

# GAUTRAIN MANAGEMENT AGENCY



**Our Ref.: GMA 2014 08 0010**  
**Your Ref: 505449**  
**GDARD Ref: Gaut: 002/14-15/0028**

8 August 2014

Strategic Environmental Focus (SEF)  
CSIR Campus  
Building 4  
2<sup>nd</sup> Floor  
Meiring Naude Street  
Brummeria

**ATTENTION: MANDLA ZUMA**

Dear Madam,

## **INVITATION TO REGISTER AS AN INTERESTED AND AFFECTED PARTY AND COMMENT ON THE BASIC ASSESSMENT PROCESS FOR THE SEWERAGE CONNECTION AND STORMWATER INFRASTRUCTURE FOR THE WEST END OFFICE PARK IN CENTURION, GAUTENG**

The letter from Strategic Environmental Focus (SEF) inviting the Gautrain Management Agency (GMA) to register as an interested and affected party (I&AP) and request to review the Draft BAR for the Sewerage Connection and Storm water infrastructure for the West End Office Park in Centurion, dated 3 July 2014 refers.

The GMA registered as an I&AP on 9 July 2014 and subsequently reviewed the Draft Basic Assessment Report (BAR), including the Environmental Management Programme (EMPr).



**GAUTENG**  
PROVINCIAL GOVERNMENT  
REPUBLIC OF SOUTH AFRICA

Directors: Mr A Mawela (Chairperson), Ms D Dondur (Deputy Chairperson),  
Mr J vd Merwe (CEO), Mr M Mokoena, Mr D Nadison, Mr M Nkumanda, Ms M Lugenwa, Prof WD Thwala  
44 Grand Central Boulevard, Grand Central Ext. 1, Midrand | P.O. Box 1266, Kelvin, 2054, Johannesburg, RSA  
Telephone: +27 (0) 11 086 3500 | Fax: +27 (0) 11 580 0604 | E-mail: info@gautrain.co.za | www.gautrain.co.za



The GMA submits the comments below for your consideration in the finalisation of the BAR.

1. Dolomitic Stability:

- o The proposed sewerage pipelines and storm water infrastructure will be constructed on dolomite. Given the real risk of sinkhole formation adjacent to the Gautrain rail reserve in this area, the GMA requests that a detailed, development-specific dolomite investigation be undertaken as part of the Basic Assessment process.
- o Specifically, it is noted that one of the proposed storm water drains are situated in close proximity to the Gautrain alignment. As a result, the Draft BAR does not conform to the requirements of Revision 3 of the Gautrain Water Management Plan Guidelines, which is a requirement as a result of recommendations made by the Council for Geoscience and endorsed by the GDARD flowing from the Centurion Variant Route Alignment Record of Decision (Gaut 002/2/35), and which are applicable to all wet services and storm water drainage infrastructure within a certain distance (as indicated in the Guidelines) from the Gautrain rail reserve. Although these Guidelines are in the process of being updated, please find attached as Appendix 1 the latest revision of the Guidelines for inclusion in the BAR and EMPr.
- o The rehabilitation of the sewerage and storm water infrastructure should ensure that no ponding occurs on the dolomite which could increase the risk of sinkhole formation.
- o Cumulative impacts on the structural integrity and operational requirements of the Gautrain have not been considered (e.g. the cumulative impact from various developments in the area, e.g. Die Hoewes X283, on the dolomite potentially impacting the stability of the Gautrain viaduct structure).



2. Water Use Licence:

- o Although not directly related to the GMA, the construction of the pipelines will result in alterations of the banks of the Hennops River, which either requires a Section 21 (c) and (i) Water Use Licence or a General Authorisation in terms of the National Water Act (Act 36 of 1998). The GMA requests the opportunity to comment on the draft Water Use Licence Application.

3. Other impacts that should have been considered in the Draft BAR include:

- o Dust caused during construction impacting on the Gautrain trains.
- o Potential increase in bird strikes on Gautrain trains due to disturbance of bird habitat during construction of sewage and storm water pipelines/culvert.
- o Overflowing of the storm water culvert adjacent to the Gautrain alignment and resultant erosion impact on the Gautrain viaduct structure.
- o Experience has shown that there is an increased occurrence of illegal waste dumping under the Gautrain viaduct, which borders the proposed development to the east, during construction of adjacent sites. Practical mitigation measures need to be identified by the EAP and included in the EMPr to manage this problem during and after the construction of the proposed development.
- o Influx of people into the area seeking employment during the construction phase could impact negatively on the Gautrain rail reserve. This influx could also increase criminal activities in the area. Impacts include: vagrants, informal settlements, defacing viaduct pier structures, illegal dumping of construction rubble, etc.

