipe 1
MD4696-RHD-PL-TH3-DR-CX-2077	Humus Sludge Pipe 2
MD4696-RHD-PF-TH3-DR-CX-2078	Humus Effluent Pipe 1 and 2
MD4696-RHD-SC-TS3-DR-CX-2104	Flowmeter Chamber
MD4696-RHD-SC-TS3-DR-CX-2107	Open Grid Support
MD4696-RHD-SC-TS3-DR-CX-2108	Structural Support
MD4696-RHD-SC-TS3-DR-CX-2301	Subsoil Drainage
MD4696-RHD-SC-TS3-DR-CX-3010	Flowmeter Roof Steel
MD4696-RHD-SC-TS3-DR-CX-3011	Flowmeter Roof Steel
MD4696-RHD-SC-TS3-DR-CX-3012	Flowmeter Roof Steel
MD4696-RHD-SC-BF3-DR-CX-2150	Connection Box at Existing Post Biofilter Channel For Biofilter Recycle Pump Station
MD4696-RHD-SC-BF3-DR-CX-2155	New Connection to Siphon Splitter Box
MD4696-RHD-SC-BF3-DR-CX-2156	Biolfilter Recycle Pump Rising Main Meter Chamber
MD4696-RHD-SC-TH3-DR-CX-2157	Humus Sludge Rising Main Meter Chamber
MD4696-RHD-SC-TH3-DR-CX-2158	Old Digester Pump Station Rising Main Meter Chamber
MD4696-RHD-PS-BF3-DR-MX-5000	Biofilter Recycle Pump Station Pipework (Sheet 1 of 2)
MD4696-RHD-PS-BF3-DR-MX-5001	Biofilter Recycle Pump Station Pipe Schedule (Sheet 2 of 2)
MD4696-RHD-PS-DA-DR-MX-5002	Digester Pump Station Pipework (Sheet 1 of 2)
MD4696-RHD-PS-DA-DR-MX-5003	Digester Pump Station Pipe Schedule (Sheet 2 of 2)
MD4696-RHD-PS-CF3-DR-MX-5004	RAS Pump Station Pipework (Sheet 1 of 2)
MD4696-RHD-PS-CF3-DR-MX-5005	RAS Pump Station Pipe Schedule (Sheet 1 of 2)
MD4696-RHD-PS-TH3-DR-MX-5006	Humus Pump Station Pipework (Sheet 1 of 2)
MD4696-RHD-PS-TH3-DR-MX-5007	Humus Pump Station Pipe Schedule (Sheet 1 of 2)
MD4696-RHD-PS-TS3-DR-MX-5008	Old Digester Pump Station Pipework (Sheet 1 of 2)
MD4696-RHD-PS-TS3-DR-MX-5009	Old Digester Pump Station Pipe Schedule (Sheet 1 of 2)
MD4696-RHD-PS-COE-M3-MX-5010	COE Pump Station Pipework (Sheet 1 of 2)
MD4696-RHD-PS-COE-M3-MX-5011	COE Pump Station Pipe Schedule (Sheet 1 of 2)

