Final Environmental Impact Assessment Report and Environmental Management Plan for the proposed Fine Ash Dam 6 (FAD 6) at Sasol Synfuels (Pty) Ltd in the Mpumalanga Province

Report Prepared for

Sasol Synfuels (Pty) Ltd

Report Number 421219/ Final EIA / EMP

DEA Reference : 12/9/11/L1/6

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Report Prepared by

srk consulting

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Executive Summary

Sasol Synfuels (Pty) Ltd (Synfuels), propose to construct a Fine Ash Dam (FAD) 6, on the farm Rietvley 320IS, in the south west direction to the current FAD 5.

The proposed FAD is situated in the Govan Mbeki Local and Gert Sibande District Municipality near Secunda in the Mpumalanga Province.

Since Synfuels operations started in the 1970's, five FAD's have been constructed, of which three have already been decommissioned. The proposed FAD 6 is to replace the existing FAD 4, which is nearing the end of its life span, and provide ash storage capacity for when the existing FAD 5 reaches its capacity.

The use of the term 'storage' rather than disposal is in accordance with discussions with the Department of Environmental Affairs (DEA) in terms of the definitions of the Waste Act in respect of ash storage facilities. The use of the term 'dam' for the FAD, rather than lagoon, is in accordance with the historical nomenclature of the FAD's at Sasol Synfuels.

The proposed FAD 6 will be constructed on land entirely owned by Sasol, and currently leased to independent farmers who are aware of the proposed FAD development.

The decommissioning and rehabilitation of FAD 5 is planned to take place in two phases from 2016 to 2020, whereby a new FAD 6 will be constructed to assist with the storage of fine ash residues produced from Synfuels coal gasification plants.

Who is conducting the Environmental Impact Assessment (EIA)?

SRK Consulting SA (Pty) Ltd (SRK) has been appointed by Synfuels as an independent Environmental Assessment Practitioner (EAP) to conduct the Environmental Impact Assessment (EIA) and prepare an Environmental Management Plan (EMP), Amendment to the Waste License Application (WLA) and Water Use License (WUL) for the proposed FAD 6.

SRK is preparing the EIA and EMP Report in accordance with Sections 31, 32, 33, and 59, and the public participation in accordance with Sections 56-59 of GNR 543 printed in terms of the National Environmental Management Act (Act No 107 of 1998[NEMA]). This report is to meet the requirements under NEMA for which the Mpumalanga Department of Economic Development, Environment and Tourism (MDEDET) is the Competent Authority for the Environmental Authorization (Reference Number: 17/2/3 GS 6). This report will inform the requirements under NEMA and the National Environmental Management: Waste Act (Act No 59 of 2008[NEM: WA]). The Department of Environmental Affairs (DEA) has been recognized as the Competent Authority for the Amendment to the WL (Reference Number: 12/9/11/L1/6).

The EIA phase was completed in two phases, namely the Scoping Phase and Impact Assessment Phase. The Scoping phase was completed in May 2011. This is the Final Environmental Impact Assessment Report (FEIAR), and is provided for comment prior to submission to the Authorities for assessment and authorization decision making.

Who will evaluate the EIA?

Upon completion of the EIA / EMP, approval must be sought from the DWA, DEA, and MDEDET prior to construction of the proposed FAD 6. The Impact Assessment Phase of the EIA entailed detailed specialist investigation, assessment and reporting.

The FEIAR will be submitted to the DEA and MDEDET, who will decide whether to authorize the project based on the EIA and EMP. Various Organs of State have been consulted and taken into

consideration during the decision making process. Other legislation, guidelines and policies pertaining to the proposed development whereby activities have been regulated, have been considered and taken into account. These include the National Water Act (NWA), NEM: WA, DWAF Minimal Requirements for Landfill sites, National Heritage Resources Act and others.

Environmental assessment process

Approach to the Environmental Impact Assessment

An EIA seeks to identify the environmental consequences of a proposed project from the beginning and helps to ensure that the project, over its life cycle, will be environmentally acceptable and integrated into the surrounding environment in a sustainable way.

An EIA is undertaken in two phases: Scoping and Impact Assessment.

During the Scoping Phase of the EIA for the proposed FAD 6 development various assessments by specialists were undertaken. Further activities undertaken were reported upon in the Scoping Report.

Further specialist studies and consultation activities undertaken during the Impact Assessment Phase are detailed in this report and the findings and recommendations for mitigation and management of identified impacts incorporated into the EMP.

As with the Scoping Phase of the Project, two parallel processes were followed during the Impact Assessment Phase of this EMP: an environmental technical process and the Public Participation Process (PPP).

Environmental technical process

Activities undertaken during the Impact Assessment Phase as part of the environmental technical process included:

- Project meetings between the client and SRK Consulting;
- Consideration and incorporation of comments received from Stakeholders on the Final Scoping Report (FSR), Draft and FEIAR;
- Preparation of the terms of reference for the specialist investigations;
- Specialist investigations; and
- Preparation of the Draft and FEIAR.

Public Participation Process

Public Participation was undertaken as part of this process, as per the recommendation of the Authorities.

The FAD 6 project was advertised in the Ekazi and Echo Ridge newspapers during the initiation phase of the project as well as during the public period whereby the Scoping Report was made available to the public for a period of 30 days in the Secunda Public Library.

The public was invited to comment on the Scoping Report in the advertisement.

The availability of the Final EIA/EMP for review will again be communicated to the registered I&AP's.

The Final EIA / EMP has been made available to public review for a period of twenty one (21) days in the Secunda Public Library and the SRK website (www.srk.co.za/en/page/za-public-documents).

Process for the remainder EIA/EMP phase of the study

The following activities will still be undertaken during the Impact Assessment Phase:

- Incorporation of comments received from the public and other Stakeholders and Authorities into the Final EIA / EMP, and associated WUL and WL Amendment;
- Submission of the FEIAR and License Amendment Applications to the relevant Authorities; and
- Authorities' decision about the project. After review of the Final EIA/EMP, the regulatory authorities will issue a decision. The decision will be communicated to stakeholders in writing and through advertisements in local and regional newspapers, and will be notified on the timeframes to appeal the decision.
- Authorities' decision about the WUL and WL Amendments. After review of the License Amendments, the regulatory authorities will issue a decision. The decision will be communicated to stakeholders in writing and through advertisements in local and regional newspapers, and will be notified on the timeframes to appeal the decision.

The project decision-making process should ensure that affected parties' inputs are being considered. This does not mean that the development should be stopped by public involvement, but rather that decisions be guided by input from the public.

Process Description

Motivation of the proposed project

It is planned that the Synfuels complex will continue as a primary coal gasification and integrated organic chemicals plant for at least the next 25 years, and will therefore require facilities to store the fine ash generated by the coal gasification and associated boiler operations.

Due to the nature of the fine ash, there are engineering limitations on suitable disposal facilities, and new facilities are required to accommodate on-going fine ash production.

It is planned that the construction of the proposed FAD 6 will replace the existing FAD 4 which is to be decommissioned and rehabilitated, and subsequently takes over from the existing FAD 5.

Alternative means of ash utilization are currently being investigated by Synfuels (i.e. brick and cement making), however the market for these product is substantially lower than the ash produced by Synfuels.

It is therefore critical that Synfuels constructs a new FAD to handle the future factory loads of ash produced from the Synfuels gasifiers and steam plants.

Background of the project

Synfuels propose to construct a FAD 6, on portions 2,3,8,9, and 10 the farm Rietvley 320IS, in the South West direction to the current FAD 5. The proposed FAD will be designed to accommodate a ash tonnage increase of 0.3% per annum compounded.

During the life time of Synfuels five FAD's have been constructed of which three have already been decommissioned. The proposed FAD 6 is to replace the existing FAD 4 which is to be decommissioned and rehabilitated, as with FAD 5 as it nears its life span.

SRK Consulting has been appointed as an independent EAP to conduct the EIA in terms of regulation R543, R544, R545 and R546 printed in terms of the NEMA.

The decommissioning and rehabilitation of FAD 4 is planned to take place in the near future, whereby a new FAD 6 will be constructed to assist with the storage of fine ash residues produced from the plant. The proposed site for the construction of FAD 6 is owned by Sasol and designated for development by Sasol. The surface is leased by Sasol to farmers who are aware of the long-term planning for the land, and Sasol Coal, who has undertaken mining activities in the area, is similarly aware of the proposed development of the surface area.

Process description

Ash is produced in the Sasol Secunda Industrial Complex (SSIC) plant from the Gasification processes for the recovery of coal based chemicals and fuels, and the burning of coal for the production of steam.

The ash from the gasifiers and steam plants are combined and treated in ash handling plants. The ash is transported in a water-slurry stream from the point of origin. The ash stream is passed over a set of screens that separates the coarse ash particles from the slurry. This coarse ash is deposited on the existing coarse ash heaps. The finer ash particles that have passed though the screens are concentrated in a gravity thickener. The bulk of the water is removed as a clear overflow and is re-used as a carrier for ash. The bottom fraction of the thickener is slurry of fine ash and water.

The fine ash slurry is pumped out to a FAD, of which there are currently a total of five within the Waste Ash Disposal Site (WADS) at the SSIC, of which the first three have been completed and decommissioned, with proposed FAD 6 for which this application is being made.

The FAD is constructed with a penstock that runs down the centre of the FAD. Slurry is pumped onto the top of the dam and is allowed to run from the outside towards the inside. In the process fine ash is deposited onto the dam and the water is decanted down the penstock and leaves the dam through a series of pipelines. Once outside the FAD the water is directed into a rundown or Clear Ash Effluent (CAE) dam from where it gravitates to a containment pond. The FAD's have a water collection system to capture seepage and side water run-off, which is also directed to the run-down or CAE Dam.

A quantity of water from these ponds is pumped back to the SSIC complex where it is treated through desalination processes to a quality suitable for boiler feed water whereby an amount is returned to the steam plant.

In this system of deposition, the fine ash is deposited to form a day wall in a series of paddocks constructed by raising low walls of previously deposited fine ash**.** The paddock walls are raised mechanically by means of excavators. Between 100 and 150 mm of fine ash is deposited in the paddock, and after settling, the supernatant water is drained off towards the pool. After a period of drying, the paddock walls are raised again, and the cycle repeated. A chain of paddocks are constructed around the dam perimeter to form the day wall. Each paddock is used in turn for deposition, and the balance of the material will be deposited in the body of the impoundment.

The deposition cycle decides the rate of rise of the dam and is kept as long as possible to allow the previous layer of deposition to dry out by draining and evaporation before the next layer is deposited. The day wall is built during daylight hours and provides freeboard to the dam. When the fine ash delivery is not being used for wall building, it is directed into the floor of the dam. The fine ash then beaches from the delivery points towards the pool.

Summary of Key Environmental Impacts

Concerns and issues regarding the proposed FAD 6 were gathered from stakeholder comments. Identified issues were documented in the Scoping Report and a number of Specialist investigations were undertaken to address the significant environmental impacts envisaged. Table ES – 1 illustrates the environmental impacts that have been identified during the Impact Assessment Phase of the FAD 6 development:

Table ES – 1: Summary of Environmental Impacts

Phase	Impact	Significance Rating	
		Before Mitigation	After Mitigation
Construction	Direct loss of vegetation of conservational concern	LOW - MEDIUM	LOW
	Direct loss of habitat and indirect loss of habitat quality	LOW - MEDIUM	VERY LOW
	Direct loss of faunal species of conservational concern	LOW - MEDIUM	VERY LOW
	Impact on site stability due to undermining Activities	LOW - MEDIUM	LOW
	Impact on the change in topography	LOW - MEDIUM	LOW
	Visual impact as a result of Dust generation	LOW - MEDIUM	LOW
	Seepage impact on groundwater quality	MEDIUM - HIGH	LOW
	Impact of runoff on the Grootspruit	MEDIUM - HIGH	LOW MEDIUM
	Impact on Surface water quality due to runoff from cleared areas	MEDIUM - HIGH	LOW MEDIUM
	Impact on Stormwater management	MEDIUM - HIGH	MEDIUM - HIGH
	Impact on Surface water quality due to spillages	LOW	VERY LOW
	Impact on Assurance of supply	LOW	LOW
	Impact on the loss of wetland vegetation and habitat	MEDIUM - HIGH	LOW - MEDIUM
	Impact on the increased sediment movement off the site	MEDIUM - HIGH	LOW
	Impact on altered flows within wetland areas	MEDIUM - HIGH	LOW - MEDIUM
	Impact on Wetland Quality deterioration due to hydrocarbon spillages	MEDIUM - HIGH	LOW
	Impact on alien vegetation	MEDIUM - HIGH	LOW
	Impact on erosion	MEDIUM - HIGH	LOW - MEDIUM
	Impact on concentration and impoundment of flow	MEDIUM - HIGH	LOW
	Impact on habitat fragmentation	MEDIUM - HIGH	MEDIUM - HIGH
	Impacts on air quality as a result of PM10	HIGH	LOW - MEDIUM
	Impacts on air quality as a result of Dust Fall Out	LOW - MEDIUM	LOW
	Impact on the destruction of cultural and heritage findings	LOW	VERY LOW
	Impact as a result of noise from vehicles	LOW - MEDIUM	LOW
	Impact as a result of noise from machinery	LOW - MEDIUM	LOW
	Impact on dust generation, congestion of	LOW - MEDIUM	LOW

Phase	Impact	Significance Rating	
		Before Mitigation	After Mitigation
	public roads and noise pollution		
	Impact on Road Safety	LOW - MEDIUM	LOW - MEDIUM
	Impact on the loss of land capability and land use potential	LOW - MEDIUM	LOW - MEDIUM
	Impact on the sterilization of soils	LOW	LOW
	Impact on the loss of land capability and land use potential	MEDIUM - HIGH	LOW - MEDIUM
	Impact on the contamination of soils	VERY LOW	VERY LOW
	Impact on Employment	+LOW MEDIUM	+MEDIUM - HIGH
	Impact on Safety due to increased vehicular movements	MEDIUM - HIGH	LOW
	Impact of fires on the surrounding areas	LOW	VERY LOW
	Impact of waste generated on site	HIGH	LOW - MEDIUM
Operation	Direct loss of vegetation of conservational concern	LOW - MEDIUM	VERY LOW
	Direct loss of habitat and indirect loss of habitat quality	LOW - MEDIUM	LOW
	Direct loss of faunal species of conservational concern	LOW - MEDIUM	LOW
	Impact on site stability due to undermining activities	LOW - MEDIUM	LOW
	Impact on the change in topography	LOW - MEDIUM	LOW
	Visual impact as a result of Dust generation	LOW - MEDIUM	LOW
	Seepage impact on groundwater quality	MEDIUM - HIGH	LOW
	Impact of runoff on the Grootspruit	MEDIUM - HIGH	LOW MEDIUM
	Impact on Surface water quality due to runoff from cleared areas	MEDIUM - HIGH	LOW – MEDIUM
	Impact on Surface water quality due to spillages	LOW	VERY LOW
	Positive impact on the reduction in MAR	+HIGH	+ HIGH
	Impact as a result of lack of stormwater management	MEDIUM - HIGH	LOW MEDIUM
	Impact on Assurance of supply	LOW	LOW
	Impact on Surface water due to overflow of process and CAE dams	MEDIUM - HIGH	LOW
	Impact on leachate generated from the FAD 6	MEDIUM - HIGH	LOW
	Impact on the spillage of ash and/or process and return clear ash effluent	MEDIUM - HIGH	LOW - MEDIUM
	Impact due to the change of hydrology in a water course	MEDIUM - HIGH	LOW
	Impact on the increased sediment movement off the site	MEDIUM - HIGH	LOW
	Impact on altered flows within wetland areas	MEDIUM - HIGH	LOW - MEDIUM
	Impact on Wetland Quality deterioration due to seepage	HIGH	LOW - MEDIUM
	Impact on alien vegetation	MEDIUM - HIGH	LOW

Phase	Impact	Significance Rating	
		Before Mitigation	After Mitigation
	Impact on erosion	MEDIUM - HIGH	LOW - MEDIUM
	Impact on concentration and impoundment of flow	MEDIUM - HIGH	LOW
	Impact on habitat fragmentation	MEDIUM - HIGH	MEDIUM - HIGH
	Impacts on air quality as a result of PM10	HIGH	LOW - MEDIUM
	Impacts on air quality as a result of Dust Fall Out	LOW	LOW
	Impact on the destruction of cultural and heritage findings	LOW	VERY LOW
	Impact as a result of noise from vehicles	LOW	VERY LOW
	Impact as a result of noise from machinery	LOW	VERY LOW
	Impact on dust generation, congestion of public roads and noise pollution	LOW - MEDIUM	LOW
	Impact on road degradation	LOW - MEDIUM	LOW
	Impact on Road Safety	LOW - MEDIUM	LOW - MEDIUM
	Impact on the loss of land capability and land use potential	LOW - MEDIUM	LOW - MEDIUM
	Impact on the contamination of soils	LOW	VERY LOW
	Impact on Dam safety	HIGH	LOW - MEDIUM
	Impact on Safety due to increased vehicular movements	MEDIUM - HIGH	LOW
	Impact of fires on the surrounding areas	LOW	VERY LOW
	Impact of waste water streams of the FAD 6	HIGH	LOW - MEDIUM
Closure	Direct loss of vegetation of conservational concern	VERY LOW	VERY LOW
	Direct loss of habitat and indirect loss of habitat quality	VERY LOW	VERY LOW
	Direct loss of faunal species of conservational concern	VERY LOW	VERY LOW
	Impact on site stability due to undermining Activities	VERY LOW	VERY LOW
	Impact on the change in topography	LOW - MEDIUM	LOW
	Visual impact as a result of windblown dust	LOW - MEDIUM	LOW
	Seepage impact on groundwater quality	MEDIUM - HIGH	LOW
	Impact of runoff on the Grootspruit	MEDIUM - HIGH	LOW
	Impact on the spillage of ash and/or process and return clear ash effluent	MEDIUM - HIGH	LOW - MEDIUM
	Impact on the increased sediment movement off the site	MEDIUM - HIGH	LOW
	Impact on altered flows within wetland areas	MEDIUM - HIGH	LOW - MEDIUM
	Impact on alien invasive vegetation	MEDIUM - HIGH	LOW
	Impact on erosion	MEDIUM - HIGH	LOW - MEDIUM
	Impact on air quality as a result of PM10	VERY LOW	VERY LOW
	Impact on air quality as a result of DFO	VERY LOW	VERY LOW
	Impact on the destruction of cultural and	VERY LOW	VERY LOW

Phase	Impact	Significance Rating	
		Before Mitigation	After Mitigation
	heritage findings		

Environmental Management Program

SRK has compiled a Final EMP for the proposed FAD 6 development. The EMP specifies the control and mitigation measures that will be required in order to effectively manage the identified biophysical and social impacts resulting from the FAD 6.

Monitoring and assigned responsibilities are also stipulated in the EMP for environmental aspects that could possibly give rise to significant environmental impacts.

The EMP will together with the EIA is made available for public comment and subsequently be amended to incorporate any issues identified by the I&AP's or stakeholders.

Authorization opinion

The management of the impacts identified in the EIA for the construction, operation and closure phase is through a comprehensive range of programmes and plans contained in the EMP. Implementation of these plans and programmes together with mitigation measures stipulate in the EMP will be institutionalized through regular monitoring and auditing.

Recommendations

The Final EIA / EMP for the Synfuels proposed FAD 6 and associated infrastructure is made available for the I&AP commenting period.

The comments raised by the I&AP's will be incorporated into the Final EIA / EMP and subsequently sent to DEA and MDEDET for consideration.

Once MDEDET and DEA has reviewed the Final EIA / EMP, they will need to determine whether the development may be undertaken and whether there is sufficient knowledge and information pertaining to the development is available and a decision can be made.

Following the decision made by the competent authorities an Environmental Authorization will be issued which will detail the decision, the reason therefore and any conditions. This decision will be communicated to the I&AP's, stipulating the period available to appeal the decision in terms of the NEMA.

Based on the assumption that these programmes and plans incorporating contingency planning for incident management will be effectively implemented on the FAD 6 and associated infrastructure developments in accordance with national and regional industry standards, it is the opinion of SRK, purely on environmental and social grounds that this development should be authorized.

Should the project be approved, SRK advocate that the following recommendations summarized below be considered and adhered to:

- Where relevant, the mitigation measures as suggested in this EMP should be implemented during all phases of the proposed development; and
- The Final EMP for all phases, assuming approval by DEA and MDEDET should be implemented and regularly audited to ensure compliance.

Conclusions

The project involved the construction of the FAD 6, associated infrastructure, D714 realignment and the relocation of the power lines. With reference to the available information of the project cycle, the confidence in the environment assessment undertaken is regarded as acceptable for decision making purposes.

Following the Scoping Phase of the EIA and the subsequent Impact Assessment, it has come to light which indicates that from a financial perspective Alternative 1 is the most preferable site. However from an environmental perspective there is no material difference from each alternative.

SRK Consulting has undertaken a detailed assessment of this on the basis of impacts identified through the public involvement programme, specialist investigation and the professional judgement of the SRK project team. It can therefore be concluded there are no fatal flaws of the FAD 6 and associated infrastructure that have been identified. Impacts that have been identified will require careful mitigation and management. These impacts include the following:

- Impacts on fauna and flora;
- Impacts on surface and groundwater quality as a result from the FAD 6 activities;
- Air Quality impacts resulting from PM10 and Dust Fall Out emissions;
- Impacts on Wetland destruction and quality;
- Traffic safety as a result of the re – alignment D714 and increased traffic;
- Noise levels during the construction and operation phase of the project; and
- Impact on the wetland areas.

An EMP has been developed as part of this EIA to ensure that mitigation and management measured are enforced.

The EMP will guide all phases of the project to minimize possible negative impacts and assign responsibility for environmental controls.

The detailed project specifications would also take cognisance of any conditions of approval as specified by DEA and MDEDET.

It is envisaged that it will be possible to effectively manage these impacts. A monitoring and auditing program will be developed by Synfuels to ensure that this is in fact the case.

This Final EIA/EMP report details the specialist studies conducted for this development. It is the opinion of the EAP that the impacts from the proposed development is acceptable when considering the advantages that the development will bring.

Way forward

The FEIAR (this document), together with the appended Specialist Reports are available for viewing at the following venues:

• Secunda Public Library; and

• SRK website (www.srk.co.za/en/page/za-public-documents).

In addition, digital copies of the report without appendices may be emailed to I&AP's on request.

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Disclaimer

The opinions expressed in this Report have been based on the information supplied to SRK Consulting (South Africa) (Pty) Ltd (SRK) by Sasol Synfuels (Pty) Ltd (Sasol) and independent reports compiled by Specialists. The opinions in this Report are provided in response to a specific request from Sasol to do so. SRK has exercised all due care in reviewing the supplied information. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data and information. SRK does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or Actions resulting from them. Opinions presented in this report apply to the site conditions and features as they existed at the time of SRK's and the independent Specialists investigations, and those reasonably foreseeable. These opinions do not necessarily apply to conditions and features that may arise after the date of this Report, about which SRK had no prior knowledge nor had the opportunity to evaluate.

List of Abbreviations

AEL	Air Emissions License
BID	Background Information Document
BPD	Black Products Dam
CAE	Clear Ash Effluent
CTF	Coal Tar Filtration
CMA	Catchment Management Agency
DEA	Department of Environmental Affairs
DEAT	Department of Environmental Affairs and Tourism
DFO	Dust Fall Out
DMR	Department of Mineral Resources
DSR	Draft Scoping Report
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Tourism
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIA	Ecological Importance and Sensitivity
EMP	Environmental Management Plan
FAD	Fine Ash Dam
FC	Fine Coal
FSR	Final Scoping Report
I&APs	Interested and Affected Parties
IGS	Institute for Groundwater Studies
DEA	Department of Environmental Affairs
DEIAR	Draft Environmental Impact Assessment Report
IDP	Govan Mbeki Integrated Development Plan
LOM	Life of Mine
MAR	Mean Annual Runoff
MASA	Meters above sea level
MBCP	Mpumalanga Biodiversity Conservation Plan
MDEDET	Mpumalanga Department of Economic Development, Environment and Tourism
MHRA	Mpumalanga Heritage Resource Agency
MPRDA	Mineral and Petroleum Resources Development Act (Act No. 28 of 2002)
NEMA	National Environmental Management Act (Act No. 107 of 1998)
NEMAQA	National Environmental Management Air Quality Act (Act No. 39 of 2004)

NEMWA	National Environmental Management Waste Act (Act No. 59 of 2008)
NHRA	National Heritage Resource Agency (Act No. 25 of 1999)
NWA	National Water Act (Act No. 36 of 1998)
PHRA	Provincial Heritage Resource Agencies
PES	Present Ecological State
PM	Particulate Matter
POS	Plan of Study
PPP	Public Participation Process
ROM	Run of Mine
RWD	Return Water Dam
RWQO	Raw Water Quality Objectives
SANBI	South African National Biodiversity Institute
SDF	Govan Mbeki Spatial Development Framework
SSIC	Sasol Secunda Industrial Complex
SRK	SRK Consulting SA (Pty) Ltd
TDS	Total Dissolved Solids
VRESAP	Vaal River Eastern Subsystem Augmentation Project
WADS	Waste Ash Disposal Site
WL	Waste Licence
WLA	Waste License Application
WRF	Waste Recycling Facility
WUL	Water Use License
WULA	Water Use License Application

1 Introduction

Sasol Synfuels (Pty) Ltd (Synfuels) propose to construct a Fine Ash Dam (FAD) 6 on adjacent land to the Sasol Secunda Industrial Complex (SSIC). The SSIC as well as the proposed FAD 6 is located in the central portion of the Highveld Ridge region in the south west portions of Mpumalanga Province falling within the District and local Municipality of Gert Sibande and Govan Mbeki respectively.

The SSIC extends over several thousand hectares, comprising two petrochemical and associated chemical processing facilities (East and West plants), coal mines, power plants, waste residue facilities (Wash Ash Site [WAS]), Fine Coal (FC), Waste Recycling Facility (WRF), former Black Products Dams (BPD), Coal Tar Filtration (CTF) plant, process effluent dams, process waste water treatment plants, general landfill (Charlie 1), water management facilities (stormwater and oily water systems), Sasol Synfuels Affiliates (Polymers, Monomers, Sasol Nitro, Sasol Oil and Sasol Solvents etc.), and associated infrastructure and services to meet the needs of the diverse operations and the personnel employed directly, and indirectly, by Sasol operations.

The town of Secunda adjacent to the SSIC has been largely developed to provide accommodation to the employees of the Sasol groups, as well as to provide service activities. The SSIC is considered of National Strategic Importance, and stringent security measures are enforced, thereby preventing and controlling unauthorized access.

The proposed FAD 6 would be situated south and south west of the existing FAD 5. The footprint earmarked for the construction of the FAD 6 falls within Portions of the Remainder of Portion 2, and Portions 3, 8, 9, and 10 and the Remainder of farm Rietvley 320IS. The regional road R546 runs through the north eastern corner of the farm Rietvley 320IS.

This report describes the Environmental Impact Assessment (EIA) Phase of the Project, and presents the Environmental Management Plan (EMP) conducted in terms of the National Environmental Management Act (Act No 107 of 1998[NEMA]), the National Environmental Management: Waste Act (Act no 59 of 2008[NEM:WA]) and the National Water Act (Act No 36 of 1998[NWA]).

The area of Mpumalanga in which Synfuels operations and Sasol Collieries are now located was historically a rural farming area. The Highveld Ridge has since been modified by mining and industrial activities related to coal and gold mining, power generation and agriculture. In turn, the land-use in the Secunda region has changed significantly over the last 50 years from a rural agricultural setting to being highly industrialised.

The first industrial developments occurred in the early 1950's with the establishment of gold mining in the area and the development of small towns to service the needs of the mining industry. The development of small settlements and towns followed, primarily to act as service centres to the gold mines, and as residential areas. However, farming remained the primary land use in the area.

Based on the coal reserves in the Secunda region the construction of the SSIC commenced in the late 1970's with the western section of the existing SSIC. Over the following two decades the complex doubled its petrochemical production capacity, the eastern section, and added further industries, such as those associated with fertiliser and explosives production.

When Brandspruit Colliery and the western portion of the SSIC were established in the late 1970's, the area was still primarily a rural farming area, although the development of further gold mine resulted in pockets of industrial and residential activity. Secunda town, initially a contractor's camp, subsequently developed into a service town to the SSIC and associated mines.

The SSIC operations are expected to continue in production for as long as coal and natural gas are available, and there is an economic demand for the products.

The various industrial activities undertaken over the past 50 years, present a number of actual and potential impacts onto the environment in the Secunda region.

SRK Consulting has been appointed by Sasol Synfuels (Pty) Ltd to conduct the EIA/EMP, Amendment to the Waste License Application (WLA) and Water Use License (WUL) for the proposed FAD 6. SRK is preparing the EIA Report in accordance with Sections 32, 33, 34, 35 and 59, and the public participation in accordance with Sections 56-59 of GNR 543 printed in terms of the NEMA. The Department of Environmental Affairs (DEA) has been recognized as the Competent Authority for the Amendment to the Waste License (Reference Number: 12/9/11/L1/6) and the Mpumalanga Department of Economic Development, Environment and Tourism (MDEDET) as the Competent Authority for the Environmental Authorization (EA) (Reference Number: 17/2/3 GS 6).

The location of the proposed FAD 6 is illustrated in Figure 1-1.

srk consulting	**SASOL SYNFUELS FINE ASHE DAM 6** Site Layout Indicating the proposed alternative	Project No. 421219

Figure 1-1: Site layout of the proposed FAD 6, indicating the proposed alternative

1.1 What is the EIA Process

The Environmental Impact Assessment (EIA) Regulations were promulgated in terms of NEMA in August 2010. These regulations list a number of activities that may not commence prior to obtaining an Environmental Authorization. The Listed Activities that are more relevant to this project, as well as the EIA requirements associated with these Activities are described in more detail in Section 2. The regulations have set out the requirements for the assessment of these activities. The Competent environmental Authority charged by NEMA with evaluating the EIA and subsequently granting or refusing and environmental authorization is in the case of the FAD 6, the DEA and the MDEDET.

The prescribed EIA process consists of two phases: Scoping Phase and the EIA phase. These are graphically illustrated in Figure 1-2

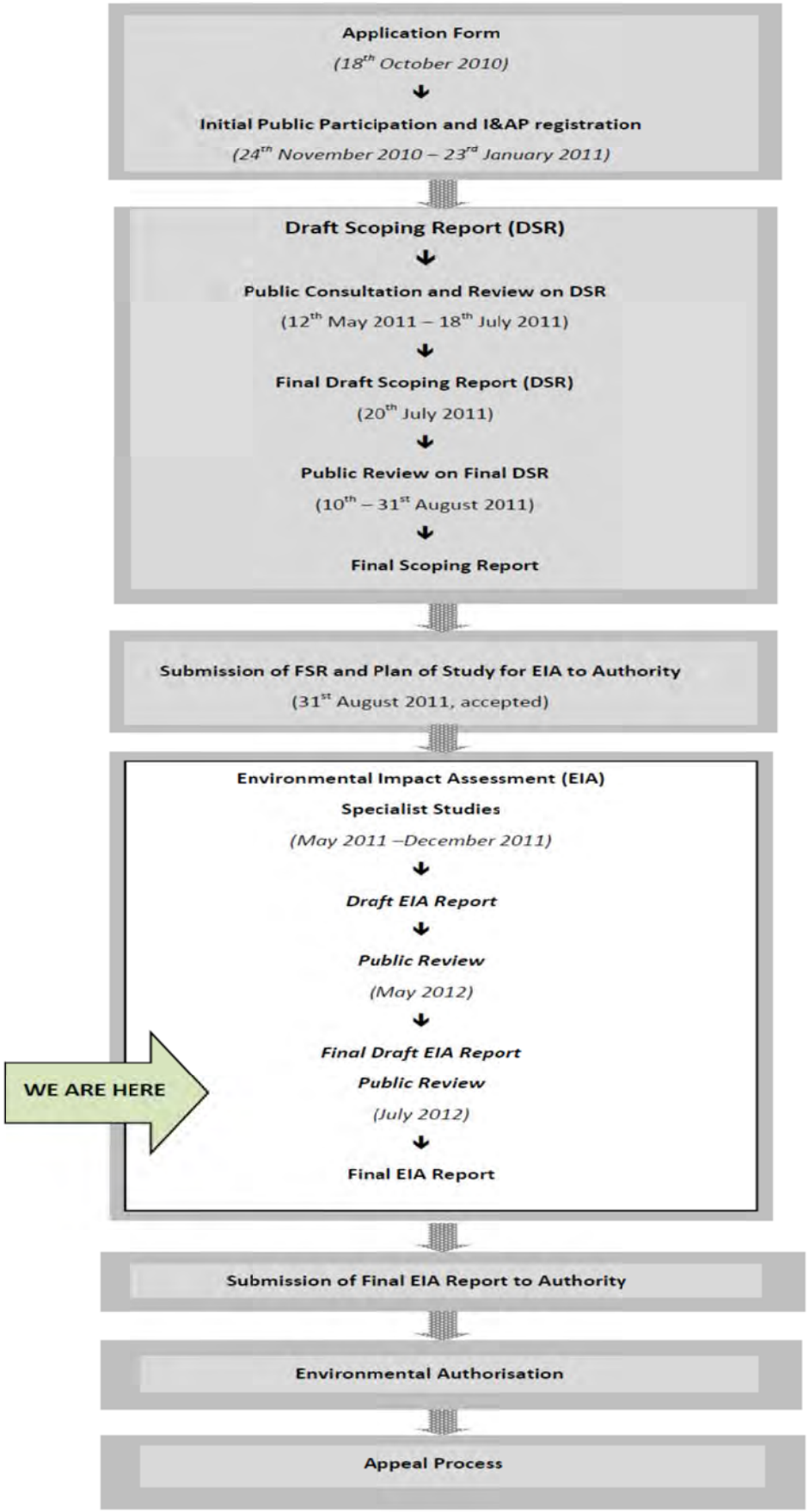

Figure 1-2: Flow diagram of the EIA process that will be followed for the FAD 6 Authorization

1.2 Objectives of the Final EIAR

The aim of the EIA phase is to assess the significance of the potential environmental and social impacts, to consider identified alternatives, to review proposed impact mitigation and management measures and to propose further measures to mitigate the negative impacts and enhance the benefits on the positive impacts relating to the proposed project, as determined to be necessary by relevant specialists.

The EIA phase includes the development of an EMP which documents the management and monitoring measures that are considered necessary to be implemented during construction, operation and decommissioning of the FAD 6. The EMP will strive to effectively mitigate the impacts and enhance the positive benefits of the project.

The Public Participation Process (PPP) is an integral component of the EIA phase, in order to gain local knowledge on the current issues and concerns in the area.

This report strives to meet objectives of the NEMA and associated regulations stipulated in Section 31 (GNR 543 Section 31).

The detailed objectives of the Final EIAR are to:

- To inform the relevant authorities of the proposed development;
- To inform the broadest range of Interested and Affected Parties (I&AP) in the area on the possible impacts and mitigation measures of the proposed FAD 6, and explain the EIA process that was followed.;
- Present the finding and recommendations in a coherent way, facilitating the competent authority to made a clear informed decision;
- Obtain contributions to the report from I&AP's (including the applicant, authorities and organs of state) and ensure that all these issue or concerns are documented and addressed in the Final Draft EIAR;
- Assess the receiving environment in the immediate vicinity of the proposed FAD 6 footprint;
- Identify and assess the significant impacts associated with the proposed FAD 6;
- Indicate the proposed Alternative;
- Formulize mitigation measures to minimize the impacts identified and issues raised by I&AP's; and
- Enhance the positive impacts of the proposed FAD 6.

1.3 Report Structure

This EIAR has been prepared to meet the requirements of the NEMA and that of the NEMWA and includes the following information;

Section 1: Introduction

This Section provides a background to the basis of the EIAR and introduces the proposed project. This Section also provides an overview of and approach to the EIA process and sets out the objectives of the report. Details of the Environmental Assessment Practitioners (EAP) and of the proponent are provided in the Section.

Section 2: Regulatory Framework

This Section provides a summary and interpretation of the relevant legislative documentation pertaining to the construction and operation of the proposed FAD 6.

Section 3: Policy Framework

This Section provides a summary of the interpretation of the relevant policies and planning documentation pertaining to the construction and operation of the proposed FAD 6.

Section 4: Project Description

This Section provides an overview of the project area, the proponent's motivation for undertaking the project, and an overview process revolving around the FAD 6 and associated activities.

Section 5: Project Alternatives

This Section provides a description of the alternatives that are assessed, including the No - Go option is provided in this section. Alternatives that have been screened are also briefly discussed.

Section 6: Description of the Affected Environment

This Section briefly describes the receiving environment in terms of the biophysical and socio – economic conditions.

Section 7: Public Participation Process (PPP)

This Section describes the detailed approach that was adopted for the PPP, and the way forward in notifying the registered I&AP's. A summary is provided detailing the issues and concerns raised by the I&AP's.

Section 8: Need and Desirability of the proposed FAD 6 and associated infrastructure

This Section provides a description of the need and desirability of the proposed FAD 6 and associated infrastructure development.

Section 9: Methodology for impact Identification and assessment

This Section provides a detailed description on the methodology used to assess the environmental impacts envisaged for the FAD 6 and associated infrastructure development.

Section 10: Description and comparative assessment of alternatives

This Section provides an assessment on the preferable alternative according to the Impact Assessed conducted for both alternatives.

Section 11: Key findings of the specialist studies

This Section provides a summary of the key findings of the specialist studies conducted for the FAD 6 and associated infrastructure development.

Section 12: Assessment of Environmental Impacts

This Section identifies and assesses the potential biophysical and social impacts of the proposed FAD 6 and its alternatives, taking into consideration the direct, indirect and cumulative impacts. The preferred alternative is identified.

Section 13: Cumulative Impacts

This Section provides a summary of the envisaged cumulative impacts resulting from the proposed development.

