

O.R. TAMBO DISTRICT MUNICIPALITY



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CONTRACT NO.: ORTDM SCMU 15-26/27

KSD PRESIDENTIAL INTERVENTION BULK WATER SUPPLY

COMPLETION OF THORNHILL WTW Ph3 UPGRADE
(80MI/d to 115MI/d): CIVIL WORKS

VOLUME 2: SCOPE OF WORK

SEPTEMBER 2026

NAME OF TENDERER:

TENDER AMOUNT: * SEE VOLUME 1 *****

CSD SUPPLIER NUMBER:

CLOSING DATE & TIME: 30 OCTOBER 2026 @ 12h00

Prepared for:

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KING SABATA DALINDYEBO PRESIDENTIAL INTERVENTION BULK WATER SUPPLY INFRASTRUCTURE:

COMPLETION OF THORNHILL WTW Ph3 UPGRADE (80MI/d to 115MI/d): CIVIL WORKS

Contents		
Number	Heading	Page
Volume 1 of 2		
The Tender		
T1: Tendering Procedures		
T1.1	Tender Notice and Invitation to Tender	
T1.2	Tender Data	
T2: Returnable Documents		
T2.1	Schedule of Returnable Documents	
T2.2	Returnable Documents	
The Contract		
C1: Agreements and Contract Data		
C1.1	Form of Offer and Acceptance	
C1.2	Contract Data	
C1.3	Tenderer's Direct Participation of Targeted Labour	
C1.4	Tenderer's Direct Participation of Targeted Enterprise	
C1.5	Performance Guarantee	
C1.6	Adjudication	
C1.7	Occupational Health and Safety Agreement	
C2: Pricing Data		
C3.1	Pricing Instructions	
C3.2	Bill of Quantities	
Volume 2 of 2 (THIS VOLUME)		
C3: Scope of Work		
C3.1	Description of the Works	1
C3.2	Engineering	4
C3.3	Procurement	5
C3.4	Construction	11
C3.5	Management	20
C3.6	Annexures	21
C4	Site Information	n/a
C5	Tender Drawings (see separate Sharepoint link to download)	n/a

C3: Scope of Work

Number	Heading	Pages
C3.1	Description of the Works	1
C3.2	Engineering	4
C3.3	Procurement	5
C3.4	Construction	11
C3.5	Management	20
C3.6	Annexures	21

Status

Should any requirement or provision in the parts of the Scope of Work conflict with any requirement of any Specification(s) forming part of this contract or any drawings, the order of precedence, unless otherwise specified, is:

- Drawings
- Project Specifications (including amendments to standard and particular specifications)
- BoQ
- Particular Specifications
- Standard Specifications.

The above notwithstanding, any discrepancy shall be brought to the attention of the Engineer for clarification.

C3.1 Description of the Works

C3.1.1 Project Overview

As part of the implementation of a Presidential Intervention large-scale regional bulk water supply encompassing small towns and villages up to 40km outside Mthatha, the existing Thornhill WTW treatment capacity needs to be increased from 80MI/d to 115MI/d. This Contract is specifically for the civil portion of the works associated with the upgrade to 115MI/d. A mechanical and electrical contract to supply and install the mechanical and electrical equipment will be part of a separate contract to follow this Contract.

C3.1.2 Employer's Objectives

The Contractor originally employed to undertake this work has his contract terminated for non-performance. The employer's objective for this Contract is to appoint another Contractor to complete all outstanding and unfinished civil works left over from the terminated contract.

C3.1.3 Scope of Works

The work to be executed under this contract can be broadly described as completing 3 No unfinished Clariflocculator tanks, an unfinished new filter building and an unfinished new chlorination building plus all associated interlinking pipelines and extensive backfilling (much of which is to be obtained from commercial sources).

The work covers activities such as, but not limited to:

- Complete restricted excavation for interlinking pipework around the clariflocculators;
- Remedial works (under Dayworks) to poorly-cast concrete work in all incomplete structures;
- Completion of walls and central well structures for one of the clariflocculators;
- Completion of foundations and whole structure for the other two clariflocculators;
- Completion of Filter Building reinforced concrete and brick structure (has 6 no. rapid gravity filter beds). Upper half of concrete structure still to complete and all building work for same.
- Completion of the brickwork and finishes to the Chlorination Building (all reinforced concrete works are already complete)
- Construction of interlinking pipework and chambers (Note: Most of the required pipe specials and fittings and pipes have already been fabricated and are available as Free Issue items on Site):
 - DN600 GRP pipe specials from existing raw water distribution channel to 3 new clariflocculators;
 - 450mm dia HDPE fusion-weld jointed HDPE pipes delivering settled clear water from the clariflocculators to the filter building;
 - DN300 uPVC waste sludge drainage pipes from clariflocculators to an existing disposal facility;
 - DN300 uPVC stormwater drainage pipes
 - DN600 pipework to link treated water outlet from the new Filter Building to adjacent existing Filter Building;
 - Various reinforced concrete drainage chambers.
- Construction of the following site works:
 - Minor extensions to existing concrete roadstone paved internal roads to include new filter building
 - Minor modification to the Works entrance to allow access to for trucks to deliver chlorine gas drums to the new Chlorination building;
 - ~ 4000m³ backfilling of extensive deep excavations around the clarifiers and filters;
 - Landscaping, topsoiling and grassing.
- Training programs for local residents by approved Accredited Service Providers.
- Liaison with local community
- Environmental compliance and management including rehabilitation after construction
- OH&S management

C3.1.4 Location of the Works

The site is located just off the R61 highway from Mthatha CBD to Ngcobo Town. Mthatha is situated within the King Sabata Dalindyebo Local Municipality which forms part of the OR Tambo District Municipality of the Eastern Cape Province. It is located approximately 230 km from East London on the N2 National Highway between East London and Kokstad.

The coordinates of the site are: 31°34'38.47"S; 28°45'54.54"E

C3.1.5 Description of Site Access

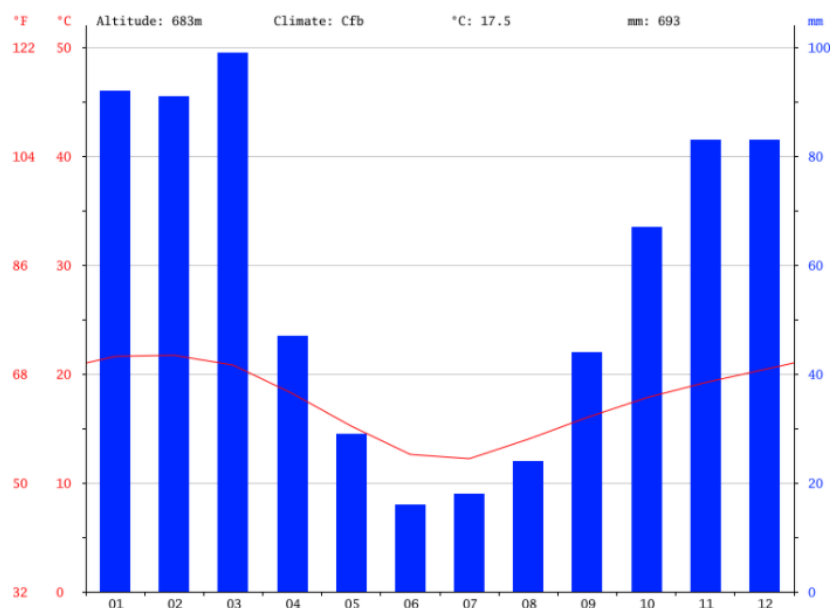
The site can be approached from Thornhill Rd (off the R61 highway).

C3.1.6 Climate

The general climatic conditions for Mthatha are as follows :

Altitude above sea level	: ~670 masl
Maximum temperature	: 40 °C
Minimum temperature	: -2 °C
Annual Average Temperature	: 17,5°C
Annual Average Rainfall	: 693mm
Rainfall season	: Summer

CLIMOGRAPH MTHATHA



Precipitation is the lowest in June, with an average of 16 mm. With an average of 99 mm, the most precipitation falls in March.

C3.1.7 Temporary Works

Temporary works include access, barricades around work-in-progress, shoring of trenches (where necessary),

C3.1.8 Geotechnical Conditions

According to the 1:250 000 geological map (3128) for Mthatha as published by the Council of Geosciences, the site is underlain by sedimentary rocks of the Beaufort Group belonging to the Karoo Supergroup.

The site lies within the Katberg formation, belonging to the Tarkastad subgroup of the greater Karoo Supergroup. The Tarkastad subgroup is characterised by a greater abundance of both sandstone and red mudstone. Although no dolerite dykes or sills were encountered in the trial pit excavations, such intrusions are common in the area.

Previous excavations show that the site is dominated by sandstone close to the surface. The upper layers (2 to 3m) are weathered to partly weathered with significant jointing (can be excavated by 30t excavator fitted with a rock bucket). Photos of previous excavations immediately adjacent to the current excavation sites are given in the Bulk Excavation drawings.

The deeper sandstone is unweathered and extremely hard and tends to break out in large blocks. As no blasting can be allowed, this has to be excavated by a heavy-duty excavator-mounted hydraulic breaker. Where inaccessible to a breaker, the use of drilled holes filled with expanding grout to break the rock will be necessary.

C3.1.9 Site Facilities

C3.1.8.1 Location of Contractor's Camp and Depot

The Contractor can also make use of the very limited space available within the WTW boundary fence, but shall make his own arrangements with the King Sabata Dalindyebo Local Municipality for a Site Camp on the open ground in the vicinity if more space is needed.

C3.1.8.2 Water Supply

The OR Tambo District Municipality is the Water Supply Authority. The Contractor shall make his own arrangements for ensuring an adequate supply of water for construction; including provision of on-site storage of sufficient capacity to allow uninterrupted construction. Water for non-potable water needs can be abstracted free of charge from the Clarriflocculators (eg water-tightness testing of tanks and pressure-testing pipelines). The incoming raw water is not suitable for concrete batching. The use of 'ready-mix' concrete for all Works is indicated.

C3.1.8.3 Power supply

The King Sabata Dalindyebo Local Municipality is the Electrical Supply Authority. There is three-phase power supply infrastructure in the area. The Contractor shall make his own arrangements for a metered offtake for the supply of electricity for construction purposes.

C3.1.8.4 Ablution facilities

There are no existing ablution facilities for the Contractor's use on site. The construction and use of temporary septic tanks and soakaways (or the like) will not be permitted. Temporary conservancy tanks or chemical toilets will be permitted.

C3.1.8.5 Accommodation

No accommodation for the Contractor's employees will be permitted on site. The Contractor shall make his own arrangements to house his employees and transport them to and from Site. No informal housing or squatting will be allowed.

C3.2 Engineering

C3.2.1 Design Services and Activity Matrix

The Employer is responsible for concept, feasibility, basic engineering and layout, for the full scope of works (civil and structural) to tender stage of the project.

The design responsibility for the Works is as per Clause 4.2 of SANS 1921-1 and GCC 4.1.1. Where conflict arises, the Contractor shall refer the matter to the Employer's Agent for resolution. The Design Responsibilities are as follows:

Design Process	Responsibility
Concept, feasibility and overall process	Employer Responsible
Basic engineering and detail layout to tender stage for full scope of works	Employer/ Employer's Agent Responsible
Final design to approved for construction stage for civil works, structural works	Employer/ Employer's Agent Responsible
Temporary works	Contractor Responsible
Preparation of as-built drawings	Contractor Responsible

The extent of the Employer's Agent's design is shown on the respective drawings.

C3.2.2 Contractor's Designs

The Contractor will be responsible for the design of all temporary works and all construction methods, all shoring and lateral support that may be required. The Contractor will also be responsible for the preparation of method statements before commencing with construction.

The Contractor is also responsible for the preparation of record drawings.

C3.2.3 Impact of Construction on Thornhill Water Treatment Works Operations

Most of the construction work can be carried out without impacting on the day-to-day operation of the waterworks. A shut down of the filters adjacent to the new filters being constructed in this Contract will be necessary for completing the interconnection pipework between the two structures clear water tanks.

C3.2.4 Drawings

The work shall be carried out in accordance with the latest available revision of the drawings to be issued by the Engineer for construction. At commencement of contract, the Engineer shall deliver to the Contractor three sets copies of the construction drawings and any instructions required for the commencement of the works.

From time to time thereafter during the progress of the works, the Engineer may issue further drawings or revisions for construction purposes as may be necessary for adequate construction and completion of the works and defects correction.

The Contractor will be required to mark up one complete set of prints of the construction drawings with as-built information and submit these to the Employer's Agent at the end of construction, prior to issue of the Certificate of Practical Completion.

C3.3 Procurement

C3.3.1 Subcontracting

C3.3.2.1 Scope of Mandatory Subcontract Works

It is a contractual requirement that particular 'ring-fenced' construction items are to be sub-contracted to local qualifying SMME's. For this purpose, particular work items in the Bill of Quantities have been identified for pricing by SMMEs. All such items are marked as "Rates Only" in the tender BoQ. a Provision Sum has been provided in the BoQ to cover the estimated quotes to be obtained from the various local SMMEs for such work. Once the instruction to commence with the Works has been given, the Contractor (together with the Employer's ISD Department and the ISD Consultant appointed for this Contract) shall consult with the local leadership regarding the division of the ring-fenced work into separate work packages for the purposes of calling for three quotes for each package from pre-approved local subcontractors.

C3.3.2.2 Subcontractor Requirements

All subcontractors appointed by the Contractor shall be:

- Registered with the CIDB
- Allocated work within the category and value limits designated by their CIDB grading
- Be in good standing with the Department of Labour
- Registered on the Central Supplier Database.
- CSD compliant

Proof of the above is to be provided to the Employers Agent before appointment of the subcontractor.

C3.4 Construction

C3.4.1 Works Specifications

C3.4.1.1 Applicable National and International Standards

a) Applicable SANS 1200 Standardised Specifications

The following SANS 1200 Standardised Specifications for Civil Engineering Construction are applicable:

• SANS 1200 A -	1986	General
• SANS 1200 AB	-	1986 Engineer's Office
• SANS 1200 C -	1980	Site Clearance (As amended 1982)
• SANS 1200 D -	1988	Earthworks (As amended 1990)
• SANS 1200 DB	-	1989 Earthworks (Pipe Trenches)
• SANS 1200 DK	-	1996 Gabions and pitching (First Revision)
• SANS 1200 DM -	1981	Earthworks (Roads, Subgrade)
• SANS 1200 G -	1982	Concrete (Structural)
• SANS 1200 H -	1990	Structural Steelwork
• SANS 1200 HA	-	1990 Structural Steelwork (Sundry items)
• SANS 1200 HC	-	1988 Corrosion Protection of Structural Steelwork
• SANS 1200 L -	1983	Medium-Pressure Pipelines
• SANS 1200 LB	-	1983 Bedding (Pipes)
• SANS 1200 LC	-	1981 Cable ducts
• SANS 1200 LD -	1982	Sewers
• SANS 1200 LE	-	1982 Stormwater Drainage
• SANS 1200 M	-	1996 Roads (General)
• SANS 1200 ME	-	1981 Sub base
• SANS 1200 MF	-	1981 Base
• SANS 1200 MJ	-	1984 Segmented paving
• SANS 1200 MK	-	1983 Kerbing and Channelling

Refer to the *Variations and Additions to the Standard SANS 1200 Specifications: General, Civil and Structural Works* in Annex C3.6.

b) Other Applicable SANS Specifications

- SANS 462 Welded Wire Fabric Gabions and Gabion Mattresses (metallic-coated or polyvinyl chloride (PVC) coated)
- SANS 974-1 Rubber Joint Rings (non-cellular) Part 1 : Joint Rings for Use in Water, Sewer and Drainage Systems
- SANS 1083 Aggregates from Natural Sources – Aggregates for Concrete

C3.4.1.2 Particular Specifications

GIBB 012:	General Building Materials and Workmanship
GIBB 015:	Dry Stack Walls
OHS	Health And Safety Specification
EMP	Construction Environmental Management Plan

C3.4.2 Plant and Materials

C3.4.2.1 Materials Supplied by the Employer

Various fabricated pipe specials and other construction materials left over from the previous (terminated) contract will be 'Free Issues' by the Employer. These are identified in the BoQ.

C3.4.2.2 Materials, Samples and Shop Drawings

The Contractor is required to provide proof of compliance with the materials specification, as well as to provide samples of materials and finishes.

Unless otherwise instructed in writing by the Employer's Agent, all proprietary materials are to be used, mixed, applied, fixed etc strictly in accordance with the manufacturer's recommendations.

Materials and/or equipment are to be ordered timeously to meet the construction program. Extension of time for non-availability of materials will only be considered subject to the Contractor satisfying the Employer's Agent of timeous ordering thereof.

C3.4.3 Construction Equipment

C3.4.3.1 Requirements for Equipment

All equipment must comply with the requirements as stipulated in the Environmental regulations and specifications and contained in the OHS Act.

All construction plant and equipment used on this contract shall be in good working order, well maintained, of adequate size and fit for purpose. No plant or equipment that leaks oil, fuel or hydraulic fluids may be used on site.

Any plant or equipment that, in the opinion of the Employer's Agent, is not of adequate size or fit for use shall be removed from the site and replaced with acceptable plant and equipment, all at the Contractor's cost.

C3.4.3.2 Equipment Provided by the Employer

No equipment shall be provided to the Contractor by the Employer.

C3.4.4 Existing Services

C3.4.4.1 General

There are many existing services within the waterworks site.

There are two underground 11kV power cables along the one edge of the bulk excavations for one of the Clariflocculator tanks. The position of these will be brought to the Contractor's attention so these are not accidentally disturbed. ALL workers on Site shall be made aware of their existence at the commencement of construction and shall be frequently reminded.

Some stockpiled material required for backfilling the various structures are located under or close to 66kV overhead powerlines. Active management to ensure that no part of any construction plant or any construction vehicle comes within 5m of the overhead powerlines will be required.

The Chlorination Building offloading portal straddles an existing buried 1200mm continuously-welded epoxy-coated steel pipeline (Works incoming raw water pipeline). The Contractor shall ensure that the pipe is undisturbed whilst constructing the access alongside the Chlorination Building gas storage room.

C3.4.4.2 Treatment of Existing Services

The Contractor shall ensure that none of the existing services are damaged during the implementation of this Contract.

C3.4.5 Site Establishment

C3.4.5.1 Services and Facilities Provided by the Employer

No services or facilities other than access to the local water reticulation will be provided by the Employer. The Contractor is to provide his own services and facilities, and to make allowance for the cost thereof in Section 1 of the Schedule of Quantities.

C3.4.5.2 Facilities Provided by the Contractor

The Contractor is to provide the facilities indicated in the Schedule of Quantities.

The Contractor shall provide, for the exclusive use of the Engineer and his staff, offices and a toilet as specified in PSAB 3.2. Survey equipment according to clause PSAB5.6 shall be supplied and maintained for the Engineer's use.

The construction camp location shall be determined by the Contractor and approved by the Engineer.

The construction camp is to be removed upon completion of the work and the site returned to the condition in which it was found, to the satisfaction of the Environmental Control Officer and Engineer.

C3.4.5.3 Storage Facilities

The Contractor is to provide all facilities for his operations; including temporary laydown areas for steel reinforcing etc and pipeyards for the pipes to be supplied under this Contract.

General storage areas are to be contained within the Contractor's designated, fenced off construction camp(s).

C3.4.5.4 Other Facilities and Services

The Contractor is responsible for the provision of all necessary temporary facilities which are not provided by the Employer, including power, telecommunications, security services, medical, fire protection, sanitation and toilets and solid waste disposal.

The Contractor shall make his own provisions for the collection, storage and disposal of all construction waste (i.e. whether it be in the camp or on the construction site); all in conformance with the Environmental Management Plan and with approval of the Employer's Agent, the Local Authority and the Environmental Officer. Payment for the clearing, loading, transport, dumping fees and any other requirement or costs incurred shall be included in the scheduled rates.

The Contractor shall provide suitable and adequate portable chemical latrines for his employees and his sub-contractors. Latrines shall be maintained by the Contractor in a clean and sanitary condition to the Employer's Agent's satisfaction. The use of latrines shall be enforced and fouling of the site will not be tolerated.

The Contractor is not permitted to house any of his employees or sub-contractors within the site camp.

The Contractor is to comply with all requirements contained in law or local bylaws, as well as any other requirements set by the local authority.

C3.4.5.5 Vehicle for the Engineer

The Contractor shall hire two bakkies under a Prime Cost item for the general use of the Site staff. These shall carry fully-comprehensive insurance.

C3.4.5.6 Notice Boards

The Contractor is to provide a notice board as indicated in the Schedule of Quantities, the layout of which is to match the template issued with the Tender Drawings.

The board shall be erected at the Works entrance in a position approved by the Employer's Agent.

The board is to be maintained for the duration of the Contract. Any damage to the boards shall be repaired within fourteen (14) days of a written instruction issued by the Employer's Agent.

The notice board and supporting structure is to be removed fourteen (14) days prior to the issue of the Final Approval Certificate.

C3.4.6 Site Usage

The Contractor shall be responsible for the control of unauthorized entry to the site and shall inform the Employer's Agent of any breach of such rules. The site shall be managed and used for its intended purpose. The Contractor is required to keep a visitors log and ensure full compliance with site safety standards.

All the possible circumstances, eventualities and events will have to be considered when the construction program is drawn up. No claims for delays as a result of restricted or difficult access will be considered

C3.4.7 Security

The Contractor may be exposed to criminal actions, including theft and vandalism and shall make all his own necessary security arrangements for the duration of the Contract.

The Contractor shall be responsible for taking all reasonable measures to ensure that effective access control and integrity of the site perimeter fence is maintained for the full duration of construction.

C3.4.8 Permits and Way Leaves

While the Engineer is responsible for obtaining all the necessary wayleaves, permissions and permits applicable to working near any existing services or other infrastructure on Site, the Contractor is responsible for abiding by the safety and other conditions imposed by such wayleaves, permissions and permits.

The Contractor shall ensure that all wayleaves, permissions and permits (furnished by the Engineer) are kept on site and are available for inspection by the relevant services authorities on demand.

C3.4.9 Alterations, Additions, Extensions and Modifications to Existing Works

The Contractor is to satisfy himself as to the dimensional accuracy, alignment, levels and setting out of existing structures or components thereof to ensure compatibility with the proposed works. Any concerns are to be raised timeously with the Employer's Agent.

C3.4.10 Water for Construction Purposes

See C3.1.8.2. Untreated water from the Works process may be used to test watertightness of tanks and pipelines..

C3.4.11 Survey Control and Setting Out of the Works

There are benchmarks in the immediate vicinity. Elevation control shall be cross-checked against existing adjacent structures where directed by the Engineer.

C3.4.12 Dealing with Water

The Contractor shall manage and dispose of water, whatever its origin, on the site so that the works are kept sufficiently dry for their proper execution and to ensure that no local person can drown in any excavation undertaken under this Contract.

The Contractor shall ensure that:

- Where it is not practically possible to make deep excavations free-draining, diversion berms are constructed to divert stormwater runoff from entering the excavations and all standing water will be removed as soon as possible after each rain event.
- Keep all completed works properly drained.
- Not inhibit surface drainage
- Protect all parts of the Works against damage and erosion caused by rain and surface water.

C3.4.13 Workmanship and Quality Control

The onus to produce work that conforms in quality and accuracy of detail to the requirements of the Specifications and Drawings rests with the Contractor, and the Contractor shall, at his own expense, institute a quality control system and provide suitably qualified and experienced Employer's Agents, foremen, surveyors, materials technicians, other technicians and technical staff, together with all

transport, instruments and equipment to ensure adequate supervision and positive control of the Works at all times.

The cost of supervision and process control will be deemed to be included in the rates tendered for the related items of work.

The Contractor's attention is drawn to the provisions of the various Standardized Specifications regarding the minimum frequency of testing required. The Contractor shall, at his own discretion, increase this frequency where necessary to ensure adequate control.

On completion and submission of every part of the work to the Employer's Agent for examination and measurement, the Contractor shall furnish the Employer's Agent with the results of the relevant tests, mix designs, measurements and levels to demonstrate the achievement of compliance with the Specifications.

C3.4.14 Features Requiring Special Attention

C3.4.14.1 Interaction and liaison between the WTW Operating Staff and M&E Contractor

A separate mechanical & electrical contract will be awarded once the civils works is well advanced. The installation of equipment and associated power cables will commence once the civil works Contract is nearly complete. The civil Contractor may be instructed to provide limited assistance to the M&E Contractor. Any such direct assistance shall be paid-for as agreed with the Engineer under Dayworks.

Any costs associated with general liaison with the WTW Operating Staff and KSD Local Municipality Electrical Department staff shall be deemed to be included in Section 1 BoQ rates.

C3.4.14.2 Restricted Access to Site and confined access for excavation and construction

The Contractor shall, at tender stage, carefully evaluate the access limitations and any special plant requirements and construction techniques necessary and time-for-construction implications due the extremely confined nature of the site and hardness of the rock excavations and depth of excavations necessary and is deemed to have made due allowance for any such associated additional costs in his tender rates and construction program.

C3.4.14.3 Dealing with stormwater runoff and ground water

The Contractor shall, at tender stage, carefully evaluate the requirements for dealing with stormwater runoff and pumping-out accumulating ground and rain water from deep excavations and is deemed to have made due allowance for any such additional costs in his tender rates and construction program.

C3.4.14.4 Backfilling Deep Excavations

The Contractor shall backfill the deep excavations around the clariflocculators in stages. This has to be carefully coordinated with the laying of deep and shallow interlinking pipework and water-tightness testing of each clariflocculators and the filters before backfilling. There are many stockpiles of soft material immediately outside the waterworks boundary. These all are contaminated with blast rock (the soil was used as cover material for blasting). The Contractor is required to select-out the larger boulders when loading this material for backfilling and prioritise the contaminated material for the lower layers of the backfilling and avoid areas where later excavation for shallower interlinking pipes is required. The Contractor is required to source approximately 4000m³ of G7 (or better material) from commercial sources to make up a shortfall of backfill material.

C3.4.14.5 Supporting Documents

The Contractor will be required to provide a detailed labour forecast of the numbers of each category of worker which he intends to employ or utilise in the execution of the Works, together with the definition of the particular tasks on which it is intended that they will be engaged and the periods during which they will be so engaged.

C3.5 Management

C3.5.1 Management of the Works

C3.5.1.1 Applicable SANS 1921 Standards

- | | | |
|--------------------|--------|---|
| • SANS 1921-1:2004 | Part 1 | General Engineering and Construction Works |
| • SANS 1921-2:2004 | Part 2 | Accommodation of Traffic on Public Roads Occupied |
| • SANS 1921-3:2004 | Part 3 | Structural Steelwork |
| • SANS 1921-5:2004 | Part 5 | Earthworks Activities Performed by Hand |
| • SANS 1921-6:2004 | Part 6 | HIV/AIDS Awareness |

C3.5.1.2 Particular Specifications (refer to Annex C3.6)

Refer to C3.6 – Annexures for particular (purpose written) specifications.

C3.5.1.3 Planning and Programming

The Contractor shall submit a detailed preliminary program within fourteen (14) days of receipt of a set of drawings issued by the Engineer for construction as stipulated in the Contract Data.

The Contract period shall include all Saturdays, Sundays, non-working days (public holidays), special non-working days, as well as an allowance for anticipated inclement weather (as per Clause 5.12.2.2: Extension of Time) during normal working hours.

Should the Contractor wish to work outside normal working hours (as defined in the Contract Data) for any reason, he shall first seek permission to do so from the Employer's Agent. Attending to emergency situations or making-safe the Works are exempt from requiring prior approval, but notification shall still be sent to the Employer's Agent.

The program shall be agreed between the Employer and the Contractor prior to the implementation of the construction works.

The program shall be updated monthly, for discussion at the monthly progress (site) meeting, to indicate planned versus actual progress.

The Contractor shall review his progress each month and should progress lag behind the latest accepted program, by more than 2 weeks, he shall submit a revised program and method statement of how he proposes to make up the lost time. If, in the opinion of the Employer's Agent, such revised program will not make up the lost time, the Employer's Agent shall have the right to request the Contractor to reorganize his work in a manner which will ensure an acceptable program. Claims for additional payment to meet any costs incurred due to such reorganisation will not be accepted.

If during the course of the contract, the execution of the work deviates in any manner from the program, the Contractor shall, on instruction by the Employer's Agent, within one week of such instruction submit a revised program.

C3.5.1.4 Program Format and Content

Program shall be submitted in Microsoft Project format in hardcopy and softcopy. The Contractor is to provide the detailed program such that it is legible.

The program of construction shall be submitted to the Engineer within the time period stipulated in these documents. The program shall clearly show all activities related to the works and shall indicate which activities are on the critical path.

The Contractor shall take cognisance of the following when programming his activities:

- Based on the tendered Time for Completion, the Due Completion Date for Practical Completion is calculated from the date of Site Handover and Instruction to Commence with the Works (see amendment to Contract Data sub-clause 1.1.1.14).
- The tendered Time for Completion;

- Site handover and commencement of execution of the Contract will only take place once all the necessary documentation (details given in Contract Data) has been submitted and approved and Construction Permit from DoL obtained. Before any site work is undertaken, an introductory meeting with the local community has to be held. The latter is arranged by the Employer's Agent.
- Establishment and de-establishment times.
- All other activities required in terms of this document.

The Contractor's program shall show:

- The various activities, related to a time scale, for each element of the Works, including those of Subcontractors, in sufficient detail to be able to assess construction progress
- Critical path activities and their dependencies
- Key dates in respect of information to be provided by the Employer's Agent and/or others.

C3.5.1.5 Methods And Procedures

Where otherwise requested in writing by the Employer's Agent, the Contractor shall submit Method Statements for constructing specific aspects of the Works. Such work shall not be started until the Contractor receives approval of the Method Statement in writing from the Employer's Agent.

C3.5.1.6 Quality Plans and Control

The Contractor is required to have in place, and follow, an approved Quality Assurance System for the execution of this Contract. To this end, the Contractor shall submit his proposed Quality Management Plan (QMP) to the Employer's Agent for approval along with his up-front documentation required before the commencement of the Works. The QMP shall include the Contractor's proposed Quality Control Plan (QCP) which shows how conformance to the QMP is to be documented.

In addition to this, the Contractor is required to follow the Employer's Agent's Site Quality Control procedures which entails the following:

- Contractor's submission of Request for Inspection of Work;
- Employer's Agent's signing-off of 'hold points' at each stage of the work (thereby authorising the Contractor to proceed with the next stage of the work). This may take several iterations should the Employer's Agent require further work before signing-off. Work may not proceed on the next stage until the previous stage has been signed-off.

Claims for particular items of completed work for each interim Payment Certificate will not be certified for payment where the required sign-offs have not been obtained.

No claims for extension of time, nor any other form of compensation, will be entertained for delays in receiving the Employer's Agent sign-offs on 'hold points' where, in the opinion of the Employer's Agent, insufficient notice has been given to inspect and approve the Works. The default notice required is 48 hours.

The Contractor shall submit copies of all his conformance documentation to the Employer's Agent on a monthly basis and proof of recent calibration of all measuring devices that are to be used.

C3.5.1.7 Environment

The Contractor shall comply with the Construction Environmental Management Plan (attached in Annexures). The Environmental Control Officer shall liaise directly with the Contractor on general environmental matters. Where such matters affect construction works, the Environmental Control Officer will be required to address such concerns with the Employer's Agent.

The Contractor is required to progressively and systematically finish and tidy the work as it proceeds. This will be monitored against the latest approved program. The Employer's Agent shall have the right to not certify full payment of particular scheduled items where such items are largely complete, but finishing and tidying is deemed still outstanding.

Under no circumstances shall spoil, rubble, materials or equipment be allowed to unnecessarily accumulate on Site. If, in the opinion of the Employer's Agent, this is occurring, the Employer's Agent shall have the right to make an allowance for the estimated cost of rectifying the above by reducing particular measured quantities from claims being processed for payment.

C3.5.1.8 Sub-Contracting of the Works

The Contractor shall sub-contract to Local Subcontractors as much of the Works as possible. A ring-fenced portion of the Works is to be subcontracted to local SMME's.

It is anticipated that the Contractor will subcontract the pipe welding and pipe special fabrication to specialists.

The sub-contracting shall be done in accordance with the provision of Particular Specification PA: Sub-letting of the Works.

C3.5.1.9 Testing and Quality Control

(i) Contractor to submit details of his proposed fabricator of all steel, GRP and HDPE pipe specials.

The Specifications pertaining to testing and quality control require the Contractor to undertake his own confirmation testing for conformance with the specifications. To this end, the Contractor is to submit details of his proposed fabricator's Quality Management Plan and Quality Control Procedures for the fabrication of pipe specials to the Engineer for approval before ordering any such fabricated specials.

The Contractor shall be responsible for ensuring that his fabricator carrying out of all such testing specified in the Contract, at not less than the frequencies and in the manner specified. The Contractor shall promptly provide the Employer's Agent with copies of the results of all such testing carried out by the independent laboratory.

(ii) Additional testing required by the Employer's Agent

There is a Prime Cost Sum in the BoQ for payment of the Employer's own independent inspectorate. This independent inspectorate is to review the proposed fabricator's QMP and QCP for materials, all weld testing and testing of fabricated pipe special coatings and linings (Dry Film Thickness of epoxy and di-electric integrity) and report on his findings to the Engineer. Based on the report, the Engineer shall approve / reject the proposed fabricator.

The Independent Inspectorate will inspect all fabricated specials and report on his findings to the Engineer. Based on the report, the Engineer shall approve / reject each special. Only approved specials may be incorporated into the Works.

The Employer's Agent shall be entitled at times during the Contract to require that the Contractor arrange with the independent inspectorate to carry out any such tests, additional to proving compliance (subclause C3.4.2.2), at such times and at such locations in the Works as the Employer's Agent shall prescribe. The Contractor shall promptly and without delay arrange with the independent laboratory for carrying out all such additional testing as required by the Employer's Agent, and copies of the test results shall be promptly submitted to the Employer's Agent.

(iii) Costs of testing

(a) Tests in terms of subclause C3.4.2.2

The costs of all compliance testing carried out by the independent inspectorate in accordance with the requirements of subclause C3.4.2.2, above shall be borne by the Contractor and shall be deemed to be included in the tendered rates and prices for the respective items of work as listed in the Bill of Quantities and which require testing in terms of the Specifications. No separate payments will be made by the Employer to the Contractor in respect of any testing carried out in terms of subclause C3.4.2.2.

Where, as a result of the consistency of the materials varying or as a result of failure to meet the required specifications for the work, it becomes necessary to carry out additional tests (e.g. re-tests on rectified work and/or replacement materials), the costs of such additional testing shall be for the Contractor's account.

(b) Additional tests required by the Employer's Agent

The costs of any additional tests required by the Employer's Agent in terms of subclause C3.4.2.2: Additional testing required by the Employer's Agent, shall be reimbursed to the Contractor against substitution of the Provisional Sum allowed therefore in the Bill of Quantities; provided always that the costs of any such additional tests ordered by the Employer's Agent, the results of which indicate that the quality of the materials utilised and/or the standard of workmanship achieved are/is not in accordance with the specifications, shall not be reimbursable to the Contractor.

C3.5.1.10 Recording of Weather

The Contractor, together with the Employer's Agent on Site shall record weather conditions in the Site Diary for purposes of agreeing on its impact on Critical Path Activities (see below).

C3.5.1.11 Extension of Time Resulting from Abnormal Weather

Extension of time will not be considered for normal adverse weather conditions. For abnormal rainfall or saturated conditions will be calculated as follows:

- The Contractor shall, in his program, allow for the expected number of working days on which work on critical path activities could be delayed – as given in the Schedule below.
- Extension of time will be calculated for each calendar month or part thereof over the full period for the completion of the Work, plus any approved extension thereof, as follows:
 - A delay caused by abnormal weather conditions will only be accepted for extension of time if, in the opinion of the Employer's Agent, it delays an item or items which lie on the critical path determined by the Contractor's approved program (irrespective of actual rainfall).
 - An extension of time will be granted for the number of days, as approved, on which adverse weather conditions delay critical path activities, less the anticipated number of days given in the Schedule below.
 - The net extension of time determined for each month, which may be negative, shall accumulate algebraically to determine the net number days for extension of time due to abnormal weather conditions, but a negative total at the end of the Completion Period will not be taken into account.
 - Where a portion of a month is involved, a pro rata number of days shall be calculated.

The anticipated number of working days on which work on critical path activities will be delayed as a result of adverse weather conditions are as follows:

Month	Days	Month	Days
January	3	July	0
February	3	August	1
March	4	September	2
April	2	October	2
May	1	November	3
June	0	December	3

C3.5.1.12 Format of Communications

All requests for information or requests for inspections are to be recorded in writing.

All instructions are to be issued in writing as a Site Instruction.

C3.5.1.13 Key Personnel

The Contractor is to compile and submit to the Employer's Agent a schedule of Key Personnel, including titles, names, designations and contact numbers of such personnel. This document is to be updated immediately in the event of any changes.

C3.5.1.14 Management Meetings

Formal project meetings will be held on site in the Employer's Agent's office (or similar suitable office). Representatives of the Employer, Employer's Agent and Contractor will be required to attend. The representatives are to have the necessary authority in respect of aspects such as planning and health and safety. The Contracts Manager and Construction Manager (Site Agent) are required to attend all such meetings.

The Contractor shall attend the following meetings during the Contract:

- a) An inaugural site meeting at the GIBB offices or as called by the Employer's Agent
- b) Monthly site meetings, at GIBB's Mthatha offices and on Site or as called by the Employer's Agent, from the commencement of the Works until the issue of the Practical Completion Certificate (or where necessary as determined by the Employer's Agent).
- c) Monthly technical meetings called by the Employer's Agent (or where necessary as determined by the Employer's Agent).
- d) Meetings during the Defects Notification Period called by the Employer's Agent (only if warranted)
- e) The following reports shall be submitted by the Contractor before the monthly Site Meetings:
 - Progress Report
 - Plant & Labour returns
 - Updated Program vs Baseline Program
 - Updated cashflow projection.

The cost of these requirements shall be included in the rates tendered for Time Related Items.

C3.5.1.15 Forms for Contract Administration

The Employer's Agent's Representative will have a full set of contract administration forms for use on site. This includes forms for recording test results, claims, inspections and the like. The Contractor may use such as a basis for his documentation should he not have adequate similar templates.

C3.5.1.16 Electronic Payments

The Employer will make payments by electronic means only.

C3.5.1.17 Daily Records

The Contractor is required to keep daily records of resources (people and construction equipment) as well as of work performed on the site. A signed copy of the previous day's record must be provided to the Employer's Agent on a daily basis.

Information relating to construction equipment shall be recorded in the Daily Site Diary. In addition, the Contractor shall deliver to the Employer's Agent, on a monthly basis, a detailed schedule of construction equipment present on the site for that month. Full particulars are to be recorded, identifying each piece of equipment, including whether the equipment is in working order or out-of-order. This schedule is to be submitted by the first day of the month following the month to be reported.

C3.5.1.18 Payment Certificates

Measurements for interim and final certificates must be agreed with the Employer's Agent prior to the issuing of a Tax Invoice by the Contractor.

The Contractor is to provide all invoices, vouchers and receipts in respect of payments made by him in connection with provisional or prime cost items when he requires payment for such.

The Contractor is to provide all invoices or receipts in respect of materials purchased and delivered to the site when he requires payment for such. Invoices or receipts are to clearly identify the material, the unit rate thereof, and the quantity/number purchased.

It is a specific requirement of this Contract that the Contractor shall collect and record all relevant information for the completion of end-of-month documentation to be submitted with each payment claim. The Payment Certificate (prepared by the Employer's Agent) will not be accepted by the Employer unless accompanied by the following:

- Local Labour Schedule (in EPWP format; ie giving employee names, IDs, gender, age group and disability status if applicable)
- Contract Participation Goal expenditure to date vs target (details of labour wages and salaries paid and payments to Targeted Enterprises vs value of work certified to date)
- Monthly Progress Report (from Site Meeting).

C3.5.1.19 Proof of Compliance with the Law

The Contractor shall insure his employees against accident in terms of the Compensation for Occupational Injuries and Diseases Act (Act 130 of 1993), as amended. A Letter of Good Standing with the Compensation Fund, as issued by the Department of Labour, must be submitted as part of the Tender.

Where the Letter of Good Standing expires during the contract period, the Contractor will be required to submit new, valid documentation. Failing to do so will result in work being stopped.

C3.5.1.20 Insurance Provided by the Employer

No insurance will be provided by the Employer.

C3.5.2 Health and Safety

C3.5.2.1 Health and Safety Requirements and Procedures

The Contractor is to comply in all respects with the Occupational Health and Safety Act (Act 85 of 1993), as amended, as well as with the Construction Regulations 2014, the Electrical Machinery Regulations, and the Employer's OH&S Particular Specification given in Part C3.6.

The Health and Safety Officer appointed by the Employer shall liaise directly with the Contractor on safety matters but shall be required to channel safety matters affecting construction work through the Employer's Agent.

With reference to the Baseline Risk Assessment given in the Employer's OH&S Particular Specification, the Contractor shall take special care of the following during construction:

- Flooding of trenches or excavations
- Possibility of collapse of excavations in sandy soils
- Protection of deep excavations and adjacent structures
- Protection of existing services
- Accommodation of traffic and pedestrians
- Proper storage and stacking of materials
- Good housekeeping and site tidiness
- Provision of welfare facilities
- Dust control
- All power supplies, power lines and cables shall be treated as live until proven otherwise
- Care shall be exercised and all necessary precautions taken while working under power lines or near cables with construction plant and when carrying or working on ladders in the vicinity of power lines.

The Baseline Risk Assessment provided is not necessarily fully comprehensive and the Contractor is responsible for carrying out his own Baseline Risk Assessment.

The Contractor's Health and Safety plan is to be approved and the Contractor's Safety Officer

is to be appointed prior to the commencement of any construction activities. It is specifically noted that the person officially appointed as the Contractor's Safety Officer shall be properly qualified and experienced and be based full-time at the site while activities are taking place.

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

The rates and prices tendered by the Contractor shall be deemed to include all costs for conforming to the requirements of the complete Act. Particular attention however needs to be made to the Construction Regulations of the Act and this specification as applicable to this Contract.

C3.5.2.2 Protection of the Public

The Contractor shall at all times ensure that his operations do not endanger any member of the public.

As the Works Site is close to formal and informal residential areas, the Contractor shall take special precautions to prevent public access to any danger areas on the Works, e.g. by temporary barricades and/or fencing.

No excavation may left open during the builder's holiday. Excavations left open over other non-working days shall be adequately safeguarded at all times.

C3.5.2.3 Barricades and Lighting

The Contractor is responsible for the safety of the site and shall provide all necessary watching, barricading and lighting. This is especially significant at excavations.

C3.5.3 Community Participation

C3.5.3.1 Community Liaison Officer

The employment of local labour shall be through a Community Liaison Officer.

A Provisional Sum allowance has been made for the short-term employment of CLOs in accordance with the following Terms of Reference (ToR):

- a) Candidates for the CLO will be selected by the local leadership.
- b) The accepted CLO will responsible for liaising with a Project Steering Committee (PSC) for each area.
- c) The CLO is to be appointed for the period of on-site activity, plus a period of 14 days prior to this period.
- d) Remuneration for the CLO will be R 5 000 wages plus R300 cell phone allowance per month for the period of employment.

The CLO will liaise with the Contractor in performing the following activities:

- Organise and assist the contractor in explaining to all workers the labour-based construction model
- Ensure labourers understand their task and the principles behind task work
- Ensure labourers are informed of their conditions of temporary employment
- Attend all site meetings and briefing for work procedures
- Keep written record of interviews and community liaison which should be summarised and included in the monthly progress reports
- Collect monthly welfare reports and submit to social facilitators
- Ensure that contractor's workers are paid what is due to them and in time

- Assist in the recruitment of labour
- Promote and maintain sound relations with community stakeholders and other role players
- Screen the supplied labour by the community through Project Steering Committees to ensure compliance with the agreed upon recruitment policy and the government's labour employment targets
- Inform local labour about their conditions of temporary employment, to ensure their timeous availability and inform them timeously when they would be relieved, where the rotation of labour is applicable
- Keep the labour register of labour and manage records of project local labourers and be able to provide reports on employment statistics
- Consult on all decisions regarding local problems and any matters of importance that, in any way will be of relevance to the Contract.
- To be on site on a daily basis
- To register concerns / perceptions and raise them in the PSC meetings
- Attend site and PSC meetings to present monthly report on the local community labour involvement and site matters
- Identify possible labour dispute and any disciplinary matter and advise the site agent / foreman and assist in the resolution, where necessary must call for the assistance of the Social Consultant for the resolution of the conflicts
- Assist the contractor in preparing records of project employees. Assist the contractor in making task measurements and the records thereof
- Monitor the production of individual task workers and arrange replacement of those workers who fail to produce a reasonable task output
- Attend disciplinary proceedings to ensure that hearings are fair and reasonable
- Communicate daily with the contractor to determine additional labour requirements with regard to numbers and skills and pass this to the PSC
- Attend weekly meetings with the contractor and make a weekly written report which shall be a prerequisite to being paid.

The CLO will liaise with the Social Facilitators in performing the following activities:

- Assist in convening of workshops
- Disseminate information to PSC members
- Articulate implementing agency policies to PSC members
- Communicate labour requirements
- Attend induction training programs for workers and induct labourers
- Submit monthly welfare reports to the social facilitators PSC

-
- Communicate labour and skills requirements to the PSC
 - Assist in the recruitment and engagement of work force
 - Verify labour records and ensure all engaged qualify as per the Contract requirements
 - Investigate and report all labour dispute matters to the PSC, advise site agent on resolution.

The community is represented by a PSC. All liaisons with the community and the committees are the responsibility of the Social Facilitator in conjunction with the OR Tambo District Municipality, the Employer and the Project Steering Committee. The Contractor will be required to liaise through them for any matters pertaining to the community.

C3.5.3.2 Employment of the Local Community

The Contractor is to limit the import of labour to skilled personnel only. Semi-skilled (where possible) and all unskilled labour is to be sourced from the local community.

It is a requirement that, at least, all unskilled labour taken-on by the Main Contractor and his sub-Contractors are sourced from the immediate local community and that such employment is arranged through the CLO and PSC.

Employment of all temporary labour, whether employed directly or through a Subcontractor, shall comply in all respects with the National Government Department of Labour's regulations; including the minimum wage applicable to construction work in the Eastern Cape.

C3.5.3.3 Certificate of Service

An employee shall, upon termination of his services, be entitled to a Certificate of Service showing the full names of his employer (i.e. the Contractor) and the employee, the type of work done by the employee, the date of commencement, a record of training received and the date of termination of his services.

C3.6 Annexures

Number	Heading	Pages
C3.6.1	Variations and Additions to the Standard SANS 1200 Specifications: General, Civil and Structural Works	21
C3.6.2	Particular Specifications	
C3.6.2.1	GIBB 012: General Building Materials and Workmanship	
C3.6.3	Health and Safety Specifications by the Employer	
C3.6.4	Construction Environmental Management Plan	

Annex C3.6.1
Variations and Additions to the Standard SANS 1200
Specifications: General, Civil and Structural Works

NOTE : Numbering in the Project Specifications corresponds with the numbering of clauses in the Standard Specifications (SANS 1200).

Tenderers must make provision for all the relevant Project Specification requirements to be included when calculating the prices of the various items in the schedule of quantities.

In addition, the sum tendered shall cover all initial costs incurred in complying with the requirements of C1.2 Contract Specific Data

TABLE OF CONTENTS

PSA	GENERAL (SABS 1200 A).....	23
PSAB	EMPLOYER'S AGENT'S OFFICE (SABS 1200 AB)	31
PSC	SITE CLEARANCE (SABS 1200 C).....	35
PSD	EARTHWORKS (SABS 1200 D).....	36
PSDB	EARTHWORKS (PIPE TRENCHES) (SABS 1200DB).....	44
PSDK	GABIONS AND PITCHING (SABS 1200 DK)	49
PSDM	EARTHWORKS (Roads, subgrade) (SANS 1200 DM – 1981).....	51
PSG	CONCRETE (STRUCTURAL) (SABS 1200 G).....	52
PSH	STRUCTURAL STEELWORK (SABS 1200H).....	82
PSHC	CORROSION PROTECTION OF STRUCTURAL STEELWORK (SABS 1200HC)	85
PSI	MEDIUM PRESSURE PIPELINES (SABS 1200 L)	88
PSLB	BEDDING (PIPES) (SABS 1200 LB)	147
PSLC	CABLE DUCTS (SABS 1200 LC)	151

NOTE

In certain clauses, the SABS 1200 standard specifications allow a choice to be specified in the project specifications between alternative materials and / or methods of construction and /or 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 section. It may also contain 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 any new clause/s or payment item/s not in the original SABS 1200 specification but which is included here, follows-on from the last clause or item number used in the relevant section of the standard specifications.

PSA GENERAL (SABS 1200 A)

PSA 1 SCOPE

Replace the first paragraph of sub-clause 1.1 with the following :-

“This specification covers requirements, principles and responsibilities of a general nature which are normally applicable to all civil engineering contracts as well as the requirements for the Contractor’s establishment on Site”

PSA 2 INTERPRETATIONS

PSA 2.3 Definitions

Add the following definitions :-

“General Conditions’ : The General Conditions of Contract specified for use with this Contract and the Special Conditions of Contract as applicable.

‘Specified’ : As specified in the Standardised Specifications, the Drawings or the Project Specifications.”.

The term “Engineer” shall be replaced by “Employer’s Agent”.

The Employer’s Agent shall be GIBB (Pty) Ltd.

The terms "ESCOM", "ESC" and "Electricity Supply Commission" shall mean "Eskom".

GCC: General Conditions of Contract (2015)

The terms “plant” and “construction equipment” shall be defined as contained in the GCC:2015. Hence, the term “plant” as contained in the SANS 1200 suite is replaced by “construction equipment”.

PSA 2.4b Abbreviations

Add to Sub-clause 2.4(b):

"MAMDD: Modified AASHTO maximum dry density".

PSA 2.8.1 Principle

In the fourth line of Sub-clause 2.8.1, after the word "specification", add: "or in the measurement and payment clause of the standard specification, particular specification or project specification".

Add the following to this clause:

Items which are designated as provisional quantities or provisional sums in the Schedule of Quantities are intended to provide for works, the need or extent of which shall be established by the Employer’s Agent during construction. Work scheduled as such shall only be undertaken on the written instruction of the Employer’s Agent and, where applicable, shall be paid for at the tendered rate or in the absence of rates shall be valued in accordance with Clause 6.4 of the General Conditions of Contract.

The Schedule of Quantities shall not be used for ordering purposes and no liability or responsibility shall be admitted by the Employer’s Agent in respect of materials ordered or procured by the Contractor on the basis of the Schedule of Quantities.

PSA 3 MATERIALS

PSA 3.1 Quality

Add to the Sub-Clause:

"No used or recycled material may be used in the Works unless expressly authorized by the Employer's Agent.

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

Samples of concrete aggregates and pipe bedding material are to be delivered to an approved laboratory.

Where a material to be used in this Contract is specified to comply with the requirements of an SABS Standard Specification, and such material is available with the official SABS mark, the material used shall bear the official mark.

The Contractor shall submit in good time, before any construction commences, to the Employer's Agent on site, samples of all materials intended to be incorporated into the works. The samples shall be accompanied by results of tests undertaken by an approved independent laboratory on the samples in question on behalf of the Contractor and at his cost, before consideration by the Employer's Agent

The Employer's Agent, during construction, will take independent samples from stockpiles of proposed construction materials on site and from the completed works. Approval will not be granted for samples delivered by the Contractor directly to the Employer's Agent's office. The Contractor shall be responsible for the cost of all failures on test samples and control testing.

All pipes, fittings and materials used in the Works, must bear the official standardisation mark of Standards South Africa where applicable. The mark on a pipe shall be visible from above after the pipe is laid.

Rubber articles, including pipe insertion or joint rings shall be stored in a suitable shed and kept away from sunlight, oil or grease.

Large items not normally stored in a building shall be neatly stacked or laid out on suitable cleared areas on the Site. Grass or vegetation shall not be allowed to grow long in the storage areas and the material shall be kept free of dust and mud and shall be protected from stormwater. Pipes shall be handled and stacked in accordance with the manufacturer's recommendations, special care being taken to avoid stacking to excessive heights and placing over hard objects. PVC pipes shall be protected from direct sunlight by suitable covers.

Every precaution shall be taken to keep cement dry and prevent access of moisture to it from the time it leaves the place of manufacture until it is required for use on the Site. Cement is to be used on a first in/first out basis. Bags of cement which show any degree of hydration and setting shall be removed from the site of the Works and replaced at the Contractor's own expense. Any cement older than six weeks is to be removed from site.

Materials shall be handled with proper care at all times. Under no circumstances may materials be dropped from vehicles. Large pipes or large plant shall be lifted or lowered only by means of suitable hoisting equipment.

Where propriety materials are specified it is to indicate the quality or type of materials or articles required, and where the terms "or other approved" or "or approved equivalent" are used in connection with proprietary materials or articles, the Contractor is to supply with their tender the name of the manufacturer and supporting documentation that show that the materials or articles comply with the relevant specifications. It is understood that the approval shall be at the sole discretion of the Employer and the Employer's Agent.

Irrespective of any approval granted by the Employer's Agent or the Employer, the Contractor shall be deemed responsible for quality of all materials used for construction and their specified performance."

Add new Sub-Clause:

“PSA 3.3 : Ordering of Materials

The quantities set out in the Schedule of Quantities have been carefully determined from calculations based on data available at the time and should therefore be considered to be only approximate quantities. The liability shall rest entirely and solely with the Contractor to determine before ordering, the required types and quantities of the various materials required for completion of the Works in accordance with the Specifications and the Drawings issued to the Contractor for construction purposes.

Any reliance placed by the Contractor on the estimated quantities stated in the Schedule of Quantities issued for tendering purposes, or measurements made by the Contractor from the drawing issued for tendering purposes, shall be entirely at the Contractor's risk, and the Employer accepts no liability whatever in respect of materials ordered by the Contractor on the basis of Tender Documents.”

PSA 4 PLANT

PSA 4.2 Contractor's Office and Stores (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 Employer will place an area of ground at the disposal of the Contractor at the pipe yard site to enable him to erect his site offices, workshops and stores. The temporary facilities and ablution facilities shall comply with the requirements of the Local Authority.

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. The site is to be rehabilitated as described elsewhere.”

PSA 5 CONSTRUCTION

PSA 5.1.1 Setting out the Works

Add before the first sentence:

The Contractor, within two (2) weeks after the site has been handed over to him, is to ascertain the correctness of all pegs and bench marks. Any discrepancy shall immediately be reported in writing to the Employer's Agent. Any costs or subsequent costs arising from discrepancies which had not been reported to the Employer's Agent, within the aforementioned period, shall be the sole responsibility of the Contractor.

Tender drawings shall not be used for construction purposes.”

PSA 5.2 Watching, Barricading, Lighting and Traffic Crossings

Add the following to this clause:

“The Contractor shall employ competent watchmen to guard the Works both by day and night.

From the time any portion of the Works commences, until the Completion of the Works and the issue of the Certificate of Completion of the Works, the Contractor shall be responsible for protecting the property of the Employer and all persons having business on the Site from anything dangerous or likely to cause damage or injury. The Contractor shall take all practical precautions to avoid nuisance or inconvenience to the owners or occupiers of properties near to the Site and to the public generally whilst carrying out the Works and shall at all times keep the Site clean and in a safe and satisfactory condition.

Temporary traffic signs shall be erected when work is being done within and adjacent to roadways. The

number and layout of the traffic signs shall comply with the Site Manual entitled "Safety at Roadworks in Urban Areas", as published by the Department of Transport

The Contractor shall control all access to the site, for authorised persons only, and shall ensure that the approved conditions of the Health and Safety Management Plan are adhered to."

PSA 5.4 Protection of Overhead and Underground Services

Add the following to this clause:

"Before construction of the Works, or any phase of the Works, the Contractor shall contact all relevant parties and authority officials to establish the existence of existing services on site. The Contractor shall be responsible for obtaining all necessary wayleaves. No claims shall be lodged by the Contractor for delays in obtaining such wayleaves or permits."

PSA 5.7 Safety

Add the following to this clause:

"Compliance with
1) OHS Act and Regulations and
2) Environmental Management Plan (EMP or EMPr)

Lump sums are provided in the Bill of Quantities to cover the contractor's cost for compliance with the requirements of the Construction Environmental Management Plan and the Occupational Health and Safety Act, 1993, the Construction Regulations, 2014 and the Health and Safety Specification respectively.

In addition, Sums are included under Time Related Items in the Preliminary and General Section of the Schedule of Quantities. The lump sums shall include full compensation for the provision of the necessary site official, the training, PPE, plans, audits, assessments, administration, etc. and all other costs required for compliance. Fines issued for non-compliance will be deducted from these Sums, but are not limited to the value of the Sums stated. "

Add the following clauses:

"PSA 5.10 Record Drawing Information

As the Works are progressing, the Contractor shall mark on a special set of drawings, all as-built details and submit them to the Employer's Agent's Representative for approval. No extra payment shall be made for preparation of these as-built plans.

All valves, chambers and the like shall be coordinated together with their invert and cover/ground levels on the as-built drawings.

The Certificate of Completion shall only be issued once all the as-built information has been received and verified by the Employer's Agent.

PSA 5.11 Clearance of Site on Completion

The Contractor shall obtain, from each property owner directly affected by the Works, a certificate to the effect that the property owner is satisfied with the standard of reinstatement of any fences, boundary walls or structures, compensation paid for loss or damage to stock, crops or property, material spoiled on their properties or any other condition affecting their properties as a result of the operations of the Contractor. The Contractor shall further obtain a Clearance Certificate from each authority whose services have been affected during the construction of the Works.

All such certificates must be lodged with the Employer's Agent before the Certificate of Completion will be issued.

PSA 5.12 Project Reporting

See C3.4.15.6

The following data is to be submitted monthly, at the site meeting, to the Employer's Agent :

- Updated program
- Construction equipment schedule
- Rainfall records

The tendered Fixed and Time Related Preliminary and General Charges in the Schedule of Quantities shall be deemed to include for all costs in this regard.

PSA 6 TOLERANCES

PSA 6.2 Degree of Accuracy

Add the following to this clause:

"Degree of Accuracy II shall apply."

PSA 7 TESTING

PSA 7.1 Testing Principles

Add the following to this clause:

"When giving notice, the Contractor shall provide the Employer's Agent with the results of the check testing indicating that the work is to specification. The Employer's Agent shall be given 48 hours' notice of when testing or inspections are required.

The Employer's Agent may from time to time carry out his own check tests on the work performed by the Contractor. Should such check tests show that the Contractor's control testing be such that the quality of the Contractor's work can be called into question, then the Employer's Agent may order further check tests to be carried out on work already completed. All costs associated with such check tests shall be for the Contractor's account, as also the costs of any other check test whose results to not comply with the specification.

Failure by the Contractor to notify the Employer's Agent or to provide the required information or, where specified, to perform the required test, will be grounds to exempt the Employer from payment for the associated work and for all subsequent work which would be affected by the failure of the Work to be tested.

The Employer's Agent will be under no obligation to the Contractor to perform the tests. If the Employer's Agent elects not to perform a particular test after notification by the Contractor, the Contractor will be issued with a written instruction to proceed with the relevant works without the acceptance test being performed.

Nothing contained in this clause will relieve the Contractor of any responsibilities under the specification or in any way limit the tests, which the Employer's Agent may call for or perform in terms of the specification.

Where the Employer's Agent is called to witness certain control tests, such as the pressure testing of a pipeline, and the results of such tests do not comply with the specifications, then the Employer reserves the right to recover costs for the Employer's Agent's presence at the unsuccessful test from the Contractor."

PSA 7.2 Approved Laboratories

Add the following to this clause:

“Acceptance testing shall be done by a laboratory selected by the Employer’s Agent. The Employer’s Agent requires twenty-four hours’ notice from the Contractor in order to perform the relevant acceptance test.

All acceptance testing by the Employer’s Agent shall be paid for by the Contractor. The costs of such tests which meet the specification requirements will be reimbursed to the Contractor in the monthly payment certificate. This payment shall consist of a billed amount plus the tendered mark-up. A Provisional Sum has been provided in the Schedule of Quantities to allow for the cost of such testing.

The Contractor shall make due allowance for testing procedures in the construction program.”

PSA 8 MEASUREMENT AND PAYMENT

PSA 8.2 Payment

PSA 8.2.1 Fixed-Charge and Value-Related Items

Add the following to this clause:

The fixed charge items will include all costs associated with dealing with compulsory sub-contracts.

PSA 8.2.2 Time-Related Items

Replace the contents of this sub-clause with the following:

Payment for time-related items will be effected as follows only after payment for the relevant fixed-charge item has been made : Subject to the provision of 8.2.3 and 8.2.4 payment will be made monthly in equal amounts, calculated by dividing the sum tendered for the item by the tendered contract period in months, multiplied by the months completed, provided always that the total of the monthly amounts so paid for the item is not out of proportion to the value of the progress of the works as a whole.

PSA 8.4 Scheduled Time-Related Items

Add the following to this clause:

The Contractor shall tender rates in the Schedule of Quantities to cover his time-related establishment costs. The amount tendered and paid shall be full compensation to the Contractor for:

- i) The maintenance of his whole organization as established for this Contract.
- ii) The maintenance of all insurances, indemnities and guarantees required in terms of the Conditions of Contract or Tender where applicable.
- iii) Compliance with all general conditions and requirements which are not specifically measured elsewhere for payment in these Contract Documents.

Payment of the lump sum shall be made monthly in compliance with the method laid down in Sub-clause 8.2.2.

The Contractor will not be paid Time-Related Preliminary and General Charges for any Special Non-Working Days, which shall be deemed to have been allowed for in his rates.

PSA 8.4.2.2 Facilities for the Contractor

Add the following to this clause:

Facilities for the Contractor shall include all the costs of providing water for construction and water tightness testing of water retaining structures and pipelines.

The costs for providing security against theft and vandalism will be included in the rates tendered for Contractor facilities. No separate payment will be made for the provision of security.

Replace the penultimate sentence of Sub-clause 8.5 to read:

PSA 8.5.1	Community Liaison Officer	 Unit : Prov Sum
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A separate item for overheads, charges and profit on the above item is applicable.

Replace the penultimate sentence of Sub-clause 8.6 to read:

PSA 8.7 Daywork

The rates submitted by the Tenderer in the relevant schedule of the Contract shall be applicable.

- a) Labour at hourly rates for skilled, semi-skilled and unskilled labourers.
- b) Purchase cost of Material with a percentage allowance on the net cost for delivery to Site and all Contractors charges.
- c) The Contractor's own construction equipment as a Provisional Sum. Where not listed in the BoQ, rates shall be agreed with the Engineer before such work is put in hand.

The Contractor will be paid the actual net cost of construction equipment hired by him for Daywork and in addition will be paid a percentage allowance on the net cost of such hire, which allowance will cover the Contractor's own overhead costs and profit.

Add the following to this clause:

The tendered rate shall further cover the cost of backfilling the excavation with selected material compacted to 90% Mod. AASHTO density, keeping the excavation safe, and taking care that the

services are not damaged in any way. The rate shall include for all negotiations with the authorities, notification to all affected parties and any other requirement to protect and complete the work.

