CONSTRUCTION OF BONATHABA DAM, WELLINGTON

PROPOSED METHOD STATEMENT

Contract: To be advised.

Date: 17 August 2020

1. Introduction

The method statement covers the construction of Bonathaba Dam, consisting of a wall height of 16 m with a total storage capacity of approximately 700 000 m^3.

2. Technical and design specifications and aspects

As part of the detailed design that must still be undertaken, a set of technical specifications will be compiled. See enclosed examples.

The technical and design specifications and aspects will be set out in the Design Report to the Dam Safety Office. The construction will be set out in the Tender Documents.

3. Where are the works to be undertaken?

The farm is located approximately 21.5 km north west of Wellington in the Western Cape Province. The works will take place within the proposed dam basin and around the embankment and spillway footprint.

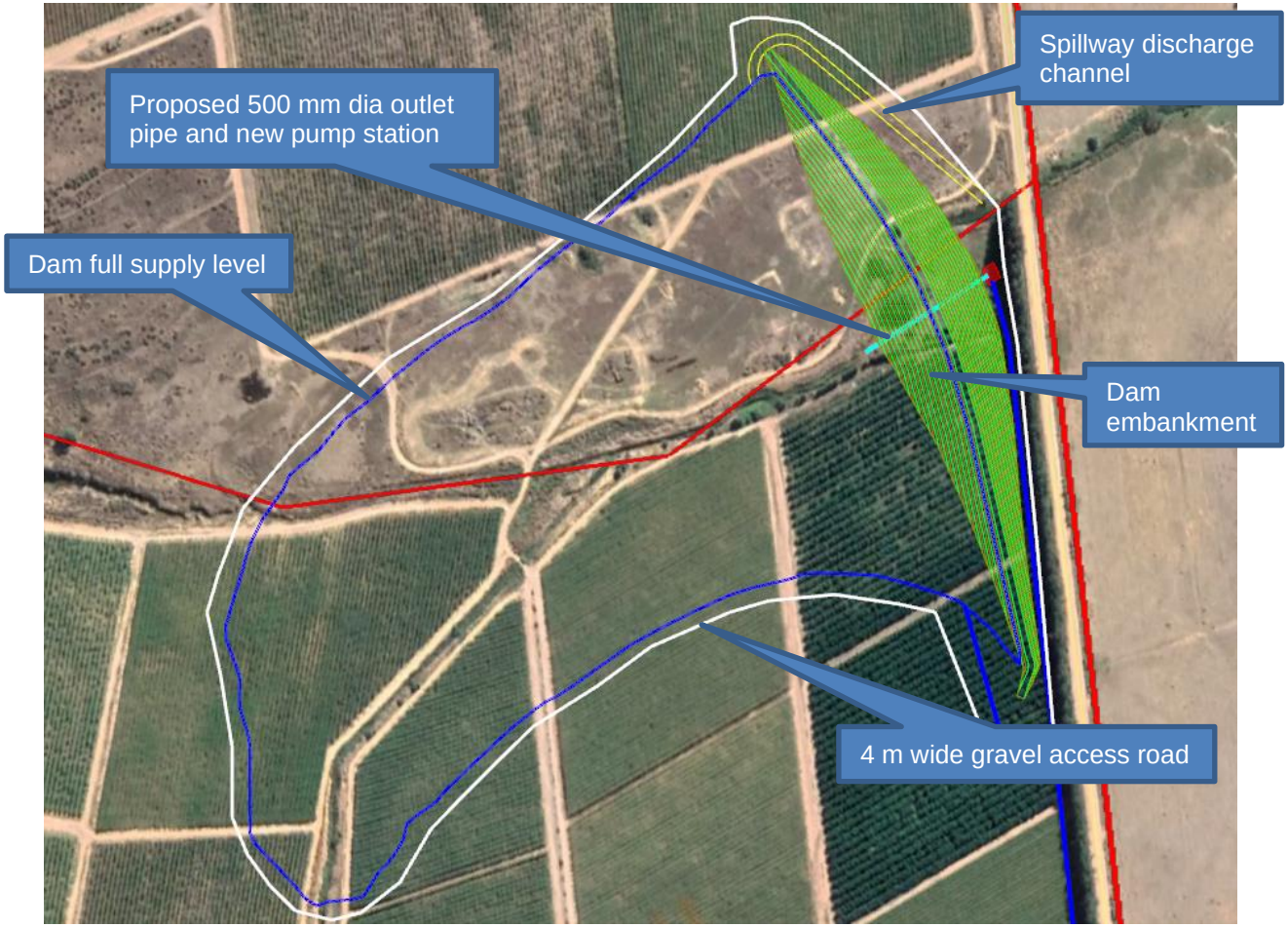

Figure 1: Proposed Bonathaba Dam embankment and associated infrastructure

4. What work is to be undertaken

The project is proposed to include the following developments:

- Construction of the proposed Bonathaba Dam (700 000 m^3 storage capacity, 16 m high embankment) with a spillway on its left abutment.
- New 500 mm dia HDPE outlet pipe will be constructed in reinforced concrete underneath the dam embankment and connected to a new pump station located at the downstream toe of the embankment.
- New 500 mm dia PVC Class 8 pipeline (600 m long) from pump station to tie into existing 400 mm asbestos-cement pipe which is connected to the pump station located on the banks of the Berg River.
- A 4 m wide gravel access road will be constructed around the entire dam basin and embankment.

5. Start and end date of Works

A construction period of 6 months over the summer period is anticipated for the dam construction, the timeframes for the other infrastructure should be confirmed. This will have to be confirmed by the successful tenderer.

6. Construction activities and sequence for the dam construction

a. Preparatory works

This will include setting out of the works, clearing and grubbing activities as required for the camp site, access, borrow areas and construction area footprints.

b. Construction activities

This will include the excavation of the required core trench, the construction of the outlet pipe and the irrigation pipeline (including all its required fittings), excavation of the spillway and placing of material for the dam embankment. Other items such as monitoring water level markers, settlement beacons and signage will also be constructed. All these items will be set out in the design report that will be submitted to the Dam Safety Office for approval.

c. Completion of the works

This will include the removal of all construction infrastructure, rubble and equipment from site. All the exposed and disturbed areas outside of the dam basin will be rehabilitated.

7. Other requirements

Comply with the conditions of the licences and authorities of the National Water Act, 1998 and the National Environmental Management Act, 1998. Furthermore, the Environmental Control Officer and Occupational Health and Safety Agent will require specific method statements on for example fuel storage, concrete mixing, etc required in terms of the Environmental Management Plan and Health and Safety Plan, which must also be complied with.

Yours faithfully

INGEROP SOUTH AFRICA
C Starke

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CONTRACT NO. ???