4. EMPr:

- o The EMPr's Table 1 needs to be updated with the additional impacts identified in this letter.
- o The EMPr should also cover operational activities to cover compliance to the Gautrain Water Management Plan Guidelines.



- o The mitigation measures proposed in the Draft BAR do not comply with the requirements of the Gautrain Water Management Plan Guidelines.
- o The mitigation measures identified should be made more practically implementable (e.g. how would the vicinity of storm water inlets be cleared of all potential pollutants, which may ultimately result in the creation of sinkholes should the infrastructure constructed start leaking over time).
- o The list of Method Statements should be expanded to include the design of the storm water infrastructure and should include the detailed design drawings of the storm water infrastructure inside the Water Management Corridor indicated in the Gautrain Water Management Plan Guidelines and should be submitted to the GMA for verification.
- o The contact details of the Environmental Control Officer (ECO) and Environmental Site Officer (ESO), once known, should be made available to the GMA and the Bombela Operating Company by the Applicant prior to construction starting.

5. General comments:

- o Please remove Mr. Abel Mawela, the Chairman of the GMA Board, from the registered list of I&APs and include both the undersigned and Ms. Clare Harrison, SHEQ Manager.
- o The requirements of the Gauteng Transport Infrastructure Act (Act No 8 of 2001) must be taken into account.
- o The description of alternatives does not include the storm water infrastructure.
- o The weighting factor used in the determination of the significance of the impacts should be at least medium to high to high for impacts on the Gautrain (as per the explanation of ranking, weighting and scaling on page 20 of the Draft BAR).





- o The EAP needs to ensure that any SHEQ risks or impacts imposed by the proposed development to the operation of the Gautrain system can be mitigated.

The GMA trusts that its comments will be incorporated into the Final BAR and EMPr. The GMA also requests that an indication be provided by the EAP when the Final BAR and EMPr will be made available for public review.

Yours faithfully,








Tshepo Kgobe

**SENIOR EXECUTIVE MANAGER: TECHNICAL**  
**On behalf of PROVINCE'S REPRESENTATIVE**

cc: Chelina Bodhie **BCC**  
Hubert Lovalo **BOC**  
Mokutu Nketu **GDARD**

**APPENDIX 1: TECHNICAL REPORT DD6A & DD6B DOLOMITE AREA WATER MANAGEMENT PLAN GUIDELINES**



<b>Project</b> <b>Gautrain Rapid Rail Link</b> Project No.:	<b>Concessionaire</b> <b>Bombela</b>
	
<b>Client</b> <b>Gauteng Province</b>	<b>Contractor</b> <b>Bombela Civils Joint Venture</b>
	<b>Murray &amp; Roberts</b>  
<b>Element</b> <b>Utilities and Services</b>	<b>Other</b>
<b>Discipline</b> <b>Civil</b>	

Rev	Date	Prepared by	Checked by	Approved by	Endorsed by	Description	Status
03	06 Jun 2012	JWI	DOD	CHE		Changes as per WMPG Workshops	SFR
02	28 Jul 2011	JWI	GWJ	CHE		Third revision	SFR
01	07 Dec 2006	LR	IV	IV		Second revision	SFR
00	12 Oct 2006	LR	IV	IV		First issue	SFR

Professional Engineer (if required):

<b>Status</b> <p style="text-align: center;"><b>SUBMITTED FOR REVIEW</b></p>
<b>Title - Document type</b> <p style="text-align: center;"><b>TECHNICAL REPORT</b></p>
<b>Title - Area / Section</b> <p style="text-align: center;"><b>DD6A &amp; DD6B (Km 399+952 – 500+015)</b></p>
<b>Title - Subject</b> <p style="text-align: center;"><b>DOLOMITE AREA</b></p>
<b>Title - Subject</b> <p style="text-align: center;"><b>WATER MANAGEMENT PLAN GUIDELINES</b></p>
<b>Drawing number</b> <p style="text-align: center;"> <span style="border: 1px solid black; padding: 2px;">CJV</span> -            <span style="border: 1px solid black; padding: 2px;">L06</span> -            <span style="border: 1px solid black; padding: 2px;">REP</span> -            <span style="border: 1px solid black; padding: 2px;">2600</span> -            <span style="border: 1px solid black; padding: 2px;">0010</span> -            <span style="border: 1px solid black; padding: 2px;">03</span> </p>
<p style="text-align: center;"> <small>Issuer                      Location                      Type                      Sub-System                      Number                      Revision</small> </p>