Section 15: Opinion and conditions on Authorization

This Section provides a professional opinion of the SRK project team on the opinion of authorization.

Section 16: Environmental impact Statement

This Section provides a summary of the key findings of the environmental impact assessment and a comparative assessment of the positive and negative impacts identified as a result of the proposed development.

Section 17 and 18: Environmental Management and Awareness Plan

This Section provides information on the proposed mitigation and management measures that will be taken to address the environmental impacts that have been identified for the proposed development. This Section stipulates the responsibility of the implementation of the EMP including monitoring, training and auditing requirements and the means of achieving full compliance to the EMP.

Section 19 and 20: Conclusion and Recommendations

This Section summarizes the key findings and recommendations of the Impact Assessment Phase.

Section 8: Way Forward

This Section outlines the way forward for the remainder of the EIA process, particularly the public review of the FEIAR.

1.4 Report Index in relation to the NEMA Regulations

Regulation 28 of GNR 543 printed in terms of NEMA precisely stipulate the minimal requirement and issues that need to be addressed in the EIA report. This report strives to address all these requirements as per the regulations.

Table 1-1 indicates the regulations that have been addressed and the section of the EIA report where these requirements can be found.

Table 1-1: Requirement of section 28 of GN R No 543

GNR 543 (30)	Description of Regulation	Section	Page
(2)(a) (i) & (ii)	Details and expertise of the EAP	Section 1.6	Pg. 9
(2)(b)	Detailed description of the proposed Activity	Section 4.5	Pg. 31
(2)(c)(i) & (ii)	Description of the property and location of the Activity on the property	Section 4.3	Pg. 30
2)(d)	Description of the environment that may be affected by the proposed Activity	Section 6	Pg. 53
(2)(e)	Details of the public participation process.	Section 7	Pg. 95
(2)(f)	Description of the need and desirability of the proposed Activity.	Section 8	Pg. 100
(2)(g)	Description of identified potential alternatives to the proposed Activity.	Section 0	Pg. 47
(2)(h)	Methodology used in determining the significance of potential environmental impacts. .	Section 9	Pg. 101
(2)(i)	Description and assessment of alternatives identified during the EIA/EMP phase.	Section 10	Pg. 105
(2)(j)	Summary of the finding and recommendations of any specialist report on a specialist process.	Section 1	Pg. 110

GNR 543 (30)	Description of Regulation	Section	Page
(2)(k)	Description of environmental issues identified, and the assessment of each.	Section 1 + 13	Pg. 125 - 203
(2)(l)	An assessment of each identified potential impact.	Section 1 + 13	Pg. 125 - 203
(2)(m)	Description of any assumptions, uncertainties and gaps in knowledge.	Section 14	Pg. 205
(2)(n)	Reasoned opinion on whether the Activity should or should not be authorized.	Section 15	Pg. 207
(2)(o)	Environmental Impact Statement.	Section 16	Pg. 208
(2)(p)	Draft Environmental Management Programme.	Section 17	Pg.216
(2)(q)	Copies of specialist reports.	Appendix D	Pg.248
(2)(r)	Any other matters required by the competent authority, or in terms of Section 24 (4)(a) and (b) of the NEMA.	N/A	N/A
(2)(s)		N/A	N/A

1.5 Details of the Proponent

For the purpose of the EIA the following people in Table 1-2 may be contacted at Sasol Synfuels (Pty) Ltd:

Table 1-2: Details of the proponent

Details	Name
Name	Gerrit Kleingeld
Address	Private Bag X1000 Secunda 2302
Telephone	(017) 610-2146
Cell	082 802 1842
Fax	(011) 219 2594
E Mail	gerrit.kleingeld@sasol.com

1.6 Project Team and expertise of the EAP

SRK originated in Johannesburg in 1974 (making the company 33 years old), and now has practices in Canada, the USA, South America (Chile), the UK, Australia, Turkey and Zimbabwe, specialising in services to the mining industry.

SRK is internationally recognised as an independent consultancy and has one of the largest and most reputable environmental consulting teams in southern Africa. SRK's environmental and social team has extensive experience in undertaking studies in support of mining and non-mining environmental authorisations in South Africa and internationally. SRK's Johannesburg and Pretoria offices are staffed with over 300 professional consultants operating in a range of disciplines, mainly related to the water, environmental, social and mining sectors. Back-up and peripheral expertise is available within these offices for all environmental projects, and external specialists are contracted as and when requires to meet the EIA requirements.

The team frequently undertakes work to the standard prescribed by the International Finance Corporation and thereby ensures compliance with the Equator Principles. This combined with

internal quality assurance mechanisms, enables the client and authorities to be confident of the quality of work that SRK produces.

The project team consists of the following members in Table 1-3 and for the purpose of this EIA, can be contacted at SRK:

Table 1-3: Details of the EIA/EMP project team.

Details	Name		
Name	Andrew Wood	Laetitia Coetser	Andrew Caddick
Designation	Project Partner and Reviewer	Project Manager and report preparation	Project coordinator, public participation and report preparation.
Address	PO Box 55291, Northlands	PO Box 35290 Menlo Park	PO Box 35290 Menlo Park
	2116	0081	0081
Telephone	(011) 441-1237	(012) 361 9821	(012) 361 9821
Fax	(011) 880 8086	(012) 361 9912	(012) 361 9912
Cell	082 600 6071	083 655 8362	072 981 0182
E Mail	awood@srk.co.za	lcoetser@srk.co.za	acaddick@srk.co.za

Appendix C contains background on experience gained in SRK in the field of Environmental Impact Assessment, Appendix B contains the curriculum vitae's of the impact assessment project team and Appendix A contains a statement of independence of SRK, (the EAP) and EIA specialists.

1.7 Independence of the Environmental Assessment Practitioners

SRK Consulting SA (Pty) Ltd hereby declares independence on the proposed FAD 6. This independence of the Environmental Assessment team is aimed at reducing the potential for bias in the process of the EIA as associated authorizations. SRK nor any Sub consultants and specialists have any correlation or interest in the proposed project or future/present developments influenced by this project in any way. Declaration of Interests has been provided by all specialists and has been included in Appendix A.

The project partner and reviewer (Dr Andrew Wood) and the Project Manager (Dr. Laetitia) Coetser are appropriately qualified and registered with the relevant professional bodies. Dr. Coetser is a registered as Professional Natural Scientists with the South African Council of Natural Scientific Professions. Dr. Wood is also registered as a Chartered Biologist. The CV's of the key SRK Consulting staff members for this project can be found in Appendix B.

2 Regulatory Framework

The following Act and Regulations have been identified as being applicable during the construction of the proposed FAD 6 and associated infrastructure. No further requirements have been identified by the relevant Authorities during the Scoping, and the following are taken to be adequate.

The Department of Water Affairs (DWA) raised their concerns regarding the Dam Safety Regulations of which the FAD and associated Return Water Dams (RWD) may trigger. These requirements will be adhered to during and assessed in the EIA/EMP phase.

2.1 The Constitution of the Republic of South Africa

Section 24 states that everyone has the right:

a) to an environment that is not harmful to their health or well-being; and
b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that.
   (i) prevent pollution and ecological degradation;
   (ii) promote conservation; and
   (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

2.2 The National Environmental Management Act (Act No.107 of 1998) as amended.

The NEMA provides the overarching legislation for environmental governance in South Africa, giving effect to Section 24 of the Constitution of the Republic of South Africa. NEMA sets out the fundamental principles that apply to environmental decision making. Of particular importance is NEMA's ruling that the interpretation of any law concerning the protection and management of the environment must be guided by the principles of NEMA. The core nature of the NEMA principles is the principle on Sustainable Development. This principle strives towards promoting development that is simultaneously meeting the needs of the present generations without compromising the needs of future generations to come.

Section 28 of the NEMA includes a far reaching general "Duty of Care" whereby care must be taken to prevent, control and rehabilitate the effect of significant pollution and environmental degradation. This section stipulates the necessity to protect the environment from degradation and pollution irrespective of the operations taking places or activities triggered / not triggered under GN544, GN545 and GN546 printed in terms of NEMA. This section places emphasis on the fact that it is a criminal offense to cause significant pollution of environmental degradation and is punishable by this legislative framework. As part of the process of integrated environmental governance, NEMA introduced a new framework for environmental impact assessments.

2.2.1 EIA Regulations (GNR 543) printed in terms of the NEMA

The EIA Regulations (GNR 543) were promulgated in terms of Sections 24 of the NEMA, to manage the process, methodologies and requirements for the undertaking of an EIA.

Section 24 and 44 of the NEMA makes provision for the identification of activities which may not commence prior to obtaining an Environmental Authorization, and stipulates the requirements of such assessments to assist the decision making process. EIA Regulations came into effect in 2006, and amended in 2010. Both these sets of regulations set out two alternative procedures in obtaining an Environmental Authorization. Depending on the type, location of the Activity that is proposed and significance of the expected impacts a Basic Assessment or a Scoping and EIA process is required for Environmental Authorization. Table 2-1 provides a summary comparison of the NEMA 2006 and 2010 regulations.

Table 2-1: Summary of the 2006 and 2010 EIA Regulations

Content	2006 EIA Regulations	2010 EIA Regulations
EIA Procedure	GN R 385	GN R 543
Listed Activities; Basic Assessment	GN R 386	GN R 544
Listed Activities: Scoping and EIA	GN R 387	GN R 545

Content	2006 EIA Regulations	2010 EIA Regulations
Listed Activities and sensitive areas per province: Basic Assessment		GN R 546

The EIA Regulations were published on the 18 June 2010 and came into effect on the 2nd August 2010. The EIA regulations (GNR 543) stipulate that the applicant for a development listed under GNR 544, 545 or 546 must appoint an independent EAP to manage the EIA process. It defines two broad categories of EIA, namely a Basic Assessment and a Full EIA. A Basic Assessment is generally intended for smaller scale projects, or activities whose impacts are well understood and can be easily managed. The process for a Basic Assessment is described in regulations 21 to 25 of GN R543 and the environmental consultant must conduct a public participation process as set out in regulation 54 to 56.

A full EIA as stipulated in GNR 543 consists of a Scoping and Impact Assessment phase. This form of an EIA is generally intended for larger scale projects, whereby the environmental impacts are more diverse and extensive thereby a more comprehensive means of impact identification is required. The impacts of such a project may lead to extensive environmental degradation, or solely require a scoping phase in order to assess and identify impacts not easily predicted or identified.

The process for a full EIA is described in regulations 26 to 35 of GNR 543 and the environmental consultant must conduct a scoping process, followed by an impact assessment process, with public participation as set out in regulations 54 to 56.

Table 2-2 provides a summary of activities triggered under GN R 544 and 545.

2.2.2 Relevance to the Project

The proposed FAD 6 and associated infrastructure, including the realignment of the provincial road triggers a number of the Listed Activities under GN R 544 and GN R 545. The environmental application for the proposed commenced following the promulgation of the 2010 regulations and NEMA amendment, therefore the process was conducted following this legislative mandate. The Listed Activities relevant to this project are provided in Table 2-2. The EIA regulations originally promulgated on the 2nd August 2010 were again amended on the 10th December 2010. This amendment was taken cognisance of in compiling the EIA / EMP. The original application submitted in October 2010 has not materially changed since the amendment and the Listed Activities originally applied for remain the same.

Table 2-2: NEMA Listed Activities as applicable for the proposed project.

NEMA Listed Activities as promulgated in 2010.			
Governmental Notice R544		**Governmental Notice R 545**	
9	The construction of facilities or infrastructure exceeding 1000 meters in length for the bulk transportation of water, sewage or storm water: (i) with an internal diameter of 0.36 metres or more; or (ii) with a peak throughput of 120 litres per second or more, excluding where: (a) such facilities or infrastructure are for bulk transportation of water, sewage or storm water drainage inside a road reserve; or (b) where such construction will occur within urban areas but further than 32 meters from a water course, measured from the edge of the water course. Construction of a residue delivery pipeline system for the transport of fine ash to the FAD 6, and the transport of water from the North Dam Return Water Dam (RWD) to the Clear Ash Effluent (CAE) systems and reuse at the processing plant.	5	The construction of facilities or infrastructure for any purpose or activity which requires a permit or license in terms of national or provincial legislation governing the generation or release or emissions, pollutants or effluent and which is not identified in Notice No. 544 of 2010 or included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act (Act No. 59 of 2008) in which case that Act will apply. Construction of the RWD, FAD 6, temporary storage dam, water canals and the diversion of a water stream requiring licensing from the DWA.
10	The construction of facilities or infrastructure for the transmission and distribution of electricity: (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts; or (ii) inside urban areas or industrial complexes with a capacity of 275 kilovolts or more. Provision for extra electricity requirements for the ash booster pumps as well as the relocation of existing power lines within the FAD 6 footprint.	10	The construction of facilities or infrastructure for the transfer of cubic meters or more water per day, from and to or between any combination of the following: (i) water catchments; (ii) water treatment works; or (iii) impoundments. The following infrastructure is anticipated for the development and operation of FAD 6: • RWD's; • Return water Canals; • FAD; • Temporary water storage dam; • Settling ponds on the decant outlet; • Catchment paddocks and solution trench; • Toe wall and under drains; and

NEMA Listed Activities as promulgated in 2010.

Governmental Notice R544		Governmental Notice R 545	
			• Water pipelines between the FAD 6 Return Water Dams and Effluent Dams.
11	The Construction of: (i) canals; (ii) channels; (iii) bridges; (iv) dams; (v) weirs; (vi) bulk storm water outlet structures; (vii) marinas; (viii) jetties exceeding 50 square meters in size; (ix) slipways exceeding 50 square meters in size; (x) buildings exceeding 50 square meters in size; or (xi) infrastructure or structures covering 50 square meters or more where such construction occurs within a watercourse or within 32 meters of a water course, measured rom the edge of a water course, excluding where such construction will occur behind the development set back line. The following infrastructure is anticipated for the development and operation of FAD 6: • RWD's; • Return water Canal's; • FAD; • Temporary water storage dam (Storage volume of 1 450 000 m^3); • Provision for crossing the provincial road (R546) (bridge) – crossings for ash lines utilities, return water pipelines and access road (a total of 3 possible crossings at different locations); • Settling ponds on the decant outlet; • Storm water diversion drains;	15	Physical alternation of undeveloped, vacant land or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more: except where such physical alterations take place for : (i) linear development Activities; or (ii) agriculture or afforestation where Activity in this Schedule will apply. The following infrastructure is anticipated for the development and operation of FAD 6 and will transform more than 20 hectares of undeveloped land: • RWD's; • Return water Canals; • Pipelines – Residue delivery Pipe System; • FAD; • Temporary water storage dam; • Security fence; • Perimeter access roads; • Provision for crossing the provincial road (R546) (bridge) – crossings for ash lines and utilities; • Return water pipelines and access road (a total of 3 possible crossings at different locations); • Provision of extra electricity requirements • Settling ponds on the decant outlet • Storm water diversion drains; • Catchment paddocks and solution trenches • Toe wall and under drains; • Upgrade of fine ash transfer system and installation of additional pumps at inside and outside ash (Ash booster pump station).

NEMA Listed Activities as promulgated in 2010.			
Governmental Notice R544		**Governmental Notice R 545**	
	• Catchment paddocks and solution trench; and • Toe wall and under drains.		
12	The construction of facilities or infrastructure for the off – stream storage of water, including dams and reservoirs, with a combined capacity of 5000 cubic meters or more, unless such storage falls within the ambit of activity 19 of Notice 545 of 2010. The following infrastructure is anticipated for the development and operation of FAD 6: • RWD's; • Return water Canals; • FAD; • Temporary water storage dam (Storage volume of 1 450 000 m^3); • Settling ponds on the decant outlet; • Storm water diversion drains; • Catchment paddocks and solution trenches; and • Toe wall and under drains.	18	The route determination of roads and design of associated physical infrastructure, including roads that have not yet been built for which routes have been determined before 03 July 2006 and which have not yet been authorized by a competent authority in terms of the Environmental Impact Assessment Regulations, 2006 or 2009, made under section 24(5) of the Act and published in Government Notice No. R. 385 of 2006: (i) It's a national road as defined in section 40 of the South African National Roads Agency Limited and National Roads Act, 1998 (Act No. 7 of 1998); (ii) It is a road administered by a provincial authority; (iii) The road reserve is wider than 30 metres; or (iv) The road will cater for more than one lane of traffic in both directions. The following infrastructure is anticipated for the development and operation of FAD 6. • Provision for crossing the provincial road (R546) (bridge) – crossings for ash lines utilities; return water pipelines and access road (a total of 3 possible crossings at different locations); and • Re alignment of the provincial road crossing the proposed footprint.
18	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand shells, shell grit, pebbles or rock of more than 5 cubic meters from: (i) a watercourse; (ii) the sea; (iii) the seashore; (iv) the littoral Active zone, an estuary or a distance of 100 metres inland of the high water mark of the sea or an estuary, whichever distance is the greater but excluding where such infilling, depositing, dredging, excavation , removal r moving	19	The construction of a dam where the highest part of the dam wall, as measured from the outside toe of the wall of the highest part of the wall , is 5 metres or higher or where the high water mark of the dam covers an area of 10 hectares or more. The following infrastructure is anticipated for the development and operation of FAD 6: • RWD's; • FAD; and • Temporary water storage dam.

NEMA Listed Activities as promulgated in 2010.			
Governmental Notice R544		**Governmental Notice R 545**	
	(i) is for maintenance purposes undertaken in accordance with a management plan agreed to by the environmental authority; or (ii) occurs behinds the development setback line The following infrastructure is anticipated for the development and operation of FAD 6: • RWD's; • Return water Canals; • FAD; • Temporary water storage dam (Storage volume of 1 450 000 m3); • Provision for crossing the provincial road (R546) (bridge) – crossings for ash lines utilities, return water pipelines and access road (a total of 3 possible crossings at different locations); • Settling ponds on the decant outlet; • Storm water diversion drains; • Catchment paddocks and solution trenches; • Toe wall and under drains.		
22	The construction of a road, outside urban areas, (i) with a reserve wider than 13.5 metres or, (ii) where no reserve exists where the road is wider than 8 meters, or (iii) for which an environmental authorization was obtained for the route determination in terms of Activity 5 in Governmental Notice 387 of 2006 or Activity 18 in Notice 545 of 2010. The construction of the following; • Perimeter access roads; • Provision for crossing the provincial road (R546) (bridge) – crossings for ash lines utilities; return water pipelines and access road (a total of 3 possible crossings at different locations). • The construction of the road realignment north of the proposed FAD 6.		

NEMA Listed Activities as promulgated in 2010.		
Governmental Notice R544		**Governmental Notice R 545**
28	The expansion of or changes to existing facilities for any process or Activity where such expansion or changes will result in the need for a permit or license in terms of national or provincial legislation governing the release of emissions or pollution, excluding where the facility, process or Activity is included in the list of waste management Activities published in terms of section 19 of the National Environmental Waste Act (Act No. 59 of 2008), in which case that Act will apply. The expansions of the FAD 6 from phase one to phase two and three, requiring an amendment to the WUL and WML.	
37	The expansion of facilities or infrastructure for the bulk transportation of water, sewage or storm water where: (a) The facility or infrastructure is expanded by more than 1000 metres in length; or (b) Where the throughput capacity of the facility or infrastructure will be increased by 10% or more. Excluding where such expansion: (i) Relates to transportation of water, sewage or storm water within a road reserve; or (ii) Where such expansion will occur within urban areas but further than 32 metres from a watercourse, measured from the edge of the watercourse. The expansion of facilities or infrastructure for the bulk transportation of water from the RWD's to the CAE systems.	
55	The expansion of a Dam where: (i) The highest part of the dam wall, as measured from the outside toe of the wall to the highest parts of the wall, was originally 5 metres or higher and where the height of the wall is increased by 2.5 metres or more; or (ii) Where the high – water mark of the dam will be increased with 10 hectares or more. . The expansion of phase one of the FAD 6, to incorporate phase two and three.	

NEMA Listed Activities as promulgated in 2010.		
Governmental Notice R544		**Governmental Notice R 545**
56	Phased activities for all activities listed in this Schedule, which commenced on or after the effective date of this Schedule, where any one phase of the activity may be below a threshold but where a combination of the phases, including expansion or extension, will exceed a specific threshold: excluding the following Listed Activities 2,11(i) – (vii), 16(i) - (iv), 17,19,20,22(i) and 22(iii), 25,26,27(iii) and (iv), 28, 39, 45(1) – (iv) and (vii) – (xv), 50, 51, 53 and 54. Phasing of North Dam Phase 1 to the final incorporation of South Dam Phase 2 and 3.	

2.3 National Environmental Management: Waste Act (Act No. 59 of 2008)

The NEMA: WA came into effect on the on 1st July 2009. Section 20 of the Environment Conservation Act 73 of 1989, under which waste management was previously governed, was repealed.

The main objectives of the NEMWA are to:

Reform the law regulating waste management in order to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development; and to provide for:

1. National norms and standards for regulating the management of waste by all spheres of government;
2. Specific waste management measures;
3. The licensing and control of waste management activities;
4. The remediation of contaminated land; to provide for the national waste information system; and
5. Compliance and enforcement;

The objectives of NEM: WA involves the protection of health, wellbeing and the environment by providing reasonable measures for the minimization of natural resource consumption. A waste hierarchy has been developed in conjunction with the waste act focusing on avoiding and minimizing the generation of waste, reducing, recycling and recovering waste, and treating and finally the safe disposal of waste as a last resort.

In general, the act seeks to ensure that people are aware of the impact of waste on their health wellbeing and the environment, and in the process giving effect to section 24 of the constitution, in ensuring an environment that is not harmful to health and wellbeing.

Waste is defined in the NEM: WA as follows:

> *"waste" means any substance, whether or not that substance can be reduced, re-used, recycled and recovered*
>
> *a) that is surplus, unwanted, rejected, discarded, abandoned or stored of;*
> *b) which the generator has no further use of for the purposes of production;*
> *c) that must be treated or stored of; or*
> *d) that is identified as a waste by the Minister by notice in the Gazette, and includes waste generated by the mining, medical or other sector, but -*
> *i) a by-product is not considered waste; and*
> *ii) any portion of waste, once re-used, recycled and recovered, ceases to be waste.*

In terms of the NEM: WA, all waste management activities must be licensed. According to Section 44 of the Act, the licensing procedure must be integrated with an EIA process in accordance with the EIA Regulations in GNR R543 printed in term of the NEMA. Government Notice 719, which was implemented on 3rd July 2009, removed all waste management activities from the EIA Regulations GN R386 and GN R387, resulting in new NEMA Listed Activities namely GNR 544 and GNR545. Government Notice 718 lists the waste management activities that require licensing. A distinction is made between Category A waste management activities, which require a Basic Assessment, and Category B activities, which require a full EIA (Scoping followed by Impact Assessment). EIA Regulation GN R543 defines the process requirements that must be followed for Basic Assessment and full EIA.

2.3.1 Governmental Notice 718: Category A and B

The following activities described in Table 2-3 have been identified from Government Notice R 719 Category A and Category B, printed in terms of the NEM: WA.

Table 2-3: NEM: WA listed Activities as applicable to the proposed project

Number and Date of the Relevant notice	Activity No(s) (in terms of the relevant notice)	Description of each Activity
GNR 718 Category A - Basic Assessment	3	The storage including the temporary storage of general waste in lagoons. Construction of the FAD 6
	7	The recycling or re use of general waste of more than 10 tons per month. The recycling and reuse of water
	8	The recovery of waste including the refining, utilization, or co – processing of the waste at a facility that has the capacity to process in excess of three tons of general waste or less than 500 kg of hazardous waste per day, excluding recovery that takes place as an integral part of an internal manufacturing process within the same premises. The recovery of fine ash waste stored at the FAD 6
	14	The disposal of inert waste in excess of 25 tones and with a total capacity of 25 000 tons, excluding the disposal of such waste for the purpose of levelling and building which has been authorized by or under other legislation. Disposal of fine ash
	15	The disposal of general waste to land covering an area of more than 25 50m^2 but less than 200 m^2 and wit a total capacity not exceeding 250 000 tons. Disposal of fine ash
	19	The expansion of facilities of or changes to existing facilities for any purpose or Activity, which requires an amendment of an existing permit or license or a new permit or license in terms of legislation governing the release of pollution effluent or waste. Expansion of the FAD 6, from phase one to phase two, as well as the amendment to the existing WUL obtained by Sasol Synfuels.
GNR 718 Category B - Scoping and EIA	1	The storage including the temporary storage of hazardous waste in lagoons. Storage of ash and desalination brine. FAD 6 will initially include a process water dam. Ash water will be used to transport the ash, which will be recovered from a Clear Water Dam to the Desalination Plants.
	9	The disposal of any quantity of hazardous waste to land. Disposal of Ash and desalination brine. FAD 6 will initially contain a process water dam, and the Clear Water Dam desalination brine may accompany the ash deposition.
	10	The disposal of general waste to land covering an area in excess of 200 m^2 Disposal of Ash

Number and Date of the Relevant notice	Activity No(s) (in terms of the relevant notice)	Description of each Activity
	11	The construction of facilities for Activities listed in Category B of this Schedule (not in isolation to associated Activity) Construction of the FAD 6 and associated infrastructure for the expansion of the Waste Ash Disposal Site.

2.3.2 Relevance to the Project

The Proposed FAD 6 and associated infrastructure, including the realignment of the provincial road triggers a number of the listed activities under GN 718 Category A and B. The FAD 6 will be initially used as a water storage dam progressing towards a fine ash storage dam.

Fine ash is produced during the gasification process conducted at Sasol.

Prior to disposal of fine ash, water is mixed together with the fine ash, resulting in the formation of thick slurry. This slurry is then transported to the FAD's via pipelines, whereby the water is decanted through the use of a penstock and recycled back to the Clear Ash Effluent Dams (CAE) and again used for Synfuels operations.

2.4 National Environmental Management: Air Quality Act (39 of 2004)

The National Environmental Management: air Quality Act (Act No.39 of 2004)(NEM:AQA) focuses on reforming the law regulating air quality in South Africa in order to protect the environment through the provision of reasonable measures protecting the environment against air pollution and ecological degradation and securing ecological sustainable development while promoting justifiable economic and social developments. This Act provides national norms and standards regulating air quality management and control by all spheres of government.

In South Africa; the main legislation with respect to air quality is the NEM: AQA. An important factor in the approach to air quality has been the promulgation of regulations with respect to ambient air quality standards under NEM: AQA. These standards provide the goals for air quality management plans and the context within which the effectiveness of these management plans is measured. The NEM: AQA identifies priority pollutants, determination of priority areas affected by these pollutants and the setting of ambient standards with respect to these pollutants within these areas (Naidoo, D., Reddy, V. 2011).

2.4.1 Relevance to the project

Ash is stored on the FAD as thick slurry. The ash is mixed with water prior to disposal. A percentage of this water is in turn re–used in the Synfuels operations, the rest is evaporated and remains as interstitial water between ash particles on the FAD. As the water is reused and the surface of the dam becomes dry, dust fall out may be generated.

It is understood by SRK that it is expected that the South African Particulate Matter (PM) 10 standard will be adjusted to 75 µg/m³ (new standard) from 120 µg/m³ (current standard) and will be effective from 1 January 2015. As the fine ash dam will be operational beyond that date, this new value has been taken into consideration in the EIA and EMP Report.

Governmental Notice No. 248 printed in terms of the NEM: AQA lists the activities requiring an Air Emissions License (AEL). This notice focuses on limiting the effect of air emissions which may have a detrimental effect on the environment, health, social and economic conditions. It is assumed that

an AEL will not be required for this project, as the major contributions to air quality will be that of dust and PM10 particle and does not trigger any listed activities in terms of the NEMA: AQA.

2.5 Minimum Requirements for waste disposal by landfill

Elimination of areas with inherent fatal flaws

Without appropriate mitigation and management, no landfill site should be developed in an area with an inherent Fatal Flaw. The following situations may represent Fatal Flaws in that they may prohibit the development of an environmentally or publicly acceptable solid waste landfill, except at excessive cost, or political preference:

Areas below the 1 in 100 year floodline. This limits location within wetlands, vleis, pans and flood plains, where water pollution could result from run-off or leachate from a landfill.

The natural runoff from the proposed site drains into the perennial stream located on south west corner of portion 8 of the farm Rietvley 320 IS, which finally drains into the Waterval River located approximately 7 km from the proposed site. The Waterval River finally joins with the Vaal River approximately 55 km downstream from the proposed site. Apart from the possible limited aquatic ecosystems, no other formal water use is experiences immediately downstream from the proposed site. The Baseline Reports do not indicate material flood risk to the project area.

As a principle FAD 6 should be located out of the 1:100 year floodline, as far as possible.

Areas in close proximity to significant surface water bodies, e.g., water courses or dams, where water pollution could result from run-off or leachate from a landfill.

As noted above, the natural runoff from the proposed site drains into a perennial stream which finally drains into the Waterval River located approximately 7 km from the site. The Waterval River finally joins with the Vaal River approximately 55 km downstream from the proposed site.

Where the concept is to recover ash water back into the Synfuels process, and operate the FAD 6 as essentially zero effluent, there should be no material impact on the Waterval River or Vaal River systems. Spillages from reticulation failures should be limited and addressed by operational and maintenance measures.

Similarly, where the concept is to apply DWAF Minimum Requirements (DWAF 1998) for the design, operation and management of the landfill, in a water deficit area, there should be adequate measures to minimise risk from landfill leachate or run-off impacting materially on the Waterval River system.

Unstable areas. These could include fault zones, seismic zones and dolomitic or karst areas where sinkholes and subsidence are likely.

The area of the proposed site is underlined by sedimentary strata of the Vryheid formation and Karoo Super group. These typically comprise sandstone, shale and mudstone with coal bands at depth. The sedimentary strata have been extensively intruded by dolerite sills and dykes. The proposed site has been partially undermined by the Sasol Coal operations that feed the Synfuels gasification and boiler plants. The area has been mapped in terms of geology and mine workings and the knowledge gained in the development of the wider WADS and FADs has indicated that the proposed area is acceptable for FAD 6 development.

The FAD 6 layout and structures can be engineered to accommodate localized areas of instability, if necessary.

Sensitive ecological areas. These include nature reserves and areas of ecological significance.

No significant sensitivities have been identified, although it is noted that there are localised perennial stream courses and localised wetland areas within the proposed FAD 6 footprint area. Considerations within the EIA will assist in defining the significance of such areas and mitigation that may be applied on the location of FAD 6.

Sensitive historical areas. These include areas of cultural or historical significance.

Considerations within the EIA will assist in defining the possible presence, and significance of, such areas and mitigation that may be applied on the location of FAD 6.

In principle, sensitive historical or cultural areas should be avoided, although consideration can be given to the relocation of certain historical artefacts and burial areas, if essential

Catchment areas for important water resources. Although all sites ultimately fall within a catchment area, the size and sensitivity of the catchment may represent a Fatal Flaw, especially if it feeds a water resource of domestic supply importance.

There is no primary domestic waters source within the immediate area of impact of the proposed FAD 6. Municipal water is derived from the Vaal water supply, and associated transfer systems. As noted above, the natural runoff from the proposed site drains into a perennial stream which finally drains into the Waterval River located approximately 7 km from the site. The Waterval River finally joins with the Vaal River approximately 55 km downstream from the proposed site.

Where the concept is to recover ash water back into the Synfuels process, and operate the FAD as essentially zero effluent, there should be no material impact on the Waterval River or Vaal River systems. Spillages from reticulation failures should be limited and addressed by operational and maintenance measures.

Similarly, where the concept is to apply DWAF Minimum Requirements (DWAF 1998) for the design, operation and management of the landfill, in a water deficit area, there should be adequate measures to minimise risk from landfill leachate or run-off impacting materially on the Waterval River system.

Areas characterised by flat gradients, shallow or emergent ground water, e.g., vleis, pans and springs, where a sufficient unsaturated zone separating the landfill and the groundwater would not be possible.

The project area has a generally flat topography, and as a consequence of the limited rainfall of the region, localised drainage channels form in topographic depressions during the rainy season, and dry out during the dry months.

No extensive vleis or springs were identified for the project area. Groundwater records for boreholes in the proposed project area indicate a possible local groundwater at approximately 20 m depth, which could suggest there is likely to be a sufficient unsaturated zone separating the base of FAD 6 and the groundwater. Groundwater monitoring wells will be expected to be a pre-requisite for the subsequent establishment of FAD 6, and FAD 6 layout and structures can be engineered to accommodate impacts.

Areas characterised by steep gradients, where stability of slopes could be problematic.

No areas of steep gradient are identified for the project areas. The topography is generally of very gentle gradient. Again, no significant or fatal flaw slopes are identified in the project area and FAD 6 layout and structures can be engineered to accommodate impacts.

Areas of ground water recharges on account of topography and/or highly permeable soils. Where infiltration from run-off or leachate could adversely affect the underlying aquifers.

No significant areas of groundwater recharge on account of topography and/or highly permeable soils have been identified, other than the local drainage paths which accumulate rain water during the rainy season and could provide hydraulic head, and the geological structures mentioned above, which will already be taken into consideration for the selection of sites for the FAD 6 as mentioned previously.

Considerations within the EIA will assist in defining the possible presence, and significance of, soil characteristics and limitations that may be applied on the location of FAD 6, but again, where the concept is to apply DWAF Minimum Requirements (DWAF 1998) for the design, operation and management of FAD 6, there should be adequate measures to minimise risk from leachate or run-off impacting materially on the Waterval River.

Areas overlying or adjacent to important or potentially important aquifers. Where infiltration run-off or leachate could adversely affect the underlying aquifers

No significant, or potentially important, water supply aquifers have been identified in the proposed area. It is noted that there are apparently local boreholes currently supplying farmsteads currently in proposed area, but the wider community is supplied with reticulated Municipal water supply, and do not rely on local borehole water supply for domestic purposes. The groundwater yield potential would appear to be limited and localised. It is expected that groundwater would not meet the needs of the project and that external water supplies would need to be brought to the area. This could be expected to further reduce the significance, or reliance, of local farmsteads on groundwater as an assured water source. Suitable sources of water for construction purposes will be investigated prior to construction commencing, with a view to minimize fresh water use for construction where possible.

Considerations within the EIA will assist in defining the possible presence, and significance of, groundwater and limitations that may be applied on the location of FAD 6, whilst again, where the FAD 6 is designed and operated according to DWAF Minimum Requirements (DWAF 1998), potential impacts on the water quality of underlying aquifer systems should be mitigated.

3 000 m from the end of any airport runway or landing strip in the direct line of the flight path and within 500 m of an airport or airfield boundary. This is because landfills attract birds, creating the danger of aircraft striking birds

The nearest airfield is taken to the Secunda airfield, which is outside the specified limitation area. The airfield is close to the existing SSIC, landfills and sewage works, and well acquainted with the attraction of such facilities to birds. The proposed FAD 6 should not have the attraction associated with conventional landfills and sewage works.

Areas characterised by shallow bedrock with little soil cover. These are frequently also associated with steep slopes, which may be unsuitable for civil structures.

No areas of shallow bedrock with little soil cover associated with steep gradient are identified for the project area. It may be expected that localised shallow bedrock areas may exist, but generally unlikely to be associated with steep slopes which do not exist in the project area.

Geological and soil structure assessments within the detailed design for FAD 6 to assist in defining the possible presence, and significance of, such areas and limitations that may be applied on the location of FAD 6, which again, can be engineered to accommodate impacts.

Areas in close proximity to land-uses that is incompatible with landfills. Land-uses that are incompatible with landfills would attract community resistance. These could include residential areas, nature reserves, sites of historical or cultural sensitivity, and cemeteries.

FAD 6 would be developed as an extension to the existing Waste Ash Disposal Site (WADS), and Synfuels complex, which has been established in the area since the 1960's. There are no known neighbouring activities that are expected to attract community resistance to the development of FAD 6. Again, where the concept is to apply DWAF Minimum Requirements (DWAF 1998) for the design, operation and management of FAD 6 there should be adequate measures to minimise nuisance to local residents.

Areas where adequate buffer zones are not possible.

There are no identified areas where a suitable buffer zone is not possible. It may be expected that a buffer zone of at least 500 m may be required between the residential area and FAD 6 for aesthetic and dust nuisance reasons. Again, where the concept is to apply DWAF Minimum Requirements (DWAF 1998) for the design, operation and management of FAD 6 there should be adequate measures to minimise nuisance to local residents.

Areas immediately upwind of a residential area in the prevailing wind direction(s).

The predominant wind directions measured at the Secunda Club are from the eastern (north-eastern to south-eastern) quadrant, with a frequency of approximately 50%. The dominant single wind direction was easterly, occurring with a frequency of 12% followed by east-north-easterly, occurring with a frequency of 11%. Wind blowing from the western quadrant accounted for 33% of the direction.

Again, it may be expected that a buffer zone of at least 500 m may be required between residential areas and FAD 6 for aesthetic reasons and dust nuisance control reasons.

Areas that, because of title deeds and other constraints, can never be rezoned to permit a landfill.

FAD 6 would be developed on land owned by Synfuels. Rezoning applications are currently underway and not expected to decline as the development of Synfuels is integrated within the Town Planning to rezoning requirements.

Areas over which servitudes are held that would prevent the establishment of a landfill.

As above, FAD 6 would be developed on land owned by Synfuels. Rezoning applications are currently underway and not expected to decline as the development of Synfuels is integrated within the Town Planning to rezoning requirements.

Areas in conflict with the Local Development Objectives process and the Regional Integrated Waste Management Plan and District Environmental Management Framework.

The proposed location of FAD 6 is on land owned by Synfuels, with the intention to develop extensions to the existing WADS. This proposed land use is understood to be recognised by the Municipality.

2.6 Other Legislative requirements applicable to the project

In addition to the NEMA and NEM: WA, a number of other Acts are of relevance to the proposed FAD 6. These Acts are briefly described below, illustrating their relevance to the project.