DAM

C3.2 – SPECIFICATION DATA

CONTENTS

Clause **Page**

Clause **Page**

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..... FAMILY TRUST

CONTRACT NO. AUR 07/2013

CONSTRUCTION OF ..... DAM –ROBERTSON

C3.2 – SPECIFICATION DATA

PORTION 2 : VARIATIONS TO SPECIFICATIONS GIVEN IN THE LIST OF SPECIFICATIONS

The Specification Data gives amendments and additions to the specifications that are listed in the List of Applicable Specifications. Clauses are prefixed by the letters "SD" followed by alphabetic and numeric characters which identify the specification and clause being amended or added to. Where the Specification Data clause is an addition and there is no appropriate clause in the standard specification to which to link it, the number after the last standard specification clause number is used.

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

SDA **GENERAL**. (SANS 1200 A)

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

SDA2 **Interpretations**

SDA2-1 **Applicable edition of standards** (Subclause 2.2)

Add at the beginning of Subclause 2.2:

"Unless a specific edition is specified (see the List of Applicable Specifications), ..."

SDA2-2 **Definitions and abbreviations** (Subclauses 2.3 and 2.4)

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

The terms "GPO", "P&T" and "Department of Posts and Telecommunications" shall mean "Telkom SA Limited".

The terms "South African Railways", "SAR", "South African Transport Services", "SATS" shall mean "Transnet Limited".

SDA2-3 **Abbreviations** (Subclause 2.4)

Add to Subclause 2.4(b):

"MAMDD: Modified AASHTO maximum dry density".

SDA2-4 **Items in Bill of Quantities** (Subclause 2.8.1)

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

SDA3 Materials

SDA3-1 Quality (Subclause 3.1)

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

Unless otherwise specified or approved, all manufactured items/materials used shall be new.

SDA4 Plant

SDA4-1 Medical facilities and safety equipment. (Subclause 4.2)

The suitable first aid services required in terms of Subclause 23(2) of the General Conditions of Contract and Subclause 4.2 of SANS 1200 A shall include, inter alia, a First Aid cabinet fully equipped and maintained with at least the minimum contents as listed in the Annexure (Regulation 3) to the General Safety Regulations of the Occupational Health and Safety Act, 1993 (Act 85 of 1993), to deal with accidents and ailments which are likely to occur during the construction period.

The Contractor shall provide personal safety equipment and facilities as required by Regulation 2 of the General Safety Regulations of the Occupational Health and Safety Act, 1993 (Act 85 of 1993).

SDA4-2 Sanitary facilities. (Subclause 4.2)

The sanitary services shall be of the chemical type and shall be readily accessible to workers at all areas of the site.

The Contractor shall make all the necessary arrangements with the relevant local authority for the disposal of the contents of the toilets on a regular basis.

SDA4-3 Security of Contractor's site establishment

The contractor must provide his own adequate security to ensure a safe and secure environment for all his temporary construction facilities for the entire duration of his contract.

SDA5 Construction

SDA5-1 Setting out of the Works (Subclause 5.1.1)

Reference and level beacons will be shown to the Contractor by the Engineer at the commencement of the Contract and the Contractor will be responsible for transferring the data to the Site of Works. These reference beacons are indicated on Drawing No …… C-0... The Works shall be set out in accordance with the co-ordinates, dimensions and levels as shown on the drawings. The co-ordinates are based on WGS 84 LoWG19 and levels to mean sea level.

The Contractor shall check the condition and accuracy of all reference and level beacons and satisfy himself that they have not been disturbed and are true with regard to position and level. A beacon that has been disturbed shall not be used until its true position and level have been re-established and the new values have been certified by the Engineer. The Contractor shall thereafter be held entirely responsible for the protection of all reference and level beacons.

The Contractor shall upon completion conduct a comprehensive completion survey of the ..... Dam, its spillway, roads, outlet works and dam basin, which shall link into the existing survey everywhere where construction activities have disturbed or changed something. This survey shall be sufficiently detailed to provide a 0.5 m contour interval on the dam wall and a 1 m contour interval in the dam basin up to RL ….0 m or the property fence. Details concerning all structures constructed as part of the Contract shall be provided. The survey shall be submitted in *.xyz format with “break lines” to be utilised in Civil Designer, as well as a contour plan in *.dwg format (AutoCAD 14 or later version).

Survey work will not be measured and paid for directly and compensation for the work involved in setting out and conducting the completion survey shall be deemed to be covered by Item A1.4 as tendered in the Schedule of Quantities.

SDA5-2 Removal of site establishment. (Subclauses 4.2 and 5.8)

On completion of the works, the Contractor shall scarify all disturbed areas where offices, stores, workshops, etc., were located and all temporary roads and tracks, and he shall place a 150 mm thick layer of approved topsoil over all such areas followed by appropriate grassing.

All rubble generated by the removal of the site establishment shall be disposed of offsite.

SDA5-3 Dealing with water

All water from rain on the site, floods from the ..... Dam basin catchment as well as the site of works, pipeline failures, subsurface water and infiltration shall be dealt with in such a way as to ensure the safety of the Works.

It is required that adequate preventive measures are taken, and maintained to ensure that the Works are protected from damage due to water from the abovementioned sources.

In the event of these measures failing to protect the Works, action shall be taken immediately to protect the Works from further damage, the costs of which shall be carried by the Contractor. The damage caused shall be made good by those responsible for the damage, or as directed by the Engineer. The costs of the work shall be carried by the responsible party.

The Contractor shall design, construct and maintain all drains, pumps and other temporary works necessary for the dewatering and flood protection of the permanent works, stockpiles, borrow areas and haul roads. All methods of dewatering and stormwater protection shall be to the approval of the Engineer.

Having served their purpose, all temporary works shall be removed, backfilled or levelled such that the operation of the Works shall not be affected in any way.

The Contractor shall be responsible for and shall repair and re-vegetate at his expense any damage to the foundations, structures or any part of the Works caused by floods from the catchment of ..... Dam, water or failure of any part of the dewatering and flood protection works.

Runoff from the ..... Dam catchment occurs mostly in winter and consists chiefly of channel flow from the ..... river. The Safety Evaluation Flood event, from the …. km^2 catchment (refer to Drawing No Figure 1.1 bound in at the back of this document), is estimated at …. m^3/s.

SDA5-4 Existing services

Apart from an electricity line, there are no existing services present on Site. Notwithstanding the wooden electric pole, which needs to be relocated by ESKOM, this power line as well as any pipelines, road drains, etc. beyond the periphery of the site need to be avoided. The existing property perimeter fencing must be maintained to at least the condition prior to construction. The Contractor shall be responsible for the protection of these services and structures during the construction of the Works and shall bear the cost of any damage caused to them or their associated components. ghj

SDA8 Measurement and payment

SDA8-1 Method of measurement, all sections (Subclause 8.1.1.)