Add the following clauses:

PSA 8.9 Survey Control and Setting out of Works Unit : Sum

Before commencement of work, the Contractor is to liaise with the Employer's Agent to establish the status of all survey pegs. If any pegs are missing, he shall immediately inform the Employer's Agent in writing.

On completion of the Contract the pegs that have been unavoidably disturbed will be replaced by the Employer. Pegs which have, in the opinion of the Employer's Agent, been disturbed due to the negligence of the Contractor will be replaced by a registered Land Surveyor at the Contractor's cost.

**PSA 8.10 Compliance with OHS Act and Regulations
(Including the Construction Regulations 2014) ... Unit : Sum**

The tendered sum shall include full compensation to the Contractor for compliance with all the requirements of the OHS Act and Regulations (including the Construction Regulations 2014), Health and Safety Officer/s, medical examinations, accommodation, transport, communication implements, consultations, meetings and any other thing necessary for OH&S) and covid-19 regulations compliance for the full duration of the Contract.

This sum will be paid to the Contractor, in equal monthly amounts, subject to proper and accepted compliance.

PSA 8.11 Compliance with Environmental Requirements Unit : Sum

The tendered sum shall include full compensation to the Contractor for compliance with all the environmental requirements.

This sum will be paid to the Contractor, in equal monthly amounts, subject to proper and accepted compliance.

PSA 8.12 Alterations to Existing Services Unit : Sum

Temporary and permanent alterations made to existing services by the Contractor upon instruction of the Employer's Agent will be measured and paid under this item. Payment for works so ordered will be made on the basis of sums actually paid for materials, construction equipment and labour, exclusive of VAT.

PSA 8.13 Miscellaneous Items Unit : as scheduled

An item which refers to this clause will be measured in the unit scheduled.

The sum or rate for such item shall cover the cost of all materials, labour and construction equipment required to execute and complete the work, as specified, or described in the Schedule of Quantities or shown on the drawings.

PSAB EMPLOYER'S AGENT'S OFFICE (SABS 1200 AB)

PSAB 3 MATERIALS

PSAB 3.1 Nameboards

Add the following:-

Employer's nameboards shall be erected within one month of the commencement of construction and shall be placed where ordered by the Employer's Agent. Any damage to these boards shall be repaired within 14 days of a written instruction received from the Employer's Agent. For details of the board refer to the Standard Drawings contained in this document.

All nameboards shall be removed 14 days prior to the date of the Final Approval Certificate.

PSAB 3.2 Office Building

Delete the first sentence and substitute the following:

The Contractor shall supply and furnish two (2 No) air-conditioned "Kwikjack" or similar (6 m x 3 m) offices and one air-conditioned "Kwikjack" or similar (9 m x 3.4 m) conference facility for conducting meetings.

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:

- (j) electrical installation to include at least two lights and two 15A plug points plus adequately sized air conditioning units (for heating and cooling) for each office or meeting space.
- (k) one refrigerator of at least 100 litre capacity
- (l) one kettle of at least 2 litre capacity
- (m) one tea set comprising six cups and saucers, six teaspoons, one teapot, one sugar bowl and one milk jug
- (n) covered parking for four vehicles.
- (o) un-covered parking space for two vehicles.
- (p) two "Barhold" or similar wall mounted racks each with 6 clamps suitable for hanging A0 sized drawings
- (q) one large meeting table
- (r) ten additional chairs

The Contractor shall supply one (1) lockable toilet for the exclusive use of the Employer's Agent's staff.

In addition, the offices for the Employers Agent shall be supplied with approved burglar proofing, the cost of which shall be taken as included in the relevant tendered rates.

PSAB 4 CONSTRUCTION EQUIPMENT

PSAB 4.1 Telephone

Delete the Sub-Clause and substitute the following:

The Contractor will be required to supply the Engineer's Site Staff with pre-paid air-time to the value of R500.00 each per month for their mobile phones as soon as the Contract commences.

Add the following new clauses:

The tendered Fixed and Time Related Preliminary and General Charges in the Schedule of Quantities

shall be deemed to include for all costs in this regard.

Add the following new clauses:

PSAB 4.2 Covered Parking Bay

The Contractor shall also supply and maintain covered parking's for the exclusive use of the Employer and Employers Agent as stated in Clause 3.2 above. The parking shall be constructed with gum pole uprights with IBR or corrugated iron roofing supported on timber with 80% shade cloth cladding to the sides. The surface bed of the parking shall be free draining and constructed with a 100 mm layer of 19 mm stone.

PSAB 4.3 Other facilities for the Engineer

The Contractor will be required to supply the Engineer's Representatives with the following:

- i) Wi-Fi Internet Connection
- ii) Access to a printer and photocopier and associated consumables

A Prime Cost item in the BoQ has been provided for the hire of at least two vehicles for the Engineer's Site Staff from an approved rental company. The Rental Agreement shall include comprehensive 3rd Party cover and waiver of all excess amounts. The commencement dates for rental and number of vehicles shall be as agreed with the Engineer at commencement of Site establishment.

The alternative of the Contractor providing one or more of their own vehicles will not be accepted.

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), the Employer's inspectors, CLO and PSC 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 educated labourers for use on and about the site on survey and other work directed by the Engineer at all reasonable times.

Add the following new clauses:

PSAB 5.6 Survey Equipment

Add new Sub-Clause:

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

One automatic reading Engineer's level plus tripod
One levelling staff (5 m long, 1 cm graduations)
One staff angle bubble
One metal change-point for levelling
One separate plumb-bob
One spirit level (one metre long)
One hammer (2 kg) with steel or wooden pegs as necessary

One 50 m steel or glass fibre tape
One 5,0 m (or longer) retractable steel tape.

The equipment may be shared by arrangement between the Contractor and the Engineer or his representative on Site. 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.

The Contractor shall maintain the equipment in good working order and keep it clean until the completion of the Works.

PSAB 5.7 Site Instruction Books

The Engineer shall supply a site instruction book for specific use on the Site. All instructions given by the Engineer's Representative must be confirmed and countersigned by the Engineer. The instruction shall be countersigned by the Contractor before implementation.

The Contractor shall supply a triplicate book for site correspondence and inspection requests to the Engineer's Representative. Reasonable notice shall be allowed prior to inspections. All inspections requests and approval/disapproval thereof shall be recorded by the Site staff in writing. All requests must be signed and dated by the Engineer's Representative before implementation.

The Contractor in conjunction with the Engineer must ensure that a suitable site quality record system is put in place to record that each section, or work item, complies with the relative works specification.

PSAB 8 MEASUREMENT AND PAYMENT

PSAB 8.1 Scheduled Items

Delete the 1st sentence and substitute the following:

Items will be scheduled in terms of Sub-Clauses 8.3.2 and 8.4.2 of SANS1200 A.

PSAB 8.2.1 Fixed and Time-related Charges

Delete the 1st sentence and substitute the following:

The terms of Sub-Clause 8.2 of SANS 1200 A shall apply.

Add the following clauses:

PSAB 8.2.2 Furnished Office and Meeting Room

The Contractor shall supply, erect, maintain and service for the sole use of the Engineer's staff facilities as defined in PSAB 3.2 and PSAB5.2.

Payment will be made for the supply and erection of the above facilities under the provided fixed rate.

Payment will be made for the maintaining the above facilities in a suitable condition under the provided time related rate.

PSAB 8.2.3 Telephone

The Contractor shall provide air time as defined in Clause 4.1, as amended.

Payment will be made for supplying 3 x R500 monthly pre-paid airtime and data for the mobile telephone under the time related rate. The cost of making the airtime available shall be included in the tendered monthly rate rather than as a percentage mark-up (which would otherwise require invoices as proof of

payment).

PSAB 8.2.4 Nameboards

The Contractor shall supply and erect nameboards in accordance with SANS 1200AB Clause 3.1. Payment will be made for the supply and erection of the nameboards under the provided fixed rate.

Payment will be made for maintaining the nameboards in a suitable condition under the relevant time related rate.

PSAB 8.2.5 Survey Assistants

Payment will be made for the employment of the survey assistants specified in Clause PSAB 5.5 under the provided fixed rate on verification of their availability by the Engineer. Should the survey assistants be removed from site during the course of the Contract then any payments made for the survey assistants will be reversed in the next interim payment certificate.

Payment will be made for the monthly cost of the survey assistants under the provided time related rate for as long as they are required to be available to assist the Engineer or his representatives.

PSAB 8.2.6 Survey Equipment

Payment will be made for the supply of the equipment specified in Clause PSAB 5.6 under the provided time-related rate on verification by the Engineer that the equipment specified is on site. No payment will be made if any of the items listed are not available to the Engineer.

The time-related rate is deemed to include maintaining the above equipment in a suitable condition.

PSAB 8.2.7 Covered Parking Bay

Payment will be made for the supply and installation of covered parking bay specified in Clause PSAB 4.2 under the provided fixed rate on verification by the Engineer that the parking bay specified is erected on site. Should the parking bays be removed from site during the course of the contract then any payments made for the supply of this equipment will be reversed in the next interim payment certificate.

Payment will be made for the maintaining of the above parking bays in a suitable condition under the provided time related rate.

PSAB 8.2.8 All other specified facilities for the Engineer

A fixed P&G lump-sum item will be measured for payment for all items specified in PSAB 4.3.

The cost of providing and maintaining all the facilities for the Engineer's Site Staff (such as cell phone airtime, access to WiFi and photocopying facilities) shall be included in the relevant fixed and time-related scheduled rates.

PSAB 8.2.9 Survey Equipment

Payment will be made for the supply of the equipment specified under the fixed P&G rate on verification by the Employer's Agent that the equipment specified is on site. Should any of this equipment be removed from site during the course of the contract then any payments made for the supply of this equipment will be reversed.

Payment will be made for maintaining the survey equipment in a suitable condition under the time-related P&G rate.

PSC SITE CLEARANCE (SABS 1200 C)

PSC 3 MATERIALS

PSC 3.1 Disposal of Material

Unless otherwise ordered by the Employer's Agent, the Contractor shall dispose of material resulting from clearing and demolition operations at a site to be determined by the Contractor. Such a site shall have the approval of the Employer's Agent, the Local Authority and the Environmental Control Officer.

Payment for the clearing, loading, transport, dumping fees and any other requirement or costs incurred shall be included in the rates submitted for site clearance.

PSC 5 CONSTRUCTION

PSC 5.3 Clearing

Add the following:

"Where any Portion of the Works traverses existing fences these shall be carefully uplifted, if required, and reinstated during the course of activities in that specific area. Where an uplifted fence interferes with the security of what it controls a temporary fence shall be installed and operated to the satisfaction of the Engineer or his Representative. Prior to removal or dismantling of any fence, the contractor will be required to photograph the fence for future reference."

PSC 8 MEASUREMENT AND PAYMENT

PSC 8.1 Basic Principles

Add the following :

"No separate payment will be made for topsoil removal or replacement along pipeline routes. The Contractor is to excavate trenches in such a manner that the top 150 mm of material is kept separate from other excavated material, for replacement on completion of backfill operations. All costs related to excavating this vegetation and topsoil, separate stockpiling, dust nuisance control and reinstatement of the topsoil upon completion of the backfilling operations, shall be deemed to be included in rates tendered for trench excavation and backfilling."

PSD EARTHWORKS (SABS 1200 D)

PSD 2 INTERPRETATIONS

PSD 2.3 Definitions

Amend the sentence headed "Restricted excavation" to read:

"Restricted excavation – All excavations for individual structures starting from the specified bulk excavation platform levels or, where no bulk excavation platform has been specified, from 150mm below natural ground level (ie excluding a nominal 150mm topsoil layer to be removed beforehand)."

Replace the definition "Borrow" with the following :-

"Borrow Material : Material, other than materials obtained from excavations required for the Works, obtained from sources such as borrow pits or the authorised widening of excavations. 'Borrow' shall have a corresponding meaning."

Replace the definition "Stockpile" with the following :-

"Stockpile (Verb) : The process of selecting and, as may be necessary, loading, transporting and off-loading material in a designated area for later use and a specific purpose."

Add the following definitions :-

"Fill : An embankment or terrace constructed from material obtained from excavations or borrow. In roads it includes the earthworks up to the underside of the Selected Sub-Grade level.

Fill (Material) : Material used for the construction of an embankment or terrace.

Roadbed : The natural in-situ material on which the fill, or in the absence of fill, any pavement layers, are to be constructed."

PSD 3 MATERIALS

PSD 3.1.2 Classes of excavation

Delete the contents of this clause and replace with the following:

"For this contract, the classes of excavation will be subdivided as follows:

(a) Soft excavation

All material which can still be efficiently excavated (in the opinion of the Engineer) by 30t excavator fitted with 'rock bucket' (excavator bucket typically fitted with not more than 3 tines designed to loosen layered weathered solid sedimentary residual material). This includes both soft soil material and weathered and fractured sandstone.

(b) Hard Excavation / Hard Rock

All partially weathered / unweathered sandstone material (in the opinion of the Engineer) which would normally be drilled and blasted if allowed:

- 1) Using Heavy Duty hydraulic breaker;
- 2) Hard Rock excavation by drilling and pouring-in expanding grout: All material where Engineer agrees cannot reasonably be broken-out by 30t heavy duty hydraulic breaker alone due to access difficulties or extreme hardness.

Any unweathered boulders encountered shall be classified as 'Hard Rock: excavation by hydraulic breaker or expanding grout (as agreed with the Engineer)' where such boulders exceed 0,125m³

(approx. 500 x 500 x 500mm) in volume. Boulders smaller than this size shall not be classified.

PSD 3.3 Selection

PSD 3.3.1 General

Replace 3.3.1 with the following:

The Contractor is required to select, strip 150mm deep and conserve all topsoil from all work areas not already stripped of topsoil; including:

- Temporary stockpile areas (except topsoil stockpile areas)
- Any other otherwise undisturbed area used by Contractor for his own purposes.

The Contractor shall, for bulk, restricted and trench excavation, actively select-out and keep separate all materials into one of the following groups:

- Soft fully-weathered soil
- Weak mudstone / siltstone / sandstone (unsuitable for backfilling), but still falls into the 'soft material' classification as defined in PSD 3.1.2 a)
- Hard rock material (as defined in PSD 3.1.2 b).

Where the selected material is to be spoiled at the designated off-site spoil dump, the material shall be stockpiled separately at the spoil site in its respective group so that it can either be recovered later or selected by others. All material stockpiled on site for later use as backfilling or fill or landscaping shall also be stockpiled in their respective classification groups.

Add the following sub clause :-

PSD 5 CONSTRUCTION

PSD 5.1.1.1 Barricading and Lighting (Refer SANS 1921-1 Clause 4.18.2 and 4.18.3)

Delete the Sub-Clause and substitute:

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 Clause 13 of 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.

PSD 5.1.1.2 Safeguarding of excavations

Replace Clause 5.1.1.2 (b) with the following:

The Contractor must note that the excavations for most of the structures are deep. The Contractor is responsible for ensuring that all temporary excavation faces are stable and safe at all times and shall either:

- Provide a shoring system, designed by the Contractor and signed by a suitably qualified Professional Engineer, or
- Reduce the slope of excavations to the safe angle as determined by a suitably qualified Professional geotechnical engineer employed by the Contractor.

Where any part of the sides of the excavation for structures are steeper than 1 vertical : 2 horizontal and deeper than 1m below ground level, a 1m high perimeter barrier fence comprising at least 75mm diameter gum-poles or mild steel 'Y' fencing standard (at no more than 1,5m c/c) firmly anchored into the ground with at least 3 strands of high tensile fencing wire shall be erected no closer than 1m from the edge of the excavation (or further back if ground is unstable or disturbed). The barrier fence shall

remain in place and be maintained until the relevant excavation is backfilled and/or profiled to shallower than 1:2 slope.

In addition, the Contractor shall provide stormwater diversion berms or ditches upstream of excavations for structures and, where reasonably possible, make all excavations free-draining. Where making excavations free-draining is not reasonably possible, the Contractor shall not allow water from any source to accumulate beyond 300mm deep anywhere in any excavations (excluding sludge and scour ponds once complete).

PSD 5.1.1.3 Blasting

Due to the proximity of structures, Mthatha Dam, and other Contractors, the use of drilling and blasting methods to excavate hard rock will not be allowed anywhere on site.

PSD 5.1.1.3d) Negligence

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

PSD 5.1.3 Stormwater

Add the following to this Clause:

In that many of the excavations for structures cannot reasonably be made free-draining, it will be necessary to actively remove accumulated rain water from the excavations. The Contractor shall provide, operate and maintain sufficient pumping equipment, pipes and other equipment on site as may be necessary to keep all excavations largely free of standing water at all times.

The Contractor shall be responsible throughout the duration of the Contract, inclusive of the Defects Liability Period, for the provision of all soil erosion preventative measures necessary to protect the trenches, pipeline(s) and land utilised by the Contractor during the Contract from any adverse effects of soil erosion, settlement, scour, etc., resulting from the construction of the Works.

Cross embankments, generally extending across the full width of the working strip, consisting of low earth mounds shaped to rounded form and so oriented as to have a fall of 1% along their length, shall be constructed with compacted material having a minimum density of 90% modified AASHTO density and minimum dimensions and maximum spacing dependent on the slope of the ground along the length of the pipeline, as indicated in the following table:

Slope of Ground	Minimum Height	Minimum Base Width	Maximum Spacing
0% - 5%	No cross-embankments required		
5% - 10%	300 mm	1,2 m	40 m
10% - 15%	375 mm	1,5 m	30 m
Greater than 15%	450 mm	1,7 m	20 m

The height of the cross-embankments for a distance of 1 metre on either side of the trench centreline shall be raised 150 mm above the remainder of the cross-embankment to allow for settlement. In order to form a satisfactory drainage channel upstream of each cross-embankment (at a slope of 1%) the crown over the backfilled trench shall be removed for a distance of 0.5 m upstream of the cross-embankment.

Cross-embankments shall be constructed to the same minimum standards and dimensions indicated above wherever artificial slopes have been formed on the working strip or other areas used during construction and, with the approval of the Engineer, are permitted to be so left.

No additional payment will be made for the construction of cross-embankments which will be deemed to be included in the excavation rates.

PSD 5.1.4.1 Dust nuisance

Add the following to this Clause:

Given the very fine texture of the soil, in dry, windy weather, extremely dusty conditions can be expected on Site unless suitable mitigation measures are taken. The Contractor shall be responsible for actively implementing effective dust control measures such that dust levels do not hamper workers' health and productivity.

The Contractor shall plan his execution of the Works accordingly and shall use sufficient water (with or without approved additives) or other methods to keep the level of dust to a reasonable minimum. Water for this purpose may be abstracted from the nearby dam. This shall be done in consultation with the Engineer and to the Engineer's approval. The cost of all such mitigation measures shall be deemed to be included in the scheduled rates for excavation or Preliminary & General items.

PSD 5.1.6 Road Traffic Control

In the 4th line of Sub-Clause 5.1.6 amend "South African road traffic signs manual1)" to read: "Southern African Development Community: Road Traffic Signs Manual1) and Chapter 13: [Road works Signing] of the South African Road Traffic Signs Manual1) ", and amend the footnote to read:

"1) Published by the Department of Transport, Pretoria."

Where traffic signals are required, they shall be provided and operated in accordance with the applicable requirements of the South African Road Traffic Signs Manual.

Where work is to be carried out while half of the roadway is closed to traffic, flagmen shall be provided and temporary road signs shall be erected, maintained and operated."

PSD 5.2.2.1 Excavation for General Earthworks and for Structures (Refer SANS 1921-1 Clause 4.10)

Regarding over-excavation and overbreak, add the following to sub-clause (e):

Where the Contractor excavates in material classified as 'soft' (in terms of PSD3.1.2) to dimensions in excess of those shown on the drawings or ordered by the Engineer or if the material in the bottom of an excavation is loosened before concrete has been cast, or if there is any over-excavation, or any loose or disturbed soil, it shall be removed and the over-excavation under structures shall be replaced, at the Contractor's expense, by imported G2 crusher run material from commercial sources compacted to 100% modAASHTO density or, alternatively, with 15MPa/20 mass concrete as ordered by the Engineer.

For restricted excavation in material classified as 'hard rock' (as defined in PSD3.1.2), an allowance for an average overbreak layer of 150mm below the required founding level (ie underside of blinding layer) for all structures will be automatically added to the quantity measured for payment for restricted excavation. Similarly, measurement for replacing overbreak with compacted G2 material (as per filling of over excavation mentioned above) will be automatically measured for payment. Over-break (and G2 filling) beyond the 150mm overbreak allowance shall be evaluated by the Engineer as 'avoidable' (and therefore deemed to be over-excavation and to the Contractor's account) or 'unavoidable' (excavation and backfilling measured for payment) .

Add the following new Sub-Clauses:

- (f) The Contractor shall inform the Engineer, in writing, at least 14 days before commencing any work which will result in a change in the topography of the site, whether such work is for the permanent works or for temporary works which the Contractor intends to execute for his own convenience. Thereupon, before commencing the work, the Contractor shall take cross-sections of the original ground profiles or another approved method to determine the ground profiles of the entire area to be worked. In addition all rock and/or foundation levels shall be recorded as the work proceeds.

The information so obtained shall be permanently recorded on a drawing or drawings which shall each be signed by both the Contractor and the Engineer. The Contractor shall then provide the Engineer with a reproducible copy of each drawing to serve as a permanent record both for the purpose of determining the quantities of excavation and earthworks carried out in the construction of the permanent works and the extent to which temporary works shall be removed or temporary excavations shall be refilled upon completion of the Works.

- (g) Excavations to final level, ready to receive a blinding layer or concrete footing, shall be completed not less than 24 hours before such layer or footing is cast. The Contractor shall arrange for the inspection by the Engineer or his Representative of all surfaces immediately before backfilling of any kind or casting blinding.
- (h) 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.
- (i) The Contractor shall not spoil, waste or stockpile excavated material without approval.

PSD 5.2 Methods and Procedures

PSD 5.2.2 Excavation

PSD 5.2.2.2 Borrow Pits

Add the following:

“A commercial source shall, for the purposes of this Specification, mean a source of material provided by the Contractor, not the Employer.

Where it is specified that material shall be obtained from commercial sources, the Contractor shall be responsible and include in his price for fill from commercial sources, for finding a source of suitable material, for making all arrangements for procuring the material with the owner of the source, for the payment of any royalties, charges or damages and for transporting the material to the site regardless of the distance involved.

Commercial sources shall not be used for any materials without the written approval of the Engineer.”

PSD 5.2.2.3 Disposal

Amend this Sub-Clause as follows:

A considerable volume of excavated material will need to be disposed of. A spoil site has been identified to the immediate North of the Site (< 1km from the WTW boundary).

As noted in PSD 3.3.1, spoil material shall be stockpiled separately at the spoil site in its respective group so that it can either be recovered later or loaded for other use by others.

PSD 5.2.5 Transport of Earthworks

PSD 5.2.5.1 Freehaul

Replace with the following:

All transportation of material within the boundary of the site and within less than 1.0 km from the site boundary shall be regarded as freehaul.

All material imported from commercial sources shall be classified as freehaul.

PSD 5.2.5.2 Overhaul

With the exception of material imported from commercial sources, all transportation of material beyond 1.0 km of the boundary of the site shall be classified as overhaul.

PSD 7 TESTING

PSD 7.2 Taking and testing of samples

Replace the contents of the sub-clause with the following:

The Contractor shall carry out sufficient process control checks on the compaction of all fill and backfill layers in the presence of the Engineer's Representative to be able to demonstrate that the specified compaction is being achieved. The frequency of testing shall be such that tests shall be carried out for every lift of backfill material starting from 300 mm. The costs of testing shall be deemed to be included in the rates for backfilling of the platform.

PSD 8 MEASUREMENT AND PAYMENT

PSD 8.1 BASIC PRINCIPALS

Add the following Sub-clauses:

PSD 8.1.4 Recording of original ground profiles

The tendered rate for excavation shall cover the cost of recording the original ground profiles, rock and/or foundation levels, as applicable prior to commencement of any excavation, including stripping of topsoil. This is required to allow the Engineer to check the Contractor's survey and adjust his design levels if necessary.

PSD 8.1.5 Backfilling of over excavation

Backfilling over-excavation with compacted G2 material or mass concrete as specified in PSD 5.2.2.1(e) will not be measured for payment unless the over-excavation is ordered by the Engineer to remove unsuitable material, in which case the additional excavation will be measured and paid as restricted excavation in 'soft' material and the G2 or mass concrete will be measured by volume, all to the additional dimensions ordered by the Engineer.

PSD 8.1.6 Overbreak

For restricted excavation in material classified as 'hard rock' (as defined in PSD3.1.2), an allowance for an average overbreak layer of 150mm below the required founding level (ie underside of blinding layer) for all structures will be automatically added to the quantity measured for payment for restricted excavation. Similarly, measurement for replacing overbreak with compacted G2 material (as per filling of over excavation mentioned above) will be automatically measured for payment. Over-break (and G2 filling) beyond the 150mm overbreak allowance shall be evaluated by the Engineer as 'avoidable' (and therefore deemed to be over-excavation and to the Contractor's account) or 'unavoidable' (excavation and backfilling measured for payment) .

PSD 8.2.1 Computation of quantities

Add the following to Clause 8.2.1:

The volume of excavated material will be measured from the net outline of the structures and the average depth of excavation unless otherwise approved by the Engineer.

As noted in PSD 5.2.2.1, for restricted excavation in material classified as 'hard rock' (as defined in PSD3.1.2), an allowance for an average overbreak layer of 150mm below the required founding level

(i.e. underside of blinding layer) for all structures will be automatically added to the quantity measured for payment for restricted excavation; as will the volume of G2 backfill.

PSD 8.3 SCHEDULED ITEMS

PSD 8.3.2 Bulk Excavation

Replace the contents of this clause with the following:

Separate scheduled items will be provided for each type of excavation material (in accordance with the selection criteria specified in PSD 3.3.1), together with its method of excavation and intended destination / use. In all cases, the rates tendered shall make allowance for liaising and agreeing with the Engineer's Representative as to which selection category material being excavated falls into, how it is to be excavated and where such material is to be placed.

Except for measurement of overhaul to the designated spoil site, there are no 'extra-over' excavation items.

The tendered rates for excavation shall cover all costs associated with excavating and spoiling or filling and any conditioning, gridding and compaction required to achieve the required compaction density. The tendered rates for overhaul shall cover all costs associated with selecting, loading and transporting the spoil material to the designated spoil dump and depositing the material in a way there is no mixing of the different selection types.

PSD 8.3.3 Restricted Excavation

Replace the contents of this clause with the following:

Separate scheduled items will be provided for each type of excavation material (in accordance with the selection criteria specified in PSD 3.3.1), together with its method of excavation and intended destination / use as per PSD 8.3.2 Bulk Excavation. Separate scheduled items will be provided for each type of structure.

PSD 8.3.5 Extra excavation to provide working space around structures

In addition to the provisions of clause 8.3.5, the tendered rates for 'extra excavation in all materials for working space' shall also include for:

- 1) Any lateral support (if necessary for stability) and any other measures required to render and maintain the excavation sides in a safe, stable state at all times as specified in clause 5.1.1.2 and PSD 5.1.1.2 b);
- 2) The cost of temporarily stockpiling working-space material (on or off-site), spoiling any unsuitable and excess material, processing to OMC and backfilling and compacting to 95% Mod AASHTO density in layers not exceeding 150mm.
- 3) Provision of access ramps into the excavation (or other means of providing safe access for personnel and plant to enter and exit the excavations).
- 4) Provision and maintenance of a 1m high barrier fence around all excavations deeper than 1,0m and where the sides of the excavation are steeper than 1 vertical : 2 horizontal.
- 5) Provision of stormwater diversion berms or ditches upstream of the excavation and maintaining a minimum of accumulated rain water in the excavations.

PSD 8.3.6 Overhaul

Replace the contents of this Clause with the following:

All movement of cut to fill material shall be regarded as freehaul. In addition, all movement of topsoil, and any other material within the boundary of the site and less than 1.0 km from the site boundary shall

be regarded as freehaul.

Overhaul will only be paid where the transportation of material is beyond 1.0 km of the boundary of the site.

Overhaul shall not apply to imported material from commercial sources.

The overhaul distance shall be measured from the point of exit of the site perimeter to the agreed centre of the designated spoil area.

PSD 8.3.17 Planting of Grass by Sodding

..... Unit : m²

The tendered rate shall include for all work, labour, materials, water etc to procure, transport and install as per the specification Grass sods, the work shall be measured by the area to be grassed.
(Top soiling measured elsewhere)

psDB EARTHWORKS (PIPE TRENCHES) (SABS 1200DB)

PSDB 3 MATERIALS

PSDB 3.1 Classes of Excavation

Delete the contents of this clause and replace with the following:

“For this contract, the classes of excavation will be subdivided as follows:

(a) Labour Intensive Excavation

(i) Soft Excavation

Soft excavation shall be that excavation in material, which in the opinion of the Engineer, can be efficiently excavated and loaded by means of hand-held tools excluding pneumatic or hydraulic breaking tools. Soft excavation shall include all boulders with a volume of less than 0.125 m³ and a maximum dimension of 500 mm, which can still be removed by hand methods.

(ii) Hard Excavation/Hard Rock

Hard excavation shall be excavation in material, which in the opinion of the Engineer, can only be removed efficiently with mechanical equipment such as jackhammers, drilling & blasting etc. Hard excavation shall also include boulders with a volume > 0.125 m³ and the maximum dimension > 500 mm, which cannot be broken down and removed by hand methods.

(b) Machine Based Excavation

In cases where heavy excavation equipment is permitted, the classes of excavation will be subdivided as follows:

(c) Soft excavation

Soft excavation shall be excavation in all materials and boulders which in the opinion of the Engineer can be efficiently excavated and loaded by a 30t excavator fitted with 'rock bucket' (excavator bucket typically fitted with not more than 3 tines designed to loosen weak rock material).

(c) Intermediate (mudstone / siltstone)

All mudstone and siltstone material that the Engineer agrees can be more efficiently loosened for excavation by 30t excavator fitted with Heavy Duty hydraulic breaker.

(d) Hard Excavation / Hard Rock

All unweathered sandstone material (in the opinion of the Engineer) which would normally be drilled and blasted if allowed:

1) Using Heavy Duty hydraulic breaker (albeit at a much slower rate of production than intermediate above);

2) Hard Rock excavation by drilling and pouring-in expanding grout: All material where Engineer agrees cannot reasonably be broken-out by 30t heavy duty hydraulic breaker alone due to access difficulties or extreme hardness.

Any unweathered boulders encountered shall be classified as 'Hard Rock: excavation by hydraulic breaker or expanding grout (as agreed with the Engineer)' where such boulders

exceed 0,125m³ (approx. 500 x 500 x 500mm) in volume. Boulders smaller than this size shall not be classified.

PSDB 3.3 Selected Granular Material

For bedding material (padding) for steel, GRP and uPVC pipes see PSLB 3.3.

For HDPE and concrete stormwater pipes, suitable material shall be selected from local excavations or stockpiles.

PSDB 3.4 Selected Fill Material

For steel, GRP and PVC pipes, all material up to the underside of backfill shall be measured as selected granular.

PSDB 3.5(a) Backfill Material

In the third line delete "150 mm" and substitute "100 mm".

PSDB 3.5(b) Backfill Material

In the second line delete "PI not exceeding 12" and substitute "PI not exceeding 6".

PSDB 3.5(c) Cement Stabilised Backfill

Add the following new Sub-Clause:

Where scheduled, or directed by the Engineer, backfill shall be stabilised with 8% 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, Sub-Clause 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 3.7 Selection

Replace the words "if he so wishes" in the first line of the second paragraph with the words "at his own cost".

PSDB 5 CONSTRUCTION

PSDB 5.4 Excavation

Add to the Subclause :

"Where a pipe is to be laid in a vertically-sided trench with temporary side support, it is necessary to ensure that the compacted bedding and backfill is hard up against the soil forming the trench side by withdrawing the temporary supports stage by stage as the backfill rises up the trench.

Where it is permitted for the pipe trench to cross surfaced roads (Generally paved road crossings will be effected by means of pipe or sleeve jacking), 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 raveling 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.

Add the following subclause:

PSDB 5.4.1 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 program for trench excavation. The trial holes shall be to the depth required for the pipeline under consideration to a maximum depth of 1.5 m.

If material that cannot, in the opinion of the Engineer, be excavated by hand methods but can be machine excavated is encountered before the bottom of the trial hole, then excavation may be deemed to be carried out by mechanical means, the length of such excavation determined on the basis of other trial hole findings.

If hard rock material that can only be removed by blasting or using jackhammers is encountered before the bottom of the trial hole, then excavation may be deemed to be carried out by hand up to the level of the hard rock where after the excavation shall be completed by means of using blasting or jackhammers as appropriate. The length of such excavation determined on the basis of 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 on the basis of other trial hole findings. Classification of excavated material shall be as per Clause PSDB 3.1.

PSDB 5.5 Trench Bottom

Add to the subclause :

Where pipes are laid in waterlogged conditions and/or where so instructed by the Engineer a 150mm thick layer of imported single sized stone (19mm 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 subclause:

PSDB 5.5.1 Jointing Holes

Jointing holes shall be cut of sufficient length and depth to allow for the proper making, welding 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 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 the following:

"Notwithstanding the requirements of subclauses 5.6.1 and 5.6.6, no pipe joint or pipe filling shall be covered by either the bedding, blanket fill or the main fill prior to the successful completion of the visual inspection, and the pressure testing of the relevant section of the pipeline."

PSDB 5.6.4 Disposal of Intermediate and Hard Rock Material

Add the Following:

"The Contractor shall make his own arrangements for the disposal of excess intermediate and/or hard

rock material. The disposal / spoil site shall meet with the approval of the Local Authority within whose area it falls, and the spoiling shall comply with the statutory and municipal regulations. The cost of all loading, hauling, dumping, spreading, compacting and any other costs or charges will be deemed to be included in the rates tendered for excavation."

PSDB 5.7 Compaction

PSDB 5.7.2 Areas subject to Traffic Loads

Add the following:

"All backfill to pipes under roads and in road reserves or future road reserves shall comply with the requirements of subclause 3.5(b) and shall be compacted in accordance with subclause 5.7.2."

PSDB 5.9 Re-Instatement of Surfaces

Add the following new subclauses:

"PSDB 5.9.7 Cultivated and Arable land

Where pipelines traverse cultivated and arable privately-owned or community land, the entire disturbed construction corridor (and any temporary construction access roads across such areas) shall be restored to their full cultivation potential; namely:

- The full original depths of the topsoil ('A' horizon) (applicable to full construction corridor) and subsoil ('B' horizon) (applicable where removed at site levelling and trench excavation stage) are replaced / reconstructed and lightly compacted to effectively match the natural undisturbed state of compaction. Where the 'B' horizon has not been excavated but has been subject to compaction by the construction activities, such compacted layers shall be scarified to the Employer's Agent's approval before replacing the topsoil over it.

"PSDB 5.9.7 Cultivated and Arable land

Where pipelines traverse cultivated and arable privately-owned or community land, the entire disturbed construction corridor (and any temporary construction access roads across such areas) shall be restored to their full cultivation potential; namely:

- The full original depths of the topsoil ('A' horizon) (applicable to full construction corridor) and subsoil ('B' horizon) (applicable where removed at site levelling and trench excavation stage) are replaced / reconstructed and lightly compacted to effectively match the natural undisturbed state of compaction. Where the 'B' horizon has not been excavated but has been subject to compaction by the construction activities, such compacted layers shall be scarified to the Employer's Agent's approval before replacing the topsoil over it.

PSDB 5.9.8 Cross Drainage Berms

Cross drainage berms are required along all steeply inclined pipeline routes at intervals to be determined by the Engineer, to minimize possible flood damage."

PSDB 8 MEASUREMENT AND PAYMENT

PSDB 8.3 Scheduled Items

PSDB 8.3.1 Site Clearance and Topsoil Removal

No separate payment shall be made for topsoil removal or replacement upon completion along pipeline routes. See clause PSC 8.1.

PSDB 8.3.2 Excavation

PSDB 8.3.2 b) Extra-over item a) above for

Extra-over for excavation in "Intermediate" and "Hard rock" excavation shall be as classified as per PSDB3.1

Each type of material and method of excavation will be scheduled separately.

PSDB 8.3.3.1 Deficiency in Backfill Materials

Payment for imported, graded stone laid under pipelines in accordance with PSDB 5.5 shall be paid for under either Sub-Clause 8.3.3.1(c) or as scheduled.

PSDB 8.3.3.4 Overhaul

No measurement for payment of overhaul will be made. All distances are Freehaul.
Add the following new item:

PSDB 8.3.4 a) Shoring

Add the following additional information to Sub-Clause 8.3.4 a):

The rate shall also include all dewatering (including operation and maintenance of pumps), piping, day work rates, for the entire duration the shoring is erect until the removal of the shoring. the contractor must take steps to ensure that the shoring or bracing is designed and constructed in such a manner rendering it strong enough to support the sides of the excavation in question. All bracing and shoring, to be inspected and recorded daily and after substantial rains. The trench opening shall be protected by a rigid barrier and have high visibility boundary indicators to prevent injuries/death from falling. All necessary and relevant steps shall be taken including submitting method statements to the engineer ensuring the safe and stable erection of the shoring/bracing. The method statements merely form part of the paperwork and the Contractor still takes full responsibility for any damage and loss of new and existing property (including the current materials, plant and equipment), injury, fatality, and any consequence that results in extra cost whatsoever.

PSDB 8.3.8 Cultivated and Arable land

..... Unit : Ha

Where extra measures are required to restore cultivated and arable land to its original cultivation potential (as described in PSDB 5.9.7), an extra-over item for the full width of the construction servitude will be measured for payment. The tendered rate shall cover all additional costs associated with taking extra care to remove, stockpile and maintain and conserve the topsoil ('A' horizon) and subsoil ('B' horizon) material and reinstate said layers to the Employer's Agent's satisfaction.

Failure to satisfactorily restore 100% of all such layers as specified in PSDB5.9.7 (including, in the opinion of the Employer's Agent, unnecessary loss / mixing / contamination of the respective layers with other, unsuitable, material), will preclude the Contractor from achieving Practical Completion until such time as the Contractor has, at his own cost, made good the deficiency (including satisfactorily disposing of any contaminated material and importing approved similar topsoil and subsoil to replace unnecessarily lost material where necessary).

PSDB 8.3.9 Cross Drainage Berms

..... Unit : Sum

The tendered rate shall include all material, labour, and plant for the construction of cross drainage berms. A cross drainage berm shall be 300 mm high, 800 mm wide. The berms shall be constructed of selected excavated material compacted to 90 % MOD AASHTO or to the approval by the engineer, with no stones or rocks exceeding 100 mm diameter in the largest dimension. Cross drainage berms shall be placed at all steeply inclined pipeline sections at intervals to be determined by the Engineer."

psDK GABIONS AND PITCHING (SABS 1200 DK)

PSDK 3 MATERIALS

PSDK 3.1.2 Gabion Cages

Add to the Sub-Clause:

The wire used for the fabrication of wire mesh cages and for lacing and bracing operations shall be zinc-coated mild steel wire with NO PVC coating. The lacing wire will be of the same or larger diameter of that used to manufacture the cage frames.

PSDK 3.1.2 Gabions

Replace Clause 3.1.2 with the following:

Gabion boxes shall consist of double twisted, hexagonal wire mesh of nominal 80 mm mesh, with 4.4 mm o/d frame wire and 2.7 mm o/d mesh wire. Complete with partitions at 1 m centres. All wire to be mild steel to SANS 1580 – 2010, zinc coated by hot-dip galvanizing to SANS 675 – 2009.

Mattresses shall consist of double twisted, hexagonal wire mesh of nominal 80 mm mesh, with 4.4 mm o/d frame and 2.7 mm o/d mesh wire. Complete with partitions at 1 m centres. All wire to be mild steel to SANS 1580 – 2010, zinc coated by hot dip galvanizing to SANS 675 – 2011.

PSDK 3.1.3 Geotextile

Add to the Sub-Clause:

Geotextile filter fabric:

Where the Engineer has authorised the use of geotextile filter fabric, this shall be measured by area as: width x nett length, where the width shall be the full or half-width supplied by the manufacturer which conforms closest to the specified of plus 2 x base width plus 200mm. The tendered rate shall include the cost of supply, placing and losses as a result of overlaps and over excavated trench widths.

Geotextile to conform to the following minimum specifications:

Material:	Nonwoven, needle punched, Continuous Filament, Polyester Geotextile (minimum)
Tensile Strength:	14 kN/m (minimum)
UV Stability:	70% strength retained after 1000 hours
Permeability @ 50mm head:	3.6 m/sx10 ⁻³

The material shall be placed as directed and shall not be exposed to direct sunlight for prolonged periods.

PSDK 3.2 Pitching

PSDK 3.2.1 Stone

Amend the Sub-Clause as follows:

In Table 2, Column 2, for extra heavy, replace 300 with 500.

PSDK 3.2.3 Wire netting

Add to the Sub-Clause:

Wire netting for gabion and mattress cages shall be hexagonal steel wire mesh strengthened by selvages of heavier wire and by mesh diaphragms that divide the cases into 1 m compartments.

Nominal 80 mm mesh shall be used for gabion cages with 2.7 (Refer to PSDK 3.1.2) mm diameter galvanised steel wires.

Nominal 80 mm mesh shall be used for mattress cages with 2.7 (refer to PSDK 3.1.2) mm diameter galvanised steel wires.

Selvage wire shall be galvanised and the diameter shall be a minimum of 4mm.

PSDK 5 CONSTRUCTION

Add new Sub-Clause:

PSDK 5.1.3 Diaphragms

Each diaphragm shall be connected in the same manner to the sides and top panels in addition to the bottom panel.

PSDK 5.2.3 Assembly

Add to the Sub-Clause:

All gabion and mattress cages shall be connected to adjacent gabion and/or mattress cages by lacing the adjacent selvages together with 2.0 mm dia. galvanised steel wire. The lacing shall be in accordance with Sub-Clause 5.1.2.

PSDK 5.2.4 Rockfilling

Add to the Sub-Clause:

Particular care shall be taken in the filling gabions and mattresses so as to ensure that the voids in the rockfill are reduced to the minimum that can be reasonably achieved. In order to minimise the voids in the rockfilling, the filling shall proceed in layers not exceeding 300 mm deep and each layer shall be rodded and barred so as to compact the rockfill before filling of the next layer commences. Where appropriate, hand packing of selected rock particles shall be carried out.

PSDK 5.2.4.2 Mattresses used in revetments and aprons

Add to the Sub-clause:

Where gabions and mattresses are placed in exposed positions the rock particles forming the exposed faces shall be specially selected so as to present a fair and even surface.

PSDK 5.3.4 Wired Pitching

Add to the Sub-Clause:

The areas in which wired or grouted wire pitching are to be used will be indicated on site by the Engineer.

psDM EARTHWORKS (ROADS, SUBGRADE) (SANS 1200 DM – 1981)

PSDM 3 MATERIALS

PSDM 3.1 Classification for excavations purposes

Delete the clause and replace with the following:

The classification of material for excavation shall be as specified in Project Specification Clause PSD 3.1.2.

PSDM 3.2.3 Selected Layer

Add the following:

The Contractor shall obtain selected subgrade material from selected excavation material on site.

PSDM 5 CONSTRUCTION

PSDM 5.2.3.3a) Preparation and compaction of road bed

Substitute the first paragraph with the following:

The roadbed shall be scarified to a depth of 150 mm, watered, shaped and compacted to 93 % of AASHTO density (100 % for sand), except where otherwise ordered by the Engineer.

PSDM 7 TESTING

PSDM 7.3.2 Routine inspection testing

Replace the contents of this sub-clause with the following:

No density shall be less than the specified minimum density for the relevant layer.

The cost of additional testing ordered by the Engineer, and of which the results do not comply with the specified minimum requirement for the material, shall be borne by the Contractor and will be subtracted from the monthly payment certificates.

PSDM 8 MEASUREMENT AND PAYMENT

PSDM 8.3.4 Cut to fill, borrow to fill

Add the following to the contents of this sub-clause:

If scheduled otherwise, classification and payment for excavation in soft, intermediate and hard material shall be as per PSD8 items.

PSG CONCRETE (STRUCTURAL) (SABS 1200 G)

PSG 2 INTERPRETATIONS

PSG 2.4.2 Strength concrete

Add the following to Clause 2.4.2:

With the exception of mixes weaker than 15 MPa, all concrete for the Works shall be considered to be strength concrete, with reference to the table below:

ELEMENT	28 DAY STRENGTH (MPa)	EXPOSURE CONDITION	COVER (mm)
BLINDING, MASS CONCRETE, SCREED	15	SEVERE	N/A
INTERNAL SURFACE BEDS	30	MODERATE	40
FISHWAY BENCHING MASS CONCRETE	25	SEVERE	N/A
RC FOUNDATIONS	35	SEVERE	50
(INTERNAL) RC COLUMNS	35	MODERATE	40
(INTERNAL) RC SLABS	35	MODERATE	40
(INTERNAL) RC BEAMS	35	MODERATE	40
WALLS	35	SEVERE	50
(EXPOSED) RC COLUMNS	35	SEVERE	50
(EXPOSED) RC SLABS	35	SEVERE	50
(EXPOSED) RC BEAMS	35	SEVERE	50

To ensure uniformity of colour of the formed surfaces of all concrete which will be visible on the exterior of the structures, the cements shall be supplied by a single cement factory. Tenderers are to make allowance for this in concrete rates.

PSG 3 MATERIALS

PSG 3.2 Cement

Add the following to Clause 3.2:

CEM1 42.5 as specified in SABS EN 197-1 common cements, a 75% CEM1 42.5 and 25% PFA blend or 50% slagment and 50% CEM1 shall be used as specified in the relevant sections of SANS 1491 and SANS EN 197-1. Any variations to these are subject to the Engineer's approval.

For non-structural concrete CEM1 32.5 is acceptable.

PSG 3.2.3 Storage

Add the following to Clause 3.2.3:

Cement shall be used in the order in which it is received (first in, first out basis)

Cement kept in storage for longer than 6 weeks shall be removed from site and not used in the Works.

Any cement that shows signs of hydration, such as the formation of lumps, may not be used and is to be immediately removed from site.

"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 3.3 WATER

Replace the contents of Clause 3.3 with the following:

Only potable quality water from an approved source may be used for mixing concrete. Water from a river or stream may only be used for curing.

PSG 3.4 AGGREGATES

PSG 3.4.1 Applicable Specification

Add the following to Clause 3.4.1:

The maximum aggregate size shall be 26mm. The nominal stone size specified in the concrete grade shall mean stone conforming to SABS 1083 for the nearest equivalent size.

Any aggregate may be used provided the free sodium alkali content in the concrete mix does not cause an alkali-aggregate reaction.

Coarse aggregate may be obtained from the nearest available commercial sources, and shall be subject to the Engineer's approval.

Flakiness index of coarse aggregates when tested in accordance with SANS 5847 shall not exceed 35.

Soundness to be tested in accordance with ASTM C33 and C88 (SANS 5839) coarse aggregates shall not show a loss in mass of more than 18% and fine aggregates not more than 15% after 5 cycles using magnesium sulphate.

Shrinkage shall be determined in accordance with SANS 5836. The upper limits of shrinkage shall be:

Fine aggregate : 150% of the shrinkage of the reference aggregate

Coarse aggregate : 150% of the shrinkage of the reference aggregate

The reference aggregate shall be defined by the *Engineer*.

The volume of water required to mould the sample in accordance with SANS 5836 shall be reported with the above results.

Fine aggregate may be obtained from local sources subject to testing of its suitability by an approved laboratory and approval by the Engineer.

Aggregates shall be tested periodically for reactivity, and shrinkage, the costs of which shall be deemed included in the rate tendered for concrete. A trial design mix will have to be prepared and the results submitted to the Engineer for approval before construction begins.

At least one month before commencement of concrete work the Contractor shall supply at his own cost representative samples to the Engineer of the aggregates he intends using, together with certificates from an approved laboratory indicating that the aggregates comply with the specifications. Approximately 50 kg of each sample of aggregate shall be supplied.

After approval, these samples shall be taken as standard for the agreed aggregates to be used in the Works. If at any time during the course of the Contract the Engineer considers that there has been any deviation from the approved standard the Contractor shall submit further tested samples of material to the Engineer for approval.

Aggregates for grouting

Notwithstanding the requirements of Sub-clause 3.4.1, the grading of the fine aggregate (sand) and coarse aggregate (stone or pea gravel) to be used for grouting shall conform to the grading given in Tables 1 and 2 respectively, below.

TABLE 1 - SAND	
Test sieve nominal aperture size, mm	% Passing (by mass)
9,5	100
4,75	95 - 100
1,18	45 - 65
0,3	5 - 15
0,15	0 - 5

TABLE 2 - STONE OR PEA GRAVEL	
Test sieve nominal aperture size, mm	% Passing (by mass)
9,5	100
4,75	95 - 100
2,36	0 - 5

Dolomitic Aggregate

Coarse and fine dolomitic aggregate may be used. When tested in accordance with the method specified in Appendix C of SANS 677, not more than 25% by mass of the dolomitic aggregate shall be insoluble in hydrochloric acid.

PSG 3.5 ADMIXTURES

Add the following Clause PSG 3.5.3:

PSG 3.5.3 Concrete using reactive aggregates

The Contractor shall provide the Engineer with sufficient data to enable him to assess the degree of alkali-aggregate reactivity of the aggregates to be used for the concrete.

Where reactive aggregates and other quarzitic aggregates are used for concrete, the Contractor shall, in order to ensure that the concrete is not subject to alkali-aggregate reaction, design his mixes and/or use cement with a sufficiently low alkali content such that the total equivalent sodium oxide content of the concrete is less than 1.8kg/m³.

(NOTE: The equivalent sodium oxide content (alkali content) is measured as (Na₂O + 0.658 K₂O). For cement it is expressed as a percentage by mass, for concrete it is expressed in kg/m³).

In the case of other aggregates that are less reactive, the Engineer will determine the type and degree of precautionary measures to be adopted.

For each delivery of cement or precast concrete units the Contractor shall provide acceptable written evidence that the requirements of this clause are being met.

PSG 3.5.4 Pulverized Fly Ash (PFA)

PSG 3.5.4.1 General

Concrete containing a percentage of Pulverized fly ash (PFA) shall be termed 'FA concrete'. The particular brand of PFA the Contractor intends to use shall conform to the requirement of SANS 50450.

All concrete used in water-retaining structures shall be 'FA concrete' unless otherwise shown on the drawings or ordered by the Engineer.

FA concrete shall conform to the requirements of SANS 1200 G for concrete and the additional requirements specified below.

PSG 3.5.4.2 Source and quality

Fly Ash shall be procured from an approved source and shall be of a consistent quality conforming to SANS 1491-2. In particular it shall be tested for and shall conform to the following:

- The loss on ignition shall not exceed 5% (Category A)
- The percentage by mass retained on 45 micron screen shall not exceed 12% (Category S)

PSG 3.5.4.3 Cementitious material

The cementitious material used for FA concrete shall consist of a mixture of between 70% and 80% by mass of ordinary Portland cement and of between 30% and 20% by mass of PFA.

PSG 3.5.5 Waterproofing Admixture

All strength concrete batched for water retaining structures shall contain 5 kg/m³ "Xpex Admix C-500NF" or similar approved.

PSG 3.6 REINFORCEMENT

Mild steel shall be in accordance with SABS 920 – Type A 250 MPa yield and high yield stress steel according to SABS 920 – Type C, Class 2, Grade 1, 450 MPa yield.

Add the following Clauses:

PSG 3.9 Granolithic screed

Granolithic screed shall consist of:

Cement	1 part by mass
Sand	1,25 parts by mass
Coarse aggregate	2 parts by mass

The coarse aggregate shall consist of granite or other approved chips which shall pass a 10 mm sieve and be retained on a 5 mm sieve.

The water/cement ratio of the mix shall be at least 0,5.

PSG 3.10 Bond breaker

The bond breaker where specified under floor slabs shall be 250 micrometre polythene sheet complying with SANS 952, Type D.

PSG 3.11 MATERIALS FOR MOVEMENT JOINTS

PSG 3.11.1 General

The various jointing materials, the manufacturers of the materials and the methods of application shall be as approved by the Engineer. Materials shall be stored and protected to avoid damage, degradation, distortion or contamination.

The joint materials shall be resistant to ultraviolet light and to biological degradation.

PSG 3.11.2 Waterstops

Waterstops shall be of approved manufacture and of the pattern and the material and widths scheduled and specified and shown on the drawings. They shall comply with the tolerances specified in clause 6.1 of SABS 1200G. The waterstops shall conform to the Specifications as set out in CKS 388 for Rubber Waterstops and shall have the appropriate physical properties as set out below:

Form

Black Rubber

Hydrostatic Head	Up to 50m
Tensile strength	>20.7 MPa
Elongation at break	500%
Hardness BS degrees (IRHD)	62 to 72°

All intersections between waterstops shall be pre-fabricated in the factory in accordance with the manufacturer's instructions and to approval of the Engineer. Only straight lengths of waterstop may be field-welded using the appropriate jigs and tools.

Where required, waterstops shall have eyelets so that they may be tied securely to the adjacent reinforcement. Waterstops shall be centre bulb unless specified otherwise elsewhere.

PSG 3.11.3 Joint Formers

Closed cell expanded polyethylene joint formers shall have the following typical properties:

Property	Unit	Value	Value Method	Test
Density	kg/m ³	110	DIN 53420	
Compression Stress at compression strains of 10% 25% 50%	kPa kPa kPa	175 210 340	DIN 53577 DIN 53577 DIN 53577	
Compression set after 24 hours recovery	%	14		
Tensile Strength	kPa	680	DIN 53571	
Elongation at Break	%	49	DIN 53571	
Max. water absorption after 24 hours by volume	%	0,1	ASTM C-177	

Joint formers shall be pre-cut to suit the application as per drawings with a tear-out strip for forming the specified recess for the sealant. The joint formers shall be developed for use in applications with a head of water of at least 10m. If so required the filler shall be glued into position with approved epoxy glue.

Joint formers will be used for expansion joints in the walls and roof and as indicated on the drawings.

Joint formers will also be used where the perimeter walls are cast up to the beams and shall have a thickness of 12 mm. Where this is the case, the joint formers will be cut out to a depth of 12 mm to allow a cavity for the application of an approved 12 mm x 12 mm UV resistant polyurethane sealant.

PSG 3.11.4 Bond Breakers, Primers and Sealants

The bond breaker (if specified) shall be self-adhesive PVC tape (or equal, approved material) with a width the same as the joint recess into which it is to be applied.

The primer, if required for the sealant, shall be fully compatible with the sealing compound that is to be used.

The elastomeric sealant shall be a one-component polyurethane liquid polymer base complying with the requirements of SABS 110. The polymer shall be pouring grade for horizontal or near horizontal joints and gun grade for vertical/overhead joints and joints steeper than 1 in 10 to the horizontal. Sealants shall have a movement tolerance of 25 %. Sealants shall have been tested to ensure that they are non-toxic and do not impart any odour or taste to, or otherwise taint, the water.

These sealants shall be suitable for indoor as well as outdoor applications and shall be UV resistant.

The sealant shall be suitable for use at movements and connection joints in floors as well as for joints in contact with potable water.

Sealant samples shall be timeously submitted for testing upon the request of the Engineer.

Selected contraction and expansion joints will be waterproofed by an approved high performance tape/bandage placed over the joint as indicated on the drawings. This tape shall have a minimum thickness of 2 mm and dimensions as indicated on the drawings.

The tape shall be bonded to the concrete and covered with an approved epoxy-paste adhesive which is not sensitive to moisture.

This tape shall have the following typical properties:

- Suited for use in Potable water
- High water pressure resistance
- High Durability and chemical resistance
- UV- and weather resistant
- Root-Resistant
- Plasticizer free

PSG 3.12 WATERPROOFING SLURRY

An approved cementitious in-depth waterproofer shall be used on planned construction joints as indicated on the drawings. Surfaces shall be prepared and the product shall be applied as per the approved manufacturer's instructions.

The waterproofing slurry shall be suitable for use on concrete substrates and should be suitable for use in potable water structures.

The slurry shall have the following typical properties:

Appearance
Workability at 20 °C
Setting time at 20 °C

Grey Powder
Approximately 30min
1-2 hours

PSG 3.13 TORCH-ON WATERPROOFING

Waterproofing for the parapets of the roofs of both the utilities building and guard house shall be with a torch-on waterproofing system. Waterproofing shall be done according to the approved manufacturer's specifications.

PSG 3.14 POLYURETHANE COATING ON FLOORS AND WALLS

Epoxy flooring and walls shall be provided for the High Lift Pump Station Building. This flooring shall have be a heavy duty self-smoothing polyurethane screed such as Sikafloor -21N PurCem or similar approved. Covering for walls and bund walls shall be a similar approved product suitable for the application. The product shall be applied to a minimum thickness of 5 mm on designated concrete surfaces including bund walls, drainage channels, plinths and on the brick walls up to a height of at least 1500 mm as per Drawings. This screed shall have excellent resistance to chemicals and be able to resist a wide range of organic and inorganic acids, alkalis, amines, salts and solvents. The screed shall be odourless, shall have a high mechanical resistance and shall be easily maintained. The epoxy shall be colour coded for different areas of the utilities building as per the Drawings. The coating shall be jointless and shall have a bond strength in excess of the tensile strength of the concrete

PSG 4 PLANT

PSG 4.3 MIXING PLANT

PSG 4.3.1 General requirement for mixing plant

Add the following to Clause 4.3.1:

Stand-by mixers of adequate capacity and with an independent power unit shall be maintained on site for immediate use in the event of breakdown of the regular mixers failure of the power supply.

PSG 4.4 VIBRATORS

Add the following to Clause 4.4:

Stand-by vibrators of adequate capacity and with an independent power unit shall be maintained on site for immediate use in the event of breakdown of the regular vibrator failure of the power supply.

Vibrators for in-situ concrete shall be of the internal or immersion type.

PSG 4.5 FORMWORK

PSG 4.5.1 Design

Add the following to Clause 4.5.1:

Detailed drawings of the formwork shall be issued by the Contractor for its fabrication. All such design and drawings shall be available for inspection by the Engineer if so required.

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.

No formwork which is in the opinion of the Engineer major formwork shall be erected without the Engineer's prior written approval of the design and moving or handling arrangements. The Contractor's proposed design and drawings shall be submitted to the Engineer in ample time to permit examination without delay to the works, and in any event not less than three clear days before the date when the Contractor proposes to commence fabrication of the formwork. The Engineer's approval for use shall not be deemed to relieve the Contractor of his responsibility for the adequacy of the formwork.

Where smooth or special formwork is required, only new or as-new steel shuttering shall be used. Where steel is definitely impractical, an alternative may be used but only as approved by the Engineer.

PSG 4.5.3 Ties

Add the following to Clause 4.5.3:

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.

The use of sleeves for formwork ties through the walls of water retaining structures will not be permitted. Ties, when cast in, shall have some form of positive anchorage to prevent any rotation when loosening formwork and some form of water bar to restrict seepage along the tie.

For Watertight concrete structures the shutters shall be fastened using an approved imbedded fastening system. Open ferrules will not be permitted.

Add the following Clause:

PSG 4.6 Water-bath

A temperature-controlled water-bath with a capacity to cure two hundred cubes shall be provided on site. The water-bath shall be located under cover.

PSG 5 CONSTRUCTION

PSG 5.1 REINFORCING

PSG 5.1.2 Fixing

Add the following to Clause 5.1.2:

Fixing of reinforcing bars by welding and heating of bars will not be permitted.

Any bars which are severely rusted or with a cross-section which is, in the Engineer's opinion, reduced by rusting or other cause, shall be rejected and immediately removed from site,

Where clips, stools and other supports are not shown on the drawings and are structurally not required, the Contractor shall provide those supports he deems necessary to ensure the correct positioning of the reinforcement, to the satisfaction of the Engineer. The cost of such steel, labour, and other fixing materials shall be inclusive in the rate for the scheduled reinforcement and no additional payment shall be made.

Fixing blocks for the attachment of fixtures may be embedded in concrete provided that the strength or any other desirable feature (such as appearance of the member) is not, in the opinion of the Engineer, impaired thereby.

Supports shall be of approved precast concrete blocks properly shaped to maintain position or proprietary supports of an approved type. Concrete blocks shall be adequately cured as specified. Wooden supports shall not be used nor shall bars be placed in succeeding layers of fresh concrete nor shall bars be adjusted during the placing of concrete. Tie-wire shall point away from the nearest formwork face.

PSG 5.2 FORMWORK

PSG 5.2.1 Classification of Finishes

Add the following to Clause 5.2.1:

Formwork panels or forms shall be free from surface markings. The form surface shall be so lined that it is free from nail, screw, rivet, weld or other marks. Special care shall be taken to avoid form oil, curing water or other stains on exposed surfaces. The forms shall not be re-used unless in perfect condition and capable, in the opinion of the Engineer, of producing exactly the same surface pattern texture and finish as the previous cast.

Rough formwork Degree of Accuracy III may be used on the outside faces where the concrete is more than 300 mm below the final ground level.

Smooth formwork Degree of Accuracy I will be used elsewhere unless specified otherwise.

All honeycombing shall be repaired by cutting back to sound concrete and patching with a suitable repair procedure to the approval of the Engineer.

PSG 5.2.2 Preparation of Formwork

Add the following to Clause 5.2.2:

All exposed external angles in concrete work shall have 20 mm x 20 mm chamfers unless otherwise specified or ordered, but the top edge of a slab that is to receive an applied finish shall not be chamfered.

Formwork shall be completely grout-tight under vibration.

PSG 5.2.5 Removal of Formwork

Add the following to Clause 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))

TYPE OF STRUCTURAL MEMBER OR FORMWORK	CEM I		CEM II/A & CEM II/ B (MAX 29% EXTENDER)		CEMII/B (30-35% EXTENDER)	
	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 the following to Clause 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 the following Clauses:

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 5.4 PIPES AND CONDUITS

Add the following Clauses 5.4.1 to 5.4.3:

PSG 5.4.1 Fixing for equipment and pipe specials

The Contractor will be responsible for the forming of pockets and grouting in of pipe items and/or holding down bolts for equipment supplied under the contract.

Upon completion of the positioning and alignment of equipment, the Contractor shall, grout up pipe items, pockets and base plates (subject to below) necessary for the permanent installation of the

equipment.

Only after the Engineer is satisfied with the alignment and the level of each item of plant shall the Contractor grout up the base plates/pipe specials with an approved non-shrink grout.

PSG 5.4.2 Pipes and conduits embedded in concrete

Except with the written approval of the Engineer, no pipes other than those shown on the drawings shall be embedded in concrete and the approval of the Engineer for the position of all services to be embedded shall be obtained before concreting commences.

The clear space between pipes of any kind embedded in reinforcement concrete and the clear space between such pipes and reinforcement shall not at any point be less than:

- a) 40 mm, or
- b) 5 mm plus the maximum size of coarse aggregate, whichever is the greater.