2.6.1 The National Environmental Management: Biodiversity Act (Act No. 10 of 2004)

The Biodiversity Act provides or the management and protection of the countries biodiversity within the framework established by NEMA. The Act provides for the protection of ecosystems that are threatened or in needs of protection to ensure the maintenance of their ecological integrity and the protection of species that are threatened or in need of protection to ensure their survival in the wild. The Act provides for the management and control of alien and invasive species to prevent or minimize harm to the environment and indigenous biodiversity. This Act encourages the eradication of such alien species where they may harm indigenous ecosystems or habitats. In addition to the above mentions objectives of the Act, the Act gives effect to South Africa's obligations under ratified international agreements regulating international trade in specimens of endangered species, and ensures that the utilization of biodiversity is managed in an ecological sustainable way.

Relevance to the project

The site is situated within Themeda veld type as described by Acocks (1988). Low & Rebelo (1996) described the vegetation of the area as Moist Clay Highveld Grassland. In the new vegetation map of South Africa (Mucina & Rutherford 2006) the area falls within the Soweto Highveld Grassland (Vegetation Unit Gm12). The site is situated on flat plains in the Ba Land Type. Most of the vegetation has been replaced by monoculture agriculture, whereas persistent grazing has probably displaced some of the more critical plants characterising these veld types (Bredenkamp, G, et al. 2011).

The majority of the project footprint falls within agricultural land, although the eradication of alien invasive species needs to be enforced. According to the National Biodiversity Assessment conducted in 2004 by the DEA, the majority of the footprint for the FAD 6 falls within a biodiversity conservation status of being of "Least Concern" or areas with "No remaining Natural Habitat". Within the Western corner of the both alternative locations a portion of the dam will fall within a conservation value of rated "Important and necessary". A small portion of this area overlaps with the dam footprint and can be conserved as a priority area

According to the Mpumalanga Biodiversity Conservation Plan, the aquatic biodiversity catchment within the footprint of the proposed dam is considered degraded. Alien eradication and ecosystem maintenance may enhance this areas biodiversity value.

Cognisance has been taken of this Act in the assessment of potential impacts, and the development of the EMP for construction, operation and closure phases of FAD 6 and during on-going and final rehabilitation of the dam and the footprints of associated infrastructure.

2.6.2 National Water Act (Act No.36 of 1998) (NWA)

Water use in South Africa is controlled through the NWA. The enforcing authority on water users is the DWA. The NWA recognises that water is a scare and unevenly distributed resource, occurring in many different forms in South Africa. National Government has the responsibility and authority over the nation's water resources and their use, distribution, allocation as well as international obligations pertaining to water matters. The purposes of the Act are aimed at achieving sustainable development; through protecting the nation's water resources to sustain current and future generations, as well as promoting equitable access to water and readdressing past racial and gender discriminations. The provisions of the Act are aimed at, amongst others, promoting dam safety and protecting aquatic and associated ecosystems as well as their biological diversity.

In terms of the NWA, a land user, occupier or owner of land where an activity takes place that has causes of has the potential to cause pollution of a water resource, has a duty to implement

measures to prevent pollution from occurring. If these measures are not implemented, the Catchment Management Agencies (CMA) establish under authority of the Minister for the specific water management area, may implement measures to prevent pollution or remedy its effects. All costs of this will be recovered from the responsible person.

Relevance to the project

The construction of the proposed FAD 6 and the associated expansion to the operations taking place at Synfuels, a number of water users will be triggered in terms of Section 21 of the NWA. The following water users in terms of the NWA are being applied for:

- Section 21(g) – disposing of waste in a manner which may detrimentally impact on a water course;
    - Waste water from the operations at Sasol Synfuels will be stored of on the FAD, whereby it will be directed to a contaminant dam and re – used at Synfuels.
- Section 21(c) – impeding or diverting the flow of water in a water course;
    - Diversion of unnamed tributary of the Waterval River and Groot-Bosjesspruit
- Section 21(i) – altering the bed, banks, course or characteristics of a watercourse;
    - Altering the beds, banks and characteristics of the unnamed tributary of the Waterval River and Groot-Bosjesspruit for the purpose of the river diversion.

Although the WUL Application falls outside the scope of the EIA, water uses and their implications on the project are carefully considered in the assessment. The WUL Amendment application will be submitted to the DWA by Synfuels for authorization.

2.6.3 National Heritage Resources Act (Act No. 25 of 1999)

The protection and management of South Africa's heritage resources are controlled by the National Heritage Resources Act (Act no 25 of 1999). This Act made provision for the establishment of Heritage Resource Authorities with their own statutory obligations. In South Africa the South African Heritage Resource Agency (SAHRA) was established as the national regulating authority and various Provincial Heritage Resource Agencies (PHRA) were subsequently formed. The provincial authority in Mpumalanga is the Mpumalanga Heritage Resource Agency (MHRA).

In terms of the Act, historically important features such as trees, graves, archaeological artefacts / sites, fossil beds and cultural findings are protected. Similarly cultural significant symbols, spaces, and landscapes are in the same way protected. Section 38 of the NHRA stipulates the requirements a developer must undertake prior to development. Section 38 has set out a number of activities that require the developer to consult with the relative PHRA during the initiation phase of a project. The PHRA will in turn confirm receipt of notification and indicate if a Heritage Impact Assessment will in fact be required.

In terms of Section 38(8) of the NHRA and the EIA regulations, the requirements of a full Heritage Impact Assessments are not required for projects where a full EIA is undertaken. Although Section 38(8) does require the Competent Authority to ensure that the evaluation of impacts on the heritage resources fulfils the requirements of the relevant heritage resource authority, and that the comments and recommendations of the heritage resources authority are taken into account prior to the granting of authorization.

Relevance to the project

Activities relating to the construction of the proposed FAD 6 and associated infrastructure constitute listed activities in terms of the NHRA are provided in Table 2-4.

Table 2-4: Section 38 of the NHRA: Listed Activities applicable to the proposed project

No.	Description
1(a)	The construction of a road, wall, power line, canal or other similar for of linear development or barrier exceeding 300 m in length.
1(b)	The construction of a bridge or similar structure exceeding 50 m in length.
1 (c)	Any Development or other Activity which will change the character of a site: • Exceeding 5 000 m^2 in extent; or • Involving three or more existing erven or subdivisions thereof.
1 (d)	The re – zoning of a site exceeding 10 000 m^2 in extent.

SAHRA was informed during the initiation phase of the project and a baseline Heritage Assessment was conducted during the Scoping Phase of the project. The EIA / EMP conducted for the proposed FAD 6 has taken into consideration the impacts of development on the heritage resources within the project footprint.

2.6.4 Conservation of Agricultural Resources Act (Act No. 43 of 1983)

Alien invasive plant control is a legal requirement in terms of this Act and the NEM: BA. The objectives of this Act are to make provision for the conservation of the natural agricultural resources of South Africa, through the maintenance of the production potential of land, by the combating and prevention of erosion and weakening or destruction of the water sources, and by the protection of the vegetation and the eradication of weeds and invader plants.

Relevance to the Project

A number of alien invasive species were identified within the project footprint by Prof. George Bredenkamp. As part of this EIA / EMP alien invasive species will be eradicated with the site clearance for the FAD 6. Cognisance of this Act, and the NEM: BA, has been made when determining rehabilitation measures, landscaping and environmental management strategies.

2.6.5 Sub Division of Agricultural Land Act (Act No. 70 of 1970)

The Sub division of Agricultural Land Act 70 of 1970, as amended, regulates the subdivision and rezoning of agricultural land and its use for any purpose other than agriculture. The original purpose of the Act was to prevent the subdivision of agricultural land to the extent where new portions that are created are too small for viable farming. The Act has two main goals:

- To disallow the change in land – use of high potential agricultural land; and
- To keep viable farm units intact.

Relevance to the project

The construction of the proposed FAD 6 and associated infrastructure is likely to subdivide adjacent agricultural lands. The applicability of this Act to any such land must be confirmed with the Department of Agriculture. The department has been notified of the project during the initiation phase of the project.

2.6.6 Mpumalanga Nature Conservation Act (Act No. of 1998)

The objectives of this Act are to consolidate the laws relating to nature conservation applicable in the Mpumalanga province and to provide for matters connected therewith. This Act focused on the protection of critically endangered to vulnerable fauna, and flora within the province.

Relevance to the project

A number of possible endangered and vulnerable fauna and flora species may be present within the footprint of the FAD. These communities need to be protected and relocated should this become necessary during construction and operation of FAD 6. Eradication of alien invasive species is also controlled through this Act, and will become necessary for this project.

3 Policy Framework

There are a number of planning instruments and guidelines initiated by National, Provincial and Local government that have been used to inform the EIA. These are considered in the planning of the EIA / EMP where applicable. The instruments considered during compilation of the EIA / EMP is listed below;

- Mpumalanga Biodiversity Conservation Plan (MBCP);
- Govan Mbeki Integrated Development Plan (IDP);
- The Govan Mbeki Spatial Development Framework (SDF);
- Mpumalanga Environmental Implementation Plan, 2001;
- Mpumalanga State of the Environment Report. 2003;
- Governmental Notice No 227, White paper on Integrated Pollution and Waste Management in South Africa, 2000;
- DWAF, 1998. Minimum Requirements for waste disposal by Landfill;
- DEAT. 2002. Integrated Environmental Management, Information series 2: Scoping. Department of Environmental Affairs and Tourism (DEAT. 2002);
- DEAT. 2002. Integrated Environmental Management, Information series 3: Stakeholder Engagement. Department of Environmental Affairs and Tourism(DEAT. 2002);
- DEAT. 2002. Integrated Environmental Management, Information series 4: Specialist Studies. Department of Environmental Affairs and Tourism (DEAT. 2002);
- DEAT. 2002. Integrated Environmental Management, Information series 12: Environmental Management Programmes. Department of Environmental Affairs and Tourism (DEAT. 2002);
- DEA. 2010. Companion to the EIA Regulations 2010, Integrated Environmental Management Guideline Series 5, Department of Environmental Affairs; and
- DEA. 2010. Companion to the EIA Regulations 2010, Integrated Environmental Management Guideline Series 7, Department of Environmental Affairs.

4 Project Description

4.1 Motivation of the proposed project

It is planned that the Synfuels complex will continue as a primary coal gasification and integrated organic chemicals plant for at least the next 25 years, and will therefore require facilities to store of the waste ash generated by the coal gasification and associated boiler operations.

Due to the nature of the fine ash, there are engineering limitations on suitable disposal facilities, and new facilities are required to accommodate on-going fine ash production.

It is planned that the construction of the proposed FAD 6 will replace the existing FAD 5 which in turn will be decommissioned and rehabilitated, and subsequently take over from the existing FAD 4.

Alternative means of ash utilization are currently being investigated by Synfuels (i.e. brick and cement making); however the market for this product is substantially lower than the ash produced by Synfuels. It is therefore critical that Synfuels constructs a FAD to handle the future factory loads of ash produced from the Synfuels gasifiers and steam plants.

4.2 Background of the project

Synfuels, propose to construct a FAD 6, on the farm Rietvley 320IS, in the south west direction to the current FAD 5. During the life time of Synfuels five FAD's have been constructed of which three have already been decommissioned. The proposed FAD 6 is to replace the existing FAD 4, which is nearing its life span. SRK has been appointed as an independent EAP to conduct the EIA in terms of regulation R543, R544, R545 and R546 printed in terms of the NEMA.

The decommissioning and rehabilitation of FAD 4 is planned to take place in the near future, whereby a new FAD 6 will be constructed to assist with the storage of fine ash residues produced from the plant. The construction of FAD 6 has been planned to compensate for the decommissioning of FAD 4 and FAD 5 in the future. The proposed site for the construction of FAD 6 is to be constructed above undermining activities. The design and engineering of the proposed FAD should incorporate stability mitigation measures where board and pillar, and total extraction mining methods are utilized.

The proposed development requires environmental authorization in terms of the NEMA and the NEM: WA therefore an EIA/EMP is required for approval of an environmental authorization.

SRK has been appointed as the independent EAP to undertake the EIA/EMP. The Scoping Report was submitted to the MDEDET, and upon approval, the Impact Assessment Phase, with a comprehensive PPP was conducted. This report serves the objectives of the Impact Assessment Phase and will be finalized after the required review period for I&AP's and Stakeholders.

4.3 Location and Context of the project area

The FAD 6 is situated south and south west of the existing FAD 5 at Synfuels Secunda. The footprint earmarked for the construction of the FAD 6 falls within Portions of the Remainder of Portion 2, and Portions 3, 8, 9, and 10 and the Remainder of farm Rietvley 320IS. The regional road R546 runs through the north eastern corner of the farm Rietvley 320IS. The D714 provincial road running through the proposed footprint will be relocated to the north of the alternatives.

4.3.1 Regional settings

The project is located within the Gert Sibande and Govan Mbeki District and Local Municipality respectively. Access to the proposed site is through the regional road (R546). Secunda is located

approximately 12 km north east from the proposed site. The existing Synfuels plant is located on the opposite side of the R546, containing FAD 4 and 5. The regional location of the FAD 6 is shown in Figure 1-1.

4.4 Magisterial district, municipality and administrative boundaries

In terms of the administrative boundaries, the proposed FAD 6 is located within the Mpumalanga province. At the municipal level the FAD 6 falls with the Gert Sibande and Govan Mbeki, District and Local Municipality respectively. The applicable magisterial district is the Highveld district.

4.4.1 Directions and approximate distances to the towns near the FAD 6.

The nearby towns cities and residential areas to the proposed FAD 6 are given in Table 4-1 (line of sight distances).

Table 4-1: Nearby Towns to the Sasol Synfuels proposed FAD 6

Town	Distance (km)
Secunda	15 km
Embalenhle	2.5 km
Kincross	23 km
Evander	16 km
Trichart	18 km
Charl Cilliers	12 km
Brendan Village	15 km
Leandra	32 km
Lebohang	33 km
Middelburg	100 km
Bethal	42 km
Balfour	54 km
Ga Nala	45 km
Amersfoort	105 km
Ermelo	90 km
Winkelhaak	12 km

4.5 Process description

Ash is produced in the SSIC plant from the Gasification processes for the recovery of coal based chemicals and fuels, and the burning of coal for the production of steam. The ash from the gasifiers and steam plants are combined and treated in ash handling plants. The ash is transported in a water-slurry stream from the point of origin. The stream is passed over a set of screens that separates the coarse ash particles from the slurry. This coarse ash is deposited on the existing coarse ash heaps. The finer ash particles that have passed though the screens are concentrated in a gravity thickener. The bulk of the water is removed as a clear overflow and is re-used as a carrier for ash. The bottom fraction of the thickener is slurry of fine ash and water.

The fine ash slurry as associated waste streams (i.e. brine water, raw water clarification sludge, contaminated soil, hot lime softening sludge, etc.) are pumped out to a FAD, of which there are currently a total of five within the Waste Ash Disposal Site (WADS) at the Sasol complex, of which the first three have been completed and decommissioned, with proposed FAD 6 for which this

application is being made. The FAD is constructed with a penstock that runs down the centre of the dam. Slurry is pumped onto the top of the dam and is allowed to run from the outside towards the inside. In the process fine ash is deposited onto the dam and the water is decanted down the penstock. The water runs down the penstock and leaves the dam through a series of pipelines. Once outside the FAD dam the water is directed into a rundown or RWD dam from where it gravitates to a containment pond.

In the Synfuels context, a quantity of excess water in these ponds are pumped back to the SSIC complex where it is treated through membrane processes to a quality suitable for boiler feed water whereby an amount is returned to the steam plant. The dam has a water collection system to capture any seepage at the bottom.

For FAD 6 the fine ash will also be deposited using the paddocking method.

In this system of deposition, the fine ash is deposited to form a day wall in a series of paddocks constructed by raising low walls of previously deposited fine ash. The paddock walls are raised mechanically by means of excavators. Between 100 and 150 mm of fine ash is deposited in the paddock, and after settling, the supernatant water is drained off towards the pool. After a period of drying, the paddock walls are raised again, and the cycle repeated. A chain of paddocks are constructed around the dam perimeter to from the day wall. Each paddock is used in turn for deposition, and the balance of the material will be deposited in the body of the impoundment. The deposition cycle decides the rate of rise of the dam and is kept as long as possible to allow the previous layer of deposition to dry out by draining and evaporation before the next layer is deposited. The day wall is built during daylight hours and provides freeboard to the dam. When the fine ash delivery is not being used for wall building, it is directed into the floor of the dam. The fine ash then beaches from the delivery points towards the pool. The upstream method of construction will be applied, in this method the centre-line of the embankment moves progressively upstream. The deposition process as conducted at Synfuels is graphically illustrated in Figure 4-1.

The terrain for FAD 6 is considerably hillier than the areas used for all previous Sasol ash dams. The relatively steeply incised valleys results in high earth starter walls being needed to impound ash until a sustainably low rate of rise in the ash allows for day walls to be packed out.

These walls will be lined with the same impermeable liner as the basin of the dam to ensure that seepage does not exit through the walls, as well as to ensure their stability.

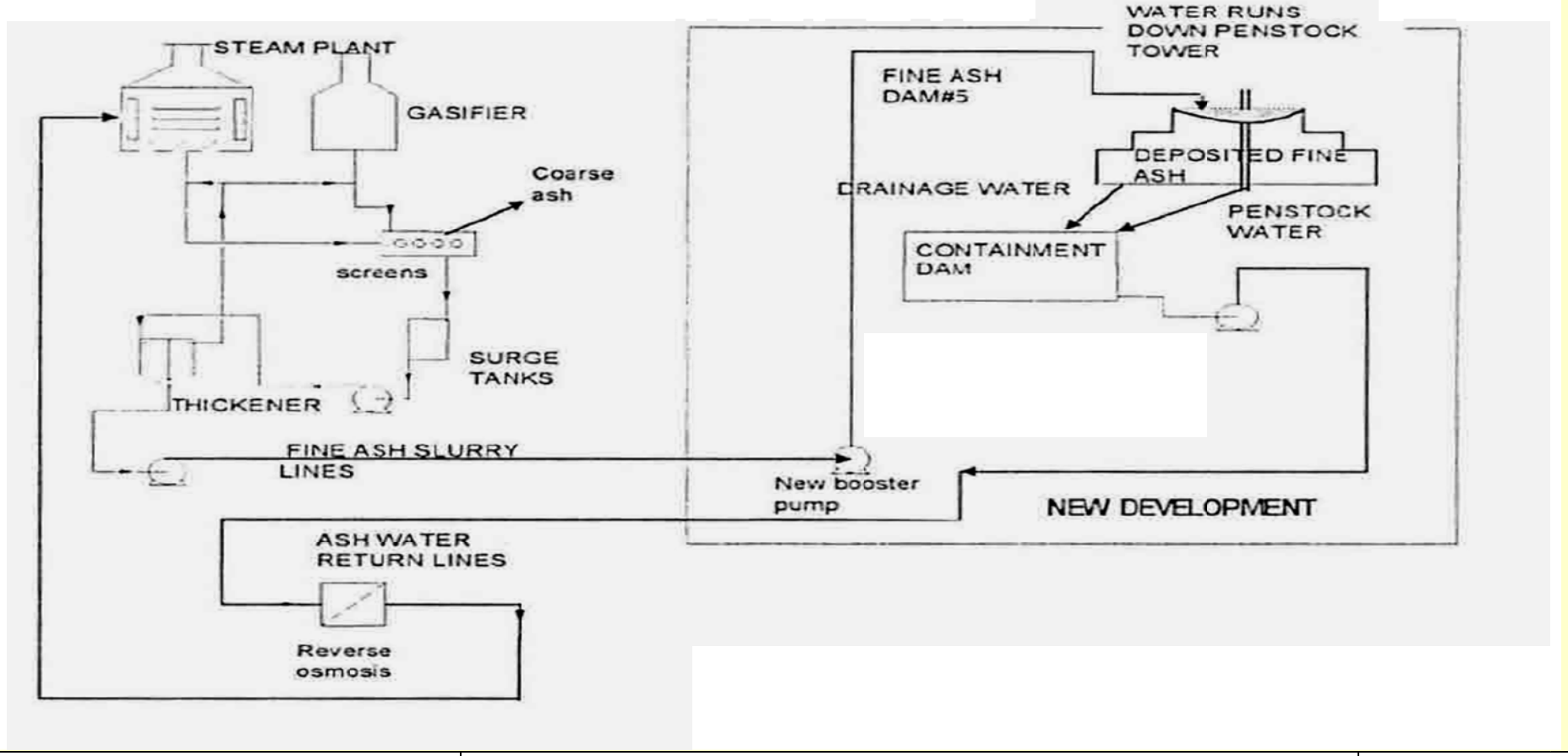

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Figure 4-1: FAD ashing process

4.6 Fine Ash Waste Classification

Fine Ash, coarse ash and ash water produced by Synfuels was collected and characterised. Table 4-2 describes the waste classification of the Fine Ash, Coarse Ash and Ash Water.

Table 4-2: Waste stream, characterisation for the current ashing Activities at Sasol Synfuels

WASTE STREAM CHARACTERISATION			
Sample ID	**Fine ash & fine ash slurry**	**Business Unit**	**Ashing**
Raw material contributing to waste character		**Primary Component of waste stream:**	
Coal feed to boilers and chemical processing **Physical Factors/ Appearance** Fine ash slurry. Predominantly single phase slurry. Minor water phase appears on extended settling. Generally alkaline pH low potential to leach		**Super fine ash material from electrostatic precipitators on off-gas from Boilers**	
Waste generation rate (quantity/ annum):		**Occurrence**	
3 900 000 tons		Continuous	
Hazard classification (SABS 0228*) **(based on primary components)**		**Hazard Rating (DWAF Minimum Requirements 1998*)**	
Class 8 corrosive waste, Class 9 miscellaneous waste		Hazard rating 3 (moderate hazard)	
Preferred disposal option **(DWAF Minimum requirements)**		**Potential disposal options:**	
Landfill		Use ash with tar to create tar balls for Gasifier feed OR use ash with catalyst waste for stabilization treatment OR use ash to quench spent Synthol catalyst and stabilize, Landfill excess	
Explosivity potential:		**Corrosive potential:**	
Non-explosive		Moderate, ash leachate saline	
Oxidative potential:		**Fire hazard**	
Non-oxidative		Non-flammable	
Environmental risk potential		**Human health risk potential**	
Ash leachate may contain salts, heavy metal compounds that may be toxic to aquatic environment		Ash leachate may contain salts, heavy metal compounds that may risk via oral ingestion respiratory irritation	

WASTE STREAM CHARACTERISATION			
Sample ID	**Fine ash & fine ash slurry**	**Business Unit**	**Ashing**
Incompatibility			
Strong acids			
Sample ID	**Clinker ash/coarse ash WS002**	**Business Unit**	**Ashing**
Raw material contributing to waste character		**Primary Component of waste stream**	
Physical Factors/Appearance Slightly alkaline clinker ash predominately solid, no phase separation, minor moisture contact		Derived from coarse coal. Leachate analysis results show; pH range (all sites) 6.6 – 8.2, Electrical conductivity (all sites) 550.- 750 uS/cm contains Na+, Ca+, Cl-, SO42-, HCO32-, also contains Li, Be, Ti, Mn, Br, Br, Zn, Sr, Ba, Al, Fe, Mn.	
Waste generation rate (quantity/annum):		**Occurrence**	
5 800 000 tons		Continuous	
Hazard classification (SABS 0228*) **(based on primary components)**		**Hazard Rating (DWAF Minimum Requirements 1998*)**	
Class 9 substance which may show dangerous characteristics, Class 6.1 toxic substance,		Hazard rating ¾ (moderate to low hazard) ash saline, may contain heavy metal compounds that may be toxic	
Preferred disposal option **(DWAF Minimum requirements)**		**Potential disposal options:**	
Landfill H:H allowable sites & design		Store to controlled landfill	
Explosivity potential:		**Corrosive potential:**	
Non-explosive		Low to moderate, ash leachate saline	
Oxidative potential:		**Fire hazard:**	
Non-oxidative		Ash not flammable	
Environmental risk potential:		**Human health risk potential:**	
Ash water may contain salts, heavy metal compounds that may be toxic to aquatic environment		Ash leachate may contain salts, heavy metal compounds that may have risk via oral ingestion Dust could be a nuisance and respiratory irritant, but low potential of coarse ash/clinker unless crushed	
Incompatibility			

WASTE STREAM CHARACTERISATION			
Sample ID	**Fine ash & fine ash slurry**	**Business Unit**	**Ashing**
Strong acids			
Sample ID	**Ash water**	**Business Unit**	**Ash & Black Products site**
Raw material contributing to waste character		**Primary Component of waste stream**	
Ash water used in transporting ash to waste site **Physical factors/Appearance** Discoloured water used as transport media, saline with organics and generally alkaline pH. Single phase liquid fine suspended solids.		Leachate from ash and process water used as transport media COD (mg/1) ~ 346 Conductivity 7355 uS/cm, Ca ~ 458 mg/1 Chlorine 752 mg/1, Potassium 146 mg/1, Sodium 1350 mg/1 Sulphate 2450 mg/1, suspended solids 207 mg/1, total dissolved solids 5050 mg/1, Total Organic carbon 55 mg/1.	
Waste generation rate (quantity/annum)		**Occurrence:**	
Variable		**Continuous**	
Hazard classification (SABS 0228*) **(based on primary components)**		**Hazard Rating (DWAF Minimum Requirements 1998*)**	
Class 6.1 toxic substance, Class 8 corrosive substance)		Hazard rating 3 (moderate hazard)	
Preferred disposal option **(DWAF Minimum requirements)**		**Potential disposal options:**	
Recycle		Water treatment	
Explosivity potential:		**Corrosive potential:**	
Non-explosive		Moderate, ash water saline	
Oxidative potential:		**Fire hazard:**	
Non-oxidative		No fire hazard	
Environmental risk potential:		**Human health risk potential:**	
Ash water may contain salts, heavy metal compounds that may be toxic to aquatic environment		Ash water may contain salts, heavy metal compounds that may have risk via oral ingestion	

WASTE STREAM CHARACTERISATION			
Sample ID	**Fine ash & fine ash slurry**	**Business Unit**	**Ashing**
Incompatibility			
Strong acids			

4.7 Penstocks

Water from the FAD 6 will decant towards the penstock of the dam whereby it will be transported to the silt traps before entering the RWD and finally to the CAE system.

The primary penstocks, which will be in long term service handling the majority of decant water must be located on stable ground to eliminate the risk of mining induced deformations. Suitable routes for the Phase 1, 2 and 3 penstocks have been identified that do not cross over sensitive mining area. It should be noted that the route for the phase 2 and 3 penstock pipe will require the installation of an elevated pipe trench along the side slope of the Phase 1 ash dam. The use of large diameter concrete pipes can possibly be used for these applications. To allow for scaling, 1200 mm nominal diameter pipes can be used (pressure pipes to SABS 676, Class T4 [400 kPa pressure rating]).

Given the topography, temporary and secondary penstock pipe routes will have to traverse total extraction panels. A flexible piping system that can accommodate settlements, bending and tension forces must be used, i.e. steel piping. In sensitive areas where failure is more likely to occur, a bentonite/cement stabilised backfill may possibly be used to control the risk of piping through a subsidence induced defect. For the flows expected in these penstocks, nominal 600 mm diameter pipes of 10.0 mm wall thickness should be used (to SABS 719 specifications). The 10 mm wall thickness provides a margin of safety to carry additional stresses due to deformations, as well as the loads applied by the ash surcharge.

4.8 Return Water Dam (RWD)

A nominal 1000 Mega Litre RWD will be constructed north of the proposed FAD 6. This dam will function in optimizing the CAE processes. This RWD will have a minimum servitude of 200 000 m^2, based on a maximum average water depth of 5 m. Water from this dam can be drained through gravity into the existing CAE system owing to the elevation of its position. Smaller RWD's will be required on the western and north eastern sides of the dam (Jones and Wagner. 2009).

The majority of the water is expected to drain into a gravity canal system which will tie in with that of FAD 5's. Seepage water entering the western and north eastern RWD's will be pumped across the water shed for the operational period of FAD6 whereas decanted ash water can be gravity fed to the canal systems once the dam reaches specific levels to allow the installation of new penstocks which will allow this.

An adequate form of engineered base preparation and lining will be required to maximize the integrity of FAD 6, and particularly the area proposed for the interim water storage capacity.

The penstock water leaves the FAD through a series of pipelines and is collected in the silt traps before entering in RWD, from where it is returned to the SSIC and a percentage treated in existing facilities to a quality suitable for process water reuse and the remainder used in the ashing process (Jones and Wagner. 2009).

The low solids content of the current ash slurry relative to previous years has been identified as the prime cause of far higher return water volumes than before. The use of a geomembrane liner will also change the pattern of return water flow; more continual flows are expected from the full blanket drain over the footprint. This gives rise to the need for new decant technologies, as well as significant return water dam storage. The FAD system can be run with two return water dams, one to the east and west of the site. However, the volumes available on these sites are small relative to the required volumes, and this system is energy intensive in that all return water must be pumped. All return water should be routed to an additional North Return water dam. Water from this dam can be returned via gravity to the CAE water handling system by means of the FAD5 canal. The North Dam is also the only dam site that has the potential to store more than the design minimum of water

storage capacity. The absolute maximum that can feasibly be stored here is in the order of 1 800 Ml, the most cost- effective storage is in the order of 1 200 Ml (Jones and Wagner. 2012).

The actual design capacities of the return water dams are a function of the following parameters:

- Need to maintain at least 800 mm freeboard from spillway level to crest of non-overspill wall;
- Physical constraints such as the R546 and gradients to allow gravity inflow of water;
- Liner design of lagoon standard as per the DWA Minimum Requirements;
- Internal side slope design of 1V: 4 H to ensure constructability and enhance the factor of safety of the liner elements against slipping;
- Undermining profile. No wall of significant height (greater than 2m) is allowed to cross from one mining method boundary to another.

From this, it was found that the West dam in particular cannot be made the appropriate size. It requires the construction of two individual dams, one being considerably higher than the other. The operating manual and systems are to be such that the lower dam is to be used in preference, water being stored in the upper dam only when the lower dam is reaching maximum operating level. Each dam is fed by drain water and penstock water from its own solution trench. A gravity outlet allows water from the upper dam to feed into the lower. This is more complex than is ideal, but no other realistic solution presents itself. This combination has sufficient design storage (Jones and Wagner. 2012).

The North dam can obtain its design capacities and can be made larger to suit other operational drivers if needed. The storage volume of the RWDs are envisaged to exceed 50 000 m^3, thus triggering the DAM Safety Regulations in terms of the NWA.

4.9 Return Water Canal

The return water drainage system for FAD 6 should maximize the use of the FAD 5's gravity feed canal. Some water from the northern portions of FAD 6 will be able to gravity feed into this system. This return water will cross underneath the Sasol Mining conveyor alignment and the R546 for which culvert/pipe systems will be required. The capacity of the existing FAD5 canal will be upgraded to cater for future loads from FAD5 and FAD 6. Water is transported through these canals towards the current CAE systems for re use within the SSIC and ashing process (Jones and Wagner. 2009).

The recent upgrades to the FAD5 canal give it a design capacity of 1.4 m^3/sec when in a clean state. The maximum average monthly load from the North Dam after including the pumping from East and West dams to it is 2 650 000 m^3 or 89 000 m^3/day (Jones and Wagner. 2012).

For gravity decant for an 8 hour dayshift, the canal capacity is 1 230 000 m^3 per month or 40 000 m^3/day. This indicates that decanting from the RWD during daylight hours only is not feasible. The decant system should possibly be designed so that a smaller flow can be decanted during the night shifts. For example, decanting at 0.8 m^3/sec during the night shift would make up the shortfall. The absolute maximum canal capacity would be 1.4 m^3/sec for a full 24 hour day, or 121 000 m^3/day. Thus on average the canal is running at 74 % capacity (Jones and Wagner. 2012).

Assuming the dam is full; when this occurs, the canal should still be able to decant this volume, as it is 80% of absolute capacity in the canal.

4.10 Temporary water storage dam

A temporary water storage dam may be constructed within the footprint of the north western dam prior to the construction of an ashing facility. This site features a well-defined valley, which can be walled off to impound water. The limiting factor for the storage capacity is that the North Dam Phase 1 toe drains must still be able to flow into the new dam. The height of the dam wall is thus limited to 14 m. The storage volume of this dam will be approximately 1 450 000 m^3. This dam may be equipped with toe drains, sump and a water extraction pump system. No silt traps will be necessary as water to this dam will be piped from existing dams. When this dam is decommissioned in 2016, the dam wall can be used as the starter wall for the north western FAD 6 area (Jones and Wagner. 2009).

4.11 Silt traps

Silt traps should be constructed prior to water entering the main or other RWD or CAE systems. Relatively long and narrow silts traps are proposed with the objective of reducing the necessity of dredging the CAE dams due to excessive silt build up. The silt traps may be lined in conjunction with similar processes followed for the RWD to aid in the reduction of seepage and possible pollution.

It is preferred that the silt load carried in the decant stream be intercepted before return water arrives in either the return water dam or the CAE dams. The loss of capacity in these dams impacts the water balance of the system, and removing silt and sludge from operational dams is costly and inefficient (Jones and Wagner. 2012).

Experience has shown that silt traps generally need to be shallow to allow for light machinery to travel in them to excavate out silt. Deep systems cannot be dried out and so need to be dredged (at high cost). The fact that Sasol own their own dredge does allow for the design of deeper silt traps, which enhances their efficiency substantially. A dual system is preferred to enable the full water flow to be diverted into a second system by means of a splitter box, while the first dries out and is cleaned (Jones and Wagner. 2012)..

The silt traps will require lining to the same standard as the return water dam to minimise seepage and pollution. The liner will then need protection from light equipment that will be doing the cleaning (very light loaders), or from the suction hose of a typical dredger (Jones and Wagner. 2012).

4.12 Waste generation

FAD 6 will be designed and operated according to best international practice for the effective management of FA wastes generated by the Synfuels Complex, in accordance with the existing WADS License conditions, and amendments as may be applied for the extension of the WADS License to include FAD 6.

Based on historical preliminary results of previous FAD's the waste disposed of at the FAD would classify as a Type 3 waste requiring a Class C landfill when using the draft Environmental Affairs Waste Classification Regulations of 2011. The liner type comprises a 1.5 mm thick geomembrane overlaying 300 mm of compacted clay. Drainage and protective layers are required above the liner to protect it from elements prior to deposition of fine ash (Jones &Wagner. 2012).

4.13 Liner Requirements

Based on the draft waste regulations developed by the DEA, the ash is classified as a Type 3 waste, which requires disposal on a Class C landfill, provided one ignores the selenium value. This classification is based on the concentrations of boron, total chrome, molybdenum, antimony,

vanadium, total dissolved salts , chloride, sulphate, nitrate and fluoride, which all exceed the Type 4 waste leach concentration values (Jones &Wagner. 2012).

The landfill barrier system for Class C landfill site is given in Figure 4-2.