In the second line of Subclause 8.1.1, after the words "standardized specification or in" add: "the measurement and payment clause of the standard specification, particular specification or".

SDA8-2 Time-related items. (Subclause 8.2.2)

Notwithstanding the stipulation of Subclause 8.2.2, an approved extension of time will only entitle the Contractor to payment in terms of Subclause 45(4) of the General Conditions of Contract.

SDA8-3 Dealing with water. (Subclause 8.3.2.2(h))

No separate payment for dealing with water shall be made in respect of controlling, abstracting or removing surface and/or seepage water and precautions against flooding for the proper execution of the Works, as it will be held to be covered by the sums tendered for Items A1.7 and A2.4. This contribution covers all costs relating to preventive measures in dealing with water, the repairing of damaged sections of the Works and any obligations as described in SDA5-3.

SDA8-4 Freehaul and overhaul

Notwithstanding any clauses in any Standardized Specification or Standard Specification section dealing with the definition, measurement and/or payment for transport, freehaul and/or overhaul, no measurement nor payment for overhaul will be made. All haulage will be considered to be freehaul and the cost thereof will be covered by the rates for the provision or disposal of the applicable material.

SDA8-5 Daywork. (Subclause 8.7)

The unit rates for labour and plant, and percentage allowances for addition to the net cost of materials, shall cover overhead charges and profit, site supervision and site staff, insurances, holidays with pay, and use and maintenance of tools and equipment. The rates for plant hire shall, in addition, cover the cost of plant operators, consumable stores, fuel, and maintenance. The rates or allowances shall also cover travelling allowances or travelling costs (transport of men by Contractor's transport or transport hired or paid for by the Contractor), lodging allowances, and any other emoluments or allowances payable to the workmen.

SDA8-6 Removal of site establishment. (Subclause 8.3.4)

The tendered rate for the removal of the Site establishment shall, in addition to Subclause 8.3.4, cover the cost of the work specified in SDA5-2.

SDA8-7 Sums stated provisionally by Engineer (Subclause 8.5)

Amend the penultimate sentence of Subclause 8.5 to read:

"The percentage rate for (b)(2) above shall cover the Contractor's overheads, charges and profit on the work covered by the sums provisionally stated for (b)(1) above. Payment will be made on the basis of the sums actually paid for such work, exclusive of VAT."

SDA8-8 Miscellaneous items

An item which, in the payment clause column of the Bill of Quantities, refers to this clause (SDA8-7), will be measured in the unit scheduled.

The sum or rate for such item shall cover the cost of all materials, labour and plant required to execute and complete the work as specified, described in the Bill of Quantities or shown on the drawing(s).

SDAB ENGINEER'S OFFICE (SANS 1200 AB)

SDAB3 Materials

SDAB3-1 Nameboards (Subclause 3.1)

In the third line of Subclause 3.1, adjust the words “South African Institute of Civil Engineers” to read: “South African Association of Consulting Engineers”.

One nameboard, manufactured as specified in Subclause 3.1 and to format as shown on Drawing 4001 CON 2F, shall be provided, and shall be erected, plumb and level, in the position as directed by the Engineer.

Particulars and the wording for the nameboard shall be as ordered at the commencement of the Works.

SDAB3-2 Medical facilities and safety equipment

The Contractor shall make the first aid services and such personal safety equipment and facilities as are required in terms of SDA4-1, available to the Engineer and his site staff for the duration of the Contract.

SDAB5 Construction

SDAB5-1 Nameboard. (Subclause 5.1)

The nameboard shall be removed by the Contractor before the issue of the Completion Certificate.

SDAB5-2 Site instruction books

Throughout the construction period the Contractor shall supply two carbon quadruplicate books as site instruction books. These books shall remain on Site and shall at all times be available to both the Contractor and the Engineer.

One book shall be used by the Contractor for providing the Engineer with any information regarding the construction of the Works which may be requested, and giving notification in writing of inspections, drawings, etc., required by the Contractor.

The other book shall be used by the Engineer for the purpose of writing day-to-day instructions and confirming any verbal information or instructions given to the Contractor.

One copy of each site note issued shall remain in the books.

SDAB5-3 Key personnel (Subclause 5.3)

The Contractor shall inform the Engineer to which person he has assigned the Site duties in terms of the Occupational Health and Safety Act, and of any person(s) which hold a valid first aid certificate.

The Contractor shall provide copies of the minutes of the Site safety meetings to the Engineer.

SDAB5-4 Protective clothing

The Contractor shall provide and maintain protective clothing, consisting of three hard hats, gumboots (at requested sizes) and rain gear to members of the Engineer's staff and any visitors.

SDAO Health and safety (refer to C3.3)

SDAO 8 MEASUREMENT AND PAYMENT

SDAO 8.1 Basic principles
SDAO 8.1.1 General

In addition to those aspects covered by 8.2 below, Occupational Health and Safety

aspects related to particular items of work will be held to be covered by the tendered sum or rate for that work.

SDAO 8.2 Billed items

SDAO 8.2.1 General safety obligations

Unit: ..... Sum

Compliance with the general health and safety obligations will be measured and paid by the sum. This item may be billed as a fixed charge item and a time-related item.
The tendered sum(s) shall cover the cost, not included under the billed work items (see 8.1) nor under items 8.2.2 to 8.2.6 below, of establishing and maintaining, on an on-going basis, the general health safety systems and general compliance with the Act and its construction regulations.

SDAO 8.2.2 Risk assessment

Unit: ..... Sum

Risk assessment will be measured and paid by the sum. This work may be billed as a fixed-charge item only.
The tendered sum shall cover the cost of carrying out a risk assessment required in terms of Clause 4.2 of Specification AO at the start of the Contract and any subsequent risk assessment that is proved necessary as the work proceeds, and the inclusion thereof in the health and safety plan.

SDAO 8.2.3 Health and safety plan

Unit: ..... Sum

The health and safety plan will be measured and paid by the sum. This item may be billed as a fixed-charge item and a time-related item.
The tendered sum(s) shall cover the Contractor's cost of the preparation, approval process, maintenance and implementation of an approved health and safety plan required in terms of Clause 5 of Specification AO.

SDAO 8.2.4 Construction Safety Officer and other appointments

Unit: ..... Sum

The Construction (Health and) Safety Officer and other appointments will be measured and paid by the sum. This item may be billed as a time-related item only.
The tendered sum shall cover the cost of the provision of a Construction (Health and) Safety Officer and such other appointments of competent persons as required on the site in terms of the Act.