Copyright: this document is the property of Bombela and shall not be copied or used wholly or in part without prior written consent of the company

# Technical Report

CJV-L06-REP-2600-0010: Water Management Plan Guidelines



## Revision Grid

Page	Change	Page	Change	Page	Change
1	The changes that have been made to the guidelines are in line with the Water Management Plan Guidelines Workshop agreements and subsequent review meetings with Province.	16		31	
2		17		32	
3		18		33	
4		19		34	
5		20		35	
6		21		36	
7		22		37	
8		23		38	
9		24		39	
10		25		40	
11		26		41	
12		27		42	
13		28		43	
14		29		44	
15		30		45	

## TABLE OF CONTENTS

1.	INTRODUCTION .....	3
2.	RISK ANALYSIS .....	5
3.	WATER MANAGEMENT MEASURES SPECIFICATIONS .....	6
4.	WATER MANAGEMENT APPLICATIONS.....	9
5.	MONITORING AND MAINTENANCE.....	12

ANNEXURE A:	DRAINAGE CORRIDOR CONSIDERATIONS
ANNEXURE B:	WATER MANAGEMENT CORRIDOR DRAWINGS

# Technical Report

CJV-L06-REP-2600-0010: Water Management Plan Guidelines



## 1. INTRODUCTION

The Water Management Plan Guidelines is a document that has been developing from the preliminary design stage of the Gautrain Rapid Rail Link (GRRL). The aim of the document is to focus attention on the dolomitic land stretching from south of Nelmapius Drive in Centurion (Chainage 399+952.496 to north of Eeufees Road in Pretoria (Chainage 500+013.240) in order to limit the possibility of ground movements affecting the GRRL.

The area concerned is known as Design Package 6 (DP6) and consists primarily of Eco Park Earthworks, Technopark Earthworks and U-shape, the John Vorster Drive Balanced Cantilever Viaduct, Centurion Precast Segmental Viaduct, Jean-Avenue Balanced Cantilever Viaduct, Military Area Earthworks and U-shape and the Viaduct 6 Precast Segmental Viaduct. The term 'dolomitic land' is used to describe areas in South Africa underlain directly or at a depth varying from 0m to 100m by the rock type dolomite.

Dolomite rock, although impervious in its un-weathered competent state, is highly fractured which allows percolating water to flow through it. Dolomite rock is composed of the mineral dolomite, which is carbonate of calcium / magnesium and manganese / iron. These carbonates are prone to dissolution in the presence of carbonic acid. Carbonic acid is generated when percolating water comes into contact with carbon dioxide. Carbonic acid dissolves the calcium and magnesium bicarbonates which results in the formation of cavities and voids. This process is extremely slow as it is dependent on water percolation and the fluctuation of the groundwater table.

One of the residual weathered products of the dissolved dolomite is made up of manganese and iron oxides and is referred to as "wad" (weathered altered dolomite). Wad is a soft, weak material and is prone to collapse upon saturation and / or shear stress resulting in voids. At various stages of weathering, voids may form in the dolomite rock and overlying residuum in the presence of circulating water.

Dolomitic land poses problems to the infrastructure / property developments due to the fact that it is prone to dissolution which results in cavity systems and voids as indicated above. The overlying residuum and soils above these openings can collapse into the cavities and voids resulting in sinkholes and dolines. Sinkholes can appear with little or no warning, triggering ground movements at the surface that may cause loss or damage to life, property, infrastructure and other movable assets. Dolines occur very slowly and generally do not constitute a risk to life, but in the long term may cause damage to property, infrastructure and other movable assets.

Sinkholes and dolines are triggered by human activities such as:

- Dewatering, due to mining activity or abstraction of ground water;
- Leakage of wet services such as water and sewer reticulation;
- Storm water drainage problems such as silted up culverts, unlined outlets, concentrated flow patterns instead of sheet flow, or ponding.

In the case of the GRRL, sinkholes and dolines can potentially cause severe damage to the track supporting structure and/or earthworks and may interrupt normal operation of the GRRL.