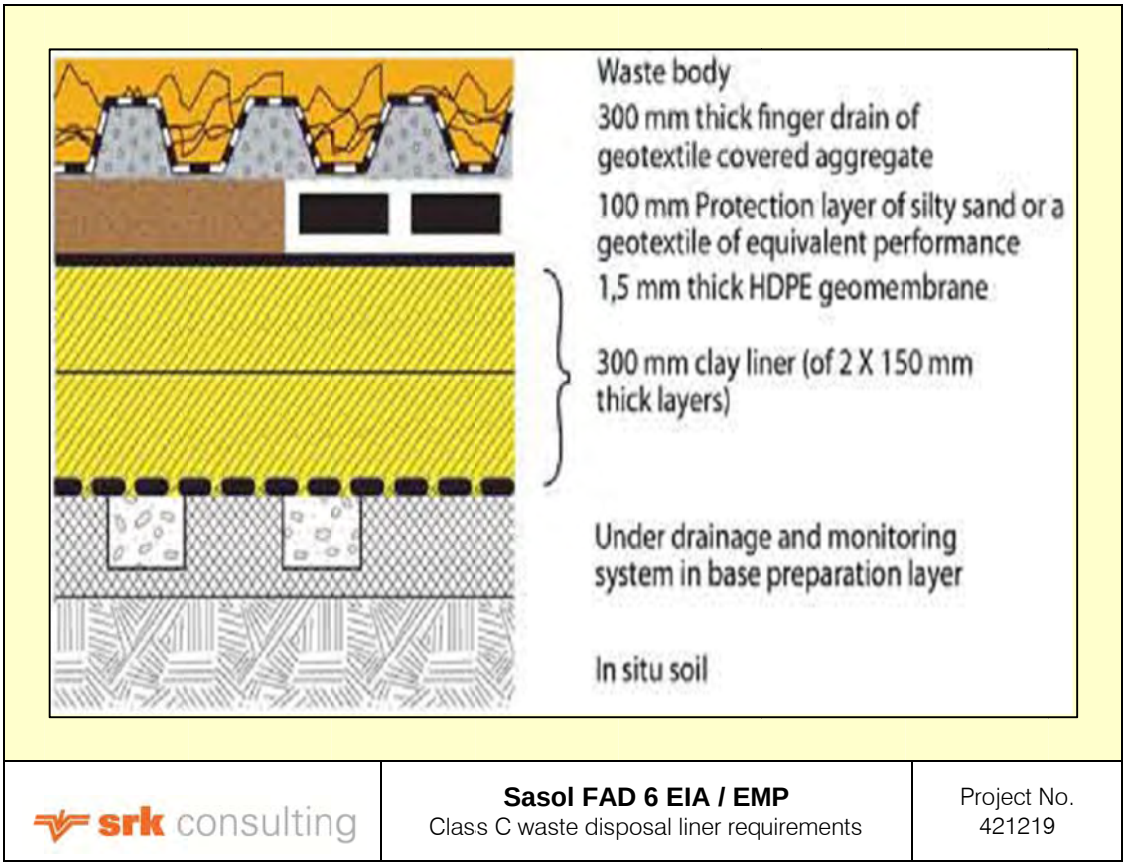


Figure 4-2: Class C waste disposal barrier system (Jones &Wagner. 2012)

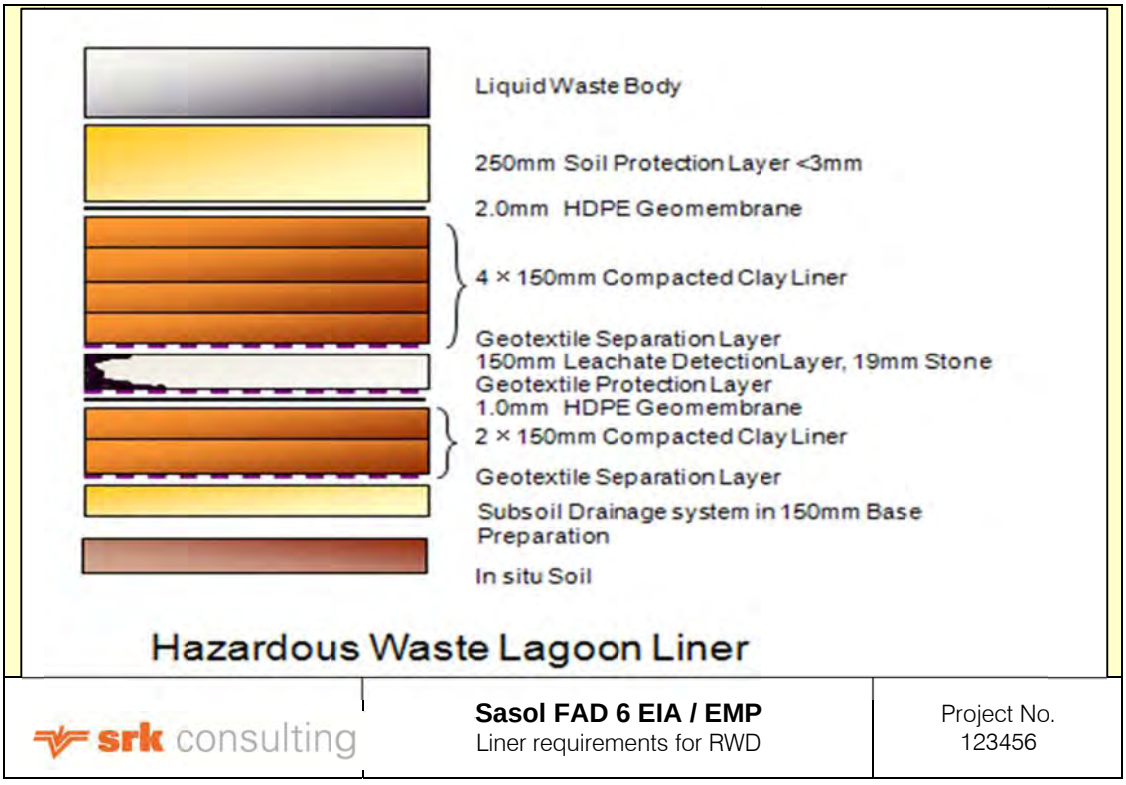


Figure 4-3: Liner Requirements for RWD (Jones &Wagner. 2012)

The return water dams will probably have to be lined to the equivalent of a lagoon level liner as determined by the DWAF Minimum Requirements. There are no liners proposed for liquid wastes or brines in the draft waste regulations, as liquid waste is to be phased out. (Jones &Wagner. 2012).

The use of a geomembrane in a wet placed ash dam has significant impacts on the quality of the drainage design required for both environmental seepage control as well as stability. The above liner drainage will consist of:

- Toe drain on the perimeter of the dam (as per typical tailings dam), of commercial graded aggregates forming a natural filter to the fine ash;
- Blanket drain, of nominal 10 m width, running approximately under the final crest perimeter, as per typical tailings dam of commercial graded aggregates forming a natural filter to the fine ash;
- Blanket drain of 200 mm coarse ash throughout the basin. The grading of the coarse ash is also compatible with the filter criteria to the fine ash;
- Herringbone drains network to abstract water from the blanket drain. Based on known ash permeability data and required performance, a spacing of 55 to 75 m is suitable to reduce the average hydrostatic head on the liner to 0.3 m. The graded aggregates used in these drains will be protected by a large mound of coarse ash to reduce possible erosion damage

Given the propensity of the Sasol fine ash leachate to clog geotextiles with a calcium carbonate precipitate, geotextiles will not be used in critical drainage applications.

4.14 Fencing and crossing of the Provincial road (R546)

The entire proposed FAD 6 should be fenced along its boundaries and linked with the current security area FAD 5 is positioned on. An access road will be constructed from the FAD 5 to the new site via a bridge crossing the Provincial road. This will allow for dedicated and controlled entry to the proposed FAD 6 site.

Temporary construction roads will be constructed during the construction phase of the FAD 6.

Ash feeders from FAD5 to FAD 6, power feeder, water feeder and communication system will cross the road by means of box culvert systems located at a central position whereas the main return water canal crosses the road at the western side and penstock outlets the road on the north eastern side of the dam.

The rural road currently intersecting the proposed FAD 6 footprint, from east to west, will be relocated to the northern side of the FAD 6 security fencing.

4.15 Site access and Security

The current WAS falls within the Secondary Security Area of Sasol. This allows unrestricted access to operators and maintenance staff, who have access to all components of the Outside Ash system, such as ash dams, pump stations, canals and pipes. The new FAD6 and associated RWD fall outside the current perimeter (Jones &Wagner. 2012).

All components of the new dams must be incorporated into an extension of the Secondary Security Area. The construction works of the dams, fencing and integration into the Security Area of Sasol will have to be done in liaison with Sasol Security. The new facilities will not require a permanently manned security access gate. There may however be reason to establish temporary manned gates during major construction periods (Jones &Wagner. 2012).

The existing Standerton road, the R546, isolates the FAD6 area from the current Sasol perimeter. This will be addressed by elevating a Synfuels overpass bridge over public road. Road access over the mining conveyors will be provided by smaller culvert overpasses. The mining conveyor servitude will be fenced off from the Synfuels road to ensure separation of the two areas of responsibility. The design vehicles for this road system are a nominal 140 ton crane and construction vehicles such as ADTs and excavators (Jones &Wagner. 2012).

4.16 Stormwater Management

Although the Synfuels WADS does not fall under the mining regulations, the principles of the NWA regulation 704 are to be applied in that clean and dirty water systems must be kept separate and must be designed, constructed, maintained and operated such that these systems do not spill into each other more than an acceptable determined spilled frequency.

Storm water will be separated using storm water berms located around the perimeter of the FAD 6. The proposed FAD 6 may require various diversion systems of clean and dirty water around the dam and upstream of the phased developed dam footprint. Toe drains will be constructed for the FAD 6 in order to collect seepage water from and direct this water back into the CAE system as well as to ensure support of the FAD walls (Jones &Wagner. 2012).

The high volumes of process water, together with the large surface area and storm water run-off results in high flow rates of decant water that need to be drawn off from the dams. The use of precast concrete stacking rings as per all previous FAD's is no longer suited, both in volumetric capacity as well as safety and operability concerns. The decant tower must be safe enough to access 24 hours a day. Two alternatives are proposed, the use of segmented steel inlets and gantry structure that is raised in 1m segments over the life of the FAD, or a 40m high reinforced concrete decant tower that is built up front for each main phase. The concrete tower is the more costly of the two, but does have safety and operability advantages (Jones &Wagner. 2012).

The proposed FAD 6 development will require upstream clean water diversion trenches to ensure proper separation of clean and dirty stormwater as per Government Notice 704.

Three broad types of clean water drains are envisaged (Jones &Wagner. 2012):

- Temporary unlined drains and berms running on contour. These will be located upstream of any lined portion that has been constructed. As these will be built over in the next phase, the construction costs are to be minimised as they will have very short lifespans;
- Permanent drains, running on contour. As these drains will have nominal slopes and falls, they can be optimised for earthen construction to ensure that they will not erode away. The aim is to present as natural a drainage feature as is practicable; and
- Permanent drains running across contour. Some of the permanent drains will run across contours and will be quite steep. They will require armouring to ensure they do not erode. A combination of geocells and rock armouring is proposed to provide a stable long term solution that will vegetate itself blend into the natural environment as much as possible.

Rainfall run-off from the side slopes will be classified as dirty until the side slopes are capped appropriately. To ensure that stormwater from a high intensity event does not overwhelm the return water systems, run-off will first be collected in catchment paddocks running the full perimeter of the dam. The water is retained here and the silt is allowed to settle. Clear water can be drawn off at a high elevation from paddock drains, these decant into the solution trench running around the dam, hence into the RWDs. The catchment paddocks will be sized to accommodate run-off from a single 1:100 year storm event (Jones &Wagner. 2012).

4.17 Ash Booster Pump Station

An upgraded Ash Booster Pump Station will be required close to the current SSIC to support the current booster pump station at Outside Ash. This station is to be located at an elevation of 1585 m and may pump to a maximum elevation of 1660 m for FAD 6 (Jones and Wagner. 2009).

Alternatives for the east and west dam pump stations were investigated, one maximising commonality with the 500mm diameter water lines and associated pump sets used by Outside Ash, the other using less numbers of 700mm diameter pipes and larger pumps. The use of the larger number of smaller pumps and pipes ensures spares commonality as well as the use of existing cleaning pigs of the pipelines. The other system makes use of larger pumps and pipe diameters, so there is a reduction in commonality. The larger pumps however are more efficient, and the reduced number of pipelines will be easier to design, construct and operate. The North RWD will be outfitted with at least one pump and pipeline to Dam 11 to enable some water to be drawn off if the gravity canal needs to be decommissioned for cleaning (Jones &Wagner. 2012).

It was found that the optimum route for handling water from the East RWD is to pump it to the North Dam, and let it gravitate into the CAE canal system.

4.18 Ringfeed and pipeline

The design of a ringfeed system to handle both factory loads over the full life of FAD6 has numerous design solutions. Running a full ringfeed ash distribution network to the entire dam perimeter with all of the current ash feeder pipes from Outside Ash is impractical and not cost effective. It is essential that the ash feeder system and ringfeed be rationalised to try and reduce the number of pipes if possible (Jones &Wagner. 2012).

4.19 Rehabilitation of side slopes

Rehabilitation of the FAD 6 will be required during the life span of the dam as well as during decommissioning. The gradient angle of the side slopes is currently expected not to exceed 18.4 degrees nor a 1:3 gradient.

FAD6 will never become part of the greater coarse ash area and so more attention must be paid to its rehabilitation than the existing FAD5 which will be covered by the coarse ash stack. The location of the dam on the southern side of the R546 Standerton road will also result in the dam having a higher visual impact to the southern and western viewpoints from the road (Jones &Wagner. 2012).

These factors indicate that rehabilitation of FAD6 is a requirement during its lifespan as well as at final decommissioning. This dictates the maximum slope angle that can be used. For the placing of topsoil, a slope angle of 1V:3H (or 18.4 degrees) is the maximum that can be trafficked by wheeled machinery (Jones &Wagner. 2012).

The other important attribute for successful operations and rehabilitation of the facility is the provision of steps or benches in the side slope. These break up the water velocity of sheet flow by collecting the water on intermediate benches, from which engineered systems can extract the stormwater to the base of the dam. These are normally provided at 10m vertical height intervals. They also provide a function during the operation of the dam in providing reasonable quality of access around the perimeter of the dam. The provision of benches enables an average side slope angle of 1V:3.5 H. This is flatter than the FAD5 slope of 1:2.5. There will be secondary benefits in terms of slope stability; this design will be inherently more stable, as well as being less sensitive to a high phreatic surface in the dam (Jones &Wagner. 2012).

The final cover and capping design will be governed by the outcomes of the long term capping trials project for the WAS, data from this is expected by 2018. In the meantime, the stripping of 200mm of topsoil is recommended for stockpiling for future use (Jones &Wagner. 2012).

4.20 Legislative requirements

The South African National Standards Code of Practice on Mine Residue (SANS 0286:1998) requires the design of tailings facilities to be evaluated in terms of its safety implications and hazards of design, operation and rehabilitation. Although FAD 6 is an industrial waste facility and not governed by the mining regulatory framework, the principals involved are considered good practice.

It was found that the proximity of the ash dam to the R546, as well as having the Brandspruit complex located downstream of the site would render this a High Hazard facility in terms of the Code. In practical terms, this hazard rating requires an inspection/audit by a qualified Professional Engineer annually (Jones &Wagner. 2012)..

In terms of the Dam Safety regulations, the ash dams and some of the return water dams would probably be classified as either Category II or Category III dams. These require a full safety audit to be done every five years in a prescribed format (Jones &Wagner. 2012)..

Given the new lining technologies that are required for this dam, it is recommended that at least annual inspections by a Professional Engineer be implemented. This enables the performance of the drains, decants, liner and protection layers to be evaluated. As the dam is constructed and lined in phases approximately two years apart, the feedback could be invaluable to optimise safety and to ensure that the most cost effective systems are being designed and built (Jones &Wagner. 2012).

4.21 Undermining

Discussion with Brandspruit staff indicated that the access to the coal reserves from the existing decline shaft at Brandspruit will cease in approximately 5 to 6 years' time. At this point coal reserves will be accessed via new shafts from the far west of the mining area. It is likely that the water compartments under the site will still be managed to prevent decanting.

4.22 Fine Ash Dam Parameters

The FAD 6 is considered to be operational with the following parameters pertaining to the ash deposition:

- Max height above the ground level of 40 m;
- Maximum rate of rise of 3.5m / annum rate at 50% commissioning ash stream; and
- Ash Density of 0.9 t/m^3 measured dry in place.

4.23 Pre-Construction phase activities

The following activities will from part of the pre – construction phase:

- Detailed design of the FAD 6 system, and associated infrastructure, and planning of proposed development and subsequent phases;
- Obtaining the necessary authorizations including WUL, and WL Amendments, relocation of power lines, realignment of the D714 road, and rezoning approvals;
- Issuing of tender, adjudication and award of contracts for the construction of FAD 6 and associated infrastructure;

- Construction personnel will be made aware of their responsibility to ensure environmental protection and conservation, such as fires, safety pollution control and the consequence of these; and
- Contractors to draft appropriate EMP's for the construction activities in accordance with Synfuels Standards and the EMP of the EIA and associated Water and Waste Licence conditions;

4.24 Construction phase activities

The following activities are proposed during the construction phase of the FAD 6:

- Transportation of equipment and machinery to the site location;
- Development of the construction camp on site, taking into consideration of the proximity of residential areas, water resources, and the provision of adequate service needs;
- Fencing of the construction site;
- Development of temporary materials and waste storage and control measures;
- Stripping and removal of surface vegetation from site to an approved location;
- Stripping and stockpiling of topsoil from the site for later use for rehabilitation and landscaping;
- Excavation for pipe trenches, canals and base for the water retaining structures, pump stations and FAD 6;
- Excavation and development of toe and blanket drains for the water retaining structures and FAD 6;
- Construction of ash and water transfer pipework and canals, pump stations, RWD's and started walls for the FAD 6;
- Establishment of affected watercourse diversions and stormwater control measures;
- Re-alignment of the D714 roads north of the proposed FAD 6 location, and modification of the intersection with the R546;
- Realignment of the power lines running through the proposed footprint;
- Site rehabilitation following the construction phase, of areas that have been disturbed and are not part of the on-going operational phase of FAD 6, and
- Commissioning of the ash transfer, ash deposition and water recovery systems.

4.25 Operation phase activities

During operation of the FAD, the following activities will take place:

- Deposition of ash on the FAD 6, with a rate of rise of approximately 3.5 m / annum;
- Recovery of ash water to the CAE dams for subsequent re-use within SSIC and the ashing process;
- Transportation of vehicles to and from the FAD 6 for service and maintenance;
- Monitoring of ash deposition, water recovery and quality and environmental parameters, and
- Rehabilitation of side walls as the FAD 6 develops.

4.26 Closure Activities

During the closure phase of the FAD 6, rehabilitation of the FAD 6 will take place:

- Monitoring of rehabilitation sustainability, maintenance of rehabilitation and environmental parameters, as necessary.

5 Project Alternatives

The position of the proposed FAD 6 is largely constricted by the availability of space in close proximity to the SSIC.

With increasing distance from the SSIC comes an increasing fiscal cost. In addition to this, Sasol Coal planned for the installation of a conveyor cutting through the proposed site or relocating it through the northern side of the site. The Sasol Nitro gas pipeline runs through the

These constraints limit the possible location for the construction of the FAD 6.

According to Section 31(g) of GN R 543 printed in terms of the NEMA, feasible and reasonable alternatives must be considered and assessed in the EIA process, along with the no – go alternative.

The project Alternatives that have been identified to date for assessment in the EIA include process and location alternatives and will be discussed in Section 5.1 - 5.3.

5.1 Location Alternatives

According to GN R 543 an alternative is defined as:

"an alternative in relation to a proposed Activity refers to the different means of meeting the general purpose and requirements of the Activity, which may include alternatives to:

- *the property on which or location where it is proposed to undertake the activity;*
- *the type of Activity to be undertaken;*
- *the design or layout of the Activity; and*
- *the operational aspects of the Activity"*

5.1.1 Alternative 1: Single large FAD

This alternative is based on the conveyor alignment relocated to the north.

The size of the proposed site offers the possible construction of a phased single FAD 6 directly south of the relocated conveyor alignments covering the majority of the proposed site. This FAD will in turn have the capability to handle the factory loads from Synfuels. The cost implications of such a FAD are more feasible than the construction of two individual dams.

The ash dam will be split into three main developments. Phase 1 starting at the north west of the site, Phase 2 from the north east of the site and then Phase 3 to the south of the site.

To ensure that the height above ground level of each dam does not become excessive, large step-backs will be created for both Phase 1 and 2, in which smaller compartments located on the higher ground portion of the main dam footprint will be lifted to final height. These not only give additional storage volume, they accept a reduced ash tonnage which will give time for the next ash dam phase to be commissioned at acceptable rates of rise

RWD's will be constructed west, north and north east of the dam for the various phases including a potential water storage facility at the western side as a first phase. The northern penstock will gravitate the water from the dam to the silt traps and the north RWD from where water will be transferred via a gravitational system to the CAE system. Penstocks located on the western and

north eastern dams will decant water into RWD's and sumps from where it will be pumped to the CAE system due to the topographical difference between the RWD and CAE system. When the level of these dam sections have been raised sufficiently the bulk of the water can be gravitated to the CAE system

The relocation of the Sasol Coal conveyors to the northern side of the site has been investigated in conjunction with the Synfuels single future ash dam development south thereof. This will allow for reduced construction of associated infrastructure and will in turn allow for reduced management and maintenance as compared to multiple cell configurations. A primary disadvantage of the construction of a single large dam is the greater surface area exposed to wind and environmental factors. The larger surface area of this alternative poses a threat of increased Dust Fall Out (DFO) and PM 10 pollution. Stringent mitigation measures will need to be put in place should this alternative be decided on. Figure 5-1 illustrates the layout of this alternative.

5.1.2 Alternative 2: North and South Dams

North Dam Phase 1

This alternative is based on the assumption that the currently planned Sasol Coal conveyor alignments cutting through the available land for FAD 6 development remains in position and that the FAD 6 dams are developed on both sides of the conveyors.

The northern dam will be constructed in three separate phases. Firstly the temporary water storage facility will be constructed where after the northern dam Phase 1 should be constructed on portion 3 of the farm Rietvley 320 IS. Northern dam Phase 3 entails the conversion of Phase 1 for receiving fine ash. The Phase 1 RWD will be constructed north of FAD6. The penstock located in the phase 1 dam will transport the water from the dam to the silt traps and the RWD from where water will be further transported via a gravitational system to the existing CAE system. Water from the water storage facility will be transported via a pipeline from the western RWD to the Phase 1 RWD and to the CAE system via a gravitational system. The northern dam will be constructed almost entirely on bord and pillar undermined areas or non-mined areas with a small area located on total extraction where strengthening of the substrata is required where dam walls are positioned. An Eskom power line runs across the area in a south west direction and may be relocated to a position alongside the proposed relocation of a section of the provincial rural road west of the western boundary of the proposed dam site. The entire phase 1 northern dam is located on Portions 3 of the farm Rietvley 320 IS, with portion 8 serving as a buffer zone.

South Dam Phase 2 and 3

The southern dam phase two and three are located south of the proposed northern dam and conveyor routes on Portions 2, 9 and 10 of the farm Rietvley 320 IS. The return water from this dam will be routed towards the north eastern RWD's north east of the provincial road R546. The latter RWD's will initially be energy inefficient owing to the additional construction of a low head pump to transfer water to the CAE system. At a later stage when the dam level is raised beyond the water crest level the bulk of the water can be gravitated to the existing CAE system. The southern dam is located on a complex mining layout, with transition between long wall, total extraction, bord and pillar and un-mined dolerite dykes. The southern dam will function in assisting the northern dam to take on the factory loads of ash from Synfuels and should be constructed during the final decommissioning Phases of FAD 5.

The construction of the FAD 6 as a segregated phased activity has potential disadvantages. The single northern dam does not have the capacity to handle two factory ash loads. Hence the construction of the southern dam is required once FAD 5 is finally decommissioned. Due to limited

space available this alternative does not offer ash stacking capacity up to 2050 which may require the development of an alternative fine ash dam elsewhere at high cost which is a less feasible alternative. The reduced capacity, hence the reduced surface area of this alternative is more favourable from an air quality perspective. With increasing surface area of the FAD comes a potential increase in DFO and PM10 emissions requiring mitigation and management. Figure 5-2 illustrates the layout for this alternative.

5.1.3 Alternative 3: Continual use of FAD 4 and / or FAD 5

Unlike coarse ash that has an inherent stability due to the coarseness of the ash; fine ash does not have the same inherent stability which limits the height, sidewall slope angle and consequently mass, that a fine ash dam can safely be developed to.

FAD 4 and FAD 5 have been designed and operated to established safety factors and to accepted design parameters. The design engineers have determined the maximum safe height and sidewall slope angles for the operation and subsequent closure of the FAD's which precludes extension of the FAD's height to accommodate more fine ash.

The basis of the Synfuels operations is the gasification of coal, and generation of coal based steam for the processing operations. Fine ash will be a by-product of the Synfuels operations for as long as coal is the basic raw material, and will require appropriate disposal facilities.

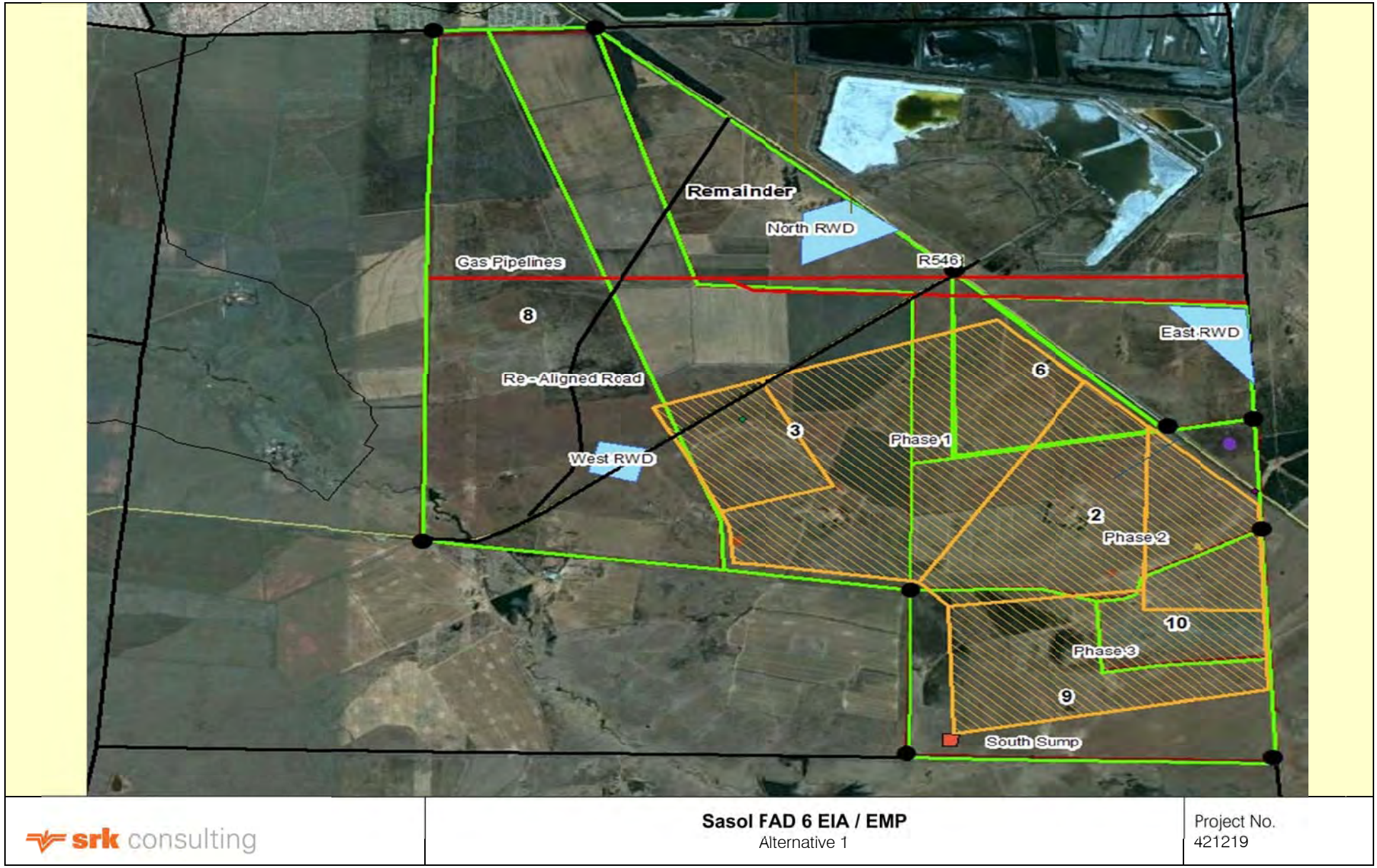


Figure 5-1: Alternative 1 of the proposed FAD 6

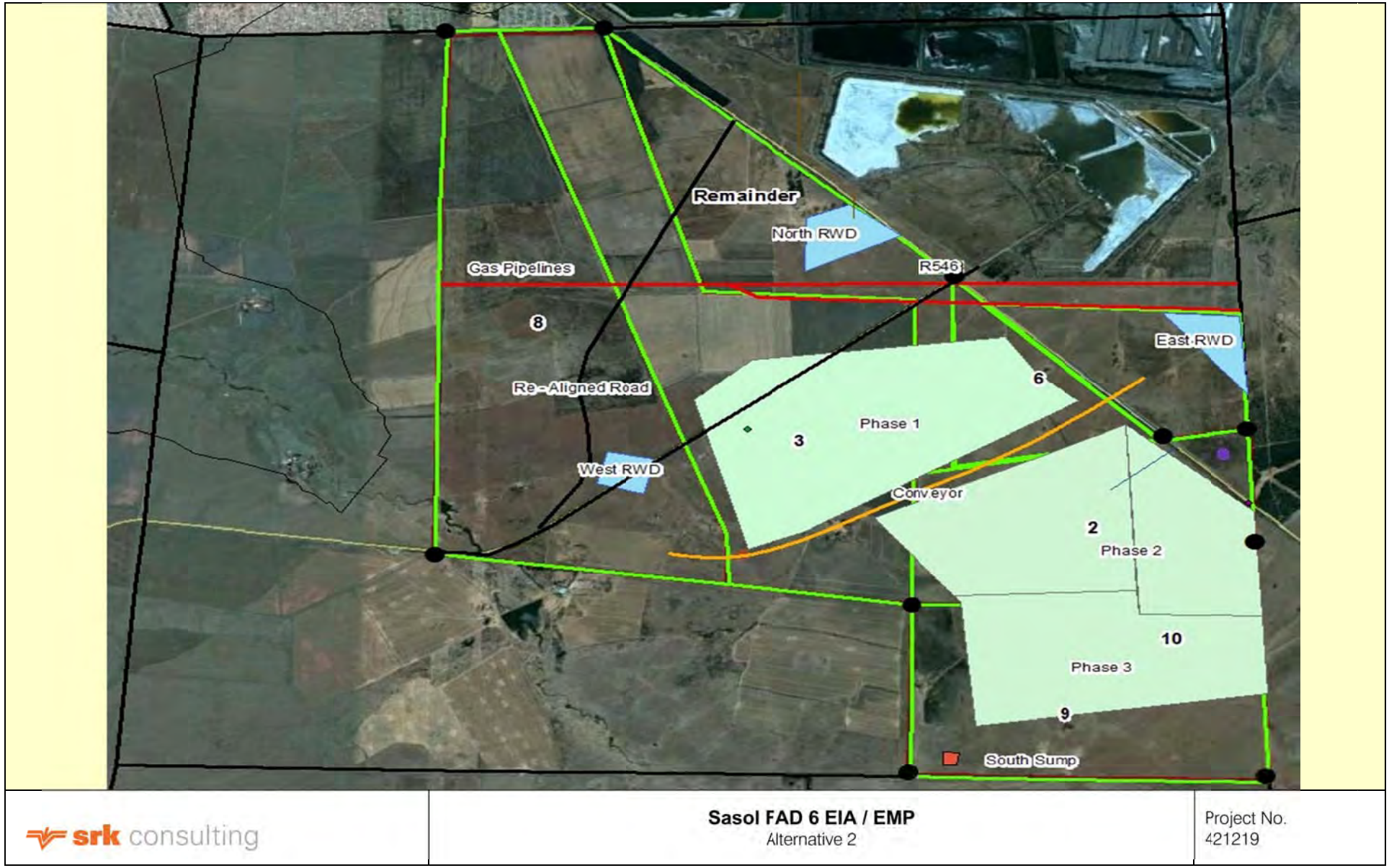


Figure 5-2: Alternative 2 of the proposed FAD 6

5.2 Process Alternatives

5.2.1 Dry Ashing

Synfuels is currently using predominantly dry conveyor system for the disposal of coarse ash, where dust generation is limited, and a wet ashing system to transfer and store the fine ash. Dry ashing of fine ash is not considered technically, environmentally or economically viable. Although the dry ashing system utilizes less water, a significant amount of dust is produced compared to the wet ashing system.

Considering the proximity of the local communities in the area and the amount of activity currently taking place by Synfuels operations, dust fall out and PM10 concentrations are more likely to exceed legislative guidelines and affect the surrounding communities after the implementation of mitigation measures with dry ashing as opposed to the existing, and proposed wet ashing of fine ash.

5.2.2 Wet Ashing

Ash is a natural constituent of coal. When coal is gasified or burned in the steam plant boilers the remaining residue is coarse and fine ash, which is segregated through a screening process, and ultimately needs to be stored of. Synfuels is currently using predominantly dry conveyor system for the disposal of coarse ash, where dust generation is limited, and a wet ashing system to transfer and store the fine ash, which has a higher dust generation potential. Wet ashing produces less dust in the vicinity of operations at Synfuels, thereby promoting health and personal wellbeing. The wet ashing system produced less dust but uses more water than the dry ashing system. The majority of this water is evaporated, trapped as interstitial water within the ash particles and finally recycled and recovered for re-use within the process. The Wet Ashing system is currently used at Synfuels. The costs to retrofit a dry ashing system at Synfuels will not be financially viable. It is thus proposed the Sasol continue with the wet ashing system.

5.3 No – Go Alternative

The final alternative assessed, is the No – Go alternative. The No Go alternative assesses the status quo of ash disposal at Synfuels.

It is planned that the Synfuels complex will continue as primary coal gasification and integrated organic chemicals plant for at least the next 25 years, and will therefore require facilities to store of the waste ash generated by the coal gasification and associated boiler operations. Due to the nature of the fine ash there are engineering limitations on suitable disposal facilities, and new facilities are required to accommodate on-going fine ash production.

It is planned that the construction of the proposed FAD 6 will replace the existing FAD 4 which in turn will be decommissioned and rehabilitated, and subsequently take over from the existing FAD 5. Without the commencement of the new FAD 6, all operations at Synfuels will be completely terminated prior to year 2019. Operations will not proceed beyond the life span of the existing FAD's. The factory will need to be shut down due to the inability of the factories to deposit and transfer fine ash. Secunda is an urban town, primarily developed for the housing of Sasol employees. A large percentage of the Secunda area is employed by Sasol. Should the FAD 6 not commence and Synfuels be forced to close down gasification and coal fired stream generation, a substantial amount of jobs will be lost.

Whilst Synfuels is investigating opportunities for the re-use of fine ash, and coarse ash, and alternative technologies for the ashing process, there is currently no technically appropriate alternative disposal outlet for the fine ash generated by the SSIC. The no go alternative will

result in retaining the environmental status quo. However considering the importance of the SSIC to the South African economy, operations may not shut down, resulting in the overflowing of existing dams and subsequent destruction of the environment which cannot be mitigated.

In the absence of FAD 6 the SSIC would not be able to continue in operation, without major associated socio-economic and environmental consequences to the local region as well as nationally in South Africa.

6 Description of the Affected Environment

This section provided an overview of relevant environmental aspects that required careful consideration in the analysis and assessment of the potential impacts and benefits to which the project may give rise. The section describes the baseline environment in which the proposed project is to take place, with emphasis on environmental aspects that are most likely to be affected during the construction of the FAD 6.

6.1 Socio – Economic environment

This site falls within the Gert Sibande District and Govan Mbeki Local Municipality. The demographics of this study area are provided by the Spatial Development Framework (SDF) of the Govan Mbeki Local Municipality (2006).

This Municipality is situated in the south western regions of Mpumalanga, bordering Gauteng, being approximately 150 km from Johannesburg to the east and approximately 300 km south west of Nelspruit. The Govan Mbeki Local Municipality is one of seven Local Municipalities under jurisdiction of the Gert Sibande District Municipality. This Municipality covers approximately 2958 km^2 with a population of approximately 480 000 people, leaving an average population density of 160 people per km^2. The unemployment, according to the SDF, reaches a phenomenal 40%. The average population growth in the area is considered to be around 1.1 %. The municipality can mostly be described as agricultural / rural, although three urban corridors have been identified. These include the following:

1) Leandra / Lebohang on the western edge;
2) Greater Secunda in the centre (Trichart, Evander, Kinross and Secunda/Embalenhle);
3) Bethal / eMzinoni on the eastern edge.

The Govan Mbeki Municipality is situated on the Gauteng Richards Bay Corridor formed by the National Road N17 and the Richards Bay rail line running through the Municipality in an east west direction. According to the SDF, the municipality has one of the largest coal mining complexes in the world, making the municipality an important strategic area within the national context. The economy of the Govan Mbeki Municipality is significantly diverse, dominated by the petrochemical industry (Sasol), coal and gold mining in the area.

Secunda is the most important urban centre in the municipal area, with Embalenhle being the largest. Secunda was established in 1975 when Sasol East and West plants were commissioned during the oil crisis in the seventies. The establishment of Secunda was a direct result of the presence of the SSIC and associated coal mining activities.

6.2 Surface Water

6.2.1 Local Context

The proposed FAD 6 falls within the Upper Vaal Water Management Area (WMA 11). The major rivers in this WMA area the Liebenbergsvlei, and Vaal Rivers. The proposed area falls within the

quaternary catchment of C12D. Secunda is at the northern boundary of the WMA. The SSIC itself is located in a sub-catchment of the Waterval River, comprising the several tributaries i.e. the Vlakspruit, Klein Bosjesspruit, the Groot Bosjesspruit, the Brandspruit, the lower reaches of the Klipspruit and Trichardspruit. Figure 6-1 illustrates the river locality of the proposed FAD 6 area (Wood, A, & Schröder, B. 2011).

The surrounding rivers of the proposed footprint, consists of: an un-named river which drains to the west and is a tributary of the Waterval River which then drains southwards and away from Synfuels property; to the east of the site is another un-named tributary that flows northwards towards the Groot-Bosjesspruit river which transverses the SSIC flowing in a westerly direction, combining with the Trichardspruit which becomes the Kleinspruit, then the Grootspruit and ultimately the Waterval River which drains off-site in a southerly direction (Wood, A, & Schröder, B. 2011).

Regional Context

The Upper Vaal WMA includes the Vaal, Klip, Wilge, Liebenbergsvlei and Mooi Rivers and extends to the confluence of the Mooi and Vaal Rivers. It covers a catchment area of 55 565 km^2. This WMA includes the very important dams Vaal Dam, Grootdraai Dam and Sterkfontein Dam. The southern half of the WMA extends over the Free-State; the north-east mainly falls within Mpumalanga and the northern and western parts in Gauteng and North West provinces respectively (Wood, A, & Schröder, B. 2011).

- The WMA is divided into various sub-catchments of which the Bosjesspruit and Grootspruit sub-catchments of the Waterval catchment are relevant to this study; and
- FAD 6 falls within the C12D quaternary catchment which covers a maximum area of 899 km2.

According to the Water Resources of South Africa the naturalised stream flow for the C12D quaternary sub catchment will be 5.3 x 106m^3/year (Wood, A, & Schröder, B. 2011).

The rivers in close proximity to the complex include the Klein Bosjesspruit which flows from the Klein Bosjesspruit dam in westerly direction towards the Klipspruit passing north of the site before flowing into the Klipspruit. The Bosjesspruit and the Brandspruit join the Klein Bosjesspruit (Wood, A, & Schröder, B. 2011).

This sub-catchment as a whole contains the most heavily impacted riverine habitats within the Waterval catchment.

The proposed FAD 6 forms part of the WADS of the SSIC that is located within the upper reaches of the Trichardspruit, a tributary of the Waterval River, which is part of the Vaal River system. The Waterval River joins the Vaal River just upstream of the Villiers River, before the most upstream extremity of Vaal Dam. The portion of the upper reaches of the Trichardspruit that is influenced by the SSCI includes the Bosjesspruit, Brandspruit, Klipspruit and Kleinspruit (Wood, A, & Schröder, B. 2011).