SDAO 8.2.5 Training

Unit: ..... Sum

Training, as required by the Construction Regulations will be measured and paid by the sum. Training may be billed as a fixed-charge item only and may, through sub items, distinguish between the various aspects of training.
The tendered sum(s) shall cover the cost of the required training.

SDAO 8.2.6 Medical assessment of employees

Unit: ..... Sum

Medical assessment of employees will be measured and paid by the sum. This work may be billed as a fixed-charge item only.
The tendered sum shall cover the cost of having the Contractor’s employees medically assessed with regard to their medical fitness for the work they will be required to perform and/or vehicles or plant they are required to operate and the provision of the appropriate certificate.

SDD EARTHWORKS (SANS 1200 D)

SDD3 Materials

SDD3-1 Classes of excavation. (Subclause 3.1.2)

The excavation of material for the purposes of measurement and payment will not be classified as intermediate excavation nor as boulder excavation Class A or Class B. Excavations in all (soft) materials will be held to include material classified in Subclause 3.1.2 as intermediate excavation, and boulder excavation Classes A and B.

SDD6 Tolerances

SDD6-1 Permissible deviations. (Subclause 6.1)

A general Degree of Accuracy III shall apply to all excavations at the outlet pipe trench, core trench and spillway.

SDD8 Measurement and payment

SDD8-1 Excavate in all materials and use for backfill. (Subclauses 3.1.2, 8.3.2 and 8.3.3)

No extra-over payment will be made for material classified as intermediate excavation in terms of Subclause 3.1.2 or as boulder excavation Class A or Class B. The cost of excavating in these materials shall be included in the tendered rate for "excavation in all (soft) materials".

SDDE SMALL EARTH DAMS. (SANS 1200 DE)

SDDE3 Materials

SDDE3-1 Selected impervious core : Zone I. (Subclause 3.2.1)

The selected impervious material in this zone shall consist of cohesive clayey silty sand / clayey silt with a Plasticity Index (P.I.) of between 12 and 20, with a mean greater than 15, and a coefficient of permeability of $1x10^{-7}$ cm/s or less. The material shall contain no pebbles greater than 50 mm. The mean clay content must be more than 15%.

The material shall be obtained from the clayey deposits in the dam basin, derived from the weathering of the above lying shale band.

The grading requirements of the material for this zone as well as the gradings of samples taken on Site are shown on Drawing No ….. C-0.

SDDE3-2 General fill - downstream: Zone II. (Subclause 3.2.1)

The material for this zone is generally the same material as that used for the clay core in Zone I. The material requires no additional selection and the available deposits in the dam basin may be used. No specific grading requirements are imposed.

SDDE3-3 Rip-rap : Zone III. (Subclause 3.2.3)

The material for this zone shall consist of clayey gravel and rock which can be obtained from the upper horizons of the borrow area in the basin of the dam (See Drawing No ….. C-0). The average rock size (D_{50}) shall be 200 mm and the maximum rock size (D_{100}) 300 mm.

SDDE3-4 Gravel capping : Zone IV. (Subclause 3.2.4)

The material for this zone shall consist of clayey gravel which can be obtained from excavations in the dam basin. Between 30 % and 40% of the material must be retained on the 13.2 mm sieve. The plasticity index must be between 6 and 12.

SDDE3-5 Chimney and blanket drains : Zone V. (Subclause 3.2.2)

The material for this zone shall consist of a clean cohesionless sand, a source of which has been identified at the borrow area indicated on Drawing No 108603 C-012.
The grading requirements of the material for this zone are shown on Drawing No 108603 C-018.

SDDE3-6 Topsoil : Zone VI. (Subclause 3.3.2)

This zone shall consist of 150 mm alternating layers of topsoil and general fill material which will be excavated in the dam basin or stripped from the dam solum prior to construction of the dam wall.

SDDE3-7 Rock toe : Zone VII. (Subclause 3.2.3)

The material for this zone shall consist of hard, durable, well-graded broken rock and gravel, obtained from the dam basin and around site. 80 % of the material must be larger than 50 mm with the largest cobble size 150 mm. The grading requirements of the material for this zone are shown on Drawing No ….. C-0

SDDE3-8 Gravel : Zone VIII. (Subclause 3.2.2)

This zone shall consist of 19 mm gravel (clean, hard and cohesionless) to be placed at the rock toe to serve as filter transition material. It can be obtained from the same location as the rock toe.

SDDE5 Construction

SDDE5-1 Topsoil (Subclause 5.2.1.3)

Suitable topsoil that is cleared from the Works shall be stockpiled and protected during construction.

SDDE5-2 Clearance (Subclause 5.2.1.4)

The dam's footprint and basin as well as the borrow area shall be cleared from all vegetation, which will be disposed at a designated spoil site on site.

SDDE5-3 Settlement allowance. (Subclause 5.2.3.1 and 6.1)

The embankment dam shall be constructed 2% higher than the height above the general ground level to the theoretical crest level as shown on the drawings, in order to allow for long term settlement. This shall be achieved by constructing the slopes 2% steeper than shown on the drawings.

SDDE5-4 Preparation of surfaces (Subclause 5.2.2.2)

The surface on which material shall be placed shall be excavated so that the slopes are not steeper than 1V:1H. This surface shall be prepared by ensuring that it is cleared of mud, silt and standing water.

Should plant roots or other unsuitable material be found at the founding depth of the core or pipe trench, these shall be removed by further excavation.

The core, outlet pipe and rock toe trenches shall be excavated into clayey or sandy silt and clayey sand to a depth specified by the Engineer on site. The Contractor's attention is drawn to the requirements of Subclause 5.2.2.2 (b). The compaction requirement for the foundation after approval shall be 95% of PROCTOR Density in all cases.

SDDE5-5 Borrow areas and excavation limits (Subclause 5.2.2.3)

The sides of all borrow areas shall be excavated to a slope of 1V:3H or shallower. No additional payment shall be made for this.
The final bottom of the excavated dam basin shall not be lower than the predetermined outlet pipe level of RL …..m.

Unless specifically instructed by the Engineer, no material in the dam basin may be excavated above the full supply level (RL …. m).

The Contractor's attention is drawn to the requirements of Sub-clause 5.2.2.3 for borrow pits outside of the full supply level of the dam, ie the proposed sand and rock toe borrow pits. The location and extend of these areas will be demarcated on site by the Engineer.

SDDE5-6 Compaction. (Subclause 5.2.3.2(d))

The core zone (Zone I) of the embankment shall be compacted to at least 98% of Proctor density and the other zones (excluding Zone VIII) to at least 95% of Proctor density. In both cases the mean density as determined from a number of tests shall be higher than or equal to the specified density (either 98% or 95% of Proctor density). Additionally, no one density may be lower than 95% for Zone I and 90% for the other zones.