PSG 5.4.3 Casting/grouting in of pipes and specials

Where pipes are to be cast into concrete, the Contractor shall provide a box-out in the wall and grout the unit in at a later stage. When constructing such a box-outs, reinforcement shall not be cut, but shall run through the opening. Reinforcement shall be cut and/or bent out at a later stage to suit the item being cast in. After installation of the item the remaining reinforcement shall be bent back in position.

Where box-outs 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.

An approved non-shrink grout shall be used for the grouting in of pipes and specials after they have been positioned. The details and method statement is to be submitted to the Engineer for approval prior to the commencement of any grouting. The approval by the Engineer shall not relieve the Contractor from his obligation to provide a watertight joint between the concrete and grout used.

PSG 5.5 CONCRETE

PSG 5.5.1 Quality

Add the following to Clause 5.5.1:

Where 35 MPa concrete is specified for severe exposure, the minimum and maximum cementitious contents of 325 kg/m³ and 450 kg/m³ respectively shall be used. For concrete containing extenders the maximum cementitious content shall be 450 kg/m³. The water to cement ratio for this class of concrete shall not exceed 0.50.

All concrete mix designs shall be approved by the Engineer in advance.

The mix design and casting procedure shall be approved by the Engineer prior to casting. All excavations and foundations must be checked and approved by the Engineer or delegated Geotechnical Engineer prior to casting.

All Water Retaining structures, manholes and valve and other chambers shall be constructed using watertight concrete. The Contractor shall abide by all conditions set out in sub-clause 5.5.11 of SABS 1200 G, and pay particular attention to this aspect of the works.

Cubes shall be taken on all pours in accordance with SABS 1200 G. Payment shall be included in the rate tendered for the supply of concrete. No payment shall be made for concrete pours on which no cube tests have been performed. A single cube test comprises the mean crushing strength of 3 cubes taken from the same batch of concrete and cubes must be taken at the frequency specified SABS 1200 G

The concrete shall be tested for water sorptivity, oxygen permeability, chloride conductivity, depth of

cover and shrinkage; the details of the tests are given in the specification.

PSG 5.5.1.4 Chloride Content

Add the following to Clause 5.5.1.4:

Efflorescence will not be acceptable on any exposed concrete surface

PSG 5.5.1.5 Durability

Add the following to Clauses 5.5.1.5:

The water/cement ratio, as specified in Table 5 in SABS 1200 G, but shall not exceed 0.5 for severe exposure conditions.

The exposure conditions for the various structural elements are as indicated on the general notes drawing.

PSG 5.5.1.6 Prescribed Mix Concrete

Add the following to Clause 5.5.1.6:

Notwithstanding the requirements of Sub-clause 5.5.1.6, samples of aggregates will not be made available by the Engineer. The Contractor shall supply aggregates from commercial sources located by him, complying with the requirements of Sub-clause 3.4.1, as amended, for the production of prescribed mix concrete.

"No-fines" concrete:

A nominal aggregate size of 19 mm shall be used in the manufacture of "no-fines" concrete.

No-fines concrete shall be laid where specified and shall consist of coarse aggregate, cement and water only. No-fines concrete shall have a 28-day characteristic strength of 15MPa unless specified otherwise elsewhere. No fine aggregate shall be used. Sandwiching or layering of pours will not be permitted. The Contractor shall cast to the profile depth in one pour.

The mixing of the cement and water paste shall have the consistency of paint capable of coating each coarse aggregate particle uniformly and sufficiently to form a small fillet at all the contact points of each stone in the aggregate.

Between 24 and 48 hours after the no-fines layer has been laid it shall be covered with 1:4 cement: sand mortar layer with a nominal thickness of 2 mm. The mix shall be comparatively dry to ensure that it does not penetrate and block the cavities in the no-fines concrete. The surface shall be steel floated to form a plane surface.

The mortar skim shall be cured in the same manner as concrete for a period of not less than 2 days.

Payment shall be per cubic metre of no-fines concrete placed. The rate shall include compaction and skimming to the approval of the Engineer.

PSG 5.5.1.7 Strength Concrete

Add the following to Clause 5.5.1.7:

The concrete mix design for strength concrete must be prepared in an approved laboratory and the results of actual test mixes must be submitted for approval together with 7-day and 28-day strength test results at least 14 days prior to casting of the concrete. Special attention is drawn to the fact that the concrete mix must provide a very dense and impervious concrete.

The Contractor shall submit details of the proposed concrete aggregates and design mix to the Engineer for approval, after which he shall be required to make a trial mix and obtain cube test results to validate

the proposed mix. Only after receipt of satisfactory cube test results, the Contractor shall be permitted to use the mix in the construction of water retaining structures. The cost of designing and proving the proposed concrete mix shall be deemed to be included in the tendered rates.

There shall be three grades of strength concrete used on the works designated Grades 35/19, 30/19 and 25/19, and composed of cementitious material, sand and stone as previously specified .

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.

The Engineer may call for revised mix designs at any stage during the Contract.

Where blinding layers are specified, the concrete shall be grade 15 MPa/19 placed and finished off to the final level.

In order to facilitate or increase the workability of concrete in the fresh/plastic state, to ensure watertightness without increasing the water/cement ratio, the Engineer may approve the use of an additive.

Design slumps shall conform to table 3 of subclause 5.5.1.2.

PSG 5.5.2 Batching

Add the following to Clause 5.5.2:

Batching of all strength concrete shall be by mass. Prescribed concrete may be batched by volume. Batching shall not be done by wheelbarrow.

All concrete shall be mechanically mixed.

Stand-by mixers of adequate capacity and with an independent power unit shall be maintained on site for immediate use in the event of breakdown of the regular mixers failure of the power supply.

PSG 5.5.3.2 Ready-Mixed Concrete

Replace the contents of Clause 5.5.3.2 with the following:

Concrete from a central concrete production facility, other than on the construction site, will be permitted if the facility is within a 40 km radius of the site and, apart from test results in terms of Sub-clauses 7.3.1, 7.3.2 and/or 7.3.3, test results obtained by such a production facility as part of its quality control system will be accepted for evaluation in terms of Sub-clause 7.3.4, provided the cubes (taken from the concrete arriving on Site) are stored and cured on site.

The contents of all ready-mixed concrete arriving on Site shall be tested for conformance to the slump criteria given in clause 5.5.1.2. Any measured slump found to exceed 100mm shall be rejected and the

load removed from Site. No modifications to the load to correct the slump shall be allowed.

PSG 5.5.5 Placing

Add the following to Clause 5.5.5:

PSG 5.5.5.1 No cast shall be started when rain is falling or, when in the Engineer's opinion, heavy or continuous rain is probable. Should rain occur after the commencement of casting, the Contractor shall provide all measures necessary to ensure satisfactory completion and protection of that section of the works being cast. No cast shall be started when weather conditions are such that sand or salt spray is blown onto steel, formwork or concrete.

Add the following Clause PSG 5.5.5.10:

PSG 5.5.5.10 Casting of Concrete in Excavation

Structural concrete shall not be cast directly against the side of any excavation without the use of formwork unless prior approval has been obtained in writing from the Engineer.

Concrete used in pipe trenches for encasement and for the thrust / anchor blocks may be cast directly against the side of the excavation.

After vibration, the concrete shall be spaded in corners, in angles and against forms to release air bubbles which may have been trapped in these positions.

PSG 5.5.6 Compaction

Add the following to Clause 5.5.6:

All concrete shall be vibrated with approved internal vibrators of minimum 65 mm diameter and ample power to maintain a speed of at least 7000 rpm when immersed. Electrically driven vibrators shall be used when practicable. Smaller diameter vibrators may be used subject to the approval of the Engineer where areas of rebar congestion restrict the use of large diameter vibrators.

Vibrators shall be inserted only at a sufficient distance from the sloping face of an advancing layer to prevent undue slumping or flow of the face.

PSG 5.5.7 Construction Joints

Add the following to Clause 5.5.7:

PSG 5.5.7.1 General

The edge of joints, exposed to view in the finished structure, shall be so formed as to provide a straight edge true to line and level.

All joints, other than expansion, contraction and other movement joints shall be treated as follows:

As soon as practical the construction joint surface shall be prepared to receive fresh concrete. This preparation, as specified in Sub-clauses 5.5.7.3(a) to (d), shall be such as to remove all laitance or inert and strengthless material which may have formed by high pressure water jets or sand blasting and the specified chipping or sand blasting shall be such as to produce a roughened surface all over. The timing of this operation is important in order to obtain the required finish. Each joint shall be inspected by the Engineer before it is rendered inaccessible by the erection of further shuttering.

Construction joints shall be covered with a waterproofing slurry as indicated on the drawings.

When concreting is interrupted concrete surfaces shall be protected from the sun as specified in Sub-clause 5.5.8(d) or by means of hessian kept damp until concreting is resumed.

About ½ hour before placing concrete or mortar, construction joints shall be saturated with water and

immediately prior to placing concrete or mortar on any part of the joint, all surplus water shall be removed by compressed air jets or other approved method.

Unless construction joints between designated joints shown on the drawings are authorized by the Engineer in writing, concrete in the floor and wall shall be cast continuously between the designated joints shown on the drawings.

All costs connected with the forming of construction joints shall be deemed to be included in the relevant concrete rates.

Particular attention should be paid to construction joints where works has been standing for a considerable period of time. In addition to the above requirements the joints shall be cleaned of any other deleterious material (e.g. fungal growths, mould, plant growth etc.) which may affect the performance of the joint.

Well before construction, the Contractor shall submit a construction plan for each structure to the Engineer for approval which shows his planned construction joint positions.

Add the following Clauses PSG 5.5.7.4 – 5.5.7.12:

PSG 5.5.7.4 Formed Joints (Generally Vertical or Near Vertical)

Formed joints will be considered to be designated joints as defined in Sub-clause 2.4.3. (The forming of a straight edge to a construction joint as specified in PSG 5.5.7.1, as amended, does not constitute a formed joint).

Each joint shall be formed as shown on the drawings, complete with rebates, formwork, waterstops, sealants, approved joint filler, dowel bars and their PVC tubes, etc. as indicated.

PSG 5.5.7.5 Non-Designated Joints

Any non-designated joints shall be identical to designated joints, as shown on the drawings, which would be used in similar positions and shall perform the same function.

PSG 5.5.7.6 Joints between Footings or Floors and Walls or Columns

Construction joints between foundations, footings or floors and walls, columns or piers connected to them, shall not be made flush with the supporting surface, but shall be made at a distance above the footing or floor shown as on the drawings or approved by the Engineer. The "kicker" shall be cast as an integral part of the foundation, footing or floor.

PSG 5.5.7.7 Construction Joints

- Construction Joints In Walls Or Footings

Construction joints may only be placed where shown on the drawings or to the approval of the Engineer.

The entire contact surface along the joint in the concrete already cast shall be chipped or water jetted to expose the coarse aggregate to 5 mm beyond the surrounding matrix. Care shall be taken to ensure that the concrete structure is not damaged and that all loose material is removed. The surface must be thoroughly cleaned and wetted before casting against the joint.

- All construction joints in the reservoir walls and footing shall be cast with water stops. Water stops shall be rubber, as per detail drawings.

Payment shall be per linear meter. The rate shall include the cost of all material and labour for the construction of the joint as indicated on the drawings, including formwork, testing and making good. Rates shall also include the cost of the supply and placing of any waterstops, dowels or other insets.

PSG 5.5.7.8 Application of Primers and Adhesives

The concrete to which the primer or adhesive is to be applied shall be dry and shall be cleaned of all dust, grit, grease, surface laitance and foreign matter by compressed air and/or water, solvents, or other suitable approved means. The Contractor shall provide on Site an approved moisture meter to measure the degree of dryness of the joint. This meter shall be made available to the Engineer for testing. The joint shall be approved for the application of the primer and adhesive if the moisture content of the concrete is less than or equal to 5%. It may be necessary to dry the concrete surfaces locally to reduce the moisture content to 5% or less.

All application and drying times shall be included in the Tender Programme.

PSG 5.5.7.9 Contraction and Expansion Joints

Expansion and contraction joints shall be constructed as detailed on drawings using rubber water stops. These joints shall be formed true to line in smooth formwork. Water stops extruded from recycled material shall not be permitted. Prior to bandaging, concrete surfaces shall be prepared by means of high pressure water jetting, scabbling, sandblasting, etc. upon approval by the Engineer.

A waterproofing bandage shall be used for joints as indicated on the drawings and as described in section PSG 3.11.4. The bandage shall be applied and installed as per the instructions of the approved manufacturer.

All surfaces shall be thoroughly cleaned of all accretions of concrete or other foreign matter by scraping or other approved means.

Particular care shall be taken to compact the concrete around waterstops, edges, etc. using adequate approved tools and experienced, reliable workmen.

Rebates for seals shall be formed to required dimensions and lines, or cut true to line and size after floating the surface and before the final set of the cement has taken place. All rebates, etc., shall be adequately protected against damage until the completion of the work; accidental damage which in the opinion of the Engineer will impair the performance or appearance of the joint shall be made good by reconstructing the work as directed by the Engineer. Rebates for seals shall be grit blasted or wire brushed on all faces to remove surface laitance and thoroughly cleaned with soft brushes and/or compressed air jets, and, if necessary, dried by blow-lamp or other approved means before priming.

Payment shall be per linear meter. The rate shall include the costs for all materials and labour for the construction of each joint as shown on the drawings including the cost of formwork, testing and making good and shall include the cost of supplying and placing any waterstops, dowels or other insets.

PSG 5.5.7.10 Installation of Waterstops in Joints

Where waterstops are required, they shall be installed in the longest practicable lengths, and securely held to shape, lines, etc. in proper formwork.

Waterstops shall be held in the formwork so as to prevent air pockets forming underneath them. Special precautions shall be taken, to the approval of the Engineer, to ensure that all flexible waterstops are in perfect contact with well compacted void-free concrete.

PSG 5.5.7.11 Installation of Joint Filler in Expansion Joints

Filler in the joints shall be neatly butted so as to exclude mortar from the joint. Edges of filler strip against waterstops, concrete, formwork, projections, etc., shall also be closely fitted to exclude mortar, so that there is no resistance (other than the compression of the filler) to the expansion movement for which the joint is designed.

Joint filler shall be fixed to the first cast of concrete with an approved adhesive and as directed by the Engineer.

PSG 5.5.7.12 Application of Joint Seals

Rebates shall be cleaned as required by PSG 5.5.7.6 Application of primers and adhesives and shall be inspected and approved by the Engineer's Representative before filling.

Joint sealants and primers shall be applied strictly in accordance with the approved manufacturer's instructions. Flow and non-slumping grades shall be used for horizontal and vertical joints respectively unless indicated otherwise. Immediately after the compound is applied the joint shall be protected against damage until completion of the Contract.

Batch numbers of sealants shall be recorded. Only skilled workmen, experienced in this type of work shall be employed to apply the sealant.

Immediately after the compound is cold the joint shall be protected against damage until completion of the contract.

PSG 5.5.8 Curing and Protection

Add the following to Clause 5.5.8:

Notwithstanding the provisions of a) to g) above, curing shall be achieved using an approved curing compound (applied in accordance with the manufacturer's specifications) in addition to water curing and well-secured plastic sheeting (where possible). The curing compound used shall be to the approval of the Engineer. Wax based curing compounds will not be permitted. Water curing alone shall not be permitted. Where the Contractor fails to make adequate provision for ensuring proper curing for a minimum continuous period of 7 days, the Engineer may condemn the affected pour whereupon the affected area shall be broken-out and replaced at the Contractor's cost. Where the Engineer does not require the affected concrete to be broken out and replaced, the Engineer shall deduct 10% of the measured concrete volume for not fully meeting the specification.

The curing compound shall be applied immediately as formwork is progressively stripped or, in the case of unformed surfaces, when the concrete has taken its initial set. It shall preferably be applied by spraying and the rate of application shall be strictly in accordance with the manufacturer's recommendations. A method of monitoring the area to which curing compound has been applied and the application rate shall be as approved by the Engineer and rigidly applied by the Contractor.

Minimum stripping times for formwork shall be strictly observed (Table 2 of subclause 5.2.5.2 shall apply).

PSG 5.5.8.1 Horizontal Surfaces

Horizontal surfaces shall be wet cured only. The Contractor shall provide a method statement describing his proposed method of curing. This method statement is to be approved by the Engineer prior to construction.

PSG 5.5.8.2 Curing for Normal Concrete Surfaces

In order to achieve durable, impermeable concrete, all exposed surfaces (including joint surfaces) of strength concrete shall be properly and carefully cured. Curing shall take place from the time that the concrete has taken its initial set. (the length of time when formwork is in place may be deducted from the curing period).

The use of membrane curing compounds will be allowed on vertical faces or steeply inclined faces (i.e. steeper than 15° to the horizontal) of cast in situ members of the structures. Approval will be subject to the Contractor producing sufficient, satisfactory cube crushing strength test results where the crushing strength of cubes which have been cured with the proposed curing membrane and left exposed to the elements are compared with those of an equal number of water cured cubes. The crushing strength of cubes cured with the proposed membrane shall be at least 85% of the crushing strength of the water cured cubes.

Before any membrane curing compound is used, each batch shall be tested on a trial surface to ensure that it forms a satisfactory membrane, and any compound which is unsatisfactory in the opinion of the Engineer, shall be rejected. Curing membranes will be disallowed if permanent discolouration of the concrete takes place. Surfaces where curing membranes are used shall be treated in such a manner that the final concrete texture and colour blends in with the rest of the concrete work. Furthermore, the Engineer shall, at his discretion, require the Contractor immediately to adopt an effective alternative means of curing any area of the structure to which a membrane has been applied which, in the opinion of the Engineer, is unsatisfactory. The curing compound used shall be to the approval of the Engineer.

Wax based curing compounds will not be permitted.

The curing compound shall be applied immediately as formwork is progressively stripped or, in the case of unformed surfaces, when the concrete has taken its initial set. It shall preferably be applied by spraying and the rate of application shall be strictly in accordance with the manufacturer's recommendations. A method of monitoring the area to which curing compound has been applied and the application rate shall be as approved by the Engineer and rigidly applied by the Contractor.

Surfaces of joint rebates, where elastomeric sealant is to be applied, shall be protected from contamination by curing compound by the use of masking tape.

Curing times shall be included in the Tender Programme.

The Contractor shall immediately adopt an effective alternative means of curing any area of the structure where, in the opinion of the Engineer, curing is unsatisfactory.

Particular attention should be taken to proper curing of the vertical surfaces of the reservoir retaining walls in order to limit drying shrinkage cracking. A suitable curing regime shall be submitted to the Engineer for approval prior to the commencement of any concrete works.

PSG 5.5.9 Adverse Weather Condition

Replace the contents of Sub-clause 5.5.9.2 with the following:

No placing of concrete shall take place if the ambient temperature exceeds 32°C, or is likely to rise to above 32°C during the casting period or within eight hours after casting is completed.

If concrete is to be cast during times of high ambient temperature or hot drying winds, the Contractor shall be responsible for taking the necessary steps to keep the placement temperature as low as possible. Such steps include the spraying of the coarse aggregate with water, the painting of silos with a reflecting aluminium paint, the insulation of tanks and pipelines, and the protection of concrete ingredients against the direct rays of the sun. The area of the pour shall be shaded before and during concreting and the concrete shall be shaded from the time of mixing until eight hours after placing.

Windbreaks shall be erected if necessary.

PSG 5.5.10 Concrete Surfaces

Replace the contents of Clause 5.5.10 with the following:

PSG 5.5.10.1 Screeded Finish

After placing and compacting the concrete on a top (unformed) surface shall be struck off with a template to the designated grades and tamped with a tamping board to compact the surface thoroughly and to bring mortar to the surface, leaving the surface slightly ridged but generally at the required elevation. No mortar shall be added, and noticeable surface irregularities caused by the displacement of coarse aggregate shall be made good by re-screeding after the interfering aggregate has been removed or tamped.

PSG 5.5.10.2 Wood-Floated Finish

Where wood-floating is ordered or scheduled, the surface shall first be given a finish as specified in Sub-clause PSG 5.5.10.1, as amended, Screeded finish and, after the concrete has hardened sufficiently, it shall be wood-floated, either by hand or machine, only sufficiently to produce a uniform surface free from screeding marks.

PSG 5.5.10.3 Steel-Floated Finish

Where steel-floating is specified or scheduled, the surface shall be treated as specified in Sub-clause PSG 5.5.10.1, as amended, Screeded finish except that, when the moisture film has disappeared and the concrete has hardened sufficiently to prevent laitance from being worked to the surface, the screeded

surface shall be steel-trowelled under firm pressure to produce a dense, smooth, uniform surface free from trowel marks.

Add the following Clauses PSG 5.5.10.4 – 5.5.10.6:

PSG 5.5.10.4 Brushed Finish

Where brushed finish is specified or scheduled, the surface shall be treated as specified in Sub-clause PSG 5.10.1, as amended, Screeded finish except that, when the moisture film has disappeared and the concrete has hardened sufficiently to prevent laitance from being worked to the surface, the screeded surface shall be finished/brushed by dragging a broom across the surface of the concrete in order to obtain a non-slip surface.

PSG 5.5.10.5 Power-Floated Finish

Where a power-floated finish is specified, the surface shall be trowelled smoothly with a well-balanced power trowel. Care shall be taken to ensure the surface is trowelled when it is at the optimum trowelling consistency.

PSG 5.5.10.6 Rough Finish

In certain special cases where a rough finish is desired or specified on the drawings, the surface shall be screed-tamped to an approximately even dense surface, and shortly after final set of cement the surface shall be wire broomed and washed down to remove any laitance, leaving a clean rough surface with coarse aggregate partially exposed, but not disturbed.

PSG 5.5.10.6 Granolithic Screeds

PSG 5.5.10.6.1 General

Before placing any granolithic screeds the base concrete shall be chipped to expose the aggregate over 100% of the area to be screeded and soaked with water for at least 24 hours.

The base concrete shall be thoroughly cleaned by scrubbing and all standing water removed after soaking. A 1:2 cement/sand grout shall then be brushed into the prepared surface followed by the granolithic screed before the grout sets. The granolithic screed shall be of the driest feasible consistency with a slump not exceeding 50 mm and shall be formed true to profile and shape as required and shown on drawings. Before placing granolithic screed against an adjacent band of granolithic screed the edge of the latter shall be prepared by chipping back to firm material, wire brushing and brushing with grout as for the base concrete.

Granolithic screed shall be compacted to remove all air and shall be screeded and finished with a steel trowel to Degree of Accuracy 1.

The trowelling shall be carried out in the following stages:

- a) First - as soon as the granolithic screed has been compacted and screeded.
- b) Second - after 2 hours to close the surface and remove laitance.
- c) Third - after a further 4 hours.

The time intervals are estimated as appropriate to normal temperature conditions and shall be varied by the Contractor to ensure a smooth dense finish.

Granolithic screed shall be cured as specified in Sub-clause 5.5.8(b), as amended, but shall additionally be protected from direct sunlight and drying winds as it is being placed.

PSG 5.5.14 Defects

Add the following to Clause 5.5.14:

All defects shall be repaired as soon as possible after the formwork has been removed and the Engineer has inspected the concrete. A statement of the method to be used for each repair shall be submitted to the Engineer for his approval before any work is carried out. The Engineer may prohibit the further placing of concrete in the particular area concerned until he is satisfied that the repair has been satisfactorily executed.

Honeycombed or otherwise defective concrete shall be cut out, together with part of the sound concrete, as directed by the Engineer; anchor reinforcement drilled into holes into sound concrete shall be provided if and as ordered by the Engineer. The cavities shall then be filled in flush with the concrete of the same mix but in general a smaller maximum aggregate size to be specified by the Engineer, placed against special formwork; the joint being treated as a construction joint. For minor honeycombing and defects, the Engineer may order a shallower cut-out, the edges of which shall be square to the face, or preferably undercut to a depth of at least 25 mm. Such cut-outs shall be filled with mortar of composition and colour similar to the concrete mortar, and applied by a tradesman or suitably skilled personnel.

Exposed corners, etc., which are patched shall be bonded to sound concrete by approved epoxy resin or similar bonding agents applied in accordance with the manufacturer's instructions. An approved experienced specialist sub-contractor shall be employed for critical work, such as the above, if directed by the Engineer.

Special care shall be taken to ensure that any repair exactly matches the formed surface in colour and texture.

No patching or filling of surface defects other than air holes shall be permitted. If the exposed surface has defects which are in the opinion of the Engineer detrimental to the desired architectural effect, that cast of concrete shall be removed and reconstructed at the Contractor's cost; any adjacent casts damaged in this process shall also be reconstructed.

Add the following Clauses PSG 5.5.16 – 5.5.18:

PSG 5.5.16 Casting Pipes and Specials in Concrete

Where the pipe or specials is to be cast into a valve or other chamber or manhole, the Contractor may elect to provide a box-out in the wall and cast the unit in at a later stage. When constructing such box-outs reinforcement shall not be cut but shall run through the opening. Reinforcement shall be cut and/or bent out at a later stage to suit the item being cast in. After installation of the item the remaining reinforcement shall be bent back in position.

Before commencing the positioning in holes of any pipes/specials the Contractor shall:

- a) remove all formwork and boxing remaining in the holes;
- b) make any alternations required to the position and shape of the holes and cut reinforcement to suit the item, as directed by the Engineer; and
- c) thoroughly scabble and water jet the sides of the holes so as to obtain a satisfactory bond surface for the new concrete and treat the surface as specified in Sub-clause 5.5.7.3, as amended.

Immediately prior to the placing of mortar and concrete around the pipes, the surface of the 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 made of the same mix as the concrete in which the pipes/specials are to be placed.

The concrete ingredients shall be mixed and placed as dry as possible to obtain a dense, waterproof concrete. 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 a falling away from pipe/special surfaces of the concrete already placed. The whole shall, when set, form a dense, homogeneous, and waterproof mass.

PSG 5.5.17 Precast Paving Slabs

The area to be paved shall be compacted to 93% of MAMDD, trimmed and then treated with an approved weed killer, with care being taken to avoid contaminating surrounding areas. The paving slabs shall be laid on a sand bed approximately 25 mm thick, which shall be graded to the required levels and slopes as approved by the Engineer. The joints between the slabs shall be 2 mm to 6 mm wide and shall be grouted with cement mortar. Gaps in the pattern of slabs shall be filled with grade 15 MPa/19 mm concrete and given a wood floated finish.

PSG 5.5.18 Items to be cast in or grouted into concrete

PSG 5.5.18.1 Fixings for equipment supplied under separate contract

- a) The Contractor will be responsible for the forming of pockets to the details shown on the drawings to accommodate holding down bolts for equipment supplied under a separate contract. Holding down bolts will be supplied by and positioned by others.
- b) After casting of the concrete all shuttering shall be removed and the sides of the bolt holes and surface on which the machine base is to be placed shall be scabbled to remove all defective concrete, laitance, dirt, oil, grease and loose material.
- c) Upon completion of the positioning and alignment of equipment and when instructed by the Engineer the Contractor shall in collaboration with the mechanical contractor, grout up pockets and baseplates by filling pockets and voids under the baseplates with an approved non-shrink grout.

PSG 5.5.18.2 Fixings for items supplied under this Contract

Holding down bolts or other fixings required for the installation of items supplied under this Contract shall be provided by the Contractor. These fixings shall be cast in or grouted into pockets or installed by other means as approved by the Engineer.

Where anchor bolts are used which are installed into holes drilled into concrete or masonry these shall be of a type approved by the Engineer. All such bolts used shall be manufactured from stainless steel or a metal with a resistance to corrosion equal to that of grade 304 stainless steel. Precautions to be taken when stainless steel fixings are used on galvanised steel members.

Anchor bolts shall have mean ultimate tensile resistance and mean ultimate shear resistance at least equal to those specified below:

Specified Anchor Size	Mean Ultimate Tensile Resistance (kN)	Mean Ultimate Shear Resistance (kN)
M10	36.8	18.90
M12	53.3	28.4
M16	72.4	53.6
M20	149.2	92.4

PSG 5.5.18.3 Supervision

The Contractor shall be responsible for ensuring that the erection of the concrete work is carried out under the supervision of a person with adequate knowledge of the mixing, transporting, placing and curing of concrete.

PSG 5.5.18.4 Programme and Plant

Prior to carrying out any concrete work, the Contractor shall obtain the approval of the Engineer in respect of:

- a) Structural programme,
- b) Concrete plant details,
- c) Materials to be used in concrete,
- d) Details of concrete

- e) Construction joints

PSG 5.7 POLYURETHANE COATING ON FLOORS AND WALLS

Polyurethane coating on floors and walls of the High Lift Pump Station building shall be installed as per the Manufacturer's specifications and by a skilled supplier or Contractor as approved by the Engineer. Designated walls shall be covered with the coating

PSG 7 TESTS

PSG 7.1.1 Facilities

Add the following to Clause 7.1.1:

Water-Bath

A temperature-controlled water-bath with a sufficient capacity to cure the amount of cubes required shall be provided on site. The water-bath shall be located under cover.

PSG 7.1.2 Frequency of Sampling

Add the following to Clause 7.1.2:

One sample shall consist of three concrete test cubes.

For each sample taken the position in the structure shall be recorded where the batch represented by that sample is placed as also the date sampled.

Sampling of concrete of a particular grade shall be as specified in Sub-clause 7.1.2 with the following frequency of sampling referred to in Sub-clause 7.1.2.2 being amended to read as follows:

"A minimum of 4 samples per day of each grade of concrete placed or 6 samples for pours in excess of 10 m³ shall be taken."

PSG 7.2 Testing

Add the following Clauses PSG 7.2.5

PSG 7.2.5 Testing Watertight Concrete

All potable water retaining structures shall be disinfected before testing only if specified on the drawings.

The procedure for disinfecting the structures shall be as follows:

The entire inside surface of the structure including columns and roof shall be thoroughly hosed down with water and brushed until properly cleaned off all dirt and other foreign matter.

The floor of the structure shall then be flooded to a depth of 300 mm with purified water, with calcium hypochlorite solution being added gradually to mix thoroughly as the water enters. The water shall be dosed with calcium hypochlorite at a rate of 150 grams per cubic metre of water entering the structure. The entire inside surface shall again be scrubbed using this water. The workers engaged in this operation shall wear clean rubber boots. On completion the water is to be run to waste once the free chlorine is reduced to an acceptable level, and the floor of the structure shall be swept clean. The chlorinated water shall be stored until the free chlorine level has dropped to an acceptable level. Excess dirt swept from the floor into the sump may be discharged subject to written approval being obtained from the Local Authority.

PSG 7.2.6 Water-tightness testing of the structure

For testing for water-tightness, the structure shall be cleaned and initially filled to the normal maximum

level with the water at a uniform rate of not greater than 2 m in 24 hours.

When first filled, the water level should be maintained by the addition of further water for a stabilising period while absorption and autogenous healing take place. After a stabilization period of 21 days, refill (top up) and record the water level at 24 hour intervals for a test period of 7 days. During this 7 day test period the total permissible drop in level, after allowing for evaporation and rainfall, should not exceed 1 mm per 1m water depth.

Notwithstanding the satisfactory completion of the test, any evidence of seepage of the liquid to the outside faces of the liquid-retaining walls shall be assessed by the Engineer against the requirements of the specification. Any necessary remedial treatment of the concrete, cracks, or joints shall be carried out from the liquid face where practicable. If a lining is used for this purpose, it shall be sufficiently flexible and not be in any way detrimental to the water quality.

In the event of any leakage or dampness being evident at any stage of the filling or testing or in the event of the Engineer considering the final degree of water-tightness to be unsatisfactory, the Contractor when ordered by the Engineer shall discontinue such filling or testing and shall, at his own expense, immediately take approved steps to rectify the leakage and to make the work thoroughly sound to the complete satisfaction of the Engineer. All such rectification work shall be continued assiduously until a satisfactory test is obtained, which shall prove to the Engineer that water-tightness has been obtained.

The Works will not be certified complete until the structure has been proved by testing to be watertight to the satisfaction of the Engineer.

Testing of the roof of water retaining structures

The roof shall be tested on completion by using a hose or sprinkler system to obtain a sheet flow over the whole area of the roof for a period of not less than 6 hours.

The roof shall be considered satisfactory if no leaks or damp patches appear on the soffit.

PSG 7.2.7 Durability Testing:

Concrete shall comply with the durability parameters defined below:

a) Water Sorptivity:

Sorptivity is sensitive to surface effects and may be used to assess the effectiveness of initial curing.

b) Oxygen Permeability:

Permeability is sensitive to changes in the coarse pore fraction and is thus a means of assessing the degree of compaction of concrete. It may be used to quantify the microstructure of the concrete and is sensitive to macro-defects such as voids and cracks. Permeability shall be tested in a manner approved by the Engineer.

c) Chloride Conductivity:

Chloride conductivity provides a method of characterisation of concrete in the marine environment and may be used to assess the chloride resistance of concrete.

Unlike oxygen permeability and water sorptivity, chloride conductivity is not really a measure of construction quality, but it shall be used for materials selection and design of mixes in aggressive chloride conditions. It will therefore only be used as a check on mix designs during the initial stages of construction.

d) Concrete Cover:

Concrete cover is a dimensional indicator of cover concrete depth. Cover concrete is the outer concrete layer which protects the internal reinforcing steel, and its depth varies according to the requirements of the different environmental exposure classes.

Test for cover shall be conducted using an approved calibrated electromagnetic cover meter.

This test shall be conducted when instructed by the Engineer to confirm that the specified depth of concrete cover has been achieved. The cover meter tests shall cover at least 1 m² for every 10 m² exposed. The average cover of the 1 m² subjected to the test shall be used to determine the payment, unless the Contractor chooses to carry out additional tests as detailed under clause PSG 7.3.8. The cover meter must be calibrated for each project by drilling and measuring actual cover in at least 3 locations to validate the readings.

Minimum cover to reinforcing for the utility building and guard house shall be as indicated on the drawings.

e) General:

Durability predictions will be based on the following tests that shall be arranged by the contractor. The durability testing shall be carried out by a laboratory approved by the Engineer.

f) Shrinkage

The dry shrinkage tests shall be conducted in accordance with SABS 1085. The drying shrinkage shall not exceed 0.04%.

PSG 7.3 Acceptance Criteria for Strength Concrete

Add the following Clauses PSG 7.3.6 – 7.3.10:

PSG 7.3.6 Durability Index Tests

Testing for durability shall be carried out using test panels which are constructed with the same concrete mix, formwork type, and compaction and curing methods as the actual concrete drums. The test panel shall be 150 mm thick, and of at least 0.5 m sides. Samples for testing shall be obtained from the face of the test panel that mimics the cast face of a drum, after a period of 28 days curing. The test panels required for durability testing shall be constructed:

- a) At the start of production
- b) Initially for the first 50m³ batch of concrete.
- c) Thereafter 2 sets for every discreet element namely floors, sloped floors and walls.

The durability tests are to be carried out by an accredited laboratory approved by the supplier in terms his Quality Management System and shall be:

- a) Oxygen permeability index test (OPI)
- b) Water sorptivity index test (including porosity)
- c) Chloride conductivity index test

The test procedures for these tests are obtained from the University of Cape Town Durability Index Test Manual.

Two sets of four cores each (70 mm dia) are required from a test panel: four cores for the oxygen permeability and water sorptivity tests; four cores for the chloride conductivity test.

The required target values for the tests are summarized in the table below. (These are the average values for the four core specimens used for the testing on each occasion). These values are required to be met simultaneously for both sets of cores, i.e. the cores must pass the requirements for both OPI and chloride conductivity.

PSG 7.3.6.1 Durability Test Parameters

DURABILITY INDEX TEST	TARGET VALUE
Oxygen permeability index	≥ 10 (log scale)
Chloride conductivity index	≤ 0.6 m.sec/cm
Water Sorptivity	≤ 8 mm / hr0.5

In the case that the results do not comply with the above values in the above table, another set of cores shall be drilled from the test panel. Where the second set of cores fails to comply with target values, a drum from that batch of concrete shall be sampled by way of drilling four cores for each of the oxygen permeability test and the chloride conductivity test. If these sets of cores fail either of the target values for OPI or chloride conductivity, all drums from that batch of concrete shall be discarded. The contractor shall keep records of all tests results relating to the samples tested.

The contractor shall ensure that site testing is carried out by a trained person. The contractor shall ensure that all off-site laboratory testing is performed in an approved laboratory approved in terms of their Quality Management System.

PSG 7.3.7 Criteria for the Compliance with the Requirements

No extra payment shall be made for cube strength testing. The cost of cube strength testing shall be included in the rates tendered for concrete.

Water used for testing shall be free of charge except for failed tests when water will be charged at standard municipal rates.

In the event that the actual achieved average cube strengths of an element are less than 85% of the target mean strength, the Engineer may instruct the taking of cores for additional strength testing. The cost of taking the cores and repairing the holes in the structures shall be for the Contractor's account.

The Engineer will conduct routine tests for the durability parameters on cores taken from the completed elements during the construction, the costs for which shall be to the Employer's account unless the parameters are not met.

The test results shall be accepted or rejected based on the criteria as set out in PSG 7.3.6.1 based on the following categories:

- a) Full Acceptance:
Concrete shall be accepted unconditionally and full payment shall be made.
- b) Conditional Acceptance:
Concrete may be accepted at the Engineer's discretion with a warning that construction methods be examined to improve the durability criteria. A reduced payment shall be applied to all the relevant pay items under SABS 1200 G for the non-conforming element or concrete pour. Alternatively, the Contractor may elect to carry out remedial work to improve the durability of the concrete to the criterion of "Full Acceptance" to the satisfaction of the Engineer, and receive full payment. All proposed remedial measures shall be subject to the approval of the Engineer. The cost of all such remedial work shall be for the Contractor's account.
- c) Rejection:
The concrete shall be removed and replaced with fresh concrete at the expense of the Contractor, as directed by the Engineer.

Should the test result(s) indicate conditional acceptance or rejection of the item tested, the Contractor shall have the option of carrying out additional tests on that item, at his own expense, to confirm or disapprove the original test result(s). Not more than two such additional tests shall be carried out.

PSG 7.3.8 Procedure in the Event of Non-Compliance with the Requirements

Structural concrete elements or concrete pours shall be represented by test cubes and extracted cores,

which shall be tested for strengths and the appropriate durability parameters.

If the durability parameters have been proved acceptable, the costs for such testing shall be borne by the Employer. However, where non-compliance to the specified parameters has been identified, the assessed element shall be rejected and at the Engineer's sole discretion any of the following measures may be considered at the Contractor's expense:

- a) Coating with an approved product specifically designed to improve the non-conforming parameter depending on the severity of the test results.
- b) Acceptance at reduced payment.
- c) Demolition and rebuilding.

PSG 7.3.9 Tests Ordered By the Engineer

One concrete cube strength test shall comprise the results of tests carried out on three standard test cubes made from concrete sampled from one batch of concrete in accordance with these specifications.

Percentage payment for concrete cover shall be based on the average result of the total number of cover meter tests performed on a particular concrete element.

The overall percentage payment applied to a concrete member shall be based on the average of the percentage payments applicable to each durability parameter, together with the percentage payment based on the strength requirements described in the project specifications.

The reduced payments shall apply to the relevant payment items scheduled in the Schedule of Quantities.

PSG 7.3.10 Grouting

The Contractor shall, where so ordered, carry out a site test for each grouting procedure. The tests shall be carried out on a dummy bedplate similar in configuration to that which is to be grouted, but not exceeding 1 m² in area unless otherwise ordered. When the dummy bedplate is dismantled, the underside shall show a minimum grout contact area of 80% with reasonably even distribution of the grout over the surface grouted except that, in the case of expanding grout, the minimum grout contact area shall be 95%. The test shall show evidence of good workmanship and materials and the results shall be to the satisfaction of the Engineer.

The Contractor shall, when so ordered, make standard test cubes from various grout mixtures and also subject them to compression tests to determine whether the specified strength has been achieved. Test procedures shall comply with the relevant requirements of Sub-clauses 7.2.1 to 7.2.3.

PSG 7.3.11 Durability Parameters Acceptance Ranges

When tested in accordance with the test procedures described below for each potential durability parameter, the concrete shall meet the limits given in the tables below:

PSG 7.3.11.1 Water Sorptivity and Oxygen Permeability

Table PSG 7.3.11.1 Water Sorptivity and Oxygen Permeability		
Acceptance Category	Test No. / Description / Unit	
	Water Sorptivity (mm/h)	Oxygen Permeability (log scale)
Concrete made, cured and tested in laboratory	6	> 10.0
Full acceptance of in-situ cast concrete	< 8	> 9.15
Conditional acceptance of in-situ cast concrete (with remedial measures)	8 - 15	8.75 – 9.15
Rejection	> 15	< 8.75

PSG 7.3.11.2 Chloride Conductivity

Table PSG 7.3.611.2 Chloride Conductivity (severe to very severe conditions)								
Concrete	100% PC		10% CSF		30% FA		50% GGBS	
Curing Period	28d	90d	28d	90d	28d	90d	28d	90d
Full wet cured	1.25	1.00	0.50	0.45	1.50	0.40	1.25	1.00
Moist cured (3 – 7d)	1.75	1.60	0.60	0.55	2.25	1.25	2.25	2.00

PSG 7.3.11.3 Concrete Cover

Table PSG 7.3.11.3 Concrete Cover			
Test Description	Specified Cover (mm)	Acceptance Range	
		Minimum	Maximum
Concrete cover to reinforcement	20 – 30	As specified	As specified + 5 mm
	30 - 80	As specified	As specified + 10 mm

PSG 8 MEASUREMENT AND PAYMENT

PSG 8.1.1 Formwork

Add the following Payment Item PSG 8.1.1.7 – 8.1.1.9:

PSG 8.1.1.7 Edges of blinding layer

No separate payment will be made for formwork to the edge of the blinding layer. The rates tendered for concrete to the blinding layer shall cover the cost of such formwork.

PSG 8.1.1.8 Chamfers and fillets

No additional payment will be made for chamfers and fillets up to 40 mm wide. Larger fillets and chamfers will be measured by length in accordance with Sub-clause 8.2.5.

PSG 8.1.1.9 Kickers

Formwork for kickers will be measured as plane (or circular) vertical (not as narrow widths) and no separate payment items will be scheduled for kickers.

PSG 8.1.2 Reinforcement

Add the following to Payment Item 8.1.2.2 and 8.1.2.3:

Notwithstanding the method of measuring and paying for reinforcement specified in Sub-clauses 8.1.2.2 and 8.1.2.3, reinforcement will be measured and paid for as scheduled.

PSG 8.1.3 Concrete

Add the following to Payment Item 8.1.3.3:

The rates for concrete shall also cover:

- a) the use of dolomitic aggregate where prescribed,

- b) the cost of the preparation of design mixes by an approved laboratory and submission for approval by the Engineer,
- c) screeded finish of unformed surface as specified in PSG 5.5.10.1, as amended, Screeded finish, and
- d) Inclusion of admixtures where specified.

PSG 8.2 SCHEDULED FORMWORK ITEMS

Add the following to Payment Item 8.2:

Rates for formwork shall include any additional items required for the fastening of formwork such as embedded fastening systems.

PSG 8.4 SCHEDULED CONCRETE ITEMS

PSG 8.4.4 Unformed surface finishes Unit: m²

Add the following to Payment Item 8.4.4:

The rates for unformed surface finishes shall cover the cost of providing the respective surface finish as specified in PSG 5.5.10, as amended, Concrete Surfaces.

- Screeded Finish Unit: m²

Add the following Payment Item PSG 8.4.7 :

PSG 8.4.7 Cast in of Pipes through Walls and Floors of Structures Unit: No

Unless scheduled separately, casting in of pipes through walls and floors of structures shall be deemed to be included in the rates for pipes and structures. For scheduled items, different items will be stated for ranges of diameters of pipes to be cast through walls and floors of structures, and thickness of the walls and floors (or type of structure) as applicable.

The tendered rate shall include full compensation for cutting and splicing reinforcing where required, for opening and closing of formwork where required, securing of pipes against uplift and for all additional costs required to install pipes in the exact positions as shown on the drawings. At box-outs for pipes below ground level and for water retaining structures the rate shall include chipping and wire brushing the concrete surfaces to expose the coarse aggregate and coating the surfaces with an approved wet to dry epoxy to specification before casting in of the pipe.

PSG 8.5 JOINTS

Add the following to Payment Item 8.5:

Only designated joints as shown on the drawings will be measured for payment according to the length of each type of joint constructed. The rate shall cover the cost of all materials, labour and plant required to construct each type of joint specified on the drawings, including the cost of all shuttering, treatment of the joint as specified in Sub-clause 5.5.7.3, as amended, the provision of chamfers as specified where concrete is exposed, as well as testing and repairing where necessary. The rate shall also include any waterbars, dowels or other inserts as indicated on the drawings.

Non-designated joints will not be measured for payment.

Add the following Payment Item PSG 8.5.1 to this payment clause:

PSG 8.5.1 Formed joints Unit: m

Formed joints will be measured by the length of the joint.

The rates shall cover the cost of all operations and materials specified in Sub-clause 5.5.7, as amended, and Sub-clause PSG 5.5.7.2, as amended, Formed joints (generally vertical or near vertical), and detailed on the drawings such as joint filler, dowel bars and tubes, joint sealant, bitumen coats, etc., including waterstops or water bars as detailed. The rates shall also include the treatment of the surfaces before applying sealants, fillers, slurries or any other coatings.

Formed joints shall be classified in the bill as on the drawings.

Construction joints which shall be covered with a waterproofing slurry as indicated on the drawings, shall include the rates of the waterproofing slurry and the application thereof.

PSG 8.7 GroutingUnit: m³

Add the following to this payment clause:

Grouting of base plates and equipment bases will be measured by the volume of grout used.

The rate shall cover the cost of the supply and floating in of grout under the plates to ensure solid and complete filling of the gap.

PSG 8.8 HD Bolts and miscellaneous Metal WorkUnit: No.

Add the following to this payment clause:

Fixing of holding down bolts will be measured by number. The rate shall cover the cost of all things necessary to ensure that the bolts are effectively and rigidly held in position during casting, complete with sleeved pockets, all as detailed on the drawings.

Add the following Payment Items PSG 8.9 – 8.16

PSG 8.9 GRANOLITHIC SCREEDSUnit: m²

Special floor finish will be measured by area. The rate shall cover the cost of the supply and application of the specified material, complete as specified by the manufacturer and to the approval of the Engineer. Repairs to unsatisfactory work will not be paid for.

Measurement of granolithic screeds will be by the surface area covered.

The unit rate or lump sum shall cover the cost of all materials, labour and equipment required to provide the screed as specified in Sub-clause PSG 5.5.10.6, as amended, Granolithic screeds. The rate shall include the steel float finish.

PSG 8.10 NO-FINES CONCRETEUnit: m³

No-fines concrete will be measured by volume. The volume measured shall be based on the neat dimensions as shown on the drawings. The Contractor shall make provision in his rates for additional volume which may be required as a result of any overbreak during excavation.

The rate shall cover the cost of supplying materials, constructing and placing in position the no-fines concrete, and shall include for the steel floated 2 mm mortar skim.

PSG 8.11 ITEMS CAST IN CONCRETEUnit: No.

Items cast in concrete will be measured by number separately for each type of item.

Notwithstanding Sub-clause 8.2.6, the rate shall cover the cost of fixing in position and casting in the item as construction proceeds, irrespective of whether the Contractor chooses to fix the item in the formwork and cast it in directly or to box out a hole and grout the item in subsequently. At box-outs for pipes below ground level and for water retaining structures the rate shall include chipping and wire brushing the concrete surfaces to expose the coarse aggregate and coating the surfaces with an approved wet to dry epoxy to specification before casting in of the pipe.

The item will be measured and paid separately.

PSG 8.12 DURABILITY TESTS Unit: Sum

The durability test will be paid by a lump sum separately for the reservoir structure.

The sum shall cover the cost of all labour, equipment and materials to carry out the tests, as specified in PSG 7.2.7, to rectify faults and to achieve a test result to the satisfaction of the Engineer. Durability tests will include tests for Sorptivity, Oxygen Permeability, Chloride conductivity, Concrete Cover and Shrinkage as specified in PSG 7.2.7.

PSG 8.13 Precast paving slabs.....Unit: m²

Precast paving slabs will be measured by the area paved.

The rate shall cover the cost of compacting the area, application of weed-killer, supplying, laying and bedding the slabs, grouting the joints and filling any gaps, all as specified.

PSG 8.14 FA concrete.....Unit: m³

Measurement and payment for FA concrete shall be as specified in Sub-clause 8.1.3 as amended.

The tendered rate shall cover all costs in connection with the supply, storage, handling on site and mixing in of PFA.

PSG 8.15 WATERTIGHTNESS TEST Unit: Sum

The watertightness test will be paid by a lump sum separately for each structure.

The sum shall cover the cost of all labour, equipment and materials to carry out the tests, as specified in PSG 7.2.6 to rectify faults and to achieve a test result to the satisfaction of the Engineer.

The sum shall include for all water required over and above that required for one filling of the relevant structure based on the assumption that water will be available in time as part of this Contract.

The sum shall include for all water required over and above that required for one filling of the water retaining structure based on the assumption that water will be available.

A provisional item is provided for an extra payment to the above to allow for the water not being available in time and the Contractor has to make his own other arrangements for providing water for testing. Such an arrangement shall only come into effect on the Engineer's instruction.

PSG 8.16 POLYURETHANE COATING ON FLOORS Unit: m²

Polyurethane coatings shall be measured per square meter. Rates for polyurethane coatings shall include supply, delivery and installation as well as all materials and colour pigments used as per drawings and specifications. The rates shall cover all components required for the application of the 5 mm screed as per the Supplier's specifications.

PSG 8.17 Black Plastic Bond Breaker.....Unit: m²

A 250 micron black plastic continuous layer is to be laid over the no-fines concrete under the reservoir floor. The side and end laps shall not be less than 100mm. Just before casting the sheeting shall be perforated in a grid pattern at 1 m centres.

Payment shall be by the square meter laid. Care shall be taken not to rip or tear the sheeting. All repairs shall be at the Contractor's expense.

PSG 8.18 BITUMEN EMULSION Unit: m²

Bitumen Emulsion will be used as a bond breaker between surfaces and joints. The rate for the emulsion shall be per square meter and shall include the rate for the cleaning of surfaces, materials and labour required for application.

PSG 8.21 TORCH-ON WATERPROOFING

Unit: m²

Rates for torch-on waterproofing required at the roofs of the guard house and utilities building will be per square meter. Rates shall include the cost of all material, plant and labour required for this installation.

PSH STRUCTURAL STEELWORK (SABS 1200H)

PSH 3 MATERIALS

PSH 3.1 Structural Steel

Add to the Sub-Clause:

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:

All structural steelwork which shall include ladders, safety cages and platforms, shall be manufactured in conformity with SABS 1431 to the following grades:

- Hot-rolled Sections: S355JR
- Hot-formed Hollow Sections: S355JR

Except where shown to the contrary on the drawings or in the schedule of quantities.

All steelwork not specified as Stainless Steel to be sand blasted to SA 2.5 and hot-dip galvanised to SABS 763.

All stainless steel shall be grade 304L, except where shown to the contrary on the drawings or in the schedule of quantities.

Grade 3Cr12 steel shall be used where scheduled or shown on the drawings and shall be fully pickled and passivated prior to installation.

PSH 3.3 Steels Used For Cold-Formed Sections

Add the following to Clause 3.3:

Cold formed sections are to be provided in accordance with BS 2994: 1967.

PSH 3.5 Welding Consumables

Add the following to Clause 3.5:

All welds to be designed to transmit full member strengths and to be 6 mm fillet welded unless specified.

PSH 3.6 Bolts, Nuts And Washers

All bolted connections to be designed in accordance with SABS 0162-1:2005.

PSH 5 CONSTRUCTION

Add the following to Clause 5:

All structural steel works to be carried out in accordance with SABS 2001 – CS1:2005 unless specified otherwise elsewhere.

PSH 5.1.2 Contractor to Provide Shop Details

Add to the Sub-Clause:

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.

PSH 5.2 Fabrication

Add the following to Clause 5.2:

Fabrication of steelwork shall be sequenced so as to limit welding distortion and the possibility of locked-in stresses.

PSH 5.2.6 Handrails

Add to the Sub-Clause:

Handrailing shall be of tubular construction in GMS or Grade 304L stainless steel of an approved proprietary make as scheduled.

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 1,6mm) 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 8mm 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 is to include for the supply and installation of the handrail, knee rail, portion of a stanchion, footing, Chemical type holding down bolts and nuts (expanding anchors will not be acceptable) and is to be inclusive of all cutting, mitring, welding, grinding and waste.

PSH 5.2.7 Ladders

Add to the Sub-Clause:

Stairs and ladders are to be provided in accordance with the details shown on the drawings.

PSH 5.2.8 Open Grid Floors

Add to the Sub-Clause:

Open grid steel flooring is to be cut and framed to the required panel shapes and sizes all in accordance with the details shown on the drawings.

PSH 5.2.10 Protective Treatment

Add to the Sub-Clause:

All mild steel shall be hot-dip galvanised except where shown to the contrary on the drawings or in the schedule of quantities. Hot-dip galvanising shall conform to SABS 121;2000 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 SABS 509.

PSH 5.2.11 Pipe Clamps and Brackets and/or Supports (New Sub-Clause)

Clamps and brackets around pipes and supports under pipes and valves are to be constructed to the details shown on the drawings and are to 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 20mm beyond the edges of the plate.

PSH 5.3.4 Welding

Add the following to Clause 5.3.4:

Details of the weld procedures, consumables to be used in the welding process as well as shop drawings shall be submitted to the Engineer for approval at least 14 days prior to fabrication.

All welding is to be carried out by suitably qualified coded welders. No welding is to take place without the approval of the Engineer.

PSH 5.3.6 Grouting

Add to the Sub-Clause:

The Contractor will be fully responsible for all grouting work under this Contract.

PSH 6 TOLERANCES

PSH 6.1.3 Accuracy of Erection

Add to the Sub-Clause:

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 given as " ± 5 " shall be read as " ± 3 ".

PSH 7 TESTING

PSH 7.1 Test Certificates

Delete the part sentence "in terms of the project specification" from the wording of the Sub-Clause and add the words "when so requested by the former" at the end of the sentence.

PSH 8 MEASUREMENT AND PAYMENT

PSH 8.3 Scheduled Items

Add the following introduction to the subsequent Sub-Clauses:

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 Sub-Clauses 8.3.1 to 8.3.6 inclusive the requirements of the introduction shall take precedence. Holding down bolts (i.e. bolts secured in concrete, brickwork etc shall be of the Chemical type (expanding anchors will not be acceptable).

m 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 STEELWORK (SABS 1200HC)

PSHC 5 CONSTRUCTION

Add the following Clause:

PSHC 5.1 Structural steel

All structural steel members shall be hot dip galvanized unless otherwise indicated on the drawings and BoQ.

PSHC 5.3 Dressing and Repairs During Fabrication

Add to the Sub-Clause:

Edges shall be ground to a smooth radius of at least 2 mm unless otherwise indicated

PSHC 5.4.1 Preparation for Coating-General

Add to the Sub-Clause:

The work of surface preparation prior to painting shall be carried out at the manufacturer's works.
The work of surface preparation prior to galvanising shall be carried out at the galvaniser's works.

PSHC 5.4.3.1 Abrasive Blast Cleaning

Add to (a) General:

The standard of blast cleaning required in terms of Swedish Standard SIS-05-59-00 is Sa 2 1/2.

The surface profile after blasting shall be in accordance with the paint manufacturer's requirements for the particular paint system being used.

Add to (b) Dry Abrasive Blast Cleaning

The blast cleaning media shall not be recycled.

PSHC 5.4.3.2 Cleaning by Hand or with Power Tools

Add to the Sub-Clause:

Cleaning by hand or power tools, where permitted or ordered by the Engineer, shall be to standard St 3 of SIS-05-59-00.

PSHC 5.7 Coating system for New Steelwork

Add to the Sub-Clause:

All structural steel members shall be hot dip galvanized

The coating system 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 system to be used shall be selected by the Contractor from the following alternative systems:

PSHC 5.7.1 Painting System No. 1

For structural steelwork coastal regions - exterior work

AECI Dulux	DFT (µm)	Plascon	DFT (µm)
Zinc galv 6 ⁽²⁾	75	Zinc rich primer M1 233	70
Zinc galv 1	touch up	Chemcote High Build	70

Chlorinated Rubber – Kemrist	<u>90</u> <u>165</u>	CHC 101 – light grey	
		Chemcote enamel	<u>30</u>
		CHC 3000 series	<u>170</u>

PSHC 5.7.2 Painting System No.2

For structural steelwork coastal regions - interior work

AECI Dulux	DFT (µm)	Plascon	DFT (µm)
Zinc galv 6 ⁽²⁾	60	Degrease with Aquasolv GR	-
Zinc galv 1	touch up	Zinc phosphate Primer UC 182	55
Chlorinated Rubber - Kemrist	<u>60</u> <u>120</u>	Alkyd undercoat UC 189	35
		Enamel	<u>30</u> <u>120</u>

PSHC 5.7.3 Painting System No.3

For overcoating galvanised work

AECI Dulux	DFT (µm)	Plascon	DFT (µm)
Prepare surface Galvkleen	-	Prepare surface cleaner GIC	-
Corrocote 2(2)	10	Galvogrip metal primer	30
Chlorinated Rubber – Kemrist	<u>70</u> <u>80</u>	Universal undercoat UCI	30
		Supergloss Enamel Code G	<u>25</u> <u>85</u>

PSHC 5.8 Application of Painting Coatings

Add to the Sub-Clause:

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° to 35°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 75mm 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.

PSHC 5.9 Application of Metal Coatings

Add to the Sub-Clause:

The grade of HDG (hot dipped galvanising) required shall be carried out in accordance with SABS 121:2000, 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 Schedule of Quantities.

PSHC 7 TESTING

PSHC 7.1d) Testing by the Contractor

Tests are not required to be carried out after the application of each intermediate coat.

PSHC 7.3.8 Dry Film Thickness

The frequency of DFT test readings required is to be in accordance with SABS Method 141.

PSI MEDIUM PRESSURE PIPELINES (SABS 1200 L)

PSL 1 SCOPE

Replace Clause 1.1 with the following:

This specification covers the supply and installation of pipelines, specials and fittings for rising mains, gravity mains, pipework for pumping installations and reservoirs as well as reticulation.

PSL 2 INTERPRETATIONS

PSL 2.4 Abbreviations

Add the following:

“HDPE	:	High Density Polyethylene
mPVC	:	Modified Polyvinyl Chloride
oPVC	:	Orientated Polyvinyl Chloride
DI	:	Ductile Iron
GRP	:	Glass Reinforced Polyester
CML	:	Cement Mortar Lining
FBMDPE	:	Fusion Bonded Medium Density Polyethylene”

PSL 3 MATERIALS

PSL 3.1 General

The materials and construction of all pipes, fittings, valves and specials shall comply with the appropriate SANS, BS or other appropriate specification, whether stated or not, and shall be approved by the Engineer. Only full-length pipes bearing the relevant standard’s mark will be acceptable. Cut pipes shall only be used at pipe junctions to position valves and specials as shown on the drawings, and at connections to structures. When laying the pipes the markings shall be visible from above.

The Contractor shall be responsible for the structural and hydraulic design of all fabricated steel pipe specials (puddle pipes in hydraulic test point anchor blocks, offtake chambers, isolating valve chambers, meter chambers, non-return valve chambers etc) where these are not standard off-the-shelf items designed and guaranteed by the manufacturer for the purpose intended (see also PSL7 for quality control requirements for specials).

Add the following subclauses:

PSL 3.1.1 Materials Control

PSL 3.1.1.1 Checking Material Lists and Drawings

In the case of materials to be supplied by the Employer as “free issue”, not more than 4 weeks after the contract has been awarded the Contractor shall complete his check of the available materials in the stock yards against the drawings and advise the Engineer of any shortages or omitted items.

The materials stored in the stock yard/s for “free issue” by the Employer to the Contractor shall be fully inspected by the Contractor to confirm compliance with the specification and once satisfied, the Contractor shall sign acceptance of the material where after, any damage or other problems with the materials so accepted by the Contractor shall be the responsibility of the Contractor.

If any variations in the contract are authorised, the Contractor shall ensure that any additional items to be supplied by the Contractor (or the Employer where applicable) are ordered in good time so as not to cause delay to the works.

The Contractor shall check the delivery timing of all items and ensure that it is in line with the Contract program. Any critical items that could be delivered late are to be brought to the attention of the Engineer.

The delivery status of materials is to be checked and followed up upon by the Contractor throughout the contract.

PSL 3.1.1.2 Materials Control – General

The Contractor is held responsible for the inspection and control on site of all the materials and equipment for the duration of the Contract. Once material and equipment has been accepted, any subsequent damage shall be made good to the satisfaction of the Engineer at the expense of the Contractor. Damage to internal linings and external coatings that are necessary and incidental to good welding practices and the manufacturing of pipe specials are excluded.

Any item damaged beyond repair shall, at the discretion of the Engineer, either be replaced at the Contractor's expense or the value reimbursed in full to the Employer as appropriate.

PSL 3.1.1.3 Acceptance of Pipes, Fittings and Materials

Before acceptance of any pipes, fittings or other items of equipment the Contractor is to carry out a thorough inspection to ensure that the materials have been delivered undamaged and are as ordered.

Pipes shall be checked for:

1. Identification
2. Certification
3. Soundness and Internal lining
4. Ends bevelled correctly
5. Circumference according to specification and within tolerance

Inspection of pipe fittings, valves and other equipment shall include, but is not limited to:

1. Identification
2. Certification
3. Material schedule and rating
4. Lining, where specified
5. Coating where specified
6. Circumference according to specification and tolerance
7. Damage to items – example flange faces

Defective items shall not be accepted, but marked, quarantined and immediately reported to the Engineer.

If accepted, the Contractor shall take the required steps to ensure that all delivery documentation together with signed acceptance notes is filed in the Construction Dossier.

PSL 3.1.1.4 Material Storage

The Contractor shall store all items so that no damage occurs whilst awaiting installation. Where practical, items are to be stored in lockable containers for protection from the weather and pilferage.

All piping, pipe fittings and equipment stored outside or awaiting installation are to be protected from the weather, stormwater and soil wash and stored on pre-prepared surfaces. Pipes taken over from the Employer shall receive the required attention in order to ensure safe storage in yards, protected from fires, vandalism and incidental damage that can reasonably be prevented.

PSL 3.1.1.5 Handling Pipe, Fittings and Equipment

Strict supervision shall be maintained at all times when handling pipes and equipment. Particular attention is to be given to correctly rated lifting gear, slings and lifting beams. All lifting gear is to be inspected regularly for signs of wear and tear in terms of the relevant Safety Legislation and Clauses. Equipment is to be lifted at the recommended points specified by the manufacturer. Pipe is to be lifted

with a lifting beam and slings, which shall be fitted at quarter points around the pipe. Due care shall be taken when fitting and placing slings to ensure that ancillary items do not get crushed during lifting. Pipe coating is to be protected by padding or otherwise from scuffing damage during lifting.

The equipment utilized for lifting pipes is subject to approval by the Engineer, which approval shall in no way absolve the Contractor of any responsibility in this regard, and all equipment judged unsuitable according to this specification or found to be unsuitable in practice shall be removed from site and replaced at the Contractor's expense. It is prohibited to handle pipes using chains or any other device involving metal contact with the pipe coating.