A water management system is part of a specific action plan required to prevent such events. A water management system aims at the proper treatment, installation,

# Technical Report

## CJV-L06-REP-2600-0010: Water Management Plan Guidelines



inspection and maintenance of wet services and ground water control through the dolomitic area.

The dolomitic land over which the GRRL crosses is under the jurisdiction of the City of Tshwane (CoT) for the section consisting of Eco Park, Technopark, the John Vorster Drive Balanced Cantilever Viaduct, Centurion Precast Segmental Viaduct, Jean-Avenue Balanced Cantilever Viaduct and the Eeufees Precast Segmental Viaduct; and the Department of Public Works of the Republic of South Africa (DPW) for the section known as the Military Area (the section from the Jean Avenue Interchange to the Eeufees Interchange).

In order to pro-actively manage the risk of sinkholes and dolines forming, it is imperative that a water management system is applied not only within the Gautrain rail reserve but within a wider corridor around the Gautrain rail reserve as ground movements in this wider area could have an impact on the GRRL. The wider area, referred to as the Water Management Corridor (WMC), is based upon a 2006 preliminary design stage conclusion (see Section 3.3) which states that the size of sinkholes are related to the depth to bedrock, hence the deeper the bedrock the wider the WMC should be. The WMC, defined as about twice the depth of ground level to bedrock on either side of the track with a minimum width of 50m wider than the Gautrain rail reserve, results in widths which vary from 90m up to more than 300m in areas with deep bedrock.

During the detailed design stage, a study was carried out that concentrated on the statistics and distributions of 'dropout' sinkhole formation (CJV-L06-REP-2600-0200: Gautrain Sinkhole Risk Study, Sinkhole Risk Overview). Probability Density Functions (PDFs) for sinkhole diameter and depth were developed from data and used in a Quantified Risk Analysis model. These PDFs indicate that 95% of sinkhole diameters are less than 15m and that 95% of sinkhole depths are less than 15m. The said studies did not establish any significant correlation between sinkhole depth and sinkhole diameter.

Although the sinkhole sizes considered at the detail design stage differ from those described at the preliminary design stage, it was decided that the WMC widths specified at the preliminary design stage be retained throughout.

The purpose of this report is to provide guidelines that aim to minimise the risk of sinkhole formation during the detailed design and construction period on DP6 (from 1.3km south of Nellmapius Road to the end of the viaduct over Eeufees Road and the Apies River at Fountains Valley) and that the guidelines are to be used in putting forward the monitoring and mitigation processes for the operation and maintenance of the GRRL.

The Water Management Plan Guidelines developed by the Concessionaire are based on the information / guidelines included in the documents that follow hereafter and in consultation with the Council for Geoscience as determined by GDARD.

- Appropriate Development of Infrastructure on Dolomite - Guidelines for Consultants, Department of Public Works, August 2004 as amended in June 2006 (DPW Guidelines)
- CIV-ALL-REP-0010-2027 Dolomitic Area - Water Management Plan - Guidelines as developed for the design and construction of the Gautrain System, December 2006
- CIV-ALL-REP-0060-2011 General Design Criteria for Drainage for the Gautrain System

# Technical Report

## CJV-L06-REP-2600-0010: Water Management Plan Guidelines



The Water Management Plan Guidelines recommend measures to prevent the ponding of water as well as measures that are to be implemented in the design, construction and maintenance of wet services and storm water drainage systems ("Services") and/or development activities in DP6 that may pose a risk to the stability of the GRRL.

Monitoring and maintenance recommendations have been developed as part of the Gautrain operation and maintenance manuals (refer to CJV-NTH-MAN-2600-5100 Dolomite Area Water Management Plan – Operations and Maintenance Manual). Also of specific importance is the Gautrain O&M Environmental Management Plan (O&M EMP).

## 2. RISK ANALYSIS

### 2.1. PRELIMINARY DESIGN STAGE

The DPW Guidelines (referred to in the bullets above), Item 2.4 Table 1, divides a dolomite site into three different inherent risk categories based on the expected stability of the dolomite area.

Table 2 also provides a further breakdown of risk into 8 distinct classes.

- Low risk: Up to 0.1 ground movement events expected per hectare in a 20 year period (Risk class 1).
- Medium risk: 0.1 to 1.0 events expected per hectare per 20 year period. (Risk classes 2, 3 and 4).
- High risk: More than 1.0 events per hectare expected in a 20 year period. (Risk classes 5 to 8).

Low, medium and high risk areas have been identified along the GRRL route.

