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APPROPRIATE DEVELOPMENT OF INFRASTRUCTURE ON DOLOMITE:

MANUAL FOR CONSULTANTS

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DEPARTMENT OF PUBLIC WORKS

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APPROPRIATE DEVELOPMENT OF INFRASTRUCTURE ON DOLOMITE: MANUAL FOR CONSULTANTS.

1. INTRODUCTION

This document serves as a guideline on appropriate development and risk management of infrastructure located on dolomite in South Africa. These guidelines are aimed at informing principal agents and other consultants of the minimum requirements of the Department of Public Works concerning the upgrading, extension and development of new infrastructure on dolomite, thereby promoting safe, sustainable development.

The objective of applying a **risk management strategy** to infrastructure is to ensure the safety of personnel and visitors, protection of property and to avoid fruitless expenditure. Avoiding sinkholes is not only important from a safety point of view, rehabilitating sinkholes and repairing buildings/infrastructure is costly.

In a climate of increasing awareness of individual rights, it is apparent that failure to pro-actively manage dolomite risk may constitute dereliction of duty and may expose the Department of Public Works, its officials, its principal agents and other consultants involved, to recourse through a number of avenues, including the Occupational Health and Safety Act of 1993. It should be clearly understood that principal agents and consultants are not absolved of their responsibilities and cannot claim ignorance in the event of damage or loss of life in a sinkhole.

In terms of bona mores, the criterion of reasonableness, it is essential that the Department of Public Works and its consultants "act" and are seen to act positively in order to prevent harm. Infrastructure must be appropriately designed, constructed, and serviced to facilitate management of the dolomite risk. To this end the Department of Public Works has adopted a Centralised Dolomite Risk Management Strategy for infrastructure located on all dolomitic land. This strategy aims to ensure appropriate:

- site selection,
- development design
- building design
- design of services, material selection, maintenance friendly systems etc.
- ongoing risk management.

The principal agent and other consultants play a crucial role in ensuring that this strategy is successfully implemented. Background information and appropriate planning, water precautionary and remedial measures are outlined below.

The Department has appointed a national Dolomite Risk Manager at head office and a single responsible person in each of the regions underlain by dolomite. These officials must ensure that the departmental Dolomite Risk Management policy is implemented on all levels of facility planning, maintenance and management. The appointed officials are as follow:

Name	Region	Designation	Tel	Fax
Theo van den Berg	Kimberley	Project Manager (ASD)	(053) 838 5204	(053) 833 1153
Michael Diale	Polokwane	Senior Project Manager	(015) 291 3221	(015) 295 8150
Anton Liebenberg	Mmabatho	DD: Projects & Maintenance	(018) 384 9331	(018) 384 9336
Philemon Maphalala	Pretoria	D: Maintenance	(012) 310 5034	(012) 310 5030
Ramoatse Masiza	Johannesburg	AsD: Health & Safety: Buildings	(011) 713 6041	(011) 339 1698
Conrad Buitendag	Nelspruit	DD: Project & Maintenance	(013) 753 6304	(013) 755 1705

The above listed officials will be present at all consultant briefings for projects located on dolomite.

2. BACKGROUND INFORMATION

This section is devoted to providing a rudimentary background perspective on the dolomite issue.

2.1 Definition of dolomitic land

The term 'dolomitic land' is used to describe areas in South Africa underlain directly or at shallow depth (i.e. <100m) by the rock type dolomite. Dolomitic rock is composed of the mineral dolomite, which is a carbonate of calcium and magnesium.

2.2 Why is dolomitic land problematical?

Dolomite is soluble, i.e. dissolves in water. Rainwater and percolating ground water gradually dissolve the rock over time as it seeps through joints, fractures and fault zones in the rock. The dissolution of the dolomite gives rise to cave systems and voids in the rock. Soils covering the rock can collapse into these caves or voids resulting in catastrophic ground movement on the surface such as sinkholes or dolines.

2.2.1 Sinkholes

Sinkholes result from the hollowing out of a space below the earth surface, which eventually breaks through, and 'daylights' at the surface. Sinkholes are usually cylindrical to conical in shape and can be 1 m to 100 m in diameter and 1 m to 150 m deep. Sinkholes are catastrophic and can cause property damage or loss of life. See figure 2 (page 61) for the mechanisms of sinkhole formation and plates 1 to 7 (page 64 -67) for typical sinkholes.

Sinkholes:

- may be catastrophic, as they occur unexpectedly with little or no warning.
- may cause property damage or loss of life, if they are sufficiently large.
- are usually precipitated by human activity such as:
  - de-watering and re-watering of groundwater compartments, due to mining activity,
  - water extraction from aquifers,
  - leakage of wet services such as water and sewer bulk services, reticulation and connections,
  - interference with natural drainage patterns by development and disturbance of superficial soil materials leading to concentrated water ingress.

2.2.2 Dolines

Dolines are less sharply defined than sinkholes, occur slowly and are not catastrophic (see doline effect on structures in Plates 8 and 9 on page 68). These features may be large ranging from tens of metres to kilometres in diameter or length. Typical visual observations at small dolines are shallow earth depressions and surface cracks in a circular or semi circular pattern.

It should be noted that in South Africa the terms sinkhole and doline are currently used to refer to geomorphologic features and are no longer distinguished by the mechanism of formation.

2.2.3 Triggering mechanisms for sinkhole and doline formation

Sinkholes and dolines are mostly caused by water seepage or a lowering of the ground water table. Seepage of water most commonly occurs from leaking water bearing services such as sewers, waters pipes, storm water systems etc. The leaking water erodes the soil covering the dolomite rock and carries the material down into the underlying cave systems resulting in a hollowing out of a space (cavity) below ground surface. A sinkhole results when this void daylights. (See Figure 2 on page 61).

The ground water level drops when boreholes are used to pump water from below ground surface. The ground water level can also be lowered when mines pump water out of ground water compartments to keep their underground workings dry. Ground water level lowering leads to lowering of pore water pressure which lowers ground bearing capacities or draining of subsurface cavities which may result in sinkhole or doline formation.

2.2.3.1 Sinkholes are generated by a change in the moisture regime in the soils constituting the arch over the upward migrating void. This change in the state of the soil leads to the arch ravelling and the void moving towards ground surface. The voids will eventually daylight and manifests as a sinkhole. Often paleo sinkholes are re-activated by groundwater level draw down. Paleo sinkholes are ancient features, in filled over time by transported soil material, e.g. wind blown, aeolian sands. These materials may extend below the original ground water level. In such instances a fall in the ground water level leads to a change in the moisture regime of the soils that re-activates the sinkhole.

The dolomitic environment is often characterised by zones of deep weathering and preferential leaching. This process of preferential weathering is particularly well advanced within the shear zones of faults. Subsurface karst valleys up to 200 m in depth may develop in these shear zones. Spectacular representations of these features can be seen on the Far West Rand.

In many of these areas, the water table is located above the bedrock, in residual soils. These residual materials are essentially composed of wad and ferroan soil. The artificial lowering of the water table may produce significant ground movement at the surface. This process manifests as a doline at ground surface.

2.3 Negative Consequences of Inappropriate Development on Dolomite

To date 38 people have died in sinkholes that have occurred under sports clubs, factories and homes and financial losses have exceeded R1,0 billion. In excess of 1000 sinkholes have occurred on the West Rand, 800 south of Pretoria, Centurion and Atteridgeville and approximately 150 on the East Rand.

Sinkholes and dolines may occur immediately after installation of services because of poor workmanship or use of inferior materials or after a period of time due to deterioration of the materials. Obviously, as the water bearing services deteriorate, the frequency of leaks increases and so does the likelihood of a sinkhole occurring.

2.4 Risk Characterisation of Dolomite Land

Broadly, the geotechnical investigation of the dolomite site culminates in the expression of the stability of the area in three risk categories, namely **low**, **medium** and **high** risk.

The following reference to incidences, gives a perspective of the magnitude of problems encountered in each of the risk zones in research areas. It is important to note that these

figures are largely derived from developments not effectively and appropriately designed or maintained.

RISK CHARACTERISATION	**GROUND MOVEMENT EVENTS ANTICIPATED PER HECTARE IN A 20 YEAR PERIOD** (STATISTICS BASED ON INAPPROPRIATE AND POOR SERVICE DESIGN AND MAINTENANCE)
LOW	Typically 0 events per hectare anticipated but occurrence of events cannot be totally excluded therefore up to 0,1 events/hectare
MEDIUM	0.1 to 1 events per hectare
HIGH	> 1,0 events or more anticipated per hectare

Table 1: Dolomite Risk Characterisation Zone definition

It should be noticed that low risk does not mean "no risk".

Current practice requires that the risk class be described in 8 distinct classes as per the Table 2 below.

RISK CLASS	**DISCRIPTION OF HAZARD**
Class 1	Areas characterised as reflecting a low Inherent Risk of sinkhole and doline formation (all sizes) with respect to ingress of water.
Class 2	Areas characterised as reflecting a medium Inherent Risk of small sinkhole and doline formation with respect to ingress water.
Class 3	Areas characterised as reflecting a medium Inherent Risk of medium sinkhole and doline formation with respect to ingress of water.
Class 4	Areas characterised as reflecting a medium Inherent Risk of large size sinkhole and doline formation with respect to ingress of water.
Class 5	Areas characterised as reflecting a high Inherent Risk of small sinkhole and doline formation (all sizes) with respect to ingress of water.
Class 6	Areas characterised as reflecting a high Inherent Risk of medium size sinkhole and doline formation (all sizes) with respect to ingress of water.
Class 7	Areas characterised as reflecting a high Inherent Risk of Large sinkhole and doline formation with respect to ingress of water.
Class 8	Areas characterised as reflecting a high Inherent Risk of a very large size sinkhole and doline formation with respect to ingress of water.

Table 2: Description of Inherent Risk Classes

Zones delineated on the site may be combinations of the above risk classes. In some instances, the Inherent Risk Classes are indicated with the primary zone description given first followed by a suffix in brackets. The primary Inherent Risk Class describes the

predominant characterisation of the zone and the suffix describes the characterisation of anticipated pockets or small sub-areas within the zone. As an example a designation of 8(4) indicates that the zone predominantly displays a high Inherent Risk of a very large size sinkhole and doline formation with respect to ingress of water with anticipated pockets of small areas of Class 4 i.e. displaying a medium Inherent Risk of large size sinkhole and doline formation with respect to ingress of water. The general description of risk in terms of the various risk classes is as described in Table 3 below.

GENERAL RISK CHARACTERISATION	**RISK CLASS**
LOW	CLASS 1
MEDIUM	CLASS 2,3,4
HIGH	CLASS 5,6,7,8

Table 3: General description of Risk in terms of Inherent Risk Classes

Table 4 below provides an indication of the terminology that describes the size of sinkhole.

Maximum diameter of surface manifestation (dimensions: meters)	**Terminology**
< 2,0 m	Small sinkhole
2,0 – 5,0 m	Medium-size sinkhole
5,0 – 15,0 m	Large sinkhole
> 15,0 m	Very Large sinkhole

Table 4: Suggested scale of sinkhole sizes

The development potential, versus the Inherent Risk Class of the site is as indicated in Table 5 below. The Inherent Risk Class will be described in relation to the primary cause (i.e. Groundwater drawndown or ingress water.)

Inherent Risk Class	Small sinkhole	Medium sinkhole	Large sinkhole	Very large sinkhole	Risk of doline formation	Recommended type of development in order to maintain acceptable Development Risk
	Sinkhole size					
	<2m	**2-5m**	**5-15m**	**>15m**		
Class 1	Low	Low	Low	Low	Low # NDS or DS	Residential, light industrial and commercial development provided that appropriate water precautionary measures are applied. Other factors affecting economic viability such as excavatability, problem soils, etc. must be evaluated
Class 2	Medium	Low	Low	Low	Medium #NDS	Residential development with remedial water precautionary measures. No site and services schemes. May consider for commercial or light industrial development
Class 3	Medium	Medium	Low	Low	Medium #NDS	Selected residential development with exceptionally stringent precautionary measure and design criteria. No site and services schemes. May consider for commercial or light (Dry) industrial development with appropriate precautionary measure
Class 4	Medium	Medium	Medium	Low	Medium #NDS	Selected residential development with exceptionally stringent precautionary measures and design criteria. No site and services schemes. May utilise for commercial or light industrial development with appropriate stringent precautionary measures.
Class 5	High	Low	Low	Low		These areas are usually not recommended for residential development but under certain circumstances selected residential development (including lower-density residential development, multi-storied complexes, etc.), may be considered, commercial and light industrial development. The risk of sinkhole and doline formation is adjudged to be such that precautionary measures, in addition to those pertaining to the prevention of concentrated ingress of water into the ground are required to permit the construction of housing units.
Class 6	High	High	Low	Low	High	These areas are usually not recommended for residential development but under certain circumstances high-rise structures or gentleman's estates (4 000 m² with 500m² proven suitable for placing a house) may be considered, commercial or light industrial development. Expensive foundations designs may be necessary. Sealing of surfaces, earth mattresses, water in sleeves or in ducts, etc.
Class 7	High	High	High	Low	High #NDS	No residential development. Special types of commercial or light industrial (Dry) development only (e.g. bus or trucking depots, coal yards, parking areas). All surfaces sealed. Suitable for parkland.
Class 8	High	High	High	High	Low-High *NDS or DS	No development, nature reserves or parkland.

* =Number of anticipated events per hectare over a period of 20years with poor design & management (see Table 1)

= Non-Dewatering Scenario and Dewatering Scenario.

Table 5: Characterisation: Inherent Risk of Doline and a specified-size sinkhole forming (Hazard).

2.5 Distribution of Dolomite in South Africa

Dolomite land occupies up to 25 percent of Gauteng and underlies some of the most densely populated areas such as Bekkersdal, Katorus, Centurion, Dobsonville, and Deapmeadow etc. The distribution of dolomitic land in South Africa is shown on the attached Map 0 (page 54). See Appendix 9 (page 282) for a list of provinces, magisterial districts, municipalities and towns located on dolomite in South Africa.

3. DEPARTMENTAL REQUIREMENTS FOR DEVELOPING SITES ON DOLOMITE

In order to prevent costly development of inappropriate sites it is proposed that the Department institute a strict land acquisition and development policy.

3.1 Appropriate Development Planning

The safe development of a site involves careful geotechnical assessment of the delineated area, appropriate planning and appropriate design of structures and services. These aspects are elaborated on below:

3.1.1 Proclamation Stage Circulation or purchase of new property

At the Proclamation Stage Circulation of a new township layout to the department or in the event of purchasing new properties in a dolomitic region the following information should be sought:

- Consult a dolomite risk specialist and the Dolomite Risk Management database of the department to establish whether the property is located on dolomite or close to the dolomite contact zone.

- The full proclamation stage geotechnical report for the township in which the property is located.

- The developer/land owner should be required to submit a standard form completed by the geotechnical consultant who undertook the township/property investigation. This form should request information concerning the broadly anticipated geotechnical conditions on the proposed sites. A pro forma of this document is enclosed in Appendix 1 on page 73.

- Consult the departmental Dolomite Risk Manager as well as a dolomite risk specialist for a review of the above report. Written recommendations on the feasibility to develop the site economically needs to be obtained prior to acceptance or purchase of the property.

- The above relevant information, reports and recommendations must be forwarded to the departmental Dolomite Risk Manager for capturing on the dolomite geographical information system (GIS). It should also be forwarded, with written confirmation of receipt, to the division responsible for further development of the site. This information should be referred to in any future procurement instruction (PI) issued.

- See also section 3.1.2.2 below and PRM 011 in Appendix 8.

3.1.2 Design of additions to existing infrastructure and planning of new infrastructure by departmental officials or consultants.

The following section contains a brief outline of the responsibilities and

prerequisite actions for the development of infrastructure on dolomite.

3.1.2.1 Briefing of Principal Agent by Project Managers

On being appointed to undertake the design and construction of new infrastructure or upgrading of existing infrastructure the principal agent/project manager (engineer, architect or quantity surveyor) must undertake the following actions ensuring that the general criteria outlined below are applied (To be read in conjunction with standard departmental investigation, briefing and reporting formats as per PRM 006, 007, 011, 012, 017, 018 and 11A as per Appendix 8 on page 237). Particular attention is to be given to Inception Check List (PRM007) to ensure that the consultant is properly briefed

- Consult a dolomite risk specialist and the Dolomite Risk Management database of the department to establish:
  * whether the infrastructure is located on dolomite or close to the dolomite contact zone,
  * in the case of existing infrastructure, establish the anticipated risk characterisation.

- A dolomite risk specialist should brief the principal agent with regard to:
  * Available information of the area in general
  * Site-specific information as well as
  * The need for and minimum requirements of detailed site investigations

- Once it is confirmed that the site is located on dolomite, the principal agent shall ensure that a geotechnical investigation is conducted and that the consultant team (all disciplines) are briefed in writing thereof. This site-specific detail geotechnical report shall be referred to a dolomite risk specialist for comments and each discipline shall be informed of the results. The dissemination of this information will ensure that services and structures are designed and routed according to the recommendations of the geotechnical report and ensure that departmental precautionary measures as outlined below are applied. (See Section 4 below).

The departmental dolomite risk manager will issue a Dolomite Status Certificate (PRM 11A) on completion of the geotechnical report (see Appendix 12 on page 319). The principal agent must ensure that all members of the consultant team receive a copy of the issued PRM 11A. The principal agent may not proceed with planning unless a PRM 11A is issued for the particular location of the proposed project.

PRIMARY RESPONSIBILITIES OF CONSULTANT TEAM

The development of infrastructure on dolomite requires that all professional be appropriately briefed regarding the current risk associated with the site. The Principal Agent must ensure that all consultants are briefed and supplied with a Dolomite Status Certificate PRM 011A (see Appendix 12 on page 319) as well as a copy of this document (PW344).

The Consultant needs to certify in writing that the designs and tender documentation comply with all elements as prescribed in this and

related documents.

3.1.2.2 Site selection and development criteria

The principal agent shall inform the department after completion of the geotechnical investigation if the following criteria are met and whether it is financially feasible to continue with the project:

- All new sites should have at least an anticipated or extrapolated yield of 50 % medium or low risk land. This medium or low risk portion of the total area must be sufficient in extent for the erection of all structures and related facilities of the proposed new development. If this yield is not feasible, due to the widespread occurrence of high risk land, then from the outset it should be noted that stringent remedial and water precautionary measures will be required, as well as rationally designed sub- and superstructures. The financial implications of such measures may place the cost of the project outside the norms and standards of the department. The appointed principal agent should immediately discuss this aspect with the project manager of the Department of Public Works. The principal agent needs to furnish the department with expected extraordinary cost estimates, based on geotechnical constraints of sites, before detail design work commences. Revision of the standard cost units (SCU) should be based on this additional information if applicable.

- It is essential that the Department follow a policy of not developing/purchasing sites until it is sure that such sites can be developed economically.

3.1.2.3 Geotechnical investigation

A site-specific geotechnical investigation, involving both a dolomite stability and soils assessment, should be carried out on a site to ensure appropriate planning and design of the development. Such an investigation must meet minimum requirements and the requested format (refer to Appendix 2 on page 76) including:

- Infrastructure located within 1000 m of the dolomite outcrop contact should be carefully evaluated to assess the need for a full dolomite stability assessment.

- The completion of geophysical work, usually gravity.

- The drilling of boreholes on anomalies.

- The logging and presentation of boreholes according to current practice.

- The excavation, profiling and sampling of representative test holes. Where necessary samples should be appropriately tested in a soils laboratory. This aspect of work should conform to current practice, i.e. Profiling according to Jennings, Brink and Williams 1973. Also follow Guidelines for Urban Engineering Geological Investigations and the SAICE Code of Practice (1995).

- The inherent dolomite stability of the site must be described in

terms of the 8 classes in accordance with current practice. These inherent risk classes are described in Table 6 of **Proposed method for dolomite land hazard and risk assessment in South Africa**, SAICE Journal Volume 43(2) 2001, paper 462 pages 27-36, Buttrick et.al. (Current industry standard document).

- The report drawings (preferably on a scale of 1:500) should clearly indicate the following:

  Site information:

  * site locality map (scale: not smaller than 1:50 000),
  * site boundary (superimposed on current cadastral grid),
  * relevant area features such as drainage, neighbouring developments, roads, etc.,
  * site contours – if available,
  * existing services – water, sewer, storm water, electricity etc
  * existing water boreholes.

  Geotechnical investigation information of current and all past investigations:

  * sinkholes, dolines, paleo features, areas of fill, areas of borrow, rock outcrop etc.,
  * existing and new boreholes,
  * existing and new soil testing trial holes,
  * residual gravity contours in mGals (indicate also survey station grid).

  Dolomite risk zonation:

  * demarcate low, medium and high-risk areas with specific development notes of each,
  * other geotechnical problematic areas with specific descriptions thereof.

  Proposed site development:

  * indicate proposed best site for erection of structures,
  * areas for limited development,
  * areas for no development.

3.1.2.4 Conclusion and recommendation of the geotechnical report

The geotechnical investigator must indicate:

* in which zones the erection of structures are permissible
* where sports facilities/parking lots/parade grounds/radio masts, etc. (structures and wet services) may be developed
* provide appropriate (site specific) comments of subsurface remedial work
* anticipated foundation problems
* water precautionary measures for each stability zone.
* Comment in general on earthworks to be conducted (borrow/fill/surficial soil disturbances, etc.)

It is important to note that the dolomite stability investigation deals with the general geology at depth and does not necessarily include the typical surficial (shallow) soils investigation that is required for specific foundation designs. The surficial soils investigation and interpretation is the responsibility of the structural engineer.

3.1.2.5 General principals to be incorporated in the conclusions of the geotechnical report and the principal agent's site development plan.

- Wherever feasible avoid high-risk areas. Locate buildings on low and medium risk areas and place sports facilities/parking lots/parade grounds/radio masts, etc. on medium to high-risk land with the exception of swimming pools. Grassed facilities to be placed on the most favourable portions of medium to high risk land whilst dry facilities such as surfaced parking etc., can be placed on most problematic land, providing no structures are erected and depending on the specific geological conditions. Swimming pools may only be placed on low risk or medium risk land with special precautions.

- Additions to existing infrastructure or buildings, particularly in high-risk areas, require the same level of investigation procedures as for new infrastructure. When linking structures, potential differential settlement between old and new components must not be permitted as it may induce failure of or leaks in any linking wet services. (NB - see also section 4.1.12 for blasting requirements)

- Where an entire site is located in a high-risk area and the development of a high-risk site is unavoidable, stringent water precautionary and remedial measures will be applied.

- It is essential that the Preliminary Site Investigation of the principal agent and his proposed development site plan (sketch plan: see PRM 017/1 for check list in Appendix 8 on page 237) be compared with the Geotechnical Report and the issued PRM 11A. Matters such as topographical constraints, position of service connections and building restrictions should be compared with the stability zones on the site. The geotechnical dolomite stability risk zones must be indicated on the site plan and the principal agent shall call for written comments from all members of the consultant team to indicate the influence thereof on the design, construction and cost of services and structures. The combination of these various factors will determine the suitability of a site for development.

  See Appendix 3 on page 79 for compulsory information to be indicated on the Principal Agent's development site plan. The geotechnical report, site development plan and services criteria to be implemented as well as budgeting thereof shall be referred to a dolomite specialist for comment.

3.1.2.6 When designing infrastructure on dolomitic land in general

Avoid:
- gardens within 5m of buildings
- water features such as garden or fish ponds within 15 metres of buildings. Water features with automatic replenishment

systems should not be permitted
- courtyards that necessitate sub-floor level drainage systems
- construction of buildings or services over natural watercourses
- construction of buildings over wet services
- creating unlined rerouting of natural drainage paths
- concentration or disposal of storm water onto high-risk land
- avoid wet services running parallel and close to buildings
- high concentrations of subsurface services near buildings
- using rigid, short length piping (promote long, unjointed, flexible piping)
- subsurface water storage tanks
- disturbance of surficial soil whenever feasible (ensure disturbed areas are properly compacted and reinstated)
- septic tanks, soak-aways or pit latrines
- boreholes for water abstraction
- site features with poor drainage characteristics

Incorporate:
- Appropriate water precautionary measures as outlined below (see Section 4 below)

4. APPROPRIATE WATER PRECAUTIONARY MEASURES FOR DEVELOPMENT ON DOLOMITIC LAND

Water precautionary measures are outlined below in the context of the minimum standards required with respect to each dolomite stability zone (see Table 1 on page 4). In general discourage placing of buildings on and traversing of high-risk areas with wet services. The cost implication of routing wet services around high-risk areas should be motivated in addition to normal cost norms as part of the site development cost:

4.1 Low Risk Areas

The risk of sinkhole and doline formation is adjudged to be such that only general water precautionary measures, which are intended to prevent the concentrated ingress of water into the ground, are required.

4.1.1 General design of services

a. Underground wet services shall be designed and constructed so as to minimise maintenance requirements and to avoid potential leakage points. In addition liquids shall be contained in watertight structures to avoid possible disturbance of the underground environment.

b. The relevant specifications of SABS 1200 DB, L, LB, LC, LD and LE shall be observed in the installation of all underground services.

c. The backfilling to service trenches and other excavations shall, except in rock, be less permeable than the surrounding material. General minimum compaction standard to be 93 % Mod AASHTO, provided permeability requirements are met. The use of non-cohesive single size graded sand or crusher sand for bedding, surround blankets and backfill shall not be allowed.

d. Water, sewer and non-concrete storm water pipes shall have a minimum cover of 600 mm outside vehicle traffic areas and a minimum cover of 1000mm in vehicle traffic areas. Where required, protect pipes with appropriately designed concrete slabs above the pipe work.

e. Water, sewer and storm water piping should, wherever possible, not be placed parallel to buildings unless it is at least 5 meters away from the structure. Single direct connections to buildings are preferred. This precaution also applies to electricity and communication cables.

f. Where feasible, provisions for future connections to all services should be made in order to minimize cutting into pipes to provide such connections at a later stage.

g. Provision should be made in all water bearing pipelines to accommodate potential differential movements without causing pipelines or joints to leak.

4.1.2 General construction activities

a. All trenches and open works are to be inspected by a competent person to assess if adverse ground conditions are present. This procedure allows for the adjustment of construction methods, i.e. special bedding requirements, additional excavation and compaction, or pipe protection measurements.

b. Construction excavations should be opened and closed as rapidly as possible. Avoid leaving trenches open over weekends or holidays.

c. Berms should be constructed on either side of the trenches to prevent the inflow of water during rainstorms.

d. Provisions shall be made in Tender documentation for the supply of pumping equipment to keep excavations dry.

e. Construction site camp services shall also be subject to the precautionary measures as above and below.

4.1.3 Storm water

a. The site and surrounding area shall be shaped (if required) to permit the rapid drainage of surface water and to prevent ponding on the site. Careful attention is to be given to the drainage of areas with gradients less than 1:100.

b. Drainage ports should be incorporated in boundary walls, particularly at the lowest point of the site, to permit the passage of surface runoff. Drainage ports shall be provided with a concrete apron slab, 1,0 m wide and 100 mm thick, on both the inlet and outlet sides of the wall or fence. The slab needs to be extended 400 mm beyond the sides of the port to prevent vegetation growth. The minimum slope on the slab is to be 1:15. Security outlet grids need to be designed not to clog.

c. Drainage onto the property shall not be allowed to accumulate against boundary walls. Drainage towards the site shall preferably be diverted away from the site by means of earth berms. Unlined cut-off trenches should be avoided if possible.

d. Natural ponds and watercourses located within 10 m of any structure shall be rendered impervious within and to a distance of 30 m from the building. (Design criteria: 1 in 5 year flood capacity minimum). The complete diversion of natural watercourses to a minimum distance of 30 m away from buildings is advised.

e. Storm water drainage around buildings and up to 10 meters away shall preferably be kept on the surface or in open canals at slopes of not less than 1:50 for surfaced areas and canals, and 1:20 minimum for unsurfaced areas. All surfaces shall slope away from buildings. Drainage in passages or between buildings needs to slope away from structures and drain along the centre of the open space. No drainage toward a structure is to be allowed. The placing of small diameter (300 mm) concrete storm water canals next to and parallel to buildings is not recommended. Preferably use 1,0 m or wider v-shaped concrete drains.

f. To facilitate drainage of grassed areas such as sports fields it should have a minimum slope of 1:80.

g. Storm water drainage conduits and open canals shall be constructed at gradients that will not permit the deposition of soil from the catchment area (Design criteria: 1 in 5 year flood capacity minimum, depending on the local conditions. Additional specific infrastructure design requirements are outlined in Section 6)

h. The storm water drainage system shall incorporate measures to ensure water tightness of conduits, canals and other compartments. All pipes should be tested for leakage using standard SABS/SANS air or water tests. All pipes and structures shall be constructed to show zero percent leakage, when tested as prescribed.

i Concrete non-pressure pipes should be of the spigot and socket type with rubber ring seals. Joints in box culverts and manholes etc. should be sealed. Ensure sufficient compaction of foundation excavations to preclude any consolidation settlement. Allow for 200 mm thick 1:12 soilcrete slab extending 200 mm beyond the structure foundation if unusually soft soil conditions are encountered. Inlet grids to subsurface systems shall preferably be locked and not allow the passing of any item larger than 40 mm in diameter. Minimum internal pipe size to be 400 mm.

j. Open drains are preferably to be shallow, 1000 mm (min) wide, cast in-situ, V-shaped drains with sealed key type construction and expansion joints. Steel reinforcement (if applicable) is to be continuous over joints to preclude horizontal displacement.

k. Subsurface materials should be as follow:

Pipe: Concrete with spigot and socket rubber ring joint **only if approved by Departmental Engineer**.

SABS 677/SANS 667 PVC with spigot and socket rubber ring joint **only if approved by Departmental Engineer.**

HDPE: Structured wall pipes with ring stiffness of 8,0 kN/m^2 or solid wall pipes of class PN 10 minimum. Pipe material to conform to type PE 100 in terms of SABS ISO 4427/SANS 4427. Supply pipe in 12 m (minimum) lengths. To ensure water tightness, use hot-gas welding (SABS 0268/SANS 10268 – Part 3) or hot-gas extrusion welding (SABS 0268/SANS 10268 – Part 4) internally and externally, or butt-welded joints (SABS 0268/SANS 10268– Part

1) for small diameter pipes, or electro-fusion welding (SABS 0268/SANS 10268 – Part 2) where gas or butt-welding is impossible. All internal burrs (welding bead) shall be specified to be removed from pipes with an internal diameter up to 400 mm. Where it is impossible, Tenderers shall state so in their Tenders and shall in this instance state the maximum internal burr height for each diameter of pipe not deburred. Purpose made industrial equipment, as proposed and approved by the various pipe manufacturers are to be used for this purpose. De-burring is to be executed from an upstream direction. Each removed bead must be numbered with the corresponding joint number and kept for the Engineer's inspection. The Tender shall allow for camera inspection of de-burred joints. Joints of solid or structured wall pipes with a diameter of 400 mm or larger could be improved by means of 300 mm wide HDPE collar (to manufacturers specification) fitted over the joint and welded to both pipes. Alternatively, this collar can be factory fitted. The use of long-sleeve spigot and socket joints with rubber rings are to be **approved by Departmental Engineer**. Use a manhole when linking different pipe material types.

Manholes: The use of pre-manufactured HDPE manholes is advised near buildings and structures or areas not trafficked by vehicles. Alternatively use concrete manholes **if approved by Departmental Engineer**. Such concrete manholes must be designed as water retaining structures.

HDPE manholes: All material for HDPE manholes to conform to HDPE: Type PE 100 SABS ISO 4427/SANS 4427 specifications and all welding to SABS 0268/SANS 10268, SABS 0269/SANS 10269, SABS 0270/SANS10270, SABS 1655/SANS1655 and SABS 1671/SANS 1671. Manhole shafts to be structured or solid wall HDPE pipes with:

- 4,0 kN/m^2 ring stiffness for depths not exceeding 1,5 m and,
- 8,0 kN/m^2 ring stiffness for depths exceeding 1,5 m or,

alternatively manufactured to same standard. Engineer to ensure design of manholes are appropriate for soil conditions. HDPE pipes to be welded to manhole. Manhole to be similar to HDPE sewer manholes (detail TYPE NO DT 04/D) and welding details as per included detail (TYPE NO DT 20/ST).

Concrete manholes and inlet structures: Design as water retaining structures. Inlet pipes to be provided with puddle flange (detail TYPE NO DT 12/W) or key joint (detail TYPE NO DT 12/W) to ensure watertight fixing into walls or construct structure with flexible watertight inlets.

4.1.4 Sewer

a. Sanitation systems shall not incorporate soakaways. Use conservancy tanks with low flush volumes where sewer connections are not available. If no alternative is available, pit latrines may be utilized in low risk areas provided that the implementation is approved by means of a geotechnical investigation. The pit latrines must be correctly constructed to preclude storm water gaining access. Example: Construct a 0.5 m high earth berm around the up slope side of the pit latrine or place floor slab 500 mm proud of natural ground level with the door facing down slope. The pit latrine should be placed as far away as possible from any permanent structures. Annual relocation of pit latrines is advised. Obviously other matters such as pollution of water resources should be considered e.g. where infrastructure relies on a borehole for its water supply. The utilization of PVC or HDPE holding tanks with chemical digestion for pit latrines should be investigated. Design and material selection for such tanks to be in accordance with relevant material specifications and **approved by the Departmental Engineer**.

b. Subsurface pipe materials should be as follow:

- HDPE: **Within 15 m of building**.

Pipe: HDPE: Type PE 100, PN 10 pipes to SABS ISO 4427/SANS 4427. Supply pipe in 12 m (minimum) lengths

Joints: To ensure water tightness, use butt-welded joints (SABS 0268/SANS 10268 – Part 1) in general or electro-fusion welding (SABS 0268 / SANS 10268 – Part 2) where butt-welding is impossible. All internal burrs (welding beads) shall be specified to be removed. Where it is impossible, Tenderers shall state so in their Tenders, and shall in this instance state the maximum internal burr height for each diameter of pipe not de-burred. Purpose made industrial equipment, as proposed and approved by the various pipe manufacturers are to be used for this purpose. De-burring is to be executed from an upstream direction. Each removed bead must be numbered with the corresponding joint number and kept for the Engineer's inspection. The Tender shall allow for camera inspection of de-burred joints. Joints of solid or structured wall pipes with a diameter of 400 mm or larger could be improved by means of 300 mm wide HDPE collar (to manufacturers specification) fitted over the joint and welded to both pipes. Alternatively can this collar be factory fitted. The use of long-sleeve spigot and socket joints with rubber rings are to be **approved by Departmental Engineer**. Use a manhole when linking different pipe material types.

Manholes: The use of pre-manufactured HDPE manholes is advised. Alternatively use concrete manholes, designed as water retaining structures, **if approved by departmental Engineer**.

HDPE manholes: All material for HDPE manholes to conform to HDPE: Type PE 100 SABS ISO 4427/SANS 4427 specifications and all welding to

SABS 0268/ SANS10268, SABS 0269/ SANS 10269, SABS 0270/ SANS 10270, SABS 1655/SANS 1655 and SABS 1671/SANS 1671. Manhole shafts to be structured or solid wall HDPE pipes with:

- 4,0 kN/m^2 ring stiffness for depths not exceeding 1,5 m and,
- 8,0 kN/m^2 ring stiffness for depths exceeding 1,5 m or,

alternatively manufactured to same standard. Engineer to ensure design of manholes are appropriate for soil conditions. See detail TYPE NO DT 04/D and TYPE DT 09/D. HDPE pipes to be welded to manholes.

Concrete manholes: Design as water retaining structures **if Departmental Engineer approves the use thereof**. Inlet pipes to be provided with puddle flange or key joint (detail TYPE NO DT 12/W) to ensure watertight fixing into walls or construct structure with flexible watertight inlets.

- PVC **Only to be used beyond 15 m from structures**.
  Pipe: SABS 791/SANS 791 Heavy duty - Class 34 (solid wall).
  Use of PVC to be approved by Departmental Engineer.

c. All connections to manholes shall be flexible and watertight.

d. All sewerage pipes and fittings must be watertight. All laid drainage and sanitary sewer pipes should be tested for leakage using the standard SABS water test on installation. Welded HDPE pipe systems to be pressure tested to relevant pipe pressure class and manufacturer's specification. The welding on of purpose made end-cap sections with feed and bleed valves as well as a pressure gauge can be used for this purpose to test welded pipe sections between manholes, prior to welding on of manholes.

e. All sewers and structures to be tested to zero percent leakage for water tests.

f. Avoid using rodding and cleaning eyes and rather use small HDPE manholes (multi directional collecting pots) that are pre-manufactured small size (300, 500 and 700 mm diameter) manholes with factory fitted HDPE benching. Piping from the manhole to surface level shall consist of HDPE pipes and long radius bends with electro fusion/butt welded connections. All HDPE material to be Type PE 100 as per SABS ISO 4427/SANS 4427 and all welding to conform to SABS 0268/SANS 10268, SABS 0269/SANS 10269, SABS 1269/SANS 1269, SABS 0270/SANS 10270, SABS 1655/SANS 1655 and SABS 1671/SANS 1671. Manhole shafts to be structured or solid wall HDPE pipes with 8,0 kN/m^2 ring stiffness or alternatively manufactured to same standard.

g. The planting of trees or general gardening within 5 meters of sewer lines should be avoided.

4.1.5 Swimming pools

a. Backwash and other water from swimming pools, shall be discharged

via HDPE (HDPE: Type PE 100, PN 10 as per SABS ISO 4427/SANS 4427) piping into either the storm water or drainage systems as required by the local authority. Discharge points shall not to be closer than 20 meter from the pool or any other structure.

b. The area surrounding the swimming pool shall be totally impervious (concrete paving) for a distance of at least 5 meters with provision of a drainage canal to collect splashed water.

c. The pool shall not have an automatic water replenishment system.

d. A Dolomite Risk Specialist should advise on the placing of the pool (not closer than 40 meters from buildings).

4.1.6 Electricity and Communication

a. The sleeve and draw box systems for electrical and communication cables shall also be water tight, flexible and constructed to avoid water entering the system. HDPE piping and small diameter manholes as described for sewers above are ideally suited for this purpose. Design and material selection to be similar as for sewer reticulation described above.

b. Trenching, backfilling and compaction of trenches to be similar as for wet services.

c. The use of non-cohesive, single size, graded sand or crusher sand for bedding, surround blankets and backfilling of trenches is not permitted. Construction details are to be similar to water and sewer pipes.

4.1.7 Water

a. The piping used in bulk supply, ring mains and secondary reticulation should be flexible. Joints should be minimal in number and of the flexible, self-anchoring type, i.e. not reliant on thrust blocks or friction for their anchorage.

b. Subsurface pipe materials should be one or more of the following:

- Pipes of 75 mm and larger diameter:

* **<u>Preferred pipe type: HDPE</u>**

<u>Pipe</u>: HDPE: Type PE 100, PN 12,5 (or higher pressure class if required) to SABS ISO 4427/SANS 4427.
<u>Supply lengths</u>: Supply pipe in 12 m (minimum) lengths.
<u>Joints</u>: Butt-welded joints (SABS 0268/SANS 10268 – Part 1) in general or electro-fusion welding (SABS 0268/SANS 10268 – Part 2) must be **approved by Departmental Engineer,** where butt-welding is impossible.

<u>Fittings</u>: Manufactured from HDPE: Type PE 100, PN 12,5 (or higher, as may be required) to SABS ISO 4427/SANS 4427.
<u>Welding</u>: All welding to relevant SABS 0268/SANS 10268, SABS 0269/SANS 10269, SABS 0270/SANS 10270, SABS 1655/SANS 1655 and SABS 1671/SANS 1671 codes. All internal burrs (welding beads) shall be

removed. Where it is impossible, Tenderers shall state so in their Tenders and shall in this instance state the maximum internal burr height for each diameter of pipe not deburred. Purpose made industrial equipment, as proposed and approved by the various pipe manufacturers are to be used for this purpose. De-burring is to be executed from an upstream direction. Each removed bead must be numbered with the corresponding joint number and kept for the Engineer's inspection. The Tender shall allow for camera inspection of de-burred joints.

* Alternative: High impact PVC pipes (SABS 966/SANS 966, class 12) with victaulic joints **only if approved by Departmental Engineer.**

* Exceptional circumstances and in above ground installations: Steel pipes with suitable internal and external corrosion protection and flexible, self-anchoring connections. **Reasons for use to be approved by departmental Engineer.**

- Pipes having a diameter of less than 75mm:

  * **Preferred pipe type: HDPE**

    Pipe: HDPE: Type PE 100, PN 16 (or higher pressure class if required) to SABS ISO 4427/SANS 4427.
    Supply lengths: Supply pipe in 100 m (minimum) lengths.
    Joints: Butt-welded joints (SABS 0268/SANS 10268 - Part 1) in general or electro fusion welding (SABS 0268/SANS 10268 – Part 2) where butt-welding is impossible. No compression fittings are allowed except if in watertight manholes. The use of underground joints are allowed only with approval of the departmental Engineer. The use of unjointed pipes between inspection chambers is mandatory.
    Welding: All welding to relevant SABS 0268/SANS 10268, SABS 0269/SANS 10269, SABS 0270/SANS 10270, SABS 1655/SANS 1655 and SABS 1671/SANS1671 codes.

c. Piping from main reticulation to the building shall be **unjointed** HDPE: Type- PE 100, PN 16 (or higher class if required) pipes to SABS ISO 4427/SANS 4427.

d. Underground valves are to be placed in watertight concrete or HDPE manholes. HDPE manholes are to be manufactured to same standard as sewer manholes described above. Concrete manholes for valves are to be designed as water retaining structures.

e. **No** high-pressure compression connections are to be allowed below ground level. All such connections are to be placed in watertight manholes.

f. Shut-off valves and water meters shall be supplied at main supply with permanently fixed pressure gauge on the building side of the main shut-off valve (for regular systems testing).

g. All site services to be tested to zero per cent leakage.

4.1.8 Roads

a. Roadways, which have a gradient of less than 1:80, shall be surfaced/sealed.

b. The velocity of the 1 in 20 year storm water, flowing along un-surfaced roadways shall not exceed 1,5 m/s.

c. Ensure that surfaced roadways and parking areas are in fact placed at a level below surrounding areas so as to facilitate drainage.

4.1.9 Plumbing

a. Unjointed flexible HDPE (HDPE: Type PE 100, PN 16, or higher pressure class if required, to SABS ISO 4427/SANS 4427.) water piping from the main supply to 100 mm above natural ground level for entry into the buildings. Place 1,0 x 1,0 m concrete slab at entry point if area is not paved.

b. Pipes through walls, at entry points to buildings, shall be sleeved to permit relative movement up to 25 mm. Seal annulus with water tight, compressible and rodent resistant material.

c. All connections between flexible and rigid pipes shall be provided with flexible, self-anchoring joints. Such connections must be in watertight structures or above ground level.

d. No water pipes shall be placed under floor slabs. If unavoidable, provide service ducts, which are watertight and can be inspected, above or below floor slab.

e. The use of surface mounted GMS water pipes on external walls and from the roof downward is preferred for all building water reticulation. The chasing of water piping into walls should be kept to a minimum. The placing, protection and support of exposed pipes are to be designed to ensure serviceability during fires.

f. The selection of piping material shall take cognisance of corrosion (both external and internal). Preferably use welded HDPE or alternatively PVC with victaulic joints if approved by departmental Engineer.

4.1.10 Drainage

a. The collection of sewer and waste pipes from multiple adjoining toilets or washbasins should be externally surface mounted. These pipes should feed into a single down pipe draining into the subsurface systems.

b. Areas of high concentrations of sewer outlets on buildings should be surfaced with concrete or paving bricks to avoid later covering of services with soil or vegetation growth and to ensure that blockages are detected early.

c. All sewer pipes and fittings shall be provided with flexible, watertight joints.

d. No sewer or waste pipes shall be placed under floor slabs. If unavoidable provide above or below floor slab level service ducts which are watertight and can be inspected.

e. Pipes through walls shall be sleeved to permit relative movement up to 25 mm. Seal annulus with water tight, compressible and rodent resistant material

f. WC pans shall be provided with a flexible connection at the junction with the outlet pipe.

4.1.11 Storm water/rainwater drainage

a. Down pipes, if provided, shall discharge into concrete lined drainage channels, which discharge the water at least 5m away from buildings. Discharge area shall have a slope of 1:20 minimum to a point 15 meters away from the building.

b. V-shaped concrete canals should be used to route all storm water towards and from buildings to an area where natural surface drainage will allow free drainage away from structures. These canals should be placed at least 5 m away from structures.

c. Construct a 2m wide impervious apron slab around the building where guttering is not provided.

d. The ground immediately against buildings shall be shaped to fall in excess of 75 mm over the first 1,5 m beyond the perimeter of the buildings, from where it will drain freely away from the structures. Concrete apron slabs or brick paving shall have a minimum of 1:20 fall away from buildings.

e. Drainage canals traversing walkways shall not be piped under walkways. Use impervious canals and grids.

f. Brick and precast concrete courtyard walls etc. must be so designed as to provide drainage ports at ground level to permit the passage of water.

4.1.12 Blasting

a. Experience on dolomite indicates that blasting may lead to severe disturbance of the meta-stable dolomite environment, giving rise to sinkhole formation. Consequently, if blasting is necessary it is essential that appropriately experienced blasters be approached to determine the particular method and specification for blasting, regarded as appropriate in the context of the geological conditions.

b. PPV to be recorded for each blasting sequence.

4.1.13 Boreholes for ground water abstraction

a. Careful consideration, as a control on dewatering, to be given before permission is granted to sink boreholes for water abstraction. If the water table is above bedrock, a blanket ban on exploitation of the ground water should be imposed. Approval should be subject to an evaluation of the implications by an engineering geologist specialising in dolomitic related matters.

b. Where data is available concerning existing boreholes, for water abstraction within 50 meters of the site, comment should be made concerning this data in the geotechnical report and on the site plan.

4.1.14 Foundations

a. Foundation excavations need to be inspected to ascertain if surficial soil problems such as collapsible soil materials and geotechnical conditions such as shallow rock outcrops, sharp soil strata changes, paleo structures etc. are present. A dolomite specialist should conduct this inspection.

b. Ensure backfilling around structures are properly backfilled with suitable material that will have a density after compaction of not less than the in–situ soil (no building rubble or course aggregate exceeding 63 mm in diameter shall be allowed). Compact to a minimum of 93 % Mod AASHTO density.

c. Termite poisoning shall be introduced around all structures

d. Sub structure design shall be appropriate in terms of the surficial soil condition and the dolomite stability conditions.

Water is a triggering mechanism, in the majority of cases, of distress in dolomitic/limestone areas. It is therefore imperative that the concentrated ingress of water into the ground be avoided at all times, including the construction period.

4.2 Medium Risk Areas

The risk of sinkhole and doline formation is adjudged to be such that stringent water precautionary measures, which are intended to prevent the concentrated ingress of water into the ground, are required to permit the construction of the infrastructure.

4.2.1 The precautionary measures as **detailed above for Low Risk areas shall apply as well as** amendments thereof and additional requirements listed below.

a. Discourage the construction of any ponds, water features and swimming pools. (Departmental approval required)

b. All water retaining structures are to have foundations on 250 mm thick soilcrete raft (1:8 mix) extended 300 mm beyond the structure. Introduce backwater stops and internal water stops to all expansion and construction joints (not only those below water level)

c. Sanitation systems shall not incorporate soakaways or pit latrines. Use watertight conservancy tanks where sewer connections are not available. .

d. Backwash and other water from swimming pools, shall only be discharged into either an impervious storm water or drainage systems as required by the local authority (HDPE piping or lined discharge systems to be provided).

e. Earth backfilling compaction standards are to be observed and SABS 1200 requirements must be fully met.

f. Earthworks on pipes: SABS 1200 LB: Bedding and selected fill - Clause 3.1 is amended to allow the maximum aggregate size, not to exceed 6 mm. Material should not be free draining as described in this particular clause. The compacted bedding and fill material shall be less permeable than the in-situ soil.

g. Special attention is to be given to drainage of all areas with gradients less than 1:80. Absolutely no ponding of water on site shall be allowed.

h. No piped storm water systems are allowed within 15 meters of buildings or under any structure. Open culverts with grating covers should be used to traverse any trafficked area in or around buildings.

i. Storm water canals should have a 250 micron HDPE lining and continuous light steel mesh reinforcement over sealed key construction and expansion joints that preclude any vertical movement.

j. The placing of small diameter storm water gulleys parallel to buildings is not allowed. Use 1,2m wide V-shaped concrete drains where drainage parallel and close to buildings is required. Joints between structures and canals to be sealed as in the case of canal expansion joints.

k. All roadways, which act as storm water collectors, shall be surfaced.

l. All brick paving shall incorporate a 250 micron HDPE lining.

m. All courtyards or narrow (< 4 m) spaces between structures are to be paved with brick paving or concrete apron slabs and 2,5 metre wide paving shall be introduced around all structures with no gutters.

n. All storm water from down pipes shall discharge into concrete lined channels which in turn will discharge the water at least 10 metres away from structures onto areas that permit free surface drainage away from structures.

o. Where necessary, use earth berms to enhance site drainage.

p. All concentrated storm water entering the site shall be diverted away from any structure or developed area by means of concrete lined channels.

q. The use of welded HDPE piping systems for water, sewer and storm water is required as the material is more tolerant of movement. The above ground mounting of a GMS water reticulation on steel pedestals is preferred. **Alternative materials only to be used if approved by Departmental Engineer**. All material for HDPE pipes, structures and fittings must be in accordance with SABS ISO 4427/SANS 4427 for type PE 100 and all welding and manufacturing to be in accordance with SABS 0268/ SANS 10268, SABS 0269/SANS 10269, SABS 0270/SANS 10270, SABS 1655/SANS 1655 and SABS 1671/SANS 1671 codes. All joints to be welded, unless joint is installed for future dismantling. Such joints are to be installed in water retaining structures that can be inspected.

r. No groundwater abstraction will be allowed.

s. The responsible regional manager should have a system whereby

follow up tests for leakages of wet services are carried out and the results monitored.

t. The need for reinforced foundation design, building articulation and special foundation earth works (i.e. extended excavation and compacted backfilling, soil rafts etc.) should be investigated and reported on in the context of the site geotechnical report.

4.3 High Risk Areas

The risk of sinkhole and doline formation is adjudged to be such that precautionary measures, in addition to those pertaining to the prevention of concentrated ingress of water into the ground are required to permit the construction of the infrastructure.

4.3.1 The water precautionary **measures listed above for Low and Medium Risk areas as well as additional measures and amendments outlined below are applicable in High Risk areas.** These measures are also applicable where development on high risk areas is unavoidable e.g. where the additions are made to existing infrastructure in a high risk area or where an entire site is regarded as a high risk area.

a. Use only HDPE piping for water (Class PN 12,5 and higher), sewer (Class PN 10 minimum) and storm water (8 kN/m^2 ring stiffness) in high-risk areas or where services traverse high-risk areas. All material for HDPE pipes, structures and fittings must be in accordance with SABS ISO 4427/SANS 4427 for type PE 100 and all welding and manufacturing to be in accordance with SABS 0268/SANS 10268, SABS 0269/SANS 10269, SABS 0270/SANS 10270, SABS 1655/SANS 1655 and SABS 1671/SANS 1671 codes.

b. In extremely problematic areas water reticulation may be placed above ground or all services may be placed in ducts or sleeves where within fifteen metres of a building. Sleeves to be provided with inspection chambers at both ends and must comply with the requirements of a sewer system for high risk areas. All sleeve systems must be constructed to **designed slopes** that permit drainage to predetermined inspection manholes.

c. Ablution facilities should not be included in the principal buildings or infrastructure. These facilities should be isolated in such a manner as to avoid damage to other parts of the development in the event of service failure and sinkhole/doline formation.

d. Use aprons of large (5,0 m min width) impervious paved areas around structures to enhance drainage. If rapid drainage (slopes 1:15 and steeper) away from structures is possible apron slabs may be reduced to 3,0 m width.

e. Blanketing of geotechnical problematic areas with impervious material (clayey soil and/or HDPE sheeting), concrete or paving bricks need to be introduced if such areas could influence the structural integrity of buildings.

f. Contouring of site to achieve a fall of least 1:40 in general and to 1:15 away from structures within a distance of 8m of a structure are required.

4.3.2 Proposed remedial and **General Precautionary Measures** for consideration on **High Risk** sites.

a. In areas of very poor stability with historical evidence of ground movement, especially in ground water compartments undergoing dewatering, monitor points shall be installed on buildings and at strategic locations on the property, e.g. on towers, plinths, manholes, etc. Accurate levels of these points should be gathered and kept as baseline data (e.g. three cycles of data). At any stage when concerns arise with respect to the stability of the site or portions thereof new levels can be taken for comparative purposes permitting the identification of problem areas.

b. In areas of shallow dolomite bedrock the highly susceptible nature of the subsurface profile to erosion necessitates the consideration of using a mattress of enhanced earth. This mattress has the dual purpose of improving founding conditions (negating differential movement) and reducing the permeability of the subsurface profile. This method involves the removal and replacement of incompetent, problematic soil beneath and for 3m beyond the periphery of buildings. The specification for the earth mattress/soil raft will be dependent on bedrock depth and the nature of the local soil materials.

c. In high-risk areas use should preferably be made of the following structure types:

- Light raft (e.g. waffle raft) foundations.
- Prefabricated or lightweight designed superstructure (PWD approved prefabricated building system).

d. Fencing of high-risk areas where sinkholes or dolines have already occurred. Personnel should not be allowed to traverse such areas.

e. No gardens are to be created within a distance of 5 m of any structure or service.

f. Water bearing services should be inspected at least twice per year preferably before and towards the end of the rainy season.

5. APPROPRIATE ENGINEERING DESIGN DETAILS AND CONDITIONS OF CONTRACT FOR WORK ON DOLOMITIC LAND

Typical, minimum standard, details for engineering designs are included in Appendix 5 and relevant Particular Specifications are given in Appendix 6. These details and specifications are to be extended/improved to suit the site-specific conditions. All drawings and specifications used, shall be the responsibility of the appointed project Engineer. Typical information to be gathered/observed during site investigations of engineering services on dolomitic land is outlined in Appendix 4

The latest revision of the Contract Data (as issued by the Department of Public Works) forming the Annexure to the General Conditions of Contract for use in connection with Works of Civil Engineering Construction – Latest edition (available from SAICE) and in particular clauses referring to work in the dolomitic environment should be discussed with the Departmental Engineer. Particular attention is to be given to **Special Risk Insurance**, particularly if the work involves excavation, demolition, blasting and/or sinkhole related repairs.

The **design Engineer** must specify, in detail, all precautionary and safety measures to be

taken in the event of work related to sinkhole and doline repairs.

6. DESIGN AND TENDER DOCUMENT STANDARDS FOR UPGRADING OF INFRASTRUCTURE ON DOLOMITIC LAND

6.1 General

The designs shall be based on the documents listed in Table 2 hereunder.

The Design Criteria for Dolomitic areas: Appropriate Development of Infrastructure on Dolomite: Manual for Consultants (**THIS DOCUMENT**)	PW344 September 2010
Civil Engineering Manual	PW 347 May 2004
Standard specification for domestic and fire water storage and fire water supply for public buildings	PW345 dated May 2004
Guidelines for the design of small sewerage treatment works for isolated DPW developments	To be issued in future
Guidelines for design of civil services for new generation prisons	PW342 March 2004
Human Settlement Planning and Design (Red Book)	CSIR April 2000
Water Supply and Drainage for Buildings (Part 1 and Part 2)	SANS 10252-1, SANS 10252-2
Code of Practice for Community Protection against Fire	SANS 10090
The Application of the National Building Regulations	SANS 10400
Specifications of Materials and Methods to be used	PW 371 1993
All documents referenced in Section F, paragraph F.2 of Civil Engineering Manual	PW 347 May 2004

Table 6: List of documents for design of engineering services in dolomitic areas.

This document must also be read in conjunction with the following list of standardized departmental documents. All stipulations of the documents listed below must be applied as well as any stipulation contained in this (PW344) document. Any stipulation of PW 344 supersedes the stipulation of the documents listed below.

6.1.1 Consultant's documents published on the NDPW web site

	3 Conditions	
	Conditions of Contract PW677	Apr 1998
	Addendum to Conditions of Contract (PW 677)	Dec 2004
4	**Architects**	
	Manual for Private Architects. PW147	Sep 2002
	Drainage Water Supply and Stormwater Drainage PW 349	May 2002
	Facilities for Disabled Persons PW 350	Mar 2001
	Fire Security: A Guide to Architects. (STS 16)	Jan 1998
	Specification of Materials and Methods to be used.PW 371	Oct 1993
	Building Specifications in Regional Offices. PW 343	Jan 1994
	Standard Specification for security equipment. FPO 9E	Sep 1995
	Standard Specification for Kitchen Equipment (Architectural)	Sep 1994
	Standard Specification for Kitchen Equipment (Afr.)	Jan 2004
	Drainage Details PW 348	Dec 1998
	5 Star specification for new police cells	2004
	5 Star specification for existing police cells	2004
	SAP 5 star drawings	2004
5	**Quantity Surveyors**	
	Manual for Consultant Quantity Surveyors. QS 90	Jan 2005
	Notes to Consultant Quantity Surveyors on the preparation of Bills of Quantities. QS 37	Dec 2004
	Preliminaries etc. forming part of Bills of Quantities PW 772	Jan 2005
	Preliminaries section B	Jan 2005
	Preliminaries section C	Jan 2005
	Standard Conitions in respect of Building Services PW 637	Mar 2005
6	**Structural Engineers**	
	Manual for Consulting Structural Engineers	Jun 2000
7	**Civil Engineers**	
	Standard conditions in respect of the supply-, delivery and Installation of electrical -, mechanical -, pneumatic- and vacuum operated equipment, control systems, plant and materials	Sep 2003
	Scheduled for inclusion in engineering contracts. PW 379 Civil	
	Contract data (GCC2004)	Dec 2004
	Guidelines for the Design of Civil Services for Prisons PW 342	Mar 2004
	Standard Specification for Domestic and Fire Water Storage and Fire Water Supply for Public Buildings PW 345	May 2004
	Civil Engineering Manual PW 347	Oct 2004
8	**Electrical Engineers**	
	Manual for Electrical, Electronical and Mechanical Consulting Engineers	Oct 2003
	Standard Conditions in respect of the supply, delivery and installation of Electrical and Mechanical Equipment, Plant and Materials. PW 379	Sep 2003

	Standard conditions in respect of the supply-, delivery and Installation of electrical -, mechanical -, pneumatic- and vacuum operated equipment, control systems, plant and materials scheduled for inclusion in engineering contracts. PW 379 Civil	Sep 2003
	Part 3: Quality Specifications for Materials and Equipment of Electrical Installations	Sep 2000
	Example of bills of quantities & specification for comprehensive services incorporating electrical installations PW 346	Apr 2004
	General Specification For Electronic and PABX Installations and Project Specification PW 359	
9	**Mechanical Engineers**	
	Manual for Electrical, Electronical and Mechanical Consulting Engineers	Oct 2003
	Standard Conditions in respect of the supply, delivery and installation of Electrical and Mechanical Equipment, Plant and Materials. PW 379	Sep 2003
	Standard conditions in respect of the supply-, delivery and Installation of electrical -, mechanical -, pneumatic- and vacuum operated equipment, control systems, plant and materials scheduled for inclusion in engineering contracts. PW 379 Civil	Sep 2003
	Air Conditioning and Ventilation Installations: Issue XI: (STS 1)	1998
	Standard Specification for Refrigeration Services: Issue VIII: (STS 2)	1998
	Steam Boiler Installations: Issue VII: (STS 3)	1997
	Central Heating Installations: Issue X1: (STS 4)	1999
	The Electrical Installations and Electrical Equipment pertaining to Mechanical Services: Issue IXa: (STS 5)	Dec 1999
	Fire Security: The Supply of a Tank and Trailer Fire Fighting Unit with Petrol Driven Centrifugal Pump and Sundry Accessories: FPO 1E: (STS 6)	Jan 1999
	Fire Security: Zone Alarms for a Sprinkler Fire Extinguishing System: FPO 2E: (STS 7)	Jan 1999
	Fire Security: Fixed Carbon Dioxide Fire Protection Installation: FPO 3E: (STS 8)	Jan 1999
	Fire Security: Automatic Fire Alarm Installation: FPO 5E: (STS 10)	Jun 1994
	Fire Security: Pump Installation for a Automatic Fire Extinguishing System: FPO 6E: (STS 11) (PW 337)	Oct 1981
	Fire Security: Automatic Sprinkler Fire Extinguishing System: FPO 7E: (STS 12)	Oct 1981
	Fire Security Evacuation and Communication Systems FPO8E: (STS 13)(PW339)	Oct 2004
	Standard Specification for Security Equipment: FPO 9E: (STS 14)	Sep 1995
	Fire Security: Schematic Diagram for a Fire Pump Installation: FPO 89: (STS 15)	Dec 1999
	Fire Security: A Guide to Architects: FPO/G61/3E (STS 16)	Jan 1998
	Preventive Maintenance, Servicing and Repair of Fire Security Installations (STS 17)	Nov 2000
10	**Geotechnical Engineer**	
	Appropriate Development of Infrastructure on Dolomite: Guidelines for Consultants PW344 (this document)	September 2010

Table 7: Consultant's documents published on the NDPW website

6.2 Status of Documents

6.2.1 Should there be any conflict between the requirements of the various documents, they shall have preference in the order as listed in Table 6 on page 26.

6.2.2 The Consultant's attention is specifically drawn to the fact that his/her

practice will accept ***full responsibility*** for the design, detail(s), specifications and drawings. The Department's input is given to ensure basic compliance with minimum statutory-, regulatory- and legislative requirements, with the specific aim of achieving best practice details/specifications in conjunction with the Consultant's expertise.

6.3 Project Standards

6.3.1 General

New infrastructure shall be located as far as possible on the lowest risk dolomitic soil.

The Project Requirements below have preference over all the listed documents.

The prescriptions of the local fire fighting authority shall prevail.

The basic design standards of the Department are as follows (in addition to the requirements of the documents listed in item 6.1).

6.3.2 Water Supply

6.3.2.1 Replace all waterlines with:
HDPE - Type PE 100, Class PN 16 for 63 mm diameter and smaller.
HDPE - Type PE 100, Class PN 12.5 for 75 mm diameter and larger (and Class PN 16 in high risk areas where pipes are not being sleeved and anticipated pressures are high).
(If the design requires pressures in excess of the above, such class shall be specified)

6.3.2.2 HDPE pipe material is to be in accordance to SABS ISO 4427/SANS 4427.

6.3.2.3 All water pipes, of 160 mm diameter and smaller, traversing High Risk Dolomite Zones, must be placed in welded HDPE sleeve pipes that terminate in HDPE manholes. Sleeve pipes shall be HDPE Type PE 100 Class PN 10. Alternatively concrete manholes may be used, provided that sleeve pipes are appropriately tied into the walls and the structure is designed as a water retaining structure. The use of concrete manholes is to be approved by the Departmental Dolomite Risk Manager. The floor and roof construction joints must be appropriately sealed with a membrane and sealant as approved by the Department. All jointing details shall be specifically indicated on drawings.

6.3.2.4 All manholes and valve chambers to be watertight heavy duty welded HDPE (material type PE 100) with minimum ring stiffness 8 kN/m^2 or cast in-situ watertight reinforced concrete manholes (if approved by departmental Engineer) with HDPE puddle flanges welded to the HDPE pipes. (See details TYPE DT 11-1/W, TYPE DT 12/W, TYPE DT 04/D, TYPE DT 09/D.

6.3.2.5 All HDPE pipes to be butt-welded (SABS 0268/SANS 10268 – Part 1) unless specifically otherwise approved by the Department. Electro fusion welding (SABS 0268/SANS

10268 – Part 2) will only be allowed in special circumstances.

6.3.2.6 Primary and secondary water loops shall be closed as far as feasible except where otherwise approved by the Department.

6.3.2.7 Design water monitoring system with bulk supply flow meters and flow meters at each secondary branch. Logging shall be facilitated by means of a portable logger for all automatic water meters to be supplied under the Contract(s).

6.3.2.8 The layout of secondary mains is to be in accordance with The South African Standard Code of Practice: The Management of Potable Water in Distribution Systems SABS 0306/ SANS 10306.

6.3.2.9 Old mains that are to be abandoned must be removed and the trenches backfilled and compacted to permeability of less than the in-situ soil. Where old mains are under surfacing and where removal would be uneconomical, pipes are to be grouted using a suitably designed soil-cement (12:1) mixture.

6.3.2.10 Water pipes, where permitted above ground shall be of hot dipped heavy-duty galvanized steel pipes to SABS EN 10240/SANS 32. Screw threads shall be cut as far as possible prior to galvanizing. No welding will be permitted after galvanizing. All screw threads, pipe ends and joints shall be treated with a mastic compound in accordance with the manufacturer's specifications on completion of the installation.

6.3.2.11 All valves on water mains to be clockwise closing.

6.3.2.12 Valves shall be flanged resilient seal gate valves and fitted to flange adaptors. They are also to be housed in watertight manholes.

6.3.2.13 Standard water meters shall be installed at each house, building, facility etc.

6.3.2.14 Pipelines are to be designed to ensure zero percent leakage and shall be hydraulically tested to a pressure of 1.5 times the maximum pipe rated pressure for a minimum period of three hours.

6.3.2.15 Fire Fighting Design shall be in accordance with the National Building Regulations, SABS 0400/SANS10400 and as required by the appropriate Metropolitan Council and shall be officially approved by the local fire fighting authority.

6.3.2.16 Fire hydrants are to be above ground, tamper proof, right angled and in accordance with SABS 1128 and the local fire fighting authority's requirements.

6.3.2.17 Domestic and fire water requirements shall be calculated in accordance with the DPW "Standard Specification for Domestic and Fire Water Storage and Fire Water Supply for Public Buildings" PW 345. Obtain latest version of these guidelines from the Departmental Engineer.

6.3.2.18 No direct connections shall be allowed on primary mains, unless approved by the Department.

6.3.2.19 All services and pipelines shall be clearly marked. Marking symbols and numbers are to be approved by the Department and be in accordance with clause C.3.9.5 and C.8.11 of the Civil Engineering Manual (PW347). Obtain latest version of these guidelines from the Departmental Engineer.

6.3.3 Sewerage Design

6.3.3.1 Replace all sewers with Type PE 100, PN 10 HDPE pipes to SABS ISO 4427/SANS 4427.

6.3.3.2 All manholes to be watertight heavy duty welded HDPE (Type PE 100) with minimum ring stiffness 8 kN/m^2 and with sewer pipes welded to the manholes. Where approved by the Department, cast in-situ watertight dolomite aggregate reinforced concrete manholes (designed as a water retaining structure) with HDPE puddle-flanges welded to the HDPE pipes may be used. (See details TYPE DT 11-1/W, TYPE DT 12/W, TYPE DT 04/D, and TYPE DT 09/D.

6.3.3.3 HDPE pipes are to be joined by butt-welding unless otherwise approved by the Department. Electro fusion welding will only be allowed in special circumstances.

6.3.3.4 Where possible, all pump stations and septic tanks are to be eliminated.

6.3.3.5 Pipelines are to be designed to ensure zero percent leakage and shall be hydraulically tested to a pressure of 1.5 times the maximum pipe rated pressure for a minimum period of three hours.

6.3.3.6 All existing buildings are assumed to be fully occupied for hydraulic design.

6.3.3.7 Provide special measuring manholes suitable for installation of portable sewage flow meters where sewage enters municipal areas or feeds into local sewage treatment works. (Venturi type is preferred for average flows in excess of approximately 10 ℓ/s.)

6.3.3.8 Sewerage flows shall be calculated in accordance with the DPW "Guidelines for the Design of Small Sewerage Treatment Works for Isolated DPW Developments". Obtain latest version of these guidelines from the Departmental Engineer.

6.3.3.9 Cover to pipes

a	Average	0.75 m
b	Outside traffic areas	0,60m (min)
c	Inside traffic areas	1,0 m (min)

6.3.3.10 Minimum sewer diameter (nominal diameter)……..160 mm

6.3.3.11 Minimum diameter for sewer house connections (nominal diameter) ……...160 mm

6.3.3.12 Minimum diameter for pump station rising mains (nominal diameter)……..….110 mm

6.3.3.13 Minimum pump flow velocity in rising mains……...0,7m/s

6.3.3.14 Maximum pump flow velocity in rising mains……..2,5m/s

6.3.3.15 Sewage pump stations shall be equipped with dry well sewage pumps, a "Muncher" and a diesel electric emergency standby generator and an alarm system as approved by the Department.

6.3.3.16 Storm water infiltration into sewers……..0 ℓ/s

6.3.3.17 All services and pipelines shall be clearly marked. Marking symbols and numbers are to be approved by the Department and be in accordance with clause C.3.9.5 and C.8.11 of the Civil Engineering Manual (PW347)

6.3.4 Storm water Design

6.3.4.1 When existing concrete pipes are to be sleeved internally, HDPE Type PE 100, class PN10 SABS ISO 4427/SANS 4427 pipes should be used.

6.3.4.2 Replace all other concrete storm water pipes with either HDPE (Type PE 100) solid (class PN10) or structured wall (8 kN/m^2) pipes up to 900 mm diameter or suitable, protected open channels where approved by the Department.

6.3.4.3 Provide items to repair or replace storm water pipes larger than 900 mm with HDPE or concrete spigot and socket pipes with rubber rings. Include both types in Schedule of Quantities in 30:70 ratios.

6.3.4.4 Existing concrete pipes with rubber rings larger than 900 mm diameter that have sagged are to be replaced with HDPE or open channels as approved by the Department.

6.3.4.5 It is critically important that open areas be reshaped and areas of ponding be identified to ensure positive storm water drainage.

6.3.4.6 Joint seals in concrete channels, box culverts and manholes are to be cleaned and re-sealed watertight with polysulphide to manufacturer's specifications.

6.3.4.7 Cable ducts shall be provided in accordance with user requirements. Draw boxes and sleeves shall be similarly watertight constructed and tested as for sewers.

6.3.4.8 Old abandoned civil engineering services and sleeves without cables are to be removed or grouted with suitably designed soil-cement (12:1) mixture to prevent the ingress of water.

6.3.4.9 All HDPE pipes shall be butt-welded unless otherwise approved by the Department. Electro fusion welding will only be allowed in special circumstances.

6.3.4.10 Storm water manholes and junction boxes shall be of welded HDPE (Type PE 100) with ring stiffness 8kN/m^2. Where approved by the Department, watertight cast-in-situ reinforced concrete manholes with HDPE puddle flanges welded to the HDPE pipes may be used. Storm water manholes and junction boxes are to be sealed and tested for 0 % leakage. See also item 8.9.

6.3.4.11 Where pipe directions change under trafficked areas, a junction box is to be used. If it occurs outside trafficked areas, manholes are to be used.

6.3.4.12 Open channels in residential areas and near traffic zones shall be properly covered/protected as approved by the Department.

6.3.4.13 The Rational Method is to be used for design flood calculations.

6.3.4.14 Design minor systems for a storm with recurrence time of…...
……1:2 years

6.3.4.15 Design major systems for a storm with recurrence time of…...
……1:25 years

6.3.4.16 Minimum pipe diameter (excluding gutter and similar connections)……450mm

6.3.4.17 Slopes of storm water pipes shall preferably be steeper than.
……1 %

6.3.4.18 Cover to pipes:

a	Average	0.75 m
b	Outside traffic areas	0,60m (min)
c	Inside traffic areas	1,0 m (min)

6.3.4.19 Friction coefficients:

a	Colebrook White friction coefficient (including secondary losses)	
i	Plastic pipes	k = 0.6 mm
ii	Concrete pipes	k = 1.5 mm

b	Manning friction coefficient (including secondary losses)	
i	Plastic pipes	0,012
ii	Concrete pipes	0,013

6.3.4.20 All services and pipelines shall be clearly marked. Marking symbols and numbers are to be approved by the Department and be in accordance with clause C.3.9.5 and C.8.11 of the

6.3.5 Pipe work design at or near buildings

Water pipe work above ground shall be of Hot Dipped Galvanized Heavy Duty steel to SABS EN 10240/SANS 32 and be fixed above ground against the building. Manifold(s) shall be above ground with single HDPE feeds from below ground, where applicable.

The sewer pipe work above ground shall be solid wall class 34 heavy-duty uPVC to SABS 791/SANS 791 fixed against the building. Manifold(s) shall be **above** ground connecting with Kimberly Sockets to below ground HDPE pipes.

6.4 Requirements for HDPE piping and fittings

6.4.1 Scope

This material specification outlines the requirements for the manufacture of PE-HD (High Density Polyethylene) Pipes & Fittings to be utilised.

6.4.2 Quality assurance

It is the responsibility of the manufacturer/supplier to establish Quality Assurance by means of quality control procedures, which shall ensure that the product will meet the requirements of this specification. The manufacturer/supplier shall maintain a quality system that conforms to the requirements of the SABS ISO 9001:2000 / SANS 9001 or national equivalent. Applicable standard for manufacture of pipe shall be SABS ISO 4427/SANS 4427.

It is the responsibility of the design Engineer to ensure that all material and manufacturing details of all pipes, fittings and structures are appropriately specified in terms of the relevant SABS (or equivalent) specifications in the Tender documents and that the Contractor supply and install all material to the required SABS standards on site. Tender documentation must include or refer to all relevant requirements, certification or testing that may be necessary for quality insurance of raw material supply, manufacturing standards, equipment used in manufacturing or tests to ensure standards are met. Refer to SABS ISO 4427/SANS 4427, SABS 0268/SANS 10268, SABS 0269/SANS 10269, SABS 0270/SANS 10270, SABS 1655/SANS 1655, SABS 1671/SANS 1671 and relevant specifications. Tender documentation must allow for relevant quality control testing either by means of an appropriate clause (stating type of test and quantity) or by inclusion (specific stipulation of test requirements) in the price of the manufactured/installed item.

6.4.3 Inspection

The design Engineer must ensure that pre-delivery tests are conducted at the manufacturer's/supplier's works.

Tender documentation must stipulate that the Contractor will arrange with the supplier access to his works for the purpose of inspecting either during the course of manufacturing or when completed and shall permit the design Engineer all reasonable access to conduct such inspections.

Copies of all test schedules and manufacturer's quality control records as

called for in the relevant SABS (or similar) specifications and Tender specifications shall be submitted by the Contractor for examination by the design Engineer.

6.4.4 General product requirements

The finished product shall be free from cracks, voids, foreign inclusions and other defects, which would impair the overall performance. It shall be smooth walled on inside and outside and shall conform to the requirements (characteristics) outlined below.

6.4.5 Characteristics

Raw material composition for pipes, fittings (e.g. stubs) and other elements (e.g. sheeting for benching) shall be **PE 100 pre-compounded black.**

6.4.5.1 Technical considerations for raw material and finished product:

Physical/Chemical Property	**Standard**	**Value**	**Unit**
Density	ISO 1183	0.949-0.960	g/cm^3
Melt Flow Index (190℃/5Kg)	ISO 1133	0.25-0.35	g/10min.
Vicat Softening Point	ISO 306	64-68	℃
Crystalline Melting Range	ISO 3146-85	130-135	℃
Viscosity Number	ISO 1628-3	390	cm^3/g

Mechanical Property	**Standard**	**Value**	**Unit**
Shore D, Hardness	ISO 868	61	-
Elastic Modulus	ISO 527	∞900	MPa
Tensile Yield strength	ISO 527 / ISO 6259	24	MPa
Ultimate Tensile	ISO 527 / ISO 6259	35	MPa
Ultimate Elongation	ISO 527 / ISO 6259	>600	%
Flexural Stress (3.5% Deflection)	ISO 178	19	MPa
Thermal Stability (OIT @ 210℃)	ISO 10837	>40	minutes
Carbon Black Content	ASTM D 1603 / ISO 6964	2.25 +/- 0.25	%

6.4.5.2 Pipe characteristics

Characteristics	**Applicable Standard**
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)

6.4.6 Welding requirements

PE-HD pipes and fittings welders to be certified under the Thermoplastics

Welding Institute of South Africa (TWISA)

The following standards shall apply:

SABS 0268/SANS 10268 Part 1	Welding of thermoplastics - Welding processes - Heated tool welding
SABS 0268/SANS 10268 Part 2	Welding of thermoplastics - Welding processes - Electro fusion welding
SABS 0268/SANS 10268 Part 3	Welding of thermoplastics - Welding processes - Hot gas welding
SABS 0268/SANS 10268 Part 4	Welding of thermoplastics - Welding processes - Hot-gas extrusion welding
SABS 0286/SANS 10268 Part 10	Welding of thermoplastics - Welding processes - Weld defects
SABS 0269/SANS 10269	Welding of thermoplastics - Testing & approval of welders
SABS 0270/SANS 10270	Welding of thermoplastics - Approval of welding procedures and welds
SABS method 1269	Welding of thermoplastics – Test methods for welded joints
SABS 1655/SANS 1655	Welding of thermoplastics – Welding rods, fillers and solvents
SABS 1671/SANS 1671 Part 1	Welding of thermoplastics – Machines and equipment – Heated tool welding
SABS 1671/SANS 1671 Part 2	Welding of thermoplastics – Machines and equipment – Electro fusion welding
SABS 1671/SANS 1671 Part 3	Welding of thermoplastics – Machines and equipment – Hot-gas welding
SABS 1671/SANS 1671 Part 4	Welding of thermoplastics – Machines and equipment – Hot-gas extrusion welding

6.4.7 Raw material acceptance tests:

The material used for the production of the pipe and fittings or structures shall be a high-density polyethylene (PE-HD) PE 100. To ascertain the quality of this product the following tests shall be performed.

- Density
- Melt Flow Index
- Carbon Black Content
- Thermal Stability

Only virgin materials (raw materials as received from the polymer producers, with no additives) shall be used for the manufacture of the pipes.

The pipe supplier shall accommodate regular visits by NDPW and/or consultants representatives to their factory as and when required to inspect/check manufacturing process and be permitted to take samples of final products to an independent certified laboratory for acceptance tests as mentioned above.

No recycled material other than clean reworked material generated from the manufacturer's own pipe production may be used in the manufacturing of the pipes if it is derived from the same resin as used for the relevant production, as specified in clause 3.4 of SABS ISO 4427: 1996. The supplier will be required to provide documented proof, as and when requested, that recycled material

conforms to the requirements of this specification.

6.4.8 Testing of pipes

Testing as contained in the SABS ISO 4427 /SANS 4427 specification shall apply. Tests shall also be conducted ad-hoc by a registered and authorised testing body as determined by the Department of Public Works.

6.4.9 Documents to be submitted by pipe manufacturer:

- Certificate of Registration – SABS ISO 9001:2000 / SANS 9001 or National Equivalent
- Permit Certification – SABS ISO 4427/SANS 4427 for PE 100
- Quality Control Plan (QCP shall include Raw Material and Product Test Certificates)
- SABS or National Equivalent Quality Systems Audit Reports – Last 2 Audits
- Certificate of Conformity and Certificate of Analysis - Certificate for the raw materials used for each batch. Documentation shall be kept/filed separately by the pipe manufacturer for all pipes ordered per each contract.

6.4.10 Pipe marking

All PE-HD Pipes shall be indelibly marked at 1 meter intervals with the following details:

Reference item	**Mark printed**
Trade name	Manufacturer/Supplier Name
SAPMA affiliation	SAPMA + SAPMA Membership number
Specification	SABS ISO 4427/SANS 4427
Pipe OD	e.g. 160
Pipe OD tolerance	Grade B
Wall thickness	e.g. 7.7
Nominal pressure	e.g. PN 10
Material designation	PE 100
Batch no.	Manufacturer/Supplier Tracebility
Application	SEWER or WATER or STORMWATER or “SLEEVE – WATER” or any other application

Typical example:

SUPPLIER A - SAPMA – “Membership number” **- SABS ISO 4427 – 160 - B - X 7.7 - PN 10 - PE 100 - BATCH NO. 123456 – SEWER (Important note:** This number should always be on top of the pipe after installation)

6.4.11 Material guarantee / product life expectancy

The manufacturer must unconditionally guarantee all HDPE products for a **period of 100 years** against any form of chemical decomposition or mechanical failure as result of normal use in a 100-year lifecycle of expected pressures.

7. GENERAL CONTRACT CONDITIONS, APPENDICES AND ANNEXURES

These shall be strictly in accordance with the Department of Public Works requirements in

letter, format and sequence. This also applies to the Contract document cover and index. See Civil Engineering Manual, PW 347 dated May 2004 or revision.

8. SPECIFICATIONS, CONSTRUCTION REQUIREMENTS AND SCHEDULE OF QUANTITIES

8.1 The General Conditions of Contract for Civil Engineering Construction: Latest edition shall be applicable. Refer to latest copy of specials/amendments.

8.2 Tender document and Schedule of Quantities shall be drawn up in accordance with SABS 1200/SANS1200 Specification except where amended by the Department.

8.3 No dumping is allowed on Site other than at the designated and approved fill areas. Dumping will only be allowed for filling sinkholes and dolines and may not be detrimental to the natural storm water drainage of the area. Only soil, rock and clean masonry and concrete rubble may be dumped in the designated dump areas.

8.4 No borrow pits are allowed on Site.

8.5 No overhaul is payable on any material whether on site or off site.

8.6 All backfill for trenches, manholes etc, shall be composed of material which, after compaction, will be less permeable than the in-situ soil. This applies to pipe bedding, blanket and surround material as well.

8.7 Rate-only items shall as far as possible not be used. Balance quantities out to allow a reasonable quantity of each item, which may be required on Site.

8.8 All storm water pipe work shall also be HDPE pipes except where otherwise approved by the Department. Provide therefore also items with quantities for HDPE storm water pipes up to the maximum available in the RSA, in addition to concrete pipes with rubber rings for the larger storm water pipes.

8.9 The inlets and outlets of each manhole and junction box shall be sealed, the structures then filled to the brim and water tight covered against evaporation, where after they are independently tested for zero leakage over a minimum period of 48 hours.

8.10 No contingency sums/items are allowed.

8.11 Where trench excavated material is utilized for bedding, surround and backfill materials, the materials shall be compacted to at least 93 % Mod AASHTO or the density of the in-situ soil, whichever is higher. Where imported materials are used for trench bedding, surround or backfill materials, laboratory permeability and density tests shall be conducted on both the in-situ trench material and the imported materials to ensure that the bedding, surround and backfill materials are less permeable than the in-situ soil after placement and compaction to at least 93 % Mod AASHTO. Suitable bill items shall be provided in the Schedule of Quantities for all the above work.

8.12 Bedding material shall conform to SABS 1200/SANS1200 LB subject to the maximum aggregate not exceeding 6mm and the permeability to be lower than the in-situ soil.

8.13 Tender specifications in terms of HDPE pipes, fittings and structures shall include or refer to all relevant specifications as per this document. Please specify the pipe materials, supply lengths, joining methods, removing of internal welding bead (de-burring), camera inspections of finished joints as well as the specific pressure testing requirements and methods. The Tender must specifically state that the tender acceptance shall be subject to the submission (one submission only) and approval of the HDPE product manufacturer/s or supplier/s to be used by the Tenderer. Such submission may be called for during the evaluation of Tenders. The Department reserves the right to reject a Tender if the proposed manufacturer or supplier of HDPE products does not meet the requirements as stipulated in the relevant SABS (or similar) specifications.

8.14 The latest revision of the Occupational Health and Safety Act shall be applicable to this contract. Consultants to note the reference to this Act and the execution thereof as per the standard forms of appointment, related to professional service

providers, as issued by the Department.

8.15 Preliminary Bills of Quantities are attached as Appendix 14 (page 327) of this document. These bills serve as a guideline and must be verified and checked by consultant for correctness and appropriateness.

9. CONDITIONS OF CONTRACT

All consultants must take note of the Contract Data for use in Civil Construction (GCC 2004) or as revised. The requirement of Special Risk Insurance (clause 35) must form part of all contracts that involve work in the dolomitic environment. **The latest edition must be obtained from the Departmental Project Manager for all new civil contracts**. This clause requires revision for contracts other than those subject to GCC 2004. The Departmental Dolomite Risk Manager should approve any revision.

10 GENERAL DESIGN PRINCIPALS TO BE APPLIED

10.1 Buildings and facilities in general

10.1.1 Architectural designs

Architects must take cognizance of the fact that designs of foundations, water, sewer, stormwater and sleeves for other services in dolomitic areas are different form the normal procedures.

The following items need to be coordinated in the consultant group.

1. Type of earthworks prescribed below foundations (normal / soilmatress / dynamic compaction etc.).
2. The foundation design (reinforced footings / raft foundations, etc.).
3. The influence of services installations in raft foundation (provision of sleeve pipes and ducts / positioning of wet cells, etc.).
4. The top structure design (column and beam / reinforced brickwork / load bearing brickwork, etc).
5. Surface mounting of all wet services.
6. The draining of internal court yards (only if approved by departmental engineer).
7. The construction of atriums.
8. Water features.
9. Gardening.
10. Brickwork on rafts (raft exposed or cladded with brick tiles or brickwork on an exterior nib)
11. Chillers, cold rooms, freezers, icemakers, air conditioners and display coolers or any other equipment that produces condensate.
12. The washing, cleaning and floor draining systems in kitchens, locker rooms, change rooms and areas where floors are normally washed by means of hosing down.
13. The pipes installed in sub-floor sleeves must have inspection and working manholes that allow for the removal and replacement of such services in future.
14. Buildings shall generally be supplied with only one water supply point. The Architect needs to liaise with the Civil Engineer regarding the supply of fire and domestic water in one or separate supply lines. The pressure reducing facilities to protect the internal installation is the responsibility of the architect. The distribution of the internal water pipe distribution network is also the sole responsibility of the Architect.
15. Termite proofing around structures require special attention to

prevent nests that may result in concentrated water ingress in future.

The above items must be resolved between all consultants prior to sketch plan stage.

10.1.2 Foundation design performance criteria

The design of structures in a dolomitic area must be based on the approved geotechnical dolomite risk assessment of the site and in particular of the footprint area of the proposed new structure.

The dolomite risk assessment must state specifically the potential size of sinkhole and doline that can be expected.

The Structural Engineer must design the structure to meet the following Performance Requirements:

1. Sinkhole having a nominal diameter (as stated in the geotechnical report) occurring anywhere beneath or adjacent to the building will not envelop the building or result in toppling or sliding failure of the building (or portion of the building) into such a sinkhole.
2. The design is such that in the event of catastrophic loss of support, there is sufficient time for occupants to safely escape from the building after the occurrence of the sinkhole or doline, and the level of expected building damage associated with soil movement unrelated to sinkhole formation in near surface horizons is kept within reasonable limits.
3. Reinforced concrete foundation design principals:
   - The reinforced concrete foundations shall be designed and constructed in such a manner that the building satisfies the performance requirements listed above.
   - The walls and floor of the structure shall withstand loss of support without collapsing into a sinkhole occurring anywhere within the footprint of the building over an area having a minimum diameter as stated in the geological report.
   - The reinforced concrete foundation should, when subjected to a loss of support, due to a sinkhole having a nominal diameter as stated in the geotechnical report, carry the proposed loads within that section of the building and have deflection limits not more severe that 1:250, permitting safe evacuation of people. It must be noted that these deflection limits will result in severe structural damage.
4. Loss of support below load bearing columns:
   - The design of the supports of the roof structure must take into account potential partial loss of support should a sinkhole develop below a pillar or roof support.

10.1.3 Special design for places of lock-up

1. The structural design for holding cells in correctional facilities shall be designed similar to the criteria as previously stated for foundation design in the event of sinkholes. An additional requirement is the guaranteed structural stability of all elements of the structure for at least 16 hours after the event.
2. The placing of such facilities must be on the lowest risk portion of the site.
3. The Departmental Dolomite Risk Manager must approve the final placing and design of all elements of the structural design.
4. Deformation of the foundation may not lead to the collapse of any

internal wall, or roof element of the installation.

5. Design drawings must refer to the specific geotechnical report used in the design procedure.
6. Design drawings must state the maximum expected size of any ground movement event for which the design allows.
7. Any structure that may affect the holding cells in the event of a catastrophic collapse shall conform to the same standards as stated here.
8. New cells must be placed far enough from existing structures to ensure conditions of paragraph 7 above are met.

10.1.4 Fuel installations.

The design of all fuel installations must be subject to close collaboration between the Departmental Dolomite Risk Manager and the Design Engineer. The following basic design principals must be applied.

1. The location of fuel tanks must be placed on the lowest risk portion of the site.
2. The structural design of fuel tank bunkers shall be the same as for any other structure.
3. In addition to clause 2 above, the structure shall preferably be placed on rock (not floaters) or on piles imbedded in solid rock to ensure complete stability in the event of ground movement. Departmental Engineer must approve structural stability of piles prior to final design.
4. All fuel lines shall be designed to span, without compromising the structural integrity, the largest potential ground movement event.
5. Special care is to be taken of the design of backfilling material that covers underground pipes. Designs must provide for the collapse of soil without dragging the pipe down. Such designs should be approved by the Departmental Dolomite Risk Manager / Engineer
6. Antistatic design measures are to be incorporated to ensure no electrical friction sparks are generated in the event of structural or pipe movement as result of ground movement.
7. The design shall in detail provide for the prevention of any environmental hazard in the event of ground movement events.
8. The maintenance procedure for the entire installation must provide detailed standard operational procedures to be implemented in the event of ground movement.

10.1.5 Sport fields

Sport fields, and in particular the long-term development thereof, needs to the described in full in all procurement instructions. The development report of all facilities must allow for the safe development of all future envisaged infrastructure. Investigations for sport fields shall demarcate specifically the geotechnical investigated and approved areas for pavilions, clubhouses, ablutions, general facilities, change rooms, gardening and equipment stores.

From the inception phase all sport fields must be developed with a specific prescribed long term approved development plan related to the dolomitic condition of the site.

For the development of the grassed areas a specific water management control plan must be approved by the Departmental Engineer. This plan must include the required irrigation precipitation rates, irrigation system type, irrigation system control as well as the general layout and drainage design.

Irrigation requirements shall be designed specifically for the type of

vegetation, region and annual rainfall.

10.1.6 Leveling of new buildings / facilities

All new buildings must be fitted with at least 4 leveling measurement pegs as per Drawing Detail TYPE NO DT 04/SB or TYPE NO DT 06/ SB.

All new concrete structures such as large valve boxes, pump stations, structures in sewerage and water plants, etc must be supplied with at least 2 leveling measure pegs as per Drawing Detail TYPE NO DT 06/SB

New site developments such as community centers, police stations, magistrate courts or clusters of buildings on existing sites must be supplied with at least 1 control beacon as per Drawing Detail TYPE NO DT 02/SB or 1 survey base station as per Drawing TYPE NO DT 05/SB. The Departmental Engineer must approve the specific site requirements in writing.

All new civil engineering projects or upgrading projects in excess of R2.0 million must allow for the installation of at least 1 control beacon as per Drawing Detail TYPE NO DT 02/SB or TYPE NO DT 03/SB and all projects in excess of R10 million shall allow for at least 3 control stations as per Drawing Detail TYPE NO DT 02/SB or TYPE NO DT 03/SB and one survey base station as per Drawing Detail TYPE NO DT 05/SB

The bills of quantities must allow for the installation of the above leveling beacons and at least 5 hours of the services of a professional land surveyor for each installation point, beacon or base station.

The requirements of installation of survey points in roads and runways must be discussed with the Departmental Engineer prior to any project regarding the construction or upgrading of runways, taxiways and hardstands for aircraft or the reconstruction, resurfacing or construction of new roads.

11. WATER SUPPLY – GENERAL REQUIREMENTS

11.1 Bulk water connections.

The consultant needs to ensure that all bulk water connections from external utility providers are formalized in terms of:

1. Agreement of supply.
2. Maximum flow and pressure criteria.
3. Location (servitudes) etc.

The design of such connections must be approved by the Departmental Engineer and must contain the following elements:

1. Strainers.
2. Pressure reducing valves (if required).
3. Main and secondary pressure reduction system (main and secondary system must be capable to handle peak fire as well as peak domestic flow)
4. Flow meters (Pressure gauges and logger connections to be approved by Departmental Engineer).

11.2 Water meters.

The installation of water meters on all bulk and secondary water supply systems are compulsory in terms of the Department's current policy of water management and

auditing control in dolomite areas.

The main feed line to a property/complex or identified group of buildings that is collectively responsible for the payment of a specific account is to be supplied with a water meter that has electronic logger capabilities. Such meters must also be fitted with a pressure gauge (supply also shutoff and bleed valve). All individual client groups on the same site shall have separate meters.

All individual new structures must also be fitted with a water meter.

The type and position of water meters are to be approved by the Departmental Engineer.

11.3 Water supply to individual facilities.

The design engineer needs to ensure that the supply to structures is in accordance with the Department's current standards (PW 347). However taking into consideration the wall thickness of HDPE piping it is policy that water connections to an individual structure (residential, office etc) is not smaller than a pipe of 19 mm Internal Diameter.

11.4 Garden taps.

All garden or outside taps must be installed with a gulley that is connected to the main sewer reticulation. The gulley and surrounding paving must ensure that all water is directed towards the gulley if the tap is fully open. No ponding of water in the area of the tap is permitted.

The branching of pipes for garden/outside taps must be buttwelded similar to all other HDPE pipes.

The tap support structure must on a minimum be able to ensure stability in the event of a 50 kg weight hanging from the spout of the tap. This is applicable for both freestanding or wall mounted taps.

11.5 Residential water meters.

All residential buildings/units must be supplied with separate water meters. The water meter shall preferably be surface mounted against the building.

For meters (25 mm / 1 inch diameter) to be installed underground the typical detail is as per Drawing Type DT 24/W.

11.6 Concrete manhole design.

The design of concrete valve boxes and manholes must conform to the relevant drawings contained in this document. The structure is to be designed as a water retaining structure. Of particular importance is the installation of the cover slab as an insitu installation that forms an integrated part of the structure. Reinforcing steel for walls must extend into the cover slab to form a watertight joint. If the cover slab is cast separately then it must be attached to the walls with an approved epoxy to form a watertight joint. The use of concrete manholes must be approved by the Departmental Dolomite Risk Manager.

11.7 Anchor blocks

Taking into account that butt-welding produces a joint with strength similar to the pipe itself the HDPE system is self-anchoring in general. However it is a requirement that the design and tender documentation allows for the installation of anchor blocks for HDPE

water supply system of all pipes larger than 100 mm in diameter.

Anchor blocks are required at:

1. All change of direction that exceeds 11,5 degrees
2. All T – junctions.
3. All Y – junctions.
4. All crosses.
5. All end caps

The pipes and filling at such points must be fitted with suitable puddle flanges to ensure that no relative movement between the anchor block and the smooth HDPE pipe is allowed. Such puddle flanges shall be constructed of material not thinner than wall thickness of the fitting it is welded to.

Due to the nature of surficial soils in the dolomite area it is proposed that in the absence of detailed geotechnical information the following allowance shall be made in tender documents:

1. 50% of anchor blocks in loose soil conditions
2. 50% of anchor blocks in medium dense soil conditions

12. SEWER SUPPLY – GENERAL REQUIREMENTS

12.1 HDPE manholes

The installation of small diameter manholes (350, 500 and 700) close to building must be designed to allow access to the pipes for cleaning operations.

The maximum depths of manholes are as follow:

HDPE MANHOLE DIAMETER (mm)	MAXIMUM DEPTH (mm)
350	350
500	450
700	750

The depth is measured from the cover level to the crown of the in/outlet pipes.

Refer to drawing Detail TYPE No DT 05/D

12.2 Installations of large diameter HDPE manholes.

The detail for HDPE manhole (Detail TYPE No DT 04/D) indicates that the area below the benching must be filled with concrete. This can also be achieved by means of turning the manhole upside-down and filling the space below the HDPE benching with concrete prior to installation. See Plates 10 and 11.(page 69). Lugs, welded horizontally to the manhole shaft, are to be supplied to ensure that the concrete stays fixed to the manhole during all handling processes.

13. HDPE PRODUCT SUPPLY, INSTALLATION AND QUALITY CONTROL

13.1 Offloading of HDPE pipes and fittings

The manufacture's instructions regarding the offloading of all HDPE pipes, fittings and manufactured items must be strictly adhered to. The specification of such procedures must be in the office of the contractor at all times. The Principal Agent must be provided with a copy of such procedures. The pipes must be offloaded by hand or mechanical crane.

During site establishment of the contractor the Principal Agent must instruct the Contractor to clear an area specifically for the purpose of offloading HDPE/ PVC products. This area must be free of rocks, boulders or any other foreign objects that may puncture, cut or scar the HDPE/PVC fittings, pipes and other manufactured items. The area must also be relatively level in one direction and the ponding of stormwater must not be permitted. The area must be kept in such condition for the duration of material being on site.

13.2 Handling of HDPE pipes on site

The manufacturers specification for the handling and transporting of material on site must be strictly enforced. The Principal Agent shall write a specific instruction regarding this in the absence of such a manufacturer's specification.

The site instruction must include: "Under no circumstances shall the dragging of pipes on site be allowed. Dragging of the pipe will result in cuts, scratches and puncture marks that may result in weakening of the pipe. Welded pipes shall be transported to the point of installation in accordance with the manufactures specification."

13.3 HDPE pipes – visual inspection for defects

The representative of the Principal Agent must inspect all HDPE pipes for any visual defects such as cracks, deformation, wall thinning etc. This in no means constitute approval of the pipes. It merely serves as an additional quality control feature to ensure that pipes with obvious defects are rejected from the beginning.

Pipes found to have such defects must be brought under the attention of the supplier in writing. The supplier must respond in writing to the responsible Consulting Engineer. Copies of such cases must also be forwarded to the Departmental Project Manager , for submission to the D/Civil & Structural Engineering, at the National Department of Public Works, Pretoria. All events involving defective work must also be referred to SABS Technical Committee TC 59P, for comments in terms of SABS ISO 4427/SANS 4427:1996

13.4 Engineer's inspection of installed pipes.

The Engineer shall inspect all HDPE pipes and fittings prior to backfilling of trenches.

All pipes with cut, scratch, punctures marks or signs of deforming must be rejected from a quality control perspective. In such cases the Contractor must submit a certificate of approval from the pipe supplier. This document must clearly state that the supplier approves the integrity of the pipes irrespective of the noted damages.

If such an approval certificate is not supplied the Principal Agent must reserve the right to reject such parts of the installation as he/she see fit.

Any dispute in this regard must be referred to both the Departmental Project Manager and Dolomite Risk Manager.

The Principal Agent must also inspect the pipe for correct manufacturer markings as

required per Clause 6.4.10 of this document.

All welds must also be inspected for obvious visual defects.

13.5 HDPE pipe quality control.

The Department requires that the following must be complied with in terms of HDPE products.

1. National product specification: SABS ISO 4427/SANS 4427:1996
2. Designation of material: All elements to be conform to specification of PE 100.
3. Nominal pressure and wall thickness of pipes: SABS ISO 4427/SANS 4427 Table 3
4. Raw Material: The HDPE product manufacturer must be able to provide certificates of conformity and certificates of analysis as issued by the Polymer producer of virgin material as per part of ISO 9002 requirements.
5. Raw material declaration: The HDPE product manufacturer must by means of stipulating in the tender documents divulges the origin (supplier) of their raw material suppliers.
6. Reworked material must comply to: SABS ISO 4427/SANS 4427: 1996 Clause 3.4
7. Carbon black content must comply to: SABS ISO 4427/SANS 4427: 1996 Clause 3.1.1 and 3.1.2. Manufacturers must by means of the tender requirements state if in-house mixing is applied or not. In the event of in-house mixing the requirements of clause 3.6 of SABS ISO 4427/SANS 4427: 1996 shall apply.
8. Ash content: To be in accordance with SABS 533 part 1,2 and 3 clause 6.3. Maximum not to exceed 0,1%(m/m)
9. Pressure testing:
   Contracts shall provide for quick pressure testing of all pipe sizes delivered to site with at least:
   - One test per 500 m of pipes having a diameter less than 75m(O.D)
   - Two test per 500 m for all pipes having a diameter in excess of 75mm (O.D)

   The pressure test involves:
   - Selection of 3 samples, at random by the independent test laboratory, of pipes having a minimum length of 1,0m with all relevant pipe markings on and free of scratches and defects. This section must contain the required pipe marking.
   - The condition of pipe or fitting in water for 12 hours at 20ºC
   - The supply of internal pressure at a rate of 5 Bar/ min until failure.
   - PE 100 pipes must reach at least 2 X the minimum required strength (MRS) as per SABS ISO 4427/SANS 4427: 1996
   - Upon failure of the test procedure as described above standard pressure test procedures as per SABS ISO 4427/SANS 4427 must be applied.
   - The Engineer needs to allow for Quick testing as per the requirements stated above as well as to standard SABS ISO 4427/SANS 4427: 1996 pressure test.
10. It should be noted that quality control, especially with HOPE pipe installation in dolomite areas, is the most important aspect of the process as it determines the quality/standard of the work/infrastructure and it is the only way in which installation risks/deficiencies are reduced. The Principal agent shall therefore supply the Department with all quality assurance documentation after the completion of a project. The documentation shall be adequately referenced with as-built and the engineering services installation drawings database.

13.6 Special notes on HDPE welding work

In general the following site procedures need to be implemented

For welds other than prepared butt welds the following practical issues must be observed and implemented.

1. The adjoining faces of plastic are scraped by means of a chisel, to roughen up the surface and remove any oxidization of surfaces to be welded.
2. Angle grinders must not be used for this process, as it burns the plastic and also leaves a powder film, which is detrimental to welding.
3. Cleaning agents (i.e. XYLENE) must be used prior to the performing of any extrusion weld. Especially on all site works and repair work on dirty items.
4. In winter conditions, preheating of the parent plastic along the prepared weld surface is sometimes necessary. This prevents heat sink (i.e. the parent plastic chill and thus removing the heat from the extruded welding filler).
5. The welders registration number must be imprinted an each weld prior to cooling. This number should always be on top of the pipe after installation.

13.7 Removal of welding beads from HDPE pipes

After butt-welding of HDPE pipes the welding bead must be removed from all solid wall sewer pipes (all diameters) and stormwater pipes smaller than 200mm diameter.

The Engineer must inspect the Contractors equipment for this work and instruct the Contractor to weld and remove beads of the various pipe types to be used on site. These examples of the removed beads as well as the welded pipe sections must be kept on site for the duration of the project.

The removed beads must show no signs of cracking (cut too cold) or extreme deformation (cut too hot)

All welding beads removed from the installed pipes shall be marked sequentially with the same number as the weld. All welded joints must be sequentially numbered with white weatherproof paint. These weld positions must be transferred to an as build drawing.

The Contractor must store the removed welding beads to the end of the retention period.

It is important to note that:

1 The cut direction is the same as the water flow direction.
2 The bead cutter must be fitted with equipment to extract the bead after cutting.
3 The machine must able to cut the bead in one operation. Multiple cuts may lead to uneven or sharp burr ends on the pipe surface.

Please none that the internal welding beads of water pipes must not be removed. Typical equipment is shown on Plate 17 (see page 72).

13.8 Removal of HDPE pipe shavings

During the preparation phase of welding surfaces all care must be taken to ensure that pipe shavings are not left behind in pipes. This is of particular importance in terms of the preparation of water pipes. No system with a diameter smaller than 32 mm may be connected to the main reticulation unless the main reticulation is thoroughly flushed. The same applies to the entire smaller systems prior to the installation of water meters. The portion of pipe work to individual buildings must also be flushed in reverse from pressure sustaining valves towards the meter prior to connection of the meter. All strainers must be cleaned and checked by the engineer prior to handing over the system.

The entire system should be monitored for blockages after installation and the Principal Agent must introduce measurements to ensure that blockages are the responsibility of the Contractor for the duration of the contract up to final delivery.

14. CONSTRUCTION CONTROL MEASURES

14.1 Excavation construction report.

The responsible Engineer must inspect all excavations. The findings of the inspection must be fully documented in a short report.

The report must contain:

1. Layout plans of inspection (A3 Format)
2. Node description of inspection routes.
3. Digital photos to elaborate on report detail.
4. Description of soil profile in general (per chainage length) in terms of colour and density as well as the presence of dolomite, chert etc.
5. The changes in soil colour, density or type must be well documented.
6. The presence of any holes/pockets/cavities must be recorded, photographed and reported to the Department Dolomite Risk Manager
7. The presence of WAD (Black insitu weathered dolomite) in the excavation profile must also be recorded and reported to the Departmental Engineer

These reports must be forwarded to the Departmental Engineer prior to backfilling of trenches. Photographs can be submitted in digital format provided that each photograph is appropriately numbered in accordance with the report reference.

14.2 Installation control plan

The Principal Agent must submit (for all water, sewer and stormwater systems) a detailed installation control plan detailing the following.

1. Points of connection into existing systems.
2. Points of connection into infrastructure of bulk external suppliers.
3. Each connection in point shall be described in terms of:
    a. Pipe diameter
    b. Pipe type
    c. Flow average
    d. Flow velocity
    e. Peak flows
    f. Average flows
    g. Invert level (reference beacon to be installed)
    h. X and Y coordinates
4. Detail description of temporary connections.
5. Expected date of connection.
6. Any preconditions for connection.
7. Expected area to be affected by the connection as well as duration thereof.
8. Emergency and standby control measures in place for tie-in periods.

14.3 Temporary connections

All temporary connections to water, sewer and stormwater systems shall not be backfilled unless with the express instruction, in writing, of the Engineer. The installation shall, as a rule, be left open and barricaded as per the contractual standards until the permanent connections are made.

15. SITE MANAGEMENT

15.1 Risk management during construction.

The Department requires that during the execution of projects the appointed Principal Agent shall assist with the site risk management. This risk management refers to any emergency maintenance issues related to the prevention of leaks of wet services.

The Principal Agent needs to make an assessment of potential emergency repairs to services to be upgraded / replaced in the specific contract as well as elements not covered by the contract but in the general area of the project.

The bills of qualities must allow for emergency repairs during the contract period without the requirement of variation orders. Specifically measured repair and if needed maintenance items must be scheduled in the tender documents to cover such eventualities. The total allowance for items included n the bill for emergency repair work must not exceed 5 % of the contract value.

Typical emergency repair items to be included are as follows:

1. Emergency water pipe bursts.
2. Replacement of defective valves.
3. Repacking of leaking valves.
4. Replacing of leaking valves.
5. Cleaning of sewer pipes.
6. Replacing of sections of sewer pipe
7. Replacement of damaged manholes
8. Replacement of defective toilets, washbasins and urinals.
9. Opening of blocked stormwater pipes.
10. Cleaning and sealing of stormwater canals
11. Replacement of damaged canal sections.
12. Repair of sinkholes and dolines.
13. Emergency barricading of areas of ground settlement with steel fencing.
14. Erection of notice boards (steel) that indicates sinkholes or area of danger

The tender must allow for the emergency repairs and general maintenance to prevent water ingress and potential sinkhole formation as result of leaks of all elements of the current system / infrastructure to be replaced until such time it is replaced.

The Department Engineer must approve the allowance for such maintenance and emergency repairs prior to tendering.

It is a specific requirement of the Department that the Principal Agent is responsible for emergency maintenance of wet services, on the site of the works for the duration of the contract.

16. MAINTENANCE OF SERVICES AFTER INSTALLATION

16.1 Engineering services installation database.

On completion of each project the Principal Agent must supply the Department with a database of all the engineering elements as installed. Such a database must include:

- Description of element – valve, pipe, manhole etc.
- X- coordinate
- Y- coordinate

- Z- coordinate
- Design flow
- Installed size
- Model or make
- Slope
- Inlet / outlet size
- Branch size

All data submission shall conform to the requirements as per Appendix 10 (see page 292) and Appendix 11(see page 314) of this document.

All as-built drawings shall be signed off by a professional engineer confirming the validity of the information and that the information has been checked and verified. The full name of the professional engineer shall be legible, complete with his/her ECSA registration number.

16.2 Service operation areas.

The individual plans for water, sewer and stormwater needs to be extended by a specific service area plan.

For water installation each valve and meter configuration shall constitute a supply zone and downstream shutoff valves shall be classified as a sub supply zone. Valves on supply lines to individual buildings shall be demarcated as point zones.

For sewer and stormwater installations each of the manholes on the bulk collector/ main pipe shall be used to define the collection zones.

The zoning must be exact in terms of the feed or collection area. It must provide the department with sufficient information to know exactly which area will be affected if a value is closed or a manhole is blocked.

This information must be clearly marked on construction and as built drawings.

16.3 Maintenance of HDPE sewer/stormwater system.

HDPE pipe systems are pressure tested closed systems. As such there are no root intrusions possible.

The use of normal sewer/stormwater cleaning equipment such as root cutters, scrubbers or spearheaded rodding equipment or augers may not be allowed.

Only rubber flange plungers or blunt and round bar twin spiral inward closing rodding equipment (double screw worm) may be used. The use of high-pressure jet cleaning equipment is the preferred cleaning method if financially viable.

The Principal Agent must inform the Departmental Engineer regarding the appropriate maintenance measures of each installation.

16.4 Maintenance report.

At completion of any new facility the Consultant must compile a basic maintenance report that includes the following.

1. Services agreement for bulk connections.
2. Servitudes and right of way registered for the installation of bulk services.
3. The cyclic monitoring or testing of all parts of the installation that requires ongoing maintenance.
4. A basic annual cost estimate for such maintenance.

5. Demarcation of priority maintenance zones based on the soil condition as described in the Construction Excavation Report (i.e. areas of poor soils, areas of paled structures / areas of rehabilitation sinkholes or dolines, areas of poor drainage etc.)
6. Elements of infrastructure not covered by the project but where upgrading must be conducted in future.
7. Proposed future emergency maintenance budget based on current project experience.

The above information is additional to the requirements as indicated in all other standard departmental consultants manuals. Particular attention must be given to the standard requirements of Civil Engineering and RAMP project documentation.

17. GROUND HAZARD REPORTING

Within a dolomatic area the events as described below constitute a hazard and must be reported immediately to the Departmental Dolomite Risk Manager. The applicable Ground Hazard Report as per Appendix 13 (page 323) should be used for this purpose.

In an area where sinkholes and doline are as result of ingress water the following must be reported.

1. Any cracks in building (irrespective of size)
2. Any cracks in floor slabs
3. Any cracks in paving or apron slabs
4. Any cracks in the ground, especially those that are circular in nature
5. Any form of a hole in the ground.
6. Any form of ground settlement
7. Any form of cracking, settlement or relative movement in canals paving slabs etc.
8. Any bursts water pipes
9. Any overflowing or blocked sewer or stormwater systems
10. Any movement in structures
11. Any unnatural wet patches
12. Any ponding of stormwater
13. Any form of movement of any structure of facility.

In areas of dewatering the above shall apply as well as any form of lowering of the water table for the particular region.

The installation of boreholes for water abstraction in any of the two area types as described above constitutes a hazard if not approved by the Departmental Dolomite Risk Management.

Any sudden structural movement or cracking or ground movement must be treated as a priority hazard. Areas of ground settlement must be temporarily fenced. The temporary fence should be placed not nearer than 20 meters to any evidence of ground movement.

A building showing sudden cracks or movement must be evacuated temporarily until the Departmental Dolomite Risk Manager is informed and an inspection by him/her is conducted.

Any photographic reference of ground hazards must show the date and time on photographs if in digital format. Printed photos shall be supplied with the same data.

Any evacuation order must be communicated with the Departmental Dolomite Risk Manager as a matter of urgency.

The consultant must ensure that any evacuation order approved by the Departmental

Dolomite Risk Manager is implemented. Any failure on the part of the client department to react must be reported to the Departmental Dolomite Risk Manager.

18. BUIDING AND FACILITIES HIRED / LEASED

All facilities on dolomite that is occupied by the NDPW or its client departments should be subject to conditions regarding dolomite risk management. The lease agreement must stipulate exactly:

1. The responsible party (to the Agreement) that will be legally responsible for appropriate service management in relation to the dolomite risk of the area.
2. What specific requirements of general maintenance and / or facility use may influence the dolomite risk and what standard procedures are to be implemented by the Department to ensure compliance.
3. What operational procedure is to be followed in the event of ground movement and what reporting protocols are required.
4. Clauses that describe the special conditions of contract in the event of structural damage that results in evacuation of the building temporarily/permanently.
5. What forms of compensation / insurance will be available to the department in the event of loss of life or property as result of a ground movement event.
6. Disputes in this regard will be settled in Court.