The Contractor shall ensure that all lifting equipment complies with the relevant safety regulations at all times.

Wet sponge tests shall be done to detect holidays on coatings and linings (where appropriate) of the pipes.

The Contractor shall, at his own expense, test each and every surface area, internal lining (where appropriate) as well as external coating during construction as per this specification. Testing for holidays shall be done after inclusion of materials, manufactured specials and equipment, as well as pipes, into the permanent works. Any defects found shall be repaired and the costs for remedial work shall be deemed to be included in the tendered rates for the construction of the pipeline. These tests and results shall be recorded on the Quality Control Plan as approved by the Engineer.

PSL 3.4 Steel Pipes, Fittings and Specials

PSL 3.4.1 General

Add to the subclause:

"All steel pipes and fittings under this contract shall be to the dimensions and details shown on the drawings or schedule of quantities. All pipes, fittings and specials shall have their relevant item numbers painted onto the exterior surface prior to despatch from the factory.

Steel pipes may be supplied by the Employer shall be checked for acceptance by the Contractor in accordance with SANS 719 and including the integrity of the coatings and linings."

Further, it is a contractual requirement that all Steel pipe and fabricated steel specials shall be fabricated in accordance with an approved quality control plan (QCP). Manufacture shall not commence until such time as the QCP has been approved by the Employer's Agent. The Contractor shall, in consultation with the Engineer, prepare and submit for approval a draft QCP within 14 days of award of the contract.

The Engineer shall approve the QCP, subject to amendments if necessary, and advise the Contractor accordingly within 14 days of receipt of the draft QCP. The QCP shall address inter alia the following tests/inspection:

TYPICAL QUALITY CONTROL TESTS OR INSPECTIONS	
PARAMETER	COMMENT
Material certification	To comply with the relevant standards
NDE testing	To comply with the relevant standards
Verification of tolerances	eg "Go, No-Go" gauges
Surface preparation	eg cleanliness and blast profile
Coating / lining performance criteria	To comply with the relevant standards
Material identification	To comply with the relevant standards
Personnel certification (including welders and	To comply with the relevant standards

TYPICAL QUALITY CONTROL TESTS OR INSPECTIONS	
PARAMETER	COMMENT
NDE)	
Weld preparation	To comply with the relevant standards
Compliance with dimensional tolerances	To comply with the relevant standards
Hydrostatic testing	To comply with the relevant standards
Coating/lining thickness tolerances	To comply with the relevant standards

An independent Inspectorate employed by the Engineer shall verify that the QMP is being adhered to and sign-off acceptance of each and every special delivered to site. No specials shall be incorporated into the Works until signed-off. A Method Statement for any remedial works required to achieve compliance shall be agreed with the Engineer and the costs of all such work be to the Contractor's account.

PSL 3.4.2 Pipes of NB up to 150mm

In the second and third lines delete '*medium class, shall be screwed and shall comply with the applicable requirements of SABS 62*' and substitute with '*heavy duty class to SANS 62 Part 1 unless otherwise specified, shall have plain ends, and be hot dipped galvanized to SANS 121.*

PSL 3.4.3 Pipes of NB over 150mm

Delete the contents of this sub clause and substitute:

PSL 3.4.3.1 Grade of Pipe

All pipes supplied shall comply with SANS 719/71, as amended by this project specification.

SANS 719 Grade B steel shall be used for pipes unless otherwise specified in the drawings or in the schedule of quantities

PSL 3.4.3.2 Welds

Pipes shall be manufactured from steel strips or plates continuously welded along the seams and the height of the inner weld reinforcement shall not exceed 1mm. In the case of pipes used with couplings, the external weld reinforcement shall be ground flush with the outer wall of the pipe over a suitable distance of the pipe. Pipes must have a continuous helical seam but for smaller than 300mm diameter, longitudinal and circumferential seams would be acceptable.

PSL 3.4.3.3 Hydraulic Testing at the Factory

Each pipe shall be hydraulically tested in accordance with SABS 719, clause 7.3 to 3500kPa."

PSL 3.4.4 Fittings and Specials

Add the following:

"All bends, fittings and specials shall be manufactured from straight pipe specified elsewhere unless otherwise stated in the Bills of Quantities

The lengths of the pipes shall be as dimensioned on the drawings but shall be verified on site prior to fabrication.

All steel pipes & fittings larger than DN 150 to be FBE or solvent free epoxy coated and lined to minimum thickness of 400 micron unless otherwise specified.

All steel bends, fittings and specials shall be fabricated to the dimensions and details shown on the drawings and/or described in the Bills of Quantities.

Where drawings containing pipework and fittings do not have dimensions and have not been individually itemized on the drawings or bill of quantities, the pipework design, supply, delivery, handle install, test and commission is the Contractors responsibility. This shall be scheduled in the bill of quantities, as well as described in the Project Specifications and/ or indicated indicatively in the drawings.

The sides of taper pieces shall diverge at an angle of not more than 11° to each other.

All steel pipes & fittings larger than DN150 to have either a minimum 4.5mm wall thickness to SABS 719 Grade B or to have a diameter to thickness ratio of 125, whichever is greater.

Individual bends, fittings and specials DN150 and smaller shall be hot-dip galvanised to heavy duty grade in accordance with SANS 121 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 as specified elsewhere.

Bends, fittings, and specials Larger than DN150 shall have the internal lining and external coating made continuous ("made good") as specified elsewhere for welded joints on coated and lined pipes.

Bends, fittings and specials shall be manufactured and tested in accordance with the specification for straight pipe and additionally with Section 8 of BS EN 10311: 2005 and BS 10224: 2002. The nominal dimensions of each bend, fitting and special required are itemised in the Bills of Quantities and/or on the drawings and 'exact length' tolerances shall be adhered to – subject to verification on site prior to fabrication. All plain ends on bends, fittings and specials shall have the plain ends prepared for butt welding except those plain ends that are to be jointed with adaptor joints or bell ends.

Bends shall generally be of the formed type except where otherwise stated or shown on the drawings.

The bend, fitting, and special fabricator shall supply written confirmation that all hand welding was carried out by coded welders.

The Contractor will be responsible for the design and 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 design and provision of this reinforcing wherever necessary. All calculations are to be submitted to the Employers Agent prior to fabrication. All crotch plates, wrappers, collars and gussets to be provided by the Contractor under this Contract are to be manufactured from SANS 719 Grade B steel, or of the same grade as the main pipe.

Bends shall be fabricated in accordance with the Table below.

Deflection of 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 9 ° but less than 15 °	2 segment bend
15 ° and larger but less than 45 °	3 segment bend
45 ° and larger but less than 60 °	4 segment bend
60 ° and larger but less than 75 °	5 segment bend
75 ° and larger but less than 90 °	6 segment bend

Long radius bends shall have a centre to face radius of at least 2.5 times the pipe diameter.

Bends greater than 90° shall be fabricated from combinations of items from the table above.

Shop drawings of bends, fittings and specials shall be submitted to the Engineer for approval prior to manufacture.

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.

All welding shall conform to SABS 0167-1984 and SABS 044 specifications.

All welded fittings and flanges shall be documented as per specifications and welders must be qualified to WQR. All welds are to be 100% visually inspected inside and out. Examination and testing of welds shall be performed in accordance with section PSL 3.4.8.

Cutting and welding of flanged bends, fittings and specials will not be permitted on site. Any adjustments required due to on site conditions will have to be made at the fabricator's premises and all coating and lining repairs and tests completed prior to being returned to site."

Add the following new subclauses:

PSL 3.4.5 Stainless Steel Pipework

Pipework fittings and specials shall comply with the dimensional requirements specified for mild steel pipe work, fittings and specials. The wall thickness shall be not less than 4,0 mm for pipes of diameter up to 150 mm and not less and 5,0 mm for pipes exceeding 150 mm in diameter, or as called for on the pipe schedules.

Stainless Steel pipework, fittings and specials shall be Grade 304L and shall not be supplied coated unless otherwise specified.

Plain ends of pipes and fittings shall be covered and protected against damage whilst being transported and stored.

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 need to 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 3.4.8 Welding Tests at fitting Fabrication Shop(s)

PSL 3.4.8.1 Qualification Tests for Welding Procedures

Only appropriately coded welders may be used.

The qualification tests for welding procedures shall be carried out generally in accordance with the requirements of the American Petroleum Institute API 1104. The detailed procedure to be adopted during manufacture shall be established and the quality of the welds so produced shall be determined by carrying out one transverse tensile weld test and two guided cold bend tests on suitable coupon plates.

The tests are to be carried out before fabrication of fittings is commenced.

The coupon plates shall be prepared either from plates of the same material as the pipe and welded in a similar manner to that to be used during production, or by cutting suitable specimens from a pipe selected at random by the Engineer from the first production. The coupon plate for the tensile weld test and those for the guided cold bend tests shall be prepared in accordance with the requirements of SANS 719.

The qualification tests shall be considered satisfactory if:

- a) The weld has a joint efficiency greater than 95% of the minimum specified tensile strength of the parent metal and,
- b) The bend test specimens are capable of being bent around a former with a diameter equal to six times the nominal thickness of the plate to an angle of 180 degrees without developing a crack, except at the arises of the specimen, of length or width greater than 3 mm.

Failure to pass the above qualification tests shall result in the rejection of any pipes welded with the procedure used and the preparation of a new qualification of procedure test.

Any changes in the electrode case type used or change of flux used shall require a qualification test before approval of the procedure is granted.

PSL 3.4.8.2 Radiographic Examination of Shop Welds

The Contractor shall include in his prices for the supply of fittings and specials, the cost of carrying out, under the supervision of the inspector appointed by the Employer, examination of shop welds on the following basis:

- a) One hundred percent radiographic examination of all welds deposited manually or semi-automatically in fittings and specials which cannot be hydraulically tested prior to the fittings and specials being installed in the pipeline.
- b) Ten percent radiographic examination of all welds deposited manually or semi-automatically in specials and fittings that are to be tested hydraulically prior to the fittings and specials being installed in the pipeline.

The Engineer shall in all cases determine which welds are to be radiographed on the quantity basis specified above. All radiographs and records thereof made by the Contractor shall be made available to the Engineer to enable him to determine whether the welds are acceptable or not and no coating, lining or wrapping of pipes shall be permitted until the welds have been accepted by the Engineer. To avoid unnecessary delays, at the option of the manufacturer, radiographs may be approved by the manufacturer's inspectors subject to them being subsequently approved by the Engineer.

When a section of the weld is shown by radiography to be unacceptable, and if the limits of the deficient weld are not defined by the radiograph, additional radiography shall be carried out at the Contractor's expense until the limits of the deficiency are determined.

Repairs shall be made to defective welds at the Contractor's expense. All repair welds shall be identified with a stamp marking, indicating which welder conducted the repair. Repaired welds shall be radiographed at the Contractor's expense but after any repair welder has had ten consecutive repairs approved, the extent of the radiography of the repairs conducted by the welder may be decreased by agreement between the Engineer and the Contractor.

PSL 3.7 Other Types of Pipes

PSL 3.7.2 Polyethylene Pipes

Delete this Subclause and replace with the following:

PSL 3.7.2: Polyethylene (PE) Pipes and Fittings

All pipe and fittings are to be PE-100, compliant to SANS ISO 4427 Part 1 unless otherwise specified. Pipe must be supplied from a SABS and ISO 9001 approved manufacturer and member in good standing with SAPPMA (South African Plastic Pipe Manufacturers Association), and will meet the following:

<u>Pipe Characteristics</u>	<u>Applicable Standard</u>
Outer Diameter	ISO 11922-1 (Grade B)
Min Wall Thickness at any point	ISO 11922-1 (Grade U) – ISO 4065
Ovality	ISO 11922-1 (Grade N)

All HDPE Pipes shall be indelibly marked at 1 metre intervals in accordance with the applicable SANS / ISO standard:

- TRADE NAME Manufacturer/Supplier Name
- SPECIFICATION SANS ISO 4427
- PIPE OD e.g. 630
- PIPE OD TOLERANCE Grade B
- WALL THICKNESS e.g. 51.4
- NOMINAL PRESSURE e.g. PN 12.5
- MATERIAL DESIGNATION PE 100
- BATCH No. Manufacturer/Supplier Trace ability
- PROJECT NAME XXXXXXXX

PSL 3.7.2.1 Unreinforced PE pipes

Unreinforced PE pipes and fittings shall comply with the relevant requirements of SANS/ISO 4427.

PSL 3.7.2.2 Steel-mesh-reinforced Polyethylene (PE) pipes

Steel-mesh-reinforced PE pipes shall comply with the requirements of SANS 370.

PSL 3.7.2.3 Materials Control – General

The Contractor is held responsible for the inspection and control on site of all the materials and equipment for the duration of the Contract. Once material and equipment has been accepted, any subsequent damage shall be made good to the satisfaction of the Engineer at the expense of the Contractor.

Any item damaged beyond repair shall, at the discretion of the Engineer, be replaced at the Contractor's expense.

PSL 3.7.2.4 Acceptance of Pipes on Delivery to Site.

The Contractor is to ensure that the manufacturer makes available a full-time field technician to supervise the offloading, stacking and protection of the pipes to ensure that all the manufacturer's specifications and requirements regarding stacking and storage are met.

Before acceptance of any pipes, the Contractor is to carry out a thorough inspection to confirm together with the field technician that the materials have been delivered undamaged and are as ordered.

Defective items shall not be accepted, but marked, and immediately reported to the Engineer.

Add the following sub-clauses:

PSL 3.7.3 mPVC Pipes

mPVC pipes shall not be permitted unless otherwise shown or agreed with the Engineer

PSL 3.7.4 oPVC Pipes

oPVC pipes shall not be permitted unless otherwise shown or agreed with the Engineer

PSL 3.7.5 Ductile Iron Pipes

Ductile Iron pipes, fittings and accessories shall be fitted with spigot and socket rubber ring joints and shall comply with the relevant requirements of BS, EN 545: 2010 and ISO 2531- 2009.

The following documents form a part of this Specification to the extent specified herein. In any case of conflict, the requirements of this Specification shall prevail. The latest issues shall apply.

BS EN545: 2010	:	Ductile Iron pipes, fittings, accessories and their joints for water pipelines – Requirements and test methods.
ISO 2351 – 2009	:	Ductile Iron pipes and fittings, fittings, accessories and their joints for water pipelines – Requirements and test methods.
ISO 4179	:	Ductile Iron pipes for pressure and non-pressure pipelines – Centrifugal cement mortar lining – general requirements.
ISO 8179-1/2	:	Ductile iron pipes – External zinc coating with finishing layer.
ISO 8180	:	Ductile iron pipes – Polyethylene sleeving.
ISO 4633	:	Rubber seals-Joining rings for water supply, drainage and sewerage pipelines- Specification for materials
EN15189	:	Ductile Iron pipes – External polyurethane coating
BS EN 14901:2006	:	Epoxy coating for Ductile Iron pipes and fittings

PSL 3.7.5.1 Ductile Iron Fittings and Accessories

All bends, fittings, couplings and other accessories for ductile iron (DI) pipe shall be fabricated from ductile iron (DI) and shall comply with the test pressures as specified.

Corrosion protection coatings (external) and linings (internal) for fitting and accessories shall be as specified for pipes save that, where appropriate, hand application of linings and coatings may be used.

Repair work shall be carried out as for pipes.

PSL 3.7.5.2 Corrosion Protection of Ductile Iron (DI) Pipes

Unless otherwise stated, ductile iron pipes shall be cleaned and then externally zinc sprayed with a finishing layer (coating) to ISO 8179-1.

Pipe ends shall be coated as follows:

1. External surface of spigot: Zinc spray coating with finishing layer
2. Flanges and sockets (face and internal surface): Bituminous paint or synthetic resin paint to supplement the zinc spray coating. All paints shall be approved for use on potable water applications by an approved body (USA Environmental Protection Agency (EPA) or similar).

External Zinc Coating and Finishing Layer

The external coating of centrifugally spun ductile iron pipes shall comprise a layer of metallic zinc, covered by a finishing layer of bituminous or synthetic resin paint compatible with zinc. Both layers (zinc and finishing layer) shall be works-applied using suitable spray equipment.

The metallic zinc coating shall cover the external surface of the pipe and provide a dense and continuous uniform layer. It shall be free of bare patches, areas of lack of adhesion or other defects and shall be visually uniform. The mean mass of zinc shall not be less than 200 g/m². Zinc purity shall be at least 99.99%.

The finishing layer (bituminous or synthetic resin paint) shall be physically and visually uniform over the entire metallic zinc layer and shall be free from defects such as bare patches, areas of lack of adhesion, air bubbles, pinholes, runs and sags. The mean thickness of the finishing layer shall not be less than 70 µm and the local absolute minimum thickness shall be 50 µm.

Shop and Field Repairs

Damage to coatings where the area of total removal of zinc has a width exceeding 5 mm or other areas designated by the Engineer shall be repaired in the following manner:

Where applicable, remove the finishing layer by mechanical or other means, to 50mm beyond the zinc area to be repaired, to achieve a sound, clean zinc substrate surround.

Repair the damaged area by means of metallic zinc spray or by means of a zinc rich paint containing at least 90% zinc by mass as appropriate. The mean mass of the cured applied zinc paint dry film shall not be less than 200 g/m². The zinc paint repair shall terminate 10 to 15 mm from the finishing layer of the repair site. The zinc repair site shall appear visually uniform and shall be free of defect.

Once the zinc repair has cured completely, the entire area shall be painted with bituminous or synthetic resin paint, overlapping at least 20mm onto the sound undisturbed finishing layer and allowed to cure. The finishing layer shall be defect free and appear to be visually uniform and shall be allowed to cure completely before being handled or buried.

Polyethylene Sleeving

Where specified for Ductile Iron pipes as an additional external corrosion protection barrier to the zinc coating and finishing layer, polyethylene sleeving shall comply with ISO 8180 – 1995. The nominal thickness of the sleeving shall not be less than 200 µm and the density shall be between 910 and 930 kg/m³.

Internal Cement Mortar Lining

The cement mortar lining of ductile iron pipes shall constitute a dense, homogeneous layer covering the entire internal surface of the pipe barrel. It shall be works applied by centrifugal spinning process or by centrifugal spray head or a combination of these methods. Troweling to achieve a smooth internal bore shall be permitted.

The cement mortar mix shall comprise cement (or high alumina cement) to ENV 197-1, suitably graded sand (with no organic impurities, fine clay particles or other deleterious matter that may adversely affect the mortar quality) and potable water. Chloride-free admixtures shall be permitted with the approval of the Engineer. The ratio of sand to cement shall not exceed 3.5 by mass. The water / cement ratio shall be determined for the particular lining process and this ratio shall be maintained to achieve the relevant specifications.

The freshly applied lining shall be cured by approved means to provide sufficient hydration of the cement and, after curing, the cement mortar shall have a minimum 28-day compressive strength of 50 MPa.

The surface of the cement mortar lining shall be uniform and smooth and shall have a nominal lining thickness and minimum lining thickness as indicated below. Trowel marks may be evident but there shall be no recesses, intrusions or local defects which reduce the thickness to below the minimum thickness specified below. Upon installation, the pipes shall have a minimum Hazen Williams smoothness coefficient of 120 ($C \geq 120$).

Fine crazing or hairline cracking associated with cured cement-rich mortars will be acceptable provided that there is no evidence of mortar disbondment from the substrate. The maximum permissible shrinkage crack width and radial displacement is given below.

CEMENT MORTAR LINING THICKNESS AND PERMISSIBLE CRACK WIDTH			
Diameter Nominal (DN)	Lining Thickness		Maximum crack width and radial displacement
	Nominal ¹	Tolerance ²	
40 to 300	4.0	-1.5	0.4
350 to 600	5.0	-2.0	0.5
700 to 1200	6.0	-2.5	0.6
1400 to 2000	9.0	-3.0	0.8
NOTE: 1. Pipe ends may have a chamfer not exceeding 20 mm in length 2. Negative tolerance specified only			

Shop and Field Repairs

Where cement mortar lining repair is deemed to be necessary, it shall be repaired in the following manner:

Defective mortar shall be carefully removed to ensure that adjacent sound mortar is fully bonded to the ductile iron pipe substrate.

The adjacent sound mortar shall not be feathered but shall be cut-back at approximately an 80° angle to achieve a "dove-tail" joint.

All mortar shall be removed from the repair area to achieve a clean ductile iron pipe substrate and the repair area shall be washed with copious quantities of potable water.

The repair shall be effected using either a rich cement mortar or a compatible polymer mortar (EPIDERMIX 338 or similar approved) which shall be worked in by hand; care being taken to avoid the inclusion of air bubbles. Latex additives, designated (by EPA or similar body) as being suitable for use

on potable water installations may be used.

Large Repair Areas.

The repair shall be smoothly and neatly trowelled to match the adjacent pipe profile.

PSL 3.7.6 Glass Reinforced Polyester Pipes (GRP)

Glass Reinforced Polyester pipes and fittings shall conform to ASTM D3262 and ASTM 3754 and AWWA C 950.

The applicable SABS specification for these pipes is:

SABS 1748 – 2004 Part 1 Glass - Fibre – Reinforced Thermosetting Plastics (GRP) pipes Part 1 Pipes for Water Supply, Sewerage or Drainage.

The manufacturer shall have an ISO 9001: 2008 Quality Management System.

Installation

Installation shall be in accordance with SABS 1200 LB and LD for Flexible Pipes. Pipes shall be either plain ended with Double Bell couplings or Bell and Spigot. A typical pipe will be described as PN 16 DN 700 SN 5000 GRP pipe

ESR - Glass shall be used for sewer applications and E- Glass shall be used for water applications."

PSL 3.8 Jointing Materials

PSL 3.8.2 Flexible Couplings

Delete the subclause and replace with the following:

"Where ordered, steel flexible couplings are to be of the "Viking Johnson"/"Klamflex"/"Aqualok" 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 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 3.9.3.8.

The tendered prices for laying and jointing are to include for the supply of all necessary materials, plant and labour to complete the joint and necessary corrosion protection as specified.

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 is to 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 epoxy coating system such as an approved solvent-free epoxy (SFE) system such as "Nordbak 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 2½. 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 are to 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 are to be hot dipped galvanised. In order to anchor the plain ended pipe to the flanged joint all of the bolts for the flanged joint are to pass through the anchoring flange and are to be fitted with nuts and washers at the flanged joint and on either side of the anchoring flange."

Dismantling joint shall comply with the above specification for flexible couplings and be of a similar design, but both ends shall be flanged to enable connection of two flanged joints. The adaptor joints are to be complete with bolts and nuts for connecting to each flange. All bolts, nuts and washers are to be hot dipped galvanized.

PSL 3.8.3 Flanges and Accessories

Add the following:

"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 under this Contract and shall comply with the following:

1. **The sizes and drillings shall comply with SANS 1123** as shown on the drawings or as scheduled in the Bills of Quantities.
2. **Flanges shall be sized and drilled to Table 16 as a minimum unless otherwise specified in the drawings or in the schedule of quantities.** Flanges shall be sized and drilled to match the pressure rating of the adjacent fitting or pipe for pipes and fittings rated > 16 bar.
3. Flanges cut from steel plate shall be machined flat on the front face, but with a raised face.
4. All PE flange connections to PE or other materials shall be of the HP type unless otherwise stated.
5. For PE flanges, the spigots shall be of sufficient length to enable both HE butt welding and HW welding.
6. Backing flanges for PE shall be manufactured from galvanised or powder coated steel
7. The use of standard stub ends for PE pipes shall not be permitted.
8. The body of PE flanges shall be manufactured in the injection moulding process or alternatively, in the case of larger dimensions, from a piece of homogeneous semi-finished material. Semi-finished materials manufactured from wound rods or the subsequent application of other forms of reinforcing shall not be permitted.
9. Proof that flanges and accessories are manufactured in accordance with DIN EN ISO 9001 shall be provided.
10. No machining need be carried out on the back face (except where insulating flanges are to be installed) provided that face is sufficiently flat to ensure square bedding of the bolt heads and nuts and provided that all weld reinforcement is removed.
11. Temporary end covers shall be provided by the Contractor for protection of flanges, and prepared plain ends of pipes and fittings to prevent damage to internal lining during transportation and during handling on site.
12. All piping and flanged surfaces shall be cleaned before connections are made.
13. The (raised) faces of flanges that are in to be 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.
14. Flanged joints shall be connected with the specified bolts, nuts and double washers (one under the bolt head the other under the nut) all of which are to be supplied by the Contractor.
15. All bolts, tie-bolts, nuts and washers shall be galvanised to SANS 121: 2011 and shall comply with the relevant requirements of SANS 135: 2011 and SANS 136: 2008 where applicable.
16. 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, but not by more than two threads. Tie-bolts on restrained/anchoring couplings shall be fitted with "backing nuts" and washers.
17. Each flanged joint is to 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).

18. All bolts are to be tightened in a predetermined pattern with opposing bolts being tightened sequentially. When all bolts are tight, each bolt is to 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.

All GMS nuts, bolts, washers, threaded bars and all other GMS or uncoated metal surfaces, both in buried and exposed situations, shall, after successful pressure- testing and after thorough brushing / chipping to remove concrete splatter etc, de-greasing and detergent cleaning and clean water rinsing, shall be corrosion protected as described in PSL 3.9.3.18 and PSL 3.9.3.19."

PSL 3.8.4 Loose Flanges

Add the following:

"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 shall occur through the joint. Bolts and nuts shall be galvanised to SANS 121: 2011 and shall comply with the relevant requirements of SANS 135: 2011 and SANS 136: 2008 where applicable. 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 PSL 3.9.3.8. "

PSL 3.9 Corrosion Protection

PSL 3.9.2 Steel Pipes

Delete Sub-Clauses 3.9.2.1 and 3.9.2.2 and replace with:

"Steel pipes, fittings, flanges and specials shall have their surfaces thoroughly cleaned by Grit blasting to a finish complying with the requirements of SIS 05 59 00 for a Sa 2½ finish. Grit for blast cleaning shall be in accordance with SABS 064.

Surfaces shall, within 4 hours after cleaning, be primed with the specified primer or if no primer is specified, with the first coat of the specified system.

All materials used shall be of the highest quality and in accordance with the manufacturer's requirements. Particular care shall be taken to ensure compatibility of all materials used with others forming part of the corrosion protected system. Manufacturer's application and overcoating times and specific instructions relating to curing periods and humidity limitations shall be strictly adhered to.

Corrosion protection systems shall not be applied over any surface containing traces of grit, grease, oil, loose rust, millscale or any contaminants or corrosion products. All surfaces shall be absolutely dry.

Welds and adjacent parent metal shall be ground smooth and all weld spatter removed. Sharp edges shall be avoided and where they are evident the removal shall be effected by grinding to a radius of not less than 3 mm.

The Contractor shall arrange for the Engineer or his representative to be present during surface preparation and coating application to ensure compliance with the specification.

Add the following new subclauses:

PSL 3.9.2.1 Holiday Testing

All Holiday Testing shall be carried out with an instrument approved by the Engineer. The sparking detection test shall conform to the standards as set out in SANS 1217:2001. The Contractor shall familiarise himself with the dielectric strength (breakdown strength) of all the coatings and linings he

works with for the different pipe sizes. The Contractor shall also have an in depth knowledge of the Holiday Testing equipment he works with, in order to calculate the Corona discharge effect for the typical brush being utilised, with reference to the specific ambient conditions for any specific test.

All Holiday Testing shall be executed at a voltage which is set at 50% of the value of the dielectric strength of the lining or coating being tested. The Contractor shall carefully analyse the loss in test voltage as a result of the Corona Effect, specific to the ambient conditions surrounding the test. The test voltage of the Holiday Testing equipment shall be adjusted such that the voltage drop as a result of the Corona Effect will be taken into account when the actual 50% threshold of the dielectric strength is calculated.

The Holiday Test equipment shall be calibrated by an approved supplier and checked every 30 minutes or every time a test at a different location is started. Each piece of equipment shall have a unique identification number with calibration certificates and detail of equipment utilized shall be submitted to the Engineer for approval. Method statements for the process of holiday testing shall be submitted to the Engineer for approval.

The correct equipment for the type of application will be utilized. For example, where pin holes have been repaired and re testing for effectiveness of repair work being done, the Contractor shall utilize the correct equipment to effect same and this shall include the use of a pencil brush which concentrates the efforts of holiday testing at the repair. Where spark tests are performed on Tape Wrap systems, the minimum brush width shall be 300 mm. The brushes utilized shall be brass bristle cone brushes. The typical brush speed shall be 200 to 300 mm/sec when doing spark tests.

The Contractor shall, at his expense, test each and every surface area, that is internal lining (where applicable) as well as external coating, during construction as per this specification. Testing for holidays shall be done after inclusion of materials, manufactured specials and equipment, as well as pipes, into the permanent works. Any defects found shall be repaired and the costs for remedial work shall be deemed to be included in the tendered rates for the construction of the pipeline. These tests and results shall be recorded on the quality control plan as approved by the Engineer.

PSL 3.9.2.1.1 Inspection, Detection and Repair of Holidays

Complete sets of transistorised portable holiday detection equipment with adjustable output voltage with interchangeable 200 mm brush and full circle electrodes, adaptable for use on damp or dry surfaces of coatings of pipes, buried valve bodies, fittings and couplings of any diameter in the range DN 200 to DN 1200 are to be provided, tested, maintained and recharged when necessary by the Contractor, for use by the Engineer's Representative in inspecting coatings, wrappings and external protection of pipes, valves, fittings and couplings at the site of the Works and/or the point of delivery in accordance with the following:

When laying of pipes or fittings or covering of pipes, buried valve bodies, fittings or couplings with padding or concrete is proceeding in more than one 250 metre long section of the working strip on any day, the Contractor shall provide a sufficient number of complete sets of holiday detection equipment in addition to the holiday detection equipment required by his own staff to permit the person appointed by the Engineer to carry out holiday inspections simultaneously at each such section of the working strip.

The Contractor shall include in his tendered rates an allowance to cover the provision by him of all the necessary equipment for the Engineer's Representative as set out above as well as any and all extra labour and equipment necessary for all special handling of pipes, valves and fittings which is required in order to facilitate the following standard holiday detection operations which will be carried out by the Engineer or his Representative.

During laying operations the full circle electrode of the holiday detector will be passed over all the external surface of each pipe, except such area as may be covered by a belt sling or other approved handling tackle not exceeding 600 millimeters in total width used for supporting the pipe in the course of the laying operation immediately prior to lowering the pipe into its trench. Only if a holiday is detected in the course of the inspection described above, will the entire external surface of the pipe have to be inspected by passing the full circle electrode of the holiday detector over the full length of the pipe. At

the laying site the holiday detection equipment will also be used to check the external coating of fittings before laying and to check completion of external coatings over welded joints or couplings after hydraulic pressure testing of the pipeline.

The Contractor shall so carry out his laying work as to provide reasonable time and access to the Engineer for the purpose of the inspections described above. The tendered rates for pipework shall be deemed to include for all holiday detection described in this Specification.

All work ordered by the Engineer in writing to be carried out by the Contractor in assisting in any holiday detection inspection which the Engineer may carry out in addition to the standard operations described above and proving of repairs mentioned below shall be carried out by the Contractor at agreed rates.

All holidays, voids, pinholes or other flaws in the coatings or wrapping or completed external covering to welds, couplings or buried valve bodies are to be made good by the Contractor at his expense. Holiday testing and repairs to free issue pipes prior to acceptance by the contractor are dealt with separately under Clause PSL 3.9 and items are included in the Bill of Quantities for the repair of such defects.

Protective coating or wrapping to pipes and fittings or completed external covering to joints and buried valve bodies which are inadequately bonded, damaged by abrasion, below the minimum thickness, do not comply with the materials specifications and are in any other manner defective must be removed and replaced at the expense of the Contractor. All pinholes and other defects located by means of the holiday detector shall be repaired to the satisfaction of the Engineer and proved sound by the holiday detector.

The coating of each pipe shall be inspected and holiday detected by the Contractor, immediately prior to being laid and these inspections will be witnessed and signed off by the Engineer or an appointed third party inspection authority. Two thirds of the circumference of each pipe and fitting will be inspected outside the trench, after the pipe/fitting has been transported to the construction site where it is to be laid. This inspection is to be carried out shortly before each pipe is hoisted for laying in the trench. The balance of the circumference of each pipe/fitting will be inspected once the pipe/fitting has been laid in the trench. This will require the pipe/fitting to be rotated to facilitate inspections.

All remedial work that is required shall be effected immediately upon detection of any holidays. The cost of holiday testing and effecting remedial work to the coating of the pipe at the installation location, as a result of construction or transportation or storage damage, shall be deemed to be included in the tendered rates for the laying of the pipe/fitting.

Each and every external coating make good at welded joints, shall be holiday tested around the full circumference and be subject to approval in terms of the relevant Quality Control Procedure. All costs associated with holiday detection and any costs of effecting remedial work, shall be deemed to be included in the tendered rates i.e. no special or "extra over" payments will be made for external repairs or make goods at joints.

All pipe specials being corrosion protected with an external epoxy coating, shall be holiday tested before being incorporated into the works as well as holiday tested after inclusion into the works. All the costs of holiday detection and any costs for effecting remedial work shall be deemed to be included in the rates for the laying of the pipe/fitting.

The corrosion protection systems on all fittings and manufactured specials shall be holiday tested once included into the permanent works. All the costs of holiday detection and any costs of effecting remedial work shall be deemed to be included in the tendered rates for the laying of the pipeline.

The appropriate wet sponge tests shall be conducted on the internal surfaces of all epoxy linings, and particularly on reinstated areas and make good at joints, and on manufactured specials and repairs to linings. This will be carried out from time to time and again before final cleaning of sections of the pipeline that are completed. All the costs associated with wet sponge holiday detection and any costs for effecting remedial work shall be deemed to be included in the rates for the laying of the pipeline.

PSL 3.9.2.1.2 Holiday Testing of Pipe at Pipe Yards (Free Issue Pipe Only)

In the case of free issue pipe, the external pipe coatings will be checked at the point of delivery, as supplied by the pipe manufacturer. All defects will be indicated on the Independent Third Party Test Reports. Some of the defect repairs will have been carried out under the pipe supply contract. The Contractor shall be required to repair the remaining defects at the cost of the Employer. Items will be provided for this purpose in the Bill of Quantities.

It shall be the Contractor's responsibility to detect defects in free issue pipes, including their ends, coatings and linings before taking receipt. The Contractor shall execute holiday detection tests on all the pipe coatings in the pipe yard before uplifting and transportation commences and this will be subject to witnessing and sign off by the Engineer or an appointed third party inspection authority. This will determine the baseline to be used when handling and transportation damage, if any, is assessed.

PSL 3.9.2.1.3 Holiday Testing of Pipe at Work Fronts

The coating and lining, if appropriate, of each pipe shall be inspected and holiday detected by the Contractor immediately prior to being laid and these inspections shall be subject to witnessing and sign off by the Engineer or an appointed third party inspection authority. Two thirds of the circumference will be inspected outside the trench, after the pipe has been transported to the construction site where the pipe will be laid, and the balance of the circumference will be inspected once the pipe has been laid into the trench and rotated 180°. All testing shall be marked on the pipe from start of test point to completion of test point. All remedial work shall be effected immediately upon detection of any holidays. The cost of holiday testing and effecting remedial work to the coating of the pipe at the installation location as a result of construction or transportation damage by the Contractor shall be deemed to be included in the tendered rates for the laying of the pipe.

PSL 3.9.2.1.4 Holiday Testing on Tape Wrap Systems

Each and every external coating repair at welded joints, that are repaired with a tape wrap system, shall be holiday tested and subject to approval in terms of the relevant Quality Control Plan. All costs for the holiday detection shall be deemed to be included in the tendered rates for the laying of the pipe.

PSL 3.9.2.2 Hot Dip Galvanising

Where ordered or specified, galvanised steel pipework shall comply with SANS 121 and be entirely coated with zinc after fabrication by complete immersion in a zinc bath. The finished surface shall be clean and uniform and any excess being removed. The zinc deposit shall exceed 0.700 kg / m²

PSL 3.9.2.3 Repairs to Epoxy Coatings

In addition to the contents of this clause, the contents of PSL 3.9.3.4 shall also be applicable.

PSL 3.9.3 Protection against Electrolytic Corrosion

Change the heading of this subclause to:

PSL 3.9.3 Protection against Electrolytic Corrosion and general repair and making good procedures for linings and coatings."

In the fifth line delete 'terms of the project specification' and substitute with 'the PSL specification or unless specified elsewhere.'

Add the following new subclauses:

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.

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.

Grit Blasting – Internal Lining Repair:

Grit blasting of bare metal surfaces shall take place after degreasing of the area. 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 finished grit blasted surface shall be to Sa 2½ of ISO 8501-1 with a 75 micron angular profile. Hackles shall be removed with coarse abrasive paper.

Transition areas from 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.

Before work commences, the Contractor shall provide the Engineer with a method statement for approval for each type/location of grit blasting.

Power Brush – External Coating Repair:

Power brushing of bare metal surfaces 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. 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 utilized to repair the internal linings of the pipeline. 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", "Nordbak", etc.

For the repair of cement mortar linings, "Epidermix 338" or similar approved shall be used.

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 shall have their cement mortar lining stopping a minimum of 25 mm from each plain end and from each end and it shall be 'chamfered' by 15 degrees to provide a positive dove-tail joint for the epoxy repair plug after field welding to another pipe.

When cement mortar lined straight steel pipes are cut, the cement mortar lining is to be cut back between 25 mm and 50 mm from the cut end of the pipe and "chamfered" by approximately 15 degrees to provide a positive dove-tail joint for the epoxy mortar repair plug after butt welding.

The surfaces are to be prepared as specified in PSL 3.9.3.1.

In the case of plain ended pipes, after welding, a band of "Epidermix 338" or similar approved epoxy, shall be applied internally on the uncoated steel adjacent to the cement mortar lining to a width to suit the cement mortar lining "cut back" and to a thickness to suit the mortar lining thickness of the pipe.

In the case of collared or bell ended pipes, the repair shall be made using a mortar mix and the plain end of the adjoining pipe shall be pushed into the bellmouth (or into the external sleeve when there is no bellmouth) in such a way that the mortar band is compressed and makes contact with the transverse face of the cement mortar lining of both pipes as follows:

Immediately before joining the pipes, a slurry of Ordinary Portland Cement (OPC – CEM I 32.5) mixed with a suitable SBR Latex for use with OPC (Nitrobond SBR from Fosroc or similar) and clean water in the proportions 1:1 shall be applied to the shoulders of the cement mortar linings in the sleeve and spigot ends of the pipes to be joined. Thereafter a sufficient suitable mix of dry plaster sand and OPC (CEM I 32.5) in a proportion of 1:1 by mass and sufficient liquid (Nitrobond SBR mixed 1:1 by volume with water) to produce the correct consistency for plastering shall be troweled against the shoulder of the cement mortar lining in the sleeve end.

As the pipes are pushed together, the cement mortar lining in the spigot end shall be pressed against the mortar in the sleeve end to make a continuous lining. The excess material that is squeezed into the bore of the pipes is to be removed by drawing a suitable plug that is 5 mm smaller than the bore of the cement mortar lining across the joint. The plug that is used shall be such as to render an even and smooth finish to the mortar at the joint. The timing of when the plug is pulled through is critical and shall be carefully controlled.

PSL 3.9.3.4 Repair and Making Good of Solvent Free Epoxy Linings

In addition to the contents of clause 3.9.2.3 of SABS 1200L, the following shall be applicable:

It making good of internal solvent free epoxy linings at damaged areas and at welded and flanged joints that is required to ensure continuous internal corrosion protection to steel surfaces shall be carried out strictly in accordance with the solvent free epoxy manufacturer's specifications. The surfaces are to be prepared as specified in PSL 3.9.3.1.

The epoxy material shall be sufficiently thixotropic that 500 micrometers dry film thickness can be achieved in one application without sagging. The material shall be applied to the clean, dry, abraded area so as to fully cover it and extend to no less than 50 mm of the edge of the abraded area. A "halo" of abraded area shall be visible around the repair material.

After curing, the repaired section and at least 250 mm of the surrounding area, shall be tested for electrical insulation defects as specified elsewhere. There shall be no electrical insulation defects.

The Contractor shall ensure that repairs and particularly the making good of linings at welded joints, is carried out progressively as the pipe is being laid and shall not be permitted to lag behind for more than three pipe lengths at each working front.

PSL 3.9.3.5 Repair of Cement Mortar Lining

Free issue pipes with linings damaged prior to acceptance by the Contractor shall be marked and recorded by both the Contractor and the Engineer's Representative and then repaired by the Contractor. The payment rate for repair shall be made at the scheduled rate. Once the Contractor has completed any repairs (if necessary) and accepted the pipes from the Employer, any subsequent damage to the lining in the pipes shall be repaired by the Contractor at his expense.

Any repairs necessary on pipe supplied by the Contractor shall be carried out at the Contractor's expense.

All repair procedures shall be subject to the prior approval of the Engineer. Generally, a crack is to 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 must 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 procedure set out in PSL 3.9.3.3.

PSL 3.9.3.6 Repair of FBMDPE Coating (Large Areas)

A large area repair is defined as an area larger than 650 mm².

Free issue pipes with external coatings damaged prior to acceptance by the Contractor shall be marked and recorded by both the Contractor and the Engineer's Representative and then repaired by the Contractor. The payment rate for repair shall be made at the scheduled rate. Once the Contractor has completed any repairs (if necessary) and accepted pipes from the Employer, any subsequent damage to the coating in the pipes shall be repaired by the Contractor at his expense.

Any repairs necessary on pipe supplied by the Contractor shall be carried out at the Contractor's expense.

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.

Under no circumstances will patching of damaged areas by means of pieces of tape wrap, be allowed.

PSL 3.9.3.7 Repair of FBMDPE Coating (Small Areas)

A small area repair is defined as an area less than 650 mm².

A small area repair is effected by means of the application of a hot spatula to repair the defect, provided that there is a residual layer of polyethylene adhering strongly to the steel surface. Alternatively, virgin Sintakote powder material may be melted with heated spatula over the damaged area, to fill the mechanical damages in the coating and fuse with the surrounding coating material, all as per the manufacturer's recommendations.

At each pinhole detected by the Holiday test, the surrounding area shall be abraded to 25mm beyond the defective area. The abrasion shall be carried out with clean emery paper of 80 to 100 mesh so as to provide a suitably rough surface profile without causing the removal of excessive amounts of coating material. A hot spatula shall be utilized to work Sintakote into the pinhole defects. It is noted that any cluster of pinholes within a radius of 25mm shall be regarded as one defect.

PSL 3.9.3.8 Repair of Three Layer Polyethylene Coatings

Free issue pipes with linings damaged prior to acceptance by the Contractor shall be marked and recorded by both the Contractor and the Engineer's Representative and then repaired by the Contractor. The payment rate for repair shall be made at the scheduled rate. Once the Contractor has completed any repairs (if necessary) and accepted pipes from the Employer, any subsequent damage to the coating in the pipes shall be repaired by the Contractor at his expense. All making good of the exterior coatings at damaged areas that is required to ensure continuous corrosion protection to steel surfaces shall be carried out strictly in accordance with an approved method statement that is to be prepared by the Contractor.

Any repairs necessary on pipe supplied by the Contractor shall be carried out at the Contractor's expense.

The basic requirements are the careful cut back of the outer sleeve and removal of the residual adhesive layer. The exposed surfaces are to be prepared as specified in PSL3.9.3.1 and this is to be followed by the application of an approved epoxy material followed by the application of a shrink sleeve covering the whole of the affected area with an overlap of no less than 50 mm.

The epoxy material shall be sufficiently thixotropic that 500 micrometres dry film thickness can be achieved in one application without sagging.

After curing, the repaired section and at least 250 mm of the surrounding area, shall be tested for electrical insulation defects as specified elsewhere. There shall be no electrical insulation defects.

PSL 3.9.3.9 External Coating Repair on Continuity Bonds

Electrical continuity bonding shall be carried out by a cathodic protection sub-contractor.

After successful testing of each weld in the presence of the Engineer's Representative the pipe coating shall be repaired in accordance with PSL 3.9.3.4.

The cable ends shall be covered with "Denso" mastic prior to tape wrapping.

PSL 3.9.3.10 External Corrosion Protection of Welded Joints and Coating Repairs

All factory coated steel pipes will be supplied with the external coating cut back 100 mm from each pipe end. Where pipes are to be cut, either on site, or for the purpose of fabricating bends, fittings and specials, or in the event of the pipe coating being damaged, 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 is to 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 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.

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.

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 shall 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 to be wrapped that same day. If primed areas are to be left overnight, those areas shall be re-primed before wrapping.

Profiling Tape:

A 1,5 mm thick x 50 mm wide "Denso profiling Mastic with a petrolatum 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).

Tape Wrapping:

The joint shall then be wrapped (minimum 55 % overlap) with a petrolatum system including mastic profiling puddy, butyl rubber/bitumen tape and PVC backing film "Denso Ultraflex 1250 Polyethylene/Bitumen" tape, or similar approved, 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 is then to be applied over the first layer with a 10% tape overlap.

An alternative tape wrapping system that may be used is the "Densotherm 35 Hot Applied Bitumen Tape" system. The procedures are similar to those for the "Denso" system described above except that the underside of the tape shall be heated as it is applied and the overlaps and seams of the tape are to be sealed by means of a heated tool.

PSL 3.9.3.11 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 "Nordbak 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 "Nordbak 1" or similar approved system.

All crotch plates and wrappers/collars shall be coated with an approved solvent-free epoxy (SFE) system such as "Nordbak 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 bends and fittings.

PSL 3.9.3.12 External Corrosion Protection of Site-Fabricated Pipe Bends and Fittings

The coating repairs/make good shall be carried out in accordance with PSL 3.9.3.10.

PSL 3.9.3.2 Payment for Inspection and Testing

Repairs by the Contractor will be subject to inspection by the Engineer and the Employer's Third Party inspection agent. 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 and shall be deductible from the Payment Certificates.

PSL 3.9.5 Joints, Bolts, Nuts and Washers

Replace clause with

"All joints, bolts, nuts and washers shall be hot-dip galvanised in accordance with SABS 121 unless stated otherwise. Electroplating shall not be permitted.

Where nuts and bolts are required for jointing, couplings, etc., there shall be 2 sets of washers per nut and bolt unless otherwise specified.

Where additional corrosion protection is specified the relevant clauses of PSL 3.9.6 shall also apply."

PSL 3.9.6 Corrosive Soil

Change the heading of this subclause to:

PSL 3.9.6 Additional Corrosion Protection

Replace clause with the following:

"Unless scheduled or ordered separately, steel or cast iron pipes, fittings, valves and joints shall be treated as follows:

PSL 3.9.6.1 Wrapping of Permanently Exposed and Cast-in Pipes and Fittings

All coated and/or galvanised steel pipes which are to be **permanently exposed (above and below ground) and cast in concrete** shall, in addition to the specified corrosion protection at flange/adaptor/anchoring joints, be protected with the "Denso rubber Bitumen/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. In the case of cast-in pipes, the wrapping shall extend for at least 150mm on either side of the soil/concrete/air interface.

Surface Preparation:

- (i) Remove all Grit and/or dust before priming at the average spread rate as specified by the manufacturer.
- (ii) The adjacent coating shall be cleaned to a minimum of 300 mm beyond the section to be wrapped.
- (iii) Grease and oil shall be removed with a non-volatile solvent. The surface shall then be cleaned with potable water and allowed to dry completely.

Priming:

- (i) "Denso Primer D" shall be applied to the prepared surfaces extending 300 mm on either side of the area to be wrapped 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 to avoid any recontamination to the pipe. If primed areas are to be left overnight, these areas shall be re-primed before wrapping. Any surface oxidation, or other foreign agents shall be removed by reprocessing through the necessary cleaning steps.
- (ii) The flow of primer shall be regulated so that the pipe surface is entirely covered. Solvents shall be allowed to flash off for a minimum of 30 minutes before application of tape or mastic. Uncoated, flooded, or areas primed over improperly cleaned pipe, shall be cleaned to the satisfaction of the Engineer and re-coated.

Tape Wrapping:

The joint shall be spirally wrapped (minimum 55% overlap) with "Denso rubber Bitumen/Acrylic Tape (Steelcoat 500)" (or approved equivalent) in accordance with the manufacturer's requirements, to at least 150mm regardless of diameter, beyond the concrete/soil or concrete/air interface and at least 1 000mm beyond the soil/air interface in the case of pipes extending above ground. A 100% overlap is required on the first and last revolutions of the tape wrapping operation. Care shall be taken to ensure a smooth profile and to avoid air bubbles being trapped beneath the tape. The tape shall not be stretched and it is important that tension in the tape be released when the wrapping of the last half circumference of the pipe.

In the case of pipes cast into concrete, the profiling tape shall stop 20mm short of any puddle flange.

PSL 3.9.6.2 External Corrosion Protection for Pipes, Joints, Fittings and Fasteners in Chambers

(a) Pipes and Fittings

For steel pipes and fittings in chambers with the same coating as mentioned in PSL 3.4.3 and 3.4.4, shall be protected by an additional UV resistant paint top coat of Re-coatable Polyurethane (Carbothane 134za) minimum dry film thickness of 40 micron unless specified elsewhere.

(b) 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 will 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).

Surface Preparation:

The entire surface area of the flange/adaptor/anchoring joint, and its bolts, nuts and washers, up to no 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.

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".

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.

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"

The "denso" petrolatum system shall be used, including mastic profiling puddy, petrolatum tape and Ultraflex PSA 180 tape

(c) Nuts, Bolts and Washers (Fasteners)

In buried situations and/or in chambers below ground level, upon completion, bolt heads, washers and nuts shall be wrapped with the "denso" petrolatum system including mastic profiling puddy, petrolatum tape and Ultraflex PSA 180 tape as described in PSL 3.9.3.10."

PSL 3.9.6.3 External Corrosion Protection for Pipes, Joints, Fittings and Fasteners below-ground (buried) exposed

(a) Buried Pipes (short runs)

This involves the external corrosion protection for buried short pipe lengths for GMS pipes, epoxy coated steel pipes and uncoated steel pipes that have not been mentioned above.

The pipes mentioned above shall be protected with a "denso" petrolatum system including mastic profiling puddy, petrolatum tape and Ultraflex PSA 180 tape or similar approved coating. The pipe surface shall be prepared, and the coating applied in strict accordance with the manufacturer's instructions.

Surface Preparation:

- (i) Remove all Grit and/or dust before priming at the average spread rate as specified by the manufacturer.
- (ii) The adjacent coating shall be cleaned to a minimum of 300 mm beyond the section to be wrapped.

- (iii) Grease and oil shall be removed with a non-volatile solvent. The surface shall then be cleaned with potable water and allowed to dry completely.

Priming:

- (i) "Denso Primer D" shall be applied to the prepared surfaces extending 300 mm on either side of the area to be wrapped 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 to avoid any recontamination to the pipe. If primed areas are to be left overnight, these areas shall be re-primed before wrapping. Any surface oxidation, or other foreign agents shall be removed by reprocessing through the necessary cleaning steps.
- (ii) The flow of primer shall be regulated so that the pipe surface is entirely covered. Solvents shall be allowed to flash off for a minimum of 30 minutes before application of tape or mastic. Uncoated, flooded, or areas primed over improperly cleaned pipe, shall be cleaned to the satisfaction of the Engineer and re-coated.

Tape Wrapping:

The pipe shall be spirally wrapped (minimum 55% overlap) with by "denso" petrolatum system including mastic profiling puddy, petrolatum tape and Ultraflex PSA 180 tape (or approved equivalent) in accordance with the manufacturer's requirements. A 100% overlap is required on the first and last revolutions of the tape wrapping operation. Care shall be taken to ensure a smooth profile and to avoid air bubbles being trapped beneath the tape. The tape shall not be stretched and it is important that tension in the tape be released when the wrapping of the last half circumference of the pipe.

(b) Fittings, Valves, Flanges and Flexible Adaptor / Anchoring Joints

Every **buried** cast iron/steel coupling, joint, flange, valve, or small unsheathed portions of pipe near the joint (flange) 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 are to be covered with an approved "denso" petrolatum system including mastic profiling puddy, petrolatum tape and Ultraflex PSA 180 tape applied strictly in accordance with the manufacturer's instructions.

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 profiling puddy is to be packed around the joint and/or valve body to form an even contour for the application of "denso" petrolatum tape and Ultraflex PSA 180 tape. A fillet is to be formed between the flange and the pipe barrel/valve body and, in the case of flexible couplings, mastic profiling puddy is to be packed around the bolts to a height of 3 mm above the bolts. Care must be taken to ensure that no air is entrapped.

A layer of petrolatum impregnated tape is to be spirally applied with a minimum overlap of 50 mm. All air pockets are to be removed.

An overwrap of adhesive PVC (Ultraflex PSA 180) tape is to 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 and pipe is to be subjected to holiday detection and, if proved sound and approved by the Engineer, may be covered with "padding" sand."

(c) Nuts, Bolts and Washers (Fasteners)

In buried situations and/or in chambers below ground level, upon completion, bolt heads, washers and nuts shall be wrapped with the "denso" petrolatum system including mastic profiling puddy, petrolatum tape and Ultraflex PSA 180 tape as described in PSL 3.9.3.10."

PSL 3.9.6.4 External Corrosion Protection for Pipes, Joints, Fittings and Fasteners above-ground exposed

(a) Pipes and Fittings

For above ground steel pipes and fittings not cast in concrete, larger than DN150 and the same coating as mentioned in PSL 3.4.3 and 3.4.4, shall be protected by an additional UV resistant paint top coat of Re-coatable Polyurethane (Carbothane 134za) minimum dry film thickness of 40 micron unless specified elsewhere.

For above ground steel pipes and fittings not cast in concrete, smaller than and including DN150 with the same coating as mentioned in PSL 3.4.2, no additional corrosion protection wrap/paint is applied.

(b) Valves, Flanges and Flexible Adaptor / Anchoring Joints

For all Flexible and Flanged Joints in above ground application with the same coating as mentioned in PSL 3.4.3 and PSL 3.4.4 shall be protected by an additional UV resistant paint top coat of Re-coatable Polyurethane (Carbothane 134za) minimum dry film thickness of 40 micron unless specified elsewhere.

(c) Nuts, Bolts and Washers (Fasteners)

All bolts, washers, threaded bars etc mentioned in PSL 3.8.3 is to be corrosion protected completely and generously by an approved heavy-duty, self-heathing, surface tolerant, hand painted, flexible polymer-modified wax corrosion-inhibitor such as 'Chesterton 740 or similar approved heavy duty rust guard' minimum dry film thickness of 36 micron

PSL 3.9.6.5 External Corrosion Protection for Pipes, Joints, Fittings and Fasteners above ground in buildings / pumpstations

(a) Pipes and Fittings

For steel pipes and fittings in buildings and pump stations (non-immersed conditions), larger than DN150 and the same coating as mentioned in PSL 3.4.3 and 3.4.4, shall be protected by an additional UV resistant paint top coat of Re-coatable Polyurethane (Carbothane 134za) minimum dry film thickness of 40 micron unless specified elsewhere.

For steel pipes and fittings in buildings and pump stations (non-immersed conditions), smaller than and including DN150 and the same coating as mentioned in PSL 3.4.2 there shall be no need for additional corrosion protection. However, if majority of the pipework in the specific location (pump station / building) is Epoxy coated then over coat with UV resistant paint top coat of Re-coatable Polyurethane (Carbothane 134za) minimum dry film thickness of 40 micron (colour to suit valves and couplings).

(b) Fittings, Valves, Flanges and Flexible Adaptor / Anchoring Joints

For all Flexible and Flanged Joints in above ground application with the same coating as mentioned in PSL 3.4.3 and PSL 3.4.4 shall be protected by an additional UV resistant paint top coat of Re-coatable Polyurethane (Carbothane 134za) minimum dry film thickness of 40 micron unless specified elsewhere.

(c) Nuts, Bolts and Washers (Fasteners)

All bolts, washers, threaded bars etc. mentioned in PSL 3.8.3 is to be corrosion protected completely and generously by an approved heavy-duty, self-heathing, surface tolerant, hand painted, flexible

polymer-modified wax corrosion-inhibitor such as 'Chesterton 740 or similar approved heavy duty rust guard' minimum dry film thickness of 36 micron

Add the following new sub-clause:

PSL 3.10 Valves

Change the heading of this clause to the following and add:

PSL 3.10 Valves and Other Mechanical/Electronic Accessories

PSL 3.10.1 Isolation Valves (General)

The Contractor is referred to the Umgeni Water Particular Specification for Valves. Where conflict exists, the requirements in this specification shall take precedence.

Unless otherwise stated, all isolation and scour valves shall be of the Waterworks Pattern Sluice Valve type.

The following general requirements shall be met:

- a) The valve class shall be at least equal to that of the pipework in which it is to be installed. All valves shall be rated for a working pressure of at least 1,6 MPa (Class 16), unless otherwise specified in the drawings and schedule of quantities.
- b) The valves shall be supplied with non-rising type spindle. Spindles shall be threaded such that two turns of the hand wheel shall effect a movement of 25 mm on the valve gate. This allows for easy identification of the valve diameter.
- c) The valves shall be fitted with a cast iron cap attached to the spindle by means of a Stout brass screw with hexagonal head or with a handwheel as indicated on the drawings or specified in the Schedule of Quantities. The handwheel shall indicate the direction of closing.
- d) The valves shall be **CLOCKWISE CLOSING.**
- e) The design of the valve guides shall be such that all valves supplied can be mounted in any position.
- f) The stuffing box may either be of the conventional type with gland packing with a gland secured with 2 No. bolts and nuts. The nuts shall be of the Tee pattern and the gland stuffing box shall be capable of holding four rings of a standard size of gland packing. The gland stuffing box shall be capable of being repacked under working pressure, preferably with the gate in the open position. The gland shall fit neatly and snugly into the stuffing box. The base of the gland and the stuffing box shall be chamfered to force the packing against the spindle.

Alternatively the sealing of the spindle in the body may be by means of O-rings which are retained in position by means of machined Grooves in the valve body and which seal against the spindle. If this type of valve is offered, tenderers should indicate with their tender the cost of a service head for each size of valve offered. Such service head shall be supplied complete with seals, gate, spindle and cap.

- g) The valves shall be double flanged and drilled in accordance with SABS 1123 appropriate to the Class of valve required/specified.
- h) Each valve shall be supplied with 2 No. full face gaskets and the requisite number of bolts, nuts and washers to suit the valves. Sufficient bolts, nuts and washers shall be supplied for both faces of the valves. The cost of these items shall be included in rates tendered.

- i) The valves shall be drop tight at the specified working pressure applied to one side of the gate and the other side subject to open end conditions.
- j) In addition to the above conditions (i) when called for in Schedule of Quantities, valves for installation on fire hydrants shall be drop tight when subjected to working pressures within in range 345 kPa to 1380 kPa under unbalanced open end conditions, and chattering of the gate in its guides during operation of the valves shall be reduced to a minimum to prevent damage to the valve seats.

Every valve shall be internally and externally fusion bonded epoxy powder coated to a minimum 250 micron DFT, as standard.

PSL 3.10.1.1 Resilient Seal Valves

a) General

Valves shall be double flanged and be resilient seated and unless otherwise specified, the valves shall be of the non-rising spindle type.

The valves shall be capable of withstanding the nominal pressure and specified test pressure and shall have the capability to seal drip tight bi-directionally. The valves shall generally be manufactured in accordance to SABS 664.

b) Gate Design

The gate shall be fully rubber encapsulated inside and outside therefore to ensure drip tight sealing and avoid corrosion. The gate shall further have a drain hole, preventing stagnant water or impurities from collecting.

Rubber utilised in the coating of the wedge shall be inert and shall not impart odour, taste and colour and shall be suitable for drinking water applications. The gate nut shall not be fixed to the wedge, thereby reducing opening torques.

c) Gate and Body Design

The gate shall have optimally placed guides of wear resistant plastic so as reduce the torques as well as reduce wear between the rubber and the coating on the body. The bore of the body shall be straight through design in order to allow cleaning with a badger.

d) Valve Bonnet

The valve shall utilise 3 independent bonnet seals which shall include a set of stem steels embedded in non-corrosive material, a back seal to prevent leakage when changing seals, and wiper ring to protect against debris entering the valve.

Two friction washes (sizes 50mm – 200mm) and thrust ball bearings (250mm – 600mm) shall be in incorporated to ensure smooth spindle operation as well as to reduce opening and closing torques.

A full circle thrust collar shall be utilised to ensure low torque operation. O-ring stem seals shall be replaceable under pressure for sizes 50mm – 200mm.

e) Spindle

Spindles shall be made of stainless steel. The stem threads shall be rolled to maintain steel structure and increase strength and, to ensure smooth thread edges and consequently a low operating torque.

f) Body and Bonnet Assembly

The rubber bonnet gasket shall fit in a recess in the valve bonnet preventing blow out of the seal under surge conditions. The bonnet bolts shall pass through the gasket and sunk into the bonnet and sealed for corrosion protection.

An edge protecting ring shall permanently be fitted around the body and bonnet joint in order to protect the coating during transportation and installation.

PSL 3.10.1.2 Wedge Gate Valves

Wedge Gate Valves shall be of the Waterworks Pattern Sluice Valve type and be manufactured to a standard of not less than that specified in SABS 664.

The following special requirements shall be met:

- a) The lugs on the gate and the spindle are to conform to 3.2.3 of SABS 664 and are to be machined to a good fit and finish.
- b) Valve trim shall be either Type B (Gun metal trim) or Type C (Stainless Steel trim) as specified in SABS 664 Clause 3.5.5. Tenderers must indicate in their tender what type of trim is offered.
- c) Seat rings shall comply with Clause 3.5.6 of SABS 664 and shall be pinned into position.
- d) The stuffing box may either be of the conventional type with gland packing with a gland secured with 2 No. bolts and nuts. The nuts shall be of the Tee pattern and the gland stuffing box shall be capable of holding four rings of a standard size of gland packing. The gland stuffing box shall be capable of being repacked under working pressure, preferably with the gate in the open position. The gland shall fit neatly and snugly into the stuffing box. The base of the gland and the stuffing box shall be chamfered to force the packing against the spindle.
- e) Valves which incorporate a thrust plate of the horseshoe type will NOT be considered.
- f) Every sluice valve shall be provided with substantial guides cast on each side of the gate, preferably extending to the top of the nut box and operating along corresponding guides cast in the sides of the valve body. (Brass trim only).
- g) When called for in the Schedule of Quantities, valves shall, in place of the guides described in (f) above, be fitted with machined bronze guide shoes on either side of the gate operating in accurately matching machined bronze guide channels fixed on the sides of the valve body. The bronze guides shall be of phosphor bronze to B.S. 1400 PB 2-0.

The gate valves shall be supplied with the gland packing installed and shall be either "Maxmech Style M57, Chesterton 1724" or similar approved.

3.10.1 4 Butterfly Valves

The valves shall be manufactured in accordance with BS 5155 (cast iron and carbon steel butterfly valves for general purposes), as far as is applicable.

The Contractor is referred to the Umgeni Water Particular Specification for Double Flanged Butterfly Valves for sizes from 400NB where working pressure does not exceed 40BAR (4000kPa) and the Umgeni Water Particular Specification for Valves.