- The FAD 6 area contributes approximately 0.015% to the Mean Annual Runoff (MAR) of the quaternary catchment;
- The Secunda area is a water scarce area located in the upper Vaal water management region consisting of perennial and non-perennial rivers;
- The study area is defined as the farms on which the proposed FAD 6 will be located being Portion 2,3,6,8,9,10 and Remainder of Rietvley 320 IS;

- The study area partially falls in the Grootspruit sub-catchment and partially within the Bosjesspruit sub–catchment. These rivers come to a confluence at the Waterval River which then drains into the Vaal River and ultimately the Vaal Dam.

The current SSIC, including related activities, fall within the Klipspruit/Trichardspruit sub-catchments of the Waterval River catchment, which are within the upper reaches of the of the Vaal River catchment. Very importantly, from a surface and shallow groundwater perspective, the Bosjesspruit, and after its confluence with the Klipspruit, the Kleinspruit roughly define the northern and north-eastern extents of the facility. In the same vein, the Brandspruit, up to its confluent with the Bosjesspruit, roughly defines the eastern boundary of the facility (Wood, A, & Schröder, B. 2011).

- The Grootspruit and Bosjesspruit sub-catchment is largely undeveloped, or under agriculture, partly due to limited surface water sources;
- Rand Water supplies potable water to the Municipal area. Local surface water resources are not formally used for water supply, other than for animal watering.

Raw Water for the SSIC is obtained from the Bosjesspruit Dam immediately adjacent to the SSIC, which forms part of the DWA supply infrastructure to Sasol. Supply to the Bosjesspruit Dam is through the Grootdraai Dam and the new Vaal River Eastern Subsystem Augmentation Project (VRESAP) supply from the Vaal river system.

Water Quality

Grootdraai Dam itself exhibits good water quality with a mean Total Dissolved Solids (TDS) concentration of 161 mg/l. The outflow of Grootdraai Dam, exhibits relatively low TDS concentrations (average 162 mg/l). The dam levels fluctuate significantly due to water transfers and releases from the dam, but the in-dam the chemistry is fairly stable (Wood, A, & Schröder, B. 2011).

The Vaal River, just below its confluence with the Waterval River, indicates a definitive increase in TDS concentrations with almost 80 % of the values exceeding the acceptable RWQO, at a TDS concentration of 195 mg/l. As the upstream location in the Vaal River display low TDS concentrations, it is evident that the Waterval catchment activities contribute to this increase. The recorded TDS display a seasonal trend, increasing from May to October due to low flows (Wood, A, & Schröder, B. 2011).

This above trend of deteriorating water quality is due to the influence of the extensive mining and industrial activities present in the Waterval catchment. The SSIC and mining complex and the Evander mining operations are two of the major water uses in Waterval catchment. It is highly likely that these activities amongst others (major towns of Secunda, Kinross, and Evander) are contributing to the recorded TDS levels (Wood, A, & Schröder, B. 2011).

The Waterval River also displays a seasonal trend with regard to TDS concentrations i.e. increase concentrations during winter months. The time series plot of TDS indicates general compliance to the acceptable RWQO concentration for the river. However, there is a discrepancy between the RWQO of this tributary and that of the main stem of the Vaal River regarding a number of constituents. The acceptable RWQO within the Vaal River main stem, just below the confluence of the Waterval River, the TDS concentration is 195 mg/l, whilst that of the Waterval River is 585 mg/l. Thus if the acceptable RWQO concentration of 195 mg/l for TDS is used for the Waterval River, there is general exceedance of this management target. The flow in the Vaal

River is not able to dilute the water quality effect of the Waterval River, as reflected by the poor water quality recorded below the confluences of these two rivers (Wood, A, & Schröder, B. 2011).

- The Waterval river catchment and its sub-catchment tributaries (Groot, Trichardt, Klip, and Bosjesspruit) water users include the Local Municipality of Govan Mbeki, the SSIC and associated industries, mines and agriculture.
- The limited and seasonal, availability of water in the area posed a challenge to the original development of the SSIC, resulting in the construction of the Bosjesspruit Dam by the Department of Water Affairs and Forestry (DWAF), to supply water to Synfuels and Eskom, the recent integration with the VRESAP pipeline transfers Vaal Dam water to the Bosjesspruit for further use by Synfuels and Eskom. Whilst Synfuels has a link to the Rand Water supply, it is generally independent of Rand Water.
- The Govan Mbeki Local Municipality is supplied by Rand Water and is independent of the water transferred to Bosjesspruit Dam.

6.2.2 Synfuels Surface Water Monitoring Network

Synfuels has developed an extensive surface quality monitoring programme illustrated in Figure 6-2, which consists of twenty eight surface monitoring points. Real time conductivity measurements are carried out at ten stations and real time flow measurement are carried out at six stations. Weekly grab samples are collected for chemical analyses (Macro chemical constituents, heavy metals, selected organics, selected biological parameters).

The DWA surface water monitoring network as illustrated in Figure 6-2, consists of many points along the rivers of interest, overlaps occur with the Synfuels monitoring network in places.

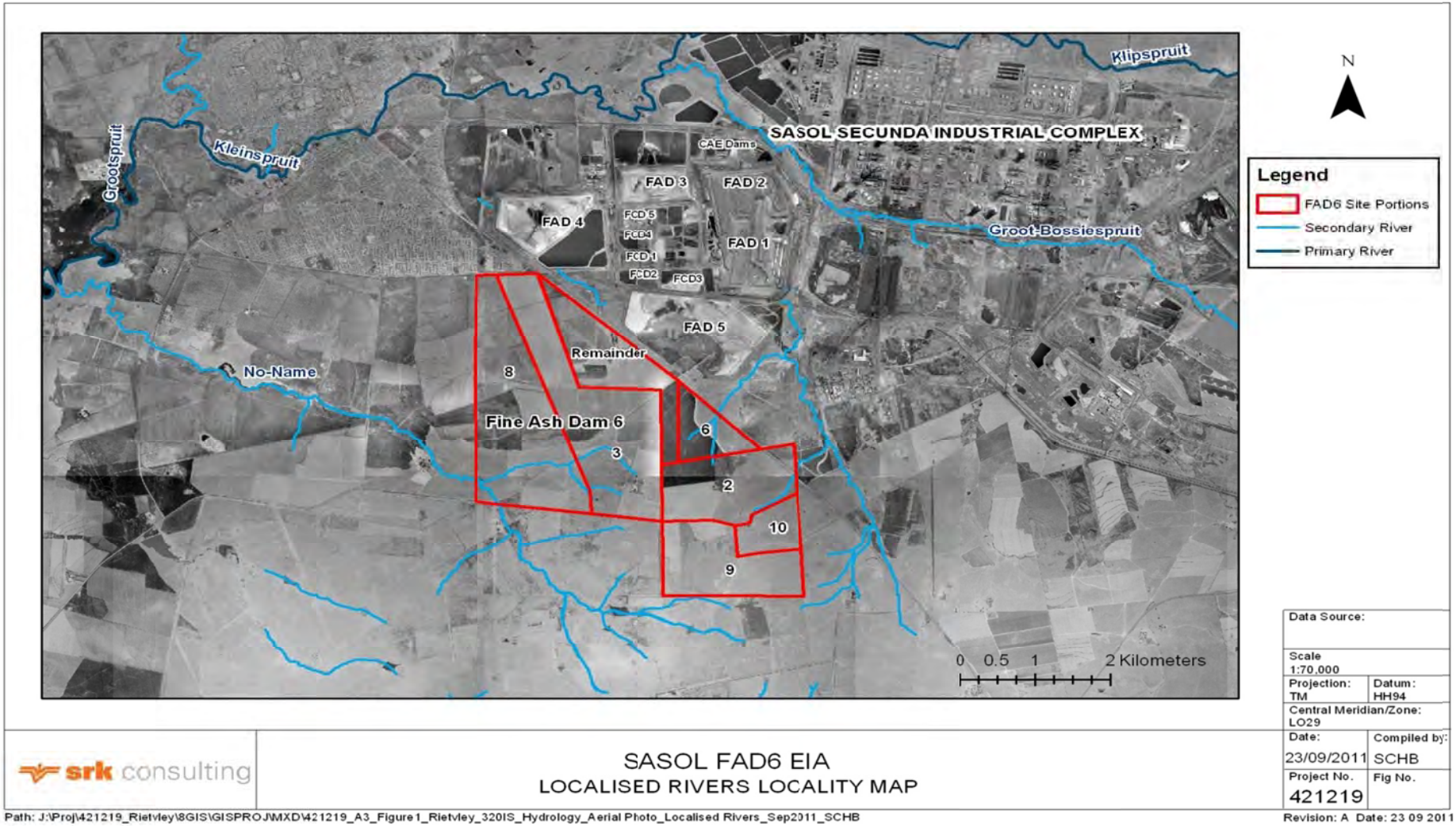


Figure 6-1: River locality map

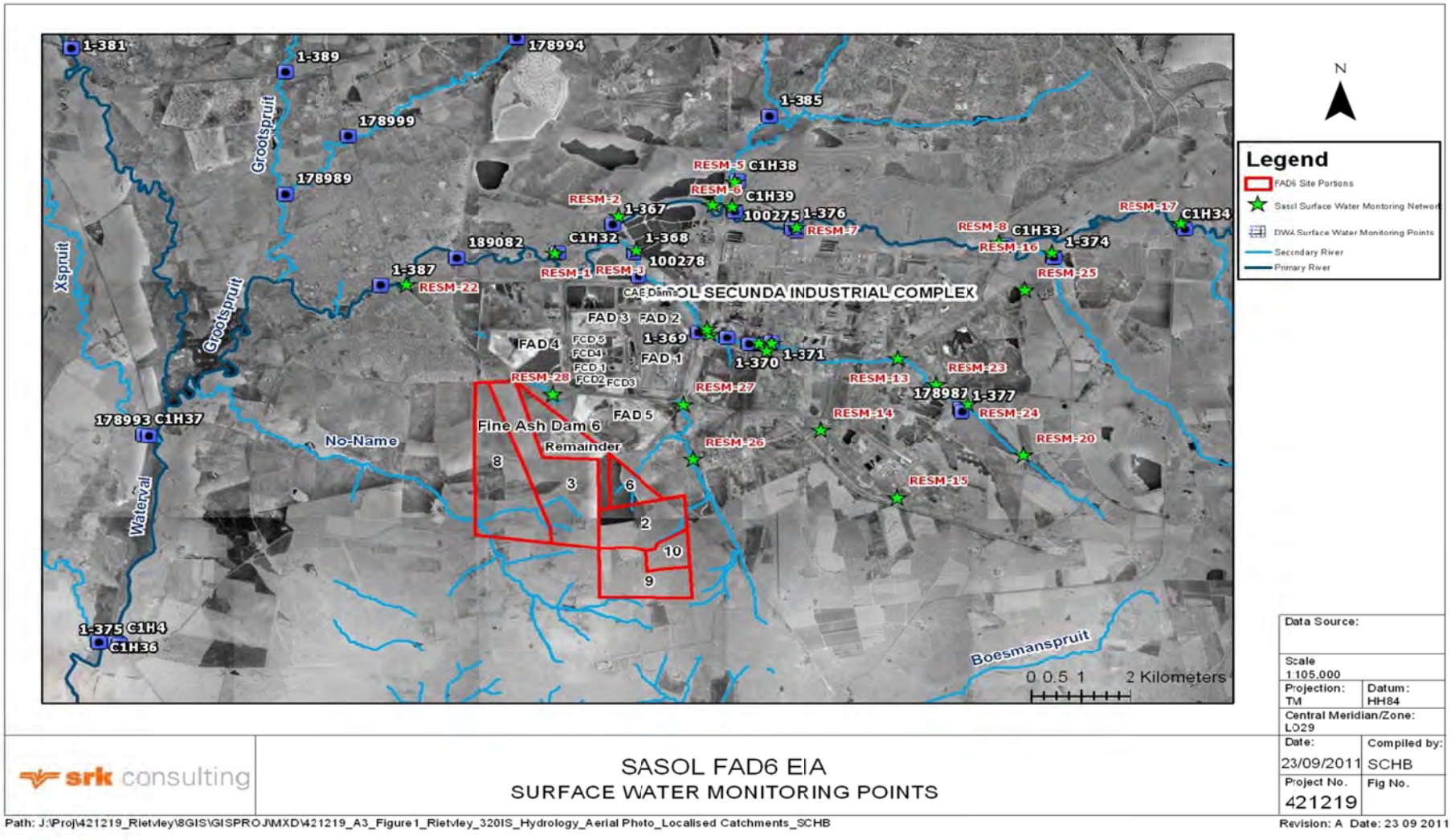


Figure 6-2: Sasol Surface Monitoring Network

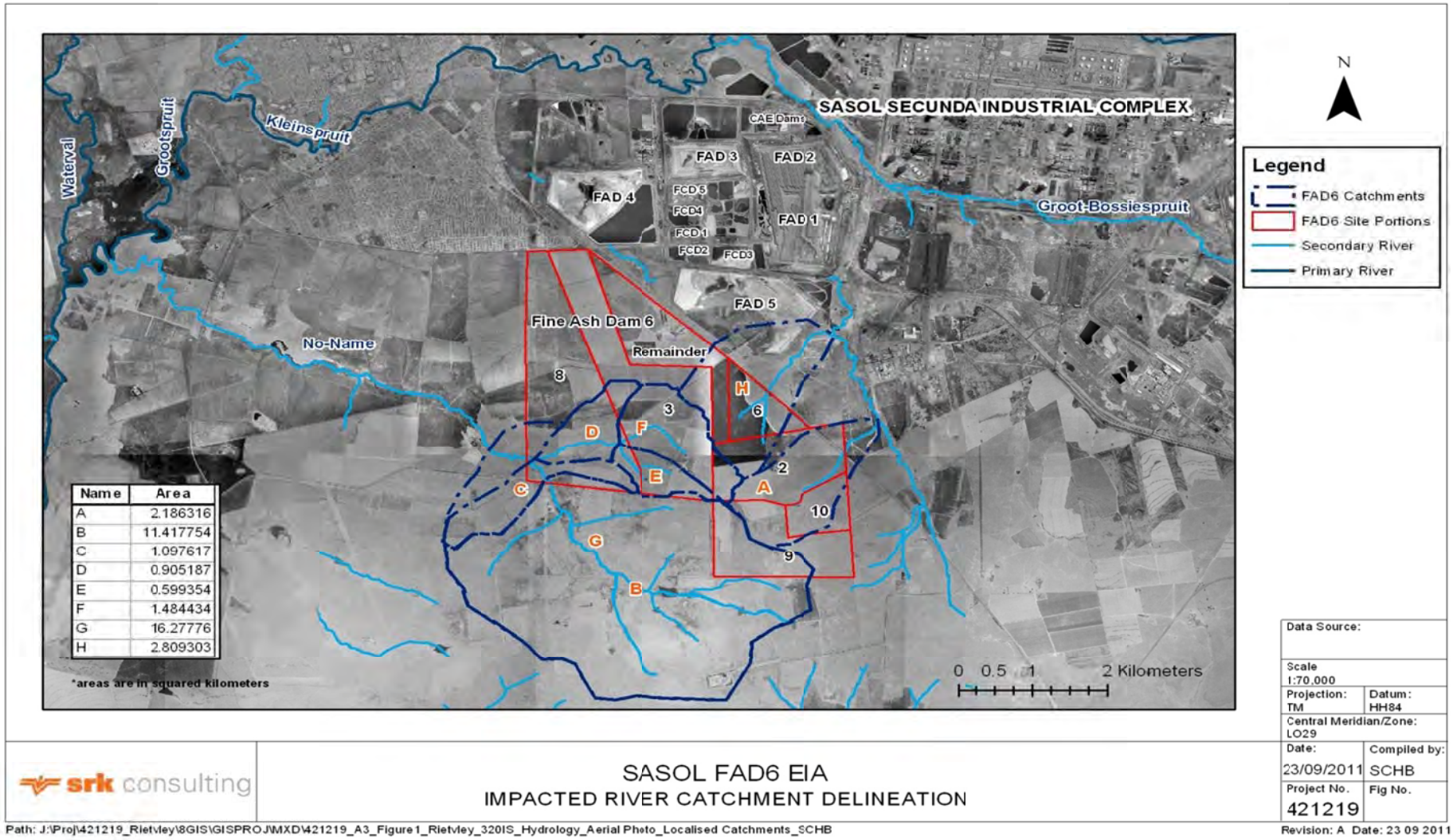


Figure 6-3: Impacted river catchment delineation

6.3 Hydrogeology

Groundwater in a geological aspect of a site is typically associated with weathered bedrock and the presence of dykes and faults. As groundwater moves closer to a stream or wet areas, the water may be associated with the presence of alluvial deposits (Theu , G, 2011).

There are two main aquifers underlying the SSIC site, namely:

- Shallow weathered aquifer at a depth of between 12 and 35 m.b.g.l. At FAD 6, the depth of weathering is 25 m.b.g.l, but was noted to be dry;
- Deep fractured aquifer has been reported at depths of between 60 and 80 m.b.g.l. This zone was not targeted for the FAD 6 investigation due to the under mining that takes place beneath some portions of FAD 6.

In general the SSIC area, reports water strike depths ranging from 2 m and 60 m below surface but generally within a range of 13 to 15 m below surface. Boreholes drilled around the WADS monitor the shallow weathered aquifer and generally intersected groundwater between 13 to 15 m below surface (Theu , G, 2011).

In general SSIC borehole blow yields have been reported to vary from seepage to a high of 7.0 *l*s with other boreholes reported as dry. Boreholes at the WADS areas are reported to be relatively low yielding with only seepage encountered during drilling (Theu , G, 2011).

Dolerite intrusions are found to be weathered and fractured and are associated with the occurrence of groundwater at the contacts with sandstone, siltstone or shale. The deep fractured aquifer has been found to be low yielding and classified according to the Parson's Classification system as being minor owing to generally low yields. The permeability of the weathered aquifer has been estimated to be in the range of 10^{-3} to 10^{-2} m/day (Theu , G, 2011).

6.3.1 Groundwater Monitoring

On behalf of Synfuels, the Institute for Groundwater Studies (IGS) of the University of the Free State (UOFS) currently conducts routine groundwater monitoring at the SSIC in terms of the WUL and WADS License. Quarterly and bi-annually sampling regimes are conducted. Laboratory analyses include organic and inorganic constituents (Theu , G, 2011).

Relevant to this study are groundwater monitoring points located around the areas consisting of the WADS, including specifically the coarse ash area, FAD's, fine coal dams and CAE dams, as indicated in Figure 6-4 (Theu , G, 2011).

In areas where undermining has taken place, the hydraulic characteristics of the aquifers could be significantly altered with groundwater possible flowing preferentially towards the mine void. Mining operations could also have an impact on groundwater quality due to oxidation/reduction processes. However, Sasol Mining will manage the water in the compartment as part of the Brandspruit underground water handling system to prevent decanting (Theu , G, 2011).

6.3.2 Groundwater Quality

The ash stored at FAD 6 could be a potential source of groundwater contamination in the footprint of FAD 6 and aquifer down-gradient of the site. Analysis of the ash from existing facilities has indicated the presence of principally inorganic salts. Since the processes have not changed the ash stored to FAD 6 is expected to have similar characteristics and therefore have a potential to contaminate groundwater with the constituents identified in the ash residue. The Institute for Groundwater Studies (IGS) concluded that the WADS do have an impact on the local

groundwater quality, but this groundwater is not used for drinking purposes and the impact does not pose a material risk to groundwater resource use of the region(Theu , G, 2011).

The weathered zone (to a depth of 25 m) within the footprint of the proposed FAD 6 was noted to be dry during drilling of boreholes in March 2011 and during a follow up water level check in April 2011 (Theu , G, 2011).

It is assumed that once FAD 6 is operational, there will be some potential for seepage from the facility to infiltrate the underlying aquifer. Unless there is preferential flow through fracture zones and other geological lineaments to the underlying mined out zone, groundwater flow will predominantly be by broad front saturating the weathered zone over a period of time before day-lighting into the tributary of the Grootspruit. Table 6-1 gives an indication (assuming that the weathered zone beneath FAD 6 is bounded) of the time it would take for the underlying weathered zone to be saturated in the case where the footprint is not lined, and therefore the time seepage would start day-lighting into the nearby Grootspruit tributary located to the immediate south of FAD 6, possibly having an impact (Theu , G, 2011). Estimates in the table below are based on the following assumptions:

Input

- Ash stream: 13 000 t/d
- Water content: 6 500 m3/d (assumed 50% of stream)

Output

- Return water: 40%
- Interstitial water: 20%
- Evaporation: 30%
- Seepage: 10%

Table 6-1: Estimated water balance

Item	Amount	Comments
Volume porous media beneath FAD 6 (m^3)	218 750 000	Estimated area of 3.5 x2.5 km and depth of 25m.
Estimated porosity (%)	30	
Volume open space (m^3)	65 625 000	
Ash Disposal (t/d)	13 000	
Water Content (m3)	6 500	50%
Return Water (m^3)	2 600	40%
Interstitial water (m^3)	1 300	20%
Evaporation (m^3)	1 950	30%
Seepage (m^3)	650	10%
Time to saturate voids (yr)	100 952	

srk consulting

Sasol FAD 6 EIA / EMP
Monitoring boreholes at waste storage facility

Project No.
421219

Figure 6-4: Monitoring boreholes at waste storage facilities

6.4 Air Quality

Air quality monitoring data for the period January 2005 to December 2010 was available as part of the current dust monitoring program of Synfuels. PM10 data for the period of January 2005 to December 2009 was obtained from the Langverwacht monitoring station while data from January 2010 to December 2010 was obtained from the station at club. The locations of these monitoring stations are provided in Figure 6-5 (Naidoo, D & Reddy, V, 2011).

srk consulting	**Sasol FAD 6 EIA / EMP** Air Quality monitoring stations	Project No. 421219

Figure 6-5: Location of the Air Quality monitoring stations

The prevailing winds in the area are relatively consistent throughout the year at Langverwacht. The prevailing winds are north-easterly with lower frequency of winds from the northwest and southwest. Embalenhle is upwind of activities at the SSIC as it is west to northwest of the SSIC facility when the prevailing winds are from the northeast and downwind when the prevailing winds are from the southwest (Naidoo, D & Reddy, V, 2011).

The data collected from the on-site monitoring at the SSIC is of sufficient duration (January 2005 to December 2010) to illustrate the seasonal trend for PM10 in the project area. PM10 concentrations increase from May to September and the highest measurements are recorded during this period. PM10 concentrations are low from October to April with occasional PM10 concentration above the standards or guidelines. The WADS, SSIC operations or off-site activities could be the source of PM10 in the area. Synfuels is continuing with the monitoring and further PM10 trends can be derived from the on-going monitoring data (Naidoo, D & Reddy, V, 2011).

Dust sources identified within the study area include windblown dust from waste dumps and tailings facilities of neighbouring mining activities such as Harmony Gold and windblown dust from the WADS. PM10 concentrations from these sources may be high during the dry season and management measures are applied to lower windblown dust from these sources (Naidoo, D & Reddy, V, 2011).

Based on the PM10 monitoring data, windblown dust generation within the project area is expected to be low (21 % of the current South African standard of 120 µg/m^3) during the wet season and higher (50 % of the current South African standard of 120 µg/m^3) during the dry season (Naidoo, D & Reddy, V, 2011).

PM10 monitoring data acquired for the monitoring station in Embalenhle, which is maintained and operated by the DEA, shows exceedance above the South African standard of 120 µg/m^3. The data -also shows seasonal variation with higher PM10 concentrations observed during the months of April to September which are the drier months and lower concentrations during the wet months (October to March).

With respect to DFO the cumulative impact associated with the operation of the current FAD's was determined to be low, due to off-site concentration being below the SANS 1929:2005 target limit of 300 mg/m^2/day.

The predicted cumulative impact associated with PM10 and dust fallout emissions from the new FAD 6 together with the current baseline air quality in the area was determined to be low due to PM10 and dust fallout concentrations being below their respective South African and SANS standards (Naidoo, D & Reddy, V, 2011).

6.5 Climate

6.5.1 Regional Climate

The project site lies in the Province of Mpumalanga and is defined but its topography, the western side of the Province is known as the Highveld, whilst the eastern side is known as the Lowveld. The varying topography influences the climate across the Province. The Highveld experiences dry and hot conditions during the summer and colder conditions during winter, whereas the Lowveld experiences high summer rainfall and mild winters. The climate on the eastern side of the Province is subtropical (Naidoo, D & Reddy, V, 2011).

6.5.2 Project Specific Climate conditions

The project site lies to the southwest of Secunda, which lies to the west and on the Highveld of Mpumalanga Province. The Climate in this area is usually hot and wet during summer and cold and

dry during the winter. The key meteorological parameters are discussed in the following sections of this report.

Rainfall

Rainfall data was obtained from the Langverwacht monitoring station that Synfuels operate and maintain. The available rainfall data was for the period November 1993 to January 2011.

The average monthly rainfall for Langverwacht for the period November 1993 to January 2011 is presented in Table 6-2. The average annual rainfall at Langverwacht was calculated to be 770.5 mm. The highest average monthly rainfall occurs during January at 166.3 mm. The rainfall season is from October to April; whilst from May to September the conditions are dry.

Data from SAWS WB 42 for Secunda was used as a comparison to show that rainfall patterns observed at the project site is similar. The average monthly rainfall for Secunda for the period 1984 to 1990 is presented in Table 6-3. The average annual rainfall at Secunda was calculated to be 693 mm. The highest average monthly rainfall occurs during December at 136 mm. The rainfall season is from October to April; whilst from May to September the conditions are dry. A comparison of the data is presented in Table 6-2.

Table 6-2: Average monthly rainfall for Langverwacht for the period November 1993 to January 2011 (Source: Sasol Weather Station).

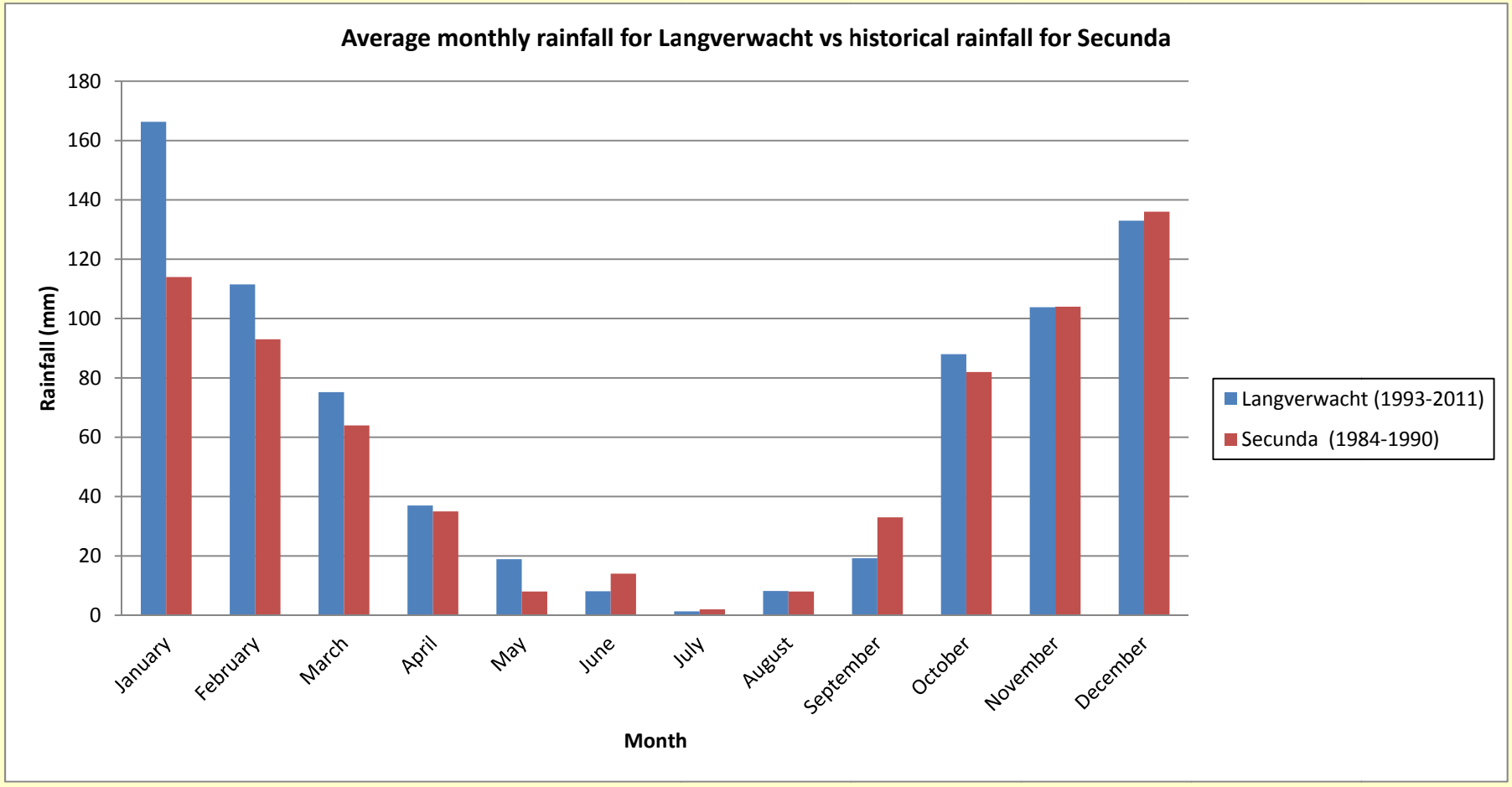
Month	Rainfall (mm)	No. of rain days
January	166.3	11
February	111.5	8
March	75.2	7
April	37.0	4
May	18.9	2
June	8.1	2
July	1.3	1
August	8.2	1
September	19.2	2
October	88	8
November	103.8	10
December	133.0	12
Total	**770.5**	**68**

Table 6-3: Historical aaverage monthly rainfall for Secunda for the period 1984 to 1990 (Source: SAWS: WB42).

Month	Rainfall (mm)	No. of rain days
January	114	9.3
February	93	9.7
March	64	7.0
April	35	4.0
May	8	1.8
June	14	1.7
July	2	0.9
August	8	1.0

Month	Rainfall (mm)	No. of rain days
September	33	3.3
October	82	7.0
November	104	8.9
December	136	9.8
Total	**693**	**64**

The Average monthly rainfall from the Langverwacht station is graphically presented in Figure 6-6 against the historical rainfall for Secunda.



srk consulting	**Sasol FAD 6 EIA / EMP** Monthly average rainfall vs. historical rainfall for Secunda	Project No. 421219

Figure 6-6: Average monthly rainfall for Langverwacht vs. historical rainfall for Secunda

Temperature

Average monthly temperatures recorded at Langverwacht for the period January 2007 to December 2009 are presented in Table 6-4 and in Figure 6-7. The maximum temperature in Langverwacht was recorded during the February 2007 with the temperature reaching 34 ˚C. The minimum temperature was recorded during July 2007 (-9 ˚C). The average temperatures are variable in the project area, ranging from 6 to 19 ˚C.

Historical temperature data recorded at Secunda for the period 1984-1990 are presented in Table 6-5 and in Figure 6-8. The historical data at Secunda was used as a comparison to show that data recorded at Langverwacht is similar to historical data. The maximum temperature in Secunda was recorded during the February with the temperature reaching 32.5 ˚C. The minimum temperature was recorded during July (-5 ˚C). The average temperatures are variable in the project area, ranging from 9.5 to 20.4 ˚C. When compared to the data at Langverwacht the Secunda data is fairly similar, but with temperatures warmer during the summer months and colder during the winter months at Langverwacht.

Table 6-4: Average monthly, maximum and minimum temperature for Langverwacht for the period January 2007 to December 2009.

Month	Average	Maximum	Minimum
January	19	32	7
February	19	34	4
March	16	31	4
April	14	28	-4
May	10	28	-9
June	8	23	-8
July	6	23	-9
August	11	27	-6
September	16	31	-5
October	17	32	6
November	18	31	5
December	19	33	4

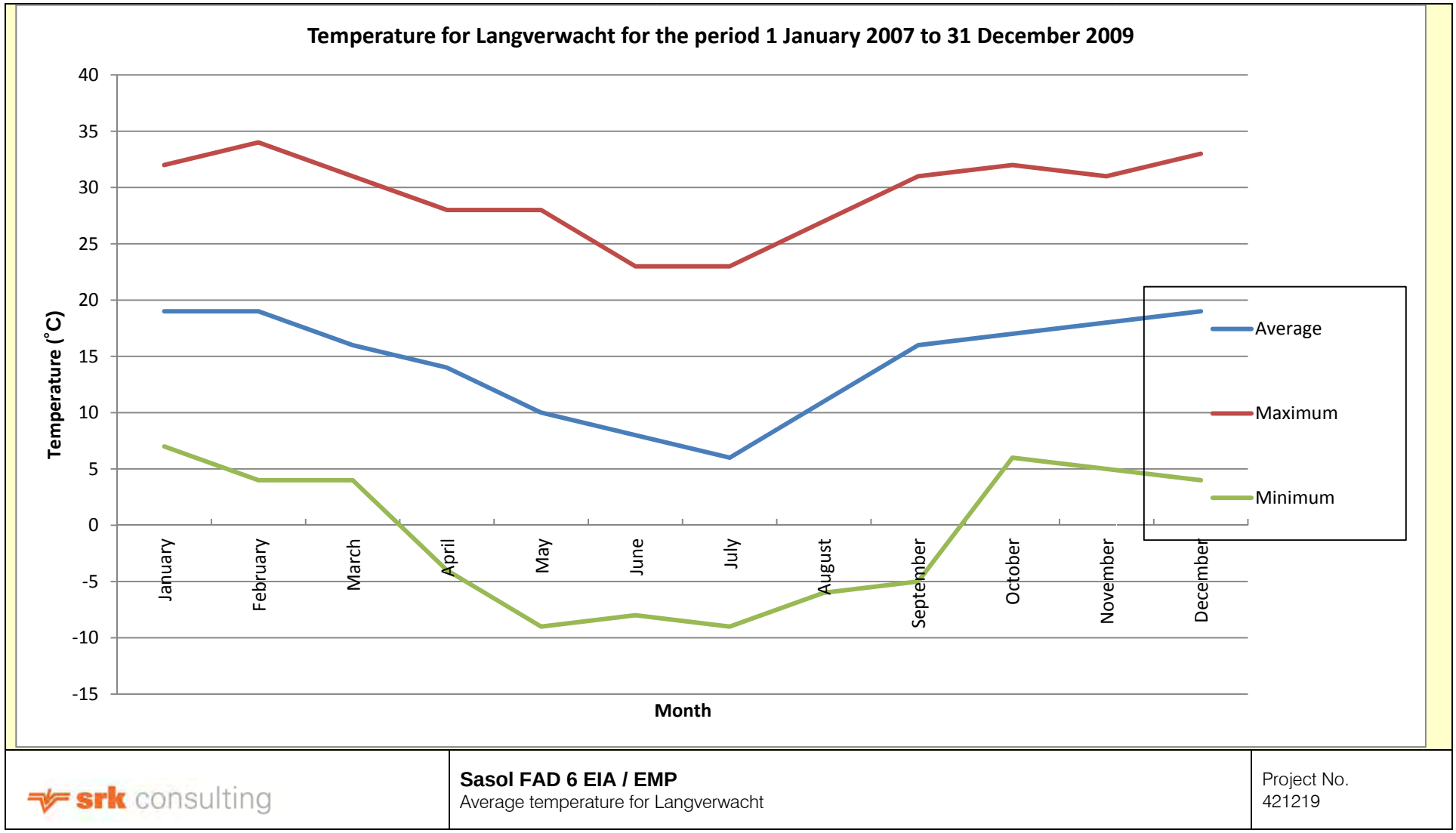
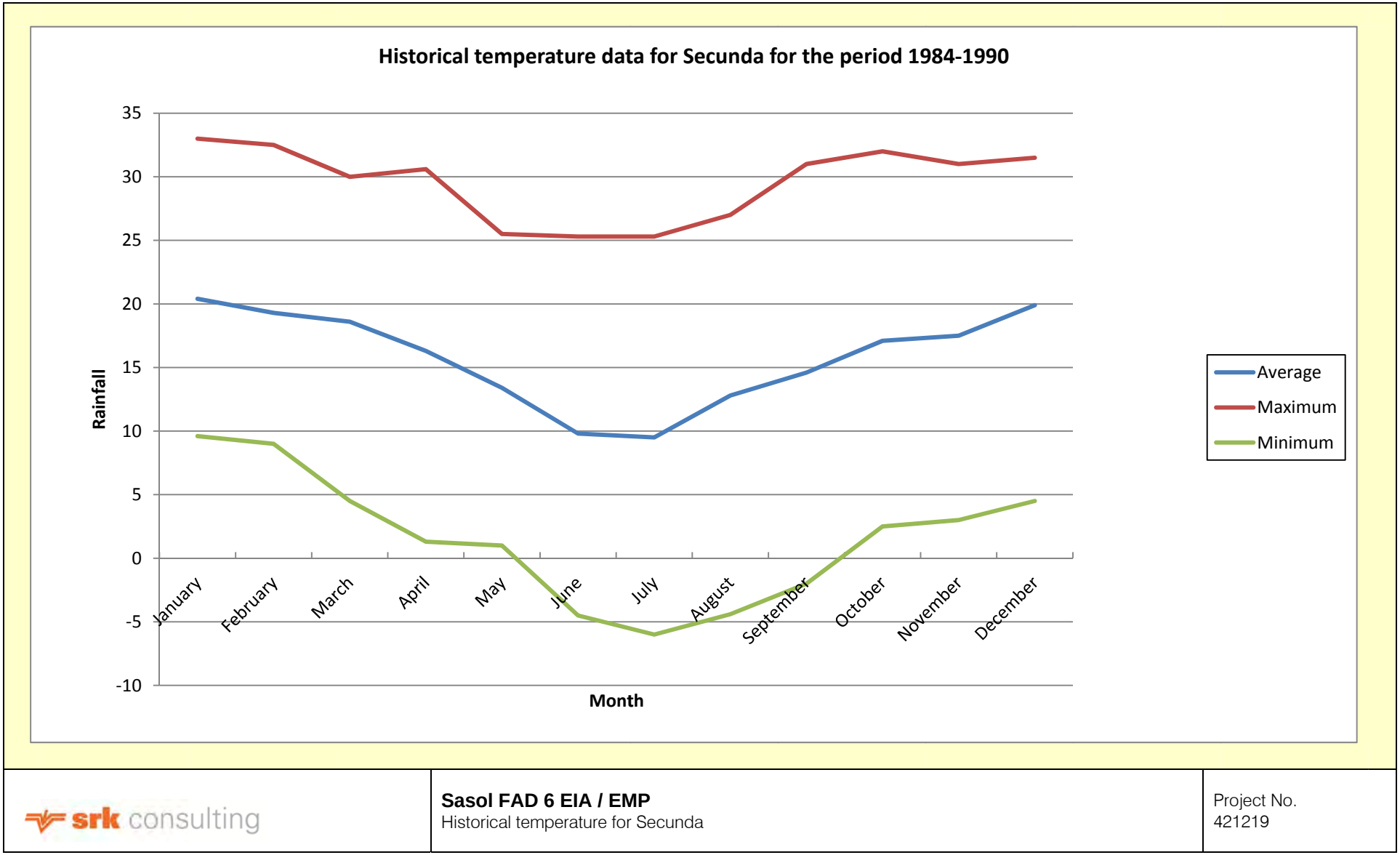


Figure 6-7: Monthly average, maximum and minimum temperatures from January 2007 to December 2009

Table 6-5: Average monthly, maximum and minimum data for Secunda for the period 1984-1990 (Source: SAWS, WB42)

Month	Average	Maximum	Minimum
January	20.4	33.0	9.6
February	19.3	32.5	9.0
March	18.6	30.0	4.5
April	16.3	30.6	1.3
May	13.4	25.5	1.0
June	9.8	25.3	-4.5
July	9.5	25.3	-6.0
August	12.8	27.0	-4.4
September	14.6	31.0	-2.0
October	17.1	32.0	2.5
November	17.5	31.0	3.0
December	19.9	31.5	4.5



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Sasol FAD 6 EIA / EMP
Historical temperature for Secunda

Project No.
421219

Figure 6-8: Historical temperature data for Secunda for the period 1984 – 1990 (SAWS, WB42))

6.5.3 Wind

Ambient temperatures, wind speed and direction, the regional atmospheric circulation, surrounding topography (SSIC and associated ash and coal dams) and operational production of the SSIC, are the main factors controlling the amount of emissions from the SSIC area and, secondly, the dispersion in terms of location and dispersion.