N

1:1,188,130

Limpopo

Mpumalanga

Gauteng

North West

Northern Cape

Free State

Kwazulu-Natal

Eastern Cape

Lesotho

0 55 110 220 330 440 Kilometers

LEGEND

- (PROPERTY CODE) MPUMALANGA PROPERTIES
- RSA POLICE STATIONS
- PROVINCES
- DISTRICT COUNCIL
- MAGISTERIAL DISTRICTS 1996
- MAJOR PLACES
- DOLOMITE BUFFER 4KM
- NATIONAL ROADS
- MAIN ROADS

PROJECT: ESTABLISHMENT OF A DOLOMITE RISK MANAGEMENT STRATEGY FOR THE ASSETS OF THE NATIONAL DEPARTMENT OF PUBLIC WORKS LOCATED ON DOLOMITE FORMATION IN SOUTH AFRICA

DOLOMITE LOCALITY MAP

WCS 037122

SOUTH AFRICA

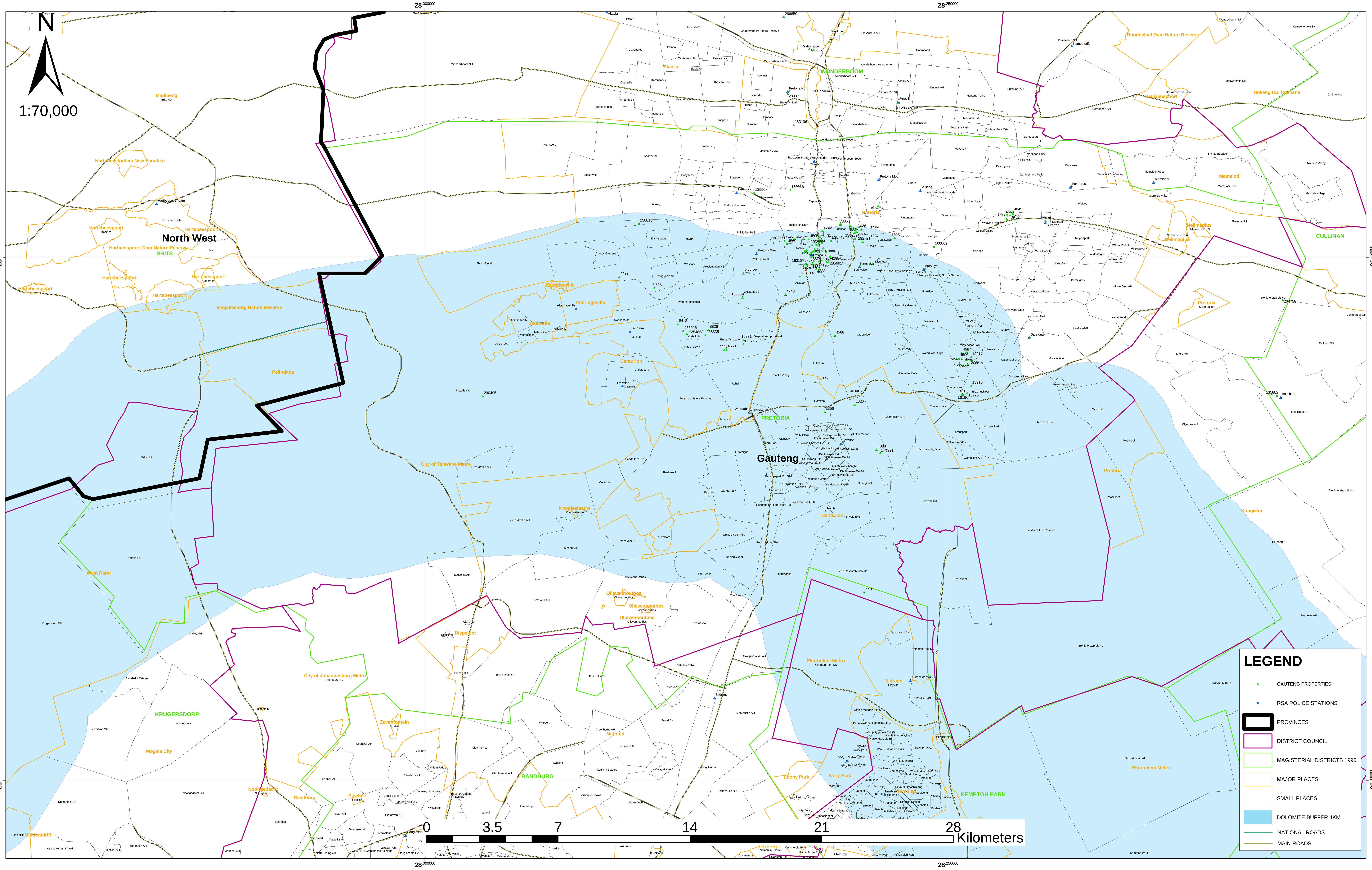
MAP 0: DISTRIBUTION OF DOLOMITE

VGIconsult
773 CAMPERI STREET
DORANDIA
PRETORIA
0182
TEL: (012) 546-3383
FAX: (012) 565-4814
E-mail: vgipta@mweb.co.za

Projection Information

Transverse Mercator
Central Meridian = °
False Easting = 0°
False Northing = 0°
Scale Factor = 1

Datum = WGS 84



PROJECT: ESTABLISHMENT OF A DOLOMITE RISK MANAGEMENT STRATEGY FOR THE ASSETS OF THE NATIONAL DEPARTMENT OF PUBLIC WORKS LOCATED ON DOLOMITE FORMATION IN SOUTH AFRICA

DOLOMITE LOCALITY MAP

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PRETORIA REGIONAL OFFICE

MAP 1: DISTRIBUTION OF DOLOMITE

VGIconsult
773 CAMPERI STREET
DORANDIA
PRETORIA
0182
TEL: (012) 546-3383
FAX: (012) 565-4814
E-mail: vgipta@mweb.co.za

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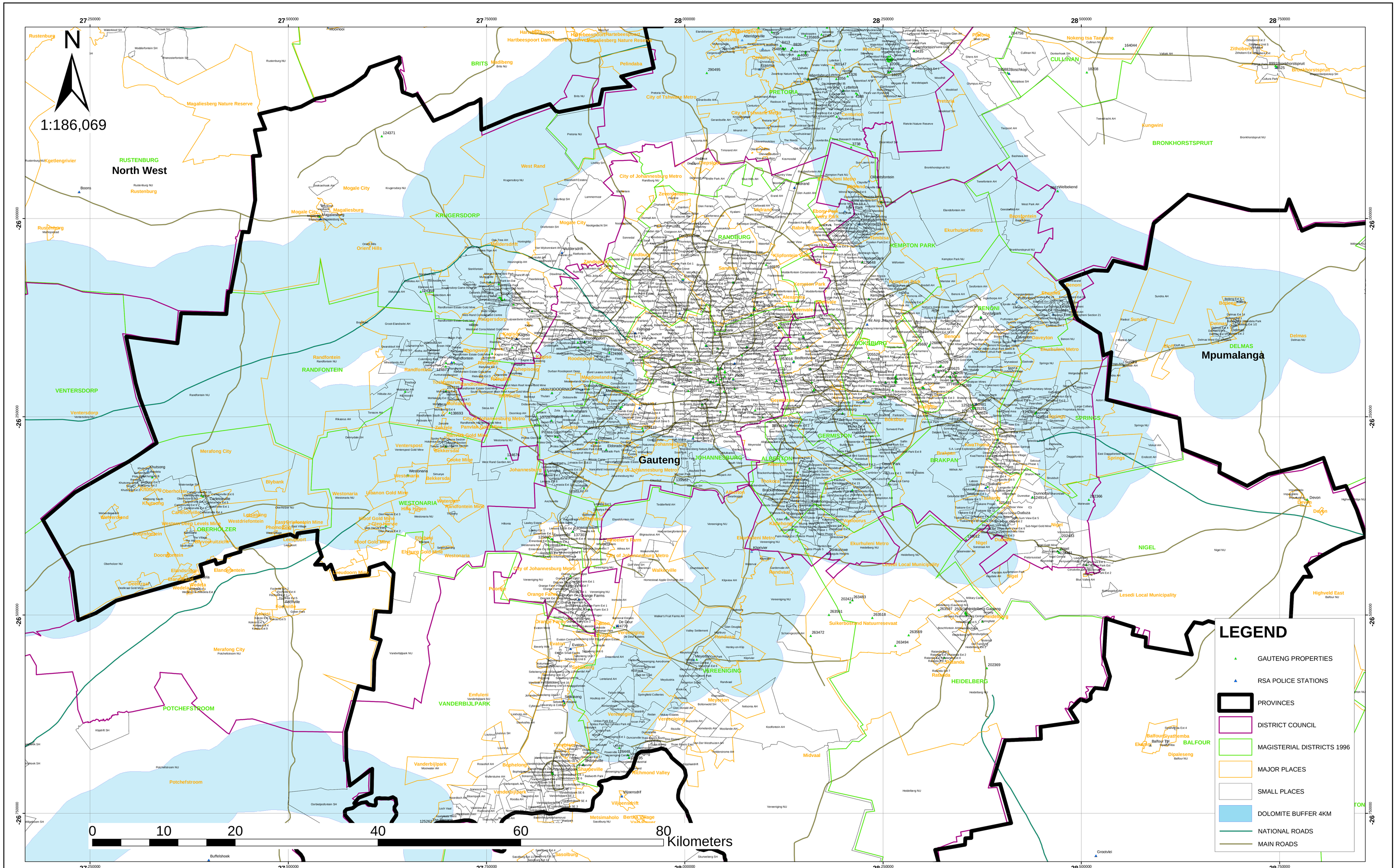

PROJECT: ESTABLISHMENT OF A DOLOMITE RISK MANAGEMENT STRATEGY FOR THE ASSETS OF THE NATIONAL DEPARTMENT OF PUBLIC WORKS LOCATED ON DOLOMITE FORMATION IN SOUTH AFRICA

DOLOMITE LOCALITY MAP

WCS 037122

JOHANNESBURG REGIONAL OFFICE

MAP 2: DISTRIBUTION OF DOLOMITE

VGIconsult
773 CAMPERI STREET
DORANDIA
PRETORIA
0182
TEL: (012) 546-3383
FAX: (012) 565-4814
E-mail: vgipta@mweb.co.za

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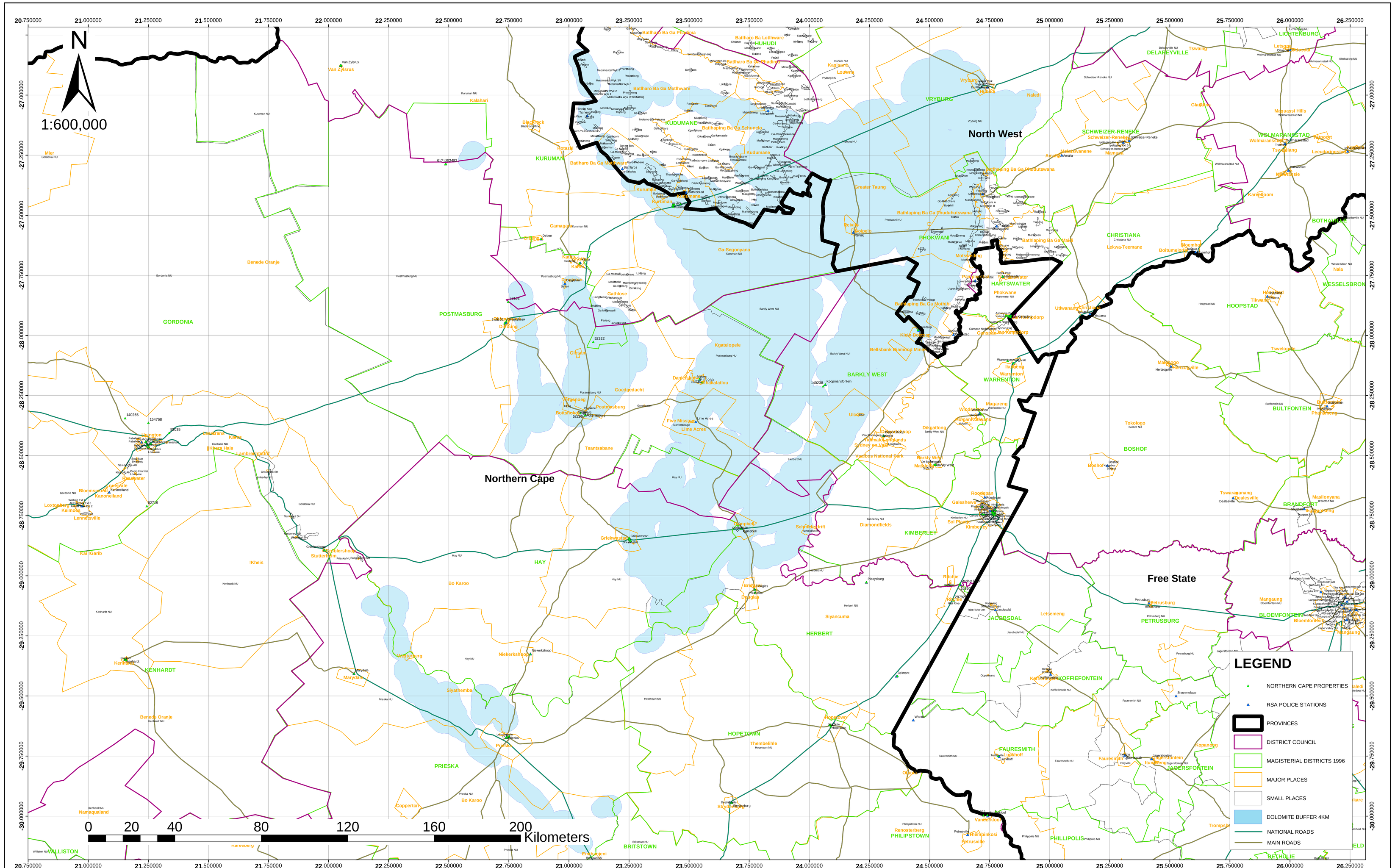
False Northing = 0°
Scale Factor = 1

Datum = WGS 84



PROJECT: ESTABLISHMENT OF A DOLOMITE RISK MANAGEMENT STRATEGY FOR THE ASSETS OF THE NATIONAL DEPARTMENT OF PUBLIC WORKS LOCATED ON DOLOMITE FORMATION IN SOUTH AFRICA

DOLOMITE LOCALITY MAP

WCS 037122

NORTHERN CAPE REGIONAL OFFICE

MAP 3: DISTRIBUTION OF DOLOMITE

VGIconsult
773 CAMPERI STREET
DORANDIA
PRETORIA
0182
TEL: (012) 546-3383
FAX: (012) 565-4814
E-mail: vgipta@mweb.co.za

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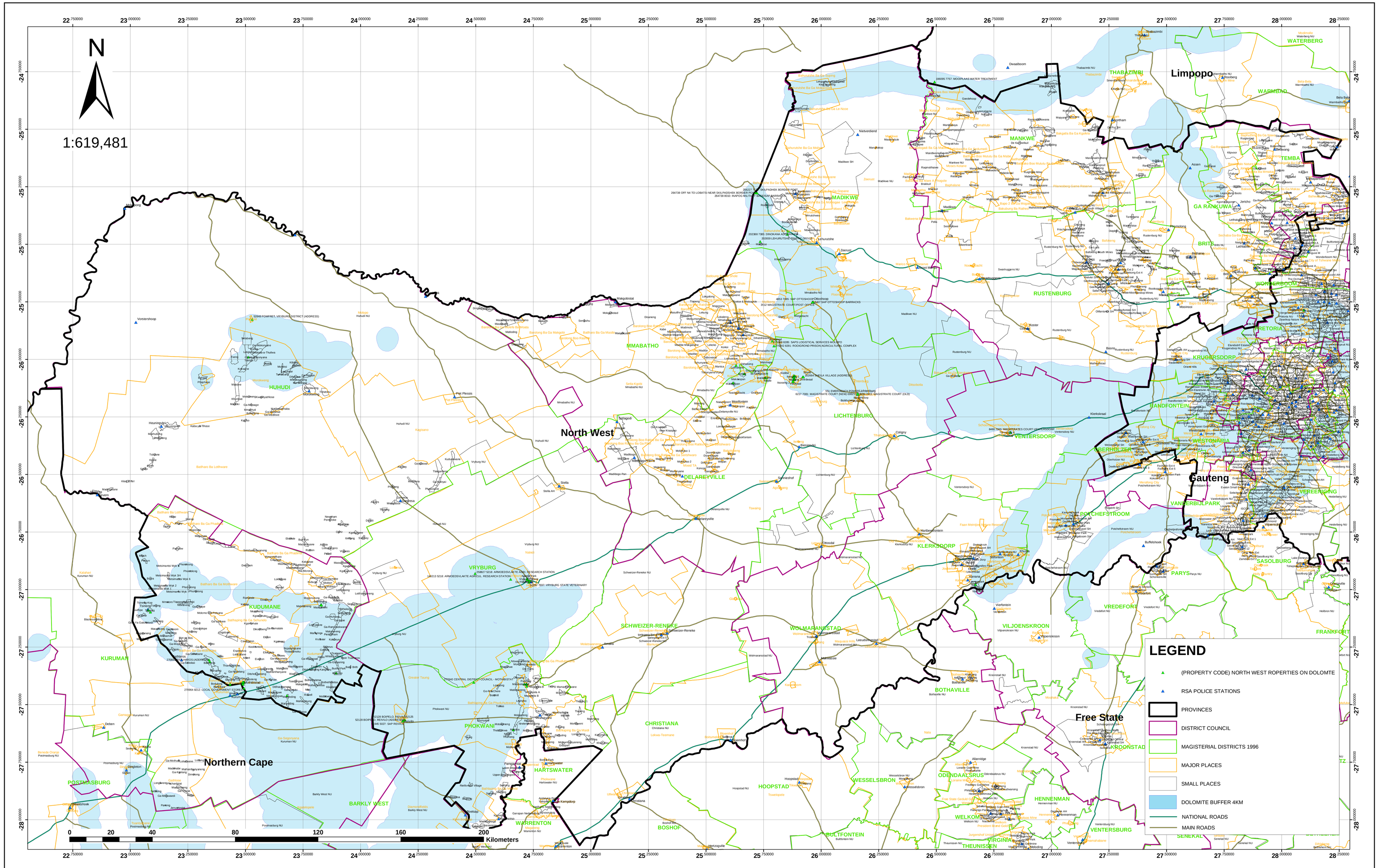
Scale Factor = 1

Datum = WGS 84



PROJECT: ESTABLISHMENT OF A DOLOMITE RISK MANAGEMENT STRATEGY FOR THE ASSETS OF THE NATIONAL DEPARTMENT OF PUBLIC WORKS LOCATED ON DOLOMITE FORMATION IN SOUTH AFRICA

DOLOMITE LOCALITY MAP

WCS 037122

MMABATHO REGIONAL OFFICE

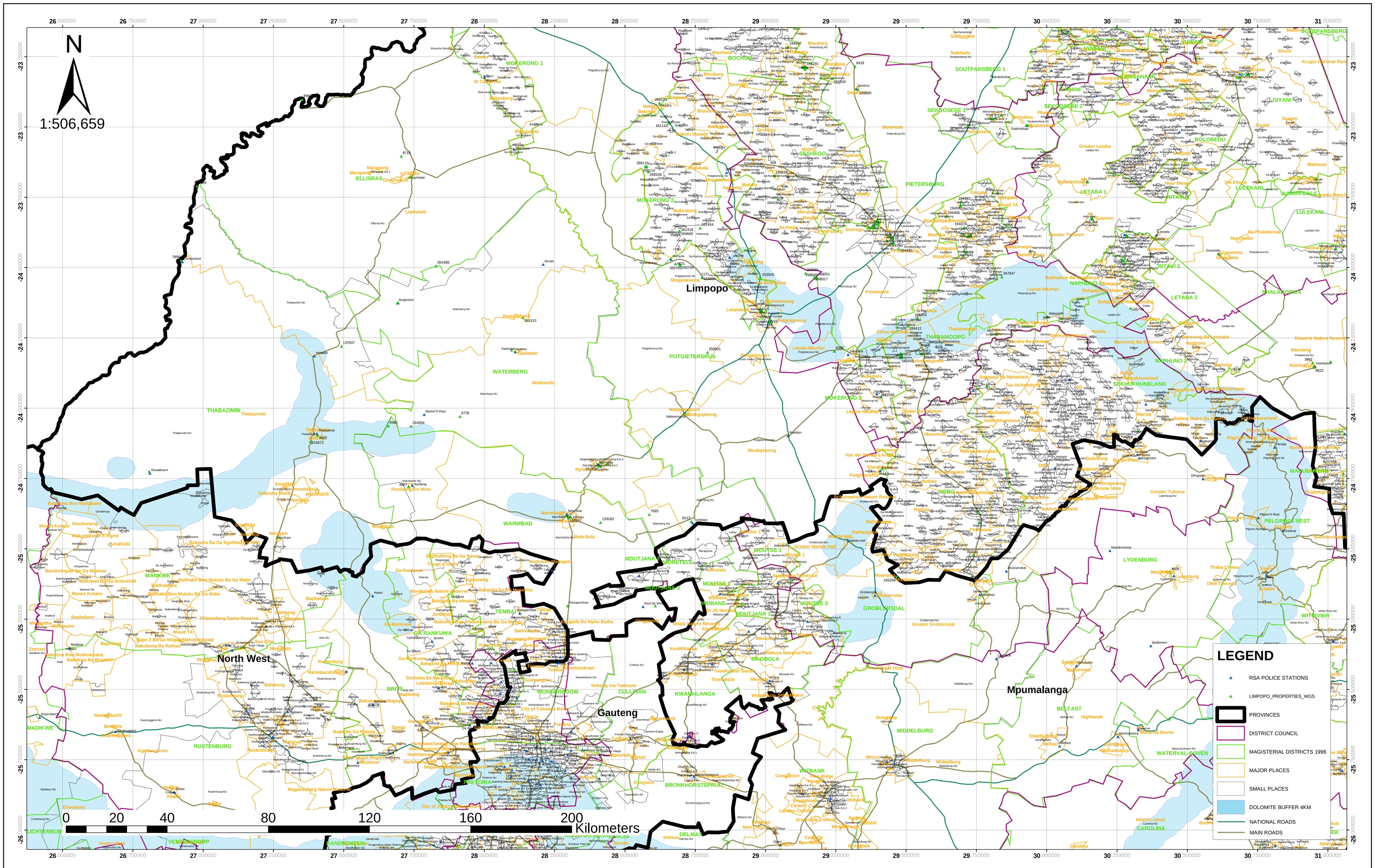
MAP 4: DISTRIBUTION OF DOLOMITE

VGIconsult
773 CAMPERI STREET
DORANDIA
PRETORIA
0182
TEL: (012) 546-3383
FAX: (012) 565-4814
E-mail: vgipta@mweb.co.za

Projection Information

Transverse Mercator
Central Meridian = °
False Easting = 0°
False Northing = 0°
Scale Factor = 1

Datum = WGS 84



PROJECT: ESTABLISHMENT OF A DOLOMITE RISK MANAGEMENT STRATEGY FOR THE ASSETS OF THE NATIONAL DEPARTMENT OF PUBLIC WORKS LOCATED ON DOLOMITE FORMATION IN SOUTH AFRICA

DOLOMITE LOCALITY MAP

WCS 037122

LIMPOPO REGIONAL OFFICE

MAP 5: DISTRIBUTION OF DOLOMITE

VGIconsult
773 CAMPERI STREET
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PRETORIA
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TEL: (012) 546-3383
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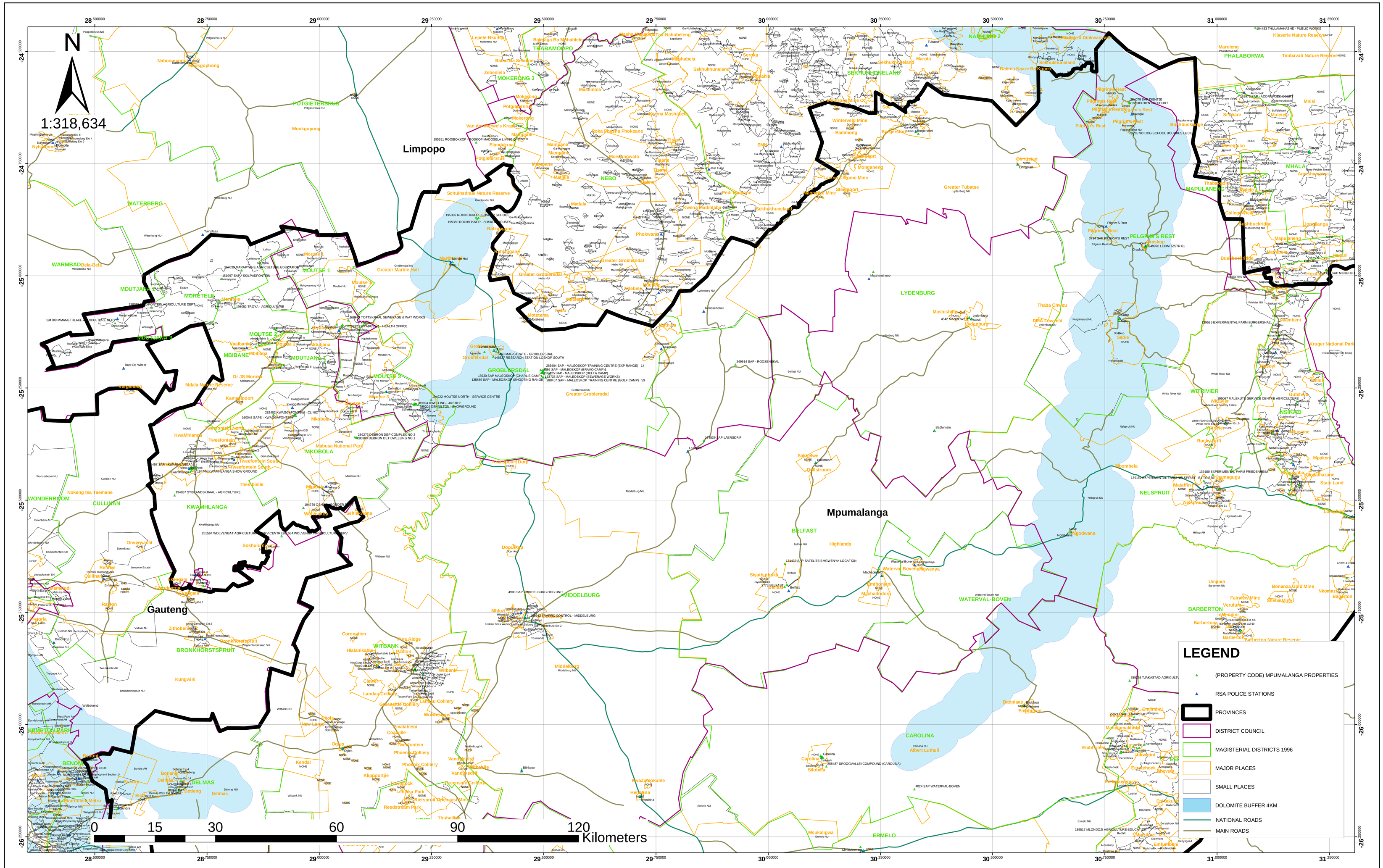
E-mail: vgipta@mweb.co.za

Projection Information

Transverse Mercator
Central Meridian = °
False Easting = 0°
False Northing = 0°
Scale Factor = 1

Datum = WGS 84



PROJECT: ESTABLISHMENT OF A DOLOMITE RISK MANAGEMENT STRATEGY FOR THE ASSETS OF THE NATIONAL DEPARTMENT OF PUBLIC WORKS LOCATED ON DOLOMITE FORMATION IN SOUTH AFRICA

DOLOMITE LOCALITY MAP

WCS 037122

MPUMALANGA REGIONAL OFFICE

MAP 6: DISTRIBUTION OF DOLOMITE

VGIconsult
773 CAMPERI STREET
DORANDIA
PRETORIA
0182
TEL: (012) 546-3383
FAX: (012) 565-4814
E-mail: vgipta@mweb.co.za

Projection Information

Transverse Mercator
Central Meridian = °
False Easting = 0°
False Northing = 0°
Scale Factor = 1

Datum = WGS 84

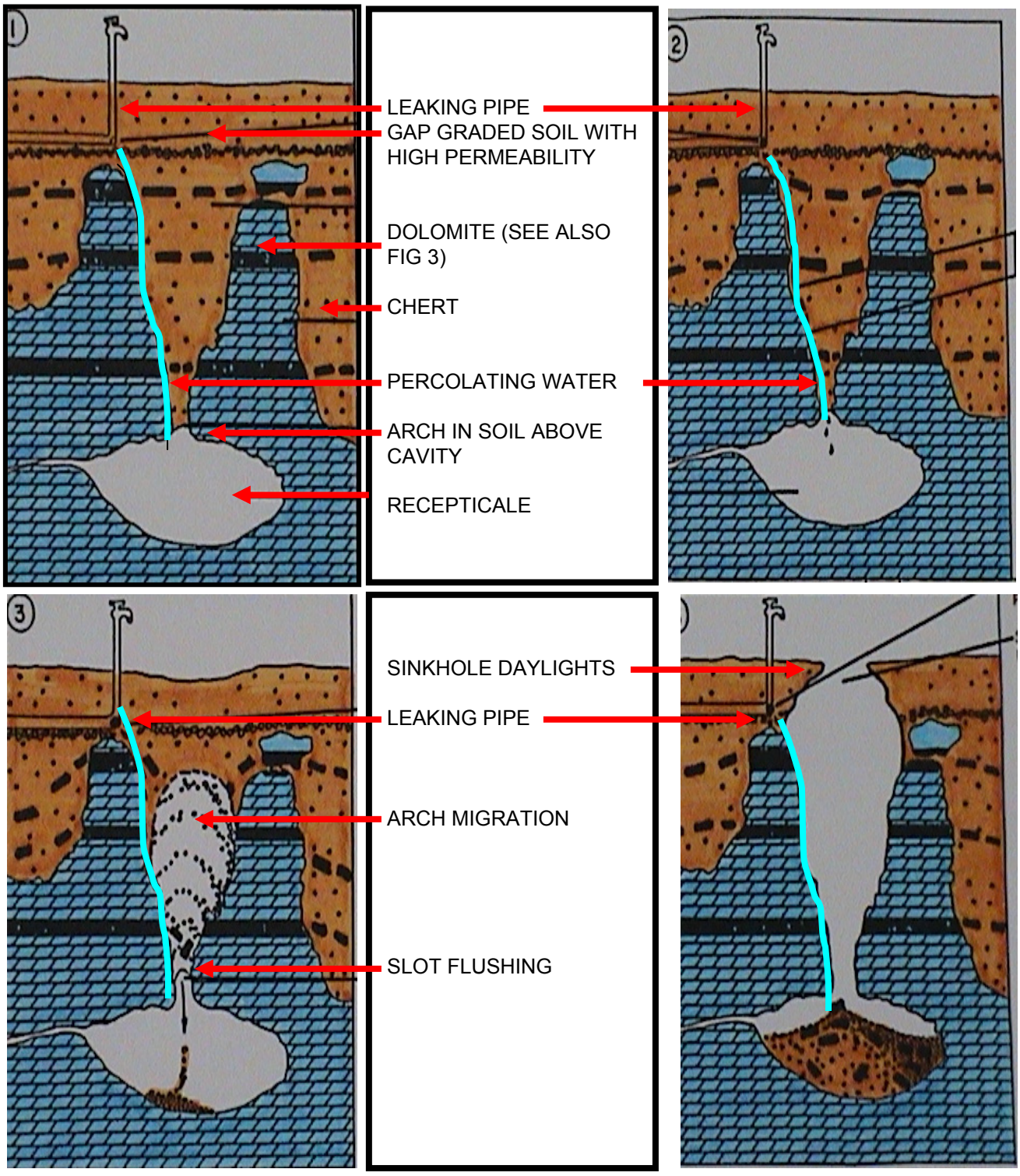


FIGURE 2: MECHANISM OF SINKHOLE FORMATION

FIGURE 3: SUBSURFACE DOLOMITE PROFILE SHOWING PINNACLES AND SOIL FILLED FRACTURE ZONES

PLATE 1: TYPICAL SINKHOLE (50 M DEEP)

PLATE 2: SINKHOLE AS RESULT OF LEAKING STORM WATER CANAL

PLATE 3: SINKHOLE ON HIGHWAY AS RESULT OF LEAKING WATER PIPE

PLATE 4: SINKHOLE AS RESULT OF STORM WATER INGRESS

PLATE 5: SINKHOLE AS RESULT OF LEAKING WATER MAINS

PLATE 6: SINKHOLE AS RESULT OF LEAKING WET SERVICE

PLATE 7: LARGE SINKHOLE AS RESULT OF DEWATERING

PLATE 8: BUILDING MOVEMENT AS RESULT OF DOLINE

PLATE 9: BUILDING MOVEMENT AS RESULT OF DOLINE FORMATION

PLATE 10: TYPICAL REINFORCED CONCRETE RAFT FOUNDATION

PLATE 11: TYPICAL REINFORCED CONCRETE RAFT FOUNDATION

PLATE 12: TYPICAL SURFACE MOUNTED WATER INSTALLATION

PLATE 13: TYPICAL SURFACE MOUNTED WATER INSTALLATION

PLATE 14: HDPE SEWER MANHOLE OF STRUCTURED WALL HDPE PIPE (BOTTOM)

PLATE 15: HDPE SEWER MANHOLE OF STRUCTURED WALL HDPE PIPE (INSIDE)

PLATE 16: HDPE STORMWATER MANHOLE OF STRUCTURED WALL HDPE PIPE (SIDE VIEW)

PLATE 17: TYPICAL EXAMPLE OF INDUSTURIAL BEADREMOVER

APPENDIX 1

PRO FORMA GEOTECHNICAL INFORMATION SHEET FOR TOWNSHIP PROCLAMATION STAGE CIRCULATION OR PROCUREMENT OF NEW SITES

The following format and relevant clauses are to be incorporated in the documentation to be submitted by any developer seeking approval for proclamation or wishing to sell property to GOVERNMENT DEPARTMENTS for the purpose of erecting police/court/community or other state facilities on dolomitic land.

PROPOSED GENERAL PLAN OF ..... (township name) FOR TOWNSHIP ESTABLISHMENT

PROVIDE TITLE / REFERENCE NO / DATE / AND AUTHOR OF GEOTECHNICAL REPORT FOR TOWNSHIP PROCLAMATION OR SITE TO BE SOLD:

STANDS ALLOCATED FOR THE DEPARTMENTS OF CORRECTIONAL SERVICES/ JUSTICE/POLICE/DEFENCE OR PUBLIC WORKS FOR ERECTION OF FACILITIES

GEOTECHNICAL CONDITIONS ON PROPOSED SITE

The township applicant/seller hereby certifies that the geotechnical engineer/engineering geologist has certified that the layout and land allocation complies with the recommendations set out in his/her geotechnical report, which was compiled in terms of current engineering geological practice. (see section 3.1.2.3 of this document)

ALLOCATED STANDS

1. **POLICE** (stand no:_____/ size _____)
   * Dolomite stability risk zonation as portion (%) of total site: Inherent Risk Class 1:…...…%, Inherent Risk Class 2,3 and 4:…...…%, Inherent Risk Class 5,6,7 and 8:…...…%
2. **JUSTICE** (stand no:_____/ size _____)
   * Dolomite stability risk zonation as portion (%) of total site: Inherent Risk Class 1:…...…%, Inherent Risk Class 2,3 and 4:…...…%, Inherent Risk Class 5,6,7 and 8:…...…%
3. **DEFENCE** (stand no:_____/ size _____)
   * Dolomite stability risk zonation as portion (%) of total site: Inherent Risk Class 1:…...…%, Inherent Risk Class 2,3 and 4:…...…%, Inherent Risk Class 5,6,7 and 8:…...…%
4. **CORRECTIONAL SERVICES** (stand no:_____/ size _____)
   * Dolomite stability risk zonation as portion (%) of total site: Inherent Risk Class 1:…...…%, Inherent Risk Class 2,3 and 4:…...…%, Inherent Risk Class 5,6,7 and 8:…...…%
5. **PUBLIC WORKS** (stand no:_____/ size _____)
   * Dolomite stability risk zonation as portion (%) of total site: Inherent Risk Class 1:…...…%, Inherent Risk Class 2,3 and 4:…...…%, Inherent Risk Class 5,6,7 and 8:…...…%

* Refer to Section 3 Item 3.1.2.3

DRAWINGS ATTACHED

Township layout and site with dolomite risk zoning indicated as well as position of boreholes and test pits.

DOCUMENT ATTACHED

Detail geotechnical report compiled in terms of current practice.

SPECIAL DEVELOPMENT CONDITIONS OR SITE SPECIFIC COMMENTS

Comments to be furnished by geotechnical engineer.

SPECIAL CLAUSES TO FORM PART OF CONDITIONS

The developer shall ensure that no borrow; fill or surficial soil disturbances occur during the township construction/development phase.

Storm water alterations due to development shall not negatively impact on current natural drainage of the proposed property.

No site camp for construction purposes shall be allowed on the property.

Special conditions as stated above shall form part of the township construction/development phase construction Contract documentation.

.....	.....	.....	.....
DEVELOPER	DATE	TEL.	FAX

APPENDIX 2

MINIMUM REQUIREMENTS FOR A GEOTECHNICAL INVESTIGATION ON A DOLOMITIC SITE

1. THE GEOTECHNICAL INVESTIGATION TO BE UNDERTAKEN SHALL INCORPORATE AND REPORT ON THE:

- geophysical investigation
- borehole work
- geological investigation
- geohydrological data
- Dolomite risk characterisation procedure
- surficial soils mantling the site and comment on the immediate environs
- Dolomite stability zonation

2. THE SITE SHALL BE DEMARCATED INTO RISK ZONES ACCORDING TO CURRENT PRACTICE.

3. OTHER FEATURES TO BE INCORPORATED AND COMMENTED ON WITH REGARD TO SPECIAL SITE CONDITIONS ARE:

- Previous investigations
- Old borrow pits
- Rehabilitated areas
- Dumpsites
- Water boreholes
- Permanent or temporary natural water drainage features traversing the site

4. REPORT FORMAT

The geotechnical report shall be structured as follows:

4.1 Terms of reference

4.2 Existing information

4.3 General location and description of site

4.4 Procedures used in the investigation:

- Desk studies
- Gravity survey
  (Note: Only drilling will be required if the footprint of building is fixed).
- Drilling programme
- Trail holes
- The visual inspection procedures used shall be referenced, i.e. Jennings et al (1973).
- Laboratory Testing. The original lab reports shall be incorporated in the report

4.5 Geology and geohydrology

4.6 Dolomite stability characterisation:

- Describe and reference the methodology used in the risk characterisation of the site.
- Current practice requires discussion of stability conditions in terms of: **Proposed method for dolomite land hazard and risk assessment in South Africa**, SAICE Journal Vol 43(2) 2001, paper 462 pages 27-36., Buttrick et.al.).

- Provide the risk characterisation of the site
- Outline the motivation for the risk characterisation of each zone.

4.7 Additional Geotechnical Considerations

- Potential problematic soils at surface level
- Active soils
- Collapsible soils
- Disturbed natural profiles (borrow, fill)

4.8 Conclusions and recommendations

- Risk characterisation
- Indicate remedial Work
- Indicate specific/special site development criteria
- Recommendation concerning appropriate development of site.
- Precautionary measures.

5.0 DATA CAPTURING IN REPORTS

The Department requires standardised data capturing forms as to ease evaluation of consultants information. The following information needs to be provided in standardised format:

- Site layout: 1:500 scale drawings showing the exact positions of:

  * Test pits
  * Boreholes (old and new)
  * Gravimetric survey
  * Specific site features
  * Risk zones
  * Proposed optimum location of buildings
  * Boreholes for water
  * Site contours (if available)

- The following information (where applicable) needs to be provided on departmental soil laboratory standardised formats:

  * Characterisation of borehole data
  * Percussion borehole drilling report
  * Test pit profiling report
  * Foundation indicator report
  * Consolidation test report
  * CBR reports

  Note: Consultant to contact departmental soil laboratory to obtain standard forms for the above.

APPENDIX 3

PRELIMINARY SITE INVESTIGATION BY THE PRINCIPAL AGENT: DOLOMITE STABILITY RELATED MATTERS

Reports presented to the Department for the development of a site (as per PRM 17) should on a minimum have the following information:

- **Cadastral information**

- **Site contours**

- **Services**
  * Existing services that traverse the site
  * Comprehensive reporting on condition and upgrading requires or shifting thereof

- **Roads**
  * Township roads (surfaced/gravel/non existing)

- **Water**
  * Municipal connection
    Size
    Pressure
    Type
    Exact location of connection

- **Storm water**
  * Natural drainage features
  * Drainage of the surrounding area
  * Canals (lined, unlined, general condition, possible connection)
  * Stormwater pipes (size, type, possible connection)

- **Sewer**
  * Municipal connection
    Location
    Size
    Material and jointing
    Manholes (type, material, joint sealing)
    Possible connections

- **Electricity and communication**

- **Geotechnical risk zonation**

APPENDIX 4

ENGINEERING SITE INVESTIGATION OF INFRASTRUCTURE ON DOLOMITE: SCOPE OF WORK

CONTENTS:

1. SITE LAYOUT DRAWINGS

Base information
Water - Drawing number.....
Sewer - Drawing number.....
Storm water - Drawing number.....
Roads - Drawing number.....
Paving - Drawing number.....
Building Layout - Drawing number.....

2. GENERAL INVESTIGATION INFORMATION

Building number:	
Base / unit	
Responsible person	
Alternative building name	
Previous name (if any)	
Physical location	
Stand number	
Farm portion	
x-y coordinates (if known)	
Age	

General comments from site representative (with relevant dates) regarding the following:

Ponding of storm water on the site.
Repairs to water pipes, during the last …… years.
Blockages of sewer system , during the last …… years.
Cracks in buildings.
Known incidences of dolines or sinkholes on the site or in the surrounding area

Names of all Contractors that do regular maintenance on the site:

Service	**Contractor**	**Tel. no**
Water		
Sewer		
General Building		
Storm water		

Information of occupants (date / /).

Description	Now	Future
Number of persons normally present.		
Normal number of staff.		
Maximum person capacity under normal conditions (including staff)		
Maximum staff capacity		
Maximum number of persons during special events (including staff).		

Information regarding services.

- Monthly water consumption for the last 12 months.
- Municipal account number
- Reasons for abnormal high water consumption

3. GENERAL INFORMATION REGARDING SURROUNDING AREA

Indicate the following on site layout drawing:
- General drainage of surrounding area onto the site.
- Type of roads surrounding the site.
- Type of storm water system surrounding the site.

4. WATER

Position of water meter
- Indicate on site layout (type, condition, shut-off valve, leakages and valve box, lockable, condition)

Pressure test
- Results, pressure and leakages

Approximate route of main water supply.
- Inspect routes for:
  Depressions
  Trees (5m zone)
  Unnatural green grass patches
  Wet patches
  Excavate and report on condition of pipe

External reticulation
- Fire hydrants
- Garden taps
- Sports fields (size, type of irrigation, frequency of irrigation and flow rate, if metered)

Building reticulation
- Indicate position of pipe distribution around building and inspect this route for any visible leakages, depressions etc.

Internal fittings (Check for leakages, damages and general condition)

- Washbasins
- Toilets
- Urinals
- Drinking fountains (excess water drainage facility)
- Fire hose reels

Pipes above natural ground level for entry into the buildings

- Pipes through walls (allowance for movement)
- All connections between flexible and rigid pipes shall be provided with flexible, self-anchoring joints.
- Pipes under floor slabs (service ducts, inspectable)

The selection of piping material and corrosion factors (both external and internal as well as between different materials - i.e. galvanised to copper etc.).

5. SEWER

Pit latrines

- Indicate position, number, can storm water ingress, type of structure, position of previous pit latrines, duration in use.

Soak-away

- Describe condition and size of septic tank and indicate position. Indicate position of subsurface soak-away, evidence of overflowing)

Conservancy tank

- Position, size, general condition, empty cycle, Contractor currently employed to empty, evidence of overflowing)

Sewage treatment works

- Type, condition, age
- Discharge
- Reed beds, maturation ponds etc.

Water borne sewerage system

- Pipe (position, type, condition, depth)
- Manholes (position, type, condition, depth, connection details, indicate regular overflowing, silt deposits etc.)
- Route (type of pipe, recent modifications, inspect line for depressions or unnatural green patches and trees or vegetation on the route).

Drains from buildings

- Position, accumulation route, cleaning and rodding eyes, valleys, inspect for general condition and indicate which portion is above and which below ground level, leakages, regular overflowing, general condition of surrounding area, paving, grass, etc.
- Pipes above natural ground level for exit from buildings
- Pipes through walls (allowance for movement)
- All connections between flexible and rigid pipes shall be provided with flexible, self-anchoring joints.
- Pipes under floor slabs (service ducts, inspection possible)
- Area of high concentration of sewer outlets out of buildings (condition)
- WC pans (provided with a flexible connection).

6. STORM WATER

General drainage onto site
- Water courses, location, ponding against boundary, entry at drive ways etc., canals, general slopes, position, etc.

Drainage system of surrounding area

The diversion of drainage onto the site
- Earth berms, cut off trenches etc.

Diversions of natural watercourses on the site

Natural ponds and watercourses located within 30m of any structure.
- Type, lining material, etc.

Drainage of site and surrounding area
- Free drainage of surface water
- Areas of ponding on the site
- Indicate any areas with gradients less than 1:100

Site fence
- Type of fence, position of storm water in/outlets, conditions of outlets, ease of draining, clogging, vegetation etc.

Lowest point of the site.

Storm water canals on the site, further than 10m from buildings.
- Gradients, type, size, position, condition, joint sealant, cracking, displacement, panel lengths, expansion joints, depositing of silt or sand

Storm water pipes
- Gradients, type, position, size, location, age, general condition, inlet structures, jointing, condition of seals.

Storm water drainage around buildings and up to 10 metres away.
- Detail of surfacing and open canals, joint sealants, panel dimensions cracking, displacement joint sealant and condition.

Sloping of surfaces around buildings.

Drainage in passages or between buildings
- Slope and direction of flow

Drainage towards a structure.

Storm water pipes and gulleys next to, under or parallel to buildings.

Drainage of grassed areas such as sports fields (minimum of 1:80)

Water tightness of all conduits.
- **Tests for leakage.**

Concrete non-pressure pipes
- Type, size, condition, jointing.

Joints in box culverts, manholes and inlet grids to subsurface systems

Gutters
- Condition of gutters
- Position of down pipes
- Canals from down pipes

Drainage away from structure
- No gutters
- Investigate the site drainage efficiency.
- Apron slabs (type width, position, condition)

7. GARDENING

Indicate all gardening and flower boxes in between or around structures

Inspect for type of gardening activity
- Excessive watering, algae, moss growth, type gardening and general condition

8. PAVED AREAS

Indicate on drawings all paved areas (e.g. drive ways and parking areas)

Type and current state

Accumulation of debris

Gradients

Purpose to facilitate drainage.

9. FOUNDATIONS

Foundation type

Exposed foundation or lowering of surrounding ground is causing exposure.

Termite activity

10. BUILDINGS

Building (original structure) (indicate in black ink)

Date of additions or alterations (indicate in red ink)

Comment on each structure individually and if known on the type foundation, bricks used etc.)
Inspect each individual structure and indicate on drawings exact positions of all cracks and magnitudes of deformation.
- Mark origin and end of all cracks on date of inspection and give indication of size.
- All cracks in excess of 1 mm and longer than 1 metre must be inspected on a regular basis and propagation thereof reported immediately.

Indicate all construction and expansion joints in buildings.

Indicate whether cracks are related to normal stress relieve, foundation settlement or heave, inadequate design or originate where different material types match, etc.

Compile exact diagrams of crack survey.

11. SWIMMING POOLS AND FISH PONDS/WATER FEATURES

Location, size, type, age, general condition

Replenishment system,

Surrounding paving

Waste/backwash and other water from swimming pools discharged system (piping or open drainage systems).

Splash drainage (impervious, brick paving, concrete paving, grass, distance). Drainage canal to collect splashed water.

Discharge point (not closer than 20 metres from pool)

Storm water drainage of area surrounding the swimming pool

Gardening of area surrounding the swimming pool

12. WATER TANKS

Type, location, condition, depth, height.

13. ELECTRICITY AND COMMUNICATION

Sleeve and draw box systems
- Condition and type. (watertight?)

Routes

Trenching, backfilling and compaction of trenches

14. SITE MAINTENANCE

General condition of site and building surrounds (general upkeep)

Presence of ash/dump pits and storm water drainage in that area

Sandpits or areas of soil removal

15. BOREHOLES FOR GROUND WATER ABSTRACTION

Position

Permission to sink boreholes as a control on dewatering.

Capacity (pump equipment).

16. GEOLOGICAL

Risk classification of the site

Indicate the known geological zones on the layout drawings.

Note site conditions (surficial soils, rock outcrop, sudden changes in soil profile, and soil consistency/type)

Sinkholes, dolines or any other depression

APPENDIX 5

TYPICAL ENGINEERING DETAILS FOR SERVICES ON DOLOMITIC LAND

Typical, minimum standard, details for engineering designs on dolomitic land are included in this section. These details and specifications are to be extended/improved to suit the site-specific conditions. All drawings and specifications are to be checked by the design Engineer.

CONTENTS:

DEPARTMENT OF PUBLIC WORKS Private Bag X65 Pretoria 0001 Tel (012) 337 2000	departmental DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS.	title DETAILS	scale N. A.	date 22/06/2006
			drawing number / type number TYPE NO DT	

WATER DETAILS: LIST OF DRAWINGS

DT 01/W	FIRE HYDRANT TYPE 1
DT 02/W	FIRE HYDRANT TYPE 2
DT 03/W	FIRE HYDRANT LAYOUT FROM OVERHEAD WATERMAIN. TYPE 3
DT 04/W	DETAIL OF FIRE HYDRANT KEY
DT 05/W	DETAIL OF HDPE WATERPIPING NEXT TO BUILDINGS.
DT 06/W	OPEN PIPE DUCT IN ROAD AND WALKWAYS WITH STANDARD RECTANGULAR, HORIZONTAL GRATING COVER.
DT 07/W	COLUMN, SUPPORT, BRACKETS AND FOUNDATION DETAILS FOR OVERHEAD WATER RETICULATION.
DT 08/W	PIPE BRACKET TO SECURE WATERPIPING TO BUILDINGS.
DT 11-1/W	CONCRETE VALVE BOX DETAILS.
DT 11-2/W	TYPICAL PIPE SCHEDULE SHEET
DT 11-3/W	VALVE BOX DETAILS FOR ISOLATING VALVE
DT 11-4/W	CONCRETE VALVE BOX DETAILS FOR ZONE METER
DT 11-5/W	CONCRETE VALVE BOX DETAILS FOR ZONE METER
DT 12/W	JUNCTION OF HDPE PIPE IN SIDEWALL
DT 16/W	CONCRETE VALVE BOX TYPE 2
DT 17/W	CONCRETE VALVE BOX TYPE 3
DT 18/W	VALVE BOX LID DETAILS FOR TYPE 1, 2 & 3
DT 19/W	EXISTING MANHOLE INLET OVER EXISTING SERVICE DUCT
DT 20/W	WATER CONNECTION TO BUILDING OVER EXISTING SERVICE
DT 21/W	NEW WATER CONNECTION TO BUIDLING
DT 24/W	CONCRETE VALVE BOX
DT 25/W	VALVE BOX LID DETAILS
DT 26/W	CONCRETE MANHOLE DETAILS
DT 27/W	CONCRETE MANHOLE DETAILS
DT 28/W	TYPICAL BOOSTER CONNECTION IN HDPE CHAMBER
DT 28-1/W	PLAN OF HDPE BOOSTER CHAMBER
DT 28-2/W	PLAN OF TYPICAL HDPE JUNCTION MANHOLE
DT 29/W	TYPICAL FIRE HYDRANT IN HDPE CHAMBER
DT 29-1/W	PLAN OF FIRE HYDRANT CHAMBER - IN LINE TYPE
DT 29-2/W	PLAN OF FIRE HYDRANT CHAMBER - ANGLE TYPED
DT 30/W	TYPICAL DETAILS OF PREFABRICATED HDPE CHAMBERS
DT 31/W	ROOF AND ACCESS COVER OF HDPE MANHOLE OVER TRAFFIC AREAS
DT 32/W	TYPICAL DETAILS OF SLEEVE PIPE SYSTEM AND ACCESS POINTS

DEPARTMENT OF PUBLIC WORKS
Private Bag X65
Pretoria
0001
Tel (012) 337 2000

departmental
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS.

title
WATER:
WATER DETAILS
LIST OF DRAWINGS.

scale
N.A.

date
22/06/2006

drawing number / type number
TYPE NO DT 00/W

DEPARTMENT OF
PUBLIC WORKS
Private Bag X65
Pretoria
0001
Tel (012) 337 2000

department
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS.

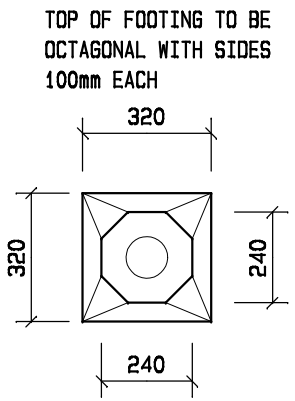
title
WATER:
FIRE HYDRANT.
TYPE 1.
(DIAGRAMMATIC)

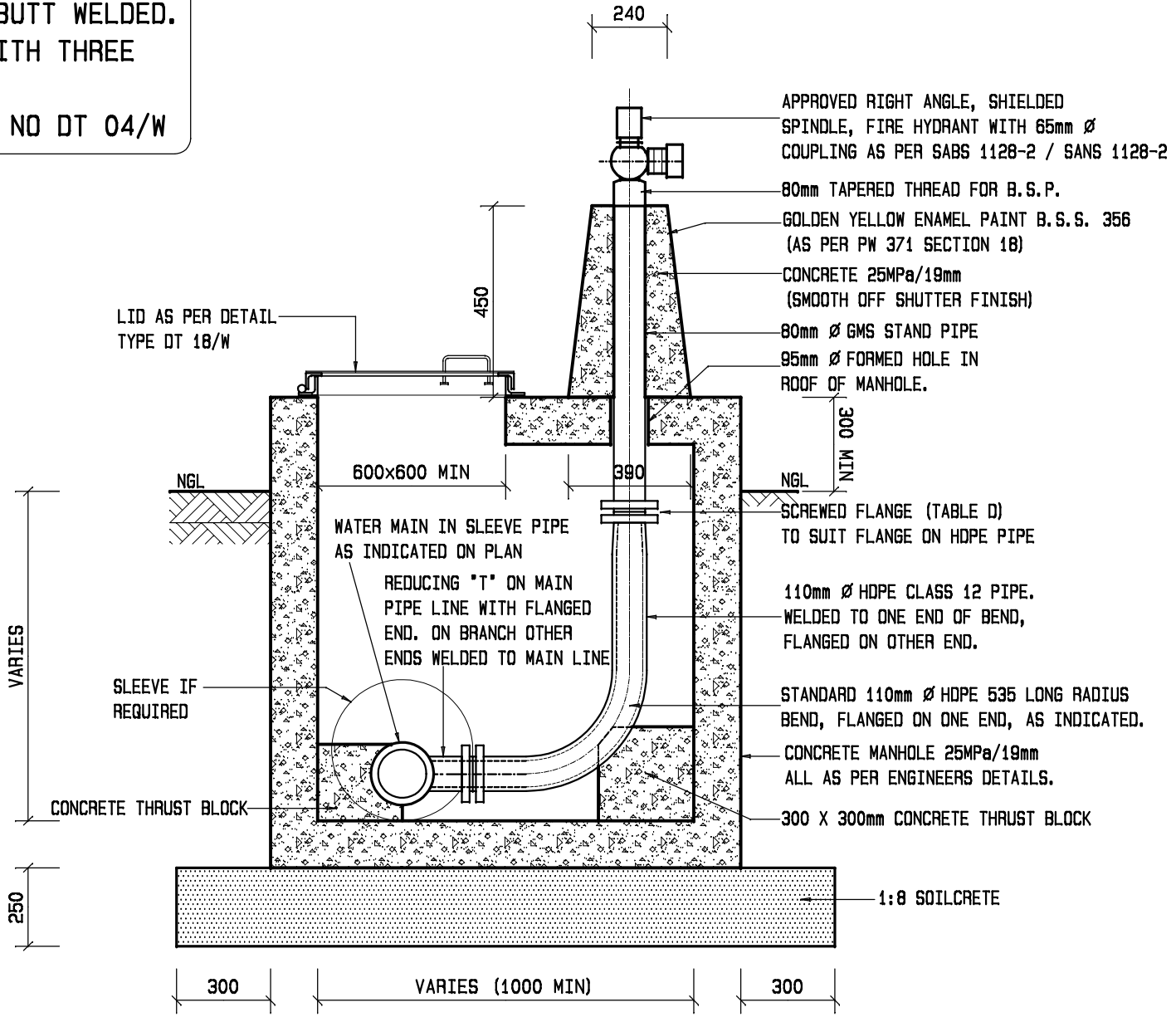
scale
1 : 20

drawing number / type number
TYPE NO DT 01/W

date
10/27/2004

NOTE:
-ALL HDPE CONNECTIONS TO BE ELECTRO-FUSION OR BUTT WELDED.
-SUPPLY EACH SITE WITH THREE HYDRANT KEYS AS PER DETAIL TYPE NO DT 04/W





DT 01/W

DEPARTMENT OF
PUBLIC WORKS
Private Bag X65
Pretoria
0001
Tel (012) 337 2000

department: DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS.

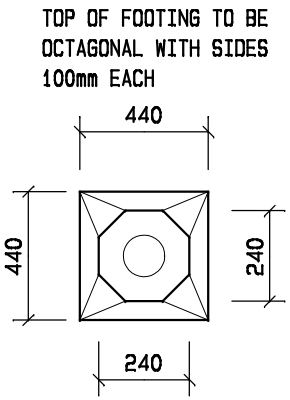
title: WATER: FIRE HYDRANT. TYPE 2. (DIAGRAMMATIC)

scale: 1 : 20

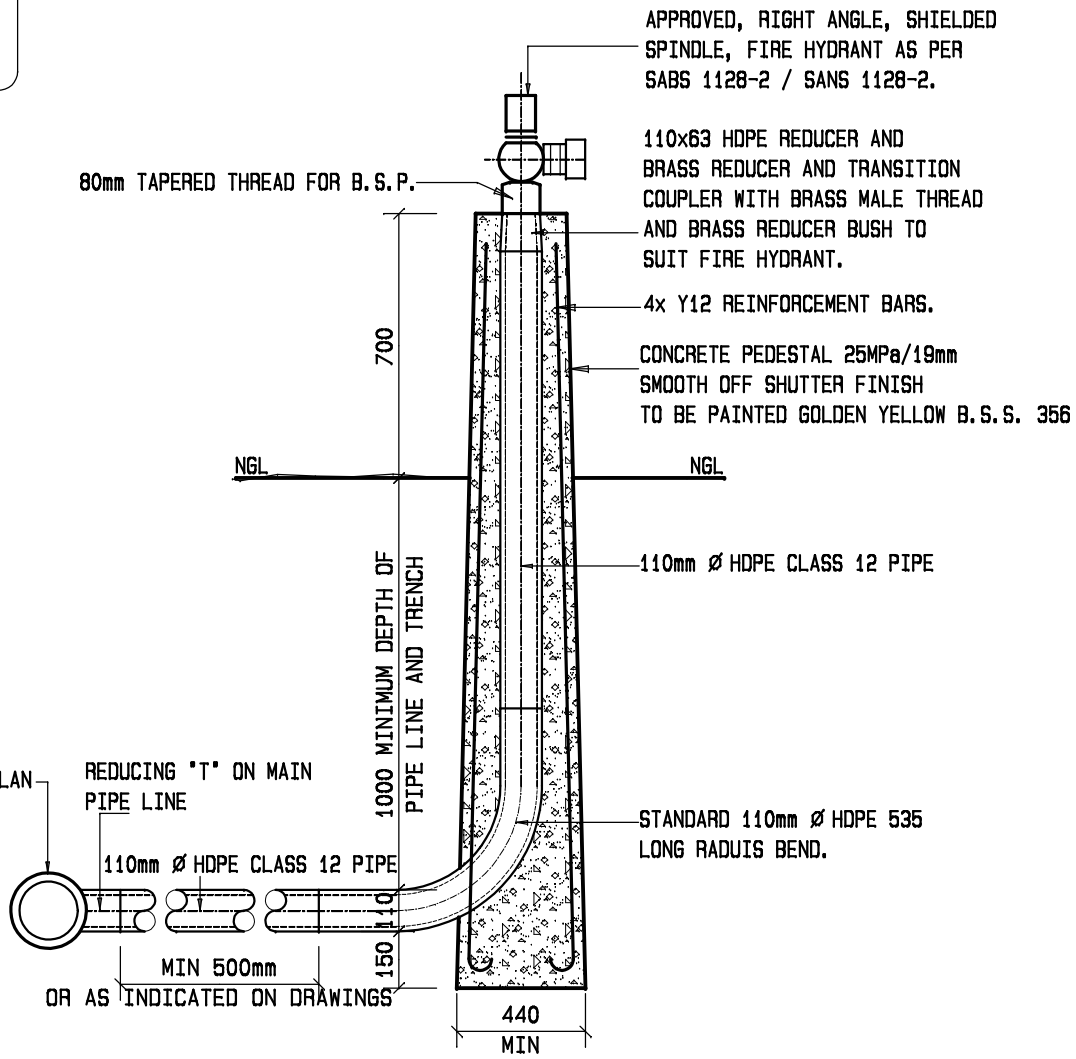
date: 10/27/2004

drawing number / type number: TYPE NO DT 02/W

NOTE:
-ALL HDPE CONNECTIONS TO BE ELECTRO-FUSION OR BUTT WELDED.
-SUPPLY EACH SITE WITH THREE HYDRANT KEYS AS PER DETAIL TYPE NO DT 04/W



TOP VIEW



DT 02/W

DEPARTMENT OF
PUBLIC WORKS
Private Bag X65
Pretoria
0001
Tel (012) 337 2000

departmental
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS.

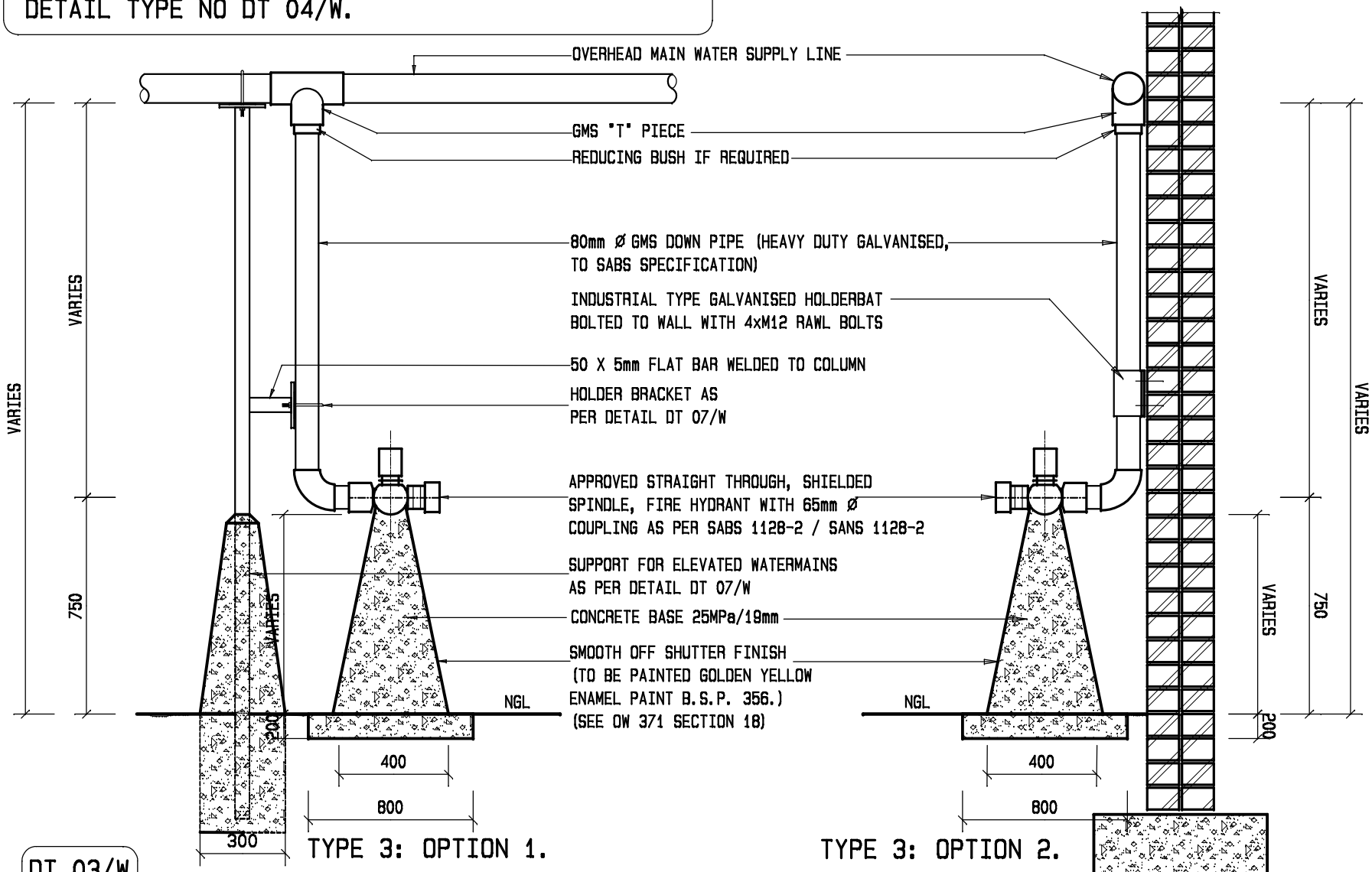
title
WATER:
FIRE HYDRANT LAYOUT FROM OVERHEAD WATERMAIN. TYPE 3.
(DIAGRAMMATIC)

scale
1 : 20

date
10/27/2004

drawing number / type number
TYPE NO DT 03/W

NOTE:
-COMPLETE UNIT TO BE HOT DIPPED GALVANISED AFTER MANUFACTURING. HEAVY DUTY (SANS 32)
-SUPPLY EACH SITE WITH THREE HYDRANT KEYS AS PER DETAIL TYPE NO DT 04/W.

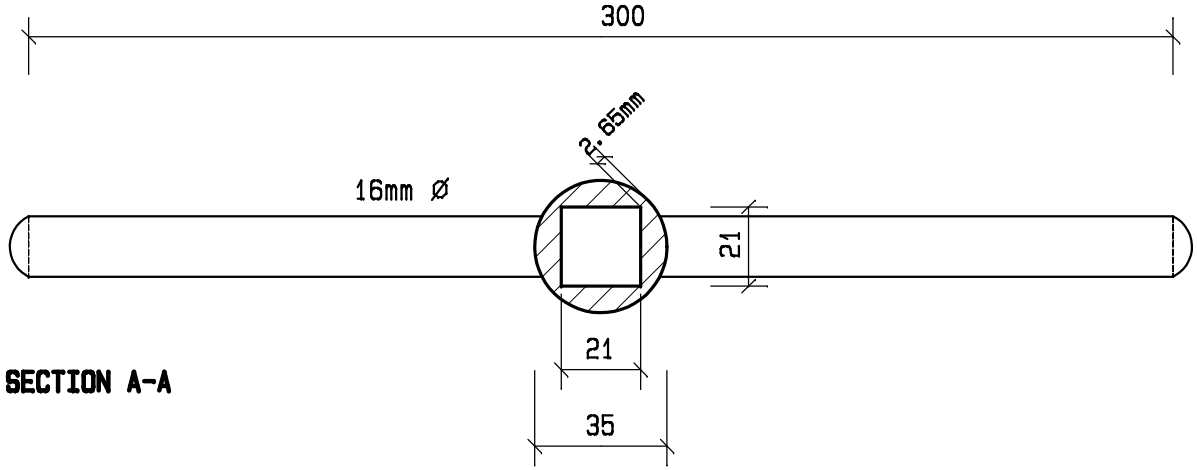


DT 03/W

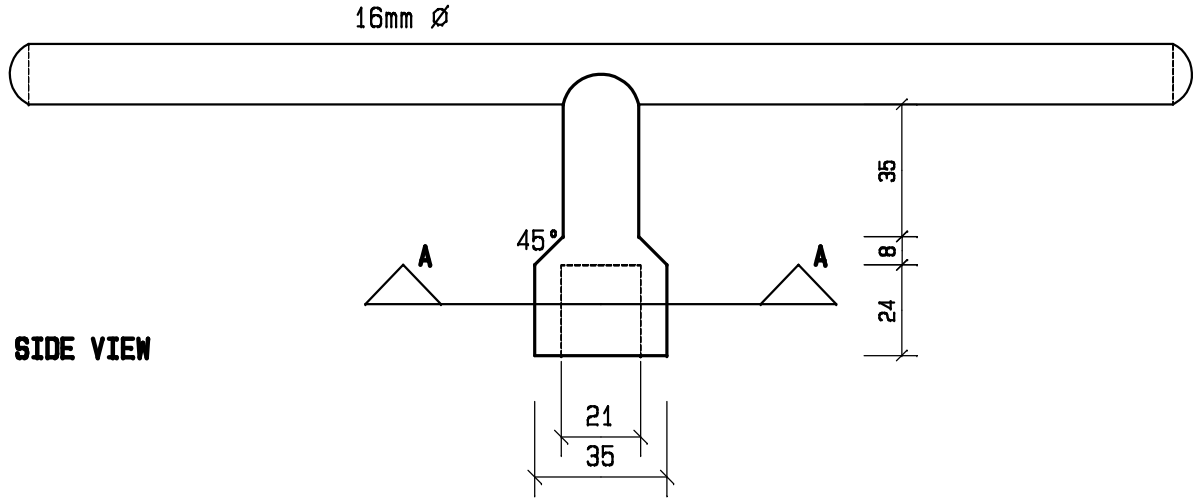
TYPE 3: OPTION 1.
FIRE HYDRANT LAYOUT
FROM OVERHEAD WATERMAIN

TYPE 3: OPTION 2.
FIRE HYDRANT LAYOUT
AGAINST BUILDING

NOTE:
-COMPLETE UNIT TO BE HOT DIPPED GALVANIZED AFTER MANUFACTURING HEAVY DUTY (SANS 32).



SECTION A-A



SIDE VIEW

DT 04W

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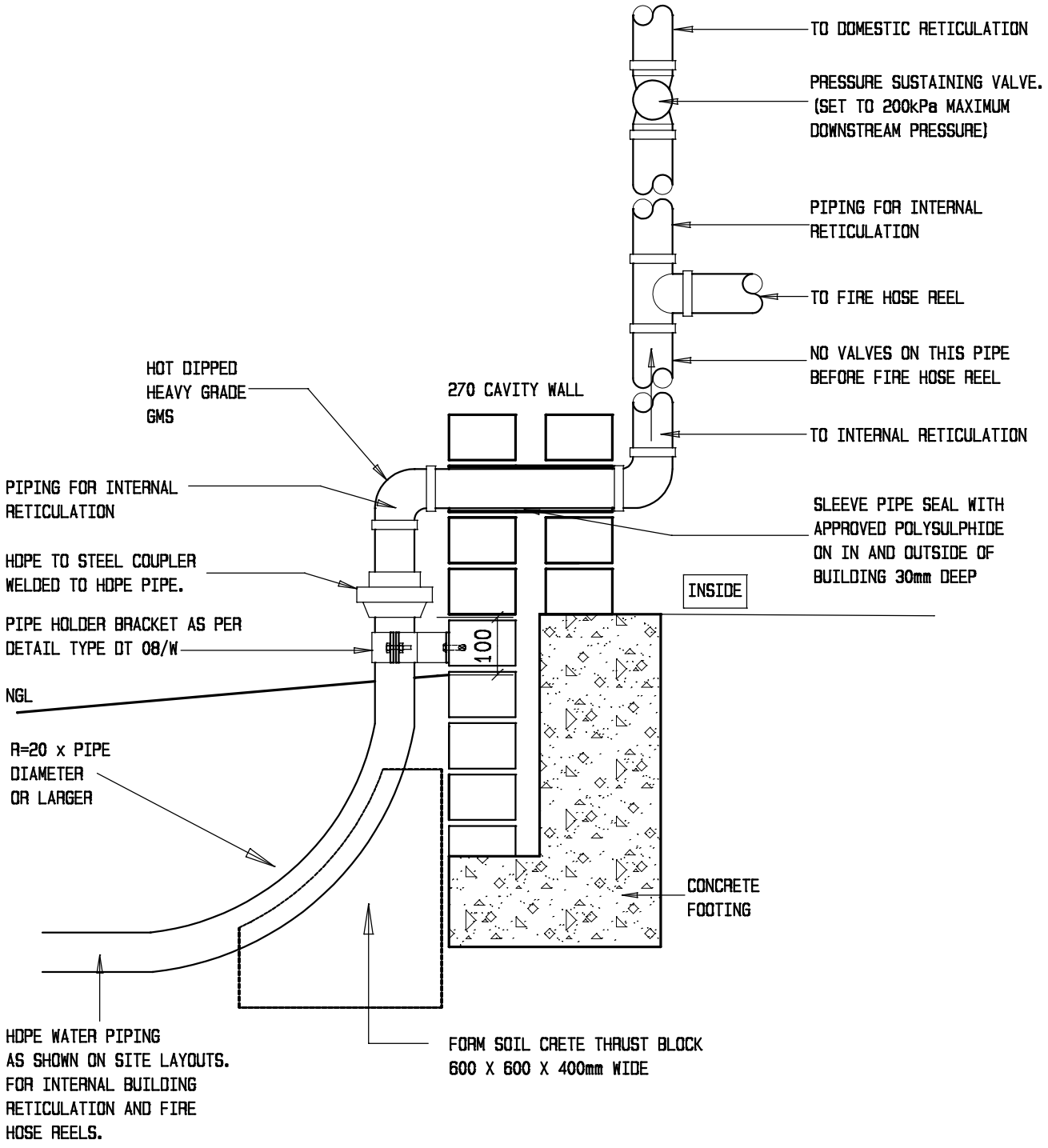
departmental
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS.

title
WATER:
DETAIL OF FIRE HYDRANT KEY.
(DIAGRAMMATIC)

scale
1 : 2

date
10/27/2004

drawing number / type number
TYPE NO DT 04/W



DETAIL OF HDPE WATERPIPING (UP TO 63mmØ) NEXT TO BUILDINGS.

DT 05/W

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departmental	title	scale	date
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS.	WATER: DETAIL OF HDPE WATERPIPING NEXT TO BUILDINGS. (DIAGRAMMATIC)	1 : 10	10/27/2004

drawing number / type number: TYPE NO DT 05/W

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department
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS.

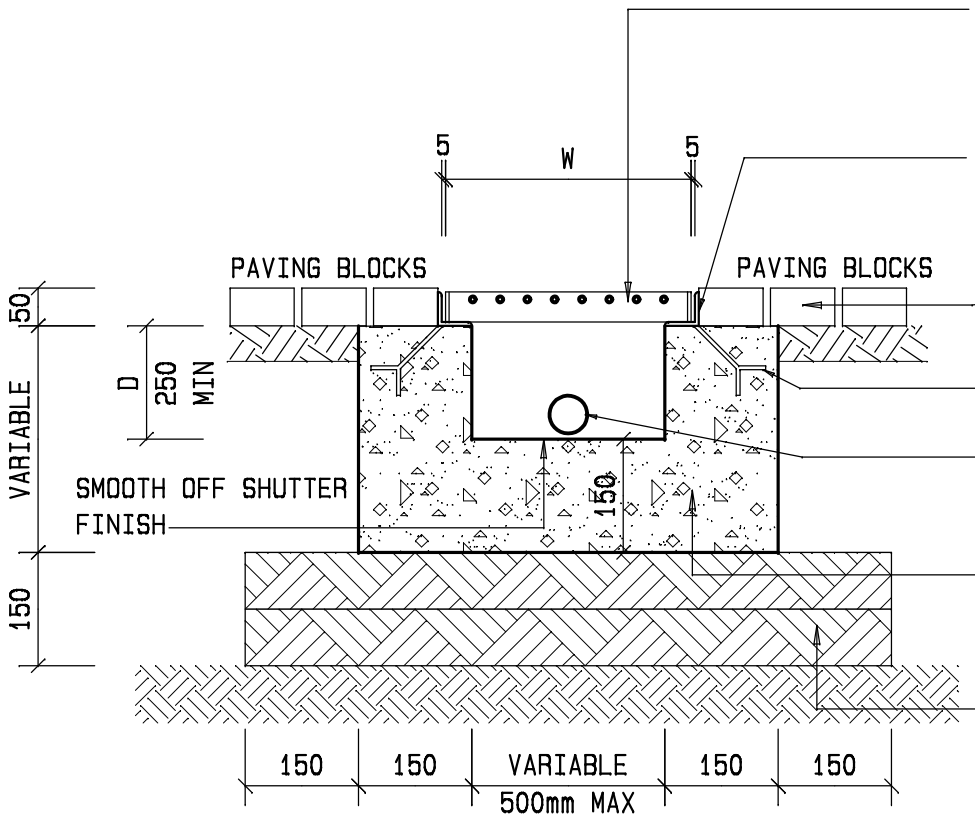
title
WATER:
OPEN PIPE DUCT IN ROAD AND WALKWAYS WITH STANDARD RECTANGULAR HORIZONTAL GRATING COVER (DIAGRAMMATIC)

scale
1 : 10

drawing number / type number
TYPE NO DT 06/W

date
10/27/2004

NOTE:
-COMPLETE UNIT TO BE HOT DIPPED GALVANIZED AFTER MANUFACTURING HEAVY DUTY (SANS 32).
-ALLOW FOR WATER DRAINAGE FROM DUCT TO STORM WATER SYSTEM



RECTANGULAR CATWALK TYPE HORIZONTAL STEEL GRATING TRENCH COVER (HEAVY DUTY)
EDGE AND CROSS BARS 40 X 4.5mm
LONGITUDINAL BARS 25 X 4.5mm
GRATING TO BE HOT DIPPED GALVANISED AFTER MANUFACTURING
GRATING TO BE "BANDED".

45X45mmX5mm HOT DIPPED GALVANISED ANGLE IRON TO SEAT GRATING, WITH TIE BACK BAR.

50mm THICK PAVING BLOCKS

75 x 25 x 5mm FLAT IRON ANCHOR IN CONCRETE

GMS PIPE

30 MPa / 19mm CONCRETE

COMPACT TO 95% MOD AASHTO DENSITY.

DT 06/W

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department: DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS.

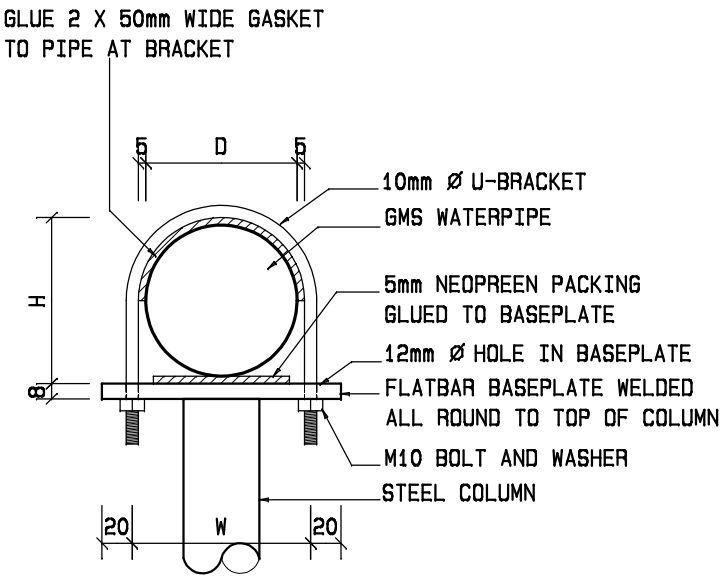
title: WATER: COLUMN, SUPPORT, BRACKETS AND FOUNDATION DETAILS FOR OVERHEAD WATER RETICULATION. (DIAGRAMMATIC)

scale: 1:5 & 1:20

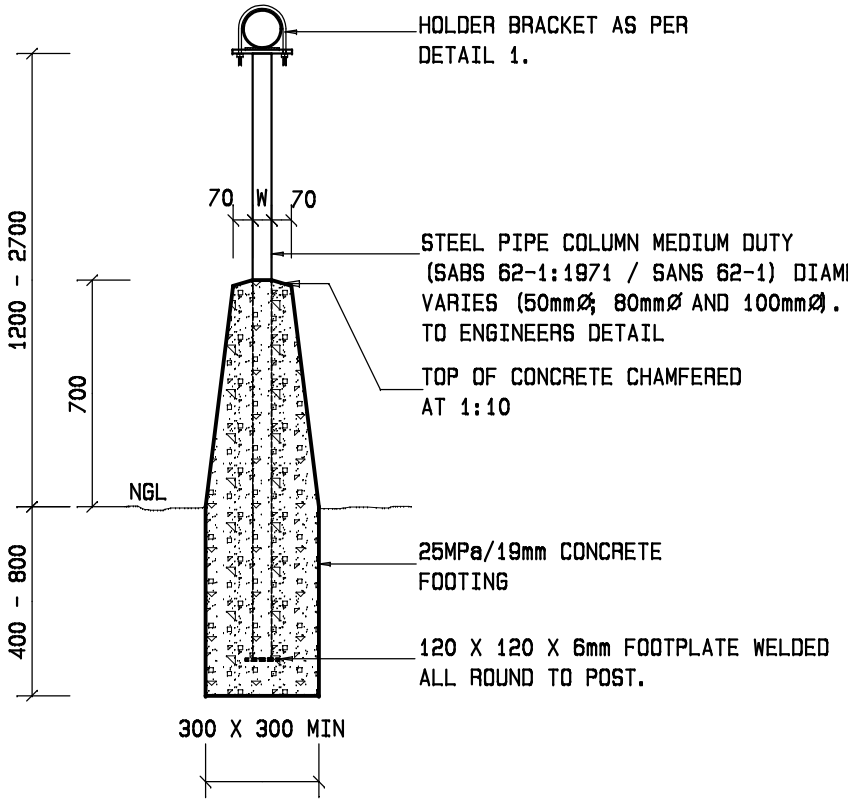
drawing number / type number: TYPE NO DT 07/W

date: 10/27/2004

NOTE:
-COMPLETE UNIT TO BE HOT DIPPED GALVANIZED AFTER MANUFACTURING HEAVY DUTY (SANS 32).
-W AND D TO ENGINEERS DETAIL FOR COLUMN AND PIPE SIZE SYSTEM



DETAIL 1:
TOP HOLDER BRACKET FOR
OVERHEAD WATER RETICULATION.
SCALE 1:5



OVERHEAD WATERPIPE
SUPPORT STAYS.
SCALE 1:20

DT 07/W

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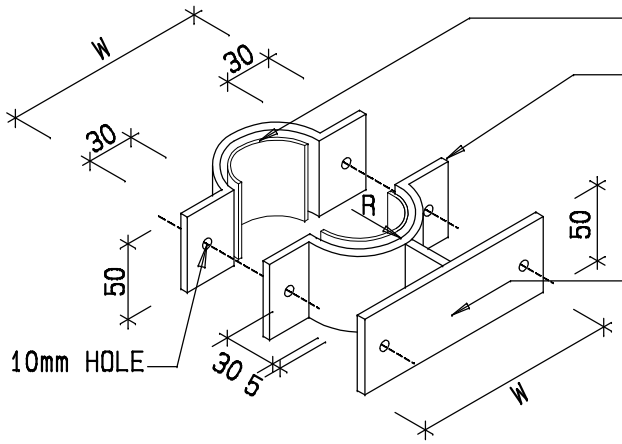
NOTE:
-COMPLETE UNIT TO BE HOT DIPPED GALVANIZED AFTER MANUFACTURING HEAVY DUTY (SANS 32).
-BRACKET SUITABLE FOR PIPE SIZE UP TO 63mmØ.



2mm NEOPRENE GASKET GLUED ON ALL BRACKETS

50mm WIDE x 5mm THICK PIPE HOLDER BRACKET BEND TO FIT SIZE OF HDPE PIPE, WITH WINGS AS SHOWN (2 X 10mm Ø HOLES AND 2 X 8mm Ø NUTS AND BOLTS).

50 x 50 x 5mm MILD STEEL BASEPLATE WITH 2 x 10mm Ø HOLES DRILLED AND FIXED TO WALL WITH M8 RAWL BOLTS.

R = PIPE DIAMETER (OD) + 2mm
W = R + 72mm

DT 08/W

department
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS.

title
WATER:
PIPE BRACKET TO SECURE WATERPIPING TO BUILDINGS.
(DIAGRAMMATIC)

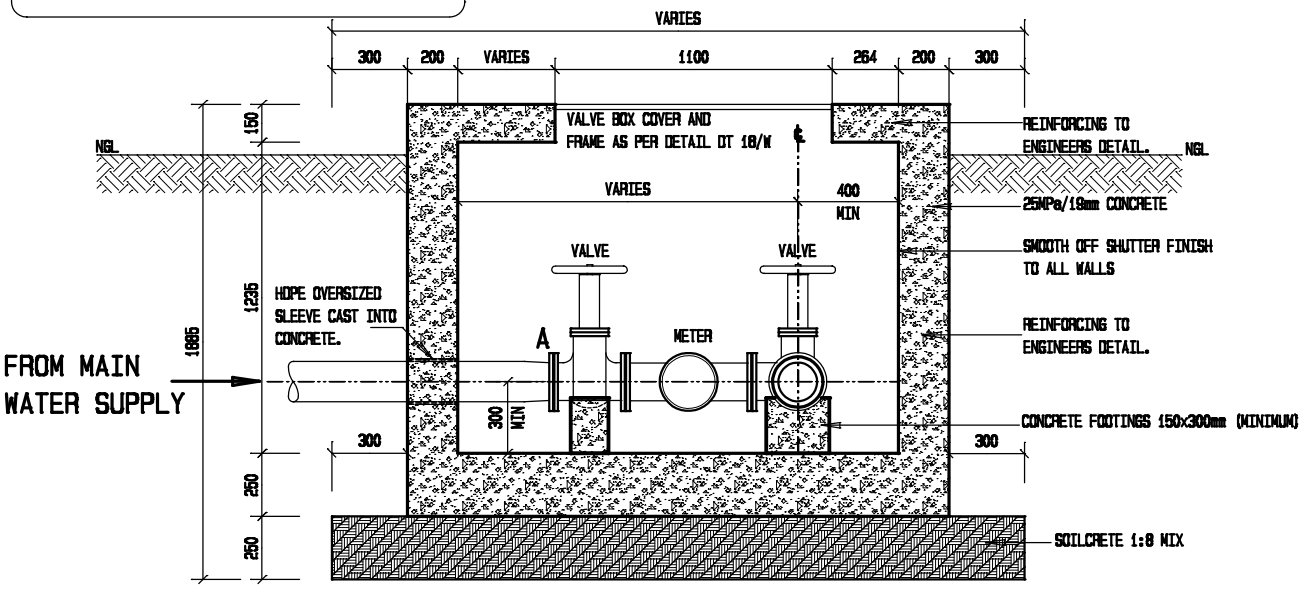
scale
1 : 5

date
10/27/2004

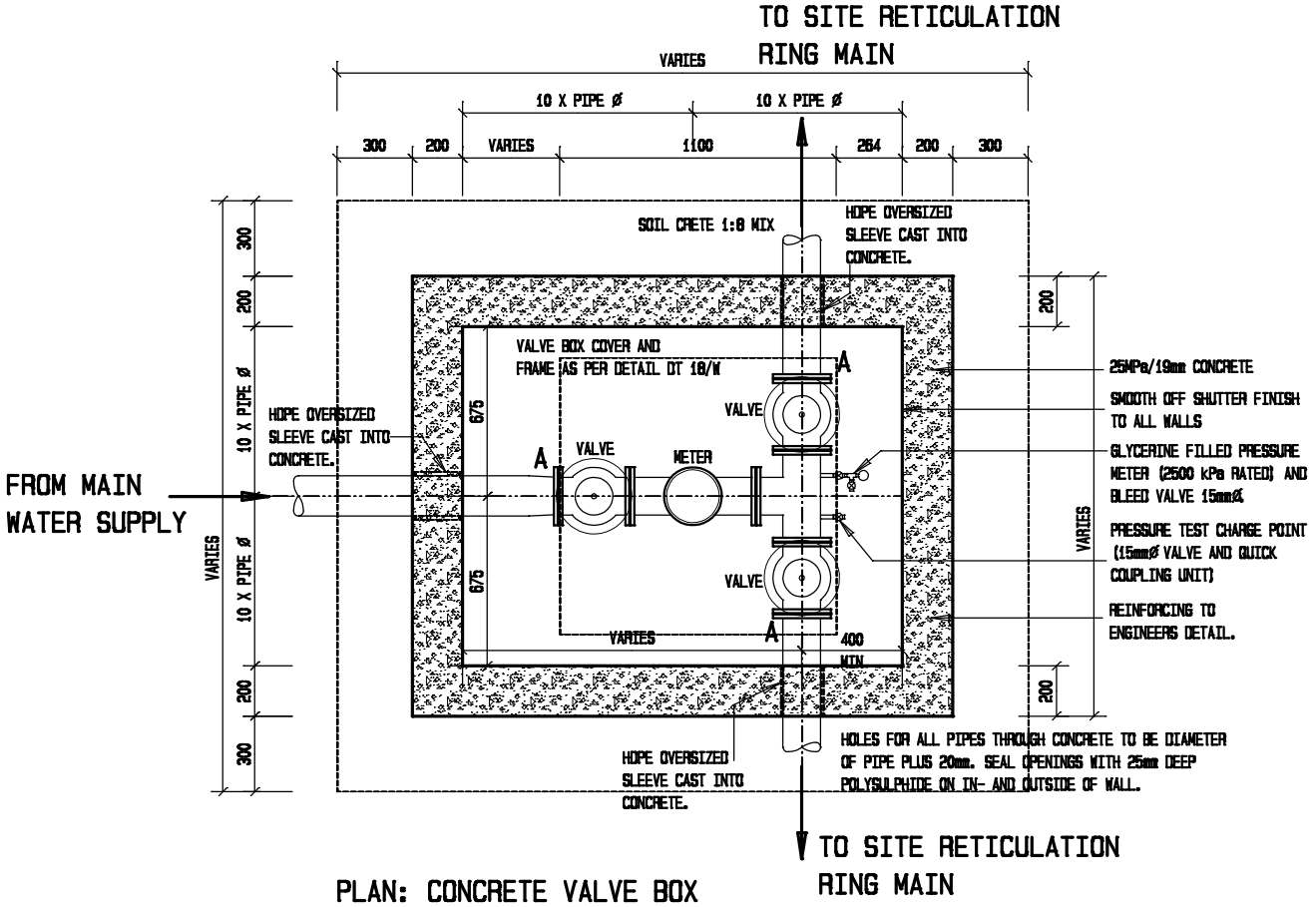
drawing number / type number
TYPE NO DT 08/W

NOTE:
-FOR PIPE SCHEDULE FORMAT SEE DETAIL TYPE NO DT 11(2)/W
-ALL VALVES TO BE RIGHT HAND CLOSING.

A = STUB AND FLANGE WELDED TO HDPE PIPE AND FLANGE ADAPTORS TO PIPE END AND VALVE AS WELL AS VJ (STEPPED IF NEEDED) COUPLING IN BETWEEN TO LOOSEN FITTINGS IN VALVE BOX
ALL FITTINGS TO BE NUMBERED P1,P2 ETC.
AND INDICATED IN PIPE SCHEDULE.



SECTION: CONCRETE VALVE BOX



PLAN: CONCRETE VALVE BOX

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departmental	DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS.
title	WATER: CONCRETE VALVE BOX DETAILS. (DIAGRAMMATIC)
scale	1 : 30
date	10/27/2004
drawing number / type number	TYPE NO DT 11-1/W

PIPE MARK OR FITTING	NUMBER	DIAMETER	DESCRIPTION	MATERIAL	SABS (SPEC)	CLASS	DRILLING TABLE	THREAD SIZE (mm)
P1								
P2								
P3								
P4								
P5								
P6								
P7								
P8								
P9								
P10								
P11								
P12								
P13								
P14								
P15								
P16								
P17								
P18								
P19								
P20								
P21								
P22								

TYPICAL PIPE SCHEDULE SHEET.

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DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS.

title
WATER:
TYPICAL PIPE SCHEDULE SHEET.
(DIAGRAMMATIC)

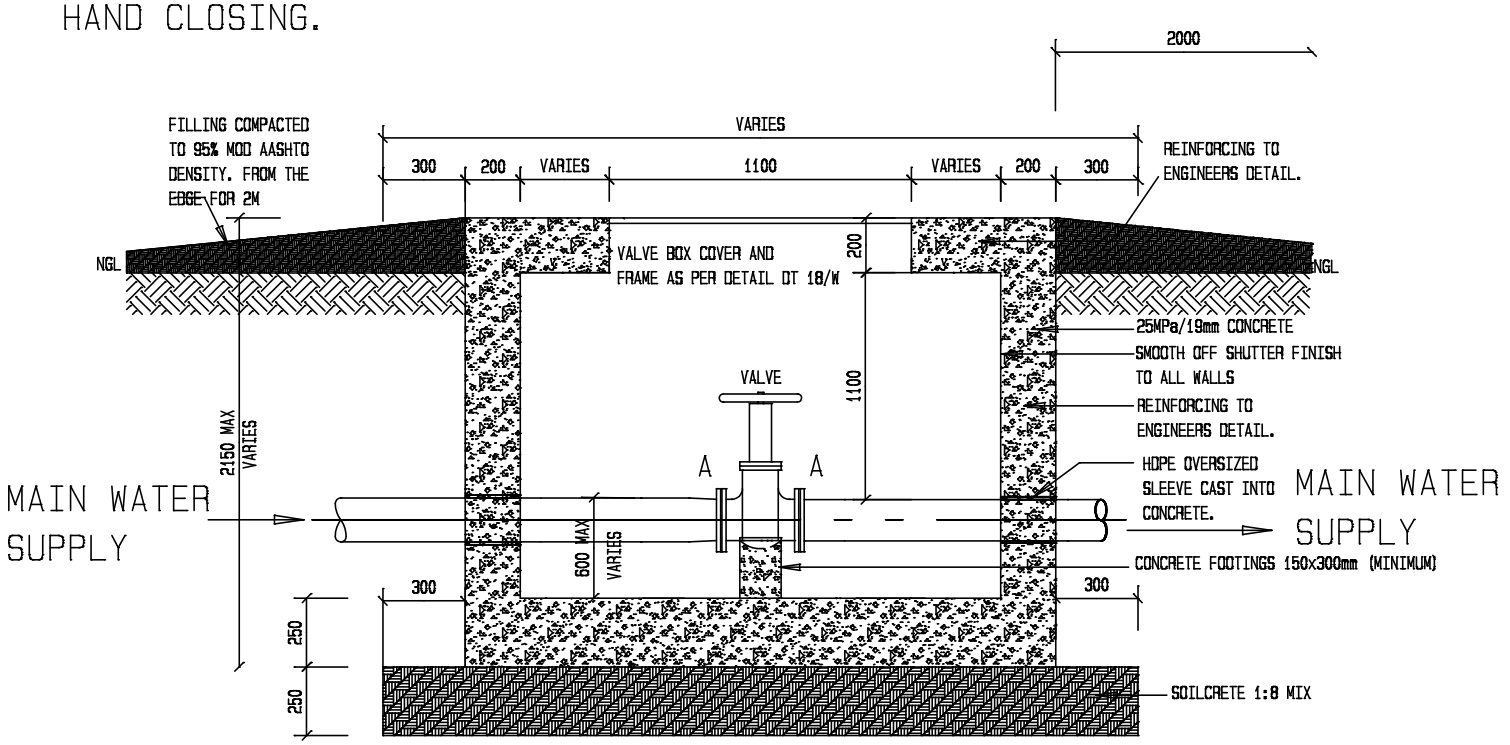
scale
N.A.

date
10/27/2004

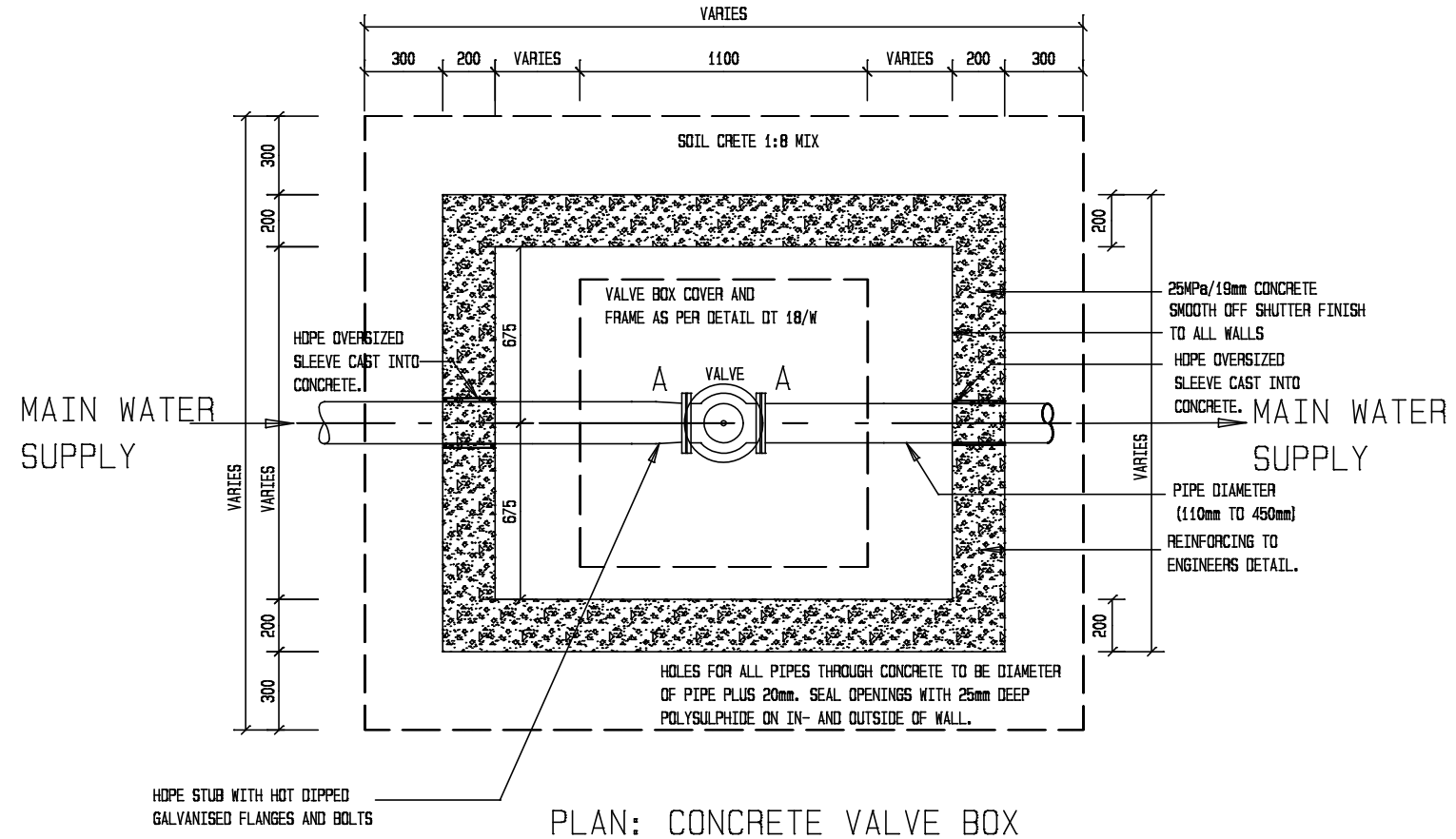
drawing number / type number
TYPE NO DT 11-2/W

NOTE:
-ALL VALVES TO BE RIGHT HAND CLOSING.

A = STUB AND FLANGE WELDED TO HDPE PIPE



SECTION: CONCRETE VALVE BOX



PLAN: CONCRETE VALVE BOX

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DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS.

title
WATER:
CONCRETE VALVE BOX DETAILS FOR ISOLATING VALVE ON BULK SYSTEM. (DIAGRAMMATIC)

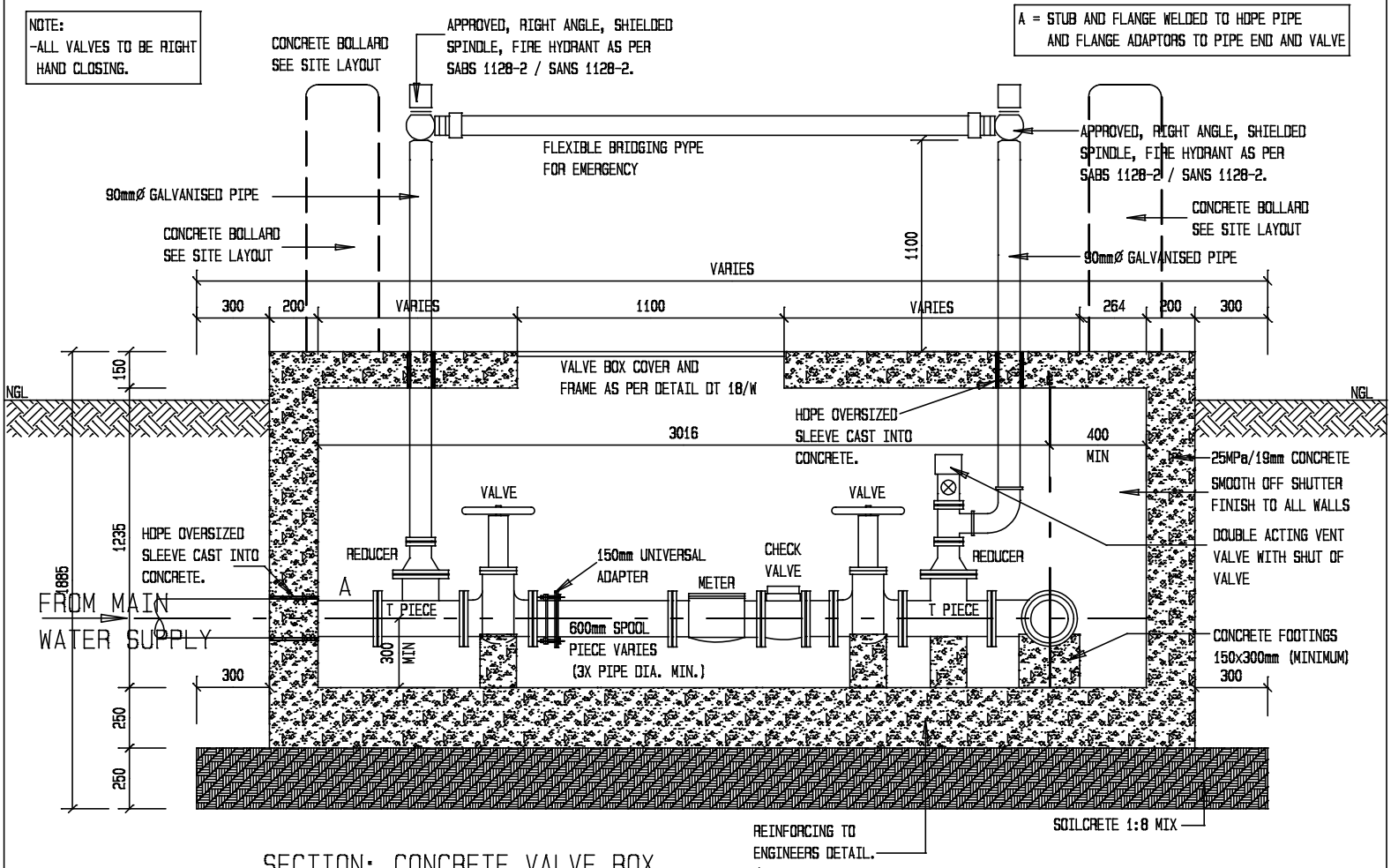
scale
1 : 30

date
22/06/2006

drawing number / type number
TYPE NO DT 11-3/W

NOTE:
-ALL VALVES TO BE RIGHT HAND CLOSING.

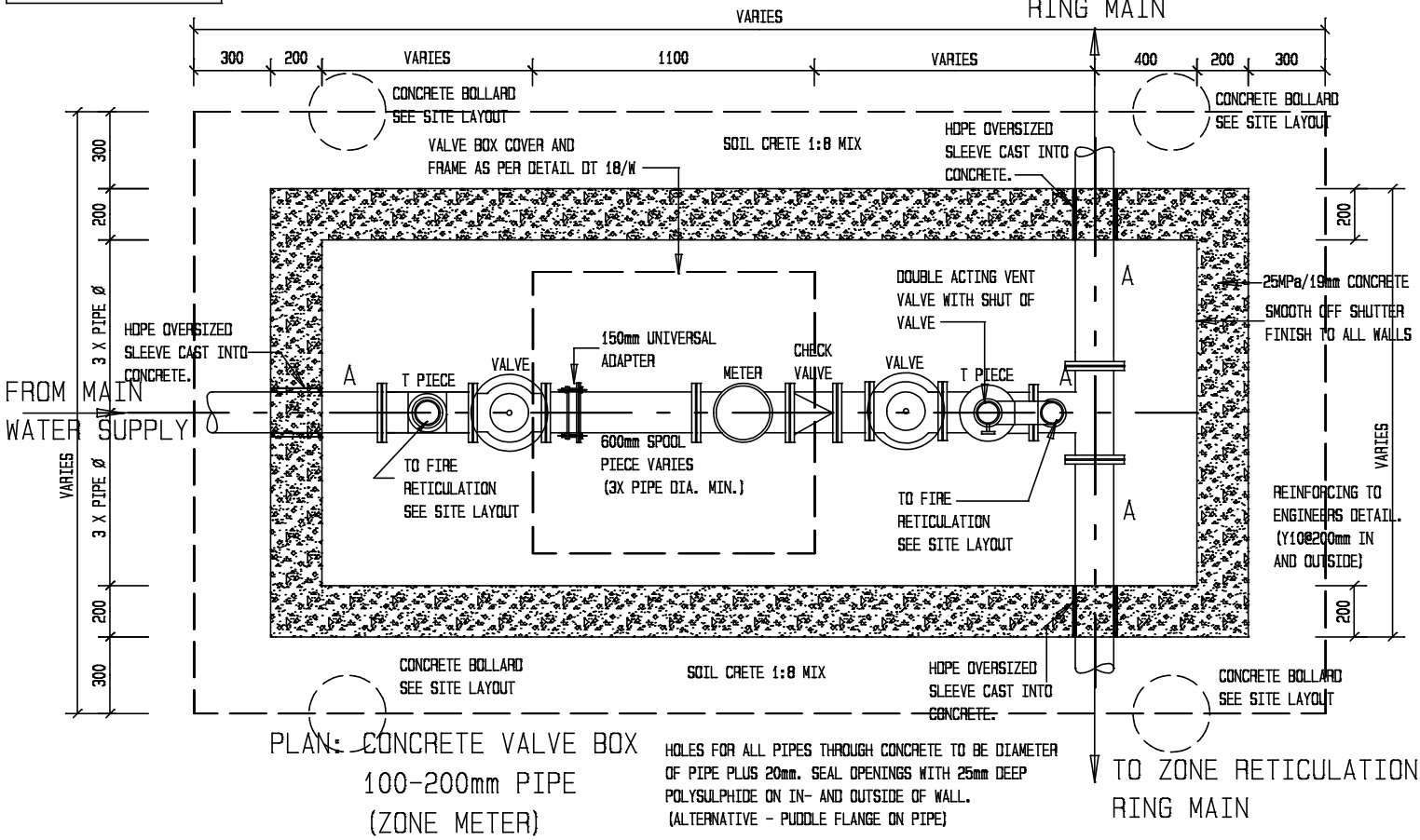
A = STUB AND FLANGE WELDED TO HDPE PIPE AND FLANGE ADAPTORS TO PIPE END AND VALVE



SECTION: CONCRETE VALVE BOX

FLANGE DRILLING TO:
BS4504 TABLE 16
SABS 1123 TABLE 1600/3 PN16

TO ZONE RETICULATION RING MAIN



PLAN: CONCRETE VALVE BOX
100-200mm PIPE
(ZONE METER)

HOLES FOR ALL PIPES THROUGH CONCRETE TO BE DIAMETER OF PIPE PLUS 20mm. SEAL OPENINGS WITH 25mm DEEP POLYSULPHIDE ON IN- AND OUTSIDE OF WALL.
(ALTERNATIVE - PUDDLE FLANGE ON PIPE)

TO ZONE RETICULATION RING MAIN

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DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS.

title
WATER:
CONCRETE VALVE BOX DETAILS
(DIAGRAMMATIC)
ZONE METER

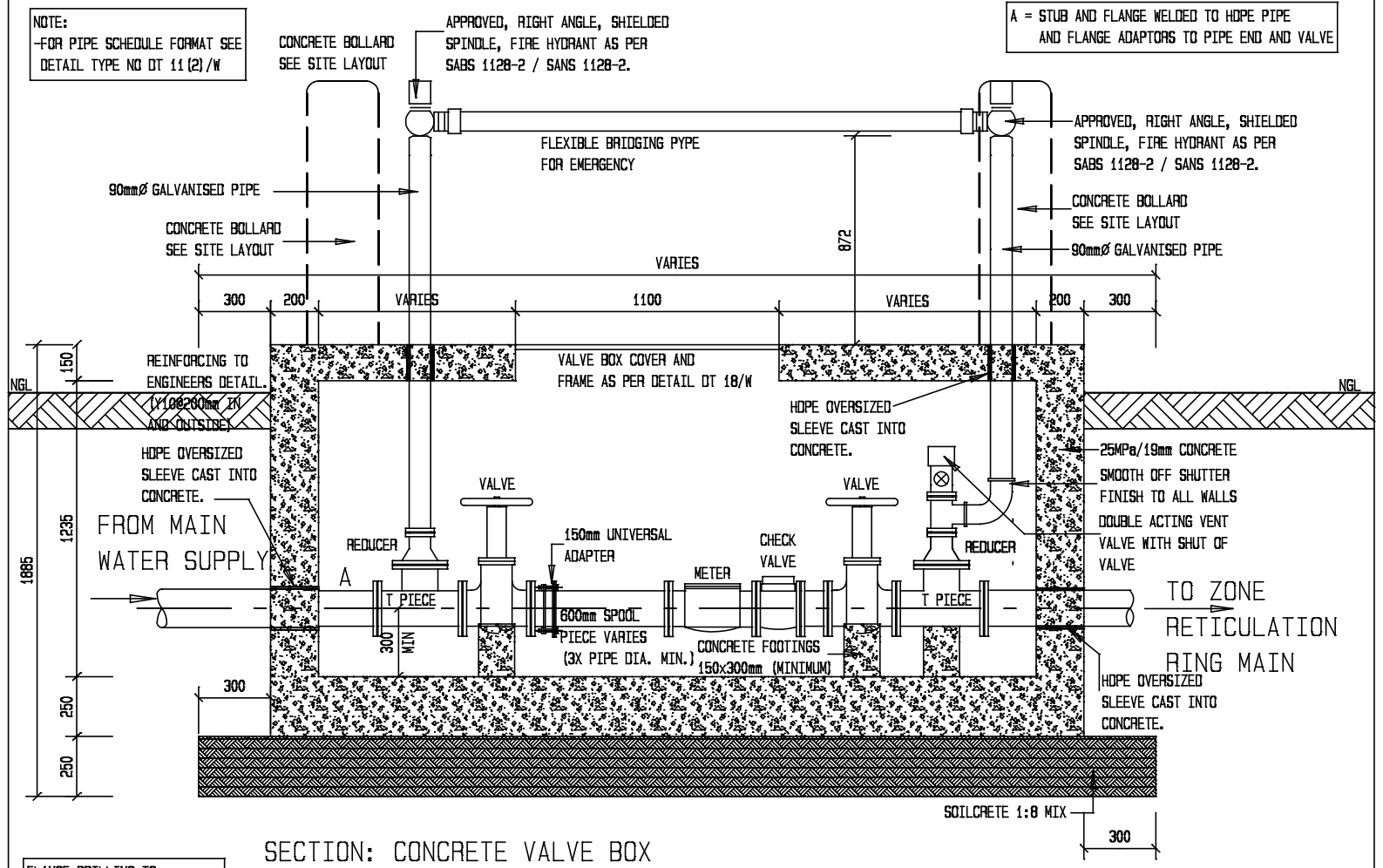
scale
1 : 30

date
22/06/2006

drawing number / type number
TYPE NO DT 11-4/W

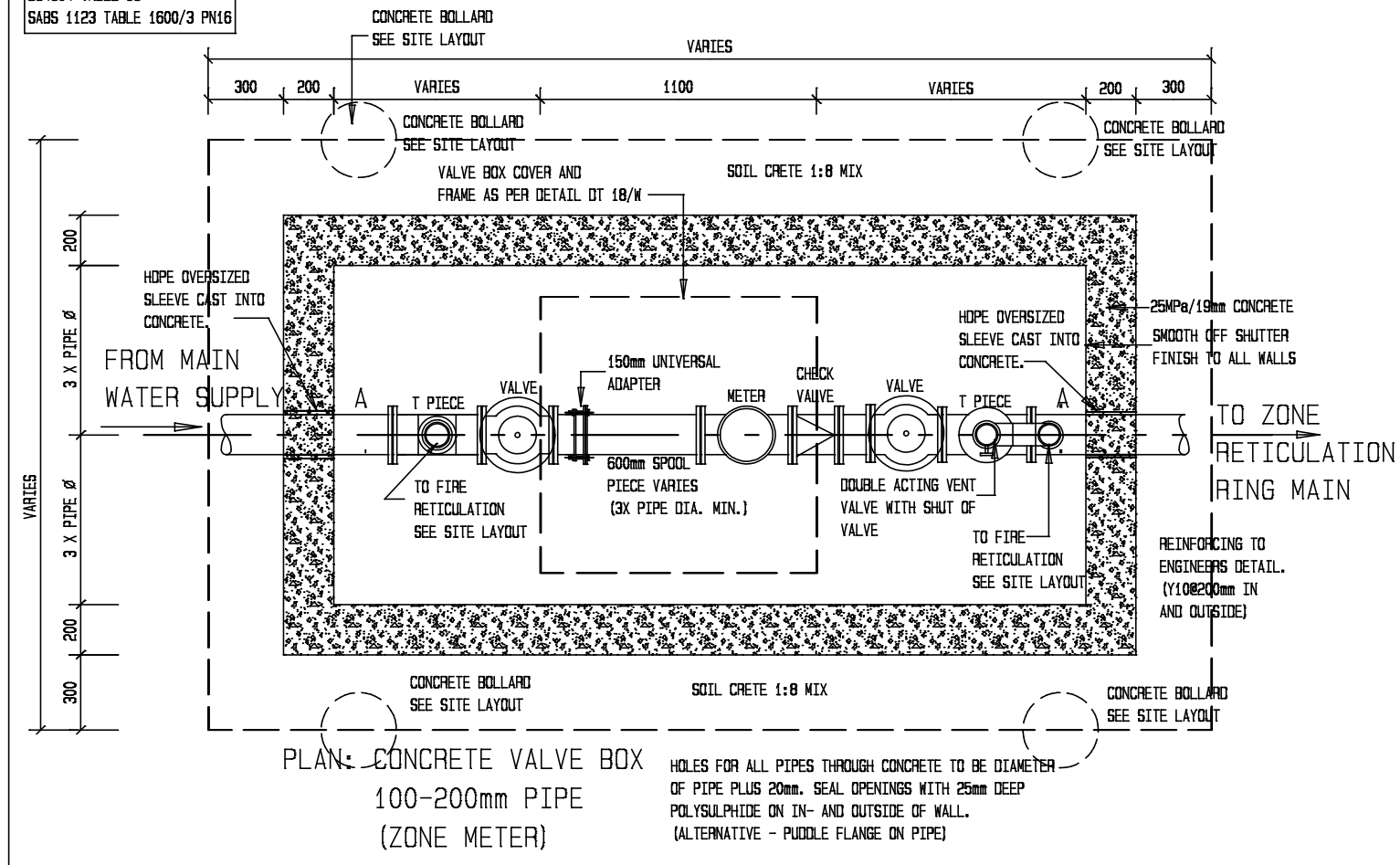
NOTE:
-FOR PIPE SCHEDULE FORMAT SEE DETAIL TYPE NO DT 11(2)/W

A = STUB AND FLANGE WELDED TO HDPE PIPE AND FLANGE ADAPTORS TO PIPE END AND VALVE



SECTION: CONCRETE VALVE BOX

FLANGE DRILLING TO:
BS4504 TABLE 16
SABS 1123 TABLE 1600/3 PN16



PLAN: CONCRETE VALVE BOX
100-200mm PIPE
(ZONE METER)

HOLES FOR ALL PIPES THROUGH CONCRETE TO BE DIAMETER OF PIPE PLUS 20mm. SEAL OPENINGS WITH 25mm DEEP POLYSULPHIDE ON IN- AND OUTSIDE OF WALL.
(ALTERNATIVE - PUDDLE FLANGE ON PIPE)

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departmental
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS.

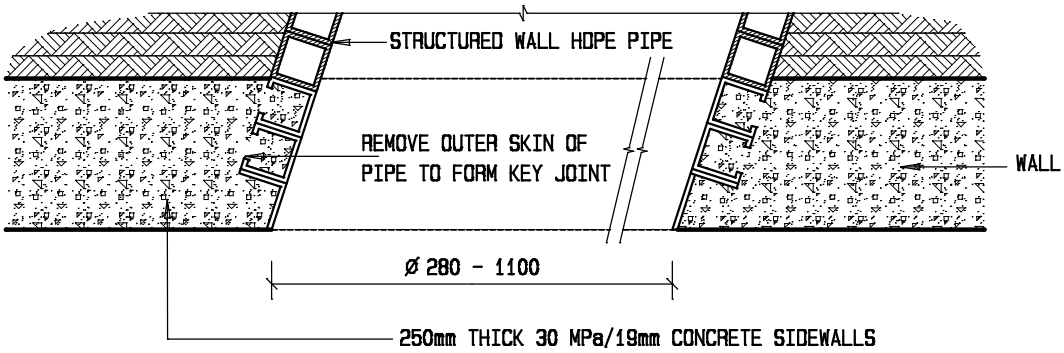
title
WATER:
CONCRETE VALVE BOX DETAILS
(DIAGRAMMATIC)
ZONE METER

scale
1 : 30

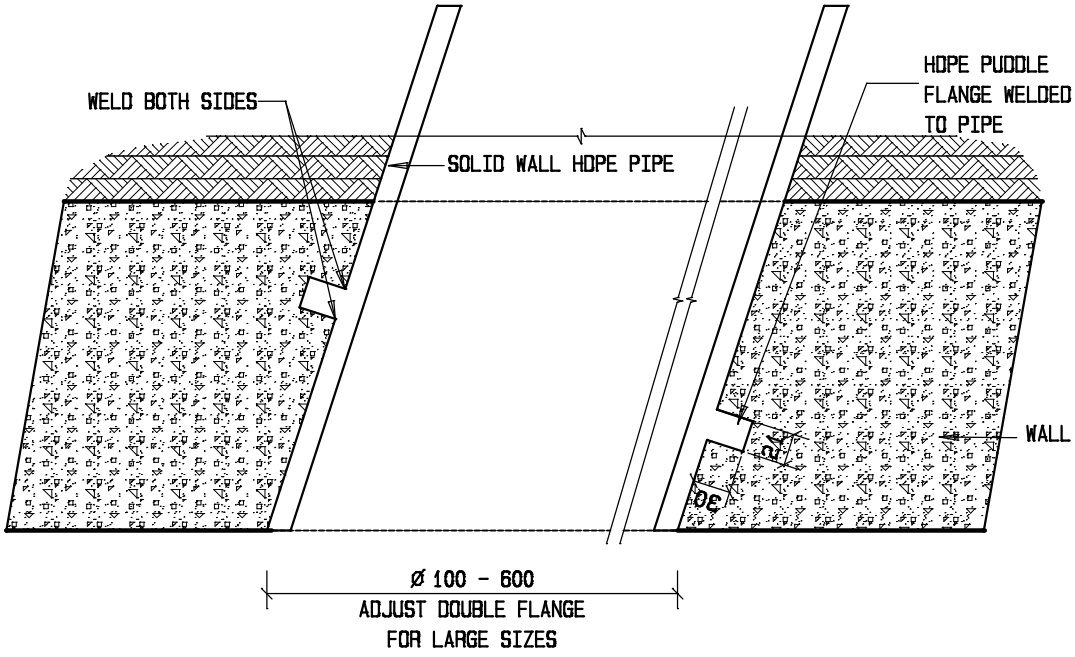
date
22/06/2006

drawing number / type number
TYPE NO DT 11-5/W

NOTE:
DETAIL APPLICABLE TO WATER, SEWER AND STORMWATER



DETAIL 1:
JUNCTION OF STRUCTURED WALL HDPE PIPE IN CONCRETE SIDEWALL.