Where conflict exists, the requirements in this specification shall take precedence. Thereafter the Umgeni Water Particular Specification for Double Flanged butterfly valves shall take precedence over the Umgeni Water Particular Specification for Valves

The following criteria for construction shall be met:-

- a) Body

Where wafer-lug type butterfly valves are specified, these shall be of the wafer-lug type, with drilled/tapped bolt holes, to allow the valve to be used at maximum working pressures of respectively 20 and 16 bars in terminal positions. This is to allow downstream pipework to be disassembled with the upstream pipework under pressure.

Valves designed for to allow the valve to be used at maximum working pressures of 16 bars at terminal positions unless otherwise specified in the drawings or schedule of quantities.

Bodies shall be one piece casting Ductile Iron, UTS 400 MPa, YP 250 MPa, (elongational 12%) grade EN GJS-400-15 to BS EN 1563 or equivalent for sizes up to 1500mm. Sizes above shall be of cast steel grade 480 to BS 1504-161. Bodies shall never be in contact with the fluid conveyed and shall be fully protected internally by the resilient seat.

b) Disc

Shall be cast or stamped, spherically machined and positively splined or keyed internally to the driving shaft. (Use of plinths or bolts is totally prohibited).

Selection of the disc material shall be made taking into account the aggressivity of the fluid. (Cupro-aluminium or stainless steel 316 or equivalent).

c) Shaft

Butterfly valve technology shall be such that the shaft will never be wetted. (Dry shaft) Stainless Steel, AISI 420 of high mechanical characteristics shall be used.

It shall be positively splined or keyed to the disc. The upper and lower shaft and tie-bolt, when assembled to the disc, shall give in effect a one-piece shaft/disc assembly. At least three bearing assemblies, consisting of steel outer shell, with sintered bronze inner lining, coated with Teflon, facing shall be used.

The upper shaft shall be carried in two bearings, the lower in one.

d) Liner

The resilient, synthetic rubber seat shall be easily replaceable (bonded liners are prohibited) and shall entirely cover the inside of the body overlapping over the sides to form the seal between the body and matching pipework.

Where necessary, it shall be keyed to the body with annular grooves in the bore of the valve. 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.

e) General

Valves with "O" Ring Shaft Backup Seals shall not be considered. The Manufacturer shall be able to offer alternative grades to cope with various fluids.

Quarter-turn handles shall be supplied for valves up to and including 150mm nominal diameter. The handle shall be lockable in all intermediate positions and be adaptable to the valves.

For valves larger than 150mm a gear shall be used. The gear operator shall be designed with a worm and nut system. The gear operator shall be irreversible in any position. The gear shall have a handwheel and an indicator protected by plexiglass, showing the position of the disc. If specified, limit switches shall be fitted, mounted in a waterproof and dustproof housing.

The direction of opening of the butterfly blade shall be such that the bottom of the blade moves in a downstream direction.

All handwheels shall be fitted with a suitably sized shear-pin that shall fail before damage can be done to the drive gearing of the valve.

Where specified, U-section wafer-type valves, as described in BS 5155, shall be acceptable, provided that:

the valve is suitable for individual bolting of each flange and the dimension between the inside faces of the flanges is not less than 3D, where D is the diameter of the flange bolts as specified in BS 4504: Part 1, or SABS 1123

PSL 3.10.2 Air Release Valves

The Contractor is referred to the Umgeni Water Technical Specification for Air Release and Vacuum Break Valve. Where conflict exists, the requirements in this specification shall take precedence.

a) Function

The required valves shall provide any of the functions, or combination of functions, described below as specified in the schedule of quantities:

- Pipeline filling
- Uninterrupted high volume air discharge through the large orifice.
- Pipeline draining or Column Separation
- Uninterrupted high volume air intake through the large orifice.
- Pipeline full and operating
- Discharge of disentrained pressurized air through the small orifice.
- Rapid Filling / Column Separation

The valve must incorporate an integral surge alleviation mechanism which will automatically dampen surge pressures due to rapid air discharge or the subsequent rejoining of separated water columns.

b) Construction and design

The air release and vacuum break valve shall be of a compact single chamber design with solid cylindrical High Density Polyethylene control floats housed in a tubular stainless steel or corrosion protected body with stainless steel ends secured by means of stainless steel tie rods.

Large orifice sealing shall be effected by the flat face of the control float seating against a nitrile/EPDM rubber 'O' Ring housed in a dovetail Groove circumferentially surrounding the large orifice. Discharge of pressurized air shall be controlled by the seating and unseating of a small orifice on a nitrile/EPDM rubber seal affixed to the control float.

The intake/discharge orifice area shall be equal to the nominal size of the valve i.e. a 150mm (6") valve shall have a 150mm (6") intake/discharge orifice. The air valve class shall be at least equal to that of the pipework in which is to be installed, with a minimum working pressure of at least 1,6 MPa (Class 16).

Surge Alleviation Mechanisms

The valve shall have an integral surge alleviation mechanism which shall operate automatically to limit transient pressure rise or shock induced by closure due to high velocity air discharge or the subsequent rejoining of separated water columns. The limitation of pressure rise must be achieved by deceleration of approaching water prior to valve closure. Relief mechanisms that act subsequent to valve closure cannot react in the low millisecond time span required and are therefore unacceptable.

Relief mechanisms shall activate at a maximum differential pressure of 5kPa between the inside and outside of the valve.

Where specified, the air valve shall be fitted with a stainless steel spring or similar device to immediately active the air release function to the surge alleviation mechanism.

c) Performance Requirements

The valve design shall be proven and performance criteria shall have been confirmed by a recognized independent authority.

The selected air valve range shall have factory test results which verify the claimed air intake and air release performance characteristics.

Air valve ranges without verified factory performance tests will not be accepted.

PSL 3.10.3 Float Control Valves

Float Control Valves shall be hydraulically controlled dual diaphragm end line type control valves with either a direct or remote pilot to facilitate automatic control of levels in tanks and reservoirs with an inherent slow closing characteristic to automatically reduce induced pressure when closing.

Float valves shall have a concentric cast iron body and bonnet, which shall be coated and lined with fusion bonded epoxy powder coated to 250 microns.

The spacer piece and plug assembly shall be manufactured from solid HDPE and the diaphragms shall be manufactured from proprietary elastomer as specified by the manufacturer. The internal filter mechanism shall be manufactured from LG2 brass and 304 stainless steel. The control orifice, trim and fasteners shall all be manufactured from Grade 304 stainless steel.

Valve construction shall be such that deformation, leaking or damage of any kind does not occur when the valve is subjected to testing pressures of 1.5 x the designed working pressure.

The valve shall be supplied with a direct or remote (as specified), magnetic two level latch type pilot with a fixed deadband. The pilot shall be constructed of brass with stainless steel trim and shall be fitted with an "Eclipse shallow pot" type magnet. The pilot float arm shall be constructed from stainless steel and the ball from polypropylene.

The pilot shall be able to remain "closed" or "open" when the water surface is turbulent and shall only change state at either end of the deadband.

Where a filter is specified to prevent debris from entering the valve, it shall be a cone filter manufactured from powder coated mild steel.

Float valves shall be supplied with stud connections suitable for alignment to flanges conforming to PN16 ratings of BS EN 1092 standards, or as otherwise specified in the drawings or specifications.

Float valves shall be suitable for operating under a static pressure of 16 bar and shall be able to operate at a residual pressure of at least 0.1 bar.

PSL 3.10.4 Meters

PSL 3.10.4.1 Woltmann Type

Water meters used in this application in nominal bore sizes from 40mm to 150mm must comply with the South African Bureau of Standards Specification No. 1529-1:1994 and Section 18 of the Trade Metrology Act No. 77 of 1973 and Regulation 80 of Part II of the Trade Metrology Regulations.

All Water Meters, sizes 40 mm to 100 mm, must be tested and sealed by an authorised officer in a SANAS (S.A.B.S. 0259) accredited laboratory, situated within the borders of the Republic of South Africa.

The Water Meter must be of the Woltmann WP helical vane inferential velocity type with the following capabilities:-

METER SIZE (mm)	40	50	80	100	150	200	250	300
Max. Flowrate $q_s \pm 2\%$ (m ³ /h)	90	90	200	250	600	1000	1600	2000
Permanent Flowrate $q_p \pm 2\%$ (m ³ /h)	50	50	120	180	450	700	1000	1500
Transitional Flowrate $q_t \pm 2\%$ (m ³ /h)	1.0	10	2.0	2.0	4.0	6.0	11.0	15.0
Minimum Flowrate $q_{min} \pm 5\%$ (m ³ /h)	.35	0.35	0.5	0.6	2.0	4.0	6.0	12.0
Starting Flow (m ³ /h)	0.15	0.16	0.22	0.25	0.90	1.2	1.8	1.8
Maximum Working Pressure (Kpa)	1600	1600	1600	1600	1600	1600	1600	1600
Body Length (mm)	311	200	200	250	300	350	450	500

In addition, the meters offered must comply with the following:-

- Epoxy coated cast iron body.
- Counter to be encased in a Copper can with mineral glass lens sealed to IP 68 standards to prevent condensation from forming under the lens, thus providing clear reading in any environment.
- Scratch resistant mineral glass counter window able to withstand the impact of a 25mm steel ball dropped onto the centre from a height of one metre.
- Counter unit must be equipped to generate pulse outputs, as per the following:

Meter sizes 40 mm to 100 mm

One pulse per 10 litres
One pulse per 1 000 litres

Meter sizes 150 mm & 200 mm

One pulse per 100 litres
One pulse per 10 000 litres

Meter must have the following features to facilitate convenience of on-site replacement :

- Fully shrouded, pre-calibrated replaceable mechanism.
 - Helical vane fitted in a shrouded cartridge designed to direct the entire volume of water through the measuring element ensuring body impact is negligible on the accuracy.
- Must be suitable for Vertical, Horizontal or Inclined Installation.
 - Meters must be capable of measuring reverse flows within the same Class B accuracy envelope as per the Specification (No. 1529-1, 1994) for forward flow, i.e. $\pm 5\%$ q_{min} & 2% q_p to q_s .
 - Meter must be provided with a pressure tapping (1/4 BSP), into which a pressure gauge or pressure transducer can be fitted to measure the downstream pressure of the meter.
 - Suitable for water temperatures up to 50°C and maximum working pressure of 1 600 kPa, unless otherwise specified in the drawings and schedule of quantities.
 - All internal plastic components to be constructed of virgin materials.

- The meter must perform within the legal accuracy specification, with a length of pipe, the same diameter as the meter, three diameters long, free from fittings and valves, fitted at the inlet to the meter body and one diameter long fitted to the outlet of the meter body.
- Each Meter must be backed with a two year warranty against faulty workmanship and/or materials.

Spare parts for all Water Meters offered must be available in South Africa and still be available for a period of ten years after the purchase of the water meter.

3.10.4.2 Electromagnetic Type

The magnetic flow meters shall be flanged to SANS 1123 for process connection sizes and pressures specified in the BOQ. Installation shall form part of the mechanical portion of the Works. The primary element casing shall be of 3CR12/mild steel, appropriately coated, painted and treated for corrosion protection. The tube material shall be at least of 304 stainless construction with a polyurethane lining. The electrodes shall be constructed of 316 stainless steel. The sensor shall have an environmental protection rating of IP68 with factory potted terminal housing and shall be equipped with integral cables long enough to reach the transmitter. No cable joins will be permitted. The transmitter shall have microprocessor-based electronics with local flow rate and total indication in an IP65 enclosure. The transmitter enclosure must be installed above any flood level.

The transmitter shall conform to the following:

Power supply	:	230V AC power supply 50Hz
Outputs	:	4 x OCT digital programmable outputs Isolated (Fwd Pulse, Rev Pulse, Empty pipe, low battery) 1 x passive 4-20mA
Range	:	0.1-10m/s
Accuracy	:	Error better than 1% of full scale > 0.5m/s
Repeatability	:	0.2% of span

The transmitter shall have Profibus, Hart Ethernet configurable connections.

3.10.4.3 Ultrasonic Type

No strap-mounted or clamp-on type ultrasonic flow meters shall be accepted.

The ultrasonic flow meters shall be the in-line type and shall be flanged to SANS 1123 for process connection sizes and pressures specified in the BOQ. Installation shall form part of the mechanical portion of the Works.

The primary element casing shall be of mild steel, appropriately coated, painted and treated for corrosion protection. The tube material shall mild steel construction with a polyurethane lining. Where a stainless steel casing and tube is specified, the grade shall be EN 1.4404 (AISI 316L). The wetted transducers and transducer holders shall be constructed of stainless steel EN 1.4404 (AISI 316L).

The sensor shall have an environmental protection rating of IP68 with factory potted terminal housing and shall be equipped with integral cables long enough to reach the transmitter. No cable joins will be permitted.

The transmitter shall have microprocessor-based electronics with local flow rate and total indication in an IP65 enclosure. The enclosure shall be of die-cast aluminum or stainless steel (EN 1.4404) construction. The transmitter enclosure must be installed above any flood level.

All externally mounted flowmeters and components shall be of stainless steel construction unless otherwise specified. All internally mounted flowmeters and applicable components shall be of mild steel construction unless otherwise specified.

The transmitter shall conform to the following:

Power supply	:	230V AC power supply 50Hz
Outputs	:	4 x OCT digital programmable outputs Isolated (Fwd Pulse, Rev Pulse, Empty pipe, low battery) 1 x passive 4-20mA
Range	:	0.1-10m/s
Accuracy	:	Error better than 1% of full scale > 0.5m/s
Repeatability	:	0.2% of span

The transmitter shall have Profibus, Hart Ethernet configurable connections.

3.10.4.4 GSM Data loggers

GSM data loggers shall be 3.6V lithium battery powered and in an IP65 wall mount enclosure with extended battery pack for the line pressure transducer. The data logger should have 2 x digital inputs and 5 x Analogue inputs. Logged data should be transferred to the Mycity server at 24hr intervals. The data should be accessed via the Mycity password protected website. Data should display graphically in graph and table format for user selectable periods. The data must downloadable in Excel format.

The flow transmitter and data logger for the flow meters shall be installed remotely and above any flood level in a wall mounted IP65 enclosure.

PSL 3.10.5 Strainers

All strainers shall be “Y” type configuration and shall conform to the following:

- Cast iron body and lid and shall be fusion bonded epoxy coated both inside and outside.
- Face to face dimension of all flanged strainers shall be according to EN 558-1 GR 1. Strainers shall be supplied with stud connections suitable for alignment to flanges conforming to PN16 ratings of BS EN 1092 standards, unless otherwise specified in the drawings and schedule of quantities..
- Strainers shall be suitable for operating under a static pressure of 16 bar, unless otherwise specified in the drawings and schedule of quantities.
- The screen shall be a fine-meshed double screen manufactured from stainless steel able to restrain parts bigger than 0.5mm for sizes DN 40mm – DN 150mm, and able to restrain parts bigger than 0.6mm for sizes DN 200mm – DN 300mm.
- All fastening bolts and nuts to be stainless steel.

PSL 3.10.6 Reflux Valves

The Contractor is referred to the Umgeni Water Particular Specification for Valves. Where conflict exists, the requirements in this specification shall take precedence.

a) General

Reflux valves shall be double-flanged, for horizontal and vertical mounting, of robust construction and suitable for the operating head and close drop tight, unless otherwise permitted in the Project Specification.

Bodies shall be one piece casting Ductile Iron, UTS 400 MPa, YP 250 MPa, (elongational 12%) grade EN GJS-400-15 to BS EN 1563 or equivalent for sizes up to 1500mm. Sizes above shall be of cast

steel grade 480 to BS 1504-161.

The body, cover and door shall be of the Ductile Iron grade EN GJS-400-15 to BS EN 1563 or equivalent approved/ The door shall be fitted with a zinc-free phosphor-bronze face, closing on a corresponding bronze face, in the body.

The valves must be of the “non-slam” type, for horizontal or vertical installation. Unless otherwise specified, all reflux valves shall be fitted with an external counterweight arm to ensure non-slam closure.

External spring assisted closure will also be permitted. Valves with a stainless steel perforated cone, or resilient conical diaphragm, are also acceptable.

Wafer-type reflux valves shall have ductile iron bodies with domed 316 stainless steel gates. Seats shall be machined with a dove-tail groove to accommodate an O-ring to ensure drip-tight sealing.

Valves shall be installed between suitable retaining flanges, which shall be independent of any other piece of equipment.

Valves shall be guaranteed to be leak tight in their particular application.

Valves shall be coated (externally) and lined (internally) in accordance with the Umgeni Water Particular Specification for Valves.

b) Nozzle-type Reflux valves

Nozzle-type or “Silent” check valves shall be double flanged. The “globe” style of construction shall be used.

The design shall be such that the disc does not rely on back flow for closure. Closure shall be performed by a stainless steel spring that pushes the disc against the stainless steel seat. The valve shall be fully open under normal operating conditions.

Discs shall close with a positive action and no possibility of slamming shut during any stage of the closing or opening operation. The spring assisted low inertia internal components must ensure rapid closing and minimise secondary slam even at high flow deceleration rates. The disc shall at all times stay perpendicular to flow.

The valve disc shall be of ductile iron grade EN-GJS-400-15 construction. Valve rings shall be of EN 1.4404 construction.

The bearings shall be of bronze construction or superior.

All internal components shall be of stainless steel construction, including the shaft, stopper, spring, bolts, nut, and setscrew.

External fasteners (flanged connections) shall be mild steel (hot dip galvanized).

PSL 3.10.7 Flow Limiting Valves

The Contractor is referred to the Umgeni Water Particular Specification for Valves. Where conflict exists, the requirements in this specification shall take precedence.

The limiter valve shall consist of a wafer pattern with rubber control ring orifice inserts, which effects a consistent flow control within $\pm 10\%$ of the rated flow for a differential pressure across the valve over a range as specified. The valve must sit between two flanges.

The valve body shall be of stainless steel grade 316 construction. The control rings shall be made of flexible nitrile elastomer rubber and shall be able to move on a tapered seat in the body as the flow increases and be replaceable. The valve shall be complete with control rings for the specified flow.

The valve design shall be proven and performance criteria shall have been confirmed by a recognized independent authority.

The valve class shall be at least equal to that of the pipework in which it is to be installed. All valves shall be rated for a working pressure of at least 1,6 MPa (Class 16), unless otherwise specified in the drawings and schedule of quantities.

PSL 3.10.8 Knife Gate Valves

The design of the knife gate valve shall be of a type suitable for the operation environment and fluid medium described elsewhere in the document.

Preference shall be given to double flanged units.

Valves and their method of actuation shall be designed to operate under the full pressure rating of the valve.

Valves shall have cast iron bodies unless otherwise specified. The knife gate shall be of stainless steel (AISI 316) construction. The handwheels shall be of cast iron, or of stainless steel (where specified).

The valves shall have chamfered blade edges and resilient body seals. Blade faces shall be surface ground or otherwise provided with two flat, parallel surfaces.

The blade seal shall be protected by a non-metallic scraper or similar device.

It shall be possible to adjust the blade seal while the valve is in line under pressure.

All fasteners on the body of the valve shall be of EN Grade 1.4401 (316), or better (this does not necessarily apply to flange bolts).

Valves shall be droptight. Blade seals shall not leak.

The valve shall be capable of operating reliably at any point in the specified range.

The valve shall be provided with manual handwheel operation or shall be provided with electric actuation with manual override, as specified elsewhere. The operation shall be smooth and handwheels shall not require a peripheral force greater than 250N (i.e. the sum of the forces on both sides shall not be greater than 250N).

Corrosion protection shall be to the Client Particular Specification for Valves, or superior.

PSL 3.11 Manholes and Surface Boxes

Add the following sub-clause:

PSL 3.11.7 Pipeline Markers

Where so instructed by the Engineer or as shown on the drawings, the Contractor shall erect pipeline markers. These markers will be precast concrete units manufactured out of 25 Mpa concrete to the dimensions shown on the drawings and shall comply with SABS 1200 GA Concrete (Small Works)."

Add the following new sub-clause:

PSL 3.12 Padlocks for Manholes, Air Valve Chambers, Reservoirs etc.

All padlocks for use in locking manholes, air valves chambers, valve chambers, reservoirs etc shall be "lock-a-like" 70 mm Discus Lock with all working mechanisms treated with copper slip. The cost of padlocks will be deemed to be included in the Contractor's rates for the manhole cover and/or locking bar."

PSL 4 PLANT

PSL 4.1 Handling and Rigging

Add the following:

"The plant and rigging equipment used for the handling of pipes shall be such that no pipe shall be overstressed during any operation.

In the transportation, loading and unloading of pipes, the Contractor shall at all times operate and maintain an adequate fleet of vehicles to ensure that pipes or their protective linings and coatings are not damaged. In particular, the use of excavation equipment for handling of pipes will not be permitted.

Pipes shall be moved with the use of padded slings of width sufficient to prevent damage to the coating. Chain slings, hooks, wire ropes, rope slings without canvas covers, composition belt slings with protruding rivets and any other equipment liable to damage the coating shall not be used. Slings shall be suitably rated for the loads to be handled and in good condition. The use of deteriorating and frayed slings is prohibited.

All pipes are to be lifted and handled with the aid of a "spreader" lifting beam. Special care shall be taken to ensure that no damages occur to pipes or coatings as a result of pipes sliding on or hitting adjacent pipes. The dragging or skidding of pipes and specials in contact with the ground shall not be permitted.

Whenever pipes are stacked, or otherwise stockpiled, or are transported, use shall be made of suitable resilient material as dunnage which shall not disintegrate or deteriorate when exposed to the elements for prolonged periods or under loads from adjacent pipes (See PSL 4.1.1 below). Pipes shall be stacked with a minimum clearance of 50 mm between adjacent pipe walls and a minimum of 75 mm clear of the ground.

The ends of the pipes should be kept covered by suitable end pieces to prevent damage through the intrusion of foreign matter. Level, cleared ground, free of vegetation should be chosen for the stacking site.

Fire breaks are essential, and pipes must be protected from damage by vandals or animals"

Add the following sub-clauses:

"PSL 4.1.1 Stacking and Storage of HDPE Pipes

All pipes shall be delivered in 9m or 12 m lengths.

Pipes of different PN designations shall not be transported or stacked together. Stacks shall be kept separate and carefully marked.

PE pipes must be evenly supported in order to prevent distortion. All bearing surfaces must be free from contact with sharp objects. Any projecting sections such as stub flanges must be supported to prevent damage.

The pipes shall be stacked in uniform stacks, as described below:

The area for stacking of pipes shall provide a suitably regular surface onto which to place the pipes.

Care should be taken to ensure that, prior to commencement of stacking, the area is free of rocks and other debris that may cause damage to the pipes.

Pipes shall be stored on timber planks (dunnage) of minimum dimension 75mm x 75mm placed directly on the prepared surface at a maximum 1.5m centers. The planks shall be of sufficient length that, once the pipe or multiples of pipes are chocked, the plank extends to at least 100mm beyond the outside edge of the outside chock. Every pipe shall be chocked, regardless of whether it is constrained by pipes on either side and pipes shall be chocked such that a gap of at least 50mm is maintained between

pipes. All chocks are to be secured (screwed/nailed) to the spacer plank to ensure that they cannot be moved/removed.

Pipes shall not be stored more than 3 (three) high and all the requirements for stacking and chocking between layers of pipes shall be as set out above.

Add the following sub-clause:

PSL 4.1.2 Stacking of Ductile Iron Pipes

The pipes shall be stacked in uniform stacks, sockets at the same end, as described below:

Bottom Layer: The bottom layer shall be laid on 2 timbers, arranged in parallel; one timber being 1m from the socket end and the other 1m from the spigot end. The pipes shall be laid parallel with one another. The sockets touch and shall not be in contact with the ground.

The pipes at the two ends shall be secured at the socket and spigot with large wooden wedges nailed to the timbers. The intermediate pipes shall be secured at the spigot end only, using smaller wedges.

Upper Layers: Each tier consists of parallel pipes laid in line vertically. Each tier is separated by timbers slightly thicker than the difference in diameter (socket – barrel).

Fittings and accessories shall be packed in robust timber crates and secured in position to prevent chaffing in transit.

The contractor shall supply all necessary timber dunnage/crating necessary to stack the pipes in accordance with the above specification. Timber dunnage shall be sufficiently robust to prevent crushing or breaking and shall be of sufficient size to prevent contact with the ground.

Add the following sub-clause:

PSL 4.4 Packing

Goods should be suitably packed in such manner as will 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 5 CONSTRUCTION

PSL 5.1 Laying

PSL 5.1.1 General

Add to the Sub-Clause:

"The Contractor will 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.

The Contractor is to allow for any and all costs in regard to the storing of pipes in his tendered rates for supply and delivery in the case of pipes supplied by the Contractor or the rates for collect from storage and transport to site in the case of free issue pipes should he require secondary storage of the free issue pipes.

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 will 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 offloading 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."

Add the following new subclause:

PSL 5.1.2 Damage

Add the following:

"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 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 the following:

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 pro-actively prevented. The ends of all laid pipes must be closed at all times when work is not being carried out.

Add the following sub-clauses:

"PSL 5.1.3.1 Cleaning Pipe Internals

The Contractor shall ensure that all pipe work installed is free from any internal contaminants. All traces of dirty water, slag, splatter, swarf, cuttings, coupons, welding rod ends, grinding dust, dirt and other debris are to be removed from the inside of the pipe as it is installed.

The relevant safety procedures are to 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 will 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 is to 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 by the Engineer. 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

Add the following:

"Water mains shall be so laid in road verges that the minimum cover from the finished surface level to the top of the pipe barrel is 800 mm. Under carriageways, water mains shall be laid horizontally and so that the minimum cover is 1 000 mm, the change to the cover under the carriageway from the verge being affected as specified in Subclause 5.1.4.2 of SABS 1200 L. Bulk supply mains shall be laid so that the minimum cover, in all situations, is 1 000mm."

Add the following new subclauses:

PSL 5.1.5 Working Inside Pipes and Protection of Internal Lining

All possible care shall be exercised during construction in order to avoid damage being inflicted to the pipe lining as a result of the installation and welding activities, and the following procedures shall always be adopted:

- Placing of rubber protection mats in the pipeline to ensure that no damage occurs as a result of foot traffic, falling tools and equipment, weld splatter and or grinding spray.
- On steep slopes, the mat is to be restrained from sliding down the pipe.
- Labourers working inside the pipe are to wear soft soled shoes.
- Wet sacking or rubber matting shall be placed on the pipe invert in the areas where welding or flame cutting operations are in progress to minimise the extent of damage to the lining from weld splatter or molten metal from flame cutting. This requirement shall be strictly enforced.
- Tools shall be placed on rubber foam or resilient rubber matting to protect the pipe lining against mechanical damage. Care must also be taken on steep slopes to restrain equipment and hand tools from sliding down the pipe during construction.
- Particular care is to be taken inside the pipe when tie-ins into the pipe are done for the purpose of fitting air valves, scour valves, by passes and other tie-ins.

Once internal work in a specific pipe sections has been completed and the pipe has been successfully cleaned, holiday detected and approved as being constructed to the satisfaction of the Engineer, the Contractor shall block off that section of pipe to prevent any further man entry into same.

The rates tendered in the Bills of Quantities shall include for all the measures required under this clause.

Detection of holidays in the internal epoxy lining will only commence once all internal activities in the pipe line have been completed. That is welding of joints, preparation of joints for epoxy reinstatement, as well as epoxy reinstatement in terms of the requirements of this specification. This excludes repair of epoxy lining as a result of damage incurred before the pipe is transported to the construction site as these defects will be repaired in the pipe yard.

Once all work is complete in a particular length of pipe, the Contractor shall arrange for the pipe to be thoroughly swept of all dust and debris. The pipe lining and joint repair will then be tested with a "wet sponge" detector set at 90 Volts in order to detect any electrical insulation defects."

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 will 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 is to 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 call for the use of cameras or any other means to inspect inaccessible areas; all at the Contractor's expense.

PSL 5.1.6 Equipment for Inspecting Internal Surfaces of Pipes

The Contractor shall make the following equipment available for use by the Engineer for the inspection of the internal surfaces of pipes DN 700 and larger:

- One pair of boots having leather uppers and rubber soles
- One one-piece overall with at least one breast pocket
- One adjustable safety harness
- Two screw drivers, 5 cm and 10 cm long
- One small peen hammer
- A two-cell torch with a 10W light bulb with two sets of rechargeable batteries and a battery charger and spare bulbs
- A sufficient length of 16 mm diameter rope to suit the conditions on site.
- One trolley suitable for inspecting pipes of the appropriate diameter(s).

The equipment shall be kept in good condition and operating order throughout the duration of the Contract. No separate payment will be made for this equipment and the costs therefore will be deemed to be included in the tendered rates.

PSL 5.1.7 Pipe Support

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 5.1.8 End Caps

The Contractor shall, at the end of each day's 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 shall 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 pipe shall be deemed to include for the supply, fitment, and maintenance of the end caps."

PSL 5.2 Jointing Methods

PSL 5.2.2 Flanges (Steel Pipelines)

In the heading delete "(Steel Pipelines)"

Add the following:

"Before being brought together, the ends of the pipes, fittings, couplings and flanges are to 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 an approved full faced jointing material (compressed fibre cement or other approved gaskets on flanged joints), cut properly to size, is to be inserted immediately before bringing the two flanges together. Before closing the joints, the flanges must 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.

Only full-face gaskets are to be used, the jointing material shall be flush with, or protrude beyond, the outer circumference of the flange (this is not applicable to raised face flanges). 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)*

Delete the title and replace with "Welding (Steel Pipelines and Specials)".

Delete the 1st sentence and replace with:

Field and shop welding of steel pipes, bends and fittings shall be carried out in accordance with the relevant requirements of the latest version of API 1104. Prior to commencement of welding, the Contractor shall produce a qualified welding procedure in accordance with the latest version of API 1104, for the intended sizes, processes, positions, and consumables to be used on the project.

Welding shall be carried out by welders who are competent in terms of the procedure approval test given in API 1104. Prior to commencement of welding, the current qualification of each welder must be produced in accordance with the welding procedure. Should constant repairs be required on welds carried out by one particular welder, the Engineer may require that the welder be re-tested or removed from the project."

Add the following Subclauses:

PSL 5.2.3.1 Radiographic Examination of Welds

The Contractor shall include in his tendered rates for supply (if appropriate), handle, lay and bed of all pipes, bends, fittings and other specials for the cost of carrying out, under the supervision of an inspector appointed by the Engineer or Employer, examination of shop and field welds on the following basis:

a) Field Welds:

All welds will be tested and adjudicated in accordance with API 1104. Radiographic testing is to be carried out on 100% of the welds.

Repairs of welds will be permitted in accordance with approved repair procedures. Repairs shall be re-examined using the relevant non-destructive testing method. All costs associated with the repair of defective welds will be borne by the Contractor.

b) Fabrication of Bends, Fittings and Specials

- i) ONE HUNDRED percent radiographic examination of all weld deposited manually or semi-automatically in bends, fittings and specials which cannot be hydraulically tested because they have a plain end.
- ii) FIFTY percent radiographic examination of all welds deposited manually or semi-automatically in all flanged bends, fittings, and specials which are to be tested hydraulically.

c) On-Site Fabrication of Bends, Fittings and Specials

ONE HUNDRED PERCENT radiographic examination of all weld deposited manually or semi-automatically in bends, fittings and specials.

The Engineer will, in all cases, determine which welds are to be radiographed on the quantity basis specified above. All radiographs and records thereof shall be made available to the Engineer to enable him to determine whether the welds are acceptable or not and no lining or wrapping of pipes, bends or fittings shall be permitted until the welds have been accepted by the Engineer. To avoid any unnecessary delays, at the option of the fabricator, radiographs may be approved by the manufacturer's inspectors subject to them being subsequently submitted to, and approved by the Engineer.

When a section of the weld is shown by radiography to be unacceptable and, if the limits of the deficient weld are not defined by the radiograph, additional radiography shall be carried out at the Contractor's expense until the limits of the deficiency are determined.

In the event of any welded joint proving unsatisfactory when the pipeline is subjected to radiographic tests, the Contractor shall be held responsible for all costs involved in repairing the joint or cutting it out and welding a new section of pipe, as may be ordered by the Engineer, and thereafter restoring the lining and wrapping, if these have become damaged, all to the satisfaction of the Engineer.

All repair welds shall be identified with a stamp marking, indicating which welder conducted the repair. Repaired welds shall be tested at the Contractor's expense.

After jointing and testing, the protective lining and wrappings are to be rendered continuous with the same materials as applied to the body of the pipe. Holiday detection tests shall be carried out in the field to ensure continuity of lining and wrapping

The tendered prices for supplying (when appropriate), transporting, laying, jointing and testing of pipes are to include for all the work described above and for the supply of all necessary materials, including welding, all necessary plant and labour.

d) Production Testing of Welds (Not applicable to pipes supplied by the Employer)

The Contractor shall also include in his prices for the supply of pipes the cost of carrying out at the factory, non-destructive tests of shop production welds (additional to the qualification tests for welding procedure) on the following basis:-

One pipe from each one hundred pipes produced shall be selected at random and specimens for two guided cold bend tests and one transverse tensile test shall be cut therefrom and tested in accordance with SABS 719:1971, Section 7.

In the case of the guided cold bend tests, where welding is carried from one side only, bend - specimens shall be tested with the rest of the bend in tension; where welded from both sides the specimens shall be tested with the inner and outer welds in tension alternately.

Tensile tests shall be carried out as for the qualification tests.

The pipes from which successfully tested specimens have been taken shall be trimmed to the maximum possible length and shall be accepted by the Employer for payment purposes as full standard pipe lengths.

In the event of the welds of any pipe failing to reach the standard of acceptance, such pipe shall be rejected. Two further plate coupons shall be prepared from different pipes, selected at random by the Engineer, for each specimen that has failed to reach the required standard. In the event of such additional tests proving to be satisfactory repairs to the pipe originally failing any test will be permitted by the Engineer and such repairs and subsequent re-test shall be at the Contractor's expense. In the event of the additional tests also failing to reach the required standard the Engineer shall have the right to reject the entire batch of pipes from which the coupon plates were cut.

PSL 5.2.3.2 Welding Procedure

Welding shall, unless otherwise prescribed in the approved welding procedure, commence at the top of the joint and proceed downwards. In addition to the root weld, at least two further passes shall be made, none of which is to exceed 3 mm in depth but this is subject to the approved welding procedure.

PSL 5.2.3.3 Aligning

The alignment of abutting ends shall be such that the offset does not exceed 1,5 mm. Line-up clamps ("dogs") shall not be used for the "fit-ups". The use of "bridges and wedges" or any other method that may reduce the pipe wall thickness when removed or in any way introduce unnecessary stresses into the pipe is forbidden.

PSL 5.2.3.4 Weather Conditions

Welding shall not be performed under conditions that could affect the quality of the welded joint (e.g. high moisture or windy conditions). Windshields may be used where practical.

PSL 5.2.3.5 Clearance

The minimum clearance around the pipe during welding shall be 500 mm or such other minimum distance that may be required to facilitate compliance with the approved welding procedure. When welding in the trench, adequately sized "fox holes" shall be excavated/formed so as to provide adequate access for the welders. The cost of which is to be included in the submitted rates for excavation of trenches

PSL 5.2.3.6 Visual Inspection

ONE HUNDRED percent of each joint will be examined and the following criteria shall be met:

All welds shall be substantially uniform in appearance with the inner and outer weld beads not exceeding 1 mm and 3 mm in height respectively unless otherwise required in terms of the approved welding procedure.

Undercut will not be permitted under any circumstances.

The weld, heat affected zone, and surrounding parent metal shall be free from cracks, porosity and trapped slag.

All weld splatter must be removed prior to corrosion protection application.

PSL 5.2.3.6 Non-Destructive Testing After Construction

The Employer's Cathodic Protection Professional Services Provider will carry out coating integrity surveys along the full length of the pipeline as prescribed in the Employer's Cathodic Protection Specification.

Any defect(s) found in the pipeline coating, as a result of the PCM or DCVG testing shall be located and repaired by the Contractor at his expense.

In the case of PCM testing, all coating defects identified with an area greater than 0,5 square centimetre per 12 metre length of pipeline shall be located and repaired.

In the case of DCVG surveys, all coating defects identified with a value greater than 3% IR (or such other value as may be determined and agreed following analyses of the results of the first section which undergoes DCVG testing) shall be located and repaired. The agreement between the Contractor and the Engineer on this baseline, will be set as the criteria for the coating repair requirements by the Contractor on the whole pipeline.

Depending on the extent of the defects identified during PCM or DCVG testing, the Engineer may call

for a further survey after the initial defects have been repaired by the Contractor, the cost of which testing shall then be borne by the Contractor.

PSL 5.2.3.7 Quality Control

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."

Add the following new subclauses:

"PSL 5.2.5 Polyethylene (PE) Pipes and Fittings

PSL 5.2.5.1 Unreinforced PE pipes

Unless otherwise specified, any of the following may be used to joint pipes together:

- a) Mechanical joint compression fittings that comply with the requirements of SANS 14236
- b) Suitable push-fit fittings recommended by the pipe manufacturer
- c) Heated-tool socket weld or electrofusion fittings that comply with the requirements of SANS 4427-3
- d) Butt fusion as per SANS 10268
- e) Ductile iron fittings that comply with the requirements of SANS 52824;
- f) Mechanical jointing systems that comply with the requirements of SANS 4427-3. Note that the use of standard stub ends for PE pipes shall not be permitted. (PSL 3.8.3)

PSL 5.2.5.3 PE Pipe Welding Requirements

PSL 5.2.5.3.1 Applicable Standards

All pipes, fittings, welding processes and equipment are to comply with the relevant standards:

- SANS 10270 - Welding of Thermoplastics – Approval of welding Procedures and Welds
- SANS 10268-1 – Welding of Thermoplastics – Part 1: Heated Tool welding
- SANS 10268-2 – Welding of Thermoplastics – Part 2: Electrofusion welding
- SANS 10268-10 – Welding of Thermoplastics – Part 10: Weld defects
- SANS 10269 – Welding of Thermoplastics – Testing and approval of welders
- SANS 1671-1 – Welding of Thermoplastics – Machines and equipment – Part 1: Heated Tool Welding
- SANS 1671-2 – Welding of Thermoplastics – Machines and equipment – Part 2: Electrofusion Welding
- SANS 6269 – Welding of Thermoplastics – Test Methods for Welded Joints

PSL 5.2.5.3.2 General Welding Requirements

Welding must take place in a dry and protect site. Suitable measures must be taken to protect the welding operation from adverse ambient conditions (rain, high humidity, wind). Ambient temperature must be recorded for each weld. . The welding machine and the supports of the pipes must be erected so that they cannot move in any direction during welding.

The contractor must apply for approval of welding procedures and welds in accordance with SANS 10270. The Welding Procedure Specification Qualification Report must be signed by the inspector with one copy handed to the Engineer. The Qualification file as described in Clause 9 of SANS 10270 must be handed to the client prior to commencement of any production / construction site welding activities.

Welding is to be carried out only by welders certified by the National approved training body (Thermoplastics Joining Committee – National Panel of Examiners). The

operator's current and valid welding certificate must be presented to the Engineer before any welding commences.

PSL 5.2.5.3.3 Butt Fusion Welding

Butt Fusion Welding may only be used to join pipes of the same SDR (Standard Dimension Ratio).

Only automated, approved, and calibrated welding machinery will be permitted. A calibration certificate must be presented to the Engineer before any welding commences. Every welding machine shall be marked in accordance with Clause 4.7 of SANS 1671-1, with the following items:

- a) The manufacturer's name
- b) Type of welding machine
- c) Manufacture date
- d) Serial number of machine
- e) Safety information for the operation of the machinery

The welding machinery shall allow for control and adjustment of the various welding parameters in accordance with Clause 4.5 of SANS 1671-1.

Instructions for the safe and correct operation, maintenance, servicing and calibration of the welding machinery must be supplied and shall include, as a minimum, the items a) to e) in Clause 4.8. of SANS 1671-1.

Process reports for each weld with the information listed in items a) to m) of Clause 4.5.4.1 of SANS 1671-1 must be compiled and handed to the Engineer prior to commencement of any welding activities.

Heated tools shall comply with Clause 5.4 and the specific requirements of Clause 6 in SANS 1671-1. Surface coatings for heated tools are permitted to allow for easy cleaning with the exception of PTFE spray and galvanic coatings containing copper and cuprous material. The requirements of Clause 5.4.3 in SANS 1671-1 shall be adhered to should PTFE be used as a surface coating. The heating plate shall be cleaned with an appropriate non-oil based cleaning solvent using the method described in Clause 5.1 of SANS 10268-1.

Pipe joint ends shall be prepared using the method described in Clause 5.2 of SANS 10268-1. This includes proper alignment of the joint (maximum offset limited to 10% of pipe wall thickness), machine facing to ensure a smooth joint end and cleaning with an appropriate solvent such as isopropyl alcohol. All measures shall be taken to prevent contamination of the joint surface by grease, dirt and dust.

The Butt Welding jointing process shall comply with Clause 5.4 of SANS 10268-1. Should the pipe manufacturer's specification and instruction differ from Clause 5.4, the manufacturer's instructions shall apply.

PSL 5.2.5.3.4 Electrofusion Welding

Electrofusion welding may be used to join pipes of different SDR. Only automated, approved, and calibrated welding machinery is permitted. A calibration certificate shall be presented to the Engineer before any welding activities commence.

Only bar coded fittings and Electrofusion Control Units shall be used. The computerised

printouts of the weld parameters and information for each weld shall be compiled and handed to the Engineer upon his/her request. Every welding machine shall be marked in accordance with Clause 8 of SANS 1671-2, with the following items:

- a) Manufacturers name
- b) Serial number of machine
- c) Type of machine
- d) Input and outlet volatages
- e) Frequency
- f) Insulation protection class (to SANS 60529) and
- g) Duty cycle

Instructions for the safe and correct operation, maintenance, servicing and calibration of the welding machinery must be supplied and shall include, as a minimum, the items a) to e) in Clause 9 of SANS 1671-2.

Joint surfaces must be prepared in accordance with Clause 6.1 of SANS 10268-2. The pipe must be cut square and all oxidation shall be removed using a purpose made reaming/scraping tool, suitable for the outside diameter of the pipe to be reamed, immediately before welding. The external surfaces of the pipes to be joined and the inside surface of the electrofusion coupling shall be wiped clean with a suitable solvent such as isopropyl alcohol as described in Clause 6.1.4.2 of SANS 10268-2.

The manufacturer's instructions for the electrofusion welding process must be strictly adhered to and only approved, certified and calibrated machinery may be used. Welding is to be carried out only by welders certified under the Thermoplastics Welding Institute of South Africa (TWISA) or the Plastics Federation of South Africa.

The Electrofusion welding jointing process must comply with Clause 6.3 of SANS 10268-2. Should the pipe manufacturer's specification and instruction differ from Clause 6.3, the manufacturer's instructions shall apply. All completed welds will be visually inspected and will be recorded on an appropriate weld defects check sheet in accordance with SANS 10268-10. Weld assessment Class III will be applicable

PSL 5.2.5.3.5 Fittings

(a) Tees and Bends

Injection moulded fittings shall be used wherever possible. Where factory fabricated fittings are to be used for tees and bends their pressure class shall be de-rated in accordance with the appropriate standard. Injection moulded fittings are deemed to be fully rated and need not be de-rated as in the case of fabricated fittings.

(b) Saddles

Only electrofusion type saddles are permitted. Electrofusion saddles shall comply with ISO 4427 – 3 and ISO 4427 – 5.

(c) Compression Fittings

Compression fittings may be used to join pipes with diameter size smaller than DN 100. Compression fittings shall comply with SABS 533 and shall conform to ISO 4427.

(d) Mechanical Couplings

Mechanical couplings must be of the tension resisting type to counter the shortening of

the pipe and resultant induced longitudinal stresses when pressurised due to Poisson effect and thermal contraction. External restraints must be provided for anchorage of the pipes to be joined, and specialist suppliers of pipes and fittings should be consulted for suitable jointing solutions.

The use of flexible couplings ("V.J couplings") is expressly prohibited under all conditions and circumstances.

(e) Flanged Connections

Flanged connections comprised of butt welded HDPE stub flanges and steel backing rings which are bolted to other flanges. The body of the PE fitting must be manufactured in the injection moulding Process or from a piece of homogeneous Semi-finished material. **Semi-Finished Materials Manufactured From Wound Rods Or The Subsequent Application Of Other Forms Of Reinforcing Are Not Permitted.** Bolts are to be numbered and tightened in a cross pattern sequence. Bolt torque must be as per the guidelines of the supplier of the stubs. Bolts are to be re-torqued 24 to 48 hours after initial tightening in accordance with the manufacturer's specification to counteract reduced tension in the tie bolts resulting from visco-elastic relaxation of the HDPE material under stress thus maintaining sealing pressures and ensuring leak free joints. Gaskets are not required provided that the mating faces of the HDPE stub flanges have not been damaged.

PSL 5.2.5.4 Steel-mesh-reinforced Polyethylene (PE) pipes

Steel-mesh-reinforced PE pipes shall be joined by means of either electrofusion couplings or flanged fittings that comply with the requirements of SANS 371.

PSL 5.2.6 Cut pipes

Cut pipes may be used where required as closure lengths. The cut ends shall be dressed square and to a smooth even finish which shall not be inferior to that of the ends of uncut pipes. The finished dimensions of ends cut on site must be within the tolerances applicable to the ends of the particular types of pipes to be laid. The cost of cutting and trimming pipes shall be included in the rates tendered for laying and jointing pipes."

PSL 5.3 Setting Valves, Specials and Fittings

Add the following to the Subclause:

"Valves are to be set correctly in the positions indicated and supported on concrete stools, 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 5.10 Disinfection of Potable Water Pipelines

Delete the clause and replace with:

"The entire pipeline disinfection will be monitored by the Engineer's Representative and/or the Employer's personnel. The disinfection criteria are stringent and the Contractor shall keep the pipeline clean throughout the Contract.

The Contractor will be required to submit a detailed method statement for approval by the Engineer. A minimum requirement will be that the method statement deals with the method of dosing and how the dosing rate will be controlled to ensure a uniform distribution throughout the pipeline being disinfected, the chemicals to be used, the anticipated range of dosing rates and equipment to be used, and the

name and qualification the Contractor's person supervising the disinfection.

Once a successful hydraulic test of the entire pipeline has been achieved and the connections have been completed, the pipeline shall be drained. The pipeline shall then be re-charged in accordance with PSL 7.3.4 – “Initial Filling of the Pipeline”. Whilst being charged, a sodium hypochlorite solution shall be dosed at a temporary connection(s) made at an air valve(s), which will be confirmed by the Engineer in order to achieve a theoretical total chlorine concentration of 25 ppm (mg/l).

Once the entire pipeline has been filled in this manner, it shall be left for a 24-hour period. Thereafter, total chlorine concentrations shall be measured at each scour point. A concentration of 20ppm total chlorine will be considered acceptable. Should this concentration not be achieved at all scours, the Contractor shall take all steps considered necessary by the Engineer to achieve satisfactory disinfection, at his/her own cost.

Once satisfactory disinfection has been achieved, the pipeline shall be drained via the scour valves (or by other means approved by the Engineer) and sufficient sodium thiosulphate (typically 1 part of total chlorine) shall be dosed into the scour-wet wells to fully neutralise the chlorine before discharging to watercourse.

The pipeline shall then be re-charged in accordance with the stated procedure and, after 24 hours, samples shall be taken and sent to an approved laboratory for analysis (at no cost to the Employer). Should the following limits not be achieved, the Contractor shall carry out at his/her own cost, all steps deemed necessary by the Engineer to achieve satisfactory disinfection.

Water Quality Limits:

PARAMETER	COUNT
<i>e. coli</i>	0
Coliforms	0
Faecal Streptococci	0

The cost of the provision of water and all chemicals for disinfection shall be deemed to be included in the tendered rates”

Add the following new subclause:

“PSL 5.11 Pipeline Markers

Markers are to be erected 300 mm off the edge of the pipe trench to the left of the trench and at right angles to the trench centre line at all horizontal changes of direction and on both sides of all road and river crossings, at valve chambers and at intermediate intervals of 50m unless agreed with the Engineer.

At bends the marker will be erected at the P.I. point of these 300 mm offset lines.”

PSL 5.12 Cement Stabilising Bedding and Selected Fill around Pipes

Where shown on the drawings or directed by the Engineer, the bedding and selected material around the pipe shall be stabilized with 8% by mass of OPC. This is applicable to water course crossings, under trafficked areas and on steep slopes.

In all cases, the cement shall be added to the bedding / selected fill material outside the trench and in such a manner so as to achieve full dispersion of the cement in the material and achieve Optimum Moisture Content when placed and compacted around the pipe. Excess water content is to be avoided so as not to create a ‘concrete encasement’ of the pipe.

PSL 6 TOLERANCES

PSL 6.2 Control Points

Add the following:

“On completion of the contract, the Contractor shall provide the Engineer with a list of as built

coordinates (Accurate to 0.1 m) for all air valves, scour valves, isolation valves and standpipes. The cost of providing this information shall be deemed to be included in the rates tendered for the individual items."

PSL 7 TESTING

PSL 7.2.1 Dye-Penetrant Test

all fillet welds shall be subject to dye penetrant testing the cost of which shall be deemed to be included in the tendered rates for pipelaying.

PSL 7.2.2 Radiographic Examination

butt-welded joints and bell-end joints shall be radiographically tested in accordance with PSL 5.2.3.

PSL 7.3 Standard Hydraulic Pipe Test

Option 1: All measures required for obtaining, purchasing, tankering, pumping and/or piping the water for testing and disinfection of the pipeline shall be deemed to be included in the tendered rates for laying of the pipeline.

Option 2: Were possible, water used for one filling of the pipeline for hydraulic testing will be provided by the Employer free of charge. Additional water used due to unsuccessful hydraulic tests will be charged at the Employer's bulk rate per kilolitre that is charged to the employer by DWS. Filling of the pipeline for hydraulic testing shall be carried out slowly to enable air to escape and under the direction of the Engineer.

Where the Employer is unable to supply water for testing, an item to collect and convey water from a specified source shall be scheduled for payment.

PSL 7.3.1 Test Pressure and Time of Test

Add the following to the subclause:

"The sections in which the pipeline may be tested will be at the discretion of the Contractor, except that the pipeline shall be tested in sections not exceeding a maximum allowable length of 2 000 m unless otherwise agreed by the Engineer. The Contractor shall make due allowance in the construction program 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.

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. In the case of cement mortar lined pipes, 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 the contents of this subclause and replace with the following:

"Subject to the provisions of 7.3.1.3 and 7.3.1.4, the test pressure for field testing shall be 1.25 times the designated working pressure at any point on the longitudinal section of the pipeline up to a maximum of 1.0 MPa, above which it shall be the designated working pressure plus 0.5 MPa.

For the purposes of this calculation, the designated working pressure shall be taken as the pressure rating of the pipe.”

PSL 7.3.1.4 Delete the contents of this subclause and replace with the following:

The field test pressure shall not exceed the appropriate of the values in the following table.

Type of pipe	Applicable materials standard	Maximum field pressure at any point of the pipeline
Steel	SANS 62-1, SANS 62-2, SANS 719	50% of the hydraulic test pressure
Ductile iron	SANS 50545	Allowable site test pressure (PEA)
Reinforced concrete	SANS 676	75% of hydraulic test pressure
Prestressed concrete	SANS 975	75% of hydraulic test pressure
Fibre cement	SANS 1223	75% of hydraulic test pressure
GRP	SANS 1748-1	1.5 times the rated pressure class
Polyethylene (PE)	SANS 4427	1.5 times the rated pressure of the pipe
Steel-mesh-reinforced PE	SANS 370	1.5 times the rated pressure of the pipe
Polypropylene	SANS 15874-2 and SANS 15874-3	1.5 times the rated pressure of the pipe
uPVC	SANS 966-1	1.5 times the rated pressure of the pipe
mPVC	SANS 966-2 or SANS 1283	1.5 times the rated pressure of the pipe
oPVC	SANS 16422	1.5 times the rated pressure of the pipe

Add the following 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 will 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 Sub-Cause 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 must 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 the following subclauses:

PSL 7.5 Testing of Valves

All valves shall be pressure tested according to SABS 664 or other applicable code at the appropriate test pressure. Test certificates shall be issued to the Engineer upon delivery to site.

No separate payment shall be made for testing of valves and hydrants and the scheduled rates for the supply and installation of valves shall include for all costs in respect of testing.

PSL 7.6 Commissioning

The pipeline will 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

Add new Sub-clause:

On completion of each concrete chamber, and prior to completion of the backfilling around the chamber, a water tightness 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 7.8 Testing of PE pipes and materials

PSL 7.8.1 Raw Material Acceptance Tests:

The material used for the production of the pipes and fittings shall be a high density polyethylene PE 100 complying to SANS ISO 4427 Part 1. To ascertain the quality of this product the following tests shall be performed, prior to manufacture of the pipes or fittings.

- Density
- Melt Flow Index
- Carbon Black Content
- Thermal Stability

Copies of all test schedules and manufacturer's quality control records shall be available for examination by the Employer and/or the Engineer.

The following documents are required:

- Certificate of Registration – SANS ISO 9001:2008 or National Equivalent
- Permit Certification – SANS 4427 for PE 100
- the Quality Control Plan (QCP shall include Raw Material and Product Test Certificates)
- SABS or National Equivalent Quality Systems Audit Reports – Last 2 Audits

PSL 7.8.2 Testing of Pipes:

Testing as contained in the SANS 4427:1996/ ISO 4427:1996 specification Part 1 and

2 will be used as guidelines. Tests shall also be conducted ad-hoc by a registered and authorised testing authority.

PSL 7.8.3 Destructive Testing of Welds

The testing of welds shall comply with the requirements of SANS 6269 Edition 1.1.

The standard destructive tests described are as follows:

- Tensile test;
- Tensile-creep test; (not required unless specified normally for chemical high end applications only)
- Bend test; and
- Peel test for electrofusion joints only.

PSL 7.8.4 Non-Destructive Testing of Welds

The testing of welds by non-destructive testing will be conducted by the Engineer's Representative on site and before any production weld is made by the contractor on site. The following procedure shall be followed:

- The Contractor shall not undertake any welding without the presence of Engineer's Representative;
- The testing machinery shall be checked and approved by the Engineer's Representative before testing commences;

PSL 7.8.5 Field Pressure Testing Procedure for HDPE pipes

The method described below describes the procedure to be followed for field pressure testing of HDPE pipe:

- Fill the pipe with water
- Bleed off any trapped air
- Over a period no longer than 10 minutes, increase the pressure at a constant rate to the specified field test pressure (the Field Test Pressure Horizon is shown on the small scale long section drawing)
- Maintain the test pressure by continuous pumping for 10 minutes, then stop pumping
- Close the shut-off valve to the pipe and monitor the pressure for a period of 60 minutes. Inspect the pipe visually for leaks during this time.
- If the pressure has dropped more than 30% at the end of the 60 minute period, the pipe shall not have passed the pressure test. Continue to look for leaks and repair as necessary.
- If the pressure has dropped less than 30% at the end of the 60 minute period, rapidly decrease the pressure in the pipe by 2,0 bar (200 kPa) by releasing water from the pipe.
- Monitor the pressure for 60 minutes. If the pressure remains constant or increases during this time the pipe is deemed to have passed the pressure test.

If the pipeline does not pass the pressure test:

- Remove the test pressure
- Permit the test section to 'relax' for not less than 8 hours

- Repeat the above procedure.

PSL 8 MEASUREMENT AND PAYMENT

PSL 8.2 Scheduled Items

PSL 8.2.1 Supply, Lay and Bed Pipes Complete with Coupling.....Unit : m

Rename this subclause PSL 8.2.1 a) and add the following:

“A maximum payment of 80 % of the tendered rates will be made for a completed section of pipeline which has not yet been hydraulically pressure tested and disinfected. A further payment of 20% of the tendered rates will be made upon successful completion of the pressure testing and disinfection for the relevant section of pipeline.”

The rates tendered for the laying and bedding of pipes, bends, fittings, and valves, shall be deemed to include the costs associated with the field pressure testing and disinfection of the pipeline.

Pipelines will be measured by length over all lengths as laid. No deduction will be made for specials and valves. Separate items will be scheduled for each diameter and each type and class of pipe laid.”

Add the following subclause:

PSL 8.2.1 b) Collect from Designated Pipe Yard/s, Transport, Lay and Bed Pipes Complete with Coupling..... Unit : m

Pipelines will be measured by length over all lengths as laid. No deduction will be made for specials and valves. Separate items will be scheduled for each diameter and each type and class of pipe laid.

The rates shall cover the cost of the collection of the pipes from pipe yard, transportation to the site of the works, offloading and placing/stringing to suit the contractor's laying methods, handling, inspecting, bedding, laying, jointing, cutting, testing and, when relevant, disinfecting the pipes and the joints.

A maximum payment of 80 % of the tendered rates will be made for a completed section of pipeline which has not yet been hydraulically pressure tested and disinfected. A further payment of 20% of the tendered rates will be made upon successful completion of the pressure testing and disinfection for the relevant section of pipeline.”

PSL 8.2.2 Extra-over 8.2.1 a) and 8.2.1 b) for the Supplying, Laying and Bedding of Specials Complete with Couplings.

Add the following:

“A maximum payment of 80 % of the tendered rates will be made for a special once installed in the pipeline which has not yet been hydraulically pressure tested and disinfected. A further payment of 20% of the tendered rates will be made upon successful completion of the pressure testing and disinfection for the relevant special.

The rates for the supply and installing of valves and specials shall cover the cost of any cutting, trimming, and jointing of pipes required for the installation of valves, bends and fittings in the positions shown on the drawings. Unless specific provision is made in the Bills of Quantities, no separate payment will be made for forming of any additional joints and/or for the supply of additional jointing materials which may be required for the connection of cut pipes.

The rates tendered for the laying and bedding of pipes, bends, fittings, and valves, shall be deemed to include the costs associated with the field pressure testing and disinfection”.

PSL 8.2.3 Extra-over 8.2.1 a) and 8.2.1 b) for the Supply, Fixing and Bedding of Valves

Add the following:

"A maximum payment of 80 % of the tendered rates will be made for a valve once installed in the pipeline which has not yet been hydraulically pressure tested and disinfected. A further payment of 20% of the tendered rates will be made upon successful completion of the pressure testing and disinfection for the relevant special.

The rates for the supply and installing of valves and specials shall cover the cost of any cutting, trimming, and jointing of pipes required for the installation of valves, bends and fittings in the positions shown on the drawings. Unless specific provision is made in the Bills of Quantities, no separate payment will be made for forming of any additional joints and/or for the supply of additional jointing materials which may be required for the connection of cut pipes.

The rates tendered for the laying and bedding of pipes, bends, fittings, and valves, shall be deemed to include the costs associated with the field pressure testing and disinfection".

PSL 8.2.15 Special Wrapping in Corrosive Soil

Change the heading of this subclause as follows:

PSL 8.2.15 Additional corrosion protection of Pipes, Specials, Joints, Valves and Fittings

a) Additional Corrosion Protection of Flanges and Flexible Adaptor/Anchoring Joints ...Unit: No.

Separate items will be scheduled for flanges, flexible joints and adaptor/anchoring joints of each diameter and type. The unit of measurement shall be the number (No) of paired flanges/joints protected as specified in the specifications. The rate will include for all materials, manufacturing, delivery, painting, wrapping and erection of each unit.

b) Additional Corrosion Protection of Buried Valves, and specialsUnit: No or m

Separate items will be scheduled for valves, flexible and flanged joints and pipes of each diameter and type. The unit of measurement shall be the number (No) of buried paired couplings, joints, flanges or valves as specified or the length of pipe as specified. The rate will include for all materials, manufacturing, delivery, painting and erection of each unit.

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."

c) Additional Corrosion protection of Cast-in Pipes and Fittings.....Unit: No or m²

If separate items are scheduled, for each diameter of cast in pipe and fittings to be wrapped, the unit of measurement shall be No. of completed wrappings inclusive of the encasement length. The rate will include for all materials, manufacturing, delivery, painting and erection of each unit.

d) Additional Corrosion protection of Permanently Exposed Pipes and Fittings....Unit: m or m²

If separate items are scheduled for each diameter of exposed pipe (above and below ground) to be protected, the unit of measurement shall be in meters for the length of exposure. If not the unit of measurement will be square metres of completed wrapping and/or painting as specified.

Add the following new payment items:

PSL 8.2.16 : Pipeline Markers..... Unit : No

The unit of measurement will be the number of markers erected and accepted by the Engineer and the rate will include for all materials, manufacturing, delivery, painting and erection of each unit.

PSL 8.2.17 : Valve Markers..... Unit : No.

The unit of measurement will be the number of markers erected and accepted by the Engineer and the rate will include for all materials, manufacturing, delivery, painting and erection of each unit.”

PSL 8.2.18 Cutting into and Connecting to Existing PipelineUnit : Sum

Cutting into and connecting to existing pipeline

The rate for cutting into and connecting to existing pipelines shall cover the cost of liaison with the Employer’s Operators, isolating and draining the existing pipeline, cleaning and preparing the pipe for cutting, cutting, 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 8.2.19 Cement Stabilising Bedding and Selected Fill around Pipes.....Unit : m³

An item, extra-over laying and bedding pipes, will be measured for payment for cement stabilising the bedding and selected fill around the pipes where directed by the Engineer. Separate items will be scheduled for stabilising on steep slopes and for stabilizing at watercourse crossings.

The tendered rates shall cover all additional costs associated with supplying the cement at the percentage specified and mixing it in and achieving Optimum Moisture Content for compaction around the pipe.

“PSL 8.2.20 Mitre Cut Joints..... Unit: No.

Mitre cuts (two piece bends) up to 15° in steel pipelines may be carried out in the field only if ordered/permited by the Engineer.

The rate 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 making good the internal linings and external coatings on the welded joints.

PSL 8.2.21 Cutting Pipes

- a) Extra over for forming scarf joint.....Unit: No.**
- b) Extra over 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 will however be made for cutting pipes to suit the installation of bends, fittings, and valves that are shown on the drawings.

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 making good the internal linings and external coatings on the welded joints.

PSL 8.2.22 Repair of FBMDPE Coatings Defects

- a) Repair defect smaller than 650mm² (Small Areas).....Unit: No**

Repair defects in FBMDPE coatings of size smaller than 651 mm² according to PSL 3.9.3.1 & PSL 3.9.3.12

- b) Repair defect larger than 650mm² (Large Areas)..... Unit: No**

Repair defects in FBMDPE coatings of size between 651 mm² and 1000 mm² according to PSL 3.9.3.1 & PSL 3.9.3.11

c) Repair defect larger than 1000mm² (Very Large Areas)..... Unit: m²

Repair defects in FBMDPE coatings of size between 651 mm² and 1000 mm² according to PSL 3.9.3.1 & PSL 3.9.3.11

PSL 8.2.23 Repair of 3 Layer PE Coatings Defects..... Unit: m²

Repair defects in 3 Layer Polyethylene coatings according to PSL 3.9.3.1 & PSL 3.9.3.13

PSL 8.2.24 Repair of Cement Mortar Lining Defects..... Unit: m²

Repair defects in CML lining according to PSL 3.9.3.1 & PSL 3.9.3.10

PSL 8.2.25 Repair of Damage due to Thermic Welding..... Unit: No

Repair defects in pipe coating and lining arising from thermic welding for continuity bonding according to PSL 3.9.3.14

psLB BEDDING (PIPES) (SABS 1200 LB)

PSLB 2.3 DEFINITIONS

Main fill:

Delete "150 mm" in second line and substitute "300 mm".