The stable conditions associated with the semi-permanent anticyclones coupled with nocturnal surface inversions, produce conditions adverse to the dispersion of pollutants in the atmosphere on a regional scale. In summer, conditions are slightly more favourable for the dispersion of atmospheric pollutants. Furthermore, sub-continental scale recirculation around the anticyclone, and between the stable layers dominating the atmosphere over Southern Africa, could also lead to an accumulation of pollutants emitted from local sources over the Highveld.

Wind roses are interpreted in the following way:

- Directions represented on the wind rose are those from which winds blow, with the longest segment representing the prevailing wind direction;
- Concentric percentage rings represent the percentage of time that winds from each respective direction blow;
- The value in the centre of the circle represents the percentage of time (for the period which the wind rose is for) of windless days;
- The colour of the sector within the segment represents the speed of the wind (see key on right of wind rose); and
- The percentage of time during which the wind blows at each speed should be calculated as the difference between the percentage where the colour representing each wind speed starts and ends.

From the wind rose data, aspects pertaining to the immediate environment of the proposed area are described below:

A phenomenon found at the top of the inversion layer over the Vaal Triangle, the Mpumalanga Highveld and the northern Free State, is the low level jet stream that may provide a ventilation mechanism in the first few hundred metres above the ground.

Hourly meteorological data was obtained from the Synfuels weather station Langverwacht for the period 1 January 2007 to 31 December 2009. Figure 6-9 presents the annual wind roses for all hours, day and night time for Secunda.

The prevailing winds are relatively consistent throughout the year at Secunda. The prevailing winds are north-easterly, with a lower frequency of winds from the northwest and southwest (Figure 6.9a). Wind patterns observed during the day (Figure 6.9b) and at night (Figure 6.9c-d) vary. Higher speed north westerly winds prevailing during the day, whilst lower speed winds from the northeast and calm conditions prevail at night.

The average wind speed for the Secunda area for all hours is 2.93 m/s with maximum speeds less than 11.1 m/s. The average wind speeds for daytime periods during the year are 3.44 m/s with calms of 3.44 %, during the earlier parts of the night the average wind speed is 2.64 m/s, whilst decreasing during the latter parts of the night to 2.10 m/s with calms of 10.84 % (Naidoo, D. et al, 2011).

Wind roses were also created for four different seasons (Figure 6.10 a-d). North-easterly prevailing winds are common during all four seasons (Figure 6-10). During spring (Figure 6.4 a) winds from the northwest are common becoming predominantly north-easterly during summer. During autumn and winter, winds from the southwest are common together with prevailing winds from east-northeast. The highest average wind speeds (3.71 m/s) occur during spring (Figure 6.10a) with the lowest frequency of calm periods (3.16 %). The lowest average wind speeds occur during autumn

(Figure 6.10c) with an average wind speed of 2.48 m/s and calm conditions prevailing 7.95 % of the time. The average wind speed for summer (Figure 6.10b) and winter (Figure 6.9d) are 3.02 m/s and 2.59 m/s respectively.

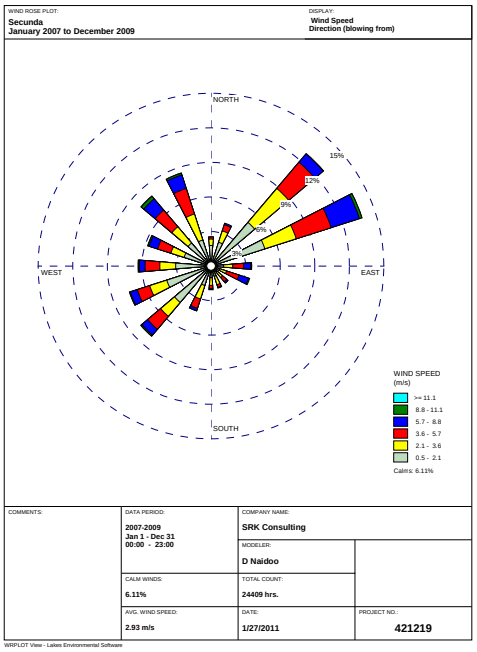


Figure 6.9a: Annual wind rose – all hours

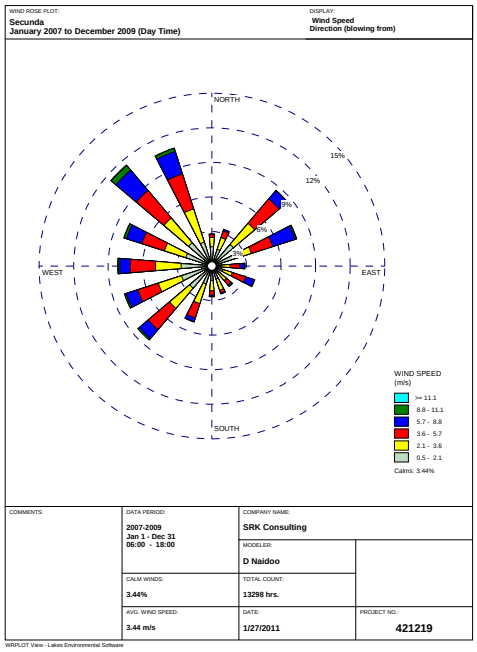


Figure 6.9b: Annual wind rose – day time 06h00-18h00

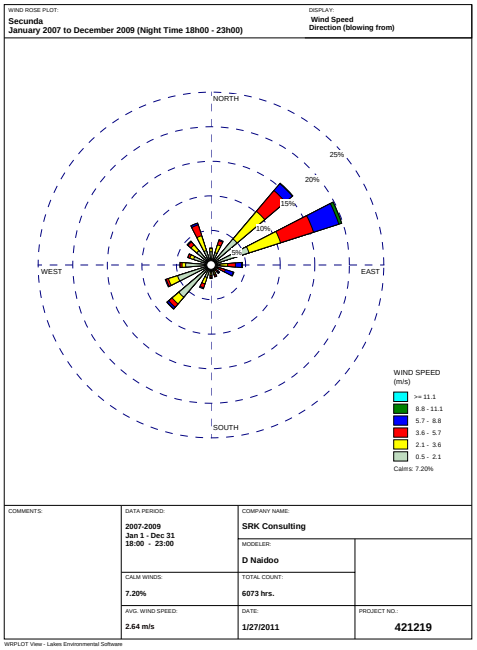


Figure 6.9c: Annual wind rose - night time 18h00 - 23h00

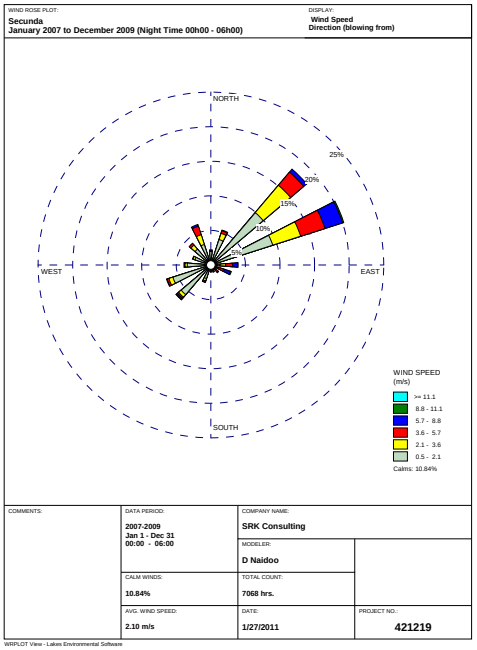


Figure 6.9d: Annual wind rose - night time 00h00 - 06h00

Figure 6-9: Annual all hours, day time and night time wind roses for Secunda

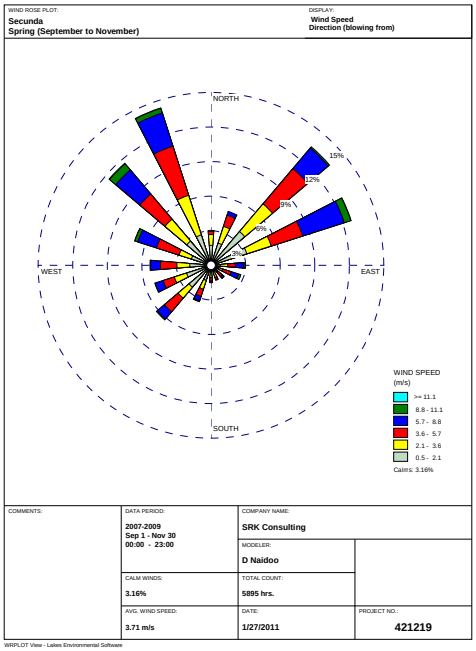


Figure 6.10a: Spring (September to November)

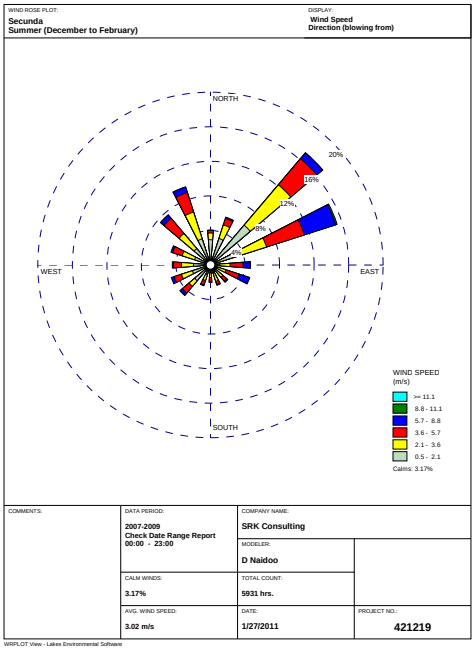


Figure 6.10b: Summer (December to February)

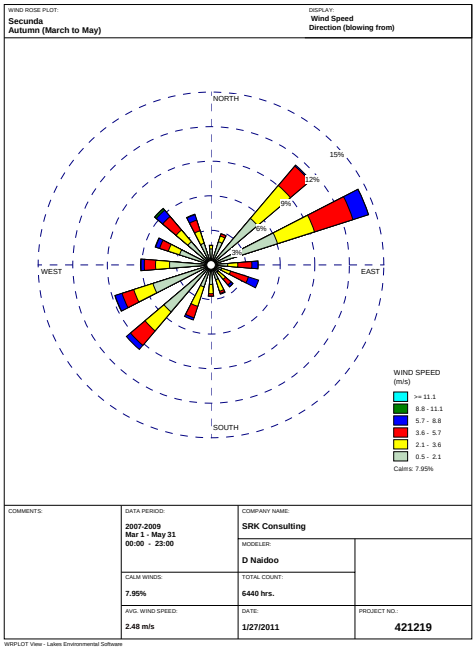


Figure 6.10c: Autumn (March to May)

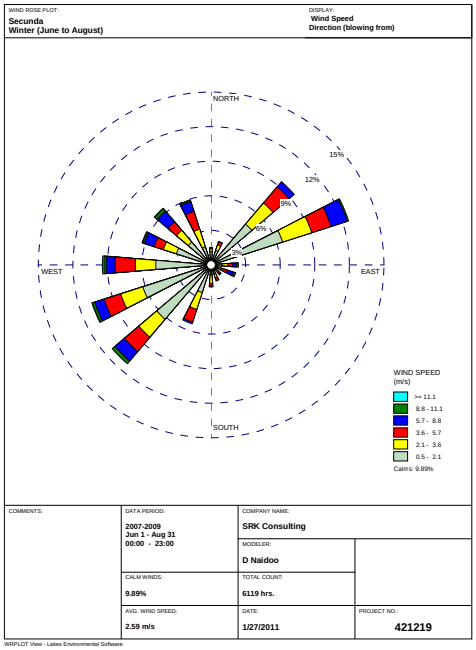


Figure 6.10d: Winter (June to August)

Figure 6-10: Seasonal wind Rose for Secunda

6.6 Visual

Approximately 2.5 km from the proposed FAD 6 and on the northern boundary of Portions 3 and 8 of the farm Rietvley 320 IS, the township of Embalenhle is located. Further north of the proposed site, after approximately 12 km, the town of Evander and Winkelhaak are found. The town of Secunda is

located approximately 10 km north east of the proposed site. To the south and south west direction of the site, scattered farmsteads are present in the area. Rehabilitation of the side slopes will be necessary during the life span of FAD 6, as well as during the decommissioning phase, contributing to the reduction of the aesthetic impact on the surrounding areas.

Due to current operations at Synfuels and Sasol Coal, and gold mines in the close vicinity, it is expected that additional visual impact will be acceptable in the context of the regional land use, although the FAD 6 will be a substantial engineered structure to commensurate with the other WADS aesthetics.

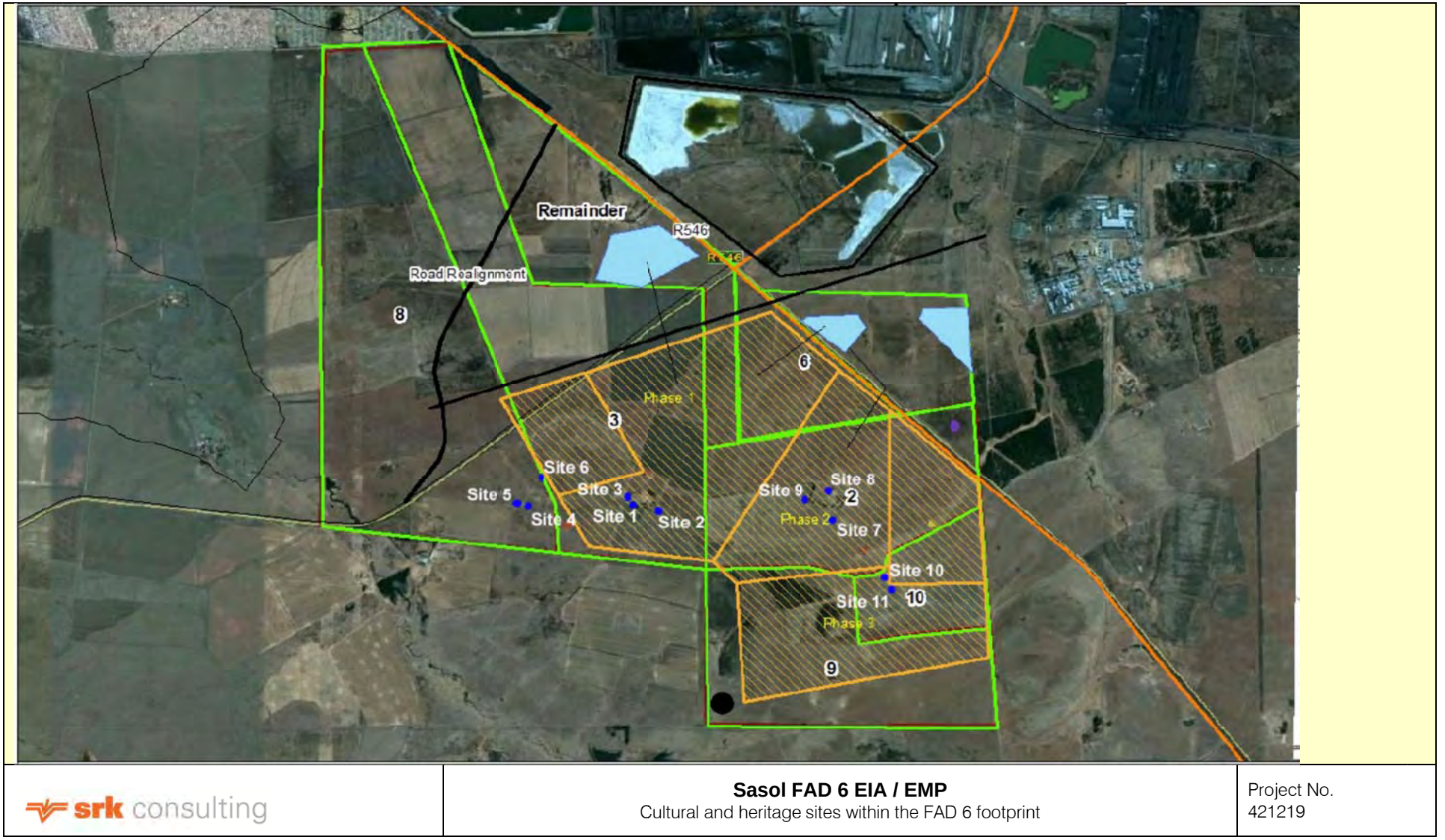
6.7 Cultural and Heritage

A cultural and heritage phase 1 survey was conducted on the proposed FAD 6 footprint, in order to identify any artefacts, structures, features, settlements or graves of local, national or international cultural and heritage importance. During the survey no stone or Iron Age resources were identified. However approximately seven graves were recorded in three different locations. Graves with no inscription are by default under the National Heritage Resources Act (Act No 25 of 1999) (NHRA) considered to be older than 60 years of age (Coetzee, F.P. 2011).

Several historical structures and foundations were identified and recorded. These structures are all older than 60 years and therefore protected by the NHRA. Figure 6-11 illustrates the locations of the graves and cultural and heritage sites within the footprint of the FAD 6 (Coetzee, F.P. 2011).

Eleven sites were identified within the footprint of the proposed FAD 6. These sites are listed below:

1) Historical farm house complex;
2) Graveyard;
3) Stone livestock kraal;
4) House foundation;
5) House foundation;
6) Midden;
7) Stone kraal;
8) Historical farm house complex;
9) 2 Graves;
10) House foundation; and
11) Possible grave.



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Cultural and heritage sites within the FAD 6 footprint

Project No.
421219

Figure 6-11: Location of cultural and heritage findings within the proposed alternative footprint

6.8 Noise

Ambient noise levels in the SSIC are monitored on a quarterly basis. The noise at the SSIC is within 85 db. Localised plant noise in excess of 85 dB will be managed by provision of protective ear-wear to be worn in any designated noise zones where noise generating equipment and tools are being used. Synfuels's SH&E Plan requirement is that the contractor should conduct a survey on noise levels and implement protection accordingly. The construction of the proposed FAD 6, although only temporary, may generate a level of noise which in the context of the SSIC will not be deemed significant.

6.9 Topography

Topography data was obtained from the survey general 1:50 000 topographical sheet data for the region of the proposed FAD 6 namely 2629CA.

The topography of the proposed FAD 6 consists of a mixture of uncultivated grasslands and ploughed fields. The site area is located on a ridge / watershed.

6.9.1 Regional Description

The site is located approximately 1600 – 1640 meters above sea level (m.a.s.l). The topography of this area is moderately undulating across the whole project area. The project area has a gradient slanting from the south of the proposed footprint to a north westerly direction.

The surrounding rivers of the proposed footprint, consists of: an un-named river which drains to the west and is a tributary of the Waterval river which then drains southwards and away from Synfuels property; to the east of the site is another un-named tributary that flows northwards towards the Groot-Bosjesspruit river which transverses the SSIC flowing in a westerly direction, combining with the Trichardspruit which becomes the Kleinspruit, then the Grootspruit and ultimately the Waterval River which drains off-site in a southerly direction. Figure 6-12 illustrates the topographical alignment of the proposed site. The topographic alignment will be significantly altered with the commissioning of the FAD 6.

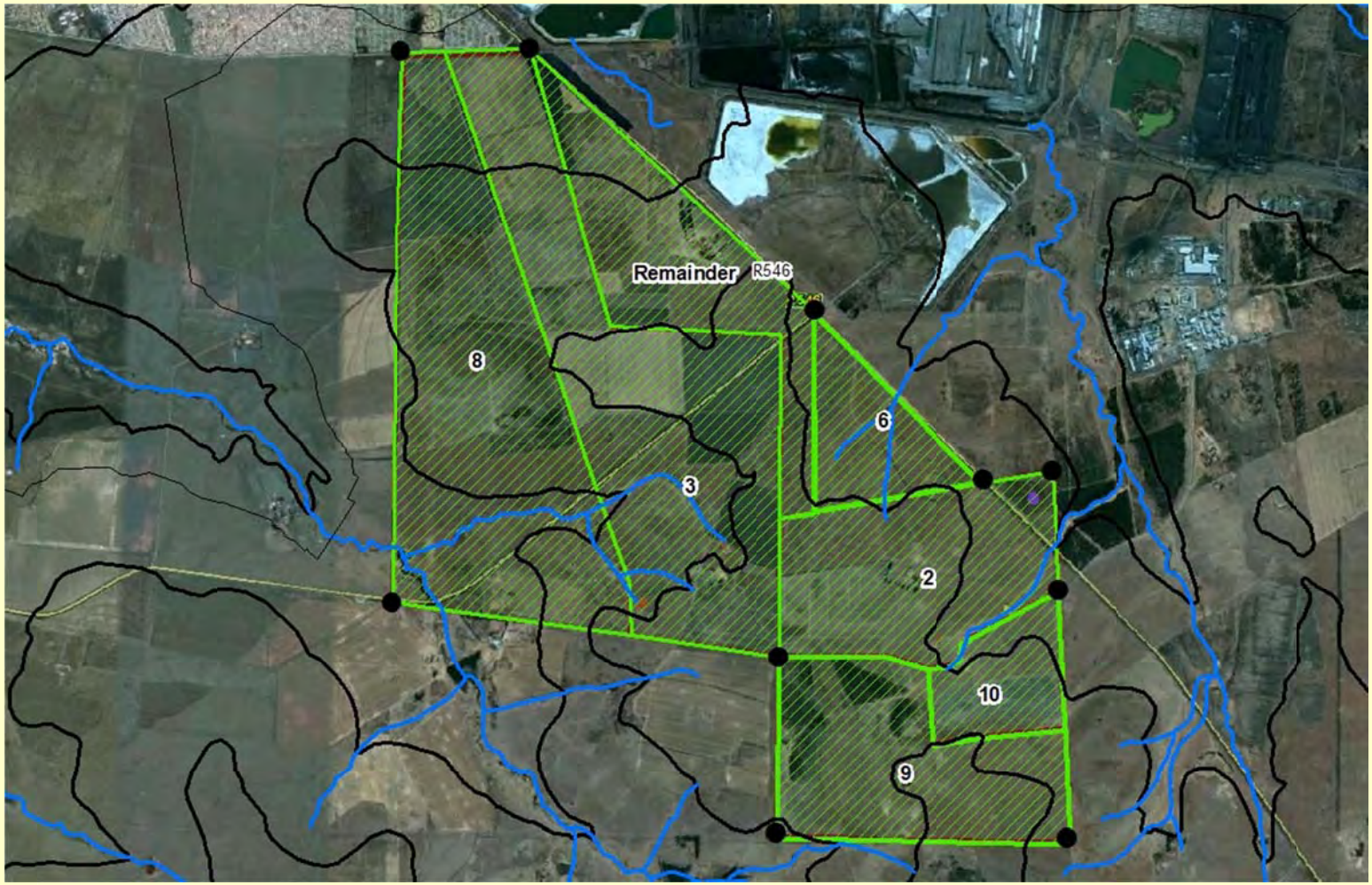

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Figure 6-12: Topography indicating the contours within the proposed FAD 6 footprint

6.10 Soils and Land Capability

In this landscape, top-soils generally contain more than 30% clay, while sub-soils commonly display more than 40% clay. Clay content extends to between approximately 450 – 700 mm deep. Carbonates are not common but the soils are strongly acid. The land is currently used for agricultural activities.

The majority of the soils in within the footprint are characteristics of soils with strong clay content. These soils are typically black or red in colour, structured clayey soils with a high base status (Batchelor, A. 2011).

Dolerite (indicated as red in Figure 6-17) is the dominant rock type found in the proposed footprint of FAD 6. This rock has a high weathering potential forming soils which are dark and clayey and Vertic in nature. Vertic soils are expansive in nature when dry and show forms of cracks on the surface. When these soils become wet they expand and become virtually impermeable to water. This results in the increased surface runoff in this area. This is augmented by the high percentage rainfall that ends up as runoff out of the catchment (Batchelor, A. 2011).

Sandstone (indicated as brown in Figure 6-17) has a contrasting effect to dolerite weathered rocks, as when this rock weathers, it typically forms a sandy soil, allowing easy infiltration of water (Batchelor, A. 2011).

The spectrum of soils does not include any which can be considered to have a higher than moderate potential for the production of rain-fed crops. In terms of economics, this means that the soils are only marginally productive for maize production. However, they can produce crops of sunflower or sorghum. Traditionally, the latter two have produced lower returns (on good soils) than maize, and have tended to replace maize production in recent years (South African National Biodiversity Institute [SANBI]).

There are also wetlands within the coal reserve area which are largely undisturbed and have both a conservation and functional status. From a land capability perspective, these wetlands have value in terms of serving as water sources, winter grazing, water purification, stream flow regulation, food attenuation and erosion control, particularly along stream banks.

The land capability is generally considered to have a moderate agricultural potential.

6.11 Biodiversity

The information contained in this section is based on the biodiversity assessment conducted to inform the EIA.

6.11.1 Vegetation

The site is situated within Themeda veld type as described by Acocks (1988). Low & Rebelo (1996) described the vegetation of the area as Moist Clay Highveld Grassland. In the new vegetation map of South Africa (Mucina & Rutherford 2006) the area falls within the Soweto Highveld Grassland (Vegetation Unit Gm12). The site is situated on flat plains in the Ba Land Type. Most of the vegetation has been replaced by monoculture agriculture, whereas persistent grazing has probably displaced some of the more critical plants characterising these veld types. The river and spruits from part of the Eastern Temperate Fresh Water Wetlands (Mucina & Rutherford 2006).

The terrain is flat to undulating and inclines mainly to the west, as shown by the flow direction of the watercourses draining into the main Tweefonteinspruit that crosses the southwest corner of the site, with only the southeast sector inclining east with tributaries to the Brandspruit. The site

comprises previously active farmland, with a large proportion of the surface area transformed into croplands that currently lie fallow or with small fields of maize and soybeans. The remaining areas and what natural habitat remains comprise grassland, and watercourses. Two parallel sets of high-tension electricity pylons run just inside the west boundary (Bredenkamp, G.J., et al.2011).

Four plant communities and agricultural fields were identified. Five red data species may occur on the site, due to suitable habitat, but only one was recorded in the Moist Grassland associated with the proposed project area (Bredenkamp, G.J., et al.2011).

A Threatened species and Species of Conservation Concern list for the Grid 2629CA was obtained from the Plants of South Africa (POSA) database on the SANBI website.

Species of conservation concern from Grids 2629CA include the following:

Table 6-6: Species of conservatory concern within the FAD 6 footprint

Species	**Status**
Stenostelma umbelluliferum	NT
Trachyandra erythrorrhiza.	NT

Stenostelma umbelluliferum occurs only on very clayey, black vertic soils and it does not occur on the site. There is suitable habitat for *Trachyandra erythrorrhiza* in the Moist Grassland and Vlei wetlands (Bredenkamp, G.J., et al.2011).

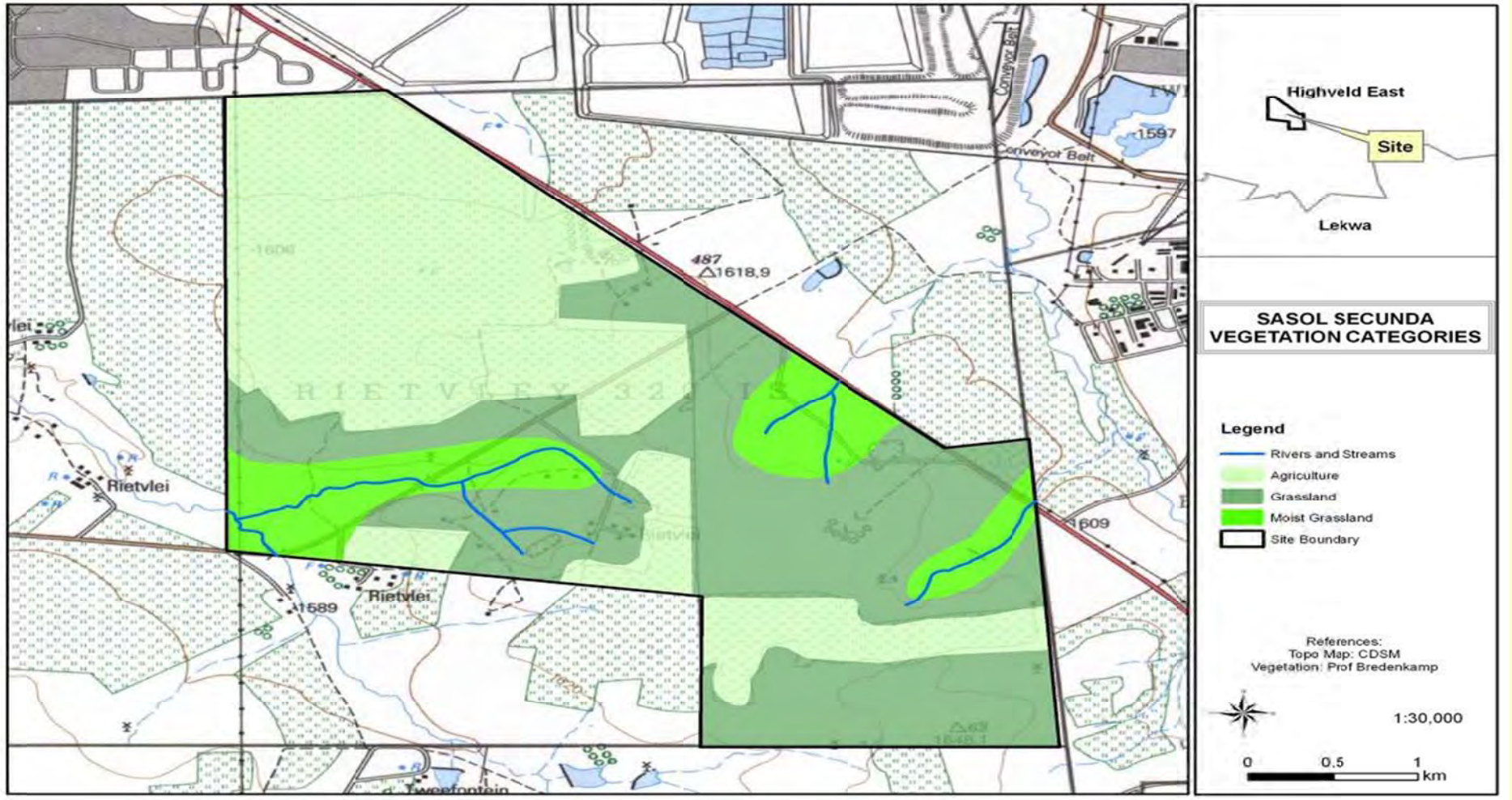
Other species of conservation concern that may be found within the footprint of the proposed FAD are found in Table 6-7.

Table 6-7: Possible occurrence of species of conservation value

Species	**Status**
Boophone disticha .	Declining
Crinum bulbispermum	Declining
Hypoxis hemerocallidea	Declining
Kniphofia typhoides	NT

Of these only *Crinum bulbispermum* was recorded from the Moist Grassland.

Although not recorded, *Boophone disticha* and *Hypoxis hemerocallidea* may occur in the study area, especially in moist areas of the wetlands/spruits, where the vegetation is still intact. There is also suitable habitat for *Kniphofia typhoides* in the vlei wetland areas (Bredenkamp, G.J., et al.2011).



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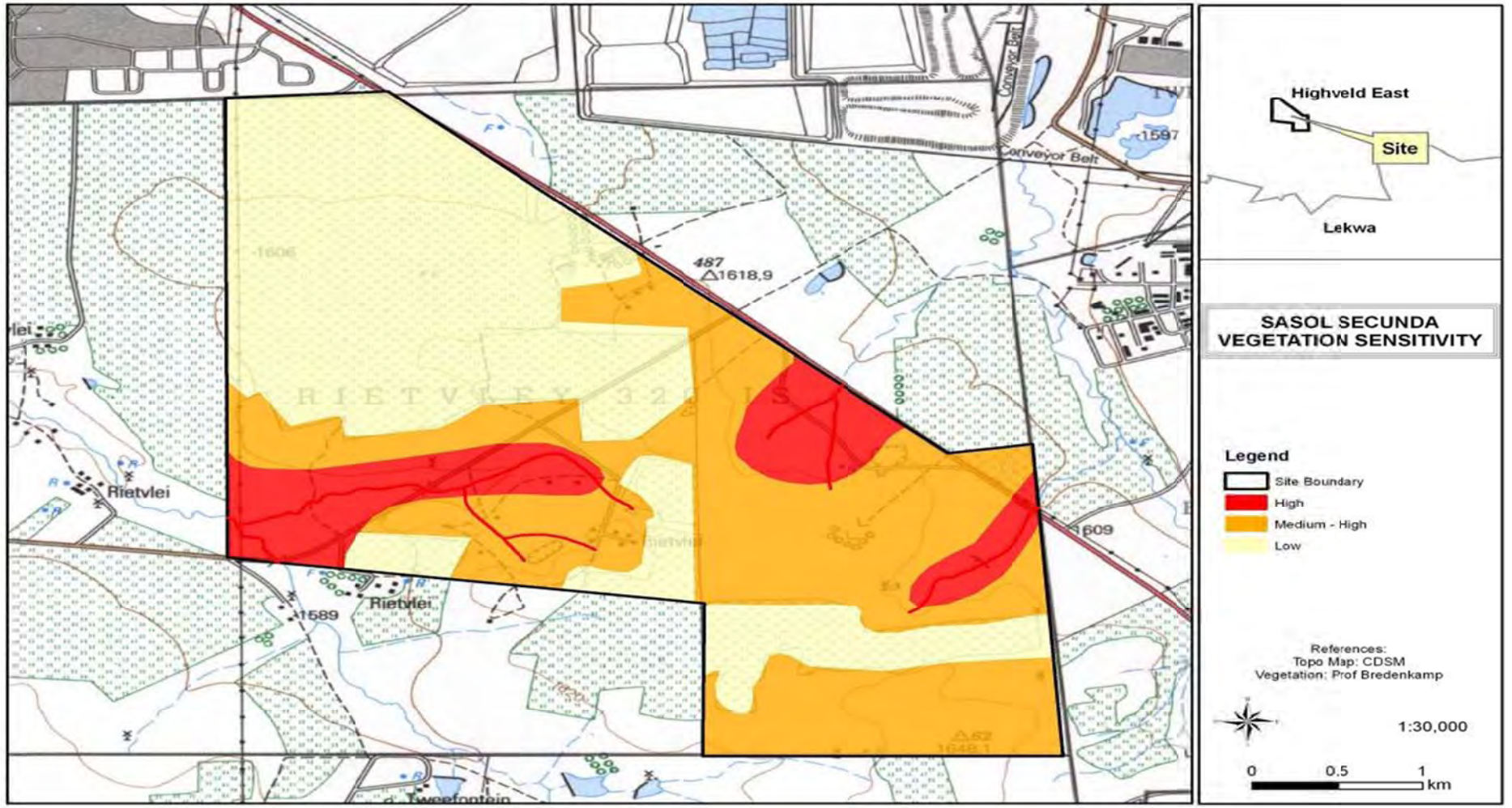
Sasol FAD 6 EIA / EMP
Vegetation map

Project No.
421219

Figure 6-13: Vegetation map of the proposed site



srk consulting	**Sasol FAD 6 EIA / EMP** Sensitivity map	Project No. 421219

Figure 6-14: Sensitivity map of the proposed site

6.11.2 Mammals

From a mammal habitat perspective, two of the four major habitats are present on the site, i.e. mainly terrestrial together with elements of wetlands.