DETAIL 2:
JUNCTION OF SOLID WALL HDPE PIPE IN CONCRETE SIDEWALL

DEPARTMENT OF PUBLIC WORKS Private Bag X65 Pretoria 0001 Tel (012) 337 2000	departmental DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS.	title WATER: JUNCTION OF HDPE PIPE IN CONCRETE SIDEWALL. (DIAGRAMMATIC)	scale N.A.	date 10/27/2004
			drawing number / type number TYPE NO DT 12/W	

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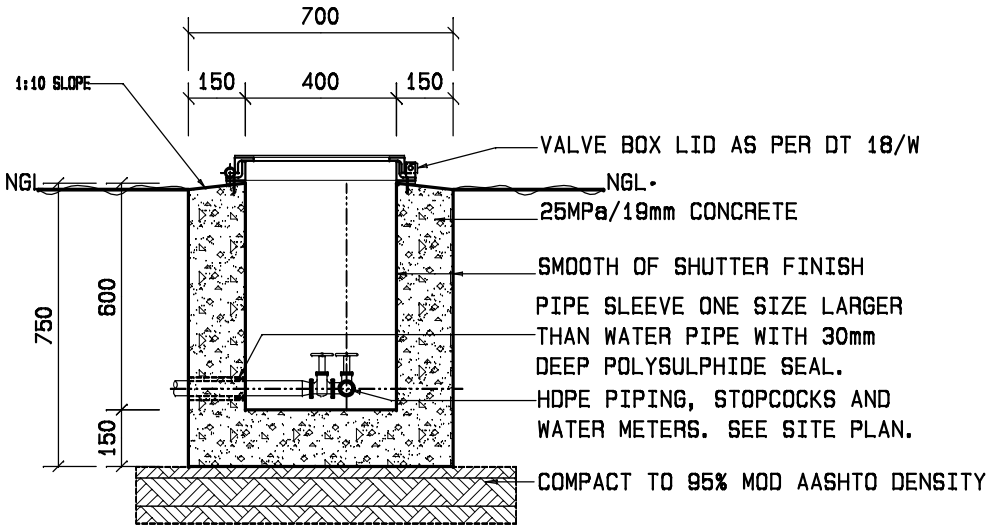
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS.

title
WATER:
CONCRETE VALVE BOX.
TYPE 2.
(DIAGRAMMATIC)

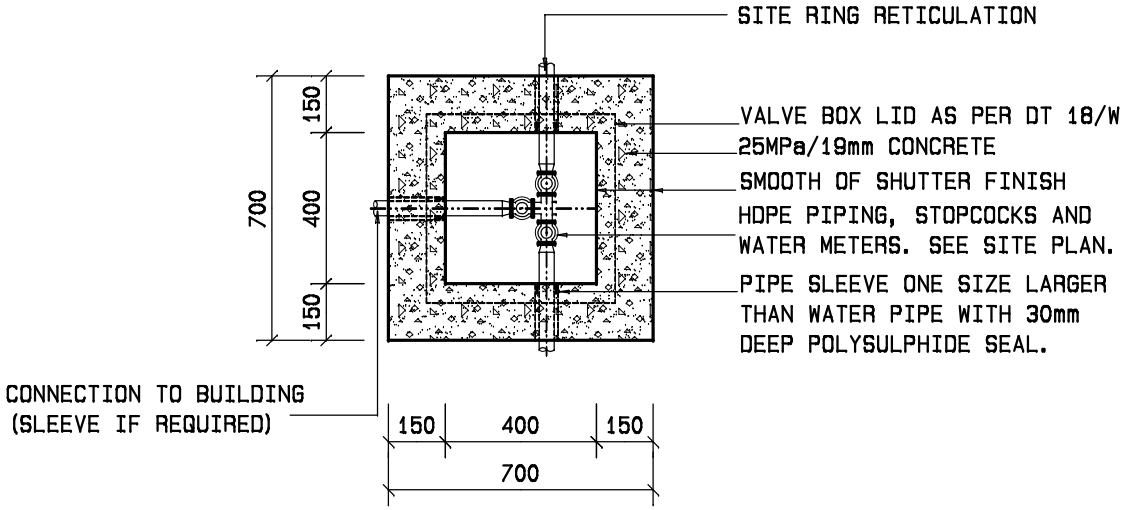
scale
1 : 20

date
10/27/2004

drawing number / type number
TYPE NO DT 16/W



SECTION: CONCRETE VALVE BOX
TYPE 2



PLAN: CONCRETE VALVE BOX FOR
CONNECTIONS TO BUILDINGS
TYPE 2

DT 16/W

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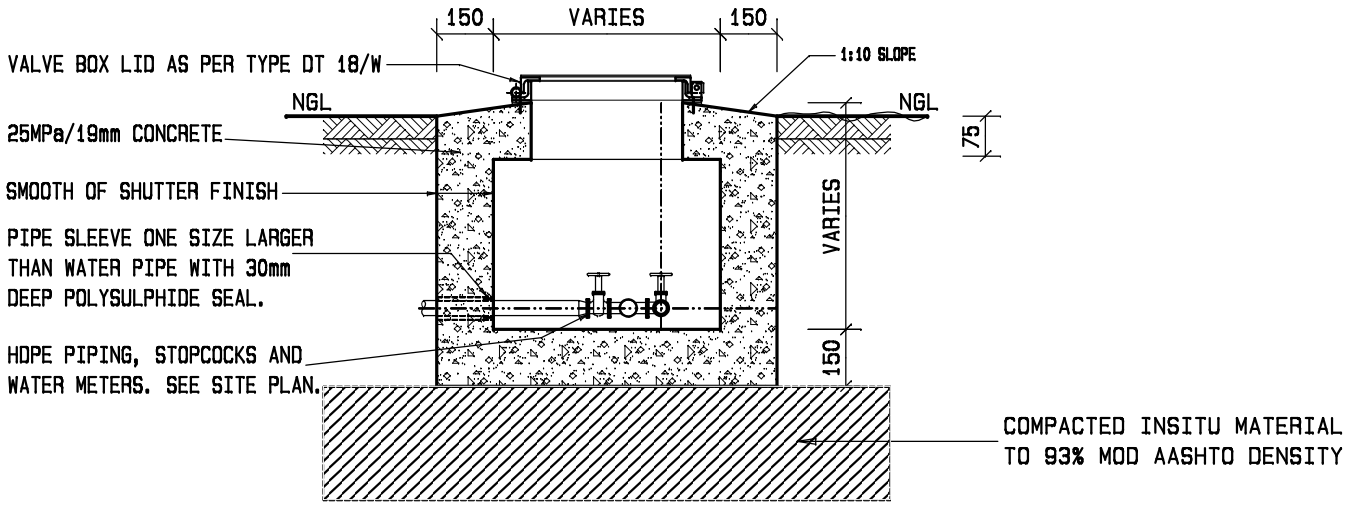
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS.

title
WATER:
CONCRETE VALVE BOX.
TYPE 3.
(DIAGRAMMATIC)

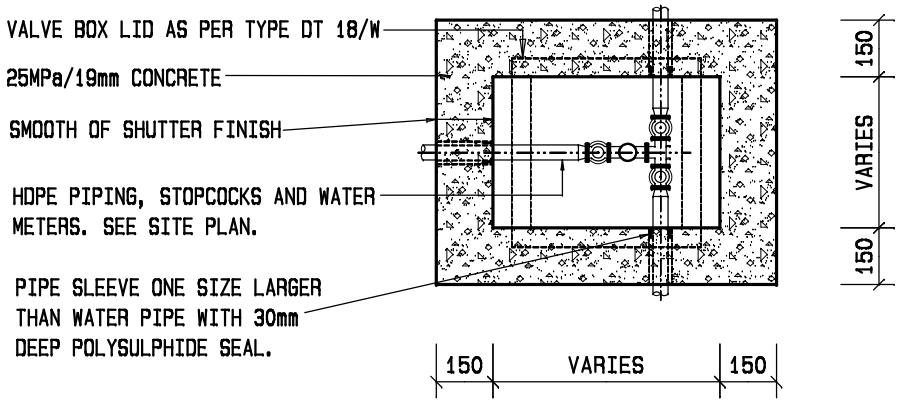
scale
1 : 10

date
10/27/2004

drawing number / type number
TYPE NO DT 17/W



SECTION: CONCRETE VALVE BOX FOR CONNECTION TO BUILDING TYPE 3



PLAN: CONCRETE VALVE BOX FOR CONNECTION TO BUILDING TYPE 3

DT 17/W

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departmental
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS.

title
WATER:
VALVE BOX LID DETAILS FOR TYPE 1, 2 & 3. (DIAGRAMMATIC)

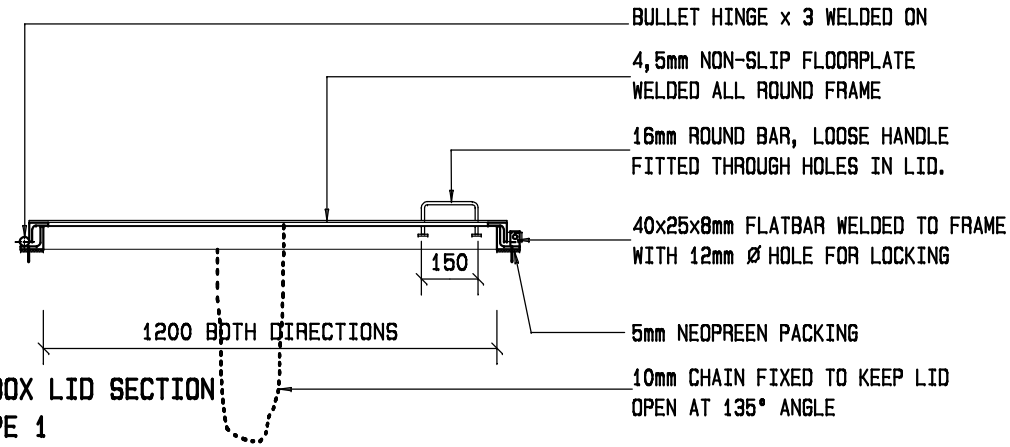
scale
1:5; 1:10 & 1:20

drawing number / type number
TYPE NO DT 18/W

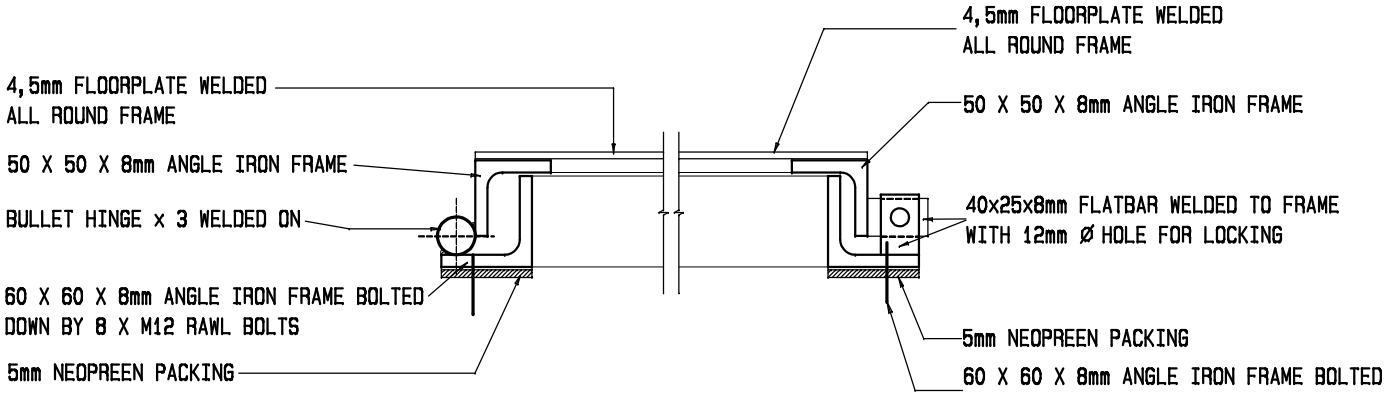
date
10/27/2004

ALL LIDS TO BE FITTED WITH LOCKS

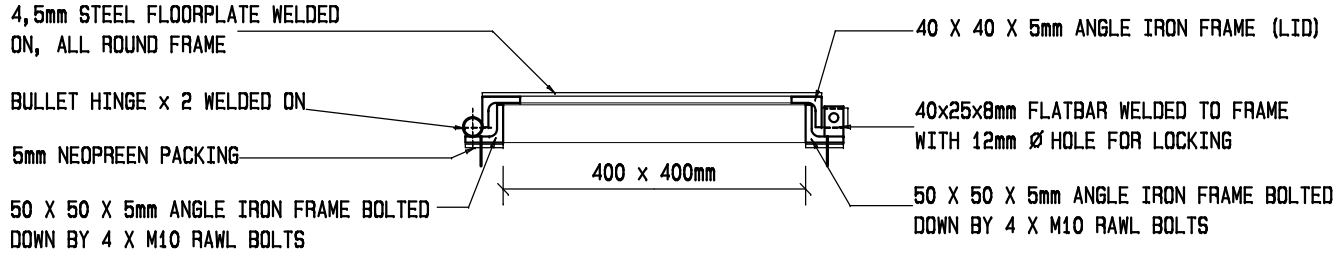
NOTE:
COMPLETE UNIT TO BE HOT DIPPED GALVANIZED AFTER MANUFACTURING.
HEAVY DUTY (SANS 32)



VALVE BOX LID SECTION
FOR TYPE 1
SCALE 1:20



VALVE BOX LID DETAIL
FOR TYPE 1
SCALE 1:5



VALVE BOX LID DETAIL
FOR TYPE 2 AND TYPE 3
SCALE 1:10

DT 18/W

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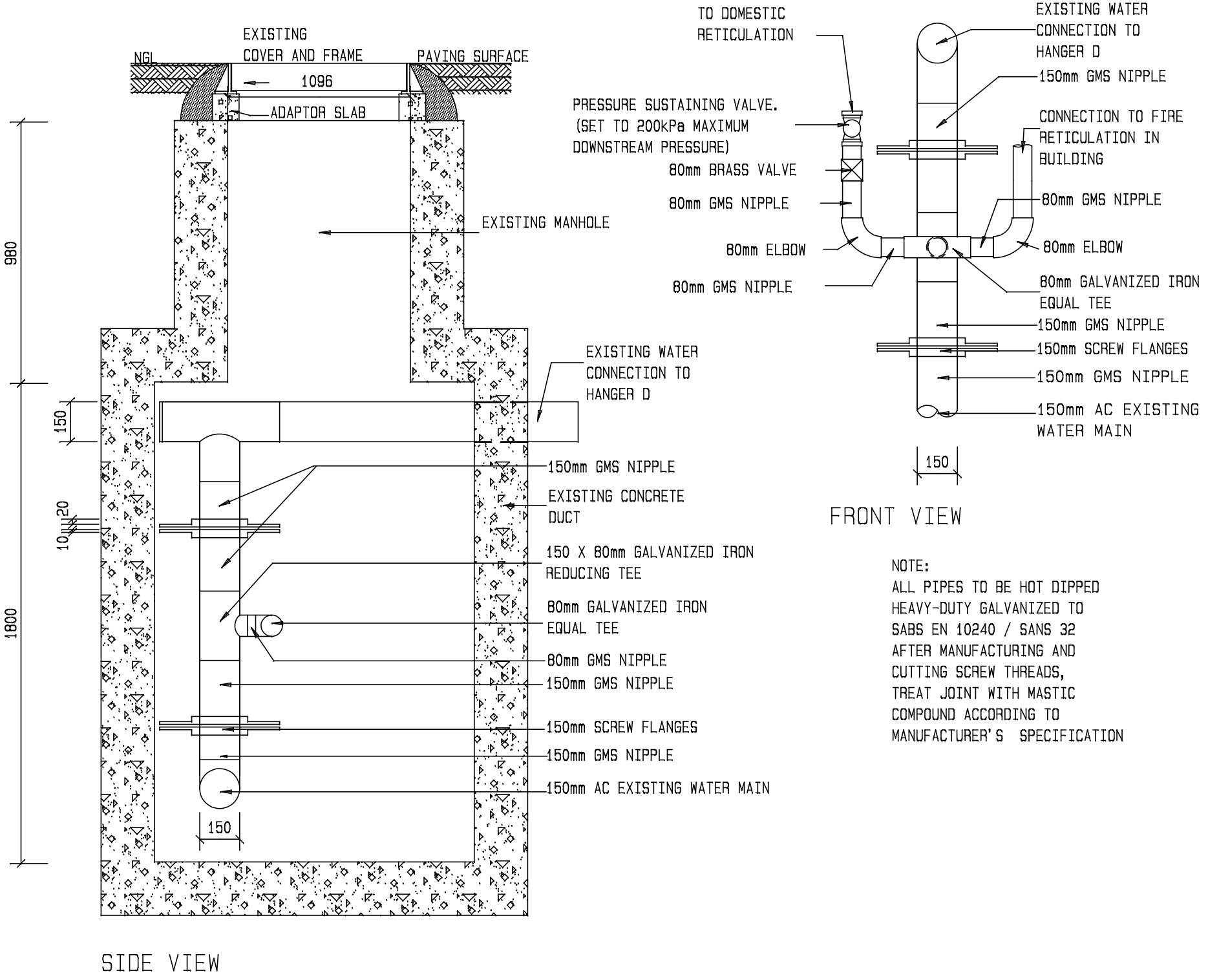
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS

title
WATER:
EXISTING MANHOLE INLET OVER EXISTING SERVICE DUCT (DIAGRAMMATIC)

scale
1:20

date
22/06/2006

drawing number / type number
TYPE NO DT 19/W



NOTE:
ALL PIPES TO BE HOT DIPPED HEAVY-DUTY GALVANIZED TO SABS EN 10240 / SANS 32 AFTER MANUFACTURING AND CUTTING SCREW THREADS, TREAT JOINT WITH MASTIC COMPOUND ACCORDING TO MANUFACTURER'S SPECIFICATION

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DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS

title

WATER:
NEW WATER CONNECTION TO BUILDING OVER EXISTING SERVICE DUCT (DIAGRAMMATIC)

scale

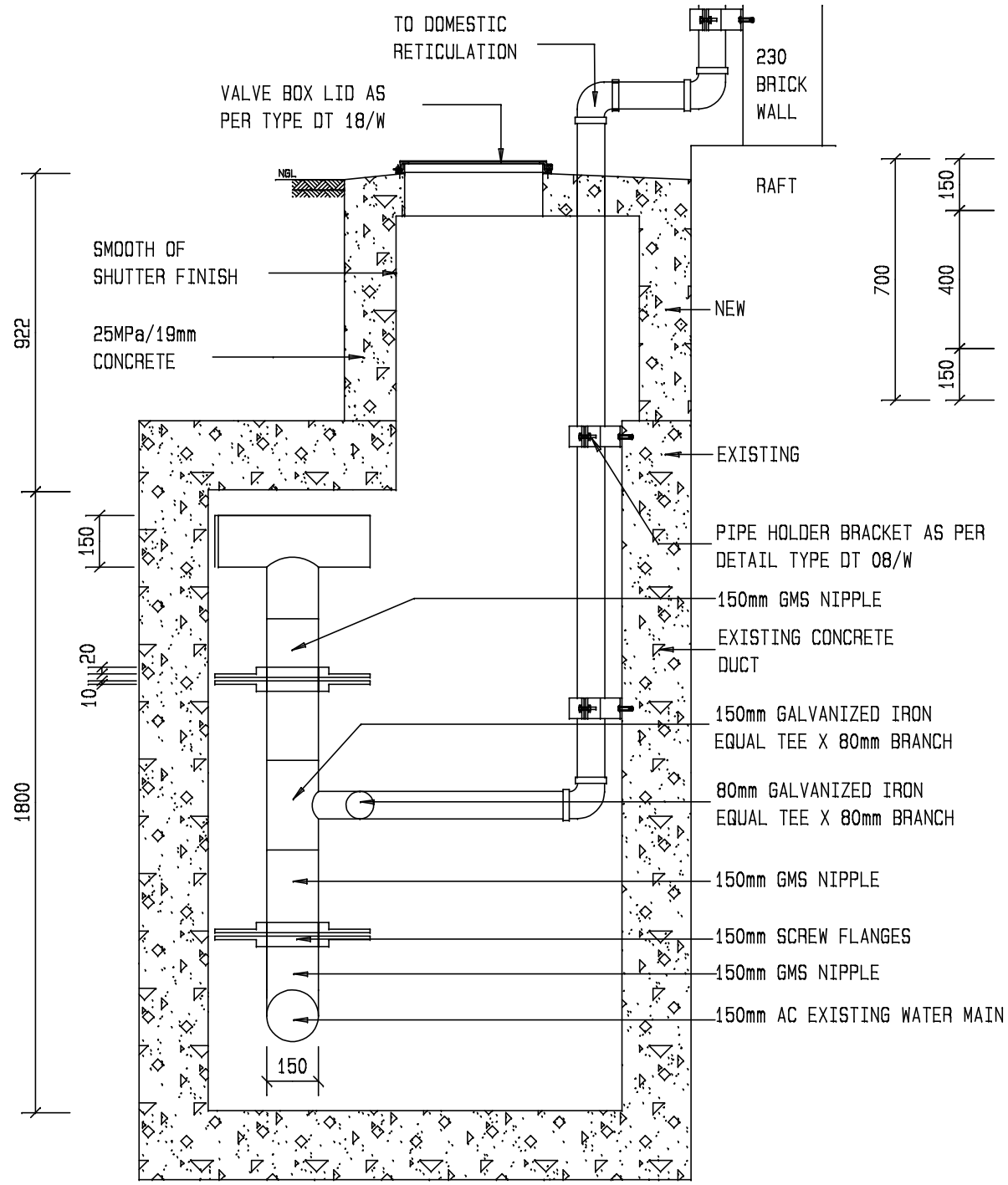
1:20

date

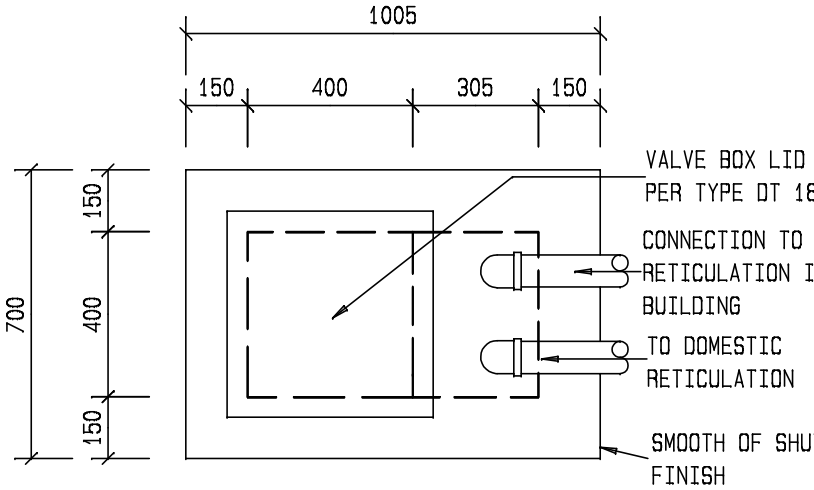
22/06/2006

drawing number / type number

TYPE NO DT 20/W



SECTION: CONCRETE VALVE BOX FOR CONNECTION TO BUILDING



PLAN: CONCRETE VALVE BOX FOR CONNECTION TO BUILDING

NOTE:
ALL PIPES TO BE HOT DIPPED HEAVY-DUTY GALVANIZED TO SABS EN 10240 / SANS 32
AFTER MANUFACTURING AND CUTTING SCREW THREADS, TREAT JOINT WITH MASTIC COMPOUND ACCORDING TO MANUFACTURER'S SPECIFICATION

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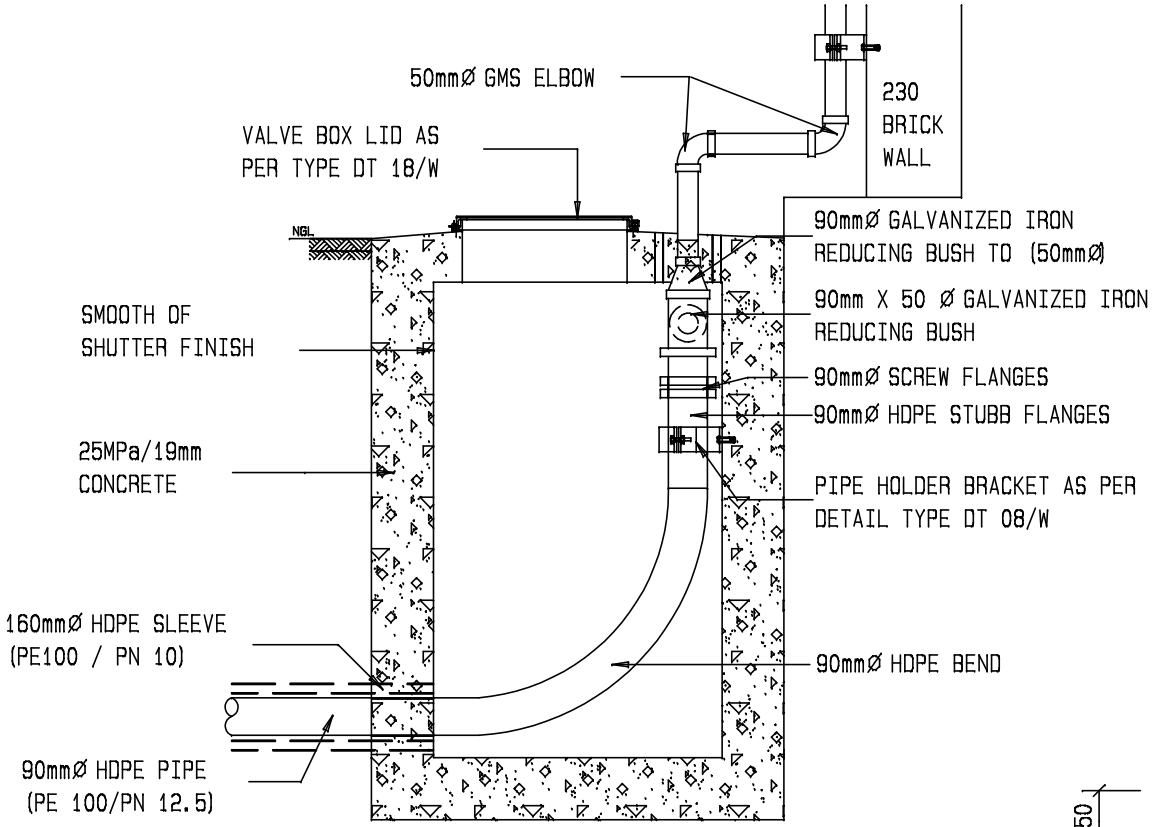
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS

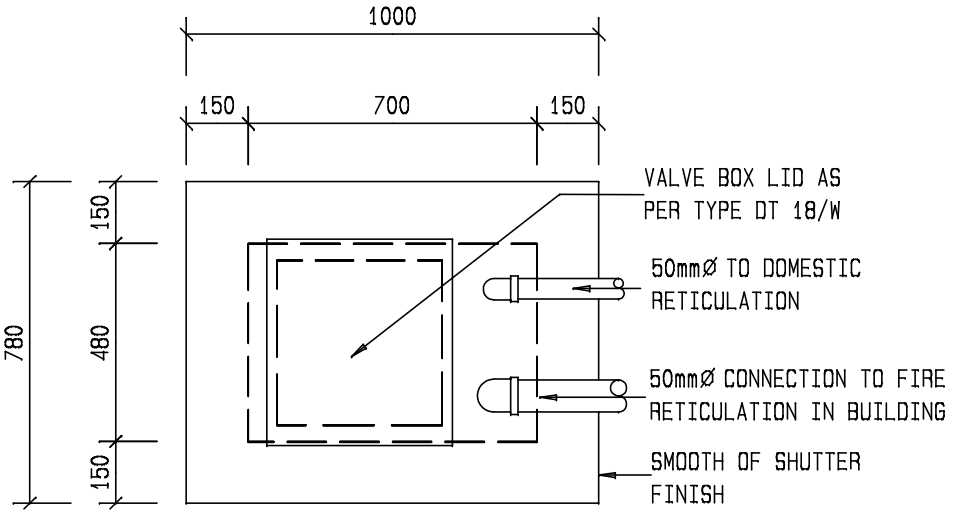
title
WATER:
NEW WATER CONNECTION TO BUILDING

scale
1:20

date
22/06/2006

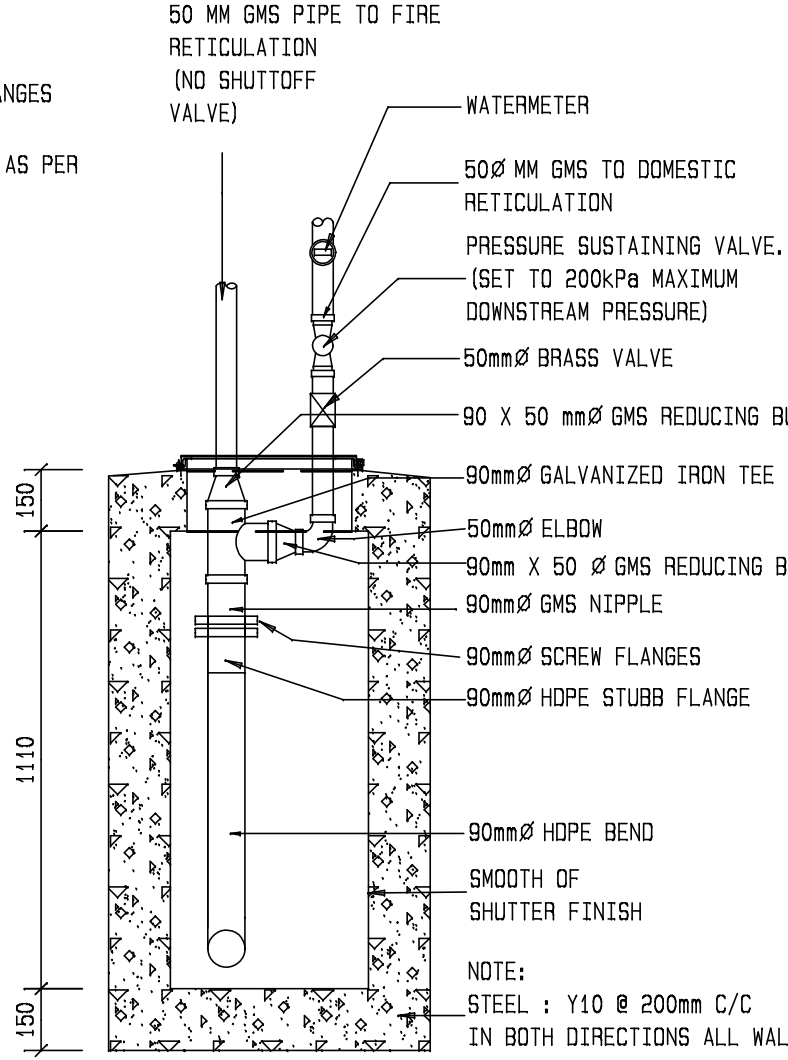
drawing number / type number
TYPE NO DT 21/W





PLAN: CONCRETE VALVE BOX FOR CONNECTION TO BUILDING

NOTE:
ALL PIPES TO BE HOT DIPPED HEAVY-DUTY GALVANIZED TO SABS EN 10240 / SANS 32 AFTER MANUFACTURING AND CUTTING SCREW THREADS, TREAT JOINT WITH MASTIC COMPOUND ACCORDING TO MANUFACTURER'S SPECIFICAT



SECTION: CONCRETE VALVE BOX FOR CONNECTION TO BUILDING

DEPARTMENT OF
PUBLIC WORKS
Private Bag X65
Pretoria
0001
Tel (012) 337 2000

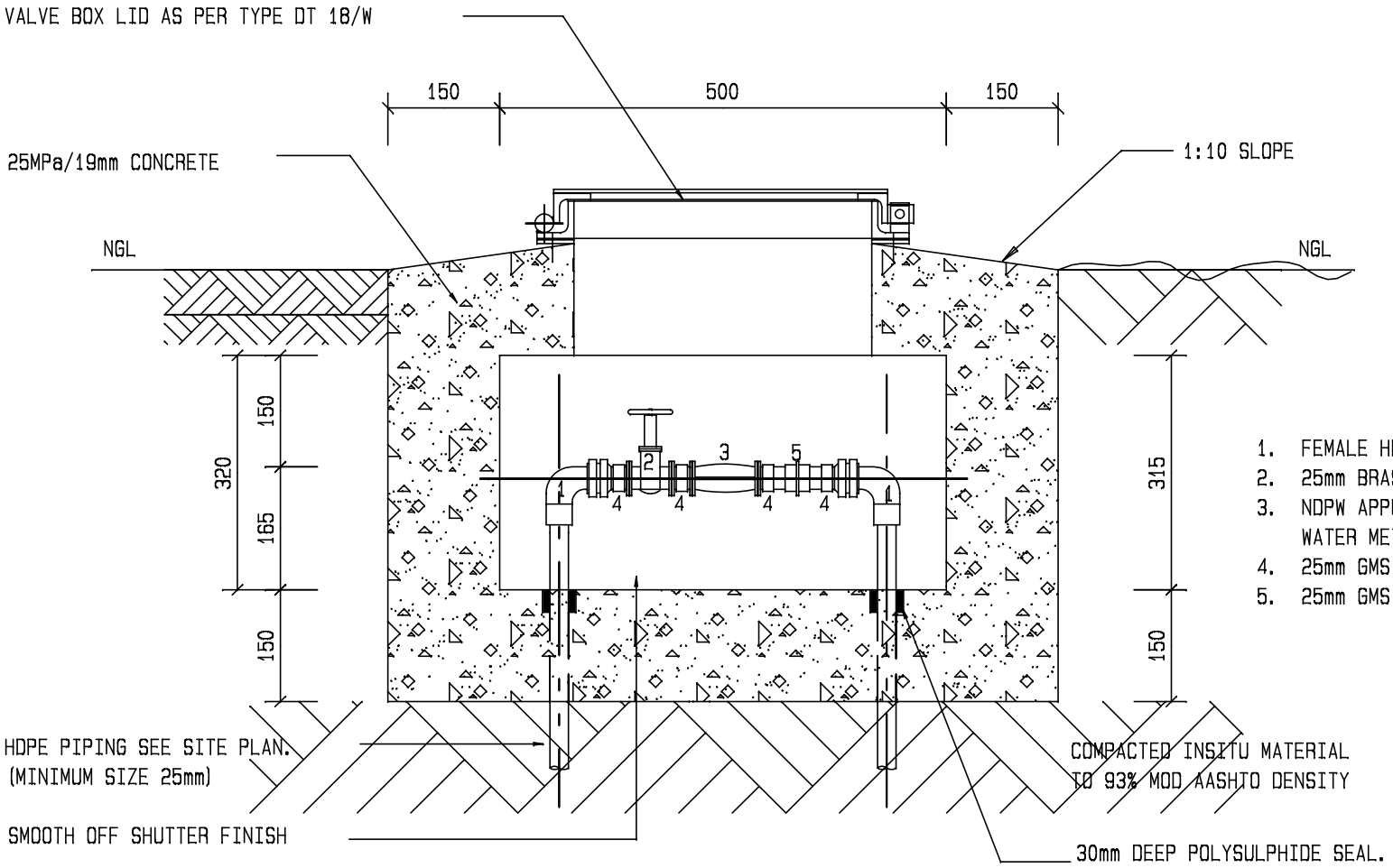
department
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS.

title
WATER:
CONCRETE VALVE BOX.
(DIAGRAMMATIC)

scale
1 : 10

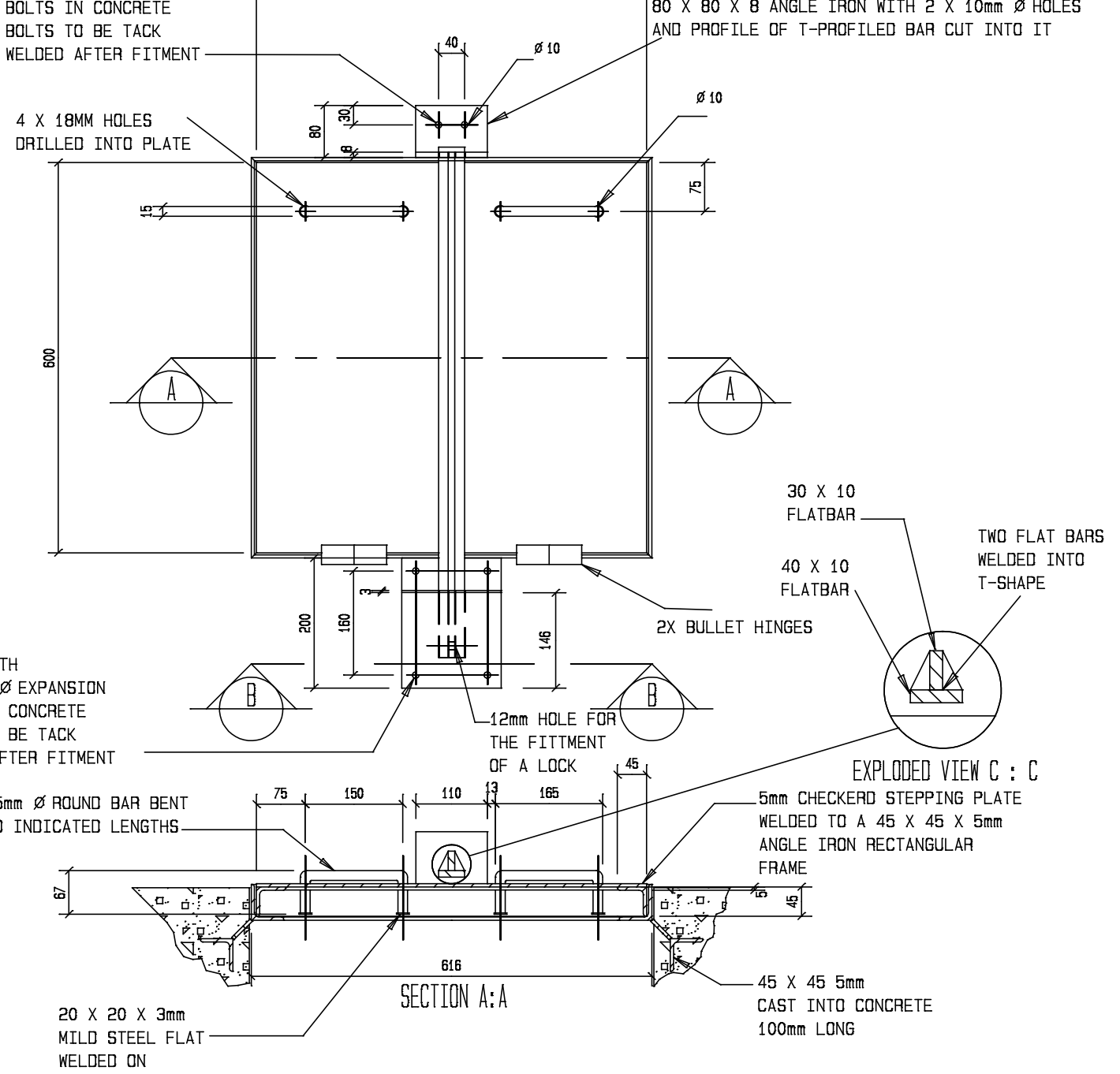
date
22/06/2006

drawing number / type number
TYPE NO DT 24/W



DT 24/W

SECTION: CONCRETE VALVE BOX FOR CONNECTION TO BUILDING



DEPARTMENT OF
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Private Bag X65
Pretoria
0001
Tel (012) 337 2000

departmental
DIAGRAMMATIC CIVIL
ENGINEERING DETAILS
FOR DOLOMITIC SOILS.

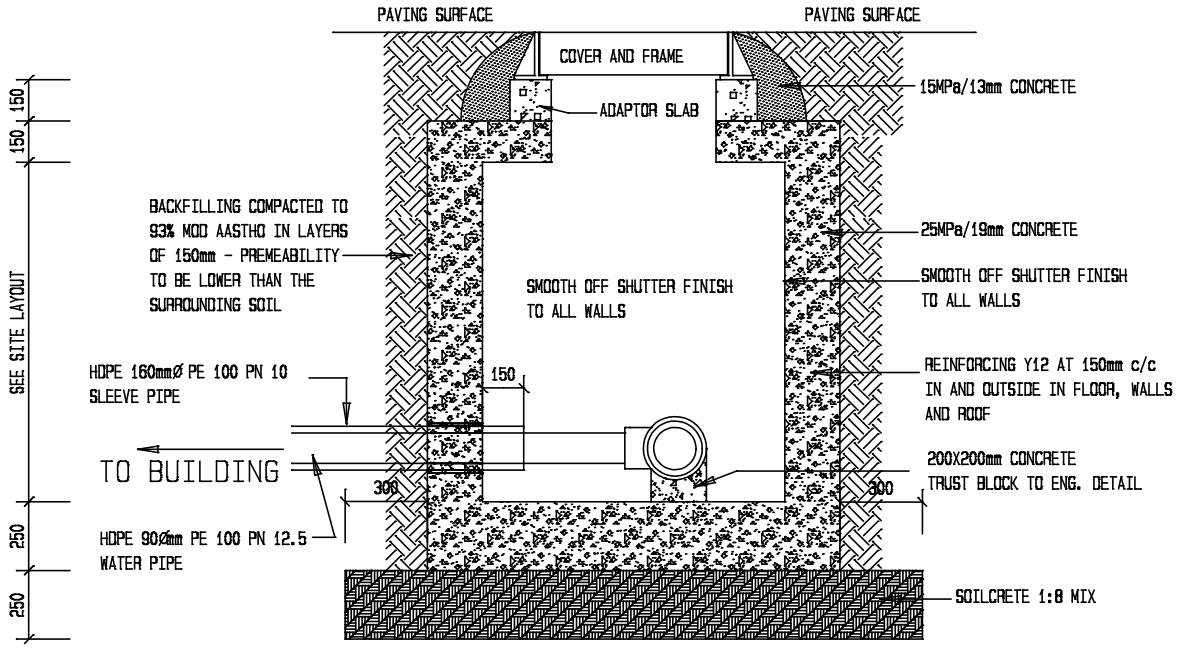
title
BOX LID DETAILS

scale
1 : 10

date
17/07/2005

drawing number / type number
TYPE NO DT 25/W

TYPE 1A COVER AND FRAME FOR
ROADS (SABS 558 / SANS 558)

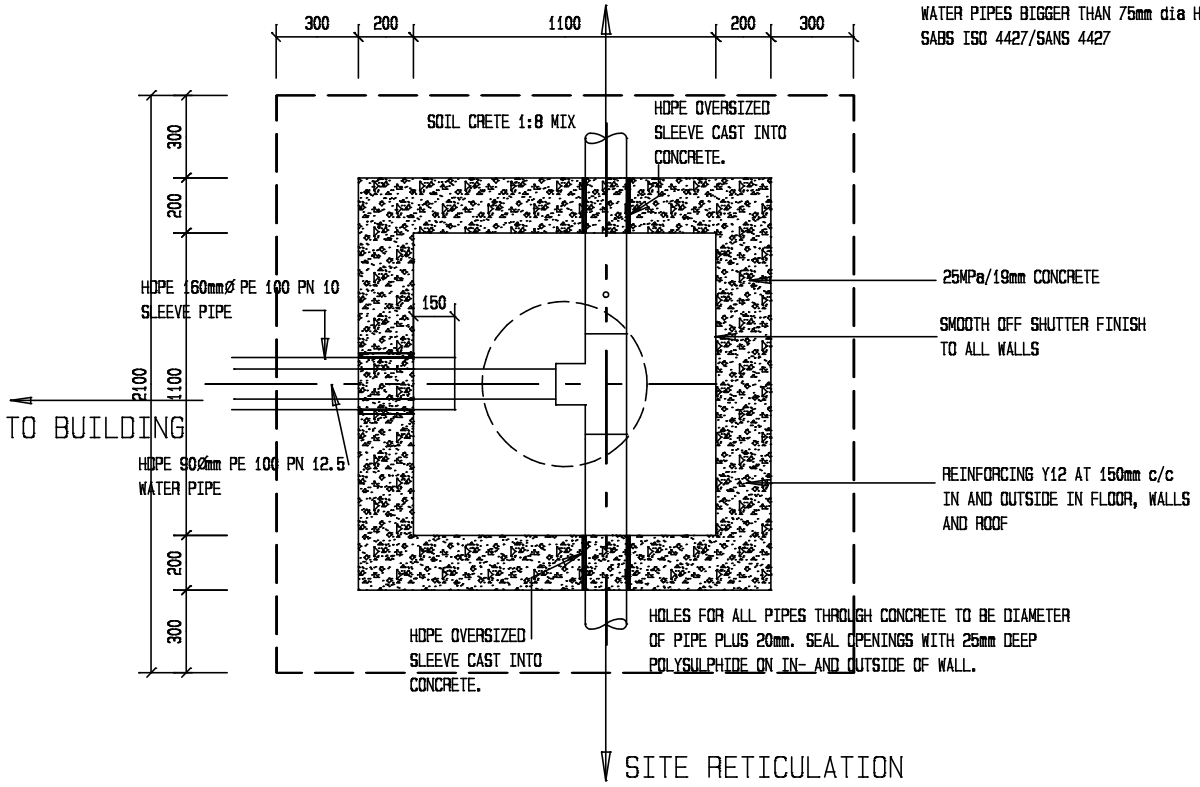


SECTION: CONCRETE WATER MANHOLE

NOTE:

uPVC PIPES TO COMPLY TO SABS 791/SANS 791
SEWER PIPES TO BE HDPE PE100 PN10 SABS ISO 4427/SANS 4427
WATER PIPES SMALLER THAN 63mm dia HDPE PE100 PN 16 SABS ISO 4427/SANS4427
WATER PIPES BIGGER THAN 75mm dia HDPE PE100 PN 12.5 SABS ISO 4427/SANS 4427

SITE RETICULATION
RING MAIN



PLAN: CONCRETE WATER MANHOLE

DEPARTMENT OF
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Pretoria
0001
Tel (012) 337 2000

departmental
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS.

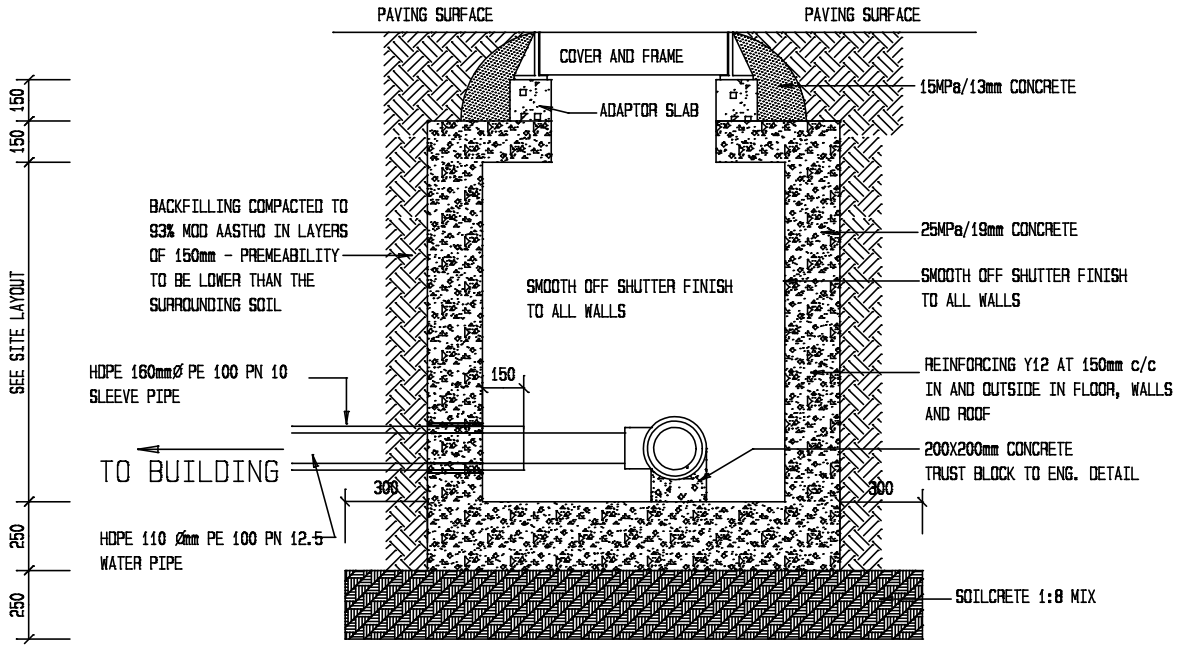
title
WATER:
CONCRETE MANHOLE DETAILS.
(DIAGRAMMATIC)

scale
1 : 30

date
22/06/2006

drawing number / type number
TYPE NO DT 26/W

TYPE 1A COVER AND FRAME FOR
ROADS (SABS 558 / SANS 558)

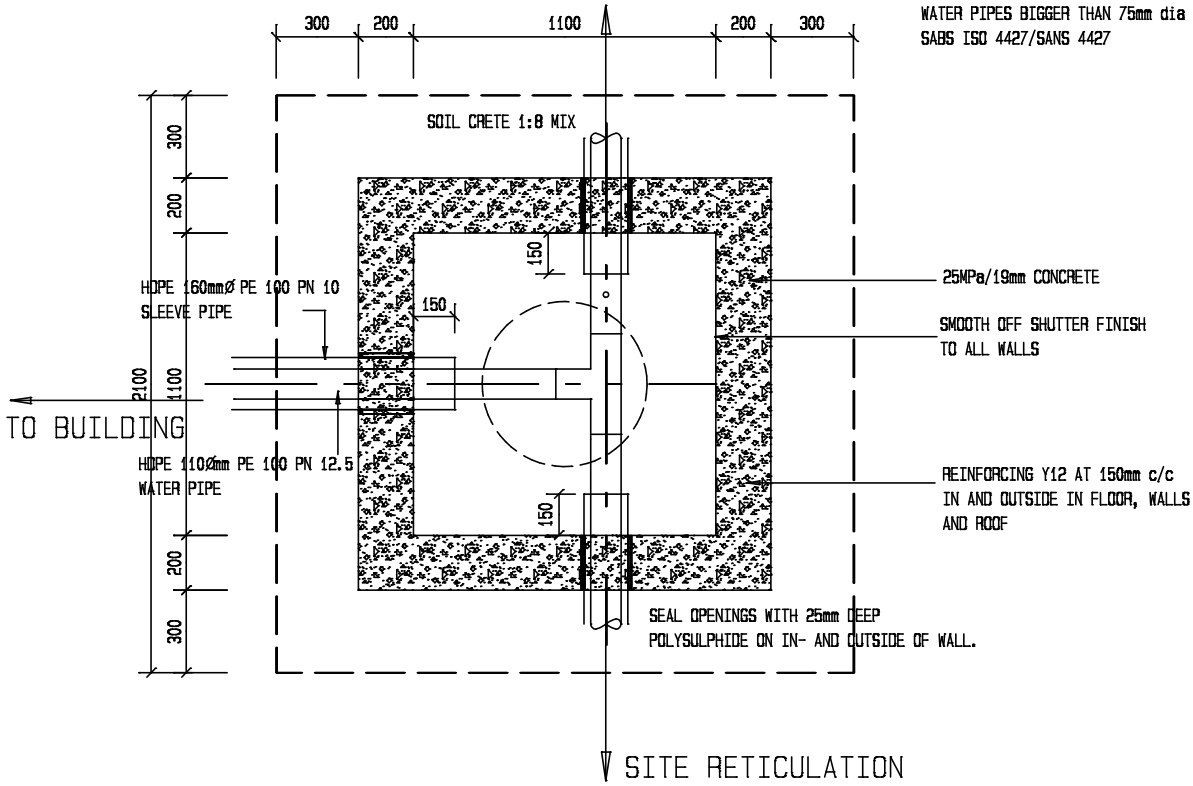


SECTION: CONCRETE WATER MANHOLE

NOTE:

uPVC PIPES TO COMPLY TO SABS 791/SANS 791
SEWER PIPES TO BE HDPE PE100 PN10 SABS ISO 4427/SANS 4427
WATER PIPES SMALLER THAN 63mm dia HDPE PE100 PN 16 SABS ISO 4427/SANS4427
WATER PIPES BIGGER THAN 75mm dia HDPE PE100 PN 12.5 SABS ISO 4427/SANS 4427

SITE RETICULATION
RING MAIN



SITE RETICULATION
RING MAIN

PLAN: CONCRETE WATER MANHOLE
WITH HDPE PIPES

DEPARTMENT OF PUBLIC WORKS Private Bag X65 Pretoria 0001 Tel (012) 337 2000	departmental DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS.	title WATER: CONCRETE MANHOLE DETAILS. (DIAGRAMMATIC)	scale 1 : 30	date 22/06/2006
			drawing number / type number TYPE NO DT 27/W	

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Tel (012) 337 2000

department
DIAGRAMMATIC CIVIL
ENGINEERING DETAILS
FOR DOLOMITIC SOILS.

title
WATER:
TYPICAL BOOSTER
CONNECTION IN
HDPE CHAMBER
(DIAGRAMMATIC)

scale
1 : 20

date
22/06/2006

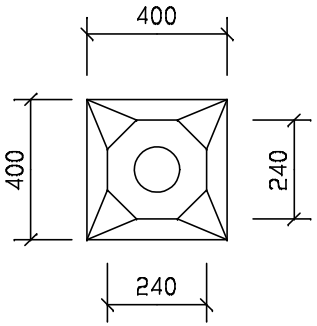
drawing number / type number
TYPE NO DT 28/W

NOTE:
- BENCHING AND SPECIFICATION THEREOF SIMILAR AS PER DETAILS TYPE NO DT 05/D.
- MANUFACTURING DETAILS AS PER TYPE NO DT 09/D.

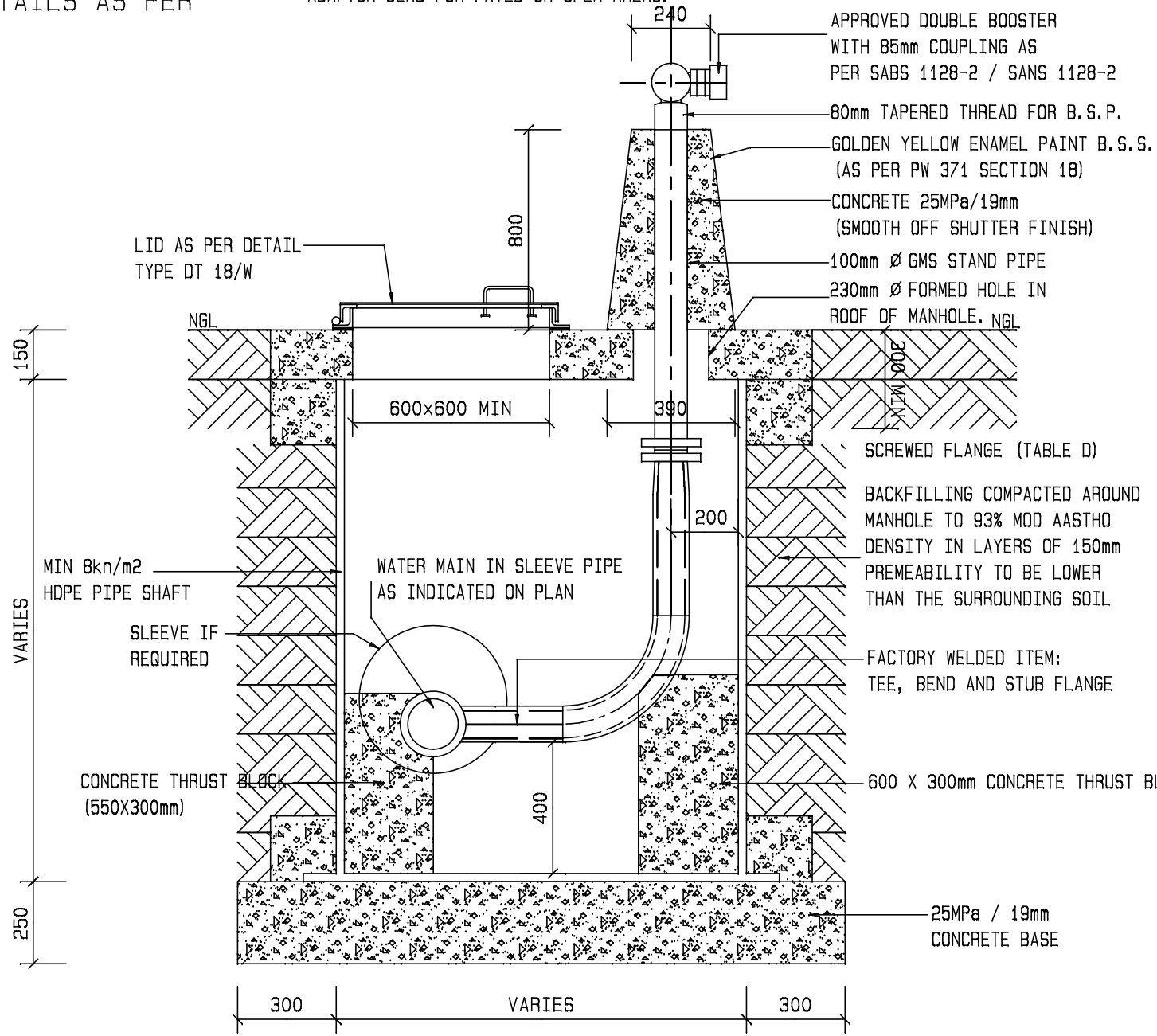
PRECAST CONCRETE
ROOF SLAB (HEAVY DUTY) WITH:
1. TYPE 1A (SABS 558 / SANS 558) COVER AND FRAME FOR ROADS OR/
2. HEAVY DUTY C.I. TYPE 4 (SABS 558 / SANS 55) MANHOLE COVER AND FRAME WITH ONE ADAPTOR SLAB FOR PAVED OR OPEN AREAS.

NOTE:
-ALL HDPE CONNECTIONS TO BE ELECTRO-FUSION OR BUTT WELDED.
-SUPPLY EACH SITE WITH THREE HYDRANT KEYS AS PER DETAIL TYPE NO DT 04/W

TOP OF FOOTING TO BE OCTAGONAL WITH SIDES 100mm EACH



TOP VIEW

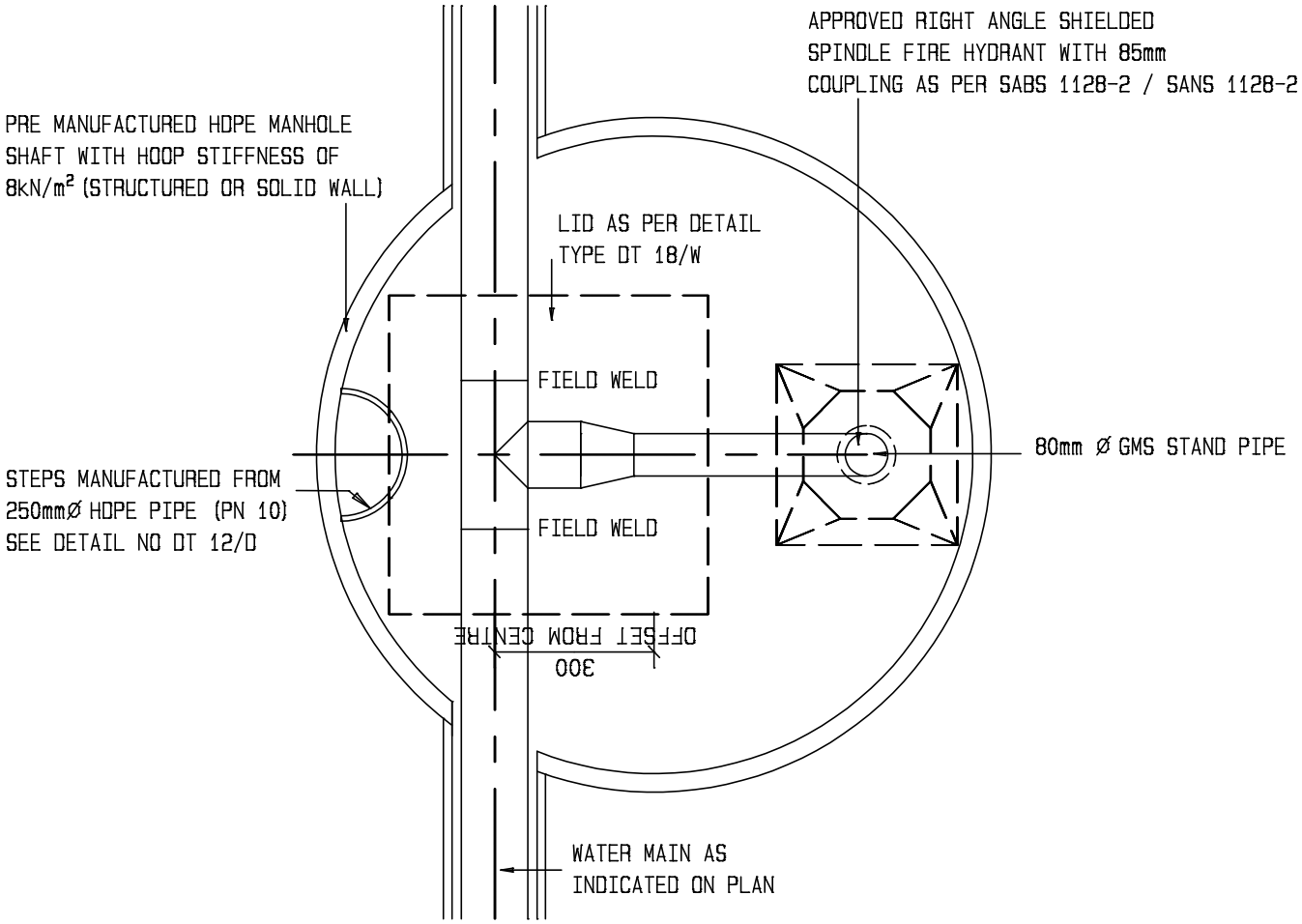


DT 28/W

/ SANS 4427
HOOP STIFFNESS OF MANHOLE SHAFT TO BE 8kN/m²

OTHER RELEVANT MANUFACTURING STANDARDS:
SABS 0268-1 / SANS 10268-1
SABS 0269 / SANS 10269
SABS 0270 / SANS 10270
SABS 1269 / SANS 1269
SABS 1655 / SANS 1655
SABS 1671 / SANS 1671-1

SANS 10268-1
- HOT GAS WELDING TO COMPLY TO SABS 0268-3:1999. SANS 10268-3
- HOT GAS EXTRUSION WELDING TO COMPLY TO SABS 0268-4:1999. SANS 10268-4



HDPE MANHOLE
PLAN
SCALE 1:15

DEPARTMENT OF PUBLIC WORKS
Private Bag X65
Pretoria
0001
Tel (012) 337 2000

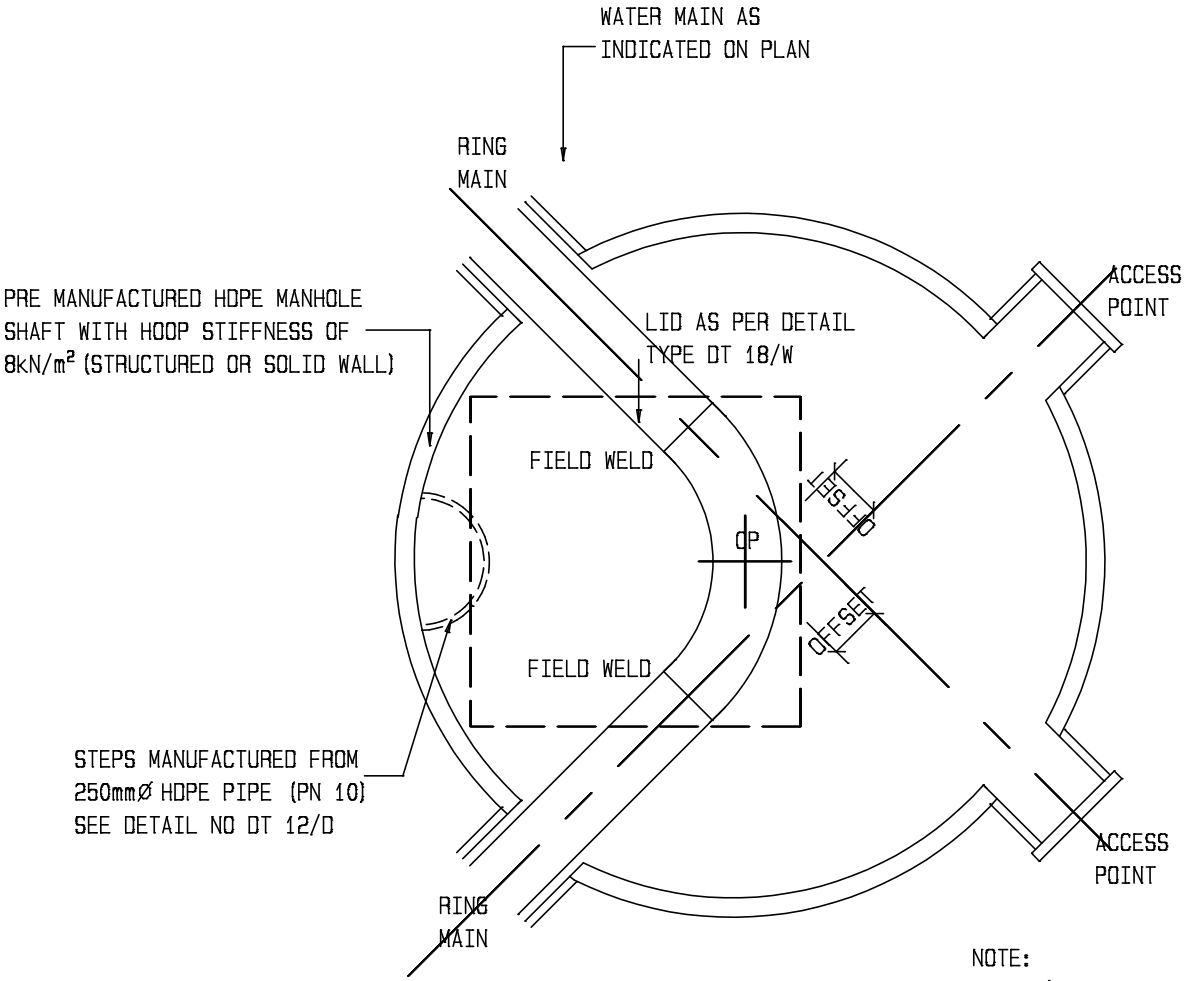
departmental	title	scale	date
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS	PLAN OF BOOSTER CHAMBER	1 : 15	22/06/2006

drawing number / type number
TYPE NO DT 28-1/W

/ SANS 4427
HOOP STIFFNESS OF MANHOLE SHAFT TO BE 8kN/m²

OTHER RELEVANT MANUFACTURING STANDARDS:
SABS 0268-1 / SANS 10268-1
SABS 0269 / SANS 10269
SABS 0270 / SANS 10270
SABS 1269 / SANS 1269
SABS 1655 / SANS 1655
SABS 1671 / SANS 1671-1

SANS 10268-1
- HOT GAS WELDING TO COMPLY TO SABS 0268-3:1999. SANS 10268-3
- HOT GAS EXTRUSION WELDING TO COMPLY TO SABS 0268-4:1999. SANS 10268-4



NOTE:
125mmØ FITTINGS
30 RADIUS BENDS
90 DEGREES, 580 c/mm, OFFSET 250
45 DEGREES, 360 c/mm, OFFSET 200
TEE, 400 c/mm, OFFSET 100
90mmØ FITTINGS
30 RADIUS BENDS
90 DEGREES, 400 c/mm, OFFSET 250
45 DEGREES, 400 c/mm, OFFSET 200
TEE, 400 c/mm, OFFSET 100

HDPE MANHOLE
PLAN
SCALE 1:15

DEPARTMENT OF PUBLIC WORKS
Private Bag X65
Pretoria
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Tel (012) 337 2000

departmental	title	scale	date
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS	PLAN OF TYPICAL JUNCTION MANHOLE	1 : 15	22/06/2006

drawing number / type number: TYPE NO DT 28-2/W

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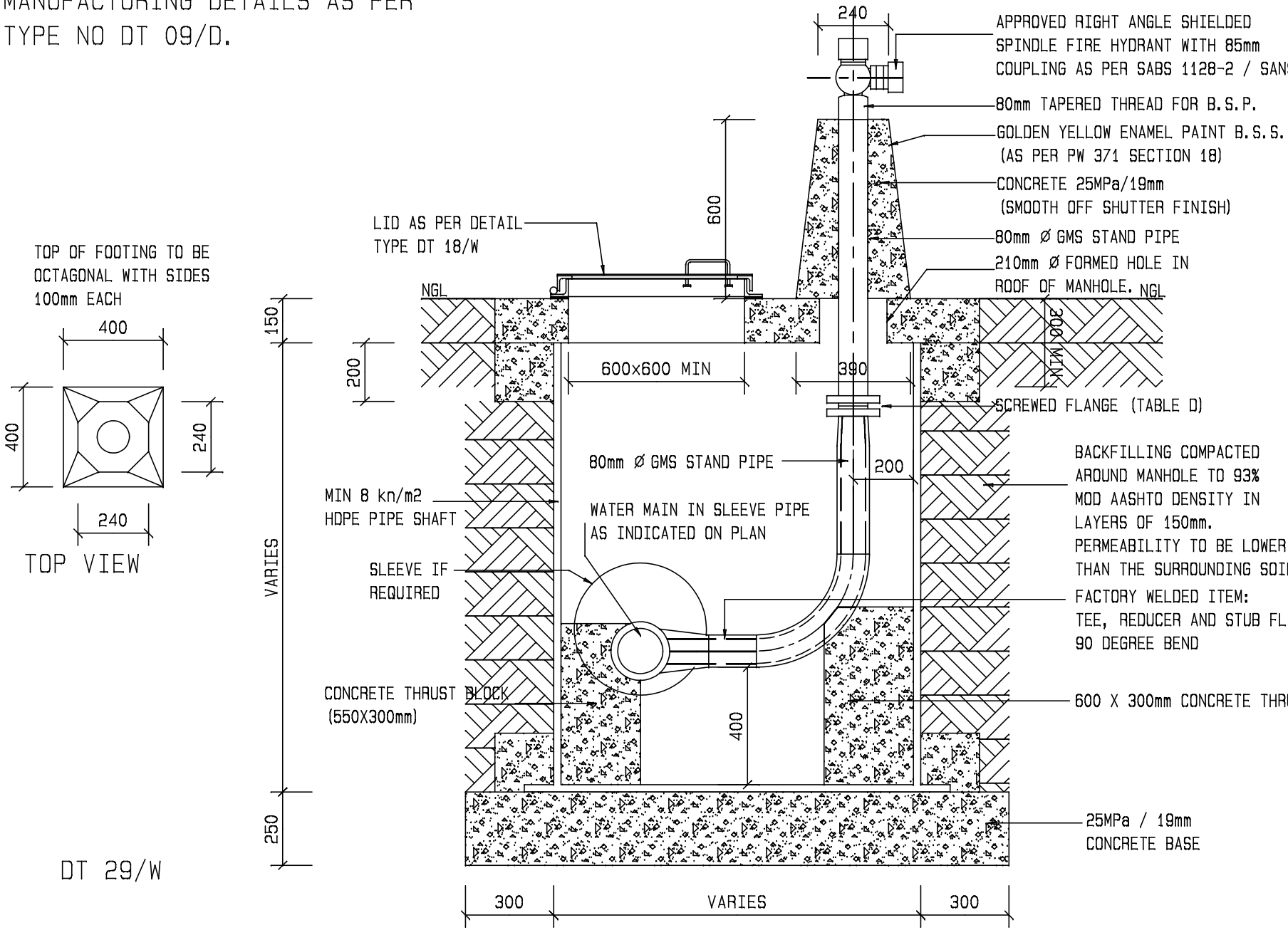
Tel (012) 337 2000

NOTE:
- BENCHING AND SPECIFICATION THEREOF SIMILAR AS PER DETAILS TYPE NO DT 05/D.
- MANUFACTURING DETAILS AS PER TYPE NO DT 09/D.

PRECAST CONCRETE
ROOF SLAB (HEAVY DUTY) WITH:
1. TYPE 1A (SABS 558 / SANS 558) COVER AND FRAME FOR ROADS OR/
2. HEAVY DUTY C.I. TYPE 4 (SABS 558 / SANS 55) MANHOLE COVER AND FRAME WITH ONE ADAPTOR SLAB FOR PAVED OR OPEN AREAS.

NOTE:
-ALL HDPE CONNECTIONS TO BE ELECTRO-FUSION OR BUTT WELDED.
-SUPPLY EACH SITE WITH THREE HYDRANT KEYS AS PER DETAIL TYPE NO DT 04/W



TOP OF FOOTING TO BE OCTAGONAL WITH SIDES 100mm EACH

TOP VIEW

DT 29/W

department
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS.

title
WATER:
TYPICAL FIRE HYDRANT IN HDPE CHAMBER (DIAGRAMMATIC)

scale
1 : 20

date
22/06/2006

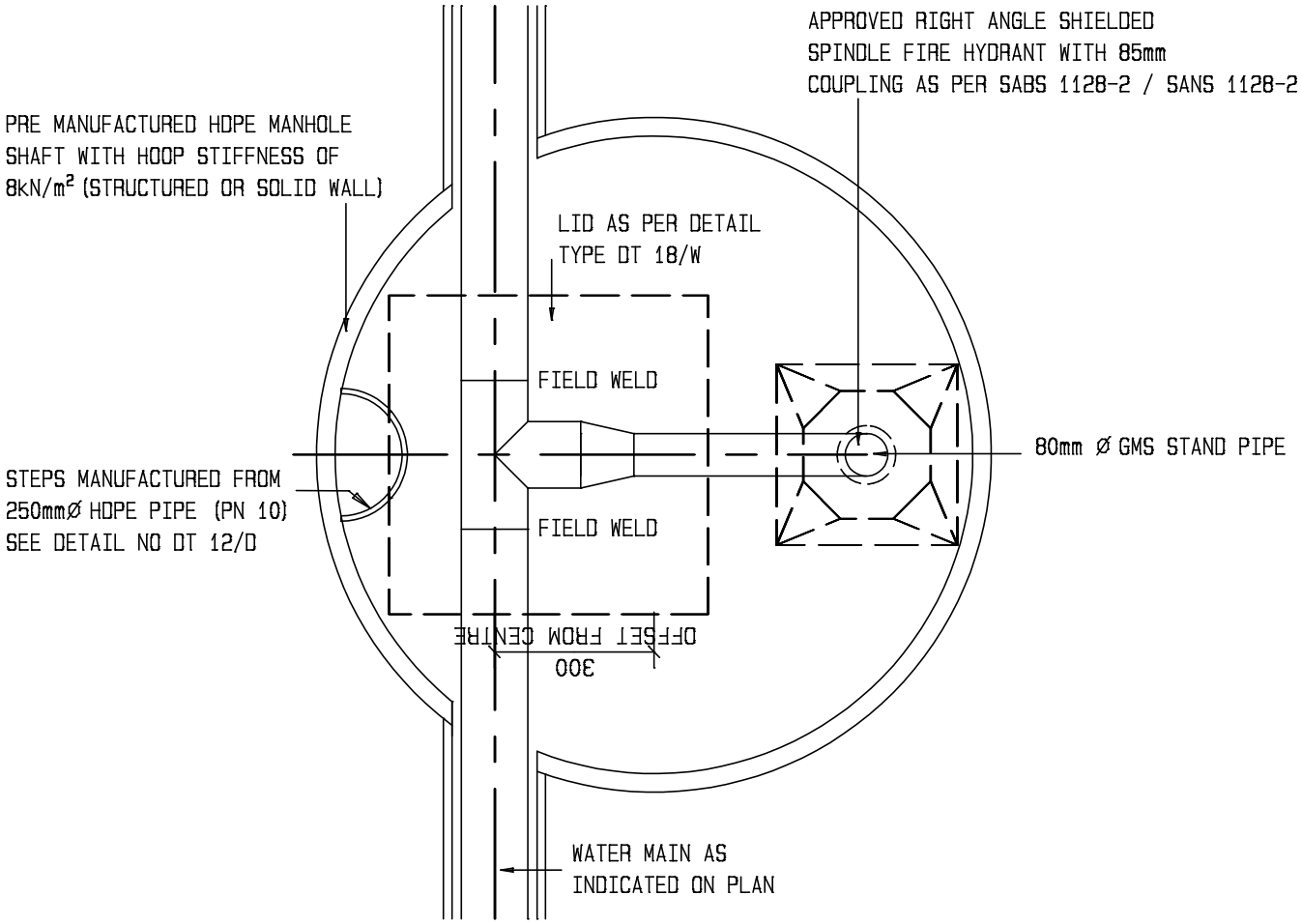
drawing number / type number
TYPE NO DT 29/W

/ SANS 4427
HOOP STIFFNESS OF MANHOLE SHAFT TO BE 8kN/m²

OTHER RELEVANT MANUFACTURING STANDARDS:

SABS 0268-1	/ SANS 10268-1
SABS 0269	/ SANS 10269
SABS 0270	/ SANS 10270
SABS 1269	/ SANS 1269
SABS 1655	/ SANS 1655
SABS 1671	/ SANS 1671-1

SANS 10268-1
- HOT GAS WELDING TO COMPLY TO SABS 0268-3:1999. SANS 10268-3
- HOT GAS EXTRUSION WELDING TO COMPLY TO SABS 0268-4:1999. SANS 10268-4



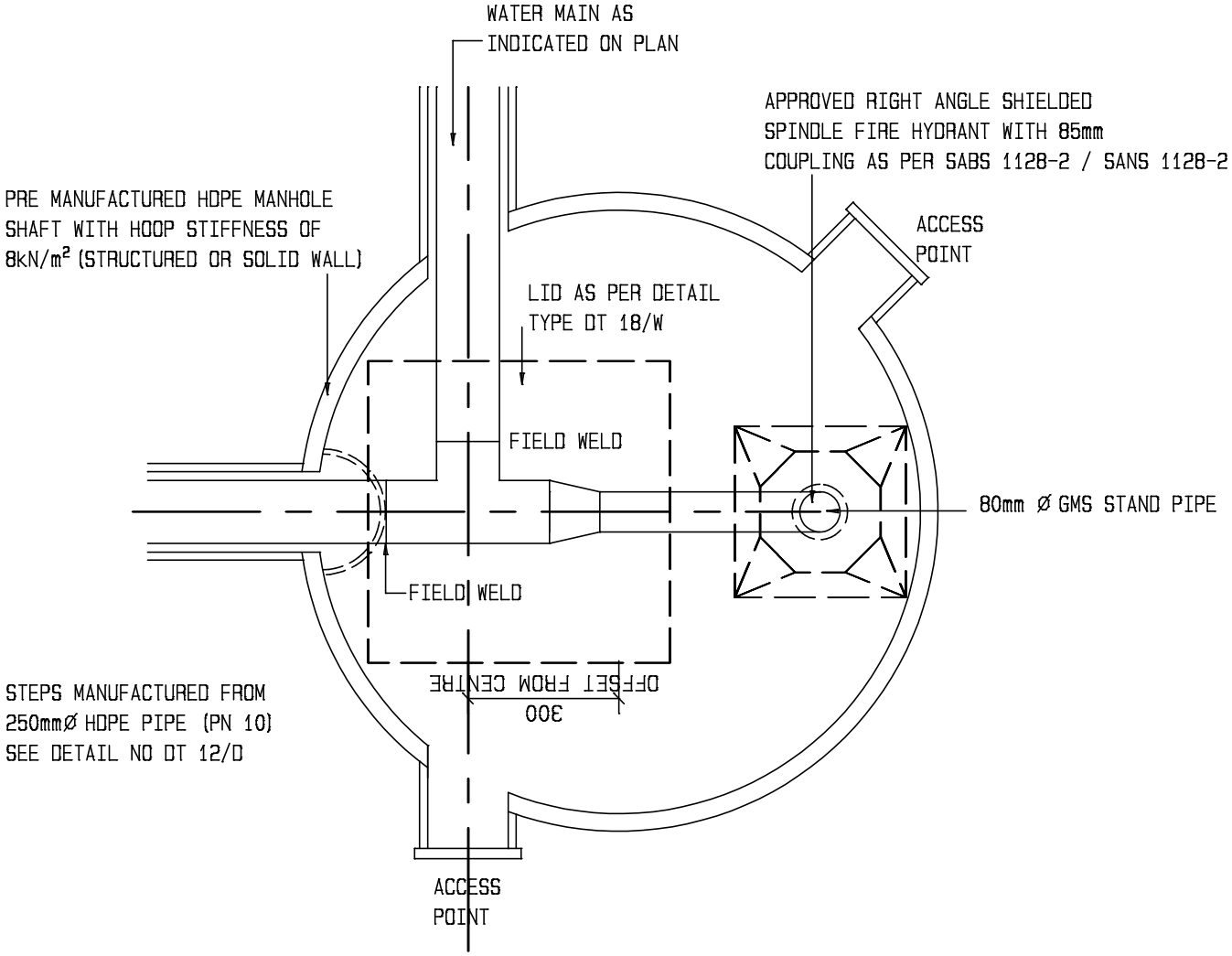
HDPE MANHOLE
PLAN
SCALE 1:15

DEPARTMENT OF PUBLIC WORKS Private Bag X65 Pretoria 0001 Tel (012) 337 2000	departmental DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS	title PLAN OF FIRE HYDRANT CHAMBER IN LINE TYPE	scale 1 : 15	date 22/06/2006
			drawing number / type number TYPE NO DT 29-1/W	

/ SANS 4427
HOOP STIFFNESS OF MANHOLE SHAFT TO BE 8kN/m²

OTHER RELEVANT MANUFACTURING STANDARDS:
SABS 0268-1 / SANS 10268-1
SABS 0269 / SANS 10269
SABS 0270 / SANS 10270
SABS 1269 / SANS 1269
SABS 1655 / SANS 1655
SABS 1671 / SANS 1671-1

SANS 10268-1
- HOT GAS WELDING TO COMPLY TO SABS 0268-3:1999. SANS 10268-3
- HOT GAS EXTRUSION WELDING TO COMPLY TO SABS 0268-4:1999. SANS 10268-4



HDPE MANHOLE
PLAN
SCALE 1:15

DEPARTMENT OF PUBLIC WORKS Private Bag X65 Pretoria 0001 Tel (012) 337 2000	departmental DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS	title PLAN OF FIRE HYDRANT CHAMBER ANGLE TYPE	scale 1 : 15	date 22/06/2006
			drawing number / type number TYPE NO DT 29-2/W	

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Tel (012) 337 2000

department
DIAGRAMMATIC CIVIL
ENGINEERING DETAILS
FOR DOLOMITIC SOILS.

title
WATER:
TYPICAL DETAILS
OF PREFABRICATED
HDPE CHAMBERS
(DIAGRAMMATIC)

scale
1 : 20

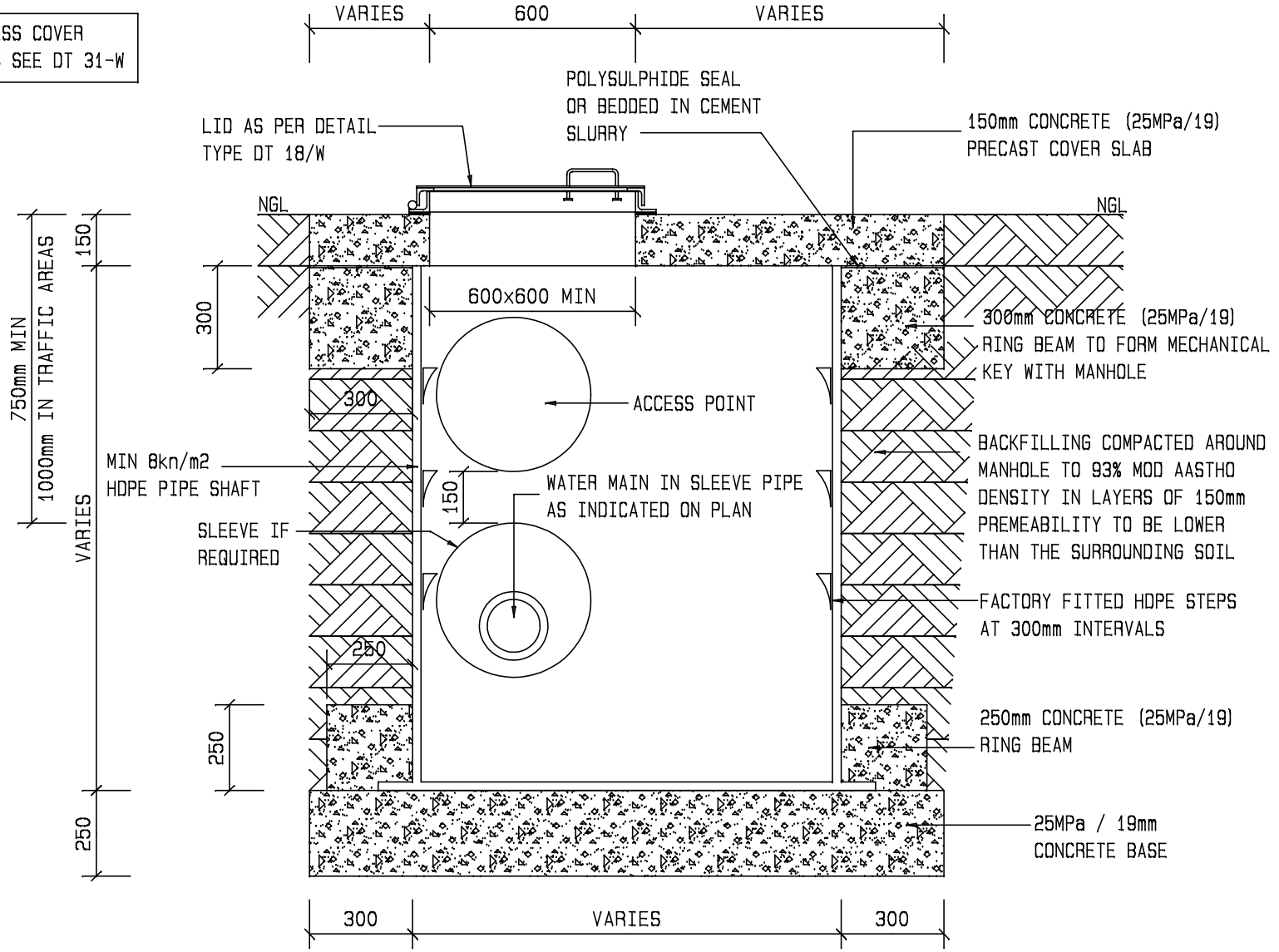
date
22/06/2006

drawing number / type number
TYPE NO DT 30/W

PRECAST CONCRETE
ROOF SLAB (HEAVY DUTY) WITH:
1. TYPE 1A (SABS 558 / SANS 558) COVER AND FRAME FOR ROADS OR/
2. HEAVY DUTY C.I. TYPE 4 (SABS 558 / SANS 55) MANHOLE COVER AND FRAME WITH ONE ADAPTOR SLAB FOR PAVED OR OPEN AREAS.

NOTE:
- BENCHING AND SPECIFICATION THEREOF SIMILAR AS PER DETAILS TYPE NO DT 05/D.
- MANUFACTURING DETAILS AS PER TYPE NO DT 09/D.

FOR ROOF AND ACCESS COVER
IN SURFACED AREAS SEE DT 31-W



DT 30/W

DEPARTMENT OF
PUBLIC WORKS
Private Bag X65
Pretoria
0001
Tel (012) 337 2000

department
DIAGRAMMATIC CIVIL
ENGINEERING DETAILS
FOR DOLOMITIC SOILS

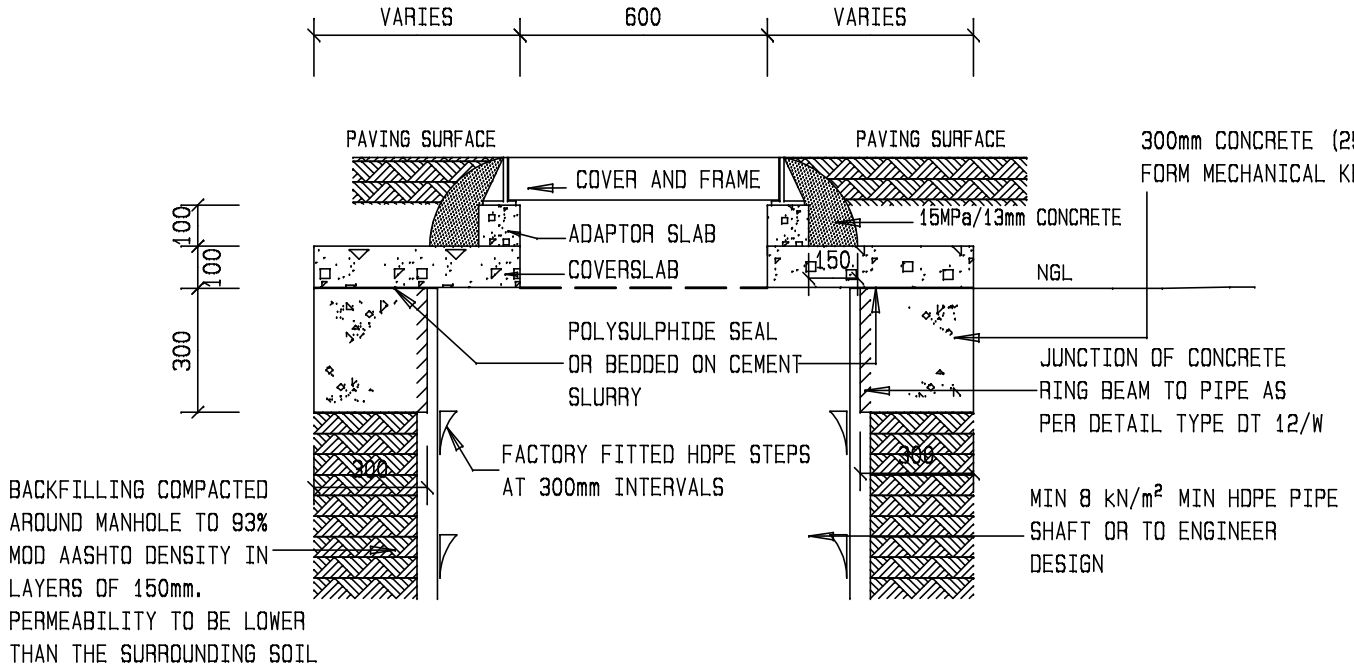
title
WATER:
SECTION OF 900-1200mm
MANHOLE ON MAIN
SEWER LINE
TRAFFIC / SURFACED AREAS
(DIAGRAMMATIC)

scale
1 : 20

date
22/06/2006

drawing number / type number
TYPE NO DT 31/W

PRECAST CONCRETE
ROOF SLAB (HEAVY DUTY) WITH:
1. TYPE 1A (SABS 558 / SANS 558) COVER AND FRAME FOR ROADS OR/
2. HEAVY DUTY C.I. TYPE 4 (SABS 558 / SANS 55) MANHOLE COVER AND FRAME WITH ONE ADAPTOR SLAB FOR PAVED OR OPEN AREAS.



ROOF AND ACCESS COVER OF HDPE MANHOLE ON MAIN WATER LINE IN TRAFFIC OF SURFACED AREAS

DT 31/W

DEPARTMENT OF
PUBLIC WORKS
Private Bag X65
Pretoria
0001
Tel (012) 337 2000

department
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS.

title
WATER:
TYPICAL DETAILS OF SLEEVE PIPE SYSTEM AND ACCESS POINTS

scale
1 : 20

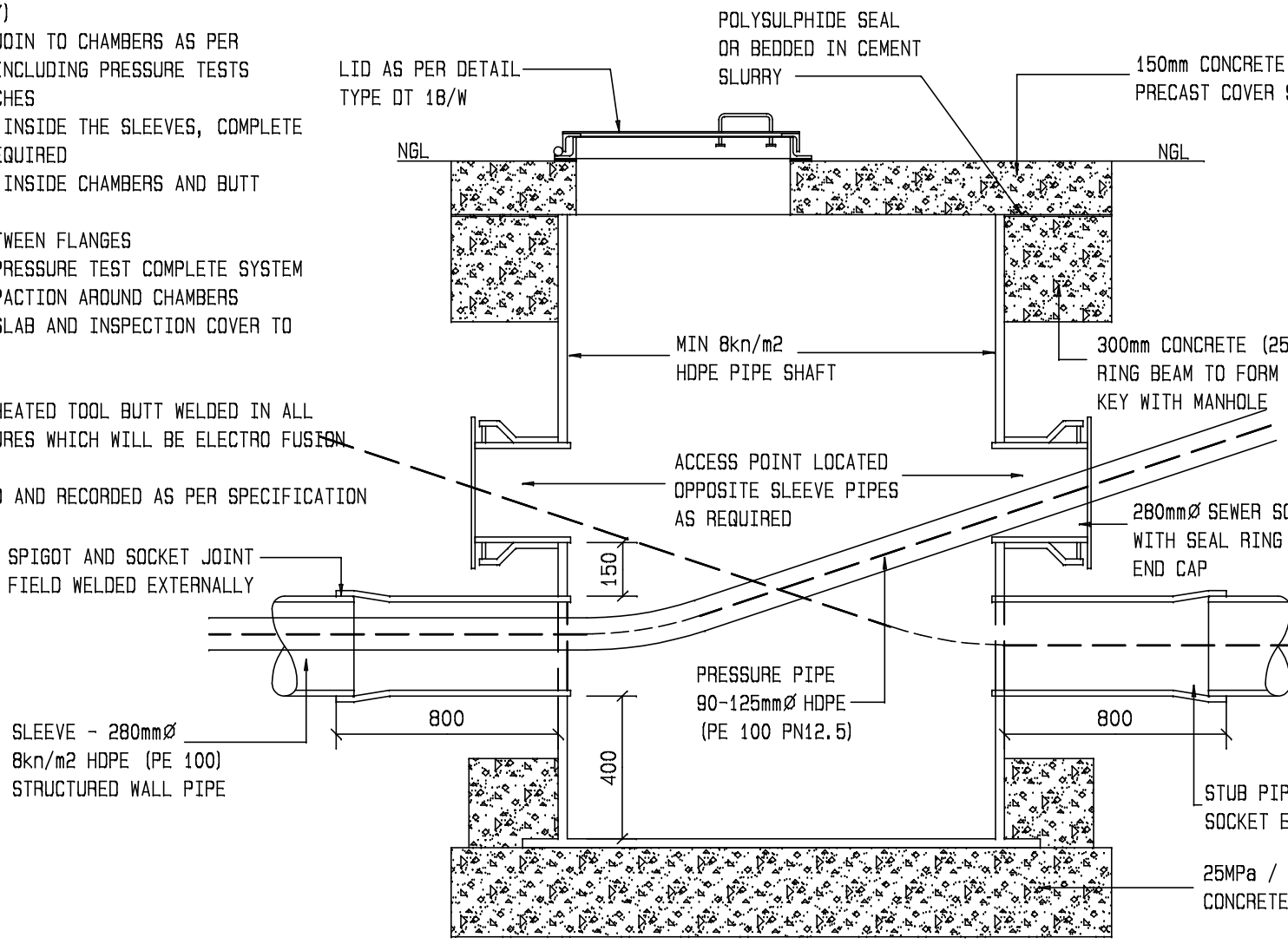
date
22/06/2006

drawing number / type number
TYPE NO DT 32/W

NOTE: INSTALLATION PROCEDURE FOR HDPE SLEEVE PIPE SYSTEM AND ACCESS POINTS

1. EXCAVATE FOR PIPE TRENCHES AND CHAMBERS
2. CONSTRUCT IN SITU CONCRETE BASES FOR CHAMBERS
3. SET MANHOLE ON BASE IN CEMENT SLURRY AND CONSTRUCT IN SITU CONCRETE ANCHOR RING
4. PREPARE BEDDING FOR SLEEVE PIPES WITH EVEN GRADE BETWEEN CHAMBERS TO ENSURE DRAINAGE (IF COMPLETELY LEVEL THEN CREATE A HIGH POINT MIDWAY BETWEEN TO PROVIDE 0,5% FALL EACH WAY)
5. INSTALL SLEEVE PIPES AND JOIN TO CHAMBERS AS PER STORMWATER SPECIFICATION INCLUDING PRESSURE TESTS
6. BACKFILL AND COMPACT TRENCHES
7. INSERT THE PRESSURE PIPES INSIDE THE SLEEVES, COMPLETE WITH STUB FLANGES WHERE REQUIRED
8. LOCATE HDPE PIPE FITTINGS INSIDE CHAMBERS AND BUTT WELD IN PLACE
9. PRESSURE TEST SECTIONS BETWEEN FLANGES
10. INSTALL ALL FITTINGS AND PRESSURE TEST COMPLETE SYSTEM
11. COMPLETE BACKFILL AND COMPACTION AROUND CHAMBERS
12. INSTALL RING BEAM, COVER SLAB AND INSPECTION COVER TO COMPLETE THE CHAMBER

NOTE:
PRESSURE PIPE JOINTS WILL BE HEATED TOOL BUTT WELDED IN ALL CASES, EXEPT UNAVOIDABLE CLOSURES WHICH WILL BE ELECTRO FUSION AS APPROVED BY ENGINEER
ALL WELDS ARE TO BE REFERENCED AND RECORDED AS PER SPECIFICATION



DT 32/W

TYPICAL DETAILS OF SLEEVE PIPE SYSTEM AND ACCESS POINTS

BACKFILLING DETAILS.

DT 02/D SOILCRETE / CONCRETE PIPE PROTECTION

DT 03/D HDPE JUNCTION CHAMBER TYPICAL CONNECTION TO ALL BUILDINGS.

DT 04/D SECTION OF 900-1200mmØ MANHOLE ON MAIN SEWER LINE.

DT 05/D SECTION OF HDPE JUNCTION CHAMBER IN OPEN AREAS

DT 06/D CASTING OF CONCRETE SLABS OVER FLEXIBLE PIPES.

DT 07/D PLAN AND ELEVATION FOR SURFACE MOUNTING OF SEWER PIPES TO EXISTING BUILDINGS.

DT 08/D STANDARD HEAVY DUTY PRECAST CONCRETE ROOFSLAB AND LID FOR HDPE MANHOLE.

DT 09/D TYPICAL WELDING DETAILS FOR HDPE SEWER MANHOLE: PLAN

DT 10/D TYPICAL WELDING DETAILS FOR HDPE SEWER MANHOLE: SECTION A

DT 11/D TYPICAL WELDING DETAILS FOR HDPE SEWER MANHOLE: SECTION B

DT 12/D TYPICAL WELDING DETAILS FOR HDPE SEWER MANHOLE: SECTION C

DT 13/D TRENCHING BEDDING AND BACKFILLING DETAILS OVER EXISTING PIPES

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departmental
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS

title
SEWER DRAINAGE:
DRAWING LIST.

scale
N. A.

date
22/06/2006

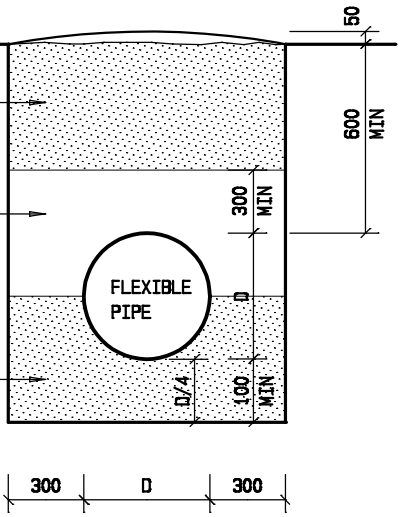
drawing number / type number
TYPE NO DT 00/D

UNSURFACED AND UNTRAFFICKED AREAS

COMPACTED SELECTED BACKFILL:
COMPACTION TO 93% MOD AASHTO.
MATERIAL TO SABS1200 DB /
SANS 1200 DB 3.5
(MAXIMUM AGGREGATE SIZE TO BE 63mm)

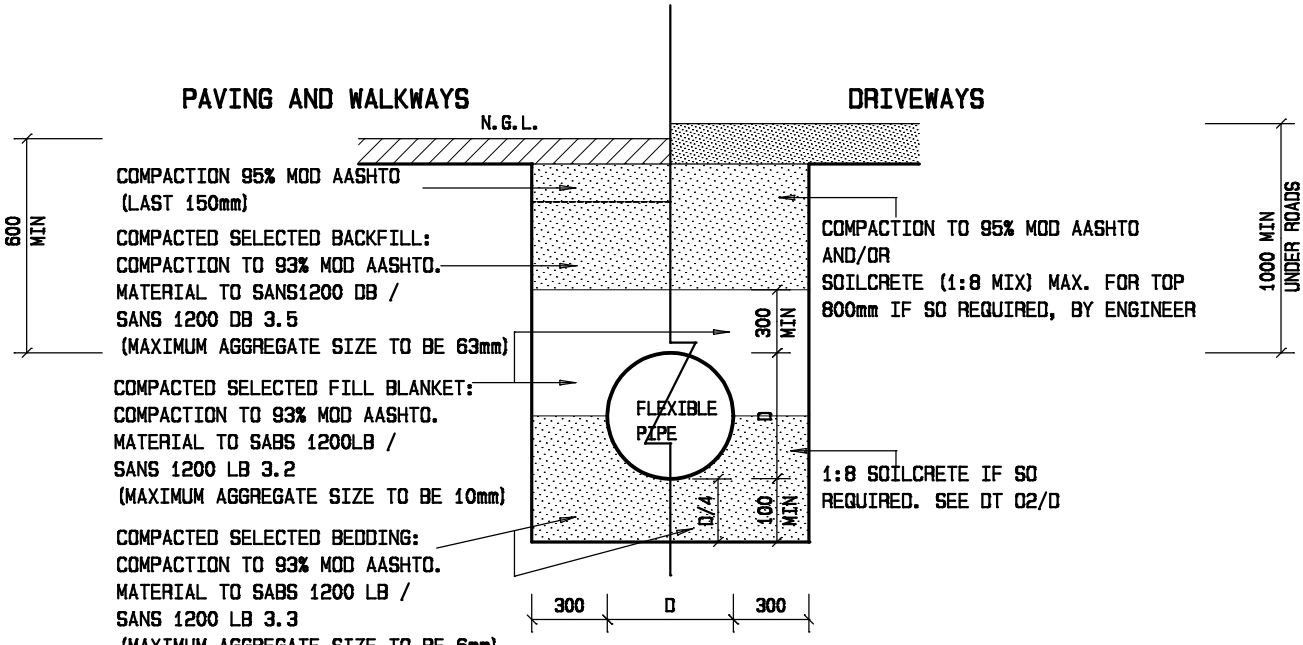
COMPACTED SELECTED FILL BLANKET:
COMPACTION TO 93% MOD AASHTO.
MATERIAL TO SABS 1200 LB /
SANS 1200 LB 3.2
(MAXIMUM AGGREGATE SIZE TO BE 10mm)

COMPACTED SELECTED BEDDING:
COMPACTION TO 93% MOD AASHTO.
MATERIAL TO SABS 1200 LB /
SANS 1200 LB 3.3
(MAXIMUM AGGREGATE SIZE TO BE 6mm)



PAVING AND WALKWAYS

DRIVEWAYS



SEWER TRENCHING, BEDDING AND BACKFILLING DETAILS SCALE 1:30

NOTE:
ALL BEDDING SURROUND AND BACKFILL MATERIALS SHALL AFTER COMPACTION BE LESS PREMEABLE THAN THE IN-SITU SURROUNDING SOIL

DT 01/D

DEPARTMENT OF PUBLIC WORKS
Private Bag X65
Pretoria
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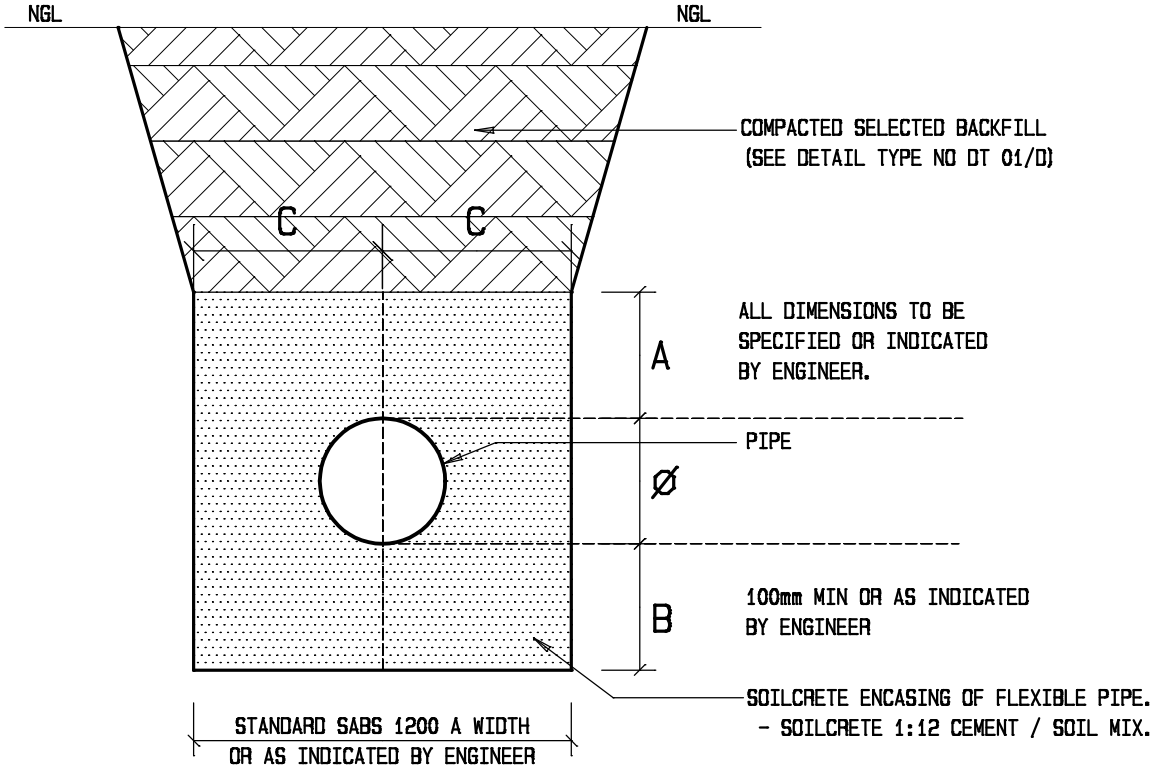
Tel (012) 337 2000

departmental: DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS	title: SEWER DRAINAGE: SEWER TRENCHING, BEDDING AND BACKFILLING DETAILS (DIAGRAMMATIC)	scale: 1 : 30	date: 10/27/2004
		drawing number / type number: TYPE NO DT 01/D	



SOILCRETE PIPE PROTECTION

NOTE:
ALL BACKFILL MATERIALS SHALL AFTER COMPACTION BE LESS PERMEABLE THAN THE IN-SITU SURROUNDING SOIL.

DT 02/D

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DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS

title
SEWER DRAINAGE:
SOILCRETE / CONCRETE PIPE PROTECTION
(DIAGRAMMATIC)

scale
1 : 10

date
10/27/2004

drawing number / type number
TYPE NO DT 02/D

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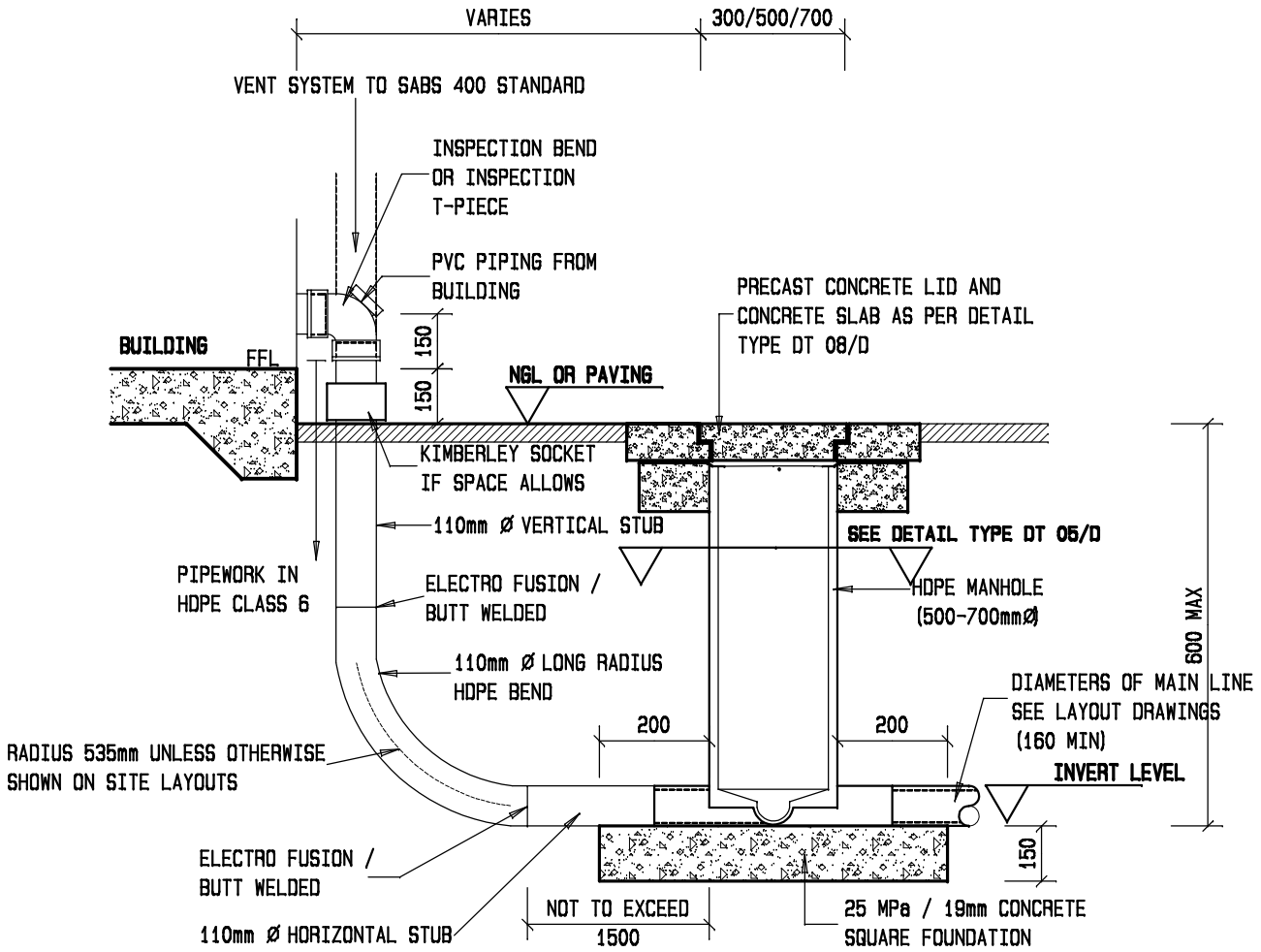
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS

title
SEWER DRAINAGE:
HDPE JUNCTION CHAMBER TYPICAL CONNECTION TO ALL BUILDINGS.
(DIAGRAMMATIC)

scale
1 : 20

date
10/27/2004

drawing number / type number
TYPE NO DT 03/D



HDPE JUNCTION CHAMBER
TYPICAL CONNECTION TO ALL BUILDINGS.

SEE TYPE DT 05/D FOR
BENCHING DETAILS

DT 03/D

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DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS

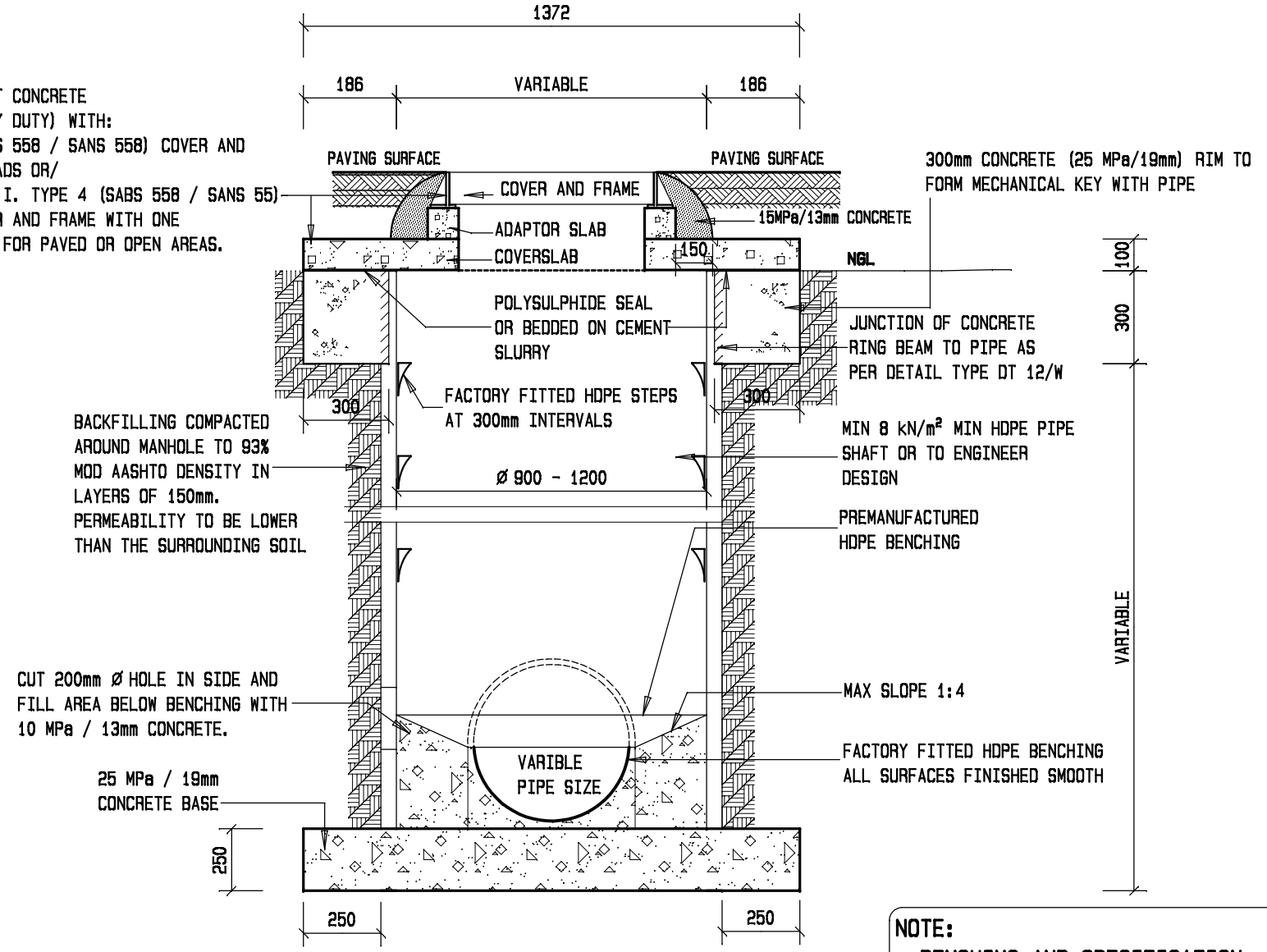
title
SEWER DRAINAGE:
SECTION OF 900-1200mm MANHOLE ON MAIN SEWER LINE
(DIAGRAMMATIC)

scale
1 : 20

date
10/27/2004

drawing number / type number
TYPE NO DT 04/D

1200mm Ø PRECAST CONCRETE ROOF SLAB (HEAVY DUTY) WITH:
1. TYPE 1A (SABS 558 / SANS 558) COVER AND FRAME FOR ROADS OR/
2. HEAVY DUTY C.I. TYPE 4 (SABS 558 / SANS 55) MANHOLE COVER AND FRAME WITH ONE ADAPTOR SLAB FOR PAVED OR OPEN AREAS.