The low risk section is located mainly at the beginning of the dolomite section between km 400.0 and km 405.3 with a total length of about 1 200m. A further 300m low risk area lies between km 412.6 and km 412.9, and a 150m section between km 413.15 and km 413.3.

The medium and high risk sections are each approximately 7000m long (total 14000m) and are spaced from the start of the dolomite intermittently with each other.

The DPW Guidelines require High Density Polyethylene (HDPE) butt-welded pipelines throughout for both medium and high risk areas. For low risk areas and at least 15m away from structures, HDPE is still the preferred type of pipeline, but Heavy Duty PVC can be used for sewers and High Impact PVC pipes for water pipes. Within 15m from a structure such as the GRRL, HDPE pipes are however also specified. Therefore in the Gautrain rail reserve water and sewer pipes should be butt welded HDPE. The material costs for wet services are therefore identical inside the Gautrain rail reserve for all three risk classes.

The low risk area only forms about 10% of the total section. In addition there are no water pipes in the low risk area and only one 150 mm sewer pipe.

This led to the proposal that all areas should be treated at the preliminary design stage as High Risk areas as far as water management is concerned. This report therefore only concentrates on the High Risk requirements stated in the DPW Guidelines.

# Technical Report

CJV-L06-REP-2600-0010: Water Management Plan Guidelines



## 2.2. DETAILED DESIGN STAGE

### 2.2.1. Structures

During the detailed design stage, the Concessionaire carried out extensive geotechnical surveys along the entire length of DP6 so that reliable geological profiles could be drawn up. The vast amount of geotechnical data was then scrutinised by engineers and geotechnical experts who then derived the roadbed treatment, pier foundation and U-shape / reinforced earth fill embankment solutions based on sound engineering principles.

### 2.2.2. Services

The preliminary design suggestion that the High Risk requirements, stated in the DPW Guidelines, be applied in the design of the various wet utilities in DP6 has been followed at detailed design stage.

## 3. WATER MANAGEMENT MEASURES SPECIFICATIONS

### 3.1. GENERAL RECOMMENDATIONS

General recommendations for the treatment of Services are as follows:

Wet services that are close to or that may cross the railway reserve should be identified, exposed and securely sealed against leakage. This may require in some instances that Services be sleeved within the Gautrain rail reserve to ensure that any leakage that may occur is properly discharged sufficiently far away, or in inspection manholes.

It should be ensured that areas beyond locations where water is discharged will not be subject to ponding or deep erosion that could lead to local collection and ingress of water into the ground. This means that specific agreement between the Concessionaire and the affected services' owners and Local Authorities or Bodies should be promoted.

In addition, the groundwater table levels within the WMC, as defined in paragraph 3.3 below, should not be disturbed. Dewatering / pumping / abstraction of ground water should therefore be controlled over an area which is likely to be much larger than the WMC.

Although it is noted that the control of groundwater abstraction has to be applied within the dolomitic zone, the Concessionaire will only monitor the boreholes that were installed for the purpose of monitoring the groundwater table within the Gautrain rail reserve / WMC. All other boreholes are to be monitored by the owners of those boreholes.

The Concessionaire' borehole data is to be addressed in line with the Operation and Maintenance Manual and data submitted to the Department of Public Works and the Department of Water Affairs.

The Concessionaire has carried out a hydro-geological desk study of the dolomite aquifer underlying the GRRL between Nelmapius Drive in the south and Eeufees Road in the north of DP6. The study included a review of extensive water level data and hydrogeological reports. The conclusions of this desk study are laid out in the Hydro-



# Technical Report

## CJV-L06-REP-2600-0010: Water Management Plan Guidelines



geological Impact Study for the Gautrain Rapid Rail Link, ARUP, February 2009 (CJV-NTH-REP-2600-1608).

### 3.2. DPW GUIDELINES

#### 3.2.1. General

The DPW Guidelines provide guiding principles that are recommended to ensure sound water management in the dolomitic area. The DPW Guidelines include the following recommendations that have been taken into account in developing the Water Management Plan Guidelines:

- All sleeve systems must be constructed to designed slopes that permit drainage to predetermined inspection manholes.
- Discourage the construction of any ponds, water features and swimming pools.
- Sanitation systems shall not incorporate soak ways or pit latrines.
- Bedding and backfilling for pipes should be less permeable than the in-situ soil.
- Storm water canals/open ditches should be in concrete and have a 250 micron ( $\mu\text{m}$ ) HDPE lining (bottom and sides) and continuous steel mesh reinforcing over sealed key construction and expansion joints that preclude any vertical movement.
- Roadways that act as storm water collectors shall be surfaced.
- No ground water abstraction is allowed.
- Wet services shall be monitored regularly for leakages.
- Future Development Regulations.