Most of the terrestrial habitat has been converted to fields for growing crops. However, substantial sections of grassland remained (consisting mostly of moist grassland on clayish soils). The grass cover is in good repair, partly since veld fires are avoided to preserve grazing (Bredenkamp, G.J., et al.2011).

The banks of the Brandspruit support narrow bands of semi-aquatic vegetation, which may support populations of vlei rats, African marsh rats, the shrew species listed and marsh mongooses. The spruit itself has large pools of permanent water, and otters occur along this water course. The spruit and its riparian zone function as a dispersal corridor (Bredenkamp, G.J., et al.2011).

Table 6-8 illustrates the mammal species that were positively recorded on the proposed FAD 6 site.

Table 6-8: Mammal species positively confirmed from the study site.

Scientific name	English name	Observation indicator	Habitat
L. saxatilis	Scrub hare	Faecal pellets	Short grassland
C. hottentotus	African mole rat	Tunnel systems	Universal
H. africaeaustralis	Cape porcupine	Burrow system	Universal
C. penicillata	Yellow mongoose	Sight record	Good cover

All four species are widespread and common. They have reticent habits, and hence possess the ability to co-exist within urban perimeters.

No other Red Data or sensitive species are deemed present on the site, either since the site is too disturbed, falls outside the distributional ranges of some species, or does not offer suitable habitat(s) (Bredenkamp, G.J., et al.2011).

Table 6-9: Red Data mammals that are deduced to possible occupy on site as a result of suitable habitats

	Scientific name	English name
NT?	Dasymys incomtus	African marsh rat
DD√	Crocidura cyanea	Reddish-grey musk shrew
DD√	Crocidura hirta	Lesser red musk shrew
NT?	Atelerix frontalis	Southern African hedgehog

DD = Data Deficient, and NT: Near threatened. All other species are deemed of Least Concern.

6.11.3 Avifauna

The principal habitat types detected on or adjacent to the site and most relevant to bird ecology and community structure were:

- Natural Grassland;
- Watercourses; and
- Croplands.

One hundred and nine species are expected or were recorded on the combined sites. Of these, 44 (40%) are scored only as 'possible' to occur. Forty three species were recorded (39% of the total species expected) during a 6.5-hours site visits. The species recorded represent 66% of the 65 species that were judged as 'likely' for the habitats available (Bredenkamp, G.J., et al.2011).

Twelve species of national conservation concern, ranging from Near Threatened to Vulnerable were considered. Nine species were considered as "possible" and three species as "likely" to occur on site. Of these, only the Near Threatened Black-winged Pratincole was recorded on site. Most of these threatened species fall into a few obvious categories by habitat preference and their likelihood of occurrence on site (Bredenkamp, G.J., et al.2011).

Table 6-10: List of threatened species possible or likely to make use of the habitats on the proposed Fine Ash Dam sites

Threatened Status	Species	'Possible'	'Likely'	Preferred Habitat Type(s)		
				Natural grassland	Watercourses	Croplands
Near Threatened	Blue Korhaan	X		X		X
	Black-winged Pratincole		XX	X		X
	Pallid Harrier		XX	X		X
	Secretary bird	X		X		X
	Lanner Falcon	X		X		X
Vulnerable	African Grass-Owl		XX	X	X	
	Denham's Bustard	X		X		X
	White-bellied Korhaan	X		X		X
	Blue Crane	X		X	X	X
	Corn Crake	X		X		X
	African Marsh-Harrier	X		X	X	
	Lesser Kestrel	X		X		
TOTALS	**12**	**9**	**3**	**12**	**3**	**9**

6.11.4 Herpetofauna

Of the ten Red Data herpetofauna species of the Mpumalanga Province, only one possible species occurs on the site for the proposed development. There is a slim chance that the giant bullfrog may

occur on the study site. Giant bullfrogs use wetlands and other temporary water bodies to breed. It was concluded that there are no Red Data Reptile species to be found on the proposed site as the proposed site falls outside of the natural range of Red Data Replies found in the Mpumalanga province (Bredenkamp, G.J., et al.2011).

Table 6-11 indicates the reptiles and amphibians that were positively identified on the proposed site.

Table 6-11: Reptile and Amphibian species positively confirmed on the study site.

Scientific name	English name	Observation indicator	Habitat
Trachylepis punctatissima	Montane Speckled Skink	Sight record	Old Farm Buildings
Amietia angolensis	Common River Frog	Sight record	Streams & Dams
Xenopus laevis	Common Platanna	Sight record	Under stone near dam during the winter.

6.12 Wetlands

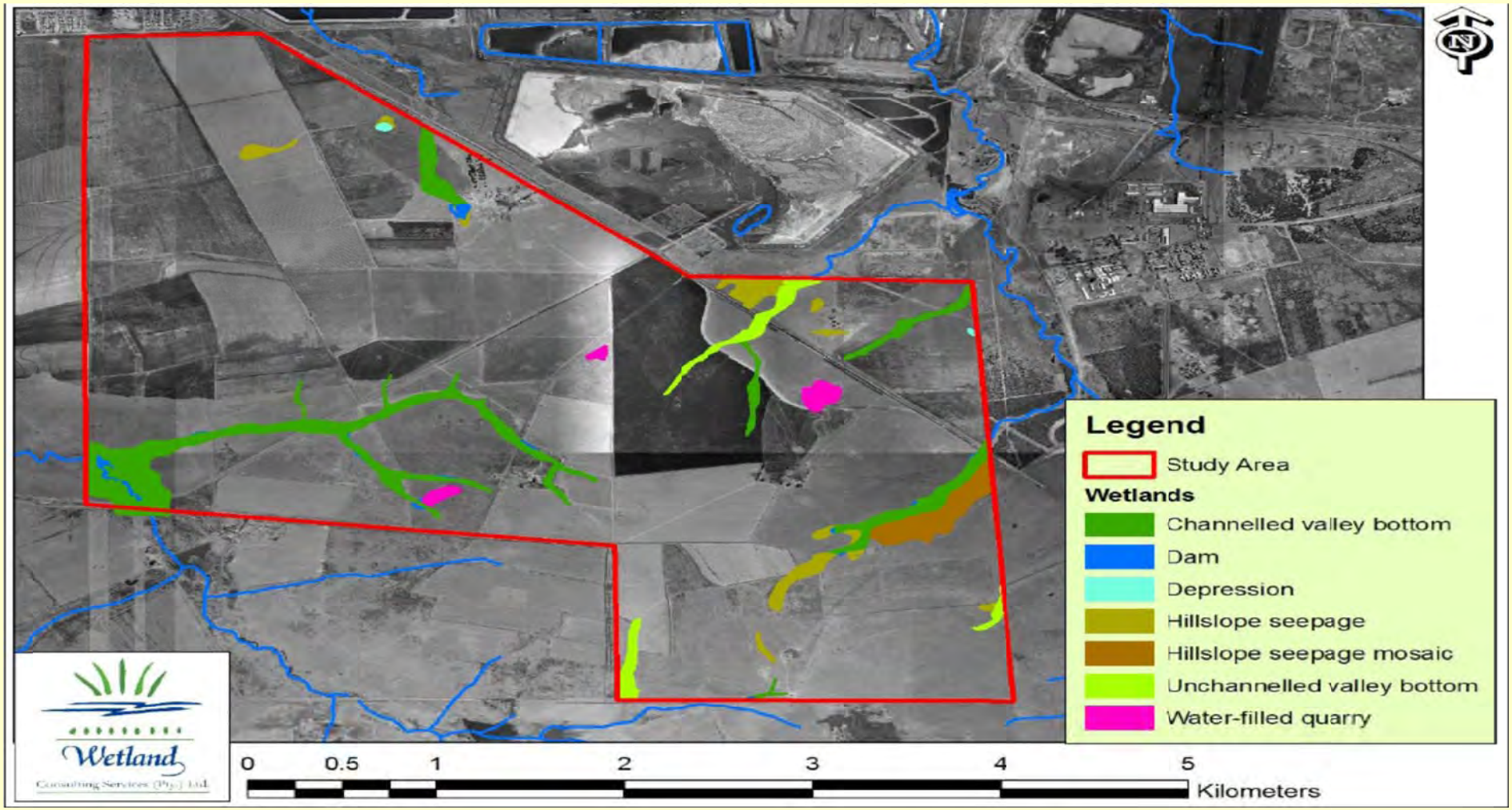
A number of wetland systems were identified within the study area associated with unnamed tributaries of the Kleinspruit (draining north east off the site) and the Waterval River (draining west off the site) respectively. The wetlands cover a total of 88.1 hectares, which includes 6 dams totalling 1.9 hectares. These dams are manmade structures that were presumably put in place to ensure/extend the availability of surface water for livestock watering (Batchelor, A. 2011).

In addition to the wetlands and dams, three small historical quarries were identified on site, two of which may represent artificial low points within the landscape in which water accumulates following rainfall, and thus represent artificial wetland areas. Some seepage from localised perched water tables might also contribute to water within the quarries. The quarries appear isolated from surrounding wetland systems, though some discharge is possible following heavy rainfall. The three quarries cover roughly 4.8 hectares (Batchelor, A. 2011).

The aerial extent per wetland type of the wider project is given in Table 6-12, while a map of the delineated and classified wetlands is provided in Figure 6-15.

Table 6-12: Extend of various wetland types recorded on site

Wetlands Type	Area (ha)	% of wetland area	% of study area
Channelled valley bottom	52.75	59.86%	4.16%
Hillslope seepage	22.84	25.92%	1.80%
Unchannelled valley bottom	10.05	11.41%	0.79%
Depression	0.53	0.60%	0.04%
Dam	1.94	2.20%	0.15%
Total Wetland Area	**88.11**	**100.00%**	**6.95%**
Water – filled quarry	4.79	n/a	n/a



srk consulting	**Sasol FAD 6 EIA / EMP** Delineated wetlands	Project No. 421219

Figure 6-15: Map delineated wetlands on the proposed site

Valley bottom wetlands from the dominate wetland systems on the project area. Most of these systems are channelled, though 3 unchannelled valley bottom wetlands were also identified. The valley bottom wetlands are all considered to be seasonal systems, though the presence of what appears to be former farm dams along these wetlands may provide areas of more permanent surface water. These wetlands are maintained predominantly by rainfall and surface run-off from the adjacent slopes. Within the southernmost tributary of the Kleinspruit seepage water was seen entering the wetland along the contact between the vertic soils and the underlying sandstone. In addition, the presence of surface water in a number of the upper reaches of the valley bottom wetlands in the middle of winter would appear to suggest the release of water into these systems from the subsurface, mostly likely from a shallow perched aquifer (Batchelor, A. 2011).

A number of small hillslope seepage wetlands were also identified. The seepage wetlands in the northern reaches of the site are associated with more sandy soils, while most of the seepage wetlands in the southern half of the site are associated with vertic soils and very clayey soils. A roughly 10 hectare area has been classified as a hillslope seepage mosaic. This area consists of a mosaic of wetland soils, exposed and shallow sandstones, and terrestrial soils (Batchelor, A. 2011).

Two shallow, seasonal depressions were identified and delineated in the northern and eastern reaches of the site.

The water-filled quarries represent low points within the landscape in which water accumulates and into which seasonal, shallow perched water tables might drain into. The extended presence of water in these quarries has resulted in the establishment of typical wetland vegetation within the quarries and the formation of artificial wetland systems (Batchelor, A. 2011).

6.12.1 Ecological Importance and sensitivity (EIS)

Ecological Importance and Sensitivity is a concept introduced in the reserve methodology to evaluate a wetland in terms of:

- Ecological Importance;
- Hydrological Functions; and
- Direct Human Benefits.

The scoring assessments for these three aspects of wetland importance and sensitivity have been based on the requirements of the NWA, the original Ecological Importance and Sensitivity assessments developed for riverine assessments (DWAF, 1999), and the work conducted by Kotze et al (2008) on the assessment of wetland ecological goods and services (the WET-EcoServices tool). Based on this methodology, an EIS assessment was undertaken for all the delineated wetlands on site (Batchelor, A. 2011).

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Sasol FAD 6 EIA / EMP
Ecological Importance and sensitivity

Project No.
421219

Figure 6-16: Ecological Importance and Sensitivity assessment of the wetlands on the FAD6 footprint

Given the extent of wetland loss and degradation that has taken place within the Mpumalanga Highveld due to agricultural activities and coal mining, as well as the importance of wetlands due to their functional value, wetlands are considered to be sensitive habitats and all wetlands should be treated as "irreplaceable" habitats according to the Mpumalanga Biodiversity Conservation Plan. The majority of the wetlands on site are considered to be of High ecological importance and sensitivity. This is based mostly on the hydrological integrity and functioning of the wetland systems which have been impacted on mostly by agricultural activities (cultivation and livestock grazing), though the water movement supporting these systems remains mostly intact. In terms of biodiversity value, the systems have been impacted and disturbed by heavy grazing pressure, and this is reflected in the invasion of Cosmos (*Bidens fromosa*) in several of the wetlands on site (Batchelor, A. 2011). Details of the scoring system used for the EIS can be found in the wetland assessment located in Appendix D.

6.12.2 Present Ecological State

The Present Ecological State assessment (PES) assesses the wetlands based on their departure from the un impacted or reference state. The greater the number and intensity of impacts acting on a specific wetland, the greater the departure for the reference state is expected to be. As no pristine or un impacted wetlands remain on site which could act as examples of the reference condition, the reference condition for the wetlands is assumed (Batchelor, A. 2011).

The wetlands on site have been impacted on by both direct (occurring within the wetland) and indirect (occurring within the wetland catchment) impacts. Various categories of impacts are included within the PES assessment, namely:

- Hydrological;
- Water quality;
- Geomorphological; and
- Biodiversity.

Within each of these categories direct and indirect impacts are considered, e.g. direct hydrological impacts could include flow concentration or impoundment due to culverts positioned within the wetland, while an example of an indirect impact could be increased surface run-off from the catchment due to catchment hardening. Both impacts are likely to have significant impacts on the wetland (Batchelor, A. 2011).

Indirect impacts acting on and influencing the wetlands on site are mostly related to changes in land use that affect the movement of water through the landscape. Within the northern and central reaches of the study area significant areas of cultivation occur (Batchelor, A. 2011). Impacts of the cultivated areas on the wetlands on site include:

- Increased surface runoff from cultivated areas due to decreased vegetation cover and compacted soils in places. Surface runoff is also often concentrated in ruts or roads, leading to increased erosion;
- Increased sediment movement into the wetlands due to surface runoff from cultivated fields. Sediments are derived from the disturbed soils as well as from the increase in erosion due to increased surface runoff; and
- Water quality deterioration through fertilisers and potentially pesticides entering adjacent and downslope wetlands.

The southern, eastern and south western areas are still characterised by natural grassland and drainage from these areas is still considered to be largely natural (Batchelor, A. 2011). These, and the cultivated areas, have however also been affected by direct impacts, which include:

- Road crossings that concentrate flows and lead to channel incision within the wetlands. Channel incision lowers the local water table within the wetland, leading to terrestrialisation of the wetland vegetation and further increasing the erosion risk within the wetland;
- Dam building. Impounding of water upslope of dams increases water retention within the wetlands, altering vegetation, while concentrated discharges over dam spillways can lead to erosion;
- Overgrazing leads to decreased vegetation diversity and increased disturbance, creating opportunity for invasion by alien vegetation. Decreased vegetation cover also increases surface runoff of rainfall and increase erosion risk;
- Invasion by alien and weedy species leads to changes in vegetation composition and biodiversity supported by the wetlands. *Bidens fromosa* is especially prevalent in some of the wetlands on site; and
- Trampling by livestock around surface water areas creates erosion nick points that can develop into gully erosion.

All of the above impacts have contributed to wetland degradation on site. No pristine wetlands were found to occur. Wetlands located within catchments still characterised mostly by natural vegetation are considered to be still in a largely natural condition. Even though in some areas the vegetation of these areas has been significantly altered (for example where dense stands of *Bidens fromosa* occur or small areas that have been cultivated), the processes that support the wetland conditions within these systems is still considered to be largely intact. The remaining wetlands are considered to be moderately modified (Batchelor, A. 2011). Details of the scoring system used for the PES can be found in in the wetland assessment located in Appendix D.

6.13 Traffic

A traffic assessment was undertaken with traffic counts carried out for 12 hours (6AM – 6PM) at the intersection of the R546 and D714. The AM and PM peak hour was determined based on the highest traffic volumes registered during the morning and afternoon period respectively. The AM peak was recorded from 06:30 to 07:30 and the PM Peak hour was recorded at 16:00 to 17:00.

Table 6-13: Overview of the existing road networks and jurisdictions

Road Link	Jurisdiction	Class of road	Function of the Road	Condition of the road	Cross Section (Typical Width of the road)
R546 (P185/1)	Mpumalanga Department of Public Works, Roads and Transport (MDPWRT)	3	The road is a Provincial road linking Kinross, Evader, Secunda (to the north) and Standerton (to the south). The traffic volumes are in the order of 400 vehicles per hour during the AM peak hour and 900 vehicles per hour during the PM peak hour (both directions).	Paved Road (tarred)	Single Carriageway (1.5m gravel shoulder, 0.3m tarred shoulder and 3.7m lane for both directions)

D714	Govan Mbeki Local Municipality	4	The D714 is a Municipal road that provides access to the local farms. It runs on the east-west direction across the farms on the Remainder of Portions 2, 3, 6, 8, 9 and 10 and the remainder of the farm Rietvley 320IS. The road serves as a link between the R546 and the R50. The current peak hour traffic volumes on this 2-lane road are in the order of 10 to 20 vph (both directions).	The road is paved (tarred) for a distance of 200m from R546 and from R50, the rest of the section is gravel road	Single Carriageway (between 3.5m to 4m lane width per direction)

6.14 Geology

6.14.1 General Description

The Highveld Coalfield extends over an area of about 7 000 km^2. A portion of this Coalfield is exploited by the Sasol Mining Collieries operations. Currently, these activities are concentrated in the central and northern-central portions of the coalfield.

The Karoo sequence, in which the coal is hosted, attains a thickness greater than 300 m near Standerton in the south, but is thin or absent in the northern portion of the coalfield. The strata of this sequence are deposited on rocks of the granite basement complex.

The northern boundary of the Highveld Coalfield is formed by felsites of the Bushveld Igneous Complex, the Witwatersrand Super group and the Klipriviersberg volcanics from the western boundary, with the Eastern Transvaal Coalfield lying to the east. The coal-bearing strata are covered by younger Karoo formations in the south.

6.14.2 Regional Geology

The Secunda area is located within an area comprising sandstones, siltstones and shales of the Vryheid Formation of the Karoo Super group, which rests un conformably on a pre-Karoo basement. Numerous dolerite sills and dykes are reported to transect the area, with a large dolerite dyke reported along the FAD 5 south eastern wall across portions of the proposed FAD 6. The dolerite sill and dykes vary from highly weathered and fractured through to unweathered (IGS, 2007).

A regional east-west graben structure intersects the area to the south of the plant with the strike changing to north-east southwest to the east of the plant area. FAD 6 is located within this graben structure (Theu, G. 2011).

Down-throws of 43 m and 10 m have been recorded on the basement along the southern and northern faulted zones of the graben respectively. A shallow sill underlies the site with the bottom contact not being more than 25 m deep for most of the area to the north of the southern graben fault zone (IGS 2007). The regional geological map is presented in Figure 6-17: Geological Map of the proposed FAD 6 footprint

It is not expected that the geology of the area will be altered within the commissioning of the FAD 6 (Theu, G. 2011).

6.14.3 FAD 6 geology

Boreholes drilled for the FAD 6 study intersected interbedded siltstone/sandstone and shale of the Vryheid Formation, underlain by a weathered dolerite sill to a depth of approximately 25 m to the north, west and south of the site. The dolerite sill is fresh below 25 m and outcrops to the south east of FAD 6. The nature and orientation of the weathering/fracturing in the dolerite sill could have an impact on the rate and direction of groundwater flow within the FAD 6 area, possibly following the pattern of the fracturing/weathering (Theu, G. 2011).

6.14.4 Stratigraphy

Table 6-14 depicts the Karoo sequence stratigraphy within the footprint of the proposed FAD 6. In this area, the younger formations (including the Drakensburg Formation volcanic) have been eroded away.

Table 6-14: Stratigraphy within the proposed FAD 6 footprint

Sequence	Group	Formation	Lithology
Karoo	Ecca	Vryheid	Sandstone, siltstone, coal
		Karoo Dolerite	Dolerite

The geology of the SSIC plant area comprises sandstones, siltstones and shales of the Vryheid Formation of the Karoo Super Group sequence, which comprises a succession of alternating layers of sandstone and siltstones, intruded by dolerite sills and dykes. The Vryheid Formation consists of the following sedimentary sequences from the surface downwards:

- A highly weathered zone of sandstone and/or siltstone extending to depths ranging between 4 and 30 m deep below the surface;
- A 20 m thick laminated to fine bedded siltstone/shale layer, underlying alternating layers of sandstone and siltstone. Onwards this layer will simply be referred to as the siltstone layer. Of the various dolerite sills and dykes intruding the Vryheid Formation one sill forms a prominent E-W striking feature and has a thickness varying between 5 and 25 m. This main dolerite sill in the area is intruded by other dykes and sills of which the geometries and thickness vary greatly;
- A prominent geological feature in the area is a 350 m wide, E-W striking graben (trough-fault) structure which is situated in the southern part of the SSIC area; and
- A coal seam is present at a depth of approximately 100 m below surface.

Sasol Mining has mined portions of this coal seam as summarized below:

- Bord and pillar mining with a fraction of total extraction on Portion 3 and 8 of the Farm Rietspruit 320 IS;
- Long Wall mining on the northern parts of Portion 2,9 and 10 of the farms Rietspruit 320 IS; and
- Total extraction bord and pillar on the southern areas of Portions 2, 9 and 10 of the farm Rietspruit 320 IS up to the dolerite dyke.

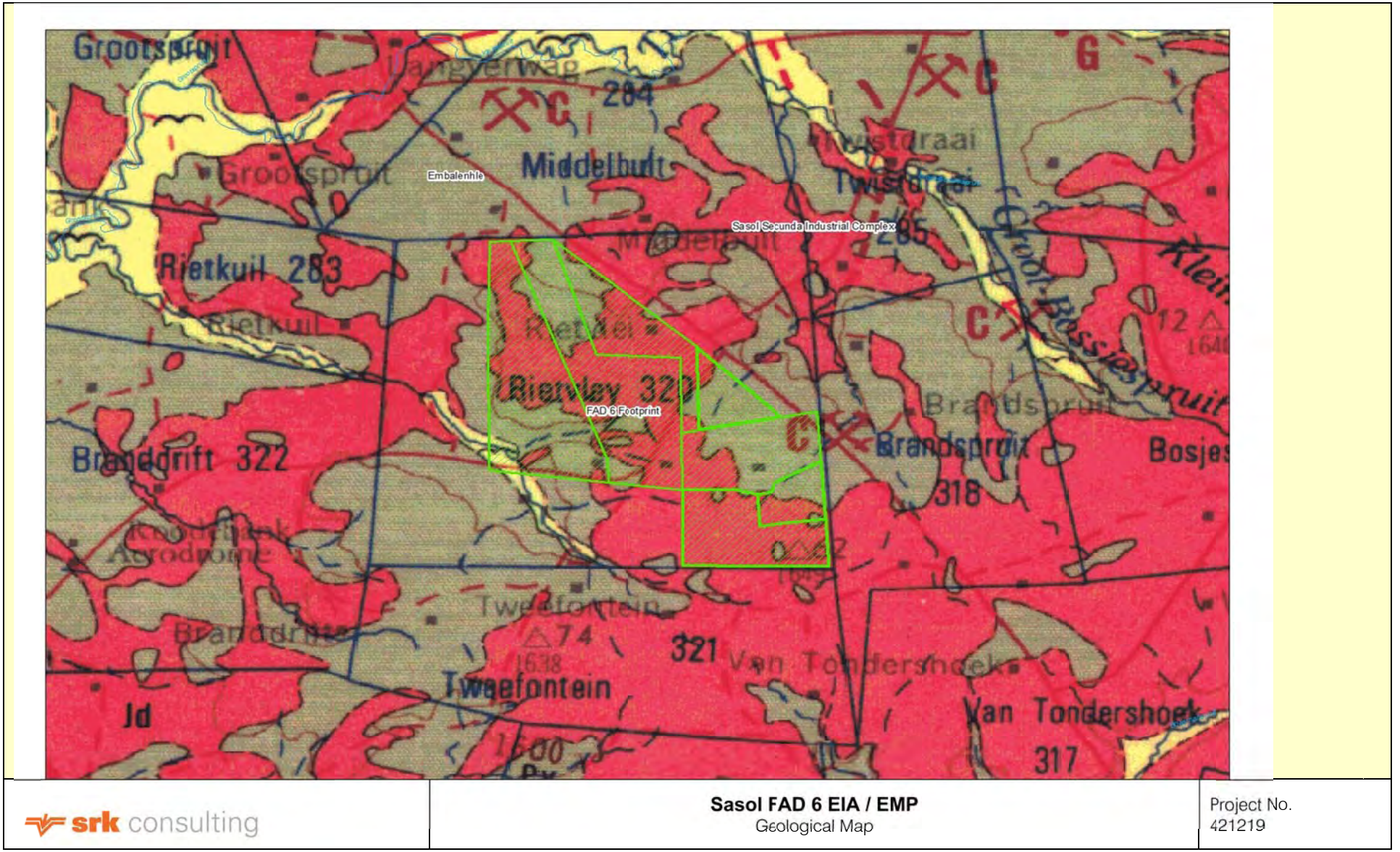

Figure 6-17: Geological Map of the proposed FAD 6 footprint

7 Public Participation

7.1 Objectives and Approach to PPP

PPP forms a key component of the EIA process. The PPP is the process where by all parties who may be potentially affected by the proposed development, directly or indirectly or those who have an interest in the proposed development are involved during all stages of the EIA process.

The purpose of the public consultation during the EIA phases is to ensure that the views, interests and concerns of the project stakeholders are taken into consideration during the assessment process of the anticipated environmental, social and economic impacts as well as the design of the of mitigation measures for the proposed FAD 6. The PPP proposed as part of this stage of the EIA process for the proposed FAD 6 aims to:

- Ensure timely distribution of information that is understandable and accessible to all stakeholders;
- Provide adequate opportunities for stakeholders to raise issues and concerns on the proposed FAD;
- Ensure that all issues and concerns raised by the public are considered and appropriately responded to in the EIA documentation;
- Ensure that all stakeholders are kept informed on the process of the EIA underway;
- Ensure and maintain relationships and channels of communication with all stakeholders for the duration of the EIA, through which communication channels for the remainder of the proposed project can be built; and
- Comply with national and provincial legislative requirements for public participation, as well as best practise.

7.2 Approach to the EIA and Public Participation Process

This section describes the objectives of and approach to the PPP, provides a summary of the activities undertaken to date and provides a brief overview of the PPP to be undertaken during the EIA / EMP phase.

7.2.1 Environmental Screening phase

During the Environmental Screening phase of the project undertaken in October 2010 prior to the Scoping phase, stakeholder engagement was primarily undertaken to obtain input from the directly affected stakeholder's regarding potential environmental, social and economic impacts. Synfuels provided SRK with a stakeholder database that has been developed by Synfuels from previous studies undertaken in the area. This database was used for the purposed of the FAD 6 stakeholder engagement process. Additional Stakeholders were identified and included within this database during the course of the PPP. These related mainly to the following:

- Responsible Municipalities;
- Residents within the proposed developments; and
- Bordering communities.

A Background Information Document (BID) and response sheet was compiled and distributed to all identified stakeholders. All stakeholders that raised comments in response to the public participation

process were recorded and added to an issues and response from. Posters advertising the project were placed at the following places:

- Govan Mbeki Local Municipality;
- Gert Sibande District Municipality;
- Secunda Library;
- Along the border of the proposed site, south west of the R546;
- Along the provincial road intersecting the proposed footprint;
- Stakeholders were notified of the project as follows:

The initial issues and response from was continually updated with the feedback received from the stakeholders. Minimal feedback was received from the stakeholders. Feedback received related the following:

- Groundwater Contamination: Groundwork, Friends of the Earth South Africa;
- Eskom Power lines crossing the footprint of the proposed FAD: Eskom Distribution;
- Land Use surface rights does not comply with current legislation: Govan Mbeki Municipality
- Heritage Impacts: SAHRA; and
- Waste Management: Groundwork, Friends of the Earth South Africa.

7.2.2 Scoping Phase

A number of consultation activates took place during the Scoping Phase of the project. These are summarized in Table 7-1 below.

Table 7-1: Public Participation Activities undertaken during the Scoping Phase

Task	Objectives	Reference
Advertise availability of the Draft Scoping Report for Review	Notified I&AP's of the commencement of the EIA process and the availability of the Scoping Report for public comment	12th May 2011 Draft Scoping Report SRK Report 421219 / Scoping
Consolidate issues received and update Issues and Response Report	Take into consideration the issues raised by the public and address the concerns during the remaining EIA stages.	13th May - 18th July 2011 Draft Scoping Report SRK Report 421219 / Scoping
Make the Final Draft Scoping Report available for a 21 day commenting period.	I&AP are given the opportunity to confirm that their issues and concerns are addressed in the Final Scoping Report (FSR).	10th August 2011 Draft Scoping Report SRK Report 421219 / Scoping
Submit Final Scoping Report (FSR) to the authorities	Provided DEA and MDEDET sufficient information for decision making.	18th August 2011 Draft Scoping Report SRK Report 421219 / Scoping

The consultation activities that were undertaken during the Scoping Phase are briefly detailed below;

- In order to ensure that all I&AP's are notified of the project and the issues and concerns of the broader public are taken into consideration, newspaper advertisements were lodged in the Ekazi and Echo Ridge Newspapers on the 12th May 2011;
- The newspaper advertisements served the purpose of inviting I&AP's to register for the proposed project and submit any issues or concerns they might experience relating to the proposed development;

- Following the 40 day commenting period, issued from I&AP's were collated and addressed in the Scoping Report. A letter was further sent to the I&AP's to inform them of the availability of the Final Report made for a 21 day commenting period;
- All issued and concerns were again collated and incorporated into the FSR and submitted to the MDEDET and DEA to accept or reject the Scoping Report and PoS.
- The FSR and PoS was accepted by the MDEDET on the 17th January 2012

The NEMA Regulations, GN R 543 stipulates in Section 28(1) (h) and Section 31(1)(e) that the responsible EAP must keep a up to date register he scoping of all the I&AP's and their comments. This has been compiled in a comments and response report together with the I&AP correspondence for the scoping and assessment phase and included in Appendix E.

Comments received to date and issued identified as significant and requires further evaluation have been incorporated into the FEIAR (this document) and have been considered in the assessment component of the report.

Many of the concerns raised by I&AP's during the consultation process of the Scoping Phase of the project relate to issues that are being dealt with during the EIA phase of the project as stipulated in the FSR Comment and Response Report. All comments from I&AP's have been taken cognisance of and assessment in Section 12 of this report. Table 7-2 summarized the issues / concerns raised during the Scoping Phase and the sections of this report where they are addressed.

Table 7-2: Comments addressed in the Final EIA Report

No.	Issues / Comments	Relevant Section of this report
Land Surface Rights		
1.	The use of the land surface right does not comply with MPRDA regulations. 2002!	The land under consideration is owned by Sasol, and whilst there is mining activity in the area, the establishment of the FAD6 is not considered to compromise the MPRDA Regulations, or compromise mineral resources under the site. Sasol Coal is aware of the proposed FAD6 development and has not raised objections. FAD6 is an extension of the existing Licensed WADS.
2.	The use of the land surface rights does not comply with the Mine Health and Safety Act (Act 29 of 1996)!	Sasol will ensure that the establishment of FAD6 will be compliant to all regulatory requirements, and be constructed and operated in accordance with the WADS License conditions, the WADS Operating Envelope (Operating, Maintenance and Reporting Procedures) and Sasol SHEQ Protocols and Procedures.
Surface Water Pollution		
3.	What mitigation steps will be in place to prevent pollution of the water way south of the Mayfield property?	These concerns were considered in the Impact Assessment in Section 12.
Health and Safety		
4.	What mitigation steps will be in place to prevent health and safety risks for the community of the adjacent cemetery?	A suitable buffer zone will be established between the FAD6 and the community areas. No material safety or health risk to the indicated community of the cemetery is envisaged. These concerns were considered in the Impact Assessment in Section 12

Electricity Power lines Relocation		
5.	Concerns were raised by Eskom on the relocation of the Power lines and the current servitudes within the proposed area. Certain mitigation measures were proposed.	These concerns were considered and assessed in the Impact assessment and EMP in Section 12 and 17.
Cultural and Heritage Remains		
6.	SAHRA informed the project team that a Heritage Specialist will be required for the proposed Development.	A heritage specialist was consulted and a report compiled to inform the EIA. Mitigation and management measures are provided in section 12 and 17.
Groundwater Pollution		
7.	Concerns were raised within regards to the proposed FAD and the impact this might have on groundwater pollution.	These concerns were considered and assessed in the Impact assessment and EMP in Section 12 and 17.
Dam Safety		
8.	Applicability of dam safety legislation in terms of the NWA to the FAD.	Sasol has been made aware of the applicability of the FAD to the Dam Safety Regulations of the NWA. Synfuels will adhere to the requirements of the NWA with this regard.
9.	On page v of the executive summary (DEIAR) it states “The day wall is built during daylight hours and provides freeboard to the dam” and then on page 38 Section 4.17 it states “Max height above the ground level of 40m”. Does this mean that the fine ash slurry aids in the building of the dam wall or is the dried fine ash slurry added onto the existing FAD wall?	To start a fine ash dam normal earth walls are constructed at lowest points on the dam perimeter as part of the initial infrastructure construction. During the dam building phase wet fine ash slurry (fine ash plus water) is deposited behind these walls from where fine ash starts settling out and the remaining water is drained from the penstock system positioned in the lower lying position of the dam to existing clear ash effluent dams. Fine ash behind the initially constructed wall dries out relatively quickly and is handled by means of excavating construction equipment to construct paddock areas on top of the initially constructed walls. These paddocks are filled in with slurry and left to dry out. Once dried out the same process of providing new paddock areas on top thereof is followed to raise the dam wall on the lowest spots of the perimeter dam wall. Due to the outer slope of the ash dam wall and the consistent safe paddock width required the inner wall for the new paddock areas on top is provided inside the area of the paddocks directly below. The above description indicates that only wet ash slurry aids in the building of the dam wall during the operational phase of the dam.
10. 11.	If the operational storage of the free water on top of a fine ash dam exceeds 50 000 m3 and the wall height exceeds 5 m, the particular dam is registered or classified as a dam with a safety risk. The requirement that the free water on top of the facility must be reduced to below 50 000 m3 , or a more stringent requirement, must be clearly specified in the Operation Manual and / or Code of Practice of the fine ash dam and should be actively enforced throughout the life of the dam. If not the dam must be registered as a dam with a safety risk in terms of dam safety legislation. It will then be classified, licensed and comply with all the requirements of the dam safety legislation in Chapter 12 of the Water Act. It is suggested that the final EIA should clearly	Synfuels propose to construct a FAD and associated infrastructure for the future waste handling processes at Synfuels. The existing FAD’s are reaching their operational capacities, hence the basis to the FAD 6 applications. The legal and safe operation of the facility will require the registration of the ash dam and some return water dams as being dams with a safety risk, and will likely prescribe the use of DWA Approved Professional Persons (APP) in their design, construction and on-going safety audits. Although not mandatory, it is suggested that such an APP monitor the dams on at least an annual basis, as per the code of practice applicable to tailings dams. This mechanism should also provide a feedback loop to improve the design and construction of subsequent phases, as construction works are scheduled to occur at relatively short intervals for many years.

	state if the proposed fine ash dam will be a dam with a safety risk or not by comparing it with the above criteria. If the proposed return water dams and temporary storage dam should have a wall height higher than 5m and the storage capacity be more than 50 000 m^3 , it will fall within the definition of a dam with a safety risk, and must comply with the requirements in Chapter 12 of the NWA (Dam Safety). This should be mentioned in the final EIA.	
12.	You are also advised to consult with Ms Florah Mamabolo of our Gauteng Regional Office with respect to the requirements of Chapter 4 of the NWA (Water Use).	SRK acknowledges this comment. Ms Florah Mamabolo has been involved with our consultation process from the initiation stage of the project. Continual consultation will be conducted in order to adhere to the requirements in Chapter 4 of the NWA.

7.3 EIA Phase Public Participation Activities

The following section explains the PPP to be followed for the remaining activities for the EIA process during the Impact Assessment Phase of the project.

7.3.1 Public Participation and Authority Consultation

Final Environmental Impact Assessment Report (FEIAR)

The FEIAR is now available for public comment for 21 days, excluding public holidays, from the 26th July 2012 until the 15th August 2012.

During this commenting period I&AP are invited to review the FEIAR and provide comments on the report in writing to the MDEDET and copied to Andrew Caddick at SRK Consulting.

- E – Mail : acaddick@srk.cio.za
- Tell : 012 361 9821
- Fax : 012 361 9912

Table 7-1: MDEDET Contact details

Details	Name
Name	Bheki Mndawe
Telephone	(017) 811 3944
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The Issues and concerns identified during this review period will be collated into a Comments and Response Report and included with the FEIAR.

The final report has been made available to the competent authority prior to awarding I&AP's the opportunity to comment on the report. At the start of the public review period, all registered I&AP's were notified of the availability of the FEIAR for public review. The Executive Summary of the FEIAR will be distributed to all registered I&AP's and the full report made available at the following locations:

- Secunda Public Library; and

- SRK website at www.srk.co.za/Recent Publications/ Public Documents/Sasol Synfuels EIA/EMP for the proposed FAD 6.