The compaction shall be tested in accordance with the sand replacement method (TMH1 Test Method A10(a)). Testing with nuclear density testing apparatus may be permitted if it can be shown to be consistent with regard to field densities and moisture contents when compared to the sand replacement method. This does not exempt the Contractor of his responsibilities in terms of Clause 7 of SANS 1200 DE.

The material at the base and sides of the dam basin excavation need not be compacted, but should be trimmed neatly to the specified slope of 1V:3H or flatter.

SDDE5-7 Backfill around outlet pipe (Subclauses 5.2.3.4)

The placing of material around or on top of the outlet pipe encasement shall only commence after a minimum of 7 days after the concrete encasement has been poured.

SDDE5-8 Freehaul and overhaul (Subclauses 5.2.5.1, 5.2.5.2 and 8.3.8)

Notwithstanding any clauses in any Standardized Specification or Standard Specification dealing with the definition, measurement and/or payment for transport, freehaul and/or overhaul, no measurement nor payment for overhaul will be made. All haulage will be considered to be freehaul and the cost thereof will be deemed to be covered by the rates for the provision or disposal of the applicable material.

SDDE5-9 Excavation of outlet pipe

Depending on the quality of the in-situ material, it is expected that it may not be possible to excavate the pipe trench to the specified tolerances in this material. Provision has therefore been made for a 4 m wide trench to an approved acceptable foundation, which is then to be backfilled with selected impervious core material to the top level of the encasement. The pipe trench, chimney drain and cut-off collars shall be excavated to size out of this material.

SDDE5-11 Stockpiling

Should the Contractor elect to temporarily stockpile any material for whichever reason, it shall be for his own account. No payment shall be made for stockpiling.

SDDE6 Tolerances

SDDE6-1 Moisture content (Subclause 6.2(b))

The moisture content for the core (Zone I) shall be as it needs to be for dispersive soils (Subclause 6.2(b)(5)).

SDDE7 Testing

SDDE7-1 Taking and testing of samples

The Contractor shall for the duration of the Contract conduct density control tests using a nuclear density testing apparatus with a qualified technician to operate the device. The Contractor shall also provide a Calibration Certificate for the device.

The Contractor may use this device to conduct his routine density control and moisture content control tests. It does, however, not exempt him from his responsibility to achieve the specified density and moisture content. The Contractor shall conduct moisture content control tests in his laboratory to check the results obtained from the nuclear device.

The frequency with which these routine density and moisture content control tests shall be conducted shall be, on average, one set per main zone per four to five layers of placed material at roughly 80 m intervals along the embankment.

The Engineer shall observe the density control tests and may conduct further control tests. The Contractor shall make the device available to the Engineer for his control tests.

The Engineer shall conduct additional control tests using the sand replacement method (TMH1 Test Method A10(a)), which shall also be used to confirm the results from the nuclear device.

The frequency with which the Engineer will conduct his density and moisture content control tests shall be one set per main zone per ten to twelve layers of placed material at roughly 80 m intervals.

The costs of any control tests conducted by the Engineer which do not conform to the requirements shall be for the Contractor’s account.

SDDE8 Measurement and payment

SDDE8-1 Calculation of quantities

Notwithstanding Subclause 8.2.1 volumes will be calculated to the theoretical levels shown on the drawings and no extra payment will be made for providing and placing the additional material required for the settlement allowance specified in SDDE5-3.

SDDE8-2 Excavation and forming embankment. (Subclauses 8.3.3 and 8.3.5)

No extra-over payment will be made for material classified as intermediate excavation in terms of Subclause 3.1.2. The cost of excavating in intermediate material shall be included in the tendered rate for "excavation in all materials".

The rates for excavation of material for use in the various zones of the dam shall cover costs as set out in Subclause 8.3.3(b) as well as Subclause 8.3.5 and shall include for selection as required.

SDDE8-3 Imported material

The rate for the potential importation of materials for the gravel filter shall cover the costs of procurement, selection, loading, hauling from the source, placing and compaction (where applicable) in the relevant embankment zone and any other costs incidental thereto.

The quantities will be calculated strictly according to the net dimensions on the drawings. The Contractor shall allow in his rates for any possible wastage.

SDDE8-4 Unsuitable material

The rate for the removal of the unsuitable material below the footprint of the embankment shall cover the costs of excavation, loading, hauling, placing and spreading in the designated spoil area.

SDDE8-5 Confined excavation in core and pipe trench (Subclause 8.3.3)

a) By machine.

b) By hand, when excavation by machine is impossible.

The rate shall allow for any confined excavation which may occur.

SDEMA ENVIRONMENTAL MANAGEMENT. (SPEC EMA)

SCOPE

A copy of the Life-Cycle Environmental Management Program (LEMP) is included under C3.3 with specification EMA (SPEC EMA). The general principles contained within the SPEC EMA (Specification EMA: Environmental Management (Basic)) shall apply to all construction activities. All construction activities shall observe any relevant environmental legislation and in so doing shall be undertaken in such a manner as to minimise impacts on the natural and social environment.

SDEMA2 INTERPRETATIONS

SDEMA2.1 Application

The LEMP Spec and EMA contains clauses specifically applicable and related to the environmental requirements for the construction of the ..... Dam.

Where any discrepancy or difference occurs between the LEMP and SPEC EMA, the provision of the LEMP shall prevail.

SDDK GABIONS AND PITCHING (SANS 1200 DK)

SDDK3 Materials

SDDK3-1 Pitching

SDDK3-1.1 Stone (Subclause 3.2.2)

The thickness, size and mass of the stone pitching shall comply with the specification for medium pitching.

Stone for gabions and pitching must be obtained from borrow areas on the farm and be approved by Engineer. Such stone shall be clean and free of foreign matter and, blend in with the environment.

SDDK3-2 Wire netting (Subclause 3.2.3)

The wire netting for gabions and mattresses shall comply with the requirements of SANS 1580 and shall consist of a hexagonal double twist mesh (Type 80 for gabions and Type 60 for mattresses) with 2,7 mm wire and 3,4 mm selvedge wire for gabions and 2,2 mm mesh wire and 2,7 mm selvedge wire for mattresses, all galvan coated to EN 10244-2 with an extruded brown PVC coating of mean wall thickness of 0,5 mm, complete with partitions at 1,0 m centres.

SDDK3-3 Geotextile (Subclause 3.1.3)

The geotextile used under and on the sides of the gabions and mattresses shall consist of continuous filaments double needle punched geotextile.

Gabion AG 200 or similar approved shall be used underneath and on the sides of gabions and mattresses.