#### 3.2.2. Water supply design

- Replace water lines with HDPE (Type PE 100), with Class PN 16 for 63mm dia and smaller and with Class PN 12.5 for 75mm dia and larger.
- HDPE pipes are preferred as they are more flexible and can therefore handle movement better.
- All HDPE pipes are to be butt welded to omit joints that could leak.
- Pipelines are to be designed to ensure zero 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.
- Old mains to be removed and trenches backfilled.
- Water pipes above ground shall be of hot dipped heavy duty galvanized steel pipes.

#### 3.2.3. Sewerage design

- Replace sewers with Type PE 100, PN 10 HDPE pipes.
- All manholes to be watertight heavy duty welded HDPE (Type PE 100) with minimum ring stiffness  $8\text{kN/m}^2$  and with sewer pipes welded to the manholes.
- All HDPE pipes are to be joined by butt-welding.
- Sewers to be watertight and shall be water pressure tested at a pressure of 1.5 times the maximum pipe rated pressure for a minimum period of three hours.

# Technical Report

## CJV-L06-REP-2600-0010: Water Management Plan Guidelines



### 3.2.4. Storm water design

- Sleeve existing concrete pipes internally with HDPE Type PE 100, class PN 10.
- Replace other concrete storm water pipes with HDPE Type PE 100, class PN 10, or structured wall ( $8\text{kN/m}^2$ ) pipes up to 900mm dia.
- Storm water pipes larger than 900mm to be HDPE or concrete spigot and socket pipes with rubber sealing rings.
- Joints in concrete channels, box culverts and manholes are to be watertight.
- All HDPE pipes to be butt-welded.
- Storm water manholes and junction boxes shall be of welded HDPE Type PE 100 with ring stiffness of  $8\text{kN/m}^2$  or cast in situ reinforced concrete manholes with HDPE puddle flanges, if approved by the Department. Manholes to be watertight by testing over a 48 hour period. 250  $\mu\text{m}$  HDPE sheeting will cover the exterior of the concrete manholes, not the HDPE manholes.
- Storm water canals/open ditches should be in concrete and have a 250  $\mu\text{m}$  HDPE lining (bottom and sides) and continuous steel mesh reinforcing over sealed key construction and expansion joints that preclude any vertical movement.

### 3.2.5. Cable Ducts and Old Services

- Cable sleeves and boxes shall be watertight and tested as for sewers.
- Old abandoned civil engineering services and sleeves without cables are to be totally removed. Trenches from which the services are removed should be backfilled and compacted to 93% Mod AASHTO density.

## 3.3. LIMIT OF WATER MANAGEMENT

A note 'Drainage Corridor Considerations' (provided in Annexure A for information), prepared by I. Venter describes a WMC width of about twice the depth of ground level to bedrock on either side of the track with a minimum width of 50m wider than the Gautrain rail reserve. The WMC width varies between a 90m corridor up to more than 300m in areas with deep bedrock. Drawings defining the WMC are attached in Appendix B.

The average width of the Gautrain rail reserve is approximately 40m. The WMC is therefore wider than the Gautrain rail reserve in all cases and though the areas outside the Gautrain rail reserve, including the WMC, are under the jurisdiction of CoT and DPW respectively and not the Concessionaire, the Concessionaire accepted to initiate a mechanism, which incorporated the Third Parties, for the management of the Services within the WMC.

Due to the inherent risk, it is imperative that wet services, being water, sewers and cable ducts between the Gautrain rail reserve and the WMC also be dealt with, where required, with the specified HDPE pipes, so as to ensure the renewal of possibly old wet services. The re-laid pipes and cable ducts will then, after being tested, ensure many years of trouble free service.

The management and treatment of storm water systems outside the Gautrain rail reserve pose a similar problem. It is therefore required that drains and culvert outlets are concrete paved up to the WMC, where possible and agreed with the property owner. In high risk areas such as the Military Area north of Jean Avenue it is also advised that storm water outlets flowing from the N14 highway be concrete lined and that this lining be continued up to the western WMC. Should the Concessionaire require to construct / upgrade