SECTION OF 900 - 1200mm Ø MANHOLE ON MAIN SEWER LINE

NOTE:
- BENCHING AND SPECIFICATION THEREOF SIMILAR AS PER DETAILS TYPE NO DT 05/D.
- MANUFACTURING DETAILS AS PER TYPE NO DT 09/D.

DT 04/D

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department: DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS

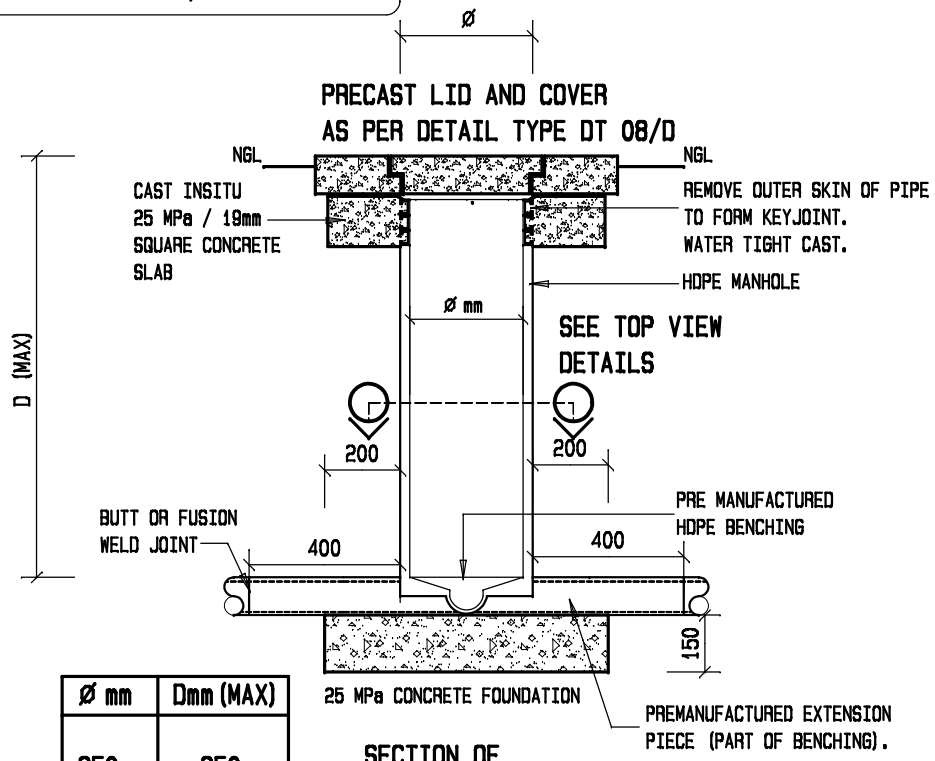
title: SECTION OF HDPE JUNCTION CHAMBER IN OPEN AREAS (DIAGRAMMATIC)

scale: 1 : 20

date: 10/27/2004

drawing number / type number: TYPE NO DT 05/D

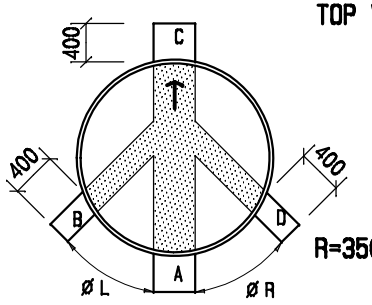
NOTE:
- ENGINEER TO SPECIFY MANHOLE SHAFT (MIN 8kN) AND ALL IN AND OUTLET SIZES AS WELL AS ANGLES.
- MANUFACTURING DETAILS AS PER TYPE NO DT 09/D.



Ø mm	Dmm (MAX)
350	350
500	450
700	750

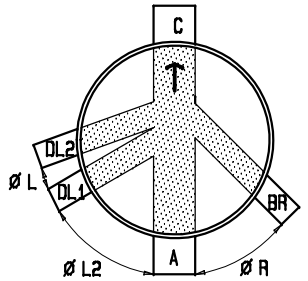
SECTION OF
HDPE JUNCTION
CHAMBER IN OPEN AREAS

TOP VIEW



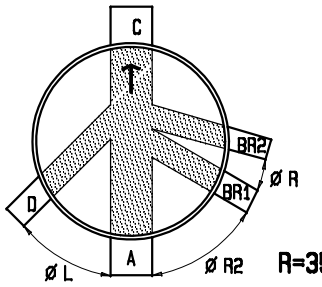
STANDARD
BENCHING LAYOUT

R=350/500/700



PURPOSE MADE
BENCHING FOR DOUBLE
LEFT JUNCTION MANHOLE

R=350/500/700



PURPOSE MADE
BENCHING FOR DOUBLE
RIGHT JUNCTION MANHOLE

R=350/500/700

DT 05/D

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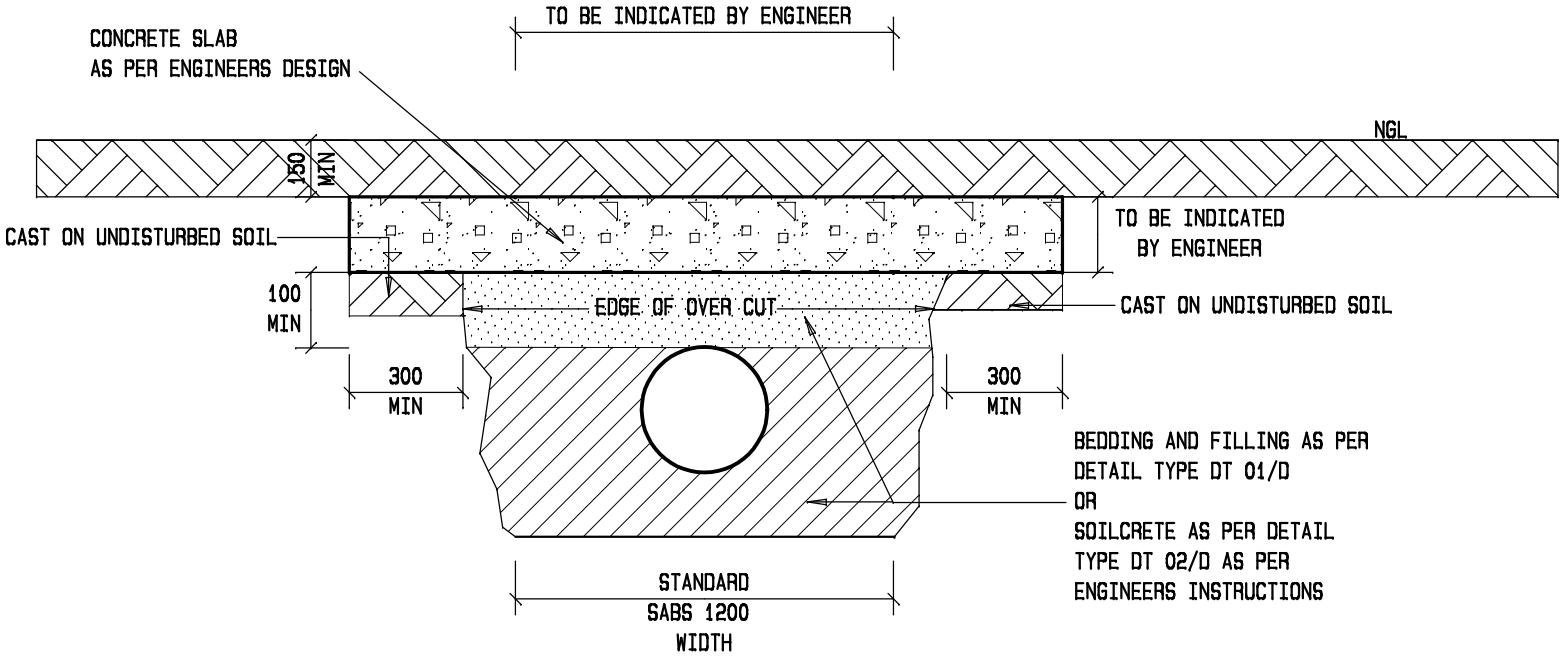
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS

title
SEWER DRAINAGE:
CASTING OF CONCRETE SLABS OVER FLEXIBLE PIPES
(DIAGRAMMATIC)

scale
1 : 20

date
10/27/2004

drawing number / type number
TYPE NO DT 06/D



CASTING OF CONCRETE SLABS OVER FLEXIBLE PIPES

DT 06/D

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department
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS

title
SEWER DRAINAGE:
PLAN AND ELEVATION FOR SURFACE MOUNTING OF SEWER PIPES TO EXISTING BUILINGS.
(DIAGRAMMATIC)

scale
1 : 60

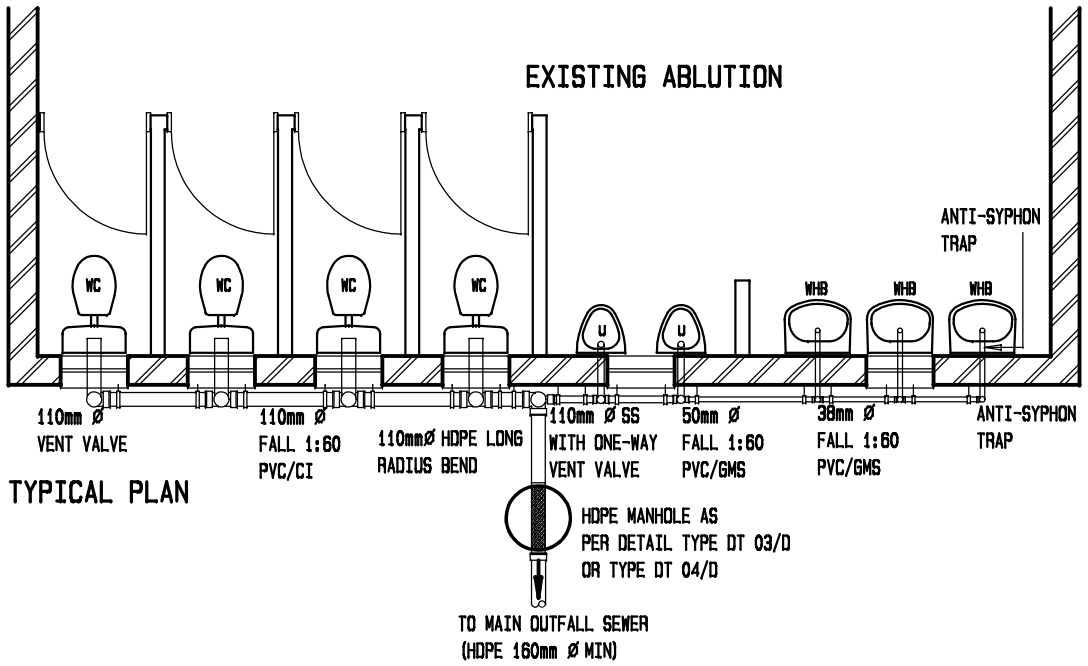
date
10/27/2004

drawing number / type number
TYPE NO DT 07/D

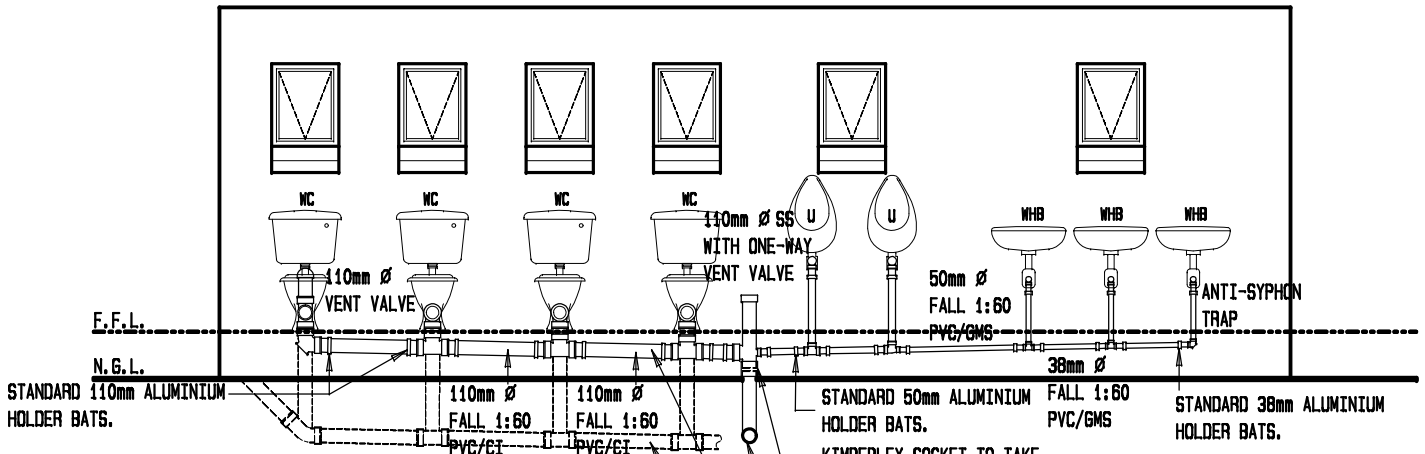
NOTE:
DRAWING SHOWS TYPICAL UPGRADING FROM SUBSURFACE TO ABOVE GROUND LEVEL INSTALLATION

PIPE TYPE
-ABOVE NGL:
ALL PIPING IN uPVC WITH SPIGOT AND SOCKET JOINTS AS PER SABS 967 / SANS 967.
FIX TO WALL WITH STANDARD ALUMINIUM HOLDER BATS (2 PER FITTING).

-BELOW NGL:
ALL PIPING IN HDPE CLASS 6 AS PER SABS 533-1 / SANS 533-1
PART II TYPE 4 WITH BUTT OR FUSION WELDED JOINTS.



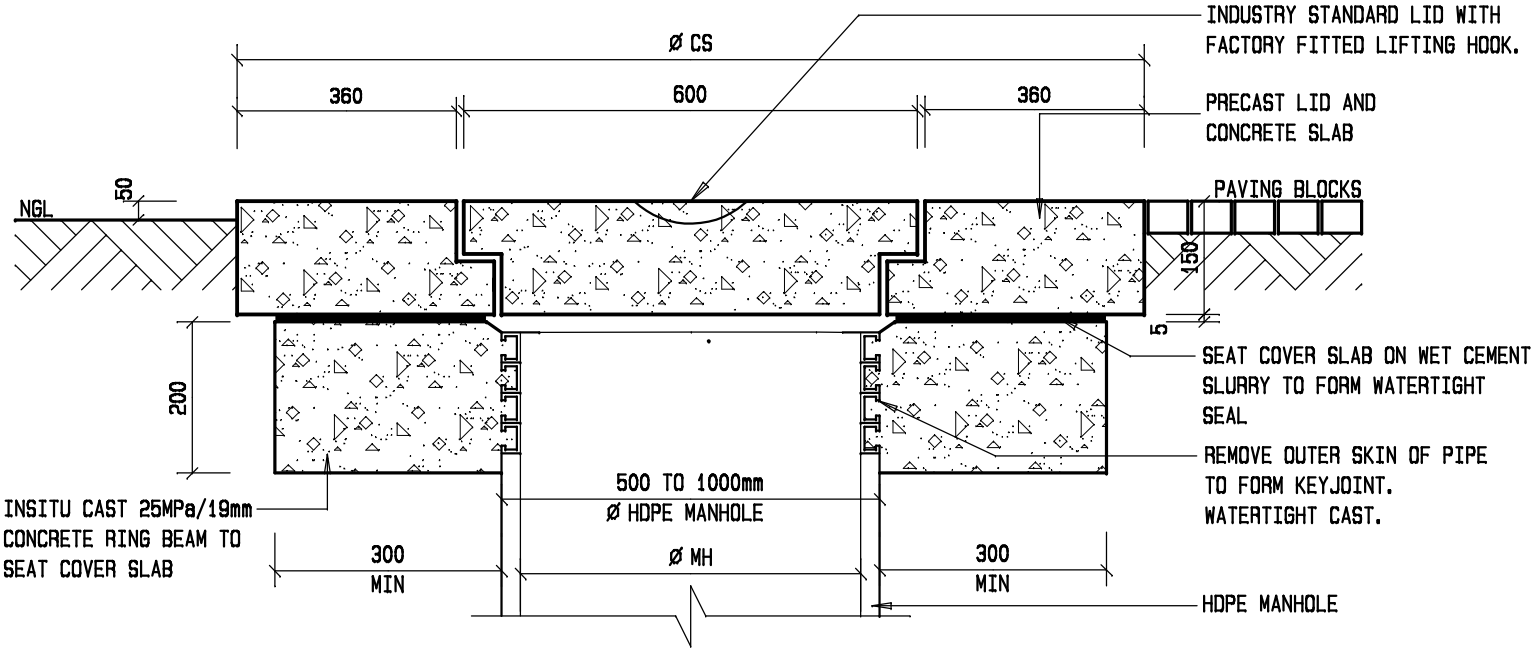
TYPICAL PLAN



TYPICAL ELEVATION FOR SURFACE MOUNTING OF SEWER PIPES TO EXISTING BUILDINGS.

DT 07/D

Ø MH	Ø CS
500mm	1100mm
700mm	1300mm
900-1000mm	1500mm



STANDARD HEAVY DUTY PRECAST CONCRETE LID AND COVER SLAB FOR HDPE MANHOLES (1200mm OD)

DT 08/D

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department: DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS

title: SEWER DRAINAGE: STANDARD HEAVY DUTY PRECAST CONCRETE ROOFSLAB AND LID FOR HDPE MANHOLE (DIAGRAMMATIC)

scale: 1 : 10

date: 10/27/2004

drawing number / type number: TYPE NO DT 08/D

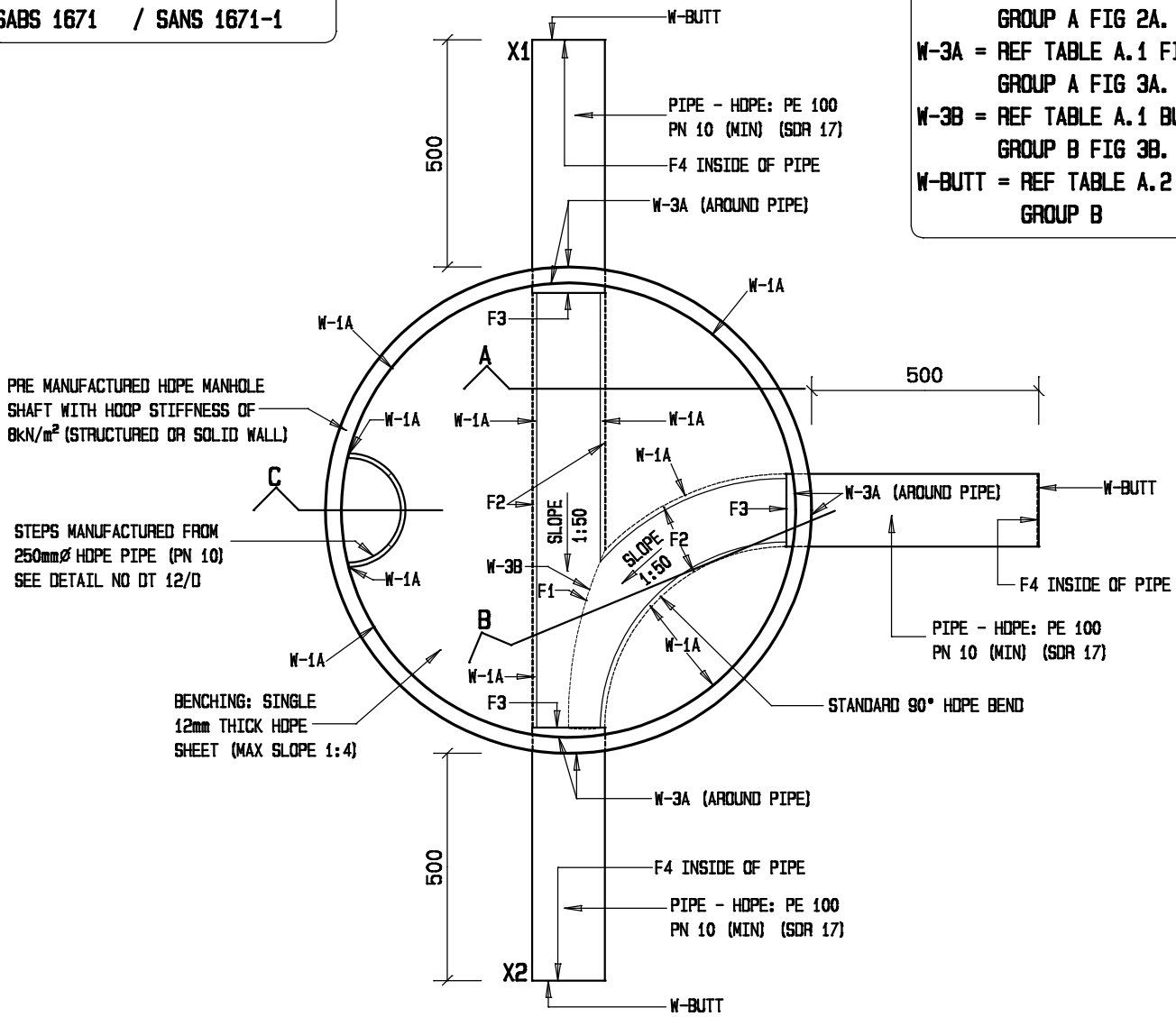
GENERAL NOTE:
- ALL MATERIALS TO BE HDPE PE-100 AS PER SABS ISO 4427 / SANS 4427
  HOOP STIFFNESS OF MANHOLE SHAFT TO BE 8kN/m²

OTHER RELEVANT MANUFACTURING STANDARDS:
SABS 0268-1 / SANS 10268-1
SABS 0269 / SANS 10269
SABS 0270 / SANS 10270
SABS 1269 / SANS 1269
SABS 1655 / SANS 1655
SABS 1671 / SANS 1671-1

GENERAL WELDING SPECIFICATION:
- BUTT WELDING OF PIPES TO COMPLY TO SABS 0268-1:1999. SANS 10268-1
- HOT GAS WELDING TO COMPLY TO SABS 0268-3:1999. SANS 10268-3
- HOT GAS EXTRUSION WELDING TO COMPLY TO SABS 0268-4:1999. SANS 10268-4

GENERAL FINISHING NOTE:
F1- REMOVE FILLER EXPULSION AND FINISH WELD SMOOTH WITH PIPE SURFACE.
F2- REMOVE FILLER EXPULSION AND FINISH WELD WITH SMOOTH ROUNDED EDGE.
F3- FINISH PIPE WITH SMOOTH ROUNDED EDGE.
F4- REMOVE INTERNAL WELDING BEAD.

WELDING NOTATION FOR JOINTS
SEE SABS 0270 / SANS 10270 PAR 5 AS WELL AS ANNEX A.
W-1A = REF TABLE A.1 FILLET GROUP A FIG 1A.
W-2A = REF TABLE A.1 FILLET GROUP A FIG 2A.
W-3A = REF TABLE A.1 FILLET GROUP A FIG 3A.
W-3B = REF TABLE A.1 BUTT GROUP B FIG 3B.
W-BUTT = REF TABLE A.2 BUTT GROUP B



X1 TO X2 IS A SINGLE LENGTH PIPE WITH SECTION REMOVED TO FORM CHANNEL

HDPE MANHOLE
PLAN
SCALE 1:15

SECTION A: SEE DT 10/D
SECTION B: SEE DT 11/D
SECTION C: SEE DT 12/D

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departmental: DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS	title: TYPICAL WELDING DETAILS FOR HDPE SEWER MANHOLE: PLAN	scale: 1 : 15	date: 10/27/2004
		drawing number / type number: TYPE NO DT 09/D	

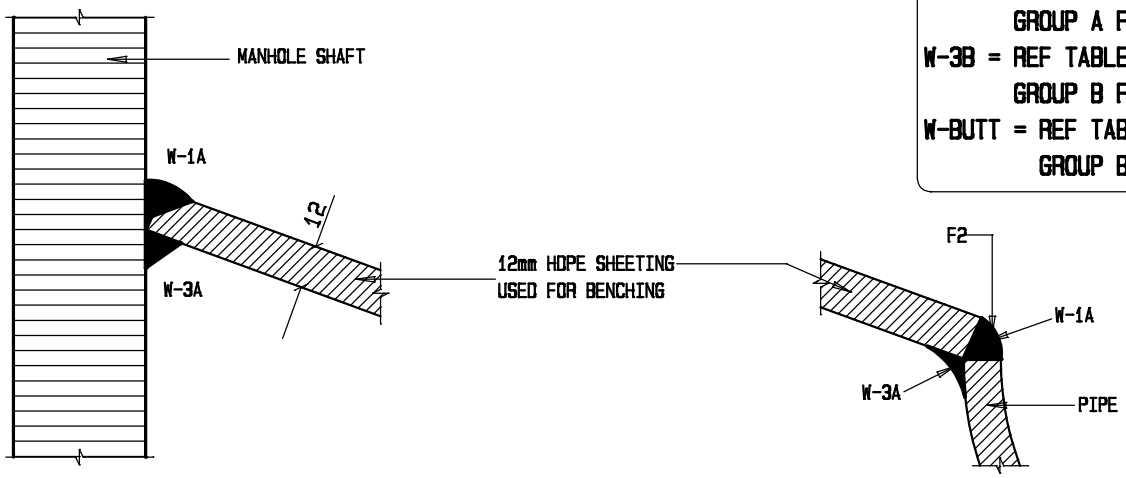
GENERAL NOTE:
- ALL MATERIALS TO BE HDPE PE-100 AS PER SABS ISO 4427 / SANS 4427
  HOOP STIFFNESS OF MANHOLE SHAFT TO BE 8kN/m^2

OTHER RELEVANT MANUFACTURING STANDARDS:
SABS 0268-1 / SANS 10268-1
SABS 0269 / SANS 10269
SABS 0270 / SANS 10270
SABS 1269 / SANS 1269
SABS 1655 / SANS 1655
SABS 1671 / SANS 1671-1

GENERAL WELDING SPECIFICATION:
- BUTT WELDING OF PIPES TO COMPLY TO SABS 0268-1:1999. SANS 10268-1
- HOT GAS WELDING TO COMPLY TO SABS 0268-3:1999. SANS 10268-3
- HOT GAS EXTRUSION WELDING TO COMPLY TO SABS 0268-4:1999. SANS 10268-4

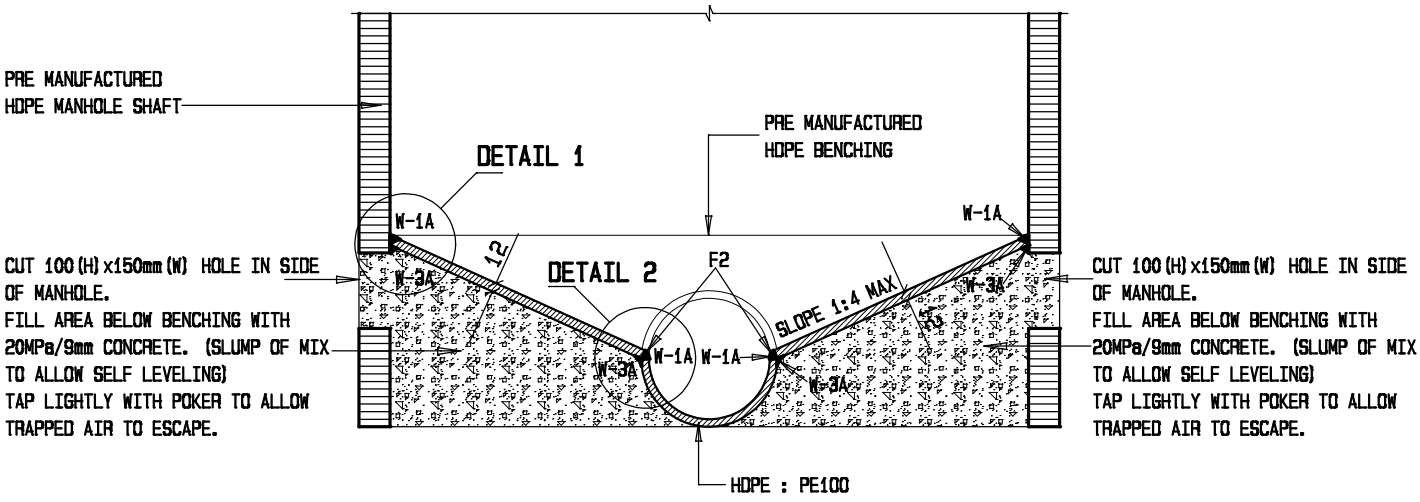
GENERAL FINISHING NOTE:
F1- REMOVE FILLER EXPULSION AND FINISH WELD SMOOTH WITH PIPE SURFACE.
F2- REMOVE FILLER EXPULSION AND FINISH WELD WITH SMOOTH ROUNDED EDGE.
F3- FINISH PIPE WITH SMOOTH ROUNDED EDGE.
F4- REMOVE INTERNAL WELDING BEAD.

WELDING NOTATION FOR JOINTS
SEE SABS 0270 / SANS 10270 PAR 5 AS WELL AS ANNEX A.
W-1A = REF TABLE A.1 FILLET GROUP A FIG 1A.
W-2A = REF TABLE A.1 FILLET GROUP A FIG 2A.
W-3A = REF TABLE A.1 FILLET GROUP A FIG 3A.
W-3B = REF TABLE A.1 BUTT GROUP B FIG 3B.
W-BUTT = REF TABLE A.2 BUTT GROUP B



DETAIL 1
SCALE 1:2

DETAIL 2
SCALE 1:2



SECTION A
SCALE 1:10

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		drawing number / type number: TYPE NO DT 10/D	

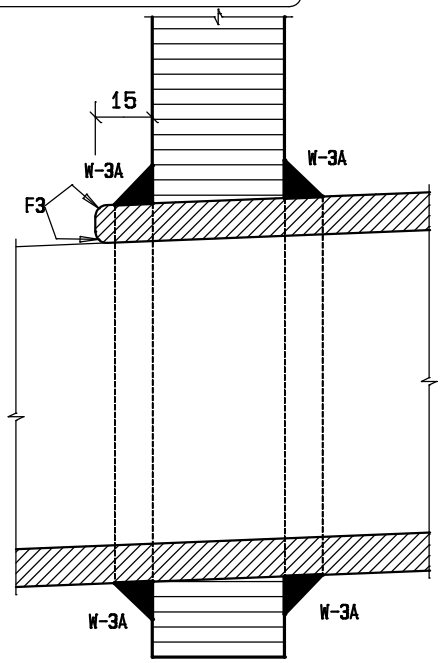
GENERAL NOTE:
- ALL MATERIALS TO BE HDPE PE-100 AS PER SABS ISO 4427 / SANS 4427
  HOOP STIFFNESS OF MANHOLE SHAFT TO BE 8kN/m^2

OTHER RELEVANT MANUFACTURING STANDARDS:
SABS 0268-1 / SANS 10268-1
SABS 0269 / SANS 10269
SABS 0270 / SANS 10270
SABS 1269 / SANS 1269
SABS 1655 / SANS 1655
SABS 1671 / SANS 1671-1

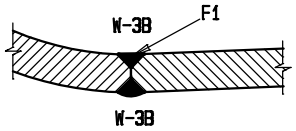
GENERAL WELDING SPECIFICATION:
- BUTT WELDING OF PIPES TO COMPLY TO SABS 0268-1:1999. SANS 10268-1
- HOT GAS WELDING TO COMPLY TO SABS 0268-3:1999. SANS 10268-3
- HOT GAS EXTRUSION WELDING TO COMPLY TO SABS 0268-4:1999. SANS 10268-4

GENERAL FINISHING NOTE:
F1- REMOVE FILLER EXPULSION AND FINISH WELD SMOOTH WITH PIPE SURFACE.
F2- REMOVE FILLER EXPULSION AND FINISH WELD WITH SMOOTH ROUNDED EDGE.
F3- FINISH PIPE WITH SMOOTH ROUNDED EDGE.
F4- REMOVE INTERNAL WELDING BEAD.

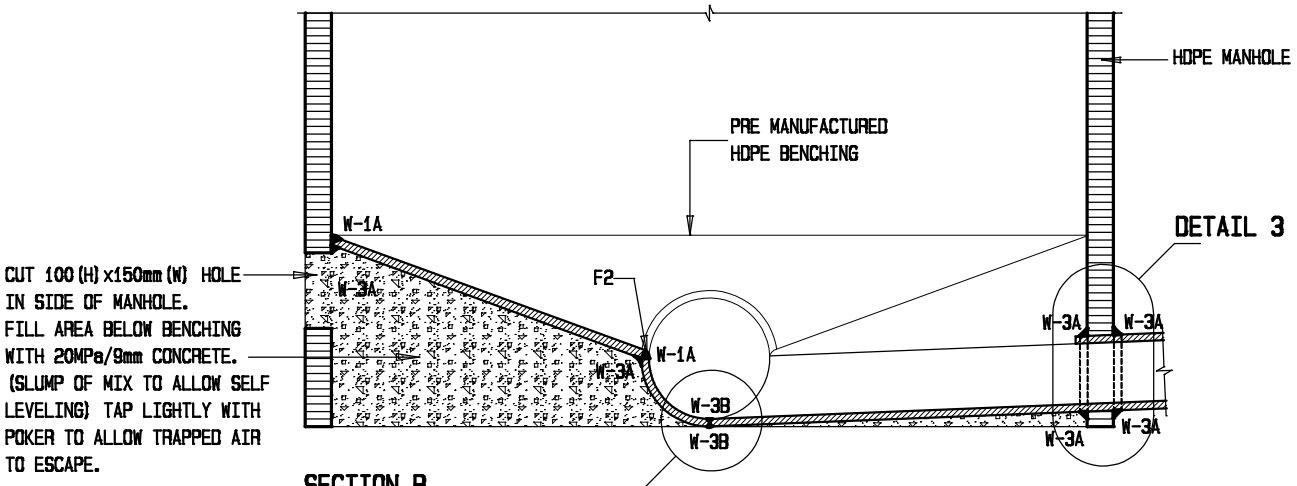
WELDING NOTATION FOR JOINTS SEE SABS 0270 / SANS 10270 PAR 5 AS WELL AS ANNEX A.
W-1A = REF TABLE A.1 FILLET GROUP A FIG 1A.
W-2A = REF TABLE A.1 FILLET GROUP A FIG 2A.
W-3A = REF TABLE A.1 FILLET GROUP A FIG 3A.
W-3B = REF TABLE A.1 BUTT GROUP B FIG 3B.
W-BUTT = REF TABLE A.2 BUTT GROUP B



DETAIL 3
SCALE 1:2



DETAIL 4
SCALE 1:2



SECTION B
SCALE 1:10

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			drawing number / type number TYPE NO DT 11/D	

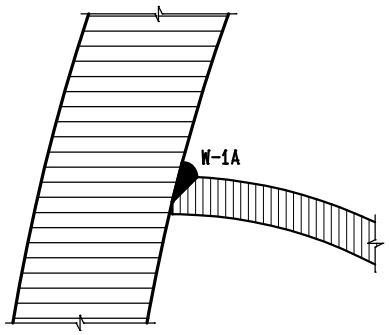
GENERAL NOTE:
- ALL MATERIALS TO BE HDPE PE-100 AS PER SABS ISO 4427 / SANS4427
  HOOP STIFFNESS OF MANHOLE SHAFT TO BE 8kN/m^2

OTHER RELEVANT MANUFACTURING STANDARDS:
SABS 0268-1 / SANS 10268-1
SABS 0269 / SANS 10269
SABS 0270 / SANS 10270
SABS 1269 / SANS 1269
SABS 1655 / SANS 1655
SABS 1671 / SANS 1671-1

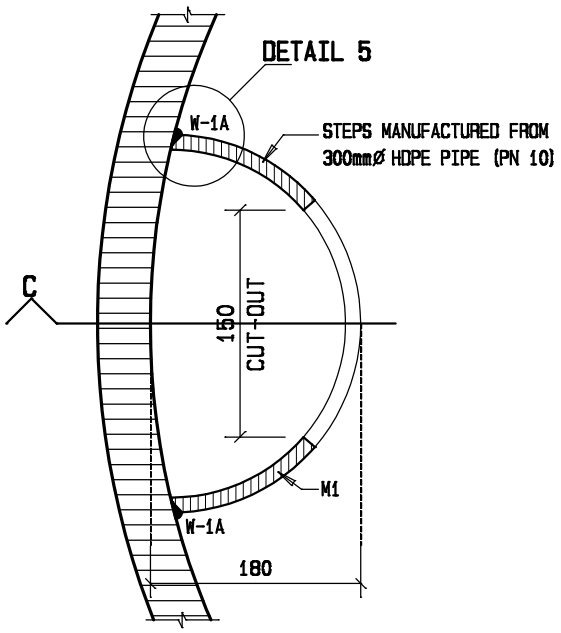
GENERAL WELDING SPECIFICATION:
- BUTT WELDING OF PIPES TO COMPLY TO SABS 0268-1:1999. SANS 10268-1
- HOT GAS WELDING TO COMPLY TO SABS 0268-3:1999. SANS 10268-3
- HOT GAS EXTRUSION WELDING TO COMPLY TO SABS 0268-4:1999. SANS 10268-4

GENERAL FINISHING NOTE:
F1- REMOVE FILLER EXPULSION AND FINISH WELD SMOOTH WITH PIPE SURFACE.
F2- REMOVE FILLER EXPULSION AND FINISH WELD WITH SMOOTH ROUNDED EDGE.
F3- FINISH PIPE WITH SMOOTH ROUNDED EDGE.
F4- REMOVE INTERNAL WELDING BEAD.

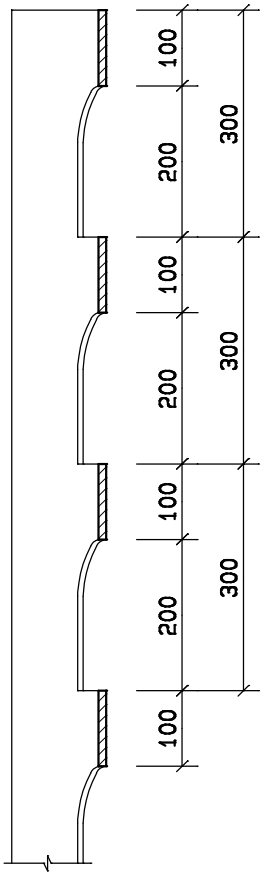
WELDING NOTATION FOR JOINTS SEE SABS 0270 / SANS 10270 PAR 5 AS WELL AS ANNEX A.
W-1A = REF TABLE A.1 FILLET GROUP A FIG 1A.
W-2A = REF TABLE A.1 FILLET GROUP A FIG 2A.
W-3A = REF TABLE A.1 FILLET GROUP A FIG 3A.
W-3B = REF TABLE A.1 BUTT GROUP B FIG 3B.
W-BUTT = REF TABLE A.2 BUTT GROUP B



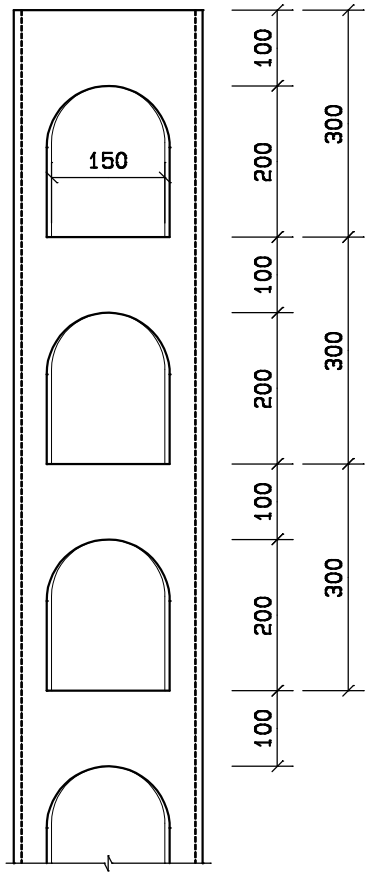
DETAIL 5
SCALE 1:2



HDPE STEPS IN MANHOLE
PLAN
SCALE 1:5



SECTION C
SCALE 1:10



ELEVATION OF STEPS
SCALE 1:10

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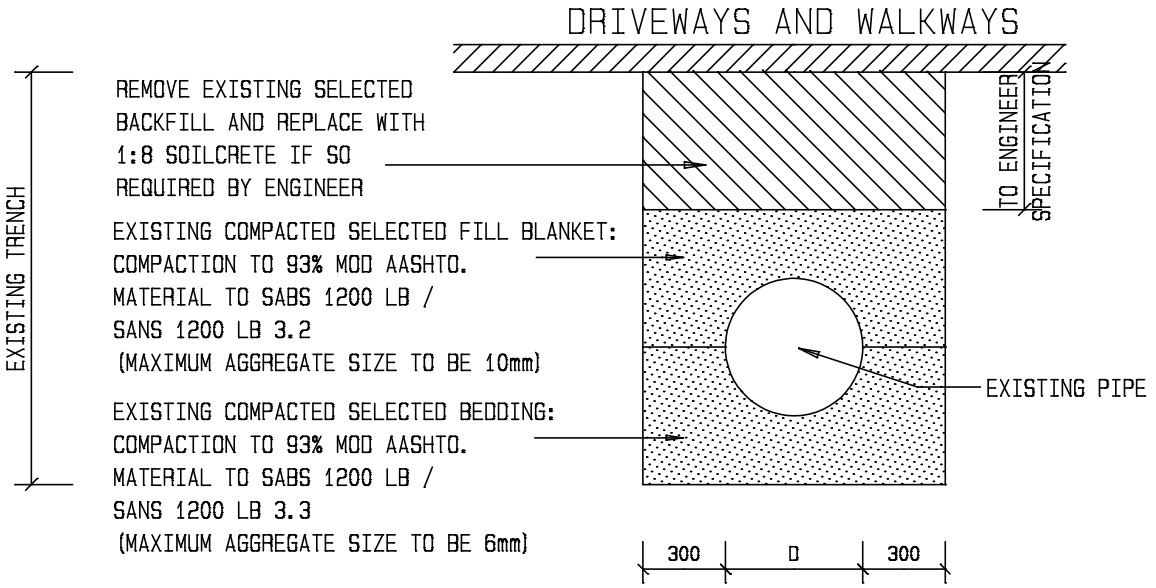
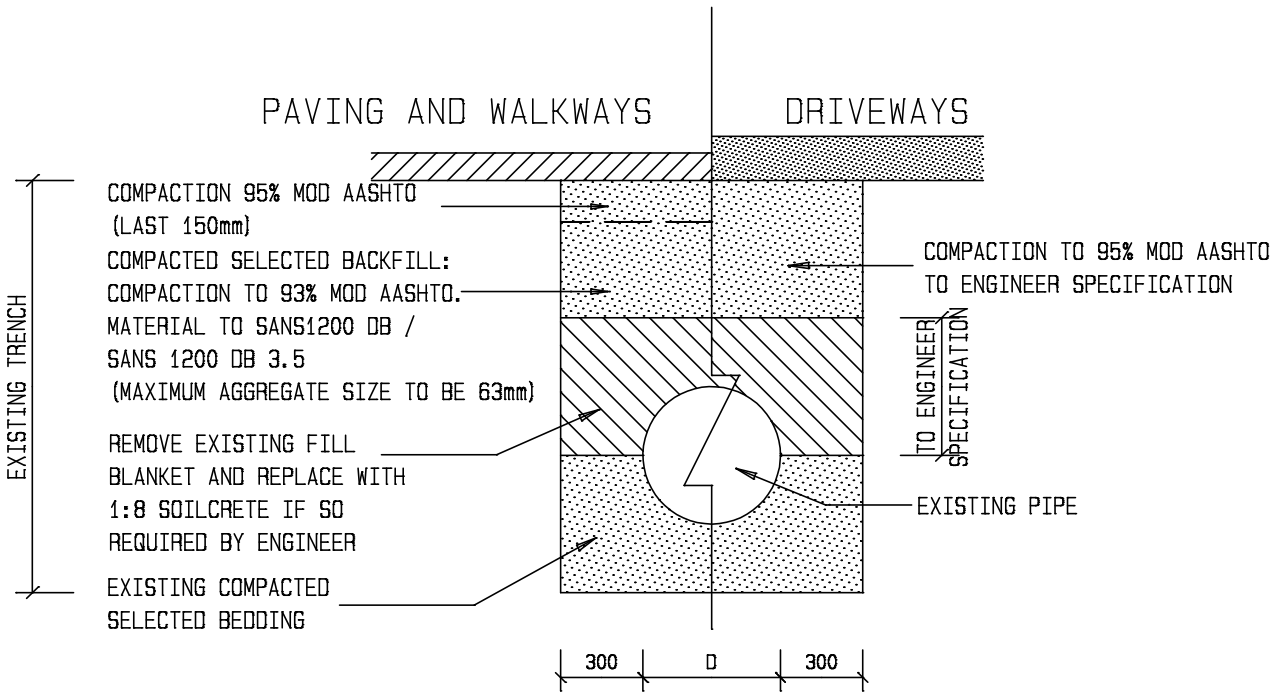
			drawing number / type number TYPE NO DT 12/D	





TRENCHING, BEDDING AND BACKFILLING DETAILS OVER EXISTING PIPES

SCALE 1:30

NOTE:
ALL BEDDING SURROUND AND BACKFILL MATERIALS SHALL AFTER COMPACTION BE LESS PREMEABLE THAN THE IN-SITU SURROUNDING SOIL

DT 13/D

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		drawing number / type number: TYPE NO DT 13/D	

STORM WATER DETAILS: LIST OF DRAWINGS

DT 01/ST STORM WATER DUCT FOR ROADWAYS AND WALKWAYS.
DT 02/ST STORM WATER CANAL IN AREAS WITH VEHICLE TRAFFIC.
DT 03/ST DETAIL OF EXIT SEWER PIPES AND STORM WATER CANAL NEXT TO BUILDINGS.
DT 04/ST EXPANSION JOINT IN CANAL.
DT 05/ST EXPANSION JOINT AGAINST BUILDING
DT 06/ST STORM WATER CANAL NEXT TO BUILDING OR IN OPEN VELD WHERE TO MATCH EXISTING ONLY.
DT 07/ST (SECTION) LARGE STORM WATER CANAL
DT 09/ST (SECTION) TYPICAL COVERED STORM WATER CANAL
DT 10/ST FLOOR EXPANSION JOINT DETAIL
DT 11/ST CONSTRUCTION JOINT DETAIL - TYPE 1
DT 12/ST CONSTRUCTION JOINT DETAIL - TYPE 2
DT 13/ST CONSTRUCTION JOINT DETAIL - TYPE 3
DT 16/ST(1) (PLAN) SPILLING BASIN - TYPE 1
DT 16/ST(2) SECTION THROUGH SPILLING BASIN - TYPE 1
DT 16/ST(3) SECTION THROUGH SPILLING BASIN - TYPE 1
DT 17/ST PLAN AND SECTION SPILLING BASIN - TYPE 2
DT 19/ST STORM WATER INLET OVER MANHOLE
DT 20/ST TYPICAL WELDING DETAILS FOR HDPE STORM WATER MANHOLE: PLAN
DT 21/ST TYPICAL WELDING DETAILS FOR HDPE STORM WATER MANHOLE: SECTION A
DT 22/ST TYPICAL WELDING DETAILS FOR HDPE STORM WATER MANHOLE: SECTION B
DT 23/ST TYPICAL WELDING DETAILS FOR HDPE STORM WATER MANHOLE: SECTION C
DT 24/ST GRID INLET NEXT TO RUNWAYS AND TAXIWAYS
DT 25/ST DUCT FOR ROADWAYS AND WALKWAYS
DT 26/ST CANAL IN AREAS WITH NO VECHILE TRAFFIC

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departmental
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS

project
STORMWATER:
DRAWING LIST.

scale
.

date
22/06/2006

drawing number / type number
TYPE NO DT 00/ST

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Tel (012) 337 2000

department: DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS.

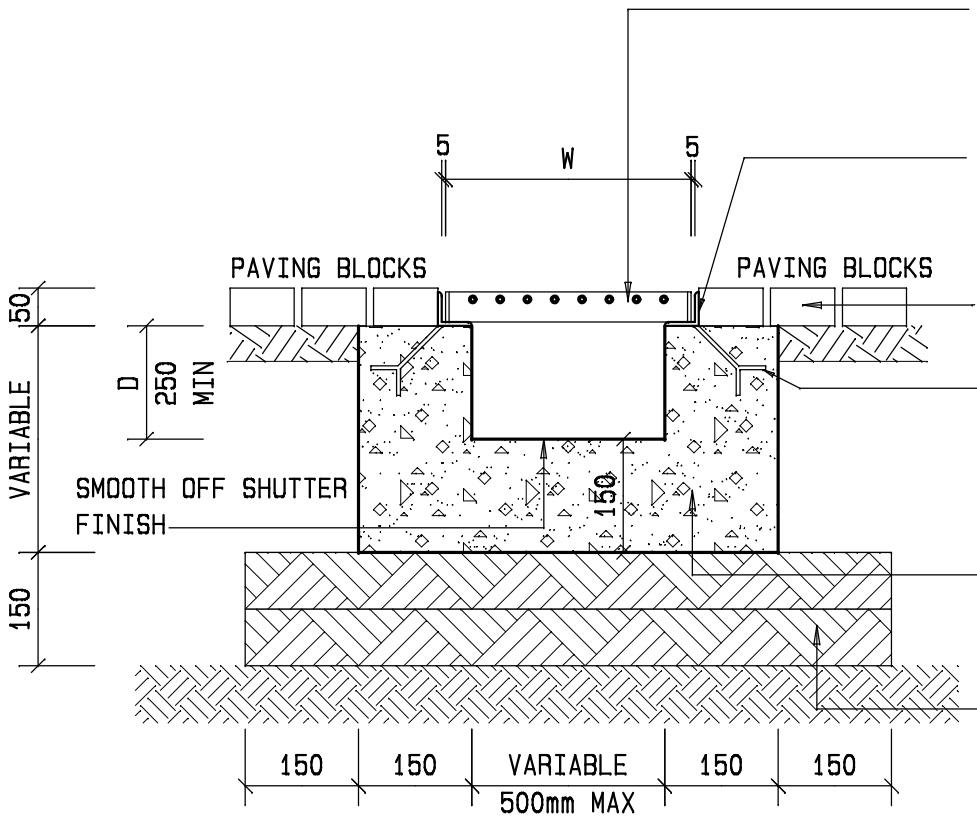
title: STORM WATER: DUCT FOR ROADWAYS AND WALKWAYS

scale: 1 : 10

date: 10/27/2004

drawing number / type number: TYPE NO DT 01/ST

NOTE:
-COMPLETE UNIT TO BE HOT DIPPED GALVANIZED AFTER MANUFACTURING (SANS 32 HEAVY DUTY).
-ALLOW FOR WATER DRAINAGE FROM DUCT TO STORM WATER SYSTEM



RECTANGULAR CATWALK TYPE HORIZONTAL STEEL GRATING TRENCH COVER (HEAVY DUTY)
EDGE AND CROSS BARS 40 X 4.5mm
LONGITUDINAL BARS 25 X 4.5mm
GRATING TO BE HOT DIPPED GALVANISED AFTER MANUFACTURING
GRATING TO BE "BANDED".

45X45mmX5mm HOT DIPPED GALVANIZED ANGLE IRON TO SEAT GRATING, WITH TIE BACK BAR.

50mm THICK PAVING BLOCKS

75 x 25 x 5mm FLAT IRON ANCHOR IN CONCRETE

30 MPa / 19mm CONCRETE

COMPACT TO 95% MOD AASHTO DENSITY.

DT 01/ST

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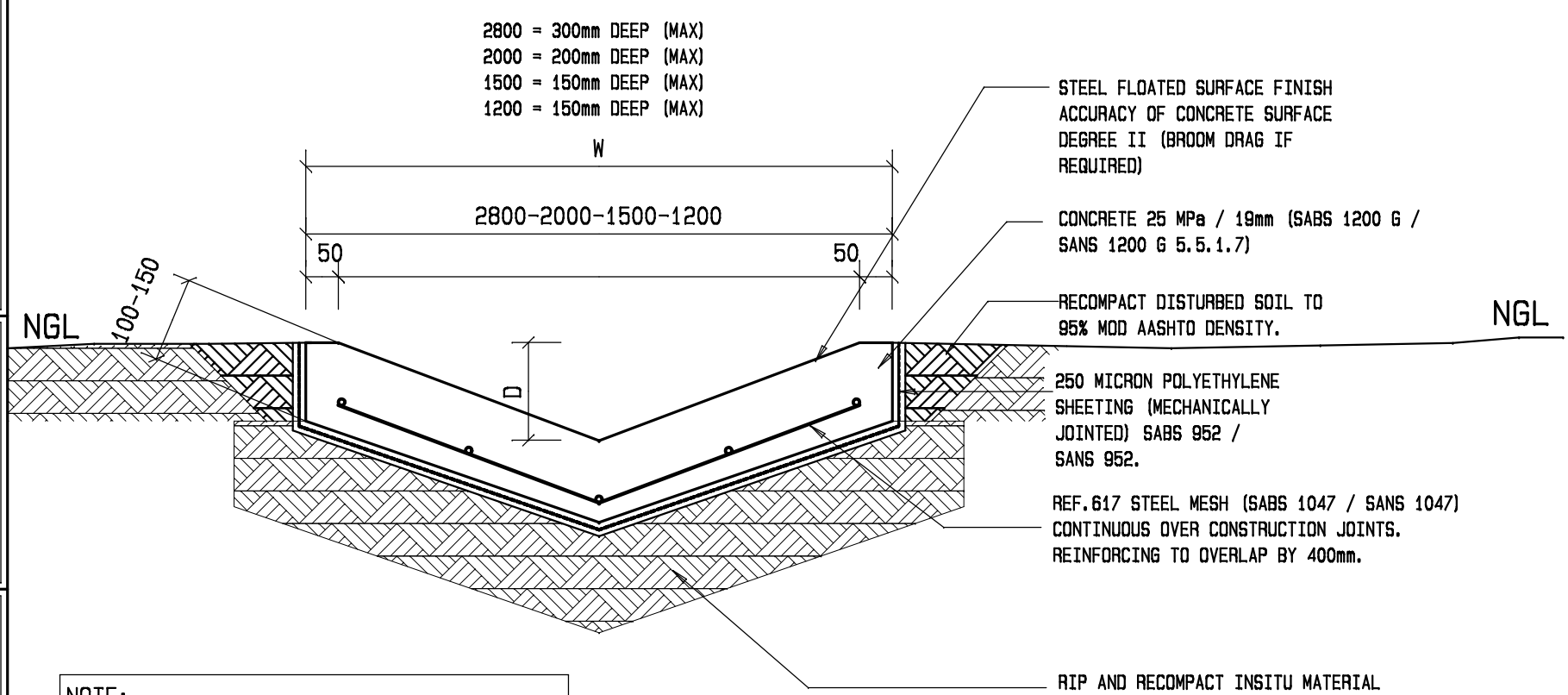
departmental
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS

title
STORM WATER:
CANAL IN AREAS WITH VEHICLE TRAFFIC
(DIAGRAMMATIC)

scale
1 : 10

date
10/27/2004

drawing number / type number
TYPE NO DT 02/ST

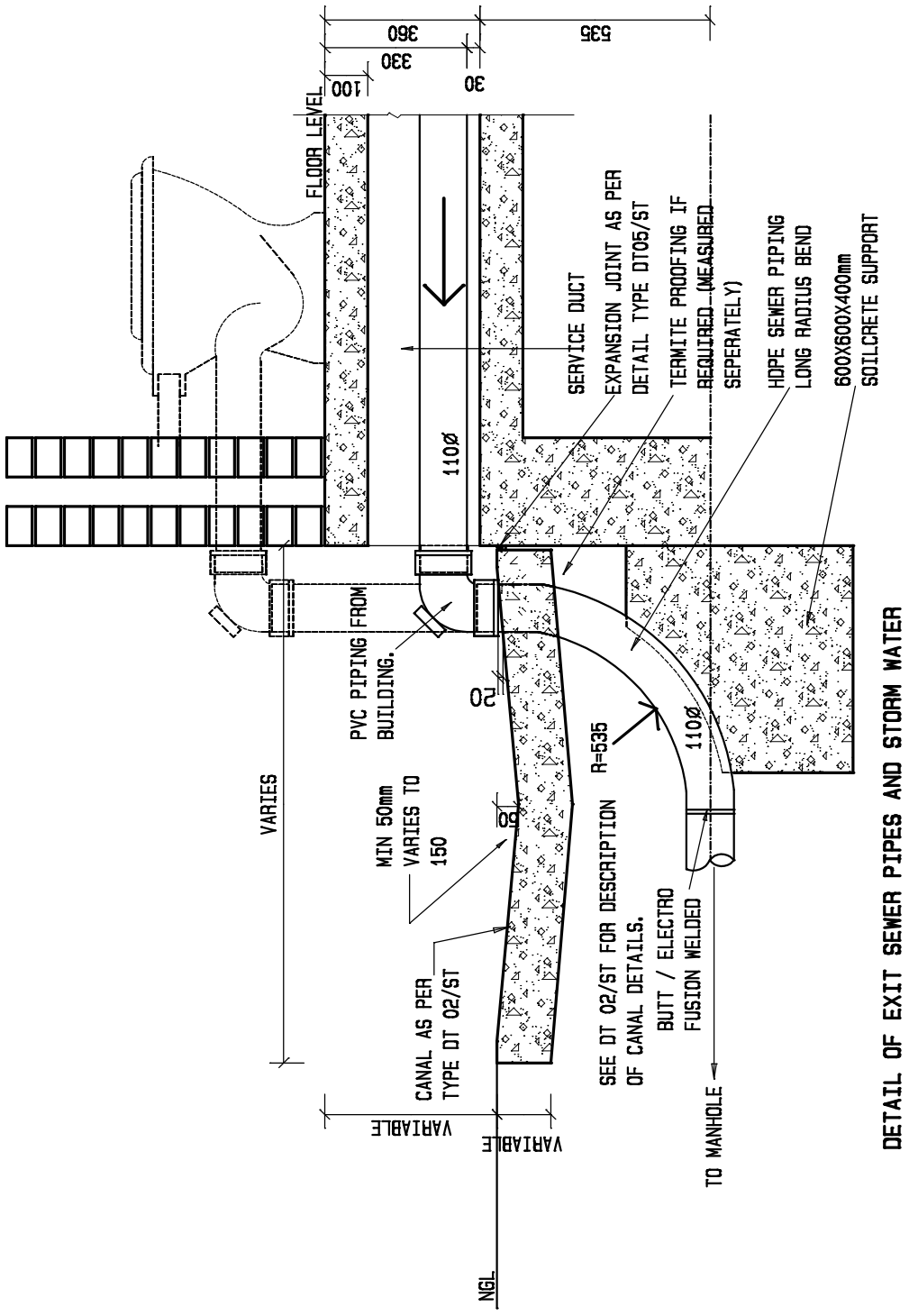


NOTE:
1. D - VARIABLE FROM 50mm TO INDICATED MAXIMUM DEPTH.
2. STEEL REINFORCING TO BE REF. 395 IN AREAS WITH NO VEHICLE TRAFFIC.
3. EXPANSION JOINT BETWEEN CANAL AND WALL ONLY IF INDICATED.

CAST IN ALTERNATIVE SECTIONS 1,5m LONG WITH EXPANSION JOINTS AT 18m. SEE STANDARD DETAIL FOR EXPANSION JOINT - TYPE NO DT 04/S

STORM WATER CANAL IN AREAS WITH VEHICLE TRAFFIC

DT 02/ST



DETAIL OF EXIT SEWER PIPES AND STORM WATER CANAL NEXT TO BUILDINGS.

DT 03/ST

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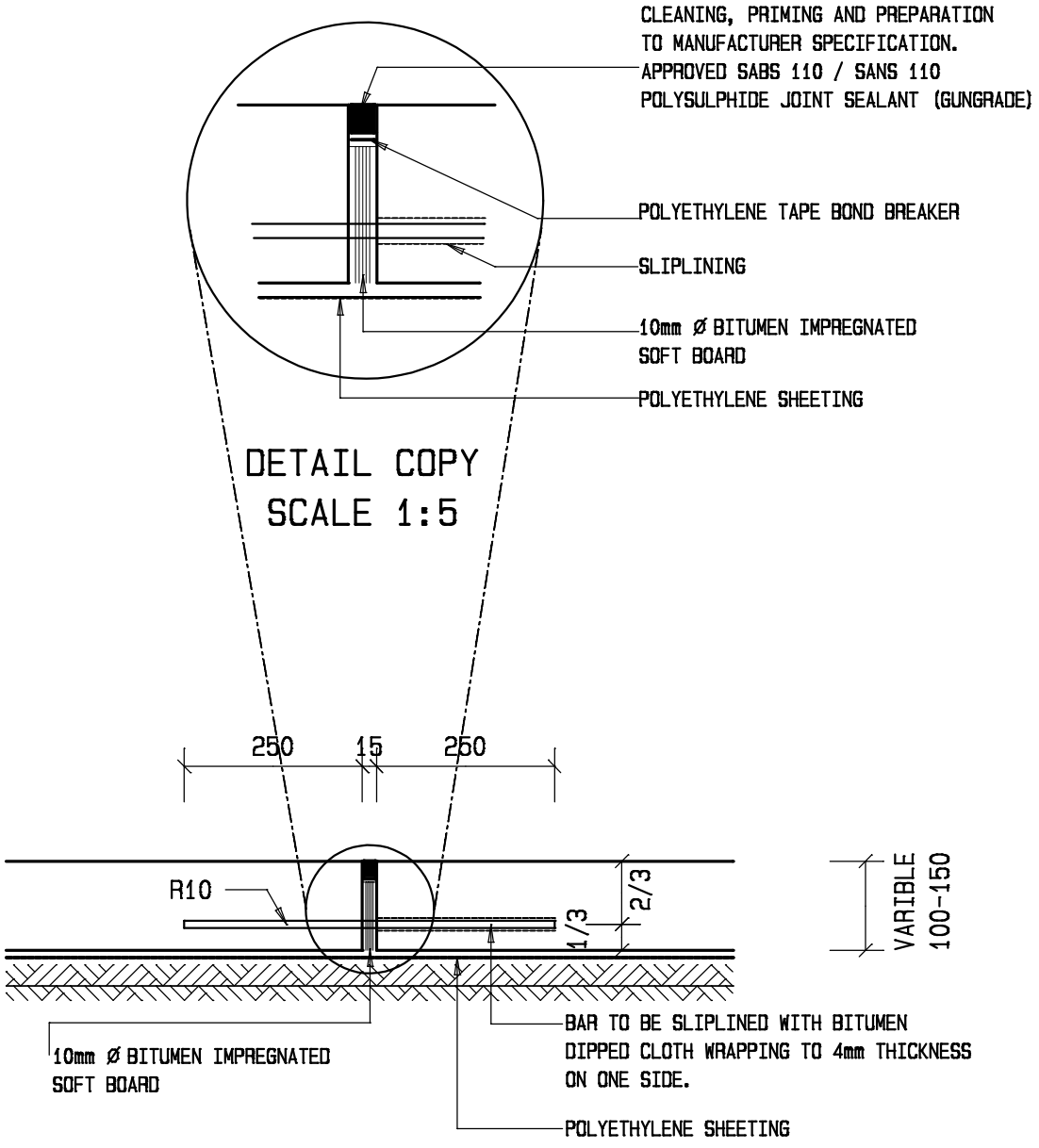
			drawing number / type number TYPE NO DT 03/ST	



EXPANSION JOINT
IN CANAL

DT 04/ST

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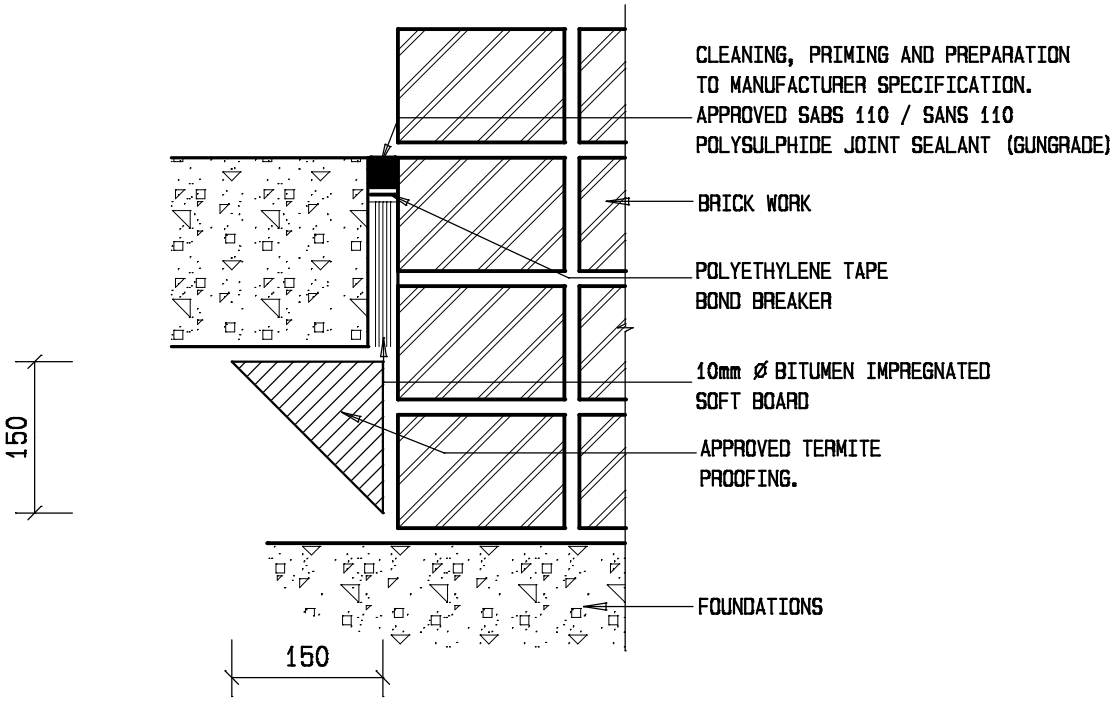
departmental	project	scale	date
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS	STORM WATER: EXPANSION JOINT IN CANAL (DIAGRAMMATIC)	1 : 10	10/27/2004

drawing number / type number

TYPE NO DT 04/ST



EXPANSION JOINT AGAINST BUILDING

DT 05/ST

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departmental
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS

title
STORM WATER:
EXPANSION JOINT AGAINST BUILDING
(DIAGRAMMATIC)

scale
1 : 5

date
10/27/2004

drawing number / type number
TYPE NO DT 05/ST

STORM WATER CANAL NEXT TO BUILDING
OR IN OPEN VELD WHERE TO MATCH
EXISTING ONLY.

DT 06/ST

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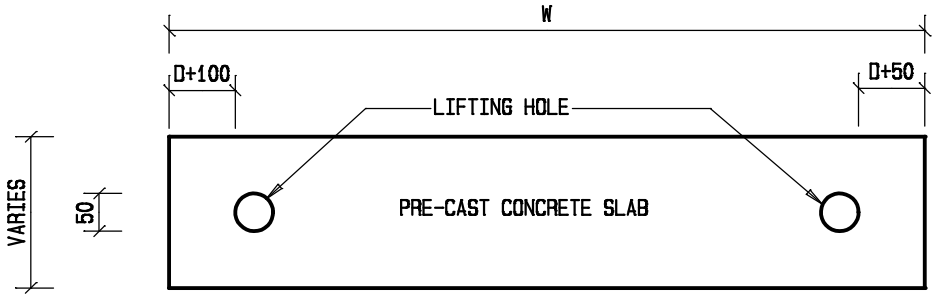
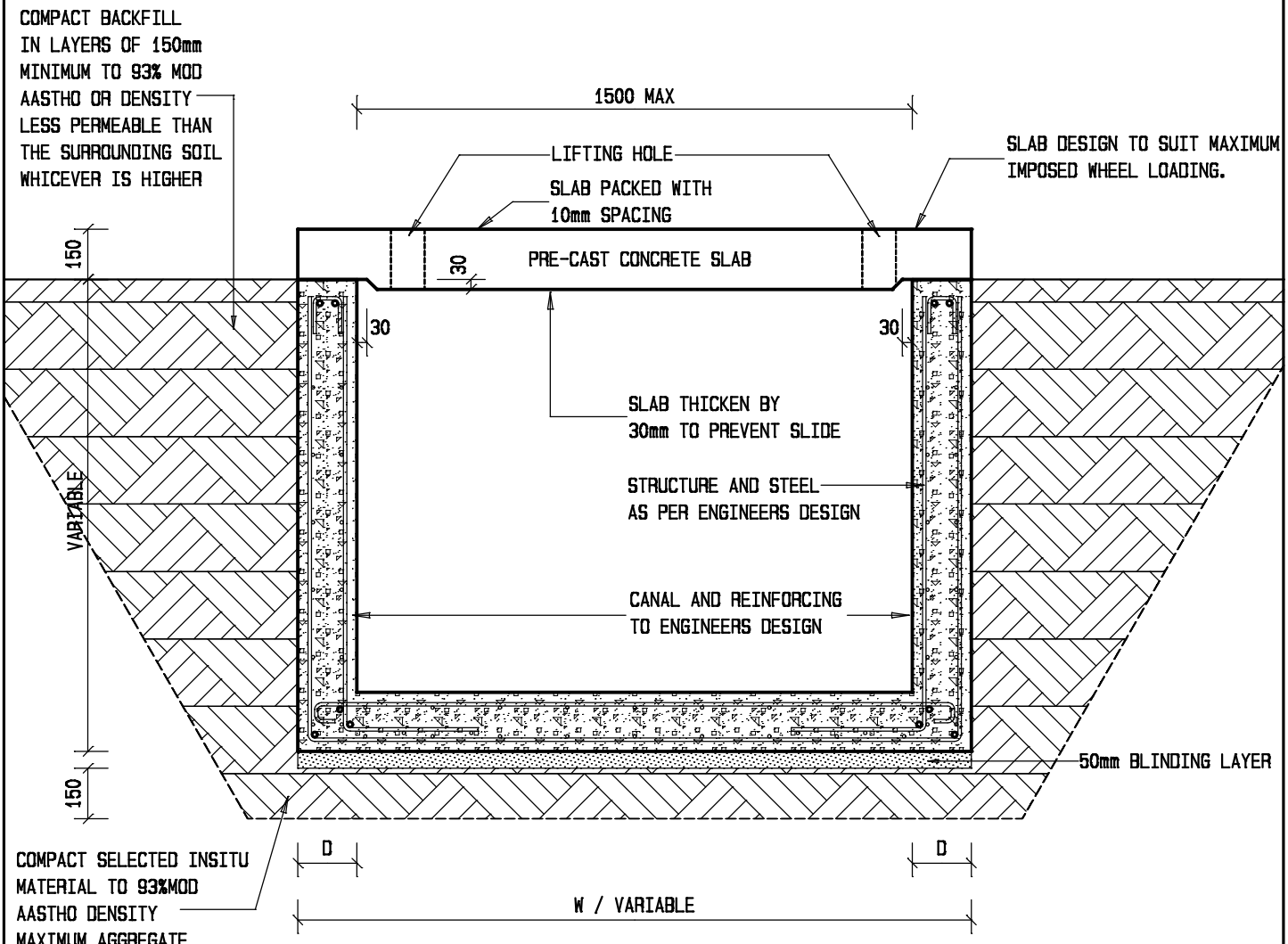
departmental	title	scale	date
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS	STORM WATER: STORM WATER CANAL NEXT TO BUILDING OR IN OPEN VELD WHERE TO MATCH EXISTING ONLY. (DIAGRAMMATIC)	1 : 5	10/27/2004

drawing number / type number

TYPE NO DT 06/ST



PRE-CAST CONCRETE SLAB
TO ENGINEERS DESIGN.
(NOT TO EXCEED 350kg)



TYPICAL COVERED STORM WATER CANAL

DT 09/ST

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departmental	title	scale	date
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS	STORM WATER: (SECTION) TYPICAL COVERED STORM WATER CANAL. (DIAGRAMMATIC)	1 : 20	10/27/2004

drawing number / type number
TYPE NO DT 09/ST

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department: DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS

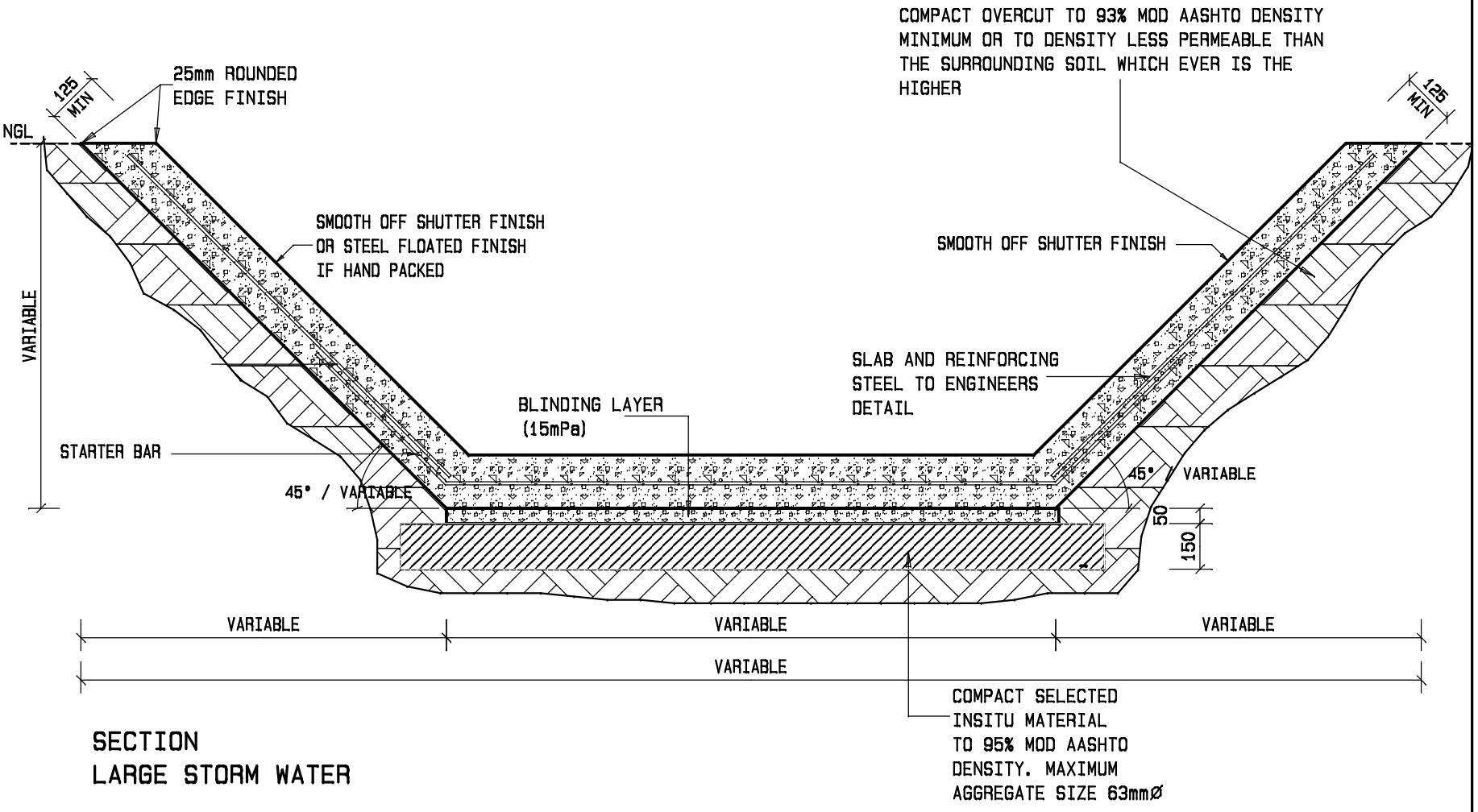
title: STORM WATER: (SECTION) LARGE STORM WATER CANAL. (DIAGRAMMATIC)

scale: 1 : 20

date: 10/27/2004

drawing number / type number: TYPE NO DT 07/ST

NOTE:
CONCRETE LINING HAND FORMED
OR CAST AGAINST SMOOTH FORMWORK.
FOR JOINT DETAILS SEE DETAIL
TYPE DT 10/ST, DT 11/ST

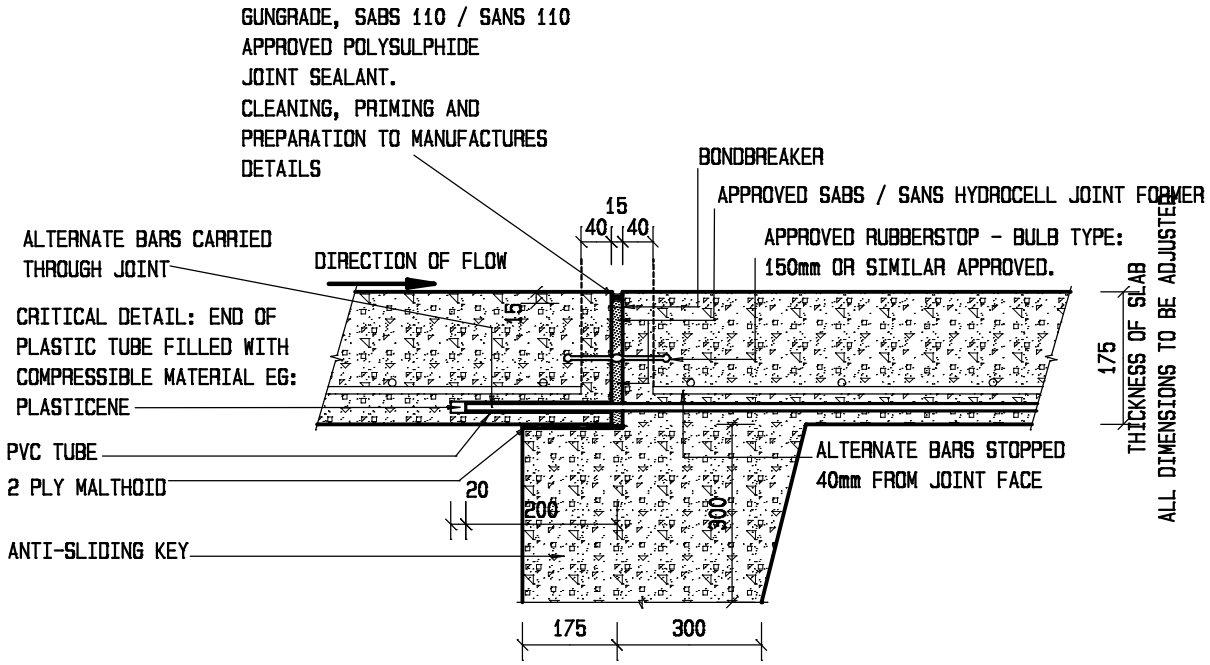


SECTION
LARGE STORM WATER

DT 07/ST

NOTE:
DIMENSIONS TO BE ADJUSTED
IN ACCORDANCE WITH
CANAL FLOORSLAB THICKNESS.

SLIDING KEY REINFORCING AND
DEPTH TO ENGINEERS DESIGN



STORM WATER CANAL
FLOOR EXPANSION JOINT.

DT 10/ST

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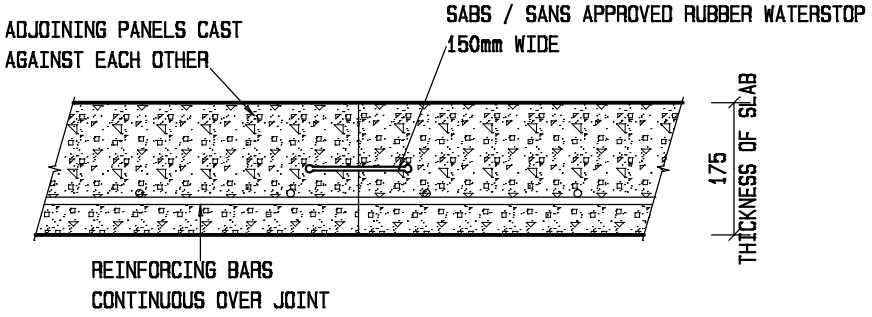
			drawing number / type number TYPE NO DT 10/ST	



STORM WATER CANAL
CONSTRUCTION JOINT - TYPE 1

DT 11/ST

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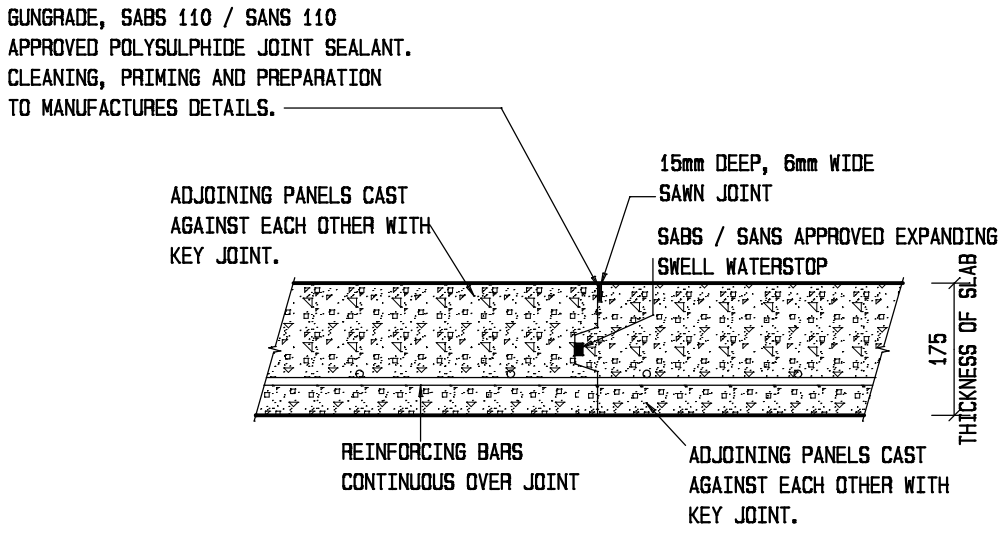
departmental	title	scale	date
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS	STORM WATER: CONSTRUCTION JOINT - TYPE 1 (DIAGRAMMATIC)	1 : 10	10/27/2004

drawing number / type number

TYPE NO DT 11/ST



STORM WATER CANAL
CONSTRUCTION JOINT - TYPE 2

DT 12/ST

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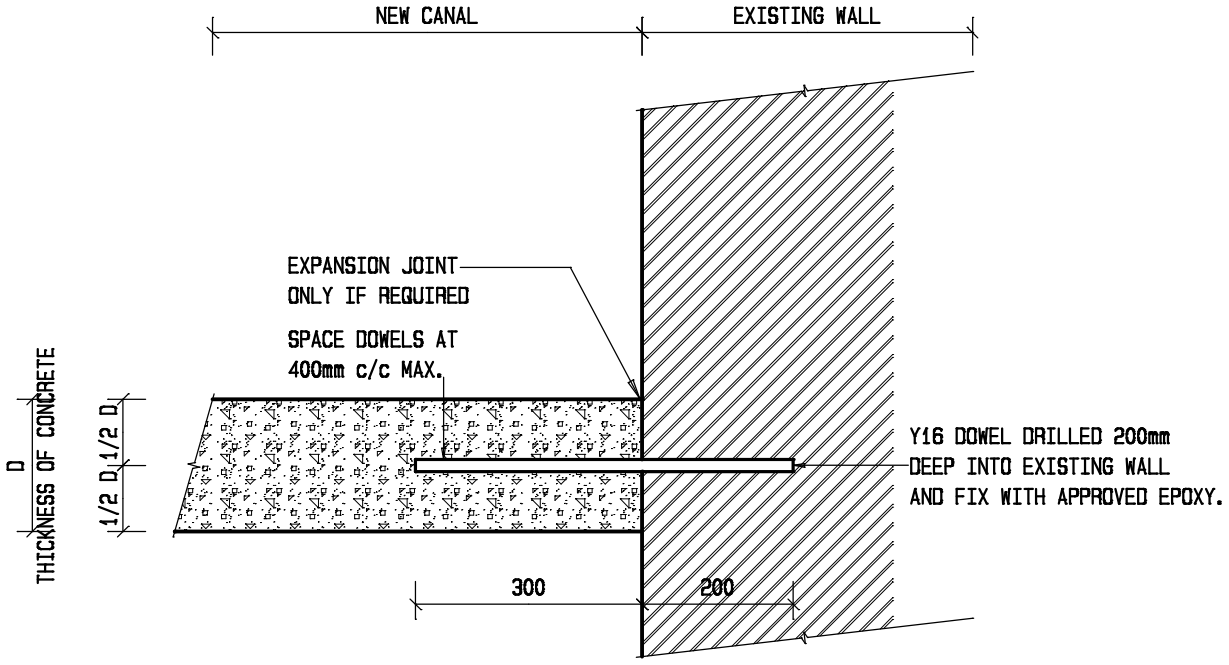
departmental	title	scale	date
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS	STORM WATER: CANAL CONSTRUCTION JOINT - TYPE 2 (DIAGRAMMATIC)	1 : 10	10/27/2004

drawing number / type number

TYPE NO DT 12/ST



STORM WATER CANAL
CONSTRUCTION JOINT - TYPE 3

DT 13/ST

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departemental
DIAGRAMMATIC CIVIL
ENGINEERING DETAILS
FOR DOLOMITIC SOILS

title
STORM WATER:
STORM WATER CANAL
CONSTRUCTION JOINT
- TYPE 3
(DIAGRAMMATIC)

scale
1 : 10

date
10/27/2004

drawing number / type number
TYPE NO DT 13/ST

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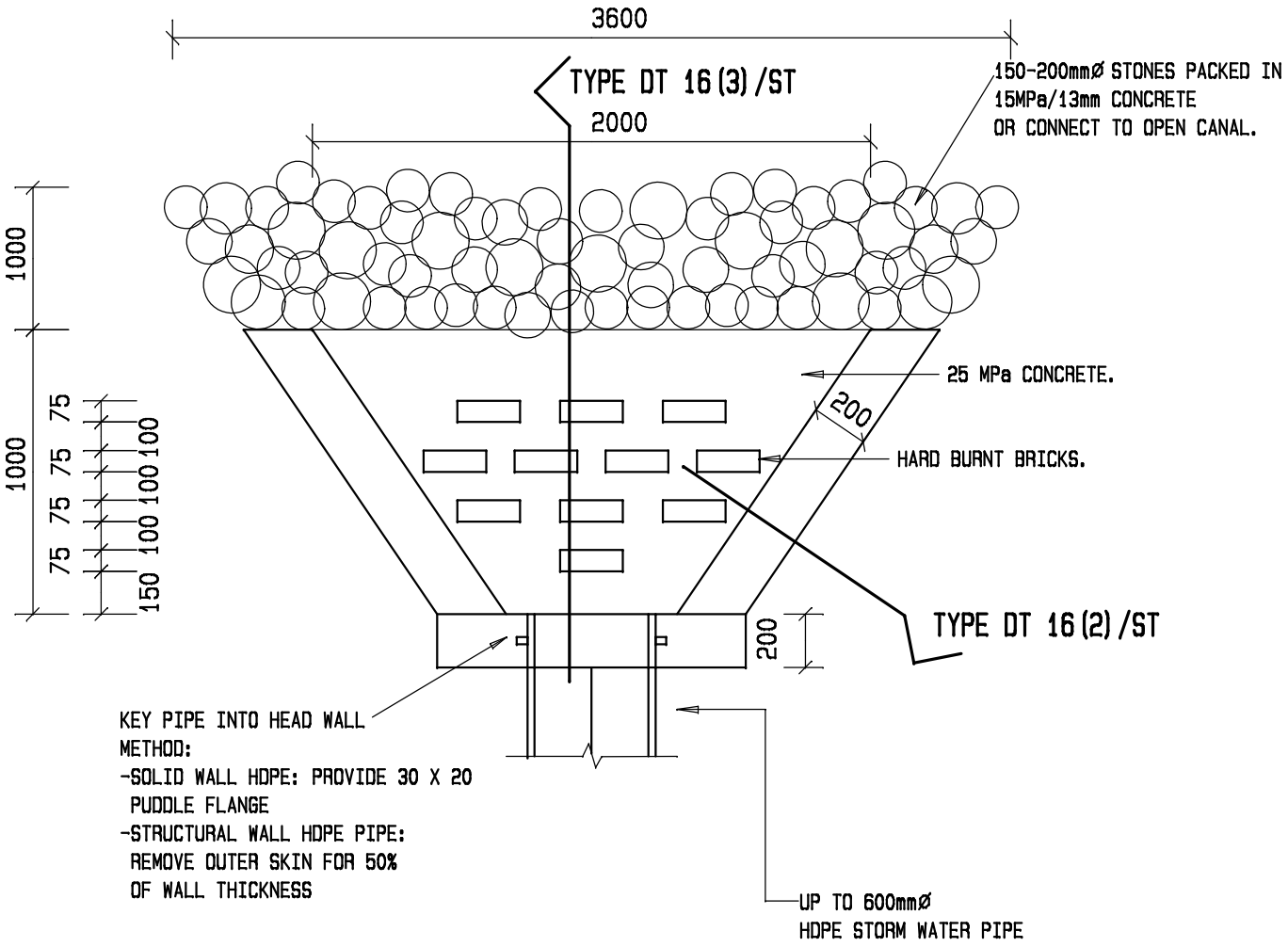
department
DIAGRAMMATIC CIVIL
ENGINEERING DETAILS
FOR DOLOMITIC SOILS

title
STORM WATER:
(PLAN) SPILLING BASIN
TYPE 1
(DIAGRAMMATIC)

scale
1 : 30

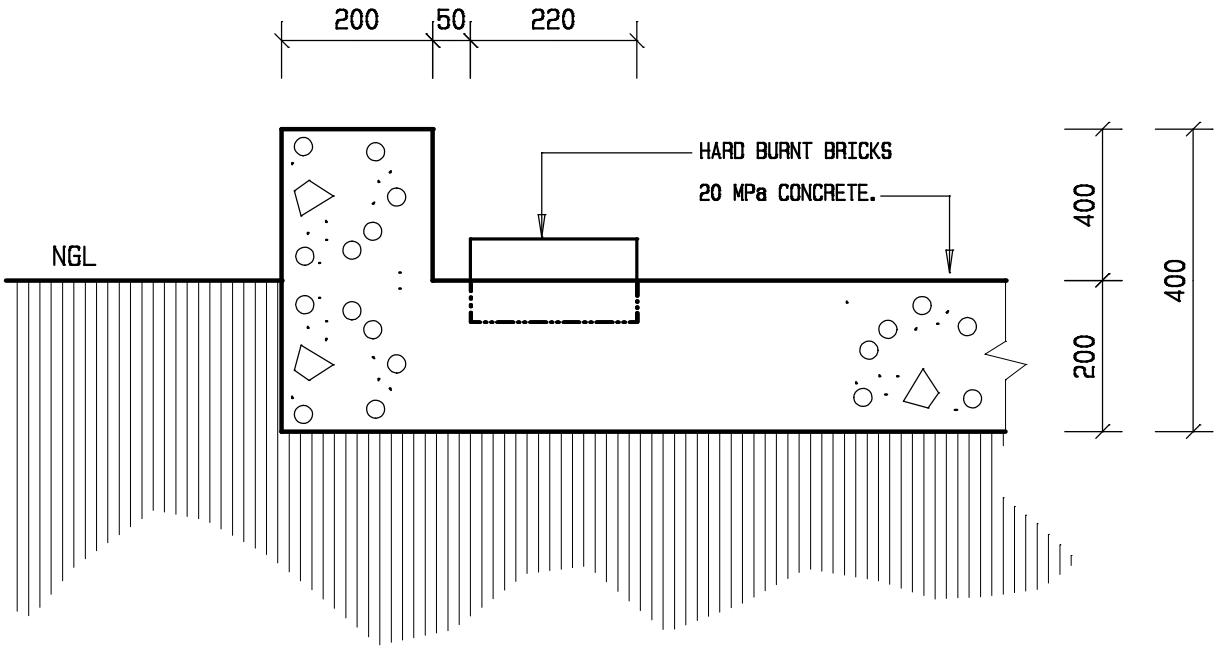
date
10/27/2004

drawing number / type number
TYPE NO DT16(1)/ST



(PLAN) SPILLING BASIN
TYPE 1

DT 16(1)/ST



SECTION THROUGH SPILLING BASIN TYPE 1

DT 16 (2) /ST

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departmental: DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS	project: STORM WATER: SECTION THROUGH SPILLING BASIN TYPE 1 (DIAGRAMMATIC)	scale: 1 : 10	date: 10/27/2004
		drawing number / type number: TYPE NO DT 16 (2) /ST	

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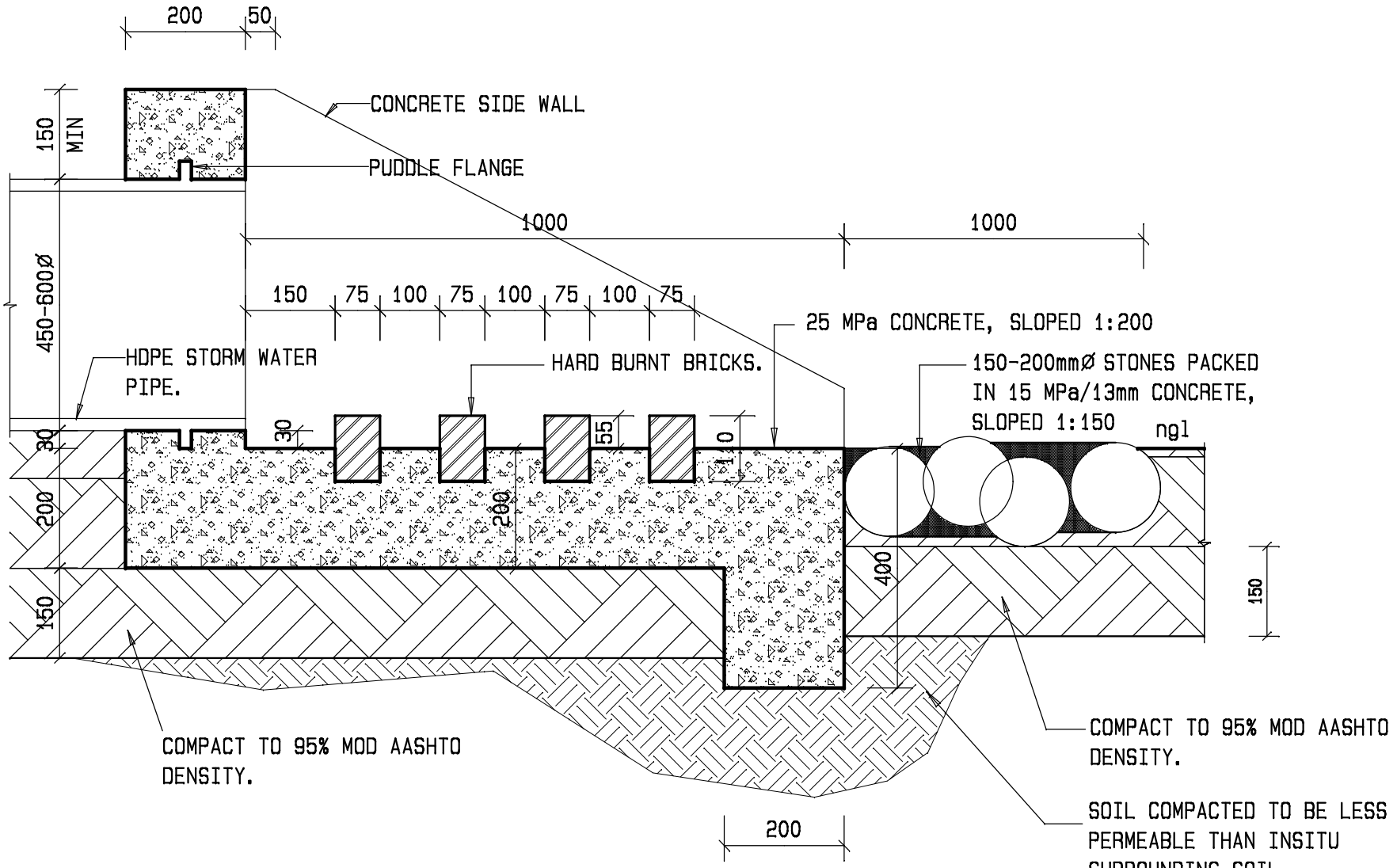
department: DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS

project: STORM WATER: SECTION THROUGH SPILLING BASIN TYPE 1 (DIAGRAMMATIC)

scale: 1 : 10

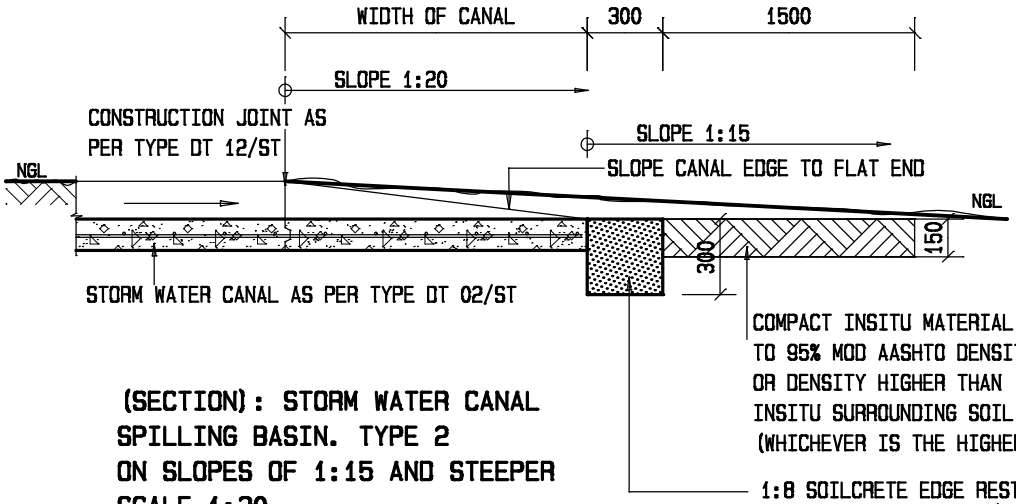
date: 10/27/2004

drawing number / type number: TYPE NO DT 16(3)/ST

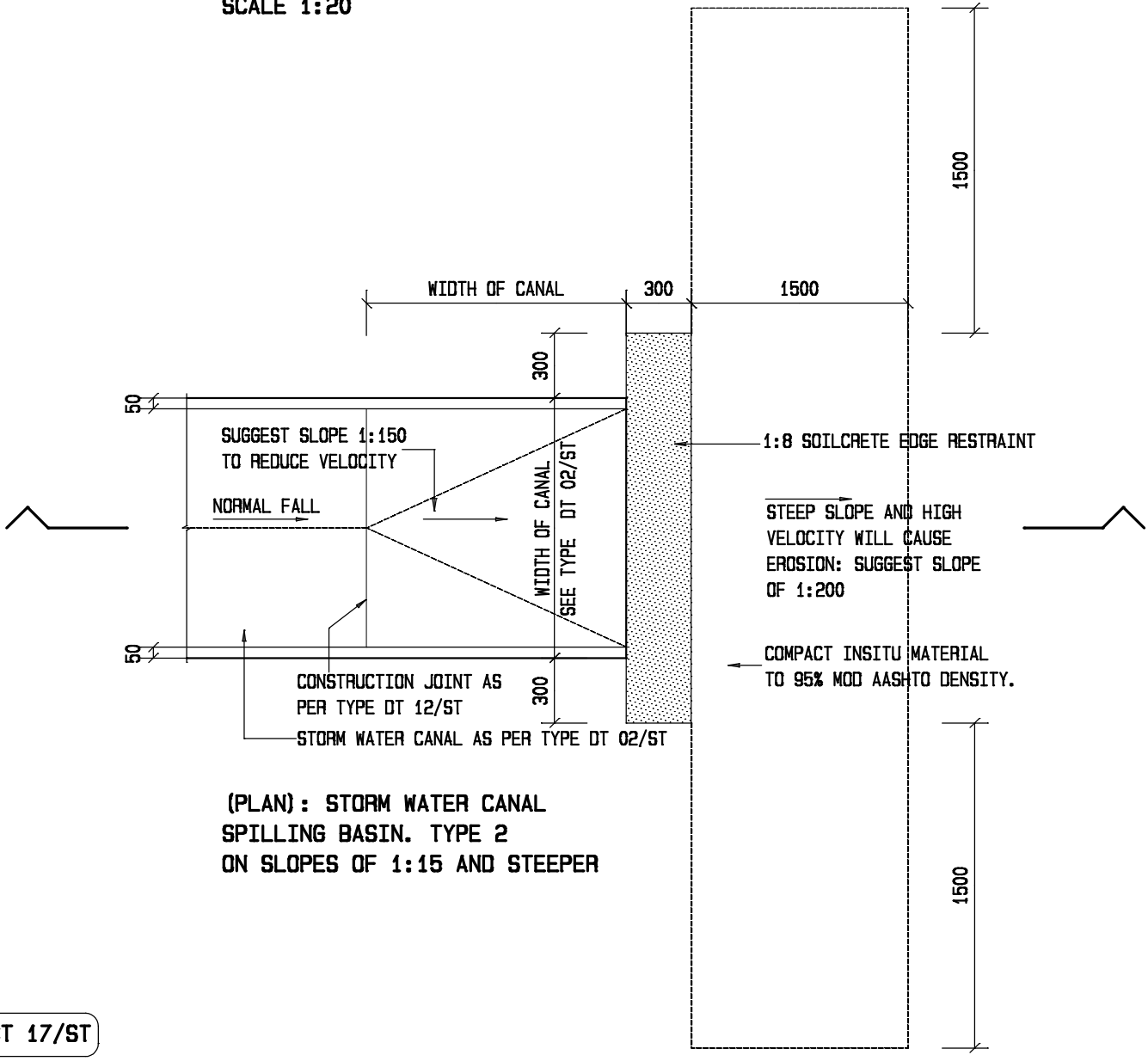


SECTION THROUGH SPILLING BASIN -TYPE 1

DT 16(3)/ST



(SECTION): STORM WATER CANAL SPILLING BASIN. TYPE 2 ON SLOPES OF 1:15 AND STEEPER SCALE 1:20



(PLAN): STORM WATER CANAL SPILLING BASIN. TYPE 2 ON SLOPES OF 1:15 AND STEEPER

DT 17/ST

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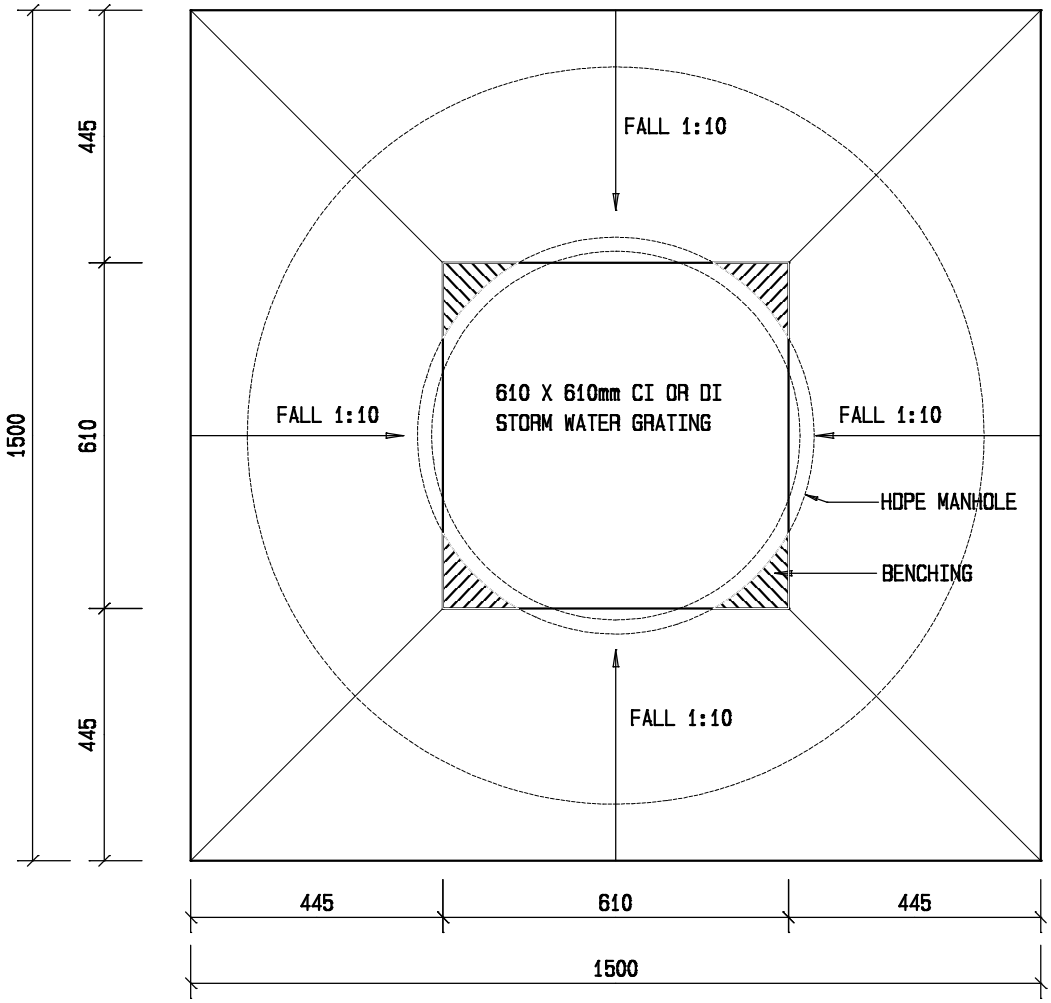
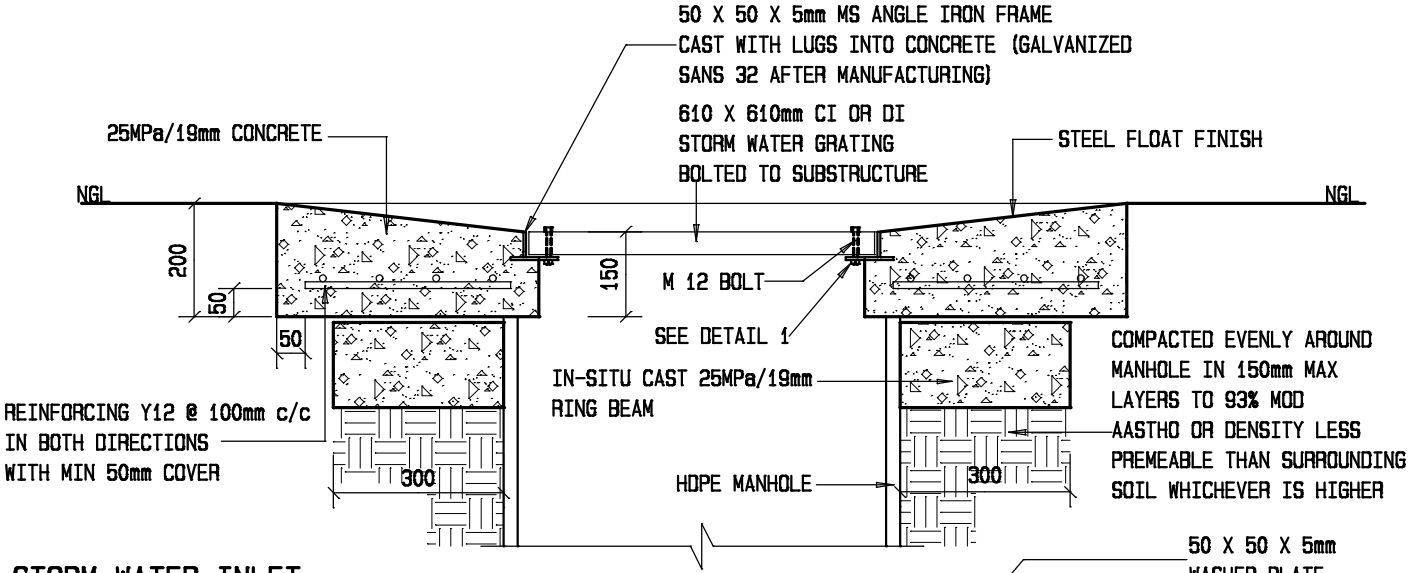
Tel (012) 337 2000

departmental	title	scale	date
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS	STORM WATER: PLAN & SECTION OF STORM WATER CANAL SPILLING BASIN. TYPE 2 (DIAGRAMMATIC)	1 : 30	10/27/2004

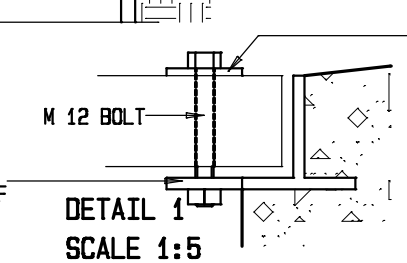
drawing number / type number: TYPE NO DT 17/ST





STORM WATER INLET OVER MANHOLE

DT 19/ST



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			drawing number / type number TYPE NO DT 19/ST	

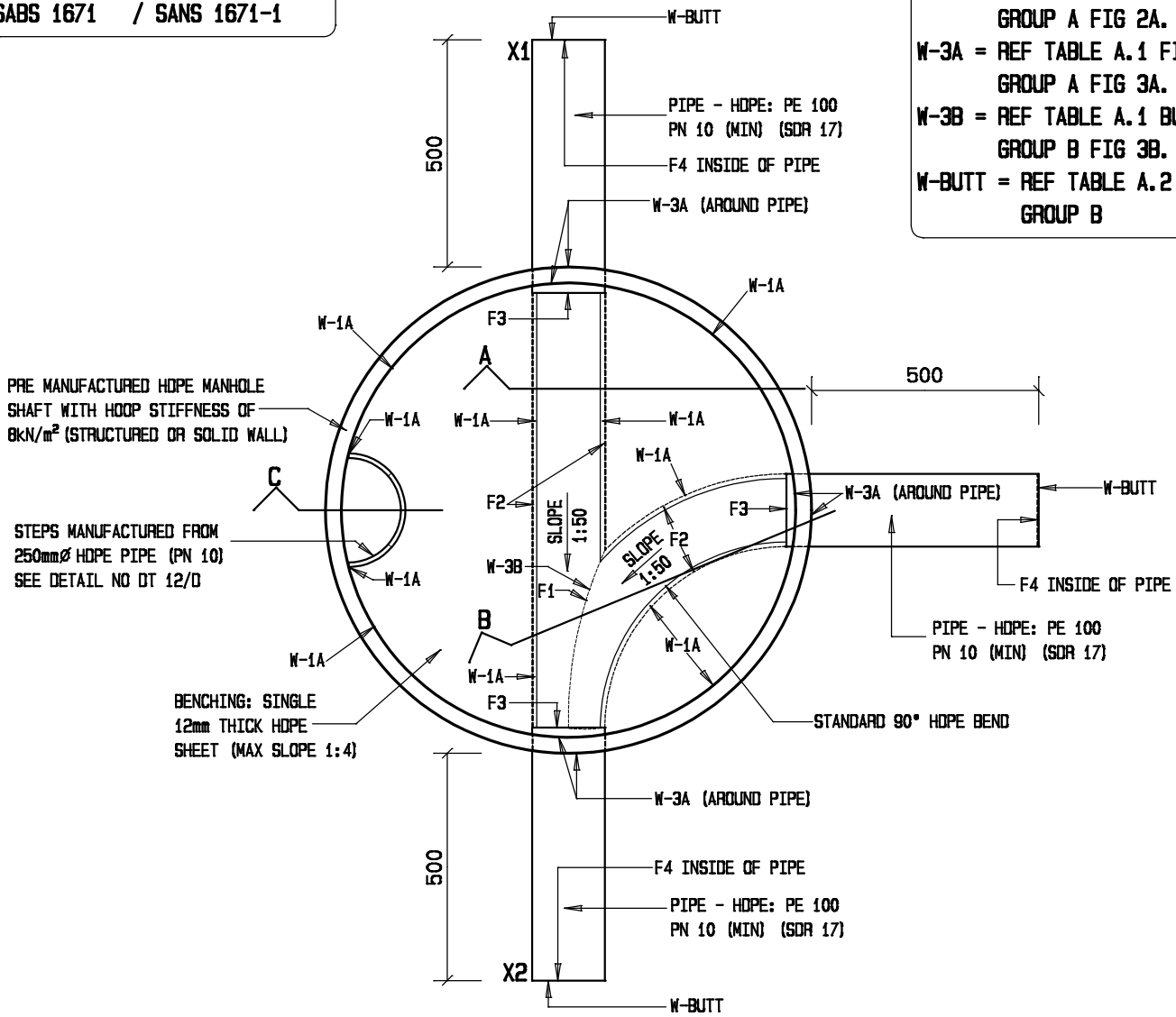
GENERAL NOTE:
- ALL MATERIALS TO BE HDPE PE-100 AS PER SABS ISO 4427 / SANS 4427.
  HOOP STIFFNESS OF MANHOLE SHAFT TO BE 8kN/m²

OTHER RELEVANT MANUFACTURING STANDARDS:
SABS 0268-1 / SANS 10268-1
SABS 0269 / SANS 10269
SABS 0270 / SANS 10270
SABS 1269 / SANS 1269
SABS 1655 / SANS 1655
SABS 1671 / SANS 1671-1

GENERAL WELDING SPECIFICATION:
- BUTT WELDING OF PIPES TO COMPLY TO SABS 0268-1:1999. SANS 10268-1
- HOT GAS WELDING TO COMPLY TO SABS 0268-3:1999. SANS 10268-3
- HOT GAS EXTRUSION WELDING TO COMPLY TO SABS 0268-4:1999. SANS 10268-4

GENERAL FINISHING NOTE:
F1- REMOVE FILLER EXPULSION AND FINISH WELD SMOOTH WITH PIPE SURFACE.
F2- REMOVE FILLER EXPULSION AND FINISH WELD WITH SMOOTH ROUNDED EDGE.
F3- FINISH PIPE WITH SMOOTH ROUNDED EDGE.
F4- REMOVE INTERNAL WELDING BEAD.