PSLB 3 MATERIALS

PSLB 3.1 Selected Granular Material

(For bedding material for steel pipes see PSLB 3.3 below)

In the second line delete "19 mm" and substitute "10 mm".

Add to the Sub-Clause:

The maximum compactibility factor shall be 0,4.

PSLB 3.2 Selected Fill Material

Not required. All material up to the underside of backfill shall be measured as selected granular. (for bedding material for steel, GRP and PVC pipes see PSLB 3.3)

PSLB 3.3 Bedding

All pipes except concrete stormwater pipes laid under this Contract will be considered as being flexible pipes. Bedding (selected granular and selected fill material) for steel, GRP, PVC, large-bore HDPE (>DN200) and concrete stormwater pipes along roads shall be (for the Mthatha area) G7 granular decomposed dolerite (known locally as "Sugar Dolerite" or "Sibunga"), carefully selected, with maximum particle size of 5 mm and which shall not cake nor form lumps when drying. Samples of bedding 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 the approved material as selected granular 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 welding, and no extra payment will be made for forming or filling the joint holes (pockets) with padding sand.

All bedding 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.

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 bedding material at all times.

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.

No extra payment will be made for forming or filling joint holes (pockets).

Bedding for small-bore HDPE pipes (water reticulation) and concrete stormwater pipes traversing open ground areas (ie *not* along roads or under platforms) shall be material selected from local excavations or stockpiles.

PSLB 3.4 Selection

PSLB 3.4.1 Suitable Material Available from Trench Excavation

Delete the Sub-Clause and substitute the following:

The excavation of a pipe trench shall comply with the requirements of Sub-Clause 5.4 of SABS 1200 DB and the provisions of Sub-Clause 3.7 of SABS 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 Sub-Clause PSLB 8.1.2).

PSLB 5 CONSTRUCTION

PLSB 5.1 GENERAL

PSLB 5.1.4 Compacting

Delete the second line and substitute: top of the pipeline) shall be 93% mod AASHTO.

Add to Sub-Clause 5.1.4:

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, Tenderers 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 will 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.

PSLB 5.1.5 Testing

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 5.2.5 Stone Bedding

In areas where waterlogged conditions exist or where ordered by the Engineer, special drains consisting of a 150 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 will be measured in cubic metres at the contract rate applying to unsuitable excavation below the bottom of the trench. The stone filling will be paid for per cubic metre and the geofabric filter will be paid for per square metre. All measurements in this connection will be to a width equal to the base widths and depths ordered.

PSLB 5.3 Placing and Compacting Flexible Pipes

PSLB 5.3 (a) Bedding Cradle

Delete the sub-clause and substitute 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 150 mm thick 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 (fox) holes shall be filled with bedding material.

PSLB 5.3 (b) Selected Fill Blanket

Delete "200 mm" from title.

PSLB 6 TOLERANCES

PSLB 6.1 Moisture Content and Density

Add to the Sub-Clause:

The permissible deviations applicable are to be those for Degree of Accuracy II class of work.

PSLB 8 MEASUREMENT AND PAYMENT

PSLB 8.1.3 Volume of Bedding Materials

Add the following:

The volume of bedding materials will be computed from dimensions shown on the drawings. The volume occupied by the pipe (measured to the outer diameter) shall be excluded from the bedding volume and will not be measured. No additional payment will be made for bedding material placed in bell (fox) holes

PSLB 8.2.3 Concrete Bedding Cradle

Add the following paragraph to the Sub-Clause:

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 substitute the following:

encasing the pipe in concrete 150mm thick each side of the pipe and to 150mm 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.

The rate for concrete encasing shall include for the supply, installation and stripping of all formwork.

PSLB 8.2.6 Drainage Layer (New Sub-Clause)

Add the new sub-clause:

Supply and place beneath pipe, 150mm crushed stone layer as ground water drainage layer. The excavation for these drains will 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).

PSLB 8.2.6 a) 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 orderedUnit : m³

PSLB 8.2.6 b) 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.....Unit : m²

psLC CABLE DUCTS (SABS 1200 LC)

PSLC 3 MATERIALS

Add the following clause

PSLC 3.5 Classes of Excavation

"For this contract, the classes of excavation will be subdivided as follows:

(a) Labour Intensive Excavation

(i) Soft Excavation

Soft excavation shall be that excavation in material, which in the opinion of the Engineer, can be efficiently excavated and loaded by means of hand-held tools excluding pneumatic or hydraulic breaking tools. Soft excavation shall include all boulders with a volume of less than 0.125 m³ and a maximum dimension of 500 mm, which can still be removed by hand methods.

(ii) Hard Excavation/Hard Rock

Hard excavation shall be excavation in material, which in the opinion of the Engineer, can only be removed efficiently with mechanical equipment such as jackhammers, drilling & blasting etc. Hard excavation shall also include boulders with a volume > 0.125 m³ and the maximum dimension > 500 mm, which cannot be broken down and removed by hand methods.

(b) Machine Based Excavation

In cases where heavy excavation equipment is permitted, the classes of excavation will be subdivided as follows:

(c) Soft excavation

Soft excavation shall be excavation in all materials and boulders which in the opinion of the Engineer can be efficiently excavated and loaded by a 30t excavator fitted with 'rock bucket' (excavator bucket typically fitted with not more than 3 tines designed to loosen weak rock material).

(e) Hard Excavation / Hard Rock

Hard excavation shall be excavation in materials and boulders, which in the opinion of the Engineer, can only be removed efficiently with mechanical equipment larger than a 30t excavator, or with jackhammers, drilling & blasting, expanding grout etc.

PSLE STORMWATER DRAINAGE (SANS 1200 LE – 1982)

PSLE 3 MATERIALS

PSLE 3.1(a) Precast Concrete Pipes

Delete the sub-clause and substitute:

Concrete pipes shall be of reinforced concrete and shall comply with SABS 677 and be of the class as indicated on the drawings or scheduled in the Bill of Quantities.

PSLE 3.1 (d) Skewed Ends

Add to the Sub-Clause:

Wherever required skew ends may be cut on site.

PSLE 3.1 (f) Pipes for Subsoil Drains (new Sub-clause)

Add new Sub-Clause:

Pipes for subsoil drains shall have the specified internal diameter, which shall not be less than 100 mm, and shall be slotted uPVC or HDPE pipes with a wall thickness in accordance with Class 4 pressure pipes to SABS 966 or SABS ISO 4427.

The size of the perforations in perforated pipes shall in all cases be 8 mm + 1,5mm diameter and the number of perforations per metre shall not be less than 26 for 100 mm pipe and 52 for 150 mm pipe. Perforations shall be spaced in two rows for 100 mm pipes and four rows for 150 mm pipes.

Slotted uPVC or HDPE pipes shall have a slot width of 8 mm with a tolerance of 1,5mm in width. The arrangement of slots shall be to the Engineer's approval but the total slot area shall not be less than specified for the perforations.

PSLE 3.4.1 Bricks

Add to the Sub-Clause:

Cement bricks complying with the relevant requirements of SABS 1215 shall be considered as being acceptable.

PSLE 3.6 Concrete (new Sub-Clause)

Concrete shall comply with the relevant requirements of SABS 1200 G or SABS 1200 GA, whichever is included in the project specification.

PSLE 3.7 Permeable Material for Groundwater Drains

Add the following new Sub-Clause:

Permeable filter materials for groundwater drains shall consist of crushed stone of suitable grading.

Permeable materials shall conform to the following requirements:

Crushed stone shall be clean, hard single sized stone and shall be free from shale, clay and other deleterious substances.

The aggregate crushing value of the stone shall not exceed 30 when tested in accordance with TMH 1 Test Method B1.

PSLE 5 CONSTRUCTION

PSLE 5.1.4 Culvert Construction after Earthfill

Add to the Sub-Clause:

Wherever possible pipes and rectangular culverts shall be laid under trench conditions.

The compacted fill shall first be constructed to a height of 300 mm above the culvert before excavating for the culvert.

The trench width shall not exceed the outside diameter of the pipe plus 600 mm. A working width of 600 mm each side shall be allowed for rectangular culverts.

PSLE 5.2.2 Pipe Culverts

Add to the sub-clause:

The bedding for stormwater pipes shall be to the requirements of SABS 1200 LB as amended by the project specification and shown on the drawings.

The ogee joints shall be fitted with 200 mm x 6 mm rubber sealing collars conforming to the latest SABS 974 Specification and with a Shore hardness of approximately 40 degrees, or alternatively, the ogee joints shall be primed and double wrapped in accordance with the manufacturer's recommendations with 200 mm wide impermeable wrapping tape to the Engineer's approval.

PSLE 5.2.3 Concrete Casing of Pipelines

In second line of the Sub-Clause substitute "Grade 15/19" for "mix 15".

PSLE 5.2.6 Construction of Groundwater Drains

Add the following Sub-Clause:

On completion of excavation the trench shall be lined with geotextile as specified or shown on the drawings.

A layer of permeable material of the class and thickness as shown on the drawings shall be placed on the bottom of the trench and lightly tamped and finished to the required gradient.

Pipes of the type and size required shall then be firmly bedded on the permeable material true to level and grades coupled where required and the trench backfilled in layers not exceeding 100mm with further permeable material to such height above the pipes as shown on the drawing or directed by the Engineer. The permeable material shall be lightly compacted and finished to the required level. The trench shall be specially protected against the ingress of water before completing the impermeable layer.

When placing successive layers the lower layer shall not be walked on or disturbed more than can be avoided. Care shall be taken to prevent the contamination of permeable material during construction of the groundwater drains and all permeable material contaminated by soil or silt shall be removed and replaced by the Contractor at his own expense.

Where plain butt joint pipes are used they shall be laid firmly together to prevent infiltration of backfill material. Perforated and slotted pipes shall be joined by couplers. Perforated pipes shall be laid with the perforations at the bottom, as instructed.

The higher end of groundwater pipe drains shall be sealed off with a cap or loose concrete cap of Class 20/19 concrete, as shown on the drawings, and at the lower end the pipe drain shall be built into a concrete headwall providing a positive outlet or connected to stormwater pipes or culverts.

PSLE 5.8 Open Drains (new Sub-clause)

Add new Sub-Clause:

Open drains are to be constructed to the details shown on the drawings, or as directed by the Engineer, to the correct line, levels and cross-sections. The material excavated from open drains is to be stockpiled for future use.

Measurement of open drain excavation shall be calculated from natural ground level or, in the case of drains within a road reserve, from the reduced level in the road excavation, and payment will be made on a rate per m³ basis irrespective of depth. The rate is to include for all work required to trim the drain(s) to the correct lines and levels.

PSLE 5.9 Stone pitching (new Sub-Clause)

Where ordered by the Engineer, open drains, stormwater outlets, etc, shall be pitched with stone. Notwithstanding the provisions of SANS 1200 DK Clause 3.2.1 Table 2 pitching for lining drains and stormwater outlets shall have a minimum size of 100 x 100 x 75 mm deep. In all other respects the provisions of SANS 1200 DK as amended by the Project Specification shall apply. Before pitching is commenced, all slopes and surfaces to receive pitching shall be carefully trimmed and dressed to the correct lines and grades. The pitching stones are to be laid with joints broken as much as possible and are to be hammered solidly into position to present a regular and uniform surface. All joints are to be grouted to their full depth with 4:1 cement:sand mortar.

PSLE 5.10 Cutting of Pipes (new Sub-Clause)

As far as is possible culvert lengths shall be such that pipe units need not be cut. Should any straight or skew cuts be necessary, such cutting will not be measured and paid for separately in terms of Sub-Clause 8.2.4 since all additional work required in cutting the pipes as well as the wasted pipe ends shall be regarded as being included in the payment for the supply, lay, joint, bed and test of the relevant pipe culverts, as per Sub-Clause 8.2.1.

PSLE 8 MEASUREMENT AND PAYMENT

PSLE 8.2.1 Supply and Lay Concrete Pipe Culverts

Delete the title of the sub-clause and substitute:

Supply, Lay, Joint, Bed and Test Pipelines

Add to the Sub-Clause:

The bedding shall be to the requirements of SABS 1200 LB as amended by the project specification and shown on the drawings.

Add to the Sub-Clause:

The rates shall cover the cost of providing the pipes as well as the cost of laying, bedding, jointing and making connections into manholes, including dealing with stormwater flow and testing the pipeline.

PSLE 8.2.4 Extra over Items 8.2.1 and 8.2.2 for Cutting End Units for Culverts on Site

Delete this Sub-Clause as no extra payment will be made for cutting end units for culverts.

PSLE 8.2.14 Minor Drainage Structures (new Sub-Clause)

Catchpits, manholes, drop inlets and headwalls constructed will be measured and paid for as complete units.

Item : Supply, construct and install drainage unit of the type, size category and depth stated in the Bill

of Quantities;..... Unit
: No

The unit of measurement shall be the number of the particular type, size and category of drainage units supplied, constructed and installed in accordance with the drawings.

The tendered rate shall include for all materials, plant labour, supervision and incidentals for the construction of the drainage units complete and in accordance with the drawings.

The tendered rate shall further include for all necessary excavation in all materials, backfilling and disposal of surplus materials, formwork, concrete, benching, concrete finish, reinforcement, precast elements, steel channels and grids, step irons and all other items not specifically measured elsewhere, necessary for completion of the unit in accordance with the drawings.

The tendered rate shall include for all costs involved in complying with the requirements of the relevant specifications in respect of the individual types of work involved in completion of the units.

The tendered rates shall exclude for excavation in intermediate and hard material, payment for which shall be made as an extra over in the Schedule of Quantities.

PSLE 8.2.15 Stone Pitching (new Sub-Clause)

Payment for stone pitching (PSLE 5.9) will be made at a rate per unit finished area and the rate is to include for all trimming and dressing of the excavation, laying of the stones and grouting of the joints:.
Unit : m²

Annex C3.6.2 Particular Specifications

In addition to the SANS Standard Specifications, Variations to the Standard Specifications, the following GIBB Particular Specifications shall apply to this contract.

GIBB 012 General Building Materials and Workmanship

GIBB 015 Dry Stack Retaining Walls

PARTICULAR SPECIFICATION

GIBB 012 – BUILDING WORKS

Table of Contents

1	SCOPE	1
2	MATERIALS	1
2.1	Standards	1
2.2	Masonry Units	2
2.2.1	General	2
2.2.2	Burnt Clay Bricks	3
2.3	Cement	3
2.4	Fine Aggregate (Sand)	3
2.5	Water	3
2.6	Mortar	3
2.7	Wall Ties	3
2.8	Reinforcement	4
2.9	Concrete To Brickwork Ties	4
2.10	Filling Material.....	4
2.11	Harcove Filling.....	4
2.12	Damp Proofing.....	4
2.13	Sills	4
2.14	Mortar	5
2.15	Air Bricks.....	5
2.16	Construction Timber	5
2.17	Roofing	5
2.18	Ceilings	5
2.19	Doors, Windows and Vents	6
2.19.1	Pressed-steel door frames	6
2.19.2	Pressed-steel doors.....	6
2.19.3	Steel window frames.....	6
2.19.4	Aluminium doors, windows, etc	7
2.20	Ironmongery.....	7
2.20.1	Door locks and handles	7
2.20.2	Miscellaneous fittings.....	8
2.21	Glazing.....	8
2.21.1	Glass.....	8
2.21.2	Putty.....	8
2.22	Plaster.....	8
2.23	Screeds.....	8
2.24	Granolithic.....	8
2.25	Floor tiles	9
2.26	Plumbing and Drainage	9
2.27	Sanitation Fittings	9
2.28	Painting.....	9
2.29	Carpentry and Joinery Timber	9
2.29.1	Preservative treatment.....	10
2.29.2	Priming.....	10
2.30	Plumbing.....	10
2.30.1	Water closet (WC) suites	10
2.30.2	Urinals.....	10
2.30.3	Wash-hand-basins	11
2.30.4	Sinks	11
2.30.5	Pipes and tubing	11

BUILDING WORKS

2.31	Painting	11
2.31.1	Primers	12
2.31.2	Undercoats	12
2.31.3	Finishing coats	12
2.31.4	Inspection and Preliminary Work	13
2.32	Storage of Materials	13
3	EQUIPMENT	13
4	CONSTRUCTION	13
4.1	Brickwork	13
4.1.1	Brickwork Generally	13
4.1.2	Reinforced Brickwork	14
4.1.3	Face Brickwork	14
4.1.4	Fairface Brickwork	14
4.1.5	Key for plaster	14
4.1.6	Damp-proofing	14
4.2	Precast Pre-Stressed Concrete Lintels	14
4.3	Concrete / Brick Ties	15
4.4	Plasterwork	15
4.4.1	Plaster coats	15
4.4.2	Thickness	15
4.4.3	Workmanship	15
4.5	Floor Screeds	15
4.6	Doors	16
4.6.1	General	16
4.6.2	Timber Doors	16
4.7	Windows	16
4.7.1	General	16
4.8	Glazing	16
4.9	Louvres	16
4.10	Sundries	17
4.11	Carpentry Work	17
4.11.1	Dimensions	17
4.11.2	Jointing	17
4.11.3	Timber roof construction	17
4.12	Joinery Work	17
4.12.1	Dimensions	18
4.12.2	Manufacture	18
4.12.3	Joints	18
4.12.4	Doors and frames	18
4.12.5	Skirtings, cornices, etc.	18
4.12.6	In-situ joinery	18
4.12.7	Ceilings	18
4.13	Plumbing	18
4.14	Painting	19
4.14.1	Painting Of Plaster, Concrete or Brick Surfaces	19
4.14.2	Painting of Woodwork	20
4.14.3	Painting of Metal Surfaces	20
4.14.4	Painting of Floor Screeds	21
4.14.5	Paint Thickness	22
4.14.6	Inspection	22

5	TOLERANCES	22
6	TESTING	23
6.1	Compressive Strength	23
6.2	Costs of Tests	23
7	MEASUREMENT AND PAYMENT.....	23
7.1	Brickwork	23
7.2	Plasterwork	23
7.3	Floor Screeds	23
7.4	Doors and Windows.....	23
7.5	Ceilings and Bulkheads	24
7.6	Joinery	24
7.7	Miscellaneous Work.....	24
7.8	Miscellaneous Items	24

Note: Where a contradiction exists between this Particular Specification and the drawings; the drawings will take precedence.

1 SCOPE

This section of the Specification covers all aspects of brickwork including building in of various items, reinforcing of brickwork etc as well as the supply of all materials and labour.

The Normative Reference is the SANS 10400, The Application of the National Building Regulations as well as the particular specification that covers the various construction activities associated with the erection of buildings with SANS 1200, Standardized Specification for Civil Engineering Construction.

In addition where SANS 10400 refers to other standards and publications, the various construction activities associated such standards and publications shall form part of the Contract only in so far as they are referred to.

2 MATERIALS

2.1 Standards

All materials used shall comply with the following standard specifications, the latest of which shall be held to apply:

SANS 28	:	Metal ties for cavity walls
SANS 227	:	Burnt clay masonry units
SANS 50197	:	Cement
SANS 1090	:	Aggregates
Concrete	:	The Masonry Manual
Masonry Assoc		
BS 952	:	Glass for glazing
BS 1199	:	Building sands from natural sources
BS 1387	:	Screwed and socketed steel tubes and tubulars and plain end steel tubes suitable for welding or for screwing to BS 21 pipe threads
SANS 22	:	Glazed ceramic wall tiles and fittings
SANS 121	:	Hot dip galvanized coatings on fabricated iron and steel articles - Specification and test methods
SANS 226	:	Water taps (metallic bodies)
SANS 227	:	Burnt clay masonry units
SANS 248	:	Bituminous damp-proof courses
SANS 266	:	Gypsum plasterboard
SANS 460	:	Plain-ended solid drawn copper tubes for potable water
SANS 497	:	Glazed ceramic sanitary ware
SANS 523	:	Limes for use in buildings
SANS 542	:	Concrete roofing tiles
SANS 545	:	Wooden doors
SANS 581	:	Semi-flexible vinyl floor tiles
SANS 673	:	Mixtures of copper - chromium - arsenic compounds for timber preservatives
SANS 679	:	Zinc chromate primers for steel
SANS 680	:	Glazing putty for wooden and metal window frames
SANS 685	:	Fibre-cement sheets (flat and profiled)

SANS 723	:	Wash primer (metal etch primer)
SANS 727	:	Windows and doors made from rolled mild steel sections
SANS 786	:	Flexible vinyl flooring
SANS 791	:	Unplasticized poly (vinyl chloride) (PVC-U) sewer and drain pipes and pipe fittings
SANS 803	:	Fibre-cement boards
SANS 903	:	Aluminium alloy corrugated and troughed sheets
SANS 920	:	Steel bars for concrete reinforcement
SANS 927	:	Precast concrete kerbs, edgings and channels
SANS 929	:	Plywood and composite board
SANS 952	:	Polyolefin film for damp- and waterproofing in buildings
SANS 967	:	Unplasticized poly(vinyl chloride) (PVC-U) soil, waste and vent pipes and pipe fittings
SANS 1215	:	Concrete masonry units
SANS 1349	:	Phendic, amino plastic and one-part polyurethane resin adhesives for the lamination and finger-jointing of timber, and for furniture and joinery
SANS 1783	:	Sawn softwood timber
SANS 10005	:	The preservative treatment of timber
SANS 10062	:	Fixing of concrete interlocking roofing tiles
SANS 10070	:	The installation of resilient thermoplastic and similar flexible floor covering
SANS 10096	:	The manufacture of finger-jointed structural timber
SANS 10107	:	The design and installation of ceramic tiling
SANS 10142	:	The wiring of premises
SANS 50197	:	Cement Part 1: Composition, specifications and conformity criteria for common cements

2.2 Masonry Units

2.2.1 General

Bricks shall be free from cracks, chips or other defects and at least one end of 20% of the bricks shall have the same general colour and texture as the faces.

Special care shall be exercised in loading, stacking and handling facebricks as no damaged bricks shall be used and bats may only be used where required to obtain bond.

General-purpose stock bricks or common bricks shall have a minimum average compressive strength of 7 MPa unless otherwise specified. Where stock bricks are required for load bearing walls, free standing walls, retaining walls or foundations then the compressive strength shall be 14 MPa.

Facing bricks shall be of the type, origin and colour specified in the Schedule of Quantities or on the drawings and shall be selected for uniformity of dimension and colour.

Satisfactory proof of load bearing capacity of bricks offered shall be submitted before deliveries are made to the site.

For samples, 6 units of each type of brick shall be submitted to the Engineer for approval. All subsequent deliveries shall be to the standard of the approved samples.

All bricks which, in the opinion of the Engineer, do not comply with the abovementioned requirements, shall be removed from the site forthwith at the Contractor's cost.

2.2.2 Burnt Clay Bricks

Burnt clay bricks shall comply with SANS 227 and :

Facing bricks shall have a minimum average compressive strength of 14 MPa. Bricks shall be clay, and pressed to wire cut. Water absorption after a 24-hour test shall not exceed 12% by mass. Bricks shall have sharp, clean and well defined arises.

General purpose stock bricks or common bricks suitable for general building work shall be clay, pressed or wire cut, even in size, smooth in texture and with sharp well defined arises. Water absorption after a 24-hour test shall not exceed 14% by mass.

2.3 Cement

Cement used in masonry shall comply with the requirements of SABS 471, SANS 50197.

2.4 Fine Aggregate (Sand)

Fine aggregates used in mortar shall be naturally occurring sand or consist of crushed rock or gravel, or a combination thereof with naturally occurring sand being hard, clean and free from dust, shale, clay, loam roots and other impurities.

Fine mortar aggregates shall comply in all respect with SANS 1090.

2.5 Water

Water shall be clean and free from injurious amounts of acids, alkalis, sugar and other organic substances. Water suitable for drinking purposes shall be acceptable. If so required by the Engineer, the suitability of water shall be proved by tests carried out by an approved laboratory.

2.6 Mortar

Mortar shall, unless otherwise specified, be Class I and for all load bearing walls, free standing walls, retaining walls or foundations shall be Class II in accordance with the SANS 10400 part K and the SANS 2001-CMI. The ingredients shall be measured in proper gauge boxes on a timber or steel-mixing platform with water added and thoroughly mixed in to obtain a uniform consistency throughout. Alternatively, mixing may be by means of an approved mechanical batch mixer.

Cement mortar shall be used within two hours of the first contact of the cement with water. No mortar which is older than two hours or has begun to set shall be used.

2.7 Wall Ties

Metal wall ties in brickwork and blockwork shall be galvanised and comply in all respects with SABS 28. Single wire type wall ties will not be permitted.

Ties for cavity walls shall be PWD butterfly type formed of 4mm diameter steel wire galvanised class A for coastal conditions and to such lengths that no less than 75mm can be built in at each end.

Wall ties will be required as follows as a minimum unless specified otherwise:

Element	Number
Grouted Cavity Walls	4 per m ²
Cavity Walls:	
General	3 per m ²
Within 200 mm of Joints Through Wall	300 mm vertical Centres

2.8 Reinforcement

Wall reinforcement shall consist of two 3.55 mm diameter longitudinal wires at appropriate centres for the thickness of the wall and with 2.80 mm diameter cross wires welded to the longitudinal wires at 300 mm centres. All wire used shall be of high tensile steel.

Brickforce used as wall reinforcing will as per the following minimum requirements unless otherwise stated:

Element	Requirement
Foundation Walls	Every Course
Walls above Foundation	Every 4th Course
Wall Openings	First 5 courses above and where applicable 2 courses below openings continuing 600 mm past opening. In addition 4 x 5.6 mm diameter rods required on 1st and 5th course above opening
Control Joints	Brickforce to be continuous through control joints

2.9 Concrete To Brickwork Ties

End of junctions of brick walling to concrete are to be tied to the concrete by means of 1.6 x 32 x 500mm galvanised hoop iron ties.

Brick linings to concrete are to be tied with 4 mm diameter crimped galvanised wire ties to SABS 28.

2.10 Filling Material

Filling material shall be approved G5 material complying with the relevant requirements of the SANS 1200, Standardized Specification for Civil Engineering Construction and compacted as specified in SANS 1200.

2.11 Hardcore Filling

Where shown on the Drawings or instructed by the Engineer, hardcore filling shall be 150 mm thick unless otherwise specified, and shall be formed with hard broken stone or brick of 75 mm maximum size and blinded with clean river sand. No clay, rubbish, tins, wood or vegetation or other debris shall be used in hardcore filling.

2.12 Damp Proofing

Damp proofing between filling or blinded hardcore filling and the underside of ground floor slabs or surface beds shall be 500 micron thick polyethylene sheeting that complies with SANS 952, i.e. USB Green co ex 500 ® or equivalent approved. All joints shall be overlapped with a 100mm seam and sealed by adhesive pressure-sensitive tape.

The damp-proof course in the brickwork shall consist of BRICKGRIP DPC 375 ® bearing AGREEMENT 2001/284, or equivalent approved, well lapped at joints and intersections and bedded and joined in cement mortar.

2.13 Sills

Where external sills are required to be of masonry, the units shall be clay face bricks and the units laid on edge. They shall be hard-burnt of approved colour and manufacture, true and even in thickness and in shape and colour, with good appearance, free from all defects and blemishes.

2.14 Mortar

Lime shall be best quality pressure hydrated type A2P and shall comply with SANS 523. It shall be well slaked and properly hydrated. Cement for mortar shall comply with SANS 50197-1 as specified for concrete.

The sand shall be clean pit sand free from clay or other impurities, and shall be properly screened and washed if directed by the Engineer.

The water shall be approved quality fresh water

2.15 Air Bricks

External wall 'Air Bricks' shall be approved 'terra cotta' with vermin proofing copper gauze at back, built in on the outside face of walls. On the inside face 225 x 150 mm square pattern fibrous plaster air gratings with vermin proofing copper gauze at back shall be built in.

2.16 Construction Timber

Unless otherwise specified, all timber work for constructional purposes shall be in "stress graded" timber, complying with the requirements of SANS 1783-2, except that no finger joints within 500 mm of the end of any member, and not more than one finger joint per 3 m length will be accepted. Timber shall be ordered in the nominal cross sectional dimensions and to the nearest 0.3 m length in which it is to be used, except that finger jointed timber made according to SANS 10096 will be permitted. All construction timber shall bear the mark of the South African Bureau of Standards and the test 'stress grade' for which it complies.

All timber shall be treated against insect and other wood damaging infestation according to the recommendations of the Department of Entomology, SANS 673 and SANS 10005.

All timber used shall be of good sound quality thoroughly seasoned, straight, sawn square and free from sap and reasonably free from shakes, large, loose or dead knots, sapwood and diminishing edges.

All timber to be built into walls and wall plates shall, in addition to the above, receive two coats of Solignum, Carbolignum or other approved wood preservative, or be wrapped in 250 micron polythene sheeting.

All timber battens and branderings shall comply with the requirements of SANS 1783-4.

2.17 Roofing

The type of roofing shall be as scheduled or shown on the Drawings. Roof sheeting shall be IBR profile Aluminium sheeting 0.8 mm thick and shall comply with SANS 903.

Fascia boards, barge boards, flashings, closures and trimmings shall be of Aluminium sheering shaped to the suitable profile with 'drip detail' and water proofing fasteners as scheduled or shown on the Drawings.

Roofing underlay Polyethylene sheeting complying with the requirements of SANS 952, Type E, having a nominal thickness of 250 micron.

2.18 Ceilings

Ceilings shall be 6 mm thick fibre cement cellulose ceiling board complying with SANS 803 or 6.4 mm thick gypsum ceiling board complying with SANS 266, and shall be fitted to branderings of approved dimensions depending on the truss/rafter spacing.

Cove cornices shall be fitted to all ceilings. For fibre cement ceilings the cornices shall be 55 mm radius x 6 mm thick fibre cement cove cornices and for gypsum board ceilings they shall be 75 mm gypsum cove cornices.

Joints between ceilings boards shall be covered with 25 mm half-round hardwood cover strips.

2.19 Doors, Windows and Vents

All steel and iron work shall be delivered clean and free from rust, pitting or other defects. Shop primers shall be applied before delivery and shall consist of a coat of red oxide paint, or any other approved anti-rust paint on all surfaces.

Unless otherwise specified, all materials shall conform at least to the appropriate SABS or BS standards where such standards apply to ironmongery, or steel, cast iron and any other related materials.

2.19.1 Pressed-steel door frames

Pressed-steel door frames shall comply with SABS 1129 and shall be manufactured from 1,6 mm thick mild-steel sheeting, pressed to the required shapes, properly mitred, welded and reinforced, with all welding neatly cleaned off.

Frames shall be of the widths required to suit the thickness of the walls into which they are built and shall be fitted with suitable tie bars and braces at the bottom. Three lugs to be built into the brickwork shall be provided on each jamb.

Rebates in frames and transoms for doors shall be of the widths required to suit the thicknesses of the doors and shall be fitted with a pair of approved steel butt hinges set flush into recesses in the frames. 4,5 mm thick reinforcing plates shall be welded to the backs of the frames at hinge positions.

Heads of frames over double doors shall be drilled where required to form keeps for bolts and shall be fitted with one rubber buffer for each leaf of the door.

Frames for single doors shall be fitted with approved chromium striking plates and an adjustable striking-plate keeper boxed in at the back of the frame by a welded-on sheet-metal box. The frames shall be fitted with a minimum of two rubber buffers.

Frames shall be protected against twisting and damage during transit and erection.

2.19.2 Pressed-steel doors

Pressed-steel doors shall be manufactured from 1,6 mm thick steel plate. The doors shall be of standard design, pressed to shape with 40 mm reveals all round. The doors shall be strengthened with full-length vertical V-shaped or other approved sectional strengthening ribs projecting to the outer face. Two horizontal stiffening rails shall also be welded to the inner face of the doors.

A door shall be hung on a pair of 100 mm long steel butt hinges with loose pins. The leaves of the hinges shall be welded to both the door and the door frame, and a 1,6 mm thick steel plate shall be welded to the inner face of the door to protect the lock.

One leaf of double doors shall be fitted at the top and bottom with approved 150 mm cast brass barrel bolts in an approved manner and the other leaf shall be fitted with a lock, the striking plate of which shall be fixed to the first leaf.

Where indicated on the drawings, doors shall be fitted with louvred ventilation grills of approved design, backed with insect and vermin-proof gauze screening.

2.19.3 Steel window frames

All steel window frames shall comply with SABS 727 and shall be of the types and sizes shown on the Drawings.

Standard industrial types of steel window frame shall be constructed from rolled mild-steel industrial sections, 35 mm wide by 3 mm thick, with opening sections constructed from standard residential sections, 25 mm wide by 3 mm thick, welded at angles and properly jointed at intersections.

2.19.4 Aluminium doors, windows, etc

The Contractor for the manufacturing and installations of the aluminium doors and windows is to submit proof of AAAMSA membership and doors and windows shall comply with AAAMSA design criteria.

The following certificates shall be provided prior to commencement of site work:

A copy of the relevant AAAMSA Performance Test Certificate from the manufacturer/contractor supplying the architectural aluminium product.

A Certificate of Conformance confirming that anodizing or powder coating has been processed in accordance with SANS 999 and SANS 1796 respectively.

A Certificate of Conformance confirming that glazing has been installed in accordance with SANS 10137, ensuring that safety glazing materials have been installed in the mandatory areas and that each individual pane of safety glazing materials has been permanently marked.

A warranty from the manufacturer of the laminated safety glass and/or hermetically sealed glazing units guaranteeing the products against delamination and colour degradation for a period of not less than five years.

The successful tenderer shall provide full shop drawings for the approval by the Engineer prior to the manufacturing of any work.

2.20 Ironmongery

All Ironmongery shall be of a robust hard wearing industrial quality, of stout design and durable construction. The type, size, material and orientation shall be as scheduled and shown on the Drawings. Samples of each item of ironmongery shall be submitted for approval before any particular item is ordered and fixed.

All external doors shall be fitted with one and a half pairs of hinges. Hinges doors shall be 100 mm loose pin hinges. All screws shall be appropriately sized and of metal similar to the article to be fixed.

2.20.1 Door locks and handles

All door locks shall comply with the requirements of the relevant SABS specification and shall be of approved manufacture and pattern. All locks shall be supplied with two keys. Keys shall be distinctly numbered with consecutive numbers and each key shall be stamped with the same number as that of the lock which it controls. No two locks in any one building may have the same key.

External doors shall be fitted with master-keyed four-lever heavy duty mortice locks or cylinder locks as indicated with brushed chromium plated furniture. All locks shall be provided with two keys, and all locks shall differ so that the key of any lock will open no lock other than the one to which it belongs. A suitable stop shall be fitted to prevent the door knob from damage against the walls. (unless otherwise shown on the drawings or specified in the bill of quantities).

All internal doors shall be fitted with 2-lever mortice locks complete with brushed chromium plated furniture and locking plates.

All locks shall be properly installed and, after completion, striker plates shall be adjusted and the locks serviced.

Door handles shall be of cast zinc of approved manufacture and pattern.

2.20.2 *Miscellaneous fittings*

All retaining devices for doors and windows as well as fittings such as coat hooks, retaining hooks, etc shall be of solid brass unless otherwise indicated. All fittings shall be secured by screws or set screws of the same material and finish as the fitting.

Fittings to be fixed to plastered walls, masonry or floors shall be fixed direct by means of patent plastic or fibre plugs fitted into drilled holes.

Door stops shall be provided at every door and shall be 40 mm diameter rubber stops.

Patented precast concrete window surrounds or blocks shall be as scheduled in the bill of quantities.

2.21 **Glazing**

Glazing to conform with the provisions of SANS 10400 – O, and unless otherwise stated, windows shall be glazed with clear sheet glass of the best quality and free from bubbles, scratches or other defects. Obscure glass shall be used at windows to showers and toilets.

2.21.1 *Glass*

Glass shall comply with the requirements of CKS 55. The quality of all window glass shall be such that surface deterioration will not develop after glazing.

All glass shall be free from bubbles, waviness, scratches, stains or other imperfections.

Unless otherwise specified, sheet glass for glazing shall be flat-drawn clear glass of ordinary glazing quality and of the thicknesses indicated below:

For panes not exceeding 1,5 m² in area: 4 mm

2.21.2 *Putty*

All putty shall comply with the requirements of SABS 680.

Putty shall not be too hard or soft or caked when used, and shall dry evenly without crazing or cracking.

Defective putty shall be cut out and replaced by the Contractor at his own expense, and any broken glass shall also be so replaced and putty so repainted.

2.22 **Plaster**

Plaster for walls shall be prepared by mixing in parts complying with SANS 2001 – EMI: 2007 (shall be composed of 4:1 sand/cement) or approved by the engineer.

2.23 **Screeds**

Screeds shall be composed of 3:1 sand/cement mortar with a controlled moisture content.

2.24 **Granolithic**

Granolithic floors shall be made from:

Cement	:	1 parts
Sand	:	1.25 parts
Coarse aggregate	:	2 parts

The coarse aggregate shall consist of granite or other approved chippings which shall pass a 10 mm sieve and be retained on a 5 mm sieve.

2.25 Floor tiles

Glazed floor tiles shall be best quality of approved manufacture, comply with SANS 22 and be true and regular in shape and free from cracks and all other defects.

Suitably matching aluminium corner and edge strips shall be used around window and door openings and along visible tile edges.

2.26 Plumbing and Drainage

All materials used for plumbing and drainage shall comply with SANS 10400, The Application of the National Building Regulations.

Above ground water supply piping shall be in Class 1, Copper Piping with capillary fittings; Delcop or similar approved. Pipe work to be wall mounted, straight and plumb and fastened at 1m c/c or less when changing direction with Master Bats or similar approved.

All valves conforming to SANS 460 and SANS 226 respectively.

Underground water supply piping shall be Class 16, HDPE Piping with imperial stranded compression fittings. Piping shall be laid underground as per the relevant requirements specified in SANS 1200, trenching, bedding, laying and backfill of water pipe.

Kitchen sinks and baths shall have 40 mm PVC-U traps and waste pipes with cleaning eyes fitted to each bend and trap and complying with SANS 967. Vent pipes shall be 110 mm PVC-U pipes to SANS 967.

Fittings for fixing waste and vent pipes to walls shall consist of approved pressed steel holder bats plugged to walls.

Drain pipes and fittings shall comply with SANS 559 for vitrified clay or SANS 791 for PVC-U. Unless otherwise listed in the Bill of Quantities, sewer and drain connections shall be in vitrified clay pipe with rubber ring or factory applied resilient plastic joints.

2.27 Sanitation Fittings

Sanitary fittings shall comply with SANS 497 and shall be subject to selection and approval.

When scheduled in the Bill of Quantities or shown on the Drawings,

Rainwater and Surface Water Channels

Channels for rainwater and surface water drainage shall be 150 mm half round precast concrete units 1.0 m long, complying with SANS 927.

2.28 Painting

All paints and stains, etc., or materials used in their preparation, shall be of the best quality of their respective kinds and shall comply with the relevant SANS specification. The paints and stains, etc., their colours and shades, shall be approved as to brand and manufacture, and the Contractor shall submit samples in their respective colours to the Engineer, for approval, at least 28 days before they are required.

2.29 Carpentry and Joinery Timber

All timber used for structural purposes shall be of merchantable grade and shall comply with the requirements of SABS 563 and SABS 1245. Structural timber shall be carefully selected and of the best quality, free from large or dead knots, shakes, waney edges or other defects. Purlins and brackerings shall comply with the requirements of SABS 653. Finger-jointed

structural timber shall comply with the requirements of SABS 096 and laminated timber with the requirements of SABS 1089.

All timber used for joinery shall be best quality, specially selected, treated against insects as specified in Clause 46.3.5.1, and shall be of good sound quality, well kiln dried and free from sap, large loose or dead knots, shakes, diminishing edges or other defects or blemishes such as flower grain. Solid shelving shall comply with SANS 1783-3.

The glue used shall be compatible with the treatment applied against insect attack and shall comply with SANS 1349. In the case of external doors, an approved waterproof glue shall be used.

Hardwoods and softwoods for joinery shall comply with SABS 1099 and SABS 1359 respectively and suitable species shall be used for the various purposes.

Unless otherwise specified, all materials shall conform to the appropriate SABS or BS Specification where such standards exist for nails, screws, bolts, adhesives, etc.

2.29.1 *Preservative treatment*

All structural timber shall be given a preservative treatment suitable for the duty for which the timber is intended in accordance with SABS 05, and no untreated timber shall be used. The preservative treatment shall not impair the final finish. The timber shall be impregnated throughout. When surface coating is specified, the compounds applied on the surfaces of the timber shall form an unbroken film.

2.29.2 *Priming*

The jointing surfaces of all joints exposed to the weather and built-in portions of frames shall be thickly primed except where adhesives are specified.

Carpentry and joinery items which are prepared for painting by the manufacturer, shall be knotted and primed before being dispatched to the Site.

Primed surfaces shall be touched up where necessary during the progress of the work or where site adjustments have been made.

2.30 *Plumbing*

All materials shall be of the best quality and shall be approved by the Engineer before installation. Cracked, chipped, dented or faulty items or materials shall be replaced at the Contractor's expense. Glazed ceramic sanitary ware shall comply with the requirements of SABS 497 and all other materials shall comply with the standards as specified, scheduled or shown on the Drawings.

2.30.1 *Water closet (WC) suites*

WC suites shall unless otherwise specified or scheduled consist of a glazed vitreous china closet with an S or P trap and seat lugs, a 14 litre low-level matching flat-bottomed flushing cistern placed and fixed on the closet, or a suspended enamelled cast-iron cistern with the flush pipe connected to the flushing rim of the closet with rubber cone joints, and a solid heavy-duty plastic seat with cover, hinges and buffers.

2.30.2 *Urinals*

Urinals shall be of the type specified or scheduled, of glazed vitreous china, wall mounted, with an automatic or a manual flushing system, and chromium-plated fittings.

2.30.3 Wash-hand-basins

Wash-hand-basins shall unless otherwise specified or scheduled be of glazed vitreous china or enamelled cast iron, wall mounted on a pair of cast-iron brackets, and fitted with chromium-plated fittings consisting of two taps, outlet and chain, and supplied with a plug and an anti-siphon trap.

2.30.4 Sinks

Sinks shall comply with the requirements of SABS 242 and shall be complete with cabinet, chromium-plated outlet, anti-siphon trap, plug, chain and two bib taps or one mixer tap, all as detailed or as scheduled.

2.30.5 Pipes and tubing

Cast-iron and steel pipes used in plumbing work shall comply with the requirements of SABS 746 and SABS 62 respectively. Copper tubing shall comply with the requirements of SABS 460 and malleable cast-iron fittings with SABS 509.

2.31 Painting

No paint shall be applied to any surface containing traces of dust, grit, grease, oil, loose rust, millscale or corrosion products of any kind or to any surface that is not free from moisture. Where necessary, surfaces shall be thoroughly washed to remove all traces of soluble salts and/or corrosive air-borne contaminants prior to painting, and the surfaces shall be dried and painted immediately thereafter.

Welding shall be completed in so far as it is possible before painting commences, but in cases where welding can be done only at a later stage, no paint shall be applied to within 75 mm of the proposed weld position unless otherwise specified. Welds and adjacent parent metal shall be abrasive blasted and/or ground and all contaminants such as flux shall be removed prior to painting.

Surfaces of members which are to rest on concrete or other floors or which will be otherwise inaccessible after erection shall receive the full paint system prior to erection.

Damaged paint areas on metal surfaces shall be cleaned, rust spots removed where applicable and the surrounding paint which is still intact shall be feathered for a distance of 20 mm beyond the damaged area. Spot priming and repair shall consist of all the coats previously applied and shall overlap the damaged area.

Damaged galvanised areas shall be cleaned and any rust spots and any flakes of the coating surrounding the damaged area removed. The coating shall then be restored by zinc spraying or soldering, or painting with a zinc-rich paint, as may be approved by the Engineer.

Where the shop coat is allowed to age for a few months before the final painting is done, light sanding or rubbing with steel wool or scrubbing with clean water using a bristle brush shall be carried out.

Steel to be embedded in concrete shall not be painted below 50 mm from the final level of the concrete.

Each priming coat and each undercoat of paint shall be inspected and approved by the Engineer before any subsequent undercoat or finishing coat is applied.

All finishing colours shall be as shown on the Drawings, or as directed by the Engineer.

Paints shall comply with the requirements of the appropriate Specifications below:

2.31.1 Primers

- SABS 678 : For wood
- SABS 679 : Zinc chromate for steel
- SABS 723 : Etch-wash primer for metals
- SABS 912 : Calcium plumbate for galvanized iron
- SABS 926 : Zinc-rich epoxy for steel

2.31.2 Undercoats

- SABS 681 : For all undercoats

2.31.3 Finishing coats

- SABS 515 : For interior use, flat and egg-shell finish
- SABS 630 : For interior and exterior use, high-gloss enamel
- SABS 631 : For interior and exterior use, oil gloss paint
- SABS 633 : For interior use, emulsion paint
- SABS 634 : For exterior use, emulsion paint
- SABS 684 : For exterior use on structural steel
- SABS 801 : For interior and exterior use, epoxy-tar paint
- SABS 802 : For interior and exterior use, bituminous aluminium paint
- SABS 887 : For interior use, glossy and egg-shell varnish

The Contractor shall furnish the Engineer with the following information and details regarding the paints and decorative materials for the painting system he proposes to use, for written approval:

- a) The name of the manufacturer and trade name
- b) The brand, type or grade of paint and the appropriate SABS Specification
- c) Manufacturer's data sheets, colour references, instructions for use, including surface preparation, sealers, primers, undercoats, finishing coats, coat thicknesses and curing periods, which shall all be considered as being part of these Specifications if approved by the Engineer
- d) Safeguards to protect the applied paint from damage until the work is accepted by the Engineer
- e) The shelf or pot life of materials, if applicable
- f) An undertaking that the proposed paint system is suitable for its intended use and that the various coats of paint are compatible with one another

Where proprietary brands are used, the manufacturer's priming and all subsequent coats of paint suitable for that particular brand shall be employed in accordance with the manufacturer's instructions.

No other materials of a similar nature and quality or from another manufacturer may be used instead of those approved, unless written permission to do so has been obtained from the Engineer.

All materials shall be brought onto the Site in containers sealed by the manufacturer. Paints of a different quality, type, brand or colour shall not be mixed, or thinned and shall not be adulterated in any way, but shall be used as supplied by the manufacturer. Any mixing or tinting required shall be carried out by the manufacturer.

Tinting of paint on the Site by the Contractor will only be allowed with the written permission of the manufacturer and the Engineer.

2.31.4 Inspection and Preliminary Work

Before commencing paintwork, the Contractor shall carefully inspect the surfaces to be painted to satisfy himself that the surfaces are in a satisfactory or acceptable condition to receive the paint system specified.

All metal fittings and fastenings shall be removed where applicable before the preparatory processes are commenced. On completion, the metal fittings and fastenings shall be cleaned and refitted in position.

2.32 Storage of Materials

Cement and aggregates shall be stored in such a manner as to prevent deterioration or contamination by foreign matter, damp and chemicals spilled on the ground or which may settle out of the atmosphere.

Perishable materials likely to be damaged by exposure shall be stored under cover.

3 EQUIPMENT

The Contractor shall provide and maintain in good working order, adequate equipment for carrying out the required work in accordance with this specification in a safe efficient manner.

4 CONSTRUCTION

4.1 Brickwork

4.1.1 Brickwork Generally

All brickwork shall be laid in stretcher bond, plumb and true to line. Mortar beds shall be 10 mm thickness, unless otherwise described, and are not to exceed 12 mm in thickness, and no four successive joints shall rise more than 40 mm (for 10 mm joints). Clay bricks are to be well wetted (saturated in hot weather) with water before being laid and the course of bricks laid last shall be well wetted before fresh bricks are bedded upon it. Bricks shall be well buttered and laid on a full bed of mortar and joints shall be flushed up. Bricks in foundation walling are to be extra hard. Beam filling is to be built to walls 106 mm thick and the space between beam filling and roof covering shall be filled with a stiff mixture of 1 to 3-cement mortar tightly pressed in. The brickwork shall be carried up in a uniform manner, no one section being raised more than 1 200 mm above another section at one time and no brickwork is to be carried more than 4 courses above immediately adjoining or intersecting brickwork. Block bonding or toothed and keyed construction will only be allowed in alterations to existing work.

Cavity Walls (270 mm) and One-brick walls (230 mm) built stretcher bond in two skins shall be tied together with galvanised wall ties staggered not more than 1 m apart horizontally and every fourth course vertically with extra ties at reveals and openings etc. as may be necessary. Brick linings to concrete walls shall similarly be tied together, while galvanised hoop iron ties cast into concrete columns, shall be built into the joints of butting brick walls as specified. Where specifically required the outer face of the inner skin of all external one-brick walls above damp course level shall be waterproofed before the outer skin is built up. The face to be treated shall be bagged over until all crevices are filled. When thoroughly dry the face shall be twice coated

with an approved liquid bituminous compound and worked around wire ties to produce an unbroken waterproof coating.

Where called for on the drawings wall and concrete ceiling surfaces shall be bagwashed with a wet sack dipped in liquid cement grout whilst the mortar in the brickwork joints is still soft until all joints and crevices are eventually filled. Projections of concrete shall be rubbed off and any defects shall be made good in cement mortar.

4.1.2 *Reinforced Brickwork*

Brickwork over door and window openings shall be reinforced with welded wall reinforcement placed in each course of brickwork over openings for a minimum of 4 courses or as shown on the drawings. Reinforced brickwork shall continue at least one and a half bricks on either side of the opening. Where two or more openings are less than 675 mm apart, the reinforced brick lintels shall be continuous over all such openings and their dividing piers, plus 1½ brick bearing at both extreme ends.

Brick lintels in cavity walls, which are exposed to the weather, shall have a continuous damp-proof bourse built into the outer skin of the wall immediately above the lintel to cover the top of the lintel, raked up one course and carried through the inner skin.

Where called for on the drawings, brickwork shall be reinforced with wall reinforcement laid in every fourth course of all brick walling or as directed by the Engineer. The reinforcement shall be built in truly central to the wall and all longitudinal laps shall not be less than 450mm. Reinforcement in half-brick walls shall be built 106 mm into main cross walls.

4.1.3 *Face Brickwork*

All facings shall be kept clean during the progress of the work and face-brick surfaces with mortar spattering will not be accepted. Unless otherwise specified, the horizontal and vertical joints shall be pointed and finished with a round key joint and both rubbed smooth as the building work proceeds.

The various colours of the face bricks shall be selected and mixed at random to prevent portions of the face work showing a preponderance of one colour. Where sufficient storage is available on site the full quantity of face bricks required for the works (or such quantity as to keep supply well advanced of construction) shall be delivered to site.

4.1.4 *Fairface Brickwork*

Where called for on the drawings and in the Schedule of Quantities, internal walls shall be of smooth stock-bricks, built fair and kept clean during construction and jointed as in Clause 4.3.

4.1.5 *Key for plaster*

Joints of all brickwork receiving plaster shall be raked out, or the brick surfaces shall otherwise be prepared with an acrylic slurry or any other approved bonding agent.

4.1.6 *Damp-proofing*

A damp-proof course shall be laid over the full width of all the walls at a minimum height of 150 mm above the final ground level or wherever else it may be required, and it shall be lapped for at least 150 mm at angles and joints. A damp-proof course shall also be laid and stepped up under all external sills.

4.2 **Precast Pre-Stressed Concrete Lintels**

Approved precast prestressed concrete lintels of suitable size of the thickness of the wall and the width of the opening shall be used over openings in plastered and bagged walls.

Wherever possible, the minimum bearing for precast prestressed lintels, at their ends and over intermediate supports, shall be:

- g) for openings not exceeding 600 mm - ½ brick (115 mm)
- h) for openings exceeding 600 mm - 1 brick (230 mm)

Where this requirement necessitates a total lintel length exceeding 6.6 m, a joint may be introduced centrally over an intermediate pier in a position to be approved by the Engineer. Such joints shall be stiffened by the introduction of welded wall reinforcement as specified in 4.2, and extending a minimum of 300 mm on either side of the joint, i.e. 600 mm minimum total length.

4.3 Concrete / Brick Ties

At end on junction of brick walls with concrete columns or walls brickwork is to have galvanised hoop iron ties built into the joints of each ½ brick skin at maximum 8 course height intervals alternately to each skin or at 4 course height intervals if single skin only.

Ties are to be cast into concrete at course heights by tacking L-shaped ties to inside face of shutters and bending down ends for building in after shutters are stripped, or shot fixed to concrete with approved nails and strength of shot to provide adequate fixing.

Galvanised crimped wire ties for fixing of brick linings to concrete are to be cast a minimum 75mm deep into concrete at brick course eights (four per square metre staggered), bent down after shutters are stripped and built into brickwork.

4.4 Plasterwork

4.4.1 Plaster coats

A plastered finish shall consist of a single coat, comprising one application of a 1:6 cement sand mixture with a wood or steel-float finish except where otherwise indicated.

4.4.2 Thickness

The total thickness of the plaster finish shall be 13 mm minimum and 20 mm maximum.

4.4.3 Workmanship

All plasterwork shall be finished smooth and ready to receive paint. Plaster shall be flush with the faces of all switch and plug boxes, the interiors of which shall be kept free from plaster. Plastered surfaces shall be plumb and jambs and reveals shall be formed square

The plasterer shall cut out and make good all cracks, blisters and other defects and leave the plasterwork, on completion, in a state which is acceptable to the Engineer.

4.5 Floor Screeds

Floor screeds shall have a mix proportion by mass consisting of one (1) part Portland cement and three (3) parts (1:3) fine aggregate. A minimum amount of water is to be used, but it shall be sufficient to allow adequate compaction.

Screeds shall be laid on clean hardened bases in panels not exceeding 14 m² and shall be steel-trowelled to a true and smooth finish. In monolithic construction, the panels shall not exceed 30 m². Joints in screeds shall coincide as nearly as possible with joints in the bases. The thickness of screeds shall be as shown on the drawings or as directed by the Engineer.

The entire screed surface shall be free from loose or raised particles of aggregate, trowel marks or any irregularities, humps or depressions exceeding 5 mm when measured from a 3 m long straight edge.

Screeds shall be cured for three (3) to seven (7) days as may be directed by the Engineer, and shall be protected from damage.

No moisture-sensitive floor finish shall be laid on screeds unless a reliable moisture test shows that the screed is sufficiently dry to receive the covering.

4.6 Doors

4.6.1 General

All built-in door frames shall be set straight, plumb and level, and shall operate to the satisfaction of the Engineer after fixing has been completed.

Fittings shall be either removed, or wrapped and protected from damage, until all rough trades have been completed

4.6.2 Timber Doors

Timber for doors shall be selected, well-seasoned kiln dried Red Meranti and shall be treated with an approved oil soluble preservative. The following preservative is recommended: 5% Pentachlorophenol in a vessel consisting of 50% white spirits and 50% power paraffin or 100% white spirits. The Contractor shall obtain and submit to the Engineer a certificate from the merchant supplying the timber or doors to the effect that the timber has been treated as required.

After erection doors shall be well sanded and prepared and then coated with two coats of an approved penetrating sealer compatible with the treatment applied to the timber.

4.7 Windows

4.7.1 General

All built-in window frames shall be set straight, plumb and level, and shall operate to the satisfaction of the Engineer after fixing has been completed.

Fittings shall be either removed, or wrapped and protected from damage, until all rough trades have been completed

4.8 Glazing

Glass shall be cut in panes to suit all glazed openings with sufficient clearance all round to prevent cracking by expansion, contraction or vibration.

In all cases the glass shall be well bedded and back-puttied and installed as specified in SABS Code of Practice 0137.

All putty shall be carefully trimmed, cleaned off and neatly finished off straight with smooth surfaces and sharp mitres. A paint primer shall be applied as soon as the putty has dried out sufficiently to prevent shrinkage cracks from forming.

The entire glazing operation shall be cleaned before the premises are handed over for occupation.

4.9 Louvres

Louvres and frames shall be manufactured from aluminium. All work to be in accordance with the recommended performance requirements of the Association of Architectural Aluminium Manufacturers of South Africa.

4.10 Sundries

- Rough and fair cutting shall be performed as required and the brickwork fitted around structural steelwork. Face brickwork shall be carefully cut and fitted when next to the finishings.
- Chases shall be left or formed in brickwork for edges of concrete floors, roofs, staircases, etc. Vertical chases shall be provided in brickwork and blockwork wherever required for pipes, conduits, switch boxes, distribution boards, etc.
- Timber doorframes and windows to be built into walls shall be primed before building in and set plumb and true. The underside of each vertical to the doorframes shall be provided with a 12 mm diameter steel peg projecting 75 mm from the bottom of the frame and these pegs shall be securely grouted into the floor threshold. 2 mm thick hoop iron cramps 40 mm wide, screwed to frames shall be built 450 mm into walls with ends turned up, four cramps to each jamb. At flush junctions of walls and frames a V-joint shall be ruled between frame and wall rendering. The junctions between timber frames or windows and face brickwork or unrendered concrete on external faces shall be sealed by pointing around the timber frames with an approved polysulphide based waterproofing compound finished off in a neat and workmanlike manner.
- Damp proof courses shall be formed in the walls as described by building three consecutive bedding joints and all vertical joints between solid walls in 2:1 cement mortar with an approved waterproofing compound added in accordance with the manufacturer's instructions.

4.11 Carpentry Work

Carpentry work shall be carried out in a manner consistent with good workmanship and in compliance with the Drawings.

The carpenter shall perform all cutting away and making good in attendance upon all other trades and he shall provide and maintain temporary coverings required for the protection of any finished work that might be damaged if left unprotected during the progress of the work.

4.11.1 Dimensions

Unwrought timber shall be as sawn and shall be to the dimensions and within the tolerances specified in the relevant SABS Standard Specifications mentioned in subclause 5.1 (1).

4.11.2 Jointing

Unless otherwise specified, all joints shall be secured by means of a suitable type and a sufficient number of approved connectors. All joints shall be carefully made in such a way that they will not impair the strength and stiffness of the beams or members.

4.11.3 Timber roof construction

The plates, joists, rafters, purlins, brandering and other pieces used for the construction of the roof and trusses shall be of the dimensions, spacing and construction as shown on the Drawings.

All the joints in the framework shall be of the most appropriate type, accurately formed and adequately secured with fasteners as specified.

4.12 Joinery Work

Joinery work shall consist of the manufacture, delivery to the Site, and fixing in the buildings, of all joinery shown on the Drawings.

Except where a special finish is specified, the Contractor shall have all stairs, landings, doors, shelves and other joinery work cleaned and scrubbed down and shall leave all his work in a good order to the satisfaction of the Engineer.

4.12.1 Dimensions

All wrought timber shall be sawn, planed, drilled or otherwise machined or worked to the correct sizes and shapes shown on the Drawings.

Reasonable tolerances shall be provided at all connections between joinery works and the building structure to compensate adequately for any irregularities, settlements or any other movements.

4.12.2 Manufacture

The joiner shall perform all the necessary mortising, tenoning, grooving, matching, tonguing, housing, rebating and all the other works necessary for correct jointing. He shall also provide all metal plates, screws, nails and other fixings that may be necessary for doing the specified joinery work properly.

4.12.3 Joints

Where joints are not specifically indicated, they shall be the recognised forms of joints for each position. The joints shall be so made as to comply with Part 2 of BS 1186.

4.12.4 Doors and frames

Door frames, linings, panel doors, framed, ledged and braced doors, flush doors, sliding doors, etc shall be supplied or made by the joiner and shall be installed, fitted or hung as detailed on the Drawings.

All timber shall be wrought and prepared for oiling, staining, varnishing or painting.

4.12.5 Skirtings, cornices, etc

Skirtings, cornices, etc shall not be installed until after the wall coverings have been applied, the flooring laid and ceilings installed, unless otherwise specified.

4.12.6 In-situ joinery

In-situ joinery work shall not be executed until after all floor, wall and ceiling surfaces have been formed or constructed, unless otherwise instructed.

4.12.7 Ceilings

Ceilings shall unless otherwise specified of scheduled consist of plaster board or fibre-cement panels as shown on the Drawings and shall be nailed to the brading or suspended from the roof structure. The panels shall be separated by exposed tees and insulated with a 50 mm thick fibreglass wool blanket where shown on the Drawings.

4.13 Plumbing

Plumbing shall be carried out strictly in accordance with the Drawings and with the National Building Regulations, with specific reference to Government Notice R1875 dated 31 August 1979.

Steel pipes and their malleable cast-iron fittings shall be joined with red lead and hemp, lead pipes shall have wiped soldered joints, and cast-iron pipes shall be joined by caulking with hemp and metallic lead.

Soil pipes from WC's shall have an internal diameter of at least 100 mm and shall be fitted with a pan connector and an access bend (or an access junction where a vent pipe is used), and

carried through walls and into the ground for connection to the sewer. Vent pipes shall be fitted with approved balloon gratings.

Waste pipes from basins and sinks shall have an internal diameter of at least 32 mm and shall discharge into gulleys. Bends for waste pipes shall incorporate cleaning eyes.

Cisterns, basins and sinks shall be connected to the pipe system with 12 mm diameter copper service pipes, and chromium-plated stopcocks shall be installed for isolation and maintenance purposes.

4.14 Painting

Paint may be applied by spray, brush or roller depending on the materials used, the surface to be painted, and the manufacturer's instructions.

Every coat of paint, irrespective of the method of application, shall be adequately and permanently keyed or bonded to the base material or previously applied coat, and shall be evenly distributed, continuous, free from sags, runs, brush marks, pin holes or other imperfections, and shall dry to a smooth finish.

An approved water trap and air-regulating valve shall be furnished and installed on all equipment used in spray painting.

Before painting the interiors of buildings they shall be cleaned and the floors shall be washed and kept free from dust during the progress of the interior work.

The Contractor shall protect all nearby surfaces against disfigurement by spatters, splashes and smirches of paint or paint materials. The Contractor shall be responsible for any damage by paint or dirt caused by his operations to vehicles or property or injury to persons and he will be required to provide protective measures to prevent any such damage or injury and make good, where required, at his own expense.

If passing traffic creates dust which may harm or spoil the appearance of external painted surfaces, the Contractor shall sprinkle the adjacent areas with water, at his own cost, for a sufficient distance on each side of the location where painting is being done.

Undercoats shall be tinted by the manufacturer to distinguish between successive coats.

The final coats or finishing coats of paint shall be applied after all the other work in the vicinity has been completed.

The painter shall keep some of the final paint in reserve in the event of his having to make good any patching which may be required as a result of damage or unforeseen circumstances.

Upon completion, the Contractor shall, in the case of buildings, clean all glass, remove all paint spots from walls, floors and fittings, and leave the premises clean and fit for occupation.

All inflammable materials, comprising solvents, thinners, wiping cloths, etc, shall be placed in tightly closed containers and properly disposed of.

4.14.1 Painting Of Plaster, Concrete or Brick Surfaces

a) Surface preparation

Surfaces for painting shall be prepared by sandpapering, scraping or wire-brushing to remove loose material, dust, laitance, scum or other deleterious materials or high spots. Defective areas shall be cut out where necessary and made good with an approved non-shrink filler. Cracks shall be cut out, suitably keyed, and given a coat of an approved bonding agent before the filler is applied. All patches shall be rubbed down to an even surface. Surfaces shall be washed and allowed to dry.