Drawing Number	Description
MD4696-RHD-PS-TH3-M3-MX-5012	Humus Effluent Pump Station Pipework (Sheet 1 of 2)
MD4696-RHD-PS-TH3-M3-MX-5013	Humus Effluent Pump Station Pipe Schedule (Sheet 1 of 2)
MD4696-RHD-0-ZZ-DR-EX-6001	Single Line Diagram for Inlet Works
MD4696-RHD-0-ZZ-DR-EX-6002	Single Line Diagram for Biofilter Pump Station
MD4696-RHD-0-ZZ-DR-EX-6003	MCC General Arrangement for Biofilter Pump Station
MD4696-RHD-0-ZZ-DR-EX-6004	Drive Schematic Diagram for Biofilter Pump Station
MD4696-RHD-0-ZZ-DR-EX-6005	Single Line Diagram for Humus Pump Station
MD4696-RHD-0-ZZ-DR-EX-6006	MCC General Arrangement for Humus Pump Station
MD4696-RHD-0-ZZ-DR-EX-6007	Drive Schematic Diagram for Humus Pump Station
MD4696-RHD-0-ZZ-DR-EX-6008	Single Line Diagram for Old Digester Pump Station
MD4696-RHD-0-ZZ-DR-EX-6009	MCC General Arrangement for Old Digester Pump Station
MD4696-RHD-0-ZZ-DR-EX-6010	Drive Schematic Diagram for Old Digester Pump Station
MD4696-RHD-0-ZZ-DR-EX-6011	Single Line Diagram for New Digester Pump Station
MD4696-RHD-0-ZZ-DR-EX-6012	MCC General Arrangement for New Digester Pump Station
MD4696-RHD-0-ZZ-DR-EX-6013	Drive Schematic Diagram for New Digester Pump Station
MD4696-RHD-0-ZZ-DR-EX-6014	Single Line Diagram for Digester Mixing Pumps
MD4696-RHD-0-ZZ-DR-EX-6015	MCC General Arrangement for Digester Mixing Pumps
MD4696-RHD-0-ZZ-DR-EX-6016	Drive Schematic Diagram for Digester Mixing Pumps
MD4696-RHD-0-ZZ-DR-EX-6017	Single Line Diagram for Substation 5
MD4696-RHD-0-ZZ-DR-EX-6018	MV Panel layout and description
MD4696-RHD-0-ZZ-DR-EX-6019	Single Line Diagram for Substation 6
MD4696-RHD-0-ZZ-DR-EX-6020	Single Line Diagram for COE Pump Station
MD4696-RHD-0-ZZ-DR-EX-6021	MCC General Arrangement for COE Pump Station
MD4696-RHD-0-ZZ-DR-EX-6022	Drive Schematic Diagram for COE Pumps
MD4696-RHD-0-ZZ-DR-EX-6100	Site Plan – Proposed Electrical Work
MD4696-RHD-0-ZZ-DR-EX-6101	Humus Pump Station: Lighting and Small Power Layout
MD4696-RHD-0-ZZ-DR-EX-6102	RAS Pump Station: Lighting and Small Power Layout
MD4696-RHD-0-ZZ-DR-EX-6103	Old Digester Pump Station: Lighting and Small Power Layout
MD4696-RHD-0-ZZ-DR-EX-6104	New Digester Pump Station: Lighting and Small Power Layout
MD4696-RHD-0-ZZ-DR-EX-6105	Site Layout: Proposed MV & LV Cable Routes
MD4696-RHD-0-ZZ-DR-EX-6106	New Proposed MV Network
MD4696-RHD-0-ZZ-DR-IX-7001	Proposed Fibre & PLC Network
MD4696-RHD-0-ZZ-DR-IX-7002	Control System Network
MD4696-RHD-0-ZZ-DR-IX-7003	Typical Transmitter Enclosure
MD4696-RHD-0-ZZ-DR-IX-7004	Typical SCADA rack
MD4696-RHD-0-ZZ-DR-IX-7005	Typical PLC panel Layout
MD4696-RHD-0-ZZ-DR-IX-7006	Typical Field Control Station

Drawing Number	Description
MD4696-RHD-0-ZZ-DR-IX-7007	Centralized Control Room & SCADA Desk Arrangement Drawing
MD4696-RHD-0-ZZ-DR-IX-7008	Dissolved Oxygen Transmitter – Typical Details
MD4696-RHD-0-ZZ-DR-IX-7009	Electromagnetic flow meter – Typical Details
MD4696-RHD-0-ZZ-DR-IX-7010	Ultrasonic flow meter – Typical Details
MD4696-RHD-0-ZZ-DR-IX-7011	Conductivity probes – Typical Details
MD4696-RHD-0-ZZ-DR-IX-7012	Level Transmitter – Typical Details
MD4696-RHD-0-ZZ-DR-IX-7013	Pressure transmitter – Typical Details
MD4696-RHD-0-ZZ-DR-IX-7014	Instrumentation Loop Diagram – Typical Details

BID FOR THE UPGRADE/ REFURBISHMENT OF BIOFILTER MODULE (3) AT OLIFANTSFONTEIN WATER CARE WORKS (WWCW) : PHASE 1
TENDER NO. ERW202009/TNDR-002

PART C4: SITE INFORMATION

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C4.3	ENVIRONEMNTAL MANAGEMENT PLAN	CD
ANNEX C	ELECTRONIC INFORMATION	CD

C4.1 SCOPE

The construction site is located at the existing Olifantsfontein Water Care works , this being an operating 105Ml/d wastewater treatment works comprising of three separate modules. The Works shall be undertaken on Modules No 3.

C4.2 GENERIC GROUND CONDITIONS ANTICIPATED AT THE SITE

The Geotechnical Investigation report is attached to Annexure A of the document.

C4.3 DISCLAIMER

Whilst the information provided above is given in good faith, the Engineer and Employer accept no responsibility for the accuracy thereof. It remains the responsibility of the Contractor to verify the actual ground conditions during construction and to take appropriate measures to ensure the safety of persons and the Works at all times.