WELDING NOTATION FOR JOINTS
SEE SABS 0270 / SANS 10270 PAR 5 AS WELL AS ANNEX A.
W-1A = REF TABLE A.1 FILLET GROUP A FIG 1A.
W-2A = REF TABLE A.1 FILLET GROUP A FIG 2A.
W-3A = REF TABLE A.1 FILLET GROUP A FIG 3A.
W-3B = REF TABLE A.1 BUTT GROUP B FIG 3B.
W-BUTT = REF TABLE A.2 BUTT GROUP B



X1 TO X2 IS A SINGLE LENGTH PIPE WITH SECTION REMOVED TO FORM CHANNEL

HDPE MANHOLE
PLAN
SCALE 1:15

SECTION A: SEE DT 21/ST
SECTION B: SEE DT 22/ST
SECTION C: SEE DT 23/ST

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departmental: DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS	title: TYPICAL WELDING DETAILS FOR HDPE STORM WATER MANHOLE: PLAN	scale: 1 : 15	date: 10/27/2004
		drawing number / type number: TYPE NO DT 20/ST	

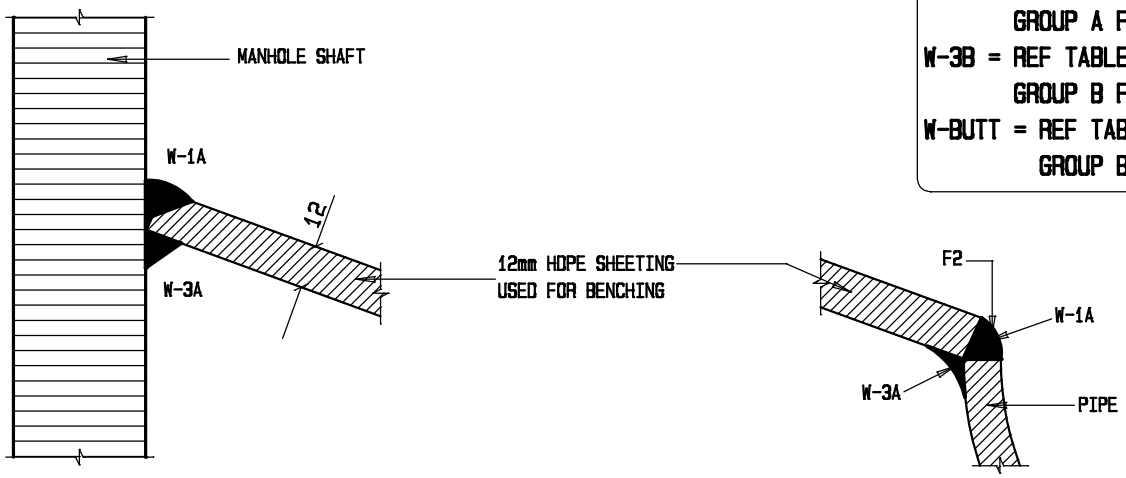
GENERAL NOTE:
- ALL MATERIALS TO BE HDPE PE-100 AS PER SABS ISO 4427 / SANS 4427.
  HOOP STIFFNESS OF MANHOLE SHAFT TO BE 8kN/m^2

OTHER RELEVANT MANUFACTURING STANDARDS:
SABS 0268-1 / SANS 10268-1
SABS 0269 / SANS 10269
SABS 0270 / SANS 10270
SABS 1269 / SANS 1269
SABS 1655 / SANS 1655
SABS 1671 / SANS 1671-1

GENERAL WELDING SPECIFICATION:
- BUTT WELDING OF PIPES TO COMPLY TO SABS 0268-1:1999. SANS 10268-1
- HOT GAS WELDING TO COMPLY TO SABS 0268-3:1999. SANS 10268-3
- HOT GAS EXTRUSION WELDING TO COMPLY TO SABS 0268-4:1999. SANS 10268-4

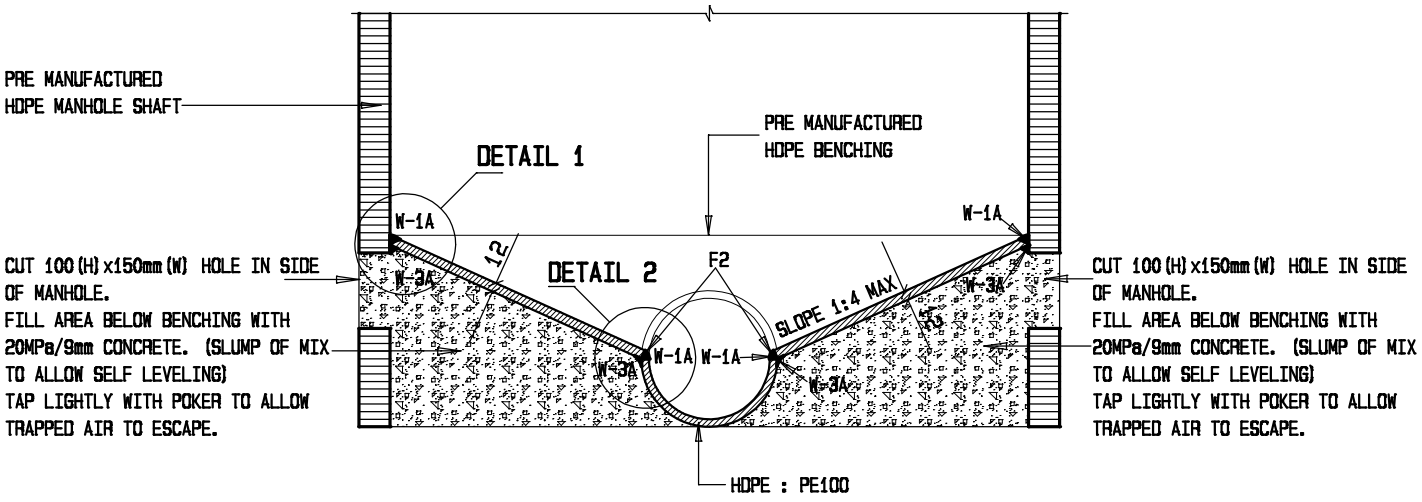
GENERAL FINISHING NOTE:
F1- REMOVE FILLER EXPULSION AND FINISH WELD SMOOTH WITH PIPE SURFACE.
F2- REMOVE FILLER EXPULSION AND FINISH WELD WITH SMOOTH ROUNDED EDGE.
F3- FINISH PIPE WITH SMOOTH ROUNDED EDGE.
F4- REMOVE INTERNAL WELDING BEAD.

WELDING NOTATION FOR JOINTS
SEE SABS 0270 / SANS 10270 PAR 5 AS WELL AS ANNEX A.
W-1A = REF TABLE A.1 FILLET GROUP A FIG 1A.
W-2A = REF TABLE A.1 FILLET GROUP A FIG 2A.
W-3A = REF TABLE A.1 FILLET GROUP A FIG 3A.
W-3B = REF TABLE A.1 BUTT GROUP B FIG 3B.
W-BUTT = REF TABLE A.2 BUTT GROUP B



DETAIL 1
SCALE 1:2

DETAIL 2
SCALE 1:2



SECTION A
SCALE 1:10

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departmental: DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS	title: TYPICAL WELDING DETAILS FOR HDPE STORM WATER MANHOLE: SECTION A	scale: AS SHOWN	date: 10/27/2004
		drawing number / type number: TYPE NO DT 21/ST	

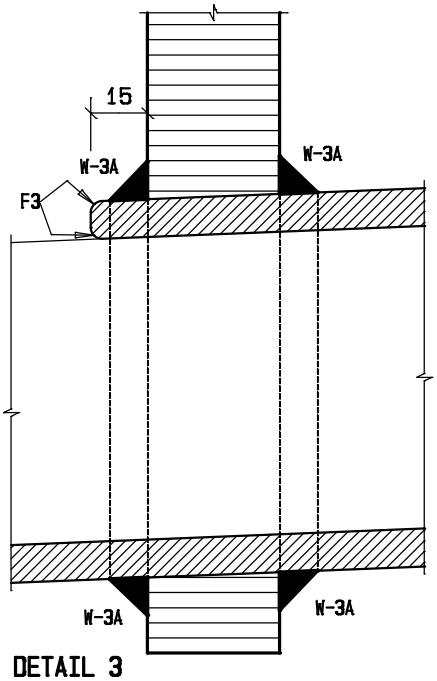
GENERAL NOTE:
- ALL MATERIALS TO BE HDPE PE-100 AS PER SABS ISO 4427 / SANS 4427
  HOOP STIFFNESS OF MANHOLE SHAFT TO BE 8kN/m^2

OTHER RELEVANT MANUFACTURING STANDARDS:
SABS 0268-1 / SANS 10268-1
SABS 0269 / SANS 10269
SABS 0270 / SANS 10270
SABS 1269 / SANS 1269
SABS 1655 / SANS 1655
SABS 1671 / SANS 1671-1

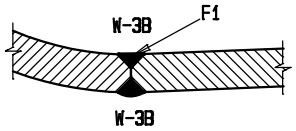
GENERAL WELDING SPECIFICATION:
- BUTT WELDING OF PIPES TO COMPLY TO SABS 0268-1:1999. SANS 10268-1
- HOT GAS WELDING TO COMPLY TO SABS 0268-3:1999. SANS 10268-3
- HOT GAS EXTRUSION WELDING TO COMPLY TO SABS 0268-4:1999. SANS 10268-4

GENERAL FINISHING NOTE:
F1- REMOVE FILLER EXPULSION AND FINISH WELD SMOOTH WITH PIPE SURFACE.
F2- REMOVE FILLER EXPULSION AND FINISH WELD WITH SMOOTH ROUNDED EDGE.
F3- FINISH PIPE WITH SMOOTH ROUNDED EDGE.
F4- REMOVE INTERNAL WELDING BEAD.

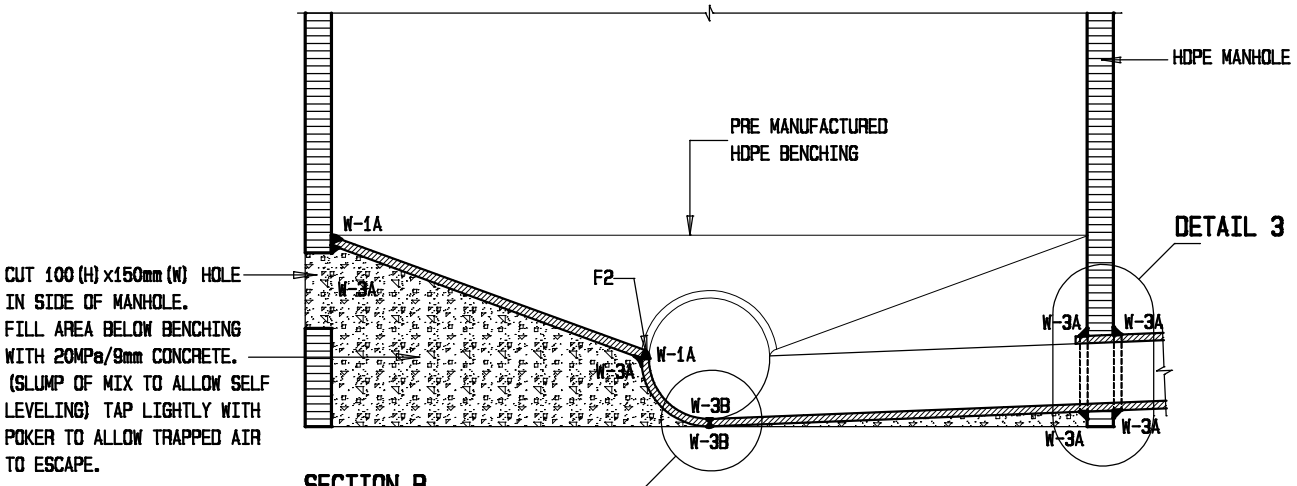
WELDING NOTATION FOR JOINTS
SEE SABS 0270 / SANS 10270 PAR 5 AS WELL AS ANNEX A.
W-1A = REF TABLE A.1 FILLET GROUP A FIG 1A.
W-2A = REF TABLE A.1 FILLET GROUP A FIG 2A.
W-3A = REF TABLE A.1 FILLET GROUP A FIG 3A.
W-3B = REF TABLE A.1 BUTT GROUP B FIG 3B.
W-BUTT = REF TABLE A.2 BUTT GROUP B



DETAIL 3
SCALE 1:2



DETAIL 4
SCALE 1:2



SECTION B
SCALE 1:10

DEPARTMENT OF PUBLIC WORKS Private Bag X65 Pretoria 0001 Tel (012) 337 2000	departmental DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS	title TYPICAL WELDING DETAILS FOR HDPE STORM WATER MANHOLE: SECTION B	scale AS SHOWN	date 10/27/2004
			drawing number / type number TYPE NO DT 22/ST	

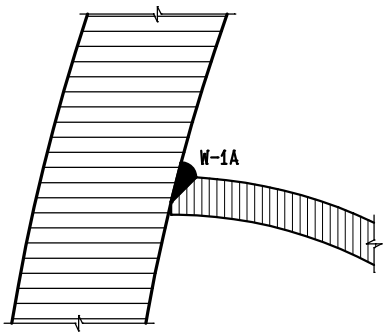
GENERAL NOTE:
- ALL MATERIALS TO BE HDPE PE-100 AS PER SABS ISO 4427 / SANS 4427
  HOOP STIFFNESS OF MANHOLE SHAFT TO BE 8kN/m^2

OTHER RELEVANT MANUFACTURING STANDARDS:
SABS 0268-1 / SANS 10268-1
SABS 0269 / SANS 10269
SABS 0270 / SANS 10270
SABS 1269 / SANS 1269
SABS 1655 / SANS 1655
SABS 1671 / SANS 1671-1

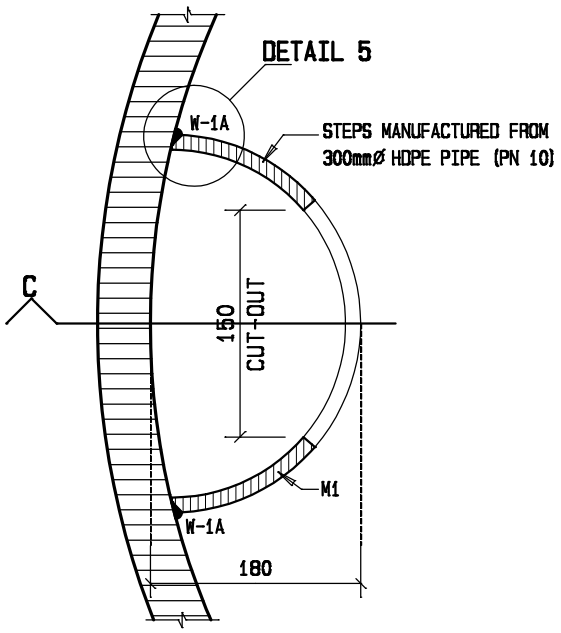
GENERAL WELDING SPECIFICATION:
- BUTT WELDING OF PIPES TO COMPLY TO SABS 0268-1:1999. SANS 10268-1
- HOT GAS WELDING TO COMPLY TO SABS 0268-3:1999. SANS 10268-3
- HOT GAS EXTRUSION WELDING TO COMPLY TO SABS 0268-4:1999. SANS 10268-4

GENERAL FINISHING NOTE:
F1- REMOVE FILLER EXPULSION AND FINISH WELD SMOOTH WITH PIPE SURFACE.
F2- REMOVE FILLER EXPULSION AND FINISH WELD WITH SMOOTH ROUNDED EDGE.
F3- FINISH PIPE WITH SMOOTH ROUNDED EDGE.
F4- REMOVE INTERNAL WELDING BEAD.

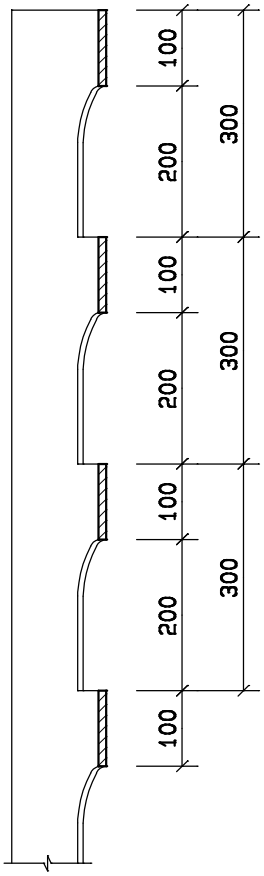
WELDING NOTATION FOR JOINTS
SEE SABS 0270 / SANS 10270 PAR 5 AS WELL AS ANNEX A.
W-1A = REF TABLE A.1 FILLET GROUP A FIG 1A.
W-2A = REF TABLE A.1 FILLET GROUP A FIG 2A.
W-3A = REF TABLE A.1 FILLET GROUP A FIG 3A.
W-3B = REF TABLE A.1 BUTT GROUP B FIG 3B.
W-BUTT = REF TABLE A.2 BUTT GROUP B



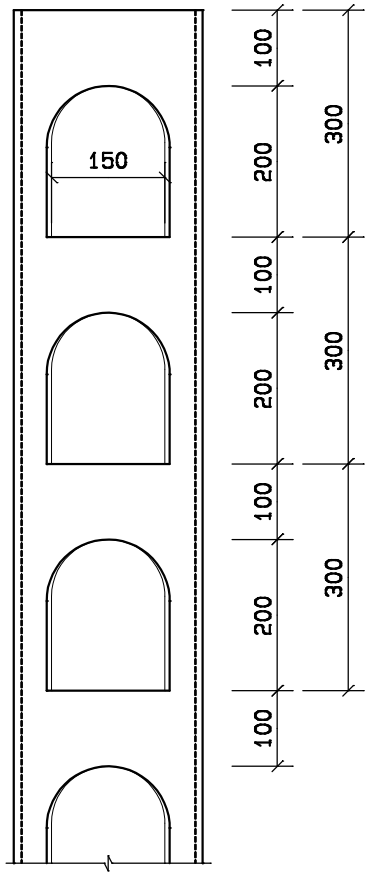
DETAIL 5
SCALE 1:2



HDPE STEPS IN MANHOLE
PLAN
SCALE 1:5



SECTION C
SCALE 1:10



ELEVATION OF STEPS
SCALE 1:10

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			drawing number / type number TYPE NO DT 23/ST	

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project
STORM WATER:
GRID INLET NEXT TO
RUNWAYS &
TAXIWAYS.

scale
1:20.

date
2003/11/01

drawing number / type number
TYPE NO DT 24/ST

NOTES TO ALL STEEL WORK:
1. ALL STEEL SHALL BE GRADE 300W TO SABS 1431 / SANS 1431
2. ALL WELDS TO BE 6mm SOLID DOUBLE FILLET WELD
3. ALL WELDING SHALL COMPLY WITH SABS 044
4. ALL STEELWORK SHALL BE HOT-DIPPED GALVANISED (250 MICRON) ACCORDING TO THE STANDARISED SPECIFICATION (SANS 32)

PLAN
SCALE 1:20

SECTION E - E
SCALE 1:20

SECTION D - D
SCALE 1:20

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DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS.

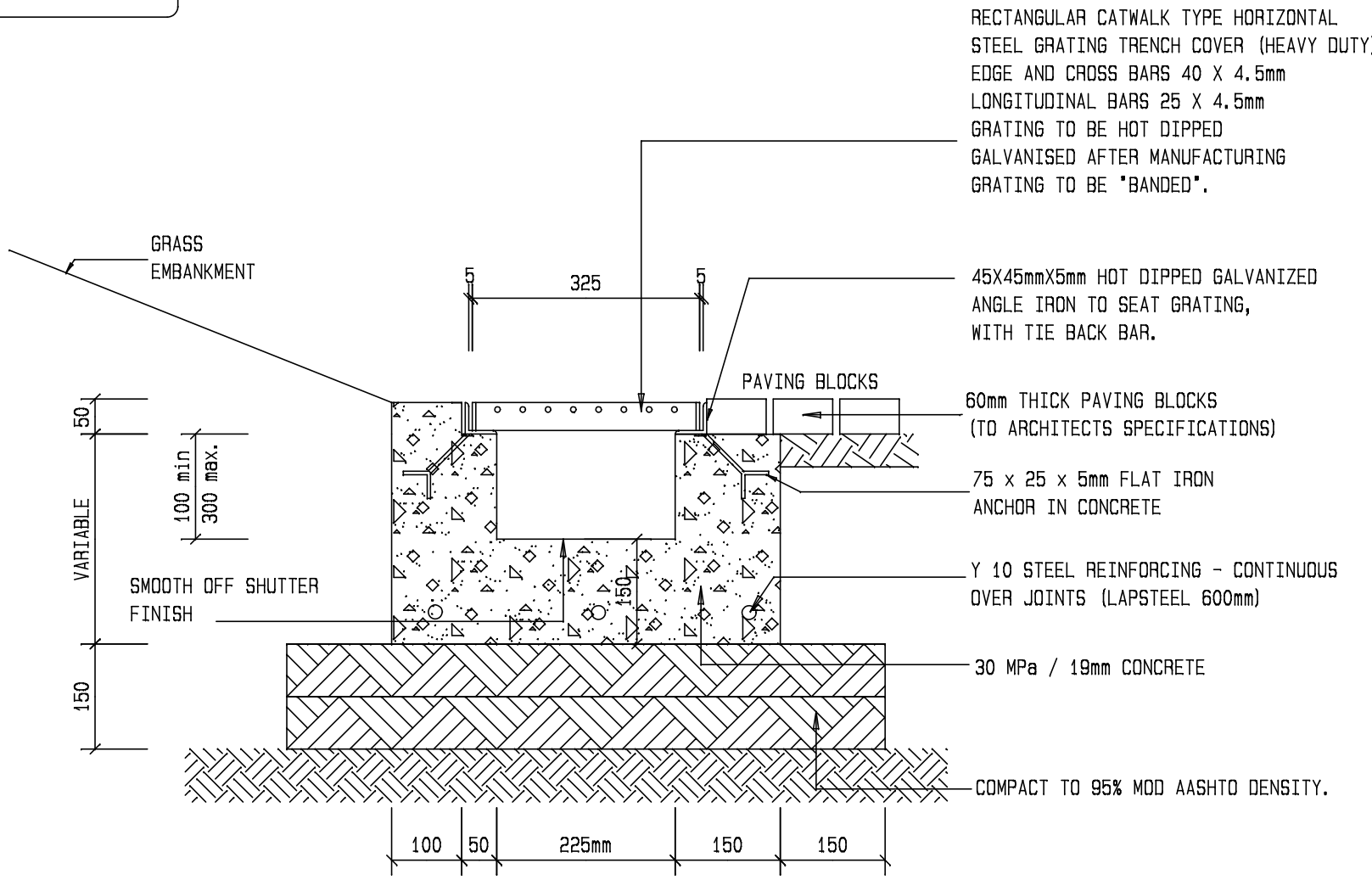
title
STORM WATER:
DUCT FOR ROADWAYS AND WALKWAYS

scale
1 : 10

date
22/06/2006

drawing number / type number
TYPE NO DT 25/ST

NOTE:
-COMPLETE UNIT TO BE HOT DIPPED GALVANIZED AFTER MANUFACTURING (SANS 32 HEAVY DUTY).
-ALLOW FOR WATER DRAINAGE FROM DUCT TO STORM WATER SYSTEM



CAST IN 2m ALTERNATIVE SECTIONS

DT 25/ST

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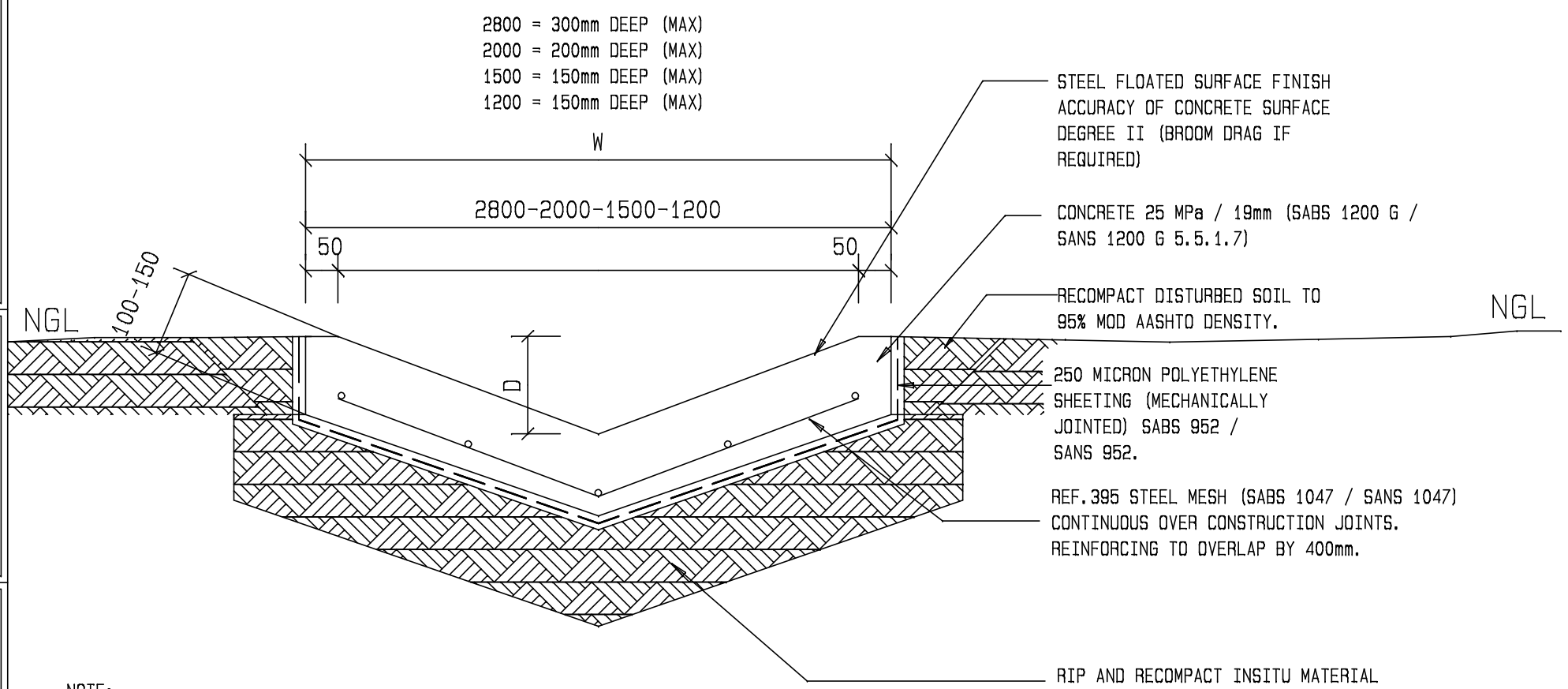
ENGINEERING DETAILS
FOR DOLOMITIC SOILS

title
STORM WATER:
CANAL IN AREAS WITH
NO VEHICLE TRAFFIC
(DIAGRAMMATIC)

scale
1 : 10

date
22/06/2006

drawing number / type number
TYPE NO DT 26/ST



NOTE:
1. D - VARIABLE FROM 50mm TO INDICATED MAXIMUM DEPTH.
2. STEEL REINFORCING TO BE REF. 617 IN AREAS WITH VECHILE TRAFFIC.
3. EXPANSION JOINT BETWEEN CANAL AND WALL ONLY IF INDICATED.

CAST IN ALTERNATIVE SECTIONS
1,5m LONG WITH EXPANSION JOINTS
AT 18m. SEE STANDARD DETAIL FOR
EXPANSION JOINT - TYPE NO DT 04/S

STORM WATER CANAL IN AREAS WITH NO VEHICLE TRAFFIC

DT 26/ST

ROADS DETAILS

ROAD DETAILS: LIST OF DRAWINGS

DT 01/R	ROAD AND PAVEMENT DETAILS
DT 02/R	ROAD AND PAVEMENT DETAILS
DT 04/R	EARTH WORKS ON PAVEMENT
DT 05/R	GUARDRAIL
DT 06/R	GUARDRAIL DETAILS
DT 07/R	GUARDRAIL DETAILS

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departmental
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title
DRAWING LIST.

scale
.

date
22/06/2006

drawing number / type number
TYPE NO DT 00/R

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title
ROAD AND PAVEMENT DETAILS (DIAGRAMMATIC)

scale
1 : 50

date
10/27/2004

drawing number / type number
TYPE NO DT 01/R

LAYER 01
BASE
SABS 1200 MF / SANS 1200 MF

3.3.2 CONSTRUCT A BASE LAYER OF 150mm GRADED CRUSHER STONE FROM COMMERCIAL OFF-SITE SOURCES. AND COMPACT TO 98% MOD AASHTO DENSITY.

LAYER 02
SUBBASE
SABS 1200 ME / SANS 1200 ME

3.2.1 CONSTRUCT 150mm THICK SUBBASE
FROM MATERIAL FROM COMMERCIAL OFF-SITE SOURCES.
COMPACT TO 95% MOD AASHTO DENSITY
ALTERNATIVE - SUBBASE FROM CEMENT (OPC) STABILISED (2%) GRAVEL FROM SITE EXCAVATIONS.

LAYERS 03 & 04 & 05
EARTH WORKS (SUBGRADE)
SABS 1200 DM / SANS 1200 DM

5.2.3.3 ROAD-BED TREATMENT - LAYER 05
RIP TO 150mm DEPTH THE IN-SITU MATERIAL OF AREA AND COMPACT TO 93% MOD AASHTO DENSITY.

3.2.3 SELECTED LAYER
CONSTRUCT 150mm SELECTED LAYERS FROM EXCAVATION STOCKPILE AND COMPACT TO 93% MOD AASHTO DENSITY FOR TYPE (REF TRH4)
G7 - LAYER 04
G5 - LAYER 03

ASPHALT SURFACING
SABS 1200 MH / SANS 1200 MH

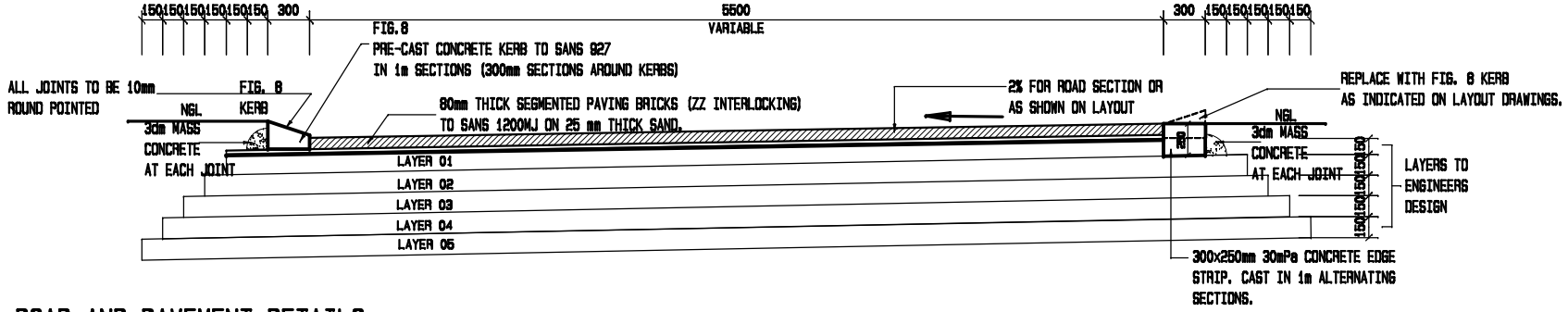
3.1 PRIME COAT
APPLY A COAT OF TAR PRIME GRADE RTH 3/12P AT NOMINAL RATE OF 0,8 l/m2.

5.5 PREMIX
PREMIX WEARING COURSE OF CONTINUOUSLY GRADED ASPHALT (TPA-MEDIUM) USING 80/100 BITUMEN BINDER (SMOOTHNESS ACCURACY II i.t.o. CLAUSE 6.3.6) FOR THICKNESS 30mm.

SEGMENTED BRICK PAVING
SABS 1200 MJ / SANS 1200 MJ

3.1.2(a) 80mm ZZ INTERLOCKING BRICKS (* 25MPa), TOP EDGES CHAMFERED, LAID IN HERRING BONE PATTERN.
* TO ENGINEERS DESIGN DEPENDING ON WEEL LOAD.

3.3 BRICKS LAID ON 25mm COMPACTED THICKNESS WELL GRADED BEDDING SAND.



ROAD AND PAVEMENT DETAILS

DT 01/R

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title
ROAD AND PAVEMENT DETAILS (DIAGRAMMATIC)

scale
1 : 50

drawing number / type number
TYPE NO DT 02/R

date
10/27/2004

LAYER 01
BASE
SABS 1200 MF / SANS 1200 MF

3.3.2 CONSTRUCT A BASE LAYER OF 150mm GRADED CRUSHER STONE FROM COMMERCIAL OFF-SITE SOURCES. AND COMPACT TO 98% MOD AASHTO DENSITY.

LAYER 02
SUBBASE
SABS 1200 ME / SANS 1200 ME

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ALTERNATIVE - SUBBASE FROM CEMENT (OPC) STABILISED (2%) GRAVEL FROM SITE EXCAVATIONS.

LAYERS 03 & 04 & 05
EARTH WORKS (SUBGRADE)
SABS 1200 DM / SANS 1200 DM

5.2.3.3 ROAD-BED TREATMENT - LAYER 05
RIP TO 150mm DEPTH THE INSITU MATERIAL OF AREA AND COMPACT TO 93% MOD AASHTO DENSITY.

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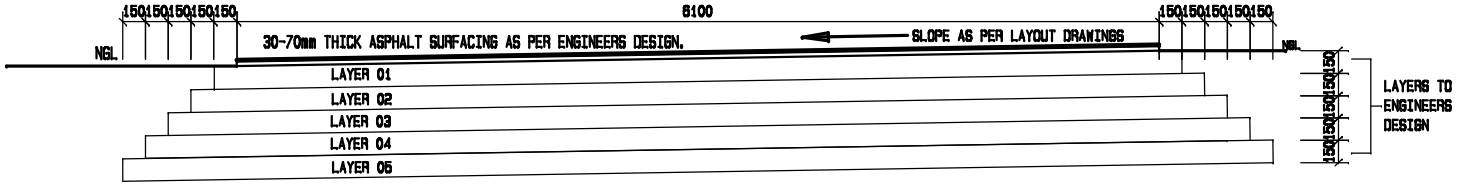
CONSTRUCT 150mm SELECTED LAYERS FROM EXCAVATION STOCKPILE AND COMPACT TO 93% MOD AASHTO DENSITY FOR TYPE (REF TRH4)
G7 - LAYER 04
G5 - LAYER 03

ASPHALT SURFACING
SABS 1200 MH / SANS 1200 MH

3.1 PRIME COAT
APPLY A COAT OF TAR PRIME GRADE RTH 3/12P AT NOMINAL RATE OF 0,8 l/m2.

5.5 PREMIX
PREMIX WEARING COURSE OF CONTINUOUSLY GRADED ASPHALT (TPA-MEDIUM) USING 80/100 BITUMEN BINDER (SMOOTHNESS ACCURACY II i.t.o. CLAUSE 6.3.6) FOR THICKNESS 30mm.



ROAD AND PAVEMENT DETAILS

DT 02/R

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title
ROAD AND PAVEMENT DETAILS (DIAGRAMMATIC)

scale
1 : 50

date
10/27/2004

drawing number / type number
TYPE NO DT 03/R

LAYER 01
BASE
SABS 1200MF / SANS 1200 MF

3.3.2 CONSTRUCT A BASE LAYER OF 150mm GRADED CRUSHER STONE FROM COMMERCIAL OFF-SITE SOURCES. AND COMPACT TO 98% MOD AASHTO DENSITY.

LAYER 02
SUBBASE
SANS 1200 ME

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ALTERNATIVE - SUBBASE FROM CEMENT (OPC) STABILISED (2%) GRAVEL FROM SITE EXCAVATIONS.

LAYERS 03 & 04 & 05
EARTH WORKS (SUBGRADE)
SABS 1200 DM / SANS 1200 DM

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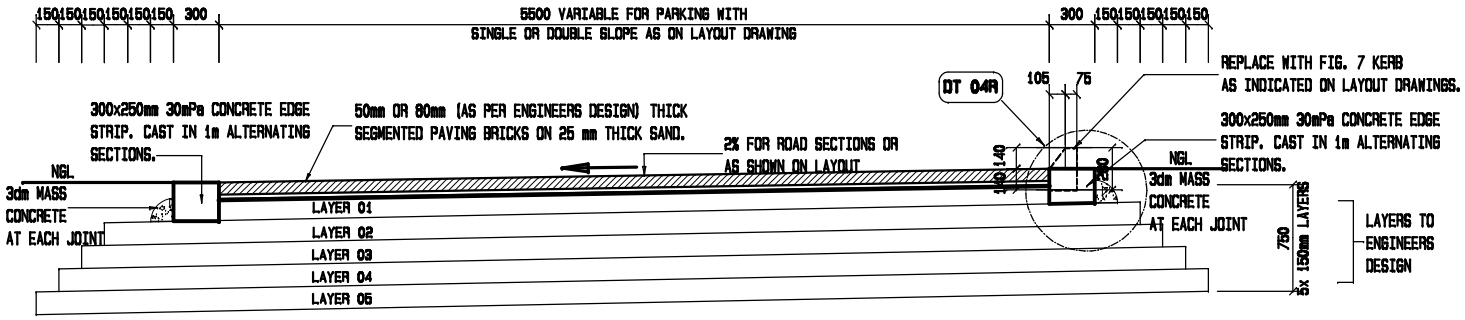
PREMIX WEARING COURSE OF CONTINUOUSLY GRADED ASPHALT (TPA-MEDIUM) USING 80/100 BITUMEN BINDER (SMOOTHNESS ACCURACY II i.t.o. CLAUSE 6.3.6) FOR THICKNESS 30mm.

SEGMENTED BRICK PAVING
SABS 1200 MJ / SANS 1200 MJ

3.1.2(a) 80mm ZZ INTERLOCKING BRICKS (30MPa), TOP EDGES CHAMFERED, LAID IN HERRING BONE PATTERN.

3.3 BRICKS LAID ON 25mm COMPACTED THICKNESS WELL GRADED BEDDING SAND.



ROAD AND PAVEMENT DETAILS

DT 03/R

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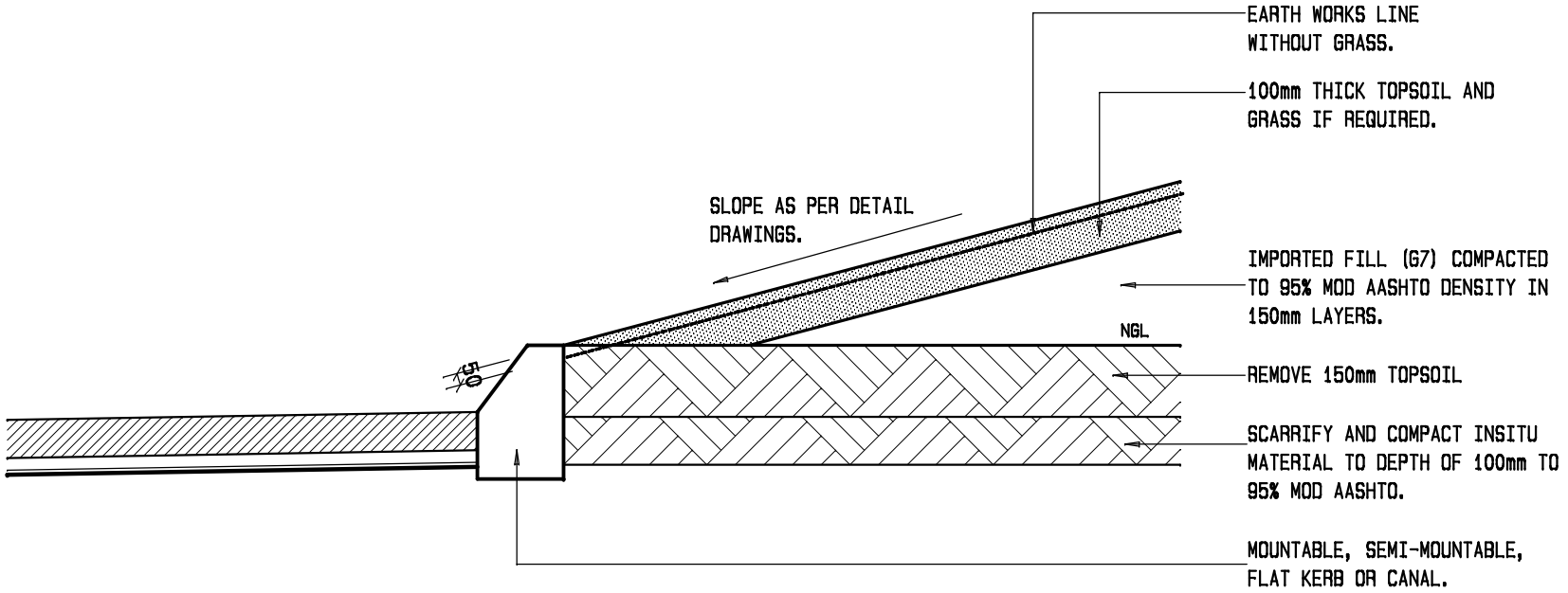
title
EARTH WORKS ON PAVEMENT
(DIAGRAMMATIC)

scale
1 : 30

date
10/27/2004

drawing number / type number
TYPE NO DT 04/R



EARTH WORKS ON PAVEMENT

DT 04/R

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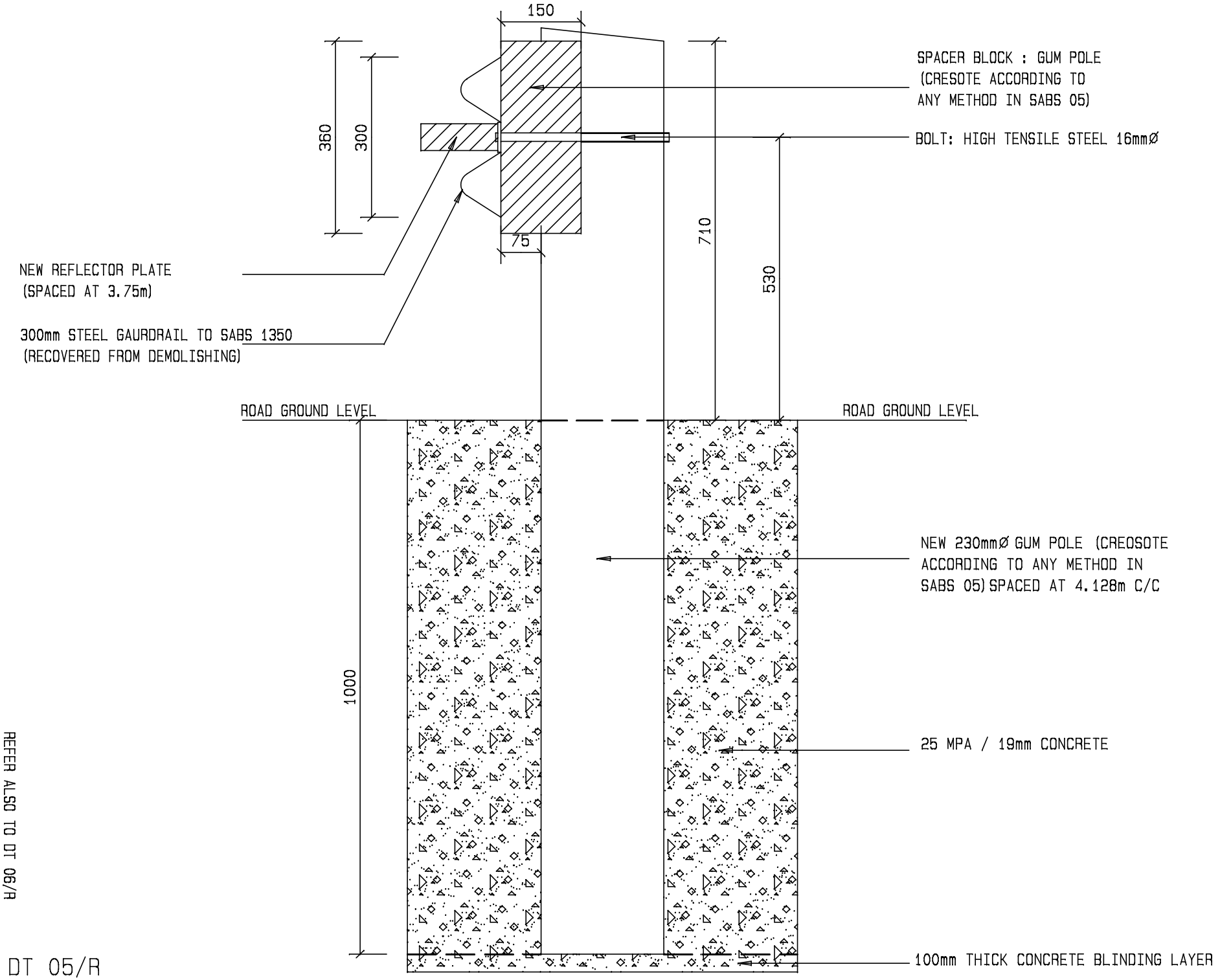
FOR DOLOMITIC SOILS

title
GAURDRAIL

scale
1 : 10

drawing number / type number
TYPE NO DT 05/R

date
22/06/2006



REFER ALSO TO DT 06/R

DT 05/R

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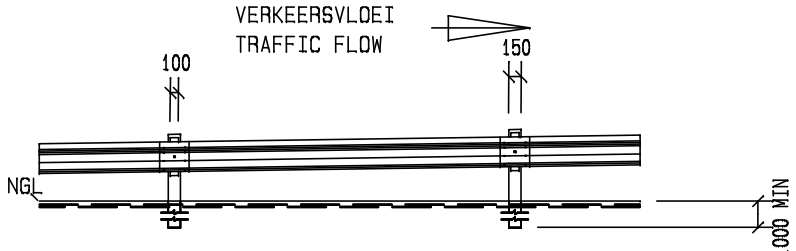
title
GUARDRAIL DETAILS

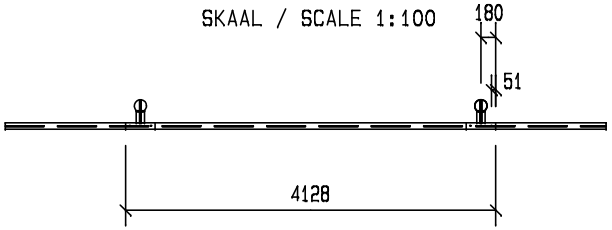
drawing number / type number
TYPE NO DT 06/R

scale
1 : 10

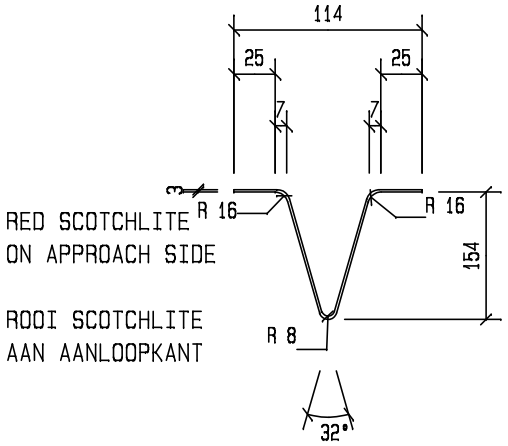
date
17/07/2005



SKRAMRELING: VOORAANSIG
GUARDRAIL: FRONT ELEVATION
SKAAL / SCALE 1:100

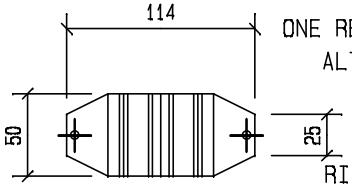


SKRAMRELING: PLAN
GUARDRAIL: PLAN



NOTA / NOTE

EEN WEERKAATSER IN DIE MIDDLE VAN ELKE TWEEDE LENGTE VAN 3.75M



ONE REFLECTOR IN THE CENTRE OF EACH ALTERNATIVE LENGTH OF 3.75M

RIVET POSITION
KLINKNAEL POSISIE

VOORAANSIG
FRONT ELEVATION
SKAAL / SCALE 1:10

SKRAMRELINGS WORD IN DIE VOLGENDE GEVALLE OPGERIG

1 WAAR DIE PAD IN N HOER OPVULLING AS 4M, EN SONDER HERSTEL AREA IS
2 WAAR WATER LANGS DIE PADFORMASIE DIEPER AS 1.5M IS
3 BY ALLE BRUE
4 AAN DIE BUITE KANT DRAAIE MET STRALE KLEINER AS 300M EN SONDER HERSTEL AREAS
5 WAAR VERSPERRINGS NADER AS 1M VANAF DIE SKOUER - KNAKPUNT VOORKOM
6 WAAR DIT LYK OF DIE VERSPERRING OP SIGSELF GE - VAARLIKER AS 'N SKRAMRELING SOU WEES

NOTA :

GOEDKEURING MOET VAN DIE DIREKTEUR VAN PAAIE VERKRY WORD VOORDAT SKRAMREELINGS OPGERIG MAG WORD

GUARD RAILS ARE REQUIRED IN THE FOLLOWING CASES °

1 WHERE THE FILL IS MORE THAN 4M WITH NO RECOVERY AREA
2 WHERE WATER NEXT TO THE ROAD FORMATION IS MORE THAN 1.5M
3 AT ALL BRIDGES
4 ON THE OUTSIDE OF CURVES WITH RADII LESS THAN 300M WITHOUT RECOVERY AREA
5 WHERE OBSTRUCTION ARE LESS THAN 1M FROM THE SHOULDER BRAKE POINT
6 WHERE AN OBSTRUCTION APEARS TO BE MORE DANGEROUS THAN A GUARDRAIL WOULD BE

NOTE :

BEFORE GUARDRAILS MAY BE ERECTED APPROVAL MUST BE OBTAINED FROM THE DIRECTOR OF ROADS

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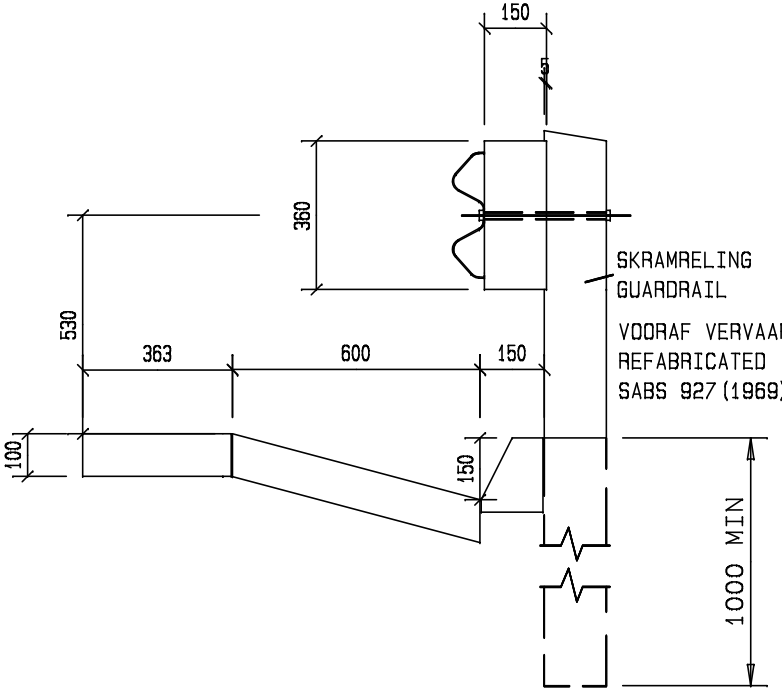
title
GUARDRAIL DETAILS

scale
1 : 10

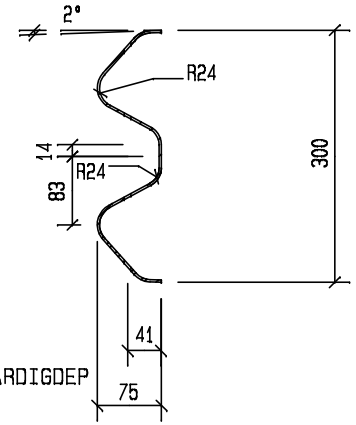
drawing number / type number
TYPE NO DT 07/R

date
14/10/2005



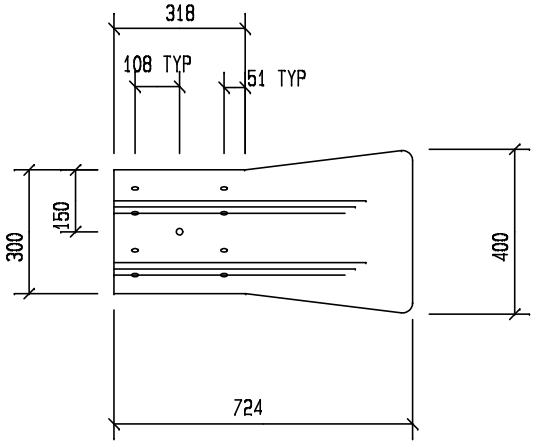
DETAIL VAN BETONGEUT
DETAIL OF CONCRETE DRAIN

SKAAL / SCALE 1:20



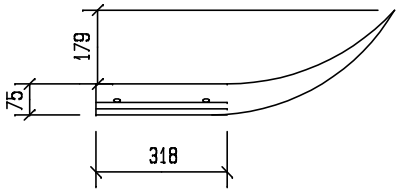
DWARS SNIT VAN SKRAMRELING
CROSS-SECTION OF GUARDRAIL

SKAAL /SCALE 1:40



VOORAANSIG: ENTVLERK
FRONT ELEVATION END WING

SKAAL / SCALE 1:20



PLAN: ENTVLERK
PLAN: END WING

SKAAL / SCALE 1:20

SPESIFIKASIES

1 BOUT HOOGSPANNINGSTAAL 16MM
2 WASTER STAAL VEER 10MM DIK
3 SPASIEERBLOK BLOEKOM OF DENNE HOUT MET KREOSOOT BEHANDEL VOLGENS ENIGE METODE VAN SABS 05
4 PAAL 150MM TOT 230MM BLOEKOM OF DENNEHOUT MET KREOSOOT BEHANDEL VOLGENS ENIGE METODE VAN SABS 05
5 ALLE SKRAMRELINGS MOET GEGALVANISEERD WEES SOOS GESPESIFISEER (NIE GEVERF NIE)

SPECIFICATIONS

1 BOLT HIGH TENSILE STEEL 16MM
2 WASHER STEEL SPRING 10MM THICK
3 SPACER BLOCK GUM OR PINE TRATED WITH CREOSOTE ACCORDING TO ANY METHOD IN SABS 05
4 POLE 150MM - 230MM GUM OR PINE TREATED WITH CREOSOTE ACCORDING TO ANY METHOD IN SABS 05
5 ALL GUARDRAILS SHALL BE GALVANIZED AS SPECIFIED (NOT TO BE PAINTED)

PAVING DETAILS: LIST OF DRAWINGS

DT 01/P	STANDARD LAYER WORK FOR 50mm BRICK PAVED WALKWAYS.
DT 02/P	STANDARD PAVING AROUND BUILDINGS
DT 03/P	STANDARD EDGE STRIPS FOR BRICK PAVED WALKWAYS.
DT 04/P	UNREINFORCED CONCRETE PAVEMENT SLAB NEXT TO BUILDINGS.
DT 05/P	UNREINFORCED CONCRETE PAVEMENT SLAB NEXT TO BUILDING AND ROADS.
DT 06/P	CONCRETE PAVEMENT SLAB WITH EDGE THICKENING.
DT 07/P	CONCRETE PAVEMENT WITH PEBBLE STONES (DIAGRAMMATIC)
DT 08/P	PAVING BLOCKS ON RAFT FOUNDATION (DIAGRAMMATIC)
DT 09/P	PAVING BLOCKS ON RAFT FOUNDATION (DIAGRAMMATIC)

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DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS

title
DRAWING LIST.

scale

date
22/06/2006

drawing number / type number
TYPE NO DT 00/P

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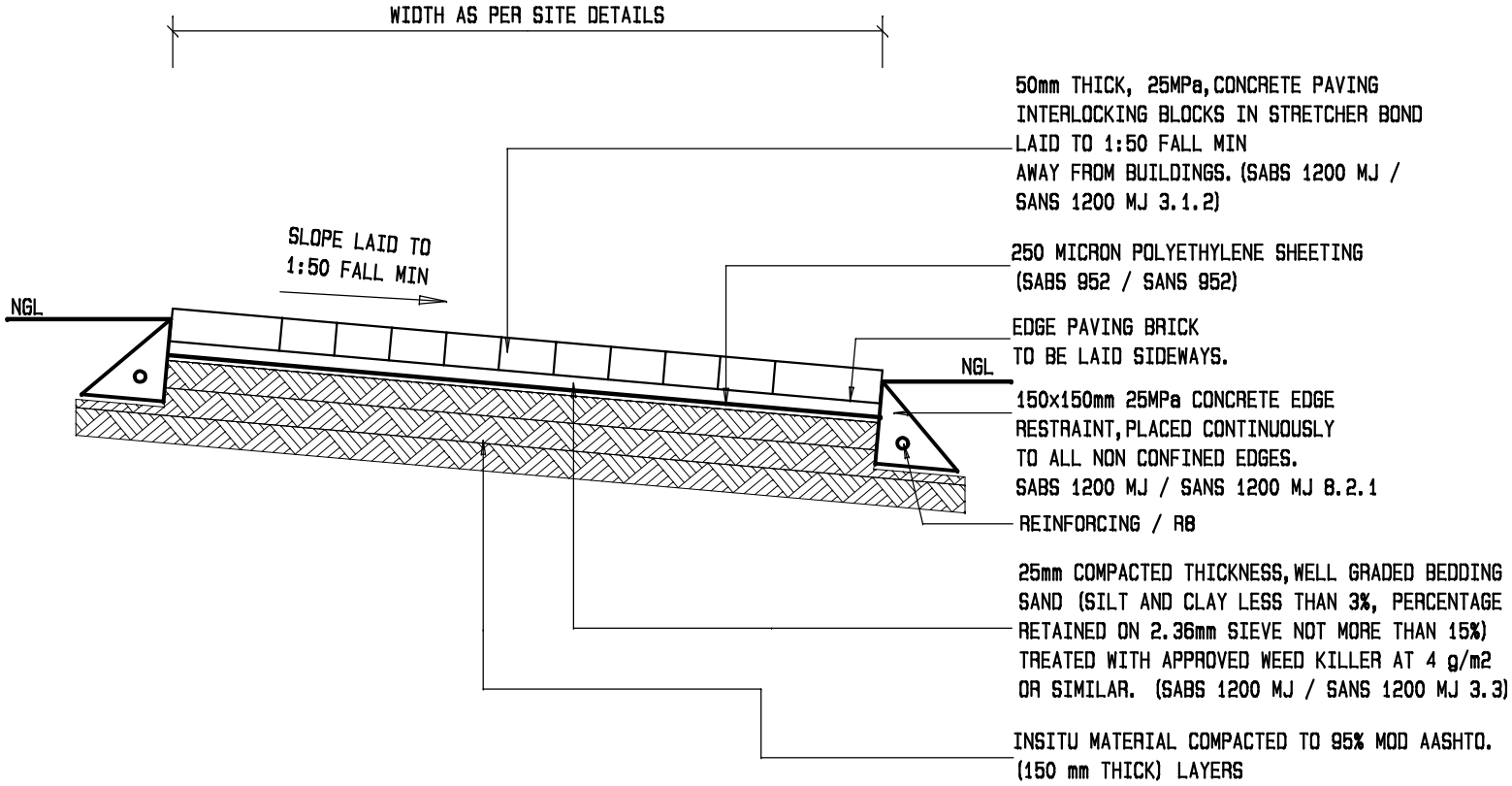
DIAGRAMMATIC CIVIL
ENGINEERING DETAILS
FOR DOLOMITIC SOILS

title
STANDARD LAYER WORK
FOR 50mm BRICK PAVED
WALKWAYS
(DIAGRAMMATIC)

scale
1 : 20

date
10/27/2004

drawing number / type number
TYPE NO DT 01/P



STANDARD LAYER WORK FOR 50mm BRICK PAVED WALKWAYS

DT 01/P

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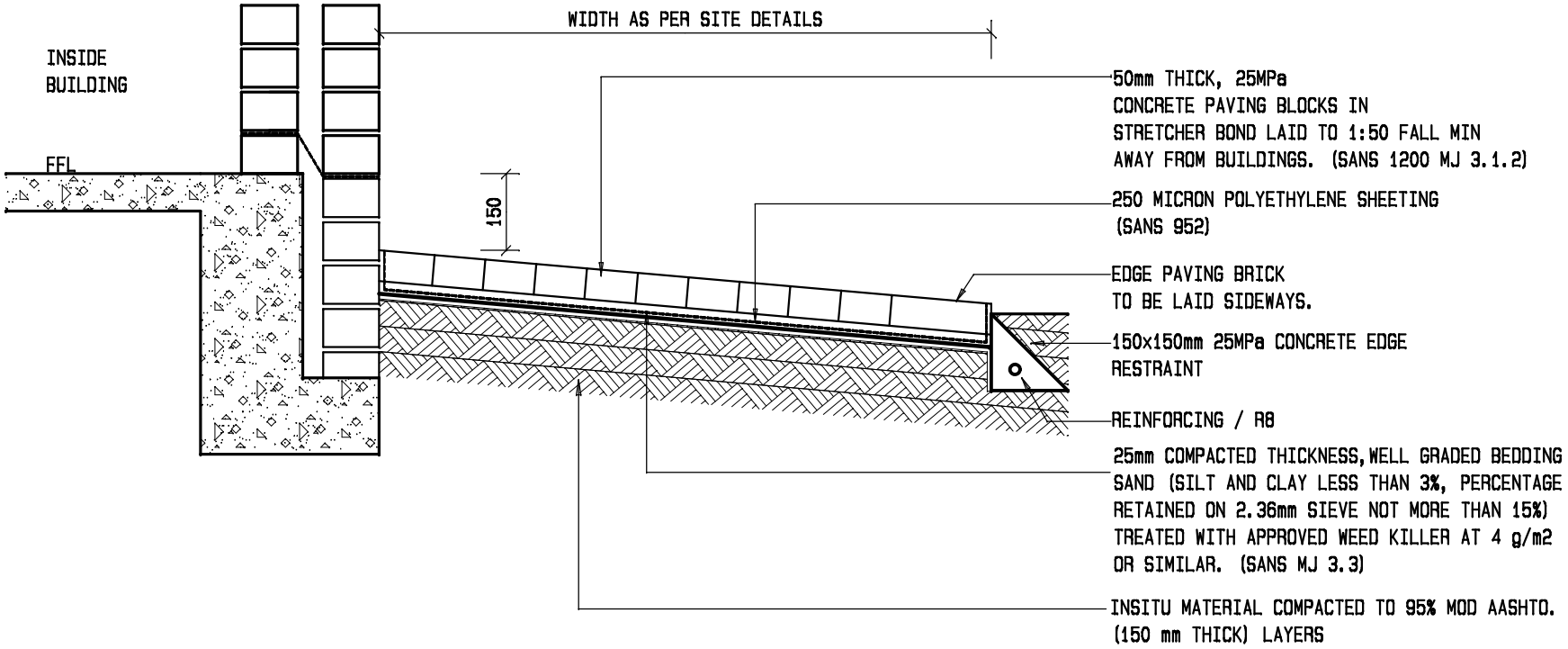
departmental
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS

title
STANDARD PAVING AROUND BUILDINGS (DIAGRAMMATIC)

scale
1 : 20

date
10/27/2004

drawing number / type number
TYPE NO DT 02/P



STANDARD PAVING AROUND BUILDINGS

DT 02/P

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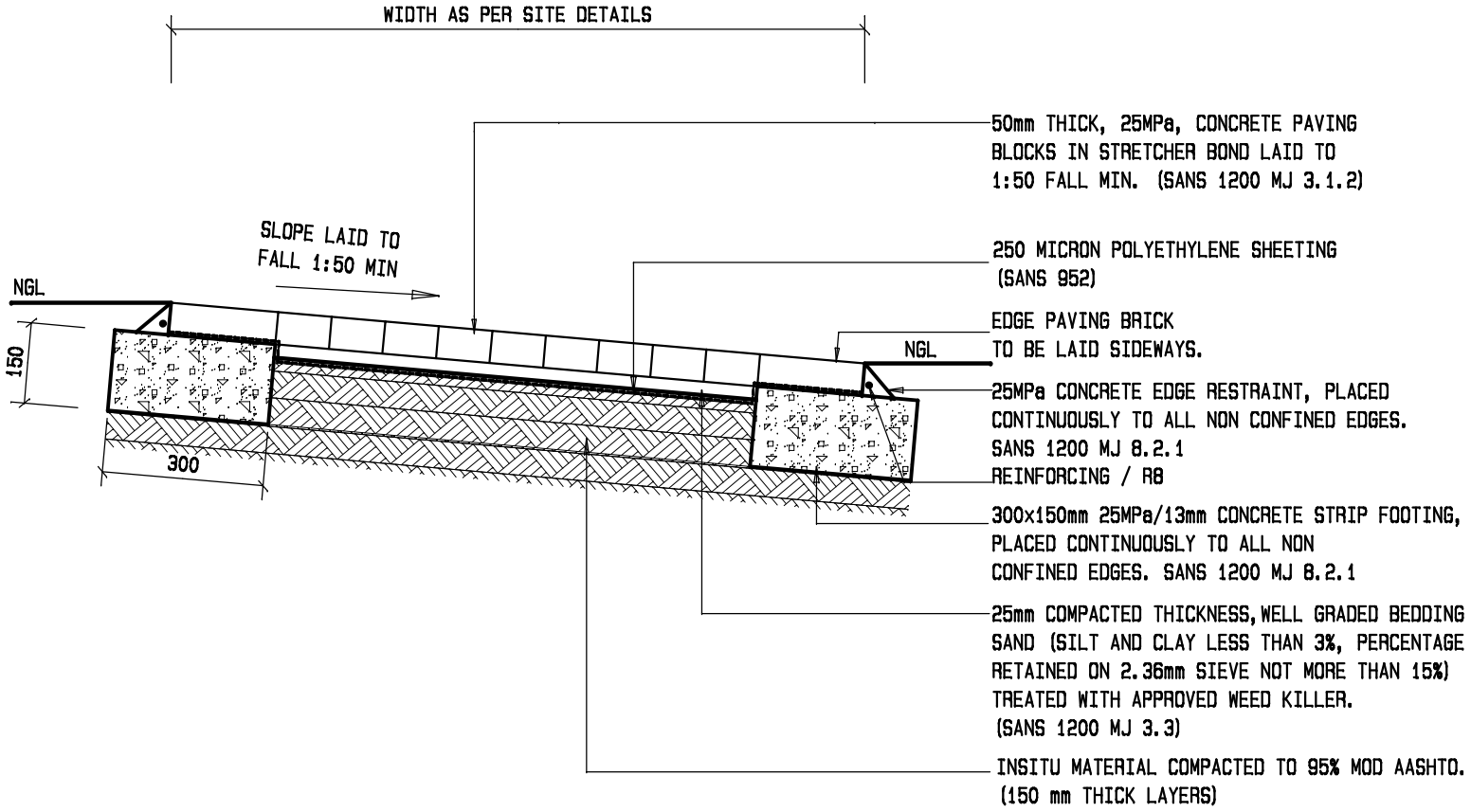
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS

title
STANDARD EDGE STRIPS FOR BRICK PAVED WALKWAYS (DIAGRAMMATIC)

scale
1 : 20

date
10/27/2004

drawing number / type number
TYPE NO DT 03/P



STANDARD EDGE STRIPS FOR BRICK PAVED WALKWAYS

DT 03/P

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department
DIAGRAMMATIC CIVIL
ENGINEERING DETAILS
FOR DOLOMITIC SOILS

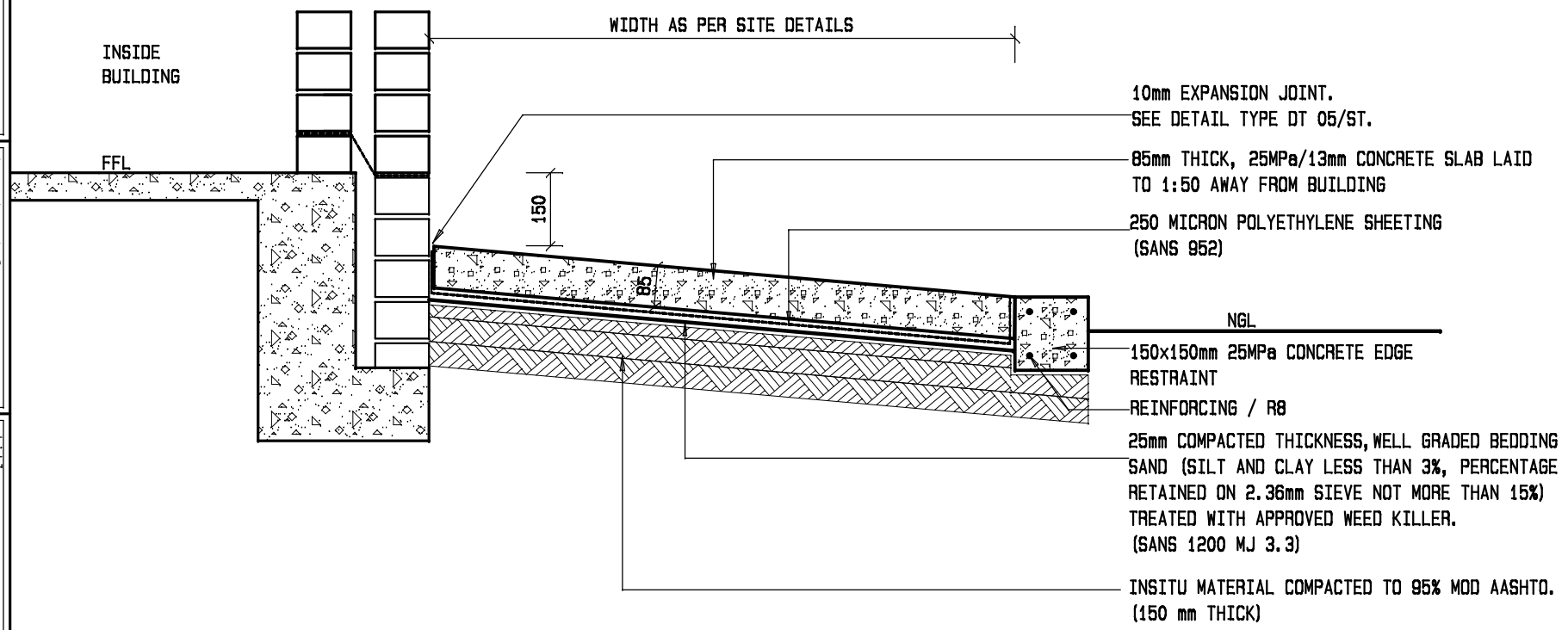
title
UNREINFORCED CONCRETE
PAVEMENT SLAB
NEXT TO BUILDINGS.
(DIAGRAMMATIC)

scale
1 : 20

date
10/27/2004

drawing number / type number
TYPE NO DT 04/P

USE DETAIL FOR: 1. NEXT TO BUILDINGS
2. UNCONFINED WALKWAYS
(PLACE EDGE STRIP BOTH SIDES)



UNREINFORCED CONCRETE PAVEMENT SLAB
NEXT TO BUILDINGS.

DT 04/P

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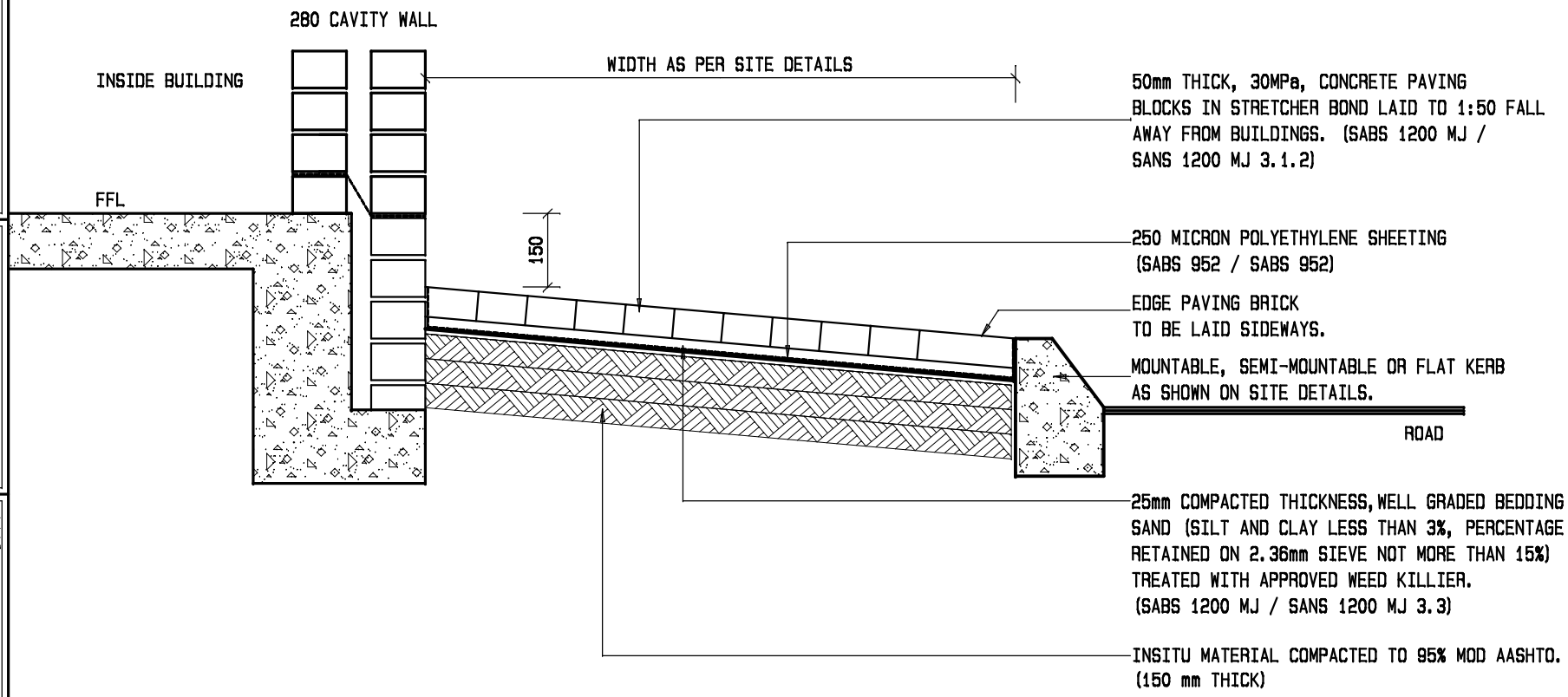
department: DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS

title: UNREINFORCED CONCRETE PAVEMENT BETWEEN BUILDINGS AND ROADS. (DIAGRAMMATIC)

scale: 1 : 10

date: 10/27/2004

drawing number / type number: TYPE NO DT 05/P



CONCRETE PAVING BLOCKS BETWEEN BUILDINGS AND ROADS.

DT 05/P

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department: DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS

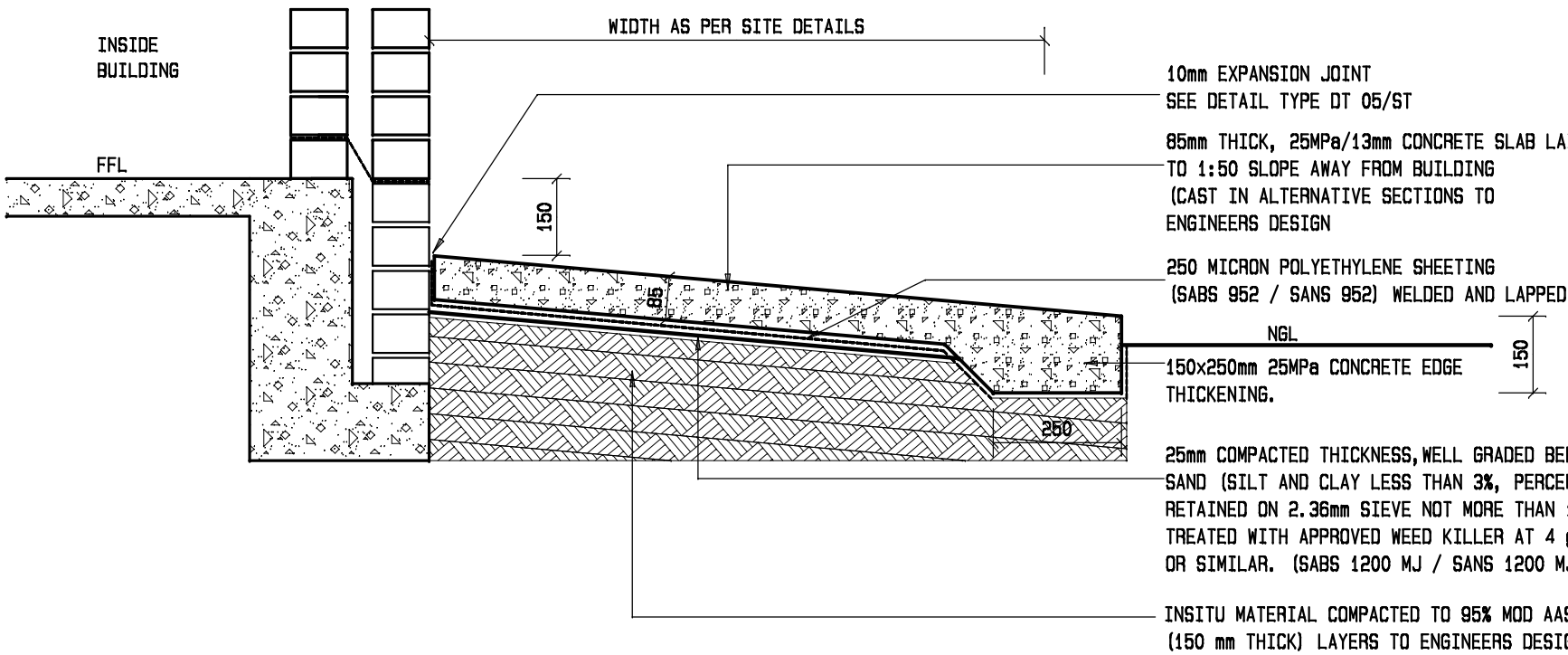
title: CONCRETE PAVEMENT SLAB WITH EDGE THICKENING. (DIAGRAMMATIC)

scale: 1 : 20

date: 10/27/2004

drawing number / type number: TYPE NO DT 06/P

USE DETAIL FOR: 1. NEXT TO BUILDINGS
2. UNCONFINED WALKWAYS
(PLACE EDGE STRIP BOTH SIDES)



CONCRETE PAVEMENT SLAB
WITH EDGE THICKENING.

DT 06/P

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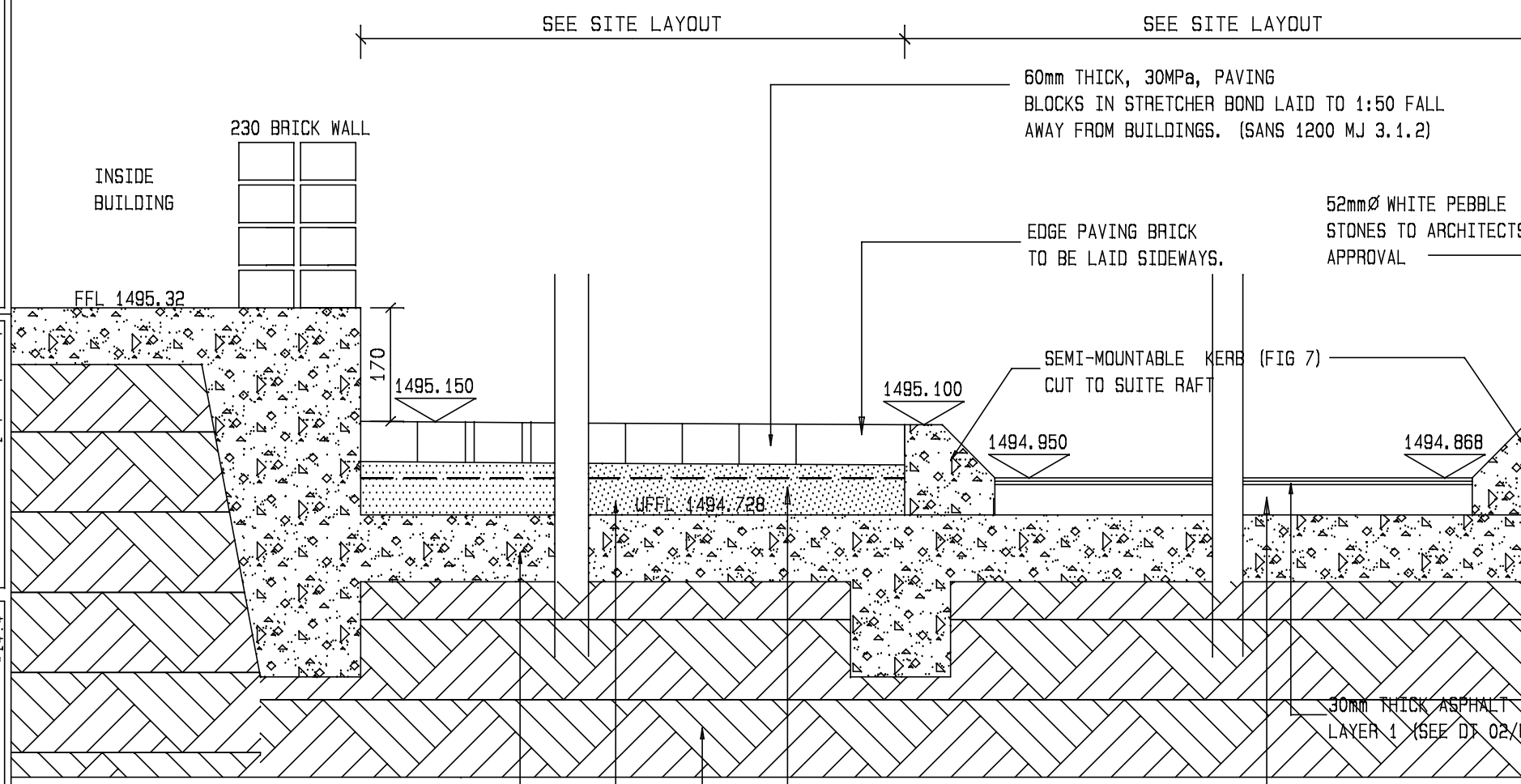
department
DIAGRAMMATIC CIVIL
ENGINEERING DETAILS
FOR DOLOMITIC SOILS

title
PAVING BLOCKS ON
RAFT FOUNDATION.
(DIAGRAMMATIC)

scale
1 : 10

date
22/06/2006

drawing number / type number
TYPE NO DT 09/P



PAVING BLOCKS ON RAFT FOUNDATION

DT 09/P

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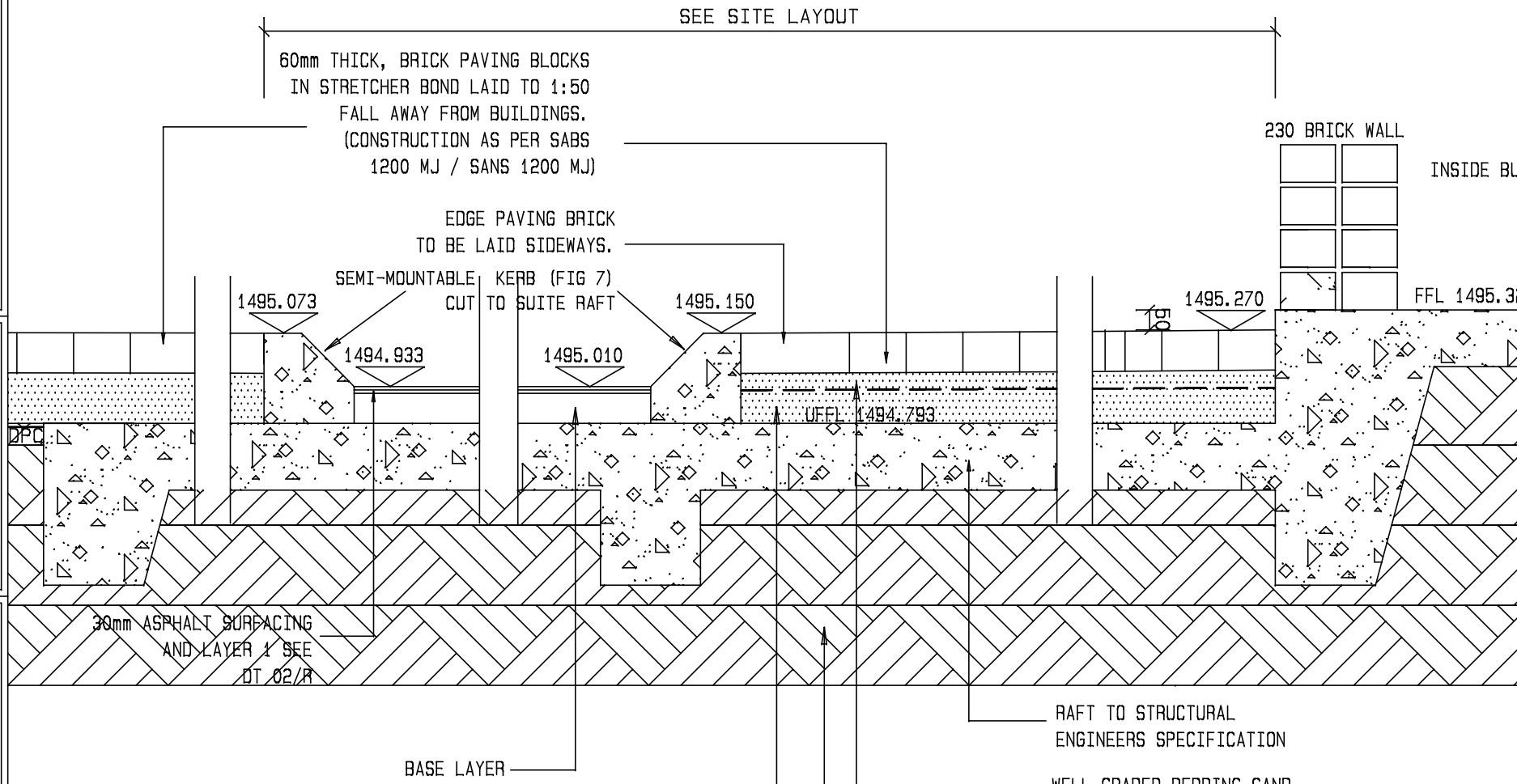
department
DIAGRAMMATIC CIVIL
ENGINEERING DETAILS
FOR DOLOMITIC SOILS

title
PAVING BLOCKS ON
RAFT FOUNDATION.
(DIAGRAMMATIC)

scale
1 : 10

date
22/06/2006

drawing number / type number
TYPE NO DT 08/P



PAVING BLOCKS ON
RAFT FOUNDATION

DT 08/P

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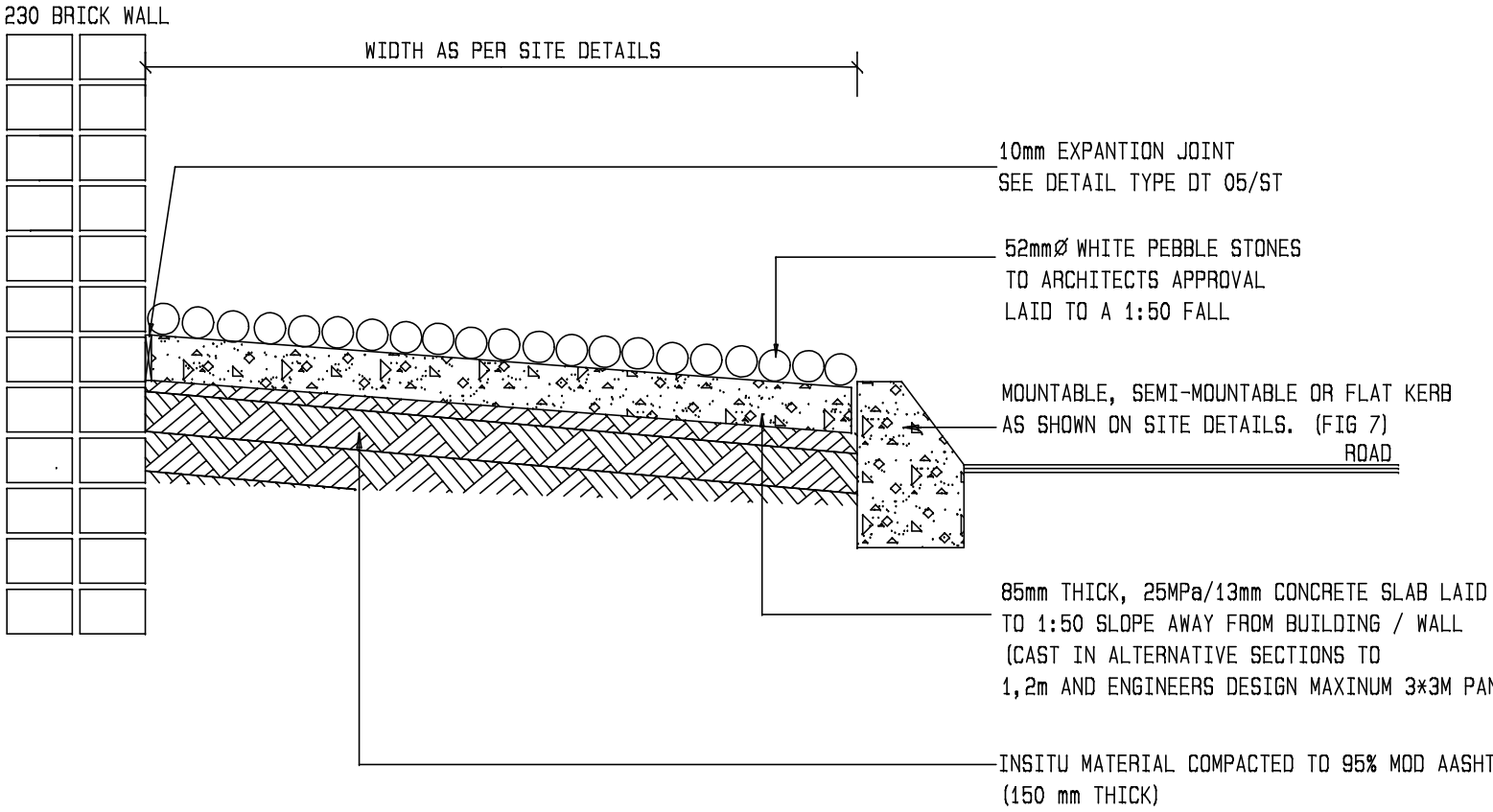
DIAGRAMMATIC CIVIL
ENGINEERING DETAILS
FOR DOLOMITIC SOILS

title
CONCRETE PAVEMENT
WITH PEBBLE STONES
(DIAGRAMMATIC)

scale
1 : 10

date
22/06/2006

drawing number / type number
TYPE NO DT 07/P



CONCRETE PAVEMENT
WITH PEBBLE STONES

DT 07/P

SINKHOLE DETAILS

SINKHOLE DETAILS: LIST OF DRAWINGS

DT 01/SH	SINKHOLE STABILISATION INVERTED FILTER METHOD.
DT 02/SH	SINKHOLE REHABILITATION SMALL TO LARGE COMPACTORS USED. INVERTED FILTER METHOD.
DT 03/SH	SINKHOLE REHABILITATION DYNAMIC COMPACTION
DT 04/SH	DOLINE REHABILITATION DYNAMIC COMPACTION
DT 05/SH	DOLINE REHABILITATION CONVENTIONAL COMPACTION.
DT 06/SH	FILLING OF LOW LAYING AREAS. (OPEN AREAS)
DT 07/SH	SETTING OUT GRID FOR DYNAMIC COMPACTION (PLAN)
DT 08/SH	EARTH WORKS TO IMPROVE STORMWATER DRAINAGE IN TRAFFICKED AREAS.

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departmental
DIAGRAMMATIC CIVIL
ENGINEERING DETAILS
FOR DOLOMITIC SOILS

title
DRAWING LIST.

scale
.

date
2001/08/08

drawing number / type number
TYPE NO DT 00/SH

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DIAGRAMMATIC CIVIL
ENGINEERING DETAILS
FOR DOLOMITIC SOILS

project
SINKHOLE STABILISATION
INVERTED FILTER METHOD
(DIAGRAMMATIC)

scale
1 : 60

date
10/27/2004

drawing number / type number
TYPE NO DT 01/SH

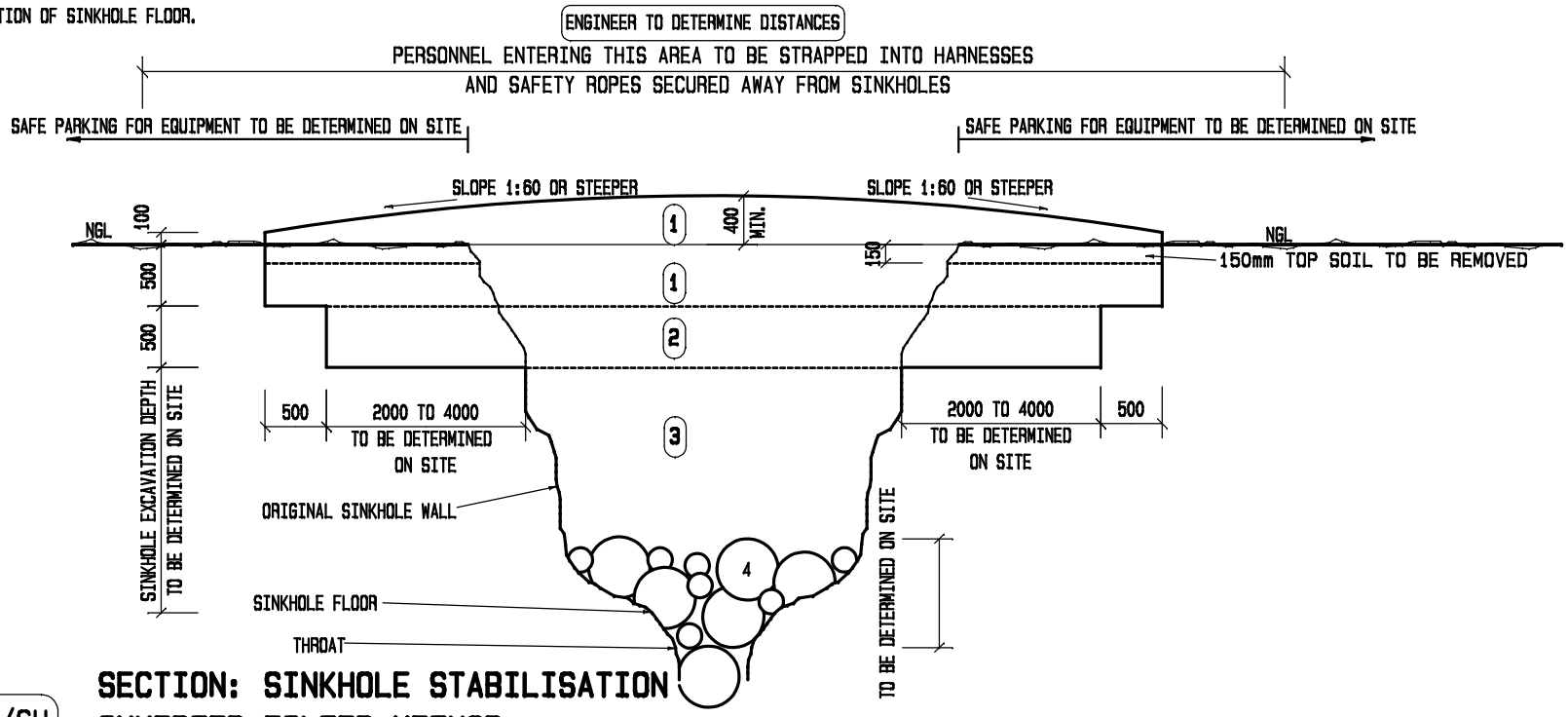
1. TOP SELECTED FILLING:
   -150mm LAYERS COMPACTED WITH WALK BEHIND COMPACTOR (90mm) TO 95% MOD AASHTO DENSITY.
   -SILTY SAND OR CLAY (PARTICLE SIZE 1,55mm AND SMALLER)

2. LOWER SELECTED FILLING:
   -150mm LAYERS COMPACTED WITH WALK BEHIND COMPACTOR (90mm) TO 95% MOD AASHTO DENSITY.
   -MAXIMUM COARSE MATERIAL SIZE NOT TO EXCEED 63mm IN DIAMETER.

3. BULK FILLING (UNCONTROLED COMPACTION):
   -200mm LAYERS COMPACTED WITH TAMPING OF 32 TON EXCAVATOR BUCKET OR SIMILAR.
   -MATERIAL TO BE TYPE G8 WITH MAXIMUM SIZE OF MATERIAL NOT EXCEEDING 125mm IN DIAMETER.

4. CHOKING OF SINKHOLE THROAT:
   -TYPE 1. BOULDERS OF 500mm Ø OR LARGER FOR OPEN THROAT.
   -TYPE 2. BOULDERS OR BUILDING RUBBLE UP TO 400mm Ø MIXED WITH 30% SOIL FINES.
   -COMPACT TYPE 1 AND TYPE 2 WITH EXCAVATOR BUCKET.
   -TYPE 3. REINFORCED CONCRETE SLAB (20MPa/19mm).
   -TYPE 4. PUMP 1:15 CEMENT:SOIL MIX INTO THROAT.
   -TYPE CHOKING TO BE DETERMINED BY ENGINEER AFTER EXCAVATION OF SINKHOLE FLOOR.

NOTE:
PC. AND PA. REFER TO PARTICULAR SPECIFICATIONS.



DT 01/SH

SECTION: SINKHOLE STABILISATION INVERTED FILTER METHOD

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department
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS

title
SINKHOLE REHABILITATION SMALL TO LARGE COMPACTORS USED. INVERTED FILTER METHOD (DIAGRAMMATIC)

scale
1 : 60

date
2001/08/08

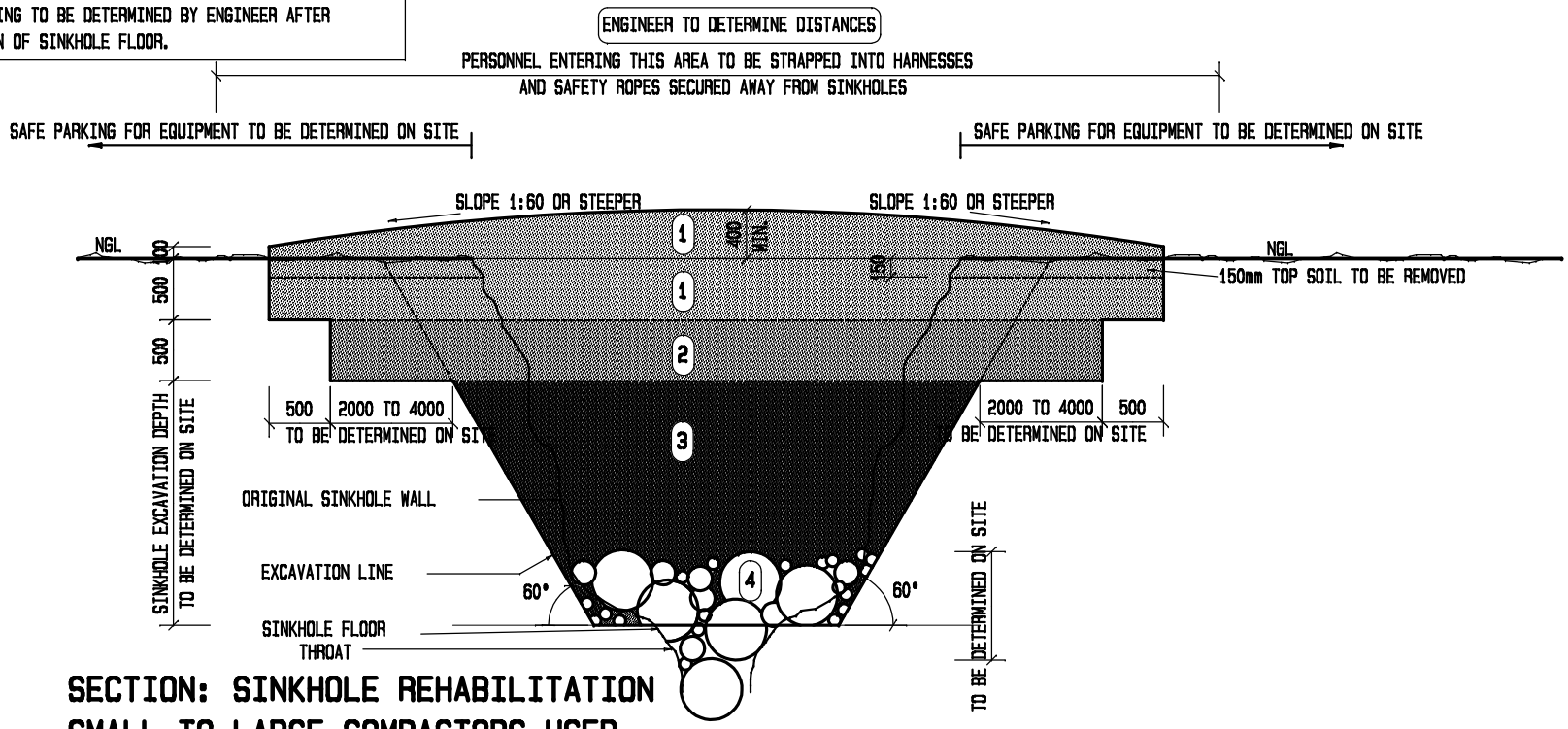
drawing number / type number
TYPE NO DT 02/SH

1. TOP SELECTED FILLING:
   -150mm LAYERS COMPACTED TO 95% MOD AASHTO DENSITY.
   -SILTY SAND OR CLAY (PARTICLE SIZE 1,55mm AND SMALLER)

2. LOWER SELECTED FILLING:
   -150mm LAYERS COMPACTED TO 95% MOD AASHTO DENSITY.
   -MAXIMUM COARSE MATERIAL SIZE NOT TO EXCEED 63mm Ø.

3. BULK FILLING:
   -200mm LAYERS COMPACTED TO 93% MOD AASHTO DENSITY OR A DENSITY LESS PREMEABLE THAN THE SURROUNDING SOIL WHICHEVER IS THE HIGHER.
   -MATERIAL TO BE TYPE G8 WITH MAXIMUM SIZE OF MATERIAL NOT EXCEEDING 125mm IN DIAMETER.

4. CHOKING OF SINKHOLE THROAT:
   -TYPE 1. BOULDERS OF 500mm Ø OR LARGER FOR OPEN THROAT.
   -TYPE 2. BOULDERS OR BUILDING RUBBLE UP TO 400mm Ø MIXED WITH 30% SOIL FINES.
   -COMPACT TYPE 1 AND TYPE 2 WITH EXCAVATOR BUCKET.
   -TYPE 3. REINFORCED CONCRETE SLAB (20MPa/19mm).
   -TYPE 4. PUMP 1:15 CEMENT:SOIL MIX INTO THROAT.
   -TYPE CHOKING TO BE DETERMINED BY ENGINEER AFTER EXCAVATION OF SINKHOLE FLOOR.



SECTION: SINKHOLE REHABILITATION SMALL TO LARGE COMPACTORS USED. INVERTED FILTER METHOD

DT 02/SH

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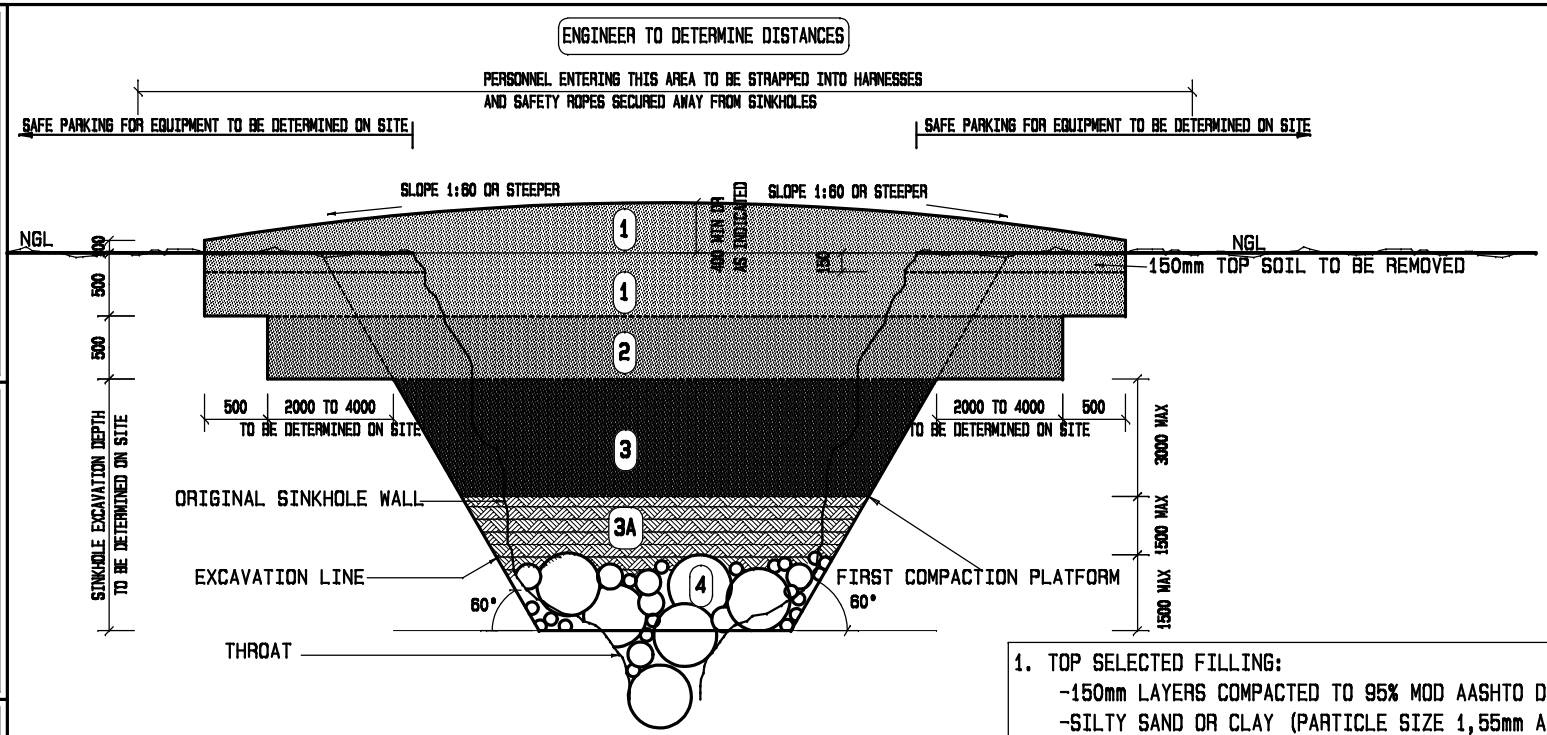
department
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS

title
SINKHOLE REHABILITATION
DYNAMIC COMPACTION.
(DIAGRAMMATIC)

scale
1 : 60

date
10/27/2004

drawing number / type number
TYPE NO DT 03/SH



SECTION:
SINKHOLE REHABILITATION
DYNAMIC COMPACTION.

1. TOP SELECTED FILLING:
   -150mm LAYERS COMPACTED TO 95% MOD AASHTO DENSITY.
   -SILTY SAND OR CLAY (PARTICLE SIZE 1,55mm AND SMALLER)

2. DYNAMIC COMPACTION FINISHING PLATFORM:
   -LAST 0,5m UNCOMPACTED LAYER OF COARSE MATERIAL, SIZE NOT TO EXCEED 63mm Ø.
   -DYNAMIC COMPACTION, CONSISTING OF PRIMARY, SECONDARY AND FINISHING COMPACTION.

3. DYNAMIC COMPACTION BULK FILLING PLATFORMS:
   -FILL IN 3m UNCOMPACTED LAYERS OF TYPE G8 MATERIAL WITH MAXIMUM SIZE OF COARSE MATERIAL NOT EXCEEDING 125mm IN DIAMETER.
   -DYNAMIC COMPACTION, CONSISTING OF PRIMARY AND SECONDARY COMPACTION.

3A. FIRST COMPACTION PLATFORM:
   -MATERIAL FROM EXCAVATION OF SINKHOLE SIDE WALLS LEVELLED OFF IN BASE WITH EXCAVATOR BUCKET.
   -DYNAMIC COMPACTION, CONSISTING OF PRIMARY AND SECONDARY COMPACTION.

4. CHOKING OF SINKHOLE THROAT:
   -TYPE 1. BOULDERS OF 500mm Ø OR LARGER FOR OPEN THROAT.
   -TYPE 2. BOULDERS OR BUILDING RUBBLE UP TO 400mm Ø MIXED WITH 30% SOIL FINES.
   -TYPE CHOKING TO BE DETERMINED BY ENGINEER.

DT 03/SH

NOTE:
PC. AND PA. REFER TO PARTICULAR SPECIFICATION.

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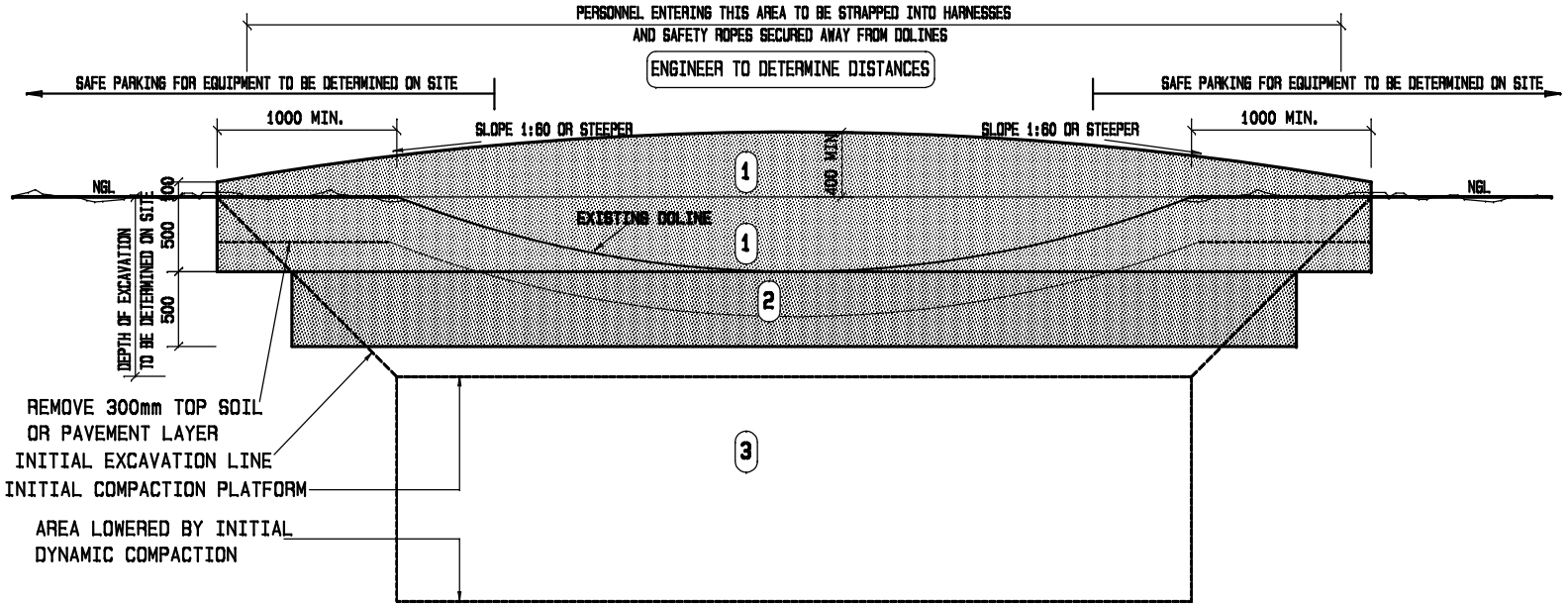
title
DOLINE REHABILITATION
DYNAMIC COMPACTION
(DIAGRAMMATIC)

scale
1 : 50

date
10/27/2004

drawing number / type number
TYPE NO DT 04/SH



SECTION:
DOLINE REHABILITATION
DYNAMIC COMPACTION

1. TOP SELECTED FILLING:
   -150mm LAYERS COMPACTED TO 95% MOD AASHTO DENSITY.
   -SILTY SAND OR CLAY (PARTICLE SIZE 1,55mm AND SMALLER)

2. DYNAMIC COMPACTION FINISHING PLATFORM:
   -LAST 0,5m FILLED IN UNCOMPACTED LAYER COARSE MATERIAL, SIZE NOT TO EXCEED 63mm Ø.
   -DYNAMIC COMPACTION, CONSISTING OF PRIMARY, SECONDARY AND FINISHING COMPACTION.

3. DYNAMIC COMPACTION BULK FILLING:
   -FILL IN 3m UNCOMPACTED LAYERS OF TYPE G8 MATERIAL WITH MAXIMUM SIZE OF COARSE MATERIAL NOT EXCEEDING 125mm IN DIAMETER.
   -DYNAMIC COMPACTION, CONSISTING OF PRIMARY AND SECONDARY COMPACTION.

NOTE:
IF PAVING IS TO BE RECONSTRUCTED OVER AREA, TOP LAYER SHALL BE OF SELECTED PAVING LAYERS.

NOTE:
PC. AND PA. REFER TO PARTICULAR SPECIFICATION.

DT 04/SH

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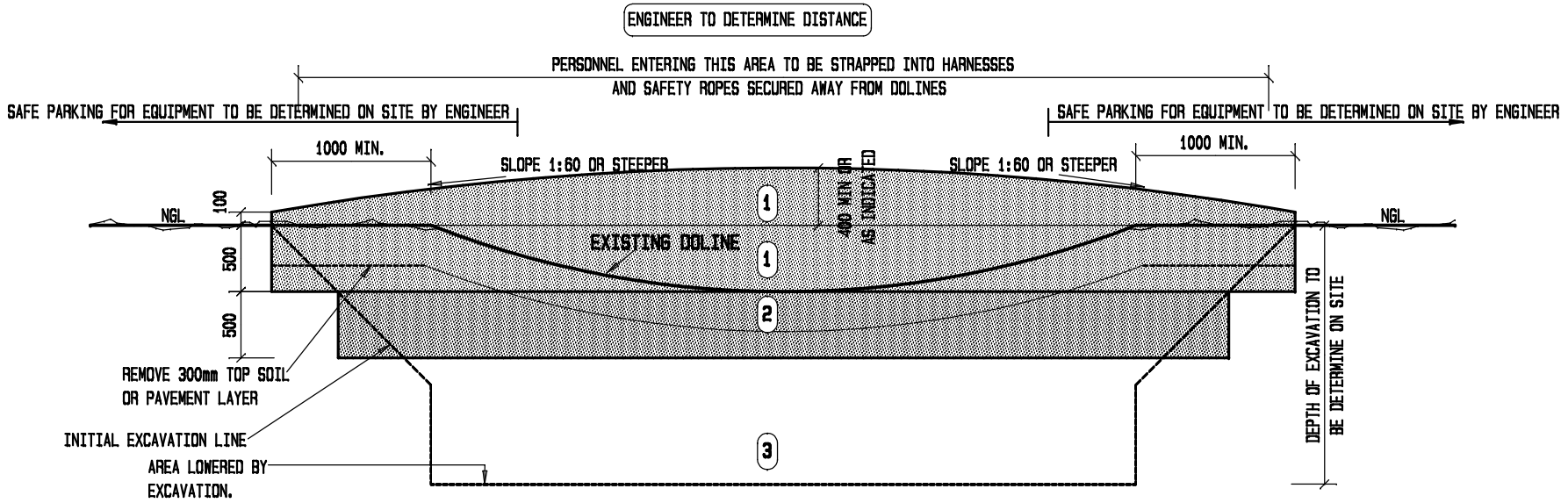
1. TOP SELECTED FILLING:
   -150mm LAYERS COMPACTED TO 95% MOD AASHTO DENSITY.
   -SILTY SAND OR CLAY (PARTICLE SIZE 1,55mm AND SMALLER)

2. LOWER SELECTED FILLING:
   -150mm LAYERS COMPACTED TO 95% MOD AASHTO DENSITY.
   -MAXIMUM COARSE MATERIAL SIZE NOT TO EXCEED 63mm IN DIAMETER.

3. BULK FILLING:
   -200mm LAYERS COMPACTED TO 93% MOD AASHTO DENSITY OR A DENSITY LESS PREMEABLE THAN THE SURROUNDING SOIL WHICHEVER IS HIGHER.
   -MATERIAL TO BE TYPE G8 WITH MAXIMUM SIZE NOT EXCEEDING 125mm IN DIAMETER.