Surfaces shall be treated with neutralising liquid for walls, and if the surface is coarse or textured, either one full coat of pigmented wall sealer or one full filler coat shall be applied in addition to the neutralising liquid.

b) Paint application

Prior to the emulsion paint being applied, the surface shall be sealed with an approved clear sealer and primed with an undercoat diluted to 50%. Emulsion paint (PVA or acrylic) shall then be applied in two finishing coats.

Egg-shell finish (alkyd oil-based), oil gloss paint or enamel gloss paint shall be applied as follows: one coat of universal undercoat shall be applied and it shall be followed by one coat of a mixture comprising 50% of the undercoat and 50% of the paint to be used for the finishing coat. A finishing coat of semi-gloss eggshell, or oil gloss paint or enamel gloss paint shall then be applied.

4.14.2 *Painting of Woodwork*

a) Surface preparation

The surfaces shall be cleaned, sandpapered and rubbed down to a smooth, even face before painting. The moisture content of the timber shall not be more than 20% at the time when the first coat is applied. All cracks, shakes or scars shall be filled flush with a filler approved by the Engineer before painting. The surface shall then be washed with cleaner and allowed to dry.

b) Primer application

One coat of an approved wood primer shall be applied.

After open-grained timber has been prepared and primed, the grain shall be stopped and filled with synthetic filler and rubbed down with water paper.

All new woodwork shall be properly primed on all surfaces and edges before being fixed in position. All woodwork not previously painted shall be given a prime coat, well brushed in.

c) Paint application

One coat of universal undercoat shall be applied followed by one coat of a mixture of 50% of the undercoat and 50% of the paint to be used for the finishing coat. A finishing coat of oil gloss paint or enamel gloss paint or semi-gloss egg-shell (alkyd oil-based) paint shall then be applied.

d) Varnish finish

Two coats of gloss varnish or egg-shell varnish shall be prepared, stopped and applied.

4.14.3 *Painting of Metal Surfaces*

Wherever possible, all painting shall be done at the manufacturer's works, but where this is not feasible, the Engineer may permit the application of the undercoat and finishing coats to be carried out on the Site, in which case a prime coat shall be applied at the manufacturer's works prior to the members being despatched to the Works.

a) Surface preparation

The preparation of metal surfaces shall comply with SABS Code of Practice 064 and shall receive the greatest care to ensure rust-free conditions prior to the paint system being applied.

All surfaces shall be prepared by removing loose paint, rust, plaster, scale, dust, dirt, grease, etc and by repairing or patching defective paint surfaces before painting or repainting. Damaged shop-primed surfaces shall be thoroughly cleaned of rust and patched with a prime coat.

b) Paint application

a. Iron and steel work

All iron and steel work shall be properly primed with a red-lead-based primer where steel work is likely to be exposed to the elements for longer than 30 days. Zinc-chromate primer may be used where overpainting will be completed within 30 days of priming. Metal-etch wash primers may be used under dry conditions where overpainting will be completed within 24 hours of priming. The dry-film thickness of the prime coat shall not be less than 0,300 mm.

After priming, one coat of universal undercoat shall be applied. If necessary, the undercoat shall be tinted to a shade just lighter than the desired finish with approved liquid stainers. The dry-film thickness shall not be less than 0,250 mm.

The two finishing coats shall either be of alkyd resin-based synthetic enamel, gloss or matt oil paint, or as specified elsewhere. The dry-film thickness shall not be less than 0,250 mm per coat.

When mating surfaces are brought together, both surfaces shall have been given the full treatment specified, but where this cannot be done, each surface shall be given a copious coating of primer and the surfaces drawn together while the paint is still wet.

The portion of structural steel members to be buried in soil, and all bases to a height of 500 mm shall be given two coats of an epoxy-tar primer instead of the zinc-chromate primer specified for other surfaces.

The surfaces of steel and cast-iron articles, such as floor gratings, grids and manhole covers, shall, after a thorough brushing to remove loose rust, be painted with two coats of epoxy-tar paint, each at least 0,230 mm thick.

b. Galvanized iron and steel

All traces of protective coating shall be removed with galvanized iron cleaner, and two coats of calcium plumbate primer shall be applied. One coat of tinted universal undercoat and two finishing coats of alkyd resin-based synthetic enamel gloss paint shall be applied.

c. Non-ferrous metals

Surfaces of aluminium, copper, etc shall be prepared and cleaned, and one coat of self-etch zinc-chromate wash primer shall be applied. One coat of universal tinted undercoat and two finishing coats of enamel gloss paint shall then be applied. Where non-ferrous metals are not to be painted, the surfaces shall be cleaned, polished and two coats of lacquer applied.

4.14.4 Painting of Floor Screeds

Where chemicals could cause damage to floors, such floors shall be painted with an approved epoxy paint. The type of paint to be used will be shown on the Drawings and will depend on the types of chemical that are used.

The preparation of such floor screeds for painting and the subsequent application of paints shall be carried out strictly in accordance with the manufacturer's instructions.

4.14.5 Paint Thickness

Unless otherwise specified, all coats of paint, whether prime coat, undercoat or finishing coat, shall have a dry-film thickness of not less than 0,200 mm, irrespective of the method of application.

4.14.6 Inspection

The Contractor shall provide the necessary equipment to establish whether the primers, undercoats and finishing coats have been applied to the correct thickness according to the correct applications. The Engineer may take samples of the paints during painting operations for testing and quality control.

5 TOLERANCES

Tolerances for clay brick dimensions, strength, warpage and efflorescence shall be as SANS 227.

Permissible deviations in the final finished surfaces to the degree of accuracy required will be applied to linear dimensions, position, verticality, level, squareness and bow.

The degree of accuracy required is Class II:

Table 1: Table of Permissible Deviations

Item	Classification Finish	Degree of Accuracy			Brick Guide
		 mm	 mm	 mm	
Stock Brickwork					
	against earth	20	15		NFX
	to receive plaster	17	10	7	NFP
	to be bagged	13	8	5	NFP
	fairfaced	8	5	3	FBS
Faced brickwork with bricks					
	generally uniform in shape and size	8	5		FBS
	high degree of uniformity in shape & size	5	3		FBX
	non-uniform in shape	13	8		FBA
Out of alignment with					
	Adjoining finishes on projecting Items(windows & door frames)	4	3		FBS
		3.5	2.5	1	FBX
		5	3.5	2	FBA
Out of verticality of perps (dependent on bond)					
		40	15	5	
Out of alignment					
	horizontally top edge to top edge adjoining bricks	2.5	2.0	15	FBS
		2.0	1.5	1	FBX
		3.0	2.5	2	FBA
Out of trueness vertically					
	top edge to lower edge of next course	2.5	2	15	FBS
		2.0	1.5	1	FBX
		3.0	2.5	2	FBA
Squareness of rooms					
	measured on the diagonals*	20	10	5	
Out of square or true of a comer or angle					
	measured 300 mm from the angle*	7	4	2	

*A similar degree of accuracy will be required to irregular shaped rooms. The governing factor shall be the general appearance and it may be necessary or acceptable to depart from the above guidelines if required.

6 TESTING

6.1 Compressive Strength

Determination of the minimum average compressive strength of clay bricks shall be in accordance with SABS 227 at frequencies required by the Engineer.

6.2 Costs of Tests

Costs of Tests described above shall be borne by the Contractor who shall be deemed to have included these costs in the scheduled rates for brickwork.

7 MEASUREMENT AND PAYMENT

7.1 Brickwork

Thickness, type and class indicatedUnit: Area (m²)

The unit of measurement shall be the square metre of each type of brickwork built, calculated from the leading dimensions of the brickwork. Areas of pipes, louvers, windows, doors, etc built into brickwork shall not be included in the areas measured. At corners and intersections common to more than one brick wall, the areas shall be measured only once.

The tendered rates shall include full compensation for the construction of the brickwork complete as specified, including pointing, the building-in of conduits, beams, lintels, pipe sleeves, doors, windows, louvers, the raking-out of joints, weepholes, wall ties, brickforce reinforcement as specified, as well as plasterwork, facings, paintwork, etc where scheduled.

7.2 Plasterwork

Thickness of plaster and finish indicatedUnit: Area (m²)

The unit of measurement shall be the square metre of each type of coat completed as specified.

The tendered rates shall include full compensation for the construction of the plasterwork, including supplying all materials, mixing, applying, finishing, forming reveals, joints, narrow widths, rounded angles, V-joints, etc complete as specified.

7.3 Floor Screeds

Description and thickness indicatedUnit: Area (m²)

The unit of measurement shall be the square metre of floor screed laid, as specified, on floors, steps or areas shown on the Drawings or as designated by the Engineer.

The tendered rates shall include full compensation for constructing the floor screeds, including supplying all materials, mixing, laying, finishing, and forming nosings, reedings, skirtings, etc.

7.4 Doors and Windows

Type and size indicatedUnit: Number (No)

The unit of measurement shall be the number of doors and windows installed complete as specified.

The tendered rates shall include full compensation for manufacturing and installing steel or aluminium doors, windows, and frames complete with hinges, handles, locks, barrel bolts, door closers, retaining devices, door stops, stays and any other work or ironmongery necessary to complete the work as specified or as shown on the Drawings. The tendered rate for doors and

windows shall also include full compensation for glazing, window sills and thresholds as specified, including all necessary timber subframes for aluminium doors and windows, etc

7.5 Ceilings and Bulkheads

Plaster-board ceiling (type and thickness indicated):

Fixed ceilingUnit: Area (m²)

Suspended ceilingUnit: Area (m²)

Fibre-cement ceiling (thickness indicated):

Fixed ceilingUnit: Area (m²)

Suspended ceilingUnit: Area (m²)

for other types of ceilings

Bulkheads (description of material and indication of vertical or horizontal)Unit: Area (m²)

Cornices (description)Unit: length (m)

The unit of measurement shall be the square metre of fixed or suspended ceiling or bulkheads installed complete as scheduled. The unit of measurement for cornices shall be linear metre.

The tendered rates shall also include full compensation for the construction of the ceilings, bulkheads and cornices including the exposed tees, grids, frameworks, hangers, trap doors, insulation blanket and banding as specified, as well as the suspension system where applicable.

7.6 Joinery

Doors (type and size indicated)Unit: Number (No)

Skirtings (type and size indicated)Unit: Length (m)

The units of measurement shall be the number or metre of each type and/or size of joinery item specified.

The tendered rates shall include full compensation for supplying all materials, and manufacturing, cutting, wasting, fixing and installing the joinery items. Tendered rates for doors shall also include for all ironmongery applicable to the specific doors as specified and indicated on the door and ironmongery schedule drawings, including fixing, installing, testing, etc.

7.7 Miscellaneous Work

PaintworkUnit: square metre, meter, Lump Sum (m²,m,Sum)

Plumbing Unit: metre, number, sum (m, No, Sum)

The unit of measurement shall be as scheduled.

The tendered sums or rates shall include full compensation for the supply of all materials, delivery to site, storage, all equipment and labour, preparation, application, installation, testing, all temporary work and safety precautions, replacement of defective work, protection of completed work and clean-up after completion.

7.8 Miscellaneous Items

Items measured by area:

Description of Item

.....Unit: Area (m²)

Items measured by length:

Description of Item

.....Unit: metre (m)

Items measured by number:

Description of Item

.....Unit: Number (No)

The unit of measurement shall be the number, linear metre and square metre as applicable to each item.

The tendered rates shall include full compensation for all labour, plant, equipment, transport, etc, manufacturing or providing and installing each item complete as scheduled and shown on the Drawings, and shall include all corrosion protection where applicable.

PARTICULAR SPECIFICATION

GIBB 015 – DRY STACK RETAINING WALL

Table of Contents

1	SCOPE AND DEFINITIONS.....	2
2	INTERPRETATIONS.....	2
2.1	Normative References.....	2
2.2	DEFINITIONS.....	2
2.3	ABBREVIATIONS.....	2
3	DESIGN REQUIREMENTS.....	2
4	MATERIALS.....	3
4.1	Footings.....	3
4.2	Blocks.....	3
4.2.1	General.....	3
4.2.2	Concrete.....	3
4.2.3	Strength.....	4
4.3	Block trough filling.....	4
4.4	Backfill behind blocks.....	4
4.5	Drainage.....	4
4.5.1	Drainage pipes.....	4
4.5.2	Filter material.....	4
4.6	Geotextile.....	4
5	PLANT.....	4
6	METHODS AND PROCEDURES.....	4
6.1	Excavation.....	4
6.2	Footings.....	5
6.3	Laying of blocks.....	5
6.4	Block trough filling.....	5
6.5	Backfilling behind blocks.....	5
6.6	Drainage.....	5
6.7	Geosynthetic reinforcement.....	5
7	TOLERANCES.....	6
8	TESTING.....	6
9	MEASUREMENT AND PAYMENT.....	7
9.1	Design, Supply and Installation of Dry-laid precast concrete block retaining wall.....	7

1 SCOPE AND DEFINITIONS

This Specification covers the design and construction of retaining walls using dry-laid proprietary precast concrete blocks of special shape and design.

The typical details for concrete block retaining walls are shown on applicable drawings provided with the tender documents.

2 INTERPRETATIONS**2.1 Normative References**

Where this Specification is required for a project the following specifications shall, inter alia, form part of the Contract Document:

- a) SANS 1200 Series of Standardized Specifications;
 - SANS 1200 D
 - SANS 1200 G
 - SANS 207:2011

2.2 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:

- Closed face. A pattern of laying the blocks abutting adjacent blocks in a course.
- Geotextile. A material in the form of a sheet, a blanket or a net that is permeable to water.
- Open face. A pattern of laying the blocks with a horizontal space between the blocks in a course.

2.3 ABBREVIATIONS

For the purpose of this Document, the following abbreviations shall have the meanings given:

- | | | |
|---------------|---|---|
| • NGL | - | Natural Ground Level |
| • MOD AASHTO. | - | Modified American Association of State Highway and Transportation Officials |
| • PI | - | Plastic Index |
| • uPVC | - | unplasticized polyvinyl chloride |
| • PD | - | Permissible Deviations |

3 DESIGN REQUIREMENTS

The drawings prepared by the Employer and provided with the tender form part of the requirements for the concrete block retaining walls. The typical details for concrete block retaining walls shown in the Drawings are provided for the purpose of indicating the height of retaining walls, the extent of the retaining walls, adjoining structures, and angles of inclination.

The Contractor is responsible for the complete design and execution of the retaining wall system, in accordance with the requirements detailed in the Drawings and the below table.

The Contractor will be required to submit to the Employers Agent all design calculations, assumptions, drawings, etc for review prior to any work being undertaken. Review of the above will not absolve the contractor of responsibility for the design.

Table 1: Requirements for Concrete Block Wall Design

Geotechnical conditions	refer to geotechnical reports on CD
Maximum loading at top of wall	The area above the dry stack walls will be inaccessible to vehicle traffic. Wall must, however be designed to with stand any surcharge that would be experienced during construction
angle at top of wall	Slope immediately behind wall 1:100 over 1m, battered back at 1:2 to tie into a 1:4 NGL thereafter (see Drawing)
Angle of inclination of wall	63°
Foundations	Reinforced or mass concrete width and depth dependant on contractors design requirements
Facing	Löffelstein, Enviro-wall, Terraforce, or other similar approved patented concrete block system
Minimum allowable block strength	21 day crushing strength of blocks: - Under full plate contact: Avg 13MPa with a minimum of 11MPa - Under simulated in-situ point loading: 8 MPa (minimum) Coefficient of friction for interlocking sliding: 0.54 (Value at 95%)
Backfill material	Backfill to be G5 quality or better from local excavations or stockpile, compacted to 95% MOD AASHTO
Geosynthetic reinforcement	If required In accordance with SANS 207:2011

4 MATERIALS

4.1 Footings

Concrete and steel used in the footings shall comply with SANS 1200 GA. To meet requirements in Table 1: Requirements for Concrete Block Wall Design

4.2 Blocks

4.2.1 General

Precast concrete blocks shall be unreinforced and of an approved commercial design, shape, colour and surface texture. They shall be free from cracks that would adversely affect their general appearance or serviceability, or both. No unit shall have any chip of dimension exceeding 15 mm or covering more than 3 % of the length of the exposed edge, whichever is the lesser.

An initial number of blocks may be kept by the Engineer as samples against which further production will be checked. The surface texture and colour of the blocks shall fall within the range of texture and colour represented by the manufacturer's approved samples. The colour shall penetrate to a depth of at least 5 mm below the exposed surface of each block and the coloured layer shall be integrally bound to the body of the block.

4.2.2 Concrete

Concrete used in the manufacture of the blocks shall be as specified in the design requirements of this specification, which shall be vibrated and cured, all in accordance with SANS 1200 GA.

4.2.3 Strength

The ultimate shear capacity of the concrete interlocking key (or "up-stand") of the blocks, if any, shall be in accordance with Table 1: Requirements for Concrete Block Wall Design at least 14 kN/m of wall.

4.3 Block trough filling

Unless the blocks are to be filled with concrete or left open, the material used to fill the blocks shall be topsoil or suitable approved material selected from excavations on site.

4.4 Backfill behind blocks

Unless otherwise approved by the Engineer, backfill material shall be a silty gravel and sand (G5 quality) or better, i.e. it shall not be less than 20% nor more than 70% mass passing a 2 mm sieve, the PI shall not be greater than 10 and the group index shall be 0.

4.5 Drainage**4.5.1 Drainage pipes**

Pipes for subsurface drains shall be perforated HDPE pipes with a nominal diameter of either 110 mm or 160 mm

4.5.2 Filter material

The filter material used around the drainage pipe, in the drainage blanket or in the vertical (or sloping) drainage layer behind the blocks shall be either:

- An aggregate complying with the applicable requirement of SANS 1083 and conforming to an approved grading for a road base layer material except that the fraction passing the 0,42 mm and 0,074 mm sieves shall not exceed 15 % and 2 % respectively, or
- An approved free-draining sand.

4.6 Geotextile

A geotextile blanket shall be made of fibres consisting of at least 85 % (by mass) of polypropylene, polyethylene, a polyester, a polyamide, or a co-polymer of vinyl chloride and vinylidene-chloride, or any combination of these polymers, and the polymer(s) shall contain such additives as are necessary to render the filaments resistant to the effects of ultraviolet radiation and heat.

The amount of water absorbed by a geotextile after it has been soaked in water at 20° C for 24 h shall be less than 1 % (by mass).

The Engineer's approval of the make and grade of the geotextile shall be obtained by the Contractor before the Contractor orders or uses any geotextile in the Works.

5 PLANT

Except for the production of the precast blocks, the construction is predominantly labour-based. The Contractor shall only provide such vehicles, cranes, compactors, pumps as are necessary for safety or to place the materials where it is agreed with the Employers Agent that labour based construction methods are not to be used.

6 METHODS AND PROCEDURES**6.1 Excavation**

Excavation shall comply with SANS 1200 D. Except that the footing shall be not less than 500 mm below finished ground level, the depth of excavation shall be such that there will be

adequate bearing capacity and resistance to sliding forces on the footing. Excavations shall be to the approval of the Engineer.

6.2 Footings

Footings shall be constructed level and, where the ground slopes along the line of the footing, stepped, taking into account the block height and the batter to which the wall is to be built or the set-back required by the particular block design.

The top surface of footings shall be given a wood-float finish.

6.3 Laying of blocks

Blocks shall be laid with their top and bottom concrete surfaces in full contact, i.e. the "down-stand", if any, shall not rest on the soil fill or concrete base in the block trough. Levelling of blocks shall be achieved by careful chipping off any high spots of the block rib.

Unless "open face" is shown on the drawings, blocks shall be laid "closed face" i.e. with full contact between adjacent blocks in a course. Blocks shall be laid to the rotation and batter shown on the drawings or ordered. Where blocks are to be laid "open face" they shall be laid with the specified horizontal spacing between them.

For curved walls, a "re-start" in the block laying sequence shall be spread over at least five blocks.

6.4 Block trough filling

Except in the case of concrete, the material used to fill the block trough shall be lightly tamped.

6.5 Backfilling behind blocks

Backfilling behind blocks shall proceed with the placing of the blocks and shall not lag the placing of the blocks by more than one course of blocks. Placing and compaction of the backfill shall be carried out in layers of 85 mm maximum thickness when a plate compactor is used and 170 mm maximum thickness when a 1 ton vibrating roller is used. Backfilling shall be compacted at optimum moisture content to at least 95 % MOD AASHTO maximum dry density.

6.6 Drainage

Where deemed necessary by the Contractor's design, the Contractor shall construct a drain, drainage blanket and/or face wall drain behind the wall. The drain, drainage blanket and face wall drain shall conform to the details specified in this document.

6.7 Geosynthetic reinforcement

Where deemed necessary by the Contractor's design, the wall shall include a geosynthetic reinforcement system. The geosynthetic reinforcement system shall be installed as the blocks are laid and the backfilling placed and compacted. It shall conform to the details specified in this document.

A geotextile shall be placed either:

- with an overlap of at least 300 mm that is securely fastened to prevent any movement or slipping during placing, or
- provided that it is sewn or bonded in an approved manner, with an overlap of at least 75 mm.

7 TOLERANCES

The materials and the finish of the work shall be to Degree of Accuracy II and the permissible deviations (PD) (see clause 6 of SANS 1200 A) shall be within the limits given below for Degree of Accuracy II:

1	2	3	4
Item	Permissible deviation		
	Degree of accuracy		
	III	II	I
a) Footings (see also (c) below)	mm	mm	mm
1) Position on plan			
PD from designated position of any point, measured from nearest grid line	+50	+35	+20
2) Linear dimension on plan cast against excavation sides	+60	+40	+20
PD from designated dimension			
3) Finished level	+30	+20	+10
PD from designated level			
b) Walls (see also (d) below)			
1) Block spacing			
PD from designated horizontal spacing	+7	+5	+3
2) Position in plan of top edge of any wall course			
PD from designated position of any point, measured from nearest grid line	+300	+200	+100
3) Alignment of top edge of any wall course			
PD from a line joining any two points 30 m apart on top of exposed edge	+20	+15	+10
4) Bulging			
PD of any block from a line determined from its adjacent blocks, horizontally and vertically	+15	+10	+10
5) Level			
PD from designated level of any course	+15	+10	+10
c) Footings	degree	degree	degree
1) Rotation			
PD from designated rotation	+2	+2	+2
d) Wall			
PD from designated batter	+2	+2	+2

8 TESTING

When requested by the Engineer, the Contractor shall submit test certificates from an approved independent testing laboratory to show that the blocks comply with the relevant product specification.

9 MEASUREMENT AND PAYMENT**9.1 Design, Supply and Installation of Dry-laid precast concrete block retaining wall**

Design, supply and installation of dry-laid precast concrete block retaining wall for heights xxm to xxm square metre (m²)

The unit rate shall cover the cost of the design, supply, handling, storage and laying of the blocks as specified, including for the supply, placing and compaction, if applicable and of the block filling and the design supply and laying of geosynthetic reinforcement if required.

The measurement and payment of earthworks, footings, and drainage systems shall be according to the applicable SANS payment clause.

Annex C3.6.3
EMPLOYER'S OCCUPATIONAL HEALTH & SAFETY SPECIFICATION:
THORNHILL WTW Ph3 UPGRADING: CIVILS

TABLE OF CONTENTS

1.	Scope
1.1	Introduction and Definitions
1.2	Purpose of the Health and Safety Specification
1.3	Implementation of the Health and Safety Specification
1.3.1	Client duties
1.3.2	Designer duties
1.4	Scope of Work
2.	Further Requirements
2.1	Duties of Principal Contractor
2.2	Management and Supervision of Construction Work
2.3	Notification of Intention to Commence Construction Work
2.4	Assignment of Contractor's Responsible Persons to Manage Health and Safety on Site
2.5	Competency for Contractor's Responsible Persons
2.6	Compensation of Occupational Injuries Act 130 of 1993 (COIDA)
2.7	Occupational Health and Safety Policy
2.8	Health and Safety Organogram
2.9	Risk Assessments
2.10	Health and Safety Representative(s)
2.11	Health and Safety Committee
2.12	Medical Certificate of Fitness
2.13	Health and Safety Training
2.13.1	Induction
2.13.2	Awareness
2.14	Competency
2.15	General Record Keeping
2.16	General Inspection, Monitoring and Reporting
2.17	Emergency Procedures
2.18	First Aid Box and First Aid Equipment
2.19	Accident / Incident Reporting and Investigation
2.20	Hazards and Potential Situations
2.21	Occupational Health and Safety Signage
2.22	Management of Contractors by Principal Contractor
2.23	Water Environments
2.24	Construction employee's facilities
2.25	Fall Protection
2.26	Excavation
2.27	Rope access work
2.28	Hazardous chemical substances (HCS)
2.29	Noise induced hearing loss
2.30	Suspended platforms
2.31	Material hoists
2.33	Pressure vessels (including gas bottles)
2.34	Lifting machinery and tackle
2.35	Ladders and ladder work
2.36	General machinery
2.37	Portable electrical tools
2.39	Scaffolding
2.40	Bulk mixing plant
2.42	Public health and safety
2.43	Use & Storage Of Flammables
2.44	Suspended platforms
2.45	Site Housekeeping
2.46	Stacking & Storage
2.47	Night work
2.48	Environmental Conditions and Flora and Fauna

- 2.49 Occupational Health
- 2.51. Penalties
- 2.52 Close-Out Requirements

1. SCOPE

1.1 INTRODUCTION AND DEFINITIONS

This Health and Safety Specification contains clauses that are generally applicable to construction activities, as well as imposing pro-active controls associated with activities that impact on Health and Safety as it relates to plant and machinery. Compliance to the requirements of the Occupational Health and Safety Act 1993 is in addition to the requirements of this Health and Safety Specification and is part of the Contractor's responsibility. The Client will monitor that the Contractors comply with the requirements of such legislation.

The Principal Contractor shall with reference to the Health and Safety Specifications, and without limiting his obligations in terms of the Occupational Health and Safety Act, 1993, develop his SHE Plan based on this document and to allocate a safety budget into his tender document.

Definitions as per the Construction Regulations 2014 applicable to this Health and Safety Specification:

"agent" means a competent person who acts as a representative or a client;

"angle of repose" means the steepest angle of a surface at which a mass of loose or fragmented material will remain stationary in a pile on the surface, rather than sliding or crumbling away;

"bulk mixing plant" means machinery, appliances or other similar devices that are assembled in such a manner so as to be able to mix materials in bulk for the purposes of using the mixed product for construction work;

"client" means any person for whom construction work is being performed;

"competent person" means a person who has, in respect of the work or task to be performed, the required knowledge, training and experience and, where applicable, qualifications, specific to that work or task: Provided that where appropriate qualifications and training are registered in terms of the provisions of the National Qualification Framework Act, 2000 (Act No.67 of 2000), those qualifications and that training must be regarded as the required qualifications and training; and is familiar with the Act and with the applicable regulations made under the Act;

"construction manager" means a competent person responsible for the management of the physical construction processes and the coordination, administration and management of resources on a construction site;

"construction site" means a workplace where construction work is being performed;

"construction supervisor" means a competent person responsible for supervising construction activities on a construction site;

"construction vehicle" means a vehicle used as a means of conveyance for transporting persons or material, or persons and material, on and *off* the construction site for the purposes of performing construction work;

"construction work" means any work in connection with-

- the construction, erection, alteration, renovation, repair, demolition or dismantling of or addition to a building or any similar structure; or
- the construction, erection, maintenance, demolition or dismantling of any bridge, dam, canal, road, railway, runway, sewer or water reticulation system; or the moving of earth, clearing of land, the making of excavation, piling, or any similar civil engineering structure or type of work;
 - "construction work permit" means a document issued in terms of regulation 3;
 - "contractor" means an employer who performs construction work;
 - "demolition work" means a method to dismantle, wreck, break, pull down or knock down of a structure or part thereof by way of manual labour, machinery, or the use of explosives;

- "design" in relation to any structure, including drawings, calculations, design details and specification.
- "designer" means a competent person who:-
 - prepares a design;
 - checks and approves a design;
 - arranges for a person at work under his or her control to prepare a design, including an employee of that person where he or she is the employer; or
 - designs temporary work, including its components;
 - an architect or engineer contributing to, or having overall responsibility for a design;
 - a building services engineer designing details for fixed plant;
 - a surveyor specifying articles or drawing up specifications;
 - a contractor carrying out design work as part of a design and building project; or
 - an interior designer, shop-fitter or landscape architect.

"excavation work" means the making of any man-made cavity, trench, pit or depression formed by cutting, digging or scooping;

"explosive actuated fastening device" means a tool that is activated by an explosive charge and that is used for driving bolts, nails and similar objects for the purpose of providing fixing;

"fall arrest equipment" means equipment used to arrest a person in a fall, including personal equipment, a body harness, lanyards, deceleration devices, lifelines or similar equipment;

"fall prevention equipment" means equipment used to prevent persons from falling from a fall risk position, including personal equipment, a body harness, lanyards, lifelines or physical equipment such as guard-rails, screens, barricades, anchorages or similar equipment;

"fall protection plan" means a documented plan, which includes and provides for -

- all risks relating to working from a fall risk position, considering the nature of work undertaken;
- the procedures and methods to be applied in order to eliminate the risk of falling;
- and a rescue plan and procedures;

"fall risk" means any potential exposure to falling either from, off or into;

"health and safety file" means a file, or other record containing the information in writing required by these Regulations;

"health and safety plan" means a site, activity or project specific documented plan in accordance with the client's health and safety specification;

"health and safety specification" means a site, activity or project specific document prepared by the client pertaining to all health and safety requirements related to construction work;

"material hoist" means a hoist used to lower or raise material and equipment, excluding passengers;

"medical certificate of fitness" means a certificate contemplated in regulation 7(8);

"mobile plant" means any machinery, appliance or other similar device that is able to move independently, and is used for the purpose of performing construction work on a construction site;

"National Building Regulations" means the National Building Regulations made under the National Building Regulations and Building Standards Act, 1977 (Act No. 103 of 1977), and promulgated by Government Notice No. R. 2378 of 30 July 1990, as amended by Government Notices No's R. 432 of 8 March 1991, R. 919 of 30 July 1999 and R. 547 of 30 May 2008;

"person day" means one normal working shift of carrying out construction work by a person on a construction site

"principal contractor" means an employer appointed by the client to perform construction work;

"Professional Engineer or Professional Certificated Engineer" means a person holding registration as either a Professional Engineer or Professional Certificated Engineer in terms of the Engineering Profession Act, 2000 (Act No. 46 of 2000);

"Professional Technologist" means a person holding registration as Professional Engineering Technologist in terms of the Engineering Profession Act, 2000.

"provincial director" means the provincial director as defined in regulation 1 of the General Administrative Regulations, 2003;

"scaffold" means a temporary elevated platform and supporting structure used for providing access to and supporting workmen or materials or both;

"shoring" means a system used to support the sides of an excavation and which is intended to prevent the cave-in or the collapse of the sides of an excavation;

"structure" means-

- any building, steel or reinforced concrete structure (not being a building), railway line or siding, bridge, waterworks, reservoir, pipe or pipeline, cable, sewer, sewage works, fixed vessels, road, drainage works, earthworks, dam, wall, mast, tower, tower crane, bulk mixing plant, pylon, surface and underground tanks, earth retaining structure or any structure designed to preserve or alter any natural feature, and any other similar structure;
- any falsework, scaffold or other structure designed or used to provide support or means of access during construction work; or
- any fixed plant in respect of construction work which includes installation, commissioning, decommissioning or dismantling and where any construction work involves a risk of a person falling.

"suspended platform" means a working platform suspended from supports by means of one or more separate ropes from each support ;

"temporary works" means any falsework, formwork, support work, scaffold, shoring or other temporary structure designed to provide support or means of access during construction work;

"the Act" means the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993);

"tunnelling" means the construction of any tunnel beneath the natural surface of the earth for a purpose other than the searching for or winning of a mineral.

Reference should be made to the following documentation in conjunction with this Safety Specification including existing surveys, drawings and reports.

1.2 PURPOSE OF THE HEALTH AND SAFETY SPECIFICATION

The purpose of this site specific Health and Safety Specification is to comply with legal requirements and to provide health and safety information about specific project risks known by the Client, Designer and Client Agent to be applicable to this project. This document also provides minimum health and safety requirements, standards and expectations that the principal contractor and contractors must adhere to.

The Contractor must take into account all information in this specification and ensure that their tenders include adequate resource and competence to deal with the matters detailed herein so that all relevant contents are dealt with in a way which is in compliance with legislation and the ethical concerns for the safeguarding of employees, contractors and other persons affected by the construction activities.

The Health and Safety Specification will be implemented' during construction of the works and any construction activity that the Client has control over.

This will also assist in ensuring that all the costs related to the compliance with Occupational Health Act 85 of 1993 and the Construction Regulations 2014, as well as this Health and Safety Specification, are taken into consideration at Tender stage.

No advice, approval of any document required by the Health and Safety Specification such as hazard identification and risk assessment action plans or any other form shall be construed as an acceptance by the Client of any obligation that absolves the Contractor from achieving the required level of performance and compliance with legal requirements.

Further, there is no acceptance of liability by the Client which may result from the Contractor failing to comply with the Health and Safety Specification unless the Client has issued an Instruction to any requirement, i.e. the Contractor remains responsible for achieving the required performance levels.

1.3 IMPLEMENTATION OF THE HEALTH AND SAFETY SPECIFICATION

This Health and Safety Specification forms an integral part of the Contract, and Contractors shall make it an integral part of their Contracts with Sub Contractors and Suppliers. Contractors employed by the Client are to ensure that the provisions of the Health and Safety Specification are applied both on the site and in respect of all off site activities relating to the project, in particular in transport activities and project dedicated off site fabrication works. The Contractor shall enforce the provisions of the Health and Safety Specification amongst all sub-contractors and suppliers for the project.

The successful Contractor will be required to compile a Health and Safety Plan based on the requirements of the Occupational Health Act 85 of 1993 and these Specifications, which will need to be approved by Client prior to commencement with construction work.

NOTIFICATION OF CONSTRUCTION WORK AND APPLICATION OF WORK PERMIT

Amatola Water shall, where the client meets the requirements stipulated in Construction Regulation 3, at least 30 days before that work is to be carried out apply to provisional director in writing and use the Annexure 1 form to perform construction work permit to commence construction work.

1.3.1 CLIENT DUTIES

In terms of the Construction Regulations 2014 the Client (or their Agent, where appointed) has legal duties. Where an Agent (refer to "definitions" section of this document) is appointed in terms of this project, these Health and Safety duties assigned will also apply.

All references to "Client" will apply to their appointed "Client Agent", where so appointed, in this Health and Safety Specification. The Client must:

- Prepare a baseline risk assessment for the construction work
- Prepare a suitable, sufficiently documented and coherent site specific Health and Safety specification for the intended construction work, based on the baseline risk assessment
- Include the Health and safety specification in the tender documents
- Ensure that potential principal contractors submitting tenders have made adequate provision for the cost of health and safety measures
- Ensure that the principal contractor to be appointed has the necessary competencies and resources to carry out the construction work safely
- Take reasonable steps to ensure co-operation between all contractors appointed by the client to enable each of those contractors to comply with the regulations
- Ensure, before work commences, that every principal contractor is registered and in good standing with the compensation fund, or with a licensed compensation insurer as contemplated in the Compensation for Occupational injuries and Diseases Act, 1993 (Act no 130 of 1993)
- Appoint each principal contractor in writing for the project, or part thereof
- Discuss and negotiate with the principal contractor the contents of the principal contractor's safety plan and thereafter finally approve that plan for implementation

- Ensure that a copy of the principal contractor's SHE plan is implemented and maintained
- Ensure that periodic health and safety audits and document verification are conducted at intervals mutually agreed upon between the principal contractor and any contractor.
- Ensure that a copy of the health and safety audit report is provided to the principal contractor within 7 days after the audit
- stop any contractor from executing a construction activity which poses a threat to the health and safety of persons which is not in accordance with the principal contractor's health and safety plan for site
- Where changes are brought about to the design or construction work, make sufficient health and safety information and appropriate resources available to the principal contractor to execute the work safely
 - Ensure that the health and safety file is kept and maintained by the principal contractor.
 - Where the client requires additional work to be performed as a result of a design change or error in construction due to the actions of the client, the client must ensure that sufficient safety information and appropriate additional resources are available to execute the required work safely.
 - Where more than one principal contractor is appointed, the client must take reasonable steps to ensure co-operation between all principal contractors and contractors to ensure compliance with the Regulations
- Where the Client has appointed a Client Agent for the project, their details for this project are contained in the Project Directory section of this health and safety specification.

1.3.2 DESIGNER DUTIES

It must be noted that the Designer also has Health and Safety duties assigned in terms of the Construction Regulations. Where the contractor fulfils a design function in terms of this project (refer to "definitions" section of this document), these duties will also apply.

The Designer to ensure that:

- all temporary works are adequately designed so that it will be capable of supporting all anticipated vertical and lateral loads that may be-applied;
- the designs of temporary works are done with close reference to the structural design drawings issued
- by the contractor, and in the event of any uncertainty consult the contractor;
- all drawings and calculations pertaining to the design of temporary works are kept at the office of the temporary works designer and are made available on request by an inspector; and
- the loads caused by the temporary works and any imposed loads are clearly indicated in the design.

1.4 SCOPE OF WORK

The works under this Contract includes:

- Establishment, clearing of the reservoir site and establishing the foundation platform.
- Construction of a 10ML prestressed concrete reservoir.
- Manufacture of fittings, specials and bends using pipes supplied by the Contractor.
- Fencing of the Site.
- Connecting the new reservoir to the existing inlet and outlet pipelines.
- OH&S compliance
- Environmental compliance and management including site rehabilitation.

2. FURTHER REQUIRMENTS

2.1 Duties of Principal Contractor

A Principal Contractor must:

- provide and demonstrate to the client a suitable, sufficiently documented and coherent site specific health and safety plan, based on the client's documented health and safety specifications, which plan must be applied from the date of commencement of and for the duration of the construction work and which must be reviewed and updated by the principal contractor as work progresses;
- open and keep on site a health and safety file, which must include all documentation
- required in terms of the Act and these Regulations, which must be made available on request to an inspector, the client, the client's agent or a contractor; and
- on appointing any other contractor, in order to ensure compliance with the provisions of the Act
- provide contractors who are tendering to perform construction work for the principal contractor, with the relevant sections of the health and safety specifications pertaining to the construction work which has to be performed;
- ensure that potential contractors submitting tenders have made sufficient provision for health and safety measures during the construction process;
- ensure that no contractor is appointed to perform construction work unless the principal contractor is reasonably satisfied that the contractor that he or she intends to appoint, has the necessary competencies and resources to perform the construction work safely;
- ensure prior to work commencing on the site that every contractor is registered and in good standing with the compensation fund or with a licensed compensation insurer as contemplated in the Compensation for Occupational Injuries and Diseases Act, 1993;
- appoint each contractor in writing for the part of the project on the construction site
- take reasonable steps to ensure that each contractor's health and safety plan is implemented and maintained on the construction site;
- ensure that the periodic site audits and document verification are conducted at intervals mutually agreed upon between the principal contractor and any contractor, but at least once every 30 days;
- stop any contractor from executing construction work which is not in accordance with the client's health and safety specifications and the principal contractor's health and safety plan for the site or which poses a threat to the health and safety of persons;
- where changes are brought about to the design and construction, make available sufficient health and safety information and appropriate resources to the contractor to execute the work safely;
- discuss and negotiate with the contractor the contents of their health and safety plan and finally approve that plan for implementation;
- ensure that a copy of both the principal contractor and contractor's health and safety plan is available on request to an employee, an inspector, a contractor, the client or the client's agent;
- hand over a consolidated health and safety file to the client upon completion of the construction work, to include a record of all drawings, designs, materials used and other similar information concerning the completed structure.

In addition to the documentation required in the health and safety file include and make available a comprehensive and updated list of all the contractors on site accountable to the principal contractor, the agreements between the parties and the type of work being done;

- ensure that all his or her employees have a valid medical certificate of fitness specific to the construction work to be performed and issued by an occupational health practitioner in the form of Annexure 3.

A contractor must prior to performing any construction work:

- provide and demonstrate to the principal contractor or a suitable and sufficiently documented health and safety plan, based on the relevant sections of the client's health and safety specification and provided by the principal contractor which plan must be applied from the date of commencement of and for the duration of the construction work and which must be reviewed and updated by the contractor as work progresses;
- open and keep on site a health and safety file, which must include all documentation required in terms of the Act and these Regulations, and which must be made available on request to an inspector, the client, the client's agent or the principal contractor;
- before appointing another contractor to perform construction work be reasonably satisfied that the contractor that he or she intends to appoint has the necessary competency and resources to perform the construction work safely;
- co-operate with the principal contractor as far as is necessary to enable each of them to comply with the provisions of the Act;
- as far as is reasonably practicable, promptly provide the principal contractor with any information which might affect the health and safety of any person at work carrying out construction work on the site, any person who might be affected by the work of such a person at work, or which might justify a review of the health and safety plan.

Where a contractor appoints another contractor to perform construction work, the duties that apply to the principal contractor will apply to the contractor as if he or she were the principal contractor,

A principal contractor must take reasonable steps to ensure co-operation between all contractors appointed by the principal contractor to enable each of those contractors to comply with these Regulations.

No contractor may allow or permit any employee or person to enter any site, unless that employee or person has undergone health and safety induction training pertaining to the hazards prevalent on the site at the time of entry.

A contractor must ensure that all visitors to a construction site undergo health and safety induction pertaining to the hazards prevalent on the site and must ensure that such visitors have the necessary personal protective equipment.

A contractor must at all times keep on his or her construction site records of the health and safety induction training and such records must be made available on request to an inspector, the client, the client's agent or the principal contractor.

A contractor must ensure that all his or her employees have a valid medical certificate of fitness specific to the construction work to be performed and issued by an Occupational Health Practitioner in the form of Annexure 3 as prescribed in the Construction Regulations, 2014.

2.2 MANAGEMENT AND SUPERVISION OF CONSTRUCTION WORK

A principal contractor must, in writing, appoint one full-time competent person as the construction manager with the duty of managing all the construction work on a single site, including the duty of ensuring occupational health and safety compliance, and in the absence of the construction manager an alternate must be appointed by the principal contractor.

A principal contractor must upon having considered the size of the project, in writing appoint one or more assistant construction managers for different sections thereof: Provided that the designation of any such person does not relieve the construction manager of any personal accountability for failing in his or her management duties- in terms of this regulation.

Where the construction manager has not appointed assistant construction managers, or, in the opinion of an inspector, a sufficient number of such assistant construction managers have not been appointed, that inspector must direct the construction manager in writing to appoint the number of assistant construction managers indicated by the inspector, and those assistant construction managers must be regarded as having been appointed.

No construction manager appointed in terms of the Regulations may manage any construction work on or in any construction site other than the site in respect of which he or she has been appointed.

A contractor must, after consultation with the client and having considered the size of the project, the degree of danger likely to be encountered or the accumulation of hazards or risks on the site, appoint a full-time or part-time construction health and safety officer in writing to assist in the control of all health and safety related aspects on the site: Provided that, where the question arises as to whether a construction health and safety officer is necessary, the decision of an inspector is decisive.

No contractor may appoint a construction health and safety officer to assist in the control of health and safety related aspects on the site unless he or she is reasonably satisfied that the construction health and safety officer that he or she intends to appoint is registered with a statutory body approved by the Chief Inspector and has necessary competences and resources to assist the contractor

A construction manager must in writing appoint construction supervisors responsible for construction activities and ensuring occupational health and safety compliance on the construction site.

A contractor must, upon having considered the size of the project, in writing appoint one or more competent employees for different sections thereof to assist the construction supervisor, and every such employee has, to the extent clearly defined by the contractor in the letter of appointment, the same duties as the construction supervisor:

Provided that the designation of such employee does not relieve the construction supervisor of any personal accountability for failing in his or her supervisory duties.

Where the contractor has not appointed such an employee, or, in the opinion of an inspector, a sufficient number of such employees have not been appointed, that inspector must instruct the employer to appoint the number of employees indicated by the inspector.

No construction supervisor appointed may supervise any construction work on or in any construction site other than the site in respect of which he or she has been appointed: Provided that if a sufficient number of competent employees have been appropriately designated on all the relevant construction sites, the appointed construction supervisor may supervise more than one site.

2.3 ASSIGNMENT OF CONTRACTOR'S RESPONSIBLE PERSONS TO MANAGE HEALTH AND SAFETY ON SITE

The Contractor shall submit management and supervisory appointments as well as any relevant appointments in writing, as stipulated by the Construction Regulations 2014 and the Occupational Safety and Health Act 1993, prior to commencement of work.

2.4 COMPETENCY FOR CONTRACTOR'S RESPONSIBLE PERSONS

The Contractor's responsible persons shall be competent in health and safety and be familiar with the Occupational Health and Safety Act 1993, and applicable regulations. Valid proof health and safety courses attended by such persons will be required to be presented to the Client.

Principal Contractor must appoint a competent and experienced Construction Health and Safety Officer to execute all the necessary health and safety tasks on site. Provision of Full Time Health and Safety Officer is required on site.

The appointed Safety Officer must have at least minimum of 3 years' experience in the field of Health and Safety, in regards to level of qualification Safety Officer must obtained a National Diploma / SAMTRAC or and NEBOSH in Health and Safety from an approved or recognized institution, and must be computer literacy. Safety officer must be registered with the statutory board approved by Chief Inspector (SACPCMP) as (CHSO).

2.5 COMPENSATION OF OCCUPATIONAL INJURIES AND DISEASES ACT 130 OF 1993

The successful Contractor shall submit to the Client a valid letter of good standing with the Compensation Insurer prior to appointment.

2.6 OCCUPATIONAL HEALTH AND SAFETY POLICY

The Contractor shall submit their Health and Safety Policy, prior to construction commencement, signed by the Chief Executive Officer. The Policy must outline objectives and how they will be achieved

and. implemented within the company operations.

2.7 HEALTH AND SAFETY ORGANOGRAM

The Contractor shall submit an organogram, prior to construction commencement, outlining the Health and Safety Site Team that will be assigned to the project, if successful with the tender. In cases where appointments have not been made, the organogram shall reflect the position. The organogram shall be updated, when there is a change in the site team.

2.8 DESIGNATION OF OCCUPATIONAL HEALTH AND SAFETY REPRESENTATIVES

Where the principal contractor employs more than 20 persons, including the employees of other contractors and sub-contractors, he shall appoint one occupational health and safety representative for every 50 employees or part thereof. The General Administrative Regulations require that the election, appointment and subsequent designation of the occupational health and safety representatives be executed in consultation with employee representatives – a consultative agreement will be compiled, approved and submitted as part of the SHE File. Occupational health and safety representatives must be designated in writing for a specified period. The designation must include the area of responsibility of the person.

2.9 DUTIES AND FUNCTIONS OCCUPATIONAL HEALTH AND SAFETY REPRESENTATIVES

The principal contractor must ensure that the designated occupational health and safety representatives conduct a monthly inspection of their respective areas of responsibility. For this inspection they will use a checklist, and report thereon to the principal contractor. Completed checklists will be kept in the health and safety file.

Health and safety representatives must be included in accident and/or incident investigations.

Health and safety representatives must attend all statutory occupational health and safety committee meetings.

The principal contractor must establish an occupational health and safety committee consisting of all the designated occupational health and safety representatives together with a number of management representatives. The management representatives shall not exceed the number of occupational health and safety representatives on the committee. The members of the occupational health and safety committee must be appointed in writing. Representatives from Amatola water will act as co-opted members to the Health and Safety Committee meetings as and when required.

Designations / Appointments (see Regulations of the Act)

OHS Act General Machinery Regulation 2(7)(a) – Assistant Supervision of machinery
OHS Act Construction Regulation 8(1) – Construction Manager
OHS Act Construction Regulation 8(2) – Assistant Construction Manager
OHS Act Construction Regulation 8(7) - Construction Supervisor
OHS Act Construction Regulation 8(8) – Assistant Construction Supervisor
OHS Act General Administrative Regulation 9(2) – Incident Investigator
OHS Act Construction Regulation 8(5) – Construction Health and Safety Officer
OHS Act General Safety Regulations 3(4) – First Aider/s
OHS Act Section 19 (3) - Health and Safety Committee Member
OHS Act Section 19(6)(a) – Co-opted Health and Safety Committee member
OHS Act Driven Machinery Regulation 18(11) - Lifting Machinery Operator (Appointment or Permit)
OHS Act Driven Machinery Regulation 18(5) & 18(6) - Lifting Machinery Inspector
OHS Act Driven Machinery Regulation 18(10)(e) - Lifting Tackle Inspector
OHS Act Electrical Machinery Regulations 10 -Portable Electrical Equipment Inspector
OHS Act Hazardous Chemical Substances Regulation 3(3) Hazardous Chemical Substances Co-coordinator
OHS Act Construction Regulation 5(3)(b) Appointment of a Contractor (if appointing subcontractors)
OHS Act Construction Regulation 9(1) – Risk Assessor
OHS Act Construction Regulation 10(1) – Fall Protection Developer
OHS Act: Pressure Equipment Regulations 11 & 12 Portable Gas Container Inspector
OHS Act: Construction Regulations 13(1) Excavation Supervisor
OHS Act: Construction Regulations 12(1) Demolition Work Supervisor
OHS Act: Construction Regulations 14(2) - Scaffolding Supervisor
OHS Act: Construction Regulations 19(2)(b) Explosive-powered Tool Inspector

OHS Act: Construction Regulations 22 - Cranes
OHS Act: Construction Regulations 23(1) - Construction Vehicle and Mobile Plant Inspector
OHS Act: Construction Regulations 22(d) & (e) -Temporary Electrical Installation Controller
OHS Act: Construction Regulations 28 - Stacking and Storage Supervisor
OHS Act: Construction Regulations 29 - Fire fighting Equipment Inspector

Proofs of competencies for each major appointment must be included with the signed appointment in the Health and Safety File.

The appointments shall be in writing on the Principal Contractor's / Contractor's letter head and the responsibilities clearly stated together with the period for which the appointment / designation is valid. This information shall be communicated and agreed with the appointees. Copies of appointments shall be submitted to Amatola Water / Agent together with concise CV's of the appointees. Amatola Water reserves the right to approve / disapprove an appointee and any changes in appointed / designated personnel shall be brought to the attention of Amatola Water before the appointee assumes responsibility.

The Principal Contractor / Contractor shall, provide Amatola Water with an organogram of all appointed / designated personnel and contractors and keep an up to date copy on site at all times.

2.11 RISK ASSESSMENTS

Baseline Risk Assessment

Amatola Water shall cause a baseline risk assessment to be conducted by a competent person before the design process and tender process commence, and the assessed risks shall form part of the health and safety specifications.

- 2.11.1 The contractor is required to develop a baseline risk assessment taking the resources, competency levels, nature and scale of their organization into consideration for submission during SHE File evaluation phase. Refer; Annexure 1, Client baseline risk assessment.
- 2.11.2 Every Contractor performing construction work shall, before the commencement of any construction work or work associated with the construction work, and during construction work, ensure that a risk assessment is undertaken by a competent person, appointed in writing, and the risk assessment shall form part of the SHE plan to be applied on the site. Risk assessments shall identify occupational health and safety hazards and risks and environmental aspects and impacts emanating from the activity to be performed by the Principal Contractor / Contractor.
- 2.11.3 The risk assessment shall include (at a minimum).
- 2.11.4 Identification of Project name, reference and area.
- 2.11.5 Date on which risk assessments were conducted / reviewed.
- 2.11.6 The identification of the risks / hazards and aspects / impacts to which persons may be exposed to per activity.
- 2.11.7. The analysis and evaluation of the risks / hazards and aspects / impacts identified.
- 2.11.8 Existing control measures and proposed corrective measures.
- 2.11.9 A plan to review the risk assessments as the work progresses and changes are introduced.
- 2.11.10 A documented plan of Safe Working Procedures (SWP)', and its relevance to the risk assessment, inclusive of method statements, to mitigate, reduce or control the risks and hazards that have been identified.
- 2.11.11 A plan to monitor the application of the Safe Working Procedures (SWP).
- 2.11.12 Signature of appointed competent person conducting risk assessment.

- 2.11.13 Signature of Principal Contractor management and employees involved in risk assessment.
- 2.11.14 Based on the risk assessments, the principal contractor must develop a set of site-specific OH&S rules that will be applied to regulate the health and safety of the construction work.
- 2.11.15 The Contractor shall ensure through his risk management processes the hierarchy of controls stipulated as follows are implemented.
- 2.11.15.1 Eliminate - The complete elimination of the hazard.
- 2.11.15.2 Substitute - Replacing the material or process with a less hazardous one.
- 2.11.15.3 Redesign - Redesign the equipment or work process.
- 2.11.15.4 Separate- Isolating the hazard by guarding or enclosing it.
- 2.11.15.5 Administrate - Providing control such as training, procedures etc.
- 2.11.15.6 Personal Protective Equipment (PPE) - Use of appropriate and properly fitted PPE where other controls are not practical. (PPE as the last resort)
- 2.11.16 The principal contractor will be required to carry out the following three forms of risk assessment:
- 2.11.17.1 Baseline Risk Assessments:

The Principal Contractor will be required carry out a risk assessment before the commencement of construction activities. This "baseline" risk assessment will form part of the Principal Contractor s SHE plan. The hazards and risk to which persons, plant, vehicles and facilities may be exposed during the construction should be identified and evaluated. Measures to reduce or control these risks or hazards should be defined during this assessment. The effectiveness of the measures defined and the baseline risk assessment prepared shall be monitored and reviewed from time to time to ensure that it remains relevant and accurate.

2.11.17.2 Issue- Based Risk Assessments:

The Contractor will be required to carry out separate risk assessments during construction of the project when methods and procedures are varied, for example when:

- Designs are amended;
- New machines are introduced;
- Plant is periodically cleaned and maintained;
- Plant is started-up or shut-down;
- Systems of work change or operations alter;
- Indents or near-misses occur; or
- Technological developments invalidate prior risk assessments.

2.11.17.3 Continuous Risk Assessments:

The Occupational Health and Safety Act (Act no. 85 of 1993) specifically requires that employers shall provide and maintain working environments that are safe and without risk to health. The general awareness of hazards needs to be raised as work ethic to maintain a safe and risk free environment on an on-going basis. This is achieved by continuous risk assessments, a form of risk assessment that takes place as an integral part of day-to-day management. Examples of continuous risk assessments include:

2.11.17.4 Maintaining general hazard awareness,

2.11.17.5 Pre-work risk assessments / Daily Safety Task Instructions, and

2.11.17.6 Pre inspections

2.11.18 Review of Risk Assessments:

- 2.11.18.1 The Principal Contractor is required to review the hazards identified, the risk assessments and the Safe Work Procedures as the contract work develops and progresses and each time changes are made to the designs, plans and construction methods and/or processes. Revisions to the approved risk assessments and Safe Work Procedures will be presented at each production planning and progress meeting.
- 2.11.18.2 Risk assessments are to be reviewed whenever there is change on the scope of work, process, and accidents or when required by Amatola Water.
- 2.11.18.3 The principal contractor must provide Amatola Water, other contractors and all other concerned or affected parties with copies of any changes, alterations or amendments to risk assessments and Safe Work Procedures within 14 days of such changes.

2.12 SAFETY IMPROVEMENT PROGRAMMES

The principal contractor is required to establish Safety Improvement Programmes for all significant (high) risks determined in the baseline risk assessment to improve on risk management performance. Safety Improvement Programmes shall include:

- Actions to be taken to reduce potential exposure to risk during the construction period;
- Personnel responsible for implementation of action;
- Target date / Time Frame for action to be completed.
- Safety Improvement programmes shall be reviewed whenever there is changes on the scope of work, significant risk profile, process, and incident/accident outcomes or when required by the client. Implementation of Safety Improvement Programmes must be monitored on a monthly basis; records of implementation must be maintained and reviewed / revised as and when necessary.

2.13 MEDICAL CERTIFICATE OF FITNESS

The contractor shall ensure that their employees on site have a valid medical certificate of fitness, specific to the construction work being performed, issued by an occupational health practitioner in the form of an Annexure 3 template (refer to the Construction Regulations 2014 on the Department of Labour website for a sample of this form).

2.14 HEALTH AND SAFETY TRAINING

The Contractor shall quarterly conduct a training needs analysis to ascertain what health and safety training is required. A plan of action should be devised and forwarded to the Client for records, once the identified people have attended the training, the Contractor must provide the Client with copies of certificates obtained.

2.14.1 INDUCTION

No Contractor may allow or permit any employee or person to enter site unless they have undergone health and safety induction training pertaining to the hazards prevalent on site at the time of entry. This includes visitors to site. The Contractor must ensure that visitors to site have the necessary protective equipment

2.14.2 AWARENESS

The Contractor shall conduct periodic toolbox talks on site, preferably weekly or before any hazardous work takes place. The talks shall cover the relevant activity and an attendance register must be signed by all attendees. This record of who attended and the content of the topic will be kept on the site health a safety file as evidence of training.

2.15 COMPETENCY

After the Contractor has identified the training to be conducted as part of the competency requirement, and based on Risk Assessment, he shall send the relevant persons on appropriate courses and keep certificates of training for reference. Familiarity with the Health and Safety Act and Regulations is an integral part of the definition of competence.

2.16 GENERAL RECORD KEEPING

The Contractor shall keep and maintain Health and Safety records to demonstrate compliance with the Health and Safety Specification and the Occupational Health and Safety Act. The contractor shall ensure that all records of incidents, spot fines, training etc. are kept on site. All documents shall be available for inspection by the Client, or the Department of Labour's Inspectors.

2.17 GENERAL INSPECTION/MONITORING AND REPORTING

The Contractor shall carry out inspections as per Health and Safety Specification requirements as well as required by the relevant Regulations.

2.18 EMERGENCY PROCEDURES

The contractor shall submit a detailed Emergency Procedure for approval by the Client prior commencement on site. The procedure shall detail the response plan including the following:

- List of key personnel;
- Details of emergency services;
- Actions or steps to be taken in the event of the emergency; and
- Information on hazardous materials/situations including each material hazardous potential impact or risk on the environment or human and measures to be taken in the event of an accident.

The contractor emergency procedure shall include, fire, spills, accidents to employees, use of hazardous substances, dangers as a result service deliver protests/ intimidation, etc. The Contractor shall advise the Client in writing of any on-site emergencies, together with a record of action taken, within 24 hours of the emergency occurring. A contact list of all service providers i.e. Fire Department, Ambulance, Police, Medical and Hospital must be maintained and available to site personnel.

2.19 FIRST AID BOX AND FIRST AID EQUIPMENT

The Contractor shall provide first aid box/es and appoint, in writing, First Aider(s) for this project in line with the results of the Contractor's risk assessment for the project, this health and safety specification as well as the provisions of the General Safety Regulations. The appointed First Aider(s) are to be sent for accredited first aid training before starting on site. Valid certificates are to be kept on site. Site First Aid boxes must be adequately stocked at all time, accessible and be controlled by a qualified First Aider. If required by the Client, the Contractor shall have a stretcher on site to be used in case of a serious incident.

2.20 ACCIDENT/INCIDENT REPORTING AND INVESTIGATION

The Contractor shall, in addition to the prescribed requirements of the Occupational Health and Safety Act and General Safety Regulations, investigate, record and report all Section 24 reportable incidents to the Client within 24 hours of the incident occurring. Incident investigations shall be conducted by the Contractor's appointed Accident Investigator who have sufficient knowledge to carry out an investigation. In the event of a fatality or a permanent disabling injury the Contractor must submit proof of reporting of incident to Department of Labour as well as proof of preventative measures to the Client. The Client reserves the right to conduct investigations into any incidents that they deem fit and the Contractor is required to provide full co-operation in this regard.

2.21 OCCUPATIONAL HEALTH AND SAFETY SIGNAGE

The Contractor shall ascertain and provide adequate on site health and safety signage. This signage shall include, but shall not be limited to, Hard Hat Helmet Area; Safety Shoes to be worn on site; Dust Masks to be worn in areas where there might be exposure to excessive dust; Ear Plugs / Muffs to be worn where there might be noise exposure over 85 dB; Gloves; Safety Goggles; Safety Harness, Workers in Excavation, traffic management, etc. the Contractor shall be responsible to maintain the quality and replacement of signage.

2.22 MANAGEMENT OF CONTRACTORS BY PRINCIPAL CONTRACTOR

The Principal Contractor shall ensure that all contractors under his control are complying with the respective Health and Safety Plans, as well as Health and Safety Legislation.

- Whenever the principal contractor appoints contractors or sub-contractors, it is a requirement that an Occupational Health and Safety Act (Act no. 85 of 1993) Section 37(2) agreement (i.e. Agreement with Mandatory) is included in his agreement with the contractor or sub-contractor.
- The principal contractor and contractor shall comply with the requirements of Construction Regulations with regard to relationship management between Principal Contractors and Contractors.
- Principal contractors are required to formally notify Amatola Water before appointing subcontractors.
- Amatola Water shall approve all specialist subcontractors to be appointed and/or engaged by the principal contractor.

2.23 SAFE WORK PROCEDURES / METHOD STATEMENTS

- The Contractor shall, in writing, clearly explain how each risk assessed to be significant will be addressed to eliminate or reduce it to a tolerable level and submit it for approval to Amatola Water before site establishment. This may be through method statements or written operational control procedures.
 - For significant risks identified after site establishment, method statements shall be submitted to Amatola Water at least two working days before the start of the associated activity.
 - Every occupational health and safety risk that is identified during the risk assessment process shall be communicated to every employee whose work is associated with the risk - this may be done in the form of a toolbox talk. Each employee shall sign to confirm understanding of the health and safety risks in the tasks.
 - No contractor shall allow or permit any employee, visitor or any other person to enter the site, unless such employee or person has undergone health, safety and environmental induction training pertaining to the hazards prevalent on the site at the time of entry.

2.24. OPERATIONAL HAZARD & RISK / ASPECT& IMPACT CONTROL REQUIREMENTS

SECURITY & ACCESS CONTROL:

- The principal contractor must establish site access rules and implement and maintain these throughout the construction period. Access control must, amongst other, include the rule that non-employees will not be allowed on site unaccompanied.
- The principal contractor must develop a set of security rules and procedures and maintain these throughout the construction period.
- The Principal Contractor shall provide a guard house for a security working during the day and at night if recommended. The guard house should be in good condition and at-least meet minimum requirements as per environmental regulations for workplaces.
- Construction Vehicles and Mobile Plant
- Construction vehicles and mobile plant will be inspected by Amatola Water prior to being allowed on a project site. Suppliers of hired vehicles, plant and equipment will be required to comply with this specification as well as the Occupational Health and Safety Act (Act no. 85 of 1993) and Regulations.

2.25 WATER ENVIRONMENTS

A contractor must ensure that where construction work is done over or in close proximity to water, provision is made for-

- preventing persons from falling into water; and the rescuing of persons in danger of drowning.
- A contractor must ensure that where a person is exposed to the risk of drowning by falling into the water, the person is provided with and wears a lifejacket.

2.26 CONSTRUCTION EMPLOYEES FACILITIES

A contractor must, in terms of the Construction Regulations 2014, provide:

- Shower facilities after consultation with the employees or employees representatives, or at least one shower facility for every 15 persons;
- at least one sanitary facility for each sex and for every 30 workers;
- changing facilities for each sex; and sheltered eating area.