SDDK6 Tolerances (Subclause 6)

Tolerances shall comply with Degree of Accuracy II for medium pitching.

SDDK7 Tests

SDDK7-1 Weathering test (Subclause 7.3)

The stone supplied for the contract shall conform to the test procedures and parameters stated under Subclause 7.3 (a), (b), (c) and (d). The cost of the tests will be deemed to be included in the gabion and mattress rates.

SDDK8 Measurement and payment

SDDK8-1 Gabions (Subclauses 8.2.1 and 8.2.2)

Gabions will be measured by volume in accordance with Subclause 8.2.2.

Notwithstanding the method of measurement of Subclauses 8.2.1 and 8.2.2 the tendered rate shall cover the cost of the supply of rockfill from borrow areas including selection, wire mesh cages, binders, connections, collection, stockpiling, bed preparation, assembly and filling of the cages and completion of the construction of the gabions. Excavation for placing the gabions will be measured separately.

SDDK8-2 Mattresses

The measurement of the mattresses will be by volume.

The tendered rate shall cover the cost of the supply of rockfill from commercial sources including selection, wire mesh cages/rockfall mesh, binders, connectors, collection, stockpiling, bed preparation, assembly and filling of the cages and completion of the construction of the mattresses. Excavation for placing the mattresses will be measured separately. In addition, stakes as specified on the drawing at 2 m c/c and fixed to the mattresses shall also be included in the rate.

SDDK8-3 Hand excavation and backfilling of material

Hand excavation and backfilling of material will be measured by volume of material excavated.

The rate shall cover the cost of excavation, trimming, backfilling and compacting.

SDGA CONCRETE (SMALL WORKS). (SANS 1200 GA)

SDGA3 Materials

SDGA3-1 Cement (Subclause 3.2)

All cement used on Site shall comply with SANS 50197-1 for CEM I 42,5.

SDGA3-2 Storage (Subclause 3.2.2)

Cement shall be used in the order in which it is received.

Unless approved by the Engineer, cement kept in storage for longer than 8 weeks shall not be used in the Works.

Any cement that contains lumps that cannot easily be crumbled to powder between the fingers shall not be used.

SDGA3-3 Admixtures

No admixtures shall be used without prior approval of the Engineer.

SDGA3-4 Cement used with reactive aggregates. (Subclauses 3.2 and 3.4)

Where the Contractor proposes to use reactive aggregates such as from the Malmesbury Series, or certain aggregates from the Table Mountain Formation, or other quartzitic sources, he shall design the mixes and/or use a low-alkali cement with a guaranteed equivalent sodium oxide content so that the concrete shall have a total equivalent sodium oxide content of less than 1,80 kg/m^3 of concrete.

The equivalent sodium oxide content is calculated as $Na_2O + 0{,}658\ K_2O$. For cement this is expressed as % mass and for concrete it is expressed as kg/m^3.

In the case where less reactive aggregate is used, the Engineer will determine the type and degree of precautionary measures to be adopted.

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

The rates tendered for concrete mixes shall include for all costs of meeting the requirements of this clause.

SDGA3-5 Reinforcement. (Subclause 3.5)

Mild steel shall be according to SANS 920 - Type A 250 MPa yield and high yield stress steel according to SANS 920 - Type C, Class 2, Grade 1, 450 MPa yield.

SDGA4 Plant

SDGA4-1 Mixing plant and vibrators (Subclauses 4.2 and 4.3)

Stand-by mixers and 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 mixers or vibrators or failure of the power supply.

SDGA4-2 Repair (plugging) of formwork ties (Subclause 4.4.3)

Where practical, tie cone recesses shall be plugged with well rammed, dry 3:1 mortar within 48 hours of casting the concrete. The surfaces of the recesses shall first be roughened by chipping and wire brushing.

Tie cone recesses which cannot be plugged within 48 hours of casting shall be roughened by scabbling and an approved screed adhesive or a wet-to-dry epoxy shall be applied before plugging the recesses with mortar.

SDGA4-3 Formwork: chamfers and fillets

All exposed external angles in concrete work shall have 20 mm x 20 mm chamfers unless otherwise specified or ordered. However, any horizontal surface which is to receive a finishing does not require any chamfering.

Internal corners in concrete work need not have fillets unless such fillets have been specified on the drawings or ordered by the Engineer.

SDGA5 Construction

SDGA5-1 Preparation of surfaces to receive concrete

Prior to concreting, the surface shall be cleaned of oil, deleterious coatings, loose or unsound rock fragments, mud, silt and clay, etc., by jetting with water or air and scrubbing with brooms, barring off, or by other methods demonstrated to be equally satisfactory.

Standing water shall be removed before concreting, and flowing water shall be kept clear of the concreting works.

After excavation and trimming of the foundations to an acceptable level and thoroughly cleaning the exposed surface, the foundations shall be prepared by compacting the surface by mechanical means to 98% of PROCTOR Density.

SDGA5-2 Spacers (Subclause 5.1.2)

Spacers of approved design include approved plastic or other proprietary spacers, or purpose made precast mortar blocks.

Where mortar blocks are used they shall be properly shaped so as not to slip out of position and shall be made of the same mix as the mortar of the concrete in which they are to be placed. The mortar shall be well compacted by approved means into the moulds to result in blocks with a density of at least 2 300 kg/m^3 and which are free from honeycombing. The mortar blocks shall be cured in water for at least 7 days. Blocks which have not been manufactured and cured strictly in accordance with these requirements or which are in any other way considered unsatisfactory by the Engineer, will be rejected and shall be removed from the Site.

SDGA5-3 Concrete surfaces. (Subclause 5.4.8)

All unformed concrete shall be wood floated unless otherwise specified.

SDGA5-4 Concrete

All structural concrete in the works shall be strength concrete Grade 25 MPa with 19 mm maximum aggregate size, in terms of subclause 5.4.1.5, unless otherwise specified on the Drawings. The mix design shall be presented to the Engineer for approval.

SDGA5-5 Water/cement ratio of the concrete

The maximum water/cement ratio of the concrete shall be 0,50.

SDGA5-6 Adverse weather conditions

No placing of concrete shall take place if the ambient temperature exceeds 32ºC, or is likely to rise to above 32ºC during the casting period or within eight hours after casting is completed, without the approval of the Engineer.

SDGA5-7 Construction joints

Should a construction joint be older than 24 hours but less than 3 days, the entire area of each joint shall be cleaned using whatever mechanical devices are required and/or compressed air and water. All laitance and similar deposits shall be removed and the coarse aggregate in the hardened concrete shall be clearly visible. The surface shall then be wetted and covered with a 20 mm thick layer of mortar, consisting of cement and sand to the same sand:cement ratio as that of the concrete. Each joint shall be inspected by the Engineer before it is rendered inaccessible by the erection of further formwork.