NOTE:
IF PAVING IS TO BE RECONSTRUCTED OVER AREA,
TOP LAYERS 1 SHALL BE OF SELECTED PAVING LAYERS.

NOTE:
PC. AND PA. REFER TO PARTICULAR SPECIFICATION.



SECTION: DOLINE REHABILITATION
CONVENTIONAL COMPACTION

DT 05/SH

department
DIAGRAMMATIC CIVIL
ENGINEERING DETAILS
FOR DOLOMITIC SOILS

title
DOLINE REHABILITATION
CONVENTIONAL COMPACTION
(DIAGRAMMATIC)

scale
1 : 50

date
10/27/2004

drawing number / type number
TYPE NO DT 05/SH

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department
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS

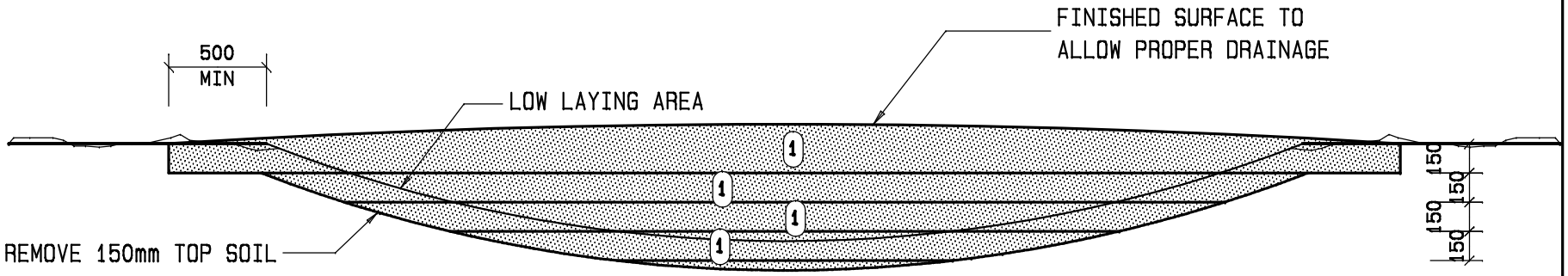
title
FILLING OF LOW LAYING AREAS (OPEN AREAS) (DIAGRAMMATIC)

scale
1 : 30

date
10/27/2004

drawing number / type number
TYPE NO DT 06/SH

1. -150mm LAYERS COMPACTED TO 93% MOD AASHTO DENSITY OR TO A DENSITY LESS PREMEABLE THAN THE SURROUNDING AREA WHICHEVER IS THE HIGHER.



SECTION:
FILLING OF LOW LAYING AREAS
(OPEN AREAS)

DT 06/SH

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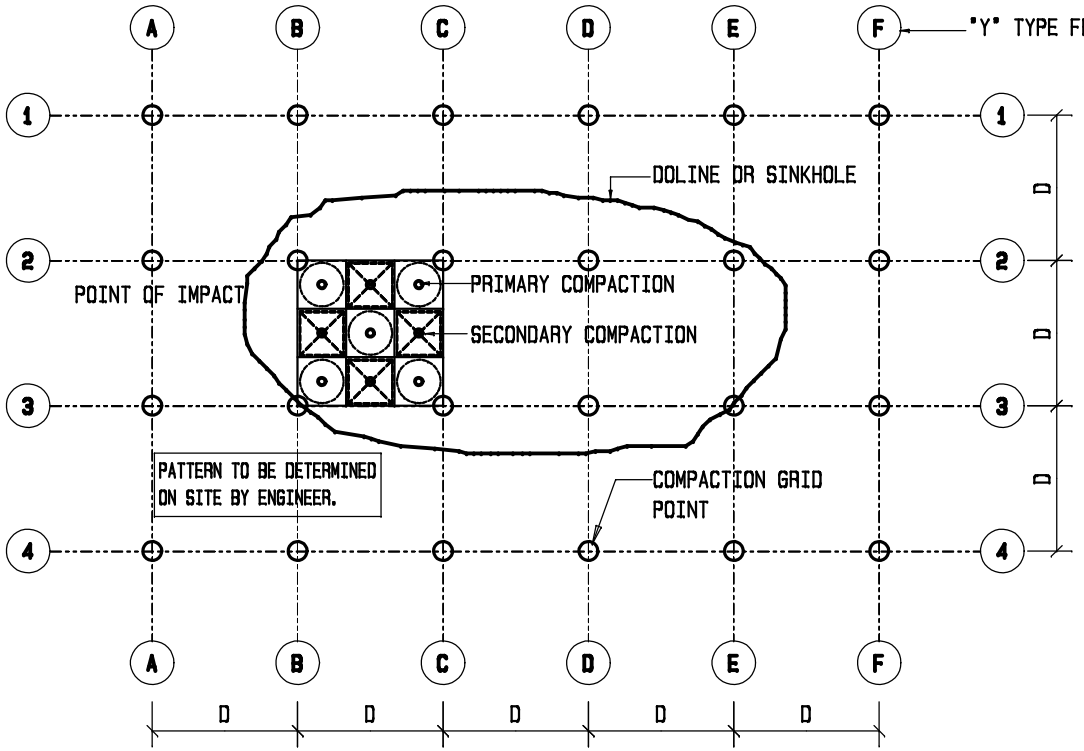
department
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS

title
SETTING OUT GRID FOR DYNAMIC COMPACTION (PLAN) (DIAGRAMMATIC)

scale
1 : 260

date
10/27/2004

drawing number / type number
TYPE NO DT 07/SH



NOTE:
1. COMPACTION FOOTPRINT SPACING (D) TO BE DETERMINED BY ENGINEER ON SITE.
2. FILLING OF COMPACTION DEPRESSIONS CONSISTING OF PRIMARY, SECONDARY AND FINISHING COMPACTION.

NOTE:
- GRID TO BE SET OUT BEFORE ANY EARTH WORKS COMMENCE.
- NGL HEIGHTS TO BE RECORDED BEFORE AND AFTER COMPACTION.

SETTING OUT GRID FOR DYNAMIC COMPACTION (PLAN)

EXAMPLE ONLY

FIELD REPORT FOR EACH BLOCK					
GRID BLOCK REFERENCE NUMBER	PRIMARY COMPACTION		SECONDARY COMPACTION		FINISHING COMPACTION
	NO. OF BLOWS	AVERAGE DEPTH	NO. OF BLOWS	AVERAGE DEPTH	NO. OF BLOWS
2/3-B/C	18		8		26
DROP HEIGHT	18m	1,6m	18m	1,3m	
2/3-B/C	14		8		22
DROP HEIGHT	18m	1,4m	18m	1.0m	
2/3-B/C	12		8		20
DROP HEIGHT	18m	1,2m	18m	1,0m	

EXAMPLE ONLY

PPV	
AVERAGE	MAXIMUM

AVERAGE DEPTH = AVERAGE DEPTH OF MATERIAL OF ALL POINTS FROM NATURAL GROUND LEVEL OF IMPACT AFTER COMPLETION OF COMPACTION PHASE.

DT 07/SH

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DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS

title
EARTH WORKS TO IMPROVE STORM WATER DRAINAGE IN TRAFFICKED AREAS (DIAGRAMMATIC)

scale
1 : 20

date
10/27/2004

drawing number / type number
TYPE NO DT 08/SH

NOTE 1:
DUST CONTROL.
ALL DISTURBED MATERIAL OR SURFACES TO BE KEPT SUFFICIENTLY MOIST TO PREVENT DUST POLLUTION.

1. GRASS SEEDING AS PER SPECIFICATION OR REPLANT REMOVED GRASS.

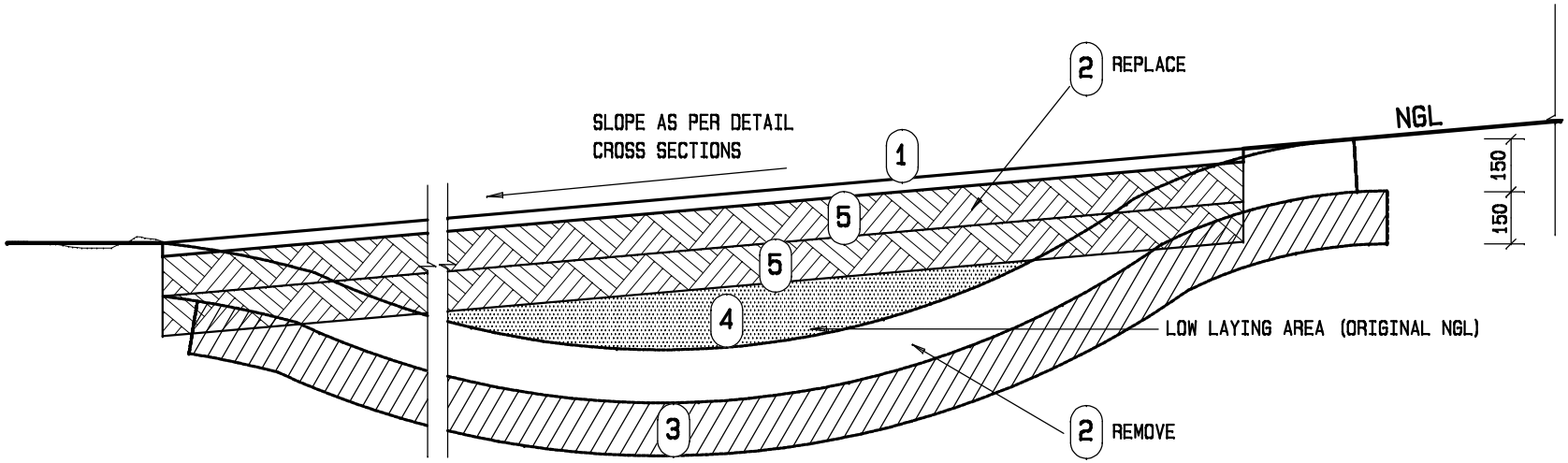
2. ALTERNATIVE 1:
REMOVE TOPSOIL AND STOCKPILE.
REPLACE TOPSOIL, LEVEL AND COMPACT TO 95% MOD AASHTO DENSITY IN ONE 150mm THICK LAYER.

ALTERNATIVE 2:
WINDROW 150mm TOPSOIL TO ONE SIDE, MAINTAIN, REDRESS, LEVEL AND COMPACT AS ABOVE.

3. RIP, SCARRIFY, GRADE TO EVEN SLOPE AND RECOMPACT 150mm INSITU MATERIAL TO 95% MOD AASHTO DENSITY.

4. IMPORTED FILL COMPACTED TO 95% MOD AASHTO DENSITY (MATERIAL TYPE PI > 14)

5. IMPORTED FILL COMPACTED TO 95% MOD AASHTO DENSITY (MATERIAL TYPE G7 IN TERMS OF TRH 14)



EARTH WORKS TO IMPROVE STORM WATER DRAINAGE IN TRAFFICKED AREAS.

DT 08/SH

SURVEY BEACON DETAILS

SURVEY BEACON DETAILS: LIST OF DRAWINGS

DT 01/SB SURVEY POINTS IN ROADS SURFACE.
DT 02/SB CONTROL BEACON ON ROCK.
DT 03/SB SURVEY POINT IN OPEN FIELD.
DT 04/SB LEVELING PIN AGAISNT BUILDING.
DT 05/SB SURVEY BASE STATION.
DT 06/SB SURVEY POINT IN CONCRETE.

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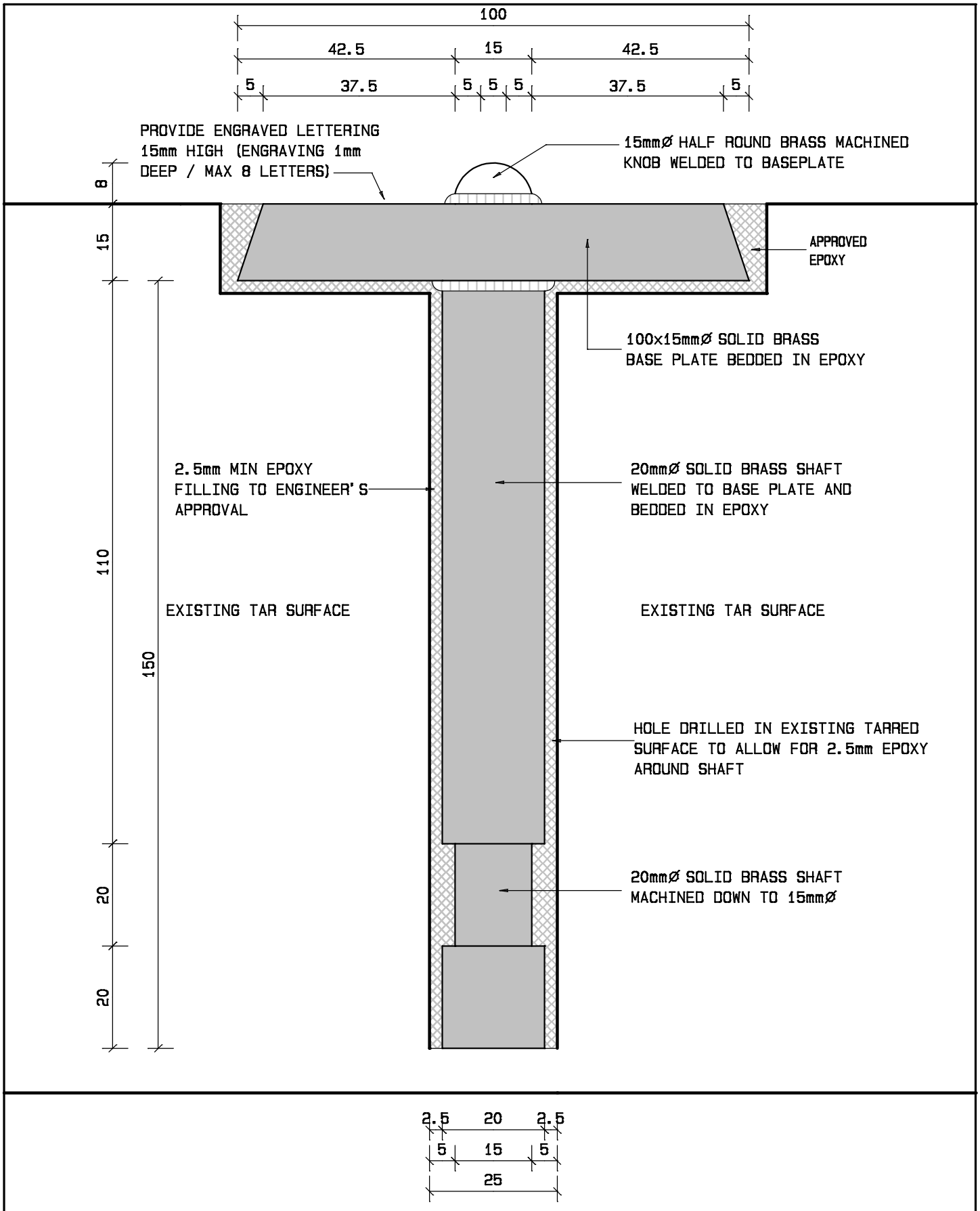
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS

project
SURVEY BEACON: DRAWING LIST.

scale
.

date
8/30/2005

drawing number / type number
TYPE NO DT 00/SB



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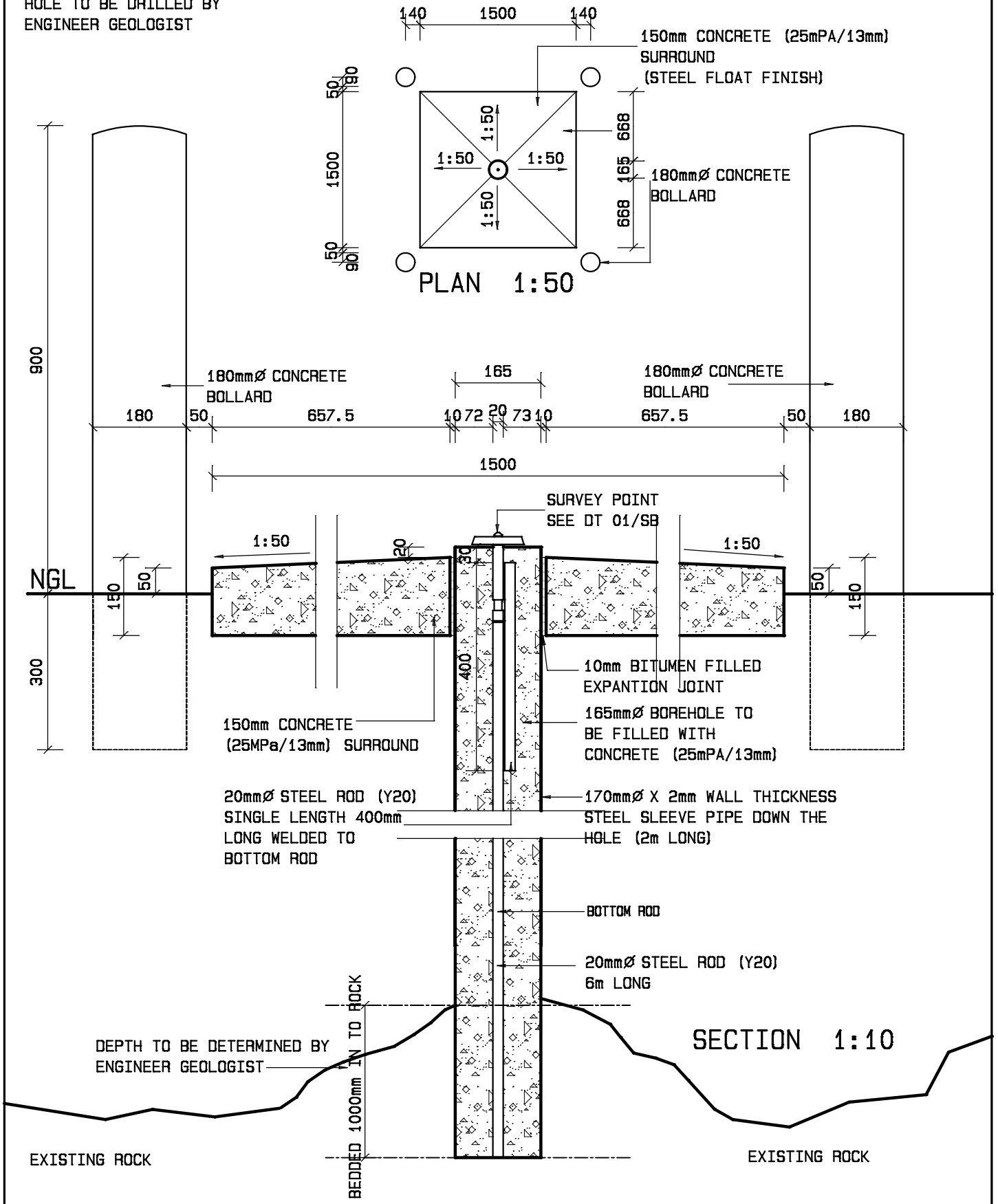
departmental	title	scale	date
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS.	SURVEY POINT IN ROADS SURFACE	1 : 1	8/30/2005

drawing number / type number

TYPE NO DT 01/SB

NOTE:
HOLE TO BE DRILLED BY
ENGINEER GEOLOGIST



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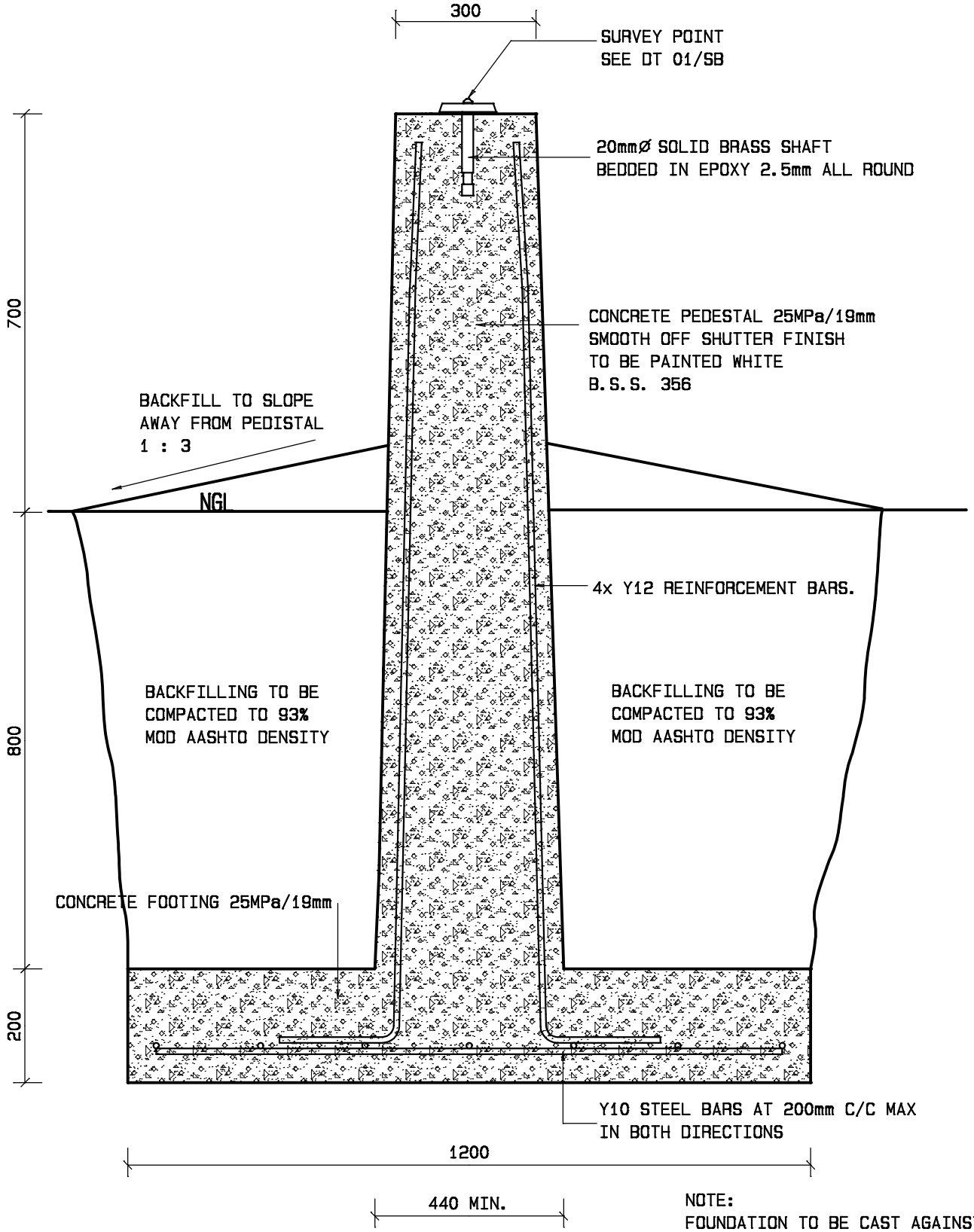
departmental: DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS.	title: CONTROL BEACON ON ROCK	scale: 1 : 10 1 : 50	date: 8/30/2005
		drawing number / type number: TYPE NO DT 02/SB	



NOTE:
FOUNDATION TO BE CAST AGAINST
NATURAL UNDISTURBED SOIL TO
ENGINEERS APPROVAL

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departmental	title	scale	date
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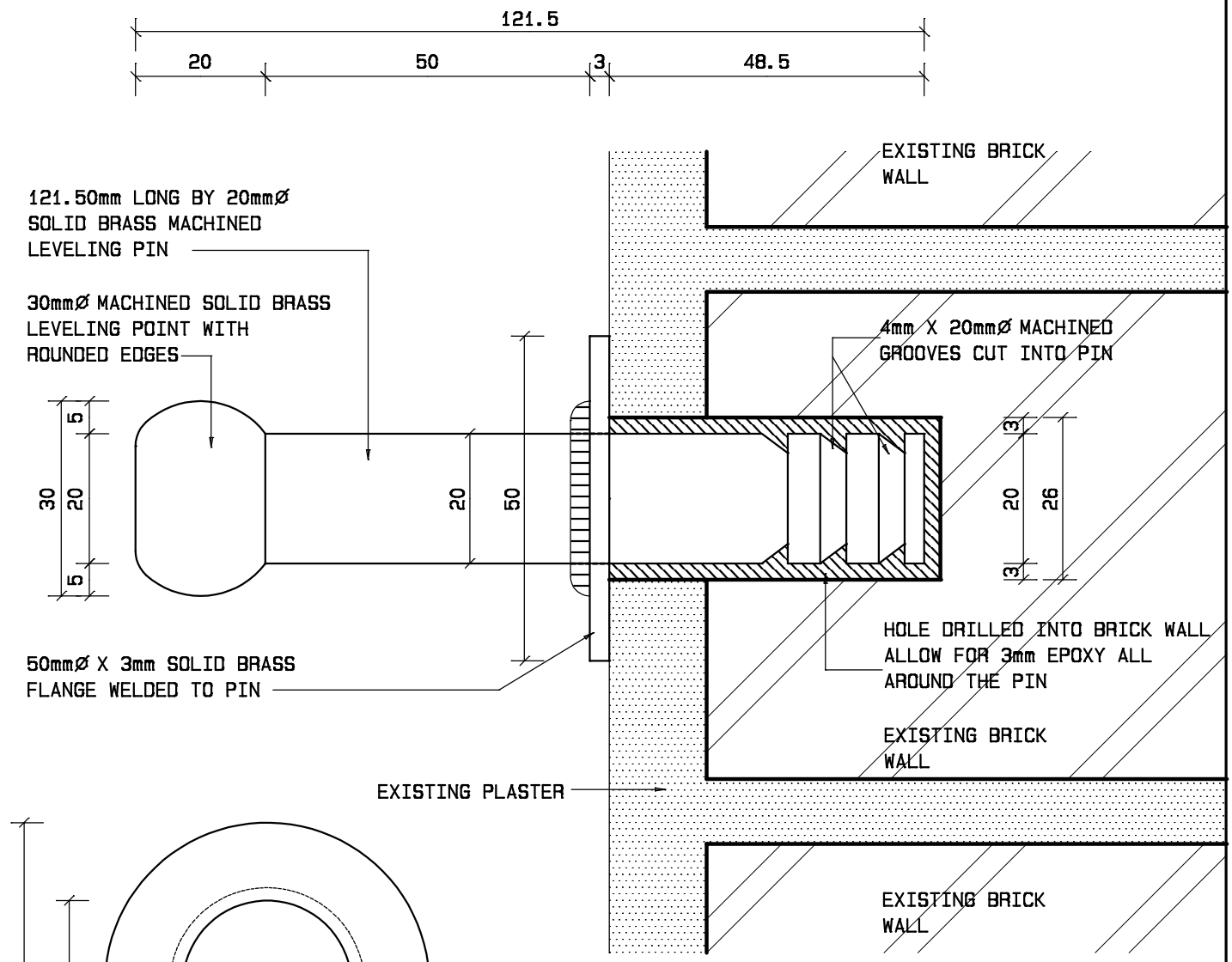
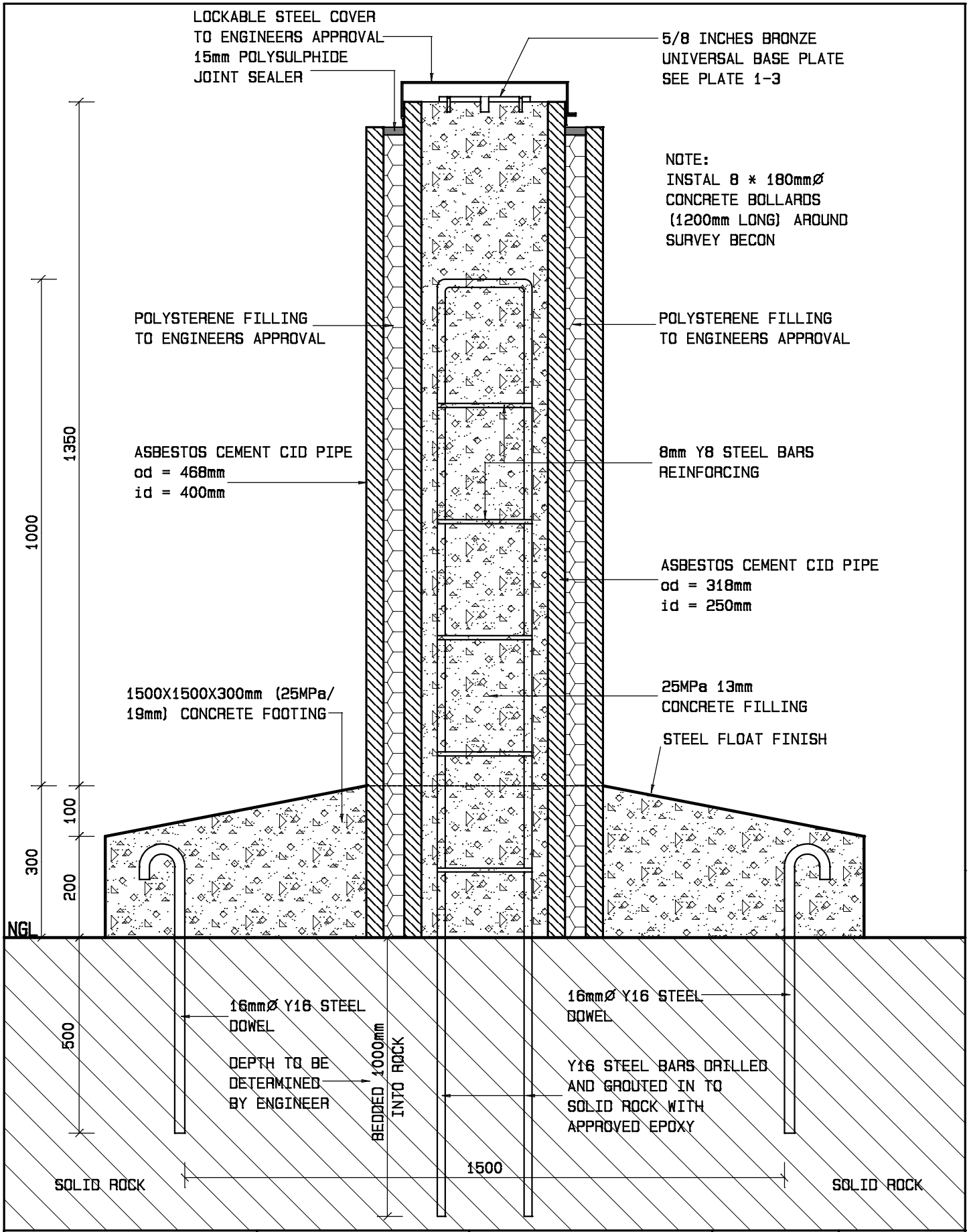
drawing number / type number
TYPE NO DT 03/SB



FRONT ELEVATION

scale 1:1

DEPARTMENT OF PUBLIC WORKS Private Bag X65 Pretoria 0001 Tel (012) 337 2000	departmental DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS.	title LEVELING PIN AGAINST BUILDING	scale 1:1	date 8/30/2005
			drawing number / type number TYPE NO DT 04/SB	



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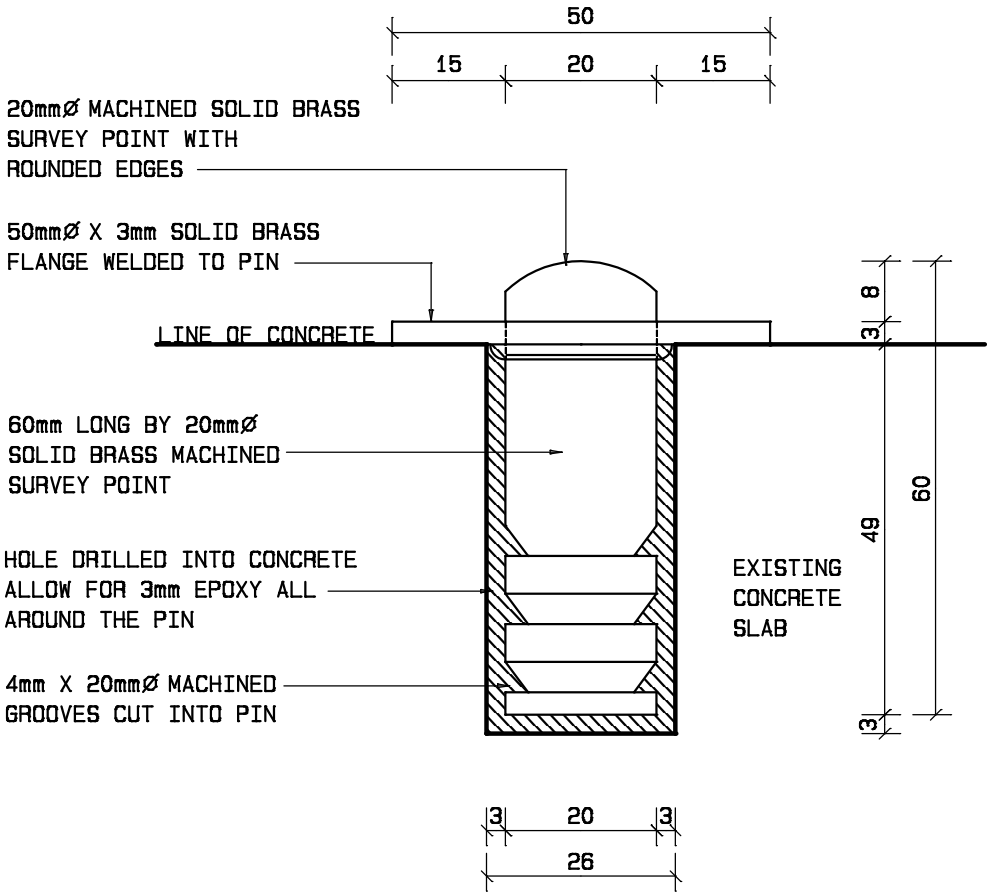
title
SURVEY
BASE STATION

scale
1:10

date
8/30/2005

drawing number / type number
TYPE NO DT 05/SB



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			drawing number / type number TYPE NO DT 06/SB	

CABLE DETAILS

CABLE DETAILS: LIST OF DRAWINGS

DT 01/C	TYPICAL DUCT DETAIL FOR CABLE SLEEVES UNDER DRIVEWAYS
DT 02/C	TYPICAL MANHOLE FOR POWER AND DATA CABLES
DT 03/C	TYPICAL DUCT DETAIL FOR CABLE SLEEVES UNDER WALKWAYS
DT 04/C	STEEL LADDER IN MANHOLE DETAIL
DT 05/C	SECTION OF 1000mmØ HDPE MANHOLE
DT 06/C	TYPICAL WELDING DETAILS FOR HDPE CABLE MANHOLE PLAN
DT 07/C	TYPICAL WELDING DETAILS FOR HDPE CABLE MANHOLE SECTION C
DT 08/C	TYPICAL WELDING DETAILS FOR HDPE CABLE MANHOLE

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title
CABLE:
CABLE DETAILS
LIST OF DRAWINGS.

scale
N. A.

date
22/06/2006

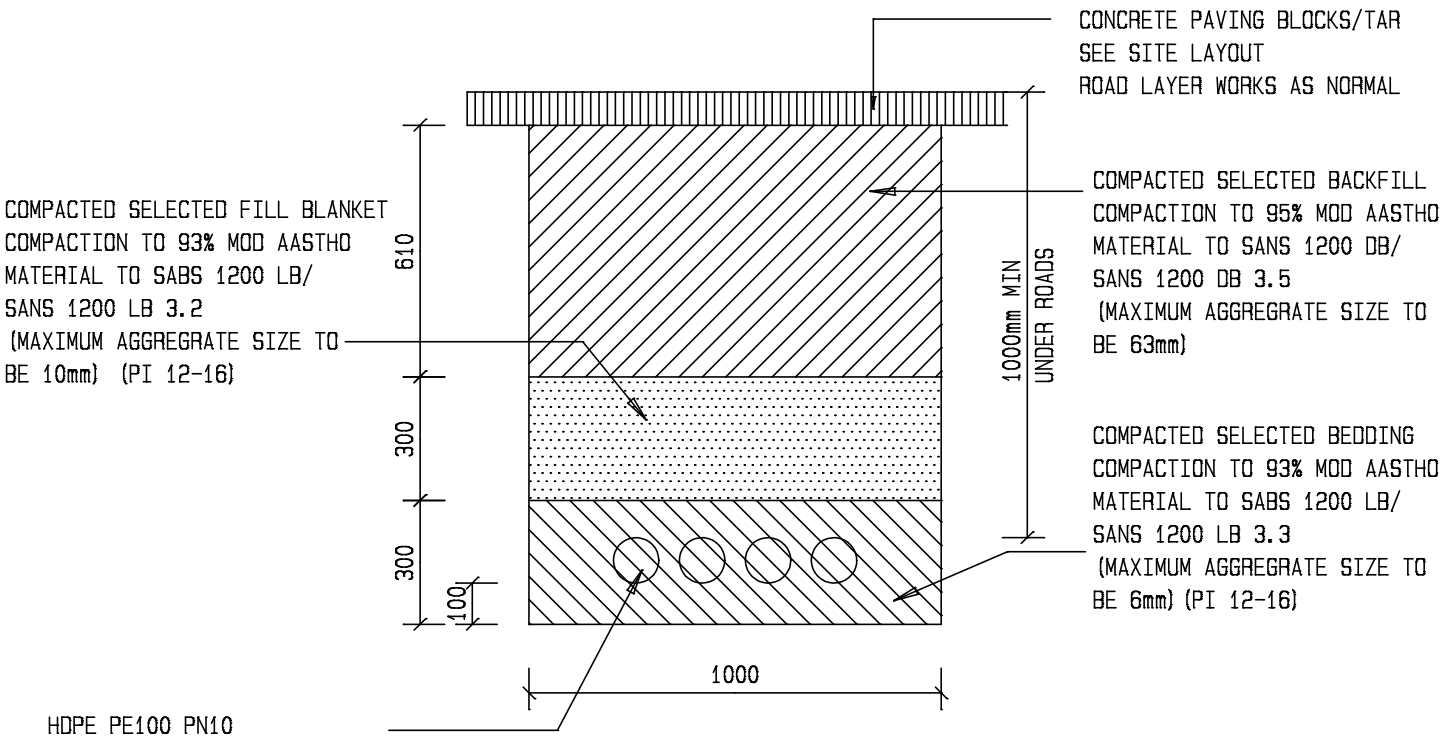
drawing number / type number
TYPE NO DT 00/C

NOTE:
SLEEVES PIPES TO BE HDPE PE100
PN10 SABS ISO 4427/SANS 4427

SLEEVE SPACING APPROVAL

DATE:
SIGNED:
ELECTRICAL ENGINEER

600mm MUST BE ALLOWED FOR
BETWEEN POWER CABLES TRENCH
AND DATA CABLES TRENCH



TYPICAL DUCT DETAIL FOR CABLE SLEEVES UNDER DRIVEWAYS

SEE SABS 1200 LC-1981
FOR PIPE SPACING

ALL DIMENSIONS TO BE
SPECIFIED OR INDICATED
BY ENGINEER.

MANUFACTURING NOTE:
SLEEVE SPACING TO SUIT
FUSION COUPLING - 50mm
BETWEEN SLEEVES MINIMUM

NOTE:
ALL BACKFILL MATERIALS SHALL
AFTER COMPACTION BE LESS
PERMEABLE THAN THE IN-SITU
SURROUNDING SOIL.

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ENGINEERING DETAILS
FOR DOLOMITIC SOILS

title
TYPICAL DUCT DETAIL FOR
CABLES SLEEVES UNDER
DRIVEWAYS (DIAGRAMATIC)

scale
1 : 20

date
22/06/2006

drawing number / type number
TYPE NO DT 01/C

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departmental
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ENGINEERING DETAILS
FOR DOLOMITIC SOILS

title
CABLING
MANHOLE FOR POWER
AND DATA CABLES

scale
1:20

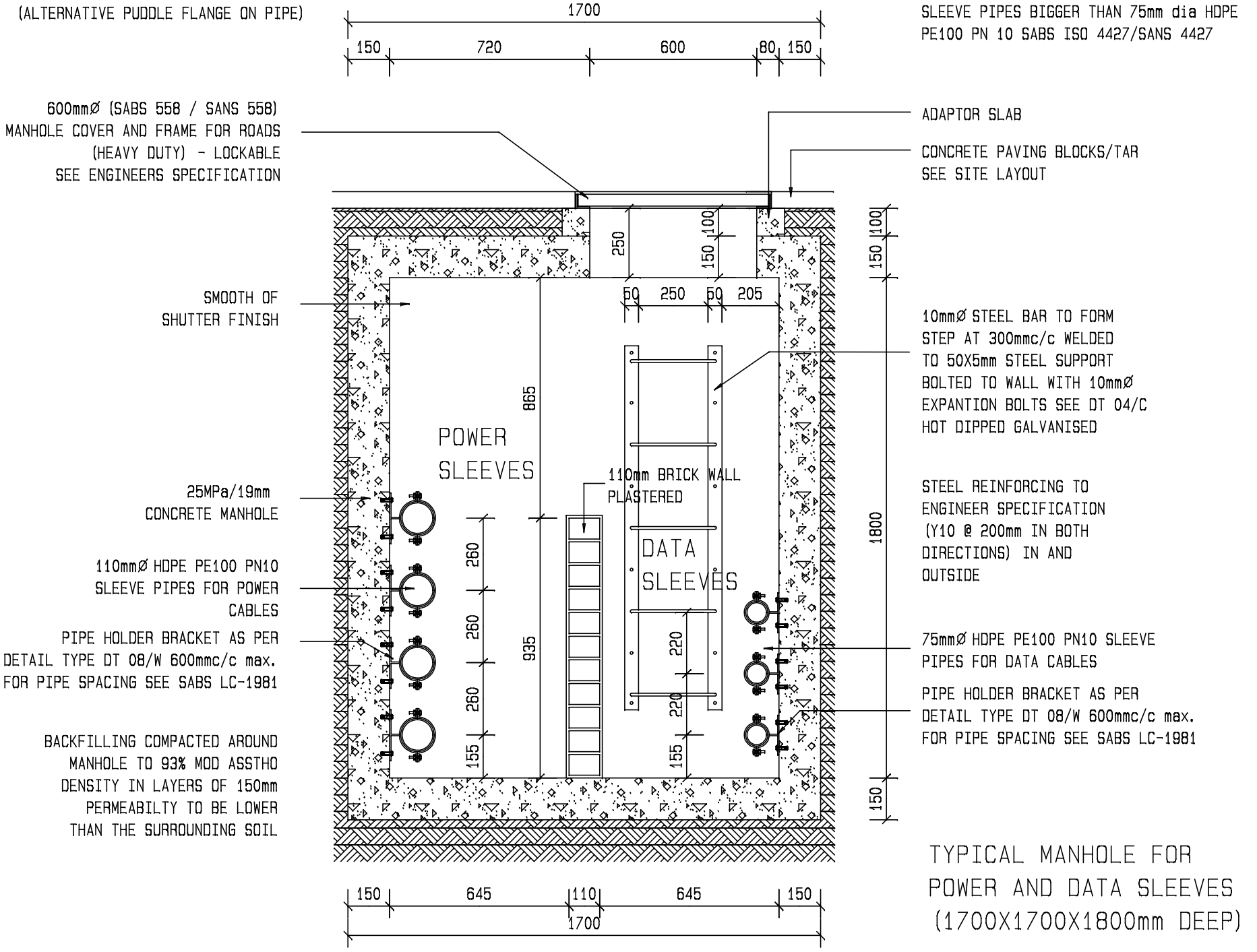
drawing number / type number
TYPE NO DT 02/C

date
22/06/2006

HOLES FOR ALL PIPES THROUGH CONCRETE TO BE DIAMETER PLUS 20mm. SEAL OPENINGS WITH 25mm DEEP POLYSULPHIDE ON IN AND OUTSIDE OF WALL.
(ALTERNATIVE PUDDLE FLANGE ON PIPE)

NOTE: ALL TO COMPLY TO SABS 1200 LC-10981

SLEEVE PIPES SMALLER THAN 63mm dia HDPE
PE100 PN 10 SABS ISO 4427/SANS4427
SLEEVE PIPES BIGGER THAN 75mm dia HDPE
PE100 PN 10 SABS ISO 4427/SANS 4427



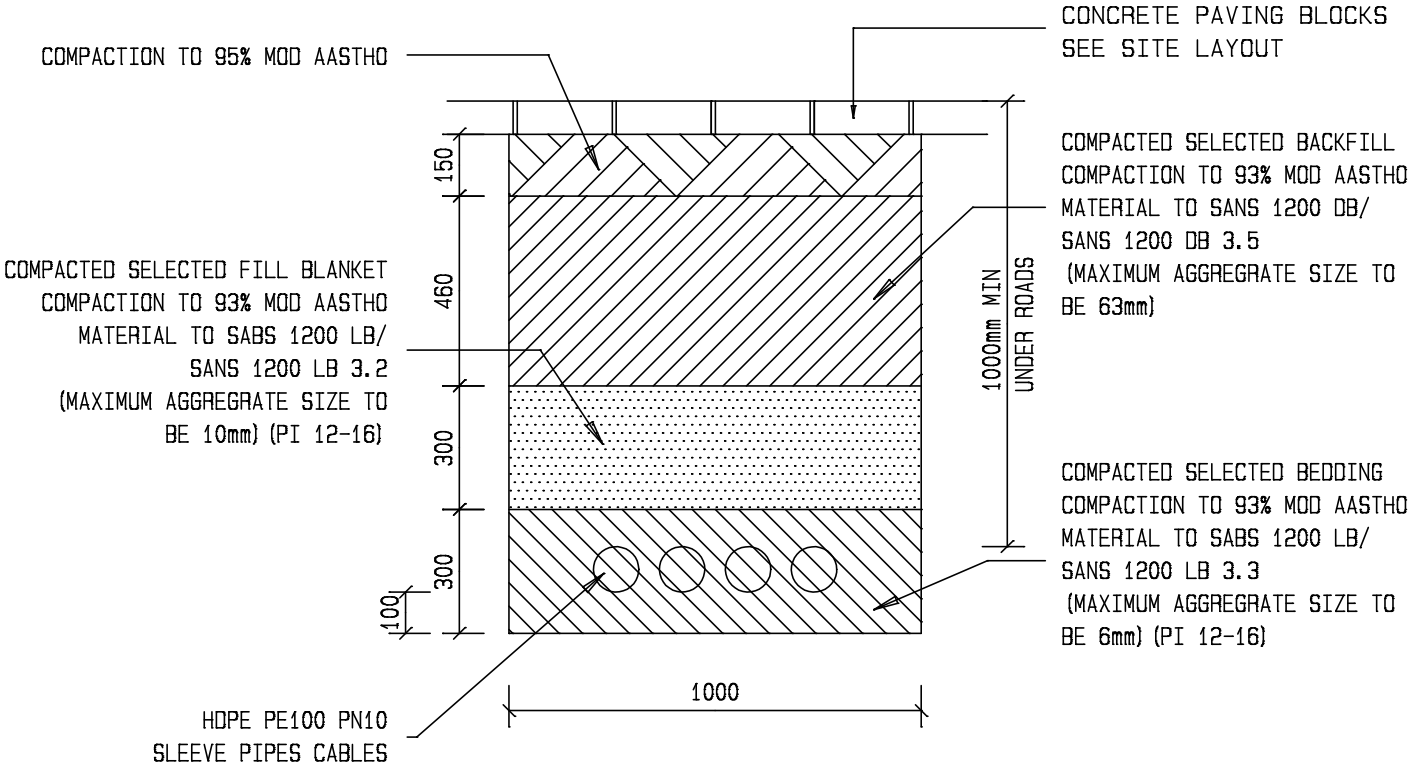
TYPICAL MANHOLE FOR POWER AND DATA SLEEVES (1700X1700X1800mm DEEP)

NOTE:
SLEEVES PIPES TO BE HDPE PE100
PN10 SABS ISO 4427/SANS 4427

SLEEVE SPACING APPROVAL

DATE:
SIGNED:
ELECTRICAL ENGINEER

600mm MUST BE ALLOWED FOR
BETWEEN POWER CABLES TRENCH
AND DATA CABLES TRENCH



TYPICAL DUCT DETAIL FOR CABLE SLEEVES UNDER WALKWAYS

SEE SABS 1200 LC-1981
FOR PIPE SPACING

ALL DIMENSIONS TO BE
SPECIFIED OR INDICATED
BY ENGINEER.

MANUFACTURING NOTE:
SLEEVE SPACING TO SUIT
FUSION COUPLING - 50mm
BETWEEN SLEEVES MINIMUM

NOTE:
ALL BACKFILL MATERIALS SHALL
AFTER COMPACTION BE LESS
PERMEABLE THAN THE IN-SITU
SURROUNDING SOIL.

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departmental
DIAGRAMMATIC CIVIL
ENGINEERING DETAILS
FOR DOLOMITIC SOILS

title
TYPICAL DUCT DETAIL FOR
CABLES SLEEVES UNDER
WALKWAYS (DIAGRAMATIC)

scale
1 : 20

date
22/06/2006

drawing number / type number
TYPE NO DT 03/C

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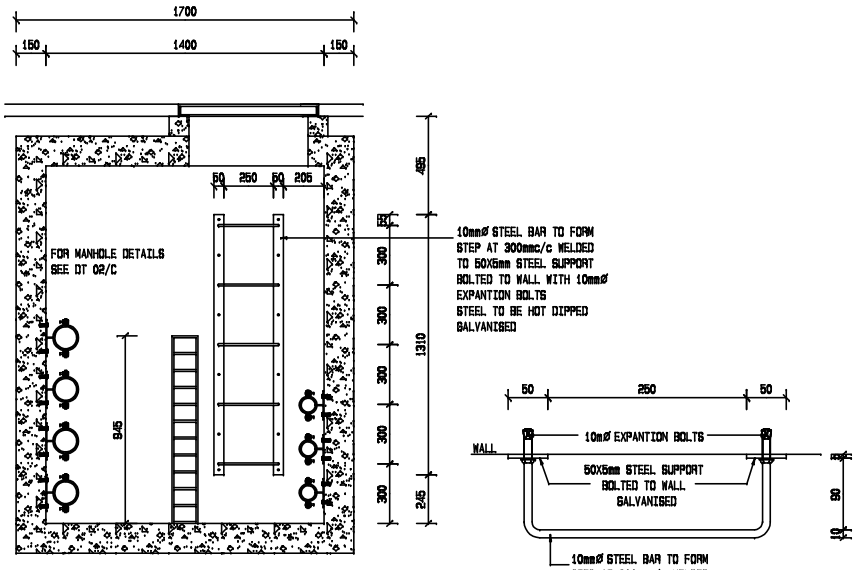
department
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS

title
CABLING
STEEL LADDER
IN MANHOLE

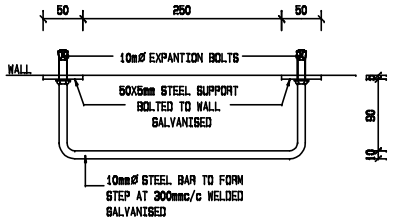
scale
1:20

drawing number / type number
TYPE NO DT 04/C

date
22/06/2006



TYPICAL LADDER FOR
CABLE MANHOLE
SCALE 1:20

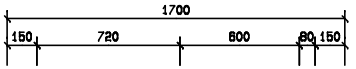


PLAN
SCALE 1:5

HOLES FOR ALL PIPES THROUGH CONCRETE
TO BE DIAMETER PLUS 20mm. SEAL OPENINGS
WITH 25mm DEEP POLYSULPHIDE ON IN AND
OUTSIDE OF WALL.
(ALTERNATIVE PUDDLE FLANGE ON PIPE)

NOTE: ALL TO COMPLY TO SABS 1200 LC-10981

SLEEVE PIPES SMALLER THAN 63mm dia HDPE
PE100 PN 16 SABS ISO 4427/SANS4427
SLEEVE PIPES BIGGER THAN 75mm dia HDPE
PE100 PN 12.5 SABS ISO 4427/SANS 4427



600mmØ TYPE 1A (SABS 558 / SANS 558)
MANHOLE COVER AND FRAME FOR ROADS
(HEAVY DUTY) - LOCKABLE

ADAPTOR SLAB

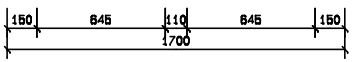
SMOOTH OF
SHUTTER FINISH

25MPa/19mm
CONCRETE MANHOLE

110mmØ HDPE PE100 PN12.5
SLEEVE PIPES FOR POWER
CABLES

PIPE HOLDER BRACKET AS PER
DETAIL TYPE DT 08/W 600mmc/c max.
FOR PIPE SPACING SEE SABS LC-1981

BACKFILLING COMPACTED AROUND
MANHOLE TO 93% MOD ASSTHO
DENSITY IN LAYERS OF 150mm
PERMEABILTY TO BE LOWER
THAN THE SURROUNDING SOIL



TYPICAL MANHOLE FOR
POWER AND DATA SLEEVES
(1700X1700X1800mm DEEP)

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department: DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS

title: SECTION OF 1000mmØ CABLE MANHOLE (DIAGRAMMATIC)

scale: 1 : 20

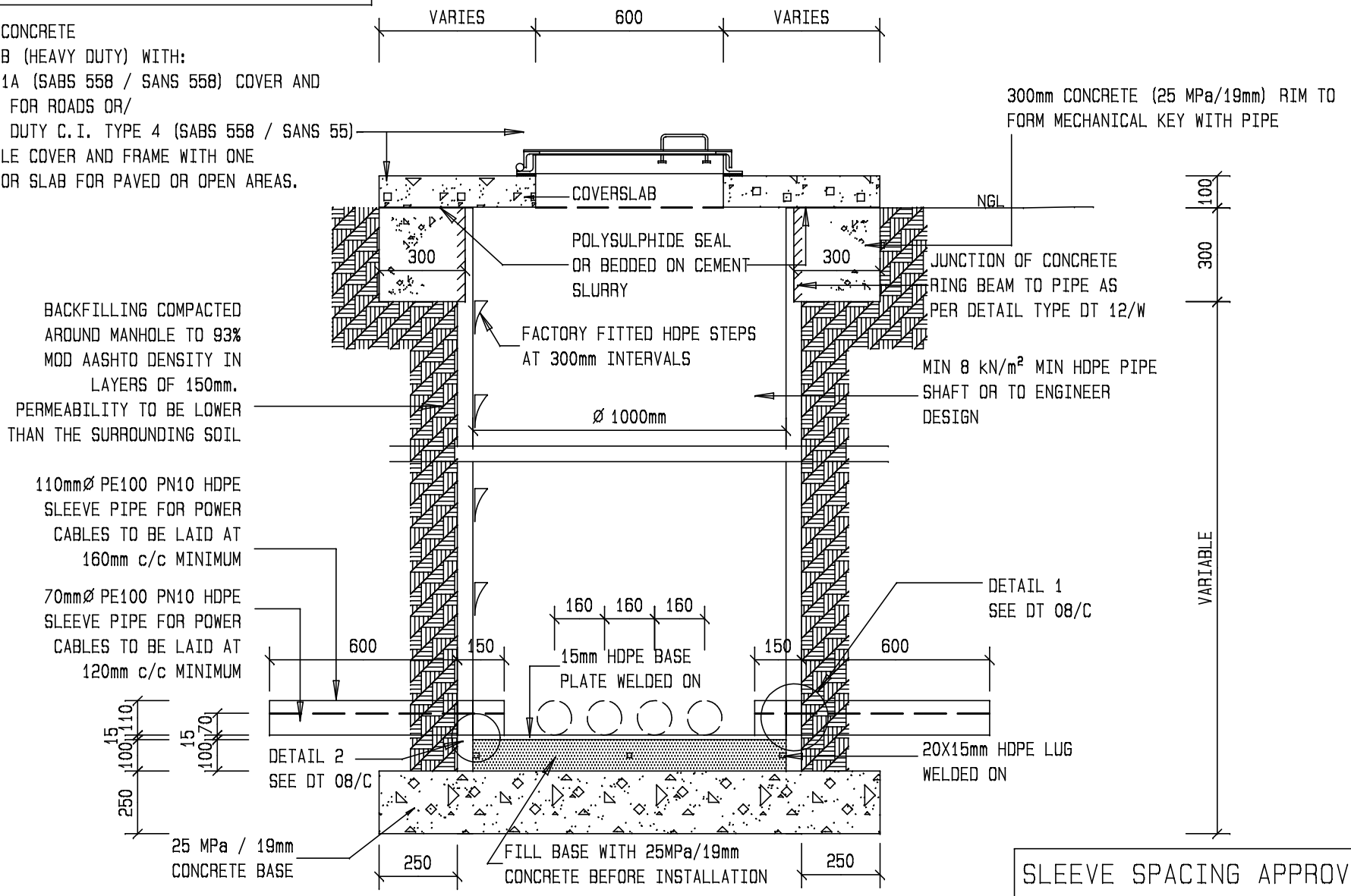
drawing number / type number: TYPE NO DT 05/C

date: 22/06/2006

600mm MUST BE ALLOWED FOR BETWEEN POWER CABLES MANHOLE AND DATA CABLES MANHOLE

NOTE:
- MANUFACTURING DETAILS AS PER TYPE NO DT 06/C.

PRECAST CONCRETE
ROOF SLAB (HEAVY DUTY) WITH:
1. TYPE 1A (SABS 558 / SANS 558) COVER AND FRAME FOR ROADS OR/
2. HEAVY DUTY C.I. TYPE 4 (SABS 558 / SANS 55) MANHOLE COVER AND FRAME WITH ONE ADAPTOR SLAB FOR PAVED OR OPEN AREAS.



MANUFACTURING NOTE:
SLEEVE SPACING TO SUIT FUSION COUPLING - 50mm BETWEEN SLEEVES MINIMUM

SECTION OF 1000mm Ø HDPE MANHOLE FOR DATA OR POWER CABLING

NOTE:
POWER AND DATA CABLES TO BE LAID IN SEPERATE MANHOLES

SLEEVE SPACING APPROVAL

DATE:
SIGNED:
ELECTRICAL ENGINEER

GENERAL NOTE:
- ALL MATERIALS TO BE HDPE PE-100 AS PER SABS ISO 4427 / SANS 4427
  HOOP STIFFNESS OF MANHOLE SHAFT TO BE 8kN/m²

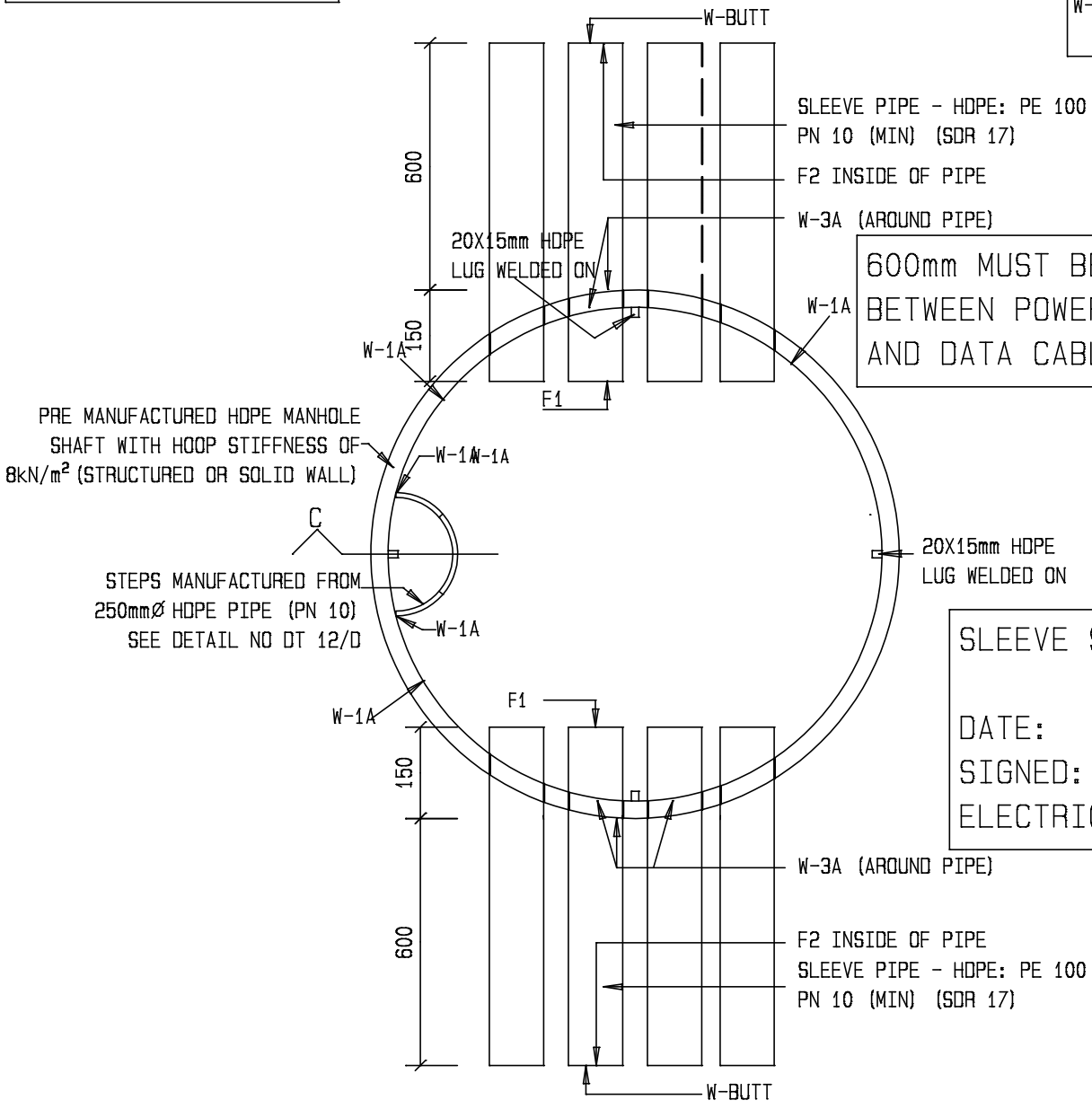
OTHER RELEVANT MANUFACTURING STANDARDS:
SABS 0268-1 / SANS 10268-1
SABS 0269 / SANS 10269
SABS 0270 / SANS 10270
SABS 1269 / SANS 1269
SABS 1655 / SANS 1655
SABS 1671 / SANS 1671-1

GENERAL WELDING SPECIFICATION:
- BUTT WELDING OF PIPES TO COMPLY TO SABS 0268-1:1999. SANS 10268-1
- HOT GAS WELDING TO COMPLY TO SABS 0268-3:1999. SANS 10268-3
- HOT GAS EXTRUSION WELDING TO COMPLY TO SABS 0268-4:1999. SANS 10268-4

GENERAL FINISHING NOTE:

F1- FINISH PIPE WITH SMOOTH ROUNDED EDGE.
F2- REMOVE INTERNAL WELDING BEAD.

WELDING NOTATION FOR JOINTS SEE SABS 0270 / SANS 10270 PAR 5 AS WELL AS ANNEX A.
W-1A = REF TABLE A.1 FILLET GROUP A FIG 1A.
W-2A = REF TABLE A.1 FILLET GROUP A FIG 2A.
W-3A = REF TABLE A.1 FILLET GROUP A FIG 3A.
W-3B = REF TABLE A.1 BUTT GROUP B FIG 3B.
W-BUTT = REF TABLE A.2 BUTT GROUP B



600mm MUST BE ALLOWED FOR BETWEEN POWER CABLES MANHOLE AND DATA CABLES MANHOLE

SLEEVE SPACING APPROVAL

DATE:
SIGNED:
ELECTRICAL ENGINEER

MANUFACURERS NOTE:
SLEEVE SPACING TO SUIT FUSION COUPLIN - 50mm BETWEEN SLEEVES MINIMUM

1000mmØ HDPE MANHOLE FOR DATA OR POWER SLEEVES
SCALE 1:15

SECTION A: SEE DT 10/D
SECTION B: SEE DT 11/D
SECTION C: SEE DT 12/D

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departmental	title	scale	date
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS	TYPICAL WELDING DETAILS FOR HDPE CABLE MANHOLE: PLAN	1 : 15	22/06/2006

drawing number / type number: TYPE NO DT 06/C

GENERAL NOTE:
- ALL MATERIALS TO BE HDPE PE-100 AS PER SABS ISO 4427 / SANS4427
  HOOP STIFFNESS OF MANHOLE SHAFT TO BE 8kN/m²

OTHER RELEVANT MANUFACTURING STANDARDS:

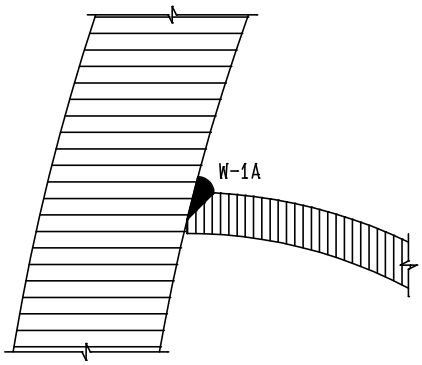
SABS 0268-1	/ SANS 10268-1
SABS 0269	/ SANS 10269
SABS 0270	/ SANS 10270
SABS 1269	/ SANS 1269
SABS 1655	/ SANS 1655
SABS 1671	/ SANS 1671-1

GENERAL WELDING SPECIFICATION:
- BUTT WELDING OF PIPES TO COMPLY TO SABS 0268-1:1999. SANS 10268-1
- HOT GAS WELDING TO COMPLY TO SABS 0268-3:1999. SANS 10268-3
- HOT GAS EXTRUSION WELDING TO COMPLY TO SABS 0268-4:1999. SANS 10268-4

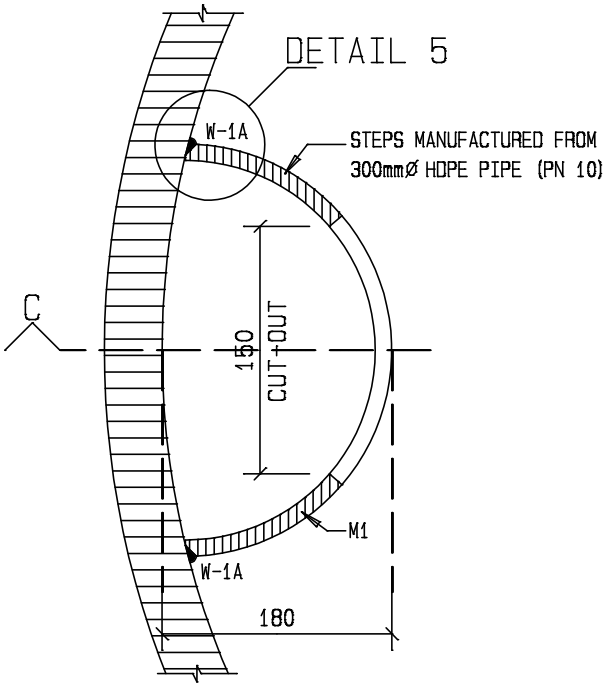
GENERAL FINISHING NOTE:

F1- FINISH PIPE WITH SMOOTH ROUNDED EDGE.
F2- REMOVE INTERNAL WELDING BEAD.

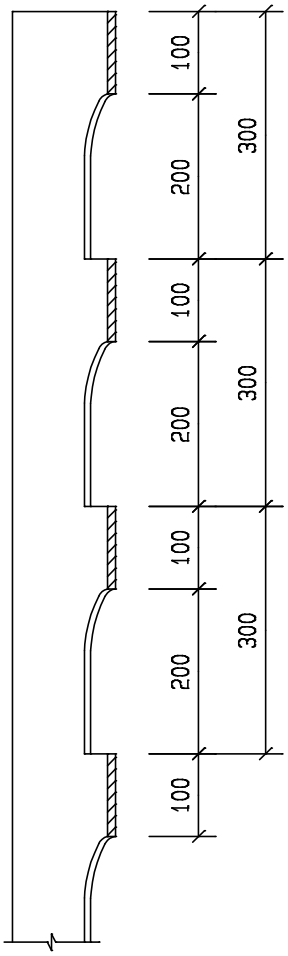
WELDING NOTATION FOR JOINTS SEE SABS 0270 / SANS 10270 PAR 5 AS WELL AS ANNEX A.
W-1A = REF TABLE A.1 FILLET GROUP A FIG 1A.
W-2A = REF TABLE A.1 FILLET GROUP A FIG 2A.
W-3A = REF TABLE A.1 FILLET GROUP A FIG 3A.
W-3B = REF TABLE A.1 BUTT GROUP B FIG 3B.
W-BUTT = REF TABLE A.2 BUTT GROUP B



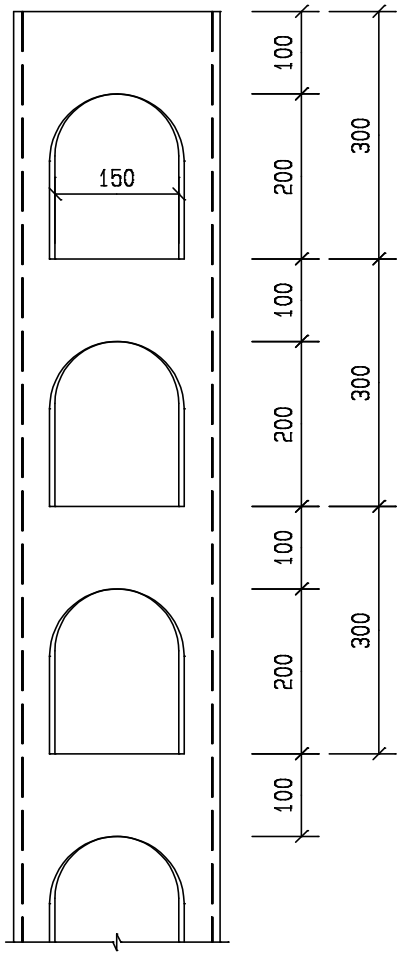
DETAIL 5
SCALE 1:2



HDPE STEPS IN MANHOLE
PLAN
SCALE 1:5



SECTION C
SCALE 1:10



ELEVATION OF STEPS
SCALE 1:10

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departmental
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS

title
TYPICAL WELDING DETAILS FOR HDPE CABLE MANHOLE: SECTION C

scale
AS SHOWN

date
22/06/2006

drawing number / type number
TYPE NO DT 07/C

GENERAL NOTE:
- ALL MATERIALS TO BE HDPE PE-100 AS PER SABS ISO 4427 / SANS 4427
  HOOP STIFFNESS OF MANHOLE SHAFT TO BE 8kN/m²

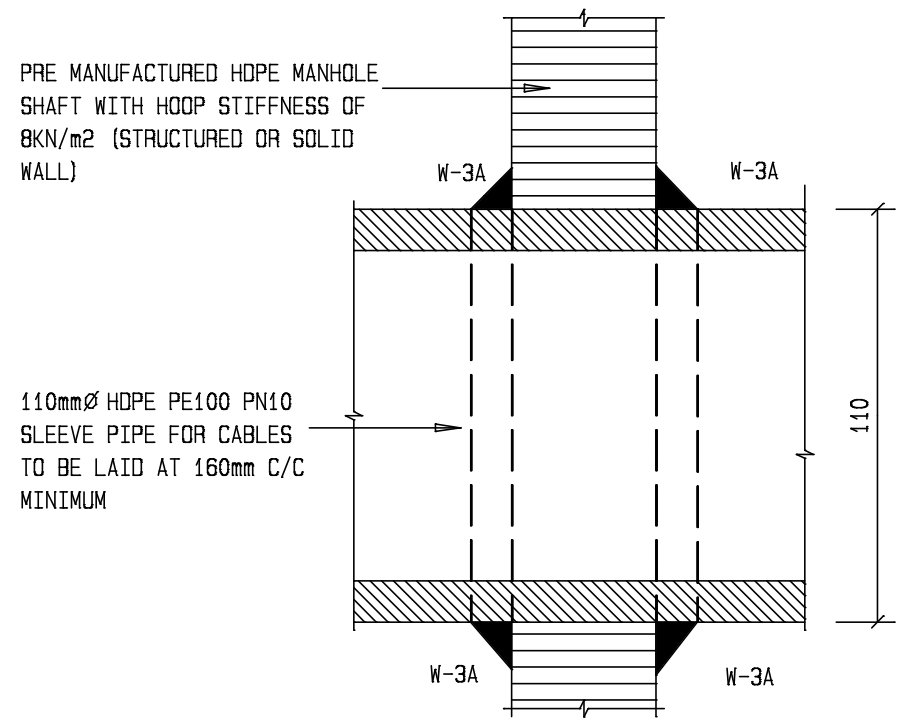
OTHER RELEVANT MANUFACTURING STANDARDS:
SABS 0268-1 / SANS 10268-1
SABS 0269 / SANS 10269
SABS 0270 / SANS 10270
SABS 1269 / SANS 1269
SABS 1655 / SANS 1655
SABS 1671 / SANS 1671-1

GENERAL WELDING SPECIFICATION:
- BUTT WELDING OF PIPES TO COMPLY TO SABS 0268-1:1999. SANS 10268-1
- HOT GAS WELDING TO COMPLY TO SABS 0268-3:1999. SANS 10268-3
- HOT GAS EXTRUSION WELDING TO COMPLY TO SABS 0268-4:1999. SANS 10268-4

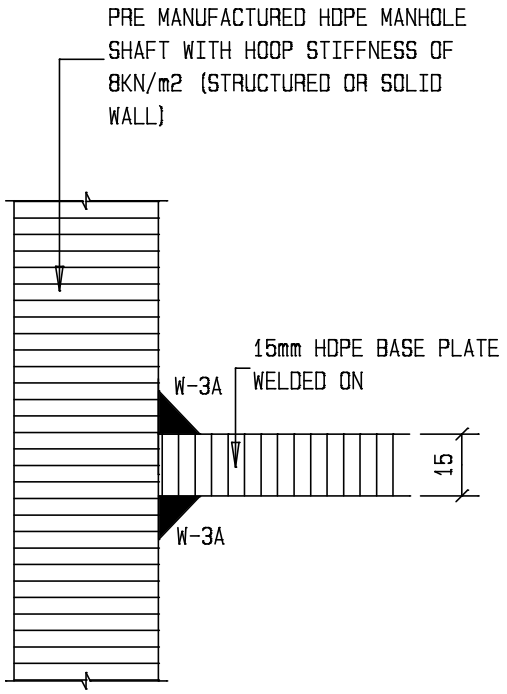
GENERAL FINISHING NOTE:

F1- FINISH PIPE WITH SMOOTH ROUNDED EDGE.
F2- REMOVE INTERNAL WELDING BEAD.

WELDING NOTATION FOR JOINTS SEE SABS 0270 / SANS 10270 PAR 5 AS WELL AS ANNEX A.
W-1A = REF TABLE A.1 FILLET GROUP A FIG 1A.
W-2A = REF TABLE A.1 FILLET GROUP A FIG 2A.
W-3A = REF TABLE A.1 FILLET GROUP A FIG 3A.
W-3B = REF TABLE A.1 BUTT GROUP B FIG 3B.
W-BUTT = REF TABLE A.2 BUTT GROUP B



DETAIL 1
SCALE 1:2



DETAIL 2
SCALE 1:2

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departmental	title	scale	date
DIAGRAMMATIC CIVIL ENGINEERING DETAILS FOR DOLOMITIC SOILS	TYPICAL WELDING DETAILS FOR HDPE CABLE MANHOLE:	AS SHOWN	22/06/2006

drawing number / type number
TYPE NO DT 08/C

APPENDIX 6

APPENDIX 6

PARTICULAR SPECIFICATIONS

The following specifications deal with the particular requirements of work to be executed in dolomitic areas.

PA: PARTICULAR SPECIFICATION: DYNAMIC COMPACTION

PB: PARTICULAR SPECIFICATION: BLASTING REQUIREMENTS

PC: PARTICULAR SPECIFICATION: REPAIR OF SINKHOLES

PD: PARTICULAR SPECIFICATION: EXPLORATORY DRILLING FOR ENGINEERING GEOLOGICAL INVESTIGATION

PE: PARTICULAR SPECIFICATION: SUBSURFACE GROUTING

PF: PARTICULAR SPECIFICATION: DEMOLISHING OF STRUCTURES

PA: PARTICULAR SPECIFICATION FOR DYNAMIC COMPACTION

Note: (*) Values indicated below are to be changed by Engineer to suit the project specification.

PA 1 TENDERER' S EXPERIENCE

Tenderer is to submit in appropriate Annexure details regarding experience in field of dynamic compaction or shall reference experience of the Subcontractor who will be responsible for the execution of this work.

PA 2 EQUIPMENT

Equipment shall comprise of the following mobile unit/s:

1. Mobile Crane (* 60 tons) fitted with boom and appropriate cable, clutch and braking system to handle (*12 tons) free falling square tamper with face not to exceed (*1,0x1,0 m) as well as a (*12-ton) ball type tamper of (*900 mm) diameter face and a (*3,0 m) diameter (*12-ton) ironing tamper.

2. The Boom configuration shall allow drop height of (*18 metres) measured from normal ground level whilst closest portion of the crane is a minimum of (*13 metres) away from point of impact. Furthest point of impact to be possible shall be a minimum of (*20 metres)

3. Crane to stay stable in the event of weight dropping into a cavity beyond its normal cable and braking configuration.

4. Cable shall allow for accidental dropping to a depth of (*20 metres) below ground level.

Details of equipment to be furnished on appropriate Annexure

PA 3 ADDITIONAL EQUIPMENT AND LOSS OF EQUIPMENT

Compaction is carried out in areas of highly compressible material in which subsurface cavities do exist. The Contractor shall provide for replacement of the tamper in the event of losing it.

The Employer or Engineer shall not be responsible or liable for any damages or loss of equipment. Tenderer shall take note of the adverse soil conditions as described previously.

PA 4 CONTRACTOR'S SUPERINTENDENCE

No work shall be executed unless supervised by a Suitable Representative of the Contractor who shall be made known, in writing, to the Engineer for his approval prior to commencement of the work.

PA 5 SETTING OUT OF THE WORKS

The Engineer shall set out the external boundaries of the compaction area with the Contractors' representative present.

PA 6 PRIORITY OF COMPACTION SEQUENCE

The Engineer reserves the right to determine priorities regarding the sequence of compaction at different sites.

PA 7 STANDING TIME

No provision or claims for standing time shall be heard or allowed. In the event of insufficient information to continue compaction due to lack of information or uncertainty regarding compaction sequence or the location of marked compaction positions the Contractor shall inform the Engineer 6 hours (normal business hours) in advance of planned execution of work.

PA 8 LOCATION, PROTECTION AND DAMAGES TO EXISTING SERVICES

The Engineer shall furnish the Contractor with locations and routes of sub surface services within an accuracy of ± 5 m. The Contractor shall excavate up to a depth of 1,5 metres to expose such services if deemed necessary by the Engineer.

Repair of damages to under/above ground services shall be for the account of the Contractor once the position of such service was known to the Contractor or indicated by the Engineer.

All damages to be reported to the Engineer within 1(one) hour of occurrence. The Contractor needs to submit a full damage report within 24 hours.

PA9 INITIAL SITE ESTABLISHMENT AND TIME RELATED COST

PA9.1 SITE ESTABLISHMENT

Site establishment shall include provision on the site of required equipment ready for work at the first site of work. It shall also include removal from the site of the aforementioned equipment and all costs related thereto. The Engineer reserves the right to terminate the Dynamic Compaction work at any time, or change the tamper size or drop height, if to his discretion the required effect is not obtained. In the event of termination, the cost of Site Establishment plus the completed work measured in m2, shall be deemed as full payment of work executed. No other claims for this stoppage of work shall be heard from or claimed by the Contractor.

PA9.2 MOVEMENT ON SITE

Movement on the site shall include the full cost of moving and downtime related costs of all crew and machinery between any two sites. It shall further include setting up the equipment and setting out the desired compaction grid as per engineering drawings (ref **TYPE DT 07/SH).**

Please note the movement on the site is restricted and road travelling of the crane may not always be possible. Rates for movement of the crane, between sites, under own power as well as per truck are allowed for in the Schedule of Quantities.

PA10 DYNAMIC COMPACTION

PA10.1 PREPARATION WORK

The sinkhole or doline needs to be excavated to depth as directed by Engineer. Base of excavated area to be levelled off using the excavator bucket if required.

PA10.2 COMPACTION

Compaction to be executed by dropping the weight from a (*18 metre) height in the desired pre-marked pattern to result in an even distribution of

a.	Primary compaction	*15 blows per 25 m2 (Engineer to specify)
b.	Secondary compaction	*15 blows per 25 m2 (Engineer to specify)
c.	Ironing/finishing compaction	*2 blows per m2 (Engineer to specify)

The compaction imprints shall be filled once it exceeds 700 mm in depth and between each compaction phase. The Contractor needs to record the settlement of each blow or number of blows as may be required by the Engineer.

As alternative can the Engineer specify the depth of influence required as well as the required compaction density at specified depths. In such cases shall the Tenderer submit a proposed method of work with the Tender.

PA10.3 MEASURED QUANTITY IN BILLS

Tenderer to note that the quantity allowed for in the Schedule of Quantities are provisional and could change depending on the site conditions encountered.

PA11 FIELD REPORT

The Contractor to provide marked drawings showing location of pre-marked grid and subsequent compaction imprints as well as the settlement per blow.

PA 12 TESTING

Plate load testing is measured in the Schedule of Quantities as well as a provisional sum for the ordering of tests as required by the Engineer.

PA13 MEASUREMENT AND PAYMENT

PA13.1 SITE ESTABLISHMENT AS PER CLAUSE PA 9.1

Unit rate: Sum

PA13.2 DISMANTLING AND RE-ERECTION FOR MOVEMENT ON THE SITE UNDER OWN POWER AS PER CLAUSE PA 9.2

Unit rate: No

PA13.3 DISMANTLING AND RE-ERECTION FOR MOVEMENT ON THE SITE PER TRUCK AS PER CLAUSE PA 9.2

Unit rate: No

PA13.4 MOVEMENT ON THE SITE UNDER OWN POWER AS PER CLAUSE PA 9.2

Unit rate: km

PA13.5 PROTECTION TO PAVED SURFACES WHILST MOVING ON THE SITE UNDER OWN POWER AS PER CLAUSE PA 9.2

The rate shall cover all costs to protect and repair (if required) all paved surfaces traversed in moving between sites.

Unit rate: m

PA13.6 MOVEMENT ON THE SITE PER TRUCK AS PER CLAUSE PA 9.2

Unit rate: No

PA13.7 DYNAMIC COMPACTION AS PER CLAUSES PA 10 AND 11

Rate to cover work described in Clauses PA 10 and 11 as well as all related hiring, operational and overhead costs for the plant and related personnel on site for duration of execution. Rate to be paid as the area (m2) treated but shall be measured on the site as the number of blows counted to suit requirements of Clause PA 10.2, namely *……(number of) **blows represent 1,0 m2 treated.** One blow shall be calculated as the dropping of a *12-ton weight from *18 metres and shall be proportionally adjusted for different height and tamper weights as requested by the Engineer as follow:

$$\text{One blow} = \frac{\text{actual drop height (m)}}{\text{(*18 metre = specified drop height)}} \times \frac{\text{actual tamper weight (ton)}}{\text{(*12 ton= specified tamper weight)}}$$

Unit: rate: m2

Note: (*) Values indicated above are to be changed by Engineer to suit the project specification.

PA 13.8 PLATE LOAD TESTING AS PER CLAUSE PA 12

The rate includes load testing up to (*1000 KPa) on (*600 mm) diameter plate.

Unit rate: No

PB: PARTICULAR SPECIFICATION FOR BLASTING

PB1: BLASTING OPERATIONS

General recommendations hereunder to be read with all SABS/SANS and related specifications regarding blasting. Applicable anywhere in dolomitic areas

a. Inter-shot delay between rows to be minimum of 25 ms
b. Charge per delay should be in accordance with AECI specification for blasting adjacent to private property
c. **All underground services to be treated as structures**
d. PPV not to exceed 12 mm/s at frequency not less than 10 Hertz
e. Preference to be given to handidets system

PC PARTICULAR SPECIFICATION: REPAIR OF SINKHOLES

PC1 SPECIAL SAFETY REQUIREMENTS

Personnel executing work in or around dolines and sinkholes are to be strapped into harnesses and safety ropes secured away from the sinkhole or suspended from crane or excavator parked at a safe position.

Personnel shall be informed of the hazardous conditions pertaining to working in or around sinkholes (Contractor to keep records of information sessions) and be made aware of the need to report any:

a. Surface cracks
b. Cavities (irrespective of size)
c. Any ground movement
d. Any sudden variation in soil profiles

Should any of the above occur or be noticed, stop work immediately and clear the site of all personnel until the Engineer inspects the site.

PC 2 METHOD OF REPAIR

Generally the Inverted Filter Method of repair as illustrated in drawing DT 01/SH shall be used for repair. See also drawings DT 02/SH to DT 06/SH

Repair of sinkholes and dolines shall consist primarily of the following operations:

a. Opening up the sidewalls of the sinkhole at 60 Degrees to the horizontal or excavating into the doline (to a depth indicated by Engineer) and a further 2 to 4 m wide by 1 m deep margin at the surface, extending from the initial excavation outward.

b. Choking the throat of the sinkhole with boulders of 500 mm and larger (no fines allowed) or with a mass or reinforced concrete slab or a combination of all these solutions.

c. Dynamic compaction of the sinkhole or doline base before choking or compaction of backfilled soil and building rubble placed on top of choked area (see Particular specification PA for detail of Dynamic Compaction).

d. Backfilling of excavated sinkhole area will be as follows depending on the success and thus the stability of c above:

    1. Backfill to depth, as indicated on the site by the Engineer, with coarse material (building rubble from demolished buildings can be used but no tin, wood, or other degradable materials are allowed) not exceeding 400 mm in diameter (measured in any direction) with a mixture of fines not exceeding 30% of mix and compact in 500 mm layers by means of tamping with excavator (min. 32 ton machine) bucket.

    2. Backfill as above and compact by means of dynamic compaction.

e. Further filling to be done with finer material compacted in 200 mm layers to 93% Mod AASHTO density by means of rammers, walk behind vibrating roller of minimum 900 mm wheel width up to 10 ton vibrating roller depending on the area to be filled. The

contact zone between fill and natural material is to be compacted by rammer to ensure full compaction. Selected material shall have typical consistency of roads sub-grade (G8) material and maximum particle size to be 125 mm in diameter

f. Filling of the sinkhole to continue, as above, to a depth of 1,0 metre below ground level. From 1,0 to 0,5 m below ground level the compaction density needs to be 95% Mod AASHTO density. Compact in layers not exceeding 150 mm in thickness and the maximum course size material to be 63 mm in diameter. Selected material shall have typical consistency of roads sub-grade (G8) material.

g. Final 500 mm to be filled to specified height above ground level with material generally classified in the range of silty sand to clay (particle size 1,55 and smaller) and compacted to 95% mod AASHTO density. This layering shall continue to a height suitable to allow a minimum of 1: 60 sloping in all directions, falling away from the centre of the filled area in order to form a positive relief feature. The area is to be finished off in smooth surfaces preventing water ponding.

PC 3 INSURANCE OF THE WORKS AND PERSONNEL OF EMPLOYER AND CONTRACTOR

See the latest revision of the Special Conditions of Contract forming the Annexure to the General Conditions of Contract for use in connection with Works of Civil Engineering Construction – Latest Edition (as issued by the Department of Public Works) and in particular clauses referring to work in the dolomitic environment should be discussed with the departmental Engineer. Particular attention is to be given to **Special Risk Insurance**, particularly if the work involves excavation, demolition, blasting and/or sinkhole related repairs.

PD: PARTICULAR SPECIFICATION: EXPLORATORY DRILLING FOR ENGINEERING GEOLOGICAL INVESTIGATION

GENERAL

This section deals with the drilling of exploratory rotary-percussion boreholes for an **Engineering Geological investigation** as well as preparation for subsurface grouting. The Contractor shall be liable for any work not executed as per specification and shall redo faulty work at own expense if ordered to do so. The Employer is not liable for any losses or damages to any equipment or personnel.

PD 1 TENDERER' S EXPERIENCE

Only offers from Tenderers with proven past experience of drilling for Engineering Geological assessments in dolomitic areas will be considered. Tenderer to submit on **Annexure I** full details regarding past experience of drilling for Engineering Geological assessments in **dolomitic** areas.

Tenderer to indicate all past experience with reference to previous work (give project/site name) for the Department of Public Works, Department of Mineral and Energy Affairs: Geoscience and individual Consultants.

PD 2 EQUIPMENT

Drilling equipment shall comprise of the following mobile unit/s:

1. A compressor unit with measured and calibrated constant air delivery rating (800cfm minimum) at 16 Bar minimum.
2. Pneumatic rotary-percussion drilling rig with 165 mm nominal diameter button bit capable of drilling in all soil types up to 100 m and at any inclination up to 30 degrees to the vertical.
3. Additional spares: 1 x drill bit, 60 metres of drilling rods, 60 metres of 150 mm steel casing.

Tenderer shall submit a Safety Certificate (attach it to Annexure J) issued by the manufacturer or SABS/ISO accredited firm for the complete compressor unit.

Details of equipment to be furnished on appropriate **Annexure J.**

PD 3 ALTERNATIVE EQUIPMENT

Tenderer needs to submit details, on **Annexure J,** of alternative equipment of similar nature available for the project. Further the Tenderer shall state the down time duration of replacement, in the event of equipment on site becoming unserviceable or experience major mechanical failure. Maximum of 4 hours down time will be allowed for minor mechanical repairs/failures per 40 hours of drilling.

PD 4 CONTRACTOR'S SUPERINTENDENCE

No work shall be executed unless supervised by a Suitable Representative of the Contractor that shall be made known, in writing, to the Engineer for his approval prior to commencement of the work. Any faulty work executed in the absence of the Contractors representative shall

be for the account of the Contractor.

PD 5 SETTING OUT OF THE WORKS

The Engineer shall set out and furnish the Contractor with drilling positions. Positions shall be marked with 0,6 m Y-fencing standards painted white.

Payment: Payment shall include the surveying cost of the surveyor as appointed by the Engineer.

Unit rate: Provisional

PD6 PRIORITY OF DRILLING SEQUENCE

The Engineer reserves the right to determine priorities regarding the sequence of drilling. The Contractor shall receive a drilling sequence before commencing drilling. No deviation from afore mentioned drilling sequence shall be allowed unless instructions to do so is issued by the Engineer.

PD 7 STANDING TIME

No provision or claims for standing/idle time shall be heard, allowed, or paid for. In the event of insufficient information to continue drilling operations due to lack of information or uncertainty regarding the drilling sequence or the location of marked drilling positions, the Contractor shall inform the Engineer 6 hours (normal business hours) in advance.

PD 8 LOCATION, PROTECTION AND DAMAGES TO EXISTING SERVICES

The Engineer shall furnish the Contractor with locations and routes of subsurface services within an accuracy of ± 5 m. The Contractor shall excavate up to a depth of 1,5 metres to expose such services if deemed necessary by the Engineer. Repair of damages to under/above ground services shall be for the account of the Contractor if the position of such services were previously made known to the Contractor or indicated by the Engineer. All damages are to be reported to the Engineer within 1(one) hour of occurrence. The Contractor to submit a full damage report within 24 hours.

PD 9 SITE ESTABLISHMENT AND SETTING UP OF DRILLING RIG

PD 9.1 SITE ESTABLISHMENT

Site establishment shall cover the provision of the drilling equipment, as previously described, and personnel on the site ready to commence setting up of equipment for the drilling of any number of boreholes.

Payment: Rate shall cover all cost to provide, maintain in working order and remove equipment from the site for the drilling phase. The site establishment shall be paid once only and no claims for standing time shall be heard or paid for.

Unit rate: no

PD 9.2 SETTING UP AND REMOVAL OF DRILLING RIG

Setting up shall include setting up the drill vertical or at any inclination and the movement of the complete drilling rig between boreholes, anywhere on the site, as per drilling sequence or as directed by the Engineer.

Payment: Payment shall include setting up complete drilling equipment, for drilling to any depth as well as taking down and movement between two boreholes.

Unit rate: no

PD10 ROTARY-PERCUSSION DRILLING (165 mm Button bit)

PD10.1 DEPTH OF DRILLING

Drilling shall be to the depth as indicated by the Engineer. The Engineer shall be notified immediately of the following:

1. Drilling into rock for more than 7 metres (stop at 7 metre and notify Engineer for further instructions).
2. Drilling through cavities or highly compressible material.
3. Encountering of water, abnormally wet soil or abnormal odours.
4. Excessive air loss

PD10.2 DRILLING CLASSIFICATION

For the purpose of this Contract drilling shall be categorised, and paid for, in depth ranges of:

1. 0 to 30 metre
2. 30 to 60 metre
3. 60 to 100 metre

The drilling shall further be categorised, and paid for, in categories of soil types classified as:

1. Hard - Solid, unweathered, hard rock
2. Soft - All other soil types and disseminated cavities
3. Cavity - No resistance or hammer action recorded

Payment: The applicable rate for drilling in the above classified depths and soil types shall cover all costs for the supply and maintenance of drilling equipment, expendable materials, drilling, recovery of samples at 1,0 metre intervals, addition of water as material to enhance sample recovery, completion of Driller's field report and delivery of samples to the Engineers' laboratory in ..... on three (3) day intervals.

Unit rate: m

PD10.3DRILLING AT INCLINATION

The inclination of boreholes, to be noted in degrees, shall be measured as the deviation from the vertical. The Driller's log shall indicate the direction of propagation and inclination.

Payment: Drilling at any inclination (larger than 0 degrees), as indicated by the Engineer, shall be rated as an **extra over** cost to the cost per metre drilled as per PD10.2, irrespective of depth or type of material. No additional payment shall be allowed for setting up at an inclination.

Unit rate: m

PD10.4 DRILLERS FIELD REPORT

Field data to be recorded on standard drilling log sheets as required by the Engineer. Reports to be submitted to the Engineers' laboratory in (name of town)…….……. with recovered samples. The compilation of field reports to be inclusive of drilling rates.

PD10.5 SAMPLE RECOVERY

Samples shall be recovered of each metre drilled and placed in sequential order at a suitable location near the borehole and be left undisturbed until inspected by the Engineer.

The Driller shall, from each metre drilled, recover two 300 ml uncontaminated samples, sealed in plastic bags (clearly marked - Hole no. and recovery depth) **directly** after drilling of each metre and place it in sequential order in a plastic sausage in order to provide two sample sets of each borehole. One set of samples is to be delivered to the laboratory of the Engineer on a three-day interval. Samples to be accompanied by Driller's field report. The other sample set is to be kept on the site with a copy of the field report at the site facility provided for the Engineer. The recovery, compilation and delivery of samples to be inclusive of drilling rates.

PD10.6 FOAM/DRILLING MUD USED

Drilling fluid shall include drill foam and those compounds that are normally used to improve sample recovery with air-flush during rotary percussion drilling. The depth range of drilling fluid application shall be clearly indicated on Driller's field report. Application of water shall be covered by standard drilling rates.

Payment: Drilling foam shall be paid for as foam used on the basis of metres drilled using drilling fluid.

Unit rate: litre

PD11 CASING

PD11.1 TEMPORARY STEEL CASING

Temporary steel casing of 170 mm nominal diameter is to be installed only if instructed by the Engineer. Casing left behind due to inability of recovery, shall be for the account of the Contractor.

Payment: The rate for this work shall cover insertion and recovery of casing.

Unit rate: m

PD11.2 PERMANENT CASING

Permanent steel casing of 170 mm nominal diameter is to be installed only if instructed by the Engineer. The annulus between the casing and the borehole walls should be backfilled and a 500 mm diameter (150 mm thick) concrete collar shall be provided at ground level. Boreholes need to be sealed with suitable watertight metal caps. The borehole number, depth, inclination and direction of propagation as well as drilling date should be marked in the wet concrete of the collar.

Payment: The rate for this work shall cover cost of supply of casing, insertion, concrete collar and sealing with a metal cap.

Unit rate: m

PD11.3 PERMANENT (1,5 M) CASING FOR GROUTING

Permanent steel casing of 170 mm nominal diameter is to be installed, to a depth of 1,5 m measured from normal ground level, as indicated by the Engineer, in boreholes which are to be grouted. The annulus between the casing and the borehole walls should be grouted with 1:6 cement: sand mixture to full depth of casing. A suitable steel collar is to be provided to prevent casing from sliding down the borehole. The borehole is to be sealed with a suitable metal cap to prevent water ingress.

Payment: The rate for this work shall cover cost of supply of casing, insertion, grouting of annulus, concrete collar and cap as described.

Unit rate: no

PD11.4 CONCRETE GROUTING SURFACE PLUG

After insertion of the down-the-hole 50 mm steel grout pipe(s), shall the space between the grout pipe and sleeve pipe be plugged for a depth of 400 mm, with concrete (1:2:3 mix) if required. This shall be deemed as exclusive to the price of the steel sleeve.

Payment: The rate for this work shall cover cost of supply of concrete and work involved.

Unit rate: no

PD12 WATER LEVEL AFTER 24 HOURS

Boreholes are to be left open until the Engineer issue instructions for backfilling. A suitable watertight cover shall be provided to prevent debris or water entering the borehole. Water levels are to be taken by the Engineer, 24 hours after completion of drilling.

PD13 BACKFILLING OF BOREHOLE

Boreholes are to be backfilled with soil, recovered from drilling, suitably wetted to form flowing slurry. Back filling and plugging shall be executed only after the Engineer issues a written instruction.

Payment: Payment shall include supply of water, mixing of slurry and filling of borehole.

Unit rate: m

PD14 STABILISED GROUTING OF BOREHOLE

If directed by the Engineer the entire or last 3,0 metre of boreholes shall be backfilled using 1:10 cement: sand mix with just sufficient water to allow mixture to flow. Note that this is to plug the hole.

Payment: Payment shall include supplying of cement, sand, water, mixing of slurry and filling of borehole.

Unit rate: m

PD 15 SEAL AND MARKING OF BOREHOLES

Driller to provide a 400 x 400 x 150 mm 15 MPa wood floated concrete cap with 200 mm concrete down the hole. The concrete cap is to be installed 100 mm below ground surfaces. A steel rod, 10 mm in diameter, 500 mm in length and protruding 10 mm from concrete is to be placed centrally of the cap. The soil is to be reinstated and compacted over the concrete cap when it has cured. The backfilling is to be slightly proud to prevent the ponding of storm water over the borehole. The borehole number, drilling date and direction of inclination shall be marked in the wet concrete.

Payment: Payment shall include supplying of cement, steel rod, wood floating and inscriptions.

Unit rate: no

PD 16 STOPPING OF WORK DUE TO INCLEMENT WEATHER

It is at the discretion of the Engineer to stop drilling operations temporarily if weather conditions may interfere with the desired drilling results. No standing time shall be paid for such stoppages.

PE: PARTICULAR SPECIFICATION: SUBSURFACE GROUTING

GENERAL

This section deals with the grouting of subsurface cavities with a pumpable concrete or soilcrete mixture. Work comprises of the pumping of grout mix directly from the mixing truck or stationary mixer into 50 mm HDPE housing connected to 50 mm steel piping down a previously drilled borehole to depths as indicated by the Engineer. Execution of each pumping operation shall be continuous and thus shall the Contractor provide for instances where grouting continues after normal working hours. The Contractor shall be liable for any work not executed as per specification and shall redo faulty work at own expenses if ordered to do so. The Employer will not be liable for any losses or damages to any equipment.

PE 1 TENDERER' S EXPERIENCE

Only offers from Tenderers with proven past experience of grouting of subsurface cavities in dolomitic areas will be considered. Tenderer to submit on Annexure K full details regarding past experience of execution of subsurface grouting in dolomitic areas.

Tenderer to indicate all past experience with particular reference to previous work (give project/site name) for the Department of Public Works, Department of Mineral and Energy Affairs: Geological Survey and individual Consultants.

PE 2 EQUIPMENT

Grouting equipment shall comprise of the following:

PE 2.1 MOBILE/MOVEABLE PUMPING UNITS

A mobile concrete pump/pumping truck with 20 m3 pump capacity per hour, equipped with suitable hoses and connectors for the required pumping pressures. The pump shall be equipped with suitable, calibrated (calibration certificate required) pressure gauges to record pumping pressures up to 1,5 MPa. The Contractor shall provide sufficient personnel as required to set-up equipment and execute grouting.

Tenderer shall submit a Safety Certificate (attach it to Annexure L) issued by the manufacturer or SABS/ISO accredited firm for the complete pump unit. Details of equipment to be furnished on appropriate **Annexure L.**

PE 2.2 GROUT VISCOSITY MEASURING INSTRUMENTS.

The Contractor needs to provide an appropriate flow metre on the site for the duration of the Contract.

PE 3 ALTERNATIVE EQUIPMENT

The Tenderer needs to submit details, on **Annexure L,** of alternative equipment of similar nature available to him. Furthermore, he shall state the down time duration of replacement, in the event of equipment on site becoming unserviceable or experiencing major mechanical failure. Maximum of 4 hours down time will be allowed for minor mechanical repairs/failures per 40 hours of grouting.

PE 4 CONTRACTOR'S SUPERINTENDENCE

No work shall be executed unless supervised by a Suitable Representative of the Contractor that shall be made known, in writing, to the Engineer for his approval prior to commencement of the work.

PE 5 SETTING OUT OF THE WORKS

The Engineer shall determine the grouting depth ranges of each borehole.

PE 6 PRIORITY OF GROUTING SEQUENCE

The Engineer reserves the right to determine priorities regarding the sequence of grouting. The Contractor shall receive a grouting sequence before commencing grouting. No deviation from aforementioned grouting sequence shall be allowed unless an instruction to do so is issued by the Engineer.

PE 7 STANDING TIME

No provision or claims for standing time during the execution of grouting shall be heard, allowed, or paid for. In the event of insufficient information to continue grouting operation, due to lack of information or uncertainty regarding grouting sequence or depth, the Contractor shall inform the Engineer thereof before commencing grouting.

PE 8 LOCATION, PROTECTION AND DAMAGES TO EXISTING SERVICES

The Engineer shall furnish the Contractor with the location and routes of sub surface services within an accuracy of ± 5 m. Repair of damages to under/above ground services shall be for the account of the Contractor if the position of such services were made known to the Contractor or indicated by the Engineer. All damages to be reported to the Engineer within 1(one) hour of occurrence. The Contractor needs to submit a full damage report within 24 hours.

PE 9 SITE ESTABLISHMENT AND SETTING UP OF GROUTING EQUIPMENT

PE 9.1 SITE ESTABLISHMENT

Site establishment shall cover the provision of the grouting equipment, previously described, and personnel on the site ready to commence setting up of equipment for any number of boreholes to be grouted.

Payment: The rate shall cover all cost to provide, maintain in working order and remove equipment from the site for the grouting phase. The site establishment shall be paid once only and no claims for standing time shall be heard or paid for.

Unit rate: Sum

PE 9.2 SETTING UP OF GROUTING EQUIPMENT AT EACH HOLE

The Contractor shall provide sufficient personnel as required to set-up equipment at each borehole to be grouted. After completion of grouting at a particular borehole all grout spilled on the surface shall be removed. Each borehole shall be defined as one set-up station irrespective of the number of grouting stages to be executed

Payment: Set-up rates shall include all costs to set-up the equipment, attaching of reusable couplings to grout pipes and decommissioning it, movement to next hole and clearing the site of the completed borehole.

Unit rate: no

PE10 GROUTING

PE 10.1 DEPTH OF GROUTING

No rate provision shall be made for grouting at different depths. The maximum grouting depth beneath normal ground level is less than 60 metres.

PE 10.2 GROUT CLASSIFICATION/SPECIFICATION

Grout of a particular borehole shall comprise of one of the mixes as described below. Ordering/batching quantities shall be continuous. The grout of each grouting phase per set-up shall be supplied and pumped continuously.

The grout provided shall be free of stones, lumps, foreign soils or any other debris. In the event of premature choking of the grout pipe as a result of negligence on the part of the Contractor, the Contractor shall be ordered to re-drill and equip the hole at own expense.

The consistency/viscosity of the grout mixture must not exceed 400 mm on the Colcrete Flow metre and if possible be limited to 350 mm. Consistency measurement must be recorded at intervals of 12m3 and supplied to the Engineer. The flow meter shall be on the site at all times. The Contractor shall provide sufficient water on the site to correct grout slump requirements if needed.

The boreholes must be pumped to a pressure not exceeding 15% of the overburden pressure of the material that covers the cavity. Overburden pressure shall be calculated with material properties taken as that of loose sand. The calculation must be approved by a competent engineering geologist and the Departmental Dolomite Risk manger.

Special requirement: Mining slimes may not be used

PE10.3 GROUT TYPES TO BE SUPPLIED AS FOLLOW

Grout type 1: 1,0-2,0 MPa / 70:30 OPC:FA self-compacting concrete utilising a mixture of crusher- and filler sand.
Grout type 2: 20:1 filler sand:cement
Grout type 3: 50 kg:1m3 Cement: Soil. (Soil to be salty sand with P.I. not exceeding 14.

Payment: The rate shall cover supply, handling, slump rectification, continuous delivery and pumping of grout as per specified type, to required depths and pressure as well as reporting. It also includes the excavation, loading and transport of any material from excavations on site.

Grout type 1: 1,0-2,0 MPa / 70:30 OPC:FA concrete.

Unit rate: m3

Grout type 2: 20:1 filler sand:cement
Unit rate: m3

Grout type 3: 50 kg:1m3 Cement: Soil
Unit rate: m3

PE 10.4 GROUTING FIELD REPORT

The Contractor shall provide a field report containing the grout mix, viscosity measurement, volume, depth of grouting stages, method of grouting and finishing pressures for each borehole. Report to be submitted to Engineer at completion of each borehole. The compilation of the field report is to be inclusive of grouting rate.

PE11 DOWN- THE- HOLE GROUT PIPES

The grout pipes shall consist of 50 mm high-pressure seamless steel pipes, to suit the required pumping pressures, lowered to the desired depth into the borehole. The surface end shall be provided with a collar or crossbar to prevent the pipe from slipping into the borehole as well as a reusable coupling to fit that of the pumping unit

.

Payment: The rate shall cover supply, insertion, anchoring to the surface, fitting and removal of the coupling unit.

Unit rate: m

PE12 SPECIAL SAFETY REQUIREMENTS

Personnel executing grouting are to be strapped into harnesses and safety ropes secured away from the cavity/borehole.

Personnel shall be informed of the hazardous conditions pertaining to this type of work (Contractor to keep records of information sessions) and be made aware to report any:

a. Surface cracks
b. Cavities (irrespective of size)
c. Any ground movement

Should any of the above occur or are noticed, stop work immediately and clear the site of all personnel until the Engineer inspects the site.

PF: PARTICULAR SPECIFICATION: DEMOLISHING OF STRUCTURES

* Engineer is to provide detail descriptions.

PF 1: TENDERERS EXPERIENCE

Tenderer needs to indicate in Annexure H experience regarding demolishing of buildings of this magnitude.

PF 2: INSPECTION OF STRUCTURE

The Tenderer needs to inspect the structure prior to tendering and sign the appropriate portion of the Bill of Quantities.

PF 3: GEOLOGICAL SETTING OF BUILDING

* Engineer is to provide detail descriptions of Geotechnical conditions as well as the safest areas for movement of equipment and personnel.

PF 4: LEGISLATION

The Contractor, whilst executing the work, shall be responsibility for compliance with the following legislation:

- Atmospheric Pollution Prevention Act, 1965 (Act 45 of 1965);
- Environmental Conservation Act, 1989 (Act 73 of 1989);
- Occupational Health and Safety Act, 1993 (Act 85 of 1993) in general and in particular with reference to Construction Regulation R1010 dated 18 July 2003. The Tenderer needs to demonstrate a high standard of safety achievement and a history of safe work practices and compliance with the Act.
- National Building Regulations and Standards Act, 1996 (Act 29 of 1996);
- Electricity Act, 1996 (Act 88 of 1996);
- National Water Act, 1998 (Act 36 of 1998);
- National Environmental Management Act, 1998 (Act 107 of 1998);
- Post Office Act, 1998 (Act 124 of 1998) (telephone installations);
- National Heritage Resources Act, 1999 (Act 25 of 1999);
- Fire Brigade Services Act, 2000 (Act 14 of 2000);
- Local Government Ordinance 1939 (Ordinance 17 of 1939);
- Latest issue of SABS 0142: “Code of Practice for the Wiring of Premises”
- Regulations of the local Gas Board, where applicable.

PF 5: USE OF EXPLOSIVES

The use of explosives will be limited due to the meta stable subsurface conditions. Demolishing methods using explosives shall be subject to the same requirements as prescribed in Particular Specification PB: Blasting Requirements.

Ground vibrations of both the blasting operation and the collapsing structural elements shall be subject to the conditions of Particular Specification PB. The Tenderer's Method Statement must reflect measures to be introduced to ensure this (include previous site recordings to proof this).

If explosive demolition is used, the following shall be covered extensively in the Tender's Method Statement:

- Steps to be taken to avoid injuring the public and causing damage to existing property in the area.
- Tender's extensive experience in explosive demolition of large structures.
- Experience in blasting large structures in dolomitic areas.
- Plans and safety measures to avoid damage to possible subsurface cavities and meta-stable ground conditions in the area.

The use of explosives to implode or weaken the structure(s) to such an extent that more than 5% of the structure collapses at any time shall not be allowed.

PF 6 PROPOSED DEMOLISHING METHODS

The proposed demolishing work generally includes the demolishing of structures, termination of engineering services at main connections, remove service lines to perimeter of works and reroute if required and general earth works to enhance site drainage.

PF 6.1 Normal single-storey Brick Structures and Foundation Slabs/Plinths

Use normal demolishing methods (no explosives)

Payment: Rate shall include the complete demolishing and removal of the super structure, foundations and foundation slabs to 300 mm below natural ground level and disposing of material at commercial dumpsites. Compacted filling 300 mm proud of natural ground level (to enhance drainage) on footprint of demolished building to be measured elsewhere as earth works.

Unit rate: m²

PF 6.2 Normal Steel Structures, Carports and Temporary Structures

Use normal demolishing methods (no explosives)

Payment: Rate shall include the complete demolishing and removal of the super structure, foundations and foundation slabs to 300 mm below natural ground level and dispose of material at commercial dumpsites. Fill of areas after demolishing to be measured elsewhere. Dismantling and recovery of material as well as future re-erection, if required, will be indicated in bill of quantities. Compacted filling 300 mm proud of natural ground level (to enhance drainage) on footprint of demolished building to be measured elsewhere as earth works.

Unit rate: m²

PF 6.3 Aircraft Hangers

All steel elements inclusive of side cladding and windows need to be dismantled for later re-erection. Structure elements are to be dismantled to sizes suitable for road transport. Floor slabs shall not be removed or damaged.

All columns and elements cast into floor slabs shall be demolished to 100 mm below the surrounding floor slab level. Finish such areas flush with surrounding floor slab by means of 20 MPa concrete.

Payment: Rate includes the dismantling of the entire structure and relocation to an indicated site. Transporting of structure measured separately. Measurement and payment for dismantling various elements of the structure will be as per the description of the bills of quantity and drawings. Compacted filling 300 mm proud of natural ground level (to enhance drainage) on footprint of demolished building to be measured elsewhere as earth works.

Unit rate: Sum

PF 6.4 Mobile structures

Mobile structures are to be removed from current location to another area.

Payment: Rates includes loading, transporting for indicated distance and unloading at a new location.

Unit rate: Sum

PF 6.5 Multi storey residential buildings

The lump sum tendered shall include full compensation for all preparatory work required, demolition of structures, excavation and removal of bases, leveling of the site and for the loading, transporting and disposal of the products of the demolition including overhaul, and commercial dumping site fees. The tendered rate shall also include full compensation for all measures to protect the surrounding structures, roads, engineering services as well as for surveying and protecting adjoining buildings, and all other items of work related to the demolition of the structures and as called for in Local, Provincial and National regulations and legislation and Codes of Practice.

Demolish structures and all improvements to the site to 1,0 m below natural ground level (including equipment, walkways, slabs, steps, terraces, services, etc.) and remove rubble to commercial dumpsite. Following demolition, reshape area and compact all disturbed soil to 93% Mod AASHTO density. Additional ground works to facilitate stormwater drainage are measured and paid for separately.

Payment: Rate includes the complete removal of entire building complex and related site services and paving. Compacted filling 300 mm proud of natural ground level (to enhance drainage) on footprint of demolished building to be measured elsewhere as earth works.

Unit rate: sum

PF 7: SAFETY

The Contractor needs to provide proper barricade or security and safety signs around the building to prevent any person from entering whilst demolishing activities are in progress. The same shall apply for after hours and over weekends.

Payment: Rate includes all measures to be introduced to prevent persons from entering the site.

Unit rate: Sum

PF 8 MATERIAL FROM THE DEMOLITION

All material from the demolishing shall become the property of the contractor except if specifically indicated that structures are to be dismantled or re-erected (i.e. Aircraft hangers, some carports and other steel structures).

PF 9 DISPOSAL OF DEBRIS

The Contractor shall make his own arrangements for disposal of the rubble or surplus material in collaboration with the Engineer. All costs related to such disposal shall be deemed to be included in the rates tendered for the demolition or cleaning up of the buildings.

The Contractor shall submit written consent from the proper authorities for the dumping of material on sites provided by him. Under no circumstances shall a Contractor be allowed to dump material on these provided sites without written consent.

Should the Contractor be required or wish to spoil any of the excavated or other material resulting from the contract on a site to be arranged by the Contractor, he shall provide the following fully signed documents to the Engineer before spoiling commences:

- An indemnity signed by the Contractor and the owner on whose property the material is to be spoiled. This indemnity must completely indemnify the Department and the Engineer against all claims whatsoever arising from the spoil of material on this particular property.

- The agreement or conditions under which spoiling would be performed.

PF 10 METHOD STATEMENT

The Tender must submit a Method Statement for the demolishing of the various structures.

The proposed submission shall include full details (in the absence of which the tender will not be considered) of the following:

- Full detail of the methods that the Tenderer propose to use to carry out the work as specified, together with the time for completion tendered.
- State start and completion dates and a detailed daily program to be implemented.
- These methods shall specifically include detail reference to the geological conditions and Dolomite Hazard and the Tenderer's experience in similar geotechnical conditions.
- Preliminary calculations and all relevant data shall be submitted with the tender.
- A full description of the assumptions and codes of practice used shall accompany the calculations.
- Specify fence / hoarding to secure site and protect the public as well as other safety measures to be introduced
- Method of notifying adjoining owners / residents.
- Evacuation procedures of surrounding buildings and areas during demolition.
- Safeguarding of the existing and adjoining properties.
- Subsurface geotechnical conditions and the impact that the proposed method may have as well as ground vibration measuring methods.
- Meeting of requirements of legislation pertaining to the work to be executed (submit relevant documentation).

The Engineer reserves the right to call on the Tenderer to submit additional method statements, calculations or information regarding the proposed demolishing to be implemented. Such further details are to be submitted in seven days of request to do so.

ANNEXURE I: PREVIOUS EXPERIENCE OF TENDERER (OR SUBCONTRACTOR) OF EXPLORATORY DRILLING FOR ENGINEERING GEOLOGICAL INVESTIGATION

Indicate only experience of drilling exploratory boreholes in **Dolomitic** areas for the purpose of an Engineering Geological Investigation of subsurface conditions.

PROJECTS BY TENDERER

PROJECT	DATE	VALUE	CLIENT	ENGINEER	TEL. NUMBER

PROJECTS BY SUBCONTRACTOR:

(name) ……

PROJECT	DATE	VALUE	CLIENT	ENGINEER	TEL. NUMBER

Signature of Tenderer ……

ANNEXURE J: PLANT AVAILABLE/OWNED BY TENDERER (OR SUBCONTRACTOR) FOR EXPLORATORY DRILLING FOR ENGINEERING GEOLOGICAL INVESTIGATION

Indicate only plant that meets the specified requirements as stated in the applicable Particular Specification: Exploratory Drilling for Engineering Geological Investigation.

PLANT OWNED BY TENDERER

DESCRIPTION	NO	AGE	SPECIFICATION/RATING

PLANT OWNED BY SUBCONTRACTOR

(name) ……

DESCRIPTION	NO	AGE	SPECIFICATION/RATING

NB: Attach Safety Certificates to this page.
Indicate also alternative plant available.