2.27. FALL PROTECTION PLAN

The Contractor must:

- designate a competent person to be responsible for the preparation of a fall protection plan
- ensure that the fall protection plan contemplated above is implemented, amended where and when necessary and maintained as required; and
- take steps to ensure continued adherence to the fall protection plan.

A fall protection plan contemplated above must include-

- a risk assessment of all work carried out from a fall risk position and the procedures and methods used to address all the risks identified per location;
- the processes, for the evaluation of the employee's medical fitness necessary to work at a fall risk position and the records thereof;
- a programme for the training of employees working from a fall risk position and the records thereafter;
- the procedure addressing the inspection, testing and maintenance of all fall protection equipment; and a rescue plan detailing the necessary procedure, personnel and suitable equipment required to affect a rescue of a person in the event of a fall incident to ensure that the rescue procedure is implemented immediately following the incident.

A contractor to ensure that a construction manager appointed under regulation 8(1) is in possession of the most recently updated version of the fall protection plan.

A contractor to ensure that all unprotected openings in floors, edges, slabs, hatchways and stairways are adequately guarded, fenced or barricaded or that similar means are used to safeguard any person from falling through such openings.

Also that no person is required to work in a fall risk position, unless such work is performed safely as contemplated in above and fall prevention and fall arrest equipment are approved as suitable and of sufficient strength for the purpose for which they are being used, having regard to the work being carried out and the load, including any person, they are intended to bear; and securely attached to a structure or plant, and the structure of plant and the means of attachment thereto are suitable and of sufficient strength and stability for the purpose of safely supporting the equipment and person who could fall, and fall arrest equipment is used only where it is not reasonably practicable to use fall prevention equipment.

2.28 TEMPORARY WORKS

A contractor shall appoint a temporary works designer in writing to design, inspect and approve the erected temporary works on site before use. A contractor must ensure that all temporary works operations are carried out under the supervision of a competent person who has been appointed in writing for that purpose.

A contractor to ensure that-

- all temporary works structures are adequately erected, supported, braced and maintained by a competent person so that they are capable of supporting all anticipated vertical and lateral loads that may be applied to them, and that no loads are imposed onto the structure that the structure is not designed to withstand;
- all temporary works structures are done with close reference to the structural design drawings, and where any uncertainty exists the structural designer should be consulted;
- detailed activity specific drawings pertaining to the design of temporary works structures are kept on the site and are available on request to an inspector, other contractors, the client, the client's agent or any employee;
- all persons required to erect, move or dismantle temporary works structures are provided with adequate training and instruction to perform those operations safely;
- all equipment used in temporary works structure are carefully examined and checked for suitability by a competent person, before being used;
- all temporary works structures are inspected by a competent person immediately before, during
- and after the placement of concrete, after inclement weather or any other imposed load and at least on a daily basis until the temporary works structure has been removed and the results have been recorded in a register and made available on site;
- no person may cast concrete, until authorization in writing has been given by the competent person contemplated above;
- if, after erection, any temporary works structure is found to be damaged or weakened to such a degree that its integrity is affected, it is safely removed or reinforced immediately;
- adequate precautionary measures are taken in order to- secure any deck panels against displacement and prevent any person from slipping on temporary works due to the application of release agents;
- as far as is reasonably practicable, the health of any person is not affected through the use of solvents or oils or any other similar substances;
- upon casting concrete, the temporary works structure is left in place until the concrete has acquired sufficient strength to safely support its own weight and any imposed load, and is not removed until authorization in writing has been given by the competent person
- the foundation conditions are suitable to withstand the loads caused by the temporary works structure and any imposed load in accordance with the temporary works design.
- provision is made for safe access by means of secured ladders or staircases for all work to be carried out above the foundation bearing level;
- temporary works drawing or any other relevant document includes construction sequences and methods statements;
- the temporary works designer has been issued with the latest revision of any relevant structural design drawing;
- a temporary works design and drawing is used only for its intended purpose and for a specific portion of a construction site; and
- the temporary works drawings are approved by the temporary works designer before the erection of any temporary works.

No contractor may use a temporary works design and drawing for any work other than its intended purpose.

2.29 EXCAVATION

Where excavations will take place, the Principal Contractor / Contractor shall submit a Method Statement to Amatola Water for approval before commencing with the excavation and Amatola Water will issue a permit to proceed once the Risk Assessment and Method Statement are approved. The contractor is required to-

- ensure that all excavation work is carried out under the supervision of a competent person who has been appointed in writing for that purpose;
- evaluate, as far as is reasonably practicable, the stability of the ground before excavation work begins.
- take reasonable and sufficient steps in order to prevent, as far as is reasonably practicable, any person from being buried or trapped by a fall or dislodgement of material in an excavation; may not require or permit any person to work in an excavation which has not been adequately shored or braced: Provided that shoring and bracing may not be necessary where:
 - the sides of the excavation are sloped to at least the maximum angle of repose measured
 - relative to the horizontal plane; or such an excavation is in stable material: Provided that-
 - permission has been given in writing by the appointed competent person contemplated above upon evaluation by him or her of the site conditions; and
 - where any uncertainty pertaining to the stability of the soil still exists, the decision by a professional engineer or a professional technologist competent in excavations is decisive
 - and such a decision must be noted in writing and signed by both the competent person and the professional engineer or technologist, as the case may be.
- take steps to ensure that the shoring or bracing contemplated above is designed and constructed in a manner that renders it strong enough to support the sides of the excavation in question;
- ensure that no load, material, plant or equipment is placed or moved near the edge of any excavation where it may cause its collapse and consequently endangers the safety of any person, unless precautions such as the provision of sufficient and suitable shoring or bracing are taken to prevent the sides from collapsing;
- must ensure that where the stability of an adjoining building, structure or road is likely to be affected by the making of an excavation, steps are taken to ensure the stability of such building, structure or road and the safety of persons; must cause convenient and safe means of access to be provided to every excavation in which persons are required to work, and such access may not be further than six meters from the point where any worker within the excavation is working; must ascertain, as far as is reasonably practicable, the location and nature of electricity, water, gas or other similar services which may in any way be affected by the work to be performed and must before the commencement of excavation work that may affect any such service, take the steps that are necessary to render the circumstances safe for all persons involved
- ensure that every excavation, including all bracing and shoring, is inspected daily, prior to the commencement of each shift after every blasting operation; after an unexpected fall of ground; after damage to supports; and after rain by the competent person, in order to ensure the safety of the excavation and of persons, and those results must be recorded in a register kept on site and made available on request to an inspector, the client, the client's agent, any other contractor or any employee;
- cause every excavation which is accessible to the public or which is adjacent to public roads or thoroughfares, or whereby the safety of persons may be endangered, to be adequately protected by a barrier or fence of at least one meter in height and as close to the excavation as is practicable and provided with warning illuminants or any other clearly visible boundary indicators at night or when visibility is poor, or have resort to any other suitable and sufficient precautionary measure where this is not practicable;

- must ensure that all precautionary measures stipulated for confined spaces as determined in the General Safety Regulations are complied with by any person entering any excavation;
- must, where the excavation work involves the use of explosives, appoint a competent person in the use of explosives for excavation, and must ensure that a method statement is developed by that person in accordance with the applicable explosives legislation; and
- must cause warning signs to be positioned next to an excavation within which or where persons are working or carrying out inspections or tests.

2.30 ROPE ACCESS WORK

A contractor must:

- appoint a competent person in writing as a rope access supervisor with the duty of supervising rope access work on the site, including the duty of ensuring occupational health and safety compliance in relation to rope access work: Provided that the appointment of any such person does not relieve the construction manager of any personal accountability for failing in his management duties in terms of this regulation;
- ensure that all rope access work on the construction site is carried out under the supervision of a competent person; and
- ensure that all rope access operators are competent and licensed to carry out their work.

No contractor may use or allow the use of rope access work unless:

- the design, selection and use of the equipment and anchors comply with the safety standards incorporated for this purpose into these Regulations under section 44 of the Act; and,
- he or she is in possession of a site specific fall protection plan developed by a competent person applicable to the specific work and environment prior to the commencement of the work, including records of maintenance and inspections of all the equipment used for the work operations.

A contractor must ensure that adequate measures are in place to allow rescue procedures to commence immediately in the event of a fall incident taking place.

2.31 HAZARDOUS CHEMICAL SUBSTANCES (HCS)

In addition to the requirements in the HCS Regulations, the principal contractor must provide proof in the Health and Safety Plan that:

- Material Safety Data Sheets (MSDS's) of the relevant materials/hazardous chemical substances are available prior to use by the contractor. All MSDS's shall be available for inspection by the agent at all times.
- Risk assessments are done at least once every 6 months.
- Exposure monitoring is done according to OESSM and by an Approved Inspection Authority (AIA) and that the medical surveillance programme is based on the outcomes of the exposure monitoring.
- How the relevant HCS's are being/going to be controlled by referring to:
 - Limiting the amount of HCS
 - Limiting the number of employees
 - Limiting the period of exposure
 - Substituting the HCS
 - Using engineering controls
 - Using appropriate written work procedures
 - The correct PPE is being used.
 - HCS are stored and transported according to SABS072 and 0228.
 - Training with regards to these regulations was given.

The Health and Safety plan should make reference to the disposal of hazardous waste on classified sites and the location thereof (where applicable).

The First Aider must be made aware of the MSDS and trained in how to treat HCS incidents appropriately.

2.32 Noise Induced Hearing Loss

Where noise is identified as a hazard the requirements of the NIHL regulations must be complied with and the following must be included / referred to in the Health and Safety Plan:

- Proof of training with regards to these regulations.
- Risk assessment done within 1 month of commencement of work,
- That monitoring carried out by an AIA and done according to SABS083.
- Medical surveillance programme established and maintained for the necessary employees.

Control of noise by referring to:

- Engineering methods considered
- Admin control (number of employees exposed) considered
- Personal protective equipment considered/decided on
- Describe how records are going to be kept for 40 years.

2.33 SUSPENDED PLATFORMS

A contractor must appoint a competent person in writing who must ensure that all suspended platforms work operations are carried out under his or her supervision and that all suspended platform erectors, operators and inspectors are competent to carry out their work.

No contractor may use or permit the use of a suspended platform, unless:

- the design, stability and construction thereof comply with the safety standards incorporated for this purpose into these Regulations under section 44 of the Act;
- he or she is in possession of a certificate of system design issued by a professional engineer; certificated engineer or a professional technologist for the use of the suspended platform system; and
- he or she is, before the commencement of the work, in possession of an operational compliance plan developed by a competent person based on the certificate of system design contemplated above and applicable to the environment in which the system is being used, which operational compliance plan must include proof of the-
- appointment of the competent person;
- competency of erectors, operators and inspectors;
- operational design calculations, which must comply with the requirements of the system design certificate;
- performance test results;
- sketches indicating the completed system with the operational loading capacity of the platform;
- procedures for and records of inspections having been carried out; and
- procedures for and records of maintenance work having been carried out.

A contractor making use of a suspended platform system must submit a copy of the certificate of system design, including a copy of the operational design calculations, sketches and test

results, to the provincial director before commencement of the use of the system and must further indicate the intended type of work that the system will be used for.

A contractor must submit a copy of the certificate of system design as per regulations for every new project.

A contractor must ensure that the outriggers of each suspended platform:

- are constructed of material of adequate strength and have a safety factor of at least four in relation to the load it is to carry; and
- have suspension points provided with stop devices or other effective devices at the outer ends to prevent the displacement of ropes.

A contractor must ensure that:

- the parts of the building or structure on which the outriggers of a suspended platform are supported, are checked by means of calculations to ensure that the required safety factor is adhered to without risk of damage to the building or structure;
- the suspension wire rope and the safety wire rope are separately connected to the outrigger;
- each person on a suspended platform is provided with and wears a body harness as a fall prevention device, which must at all times be attached to the suspended platform;
- the hand or power driven machinery to be used for the lifting or lowering of the working platform of a suspended platform is constructed and maintained in such a manner that an uncontrolled movement of the working platform cannot occur;
- the machinery referred to above is so situated that it is easily accessible for inspection;
- the rope connections to the outriggers are vertically above the connections to the working platform; and
- when the working platform is suspended by two ropes only, the connections of the ropes to the working platform are of a height above the level of the working platform to ensure the stability of the working platform.

A contractor must ensure that a suspended platform:

- is suspended as near as possible to the structure to which work is being done to prevent as far as is reasonably practicable horizontal movement away from the *Face* of the structure;
- is fitted with anchorage points to which workers must attach the lanyard of the safety harness worn and used by the worker, and such anchorage connections must have sufficient strength withstand any potential load applied to;
- is fitted with a conspicuous notice easily understandable by all workers working with the suspended platform, showing:
 - the maximum mass load;
 - the maximum number of persons; and
 - the maximum total mass load, including load and persons; which the suspended platform can carry.

A contractor must cause:

- the whole installation and all working parts of a suspended platform to be thoroughly examined by a competent person in accordance with manufacturer's specification;
- the whole installation to be subjected to a performance test as determined by the standard to which the suspended platform was manufactured;
- the performance test contemplated above to be done by a competent person appointed in writing, with the knowledge and experience of erection and maintenance of suspended

platforms or similar machinery, and who must determine the serviceability of the structures, ropes, machinery and safety devices before they are used, every time suspended platforms are erected; and

- the performance test contemplated above of the whole installation of the suspended platform to be subjected to a load equal to that prescribed by the manufacturer's or, in the absence of such load, to a load of 110% of the rated mass load, at intervals not exceeding 12 months and in such a manner that every part of the installation is stressed accordingly.

A contractor must cause every hoisting rope, hook or other load-attaching device which forms part of the suspended platform to be thoroughly examined in accordance with the manufacturer's speculation by the competent person before they are used every time they are assembled, and, in cases of continuous use, at intervals not exceeding three months.

A contractor must ensure that the suspended platform supervisor or the suspended platform inspector carries out a daily inspection of all the equipment prior to use, including establishing whether:

- all connection bolts are secure;
- all safety devices are functioning;
- all safety devices are not tampered with or vandalized;
- the total maximum mass load of the platform is not exceeded;
- the occupants in the suspended platform are using body harnesses which have been properly attached;
- there are no visible signs of damage to the equipment and
- all reported operating problems have been attended to.

A contractor must ensure that all inspection and performance test records are kept on the construction site at all times and made available to an inspector, the client, the client's agent or any employee upon request.

A contractor must ensure that all employees required to work or to be supported on a suspended platform are:

- medically fit to work safely in a fall risk position or such similar environment by being in possession of a medical certificate of fitness;
- competent in conducting work related to suspended platforms safely;
- trained or received training, which includes at least-
 - how to access and egress the suspended platform safely;
 - how to correctly operate the controls and safety devices of the equipment;
 - information on the dangers related to the misuse of safety device; and
 - information on the procedures to be followed in the case of:
 - an emergency;
 - the malfunctioning of equipment; and
 - the discovery of a suspected defect in the equipment;
 - and instructions on the proper use of body harnesses.

A contractor must ensure that where the outriggers of a suspended platform are to be moved, only persons trained and under the supervision of the competent person effect such move, within the limitation stipulated in the operational compliance plan, and that the supervisor must carry out an inspection and record the result thereof prior to re-use of the suspended platform.

A contractor must ensure that the suspended platform is properly isolated after use at the end of each working day in such a manner that no part of the suspended platform presents a danger to any person thereafter.

2.34 MATERIAL HOISTS

A contractor must ensure that every material hoist and its tower have been constructed in accordance with the generally accepted technical standards and are strong enough and free from defects.

A contractor must ensure that the tower of every material hoist is:

- erected on firm foundations and secured to the structure or braced by steel wire guy ropes, and extends to a distance above the highest landing to allow a clear and unobstructed space of at least 900 mm for over travel;
- enclosed on all sides at the bottom, and at all floors where persons are at risk of being struck by moving parts of the hoist, except on the side or sides giving access to the material hoist, with walls or other effective means to a height of at least 2100 mm from the ground or floor level; and
- provided with a door or *gate* at least 2100mm in height at each landing, and that door or gate must be kept closed except when the platform is at rest at such a landing.

A contractor must cause-

- the platform of every material hoist to be designed in a manner that it safely contains the loads being conveyed and that the combined mass of the platform and the load does not exceed the designed lifting capacity of the hoist;
- the hoisting rope of every material hoist which has a remote winch to be effectively protected from damage by any external cause to the portion of the hoisting rope between the winch and the tower of the hoist; and
- every material hoist to be provided with an efficient brake capable of holding the platform with its maximum load in any position when power is not being supplied to the hoisting machinery.
- No contractor may require or permit trucks, barrows or material to be conveyed on the platform of a material hoist and no person may so convey trucks, barrows or material unless those articles are secured or contained in a manner that displacement thereof cannot take place during movement.
- A contractor must cause a notice, indicating the maximum mass load which may be carried at any one time and the prohibition of persons from riding on the platform of the material hoist, to be affixed around the base of the tower and at each landing.
- A contractor of a material hoist may not require or permit any person to operate unless a hoist, person is competent in the operation of that hoist.
- No contractor may require or permit any person to ride on a material hoist. A contractor must ensure that every material hoist:
 - is inspected on daily basis by a competent person appointed in writing by the contractor and such competent person must have the experience pertaining to the erection and maintenance of material hoists or similar machinery;
 - inspection contemplated above, includes the determination of the serviceability of the entire material hoist, including guides, ropes and their connections, drums, sheaves or pulleys and all safety devices;
 - inspection results are entered and signed in a record book by a competent person, which book must be kept on the premises for that purpose;
 - is properly maintained and the maintenance records in this regard are kept on site.

2.35 PRESSURE VESSELS (INCLUDING GAS BOTTLES)

The Contractor shall comply with Pressure Vessel Regulations, including:

- Providing competency and awareness training to the operators;
- Providing PPE or clothing;
- Providing appropriate signage in areas where pressure vessels are used, as applicable;
- Inspect equipment regularly and keep records of inspections;
- Providing appropriate firefighting equipment (Fire Extinguishers).

2.36 LIFTING MACHINERY AND TACKLE

The Contractor shall ensure that lifting machinery and tackle is inspected before use and on a monthly basis. The Contractor shall have lifting machinery and tackle Inspector who will inspect the equipment at intervals required by the Driven Machinery Regulations, taking into account that:

- All lifting machinery and tackle have a safe working load clearly indicated;
- Regular inspection and servicing is carried out;
- Records are kept of inspections and of service certificates;
- Thorough examinations are carried out by competent personnel at the frequencies required by legislation
- There is proper supervision in terms of guiding the loads which includes a trained banks man to direct and check lifting tackle if it is safe for use.

2.37 LADDERS AND LADDER WORK

The Contractor shall ensure that all ladders are numbered and inspected regularly keeping record of inspections. It should be noted that aluminium ladders are preferred to wooden ladders.

2.38 GENERAL MACHINERY

The Contractor shall comply with the Driven Machinery Regulations, which include inspecting machinery regularly, appointing a competent person to inspect and ensure maintenance, issuing PPE or clothing and training those that use machinery and enforce compliance.

2.39 PORTABLE ELECTRICAL TOOLS

The Contractor shall ensure that use and storage of all explosive actuating fastening devices and portable electrical tools are in compliance with relevant legislation.

The Contractor shall consider that:

- A competent person undertakes routine inspections;
- Only authorized persons use the tools;
- There are safe working procedures applied;
- Awareness training is carried out and compliance is enforced at all times; and
- PPE and clothing is provided and maintained.

2.40 HIGH VOLTAGE ELECTRICAL EQUIPMENT

The installation of temporary electricity for Construction shall be in accordance with the Construction Regulation 22 and the Electrical Installation Regulations.

The Contractor must ensure that:

- existing services are located and marked before construction commences and during the progress thereof
- where the abovementioned is not possible, workers with jackhammers etc. are protected against electric shock by the use of suitable protective equipment e.g. rubber mats, insulated handles etc.
- electrical installations and -machinery are sufficiently robust to withstand working conditions on site
- temporary electrical installations shall be inspected at least once per week by a competent person and a record of the inspections kept on the OH&S File
- electrical machinery used on a construction site shall be inspected daily before start-up by the competent driver/operator or any other competent person and a record of the inspections kept on the OH&S File
- A competent person appointed in writing shall control all temporary electrical installations.

An electrical and mechanical lock-out procedure shall be developed and implemented. This lock-out procedure is to be adhered to by all Contractors on site.

2.41 SCAFFOLDING

A contractor must appoint a competent person in writing who must ensure that all scaffolding work operations are carried out under his or her supervision and that all scaffold erectors, team leaders and inspectors are-competent to carry out their work.

A contractor using access scaffolding must ensure that such scaffolding, when in use, complies with the safety standards incorporated for this purpose into these Regulations under section 44 of the Act. Access Scaffolding shall be erected, used and maintained safely in accordance with Construction Regulation 14 and SA Bureau of Standards Code of Practice, SANS 1085 entitled, "The Design, Erection, Use & Inspection of Access Scaffolding.

Detailed consideration shall be given to all scaffolding to ensure that it is properly planned to meet the working requirements, designed to carry the necessary loadings and maintained in a sound condition. It shall also be ensured that there is sufficient material available to erect the scaffolding properly.

Scaffolding may only be erected, altered or dismantled by a person who has adequate training and experience in this type of work or under the supervision of such a person.

2.42 BULK MIXING PLANT

A contractor must ensure that the operation of a bulk mixing plant is supervised by a competent person who has been appointed in writing and is :

- Aware of all the dangers involved in the operation thereof; and
- conversant with the precautionary measures to be taken in the interest of health and safety.

No person supervising or operating a bulk mixing plant may authorize any other person to operate the plant, unless that person is competent to operate a bulk mixing plant. A contractor must ensure that the placement and erection of a bulk mixing plant complies with the requirements set out by the manufacturer and that such plant is erected as designed.

A contractor must ensure that all devices to start and stop a bulk mixing plant are provided and that those devices are placed in an easily accessible position and constructed in a manner to prevent accidental starting.

A contractor must ensure that the machinery and plant selected is suitable for the mixing task and that all dangerous moving parts of a mixer are placed beyond the reach of persons by means of doors, covers or other 'similar means.

No person may remove or modify any guard or safety equipment relating to a bulk mixing plant, unless authorized to do so by the appointed person. A contractor must ensure that all precautionary measures stipulated for confined spaces as determined In the General Safety Regulations, 2003, are complied with when entering any silo.

A contractor must ensure that a record is kept of all repairs or maintenance to a bulk mixing plant and that the record is available on site to an inspector, the client, the client's agent or any employee.

2.43 USE & STORAGE OF FLAMMABLES

The Principal Contractor / Contractor to ensure that:

- No person is required or permitted to work in a place where there is the danger of fire or an explosion due to flammable vapors being present unless adequate precautions are taken;
- No flammable is used or applied e.g. in spay painting, unless in a room or cabinet or other enclosure specially designed and constructed for the purpose unless there is no danger of fire or explosion due to the application of adequate ventilation;
- The workplace is effectively ventilated. Where this cannot be achieved:
 - Employees must wear suitable respiratory equipment
 - No smoking or other sources of ignition is allowed in the area
 - The area is conspicuously demarcated as "flammable"
- Flammables stored on a construction site are stored in a well-ventilated, reasonably fire-resistant container, cage or room that is kept locked with access control measures in place

- and sufficient firefighting equipment installed and fire prevention methods practiced e.g. proper housekeeping;
- Flammables stored in a permanent flammables store are stored so that no fire or explosion is caused i.e.:
 - stored in a locked well-ventilated reasonably fire resistant container, cage or room conspicuously demarcated as “Flammable Store – No Smoking or Naked Lights”
 - the flammables store to be constructed of two-hour fire retardant walls and roof and separated from adjoining rooms or workplaces by means of a two-hour fire retardant fire wall
 - Adequate and suitable fire fighting equipment installed around the flammables store and marked with the prescribed signs
 - All electrical switches and fittings to be of a flameproof design
 - Any work done with tools in a flammables store or work areas to be of a non-sparking nature
 - No Class A combustibles such as paper, cardboard, wood, plastic, straw etc. to be stored together with Flammables
 - The flammable store to be designed and constructed to, in the event of spillage of liquids in the store, to contain the full quantity + 10% of the liquids stored
 - A sign indicating the capacity of the store to be displayed on the door
- Only one day's quantity of Flammables is to be kept in the workplace
- Containers (including empty containers) to be kept closed to prevent fumes/vapors from escaping and accumulating in low lying areas
- Metal containers to be bonded to earth whilst decanting to prevent build-up of static
- Welding and other flammable gases to be stored segregated as to type of gas and empty and full cylinders.

2.44 SUSPENDED PLATFORMS

A contractor must appoint a competent person in writing who must ensure that all suspended platforms work operations are carried out under his or her supervision and that all suspended platform erectors, operators and inspectors are competent to carry out their work.

No contractor may use or permit the use of a suspended platform, unless:

- procedures for and records of maintenance work having been carried out. the design, stability and construction thereof comply with the safety standards incorporated for this purpose into these Regulations under section 44 of the Act;
- he or she is in possession of a certificate of system design issued by a professional engineer; certificated engineer or a professional technologist for the use of the suspended platform system; and
- he or she is, before the commencement of the work, in possession of an operational compliance plan developed by a competent person based on the certificate of system design contemplated above and applicable to the environment in which the system is being used, which operational compliance plan must include proof of the-
 - appointment of the competent person;
 - competency of erectors, operators and inspectors;
 - operational design calculations, which must comply with the requirements of the system design certificate;
 - performance test results;
 - sketches indicating the completed system with the operational loading capacity of the platform;
 - procedures for and records of inspections having been carried out; and

A contractor making use of a suspended platform system must submit a copy of the certificate of system design, including a copy of the operational design calculations, sketches and test results, to the provincial director before commencement of the use of the system and must further indicate the intended type of work that the system will be used for.

A contractor must submit a copy of the certificate of system design as per regulations for every new project.

A contractor must ensure that the outriggers of each suspended platform:

- are constructed of material of adequate strength and have a safety factor of at least four in relation to the load it is to carry; and

- have suspension points provided with stop devices or other effective devices at the outer ends to prevent the displacement of ropes.

A contractor must ensure that:

- the parts of the building or structure on which the outriggers of a suspended platform are supported, are checked by means of calculations to ensure that the required safety factor is adhered to without risk of damage to the building or structure;
- the suspension wire rope and the safety wire rope are separately connected to the outrigger;
- each person on a suspended platform is provided with and wears a body harness as a fall prevention device, which must at all times be attached to the suspended platform;
- the hand or power driven machinery to be used for the lifting or lowering of the working platform of a suspended platform is constructed and maintained in such a manner that an uncontrolled movement of the working platform cannot occur;
- the machinery referred to above is so situated that it is easily accessible for inspection;
- the rope connections to the outriggers are vertically above the connections to the working platform; and
- when the working platform is suspended by two ropes only, the connections of the ropes to the working platform are of a height above the level of the working platform to ensure the stability of the working platform.

A contractor shall ensure that a suspended platform:

- is suspended as near as possible to the structure to which work is being done to prevent as far as is reasonably practicable horizontal movement away from the face of the structure; is fitted with anchorage points to which workers must attach the lanyard of the safety harness worn and used by the worker, and such anchorage connections must have sufficient strength to withstand any potential load applied to it; and
- is fitted with a conspicuous notice easily understandable by all workers working with the suspended platform, showing-
 - the maximum mass load;
 - the maximum number of persons; and
 - the maximum total mass load, including load and persons; which the suspended platform can carry.

A contractor shall cause:

- the whole installation and all working parts of a suspended platform to be thoroughly examined by a competent person in accordance with manufacturer's specification;
- the whole installation to be subjected to a performance test as determined by the standard to which the suspended platform was manufactured;
- the performance test contemplated above to be done by a competent person appointed in writing, with the knowledge and experience of erection and maintenance of suspended platforms or similar machinery, and who must determine the serviceability of the structures, ropes, machinery and safety devices before they are used, every time suspended platforms are erected; and
- the performance test contemplated above of the whole installation of the suspended platform to be subjected to a load equal to that prescribed by the manufacturer's or, in the absence of such load, to a load of 110% of the rated mass load, at intervals not exceeding 12 months and in such a manner that every part of the installation is stressed accordingly.

A contractor shall cause every hoisting rope, hook or other load-attaching device which forms part of the suspended platform to be thoroughly examined in accordance with the manufacturer's specification by the competent person before they are used every time they are assembled, and, in cases of continuous use, at intervals not exceeding three months.

A contractor shall ensure that the suspended platform supervisor or the suspended platform inspector carries out a daily inspection of all the equipment prior to use, including establishing whether:

- all connection bolts are secure;
- all safety devices are functioning;
- all safety devices are not tampered with or vandalized;
- the total maximum mass load of the platform is not exceeded;
- the occupants in the suspended platform are using body harnesses which have been properly attached;
- there are no visible signs of damage to the equipment and
- all reported operating problems have been attended to.

A contractor shall ensure that all inspection and performance test records are kept on the construction site at all times and made available to an inspector, the client, the client's agent or any employee upon request.

A contractor shall ensure that all employees required to work or to be supported on a suspended platform are:

- medically fit to work safely in a fall risk position or such similar environment by being in possession of a medical certificate of fitness;
- competent in conducting work related to suspended platforms safely;
- trained or received training, which includes at least-
- how to access and egress the suspended platform safely;
- how to correctly operate the controls and safety devices of the equipment;
- information on the dangers related to the misuse of safety device; and
- information on the procedures to be followed in the case of:
 - an emergency;
 - the malfunctioning of equipment; and
 - the discovery of a suspected defect in the equipment;
 - and instructions on the proper use of body harnesses.

A contractor shall ensure that where the outriggers of a suspended platform are to be moved, only persons trained and under the supervision of the competent person effect such move, within the limitation stipulated in the operational compliance plan, and that the supervisor must carry out an inspection and record the result thereof prior to re-use of the suspended platform.

A contractor shall ensure that the suspended platform is properly isolated after use at the end of each working day in such a manner that no part of the suspended platform presents a danger to any person thereafter.

2.45 SITE HOUSEKEEPING

The Principal Contractor / Contractor to ensure that:

- Housekeeping is continuously implemented
- Materials & equipment are properly stored
- Scrap, waste & debris are removed regularly
- Materials placed for use are placed safely and not allowed to accumulate or cause obstruction to free flow of pedestrian and vehicular traffic
- Waste & debris not to be removed by throwing from heights but by chute or crane
- Where practicable, Construction sites are fenced off to prevent entry of unauthorized persons
- Catch platforms or nets are erected over entry and exit ways or over places where persons are working to prevent them being struck by falling objects
- An unimpeded work space is maintained for every employee
- Every workplace is kept clean, orderly and free of tools etc. that are not required for the work being done materials
- As far as is practicable, every floor, walkway, stair, passage and gangway is kept in good state of repair, skid-free and free of obstruction, waste and materials
- The walls and roof of every indoors workplace is sound and leak-free

- Openings in floors, hatchways, stairways and open sides of floors or buildings are barricaded, fenced, boarded over or provided with protection to prevent persons from falling.

2.46 STACKING & STORAGE

The Principal Contractor / Contractor shall ensure that:

- A competent person is appointed in writing to supervise all stacking and storage on a construction site
- Adequate storage areas are provided and demarcated
- The storage areas are kept neat and under control
- The base of any stack is level and capable of sustaining the weight exerted on it by the stack
- The items in the lower layers can support the weight exerted by the top layers
- Cartons and other containers that may become unstable due to wet conditions are kept dry
- Pallets and containers are in good condition and no material is allowed to spill out
- The height of any stack does not exceed 3X the base unless stepped back at least half the depth of a single container at least every fifth tier or
- The approval of an inspector has been obtained to build the stacks higher with the aid of a machine. (The operator of the machine must be protected against items falling from overhead off the stack and no items may overhang)
- The articles that make up a single tier are consistently of the same size, shape and mass
- Structures for supporting stacks are structurally sound and able to support the mass of the stack
- No articles are removed from the bottom of the stack first but from the top tier first
- Anybody climbing onto a stack can and does do it safely and that the stack is sufficiently stable to support him/her
- Stacks that are in danger of collapsing are broken down and restacked
- Stability of stacks are not threatened by vehicles or other moving plant and machinery
- Stepped back at least half the depth of a single container at least every fifth tier
- Persons climbing onto stacks do not approach unguarded moving machinery or electrical installations.

2.47 PUBLIC HEALTH AND SAFETY

The Contractor shall ensure that each person working on or visiting a site, and the surrounding community, shall be made aware of the dangers likely to arise from onsite activities and the precautions to be observed to avoid or minimize those dangers. Appropriate health and safety signage shall be posted at all times.

2.48 NIGHT WORK

The Contractor shall not undertake any night work without prior arrangement and a written permit from the Client. The Contractor shall ensure that adequate lighting is provided for all night work and failure to do so shall result in work being stopped.

2.49 ENVIRONMENTAL CONDITIONS AND FLORA AND FAUNA

The Contractor must be mindful of adverse weather conditions upon the health and safety of the workforce. This includes inclement weather, strong wind, heat stress, extreme cold, etc. The Contractor's risk assessment process must take into account the risks associated with such weather conditions. The same is true when working in an environment where there is a risk to employees' health and safety from presence of poisonous flora, or wildlife (including bees, snakes, etc.). The Contractor's risk assessment process must take these risks into account.

2.50 OCCUPATIONAL HEALTH

Exposure of workers to occupational health hazards and risks are very common in any work environment, especially in construction. Occupational health hazards and risks exposure is a major problem and all Contractors are to ensure that proper health and hygiene measures are put in

place to prevent exposure to these hazards and risks. The occupational hazards and risks may enter the body in three ways:

- Inhalation through breathing e.g. cements dust;
- Ingestion through swallowing maybe through food intake;
- Absorption through the skin (pores) e.g. painting or use of thinners.

The contractor is required to ensure that all his personnel are medically fit prior to being allowed onto the work site. All Contractors should ensure that Occupational Hygiene surveys are conducted as per the Occupational Health and Safety Act to ensure employees are not exposed to hazards. Risk Assessments should identify areas where survey has been conducted.

2.51. PENALTIES

Should at any time the work, or part of the works, be stopped due to unsafe act on noncompliance with Amatola Water or PCs OHS Plan, neither the PC nor any other contractor or SMMME shall have a claim for extension of time or any other compensation.

In case of any repetitive non – conformance the non- conforming party shall be penalised as per the table below:

Minor Fine R500 Count	Medium Fine R1000 Count and a non-conformance	Serious Offense Fine R5000/ Count and a non-conformance and /or activity stoppage
Non – usage of basic PPE Supplied on site (e.g. Overalls Safety boot. Hard hat identified during the previous audit and not addressed within agreed time frame	Toilet not supplied or regularly serviced and inspected and or no drinking water on site identified during the previous audit and not addressed within agreed time frame	PC working without the approved OHS plan
Non Complaint of PC registers on site identified during the previous audit and not addressed within agreed time frame	PC not performing their site inspection or sub- contractors audits	Workers transport in contravention with OHS Plan or legal requirements
Lack of all required site signage identified during the previous audit and not addressed within agreed time frame	Working without or appropriate site Method Statement/ SWP and HIRA identified during the previous audit and not addressed within agreed time frame	Invalid/expired Letter of Good standing with the Workmen Compensation letter from FEM or Workmen Compensation
Tools and equipment identified in poor condition identified during the previous audit and not addressed within agreed time frame	Non- conformances identified during the previous audit and not addressed within agreed time frame	Allow workers to work at height without proper personal protective equipment's
	Unsafe Working at height	Fall Arrest harness not tied off/worn when a risk of falling exists on site
	No medical certificate of Fitness for all workers	Threat to the OHS of person
		3 rd offence on site
		Failure to submit you OHS Plan on completion of this project

2.52. CLOSE- OUT REQUIREMENTS

The Principal contractor shall submit a formal letter to the project appointed SHE AGENT or the Client consolidating the health and safety data of this project.

The following summary of information is required in the letter but not limited to:

- Monthly SHE Agent H&S audits and reports
- Minutes of the monthly SHE Committee on site
- Site Incidents and injury on duty (IOD)
- WCA Claims
- Total Man- hours and disabling Injurie Frequency Rate (DIFR)
- All site SHE Non–conformances.

Handover of the consolidated file can only commence once all personnel has been demobilised and nil man hours are recorded.

SHE Agent or the Client will evaluate the SHE performance of the Principal Contractor i.e.

- Compliance
- Performance
- Quality

The refer same in their cover letter which will be added to the Principal Contractor portfolio of evidence.

THORNHILL WTW - COMPLETION OF Ph3 CIVILS- BASELINE RISK ASSESSMENT (1 of 2)						
Process/ activity	Hazard	Risk	Consequence	Likelihood	Raw Risk rating	Controls / Mitigation
Transportation of employees and work tools to and from site	Vehicle accidents/incidents due to collision or overloading. Employees falling from vehicle	MVA, injury to personnel	5	5	25	Foreman responsible for vehicle roadworthiness, competency of drivers
Preparation of site	Manual manipulation of bulky equipment	Overexertion, repetitive movement or awkward postures can cause muscular strain or injury. Drop of material and or equipment.	4	4	16	A safe work procedure should be prepared and implemented for lifting heavy and bulky loads that present a risk of injury (e.g. stretching, stooping, twisting). This can include the use of a trolley to transport heavy items and training in lifting techniques.
Stacking and storage of material on site	Temporary storage of equipment and material	Theft /Loss/ Damage to equipment's / property	4	3	12	Storage areas must be designated, demarcated and fenced if necessary. The storage area or facility should have adequate space for ease of access without posing a risk to personnel and damage of infrastructure. Storage areas should be secure so as to minimize the risk of crime.
	Loading / unloading activities	Being hit by moving vehicles, or being caught by moving parts of machinery can cause fractures, bruises, lacerations, dislocations, permanent injuries or death	4	3	12	A safe work procedure should be prepared and implemented for lifting heavy and bulky loads that present a risk of injury (e.g. stretching, stooping, twisting). This can include the use of a trolley to transport heavy items and training in lifting techniques.
Site Establishment	Precautionary steps to prevent any pollution of the Environment	Negative impact on environment caused by pollution on site	4	4	16	Comppliance with requirements of the EMP including bins and / or skips to be provided at convenient intervals for disposal of waste within the construction site. Bins should have liner bags for efficient control and standard disposal of waste
Traffic accommodation	Contact with the public at entrance and site.	Injuries/death due to collision with moving vehicles	5	5	25	The provision of Access control at the entrance of site is essential. Prior to moving onto site, agreed turning areas for haulage vehicles are to be formalised and used by the Contractor. No turning manoeuvres other than at the designated places must be permitted.
Fire control / and Assembly points	The risk of fire is generally ever present on site or to a nearby private property	Injury or death or damages to the site or neighbouring property causing major losses	4	4	16	Compliance with the Health and Safety Plan and the relevant Health and Safety specifications

THORNHILL WTW - COMPLETION OF Ph3 CIVILS - BASELINE RISK ASSESSMENT 2 of 2						
Process/ activity	Hazard	Risk	Consequence	Likelihood	Raw Risk rating	Controls / Mitigation
Keeping members of public off Site	Injury from construction activities and associated physical hazards	Negative impact on environment caused by pollution on site	4	3	12	Contractor to erect perimeter fence up-front and maintain strict 24/7 access control
Delivery, storage and transfer of fuel & inflammatory products	Fuel & inflammatory products can catch alight	Injury or death of workers	4	4	16	Strict adherence to standard safety procedures
Provision of temporary ablution facilities for workers	Diseases	Cholera, Hepatitis, Typhoid fever, Tetanus	5	4	20	Strict adherence to hygienic practices on Site; incl worker training
Dust generated by vehicle movements on Site	Respiratory and eye damage to workers on site and surrounding public	Site will be unacceptably dusty in dry weather if no active dust mitigation measures in place	4	5	20	Contractor must apply dust-control measures in dry weather (water readily avail from dam nearby)
Working in vicinity of 11 kV electrical supply	Working within a MV voltage environment & an environment with high low voltage fault currents	Injury or death of workers	5	3	15	Provide competent supervision
Site location	Working close to operational dam	Accidental drowning or falls	5	2	10	- Regular safety on Site toolbox talks
Excavation	Use of heavy earth moving machinery: vehicle movement	Danger to workmen working in vicinity	5	4	20	- Vehicle reversing alarm to always be in functional state. - No hearing-impaired worker be allowed in vicinity of heavy plant
		Danger to public from dump trucks travelling to and from external spoil site	5	4	20	- Active liaison with community leadership and schools to warn public and learners of dangers. - Monitor behaviour of members of public for signs of disregarding the risk.
	Excavation by blasting	Danger to workmen and public due to incorrect blasting procedures	5	3	15	- Proper blast design - Strict adherence to correct procedures
	Manual excavation	Ergonomics, injury, repetitive strain.	5	4	20	- Supervisor to give training on correct techniques
		Injuries due to fall / slip on uneven walking surfaces.	5	4	20	- Supervisor to ensure uneven surfaces kept to a minimum
		Injury, bruises, contusions, employees accidentally strike each other with tools.	4	4	16	- Regular safety on Site toolbox talks
	Deep Excavations	Death, injury, bruises, contusions due to embankment collapses, rock falls, or falling over the edge of a deep excavation	5	4	20	- Qualified person to assess and continue to monitor slope stability of excavations. - Erect 1.0m high 3-strand wire fence around excavation
		Drowning in flooded deep excavations	5	3	15	- Supervisor to ensure dewatering equipment is maintained in good working order - Protocols for rescues/evacuations to be established
Importing materials and plant	Delivery with heavy duty vehicles and offloading	MVA, collision with workman on site	5	3	15	Provide competent supervision
		MVA, Injury to third party	5	2	10	Provide competent supervision
Construct Buildings	Used lifting equipment	Injury, collision with workman	5	3	15	Provide competent supervision
	Working at height	Injury but by falling objects	4	2	8	- Regular safety on Site toolbox talks
	Manual manipulation of heavy and bulky material	Ergonomics, Injury, muscle strain	4	3	12	- Supervisor to give training on correct techniques
		Death, Injury, bruises contusions, employees accidentally strike each other with tools.	5	4	20	Regular safety on Site toolbox talks
	Formwork and shutter assembly	Injury, bruises, contusions.	4	3	12	Regular safety on Site toolbox talks
		Slippery surface, injury slip trip fall.	5	3	15	Provide competent supervision

Annex C3.6.3

Construction Environmental Management Plan

PES1 ENVIRONMENTAL CONTROL OFFICER (ECO)

An Environmental Control Officer (ECO) will be appointed to ensure and monitor the implementation of the Environmental Management Plan (EMP). The ECO will have the following responsibilities:

- PSA1 To advise the Engineer on the interpretation and enforcement of the Environmental Specifications
- PSA2 To supply environmental information
- PSA3 To undertake inspections as required and submit reports on the Contractor's compliance with the Environmental Specifications; these reports shall be copied to the Project Manager and Project Engineer.
- PSA4 To demarcate particular sensitive areas and pass instructions through the Engineer concerning works in these areas.

PES2 CONTRACTOR

The Contractor has the responsibility to:

- Be familiar with the Environmental Specifications contained in this document
- Comply with the Environmental Specifications contained in this document
- Notify the ECO and Engineer immediately in the event of any accidental infringements of the Environmental Specifications to enable appropriate remedial action to be taken
- Notify the ECO and Engineer, at least 10 working days in advance, of any activity he has reason to believe may have significant negative impacts, so that mitigatory measures may be implemented timeously
- Ensure environmental awareness among his employees and sub-contractors so that they are fully aware of, and understand the Environmental Specifications and the need for them
- Undertake progressive rehabilitation of all areas affected by construction activities to restore them to their original states, as determined by the Engineer
- Undertake the required works within the designated working areas

PES3 ENGINEER

The Engineer is required to:

- Be familiar with the contents of the EMP
- Monitor the Contractor's compliance with the Environmental Specifications on a daily basis and enforce compliance.
- Communicate to the Contractor the advice of the ECO and the contents of the ECO reports and issue site instructions giving effect to the ECO requirements where applicable
- Communicate to the ECO any proposed actions, which may have negative impacts on the environment, at least 10 working days in advance
- Designate all working areas
- Communicate to the ECO any infringements of the Environmental Specifications and accompany the ECO during site inspections
- Discuss with the ECO and Project Manager the application of any penalties and other possible enforcement measures when necessary
- Maintain a record of complaints from the public and communicate these to the Project Manager
- Facilitate communication between all role-players in the interest of effective Environmental Management.
- Monitor the compliance of the Contractor through the ECO reports
- Allow for environmental protection works within the project budget
- Determine the imposition of penalties for the infringement of the Environmental Specifications.

PES4 WORKING AREAS

Construction activities may be conducted only in designated working areas. Limitation of construction activities to specific working areas minimises the impact on the natural environment and facilitates control of the works. Sites should be divided into working areas and "no-go" areas:

Working areas are those areas required by the Contractor to construct the works and as approved by the Engineer. These areas include the area of permanent works, borrow areas and haul roads between site and borrow areas. If

necessary, the working areas may be demarcated during the construction period. The Contractor will not be permitted beyond the designated working areas.

"No-go" areas are those areas outside of working areas.

PES 5 PROTECTION OF FLORA, FAUNA, NATURAL FEATURES AND ARCHAEOLOGICAL MATERIAL

Natural features, flora and fauna in the vicinity of the project works should be protected and damage or disturbance prevented or minimised, specifically:

1. No plant species may be removed or damaged unless agreed by the ECO.
2. All fauna (including domestic livestock) within and surrounding the site shall be protected; they shall not be caught or killed.
3. Natural features should not be defaced or painted or otherwise tampered with, even for survey purposes, unless agreed by the ECO. Any features defaced by the Contractor shall be reinstated by the Contractor to the satisfaction of the Engineer.
4. In the event of unearthing any artefacts, which may be of significant archaeological or historical value, excavations are to cease until approval for excavating is given by the Engineer and ECO. Should any graves be unearthed, excavations are to cease immediately, and the Engineer and ECO notified.
5. No "working areas" are to be defined within 10 meters of any gravesites.

PES6 CONSERVATION AND STOCKPILING OF TOPSOIL

1. All areas to be excavated:
Areas to be occupied by roads, Topsoil shall be excavated from the following areas no longer than five days before the start of construction:
2. Including temporary roads
3. Areas for the storage of fuels
4. Areas to be used for batching / mixing of concrete
5. Areas for stockpiling of construction materials.

Topsoil shall be excavated to the base of the A-Horizon or approximately 150mm, whichever is deeper, and stockpiled in the area designated by the Engineer. Topsoil should be stored in piles $\square$ 1 m in height. This soil is valuable for its humus and seed content and shall be used for rehabilitation purposes. Grass should not be removed prior to stripping of the topsoil. Topsoil should not be mixed with any other material (construction rubble, subsoil's etc) and erosion of the topsoil stockpiles should be prevented.

PES7 REHABILITATION

Once the pipeline is laid in the trench and has been covered with soil and once there is no more vehicular movement over that portion of pipeline corridor, rehabilitation can take place. The Contractor should not wait until the end of the project to begin rehabilitation, but should instead begin rehabilitation in a piecemeal manner (i.e. by the time the pipeline has been fully instated the Contractor will be able to see the results of the rehabilitation programme).

Rehabilitation must include:

1. Shallow ripping of the top layer of soil covering the pipeline corridor
2. Dressing of the recently ripped surface with the previously stockpiled topsoil
3. Seeding the areas with appropriate grass species, which will stabilise the topsoil (approx. 75% cover required).

PES8 GENERAL EROSION CONTROL

No erosion will be tolerated on the site. The Contractor should take all reasonable measures to prevent soil erosion resulting from exposed soil surfaces, a diversion, restriction or increase in the flow of stormwater or river flow caused by the presence of temporary / permanent works, operations and activities. Erosion prevention measures must be implemented to the satisfaction of the Engineer.

Areas affected by construction related activities must be monitored regularly for evidence of erosion. Areas particularly susceptible to erosion are: areas stripped of topsoil, soil stockpiles and steep slopes (gradients > 6 %). In this regard, the contractor is advised to take special precautions when working in the vicinity of the gullies which the pipeline crosses. Where evidence of erosion appears, the construction of contour berms, cut-off drains or planting of grass sods may be necessary.

Where soil erosion does occur the Contractor shall reinstate such areas and areas damaged by the erosion, at his

own cost and to the satisfaction of the Engineer and ECO.

PES9 REINSTATEMENT OF TRENCHES AND IMPACTED AREAS

The topsoil shall be replaced on top after backfilling and only lightly compacted e.g. by trampling under foot. Where grass seeding is required it must be carried out within 2 days of topsoil replacement and before lightly compacting the soil.

Care shall be taken to ensure that the surface is finished in a manner, which does not result in the channelling of water or the concentration of flows. Where slope gradients exceed 15% in long-section, anti-erosion berms shall be made which are angled at $\pm 10^\circ$ across the contours such that they lead water off the disturbed corridor. These berms shall be 300mm high and shall be long enough to lead water off the entire disturbed surface. These berms shall be made immediately after backfilling and before topsoil replacement. Earth berms must be composted and grass seeded if berms are not covered with topsoil.

PES10 GULLY AND DONGA EROSION CONTROL

It is possible that existing erosion gullies or dongas in the landscape may be used for spoiling of rock 100-400 mm diameter in order to arrest erosion. Choice of such sites shall be at the discretion of the Engineer in consultation with the ECO. Spoiling shall be conducted in a manner specified by the Engineer. Only spoiling of rock will be allowed in erosion gullies, as soil will be washed out. Access to such spoil sites must not be permitted to lead to further erosion.

PES11 PREVENTION OF POLLUTION

Pollution could result from the release, accidental or otherwise, of chemicals, oils, fuels, sewage, waste water containing kitchen waste, detergents, solid waste and litter, etc. The Contractor should ensure that pollution of the ground or water does not occur as a result of any activities on site.

PES12 DUST CONTROL

Dust is regarded as a nuisance when it reduces visibility, soils private property and is aesthetically displeasing. Dust reduces the palatability of grazing grasses and may retard plant growth.

The Contractor shall be responsible for the control of dust arising from his operations and activities. Control measures could include regular spraying of working / bare areas with water, at an application rate that will not result in soil erosion.

PES13 NOISE CONTROL

The Contractor should take reasonable measures to limit noise levels during construction, taking into account the rural setting of the project. If necessary the Contractor should familiarise himself with the legislation pertinent to noise generation.

Vehicles should be fitted with standard silencers, where possible.

PES14 BLASTING

No blasting will be permitted unless the Contractor has satisfied the Project Manager that his proposed blasting methods and controls are such that no damage will be caused to any adjoining structure, pipeline, service or surrounding sensitive environmental areas. The Contractor is advised to take special precautions where local community houses are in close proximity to the site.

The Contractor is to inform the PSC of the days on which blasting is to occur. This notification is to be given at least 48 hours before blasting occurs.

Topsoil may not be used as cover material for blasting. Suitable cover material is to be confirmed with the Engineer.

PES15 TRAFFIC CONTROL

Increased traffic, especially heavy vehicle traffic, has the potential to draw complaints from nearby residents. The Contractor will be expected to address any complaints received.

The Contractor shall comply with all legislation including the applicable local by-laws with regard to road safety and

transport. He shall instruct his drivers and plant operators that vehicles will be expected to comply with all road ordinances, such as speed limits, roadworthiness, load securing / covering.

PES16 FIRE PREVENTION AND CONTROL

The Contractor shall take all the necessary precautions to ensure that fires are not started as a consequence of his activities on site. The Contractor, sub-contractors and all employees are expected to be conscious of fire risks. The Contractor shall hold at least one fire prevention talk with staff to create an awareness of the risks of fire. Regular reminders to his staff on this issue are required.

No fires may be made other than for the purpose of cooking, and must be extinguished with water once they have served their purpose. Cooking fires should be contained in a fire drum, in an area approved by the Engineer. The Contractor shall ensure that there is adequate fire-fighting equipment on site.

The Contractor shall be liable for any expenses incurred by any organisations called to assist with fighting fires and for costs involved in rehabilitation of burnt areas / property / persons, should the fire be the result of the Contractor's activities on site.

PES17 SOCIAL DISRUPTION

The Contractor's employees shall in no way be a nuisance to nearby residents. Any complaints received by the Engineer will be addressed and the relevant persons will be suspended from the project.

The Contractor shall give at least seven days notice to the residents in the vicinity of the construction activities of his intention to begin construction activities in their area. The Engineer may request a representative to be available to discuss issues raised by residents and make information available to them on construction activities.

The Contractor shall ensure that access to property is not unreasonably disrupted.

Where construction activities require the removal of fences from around private land, the occupants shall be warned at least 3 days in advance. These fences / boundary markers shall be reinstated as soon as construction is complete.

PES18 PROTECTION OF THE PUBLIC

The Contractor shall be responsible for the protection of the public, and public property, from any dangers associated with construction activities, and for the safe and easy passage of pedestrians and traffic in areas affected by project activities.

Any obstructions or excavations shall be suitably barricaded and/or demarcated with hazard tape.

PES19 VEHICLES AND ACCESS ROADS

Site vehicles should be permitted only within the demarcated construction sites or on existing roads, as would be required to complete their specific tasks. Vehicles are not permitted on re-vegetated areas and site traffic should be limited to prevent unnecessary damage to the natural environment.

PES20 STOCKPILING OF MATERIALS

The Engineer should approve all stockpiling sites. The stockpiles should be located in demarcated construction sites, or areas such as exhausted borrow pits / quarries. Material stockpiled should be done so in such a way as to minimise the spread of materials and the impact on the natural vegetation. The Contractor should ensure that no materials 'creep' into "no-go" areas.

Areas used for stockpiling should be reinstated upon completion of the project.

PES21 SITE CAMP

Where site camps are to be established the feasibility of removing topsoil from the site, before site establishment, should be investigated. Removed topsoil should then be stockpiled for use in rehabilitation of the site camp.

The site camp shall not be located in an environmentally sensitive area. The site shall be located > 20 m from a watercourse. Runoff from site must be prevented from entering any water bodies; all water requiring discharge should be discharged in a manner approved by the Engineer.

Site camps and surrounds are to be maintained in a clean, tidy and orderly condition at all times.

Tanks for fuels, oils etc should be stored in the site camp and shall be bunded with earth berms to sufficiently contain any possible spills. The earth beneath the tanks should be covered with crusher run (or the likes thereof) and this cover replaced periodically. The Contractor shall remove all oil-, petrol-, and diesel-soaked sand immediately and shall dispose of it as hazardous waste to a registered hazardous waste disposal site.

After completion of the works the Contractor shall restore the area used by him to its former condition, including removal of rubble and foundations. Any compacted ground shall be ripped to loosen soil, topsoil is to be spread evenly over the site and watered to encourage grass cover.

PES22 SANITATION

No staff is to use the river for personal washing, including cleaning of clothes. Toilet facilities, in the form of chemical toilets are to be provided at the site camp and within 200 m of any location where a significant number of workers will be working for an extended period of time.

Contractors shall instruct their staff and sub-contractors that they must use toilets provided and not the veld, bush or streams.

PES23 REFUSE / LITTER

The construction site is to be kept clean and litter free. The Contractor shall provide refuse bins at the work sites and shall be responsible for the disposal of all litter generated by all staff, at an approved landfill site. No burning of refuse is permitted.

PES24 DRINKING AND CONSTRUCTION WATER

Water for drinking and construction purposes should be obtained from local reticulation works, or an approved source. Unless approved by the local authority, water should not be extracted from nearby dams and rivers, and construction activities should not be conducted in or directly adjacent to rivers and dams.

PES25 CONCRETE BATCHING

Concrete batching / mixing plants should be located > 200 m from the nearest watercourse / wetland. The batching site must be bunded with earth berms or sandbags to prevent runoff escaping. Contaminated water should be allowed to soak away in a soak pit. In the event that water with a pH exceeding pH 9 reaches a stream, this would be in contravention of the National Water Act of 1998.

Waste concrete and cement sludge shall be scraped off the site and disposed of in an approved landfill site.

After closure of the batching plant or any area where concrete was mixed, all waste concrete/cement sludge shall be removed together with contaminated soil. The surface shall then be ripped to a depth of 150 mm and the topsoil replaced evenly over the site and watered. Where the site was originally grassed, reseedling may be required.

PES26 EXISTING SERVICES AND INFRASTRUCTURE

The Contractor shall ensure that existing services (road, rail, pipelines, powerlines and telephone services) are not disrupted or damaged, unless required by the contract and with the permission of the Engineer.

PES27 ALIEN VEGETATION

Alien species of vegetation should be removed from any working areas and the site camp(s), unless their removal would lead to increased erosion. Alien vegetation species should also be eradicated when they begin to establish themselves in disturbed areas (disturbance of the natural vegetation will encourage the establishment of invasive species). In order to discourage the spread of alien species, soil should not be moved from one part of the site to another without the consent of the ECO.

The ECO will assist in the identification and eradication of alien species. Methods of removal / eradication usually involve hoeing by hand. Removed vegetation shall not be burned.

PES28 WORK STOPPAGE

The Engineer shall have the right to order work to be stopped in the event of significant infringements of the Environmental Specifications, until the situation is rectified in compliance with the specifications. In this event, the Contractor shall not be entitled to claim for delays or incurred expenses.

PES29 MONITORING OF COMPLIANCE TO THE ENVIRONMENTAL SPECIFICATIONS

The Engineer will monitor the Contractor's performance in relation to the Environmental Specifications on a daily basis. He will be assisted in his monitoring by the ECO.

The ECO shall inspect the site on a regular basis. After such visits a report will be submitted to the Engineer, the Project Manager and the Client. The reports will contain any infringements of the Environmental Specifications. The reports may also aim at anticipating problems and so alert the Contractor to potential environmental risks and the appropriate action that may be taken. The Engineer will make the content of these reports known to the Contractor.

PES30 PENALTIES

The Responsible Person shall issue fines if the Contractor infringes these Environmental Specifications. The Contractor shall be advised in writing of the nature of the infringement and the amount of the fine. Monies for the fine will be deducted from the monthly certificate. The Contractor shall determine how to recover the fine from the relevant employee and/or sub-contractor. The Contractor shall also take the necessary steps (e.g. training) to prevent a recurrence of the infringement.

The Contractor is also advised that the imposition of spot fines does not replace any legal proceedings the authorities, landowners and/or members of the public may institute against the Contractor. In addition to the fine, the Contractor shall be required to make good any damage caused as a result of the infringement at his own expense.

A preliminary list of infringements for which fines will be imposed is as follows:

INFRINGEMENT	C3.1. PENALTY
C3.2. Infringement of PES 4	R1 000
Infringement of PES 5	R 1 000 per plant
Infringement of PES 6.	R1 000 per 5 m ³ .
Infringement of PES 8.	R1 000 per serious erosion incident.
Infringement of PES 11.	R1 000 per pollution incident.
Infringement of PES 16.	R1 000 per incident.
Any other infringement of the Environmental Specifications.	R500 per infringement.

C 4. Site Information

NIL

C 5. Drawings

A pdf document with a Sharepoint download link for the drawings listed below is included on the ORTDM Tender website.

GENERAL LAYOUTS (LAY)	
J31067/LAY/101	General Site Layout Plan
J31067/LAY/102	Clari-Flocculator setting-out Plan
J31067/LAY/120-01	Interlinking Pipelines Layout Sheet 1 of 5
J31067/LAY/120-02	Interlinking Pipelines Layout Sheet 2 of 5
J31067/LAY/120-03	Interlinking Pipelines Layout Sheet 3 of 5
J31067/LAY/120-04	Interlinking Pipelines Layout Sheet 4 of 5
J31067/LAY/120-05	Interlinking Pipelines Layout Sheet 5 of 5
SERVICE LAYOUT	
J31067/RD/120	Internal Road Extensions for Ph3 Filter Building
J31067/RD/125	Entrance Road Modifications for Chlorine Building
J31067/SW-171	Clarifier Stormwater Drain
CIVIL DETAIL DRAWINGS	
J31067/DET/200-01	Splitter Box to Clari-Flocculators - Layouts, Sections & Details - Sheet 1 of 2
J31067/DET/200-02	Splitter Box to Clari-Flocculators - Layouts, Sections & Details - Sheet 2 of 2
J31067/DET/210-01	Clari-Flocculator Tanks 8,9 & 10 Sheet 1 of 5
J31067/DET/210-02	Clari-Flocculator Tanks 8,9 & 10 Sheet 2 of 5
J31067/DET/210-03	Clari-Flocculator Tanks 8,9 & 10 Sheet 3 of 5
J31067/DET/210-04	Clari-Flocculator Tanks 8,9 & 10 Sheet 4 of 5
J31067/DET/210-05	Clari-Flocculator Tanks 8,9 & 10 Sheet 5 of 5
J31067/DET/220-01	Rapid Gravity Sand Filter Building: Front Elevation & Roof Layout Sheet 1 of 12
J31067/DET/220-02	Rapid Gravity Sand Filter Building: Sectional Elevations Sheet 2 of 12
J31067/DET/220-03	Rapid Gravity Sand Filter Building: Foundation Level Layout Sheet 3 of 12
J31067/DET/220-04	Rapid Gravity Sand Filter Building: Lower & Upper Filter Gallery Sheet 4 of 12
J31067/DET/220-05	Rapid Gravity Sand Filter Building: Section A-A and Section N-N Sheet 5 of 12
J31067/DET/220-06	Rapid Gravity Sand Filter Building: Sections B-B, C-C & D-D Sheet 6 of 12
J31067/DET/220-07	Rapid Gravity Sand Filter Building: Section G-G & Filter Backwash System Sheet 7 of 12
J31067/DET/220-08	Rapid Gravity Sand Filter Building: Sections & Details Sheet 8 of 12
J31067/DET/220-09	Rapid Gravity Sand Filter Building: Section H - H & Details Sheet 9 of 12
J31067/DET/220-10	Rapid Gravity Sand Filter Building: Connection Pipework to Existing Sheet 10 of 12
J31067/DET/220-11	Rapid Gravity Sand Filter Building: Incoming Pipework from Clariflocculators Sheet 11 of 12
J31067/DET/220-12	Rapid Gravity Sand Filter Building: Filter Backwash System Pipework Details Sheet 12 of 12
J31067/DET/221	Rapid Gravity Sand Filter Building: Finishing Schedule
J31067-DET/250-01	Interlinking Pipework Chambers Layouts and Details
J31067-DET/400-01	Chlorination Building (Sheet 1 of 7)
J31067-DET/400-02	Chlorination Building (Sheet 2 of 7)
J31067-DET/400-03	Chlorination Building (Sheet 3 of 7)
J31067-DET/400-04	Chlorination Building (Sheet 4 of 7)
J31067-DET/400-05	Chlorination Building (Sheet 5 of 7)
J31067-DET/400-06	Chlorination Building (Sheet 6 of 7)
J31067-DET/400-07	Chlorination Building (Sheet 7 of 7) Door & Window Schedule
J31067/STD/021	Galvanised Ball Type Handrail, Stanchions Base Mounting Details
J31067/STD/022	Galvanised Ball Type Handrail Bends, Stairs Return & Kink Bends
J31067/STD/030	Standard Gate Detail
J31067/STD/032	Road Details
J31067/STD/570	GMS Hinged MH Cover
J31067/STD/712	Dry Stack Retaining Wall