For horizontal joints, the mortar layer specified in procedure (b) of Subclause 5.5.7.3 shall be 20 mm thick. The mortar shall be protected from drying out before the fresh concrete is placed against it.

In the case where the construction joint is older than 3 days, the abovementioned procedure shall be followed, but the surface being prepared shall be wetted for a period of 24 hours prior to the application of the mortar layer.

SDGA5-8 Watertight concrete

All concrete used in the Works shall be watertight concrete.

SDGA5-9 Reinforcement

Reinforcement bars shall not be welded.

SDGA6 Tolerances

SDGA6-1 Permissible deviations. (Subclause 6.4)

The general Degree of Accuracy III shall apply to all concrete in the Works.

SDGA8 Measurement and payment

SDGA8-1 Preparation of surfaces to receive concrete

Preparation of surfaces to receive concrete will be measured by the area of surfaces excavated against which structural concrete is to be cast based on the neat planes defined by the dimensions shown on the drawings.

The rate shall cover all costs to comply with SDG5-1.

SDGA8-2 Chamfers and fillets

The cost of all chamfers and fillets will be deemed to be included in the unit rate for formwork.

SDGA8-3 Joints (Subclause 8.5)

The cost of construction joints which are not formed will be deemed to be included in the unit rate for concrete.

Formed construction joints shall be measured according to the net area of a single surface making up the joint. The rate shall cover the cost of all materials, labour and plant required to construct each joint as well as to prepare it as specified.

SDGA8-4 Y 16 eye bolts

The Y16 eye bolts in the toe block of the reno-matresses shall be measured and paid by number .

The rate shall cover the costs of all materials, drilling, flushing of holes, grouting of bolts and construction.

SDGA8-5 Concrete slab and support brickwork at downstream end of outlet pipe

The concrete slab and support brickwork at downstream end of outlet pipe shall be measured and paid as Sum.

The rate shall cover the costs of all materials, clearing, excavation, concrete, mesh reinforcement, plaster and brickwork and construction as shown on Drawing No 108603 C-015.

SDL MEDIUM-PRESSURE PIPELINES. (SANS 1200 L)

SDL3 Materials

SDL3-1 Pipes

SDL3-1.1 Outlet pipe

The dam's inlet and outlet pipe shall be 400 mm OD High Density Polyethylene (HDPE) Class PE100 PN6 suitable for butt-welding manufactured complying with SANS 4427:1996.

The full physical and chemical properties of the pipe product are also to be submitted with the tender for scrutiny by the Engineer. The HDPE piping shall be supplied in the maximum lengths in order to reduce the number of site welds. The Contractor shall provide the Engineer with the name of the supplier of the HDPE piping.

SDL3-1 Pipe specials (Subclause 3.4.4)

Pipe specials shall be manufactured in accordance with Subclause 3.4.4 and SDLQ3-1.

SDL3-4 Flanges (Subclause 3.8.3)

All flanges shall be drilled and come supplied with join material and conform to SANS 1123 (Table 10) unless otherwise specified in the Drawings or the Bill of Quantities.

All mild steel bolts, nuts and washers shall be hot-dip galvanized to SANS 763 after threading

SDL3-5 Corrosion protection (Subclause 3.9.2)

The mild steel pipe specials shall be protected against corrosion in accordance with SDLS.

SDL3-6 Storage of couplings and fittings and stacking of pipes. (Subclause 3.1)

The Contractor shall provide adequate storage facilities for pipes, couplings and specials to conform with the following:

a) Couplings and specials

Until required for use the rubber rings shall be stored in a cool, dark place, away from grease, oil or harmful chemicals. If rubber rings have been tied they shall be separated a few days before they are required for use in order to eliminate minor impressions which the ties may have caused.

Couplings into which rubber rings have been fitted, ready for use, shall be stored under cover. All couplings and specials shall be stacked off the ground to ensure that the protective coatings are not damaged.

b) Stacking of pipes and specials

Pipes and specials may be strung out alongside the position to be installed. The pipes shall be stored off the ground to prevent damage to them. When stacking is necessary the Contractor shall make the necessary arrangements for stacking areas and shall stack as recommended by the manufacturer.

c) Valves

All valves shall be stored under cover and shall be stacked off the ground in a manner which will prevent the ingress of dirt and ensure that the valve faces are not damaged.

SDL5 Construction

SDL5-1 Laying and concrete encasement of pipes underneath embankment.
(Subclause 5.4)

The outlet pipe underneath the embankment shall be encased in concrete.

The section of the pipe platform below the encasement shall be prepared in accordance with Subclause SDGA5-1, whereafter a blinding layer shall be placed true to line and level. The outlet pipe shall be placed on precast Grade 25/19 pedestals placed on the blinding layer. The blinding layer shall be treated as a construction joint and shall be prepared in accordance with SDGA5-7.

The pipes shall be anchored to the blinding layer or filled with water to prevent the pipes from floating during concreting. Concrete shall be placed from one side of the pipe only and shall be worked to the other side until the bottom third of the pipe circumference is in contact with the concrete bed.

The concrete shall preferably be cast without interruption, but if this is not possible, a vertical construction joint shall be made at a pipe joint.

The concrete shall have reached 80% of its specified strength and be covered with at least 300 mm of soil before construction plant will be allowed to drive over the encasement.

SDL5-2 Welding of the HDPE pipe

The HDPE pipe shall be joined by means of heat fusion using approved, butt welding equipment and fully trained operators in accordance with the pipe manufacturer's code of practice. The Contractor shall undertake the following steps prior to the commencement of welding on site:

a) Provide welding tables applicable specifically to 400 mm OD HDPE PE 100 PN6 pipe and the welding equipment to be used.

b) Provide a certificate of calibration for the welding machine to be used. The certificate shall bear the model number of the welding machine, the name and address of the certifying agent, the date of the test and a statement as to the accuracy of the temperature and pressure gauges on the machine in question.

   A certificate of calibration dated prior to the date on the letter from the Employer, instructing the Contractor to commence work, is **not** acceptable.

c) Provide certification that the welder/operator has successfully completed an approved training course and is qualified to weld the size and class of HDPE pipe to be used on this Contract.

d) A test weld is to be undertaken on site in the presence of the Engineer's Representative for approval prior to the commencement of welding the liner.

   Under **no** circumstances will welding be permitted to commence prior to the provision of the above certificates and the test weld, and the cost of delays resulting from failure to timeously undertake the abovementioned steps shall be borne by the Contractor.

   Each joint is to be uniquely numbered.

   Each joint shall be carefully examined and be watertight.