Signature of Tenderer ……

ANNEXURE K: PREVIOUS EXPERIENCE OF TENDERER (OR SUBCONTRACTOR) OF SUBSURFACE GROUTING

Indicate only experience that meets the description of work as stated in the applicable Particular Specification: Subsurface Grouting

PROJECTS BY TENDERER

PROJECT	DATE	VALUE	CLIENT	ENGINEER	TEL. NUMBER

PROJECTS BY SUBCONTRACTOR:

(name) ……

PROJECT	DATE	VALUE	CLIENT	ENGINEER	TEL. NUMBER

Signature of Tenderer ……

ANNEXURE L: PLANT AVAILABLE/OWNED BY TENDERER (OR SUBCONTRACTOR) FOR SUBSURFACE GROUTING

Indicate only plant that meets the specified requirements as stated in the applicable Particular Specification: Subsurface Grouting.

PLANT OWNED BY TENDERER

DESCRIPTION	NO	AGE	SPECIFICATION/RATING

PLANT OWNED BY SUBCONTRACTOR

(name) ……

DESCRIPTION	NO	AGE	SPECIFICATION/RATING

NB: Attach Safety Certificates to this page.

Signature of Tenderer ……

ANNEXURE M: PREVIOUS EXPERIENCE OF TENDERER (OR SUBCONTRACTOR) OF DYNAMIC COMPACTION

Indicate only experience that meets the description of work as stated in the applicable Particular Specification: Dynamic Compaction

PROJECTS BY TENDERER

PROJECT	DATE	VALUE	CLIENT	ENGINEER	TEL. NUMBER

PROJECTS BY SUBCONTRACTOR:

(name) ……

PROJECT	DATE	VALUE	CLIENT	ENGINEER	TEL. NUMBER

Signature of Tenderer ……

ANNEXURE N: PLANT AVAILABLE/OWNED BY TENDERER (OR SUBCONTRACTOR) FOR DYNAMIC COMPACTION

Indicate only plant that meets the specified requirements as stated in the applicable Particular Specification: Dynamic Compaction.

PLANT OWNED BY TENDERER

DESCRIPTION	NO	AGE	SPECIFICATION/RATING

PLANT OWNED BY SUBCONTRACTOR

(name) ……

DESCRIPTION	NO	AGE	SPECIFICATION/RATING

NB: Attach Safety Certificates to this page.

Signature of Tenderer ……

APPENDIX 7

SPECIAL CONDITIONS OF CONTRACT

The latest revision of the Contract Data the Annexure to the General Conditions of Contract for use in connection with Works of Civil Engineering Construction – Latest Edition (as issued by the Department of Public Works) and in particular clauses referring to work in the dolomitic environment should be discussed with the departmental Engineer prior to compilation of documentation.

APPENDIX 8

DEPARTMENTAL PROJECT MANAGEMENT FORMS (PRM)

CONTENTS:

The latest version of the above PRM forms should be obtained from the Project Manager or downloaded from the official departmental website at http://www.publicworks.gov.za.

DEPARTMENT OF PUBLIC WORKS
CONSULTANTS TEAM

WCS NO: _____
REFERENCE NO: _____

PROJECT: _____

_____

PROJECT MANAGER: _____

Tel: _____ **Fax:** _____

User/client department: .....

Contact person (Head Office): .....
Tel: ..... Fax:.....
Address: .....
.....
Contact person (Regional Office): .....
Tel: ..... Fax:.....
Address: .....
.....

Principal agent (firm): .....

Name of person: .....
Address: .....
.....
.....
Tel: ..... Fax: .....
Departmental registration number:.....
Vat registration number:.....

* If applicable

DEPARTMENT OF PUBLIC WORKS: DOLOMITE RISK MANAGER

Name of person: Johann de Wit
Address: Private Bag X65
PRETORIA
0001
Tel: (012) 337-2334 Fax: (012) 325-8094
Cell: 082 889 0283

Consultant (Firm): ....

Name of person: .....
Address: .....
.....
.....
Tel: ..... Fax: .....
Departmental registration number:.....
Vat registration number:.....

Consultant (Firm): ....

Name of person: .....
Address: .....
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Tel: ..... Fax: .....
Departmental registration number:.....
Vat registration number:.....

Consultant (Firm): ....

Name of person: .....
Address: .....
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Tel: ..... Fax: .....
Departmental registration number:.....
Vat registration number:.....

Consultant (Firm)..... .....

Name of person: .....
Address: .....
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Tel: ..... Fax: .....
Departmental registration number:.....
Vat registration number:.....

Consultant (Firm): ....

Name of person: .....
Address: .....
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Tel: ..... Fax: .....
Departmental registration number:.....
Vat registration number:.....

Consultant (Firm): ....

Name of person: .....
Address: .....
.....
.....
Tel: ..... Fax: .....
Departmental registration number:.....
Vat registration number:.....

CONSULTANT SPECIALIST/LANDSCAPE ARCHITECT/PROCESS ENGINEER/
ACOUSTICS/ TOWN PLANNER

Firm (1): .....
Name of person: .....
Address: .....
.....
.....
Tel: ..... Fax: .....
Departmental registration number:.....
Vat registration number:.....

Firm (2): .....
Name of person: .....
Address: .....
.....
.....
Tel: ..... Fax: .....
Departmental registration number:.....
Vat registration number:.....

Firm (3): .....
Name of person: .....
Address: .....
.....
.....
Tel: ..... Fax: .....
Departmental registration number:.....
Vat registration number:.....

DEPARTMENT OF PUBLIC WORKS
INCEPTION CHECK LIST

1. The inception check list is a tool enabling the Project Manager to check whether all information needed for the planning of the facility has been made available including an accommodation schedule, with room usage, required equipment, furniture and services with dimensioned positions.

2. The inception check list must be adapted/adjusted and/or amplified to satisfy the needs of a specific project being either a new or an existing building/facility.

INCEPTION CHECK LIST

1. Nature of Project: **WCS:**
Outline of objective

No.	Description	Yes	No	Comments
1.01	function			
1.02	services			
1.03	finishes			
1.04	furniture and fittings			
1.05	landscape and site.			

2. Schedule of accommodation

No.	Description	Yes	No	Comments
2.01	Population figures			
2.02	Functional diagrams, etc.			

3. Expenditure intended

No.	Description	Yes	No	Comments
3.01	Statements of costs limits if any, see Part 3.514 Cost Limits			

REMARKS:

4. Dates and tentative programme

No.	Description	Yes	No	Comments
4.01	Survey and detailed analysis of site;			
4.02	Submission of outline proposals, scheme design and approximate estimates;			
4.03	Statutory applications;			
4.04	Start of production information;			
4.05	Start of bills of quantities			
4.06	Out to tender			
4.07	Contract let			
4.08	Possession of site and start of works			
4.09	Completion and handover			
4.10	Defects liability period and final account			

5. Procedure

No.	Description	Yes	No	Comments
5.01	Client's authorised representative			
5.02	Client's special requirements regarding selection of main contractor, sub-contractors and suppliers			
5.03	Client's special requirements regarding cost control; formal approval of overall cost only; or detailed breakdown of elements, finishes, services, etc., item by item, see Part 3.260 Cost Control			

REMARKS:

6. PWD Conditions of Engagement

No.	Description	Yes	No	Comments
6.01	Scope of services			
6.02	Scale of charges			
6.03	Incidental expenses and travelling			

7. Clerk of Works

No.	Description	Yes	No	Comments
7.01	If constant supervision is required, refer to PWD Conditions of Engagement			
7.02	Mechanical services Clerk of Works			
7.03	Electrical services Clerk of Works			
7.04	Site supervision generally			

8. Other members of the design team already appointed or to be recommended; method of appointment and scale of fees.

No.	Description	Yes	No	Comments
8.01	Quantity surveyor			
8.02	Structural engineer / Civil engineer			
8.03	Mechanical services engineer			
8.04	Sanitary engineer			
8.05	Electrical engineer			
8.06	Acoustical expert			
8.07	Landscape architect			
8.08	Painters and sculptors			
8.09	Model makers etc.			
8.10	Dolomite Risk Manager			Departmental (HQ)

REMARKS:

9. Site

No.	Description	Yes	No	Comments
9.01	Survey available or required to be done by the Department or outside surveyor			
9.02	Legal position: freehold, leasehold, etc. restrictive covenants			
9.03	Name, address and telephone numbers: solicitor, ground landlord, adjoining owners, etc.			
9.04	Geotechnical Survey and classification			Departmental Dolomite Risk Manager
9.05	Is site located on dolomite			Departmental Dolomite Risk Manager

10. Statutory and other approvals

The client should be told of the statutory and other consents to be gained, notices to be served, awards to be made and related expenses such as adjoining owners/surveyor fees, own architect's fees for special negotiations, etc.

No.	Description	Yes	No	Comments
10.01	Town and Country Planning Acts			
10.02	Provincial Fine Arts Commission / Heritage			
10.03	Building Acts and Byelaws			
10.04	Public Health Acts			
10.05	Fire Regulations			
10.06	Factories Act, etc.			
	Others			
10.07	Landlord, lessor, etc. and their architects and surveyors			
10.08	Adjoining owners			
10.09	Insurance companies, etc.			

11. Other architects

No.	Description	Yes	No	Comments
11.01	The names and addresses of other architects who have worked or been instructed to work on the scheme and who must be notified of Professional Conduct.			

12. Other information

NAME..... DATE.....

LOCAL INFORMATION CHECK LIST

1. Neighbouring owners **WCS .....**
Check and consult documents, drawings, people regarding:

No.	Description	Yes	No	Comments
1.01	Access to site			
1.02	Right of light and air			
1.03	Noise			
1.04	Smells			
1.05	Fire risks			
1.06	Drainage			
1.07	Services			
1.08	Right of support			
1.09	Possibility of flooding			
1.10	Conflicting interests			
1.11	Condition of adjacent property			Photographs?
1.12	Dolomite			

2. Civil engineering contractors and building contractors
Obtain:

No.	Description	Yes	No	Comments
2.01	Information relating to adjacent sites			
2.02	Information relating to earlier use of site			
2.03	Details of local materials			
2.04	Details of sub-soil conditions to be anticipated (Initiate engineering geological investigation in terms of current practice if site is located on dolomite. Please note this investigation is not a standard foundation investigation)			
2.05	Names and addresses of local suppliers of aggregates, hardcore, premix concrete etc. and approved laboratories.			

REMARKS:

3. Suppliers

No.	Description	Yes	No	Comments
3.01	Check on quality, availability and cost of local material			
3.02	Inspect quarries, brickwork, etc., for samples and prices			

4. Local facilities
Check with appropriate authorities, present and future availability of:

No.	Description	Yes	No	Comments
4.01	Transport			
4.02	Schools			
4.03	Shops			
4.05	Other local facilities			
4.06	Parking			

5. Underground hazards
Check with local authority engineer, Spoornet, local Transport or other operator:

No.	Description	Yes	No	Comments
5.01	Details of railway or tunnels			
5.02	Details of mineral workings/rights			
5.03	Springs, water table, ground movement, soil conditions			
5.04	Dolomitic land			Contact Risk Manager

6. Climate

No.	Description	Yes	No	Comments
6.01	Find out prevailing climatic conditions (wind, rain, etc.)			
6.02	Check if there are any unusual conditions			
6.03	Check on sea air, smoke, fumes, acid rain, corrosion, etc.			

REMARKS:

NAME..... DATE.....

SITE AND BUILDING SURVEYS CHECK LIST

1. Preliminaries **WCS .....**

No.	Description	Yes	No	Comments
1.01	Consider purposes of survey, type of information required including type of drawings, reports, etc., and time allowed			
1.02	Consider employment of qualified land surveyor, air surveyor, photographer, etc., if site is large, obtain client's approval and consider brief and programme			
1.03	Consider requesting reports from local specialist sub-contractors or local supply companies on existing heating, hot water, electrical, gas or other services installation; obtain client's approval if necessary and consider brief and programme			
1.04	Check what special fees, expenses, etc., have been agreed with the client			
1.05	Check that client has right of access to site			
1.06	Check accuracy and availability of survey equipment, e.g.: Compass, level, staff sighting rods and makers ladder, chain manhole lifting irons tape, 2m rod survey board scales, camera (Much of this equipment may be hired from surveying and drawing equipment suppliers)			
1.07	Consider appointment with local authority officers including Town Planning, Building Inspector, Public Health, Fire Brigade, etc.			
1.08	Obtain Surveyor sheet or General map and/or Registered Land Plan and establish boundaries, servitudes.			
1.09	Discuss site development with Departmental Dolomite Risk Manager			

REMARKS:

2. General: Legal
Obtain from the user Department or his agent:

No.	Description	Yes	No	Comments
2.01	Names and address of solicitors/agents			
2.02	Existing drawings			
2.03	Property: leasehold, freehold, if ground rent, tithes or restrictive covenants as to usage, tenure or sale			
2.04	Ownership of fences			
2.05	Rateable values			
2.06	Insurances and insurance companies			
2.07	Approvals already received			
2.08	Highway rights and road access.			

3. Building work: Legal
Obtain from local or other statutory authority:

No.	Description	Yes	No	Comments
3.01	Names and addresses of officials concerned			
3.02	Town planning: requirements, restrictions and intentions			
3.03	Future developments including new roads and widening			
3.04	Building surveyor: obtain copy of local special byelaws if any			
3.05	Copy of ordnance block plan			
3.06	Submission requirements and forms and last date each month for submitting applications			
3.07	Record plans for foundations, etc.			
3.08	Building lines or restrictions			
3.09	Possible road charges and liabilities			
3.10	Small Holdings Act, etc.			
3.11	Restrictions under Clean Air Act			
3.12	Ancient monuments or scheduled historic buildings			
3.13	Housing unit limitations			
3.14	See Departmental Standards for development on Dolomitic Land. Obtain			

	similar applicable standards from the Local Authority.			

REMARKS:

4. Services:
Obtain from local authority or public utilities

No.	Description	Yes	No	Comments
4.01	Names and addresses of officials concerned			
4.02	Foul sewer: line and invert levels			
4.03	Surface water sewer: line and invert levels (stormwater).			
4.04	Existing septic tanks and if emptied by the local authority			
4.05	Future drainage schemes by the local authority: possible future connections and charges			
4.06	Water supply			
4.07	Electricity supply: voltage, capacity, AC or DC			
4.08	Gas supply			
4.09	Telephone service			
4.10	Postal services			

5. Local enquiries:

No.	Description	Yes	No	Comments
5.01	Present or future existence of undesirable features in proximity of site, e.g. sewage works, tanneries, aerodromes, dairies, railway sidings, rivers, ponds etc., liable to overflow or flooding on or near site			
5.02	Age of property			
5.03	Adequacy of local facilities, e.g. transport, schools, shops, post			
5.04	Names of reliable local builders			
5.05	Special materials available locally			

REMARKS:

6. Underground hazards

No	Description	Yes	No	Comments
6.01	Mineral workings			
6.02	Railway or tube/tunnels			
6.03	Springs			
6.04	Level of water table			
6.05	Ground movement or erosion			
6.06	Dolomite			

7. Adjoining properties

No.	Description	Yes	No	Comments
7.01	General character, condition and usage			
7.02	Rights of air and light			
7.03	Conflicting interests			
7.04	Subsidence evidence			

8. Actual site

No.	Description	Yes	No	Comments
8.01	Orientation			
8.02	Prevailing wind			
8.03	Local climatic or other hazards, e.g. sea air, smoke, fumes			
8.04	Views from and on to site			

8.05	Trees: species, height, girth and condition			
8.06	Rock outcrops, gardens, pons			
8.07	Soil, sub-soil, trail holes			
8.08	Evidence of flooding or ground movement			
8.09	Fences, gates, boundary/and retaining walls, ownership, condition			
8.10	Building lines			
8.11	Paths, roads, pavings			
8.12	Existing buildings: position and floor levels, obvious failures of materials or construction			
8.13	Levels and sections reduced to ordnance datum by relation to bench mark			
8.14	Position and description of bench marks or other datum points			
8.15	Septic tanks			
8.16	Manholes: invert and cover levels			
8.17	Gullies			
8.18	Stopcocks			
8.19	Hydrants			
8.20	Overhead wires			
8.21	External lighting			
8.22	Consecrated ground (Graves, etc.)			

REMARKS:

NAME..... DATE.....

9. Buildings: Construction general

No.	Description	Yes	No	Comments
9.01	- roof - construction, covering, pitch - roof lights, hatches - chimneys: flues, evidence of smoke or leaks in roof space, headroom - rainwater disposal, pipes, gutters, heads - flashing - aerials, wires - access on to roof and into roof space			
9.02	Walls: - construction: e.g. bond, gauge, type of brick - finishes, rendering, pointing - DPCs - flashing, coping - air bricks - windows, sills, lintels - doors, sills, lentils - pre-fabricated - other			
9.03	Basements: - level of floor below ground - ventilation - damp proofing - drainage etc. - fire protection			
9.04	Floors: - construction: for timber floors; direction of joists, beams. Trimmers, details of other types of floor construction - sleeper walls - DPCs - air bricks			
9.05	Stairs: - construction - floor to floor height - number of risers - hand rails			

10. Buildings: Room by room

No.	Description	Yes	No	Comments
10.01	Floor including skirting			
10.02	Walls including dado rail, cornice, air bricks			
10.03	Ceiling			
10.04	Doors including frame, architrave and ironmongery			
10.05	Electrical including fittings, sockets, switches			
10.06	Heating and ventilation including radiators, valves, grilles, cookers, stoves, fireplaces			
10.07	Sanitary fittings including baths, Lbs, WCS and cisterns, bidets, sinks, pipes, taps, internal manholes			
10.08	Joinery fittings including cupboards, shelving, benches			
10.09	Miscellaneous			

REMARKS:

11. Buildings: Water supply

No.	Description	Yes	No	Comments
11.01	Stopcocks: main supply and point of entry (Brass, chrome plated, PVC, etc.)			DZB
11.02	Drain cocks			
11.03	Piping			
11.04	Circuits and external water points			
11.05	Insulation			
11.06	Cisterns, size supports, insulation access			
11.07	All sanitary fittings and services, including taps, traps, puff pipes, wastes			
11.08	Shower floor and fittings/walls			
11.09	Adequacy and type of supply, pressure hardness, need for analysis, e.g. well water, lead pipes carrying soft water, wells, springs, underground or under-floor storage tanks, pumps or rams			

12. Buildings: Drainage

No.	Description	Yes	No	Comments
12.01	Surface water: record plan, levels, disposal means			
12.02	Sewage: record plan, levels, disposal means, if combined system or otherwise			
12.03	Manholes: invert and cover levels			
12.04	Gullies, vent pipes, fresh air inlets, interceptors, grease traps, pumps (test pipes and manholes by water test)			

REMARKS:

13. Buildings: Hot water

No.	Description	Yes	No	Comments
13.01	Systems			
13.02	Piping			
13.03	Circuit			
13.04	Drain cocks			
13.05	Cylinder			
13.06	Insulation			
13.07	Boiler and flue			
13.08	Safety valve, thermometer, thermostat			
13.09	Fuel and storage			
13.10	Efficiency test and/or report from local specialist if necessary			
13.11	Running costs			

14. Building: Heating and ventilation

No.	Description	Yes	No	Comments
14.01	System			
14.02	Fittings, radiators, convectors, grilles, fans, filters, diffusers etc.			
14.03	Piping			
14.04	Circuits			
14.05	Drain cocks			
14.06	Expansion tank			
14.07	Insulation			
14.08	Boiler and flue			
14.09	Safety valve, thermometer, thermostat, altitude gauges, fusible links, controls, pumps			
14.10	Fuel and storage			
14.11	Efficiency test and/or report from local specialist inf necessary			
14.12	Running costs			
14.13	Refrigeration			

REMARKS:

15. Building: Electrical

No.	Description	Yes	No	Comments
15.01	Overhead or underground			
15.02	Plot poles, wires or cable on survey			
15.03	Metres and main switch gear, phasing, voltage, current, AC or DC, Watts.			
15.04	Wiring external and internal			
15.05	System, conduits and earthing			
15.06	Distribution boards			
15.07	Light points and voltage including external lighting			
15.08	Special fittings: fans, cooker panels, low voltage transformers, bell system			
15.09	Test and report by local supply company if necessary with advice on size and adequacy of main cable for future loading			

16. Buildings: Gas

No.	Description	Yes	No	Comments
16.01	Main size, depth and position			
16.02	Metres: adequacy for future requirements			
16.03	Points and fittings, flue, hoods, etc.			
16.04	Test and report by local supply company if necessary with advice on size and adequacy of main supply for future loading			
16.05	Gas banks and types			

REMARKS:

17. Building: Other services

No.	Description	Yes	No	Comments
17.01	Telephone: overhead wires (plot poles on survey)			
17.02	Lighting precautions and conductors			
17.03	Steam			
17.04	Compressed air			
17.05	Standby electricity engines or batteries			
17.06	Public address system			
17.07	Lifts: hydraulic, electric or hand			
17.08	Refrigeration			
17.09	Escalators			
17.10	Pneumatic tubes			
17.11	Central vacuum			
17.12	Closed circuit television, etc.			

18. Buildings: Structural defects

No.	Description	Yes	No	Comments
18.01	Dry tor and causes			
18.02	Damp patches and causes			
18.03	Evidence of rodents, woodworm, beetle (death-watch, Lyctus, etc.), insects			
18.04	Recent repairs and decorations			
18.05	Settlement cracks or misshapen openings, skirting or window gaps			
18.06	Bulges in walls, walls out of plumb			

18.07	Sagging roofs			
18.08	Floors			
18.09	Deflection on beams, lintels, etc.			
18.10	Cracks at beam bearings			
18.11	Smells			
18.12	Condition of basements			

REMARKS:

19. Buildings: Specialist fittings

No.	Description	Yes	No	Comments
19.01	Altars, vestment presses, tabernacles			
19.02	Engine pits, beds, ducts			
19.03	Fire equipment: sprinklers, foam hydrants, etc., illuminated and other fire signs, hoses, extinguishers, locks, door closes, fire doors			
19.04	Emergency lighting			
19.05	Fire escapes			
19.06	Fire routes			
19.07	Stair cases			

20. Buildings: reports

The architect or surveyor should carefully define in his report whether or not he was able to see inside the structure of a building. If able to do so, describe exactly how much he was able to see and where. The condition of the rest of the building should not be inferred from the sight of one piece of it. Back up with photographs, and/or drawings/diagrams.

A statement in terms stipulated the indemnity insurance policy, or similar to the following wording should be included at the end of the relevant section of the report, if required:

“It was not possible to make a detailed examination of either the floor or roof construction except at the positions described above, as to do so would have required material damage being done to obtain access. It is, therefore, impossible to make any statement on the condition of the un-examined structure”.

Where applicable, it should be advised to call in a specialist in rot, woodworm, etc., to make a more detailed examination

OTHER REMARKS:

NAME..... DATE.....

DEPARTMENT OF PUBLIC WORKS
REPORT ON PROPERTY

WCS NO: _____
REFERENCE: _____

PROJECT MANAGER: _____

NOTE:-
i) **Before completing this form, read the explanatory notes and instructions on the last page.**
ii) **Complete the appropriate sections as requested please.**

1. PROJECT NAME/SITE

a) City/Town: _____
b) Name: _____
c) Address: _____

2. DETAILS OF PROPERTY

a) Is the recommended site State/privately-owned property? _____ Yes/No
b) If State-owned, is the proposed site situated within the boundaries of a larger area of State owned land? _____ Yes/No
c) Furnish the Title Deed description of the property:

_____

d) Furnish the deed transfer number, if State-owned: _____
e) State how land was acquired by State (purchased, donated, exchanged, acquired under township conditions or unalienated State-owned land).

_____

f) The property is not recommended for this service for the following reasons:

_____
_____
_____

g) Give particulars of other available State-owned land, suitable for this service:

_____
_____

h) Full name of owner (in the case of privately-owned land)

_____
_____

l) Address of owner:

_____
_____
_____

Postal code _____ Tel no: _____

3. SIZE OF PROPERTY

a) Give the boundary dimensions and area (in metres):

b) Does the size correspond with the Surveyor-general's diagram? _____ Yes/No
c) Have the survey beacons been located? _____ Yes/No
d) Is a survey of resurvey required? _____ Yes/No
e) In case of encroachments, furnish details:

4. VALUATION OF PROPERTY

a) My valuation based on the market value of properties (in the case privately-owned land) in the vicinity is:

i)	Site	R	
ii)	Buildings	R	
iii)	Other improvements	R	
	Total	R	

b) Municipal valuation:

i)	Site	R	
ii)	Buildings	R	
iii)	Other improvements	R	
iv)	Total	R	
v)	Year when determined	19	

5. MINING RIGHTS

a) If the site is situated on proclaimed mining land and held under surface right permit, give the number of surface right permit.

b) Section of the Mining Rights Act. 19967 (Act 20 of 1967) as amended or Mining Titles Registration Act 1967 (Act 16 of 1967) as amended, under which it was granted.

c) Purpose for which it was granted.

d) Name of freehold title holder. Name of mining title holder.

e) Mine rights according to Mineral Act 50 of 1991.

i)	Prospector permit	iii)	Mine permit
ii)	Reclaiming authorisation	iv)	Mine licence

6. RESTRICTIVE CONDITIONS

Do any servitude and/or restrictive conditions, which may interfere with the proposed use of the site, exist in the following (give details of the restriction):

a) Title deed
b) Township Establishment Conditions
c) Local By-laws

d) Local Town Planning Scheme
   i) Zoning (residential, business etc.)
   ii) Building-line restriction
   iii) Height restriction
   iv) Density
   v) Coverage
   vi) Any new roads or road widening

e) Provincial ordinances relating to roads and buildings

f) Advertising on Roads and Ribbon Development Act 1940 (Act 21 of 1940) as amended.

g) Abolition of Racially BASED Land Measures Act 1991 (Act 108 of 1991).

h) Abolition of Influx Control Act 1986 (Act 68 of 1986).

i) Physical Planning Act 1967 (Act 88 of 1967) as amended.

j) Mining regulations

k) Any other statutes applicable to the area (quote the Act or Ordinance).

l) Is the site subject to a lease agreement (if so, furnish conditions, particulars of lessee and whether lessee is using the property for his purpose).

7. SITE PLAN

State whether the following information has been indicated on the site plan:

a) Boundary beacons, site dimensions and angles
b) Positions and dimensions of improvements (e.g. buildings, lenses, encroachments, etc.)
c) Positions and dimensions of existing features (e.g. rock outcrops, furrows, etc.).
d) Positions, diameters, heights and species (if known) of trees, hedges and shrubs.
e) Any trees that are a danger to people and property, that must be removed.
f) Distances to, positions and dimensions of adjoining property, roads, etc.
g) Notes on the construction and finish of buildings on adjoining sites.
h) North point.
i) Building lines where set back from boundaries.
j) Services (e.g. electrical supply, water supply, storm water pipes, sewer pipes, etc.) Their dimensions and depths with recommendations about removing or diverting where applicable.
k) Positions of connections to services (e.g. water supply, electricity, etc.)
l) Spot levels, floor levels, bench marks and contours (if possible)
m) Position of trial holes, with detail sections.
n) Areas subject to flooring or marshy conditions during rains. (All negative replies should be explained in a covering letter)

8. a) The following roads, streets, footpaths, drains, cables, power lines, water mains, furrows, etc. traverse the site.

b) These exist under the following authority:

9. SITING

Give recommendations as to the siting of buildings with particular reference to the relative importance of streets bounding or adjoining the site, and adjoining property.

10. CLIMATIC CONDITIONS

a) Describe local climatic conditions whether in mist-, rain-, or snow belt direction of prevailing winds and whether the temperature is subtropical or tropical.

b) Is the site in a Malaria area: Yes/No

c) Should fly/mosquito proofing be provided to the following:

i) Opening portions of all windows Yes/No

ii) Verandas Yes/No

iii) All doors Yes/No

iv) Kitchen and pantry windows and doors only Yes/No

v) If not required, state reasons:

11. DESCRIPTION OF IMPROVEMENT

a) Give a brief description of the improvements with reference to the construction and finish of roof, walls, floors and joinery.

b) Are floor plans/sketches of the improvements attached? Yes/No

c) Can these improvements be adapted? Yes/No

d) How can they be adapted? (Give details):

e) Estimated cost of alterations

i) Building R

ii) Electrical R

iii) Mechanical R

Total R

f) Are full appropriation drawings, foundation remeasurement plans and any other information available attached? Yes/No

g) Are photographs of the building showing main construction features, attached? Yes/No

h) In case where existing building on the site are to be demolished, should this:

i) Be done departmentally? Yes/No

ii) Be carried out under separate contract? Yes/No

iii) Be included in the main building? Yes/No

iv) Are full appropriation drawings and a short demolition specification attached? _____ Yes/No

i) Is the site immediately available for building work? _____ Yes/No

j) Is the whole site suitable for building work? _____ Yes/No

12. FOUNDATION INFORMATION

a) Have trial hole samples been submitted to Head Office? _____ Yes/No

b) Probable proportions of subsoil are as follows:

i) Hard rock _____ _____ %

ii) Soft rock _____ _____ %

iii) Earth _____ _____ %

iv) Dolomite _____ _____ %

c) Recommended depth of satisfactory foundations.

d) Should the foundations be reinforced/raft foundation? Yes/No
(Specific foundation recommendations are required in the event of a dolomitic site. These recommendations must include comments regarding the appropriate foundation as well as treatment of in-situ soil.)

e) Should the ground under the building be treated with termite poison? _____ Yes/No

f) Do buildings in the vicinity show signs of cracking? _____ Yes/No

g) Is there any danger of sinkholes, dolines or ground movement in or near the area? _____ Yes/No

13. BUILDING MATERIALS

Which of the following materials are available and recommended?

a) Type of face brick (e.g. A39, B20. etc.) _____
State nearest source of supply. _____

b) Type of general purposes brick for foundations. _____

c) Type of general purposes brick for superstructure. _____

d) Nature of stone available suitable for concrete work? (e.g. mountain stone, granite, freestone, etc.)

_____

Distance to be transported.: _____

e) Nature of sand available, suitable for concrete work?

_____

Distance to be transported.: _____

f) Nature of sand available, suitable for building and plaster work?

_____

Distance to be transported.: _____

g) Details of roof required, considering surrounding and climatic conditions (e.g. tiles, galvanised iron, etc.).

_____

_____

h) Other materials used in the district for construction, state type.

_____

_____

14. FENCING

a) Is the site fenced or is there any other means of enclosure? _____ Yes/No

b) If Yes/No, state whether the fencing:

i) Can be retained for future use. _____ Yes/No

ii) Can be repaired and re-used. _____ Yes/No

iii) Can not be used. _____ Yes/No

c) State details of fence if reusable (e.g. type, height size of gates, etc.).

d) May the fencing on boundaries of adjoining sites be removed, if unsuitable for future use? Yes/No

N.B. Any new fencing required must be indicated on the site plan together with suitable positions for entrance gates.

e) State type of fencing recommended. If not a standard type, give full details of recommended fencing

15. PROVISION OF SERVICES

Which of the following services are available? Yes/No

a) Local authority water

i) Cost of the following connections (if available)

12mm		R	37mm		R
18mm		R	50mm		R
25mm		R	75mm		R
100mm		R			

ii) Water pressure available at site boundary

iii) Is the water supply metered? Yes/No

Domestic

Fire Fighting

Irrigation

b) Bore hole water Yes/No

i) Depth

ii) Equipment

iii) Yield

c) Other source (perennial springs, rivers, tanks, etc.)

d) Local authority water borne sewer network: Yes/No

i) Are the position, depth, size and ground levels of existing sewers indicated on the plan? Yes/No

ii) If not state reasons.

iii) What is the cost of connection? R

e) Vacuum tank water borne sewerage system Yes/No

i) What is the minimum size of tank specified by the local authority?

ii) State number of removals per week.

iii) State cost of removals R

f) Septic tank water borne sewerage system.

i) Are septic tanks permitted? Yes/No

ii) Are details of the standard absorbency test shown on site plan? Yes/No

g) Bucket removal or other system Yes/No

i) Description of system (pit chemical. etc.)

ii) State cost of system R

iii) State number of weekly removals _____

h) Waste water

Where soil conditions are unfavourable for the disposal of waste water, and there is no water borne system, suggestions should be given for the disposal of waste water.

_____

_____

i) Stormwater disposal

i) Are positions, sizes, depths and levels of existing storm water pipes, channels, culverts, in- and outlets indicated on the plan? _____ Yes/No

ii) Is the site traversed by any natural stormwater courses? _____ Yes/No

iii) Is protection from natural run-off from higher lying areas required? _____ Yes/No

iv) State recommended method of stormwater disposal.

_____

_____

j) Fire service

i) Is a professional fire brigade available? _____ Yes/No

ii) What is the distance between the fire station and the site in kilometre?

_____

iii) Are hydrants available? ___ Yes/No

iv) Are the positions of the nearest hydrants indicated on the plan? ___ Yes/No

v) In cases of additions, state number and positions of existing fire hose reels and/or extinguishers.

_____

_____

vi) What size water supply is available for fire service? (Give cost of connection)

75mm ____ R _____ 100mm R _____

150mm ____ R _____

vii) Average pressure of water supply for fire service _____

viii) Will the local authority permit a combined fire and domestic water supply? _____ Yes/No

ix) Does the local authority require the separate fire main to be metered? _____ Yes/No

k) Heating, lighting and cooking.

NB (i), (ii) and (iii) must be completed by the electrical consultant.

i) Is an electricity supply available? _____ Yes/No
(If yes, from OW300, must be submitted as well).

ii) If not, when will it be available? _____

iii) If not, state proposed method of lighting etc.

_____

iv) What fuel is recommended for cooking?

_____

v) What fuel is recommended for heating?

_____

l) Public transport.

i) Name of nearest railway station. _____

ii) Distance from station to site. _____

16. GENERAL

PRINCIPAL AGENT **DATE**

EXPLANATORY NOTES

NOTE :

i) Full details are to be furnished with a view to facilitating the preparation of working drawings.

ii) A detailed site plan together with photographs which illustrate the site's features as well as photographs from the site in all directions to show the outlook, must be submitted with this form.

iii) A locally plan/sketch should also be submitted.

iv) The form, photographs, plans and other relevant information must be submitted in triplicate to Head Office.

v) Attach a loose sheet of paper for all items where the space is insufficient with the necessary cross referencing.

vi) The following notes should be carefully read:

Trial Holes and Foundations

The officer must view the trial holes and check levels before particulars are submitted to Head Office. All trial holes other than those where rock is encountered, are to be excavated to a depth of three metres at least, even if gravel or shale formations are encountered, as these formations often occur in a thin layer with doubtful material below. A full description of each trial hole is to be submitted to Head Office, detailing the thickness of the formations cut through, to the full depth of trial holes. The average depth to approved bottom is also to be given. Samples of the formations cut through in sequence from the top to bottom of holes are to be submitted to Head Office, giving descriptions and thickness.

Accurate particulars and levels are essential as it is on this information that foundations, surface and soil drainage, and other factors are determined.

Dolomitic sites must be inspected/investigated by an appropriate qualified engineering geologist.

Works on Site and Demolitions

The short specification submitted for the demolition of existing buildings, when such demolitions are to be included in the main building contract, must include a description of the materials of which the foundations, superstructure, roof, floors, ceilings, windows, etc., are constructed. In addition the overall dimensions of the buildings must be given. In the most cases those dimensions will appear on the appropriation drawings but if such drawings are not available or dimensions are not given thereon, then they must be given separately.
State whether any of the old materials or fitting should be handed over to the Department. Describe such materials and state where they should be handed over (i.e. on site, at P.W. and LA Store, etc.) Also give full particulars of any materials or fittings considered serviceable and suitable for re-use in a new building.

When furrows are to be filled in, or any other such work is to be done on the site, give the length, width and depth of such furrows or word.

When walls and similar structure have to be pulled down, give their length, height and thickness and state the materials of which they are constructed.

When earth, stone or other surplus materials debris have to be removed from the site, and estimated amount in cubic metres should be stated.

Alterations and Additions to Existing Buildings.

State whether any of the old materials or fitting should be handed over to the Department. Describe such materials and state where they should be handed over (i.e. on site, at P.W. and LA Store, etc.) Also give full particulars of any materials or fittings considered serviceable and suitable for re-use in a new building.

When furrows are to be filled in, or any other such work is to be done on the site, give the length, width and depth of such furrows or word.

When walls and similar structure have to be pulled down, give their length, height and thickness and state the materials of which they are constructed.

When earth, stone or other surplus materials debris have to be removed from the site, and estimated amount in cubic metres should be stated.

Alterations and Additions to Existing Buildings.

Comprehensive and explicit information must be furnished in this respect. In addition to appropriation drawings. Remeasurement of Foundation plan and photographs, full information must also be submitted in regard to the materials of which the walls, floors, ceiling, windows, roof covering, caves, gutters, rainwater pipes etc., are constructed. The interior and exterior finishing, especially of those portions of the buildings that will be afflicted by the alterations and/or additions, must be specified.

Particulars of drains, water supply, fire, lighting and other services must be furnished.

Fencing:

It is recommended that the existing fencing should be repaired and re-used, a full description of the fence should be given. State the materials of which the fence is constructed, the number of wires, the distance between posts, the number of standards and droppers and the estimate amount of material required to repair the fence.

Dolomite:

Special precautions should be taken in the design of services and structures in dolomitic area. The Departmental standards for development on dolomitic areas should be strictly adhered to. This is also applicable to upgrading, repair and renovation projects. Special attention should be given to the existing wet services for new and existing facilities.

DEPARTMENT OF PUBLIC WORKS
ENVIRONMENTAL AND SOCIAL ASPECTS TO BE CONSIDERED

Issues to consider with regards to the future **Environmental** policy for PWD:

SITE SELECTION:

Could the proposed development have a significant impact on, or be constrained by any of the following:

Degradation of atmosphere i.e.

Levels of air pollution
Production of offensive odours

Structures and sites of architectural, cultural or historic heritage, i.e.

Site or areas of religious or spiritual significance. The integrity of cultural resources.

Prominent landscape/geological features, i.e.

Conservation or recreational value of rivers, streams, lakes, wetland dams or islands.

Survival of rare or endangered animals/plant species, i.e.

Diversity of animal communities
Natural immigration of species

Compatibility with surrounds, i.e.

Aesthetic quality of the area
Need for additional recreational facilities

Land characteristics, i.e.

Natural drainage patterns
Water table
Ability to absorb run-off
Availability of or access to construction materials such as rock and gravel
Availability of topsoil or fill material

Water, i.e.

Level of water pollution/effect on irrigation schemes

Dolomite land

CONCEPT DESIGN:

Indoor air quality, i.e.

Natural ventilation/air movement
Maximum use of north/east orientation
Proper operation, maintenance, housekeeping
Building materials and methods

Acoustic, i.e.

Speech-privacy
Orientation of building with regards to roads etc.

Water efficient design and appliances, i.e.

Luminous environment

Maintaining physical contact with nature, i.e.

Protection of indigenous trees and other natural features
Minimise visual impact
Promote open green spaces for recreation
Promote safe and appropriate routes and facilities for pedestrians and cyclists

Minimise interference with natural systems, i.e.

Earth removals or excavations
Storm water run off
Ground water

Social acceptability, i.e.

Interface with community structures
Use of local skills
Incorporate training schemes
Labour intensive process (appropriate technology and design)
Task based payment (Civil work)

Compatibility with surrounds, i.e.

Promote public transport
Effect on views, overlooking and privacy
Lifestyle, neighbourhood character
Access for elderly, wheelchairs

DEPARTMENT OF PUBLIC WORKS
COMPOSITION OF CONTRACT

WCS. NO: _____
REFERENCE NO : _____

PROJECT: _____

ITEM		NATURE OF CONTRACT
Building:		Comprehensive
Civil:	Structural	Comprehensive
	Water treatment	Comprehensive Eng contract
	Sewerage works	Comprehensive Eng contract
	Roads and/or stormwater	Comprehensive Eng contract
Electrical:	Electrical installation	Comprehensive (Part A)
	Lift/escalator	Either nominated sub contract / Comprehensive
	Uninterrupted power supply (UPS)	Direct (A / C in Battery Room)
	Emergency generator	Comprehensive
	High voltage installation	Engineering contract
	Communications/Call system	Comprehensive
	Security lighting/Alarm system	Comprehensive
	Transformer / High tension gear	Comprehensive
	Access control/Metal detectors	Comprehensive / Direct
	Other	
Mechanical:	Air conditioning	Comprehensive
	Ventilation system	Part of A / C
	Overhead crane / gantry	Nominated / Comprehensive
	Fire detection system	Comprehensive
	Fire extinguishing system (gas)	Comprehensive
	Sprinkler system	Comprehensive
	Freezer and cold rooms	Part of A / C
	Compressed air / Vacuum / Gas	Comprehensive
	Acoustics	Comprehensive
	Kitchen equipment	Comprehensive
	Steam plant	Comprehensive Eng contract
	Other	
Landscape:		Comprehensive
Other:		

Note:

1 Entrance control through metal detection or X-ray scanning can either be a nominated sub-contract or direct, depending on the installation.

2 Electrical and mechanical installations being part of the main contract to be measured by Quantity Surveyor.

3 Where items above are indicated as comprehensive, the Bill of Quantities may be divided into sections, e.g. Section A: electrical, etc.

4 Please be sure to prescribe in Bill of Quantities what measures of approval / testing is required in terms of the Occupational, Health and Safety Act (1993) Act 83 of 1993 / maintenance contracts / operating manuals and training.

5 Please take note that there may be exceptions.

DATE **PROJECT MANAGER**

DEPARTMENT OF PUBLIC WORKS
SKETCH PLAN CHECK LIST

PROJECT: _____ **WCS NO :** _____

_____ **REFERENCE NO:** _____

_____

_____

To be completed by the Private Architect
Indicate in box next to EACH item whether provided or not applicable

1.	**SITE PLAN**		**3.**	**ACCOMMODATION**	
1.1	Site dimension.....	____	3.1	Comparative schedule of rooms required and provided with areas.....	
1.2	Building line setbacks.....	____	**4.**	**ELEVATIONS**	
1.3	Contours at suitable intervals and spot levels of pavements and floors	____	4.1	General architectural treatment	
1.4	North point	____	4.2	Principal materials	
1.5	Prevailing winds	____	**5.**	**SECTIONS**	
1.6	Street names	____	5.1	Dimensioned floor to floor and floor to ceiling heights.....	
1.7	Type of existing and proposed-				
	1.7.1 boundary fences, walls and gates.....	____	5.2	Floor levels and adjacent natural and formed ground levels, showing excavation and filling.....	
	1.7.2 retaining walls.....	____			
1.8	Existing buildings on adjoining sites likely		5.3	Roof slopes and type of construction and	
1.9	to affect the design of new buildings.....	____		Consideration given to-covering.....	
	1.9.1 rights of adjoining owners.....	____	5.4	Material and finish of walls.....	
	1.9.2 need for lateral support, etc.....	____	**6.**	**CONSULTATIONS** : Has the scheme been discussed with :	
1.10	Existing buildings on site to be -				
	1.10.1 retained	____	6.1	Specialist Department.....	
1	.10.2 demolished.....	____	6.2	User Department.....	
1.11	Trees to be removed or retained.....	____	6.3	Divisional Engineer, Telkom, for telephone requirements.....	
1.12	Natural water courses with flood lines and				
	levels.....	____	6.4	Local Authority for -	
1.13	Servitudes and Departmentally owned			services.....	
	service mains which -			town-planning requirements.....	
	1.13.1 cannot be disturbed.....	____	6.5	Quantity Surveyor for costs.....	
	1.13.2 need to be diverted.....	____		Consultant and/or Departmental Specialist	
1.14	New buildings.....	____	6.6	Structural.....	
1.15	Site terracing, with treatment of banks.....	____	6.7	Civil Works for -	
1.16	Site terracing, with treatment of banks-			roads, drainage and stormwater.....	
	grassed, stone pitched, concrete retaining			6.8 Mechanical, for -	
	walls, etc.	____		fire service.....	
1.17	Roads, paths and paving with finishes-			heating, ventilating, and air-conditioning	
	gravel, tarmac, concrete etc.	____		mechanical plant/equipment.....	
1.18	Positions and depths of connection points		6.9	Electrical Emergency Generators for lifts.....	
	of sewer, stormwater drain, water and fire		6.10	Chemical Technology: Process design of water	
	service.....	____		and sewerage treatment facilities.....	
1.19	Dolomiterisk zonation……..	____	6.11	Dolomite Risk Manager…….....	
2.	**BUILDING PLANS**		**7.**	**GENERAL**	
2.1	Overall dimensions of new work.....	____	7.1	Any other information likely to affect the	
2.2	Treatment at junction of new and old work..	____		Estimate (state) (Items 1 to 6):	
2.3	Structural column grid.....	____		.....	
2.4	Room dimensions and areas (toilets			.....	
	excepted) and corridor widths.....	____		.....	
2.5	Engineering service rooms and ducts.....	____		.....	
2.6	Position of sanitary and other fittings.....	____		.....	
2.7	Floor finishes.....	____		.....	

8. CERTIFICATE BY PRIVATE ARCHITECT

The Department's instructions given in the letter of appointment, the "Architects' Manual", with annexures, and the items on this Check List and the "Schedule of Construction and Finishes, etc." have been studied by me/us and, where applicable, complied with items which have not been complied with, or for which alternative proposals are made, are as follows :

PRIVATE ARCHITECT / PRINCIPAL AGENT **DATE**

9. APPROVAL BY DEPARTMENTAL PROJECT MANAGER:

PROJECT MANAGER **DATE**

10. REMARKS BY CLIENT / USER:

CLIENT/USER REPRESENTATIVE **DATE**

SUBMISSION OF DRAWINGS TO LOCAL AUTHORITIES IN TERMS OF THE NATIONAL BUILDING REGULATIONS AND BUILDING STANDARDS ACT 1977, (ACT NO 103 OF 1977).

To: Local Authority:

Project:

WCS:
File Reference:

In terms of section 2(4) of Act No 103 of 1977, receive herewith, for your information and comments, the following drawings and particulars in respect of the said project:

DESCRIPTION:	**DRAWING NUMBERS:**
Site Plan(s):	
Layout Drawings: (1:100 Scale Plans, Sections and Elevations plus relevant details)	
Fire Installation Drawing(s): (Including water reticulation system to fire fighting equipment)	
Drainage Installation Drawing(s): (Sewer- and storm water)	
Structural Drawing(s):	
Detail(s) of Artificial Ventilation:	
Other:	

It is hereby certified that the building(s) to be erected / upgraded will comply with the National Building Regulations, issued in terms of Act 103 of 1977, and will only deviate, in terms of prior negotiations with your office, in respect of:

Submitted on Behalf of: The Department of Public Works By: (Name of Firm)*

Address: (Address of Firm)*

Signed:

Capacity:

Date:

The above has been verified, certified herewith and presented to the Local Authority in terms of Regulation A1(2) of the National Building Regulations, issued in terms of Act 103 of 1977.

Signed:

Capacity: (Project Manager)*

Date:

Signed:

Capacity: (Regional Manager / Chief Director: Development Operations)*

Date:

For: **Director-General**

** For info only – to be deleted in actual submissions*

DEPARTMENT OF PUBLIC WORKS
SCHEDULE OF CONSTRUCTION AND FINISHES, USE FACTOR ANALYSIS AND ESTIMATE

PROJECT : _____ **WCS NO**: _____
_____ **REFERENCE NO**: _____
_____

This form is to be completed by the private Architect in every detail and submitted with the Sketch Plan and Sketch Plan Check List. Indicate applicable items by marking the appropriate line:-

1. FOUNDATIONS

1.1 FOOTINGS

1.1.1 Conventional unreinforced concrete painted.....
strip..... ___

1.1.2 Reinforced concrete..... ___

1.1.3 Foundation beams and piles average anodized.....

1.14 Raft foundations……

1.2 FOUNDATION WALLING

1.2.1 Brickwork (not reinforced)..... ___

1.2.2 Reinforced brick..... ___

1.2.3 Reinforced concrete..... ___

1.2.4 Other (describe on separate sheet).
panels.....

1.3 FINISH

1.3.1 Face brick..... ___

1.3.2 Plaster and paint..... ___

1.3.3 Precast terrazzo..... ___

1.3.4 Other (describe on separate sheet)..... ___

2. SUPER STRUCTURE

2.1 Load bearing brickwork..... ___

2.2 Reinforced concrete frame..... ___
sheet).....

2.3 Structural steel frame..... ___

2.4 Beam and panel slab floors..... ___
sheet).....

2.5 Other (describe on separate sheet)..... ___

3. EXTERNAL WALLING SYSTEM

TYPE : POSITION :

3.1 Brick with the following facings:

3.1.1 Face brickwork..... ___

3.1.2 Plaster and paint..... ___

3.1.3 Precast terrazzo..... ___

3.1.4 Other (describe on separate sheet) ___

4. INTERNAL WALLING SYSTEM

4.1 Brick, plaster and paint..... ___
R.....

4.2 Other (describe on separate sheet)..... ___

5. WINDOWS

TYPE : POSITION :

5.1 Steel,

5.2 Steel, galvanized.....

5.3 Aluminium, untreated.....

5.4 Aluminium

6. CEILING TREATMENT

TYPE : POSITION :

6.1 Gypsum or fibreboard on brandering.....

6.2 Plaster on concrete.....

6.3 Suspended under concrete.....

___ 6.4 Acoustic

6.5 Other (specify on separate sheet).....

7. FLOOR FINISH

TYPE : .....POSITION: .....

7.1 Vinyl asbestos tiles.....

7.2 Granolithic.....

7.3 Ceramic.....

7.4 Wood Mosaic.....

7.5 Concrete paving.....

7.6 Other (specify on separate sheet).....

8. EXTERNAL SUN PROTECTION

Required? (Described on separate sheet).....

9. SPECIAL GLAZING

Required? (Describe on separate sheet).....

10. USE FACTOR ANALYSIS

Total area of building, all floors but exluding basement

.....square metres

Total net usable area. excluding corridors, foyers toilets. engineering service rooms .....square metres

Usable area expressed as a percentage of the total area

.....

11. ESTIMATE

All inclusive estimate of cost of service excluding -VAT

Note: Describe on a separate sheet any additional features likely to affect the estimate. If necessary, also elaborate in like manner on any items appearing on this sheet, quoting the relevant reference numbers

PRIVATE ARCHITECT	**PRINCIPAL AGENT**
DATE	**DATE**

APPENDIX 9

LIST OF PROVINCES, MAGISTERIAL DISTRICTS, MUNICIPALITIES AND TOWNS LOCATED ON DOLOMITE

TABLE 9.1 LIST OF PROVINCES LOCATED ON DOLOMITE

PROVINCE
LIMPOPO
MPUMALANGA
NORTH WEST
NORTHERN CAPE
GAUTENG
FREE STATE

TABLE 9.2 LIST OF MAGISTERIAL DISTRICTS LOCATED ON DOLOMITE

MAGISTERIAL DISTRICTS	
ALBERTON	MOKERONG 3
BARBERTON	MOUTSE 3
BARKLY WEST	NAPHUNO 1
BENONI	NAPHUNO 2
BOKSBURG	NELSPRUIT
BRAKPAN	NIGEL
BRITS	OBERHOLZER
BRITSTOWN	PARYS
BRONKHORSTSPRUIT	PELGRIM'S REST
CAROLINA	PHALABORWA
DELAREYVILLE	PHOKWANI
DELMAS	PIETERSBURG
GA RANKUWA	POSTMASBURG
GERMISTON	POTCHEFSTROOM
GROBLERSDAL	POTGIETERSRUS
HAY	PRETORIA
HEIDELBERG	PRIESKA
HERBERT	RANDFONTEIN
HOPETOWN	RUSTENBURG
HUHUDI	SASOLBURG
JOHANNESBURG	SEKHUKHUNELAND
KEMPTON PARK	SPRINGS
KIMBERLEY	THABAMOOPO
KLERKSDORP	THABAZIMBI
KROONSTAD	VANDERBIJLPARK
KRUGERSDORP	VENTERSDORP
KUDUMANE	VEREENIGING
KURUMAN	VILJOENSKROON
LETABA 2	VREDEFORT
LICHTENBURG	VRYBURG
LYDENBURG	WARMBAD
MADIKWE	WATERBERG
MANKWE	WATERVAL-BOVEN
MMABATHO	WESTONARIA
MOKERONG 2	WITRIVIER

TABLE 9.3 LIST OF MUNICIPALITIES LOCATED ON DOLOMITE

MUNICIPALITIES	
COMMON NAME	**NEW NAME**
BARBERTON	UMJINDI
BARKLEY WEST	THUSANANG MUNICIPALITY
BELFAST	HIGHLANDS
BENEDE	BENEDE
BO KAROO	BO KAROO
BRITS	NW372 LOCAL COUNCIL
BRONKHORSTSPRUIT	KUNGWINI LOCAL MUNICIPALITY
BURGERSFORT/OHRIGSTAD/EASTERN TUBATSE	GREATER TUBATSE MUNICIPALITY
BUSHBUCKRIDGE	BUSHBUCKRIDGE MUNICIPALITY
CARLETONVILLE	MERAFONG CITY LOCAL MUNICIPALITY
DANIELSKUIL	DAN-LIME MUNICIPALITY
DELMAS	DELMAS
DIAMONDFIELDS	DIAMONDFIELDS
DMA LOWVELD	DMA LOWVELD
EAST RAND	GREATER EAST RAND METRO
ELLISRAS	LEPHALALE
ELUKWATINI/CAROLINA	ALBERT LUTHULI
GANYESA	KAGISANO LOCAL MUNICIPALITY
GRIEKWASTAD	SIYANCUMA MUNICIPALITY
GROBLERSDAL	GREATER GROBLERSDAL MUNICIPALITY
HEIDELBERG	LESEDI LOCAL MUNICIPALITY
HOEDSPRUIT	DRAKENSBERG MUNICIPALITY
HOPETOWN	ORANJE-KAROO MUNICIPALITY
JOHANNESBURG	CITY OF JOHANNESBURG
KALAHARI CBDC	KALAHARI CBDC
KATHU	GAMMAGARA MUNICIPALITY
KGALAGADI	SEGONYANA MUNICIPALITY
KLERKSDORP	KLERKSDORP LOCAL MUNICIPALITY
KOSTER	NW374 LOCAL MUNICIPALITY
KROONSTAD	MOQHAKA LOCAL MUNICIPALITY
KRUGERSDORP	MOGALE CITY LOCAL MUNICIPALITY
KURUMAN	KURUMAN-MOTHIBISTAD MUNICIPALITY
LEBOWAKGOMO	LEPELLE-NKUMPI
LICHTENBURG	LICHTENBURG LOCAL MUNICIPALITY
MAFIKENG	MAFIKENG LOCAL MUNICIPALITY
MARBLE HALL	GREATER MARBLE HALL MUNICIPALITY
MEYERTON	MIDVAAL LOCAL MUNICIPALITY
MOGWASE	MANKWE-MADIKWE LOCAL MUNICIPALITY
NELSPRUIT	MBOMBELA
NYLSTROOM	MODIMOLLE
PARYS	NGWATHE LOCAL MUNICIPALITY
PIETERSBURG	POLOKWANE
POMFRET	MOLOPO LOCAL MUNICIPALITY
POSTMASBURG	RE A IPELA MUNICIPALITY
POTCHEFSTROOM	POTCHEFSTROOM LOCAL MUNICIPALITY
POTGIETERSRUS	MOGALAKWENA
PRETORIA	TSHWANE METROPOLITAN MUNICIPALITY
PRIESKA	PRIEMANDAY MUNICIPALITY

MUNICIPALITIES	
COMMON NAME	**NEW NAME**
RANDFONTEIN	RANDFONTEIN LOCAL MUNICIPALITY
REIVILO	GREATER TAUNG LOCAL MUNICIPALITY
RUSTENBURG	RUSTENBURG LOCAL MUNICIPALITY
SABIE	THABA CHWEU
SASOLBURG	METSIMAHOLO LOCAL MUNICIPALITY
SCHUINSDRAAI NATURE RESERVE	SCHUINSDRAAI NATURE RESERVE
STERKFONTEIN	STERKFONTEIN
THABAZIMBI	THABAZIMBI
TZANEEN	GREATER TZANEEN MUNICIPALITY
VENTERSDORP	VENTERSDORP LOCAL MUNICIPALITY
VEREENIGING	EMFULENI LOCAL MUNICIPALITY
VRYBURG	NALEDI LOCAL MUNICIPALITY
WARMBATH	BELA BELA
WESTONARIA	WESTONARIA LOCAL MUNICIPALITY
ZEERUST	ZEERUST LOCAL MUNICIPALITY

TABLE 9.4 LIST OF TOWNS LOCATED ON DOLOMITE

PROVINCE	DISTRICT NAME	MUNICIPAL - COMMON NAME	MUNICIPAL - NEW NAME	TOWN NAME
FREE STATE	VREDEFORT	KROONSTAD	MOQHAKA LOCAL MUNICIPALITY	SPES BONA
GAUTENG	ALBERTON	EAST RAND	GREATER EAST RAND METRO	KATLEHONG
GAUTENG	ALBERTON	EAST RAND	GREATER EAST RAND METRO	TOKOZA
GAUTENG	BOKSBURG	EAST RAND	GREATER EAST RAND METRO	VOSLOORUS
GAUTENG	BRONKHORSTSPRUIT	EAST RAND	GREATER EAST RAND METRO	BAPSFONTEIN
GAUTENG	JOHANNESBURG	JOHANNESBURG	CITY OF JOHANNESBURG	ELDORADO PARK
GAUTENG	JOHANNESBURG	JOHANNESBURG	CITY OF JOHANNESBURG	LENASIA
GAUTENG	KEMPTON PARK	EAST RAND	GREATER EAST RAND METRO	TEMBISA
GAUTENG	OBERHOLZER	CARLETONVILLE	MERAFONG CITY LOCAL MUNICIPALITY	CARLETONVILLE
GAUTENG	OBERHOLZER	CARLETONVILLE	MERAFONG CITY LOCAL MUNICIPALITY	WELVERDIEND
GAUTENG	PRETORIA	PRETORIA	TSHWANE METROPOLITAN MUNICIPALITY	ATTERIDGEVILLE
GAUTENG	PRETORIA	PRETORIA	TSHWANE METROPOLITAN MUNICIPALITY	CENTURION
GAUTENG	RANDFONTEIN	RANDFONTEIN	RANDFONTEIN LOCAL MUNICIPALITY	BANK
GAUTENG	RANDFONTEIN	RANDFONTEIN	RANDFONTEIN LOCAL MUNICIPALITY	MOHLAKENG
GAUTENG	VEREENIGING	MEYERTON	MIDVAAL LOCAL MUNICIPALITY	DALESIDE
GAUTENG	VEREENIGING	MEYERTON	MIDVAAL LOCAL MUNICIPALITY	MEYERTON
GAUTENG	VEREENIGING	MEYERTON	MIDVAAL LOCAL MUNICIPALITY	RANDVAAL
GAUTENG	WESTONARIA	WESTONARIA	WESTONARIA LOCAL MUNICIPALITY	WESTONARIA
LIMPOPO	LETABA 2	LEBOWAKGOMO	LEPELLE-NKUMPI	THE DOWNS
LIMPOPO	THABAMOOPO	LEBOWAKGOMO	LEPELLE-NKUMPI	CHUNIESPOORT
LIMPOPO	THABAZIMBI	THABAZIMBI	THABAZIMBI	GANSKUIL
LIMPOPO	THABAZIMBI	THABAZIMBI	THABAZIMBI	KOEDOESKOP
LIMPOPO	THABAZIMBI	THABAZIMBI	THABAZIMBI	MIDDELWIT
LIMPOPO	THABAZIMBI	THABAZIMBI	THABAZIMBI	SENTRUM
LIMPOPO	THABAZIMBI	THABAZIMBI	THABAZIMBI	THABAZIMBI

PROVINCE	DISTRICT NAME	MUNICIPAL - COMMON NAME	MUNICIPAL - NEW NAME	TOWN NAME
MPUMALANGA	DELMAS	DELMAS	DELMAS	DELMAS
MPUMALANGA	GROBLERSDAL	GROBLERSDAL	GREATER GROBLERSDAL MUNICIPALITY	GROBLERSDAL
MPUMALANGA	GROBLERSDAL	MARBLE HALL	GREATER MARBLE HALL MUNICIPALITY	MARBLE HALL
MPUMALANGA	LYDENBURG	BURGERSFORT/OHRIGSTAD/EASTERN TUBATSE	GREATER TUBATSE MUNICIPALITY	BRANDDRAAI
MPUMALANGA	NELSPRUIT	NELSPRUIT	MBOMBELA	KAAPSEHOOP
MPUMALANGA	PELGRIM'S REST	SABIE	THABA CHWEU	GRASKOP
MPUMALANGA	PELGRIM'S REST	SABIE	THABA CHWEU	HENDRIKSDAL
MPUMALANGA	PELGRIM'S REST	SABIE	THABA CHWEU	MAUCHSBERG
MPUMALANGA	PELGRIM'S REST	DMA LOWVELD	DMA LOWVELD	PILGRIMS REST
MPUMALANGA	PELGRIM'S REST	SABIE	THABA CHWEU	SABIE
MPUMALANGA	PELGRIM'S REST	SABIE	THABA CHWEU	VAALHOEK
NORTH WEST	BRITS	BRITS	LOCAL COUNCIL	ASSEN
NORTH WEST	BRITS	BRITS	LOCAL COUNCIL	ATLANTA
NORTH WEST	HUHUDI	POMFRET	MOLOPO LOCAL MUNICIPALITY	POMFRET
NORTH WEST	KLERKSDORP	KLERKSDORP	KLERKSDORP LOCAL MUNICIPALITY	STILFONTEIN
NORTH WEST	KUDUMANE	KURUMAN	KURUMAN-MOTHIBISTAD MUNICIPALITY	MOTHIBISTAT
NORTH WEST	KUDUMANE	KGALAGADI	SEGONYANA MUNICIPALITY	TSINENG
NORTH WEST	LICHTENBURG	LICHTENBURG	LICHTENBURG LOCAL MUNICIPALITY	BAKERVILLE
NORTH WEST	LICHTENBURG	LICHTENBURG	LICHTENBURG LOCAL MUNICIPALITY	CARLSONIA
NORTH WEST	LICHTENBURG	LICHTENBURG	LICHTENBURG LOCAL MUNICIPALITY	ELANDSPUTTE
NORTH WEST	LICHTENBURG	LICHTENBURG	LICHTENBURG LOCAL MUNICIPALITY	ITSOSENG

PROVINCE	DISTRICT NAME	MUNICIPAL - COMMON NAME	MUNICIPAL - NEW NAME	TOWN NAME
NORTH WEST	MADIKWE	LICHTENBURG	LICHTENBURG LOCAL MUNICIPALITY	LEAD MINE
NORTH WEST	MADIKWE	MAFIKENG	MAFIKENG LOCAL MUNICIPALITY	OTTOSHOOP
NORTH WEST	MADIKWE	LICHTENBURG	LICHTENBURG LOCAL MUNICIPALITY	WONDERMERE
NORTH WEST	PHOKWANI	REIVILO	GREATER TAUNG LOCAL MUNICIPALITY	MADIPELESA
NORTH WEST	PHOKWANI	REIVILO	GREATER TAUNG LOCAL MUNICIPALITY	REIVILO
NORTH WEST	PHOKWANI	REIVILO	GREATER TAUNG LOCAL MUNICIPALITY	STEEKDORINGS
NORTH WEST	RUSTENBURG	LICHTENBURG	LICHTENBURG LOCAL MUNICIPALITY	GROOTPAN
NORTH WEST	RUSTENBURG	KOSTER	LOCAL MUNICIPALITY	MERINDOL
NORTH WEST	VENTERSDORP	VENTERSDORP	VENTERSDORP LOCAL MUNICIPALITY	KLERKSKRAAL
NORTH WEST	VENTERSDORP	VENTERSDORP	VENTERSDORP LOCAL MUNICIPALITY (NW401)	SWARTPLAAS
NORTH WEST	VRYBURG	VRYBURG	NALEDI LOCAL MUNICIPALITY	DE BEERS
NORTH WEST	VRYBURG	GANYESA	KAGISANO LOCAL MUNICIPALITY	GELUK
NORTH WEST	VRYBURG	REIVILO	GREATER TAUNG LOCAL MUNICIPALITY	LYKSO
NORTH WEST	VRYBURG	VRYBURG	NALEDI LOCAL MUNICIPALITY	SALPETERPAN
NORTH WEST	VRYBURG	VRYBURG	NALEDI LOCAL MUNICIPALITY	TIERKLOOF
NORTHERN CAPE	BARKLY WEST	DANIELSKUIL	DAN-LIME MUNICIPALITY	BLESMANSPOS
NORTHERN CAPE	BARKLY WEST	DANIELSKUIL	DAN-LIME MUNICIPALITY	BLIKFONTEIN
NORTHERN CAPE	HAY	GRIEKWASTAD	SIYANCUMA MUNICIPALITY	GRIQUATOWN
NORTHERN CAPE	HERBERT	GRIEKWASTAD	SIYANCUMA MUNICIPALITY	CAMPBELL
NORTHERN CAPE	KURUMAN	KURUMAN	KURUMAN-MOTHIBISTAD MUNICIPALITY	BEKKER
NORTHERN CAPE	KURUMAN	KURUMAN	KURUMAN-MOTHIBISTAD MUNICIPALITY	KURUMAN

PROVINCE	DISTRICT NAME	MUNICIPAL - COMMON NAME	MUNICIPAL - NEW NAME	TOWN NAME
NORTHERN CAPE	KURUMAN	POSTMASBURG	RE A IPELA MUNICIPALITY	LOHATLHA
NORTHERN CAPE	POSTMASBURG	DANIELSKUIL	DAN-LIME MUNICIPALITY	ARIESFONTEIN
NORTHERN CAPE	POSTMASBURG	POSTMASBURG	RE A IPELA MUNICIPALITY	BEESHOEK
NORTHERN CAPE	POSTMASBURG	POSTMASBURG	RE A IPELA MUNICIPALITY	BOKKOPPIE
NORTHERN CAPE	POSTMASBURG	DANIELSKUIL	DAN-LIME MUNICIPALITY	DANIELSKUIL
NORTHERN CAPE	POSTMASBURG	POSTMASBURG	RE A IPELA MUNICIPALITY	GLOSAM
NORTHERN CAPE	POSTMASBURG	DANIELSKUIL	DAN-LIME MUNICIPALITY	LIME ACRES
NORTHERN CAPE	POSTMASBURG	POSTMASBURG	RE A IPELA MUNICIPALITY	LOHATLHA
NORTHERN CAPE	POSTMASBURG	POSTMASBURG	RE A IPELA MUNICIPALITY	MOOKANENG
NORTHERN CAPE	POSTMASBURG	POSTMASBURG	RE A IPELA MUNICIPALITY	PALINGPAN
NORTHERN CAPE	POSTMASBURG	DANIELSKUIL	DAN-LIME MUNICIPALITY	PAPKUIL
NORTHERN CAPE	POSTMASBURG	KATHU	GAMMAGARA MUNICIPALITY	SISHEN
NORTHERN CAPE	POSTMASBURG	DANIELSKUIL	DAN-LIME MUNICIPALITY	SWARTPUTS
NORTH WEST	MADIKWE	ZEERUST	ZEERUST LOCAL MUNICIPALITY	RAMOTSWA

APPENDIX 10

SUBMISSION OF DRAWINGS IN ELECTRONIC FORMAT FORMAT FOR INTEGRATION INTO DEPARTMENTAL GEOGRAPHICAL INFORMATION SYSTEM (GIS).

SUBMISSION OF DRAWINGS IN ELECTRONIC FORMAT FORMAT FOR INTEGRATION INTO DEPARTMENTAL GEOGRAPHICAL INFORMATION SYSTEM (GIS).

1. REFERENCE DOCUMENTS

All engineering and related drawings must comply with the standards as set out in PW347, Civil Engineering Manual of May 2004 or later revisions.

2. GENERAL

The Department intent to incorporate all "as built" drawings in a single Geographical Information System (GIS) and as such requires that drawings shall be submitted in a format that is compatible with the currently adopted system in ArcGIS suite of programmes.

The ArcGIS suit format of drawings are filename.shp (shape) files and the programme is compatible to incorporate "filename.dxf" formats. As such it will thus be a requirement that all electronic drawings be submitted as follow:

- format normally used by consultant (i.e. Caddie, AutoCad, MicroStation, etc. – See PW347 Annexure A2 paragraph 6.5);
- dxf.format
- pdf (portable document format) format at 300 dpi (dots per inch) minimum (complete drawing as used for construction).

3. PRIMARY DRAWING LAYER SYSTEM

The current NDPW drawing layer system contains a 1000 drawing layers with the primary layer groups as per table A10.1 and the defined layers as per table A10.2

Not all layers have been assigned yet and the consultant needs to assign new layer names for elements not already in the primary layer system. See paragraph 4 below.

All existing work must be shown on layers with names as currently assigned.

All new work (only new work) must be placed on layers created by the consultant (See Section 4 below).

4. LAYERS CREATED BY CONSULTANT

The consultant needs to create new layers for all new work. If the element to be drawn is already defined on the layers system then the consultants shall create a new layer with the WCS number as prefix to the existing layer description (e.g. layer with name "20 mm HDPE Water Line" shall now be extended by creating a new layer with name "WCS3365_20 mm HDPE WATER LINE"

Only new work shall be on layers with the "WCS" number prefix. All existing work shall be indicated on the already defined layers or consultant created layers. If existing elements are not described in the current layer system then the consultant shall add additional layers with a WCS number prefix followed by the word "EXISTING" and then the description of the entity. (e.g. "WCS3365_EXISTING_15 mm HDPE WATER LINE").

5. ELECTRONIC COMPATIBILITY OF DRAWINGS

The GIS software uses lines, circles, polygons and points to define all drawing elements. As such must all "filename.dxf" drawings only contain lines, circles, polygons (closed drawing elements) or points to be compatible for integration into the GIS program. Drawings submitted for incorporation into the GIS must be as simplified as possible.

All lines, circles, points or polygons must be drawn spatially (X, Y position) and dimension wise correct.

In preparing CAD drawings the placing of drawing element attributes (text to describe the element) in addition to the drawing layer name must conform to the following:

- Lines - text origin on line
- Circles - text origin on the centre of circle
- Polygons - text origin in polygon
- Points - text origin on point

All circles or polygons must be closed elements. Circles must consist of one single line. (Test: must be able to delete entire circle as one function.) The hatch function for the majority of cad programmes can be used to ensure polygons are closed entities. Do not submit drawings with hatching. Closing of line ends or T-junctions in lines are best extended by CAD programme "snap to" functions.

If only the layer with the particular item is switch on in the CAD drawing it must only show that element and attributes as a line, closed circle, point or closed polygon.

Any element with a common boundary with another element must be drawn as a closed polygon separate form such other element.

The converting of "filename.dxf" files to "filename.shp" files is the separate transfer of each layer in the CAD environment to a layer in the GIS environment.

Polygons (similar in nature) with a common boundary on the same drawing layer (e.g. stands in township development, geotechnical zoning, land use demarcations etc.) can be drawn with a common boundary provided that each polygon is closed and defined by text attributes with origin of such text inside the polygon.

Polygons that demarcate areas such as geotechnical zones, land use demarcation, pressure zones etc. must be closed at the extent of the area covered by such zoning. A zone with one open side is not defined as a zone.

In preparing drawings, only the dimensions wise correct outline (plan view) of a particular entity must be on the drawing, for example:

- Building - Footprint of building must be defined by a single polygon with no internal lines or connections to other buildings.
- Walkway between buildings – Footprint of walkway defined by a polygon separate from building.
- Storm water canal around building – Dimension correct polygon drawn separate from building even if it shares a common boundary with the building wall.
- Roads – Outline of entire road surface, with similar design (e.g. one polygon to define a bituminous surfaced road and another to define a road with concrete interlocking brick paving even if the one is an extension of the other. The same for parking adjacent to a road.
- Kerbs – Closed polygon with width exactly the same as the kerbs (e.g. 200 mm) for the area of a particular kerb type. The transition to another kerb shall be defined by another polygon.
- Storm water inlet or manhole – Closed polygon or circle exactly to external dimensions of the manhole to be constructed. No covers, cover slabs etc. must be within the polygon that defines the structure. Item such as lids or grids must be drawn on a separate layer that exactly describes such element.
- Sewer manholes – Same as storm water above.
- Sewer gulleys, rodding eyes, inspection eyes, etc. – Circular elements with 200 mm diameter. All different elements on different layers.
- Water valve boxes – Same as storm water manholes.
- Water valves – Circular element not exceeding the diameter of the pipe. Different sizes and types to be on different layers.
- Pumps – Polygon that shows extent of plinth.
- Sewer valves, flow meters, etc – Same as water valves.
- Dams (concrete) – Same as buildings.

- Dams (earth) – to be defined by two polygons. The internal polygon must show the maximum water level surface area. The external polygon must define the toe of the earthworks on the outside slope.
- Pipes – All pipes or circular conduits for water, sewer, fuel, storm water, cables etc. shall be defined as a single line. All lines that define a network such as a water or sewer system shall be on different layers to define various diameters or types but must be drawn with the "snap to end point" function to show a continuous line if all drawing layers are displayed. If a straight pipe of similar diameter enters and exit from a manhole, valve or valve chamber or similar structure shall the line be ended and again be continued at the origin (centre point) of such structure. Similarly shall lines that joins other lines at an angle be joined by means of "snap to middle of line" or "snap to end point" functions. It also applies to lines that converge in a manhole or chamber. No breaks may exist in lines that defines a network.
- Cables – The same as for pipes.
- Rectangular or square service ducts – Must be drawn as a polygon with exact dimensions as the plan view of the duct. Various shapes and sizes to be drawn in different layers.
- Storm water canal – Draw as polygon with dimensions same as plan view of canal. Various types, shapes and lining material to be drawn as separate layers.

The following may not be used:

- Hatching (solid or line)
- Double lines for conduits
- Text boxes with arrows
- Standard drawing symbols such as valves, manholes etc. These symbols can only be placed on drawings other than those submitted for GIS incorporation.
- Leaders or arrows
- Text to show dimensions (element must be drawn exactly to scale)
- Dimensioning text. It is only applicable to drawings not submitted for GIS integration.

Text to describe line elements shall be with text origin on line and be as follows:

- Water pipes (gravity and rising mains)
  - Pipe number or mark
  - Internal diameter in mm:
  - Type
  - Pressure class
  - Type material
  - Design flow per second

  Text attribute notation e.g:

  14 :50mm:HDPE:PN12,5:PE100:D 3 ℓ/s

- Sewer pipes (gravity and rising mains)
  - Pipe number
  - Internal diameter mm:
  - Type
  - Class
  - Material type
  - Slope
  - Design flow in litre/second:
  - Design flow in meter per second

  70% full flow capacity in ℓ/second.

  Text attribute notation e.g:

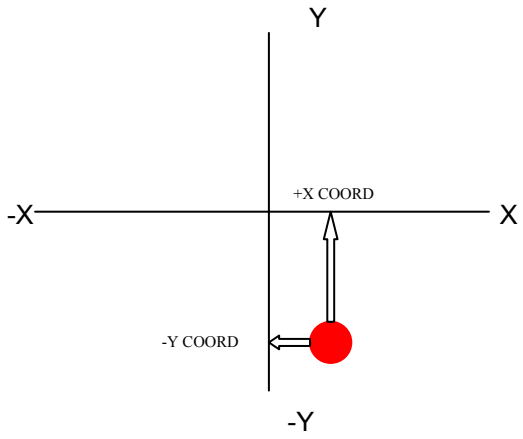
  12 :100mm:HDPE:PN10:PE100:1in50:DQ2 ℓ/s:DF 1,2m/s:FQ 10,6 ℓ/s

- Storm water pipes (Same as sewer pipes)

6. GIS - GEOGRAPHIC COORDINATE SYSTEM

In preparing drawings the following are important:

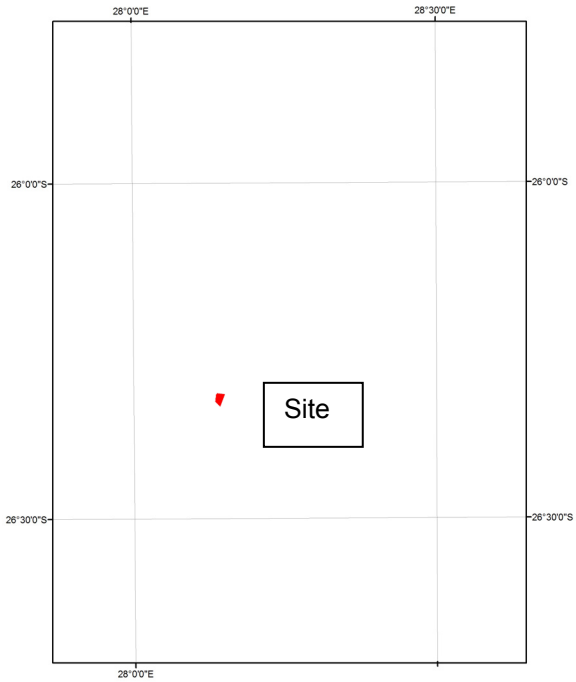
- the way surveyors and the GIS describe coordinates differ.
- the x coordinate supplied by surveyors are the y coordinate in the GIS and the y coordinate supplied by surveyors are the x coordinate in the GIS.
- the GIS defines coordinates as follows:



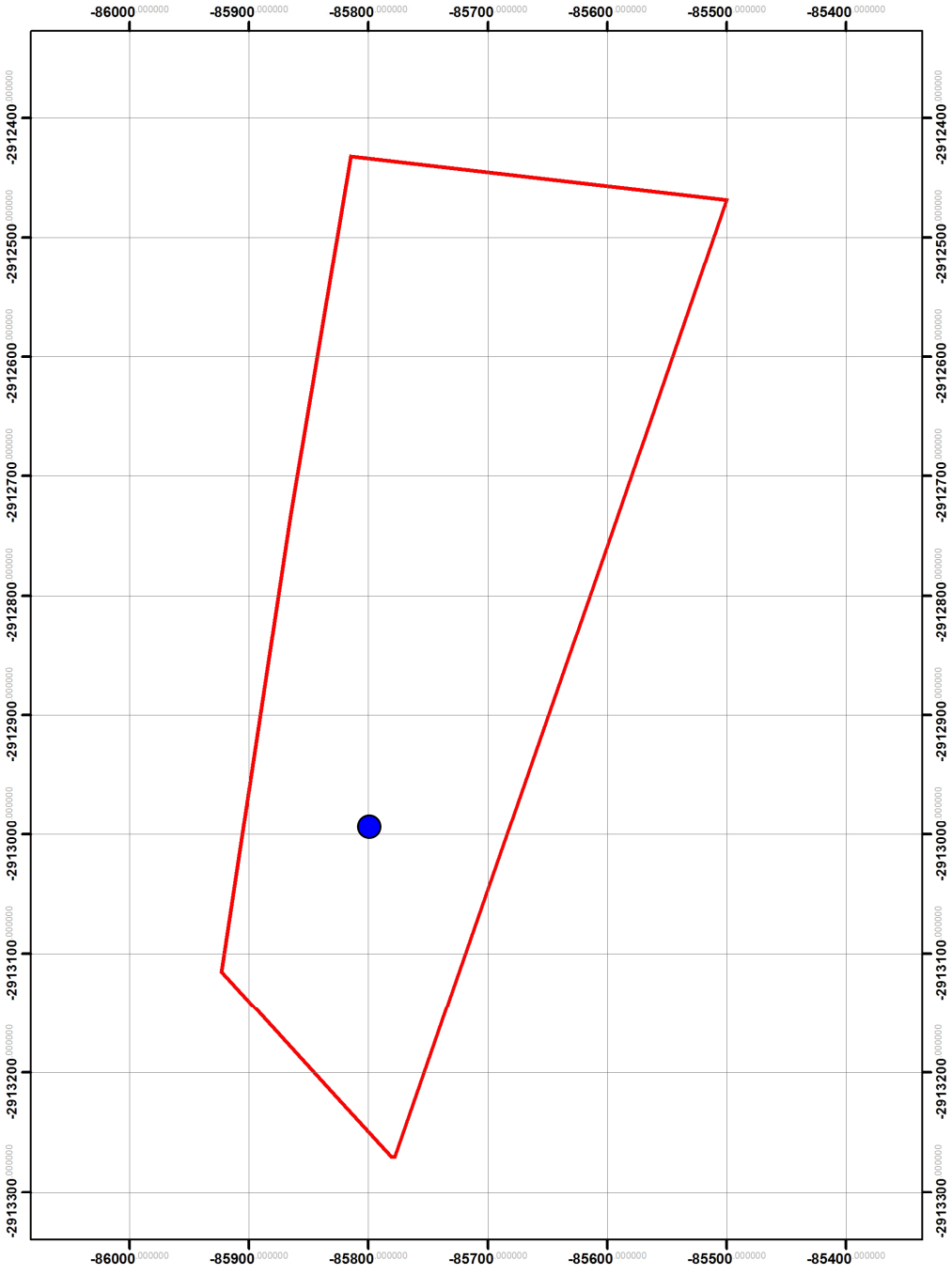
- The dot represents South Africa
- The x-axis represents the equator and the y-axis the Greenwich meridian.
- Vertical lines crossing the x-axis are lines of longitude and horizontal lines crossing the y-axis are lines of latitude
- Because South Africa is east of the Greenwich meridian the x coordinate (longitude) is positive
- Because South Africa is south of the equator the y coordinate (latitude) is negative

7. GIS - PROJECTED COORDINATE SYSTEM

The coordinate notation that defines a site in Transverse Mercator – Central Meridian = 29° (lo 29) can be described as follows:



- The site is located west of 29° longitude and south of the equator, therefore the x and y coordinates will be negative in the Transverse Mercator projection.
- If the site was located east of 29° longitude the x -coordinates would be positive.

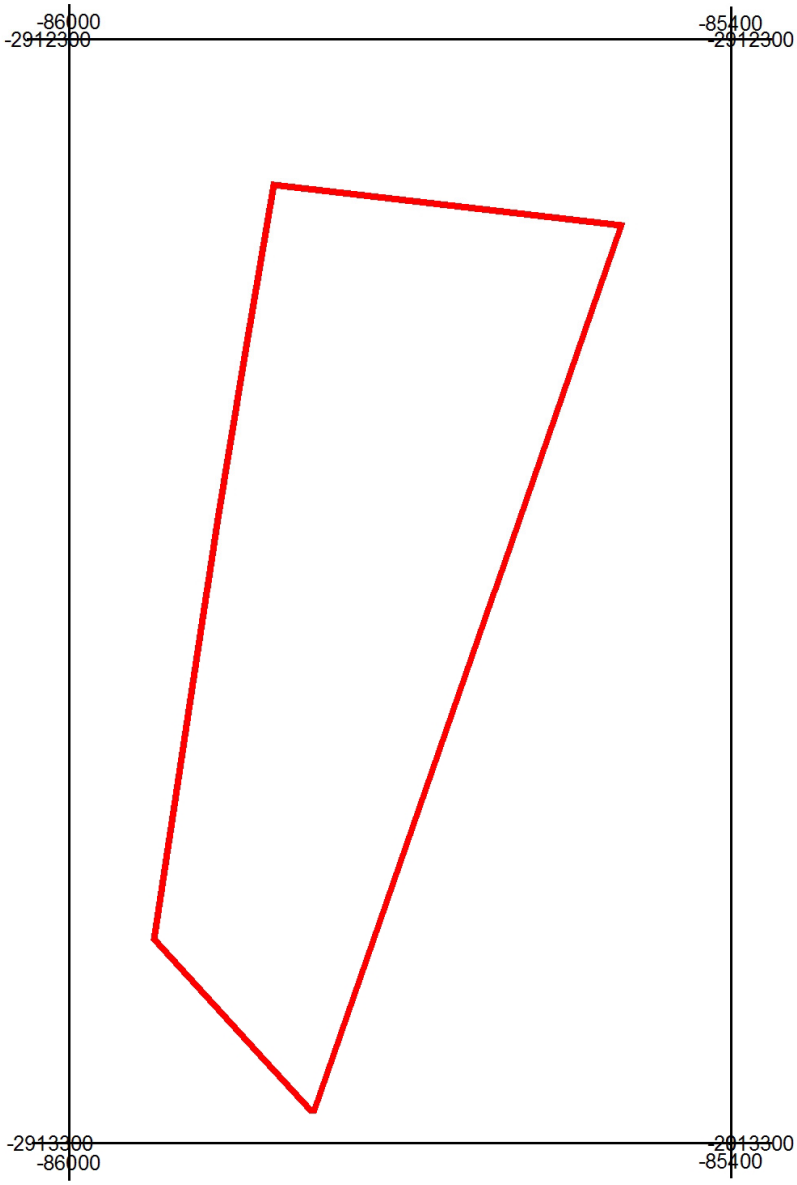


- an example of a coordinate from the picture above would be
  - x-coordinate = - 85 800
  - y-coordinate = - 2 913 000

8. GRID AND GENERAL RULES FOR DRAWINGS TO BE IMPORTED INTO GIS

All drawings submitted by the consultant must be referenced as follow:

- All drawings must be done in a grid block as shown below.
- The grid block must be in a Transverse Mercator (gauss) projection in WGS 84 datum.



- The x and y (coordinate) values must be given on the drawing
- The drawing must not exceed the grid block
- The drawing must be supplied as a “dxf” file format
- Drawing units must be meters
- Only the actual drawing (points, lines and polygons) must be exported to “dxf” format (no title block etc)
- North must always be on the top of the page (no rotation are allowed to make drawing fit on landscape page)
- All drawings must be done on the layer system supplied by NDPW.
- If a layer does not exist for the feature being drawn it must be added as a new layer with a descriptive layer name as previously explained.
- Only one feature per layer allowed (e.g. only 20 mm HDPE pipes are allowed on a specific layer. 25 mm HDPE pipes must be drawn on a different layer.
- All features drawn must be describing by means of text attributes that clearly defines the feature. Length of text depends on CAD program capability (generally less than 250 characters).

- Points, lines and polygons (closed line features) are allowed.
- Line features should be drawn as single lines e.g. only one line must represent a feature i.e. centre line of a pipe.
- The text origin for line features must be placed on the line
- Polygon features should be checked to make sure they are closed.
- No hatching must be used to symbolise polygons – no fill to be used, only the border line of polygon
- Annotation (text) must be placed in the centre of the polygon with the text origin in centre of polygon
- Point features can be drawn as points or circles such as manholes. If circles are used the text origin must be placed in the centre of the circle. For point features the text origin must be placed on the point.
- Circles must be completely closed with no hatching.
- The projection parameters used for the drawing must be supplied as a text document with the "dxf" file.

9. FIELD DATA COLLECTED BY GLOBAL POSITIONING SYSTEM (GPS) OR SURVEYS

In collecting field data with a GPS the following are important:

- Make sure the GPS is set to WGS84 datum before collection of data.
- Collected data to be supplied in "dbf" file format, tab or comma delimited "txt" file.
- Latitude and longitude must be converted to decimal degrees.
- Formula for conversion is as follows:
  degrees + [((minutes*60) + seconds)/3600]
- table columns should contain at least the following fields:
  id = unique identifier
  x-coord = longitude in decimal degrees
  y-coord = latitude in decimal degrees
- Data to be supplied in a geographic coordinate system (latitude, longitude) in WGS84 datum or in a Transverse Mercator (gauss) projection in WGS84 datum
- If a projection is used all projection parameters must be supplied e.g.:
  Projection: Transverse Mercator
  Central meridian = 29°
  Scale factor = 1
  False easting = 0
  False northing = 0
  Datum = Hartebeeshoek 1994 (wgs84)

10. DRAWING FILE NAMES

The file name of a drawing must correspond exactly with the drawing number as well as the WCS number of the project. The file name shall be as follow:

WCS NUMBER_project drawing number_drawing number_Additional drawing notation
e.g.: WCS03215_C3365_25_ PRELIM1. dxf

Please note that all "/,\.(,) or- " in drawing number must be replaced by an underscore "_" in the file name.

The drawings in the consultants CAD format, "dxf" format as well as the "pdf" format with the same information must have exactly the same name.

11. DIGITAL SUBMISSION

Drawings must be submitted on CD (compact disk) with the following requirements:

Cover label of disk (not case) shall contain the following information:

- WCS no.
- Project name

- Date
- Consultant's name
- Regional office
- Town
- General name of site
- Property code of site

12. DRAWING AND TEXT FILE LIST

Drawing lists shall be compiled in Excel ("xls")format with the following headings:

WCS NO	PROJECT TITLE	DICIPLINE	DRAWING NUMBER	DRAWING TITLE	CAD FILE NAME	REGIONAL OFFICE	TOWN	DATE ON DRAWING
WCS NO	**PROJECT TITLE**	**DICIPLINE**	**DRAWING NUMBER**	**DRAWING TITLE**	**TEXT FILE NAME**	**DESCRIPTION OF CONTENT**	**COMPILER NAME**	**DATE**

(Please note the table must not include any merged cells. All cells must be filled irrespective if a column or row has repeatedly the same entry. All "txt" files that give information regarding particular drawing must also be included in the drawing list and shall have the same name as the drawing file.

TABLE A10 .1: PRIMARY DRAWING LAYER GROUPS

DRAWING ELEMENT REFERENCE TYPE GROUPS
TITLE BLOCKS
SITE IDENTIFICATION
DRAWING ORIENTATION
SURVEY
CADASTRAL
TOPO CADASTRAL
TOWNSHIP PLANNING
TOWN PLANNING FLOOD LINES
CONSTRUCTION NOTES
WATER RETICULATION
WATER SOURCE
WATER TREATMENT
WATER MANAGEMENT
SEWER DISPOSAL
SEWER RETICULATION
SEWER TREATMENT
STORMWATER RETICULATION
ROAD DESIGN
ROAD MANAGEMENT
ROAD MARKING
ROAD PAVING
ROAD SIGNS
RUNWAY
WASTE DISPOSAL
ELECTRICAL RETICULATION
ELECTRICAL SUPPLY
COMMUNICATION
FENCING
EARTH WORKS
MECHANICAL
PNEUMATIC
STEAM
RAIL
BUILDING DEMOLISHED
BUILDING ELEMENTS
BUILDING MOBILE
BUILDING REFERENCE
BUILDINGS
BUILDINGS RECREATIONAL
BUILDINGS TEMPORARY
BUILDINGS UTILITY
SPORT FACILITY
GEOTECHNICAL INVESTIGATIONS
ENVIRONMENTAL IMPACT ASSESSMENT

TABLE A10 .2: CAD DRAWING LAYERS ALREADY DEFINED ON NDPD CAD FILE DATABASE

DRAWING ELEMENT REFERENCE TYPE	LAYER NAME	LAYER NO ON DPW CAD FILES
BUILDING DEMOLISHED	CONCRETE BASES	920
BUILDING DEMOLISHED	CONCRETE SLAB REMOVED BUILDING	911
BUILDING DEMOLISHED	DEMOLISHED STRUCTURES	961
BUILDING DEMOLISHED	OLD FOUNDATIONS	912
BUILDING ELEMENTS	FISH POND	933
BUILDING ELEMENTS	FLAG POLES	916
BUILDING ELEMENTS	LOW WALLS	925
BUILDING ELEMENTS	PLANT BOX	960
BUILDING ELEMENTS	RAMPS	921
BUILDING ELEMENTS	RETAINING WALL	930
BUILDING MOBILE	CONTAINERS	957
BUILDING MOBILE	MOBILE ABLUTIONS	935
BUILDING MOBILE	MOBILE UNIT	953
BUILDING MOBILE	MOBILE UNITS	934
BUILDING REFERENCE	BUILDING NAME	908
BUILDING REFERENCE	BUILDING NUMBERS	910
BUILDING REFERENCE	FRN NUMBER	909
BUILDING REFERENCE	STAND NUMBER	940
BUILDINGS	BRIDGE	913
BUILDINGS	BUILDING HANGER LEAN TO	905
BUILDINGS	BUILDINGS	900
BUILDINGS	DAMAGED STRUCTURES INVESTIGATION	936
BUILDINGS	FURNACE	904
BUILDINGS	HANGERS	901
BUILDINGS	KENNEL	914
BUILDINGS	MONUMENTS	926
BUILDINGS	WATCH TOWERS	902
BUILDINGS	CARPORTS WITH ENCLOSING WALLS	942
BUILDINGS RECREATIONAL	LAPA	932
BUILDINGS RECREATIONAL	LAPA	958
BUILDINGS RECREATIONAL	PAVILION	944
BUILDINGS RECREATIONAL	SWIMMING POOLS	903
BUILDINGS TEMPORARY	CANOPY	955
BUILDINGS TEMPORARY	CARPORT	956
BUILDINGS TEMPORARY	TEMPORARY STRUCTURES	931
BUILDINGS UTILITY	FUEL PUMPS	915
BUILDINGS UTILITY	FUEL TANKS	922
BUILDINGS UTILITY	PYLON	907
BUILDINGS UTILITY	SUBSTATION	946
BUILDINGS UTILITY	SUBSTATION	965
BUILDINGS UTILITY	TELEPHONE BOOTH	917
BUILDINGS UTILITY	TRANSFORMER	951
BUILDINGS UTILITY	WATCHTOWER	959
CADASTRAL	ELECTRICAL SERVITUDE	721
CADASTRAL	ERFS	701

DRAWING ELEMENT REFERENCE TYPE	LAYER NAME	LAYER NO ON DPW CAD FILES
CADASTRAL	FARMS	702
CADASTRAL	MAGISTERIAL BOUNDARY	705
CADASTRAL	PROVINCIAL BOUNDARY	706
CADASTRAL	RIGHT OF WAY SERVITUDE	725
CADASTRAL	ROADS SERVITUDE	724
CADASTRAL	SEWER SERVITUDE	723
CADASTRAL	SMALL HOLDINGS	703
CADASTRAL	TOWNS	704
CADASTRAL	WATER SERVITUDE	722
COMMUNICATION	100MM PITCH FIBRE COM CABLE SLEEVE	612
COMMUNICATION	110MM PVC SLEEVE PIPE	613
COMMUNICATION	150MM PVC SLEEVE PIPE	614
COMMUNICATION	50MM COM CABLES	617
COMMUNICATION	75MM COM SLEEVE	611
COMMUNICATION	AERIAL LEVELS	604
COMMUNICATION	AERIAL MAST	600
COMMUNICATION	AERIAL SUPPORT POLES	601
COMMUNICATION	AERIALS	605
COMMUNICATION	CLEARED AREAS AROUND MASTS	603
COMMUNICATION	COM CABLE MANHOLES	620
COMMUNICATION	COMMUNICATION LEVELS	616
COMMUNICATION	COMMUNICATION OVERHEAD	610
COMMUNICATION	COMMUNICATION UNDERGROUND	615
COMMUNICATION	FIBRE H BS POINT	618
COMMUNICATION	FOUNDATIONS MAST	602
COMMUNICATION	IDF OR DF POINT	619
COMMUNICATION	SERVICE MARKER COMMUNICATION	621
COMMUNICATION	SERVICE MARKER DATA CABLES	622
COMMUNICATION	SERVICE MARKER TELCOM	623
COMMUNICATION	TELKOM MANHOLE	609
COMMUNICATION	TELKOM OVERHEAD	606
COMMUNICATION	TELKOM POLES	608
COMMUNICATION	TELKOM UNDERGROUND	607
CONSTRUCTION NOTES	GENERAL CONSTRUCTION NOTES	7
CONSTRUCTION NOTES	SPECIFIC CONSTRUCTION NOTES	8
DRAWING ORIENTATION	BOUNDARY OF LOCALITY MAP	4
DRAWING ORIENTATION	BOUNDARY OF PLANNED WORKS	5
DRAWING ORIENTATION	COORDINATE SYSTEM DEFINITION	69
DRAWING ORIENTATION	GRIDS X AND Y AS WELL AS GRID TEXT	67
DRAWING ORIENTATION	KEY PLANS	6
DRAWING ORIENTATION	NORTH INDICATOR	65
DRAWING ORIENTATION	PRIMARY SITE BOUNDARY INDICATION	3
DRAWING ORIENTATION	SCALE REFERENCE AND TEXT	66
DRAWING ORIENTATION	TRIG BEACON REFERENCING	68
EARTH WORKS	BULK EARTH WORKS	80
ENVIRONMENTAL IMPACT ASSESSMENT	AREAS FOR NORMAL DEVELOPMENT	743
ENVIRONMENTAL IMPACT ASSESSMENT	BIOSPHERE ZONES	747
ENVIRONMENTAL IMPACT ASSESSMENT	BOUNDARY OF INVESTIGATION AREAS	741

DRAWING ELEMENT REFERENCE TYPE	LAYER NAME	LAYER NO ON DPW CAD FILES
ENVIRONMENTAL IMPACT ASSESSMENT	ECHO SYSTEM BOUNDARIES	745
ENVIRONMENTAL IMPACT ASSESSMENT	ENVIRONMENTAL IMPACT ASSESSMENT NOTE	740
ENVIRONMENTAL IMPACT ASSESSMENT	FAUNA AND FLORA PROTECTED AREAS	744
ENVIRONMENTAL IMPACT ASSESSMENT	HERITAGE SITES	748
ENVIRONMENTAL IMPACT ASSESSMENT	SANCTUARIES	746
ENVIRONMENTAL IMPACT ASSESSMENT	SENSITIVE AREAS TO BE EXCLUDED FROM DEVELOPMENT	742
ELECTRICAL RETICULATION	ELECTRICAL LEVELS	655
ELECTRICAL RETICULATION	ELECTRICAL MANHOLES	656
ELECTRICAL RETICULATION	ELECTRICAL SERVICES OVERHEAD	651
ELECTRICAL RETICULATION	ELECTRICAL SERVICES UNDERGROUND	652
ELECTRICAL RETICULATION	ELECTRICAL SLEEVES	650
ELECTRICAL RETICULATION	LAMP POLES	653
ELECTRICAL RETICULATION	POLE	654
ELECTRICAL RETICULATION	SERVICE MARKER ELECTRICAL	661
ELECTRICAL RETICULATION	SUBSTATION NOT BUILDING	659
ELECTRICAL SUPPLY	GENERATOR	657
ELECTRICAL SUPPLY	MUNICIPAL CONNECTION	658
ELECTRICAL SUPPLY	UPS PLANT	660
FENCING	CONCRETE GUNNITE FENCING	803
FENCING	CONCRETE PALISADE FENCING	802
FENCING	GATES PEDESTRIAN	820
FENCING	GATES VEHICLE	821
FENCING	PRECAST CONCRETE FENCING	805
FENCING	STEEL FENCING 1,2 M DIAMOND MESH	800
FENCING	STEEL FENCING 2,4 M DIAMOND MESH	801
FENCING	STEEL PALISADE FENCING	804
GEOTECHNICAL INVESTIGATIONS	ABANDONED LAND AS RESULT OF MINING	521
GEOTECHNICAL INVESTIGATIONS	AUGER HOLE	523
GEOTECHNICAL INVESTIGATIONS	BOREHOLES	501
GEOTECHNICAL INVESTIGATIONS	CORE DRILLING HOLES	524
GEOTECHNICAL INVESTIGATIONS	DOLINES	503
GEOTECHNICAL INVESTIGATIONS	FILE REFERENCE	509
GEOTECHNICAL INVESTIGATIONS	GEOLOGICAL AREA'S	513
GEOTECHNICAL INVESTIGATIONS	GEOLOGICAL INVESTIGATIONS	508
GEOTECHNICAL INVESTIGATIONS	GEOTECHNICAL ZONES AND DESCRIPTION	522
GEOTECHNICAL INVESTIGATIONS	GRAVITY BOUNDARIES	502
GEOTECHNICAL INVESTIGATIONS	GRAVITY CONTOURS	505
GEOTECHNICAL INVESTIGATIONS	GRAVITY POINTS	506
GEOTECHNICAL INVESTIGATIONS	GROUND WATER CONTOURS	520
GEOTECHNICAL INVESTIGATIONS	GROUND WATER LEVELS	519
GEOTECHNICAL INVESTIGATIONS	NOTES	510
GEOTECHNICAL INVESTIGATIONS	REPORT AREAS	512
GEOTECHNICAL INVESTIGATIONS	RISK ZONES	504
GEOTECHNICAL INVESTIGATIONS	SCANNED IMAGES	514

DRAWING ELEMENT REFERENCE TYPE	LAYER NAME	LAYER NO ON DPW CAD FILES
GEOTECHNICAL INVESTIGATIONS	SINKHOLES	500
GEOTECHNICAL INVESTIGATIONS	TEST PITS	516
GEOTECHNICAL INVESTIGATIONS	UNDER MINING	517
GEOTECHNICAL INVESTIGATIONS	WATER COMPARTMENTS	518
MECHANICAL	CRANES	860
PNEUMATIC	AIR TANKS	882
PNEUMATIC	COMPRESSOR	881
PNEUMATIC	PNEUMATIC PIPES	880
RAIL	PROPOSED RAILWAY LINE	412
ROAD DESIGN	ROAD CENTER LINE, CHAINAGE AND LEVEL	419
ROAD DESIGN	ROAD GRADIENTS	420
ROAD DESIGN	ROAD SIGHT DISTANCE	422
ROAD DESIGN	ROAD VERTICAL CURVES	421
ROAD MANAGEMENT	TRAFFIC CONFLICT NODES	441
ROAD MANAGEMENT	TRAFFIC FLOW DIRECTION INDICATORS	439
ROAD MANAGEMENT	TRAFFIC FLOW VOLUMES	440
ROAD MARKING	BOLLARDS	445
ROAD MARKING	ROAD MARKING BLUE (100 MM WIDE)	437
ROAD MARKING	ROAD MARKING RED (100 MM WIDE)	436
ROAD MARKING	ROAD MARKING WHITE (100 MM WIDE)	435
ROAD MARKING	ROAD MARKING YELLOW (100 MM WIDE)	438
ROAD PAVING	COVERED WALKWAY	416
ROAD PAVING	ENTRANCE ROADS	401
ROAD PAVING	FOOT PATHS	407
ROAD PAVING	GRAVEL ROADS	402
ROAD PAVING	KERBS	403
ROAD PAVING	MAIN ROAD	400
ROAD PAVING	PARKING BITUMINOUS	424
ROAD PAVING	PARKING CONCRETE	425
ROAD PAVING	PARKING EARTH	428
ROAD PAVING	PARKING GRASS	426
ROAD PAVING	PARKING GRAVEL	427
ROAD PAVING	PARKING INTERLOCKING PAVING	423
ROAD PAVING	PAVING	404
ROAD PAVING	PEDESTRIAN CROSSING	418
ROAD PAVING	PEDESTRIAN WALKWAY BITUMINOUS	430
ROAD PAVING	PEDESTRIAN WALKWAY CONCRETE	429
ROAD PAVING	PEDESTRIAN WALKWAY EARTH	432
ROAD PAVING	PEDESTRIAN WALKWAY GRAVEL	431
ROAD PAVING	PEDESTRIAN WALKWAY PAVING CLAY BRICK	433
ROAD PAVING	PEDESTRIAN WALKWAY PAVING CONCRETE BRICK	434
ROAD PAVING	PROPOSED NEW ROADS	413
ROAD PAVING	RELATED DRAWINGS	417
ROAD PAVING	ROAD PAVING KERB LEVELS	405
ROAD PAVING	TRAIN TRACKS	406

DRAWING ELEMENT REFERENCE TYPE	LAYER NAME	LAYER NO ON DPW CAD FILES
ROAD SIGNS	FILE REFERENCE	409
ROAD SIGNS	BOARDS	443
ROAD SIGNS	NOTES	410
ROAD SIGNS	ROAD NAMES	408
ROAD SIGNS	ROAD REFERENCE MARKER	444
ROAD SIGNS	ROAD SIGN BOARDS	414
ROAD SIGNS	ROBOTS	411
ROAD SIGNS	SIGNS	442
ROAD SIGNS	STREET POLES	415
RUNWAY	ARRESTOR NET	456
RUNWAY	HARD STANDS	453
RUNWAY	RUNWAY LIGHTS	454
RUNWAY	TAXI WAY	451
RUNWAY	TURN CIRCLES	452
RUNWAY	WIND SOCK	455
RUNWAY	RUNWAYS	450
RUNWAYS	HELIPAD	457
SEWER DISPOSAL	MUNICIPAL SEWER MAIN	200
SEWER RETICULATION	110MM CLAY PIPE	229
SEWER RETICULATION	110MM HDPE PIPE	217
SEWER RETICULATION	110MM UNKNOWN PIPE TYPE	248
SEWER RETICULATION	110MM UPVC PIPE	218
SEWER RETICULATION	150MM AC PIPE	214
SEWER RETICULATION	160MM CLAY PIPE	230
SEWER RETICULATION	160MM HDPE PIPE	213
SEWER RETICULATION	160MM UNKNOWN PIPE TYPE	245
SEWER RETICULATION	160MM UPVC PIPE	212
SEWER RETICULATION	200MM AC PIPE	210
SEWER RETICULATION	200MM CLAY PIPE	231
SEWER RETICULATION	200MM HDPE SEWER	250
SEWER RETICULATION	200MM UNKNOWN PIPE TYPE	247
SEWER RETICULATION	250MM CLAY PIPE	244
SEWER RETICULATION	250MM UNKNOWN PIPE TYPE	239
SEWER RETICULATION	300MM AC PIPE	235
SEWER RETICULATION	300MM CLAY PIPE	234
SEWER RETICULATION	300MM HDPE PIPE	232
SEWER RETICULATION	300MM UNKNOWN PIPE TYPE	246
SEWER RETICULATION	300MM UPVC PIPE	233
SEWER RETICULATION	375MM CLAY PIPE	243
SEWER RETICULATION	75MM AC PIPE	220
SEWER RETICULATION	75MM PVC PIPE	241
SEWER RETICULATION	90MM UNKNOWN PIPE TYPE	249
SEWER RETICULATION	CE AND IE	227
SEWER RETICULATION	CONCRETE SEWER MANHOLES	203
SEWER RETICULATION	CONSERVANCY TANK	208
SEWER RETICULATION	CONTROL CHAMBER	222
SEWER RETICULATION	END CAP	228
SEWER RETICULATION	EXTERNAL SEWER LAYOUT	201
SEWER RETICULATION	GENERAL TEXT	225
SEWER RETICULATION	GREASE TRAP	252
SEWER RETICULATION	GULLEY	204
SEWER RETICULATION	HDPE MANHOLES	238

DRAWING ELEMENT REFERENCE TYPE	LAYER NAME	LAYER NO ON DPW CAD FILES
SEWER RETICULATION	INTERNAL SEWER LAYOUT	202
SEWER RETICULATION	OIL PITS	207
SEWER RETICULATION	OLD SYSTEM REMOVED	236
SEWER RETICULATION	PIPE CAST IN CONCRETE	237
SEWER RETICULATION	PIPES CAMERA INSPECTED	226
SEWER RETICULATION	PIT LATRINES	257
SEWER RETICULATION	PUMP LINE	242
SEWER RETICULATION	PUMP STATION	221
SEWER RETICULATION	RELATED DRAWINGS SEWER	251
SEWER RETICULATION	SEPTIC TANKS	206
SEWER RETICULATION	SERVICE MARKER SEWER	254
SEWER RETICULATION	SEWER DAMAGED PIPE	224
SEWER RETICULATION	SEWER LEVELS	205
SEWER RETICULATION	SEWER SLEEVE PIPE	223
SEWER TREATMENT	BIOFILTERS	260
SEWER TREATMENT	CLARIFIERS	259
SEWER TREATMENT	DIGESTERS	264
SEWER TREATMENT	EVAPORATION PONDS	263
SEWER TREATMENT	HUMUS TANKS	261
SEWER TREATMENT	MACERATORS	266
SEWER TREATMENT	MATURATION PONDS	262
SEWER TREATMENT	PRIMARY SETTLEMENT UNIT	258
SEWER TREATMENT	PUMP CHAMBERS NOT BUILDINGS	265
SEWER TREATMENT	SEWERAGE PRIMARY SCREENING UNIT	267
SITE IDENTIFICATION	CORRECTIONAL FACILITY	9
SITE IDENTIFICATION	JUSTICE BUILDING	10
SITE IDENTIFICATION	MILITARY UNITS	7
SITE IDENTIFICATION	POLICE STATION	8
SPORT FACILITY	GOLF GREENS	941
SPORT FACILITY	PARADE GROUND	924
SPORT FACILITY	SPORT GROUNDS RUGBY, TENNIS, CRICKET	906
SPORT FACILITY	SPORT FIELD	963
STEAM	STEAM PIPES	840
STEAM	STEAM PLANT	841
STORMWATER RETICULATION	1000MM AC SW PIPE	365
STORMWATER RETICULATION	1000MM DIA UNKNOWN TYPE	379
STORMWATER RETICULATION	1000MM HDPE PIPE	331
STORMWATER RETICULATION	1000MM WIDE CON CHANNEL	385
STORMWATER RETICULATION	100MM DIA UNKNOWN TYPE	377
STORMWATER RETICULATION	1050MM CONCRETE PIPE	325
STORMWATER RETICULATION	110MM AC PIPE	361
STORMWATER RETICULATION	110MM STEEL PIPE	357
STORMWATER RETICULATION	110MM UPVC PIPE	312
STORMWATER RETICULATION	1200MM CONCRETE PIPE	326
STORMWATER RETICULATION	1200MM WIDE CON CHANNEL	336
STORMWATER RETICULATION	1300MM DIA UNKNOWN TYPE	370
STORMWATER RETICULATION	1300MMAC PIPE	366
STORMWATER RETICULATION	1350MM CONCRETE PIPE	327
STORMWATER RETICULATION	1500MM CON PIPE	348
STORMWATER RETICULATION	1500MM WIDE CON CHANNEL	386

DRAWING ELEMENT REFERENCE TYPE	LAYER NAME	LAYER NO ON DPW CAD FILES
STORMWATER RETICULATION	150MM AC PIPE	313
STORMWATER RETICULATION	160MM AC SW PIPE	367
STORMWATER RETICULATION	160MM DIA UNKNOWN TYPE	380
STORMWATER RETICULATION	160MM UPVC PIPE	355
STORMWATER RETICULATION	1700MM WIDE CON CHANNEL	335
STORMWATER RETICULATION	1800MM CON PIPE	349
STORMWATER RETICULATION	2000MM DIA UNKNOWN TYPE	369
STORMWATER RETICULATION	2000MM ROUND CHANNEL	347
STORMWATER RETICULATION	2000MM WIDE CON CHANNEL	334
STORMWATER RETICULATION	200MM AC PIPE	314
STORMWATER RETICULATION	200MM DIA AC PIPE	383
STORMWATER RETICULATION	200MM DIA CLAY PIPE	387
STORMWATER RETICULATION	200MM DIA UNKNOWN TYPE	374
STORMWATER RETICULATION	200MM UPVC PIPE	356
STORMWATER RETICULATION	250MM AC PIPE	315
STORMWATER RETICULATION	250MM DIA UNKNOWN TYPE	378
STORMWATER RETICULATION	3000MM WIDE CON CHANNEL	333
STORMWATER RETICULATION	300MM AC PIPE	351
STORMWATER RETICULATION	300MM CONCRETE PIPE	316
STORMWATER RETICULATION	300MM DIA UNKNOWN TYPE	372
STORMWATER RETICULATION	300MM HDPE PIPE	328
STORMWATER RETICULATION	300MM WIDE CON CHANNEL	338
STORMWATER RETICULATION	350MM AC PIPE	350
STORMWATER RETICULATION	350MM DIA UNKNOWN TYPE	381
STORMWATER RETICULATION	375MM CONCRETE PIPE	317
STORMWATER RETICULATION	400MM AC PIPE	358
STORMWATER RETICULATION	400MM DIA UNKNOWN TYPE	371
STORMWATER RETICULATION	450MM AC SW PIPE	364
STORMWATER RETICULATION	450MM CONCRETE PIPE	318
STORMWATER RETICULATION	450MM HDPE PIPE	329
STORMWATER RETICULATION	4900MM WIDE CON CHANNEL	332
STORMWATER RETICULATION	500MM AC PIPE	352
STORMWATER RETICULATION	500MM DIA UNKNOWN TYPE	375
STORMWATER RETICULATION	500MM WIDE CON CHANNEL	384
STORMWATER RETICULATION	525MM CONCRETE PIPE	319
STORMWATER RETICULATION	550MM HDPE PIPE	330
STORMWATER RETICULATION	600MM AC PIPE	353
STORMWATER RETICULATION	600MM CONCRETE PIPE	320
STORMWATER RETICULATION	600MM DIA PVC PIPE	382
STORMWATER RETICULATION	600MM DIA UNKNOWN TYPE	376
STORMWATER RETICULATION	675MM CONCRETE PIPE	321
STORMWATER RETICULATION	750MM CONCRETE PIPE	322
STORMWATER RETICULATION	750MM WIDE CON CHANNEL	337
STORMWATER RETICULATION	75MM DIA AC PIPE	389
STORMWATER RETICULATION	800MM AC PIPE	354
STORMWATER RETICULATION	800MM DIA UNKNOWN TYPE	373
STORMWATER RETICULATION	825MM CONCRETE PIPE	323
STORMWATER RETICULATION	900MM CONCRETE PIPE	324
STORMWATER RETICULATION	CAMERA INSPECTION	341
STORMWATER RETICULATION	CATCH PITS	302
STORMWATER RETICULATION	DAMAGED SECTIONS	346

DRAWING ELEMENT REFERENCE TYPE	LAYER NAME	LAYER NO ON DPW CAD FILES
STORMWATER RETICULATION	EARTH CHANNELS	306
STORMWATER RETICULATION	EARTH DRAIN	307
STORMWATER RETICULATION	GENERAL TEXT	345
STORMWATER RETICULATION	GRID INLET	309
STORMWATER RETICULATION	HEAD WALLS	303
STORMWATER RETICULATION	KERB INLETS	339
STORMWATER RETICULATION	OPEN CHANNELS	304
STORMWATER RETICULATION	OUTLETS WALLS , FENCES	342
STORMWATER RETICULATION	PIPES	311
STORMWATER RETICULATION	PIT	308
STORMWATER RETICULATION	PONDING WATER	344
STORMWATER RETICULATION	RELATED DRAWINGS STORMWATER	388
STORMWATER RETICULATION	REMOVED SYSTEMS	359
STORMWATER RETICULATION	ROCK FILL	368
STORMWATER RETICULATION	SERVICE DUCTS, SHAFTS AND SLEEVES	340
STORMWATER RETICULATION	SERVICE MARKER STORMWATER	391
STORMWATER RETICULATION	STILLING BASINS	360
STORMWATER RETICULATION	STORMWATER LAYOUT	300
STORMWATER RETICULATION	STORMWATER LEVELS	305
STORMWATER RETICULATION	STORMWATER MANHOLE	301
STORMWATER RETICULATION	STORMWATER SUMPS	310
STORMWATER RETICULATION	SURFACE BREAKING UP	343
STORMWATER RETICULATION	UNCONFIRMED SW LAYOUT	362
STORMWATER RETICULATION	UNCONFIRMED SW MANHOLE	363
SURVEY	CONTOURS	71
SURVEY	NEWLY PLACED SURVEY STATIONS FOR PROJECT	74
SURVEY	SPOT LEVELS	70
SURVEY	SURVEY STATIONS NOT ON SITE EXISTING	73
SURVEY	SURVEY STATIONS ON SITE EXISTING	72
TITLE BLOCKS	NOTES	2
TITLE BLOCKS	TITLE BLOCK	1
TOPO CADASTRAL	DRAINAGE PATHS MAJOR	789
TOPO CADASTRAL	DRAINAGE PATHS MINOR	790
TOPO CADASTRAL	RIVERS	787
TOPO CADASTRAL	STREAMS	788
TOWN PLANNING FLOOD LINES	1:10 YEAR FLOOD LINE	783
TOWN PLANNING FLOOD LINES	1:100 YEAR FLOOD LINE	786
TOWN PLANNING FLOOD LINES	1:2 YEAR FLOOD LINE	781
TOWN PLANNING FLOOD LINES	1:20 YEAR FLOOD LINE	784
TOWN PLANNING FLOOD LINES	1:5 YEAR FLOOD LINE	782
TOWN PLANNING FLOOD LINES	1:50 YEAR FLOOD LINE	785
TOWN PLANNING FLOOD LINES	FLOOD LINES	780
TOWNSHIP PLANNING	ANTICIPATED FUTURE LAND USE	767
TOWNSHIP PLANNING	AREAS NOT TO BE DEVELOPED	765
TOWNSHIP PLANNING	FUTURE DEVELOPMENT AREAS	766
TOWNSHIP PLANNING	LAND USE PLANNING	760
TOWNSHIP PLANNING	OFFICE ZONES	763
TOWNSHIP PLANNING	RECREATIONAL ZONES	762
TOWNSHIP PLANNING	RESIDENTIAL ZONES	761

DRAWING ELEMENT REFERENCE TYPE	LAYER NAME	LAYER NO ON DPW CAD FILES
TOWNSHIP PLANNING	WORKSHOP AND TECHNICAL RELATED AREAS	764
WASTE DISPOSAL	LANDFILL UNITS	281
WASTE DISPOSAL	SOLID WASTE DISPOSAL	282
WASTE DISPOSAL	WASTE DISPOSAL SITE BOUNDARY	280
WATER MANAGEMENT	WATER PRESSURE ZONES	187
WATER RETICULATION	100MM AC PIPE	114
WATER RETICULATION	100MM STEEL OVERHEAD PIPES	161
WATER RETICULATION	100MM STEEL PIPE	124
WATER RETICULATION	110MM HDPE CLASS 12	151
WATER RETICULATION	110MM PVC PIPE	131
WATER RETICULATION	150MM AC PIPE	115
WATER RETICULATION	150MM STEEL OVERHEAD PIPES	145
WATER RETICULATION	150MM STEEL PIPE	125
WATER RETICULATION	15MM STEEL PIPE	117
WATER RETICULATION	160MM HDPE CLASS 12	152
WATER RETICULATION	160MM PVC PIPE	132
WATER RETICULATION	200MM AC PIPE	116
WATER RETICULATION	200MM HDPE CLASS 12	153
WATER RETICULATION	200MM PVC PIPE	147
WATER RETICULATION	200MM STEEL PIPE	126
WATER RETICULATION	20MM HDPE WATER LINE	176
WATER RETICULATION	20MM STEEL PIPE	118
WATER RETICULATION	225MM AC WATER PIPE	168
WATER RETICULATION	225MM STEEL PIPE	166
WATER RETICULATION	250MM AC PIPE	133
WATER RETICULATION	250MM STEEL PIPE	127
WATER RETICULATION	25MM AC PIPE	134
WATER RETICULATION	25MM GI STEEL OVERHEAD	156
WATER RETICULATION	25MM HDPE WATER LINE	177
WATER RETICULATION	25MM STEEL PIPE	119
WATER RETICULATION	280MM HDPE CLASS 12	154
WATER RETICULATION	280MM HDPE SLEEVE PIPE CLASS 6	155
WATER RETICULATION	300MM AC WATER PIPE	167
WATER RETICULATION	32MM AC PIPE	135
WATER RETICULATION	32MM GI STEEL OVERHEAD	157
WATER RETICULATION	32MM HDPE WATER LINE	180
WATER RETICULATION	32MM STEEL PIPE	120
WATER RETICULATION	350MM AC WATER PIPES	142
WATER RETICULATION	375MM AC WATER PIPE	169
WATER RETICULATION	40MM HDPE WATER LINE	178
WATER RETICULATION	40MM PVC PIPE	164
WATER RETICULATION	40MM STEEL PIPE	121
WATER RETICULATION	50MM AC WATER PIPES	143
WATER RETICULATION	50MM HDPE CLASS 12	149
WATER RETICULATION	50MM PVC PIPE	165
WATER RETICULATION	50MM STEEL OVERHEAD PIPES	159
WATER RETICULATION	50MM STEEL PIPE	122
WATER RETICULATION	75MM AC PIPE	113
WATER RETICULATION	75MM AC WATER PIPES	144
WATER RETICULATION	75MM STEEL WATER PIPES	146

DRAWING ELEMENT REFERENCE TYPE	LAYER NAME	LAYER NO ON DPW CAD FILES
WATER RETICULATION	80MM HDPE CLASS 12	162
WATER RETICULATION	80MM STEEL OVERHEAD PIPES	160
WATER RETICULATION	80MM STEEL PIPE	123
WATER RETICULATION	90MM UPVC WATER PIPE	179
WATER RETICULATION	DUCTS AND SLEEVES	129
WATER RETICULATION	ELEVATED TOWERS	148
WATER RETICULATION	END CAP	136
WATER RETICULATION	EXTERNAL WATER LAYOUT UNKNOWN PIPE	103
WATER RETICULATION	FIRE HOSE REELS	90
WATER RETICULATION	FIRE HYDRANT	91
WATER RETICULATION	FIRE HYDRANTS	141
WATER RETICULATION	FIRE MAINS	183
WATER RETICULATION	GARDEN STAND PIPE	181
WATER RETICULATION	GATE VALVE	110
WATER RETICULATION	GENERAL TEXT	139
WATER RETICULATION	INTERNAL WATER LAYOUT	102
WATER RETICULATION	MAIN VALVE BOOSTER PUMPS	111
WATER RETICULATION	MANHOLE WATER	101
WATER RETICULATION	OLD REMOVED SYSTEMS	158
WATER RETICULATION	PIPES ABOVE NGL	138
WATER RETICULATION	PIPING ABOVE NGL	130
WATER RETICULATION	REDUCER	140
WATER RETICULATION	SERVICE MARKER WATER	182
WATER RETICULATION	SLEEVE PIPES	137
WATER RETICULATION	STOP TAP	107
WATER RETICULATION	STOP VALVE	109
WATER RETICULATION	TAPS	106
WATER RETICULATION	UNCONFIRMED WATER LAYOUT	150
WATER RETICULATION	UNKNOWN PIPE	163
WATER RETICULATION	VALVE BOX	128
WATER RETICULATION	WATER LAYOUT LEVELS	105
WATER RETICULATION	WATER METER	112
WATER RETICULATION	WATER PUMP	108
WATER RETICULATION	WATER TANKS	104
WATER SOURCE	BOREHOLE AND CAPACITY	185
WATER SOURCE	BOREHOLE PUMP	186
WATER SOURCE	BOREHOLES	184
WATER SOURCE	CLAY LINED DAMS OR PONDS	199
WATER SOURCE	CONCRETE DAM WALL	196
WATER SOURCE	CONCRETE DAMS	195
WATER SOURCE	EARTH DAM	197
WATER SOURCE	EARTH DAM WALL	198
WATER SOURCE	LINED DAMS OR PONDS	170
WATER SOURCE	MAIN WATER FEED AREA	172
WATER SOURCE	MUNICIPAL MAIN WATER SUPPLY	100
WATER SOURCE	MUNICIPAL WATER CONNECTION	171
WATER SOURCE	MUNICIPAL WATER RESERVOIRS	189
WATER SOURCE	POTENTIAL WATER SOURCES	188
WATER SOURCE	PRIVATE BOREHOLES	193
WATER SOURCE	PRIVATE DAMS	192

DRAWING ELEMENT REFERENCE TYPE	LAYER NAME	LAYER NO ON DPW CAD FILES
WATER SOURCE	RESERVOIR	175
WATER SOURCE	WATER BOARD DAMS	191
WATER SOURCE	WATER BOARD PIPES	190
WATER SOURCE	WATER POINTS AT RIVERS	194
WATER TREATMENT	CLARIFIERS	92
WATER TREATMENT	DOSING UNITS	93
WATER TREATMENT	PUMP STATIONS OTHER THAN BUILDING	94
WATER TREATMENT	SAND FILTERS	95
WATER TREATMENT	SETTLEMENT UNITS	174
WATER TREATMENT	WATER PURIFICATION PLANT BOUNDARY	173

APPENDIX 11

SUBMISSION OF DRAWINGS IN ELECTRONIC FORMAT FOR CENTRALISED DRAWING ARCHIVE.

NATIONAL DEPARTMENT OF PUBLIC WORKS

CENTRALISED **DRAWING ARCHIVE**

AS-BUILT DRAWING REQUIREMENTS

HARD COPY

a) POLYESTER FILM OF MINIMUM O.08mm THICKNESS
b) "A" SIZE FORMAT SHEETS
c) DRAWINGS ARE TO BE TO SCALE
d) INFORMATION IS TO BE CLEAR AND LEGIBLE
e) EACH SHEET TO BE CLEARLY MARKED "AS-BUILT"
f) EACH SHEET TO BE SIGNED BY THE RESPECTIVE PROFESSIONAL WITH THE REGISTRATION NUMBER CLEARLY INDICATED THEREON
g) ALL RELEVANT INFORMATION ON TITLE BLOCKS TO BE FULLY AND CORRECTLY COMPLETED i.e. DATE, WCS No, TITLE, SERVICE etc
h) INCLUDE A LOCALITY PLAN WHERE APPLICABLE

i)

ELECTRONIC FORMAT

a) ALL DRAWINGS ARE TO BE STORED ONTO STANDARD SIZE COMPACT DISKS
b) DRAWINGS TO BE STORED IN NORMAL C.A.D. FORMAT IN ADDITION IS REQUIRED IN DXF, PDF, AND TIFF FORMAT TO FACILITATE USE IN VARIOUS SOFTWARE APPLICATIONS (SEPARATE DISKS ARE PREFERRED)
c) THE FOLLOWING INFORMATION IS TO BE CLEARLY PRINTED ON THE PRINTABLE SIDE OF THE COMPACT DISKS IN STRICT ACCORDANCE WITH MANUFACTURE'S SPECIFICATIONS (NO "STICK ONS","PRITT" etc)
    - FACILITY NAME
    - SERVICE/PROJECT NAME
    - CONSULTANT FIRM NAME, TEL No, ADDRESS AND CONTACT PERSON NAME
    - WCS and/or REFERENCE NUMBER
    - THE NUMBER OF THE DISK (e.g. DISK 01 OF 02)
    - THE TYPE OF DISCIPLINE e.g. ARCHITECTURAL, CIVIL etc
    - THE NAME AND VERSION OF THE C.A.D. PROGRAMME USED TO PRODUCE THE DRAWINGS e.g. CADDIE 10 or AUTOCAD 2006
d) THE DISK IS TO BE PRESENTED IN A SUITABLE COVER
e) THE COVER MUST CONTAIN A CLEARLY PRINTED LIST OF THE DRAWINGS AS SAVED ON THE RESPECTIVE COMPACT DISK

APPENDIX 12

APPENDIX 12

DOLOMITE STATUS CERTIFICATE (PRM 011A)

The Principal Agent of each upgrading, repair, maintenance or new capital project must ensure that the preliminary design report of each Consultant contains a signed copy of the Dolomite Status Certificate.

public works
Department:
Public Works
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF PUBLIC WORKS

PRM 11A

DOLOMITE RISK MANAGEMENT SYSTEM

DOLOMITE STATUS CERTIFICATE

PROVINCE						
NDPW REGIONAL OFFICE		HO REF		FILE REF		
MAGISTERIAL DISTRICT						
DISTRICT COUNCIL						
LOCAL MUNICIPALITY						
SUBURB						
TOWN/SUBURB EXTENTION NO						
SITE DESCRIPTION/NAME AND SUB-PORTION/SUB-UNIT						
BUILDING DESCRIPTION	FRN No		No		Name	
MUNICIPAL ERF NO						
PROPERTY CODE (NDPW)						
SG CODE (21 DIGIT)						
FARM NAME						
FARM NO (SG)	No		subdivision (portion)			
PROJECT NAME (NDPW WCS SYSTEM NAME)						
WCS NO						
CLIENT DEPARTMENT						
NDPW PROPERTY	Yes		No		Lease	
MAP REFERENCE	1:50 000			1:10 000		
CO-ORDINATES (dd: mm : ss)	Geographic reference	X (longitude)		Y (latitude)		
	Datum:	WGS 84	**X**	CAPE		
	Lo block:	Lo X **:** **+**		LoY: **+**		
REPORT NO AND DATE						
Project Manager						
Date submitted						

RISK ZONE CLASS.	**DESCRIPTION**	**% OF SITE ***
Class 1 Low risk	Residential, light industrial and commercial development provided that appropriate water precautionary measure are applied. Other factors affecting economic viability such as excavatability, problem soils, etc. must be evaluated.	**%**
Class 2 Medium risk	Residential development with remedial water precautionary measures. No site and service schemes. May consider for commercial or light industrial development	**%**
Class 3 Medium risk	Selected residential development with exceptionally stringent precautionary measures and design criteria. No site and service schemes. May consider for commercial or light (dry) industrial development with appropriate precautionary measures.	**%**
Class 4 Medium risk	Selected residential development with exceptionally stringent precautionary measures and design criteria. No site and service schemes. May utilise for commercial or light (dry) industrial development with appropriate stringent precautionary measures.	**%**
Class 5 High risk	These areas are usually not recommended for residential development but under certain circumstances selected residential development (including lower-density residential development, multi-storied complexes, etc.), may be considered, commercial and light industrial development. The risk of sinkhole and doline formation is adjudged to be such that precautionary measures, in addition to those pertaining to the prevention of concentrated ingress of water into the ground are required to permit the construction of housing units.	**%**
Class 6 High risk	These areas are usually not recommended for residential development but under certain circumstances high-rise structures or gentleman's estates (stands 4 000m^2 with 500m^2 proven suitable for placing a house) may be considered, commercial or light industrial development. Expensive foundation designs may be necessary. Sealing of surfaces, earth mattresses, water in sleeves or in ducts, etc.	**%**
Class 7 High risk	No residential development. Special types of commercial or light industrial (dry) development only (eg. bus or trucking depots, coalyards, parking areas). All surfaces sealed. Suitable for parkland.	**%**
Class 8 High risk	No development, nature reserves or parkland.	**%**

NO RISK	Non Dolomitic site (No risk of sinkhole and doline formation)	**0%**

* The proportional percentages of the site in general or the proportional percentages of the selected area of the site. Attach sketch to clarify.

All infrastructure development, additions, reparations, maintenance and upgrading must comply with "PW 344 APPROPRIATE DEVELOPMENT OF INFRASTRUCTURE ON DOLOMITE: GUIDELINES FOR CONSULTANTS"

Manual - http://ads.asaqs.co.za/cpd.php?File_Name=DolomiteManual.pdf

Drawings - http://ads.asaqs.co.za/cpd.php?File_Name=DolomiteManual.html

OTHER SPECIFIC COMMENTS

Development potential

Foundation design

Site works

Monitoring

REFERENCED BY DRMS UNIT (F LOUW)

Please ensure that PRM 006, 007, 011, 012 and 016 that relates to Dolomite conditions have been completed, together with any other relevant documents, as part of the Contract Documentation list of documents.

Departmental confirmation

The Directorate Civil and Structural Engineering (DRMS Unit) hereby confirms that the above-mentioned site / buildings fall on the Risk Zone Class as specified above.

Signature **DRMS Unit**	Signature **D / Civil and Structural Engineering**
Date	Date

Sketch attached:	Yes		No	

APPENDIX 13

GROUND HAZARD REPORT

DEPARTMENT OF PUBLIC WORKS

FORWARD TO DEPARTMENTAL DOLOMITE RISK MANAGER:

MR. N. PIETERSE

TEL : (012) 337-2393

FAX : (012) 323-8509

DOLOMITE RELATED INVESTIGATIONS, REPORTS AND MANAGEMENT SYSTEMS

REF NO
DATE

GROUND HAZARD REPORT

REPORTING UNIT

RESPONSIBLE CLIENT	
REPORTING MEMBER	
TEL	
DATE	
TIME	

BUILDING EFFECTED

BUILDING NAME	
CURRENT USE	
FRN/PROPERTY/COMPLEX NO	
BASE/PROPERTY NAME	
INVENTORY HOLDER NAME	

DESCRIPTION OF HAZARD/INCIDENT

SINKHOLE	
DOLINE	
CRACKED BUILDING	
DAMAGED SERVICE	
OTHER	

LOCATION		
MAKE DIAGRAMMATIC SKETCH OF THE LOCATION, BUILDINGS AND KNOWN UNDERGROUND SERVICES		
ACTIONS ALREADY TAKEN		
ACTION TO BE TAKEN		
NAME	DATE	TEL

APPENDIX 14

TYPICAL PRELIMINARY BILLS OF QUANTITY FOR WORK IN DOLOMITIC AREA

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
	SABS 1200 A	**SECTION 1: PRELIMINARY AND GENERAL**				
	8.3	**FIXED- CHARGE AND VALUE-RATED ITEMS**				
1.1.0.0	8.3.1	**CONTRACTUAL REQUIREMENTS**	sum			
		Contractor to notice requirements regarding HIGH Risk Insurance(see DPW-05 :(EC) CONTRACT DATA -(GCC 2004). Clause 35A) to cover plant and personnel working in or around sinkholes and trench excavations in a dolomitic High Risk area. Contractor to execute work with safety requirements as per General and Particular Specification of this document.The Occupational Health and Safety Act compliance for all parts of the work is the responsibility of the contractor.				
1.2.0.0	8.3.2	**PROVISION OF FACILITIES ON SITE**				
1.2.1.0	8.3.2.1	**FACILITIES FOR ENGINEER**				
1.2.1.1	8.3.2.1(a)	Site office and ablution (1room plus store) with telephone and facsimile facility	sum			
1.2.1.2	8.3.2.1(c)	Name board (no 2)(Drawing (5210 /GEN)	sum			
1.2.2.0	8.3.2.2	**FACILITIES FOR CONTRACTOR**				
1.2.2.1	8.3.2.2 (a to i)	All facilities, tools, laboratory and services as per own requirements. (Additional: Telephone and facsimile facility must be provided) Special plant are covered in respective bills.	sum			
1.3.0.0	8.3.3	General responsibilities and other fixed charged obligations	sum			
1.4.0.0	8.3.3	Site safety regarding drilling, grouting, sinkhole repair and upgrading of services. (See Particular Specifications)	sum			
1.5.0.0	8.3.4	Removal of site establishment.	sum			
	8.4	**TIME-RELATED ITEMS**				
1.6.0.0	8.4.1	**CONTRACTUAL REQUIREMENTS**	sum			
1.7.1.0	8.4.2.1	**FACILITIES FOR ENGINEER**	sum			
1.7.0.0	8.4.2.1	**OPERATE AND MAINTAIN FACILITIES ON SITE**				
1.7.2.0	8.4.2.2	**FACILITIES FOR CONTRACTOR**				
1.7.2.1	8.4.2.2 (a to i)	All facilities as per own requirements	sum			
1.8.0.0	8.4.3. Additional	**DIRECT SUPERVISION OF WORKS**. Special requirement: The Contractor is to provide full time construction supervision by a written appointed construction supervisor for work in or around sinkholes and dolines.	week			
1.9.0.0	8.4.4	Company and Head Office overheads.	sum			
1.10.0.0	8.4.5	General responsibilities and other time related obligations.	sum			
1.11.0.0		Site safety (See Particular Specifications)	sum			
1.12.0.0	8.5	**PROVISIONAL ITEMS**				
1.12.1.0	8.5.b.1	Reference beacons set out by Professional Land Surveyor.	hrs			
1.12.2.0	8.5.b.1	Machinery - Supply and operation of excavator (minimum weight - 32 ton, minimum boom reach - 6 metre) for excavations as directed by the Engineer	days			
1.12.3.0	8.5.b.1	Soil and HDPE testing as directed by the Engineer	Prov sum			
1.12.4.0	8.5.b.1	Building and structure repairs as ordered by Engineer	Prov sum			
1.12.5.0	8.5.b.1	WATER METER BY CTMM	Prov sum			
1.13.0.0	8.8	**TEMPORARY WORKS**				
1.13.1.0	8.8.2.0	Dealing with pedestrians: The Contractor must provide barricading to prevent pedestrians from entering the site of works (note all of the excavations are open to the public.	sum			
1.13.2.0	8.8.2.1	Dealing with traffic: (Military Base roads) Provide road traffic signs for working next to or in roads within the Military Complex. Provide road signs: 2 x TW 40 (1200mm), 2 x TR 17 (900 mm), 2x TW 16 (1200 mm), 40 x DTG(L), 20 x DTG(R) and 60 plastic cones (700mm), 30 yellow strobe warning lights	sum			
TOTAL: CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
TOTAL: BROUGHT FORWARD						
1.13.3.0	8.8.2.2	Dealing with traffic:Please note that excavations are primaraly along puplic roads and the contractor needs to schedule work to allow access to all premises and provide effective barricading at all times to prevent vehicles from driving into open trenches or colliding with construction machinery.	sum			
1.13.4.0	8.8.4(a,b)	Supply and operate specialised equipment to detect underground services as directed by Engineer.	hour			
1.13.5.0	8.8.4	Excavate by hand in all material to expose existing services as directed by Engineer.	m3			
1.13.6.0	8.8.6	Special water control The Contractor to ensure that no water shall flood any portion of the works by providing necessary earth berms from excavated material or placing excavated material on suitable locations. Typical earth berm height min. 400 mm and width at base 1000mm.	sum			
TOTAL SECTION 1: CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
	SABS 1200 C	**SECTION 2: SITE CLEARANCE**				
		GENERAL				
		All rates hereunder shall include the loading, transport, offloading and levelling of dumpsite where material is dumped. All material to be transported to commercial dumpsites.				
2.1.0.0	8.2.1	**CLEAR AND GRUB**				
2.1.1.0	8.2.1	Clear and grub areas between buildings and structures (currently covered with shrubs, bushes and flower beds) . Predominantly hand operations.	m2			
2.2.0.0	8.2.2	**REMOVE AND GRUB LARGE TREES OF GIRTH:**				
2.2.1.0	8.2.2(a)	Over 1,0 m and up to 2,0 m. Contractor needs to remove complete stump and spoil material at commercial off-site dumpsites.	no			
2.3.0.0	8.2.5	**TAKE DOWN FENCE**				
2.3.1.0	8.2.5	Take down 1,5 m to 2,4 m high precast, panel type, concrete wall and columns. Store material on site for re-use.	m			
2.3.2.0	8.2.5	Take down 1,2 m high wire fence and erect again.	m			
2.3.3	8.2.5	Take down 1.8 to 2.4 m electrified wire fence (10 electric wires) and re-erect as well as commisioning of electricity.	m			
2.4.0.0.	8.2.7	**DISMANTLE STEEL PIPES**				
2.4.1.0	8.2.7	Cut, dismantle and remove 200 mm to 300 mm pipe	m			
2.4.2.0	8.2.7	Cut, dismantle and remove 100 mm to 150 mm steel pipe	m			
2.4.3.0	8.2.7	Cut, dismantle and remove 32 mm to75 mm steel pipe	m			
2.4.4.0	8.2.7	Cut, dismantle and remove 25 mm or smaller steel pipe	m			
2.4.5.0	8.2.7	Remove 10 to 20 mm diameter communication or electrical cable from sleeve pipes. Coil for re-use	m			
2.4.6.0	8.2.7	Remove 20 to 70 mm diameter communication or electrical cable from sleeve pipes. Coil for re-use	m			
2.5.0.0		**DEMOLISHING OF STRUCTURES**				
		All material from demolishing to be transported to Commercial Dump Site. Demolish the following:				
2.5.1.0	8.2.9	a) Load, transport and off load soil, trees and rubble from any site	m3.km			
2.5.2.0.	8.2.9	b) Floor slabs, foundations and building rubble.	m3.km			
2.5.3.0	8.2.8	c) Rip up and remove kerbs(up to 350 mm high and 400 mm wide) and concrete edge restraints of similar size	m			
2.5.4.0	8.2.7	d) Rip up and remove water, sewer and storm water pipe. Excavation and backfilling to be measured under trench excavations. Pipes other than those in excavations. For pipe dimensions:				
2.5.4.1		80 to 160 mm all types of pipe	m			
2.5.4.2		160 to 250 mm steel pipes	m			
2.5.4.3		160 to 250 mm concrete or clay pipes	m			
2.5.4.4		250 to 400 mm concrete pipes	m			
2.5.4.5		400 to 600 mm concrete pipes	m			
2.5.4.6		800 to 1400 mm concrete pipes	m			
2.5.5.0	8.2.8	e) Reinforced concrete paving or floor and wall of canal sections of thickness:				
2.5.5.1		75-150 mm	m2			
2.5.5.2		151-200 mm	m2			
2.5.5.3		201-250 mm	m2			
2.5.5.4		251-300 mm	m2			
2.5.6.0	8.2.8	f) Concrete paving or floor and wall of canal sections of thickness:				
2.5.6.1		75-150 mm	m2			
2.5.6.2		151-200 mm	m2			
2.5.6.3		201-250 mm	m2			
2.5.6.4		251-300 mm	m2			
TOTAL: CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
TOTAL: BROUGHT FORWARD						
2.5.7.0	8.2.8	g) Expose, demolish and dispose of reinforced column bases.	m3			
2.5.8.0	8.2.8	h) Reinforced walls and floors of service ducts and other large sub-surface chambers(wall thickness up to 250 mm)	m2			
2.5.9.0	8.2.8	i) Walls, floor and roof of manholes, valve chambers and stormwater inlet structures.				
2.5.9.1		Brick walls (110 mm thick)	m2			
2.5.9.2		Brick walls (220 mm thick)	m2			
2.5.9.3		Concrete (200 mm thick)	m2			
2.5.9.4		Reinforced Concrete (110 to 200mm thick)	m2			
2.5.10.0	8.2.8	j) Brick Walls				
2.5.10.1		110 mm thick	m2			
2.5.10.2		220 mm thick	m2			
2.6.0.0		**TOPSOIL**				
	8.2.10	Remove topsoil to 150 mm, stockpile, maintain and redress and compact designated area after completion of work. Item refer to areas other than sinkholes for:				
2.6.1.0		Confined areas between buildings where hand excavation is required	m3			
2.6.2.0		Areas suitable for machine excavation	m3			
2.7.0.0		**GRASS**				
2.7.1.0	8.2.10	Remove in blocks and plant, within 100 m, grass on road shoulder	m2			
TOTAL SECTION 2: CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
	SABS 1200 D	**SECTION 3: EARTH WORKS**				
		NOTE 1: Amendment to clause 5.2.5.1 - All haul within the site boundary(see drawing NoC5210/1) shall be free.				
		NOTE 2: Earthworks measured here would be general earthworks to improve stormwater drainage, rehabilitation of borrow areas and a limited amount of over-excavation and backfilling of potentially dangerous sinkholes and dolines. The Engineer shall be called to site before commencing excavation at any sinkhole or doline and will discuss the geological conditions with the Contractor in full as to ensure safe working areas are determined.				
3.1.0.0	8.3.1.2	Remove topsoil to depth of 150 mm, stockpile, maintain and redress and compact area after completion of filling.				
3.2.0.0	8.3.1.2 Additional	Windrow with grader grass vegetation to depth of 150 mm on a 10 to 15 m wide strip or in large open areas. Scarify in-situ material to 150 mm depth, shape with grader to even slopes in general or away from roads and structures or open areas to enhance natural drainage. Recompact to 95% Mod AASHTO density and redress surface with topsoil and vegetation from windrow. Compact topsoil to 93% Mod AASHTO density.				
3.3.0.0	8.3.2	**BULK EXCAVATIONS**				
3.3.1.0	8.3.2(a)	Excavate in all material, from designated borrow or areas for backfilling of sinkholes or dolines in base. (all haul within the site boundry shall be included in the rates below). Work shall include excavation, selecting, transporting, off loading, placing and compaction for:				
3.3.1.1		a) 0,5 m uncompacted layers spread level in sinkhole or doline or uncompacted filling over old doline or sinkhole.				
3.3.1.2		b) 150 mm layers compacted to 93% Mod AASHTO density (using small walk behind compactors) within the sinkhole, doline or other areas requiring filling. (max. boulder size 63 mm)				
3.3.1.3		c) 150 mm layers compacted to 93% Mod AASHTO density (using medium to large compaction equipment) within the sinkhole, doline or other areas requiring filling.				
3.3.1.4		d) filling of any areas with poor drainage in 150 mm layers compacted to 95% Mod AASHTO density (using medium to large compaction equipment) (max. boulder size 63 mm)				
3.3.2.0	8.3.2(a)	Import material from commercial off-site sources for backfilling of areas where stormwater drainage needs to be improved, sinkholes or dolines or filling of areas of dynamic compaction. Work shall include excavation, selecting, transporting, off loading, placing and compaction for:				
3.3.2.1		a) 150 mm layers compacted to 93% Mod AASHTO density (using small walk behind compactors) within the sinkhole, doline or other areas requiring filling. (max. boulder size 63 mm).				
3.3.2.2		b) 150 mm layers compacted to 93% Mod AASHTO density (using medium to large compaction equipment) within the sinkhole, doline or other areas requiring filling.				
3.3.2.3		c) filling of any areas with poor drainage in 150 mm layers compacted to 95% Mod AASHTO density (using medium to large compaction equipment) (max. boulder size 63 mm)				
TOTAL: CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
TOTAL: BROUGHT FORWARD						
3.4.0.0	8.3.2(a)	Excavate loose rock boulders in designated borrow (2 km from site), for recovery of loose rock boulders, previously dumped, of diameter 500 mm and larger to place in any sinkhole throat before normal filling commence. Work shall include excavation, selecting, transporting, off loading and placing:				
3.5.0.0	8.3.2(b)	Extra over 3.3.1.0 and 3.3.2.0				
3.5.1.0	8.3.2(b)1	a) Intermediate excavation				
3.6.0.0	8.3.3	**RESTRICTED EXCAVATIONS**				
3.6.1.0	8.3.3(a)	Excavate and backfilling in all material to open up areas in or around sinkholes or dolines for backfill in imported layers. Excavation walls shall be trimmed to 60 degrees to the horizontal. (Machine to use: minimum of 6 m reach on boom of excavator). Rate include backfilling and compaction to 95% Mod AASHTO density.				
3.6.2.0	8.3.3(a)	Excavation for stormwater canals and other related structures. Excavated material to be levelled, compacted and generally disposed of within 1000 m of point of excavation. Rate include spreading and levelling of material.				
3.7.0.0	8.3.3(b)	Extra over 3.6.1.0 and 3.6.2.0 for:				
3.7.1.0	8.3.3(b)1	Intermediate excavation				
3.7.2.0	8.3.3(b)2	Hard rock excavation (refer to PB for restrictions on blasting)				
3.7.3.0	8.3.2(b)3	Boulder excavation Class A				
3.8.0.0		**EXTRA OVER FOR SELECTION AND COMPACTION**				
3.8.1.0		Extra over 3.3.1.2, 3.3.1.3, and 3.3.1.4 to select material suitable for backfilling of pipe trenches (as per Particular Specification PC.2.4). Rate includes selection loading, carting for 4 km (max.), off loading and compaction to 95% Mod AASHTO density.				
3.9.0.0		**DEALING WITH OVERBURDEN**				
3.9.1.0	8.3.4(c)	Push material on side of any Dump Site into the dump				
3.10.0.0		**OVERHAUL**				
3.10.1.0	8.3.6(a)	limited overhaul				
3.10.2.0	8.3.6(b)	long overhaul				
3.11.0.0		**TOPSOIL**				
	8.3.10	Topsoil in 100 mm layer provided from:				
3.11.1.0		Stockpile				
3.12.0.0		**GRASSING**				
3.12.1.0	8.3.11	Grassing of area with "roll on lawn" applicable for recreation areas, planted without gaps or areas to be covered later. Samples to be approved by Engineer.				
3.13.0.0		**COMPACTION OF EXCAVATION BASE**				
3.13.1.0		Trim, level and compact any excavation (see 3.6.2.0) to 95% Mod AASHTO density for a depth of 150 mm.				
TOTAL SECTION 3: CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
	SABS 1200 DB	**SECTION 4: EARTH WORKS (PIPE TRENCHES)**				
		Note: All unsuitable material from trench excavations to be disposed of in Commercial dumpsite. **The extra over rates for intermediate and hard rock excavation shall include the cost of disposing of such material, not suitable for backfill,at commercial dumpsites. See also Scope of Works C 3.2 Part A (Cluase PS3) and Particular Specification PA (Clause PA 1 to 4)**				
4.1.0.0	8.3.1	**SITE CLEARANCE**				
4.1.1.0	8.3.1.a	Clear trees and vegetation(Limited on existing earth pavements)				
4.1.2.0	8.3.1.b	Clear trees with girth over 1m. Note : Trees with girth under 1,0 m is included in trench excavation cost				
4.1.3.0	8.3.1.c	Remove topsoil to 150 mm depth, stockpile, maintain and replace and compact at completion of work.				
4.2.0.0	8.3.1.d additional	Remove surfaced areas by square cutting and disposal of for:				
4.2.1.0		a) Asphalt sections on pipe routes by means of cutting with a diamond tip pavement cutter. The rate shall cover square cutting and removal of Asphalt for all trench excavation routes up to 1,2 m wide:				
4.2.1.1		30 mm thick				
4.2.1.2		70 mm thick				
4.2.1.3		100 mm thick				
4.2.1.4		150 mm thick				
4.2.2.0		b) Concrete:				
4.2.2.1		0 - 125 mm				
4.2.2.2		125 - 200 mm				
4.2.2.3		200 - 300 mm				
4.2.3.0		c) Brick Paving (stockpile for re-use)				
4.3.0.0		Cut single line in asphalt or concrete with diamond tip pavement cutter. The rate shall cover the cost of plant labour and consumables. For depths:				
4.3.1.0		30 mm thick				
4.3.2.0		70 mm thick				
4.3.3.0		100 mm thick				
4.3.4.0		150 mm thick				
4.4.0.0	8.3.2	**EXCAVATION FOR ALL PIPES / DUCTS**				
		NOTE: Excavations are primarily along main tarred roads within the base and vehicle movement areas of hangers and offices. The Contractor needs to provide sufficient warning and danger signs as well as barricading tape around excavations to prevent pedestrians(not residential area)and vehicles from entering the area of work. The repair of damage to existing surfaces areas(excluding trench route) to existing standard shall be for the account of the contractor.				
	8.3.2(a)	**Note: Shoring of deep excavations are included in the rates quoted below. Excavation safety is the responsibility of the contractor.**Excavate in all material for pipe trenches with inclusion of backfilling and compaction to 93% Mod AASHTO density and dispose of surplus material in commercial dump site. No material from hard or intermediate excavations exceeding 100 mm in diameter shall be used for backfilling of pipe trenches. Excavate for pipes of nominal diameter:				
4.4.1.0		a) 25 - 125 mm diameter				
4.4.1.1		0,0 - 1,0 m				
4.4.1.2		1,0 - 2,0 m				
4.4.1.3		2,0 - 3,0 m				
4.4.2.0		b) 125 - 700 mm diameter				
TOTAL : CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
TOTAL: BROUGHT FORWARD						
4.4.2.1		0,0 - 1,0 m				
4.4.2.2		1,0 - 2,0 m				
4.4.2.3		2,0 - 3,0 m				
4.4.2.4		3,0 - 4,0m				
4.4.3.0		c) 700 -1000 mm diameter				
4.4.3.1		0,0 - 1,0 m				
4.4.3.2		1,0 - 2,0 m				
4.4.3.3		2,0 - 3,0 m				
4.4.4.0		d) 1000 - 2000 mm diameter				
4.4.4.1		1,0 - 2,0 m				
4.4.4.2		2,0 - 3,0 m				
4.4.4.3		3,0 - 4,0 m				
4.5.0.0	8.3.2(b)	Extra over 4.4.0.0 for:				
4.5.1.0	8.3.2(b)1	Intermediate excavation. Note: rate includes the cost of disposing of material suitable for backfilling at commercial dump sites.				
4.5.2.0	8.3.2(b)2	Hard rock excavation NOTE: Blasting requirements as per Particular Specification PB				
4.5.3.0		Tunnelling under fence,electric, palacade, precast or brick or to 1,0 m measured horizontally under foundations				
4.5.4.0	8.3.2(b)	Extra over trench and manhole or related excavations to allow for work in confined areas such as between buildings and other structures where access is limited to the use of a TLB only and blasting is prohibited. These excavation rates are subject to written approval by Engineer. Extra over for:				
4.5.4.1	8.3.2(b)	Soft excavation				
4.5.4.2	8.3.2(b)1	Intermediate excavation				
4.5.4.3	8.3.2(b)2	Hard rock excavation				
4.5.5.0	8.3.2(b)	Extra over trench and manhole or related excavations to allow for work in confined areas such as between buildings and other structures or close to foundations and in between existing services where access is limited to the use of manual labour only and blasting is prohibited. Rate shall also apply to the location of services specifically called for by the Engineer. These excavation rates are subject to written approval by Engineer. Extra over for:				
4.5.5.1		Soft excavation				
4.5.5.2	8.3.2(b)1	Intermediate excavation				
4.5.5.3	8.3.2(b)2	Hard rock excavation				
4.6.0.0	8.3.2©	Excavate and dispose of unsuitable material from trench bottom in commercial dumpsite				
4.7.0.0	8.3.3	**EXCAVATION ANCILLARIES**				
4.7.1.0	8.3.3.1(b)	Make up deficiency in backfilling by importing material from commercial sources. Rate shall include excavation, loading, carting, placing and compaction.				
4.7.2.0	8.3.3.3	Compaction in road reserve as per 5.7.2. Compaction to 95% Mod AASHTO density				
4.8.0.0	8.3.4	**PARTICULAR ITEMS**				
4.8.1.0	8.3.4.a	Shore trench on instruction of engineer opposite structure or service for depth:				
4.8.1.1		0 to 1 m				
4.8.1.2		1 to 2 m				
4.8.1.3		2 to 3 m				
4.8.2.0	8.3.4.b	Provide 10 l/s sludge pump and 150 m of 75 mm diameter flexible hose for temporary sewer				
4.9.0.0	8.3.5	**EXISTING SERVICES**				
4.9.1.0	8.3.5(a)	Services intersecting trench (drawings of services are available)(See preliminary drawing No C5210/2)				
4.9.2.0	8.3.5(b)	Services adjoining trench				
4.10.0.0	8.3.6	**FINISHING**				
4.10.1.0	8.3.6.1	Reinstate surfaces of trenched areas with:				
4.10.1.1		Asphalt 30 mm thick				
4.10.1.2		Concrete: 25 MPa/ 19 mm 150 mm thick, wood floated finish to match existing				
4.10.1.3		Concrete: 25 MPa/ 19 mm 100 mm thick, wood floated finish to match existing				
TOTAL : CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
TOTAL: BROUGHT FORWARD						
4.10.1.4		50 mm Brick paving previously removed				
4.10.1.5		80 mm interlocking paving previously removed				
4.11.0.0	8.3.7	**ACCOMMODATION OF TRAFFIC**				
4.11.1.0	8.3.7	Set up and maintain the road deviation signs as supplied under Section 1 Item 1.13.1 to 1.13.3. Rate to cover a setup off each set of signs.				
4.11.2.0	8.3.7	Provide 4 sets of trench bridges for vehicle acces to span trench width of 2.0 m. Bridges must accommodate trucks up to 15 ton(wheel base width up to 2,3 m)				
TOTAL SECTION 4: CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
	SABS 1200 LB	**SECTION 5: BEDDING**				
5.1.0.0	8.2.1	Provide class B bedding selected from trench excavation and compacted to 93% Mod AASHTO density(material P.I to be between 12 and 16)				
5.1.1.0	8.2.1(a)	selected granular material not exceeding 6 mm in diameter.	m3			
5.1.2.0	8.2.1(b)	selected fill (compaction in 150 mm layers)	m3			
5.1.3.0	8.2.1(b)	Selected fill (compaction in 150 mm layers). First 150 mm above HDPE pipes to be filled with material not exceed 6 mm in diameter. (material P.I to be between 12 and 16)	m3			
5.2.0.0	8.2.2.3	Provide class B bedding imported from commercial sources and compact to 93% Mod AASHTO density. Rates include loading, transport, offloading and compaction.(material P.I to be between 12 and 16)	m3			
5.2.1.0	8.2.2.3(a)	Selected granular material not exceeding 6 mm in diameter. (P1 12 TO 16)	m3			
5.2.2.0	8.2.2.3(b)	Selected fill (compaction in 150 mm layers). First 150 mm above HDPE pipes to be filled with material not exceed 6 mm in diameter. (P1 Between 13 and 16)	m3			
5.3.0.0	8.2.3	Provide class A bedding of (1:15) soilcrete cradle to 50% of pipe diameter. Note that soilcrete will be paid according the limitation of excavation width for the particular pipe size as per SABS 1200 DB or the actual trench width which ever is the smaller	m3			
5.4.0.0	8.2.4	Provide 5 MPa crusher sand Trench fill in cradle or complete encasing of any type or diameter of pipe. Note that trench fill will be paid according the limitation of excavation width for the particular pipe size as per SABS 1200 DB or the actual trench witch ever is the smaller	m3			
5.5.0.0	8.2.4	Encasing of water and sewer pipes up to a nominal diameter of 450 mm in 15 MPa/13 mm concrete of minimum 150 mm thickness.	m3			
TOTAL SECTION 5: CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
	SABS 1200 L	**SECTION 6: PIPE WORK (WATER)**				
		See Particular Specification PA				
6.1.0.0	8.2.1	**PIPES - HDPE**				
6.1.1.0		Supply, butt weld jointing and lay approved solid wall HDPE (high density polyethylene), type PE 100, Class PN 16 Pipe to SABS ISO 4427. Lay pipe in trenches. Pipes to be supplied in 12 m lengths. . For pipes of nominal diameter.				
6.1.1.1		110 mm	m			
6.1.1.2		125 mm	m			
6.1.1.3		160 mm	m			
6.1.1.4		180 mm	m			
6.1.1.5		200 mm	m			
6.1.1.6		225 mm	m			
6.1.1.7		250 mm	m			
6.1.1.8		280 mm	m			
6.1.1.9		315 mm	m			
6.1.1.10		355 mm	m			
6.1.1.11		400 mm	m			
6.1.1.12		450 mm	m			
6.1.2.0	8.2.1	Supply, butt weld jointing and lay approved solid wall HDPE (high density polyethylene), type PE 100, Class PN 16 Pipe. Lay pipe in trenches. Pipes to be supplied in 100 m lengths. For pipes of nominal diameter.				
6.1.2.1		20 mm	m			
6.1.2.2		25 mm	m			
6.1.2.3		32 mm	m			
6.1.2.4		63 mm	m			
6.1.2.5		75 mm	m			
6.1.2.6		90 mm	m			
6.2.0.0	8.2.5	**PIPES GMS**				
6.2.1.0		Supply, fit (or lay and bed) complete with couplings, SABS 62:1971 approved hot dipped galvanised to SABS 763, Mild Steel, Class Medium, pipes and fittings.				
6.2.1.1		15 mm	m			
6.2.1.2		20 mm	m			
6.2.1.3		25 mm	m			
6.2.1.4		32 mm	m			
6.2.1.5		40 mm	m			
6.2.1.6		50 mm	m			
6.2.1.7		80 mm	m			
6.2.1.8		80 mm (short runs of approximately 2m - threaded both ends)	m			
6.2.1.9		100 mm	m			
6.2.1.10		150 mm	m			
6.2.1.11		200 mm	m			
6.2.2.0		a) Pipes, mounted with holderbats spaced at 1000 mm minimum, horizontally or vertically to external or internal walls or in roof. Rate include all straight couplings and holderbats. For diameters:				
6.2.2.1		15 mm	m			
6.2.2.2		20 mm	m			
6.2.2.3		25 mm	m			
6.2.2.4		32 mm	m			
6.2.2.5		40 mm	m			
6.2.2.6		50 mm	m			
6.2.2.7		65 mm	m			
6.2.2.8		80 mm	m			
6.2.2.9		100 mm	m			
6.2.2.10		150 mm	m			
6.2.3.0		b) Pipes, mounted on columns 1,0 to 2,7 m high as per Drawing detail Type No. DT 07 / W. Columns measured elsewhere. For diameters:				
6.2.3.1		20 mm	m			
6.2.3.2		25 mm	m			
6.2.3.3		32 mm	m			
6.2.3.4		40 mm	m			
6.2.3.5		50 mm	m			
6.2.3.6		80 mm	m			
6.2.3.7		100 mm	m			
TOTAL: CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL R
TOTAL: BROUGHT FORWARD						
6.2.3.8		150 mm	m			
6.3.0.0	8.2.2	**FITTINGS - HDPE**				
	8.2.2	Supply, butt weld jointing and lay approved solid wall HDPE (high density polyethylene), type PE 100, Class PN 16 fittings to SABS ISO 4427. All fittings to be butt welded to HDPE pipes. Each fitting must be supplied with stubs welded on the outside for securing fitting into concrete anchor blocks. Stubs (Partial puddle flange) to be designed by fitting manufacturer for pipe size and maximum presure rating as well as fitting configuration. Each fitting shall be supplied with a mimimun of two HDPE stubs (25 mm thick by 0.25 x diameter of fitting high by 0.75 x diameter of fitting long), welded to the outside. For fittings:				
6.3.1.0	8.2.2	HDPE EQUAL T PIECE				
6.3.1.1		110 mm	no			
6.3.1.2		160 mm	no			
6.3.1.3		180 mm	no			
6.3.1.4		200 mm	no			
6.3.1.5		250 mm	no			
6.3.1.6		280 mm	no			
6.3.1.7		300 mm	no			
6.3.1.8		315 mm	no			
6.3.1.9		355 mm	no			
6.3.1.10		400 mm	no			
6.3.1.11		450 mm	no			
6.3.2.0	8.2.2	HDPE LONG RADIUS 90 DEGREE BEND (SEAMLESS)				
6.3.2.1		110 mm	no			
6.3.2.2		160 mm	no			
6.3.2.3		180 mm	no			
6.3.2.4		200 mm	no			
6.3.2.5		250 mm	no			
6.3.2.6		280 mm	no			
6.3.2.7		300 mm	no			
6.3.2.8		315 mm	no			
6.3.2.9		350 mm	no			
6.3.2.10		400 mm	no			
6.3.2.11		450 mm	no			
6.3.3.0	8.2.2	HDPE LONG RADIUS 45 DEGREE BEND (SEAMLESS)				
6.3.3.1		110 mm	no			
6.3.3.2		160 mm	no			
6.3.3.3		180 mm	no			
6.3.3.4		200 mm	no			
6.3.3.5		250 mm	no			
6.3.3.6		280 mm	no			
6.3.3.7		300 mm	no			
6.3.3.8		315 mm	no			
6.3.3.9		355 mm	no			
6.3.3.10		400 mm	no			
6.3.3.11		450 mm	no			
6.3.4.0	8.2.2	HDPE LONG RADIUS 11 to 22 DEGREE BEND (SEAMLESS)				
6.3.4.1		110 mm	no			
6.3.4.2		160 mm	no			
6.3.4.3		180 mm	no			
6.3.4.4		200 mm	no			
6.3.4.5		250 mm	no			
6.3.4.6		280 mm	no			
6.3.4.7		300 mm	no			
6.3.4.8		315 mm	no			
6.3.4.9		355 mm	no			
6.3.4.10		400 mm	no			
6.3.4.11		450 mm	no			
6.3.5.0	8.2.2	HDPE REDUCING T-PIECE				
6.3.5.1		450 X 250	no			
6.3.5.2		400 X 250	no			
6.3.5.3		355 X 250	no			
6.3.5.4		315 X 250	no			
TOTAL: CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
TOTAL: BROUGHT FORWARD						
6.3.5.5		300 X 250	no			
6.3.5.6		280 X 250	no			
6.3.5.7		355 X 315	no			
6.3.6.0	8.2.2	HDPE REDUCER(CONCENTRIC)				
6.3.6.1		450 X 400	no			
6.3.6.2		450 X 250	no			
6.3.6.3		400 X 355	no			
6.3.6.4		450 X 315	no			
6.3.6.5		400 X 315	no			
6.3.6.6		355 X 315	no			
6.3.6.7		355 X 280	no			
6.3.6.8		315 X 250	no			
6.3.6.9		280 X 250	no			
6.3.6.10		250X 180	no			
6.3.7.0	8.2.2	Extra over any fitting or pipe to supply and weld on, in factory, A HDPE stub and steal flange drilled to BS 4504 table 16. Rate include supply lay, installation and fixing as well as all bolts and nuts. For HDPE pipe or fitting diameters:				
6.3.7.1		110 mm	no			
6.3.7.2		160 mm	no			
6.3.7.3		180 mm	no			
6.3.7.4		200 mm	no			
6.3.7.5		250 mm	no			
6.3.7.6		280 mm	no			
6.3.7.7		300 mm	no			
6.3.7.8		355 mm	no			
6.3.7.9		400 mm	no			
6.3.7.10		450 mm	no			
6.3.8.0	8.2.2	Extra over any fitting or pipe to supply and weld on, at site, a HDPE stub and steal flange drilled to BS 4504 table 16. Rate include supply lay, installation and fixing as well as all bolts and nuts. For HDPE pipe or fitting diameters:				
6.3.8.1		110 mm	no			
6.3.8.2		160 mm	no			
6.3.8.3		180 mm	no			
6.3.8.4		200 mm	no			
6.3.8.5		250 mm	no			
6.3.8.6		280 mm	no			
6.3.8.7		300 mm	no			
6.3.8.8		315 mm	no			
6.3.8.9		355 mm	no			
6.3.8.10		400 mm	no			
6.3.8.11		450 mm	no			
6.4.0.0	8.2.2	**FITTINGS - CAST IRON**				
6.4.1.0		All fittings to SABS 564 Class 18, CID, covered with three coats epoxy tar to SABS 801 and thickness 300 micron minimum. All flanges drilled to BS 4504, table 16. Rate include supply, lay and all packing and bolts. Bolts to be high tensile and heavy duty hot dipped galvanised to SABS 763. Cover complete fitting again after installation with epoxy tar.				
6.4.1.1		200 mm flange adaptor	no			
6.4.1.2		250 mm flange adaptor	no			
6.4.1.3		250 mm blank flange	no			
6.5.0.0	8.2.2	**A.C SHORT COLLARS**				
6.5.1.0		150 mm	no			
6.6.0.0	8.2.2	**CAST IRON TEE FOR A.C PIPE class 16**				
6.6.1.0		150 mm	no			
6.6.1.1		100	no			
6.7.0.0	8.2.2	**BLANK STEEL FLANGE COPON COUTED**				
6.7.1.0		250 mm	no			
6.8.0.0	8.2.2	**uUPVC CLASS 12 FITTINGS**				
6.8.1.0		200 mm bend	no			
6.8.1.1		200 mm socketed end T piece	no			
6.9.0.0	8.2.2	**VJ - COUPLINGS**				
6.9.1.0		Fittings coated with epoxy.				
6.9.1.1		100 mm steel to 110 HDPE	no			
6.9.1.2		100 mm steel to 160 mm HDPE	no			
6.9.1.3		80 mm steel to steel	no			
6.9.1.4		100 mm steel to steel	no			
TOTAL: CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL R
TOTAL: BROUGHT FORWARD						
6.9.1.5		150 mm steel to steel	no			
6.9.1.6		200 mm CI to CI	no			
6.9.1.7		250 mm CI to CI	no			
6.9.1.8		250 mm CI to AC	no			
6.9.1.9		250 mm steel with locking ring welded on to pipe	no			
6.9.1.10		200 mm steel with locking ring welded on to pipe	no			
6.9.1.11		80 x 100 universal adaptor	no			
6.9.1.12		100 x 150 universal adaptor	no			
6.9.1.13		83 x 100 universal adaptor	no			
6.10.0.0	8.2.3	**VALVES (CAST IRON) - CLASS PN 16**				
6.10.1.0		Supply and install complete waterworks type, SABS 664 approved, non-rising spindle, right hand closing, handwheel and ball thrust collar, cast iron, flanged resilient seal valve. (Drilled to BS 4504 table 16) All valves in and outside coated with 250 micron fusion bonded Epoxy resin coating Electrostatically applied (DIN 30677). One person to be able to open valve, with unbalanced pressure of 850 kPa. For diameter:				
6.10.1.1		80 mm	no			
6.10.1.2		100 mm	no			
6.10.1.3		150 mm	no			
6.10.1.4		200 mm	no			
6.10.1.5		250 mm	no			
6.10.1.6		300 mm	no			
6.10.1.7		350 mm	no			
6.10.1.8		400 mm	no			
6.11.0.0	8.2.5	**VALVES (CAST IRON) - CLASS PN 25**				
6.11.1.0		Supply and install complete waterworks type, SABS 664 approved, non-rising spindle, right hand closing, handwheel and ball thrust collar, cast iron, flanged resilient seal valve. (Drilled to BS 4504 table 23) All valves in and outside coated with 250 micron fusion bonded Epoxy resin coating Electrostatically applied (DIN 30677). One person to be able to open valve, with unbalanced pressure of 850 kPa. For diameter:				
6.11.1.1		50 mm	no			
6.11.1.2		100 mm	no			
6.11.1.3		150 mm	no			
6.11.1.4		200 mm	no			
6.11.1.5		250 mm	no			
6.12.0.0	8.2.5	**WATER METER**				
6.12.1.0		150 mm Nominal diameter Compound Water Meter rated for working pressure 16 bar, continuous flow rate 400 m3/h (600m3/h max) for main meter and 10 m3/h for bypass meter. Main meter to be fitted with hydrodynamically balanced rotor. Meters to be flanged with drilling to BS 4504 Table 16, and fitted with electronic logger port. (logger not to be supplied). Registers, 6 digit cyclometer-type totalisers, registering in kL, must be hermetically sealed. Main valve body to be cast iron and bypass meter from brass. Install meter horizontally. Meter also to be fitted with "inteligent" automatic data register. Accuracy better than 2% (Meter type tendered ....) See Detail drawing type DT 11-4W AND dt 11-5W	no			
TOTAL: CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL R
TOTAL: BROUGHT FORWARD						
6.12.2.0		250 mm Nominal diameter in line through flow Water Meter rated for working pressure 16 bar, continuous flow rate 1250 m3/h (1600 m3/h max.). Meter to be fitted with mechanical turbine. Meters to be flanged with drilling to BS 4504 Table 16, and fitted with electronic logger port. (logger not to be supplied). Registers, 6 digit cyclometer-type totalisers, registering in kL, must be hermetically sealed. Main valve body to be cast iron. Install meter horizontally. Meter also to be fitted with "inteligent" automatic data register. Accuracy better than 2% (Meter type tendered ....) See Drawing C5210/4	no			
6.12.3.0		200 mm Nominal diameter in line through flow Water Meter rated for working pressure 16 bar, continuous flow rate 800 m3/h (1200 m3/h max.). Meter to be fitted with mechanical turbine. Meters to be flanged with drilling to BS 4504 Table 16, and fitted with electronic logger port. (logger not to be supplied). Registers, 6 digit cyclometer-type totalisers, registering in kL, must be hermetically sealed. Main valve body to be cast iron. Install meter horizontally. Meter also to be fitted with "inteligent" automatic data register. Accuracy better than 2% (Meter type tendered ....)	no			
6.13.0.0		**PRESSURE REDUCING VALVES**				
6.13.1.0		100 mm Pressure reducing valve capable of reducing pressure from 2400 KPa to 650 Kpa. Reduver to be fitted with V port to accommodate near zero flow volumes effectively. All valves in and outside coated with 250 micron fusion bonded Epoxy resin coating Electrostatically applied (DIN 30677) (Valve type tendered ....)	no			
6.13.2.0		200 mm Pressure reducing valve capable of reducing pressure from 2400 KPa to 650 Kpa. Reduver to be fitted with V port to accommodate near zero flow volumes effectively. Maximum flow rates expected to exceed 150 l/s. All valves in and outside coated with 250 micron fusion bonded Epoxy resin coating Electrostatically applied (DIN 30677) (Valve type tendered ....)	no			
6.13.3.0		250 mm Pressure reducing valve capable of reducing pressure from 2400 KPa to 650 Kpa. Reduver to be fitted with V port to accommodate near zero flow volumes effectively. Maximum flow rates expected to exceed 250 l/s. All valves in and outside coated with 250 micron fusion bonded Epoxy resin coating Electrostatically applied (DIN 30677) (Valve type tendered ....)	no			
TOTAL: CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL R
TOTAL: BROUGHT FORWARD						
6.14.0.0	8.2.5	**PRESSURE RELEASE VALVE**				
6.14.1.0		150 mm Pressure release valve sesitive for pressures 200 Kpa to 2400 KPa to 650 Kpa. Maximum flow rates expected to exceed 250 l/s. All valves in and outside coated with 250 micron fusion bonded Epoxy resin coating Electrostatically applied (DIN 30677) (Valve type tendered ....)	no			
6.15.0.0	8.2.5	**CHECK VALVES**				
6.15.1.0		Swing Type Check valve for high flow application on water network. Working pressure 1600KPa. All valves in and outside coated with 250 micron fusion bonded Epoxy resin coating Electrostatically applied (DIN 30677). Flanges to BS 4504 Table 16. (Valve type tendered ....) For Nominal diameter:				
6.15.1.1		150 mm	no			
6.15.1.2		200 mm	no			
6.15.1.3		250 mm	no			
6.16.0.0	8.2.3	**AIR RELEASE VALVES**				
6.16.1.0		80 mm Nominal diameter Combination air valve for high flow non slam application on water network. Working pressure 1600KPa. All valves in and outside coated with 250 micron fusion bonded Epoxy resin coating Electrostatically applied (DIN 30677). Flanges to BS 4504 Table 16. (Valve type tendered ....)	no			
6.16.2.0		50 mm Nominal diameter Combination air valve for high flow non slam application on water network. Working pressure 1600KPa. All valves in and outside coated with 250 micron fusion bonded Epoxy resin coating Electrostatically applied (DIN 30677). Flanges to BS 4504 Table 16. (Valve type tendered ....)	no			
6.17.0.0	8.2.5	**STRAINER**				
6.17.1.0		Cast iron horizontally mounted strainer with stainless steel inner. Working pressure 2400KPa. In and outside coated with 250 micron fusion bonded Epoxy resin coating Electrostatically applied (DIN 30677). Flanges to BS 4504 Table 23. (Strainer type tendered ....) For Diameter:				
6.17.1.1		250 mm	no			
6.17.1.2		200 mm	no			
6.18.0.0	8.2.5	**FIRE HYDRANT (valve only**)				
6.18.1.0		Supply and install approved, right angle, shielded spindle, fire hydrant as per sabs 1128 / ans 1128-2	no			
6.19.0.0	8.2.5	**STEEL FITTINGS**				
6.19.1.0		**Pipe fittings and specials in zone meter as per detail Drawing no DT 11-4/w and DT 11-5/W. General specification: Working pressure 1600 KPa. All fittings in and outside coated with 250 micron fusion bonded Epoxy resin coating Electrostatically applied (DIN 30677). Flanges to BS 4504 Table 16. For fittings:**				
6.19.1.1		150 mm diameter - 600 mm long spool piece one end flanged	no			
6.19.1.2		150 mm diameter - equal T-piece all ends flanged	no			
6.19.1.3		150 mm diameter - 200 mm long spool piece both ends flanged	no			
TOTAL: CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL R
TOTAL: BROUGHT FORWARD						
6.19.1.4		150 X 80 mm concentric reducer 150 mm long, flanged both ends	no			
6.19.1.5		150 mm Lockable VJ Coupling	no			
6.19.1.6		80 mm diameter - equal T-piece all ends flanged	no			
6.19.2.0	8.2.5	**Pipe fittings and specials in pressure reducing valve chamber as per Drawing C5210/3 . General specification: Working pressure 1600 KPa downstream of reducing valve and 2400 KPa upstream of pressure reducing valve. All fittings in and outside coated with 250 micron fusion bonded Epoxy resin coating Electrostatically applied (DIN 30677). Flanges to BS 4504 Table 16 unless other wise indicated. For fittings**				
6.19.2.1		P1: 250 mm Spool Piece with puddle flange(1500 mm long) - both ends flanged. Flanges to BS 4504 Table 23 - (fitting to have 10 mm pressure guage outlet)	no			
6.19.2.2		P5: 250-100 mm Reducing Tee (525 mm long) - all ends flanged. Flanges to BS 4504 Table 23 - (fitting to have 10 mm pressure guage outlet)	no			
6.19.2.3		P13: 250x50mm Reducing Tee (300 mm long) - all ends flanged. Flanges to BS 4504 Table 23 - (fitting to have 10 mm pressure guage outlet)	no			
6.19.2.4		P14: 50 mm Bend both ends flanged (Flanges to BS 4504 Table 23)	no			
6.19.2.5		P16: 100 mm Spool Piece (940 mm long) - both ends flanged. (Flanges to BS 4504 Table 23)	no			
6.19.2.6		P17: 100 mm flaged adaptor (Flanges to BS 4504 Table 23)	no			
6.19.2.7		P34: 50 mm Spool Piece (1056 mm long) - both ends flanged. (Flanges to BS 4504 Table 23)	no			
6.19.2.8		P add 1: 250 mm Flange Adaptor (Flanges to BS 4504 Table 23)	no			
6.19.2.9		P6: 100 mm Bend both ends flanged	no			
6.19.2.10		P7: 250 mm Lockable VJ Coupling	no			
6.19.2.11		P12: 100 mm Lockable VJ Coupling	no			
6.19.2.12		P15: 150x80 reducer both ends flanged	no			
6.19.2.13		P19: 250-100 mm Reducing Tee all ends flanged	no			
6.19.2.14		P21: 150 mm Spool Piece (415 mm long) - both ends flanged.	no			
6.19.2.15		P22: 150 mm Lockable VJ Coupling	no			
6.19.2.16		P24: 150 mm Bend both ends flanged	no			
6.19.2.17		P25: 250 mm Spool Piece with puddle flange (975 mm long) - both ends flanged.	no			
6.19.2.18		P27: 250 mm Universal Adaptor	no			
6.19.2.19		P28: 250 mm Flange Adaptor	no			
6.19.2.20		P29: 250-150 mm Reducing Tee all ends flanged	no			
6.19.2.21		P31: 450x250 mm Flanged Reducer 890 mm long both ends flanged	no			
6.19.2.22		P33: Bracket for 150 mm pipe as per Detail no 101 on Drawing no C5210/4	no			
6.19.2.23		P34: 50 mm Spool Piece (1056 mm Long) both ends flanged	no			
6.19.2.24		P36: 50 mm T-Piece all ends flanged	no			
6.19.2.25		P37: Presure guage (Glycerine) with base shut off and bleed valve(10 mm Brass Gate Valve - SABS 776)(Meter 2500 kPA Rated) - rate includes fitting welded to main pipeline	no			
6.19.2.26		P add2: 150 mm Spool Piece (1875 mm long) - both ends flanged.	no			
6.19.2.27		P add3: 150 mm Spool Piece (750mm long) - both ends flanged.	no			
TOTAL: CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL R
TOTAL: BROUGHT FORWARD						
6.19.3.0	8.2.5	**Pipe fittings and specials in pressure reducing valve chamber similar as per Drawing C5210/3 but with main line 200 mm . General specification: Working pressure 1600 KPa downstream of reducing valve and 1800 KPa upstream of pressure reducing valve. All fittings in and outside coated with 250 micron fusion bonded Epoxy resin coating Electrostatically applied (DIN 30677). Flanges to BS 4504 Table 16 unless other wise indicated. For fittings**				
6.19.3.1		P1: 200 mm Spool Piece with puddle flange(1500 mm long) - both ends flanged. Flanges to BS 4504 Table 23 - (fitting to have 10 mm pressure guage outlet)	no			
6.19.3.2		P5: 200-100 mm Reducing Tee (525 mm long) - all ends flanged. Flanges to BS 4504 Table 23 - (fitting to have 10 mm pressure guage outlet)	no			
6.19.3.3		P13: 200x50mm Reducing Tee (300 mm long) - all ends flanged. Flanges to BS 4504 Table 23 - (fitting to have 10 mm pressure guage outlet)	no			
6.19.3.4		P14: 50 mm Bend both ends flanged (Flanges to BS 4504 Table 23)	no			
6.19.3.5		P16: 100 mm Spool Piece (940 mm long) - both ends flanged. (Flanges to BS 4504 Table 23)	no			
6.19.3.6		P17: 100 mm flaged adaptor (Flanges to BS 4504 Table 23)	no			
6.19.3.7		P34: 50 mm Spool Piece (1056 mm long) - both ends flanged. (Flanges to BS 4504 Table 23)	no			
6.19.3.8		P add 1: 200 mm Flange Adaptor (Flanges to BS 4504 Table 23)	no			
6.19.3.9		P6: 100 mm Bend both ends flanged	no			
6.19.3.10		P7: 200 mm Lockable VJ Coupling	no			
6.19.3.11						
6.19.3.12		P12: 100 mm Lockable VJ Coupling	no			
6.19.3.13		P15: 150x80 reducer both ends flanged	no			
6.19.3.14		P19: 200-100 mm Reducing Tee all ends flanged	no			
6.19.3.15		P21: 150 mm Spool Piece (415 mm long) - both ends flanged.	no			
6.19.3.16		P22: 150 mm Lockable VJ Coupling	no			
6.19.3.17		P24: 150 mm Bend both ends flanged	no			
6.19.3.18		P25: 200 mm Spool Piece with puddle flange (975 mm long) - both ends flanged.	no			
6.19.3.19		P27: 200 mm Universal Adaptor	no			
6.19.3.20		P28: 200 mm Flange Adaptor	no			
6.19.3.21		P29: 250-150 mm Reducing Tee all ends flanged	no			
6.19.3.22		P31: 350x200 mm Flanged Reducer 890 mm long both ends flanged	no			
6.19.3.23		P33: Bracket for 150 mm pipe as per Detail no 101 on Drawing no C5210/4	no			
6.19.3.24		P34: 50 mm Spool Piece (1056 mm Long) both ends flanged	no			
6.19.3.25		P36: 50 mm T-Piece all ends flanged	no			
6.19.3.26		P37: Presure guage (Glycerine) with base shut off and bleed valve(10 mm Brass Gate Valve - SABS 776)(Meter 2500 kPA Rated) - rate includes fitting welded to main pipeline	no			
6.19.3.27		P add2: 150 mm Spool Piece (1875 mm long) - both ends flanged.	no			
6.19.3.28		P add3: 150 mm Spool Piece (750mm long) - both ends flanged.	no			
6.20.0.0	8.2.5	**WELDED FLANGE REDUCER**				
6.20.1.0		Welded flange reducer with flanges on both ends. Copon Coated to SABS specifications				
6.20.1.1		250x 100 mm reducer	no			
6.20.1.2		250x 150 mm reducer	no			
6.21.0.0	8.2.5	**FIRE HYDRANT COMPLETE**				
6.21.1.0		Supply and install a complete fire hydrant (SABS 1128) next to main line. Rate includes all fittings from main line according to the detail . Hydrants as per:				
6.21.1.1		Detail drawing Type No. DT 01/W. (Excluding the T-piece on mainline and the concrete manhole)	no			
TOTAL: CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
TOTAL: BROUGHT FORWARD						
6.21.1.2		Detail drawing Type No. DT 02/W. (Include concrete pedestal and exclude T-piece on main line)	no			
6.21.1.3		Detail drawing Type No. DT 03/W. (Include concrete pedestal 750 mm high and pipe to overhead line 3,0 m high)	no			
6.22.0.0	8.2.5	**FITTINGS GMS**				
		Supply and fit complete, SABS 509 approved hot dipped galvanised to SABS 763, Mild Steel, Class Medium srewed fittings:				
6.22.1.0		**a) T- Piece Equal (female):**				
6.22.1.1		15 mm	no			
6.22.1.2		20 mm	no			
6.22.1.3		25 mm	no			
6.22.1.4		32 mm	no			
6.22.1.5		40 mm	no			
6.22.1.6		50 mm	no			
6.22.1.7		65 mm	no			
6.22.1.8		80 mm	no			
6.22.1.9		100 mm	no			
6.22.1.10		150 mm	no			
6.22.2.0		**b) T-Piece Reducing:**				
6.22.2.1		150 mm x 100 mm	no			
6.22.2.2		100 x 80 mm	no			
6.22.2.3		100 x 50 mm	no			
6.22.2.4		100 x 25 mm	no			
6.22.2.5		80 x 50 mm	no			
6.22.2.6		80 x 32 mm	no			
6.22.2.7		80 x 25 mm	no			
6.22.2.8		50 x 40 mm	no			
6.22.2.9		50 x 32 mm	no			
6.22.2.10		50 x 25 mm	no			
6.22.2.11		50 x 15 mm	no			
6.22.2.12		32 x 25mm	no			
6.22.2.13		32 x 20 mm	no			
6.22.2.14		32 x 15 mm	no			
6.22.2.15		25 x 20 mm	no			
6.22.2.16		25 x 15 mm	no			
6.22.3.0		**b) Elbow**				
6.22.3.1		15 mm	no			
6.22.3.2		20 mm	no			
6.22.3.3		25 mm	no			
6.22.3.4		32 mm	no			
6.22.3.5		40 mm	no			
6.22.3.6		50 mm	no			
6.22.3.7		65 mm	no			
6.22.3.8		80 mm	no			
6.22.3.9		100 mm	no			
6.22.3.10		150 mm	no			
6.22.4.0		**c) Nipple (barrel)**				
6.22.4.1		15 mm	no			
6.22.4.2		20 mm	no			
6.22.4.3		25 mm	no			
6.22.4.4		32 mm	no			
6.22.4.5		40 mm	no			
6.22.4.6		50 mm	no			
6.22.4.7		65 mm	no			
6.22.4.8		80 mm	no			
6.22.4.9		100 mm	no			
6.22.4.10		150 mm	no			
6.22.5.0		**d) Cross**				
6.22.5.1		15 mm	no			
6.22.5.2		20 mm	no			
6.22.5.3		25 mm	no			
6.22.5.4		32 mm	no			
6.22.5.5		40 mm	no			
6.22.5.6		50 mm	no			
6.22.6.0		**e) Union**				
6.22.6.1		15 mm	no			
6.22.6.2		20 mm	no			
6.22.6.3		25 mm	no			
6.22.6.4		32 mm	no			
6.22.6.5		40 mm	no			
6.22.6.6		50 mm	no			
TOTAL: CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
TOTAL: BROUGHT FORWARD						
6.22.6.7		80 mm	no			
6.22.6.8		100 mm	no			
6.22.7.0		**f) Reducing bush**				
6.22.7.1		100 x 80 mm	no			
6.22.7.2		100 x 50 mm	no			
6.22.7.3		80 x 50 mm	no			
6.22.7.4		80 x 25 mm	no			
6.22.7.5		50 x 32 mm	no			
6.22.7.6		50 x 25 mm	no			
6.22.7.7		50 x 15 mm	no			
6.22.7.8		32 x 25 mm	no			
6.22.7.9		32 x 20 mm	no			
6.22.7.10		25 x 20 mm	no			
6.22.7.11		25 x 15 mm	no			
6.22.7.12		150 x 100 mm	no			
6.22.8.0		**g) Galvanised iron Reducing sockets**				
6.22.8.1		150 x 100 mm	no			
6.22.8.2		100 x 80 mm	no			
6.22.8.3		100 x 50 mm	no			
6.22.8.4		80 x 50 mm	no			
6.22.9.0		**h) Galvanised iron spring bend 45 degree**				
6.22.9.1		100 mm	no			
6.22.9.2		80 mm	no			
6.22.10.0		**I) Galvanised iron sockets**				
6.22.10.1		40 mm	no			
6.22.10.2		50 mm	no			
6.22.10.3		80 mm	no			
6.22.10.4		100 mm	no			
6.22.10.5		150 mm	no			
6.22.11.0		**j) Galvanised iron plugs**				
6.22.11.1		15 mm	no			
6.22.11.2		20 mm	no			
6.22.11.3		25 mm	no			
6.22.11.4		32 mm	no			
6.22.11.5		40 mm	no			
6.22.11.6		50 mm	no			
6.22.11.7		80 mm	no			
6.22.11.8		100 mm	no			
6.22.11.9		150 mm	no			
6.23.0.0	8.2.5	**FLANGES**				
6.23.1.0		Hot dipped galvanised steel screwed boss flanges drilled to BS 4504, table 16. Rate include all bolts and packing. For for nominal diameter:				
6.23.1.1		80 mm	no			
6.23.1.2		100 mm	no			
6.23.1.3		150 mm	no			
6.24.0.0	8.2.5	**GATE VALVES - BRASS**				
6.24.1.0		Approved brass, full way gate valve tested to 2500 kPa for diameter:				
6.24.1.1		15 mm	no			
6.24.1.2		20 mm	no			
6.24.1.3		25 mm	no			
6.24.1.4		32 mm	no			
6.24.1.5		40 mm	no			
6.24.1.6		50 mm	no			
6.24.1.7		65 mm	no			
6.24.1.8		80 mm	no			
6.24.1.9		100 mm	no			
6.25.0.0	8.2.11	**20 MPa CONCRETE BLOCKS**				
6.25.0.1		Thrust block	m3			
6.26.0.0	8.2.5	**PERMANENT PRESSURE/LEAK TEST FACILITY**				
6.26.0.1		Supply silicon filled pressure gauge rated at 2500 kPA with base shut and bleed valves as well as 1 x 15 mm horizontal wet dial water metre and 2 x 25 mm Quick coupling units to suit 15 mm hose connection.	unit			
6.27.0.0	8.2.11	**OVERHEAD WATER PIPE SUPPORT STANDS**				
6.27.1.0		Supply pipe holder bracket as per Drawing detail Type No. DT 07/W. Detail 1				
6.27.1.1		25 to 50 mm	no			
6.27.1.2		50 to 80 mm	no			
6.27.1.3		80 to 150 mm	no			
TOTAL: CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
TOTAL: BROUGHT FORWARD						
6.27.2.0		Supply steel pipe column as per Drawing detail Type No. DT 07/W. Rate per meter length for pipe sizes.				
6.27.2.1		50 mm	m			
6.27.2.2		80 mm	m			
6.27.2.3		100 mm	m			
6.27.3.0		Construct concrete footing for pipe column as per Drawing detail Type No. DT 07/W.	no			
6.28.0.0	8.2.11	**SERVICE DUCT**				
6.28.0.1		Construct complete stormwater canal as per Drawing detail Type No. DT 06/W. Rate per metre length.	m			
6.29.0.0	8.2.13	**VALVE BOX COVERS**				
6.29.1.0		Valve box cover as per Drawing detail Type No. DT 18/W - for Type 1: 1200mm x 1200mm	no			
6.29.2.0		Valve box cover as per Drawing detail Type No. DT 18/W - for Type 2 and Type 3: 400mm x 400mm	no			
6.29.3.0		Valve box cover as per Drawing detail Type No. DT 25/W - for: 600mm x 600mm	no			
6.30.0.0		Supply 200 x 40 x 5 mm stainless steel strip with 6 letters (size 20 mm high) punched to depth of 1 mm to indicate valve box number. Set plate in concrete.	no			
6.31.0.0		**PAINT**				
6.31.1.0		Paint GMS pipes and fittings in accordance with OWG 371, section 18.1.3 with 1 coat of self etching primer (SABS 723) and two coats high gloss enamel for exterior use. For colours:				
6.31.1.1		yellow	m2			
6.31.1.2		red	m2			
6.31.1.3		blue	m2			
6.32.0.0		**CONNECT TO EXISTING PLUMBING**				
6.32.1.0		Rate include the cutting, dismantling of existing fittings next to buildings and connection of new GMS pipes and fittings. For existing connection to building of diameter:				
6.32.1.1		15 mm	no			
6.32.1.2		20 mm	no			
6.32.1.3		25 mm	no			
6.32.1.4		32 mm	no			
6.32.1.5		40 mm	no			
6.32.1.6		50 mm	no			
6.32.1.7		65 mm	no			
6.32.1.8		80 mm	no			
6.32.1.9		100 mm	no			
6.33.0.0		**DRILLING THROUGH WALLS**				
6.33.1.0		Drill hole through 230 mm brick wall to insert new GMS pipes. For holes of diameter:				
6.33.1.1		20 mm	no			
6.33.1.2		30 mm	no			
6.33.1.3		40 mm	no			
6.33.1.4		60 mm	no			
6.34.0.0		**QUICK REPAIR CLAMP COUPLINGS**				
6.34.1.0		Full circle single band stainless steel repair clamp with rubber lining. For pipe diameters				
6.34.1.1		20 mm	no			
6.34.1.2		25 mm	no			
6.34.1.3		40 mm	no			
6.34.1.4		50 mm	no			
6.34.1.5		80 mm	no			
6.34.1.6		100 mm	no			
6.34.1.7		150 mm	no			
6.34.1.8		200 mm	no			
TOTAL SECTION 6: CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
		SECTION 7: PIPE WORK - SEWERS				
	SABS 1200 LD	**SEWERS**				
		See Particular Specification PA				
7.1.0.0	8.2.1	**PIPES - HDPE**				
		Supply, butt weld jointing and lay approved solid wall HDPE (high density polyethylene), type PE 100, Class PN 10 Pipe to SABS ISO 4427. Lay pipe in trenches or insert into sleeves. Sleeves measured elsewhere. Pipes to be supplied in 12 m lengths. See Particular Specification PA. For pipes of nominal diameter.				
7.1.1.0		110 mm	m			
7.1.2.0		160 mm	m			
7.1.3.0		200 mm	m			
7.2.0.0	8.2.1	**PIPES - PVC**				
		Supply and fix to outer/inner walls in short lenghts to toilet outlets, basins etc. Unplasticised Polyvinyl Chloride pipes (SABS 967) with diameter:				
7.2.1.0		110 mm	m			
7.2.2.0		75 mm	m			
7.2.3.0		50 mm	m			
7.2.4.0		40 mm	m			
7.2.5.0		32 mm	m			
7.3.0.0	8.2.1	**PVC FITTINGS**				
		Supply and fix to outer/inner walls to toilet outlets, basins etc. Unplasticised Polyvinal Chloride fittings with spigot and socket joints and O-ring seals (SABS 967) with diameter:				
7.3.1.0		110 mm bend with inspection eye	no			
7.3.2.0		40 mm bend with inspection eye	no			
7.3.3.0		50 mm bend with inspection eye	no			
7.3.4.0		110 mm bend with 50mm vent horn	no			
7.3.5.0		110 mm Kimberley socket	no			
7.3.6.0		50 mm Kimberley socket	no			
7.3.7.0		40 mm Kimberley socket	no			
7.3.8.0		110 x 110 mm single junction with inspection eye	no			
7.3.9.0		50 x 50 mm single junction with inspection eye	no			
7.3.10.0		110 x 50 mm single reducing junction with inspection eye	no			
7.3.11.0		110 x 110 x 110 double junction with inspection eye	no			
7.3.12.0		110 x 50 x 50 mm double reducing junction	no			
7.3.13.0		110 inspection pipe	no			
7.3.14.0		110 x 50 reducer	no			
7.3.15.0		110 mm bend pan piece with enlarged socket	no			
7.3.16.0		110 mm pan piece with enlarged socket	no			
7.3.17.0		110 mm vent valve	no			
7.3.18.0		50 mm vent valve	no			
7.3.19.0		40 mm adaptor BSP	no			
7.3.20.0		50 mm adaptor BSP	no			
7.3.21.0		Gully head - square 250 x 250 mm	no			
7.3.22.0		Gully head - round 150 x 110 mm	no			
7.3.23.0		110 mm adaptor uPVC/cast iron	no			
7.3.24.0		40 mm aluminium holderbats	no			
7.3.25.0		50 mm aluminium holderbats	no			
7.3.26.0		110 mm aluminium holderbats	no			
7.4.0.0	8.2.3	**MANHOLES - PRE-MANUFACTURED - HDPE**				
		Construct manhole complete from a single length 1000 mm diameter HDPE (8 kN / m2 ring stiffness) pipe Type PE 100 to SABS ISO 4427. See Drawing detail Type No. DT 04/D, DT 09/D, DT 10/D, DT 11/D and DT 12/D. Price includes complete manhole with bencing, step irons, concrete base and ringbeam at top. Manhole covers measured elsewhere. See also Particular Specification PA .				
7.4.1.0		0000 - 1000 mm	no			
7.4.2.0		1000 -1500 mm	no			
7.4.3.0		1500 - 2000 mm	no			

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
TOTAL: CARRIED FORWARD						
TOTAL: BROUGHT FORWARD						
7.4.4.0		2000 - 2500 mm	no			
7.4.5.0		2500 - 3000 mm	no			
7.5.0.0	8.2.3	**FACTORY FITTED BENCHING - HDPE LARGE MANHOLES**				
		Extra over 7.4.1.0 to 7.4.5.0 to factory fit HDPE manholes with connections, channels and benching for site welding on (not ruber socket ends) of HDPE pipes of nominal diameter and configuration as follow:				
7.5.1.0		100 mm straight channel	no			
7.5.2.0		160 mm straight channel	no			
7.5.3.0		200 mm channel at 45 degrees bend with 1 x 160 mm side inlet	no			
7.5.4.0		200 mm straight channel with 2 x 160 mm side inlets	no			
7.5.5.0		160 mm channel at 45 degrees bend with 2 x 110 mm side inlets	no			
7.5.6.0		160 mm straight channel with 2 x 160 mm side inlets	no			
7.5.7.0		160 mm straight channel with 1 x 160 mm side inlets	no			
7.5.8.0		160 mm channel at 90 degrees bend	no			
7.5.9.0		Extra over any junction to weld on in factory a 1000 mm long pipe of diameter:				
7.5.9.1		110 mm	no			
7.5.9.2		160 mm	no			
7.5.9.3		200 mm	no			
7.6.0.0	8.2.11	**CONNECTION TO EXISTING MANHOLES**				
		Cut into existing manhole, remove benching, replace benching and new clay channels and provide flexible connection joint for:				
7.6.1.0		100 mm HDPE pipe	no			
7.6.2.0		160 mm HDPE pipe	no			
7.6.3.0		200 mm HDPE pipe	no			
7.7.0.0	8.2.3	**MANHOLES - PRE-MANUFACTURED - HDPE**				
		Construct manhole complete from a single length 1000 mm diameter HDPE (8 kN / m2 ring stiffness) pipe Type PE 100 to SABS ISO 4427. See Drawing detail Type No. DT 05/D, DT 09/D, DT 10/D and DT 11/D. Price includes complete manhole with bencing, concrete base and ringbeam at top. Manhole covers measured elsewhere. See also Particular Specification PA				
7.7.1.0		a) 350 mm and 500 mm deep	no			
7.7.2.0		b) 500 mm and 750 mm deep	no			
7.7.3.0		c) 700 mm and 1,0 m deep	no			
7.7.4.0		Extra over 7.4 to raise manhole 0,5 m	no			
7.7.5.0		Extra over 7.7 to raise manhole 0,5 m	no			
7.7.6.0		Extra over manhole for factory welding on of 110 mm long radius HDPE bend	no			
7.7.7.0		Extra over manhole for factory welding on of 110 mm diameter PE PN 10 HDPE pipe 1000 mm long	no			
7.8.0.0	8.2.11	**REPLACEMENT OF CAST IRON PIPES**				
7.8.1.0		Chase into wall and replace complete 110 mm cast iron wastepipe with PVC from toilet to inspection outlet bend. Rate include fixing of wall and paint.	no			
7.8.2.0		Dismantle 110 mm cast iron pipe and fittings	m			
7.9.0.0		**SANITARY FITTINGS**				
7.9.1.0		Replace complete white vitreous china pedestal water closet (SABS 497).	no			
7.9.2.0		Replace complete, with flush valve, vitreous china wall mounted urinal with bottle trap.	no			
7.10.0.0	8.2.3	**MANHOLE COVERS**				
		Cast iron manhole covers and frames (SABS 558) build into roofs of valve, stormwater and sewer chambers. See Drawing detail Type No. DT 04/D. For type:				

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
7.10.1.0		Type 4	no			
TOTAL: CARRIED FORWARD						
TOTAL: BROUGHT FORWARD						
7.10.2.0		Type 1A	no			
		Concrete manhole covers and frames build into roofs of valve, stormwater and sewer chambers. See Drawing detail Type No. DT 08/D. For diameter:				
7.11.1.0		900 mm	no			
7.11.2.0		1050 mm	no			
7.11.3.0		1200mm	no			
TOTAL SECTION 7: CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
	SABS 1200 LE	**SECTION 8: PIPE WORK - STORM WATER**				
8.0.0.0	8.2.1	**PIPES**				
		See Particular Specification PA				
8.1.0.0	8.2.1	Supply, handle and lay Class 100 D SABS 677 concrete pipe with rubber ring. Nominal diameter:				
8.1.1.0		1200 mm	m			
8.1.2.0		900 mm	m			
8.1.3.0		825 mm	m			
8.1.4.0		600 mm	m			
8.1.5.0		450 mm	m			
8.2.0.0	8.2.1	Supply, handle and lay structured wall, 8 kN/m2 HDPE (high density polyethylene) pipe Type PE 100 to SABS ISO 4427. Supply pipe in 12 metre lengths with welded joints. Install on Class B bedding. See Particular Specification PA. Nominal diameter of pipes:				
8.2.1.0		1200 mm in trenches	m			
8.2.2.0		1000 mm in trenches	m			
8.2.3.0		900 mm in trenches	m			
8.2.4.0		600 mm in trenches	m			
8.2.5.0		500 mm in trenches	m			
8.2.6.0		450 mm in trenches	m			
8.2.7.0		350 mm in trenches	m			
8.3.0.0	8.2.8	**INLET / OUTLET STRUCTURES**				
8.3.1.0		Construct steel inlet grid as per Detail TYPE NO DT 19/ST	no			
8.4.0.0	8.2.8	**MANHOLES**				
		Construct manhole complete from a single length diameter 1000 mm diameter HDPE (8 kN / m2 ring stiffness) Type PE 100 to SABS ISO 4427 pipe with inclusion of factory fitted benching (separate item scheduled for types of benching), step irons and Cover slab as per Detail TYPE DT 20/ST				
8.4.1.0		0000 - 1000 mm	no			
8.4.2.0		1000 -1500 mm	no			
8.4.3.0		1500 - 2000 mm	no			
8.4.4.0		2000 - 2500 mm	no			
8.5.0.0	8.2.8	**FACTORY FITTED BENCHING - HDPE MANHOLES**				
		Extra over 8.4.0.0 to factory fit HDPE manholes with connections, channels and benching for Weholite HDPE pipes of nominal diameter and configuration as follow:				
8.5.1.0		450 mm straight channel with 280 mm side inlet	no			
8.5.2.0		450 mm channel bend at 45 degrees	no			
8.5.3.0		500 mm straight channel, one end to fit 450 mm pipe	no			
8.5.4.0		600 mm straight channel	no			
8.5.5.0		500 mm straight channel with 450 mm side inlet at 90 degrees	no			
8.5.6.0		500 mm straight channel with 500 mm side inlet at 45 degrees.	no			
8.6.0.0		**CONNECTING TO EXISTING MANHOLES**				
		Cut into existing concrete inlet structure with concrete wall 300 mm thick and join pipe, repair concrete and remove and replace benching for pipes of diameter:				
8.6.1.0		1000 - 1200 mm	no			
8.6.2.0		600 - 900 mm	no			
8.6.3.0		300 - 600 mm	no			
TOTAL SECTION 8: CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
	SABS 1200 LG	**SECTION 9: PIPE JACKING**				
9.1.0.0		**DRILLING**				
9.1.1.0	8.2.6	Horizontal (auger) drilling or pneumatic hammer pipe jacking under railway line and install 600mm class 100 D (SABS 667) concrete pipe. Distance from thrust to reception station is 6 m with no intermediate stations. Rate include the full cost of site establishment, drilling, pipe insertion, supervision, labour, material and plant. Sleeve pipe measured separately.				
9.2.0.0		**GROUT**				
9.2.1.0		Grout space between 450 mm HDPE and 600 mm concrete pipe with 400 mm wide 20 MPa /13 mm concrete band at entry and exit from sleeve pipe.				
9.3.0.0	8.2.8	**EXCAVATION IN ROCK**				
9.3.1.0	8.2.8	Extra over 9.1.1.0 for excavation in rock				
TOTAL SECTION 9: CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
	SABS 1200 MK	**SECTION 10: KERBINGS AND CHANNELLING**				
	8.2.1	**CONCRETE KERBINGS**				
10.1.0.0		30 MPa kerbings, inclusive of all excavation, bedding, joint sealing and pointing, concrete at back of joints as well as backfilling and compaction of soil to 1000 mm beyond kerb as per Detail drawing Type No. DT 01/R.				
10.1.1.0	8.2.1(b)	a) Precast Semi-mountable: Type - Fig 7 (SABS 927)				
10.1.1.1		1000 mm sections	m			
10.1.1.2		300 mm sections on curves	m			
10.1.2.0	8.2.1(b)	b) Precast mountable: Type - Fig 8 (SABS 927)				
10.1.2.1		1000 mm sections	m			
10.1.2.2		300 mm sections on curves	m			
10.1.3.0	8.2.1	c) 300 x 250 mm in situ cast flat kerb as per Detail drawing DT 01/R and DT 03/R	m			
10.1.4.0	8.2.1.(c)	d) 150 x 150 mm edge restraint for concrete pavements as per Detail drawing Type No. DT 04/P	m			
10.2.0.0		Storm water channelling next to buildings as per Detail drawing Type No. DT 06/ST. For canal width:				
10.2.1.0		a) 300 mm				
10.2.1.1		1000 mm sections	m			
10.2.1.2		90 degree Corner unit	no			
10.2.1.3		Gully entrance	no			
10.2.1.4		T- junction	no			
10.3.0.0	8.2.4	Depressed kerbings, extra over normal kerbings straight or curved	m			
10.4.0.0		**SERVICE DUCTS IN ROADS**				
10.4.1.0		Type R 600 x 600 mm rectangular portal culvert Class C to SABS 986 installed with roof to bottom for service ducts in paved areas. Place on 100 mm 25 MPa/19 mm concrete foundation and seal all joints with approved polysulphide sealant.	m			
10.4.2.0		Steel grid to fit culvert of 10.4.1.0 manufactured in 3 m lengths consisting of a 60 x 60 x 8 mm angel iron welded onto sides of 500 mm catwalk type grating with cross bars of minimum 50 x 5 mm flat iron. Weld grating to fit into and rest on culvert edge. All joints to be 5 mm filet welds on all sides.	m			
10.4.3.0		Cast in situ service duct with grating over as per Detail drawing Type No. DT 01/ST(internal width 500 mm and depth 450 mm.	m			
10.5.0.0	8.2.8	**CAST IN SITU CONCRETE OPEN DRAINS**				
10.5.1.0		Construct a 2,8 metre wide, 300 mm deep V - shaped 25 MPa/ 19 mm concrete (SABS 1200 G 5.5.1.7)drain. Complete as per Detail drawing Type No. DT 02/ST. Thickness of concrete - 150 mm. Reinforcing - Ref 617 (SABS 1047) welded mesh continuous over alternating slabs. (**Steel - Y 10 mm diameter at 200 h/h in both directions**). Joints - Cannel to be cast in 3 metres alternating panels with construction / contraction joints as per Detail drawing Type No. DT 12/ST and expansion joints at every 12 meters as per Drawing detail Type No. DT 04/ST with slip lined bars at 200 mm c/c. Surface finishing - wood floated (SABS 1200 G). Accurancy of concrete surface - Degree II. Provide also 250 micron Polyethylene sheeting to base. Base preparation - Compact to 95 % Mod AASHTO density. Rate shall include all preparation, material and form work. Excavations measured separately.	m2			
10.5.2.0		As above 2,0 metre wide, 200 mm deep and concrete thickness 125 mm. Cast in 3 metre alternating panels.	m2			

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
TOTAL: CARRIED FORWARD						
TOTAL: BROUGHT FORWARD						
10.5.3.0		As above 1,5 metre wide, 150 mm deep and concrete thickness 120 mm. Cast in 2 metre alternating panels.	m2			
10.5.4.0		As above 1,2 metre wide 150 mm deep and concrete thickness 100 mm. Cast in 2 metre alternating panels.	m2			
10.6.0.0		**CONCRETE PAVING SLABS**				
10.6.1.0		Cast concrete paving slabs as per as per Detail drawing Type No. DT 04/P and DT 06/P.	m2			
10.6.2.0		Extra over 10.6.1.0 to cast edge thickening as shown in Detail drawing Type No. DT 06/P.	m			
10.7.0.0	8.2.13	**POLYETHYLENE SHEETING**				
10.7.1.0		Provide, lay and join 300 micron polyethylene sheeting on prepared surface beds for channelling other than above.	m2			
10.8.0.0	SABS 1200 DA	**EXCAVATION FOR STORMWATER DRAIN**				
	8.3.2(a)	Excavate in all material, including trimming for dished concrete stormwater drains and dispose of surplus material to designated commercial dump site, For depths:				
10.8.1.0		0 - 1,0 m	m3			
		Extra over 10.8.1.0 for:				
10.8.2.0	8.3.2(b)1	Intermediate excavation	m3			
10.8.3.0	8.3.2(b)2	Hard rock excavation	m3			
TOTAL SECTION 10: CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
		SECTION 11: ROAD WORKS				
	SABS 1200 DM	**EARTH WORKS (SUB-GRADE)**				
		All material from excavations that needs to be spoiled shall be taken to commercial dump site				
11.1.0.0	8.3.2	**PREPARATION**				
11.1.1.0	8.3.2	Remove existing Bitumen surface to a depth of 70 mm and dispose of it commercial dump site. Rates for thinner and thicker layers to be calculated as a direct proportion of a 70 mm thick layer.	m2			
11.1.2.0	8.3.2	Remove topsoil to a depth of 200 mm and spoil, spread and compact to 90% Mod AASHTO density within 600 m from point of excavation.	m3			
11.2.0.0		**EXISTING BASE/SUBBASE TO WINDROW**				
11.2.1.0	8.3.10	Rip, remove to stockpile or windrow and maintain existing base-course to a depth of 150 mm from area to be re-constructed.	m3			
11.2.2.0	8.3.10	Rip, remove to stockpile or windrow and maintain subbase to a depth of 150 mm from area to be reconstructed.	m3			
11.3.0.0		**CUT TO SPOIL**				
11.3.1.0	8.3.7(b)	Rip, remove and dispose of in-situ material, old base, old subbase or selected layers from area to be reconstructed. Spoil material in commercial dump site.	m3			
11.4.0.0	8.3.3	**ROAD-BED TREATMENT**				
11.4.1.0	8.3.3(a)2	Scarify/rip to 150 mm depth the in situ material of area to be reconstructed, and re-compact to 93 % Mod AASHTO density.	m3			
11.4.2.0	8.3.3(b)2	Blasting of hard rock in road bed	m3			
11.5.0.0		**SELECTED LAYER**				
11.5.1.0	8.3.5	Construct 150 mm selected layers from previous roadbed excavation stockpile (in terms of 11.2.1.0 and 11.2.2.0) and compact to 93% Mod AASHTO density for type G7 (ref TRH4).	m3			
11.5.2.0	8.3.5	Construct 150 mm selected layers from roadbed excavation and compact to 93% Mod AASHTO density for type G7 (ref TRH4). Rate include also excavation from road bed.	m3			
11.5.3.0	8.3.5	Construct 150 mm selected layers from material from commercial off-site sources. Rate include loading, haul, spreading and compaction to 93% Mod AASHTO density for type G7 (ref TRH4).	m3			
11.6.0.0		**STORM WATER IMPROVEMENT ON EDGE OF ROAD**				
11.6.1.0	8.3.10	Blade 100 to 300 mm thick topsoil to windrow on 5 to 15 m wide shoulder of road and stockpile material 10 m from edge of road. Redress same area with topsoil from stockpile and compact to 95% Mod AASHTO density.	m3			
11.6.2.0	8.3.3.2	Scarify, shape to even levels and compact in-situ material to 95% Mod AASHTO density.	m3			
11.6.3.0	8.3.7(a)	Cut to spoil soft material from road shoulder	m3			
TOTAL SECTION 11: CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
	SABS 1200 ME	**SECTION 12 :SUBBASE**				
12.1.0.0	8.3.3	Construct 150 mm thick subbase from material from commercial off-site sources. Compact to 95% MOD AASHTO density	m3			
12.2.0.0		Extra over 12.1.0.0				
12.3.1.0	8.3.3	areas 2,0 m2 and smaller (i.e. potholes)	m3			
12.3.2.0	8.3.3	areas less than 100 m2 .	m3			
12.4.0.0	8.3.5(d)	Stabilisation	m3			
12.5.0.0	8.3.8	Stabilising agent: Ordinary Portland Cement	ton			
12.6.0.0	8.3.3	Construct 150 mm thick subbase, in confined areas between building where only small walk- behind compactors have access to. Material from commercial off site sources. Compact to 95% Mod AASHTO density.	m3			
12.7.0.0	8.3.5(d)	Extra over 12.6.0.0 for stabilisation	m3			
TOTAL SECTION 12: CARRIED FORWARD TO SUMMARY						**0.00**

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
	SABS 1200 MF	**SECTION 13: BASE**				
13.1.0.0	8.3.3(b)	Construct a base layer of 150 mm graded crusher stone from commercial off-site sources and compact to 98% Mod AASHTO density.	m3			
13.2.0.0		Extra over13.1.0.0 for:				
13.2.1.0		areas 2,0 m2 and smaller (i.e. potholes)	m3			
13.2.2.0		areas less than 100,0 m2	m3			
13.3.0.0	8.3.5(d)	Stabilisation (Extra over 13.1.0.0)	m3			
13.4.0.0	8.3.8	Stabilising agent - Ordinary Portland Cement.	ton			
13.5.0.0	8.3.3(b)	Construct 150 mm thick base, in confined areas between buildings where only small walk-behind compactors have access to. Material from commercial off site sources. Compact to 95% Mod AASHTO density.	m3			
13.6.0.0	8.3.5(d)	Extra over 13.5.0.0 for stabilisation	m3			
TOTAL SECTION 13: CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
	SABS 1200 MH	**SECTION 14: ASPHALT SURFACING**				
14.1.0.0	8.5.1	PRIME COAT Apply a coat of tar prime Grade RTH 3/12P at nominal rate of 0,8 l/m2	m2			
14.2.0.0	8.5.3	TACK COAT Apply tack coat of 30% stable grade emulsion at 0,8 l/m2	m2			
14.3.0.0	8.5.4	PREMIX Supply and lay a premix wearing course of continuously graded asphalt (TPA - Medium) using 60/70 bitumen binder (smoothness accuracy I i.t.o.. Clause 6.3.6) for thickness:				
14.3.1.0		30 mm	ton			
14.3.2.0		30 - 75 mm	ton			
14.3.3.0		75 - 100 mm	ton			
14.4.0.0	8.5.5	**VARIATIONS IN QUANTITIES**				
14.4.1.0		RTH 3/12P	liter			
14.4.2.0		30% stable grade emulsion	liter			
14.4.3.0		60/70 bitumen binder	liter			
14.5.0.0	8.5.6	**MINERAL FILLER**				
14.5.1.0		Ordinary Portland cement	ton			
14.6.0.0		**CRACK SEALING**				
14.6.1.1		a) Sealing of cracks less than 3mm with anionic stable grade emulsion	liter			
14.6.2.0		b) Crack sealing (3 mm to 10 mm) in bitumen surfaces.	liter			
14.6.2.1		Clean cracks by means of compressed air and apply an approved herbicide in accordance with the manufacturers description and allow to dry for 24 hours. Penetrate cracks with MSP/1 or similar suitable primer. Apply one coat of anionic stable grade emulsion by means of pneumatic spraying equipment.	m			
14.6.2.2		Fill crack with rubber slurry mix of 8 parts rubber crumbs, 2 parts crusher dust, 4,5 parts of 60% cationic stable grade bitumen emulsion, 0,2 parts of ordinary Portland cement and 1,1 part SBR (net rubber). Work slurry neatly into cracks with rubber squeegees and remove excess slurry as soon as emulsion has broken.	liter			
14.6.2.3		Same as above but fill crack with hot bitumen rubber mixture. Rubber content shall be at least 25% by mass of the total bitumen rubber mix.	liter			
14.7.0.0	SABS 1200 MM	**ANCILLARY ROADWORKS**				
14.7.1.0	8.3	Permanent road/danger signs(remove and replace existing)	no			
14.7.2.0	8.3.6	Statutory signs complete(remove and replace existing)	no			
14.7.3.0	8.4.	Road marking				
	8.4.1	Non-reflecting paint applied at nominal rate of 0,42 l/m2				
14.7.3.1	8.4.1(a)	White lines, 100 mm wide	m2			
14.7.3.2	8.4.1(b)	Yellow lines, 100 mm wide	m2			
14.7.3.3	8.4.1(c)	White characters	m2			
14.7.3.4	8.4.1(d)	White lines 100 - 600 mm wide	m2			
TOTAL SECTION 14: CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
	SABS 1200 MJ	**SECTION 15: SEGMENTED PAVING**				
		Paving measured are predominantly around buildings and at entrance roads, with widths varying from 1,0 m to 5,0 m.				
15.1.0.0	8.2.1	Edge restraints formed with last brick on edge on a 150 x 300 mm, 25 MPa surface bed and 150 x 150 mm triangular concrete restraint on edge. As per detail Drawing Type No. DT 03P.				
15.2.0.0	8.2.1	Triangular edge restraints as per drawing Detail Drawing TYPE NO DT 01/P				
15.3.0.0	8.2.2	Paving construction of 80 mm grey double ZZ, 25 MPa inter-locking paving bricks, complete including 45 mm (uncompacted thickness) bedding sand, approved weed killer, filler sand with grading less than 1.18 mm and PVC sheeting . Bricks laid in stretcher or herring-bone pattern (Base, subbase and earthworks measured elsewhere). See detail drawing Type No. DT 01P, 02P, 03P, 05P, 01R, 03R.				
15.4.0.0	8.2.2	Paving construction of 50 mm grey standard bond, 25 MPa paving bricks, complete including 45 mm (uncompacted thickness) bedding sand, approved weed killer, filler sand with grading less than 1.18 mm and PVC sheeting . Bricks laid in stretcher or herring-bone pattern (Base, subbase and earthworks measured elsewhere). See detail drawing Type No. DT 01P, 02P, 03P, 05P, 01R, 03R.				
15.5.0.0	8.2.2	Remove and replace existing 50 mm paving in sidewalk with inclusion of 150 mm deep surface preparation of rip and compact to 93 % Mod AASHTO density of in situ material.				
15.6.0.0	8.2.3	Cutting of paving bricks to fit edge restrains from paving of thickness:				
15.7.1.0		50 mm				
15.7.2.0		80 mm				
TOTAL SECTION 15: CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
		SECTION 16:SURVEY BEACONS				
16.1.0.0		**SURVEY POINT**				
		See Detail Drawing Group No 7 : Survey Beacon Details				
16.1.1.0		Install : Survey Point in road surface as per Detail Drawing TYPE NO DT 01/SB	No			
16.2.0.0		**CONTROLE BEACON**				
16.2.1.0		Install : Controle beacon on rock as per Detail Drawing TYPE NO DT 02/SB	No			
16.3.0.0		**SURVEY POINT**				
16.3.1.0		Install : Survey Point in open field as per Detail Drawing TYPE NO DT 03/SB	No			
16.4.0.0		**LEVELING PIN**				
16.4.1.0		Install : Leveling Pin against building as per Detail Drawing TYPE NO DT 04/SB	No			
16.5.0.0		**SURVEY BASE STATION**				
16.5.1.0		Install : Survey Base Station as per Detail Drawing TYPE NO DT 05/SB	No			
16.6.0.0		**SURVEY POINT**				
16.6.1.0		Install Survey Point in Concrete as per Detail Drawing TYPE NO DT 06/SB	No			
TOTAL SECTION 16: CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
		SECTION 17 : FENCING				
		PRECAST CONCRETE FENCE				
17.1.0.0		Supply and erect 2000 mm high precast concrete fence complete. Rate shall include the clearance of vegetation, filling or excavation of minor irregular surface areas, and erect complete wall.	m			
17.2.0.0		**STEEL FENCE**				
17.2.1.0		Repairs to security fences by specialist contractor	m			
TOTAL SECTION 17: CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
18.0.0.0	PE	**SECTION 18: SUBSURFACE GROUTING**				
		This section deals with the grouting of subsurface cavities or abandoned services with a pumpable concrete or cement/sand or cement/soil mixture. Work shall comprise of the pumping of grout mix directly from grout mixer via flexible pipes attached to down-the-hole steelpipes lowered to a depth as indicated by the Engineer into boreholes or existing sub-surface pipe systems. See Particular Specification PE; Subsurface Grouting				
18.1.0.0	PE9.1	**SITE ESTABLISHMENT**				
18.1.1.0		Site establishment of grout mixer, pump, flexible hoses and pressure metres. Rate shall include the establishing and maintenance of all equipment on site for the duration of grouting operation.	Sum			
18.2.0.0	PE9.2	**SETTING UP OF GROUTING EQUIPMENT**				
18.2.1.0		Set up grouting equipment at each borehole or at a position to grout abandoned sewer and water pipes.	no			
18.3.0.0	PE11	**STEEL GROUT PIPES**				
18.3.1.0		Insert 50mm screwed seamless steel pipe in borehole or underground pipe	m			
18.4.0.0	PE10.3	**GROUTING**				
		Supply, deliver, mix and pump continuously grout as specified below. The amount to be pumped per setup shall be determined by Engineer. For grout type:				
18.4.1.0		Grout type 1 - 1 to 2 MPa / 70:30 OPC:FA self compacting concrete utilising crusher- and filler sand to suit a slump of 90 mm. Mix to be pumpable.	m3			
18.4.2.0		Grout type 2 - 20 /1 filler sand: cement with controlled slump to allow free flowing.	m3			
18.4.3.0		Grout type 3 - 50 kg cement per /1m3 soil with controlled slump to 350 mm on calcrete flow metre. (See PE 10.2)	m3			
		Grout type 3 - pumped into existing abandoned water and sewer pipes.	m3			
18.5.0.0		**MATERIAL FOR VARIATIONS IN QUANTITIES**				
18.5.1.0		Cement: PC 25	ton			
18.5.2.0		Fine filler/plaster sand	m3			
TOTAL SECTION 18: CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL R
	SABS 1200 GA	**SECTION 19: CONCRETE**				
		Note: No air entraining agents shall be used unless by written instruction of the Engineer. All concrete shall be compacted by vibrating. Slump as per Clause 5.4 1.2.				
		Concrete work primaraly for the construction of valve chambers as per Detail Drawing DT 11-1/W, DT 11-3/W, DT 11-4/W, DT 11-5/W AND Drawing C 5210/4				
19.1.0.0	8.2	**FORMWORK**				
19.1.1.0	8.2.3	Smooth formwork in narrow widths (up to 300 mm) for floor slabs. Form work to allow for continuous reinforcement over joint.	m2			
19.1.2.0	8.2.2	Smooth formwork in widths (up to 800 mm) for platforms or stormwater energy - dissipating splitters or survey beacons.	m2			
19.1.3.0	8.2.2	Smooth - vertical walls of canal 1,0 to 1,5 m deep at an 45 degree angle	m2			
	8.2.2	Smooth - vertical on inside of valve chambers, sleeve chambers and stormwater catch pits.	m2			
19.1.4.0	8.2.2	Smooth - horizontal under slabs in valve chambers etc.	m2			
19.1.5.0	8.2.1	Rough - vertical outside walls of valve boxes etc.	m2			
19.1.6.0	8.2.4	Box out 100 mm circular holes in 200 mm roof slabs.	no			
19.2.0.0	8.3.1	**STEEL**				
19.2.1.0	8.3.1	Y - 25 mm in floor slabs or sinkhole bases	ton			
19.2.2.0	8.3.1	Y - 20 mm in floor slabs or sinkhole bases	ton			
19.2.3.0	8.3.1	Y - 16 mm in walls and floors	ton			
19.2.4.0	8.3.1	Y - 12 mm in walls and floors	ton			
19.2.5.0	8.3.1	Y - 10 mm in walls and floors	ton			
19.3.0.0		**BLINDING LAYER**				
19.3.1.0	8.4.2	50 mm 15 MPa/19 mm blinding layer under 2,0 to 3,0 m wide canal floor slabs.	m3			
19.4.0.0	8.4	**CONCRETE**				
19.4.1.0	8.4.3	25 MPa/19 mm (rapid hardening Portland) concrete placed at base of sinkhole against natural ground formation. Curing as per Clause 5.4.7(a).	m3			
19.4.2.0	8.4.3	30 MPa/19 mm concrete placed in reinforced floor slabs, canal floors or foundations. Curing as per clause 5.4.7(b) with uPVC sheets. Accuracy degree II (Clause 6.4)	m3			
19.4.3.0	8.4.3	30 MPa/19 mm concrete placed in reinforced floor and roof slabs. Curing as per clause 5.4.7(b) with uPVC sheets. Accuracy degree II (Clause 6.4)	m3			
19.4.4.0	8.4.3	25 MPa/19 mm concrete placed in reinforced vertical walls of manholes, valve boxes , canal, etc. Curing of exposed surfaces as per clause 5.4.7(b) with uPVC sheets. Accuracy degree II (Clause 6.4)	m3			
19.4.5.0	8.4.3	30 MPa/19 mm concrete placed in reinforced vertical or skew (45 degrees) walls of canal. Curing of exposed surfaces as per clause 5.4.7(b) with uPVC sheets. Accuracy degree II (Clause 6.4)	m3			
19.5.0.0	8.4.4	**FINISHES**				
19.5.1.0	8.4.4(b)	Steel- floated finish	m2			
19.5.2.0	8.4.4(a)	Wood- floated finish	m2			
19.6.0.0	8.5	**JOINTS**				
19.6.1.0		Construction joint Type 1 in stormwater canal as per drawing Type No. DT 11/ST. Rate includes waterstop and allowance for shutter to accommodate water stop and steel continuous over joint.	m			
TOTAL CARRIED FORWARD						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
TOTAL BROUGHT FORWARD						
19.6.3.0		Expansion joint in floor slab or canal as per detail drawing Type No. DT 04/ST.	m			
19.6.4.0		Expansion joint against building. Same as per detail drawing Type No. DT 05/ST.	m			
19.6.5.0		10 mm Bitumen impregnated soft board in any joint.	m2			
19.7.0.0		**PRECAST CONCRETE**				
19.7.1.0		Concrete bollard placed around valve chambers(diameter 300, 1800 mm long) complete with 600 x 600 x 600 concrete foundation(25 mPA/10 m	no			
19.7.2.0		Precast concrete pipe route markers (diameter 200 m; 1200 mm long)complete with 600 x 600 x 600 concrete foundation(25 mPA/10 m	no			
TOTAL SECTION 19: CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
		SECTION 20: JOINT SEALANT				
		This section deals with the sealing of joints around buildings and paved areas. Priced items shall allow for the cleaning of joint from all old filler or debris and jetting clean with compressed air. The joint shall be dry (min 4 days without rain after cleaning), cleaned and prepared inclusive of surface preparation as per manufacturer's instructions for the particular application and insertion of bond breaker and compressible joint filler before applying sealant. No claims for recleaning shall be allowed. Joint filler width to depth dimensions are to be according to supplier detail.				
20.1.0.0		**JOINTS - LABOUR AND PROFIT**				
		For items 20.1.1.0 to 20.1.2.3 the contractor must submit the total cost of labour, plant and profit of joint sealing exclusive of material.				
		Clean joints, prepare surface and apply:				
20.1.1.0		a) Bitumen Based				
20.1.1.1		Joints 0 - 15 mm	m			
20.1.1.2		Joints 15 -22 mm	m			
20.1.1.3		Joints 22 - 25 mm	m			
20.1.2.0		b) Polysulphite Based				
20.1.2.1		Joints 0 - 15 mm	m			
20.1.2.2		Joints 15 -22 mm	m			
20.1.2.3		Joints 22 -25 mm	m			
20.2.0.0		**MATERIAL**				
		The rate for material shall allow for the supply of material on site ready to use:				
20.2.1.0		Bitumen Based (specified type ……..……..…….. ……..) suitable for sealing of stormwater canals as well as open paved areas such as roads, etc.	liter			
20.2.2.0		Polysulphite Based (specified type ……..……..…….. ……..) suitable for sealing of stormwater canals as well as open paved areas such as roads, etc.	liter			
TOTAL SECTION 20: CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL
						R
	PD	**SECTION 21: GEOTECHNICAL DRILLING**				
		Refer to the Particular Specification PD: Exploratory Drilling for Engineering Geological Investigation.				
21.1.0.0	PD 8	**SITE ESTABLISHMENT**				
21.1.1.0	PD 8.1	Site establishment includes all cost to establish the complete drilling rig and personnel on site as well as the removal thereof after completion of a drilling phase.	no			
21.2.0.0	PD 8.2	**SETTING UP AND REMOVAL OF RIGS AT EACH BOREHOLE**	no			
21.3.0.0	PD 9	**ROTARY PERCUSSION DRILLING (165 MM DIAMETER) FOR DEPTHS:**				
21.3.1.0	PD 9.2.1	0 TO 30 M				
21.3.1.1		Hard	m			
21.3.1.2		Soft	m			
21.3.1.3		Cavity	m			
21.3.2.0	PD 9.2.2	30 to 60 m				
21.3.2.1		Hard	m			
21.3.2.2		Soft	m			
21.3.2.3		Cavity	m			
21.3.3.0	PD 9.2.3	60 to 100				
21.3.3.1		Hard	m			
21.3.3.2		Soft	m			
21.3.3.3		Cavity	m			
21.4.0.0	PD 9.3	**DRILLING AT INCLINATION (1 - 30 DEGREES) Extra over 21.3.1.1 to 21.3.3.3**	m			
21.5.0.0	PD 9.6	**FOAM/DRILLING MUD**	liter			
21.6.0.0	PD 10	**CASING**				
21.6.1.0	PD 10.1	Temporary	m			
21.6.2.0	PD 10.2	Permanent	m			
21.6.3.0	PD 10.3	Permanent (1,5 m) casing for grouting	no			
21.6.4.0	PD 10.4	Concrete grouting surface plug	no			
21.7.0.0	PD 12	**BACKFILLING OF BOREHOLE**	m			
21.8.0.0	PD 13	**STABILISED GROUTING OF BOREHOLE**	m			
21.9.0.0	PD 14	**SEAL AND MARKING OF BORE HOLES**	no			
21.10.0.0		**DRILLING THROUGH ASPHALT SURFACES**	no			
TOTAL SECTION 21: CARRIED FORWARD TO SUMMARY						

ITEM NO	PAYMENT REFERS	DESCRIPTION	UNIT	QUANTITY	RATE	TOTAL R
	PA	**SECTION 22: DYNAMIC COMPACTION**				
		General work description: Compact area of subsidence with 12 ton free falling weight from a height of 18 metres. (minimum of 60- ton crane)				
		Primary compaction: 10 blows/25 m2				
		Secondary compaction: 5 blows/25 m2				
		Finishing compaction: 1 blows/1 m2				
		Alternatively depth treatment to contractors design and subject to 3 year guarantee.				
		SITE ESTABLISHMENT				
	PA 13.1	Rate shall include all procurement and site establishment of equipment and personnel as per conditions in Particular Specification PA Clause 2 and 9.1.	sum			
		MOVEMENT ON SITE				
		Rate shall cover the full cost to move, level machine area and setup all equipment, between any two locations on the base as per Particular Specification PA Clause 9.2 for:.				
	PA 13.2	Dismantling and re erection for movement under own power	no			
	PA 13.3	Dismantling and re erection for movement with truck.	no			
	PA 13.4	Movement under own power.	km			
	PA 13.5	Protection of paved areas.	m			
	PA 13.6	Movement per truck.	no			
		DYNAMIC COMPACTION				
	PA 13.7	Compaction of designated areas as per requirements of Particular Specification PA Clause 10.2 and 13.7	m2			
		Depth treatment, in accordance with contractors own design, of borrow areas, with assorted loose fill of concrete pipes, rocks and general building rubble etc. Treatment to be sufficient to allow surface bearing capacity of 400 Kpa. Treatment of depth:				
		2 to 3 m	m2			
		3to 5 m	m2			
		5 to 7 m	m2			
		TAMPER				
		Remove and replace with other type as directed by Engineer	prov.			
		TESTING				
	PA 13.8	Testing, as ordered by Engineer, to be conducted by external laboratory	prov			
	PA 13.8	Plate load testing to 600 KPa	no			
TOTAL SECTION 22: CARRIED FORWARD TO SUMMARY						