   No separate payments will be made for butt welding of the HDPE pipe liner.

SDL7 Testing

SDL7-1 General (Subclause 7.1)

All pipes shall be hydraulically tested after their installation but prior to their encasement. The pipes under the dam wall shall be retested hydraulically 7 days after the pipe encasement has been completed.

SDL7-2 Test pressure and time of test (Subclause 7.3.1)

Except that the test pressure shall not be less than 6 bars, the Contractor shall carry out testing as detailed in Clause 7 of SANS 1200 L.

The Contractor shall:

- give the Engineer 48 hours notice before conducting a test
- pressurize the pipeline and keep it at the required test pressure for 2 hours before the test
- be present during the test.
- be responsible for providing temporary valves, end caps, blank flanges or other isolating devices to complete the testing.

SDL8 Measurement and payment

SDL8-1 Couplings for fittings

Unless the rate for pipes and fittings includes the cost of couplings, these couplings shall be separately measured by number.

This rate shall cover the cost of supplying and installing the couplings including all bolts, nuts and join material.

SDL8-2 Corrosion protection

Notwithstanding Subclauses 8.2.7 and 8.12.15, the corrosion protection measures shall not be separately measures or paid for.

The tendered rate for pipes, valves, specials and couplings, etc., shall also cover the cost of all corrosion protection as specified.

SDL8-3 Specials cast in concrete

Specials cast in concrete will be measured by number.

The tendered rate shall cover the manufacture, corrosion protection, transport, handling, supply and delivery to Site, and fixing into position of the specials and all alterations required to formwork and grouting in where applicable, including Denso – wrapping a 200 mm length straddling the encased/non-encased interface each end and flanged end where buried.

SDL8-4 Pressure testing equipment

The cost of providing the equipment for testing will be deemed to be included in the rates tendered for pipe laying.

SDL8-5 Laying of outlet pipe underneath embankment

The laying of the outlet pipe underneath the embankment shall be measured per length. The rate shall cover the transporting of the pipes from the laydown area, the laying of the pipe true to line and level including the supply and installation of the concrete pedestals, the welding of the pipes and the making good of the corrosion protection.

SDLK VALVE INSTALLATIONS. (SPEC 1200 LK)

SDLK3 Materials

SDLK3-1 Gate valves. (Subclause 3.1)

Gate valves shall be doubled flanged full-bore types and shall be in accordance with SANS 664 Class 10. It shall be fitted with a non-rising spindle and handwheel.

The valves shall be suitable for flow in either direction.

SDLK3-2 Valve flanges

All flanges shall be drilled and supplied with jointing materials in accordance with SANS 1123, Table 10.

SDLK3-3 Corrosion protection (Subclause 3.14)

Refer to the relevant clauses of SPEC LR

The inner and outer surfaces of the valve shall be cleaned in accordance with Subclause 5.2 of SPEC LR. The entire surface shall be free of dust or moisture before it is coated. The valve surfaces shall then be coated with a fusion-bonded epoxy powder (FBE) in accordance with Subclause 3.14.2(f) to a total dry film thickness of 300 micrometres (± 50 micrometres).

The coating shall be such that all trimmings are covered by FBE for a distance of at least 5 mm to discourage bi-metal corrosion.

The sealing area of the flanges shall be treated to a dry film thickness of 150 micrometres (± 25 micrometres) (i.e. masked off before the second coat is applied.

The above specified coating shall be applied once the valve has passed its hydraulic test.

All damage to the coating (if any) caused by the transport and handling of the valves shall be repaired by the Contractor in accordance with the above specification, prior to the installation of the valves. Any damage to the coating caused by the installation of the valves shall be repaired in accordance with SPEC LR. The grinding down of the damaged area to Sa 2½ and the feathering of the edges are an acceptable alternative to re-blast cleaning.

SDLQ **STEEL PIPE MANUFACTURE**. (SPEC LQ)

SDLQ3 **Materials**

SDLQ3-1 **Type of steel and minimum thickness**

The minimum wall thickness for all pipe specials is 6 mm.

SDLR **CORROSION PROTECTION OF STEEL PIPES AND STEEL AND CAST IRON SPECIALS** (SPEC LR)

SDLR5 **Application/requirements**

SDLR5-1 **Flanges, nuts and bolts**

All flanges, nuts and bolts at the downstream end of the outlet pipe shall be treated with"Denso" paste and wrapped in "Denso" tape after installation as specified in Subclauses 5.10.2.1 and 5.10.9.2.

SDLR8 **Measurement and payment**

SDLR8-1 **Corrosion protection of flanges nuts and bolts** at the downstream end of the outlet pipe

The corrosion protection of all flanges, nuts and bolts at the downstream end of the outlet pipe (See Figure 1) as specified in specification SDLR5.1 shall be measured as a single Item in the Schedule of Quantities.

SDLS **CEMENT-MORTAR PROTECTIVE LININGS AND COATINGS FOR STEEL PIPES**. (SPEC LS)

SDLS5 **Application and workmanship**

SDLS5-1 **Extent of coverage**

The exterior of all pipe specials which are encased in concrete shall, over a distance of 300 mm from the concrete's ends be treated with zinc in accordance with Subclause 5.2.2.

All special which are not encased in concrete shall be protected by a cement mortar lining and additional cladding.

The flanged ends of specials (as shown on the drawings) shall be treated with zinc in accordance with Subclause 5.2.2.

SDLS8 **Measurement and payment**

SDLS8-1 **Protection against corrosion**

No additional payment for corrosion protection of steel pipes and specials shall be made. The tendered rate for steel pipes and specials shall cover the cost of all corrosion protection as specified.

SDX ADDITIONAL CLAUSES

SDX1 Outlet sieve

The outlet sieve shall be supplied and installed as specified on the drawings.

SDX2 Settlement beacons

Settlement beacons shall be installed every 50 m as shown on Drawing No …. C-0

SDX3 Depth gauges (Subclause 3.3)

Depth gauges shall be supplied and installed as specified on the drawings. The gauges shall be installed with the zero-mark level to the bottom of the invert of the S-piece on the upstream side of the outlet pipe

SDX4 Measurement and payment

SDX4-1 Outlet sieve

The outlet sieve will be measured by number.

The rate shall cover the costs of supplying and installing the sieve complete as detailed.

SDX4-2 Depth gauge

Depth gauges will be measured by number (See Drawing No ….. C-0).

The rate shall cover all costs of supplying and installing the gauges complete with the concrete footing and including the excavation and backfilling for the footing.

SDX4-3 Settlement beacons

The settlement beacons shall be measured by number (See Drawing ….. C-0). The rate shall cover all costs of supplying and installing the beacons including the excavation.

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