Registered I&AP's will be informed on the lodging of the final report through email, fax, posted letters and the placement of newspapers adverts. The report will be made available for a 21 day commenting period. All comments and issues raised by I&AP's will be taken into consideration during the final assessment process.

Public meetings held with registered I&AP's will be conducted upon request from any I&AP.

7.3.2 Final Environmental Impact Assessment Report (FEIAR)

Registered I&AP's will be notified on the availability of the FEIAR. The final report will be made available for a commenting period of 21 days. Comments raised on the final report will be submitted to the competent authority with a copy sent to Andrew Caddick at SRK.

7.3.3 FEIAR and Environmental Management Program (EMP)

An EMP will be compiled for the proposed FAD 6 and submitted to the competent authorities in conjunction with the FEIAR. The EMP will prioritize management and mitigation measures for the construction operation and decommissioning of the proposed FAD 6. The EMP will be based on the recommendations from the specialist studies conducted, professional judgement of the EIA project team and inputs from I&AP's. The proponent will be required to adhere to the mitigation and management measures put forth in the EMP.

7.3.4 Appeal

All registered stakeholders are notified on the acceptance or refusal of the EA and WLA. I&AP's will be reminded on the opportunity to appeal to the Minister of MDEDET, DEA and DWA on the decision made by the relevant Competent Authority.

8 Need and desirability of the proposed FAD 6 and associated infrastructure

Fine Ash is produced during the gasification process conducted at Synfuels. Synfuels currently have two FAD's in operation (FAD 4 and FAD 5). FAD 4 is reaching the end of its life span, and Synfuels has to thus investigate additional locations for ash deposition. Without the usage of an additional FAD, Synfuels will not be able to continue current production rates and social demands. Synfuels thus need a means of depositing its factory loads of fine ash in a sustainable manner. The construction of a FAD has in recent years therefore become a priority.

The FAD 6 has been located in close proximity to the current SSIC, in order to reduce the energy costs and cumbersome tasks of transporting fine ash over a large distance. The current location of the FAD 6 on Synfuels property will result in the realignment of the D714 road crossing through the North West areas of the proposed FAD 6. Together with this the FAD 6 will be located within the servitude of a number of power lines in the area, which in turn will need to be re located.

Over 27 000 people are employed by Sasol Secunda groups, of which approximately 140 000 people are supported by these staff members. Without an alternative means of ash deposition, Synfuels will not be able to continue current operations beyond the life span of FAD 4, resulting in unemployment of a large sum of residents in Secunda and surrounding communities accumulating to the current 40% unemployment rate in the Gert Sibande Local Municipality. Synfuels are in the process of investigating alternative means of ash disposal.

9 Methodology for Impact Identification and assessment

The first stage of impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change.

The following definitions therefore apply:

- An "**Activity"** is defined as a distinct process or risk undertaken by an organization for which a responsibility can be assigned. Activities also include facilities or pieces of infrastructure that are possessed by an organization;
- An environmental "**Aspect"** is an element of an organizations activities, products and services which can interact with the environment. The interaction of an aspect with the environment may result in an impact.
- Environmental "**Impacts"** are the consequences of these aspects on environmental resources or receptors of particular value, sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. Receptors can comprise, but are not limited to, people or human made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as aquifers, flora and palaeontology. Impacts on the environment can lead to changes in existing conditions; the impacts can be direct, indirect or cumulative. Direct impacts refer to changes in environmental components that result from direct cause effect consequences of interactions between the environments and development activities. Indirect impacts result from cause effect consequences of interactions between the environment and direct impacts. Cumulative impacts refer to the accumulation of changes to the environment caused by human activities.

9.1 Description of the aspects and potential impacts

The accumulative knowledge of the findings of the environmental investigations forms the basis for the prediction of impacts. Once a potential impact has been determined during the Scoping process, it is necessary to identify which development activity will cause the impacts, the probability of occurrence of the impact, and its magnitude and extent. This information is important for evaluating the significance of the impact, and for determining mitigation and monitoring strategies.

The assessment of significance should be undertaken twice. Initial significance should be based on only natural and existing mitigation measures (including built-in engineering designs). The subsequent assessment should take into account the recommended management measures required to mitigate the impacts. Some of the specialist consultants have used variations of these procedures.

Table 9-1: Criteria for assessing significance of impacts

SEVERITY OF IMPACT	RATING
Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful	5
SPATIAL SCOPE OF IMPACT	**RATING**
Activity specific	1
Mine specific (within the mine boundary)	2
Local area (within 5 km of the Activity boundary)	3
Regional	4
National	5
DURATION OF IMPACT	**RATING**
One day to one month	1
One month to one year	2
One year to ten years	3
Life of operation	4
Post closure / permanent	5

SIGNIFICANCE

FREQUENCY OF ACTIVITY / DURATION OF	RATING
Annually or less / low	1
6 monthly / temporary	2
Monthly / infrequent	3
Weekly / life of operation / regularly / likely	4
Daily / permanent / high	5
FREQUENCY OF IMPACT	**RATING**
Almost never / almost impossible	1
Very seldom / highly unlikely	2
Infrequent / unlikely / seldom	3
Often / regularly / likely / possible	4
Daily / highly likely / definitely	5

LIKELIHOOD

The method as described above is further explained in the following section in order to give a better understanding on how the Likelihood and Significance of an impact is identified. Attributes contributing to the significance and likelihood will be explained below:

9.1.1 Spatial Scope

The spatial cope can be defined as the geographical coverage, and will take into account the following factors:

- The physical extent / distribution of the aspect, receptor and proposed impact; and
- The nature of the baseline environment within the area of impact

For example, the impact of noise is more likely to be confined to a smaller geographical area than that of air emissions, which may be experiences at some distances. The significance of an impact varies spatially. Many will be significant only within the immediate vicinity of the site or within the surrounding community, while others may be significant at a regional or national level.

9.1.2 Duration

Duration refers to the length of time that the aspect may cause a change, either positive or negative, on the environment. The environment assessment methodology distinguished between different time periods by assigning a rating to duration of an impact.

9.1.3 Severity

The severity of an environmental aspect is determined by the degree of change to the baseline environment and includes consideration of the following factors:

- The reversibility of the impact;
- The sensitivity of the receptors to the stressor;
- The impact duration, its permanency and weather it increases or decreases with time;
- Weather the aspect is controversial or would set a precedent; and
- The threat to environmental and health standards and objectives.

9.1.4 Frequency of Activity

The frequency of an activity refers to how regularly the activity takes place. The more frequent the activity takes place, the higher potential there is for a related impact to occur.

9.1.5 Frequency of Impact

The frequency of an activity refers to how often the aspect impacts, or may impact, either positively or negatively, on the environment.

9.1.6 Additional variables

There are additional variables that must be taken into consideration when assessing the impacts of the FAD 6 and associated infrastructure. These variables will have a bearing on the significance of the impacts being assessed. These variables may include Cumulative impacts and inputs received from I&AP's. In scenarios where this is applicable, more emphasis will be placed on the management measure requirements. Cumulative and Impact identified by I&AP's are discussed below.

- Cumulative impacts: These are impacts which are considered where off site activities take place together with activities associated with the FAD result in an accumulative impact imposed on the environment.
- Impacts / Issues raised by I&AP's: I&AP's will be consulted during the entire process of the FAD 6 EIA / EMP and WLA. Issues and concerns may be raised by the I&AP's which will bear more weight in the significance of the impact being assessed.

9.2 Determining the Impact Rating

This rating methodology is used to evaluate the importance of a particular impact, the consequence and likelihood t

The significance of the impact is assessed by rating each variable numerically according to defined criteria as outlined in Table 9-1. The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of the impact and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together

comprise the likelihood of the impact occurring and can obtain a maximum value of 10. The values for likelihood and consequence of the impact are then read off a significance rating matrix as shown in Table 9-2.

Table 9-2: Significance Rating Matrix

LIKELIHOOD (Frequency of activity + Frequency of impact)	CONSEQUENCE (Severity + Spatial Scope + Duration)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	3	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75
	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90
	7	14	21	28	35	42	49	56	63	70	77	84	91	98	105
	8	16	24	32	40	48	56	64	72	80	88	96	104	112	120
	9	18	27	36	45	54	63	72	81	90	99	108	117	126	135
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150

The model outcome as determined from Table 9-1 is then assessed in terms of impact certainty and consideration of available information. Where a particular variable requires weighing or an additional variable requires consideration the model is adjusted accordingly.

The numerical rating is determined through the use of Table 9-1. The colour code from Table 9-2 corresponding to Table 9-3 is then used to determine the appropriate level of mitigation that will be required to reduce the current rating.

Table 9-3: Positive/Negative Mitigation Ratings

Colour Code	Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
	Very high	126-150	Improve current management	Maintain current management
	High	101-125	Improve current management	Maintain current management
	Medium-high	76-100	Improve current management	Maintain current management
	Low-medium	51-75	Maintain current management	Improve current management
	Low	26-50	Maintain current management	Improve current management
	Very low	1-25	Maintain current management	Improve current management

9.3 Mitigation

In assessing the significance of an impact, natural and existing mitigation is taken into account. Natural and existing mitigation measures are defined as natural conditions, conditions inherent to the development design and existing management measures that alleviate impacts.

The significance of impacts is assessed taking into account any mitigation measures that are proposed. An EMP, specifying the methods and procedures for managing the environmental impacts of the proposed development, during the construction and operation phases is compiles and submitted to the competent authority. Once approved this EMP becomes a legal document that must be adhered to by Synfuels.

Commissioning, operational and monitoring requirements, targets and responsibilities for those environmental aspects that give rise to potential environmental impacts will be incorporated into the EMP.

10 Description and comparative assessment of alternatives

Table 10-1 provides a summary of the significance ratings for the two alternatives identified for the construction of the FAD 6. This table incorporates the assessment of the impacts once mitigation measures have been implemented.

It must be noted that no alternatives for the road deviation and powerlines re alignments were considered, as the FAD will occupy the majority of the site, and limited areas will be made available for the relocation. SRK has thus not assessed any alternatives to these aspects; however these were included within the impact assessments. The comparative assessment of the alternatives was conducted by adding the negative numerical ratings for each impact, and subtracting the positive impacts from the total.

Alternative one and two do not differ from each other to a great extent from an environmental perspective, as the footprint to be disturbed will remain the same, within the same area. From Table 10-1 it can be seen that there is no material difference between the two alternatives. The only deviation relates to the Air Quality impact. With the construction of two separate dams (Alternative 2), the total surface area of the proposed dams will be smaller than that of only large dam (Alternative 1). This will be directly proportional to the storage capacity of the dam, thus requiring the construction of a new dam at an earlier stage. The construction of a single dam will prolong the life span of the dam, allowing for the increased storage of fine ash.

The technical advantage of a single dam is the consolidated maintenance and management programs applicable to ensure safety and stability of the dam. With separate dams, construction and maintenance activities become a cumbersome task. Additional piping systems, RWD's and associated infrastructure will be required, which will subsequently inflict additional environmental disturbance on the site.

Alternative one is a more financially and environmentally sound option. This will allow for minimal construction of associated infrastructure and will in turn allow for better management and maintenance. The only disadvantage of the construction of a single large dam is the greater surface area exposed to wind and environmental factors. The larger surface area of this alternative posed a threat to increased DFO and PM 10 pollution. Considering the base line Air Quality Assessment, and the future decommissioning of FAD 4 and FAD 5, this impact can be effectively mitigated. From an environmental perspective, alternative two is lightly favourable. However from a technical perspective the advantages of Alternative one greatly overweight that of Alternative two.

Table 10-1: Impact Significance and summary table of Alternatives one and two for the FAD 6

Phase	Impact	Significance Rating	
		Alternative 1	Alternative 2
Construction	Direct loss of vegetation of conservational concern	-49	-49
	Direct loss of habitat and indirect loss of habitat quality	-24	-24
	Direct loss of faunal species of conservational concern	-25	-25
	Impact on site stability due to undermining activities	-42	-42
	Impact on the change in topography	-42	-42
	Visual impact as a result of dust generation	-36	-36
	Seepage impact on groundwater quality	-49	-49
	Impact of runoff on the Grootspruit	-70	-70
	Impact on Surface water quality due to runoff from cleared areas	-63	-63
	Impact on Stormwater management	-81	-81
	Impact on Surface water quality due to spillages	-24	-24
	Impact on Water Quality by Stormwater management	-72	-72
	Impact on Assurance of supply	-36	-36
	Impact on the loss of wetland vegetation and habitat	-70	-70
	Impact on the increased sediment movement off the site	-48	-48
	Impact on altered flows within wetland areas	-56	-56
	Impact on Wetland Quality deterioration due to hydrocarbon spillages	-48	-48
	Impact on alien vegetation	-49	-49
	Impact on erosion	-54	-54
	Impact on concentration and impoundment of flow	-48	-48
	Impact on habitat fragmentation	-90	-90
	Impacts on air quality as a result of PM10	-72	-70
	Impacts on air quality as a result of DFO	-30	-30
	Impact on the destruction of cultural and heritage findings	-36	-36
	Impact as a result of noise from vehicles	-49	-49

Phase	Impact	Significance Rating	
		Alternative 1	Alternative 2
	Impact as a result of noise from machinery	-49	-49
	Impact on dust generation, congestion of public roads and noise pollution	-48	-48
	Impact on Road Safety	-64	-64
	Impact on the loss of land capability and land use potential	-60	-60
	Impact on the sterilization of soils	-36	-36
	Impact on the loss of land capability and land use potential	-60	-60
	Impact on the contamination of soils	-25	-25
	Impact on Employment	+77	+77
	Impact on Safety due to increased vehicular movements	-48	-48
	Impact of fires on the surrounding areas	-24	-24
	Impact of waste generated on site	-56	-56
Operation	Direct loss of vegetation of conservational concern	-24	-24
	Direct loss of habitat and indirect loss of habitat quality	-42	-42
	Direct loss of faunal species of conservational concern	-42	-42
	Impact on site stability due to undermining activities	-42	-42
	Impact on the change in topography	-42	-42
	Visual impact as a result of Dust generation	-42	-42
	Seepage impact on groundwater quality	-49	-49
	Impact of runoff on the Grootspruit	-70	-70
	Impact on Surface water quality due to runoff from cleared areas	-80	-80
	Impact on Surface water quality due to spillages	-24	-24
	Positive impact on the reduction in MAR	+104	+104
	Impact as a result of lack of stormwater management	-56	-56
	Impact on Assurance of supply	-36	-36
	Impact on Surface water due to overflow of process and CAE dams	-32	-32
	Impact on leachate generated from the FAD 6	-32	-32

Phase	Impact	Significance Rating	
		Alternative 1	Alternative 2
	Impact on the spillage of ash and/or process and return clear ash effluent	-70	-70
	Impact due to the change of hydrology in a water course	-48	-48
	Impact on the increased sediment movement off the site	-48	-48
	Impact on altered flows within wetland areas	-56	-56
	Impact on Wetland Quality deterioration due to seepage	-60	-60
	Impact on alien vegetation	-49	-49
	Impact on erosion	-54	-54
	Impact on concentration and impoundment of flow	-48	-48
	Impact on habitat fragmentation	-90	-90
	Impacts on air quality as a result of PM10	-72	-70
	Impacts on air quality as a result of DFO	-30	-30
	Impact on the destruction of cultural and heritage findings	-25	-25
	Impact as a result of noise from vehicles	-21	-21
	Impact as a result of noise from machinery	-21	-21
	Impact on dust generation, congestion of public roads and noise pollution	-48	-48
	Impact on road degradation	-48	-48
	Impact on Road Safety	-64	-64
	Impact on the loss of land capability and land use potential	-60	-60
	Impact on the contamination of soils	-25	-25
	Impact on Dam safety	-63	-63
	Impact on Safety due to increased vehicular movements	-48	-48
	Impact of fires on the surrounding areas	-24	-24
	Impact of waste water streams of the FAD 6	-63	-63
Closure	Direct loss of vegetation of conservational concern	-6	-6
	Direct loss of habitat and indirect loss of habitat quality	-6	-6
	Direct loss of faunal species of conservational concern	-6	-6

Phase	Impact	Significance Rating	
		Alternative 1	Alternative 2
	Impact on site stability due to undermining activities	-14	-14
	Impact on the change in topography	-42	-42
	Visual impact as a result of windblown dust	-30	-30
	Seepage impact on groundwater quality	-48	-48
	Impact of runoff on the Grootspruit	-48	-48
	Impact on the spillage of ash and/or process and return clear ash effluent	-70	-70
	Impact on the increased sediment movement off the site	-48	-48
	Impact on altered flows within wetland areas	-56	-56
	Impact on alien invasive vegetation	-49	-49
	Impact on erosion	-54	-54
	Impact on air quality as a result of PM10	-18	-18
	Impact on air quality as a result of DFO	-6	-6
	Impact on the destruction of cultural and heritage findings	-25	-25
Total Significance rating		**-3826**	**-3822**

11 Key Findings of the specialist studies

The section of the report presents the key findings of the specialist studies regarding the current environment and outlines the issues and recommendations relating to the construction, operation and closure phase of the proposed project. All specialist studies are found in Appendix D.

All the specialist studies were conducted prior to the distribution of the FEIAR (this report). The findings and recommendations of all the studies are presented in Table 11-1. The recommendations from the specialist studies inform the EMP which sets management measures for mitigation impacts enhances benefits and assigns related responsibilities.

Table 11-1: Summary of the key findings and recommendations from specialist studies

Specialist study	Current Environment	Key Findings				Recommendations
		Pre-Construction	Construction	Operation	Closure	
Surface Water Assessment	The area is in the Upper Vaal WMA with major rivers being the Liebenbergsvlei, and Vaal Rivers. The quaternary catchment associated with this area is C12D. Thus, Secunda is at the north boundary of the WMA. The SSIC itself is located in a sub-catchment of the Waterval River, comprising the several tributaries i.e. the Vlakspruit, Klein Bosjesspruit, the Groot Bosjesspruit, the Brandspruit, the lower reaches of the Klipspruit and the lower reaches of the Trichardspruit. The Upper Vaal WMA includes the Vaal, Klip, Wilge, Liebenbergsvlei and Mooi Rivers and extends to the confluence of the Mooi and Vaal Rivers. It covers a catchment area of 55 565 km^2. This WMA includes the very important dams Vaal Dam, Grootdraai Dam and Sterkfontein Dam. The	The FAD 6 system is to be operated to ensure that the accumulation of water in the pool area does not present a stability risk and that drainage of pool water accommodates the 1:50 year flood event. The process water control dam is to be operated to ensure that the 1:50 year flood event is contained plus free-board at full operating level of 0.8 m. The process water control dam and the CAE dam (RWD) are to be provided with a formal engineered liner system appropriate to the containment of impacted waters for reuse purposes.	Surface water quality in the catchment may be impacted upon during site clearing and construction of the FAD 6 infrastructure and FAD 6 itself, with associated process water and CAE dams. The boundaries of the study area for FAD 6 are situated approximately 5 kilometres away from the Grootspruit and Trichardt Spruit and >15 km from the Waterval River. Water tends to pond and soak away on flat areas and flows away where drainage courses exist. Therefore the probability that contaminated runoff will reach the Grootspruit, Trichardt Spruit or Waterval River via surface water drainage channels during the construction phase is considered probable, if not appropriately mitigated. The rainfall water within the designated dirty water area of FAD 6 that forms part of the MAR to the local water courses will be removed from the catchment this will result in a low intensity potential on the local surface water resource.		During the closure and decommissioning phase of FAD 6 the CAE dams lining and associated infrastructure will be removed and the footprint area rehabilitated as with the FAD 6 being re - vegetated to manage on-going dust generation and erosion. FAD 6 will remain in-situ. The surface water quality should not be further impacted by any of the closure and decommissioning activities of FAD 6 as it will be restricted to the already disturbed area.	The FAD 6 will be provided with formal engineered drainage and seepage collection systems appropriate to the collection of impacted waters for reuse purposes. The FAD 6 system will be compliant to Regulation 704 in diverting clean water from the upper catchment area around the site to the natural environment, and containing dirty water within the FAD 6 water management system. The CAE/RWD is to be operated to ensure that the 1:50 year flood event is contained plus free-board at full operating level of 0.8 m in balance with appropriate drainage control from the pen-

Specialist study	Current Environment	Key Findings				Recommendations
		Pre-Construction	Construction	Operation	Closure	
	southern half of the WMA extends over the Free-State; the north-east mainly falls within Mpumalanga and the northern and western parts in Gauteng and North West provinces respectively. The FAD 6 area contributes approximately 0.015 % to the MAR of the quaternary catchment.					stock and recovery of water to the SSIC. CAE will be recycled to the SSIC. A competent surface water and groundwater monitoring programme will be established for FAD 6. FAD 6 will be licensed as an integral part of the existing WADS and Synfuels Water Uses.
Hydrogeological Assessment	The hydrogeological assessment for the proposed FAD 6 area indicates that there is no existing use of groundwater within the immediate vicinity of the proposed FAD 6 location, although boreholes are registered with the National Groundwater Database. Historical, non-operational farmstead boreholes have been located in the area, indicating that groundwater was utilised in the past. Synfuels Coal mining activities	The potential impact on groundwater resources should be mitigated by appropriate design and construction of the infrastructure for FAD 6, in particular the phase 1 process water dam and RWD be provided with appropriate engineered linings, and the FAD 6 provided with drainage and seepage collection facilities to return as much water as possible to the SSIC for reuse.	During operational phase, there will be a steady stream of potential contaminants discharged to FAD 6. It is expected that over the life of FAD 6, the production procedure and the quality of the ash transport media will remain the same. Reduce infiltration rates into the underlying aquifer through a combination of engineered mitigation and management measures to reduce seepage rate to the underlying aquifer. Install and operation of seepage interception trenches at the toe of FAD 6 to reduce plume migration and prevent plume from day lighting in the Grootspruit. Utilize the available storage		Once ash is no longer discharged to FAD 6 at the end of life, the site will be decommissioned and closed in terms of the legislative requirements. In terms of risk posed by FAD 6, the risk will be reduced over time as the potential contaminants are diluted and or naturally attenuated over time. With	Clean and dirty water segregation, in accordance with regulation 704, should be provided for FAD 6. Boreholes installed around FAD 6 are monitored monthly for water levels and every three months for water quality. The water level measurements will assess the potential for seepage from FAD 6 that could potentially recharge the shallow

Specialist study	Current Environment	Key Findings				Recommendations
		Pre-Construction	Construction	Operation	Closure	
	in the area are considered to have affected the regional groundwater regime, including the location of exploration boreholes and operational boreholes in the proposed regional area. Sasol Coal indicates no objections to the construction of the proposed FAD 6 in the area of their mineral resources and mine workings. Natural groundwater flow from FAD 6 is expected to be predominantly to the southern directions towards the tributary of the Grootspruit. However, underground mining operations and existing WADS may have an impact on, and influence groundwater flow, as a result of possible preferential fracture flow and possible mounding from the WADS respectively. The weathered aquifer beneath FAD 6 area overlies semi-permeable bedrock that may restrict ingress of groundwater from		facilities to manage the water intercepted at the toe of FAD 6. Construct cover material on FAD 6 so that natural vegetation can be established to provide a non-contaminating surface for runoff.		management options in place, the risk is expected to reduce even further. There is the possibility at this stage that the integrity of the liner will have been compromised. However, with no more deposition taking place, the salt loads will reduce with time. Ensure the long term integrity of the interception trenches located at the toe of FAD 6 and repair as may be required. Enhance the interception trenches locate at the toe of FAD 6 with the installation of abstraction boreholes at the toe of FAD 6 to reduce plume migration and prevent plume from day	weathered aquifer around this facility. The monitoring is a requirement as per the Minimum Requirements for Water Monitoring at Waste Management Facilities (DWAF, 1998). The analysis should include the parameters as specified by DWAF Minimum Requirements, and as a minimum: water levels, ICP scan for dissolved metals, major anions, major cations, pH, EC, microbiological elements and organics. Suitable background monitoring boreholes are recommended to assess groundwater quality outside the zone of influence of the FAD 6. It is noted that within the Synfuels area this might be difficult because operations have taken

Specialist study	Current Environment	Key Findings				Recommendations
		Pre-Construction	Construction	Operation	Closure	
	the shallow weathered rock aquifer to the underlying fractured rock aquifer. It is however expected that where the weathering is deep and where preferential downward flow paths exist, the shallow weathered rock aquifer may be hydraulically linked to the deeper fractured rock aquifer. The deeper fractured aquifer may seep into the mine workings that are known to exist below some sections beneath FAD 6. Analysis of groundwater for the hydrogeological study indicated groundwater for the proposed FAD 6 area to be of generally good quality, and within the guidelines for drinking water.				lighting in the Grootspruit. Utilising the available storage facilities to manage the water intercepted at the toe of FAD 6. Consider treatment and re-use.	place for almost 45 years. The background boreholes should be monitored as those around FAD 6. Results of groundwater quality data should be compared to and interpreted in terms of guidelines that are specified by the relevant authorities. The groundwater monitoring programme should be adjusted accordingly as may be required by relevant authorities.
Air Quality Assessment	The maximum predicted 24-hr PM10 concentration for operational conditions for FAD 3, 4 and 5 with management is 165.2 µg/m³. This concentration is observed to	The prevailing winds are relatively consistent throughout the year at Langverwacht. The prevailing winds are north-easterly with lower	In places of high vehicular traffic, dust suppression measures on the roads may be implemented to reduce dust levels from the entrainment of dust. These measures will range from watering of roads, application of a		Rock cladding, grassing or any other form of dust suppression of the side walls and the top of the FAD at closure.	Maintain the current monitoring network and where necessary make minor adjustments to accommodate the installation of new

Specialist study	Current Environment	Key Findings				Recommendations
		Pre-Construction	Construction	Operation	Closure	
	be to the southwest of the FAD 4 and is within the footprint of the FAD 6. The maximum predicted PM10 concentration is above the South African Standard of 120 µg/m³. PM10 concentrations at the township range between 10-75 µg/m³ which is below the South African Standard. PM10 also reaches Secunda but concentrations are below 20 µg/m³. PM10 concentrations decrease away from the FAD's, with concentrations off-site below the South African Standard of 120 µg/m³. Hence, PM10 emissions from the FAD may not be a concern off-site at the closest towns to the project area, such as Embalenhle and Secunda.	frequency of winds from the northwest and southwest. Embalenhle is upwind of activities at Synfuels as it is west to northwest of Synfuels. Secunda is upwind of the Synfuels facility when the prevailing winds are from the northeast and downwind when the prevailing winds are from the southwest.	chemical dust suppressant and/or paving of roads. · Reduce vehicle speeds on roads to less than 40 km/h within the project area. · During the operational phases for FAD 3, 4 and 5 any bare ground surrounding the main operational area but within the boundaries of the facility must be covered with suitable vegetation that will be able to grow in the area. · Whilst in operation the area of the dry beach portion of the FAD 6 should be kept to a minimum and the area or covering the moist or water pooling portions of the dam must be maximised in order to minimise windblown dust from this source. If possible a chemical dust suppressant should be used to suppress dust emissions from the dams when it is not practical to maintain stable moisture content over a long period of time.		infrastructure. PM10 and wind data from the DEA monitoring station at Embalenhle should be acquired by Synfuels on a regular basis in order to monitor PM10 trends in Embalenhle during the decommissioning of the existing FAD's and prior to and during the construction and operation of FAD 6. Conduct periodic independent audits of monitoring systems and the implementation of management plans.
Heritage Impact Assessment	Approximately seven graves were recorded in three different locals .Note that some graves do not have inscriptions and that in terms of Section 36(3) of the NHRA	Mitigation measures may entail full grave relocation. Such a relocation process must be undertaken by suitably qualified	Should archaeological artefacts or skeletal material be revealed in the area during development activities, such activities should be halted, and a university or museum notified in order for an investigation and evaluation of the		No key findings applicable during the closure phase. All impacts would have been identified and mitigated at the time	Furthermore, a concerted effort must also be made to identify all buried individuals and to contact their relatives and descendants. Other

Specialist study	Current Environment	Key Findings				Recommendations
		Pre-Construction	Construction	Operation	Closure	
	graves without inscriptions are by default regarded as older than 60 years and are therefore protected by the Act. Several historical houses and house foundations were recorded. These historical structures are all older than 60 years and are therefore protected by the NHRA. All the structures will be affected by the proposed development activities.	individuals with a proven track record. The relocation must also be undertaken in full cognisance of all relevant legislation, including the specific requirements of the NHRA.	findings to take place.		of closure.	legislative measures which may be of relevance include the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925), the Human Tissues Act (Act no. 65 of 1983, as amended). Phase 2 Heritage Investigation will be required and entails the following aspects: • Surveying and mapping of the site; • Compiling a detailed report of the affected sites; and • Application for a destruction permit from SAHRA. In terms of graves it usually entails a comprehensive social consultation and permit application process for the exhumation and

Specialist study	Current Environment	Key Findings				Recommendations
		Pre-Construction	Construction	Operation	Closure	
						reburial of the graves. In terms of the alternatives for the FAD 6, both Alternative 1 and Alternative 2 will have the same impact on heritage sites. Thus no preferred option is recommended.
Biodiversity Assessment	<u>Vegetation</u> Four plant communities and agricultural fields were identified. Five red data species may occur on the site, due to suitable habitat, but only one was recorded in the Moist Grassland associated with the proposed project area. <u>Mammals</u> Assuming that the FAD 6 will be constructed between the re - aligned regional road and over and beyond the location of the existing road, the FAD 6 will replace mostly maize fields (which is ecologically of no significance), and some	The crossing of natural drainage systems should be minimized and only constructed at the shortest possible route, perpendicular to the natural drainage system. Where possible, bridge crossings should span the entire stretch of the buffer zone. Where a road / railway / pipeline/ power line is to traverse a wetland, measures are required to ensure that the road / railway / pipeline/ power line has minimal effect	Should hedgehogs be encountered during the development, these should be relocated to natural grassland areas in the vicinity. Should any giant bullfrogs or other herpetological species be encountered during the development, these should be relocated to natural areas in the vicinity. The contractor must ensure that no fauna species are disturbed, trapped, hunted or killed during the construction / operation phase. Conservation-orientated clauses should be built into contracts for construction personnel, complete with penalty clauses for non-compliance. It is reiterated that the sanctity of the Brand Spruit and the drainage lines draining into it must be actively protected by an Ecological Management		Closure rehabilitation activities will involve the eradication of alien invasive species and incorporate the utilization of indigenous species for rehabilitation.	The proposed construction of FAD 6 and its associated infrastructure will destroy the ecosystems associated with the direct footprint area. Whilst the ecosystems that would be destroyed by the proposed construction of FAD 6 are of little scientific importance or conservation value in a local regional or national context, certain mitigation and management would be expected and required.

Specialist study	Current Environment	Key Findings				Recommendations
		Pre-Construction	Construction	Operation	Closure	
	grasslands. The latter has been grazed for decades, and in the process the habitat quality has been degraded. In particular, it is of importance to guard against the leaching of noxious substances from the FAD 6 into one of the drainage courses and hence into the Brand Spruit. From a mammalian perspective and given implementation of the proposed mitigation measures, no compelling biological reasons can be submitted against the proposed development. <u>Birds</u> The main conservation objectives for birds at the proposed site for a FAD serving Synfuels near Secunda are to retain as much as possible of the natural grasslands and watercourses and ensure that they are not	on the flow of water through the wetland, e.g. by using a high level clear span bridge or box culverts rather than pipes.	Plan, which should include a fire management programme to ensure persistence of grassland, include an on-going monitoring and eradication programme for all nonindigenous species, with specific emphasis on invasive and weedy species, include a comprehensive surface runoff and storm water management plan, indicating how all surface runoff generated as a result of the development (during both the construction and operational phases) will be managed (e.g. artificial wetlands / storm water and flood retention ponds) prior to entering any natural drainage system or wetland and how surface runoff will be retained outside of any demarcated buffer/flood zones and subsequently released to simulate natural hydrological conditions, include a monitoring programme for all Red and Orange List species, include management recommendations for neighbouring land, especially where correct management on adjacent land is crucial for the long-term persistence of sensitive species present on the development site, result in a report back to the Directorate of Nature			This would include: • Segregation of clean and dirty water systems in terms of Regulation 704; • No direct discharge of polluted water to the environment, other than may be provided for in the WUL, and under appropriate control in terms of the WUL; • The establishment of an adequate buffer zone between the FAD 6 system and watercourses; • The construction, operation and maintenance of water retaining structures i.e. pollution control dams, seepage collection drains and stream diversion in accordance with

Specialist study	Current Environment	Key Findings				Recommendations
		Pre-Construction	Construction	Operation	Closure	
	transformed by the proposed development. If possible, all natural grassland and watercourse habitats should be designated as sensitive areas and excluded from any development. An adjustment to the proposed route for the road realignment would further assist this conservation policy. <u>Herpetofauna</u> Of the ten Red Data herpetofauna species of the Mpumalanga Province, only one possible specie occurs on the site for the proposed development. There is a slim chance that the giant bullfrog may occur on the study site. If the development should go ahead, an important indirect effect would be the likely impact that the proposed development might have on the surface water runoff and water quality of the catchment area. This could have a negative impact on the		Conservation on an annual basis. Outside lighting should be designed to minimize impacts on fauna. All outside lighting should be directed away from sensitive areas. Fluorescent and mercury vapour lighting should be avoided and sodium vapour (yellow) lights should be used wherever possible. It is strongly recommended that the implementation of the Ecological Management Plan must be audited on an annual basis by a specialist registered in terms of the Natural Scientific Professions Act (No. 27 of 2003) in the field of Ecological Science.			Regulation 704; • The construction of the FAD 6 in terms of an approved WUL and WL; • The operation, maintenance and monitoring of the FAD 6 in terms of an approved COP; • The monitoring of FAD 6 in terms of the Dam Safety Regulations of the NWA; • An adequate mitigation and management plan to address spills and incidents in terms of the WUL and WL conditions; • Water quality monitoring or surface and groundwater resources associated with the project area in

Specialist study	Current Environment	Key Findings				Recommendations
		Pre-Construction	Construction	Operation	Closure	
	herpetofauna.					terms of the WUL; • Bio monitoring or surface water resources associated with the project area in terms of the WUL.
Wetland Assessment	A number of wetland systems were identified within the study area associated with unnamed tributaries of the Kleinspruit (draining north east off the site) and the Waterval River (draining west off the site) respectively. The wetlands cover a total of 88.1 hectares, which includes 6 dams totalling 1.9 hectares. These dams are manmade structures that were presumably put in place to ensure/extend the availability of surface water for livestock watering. In addition to the wetlands and dams, a further three quarries were identified on site. At least two of the quarries represent artificial low points	Prior to the start of construction activities on site an alien vegetation management plan should be compiled for implementation throughout the construction phase and the operational. The management plan should be continually revisited and revise, as required. In addition, the disturbance of wetland areas outside the direct footprint of the proposed developments should be minimised by clearly defining the construction servitude and excluding and vehicular or human	Impacts expected to occur during the construction phase include the following: • Loss of wetland vegetation and disturbance of wetland habitat; • Increased sediment movement off the construction sites due to erosion on bare soil surfaces, resulting in increased sediment load in the downslope valley bottoms; • Altered run-off patterns and altered flows within receiving wetlands; • Water quality deterioration due to spillages of hazardous materials and incorrect waste disposal; and • Increase in alien vegetation. The current proposed location and size of the FAD 6 will result in the permanent destruction of approximately 32.9		Disturbed areas should be ripped and scarified (if necessary) and re-vegetation should be encouraged and monitored to ensure success. If rapid vegetation establishment does not occur these areas will need to be seeded with an appropriate seed mix.	The only way to avoid the loss of wetland habitat is to locate the dams in such a way that no wetlands fall within the footprint of the dams. Given the size of the dams required and the extent of wetlands on the Mpumalanga Highveld, it is unlikely that such sites would be found in close proximity to the SSIC. Emphasis should however be placed on limiting the disturbance to wetland habitat falling outside the direct footprint of the proposed FAD 6 and RWD's.

Specialist study	Current Environment	Key Findings				Recommendations
		Pre-Construction	Construction	Operation	Closure	
	within the landscape in which water accumulates following rainfall, and thus represent artificial wetland areas. Some seepage from localised perched water tables might also contribute to water within the quarries. The quarries appear isolated from surrounding wetland systems, though some discharge is possible following heavy rainfall. The three quarries cover roughly 4.8 hectares.	traffic from all areas falling outside the construction servitude.	hectares of wetland habitat. In order to limit seepage and leakage out of the dam, it is recommended that the FAD 6 and RWD's be lined with a suitable engineered liner. In addition, dirty water management infrastructure should ensure that any seepage water out of the FAD 6 that might still occur in spite of the liner be captured and conveyed to the RWD. No dirty water should be allowed to enter any water resource or wetland untreated, and dirty water management infrastructure should comply fully with GN704 at all times. Water quality monitoring points should be installed in all wetlands and water resources that could be potentially affected by the proposed developments. The FAD 6 should be sloped so as to ensure the successful vegetation of the side slopes. Vegetated side slopes will bind the soil and slow down run-off, reducing erosion. In addition, the side slopes should be terraced, to allow for the slowing down of flows on the side slopes and the creation of depositional zones on the side slopes. Eroded sediments are likely to be captured by			Ideally the construction servitude for each of the propose developments should be clearly defined and fenced off prior to the arrival of construction machinery on site. No movement of vehicular or human traffic should be allowed in any wetlands falling outside the defined construction servitude. Construction workers should be informed on the location of the wetland habitats and their sensitivity as part of the induction process prior to starting work on site. Following completion of construction activities a clean-up and rehabilitation program should be implemented for all wetlands located adjacent to the construction servitudes,

Specialist study	Current Environment	Key Findings				Recommendations
		Pre-Construction	Construction	Operation	Closure	
			the dirty water management system and be deposited in the RWD, overtime decreasing the storage capacity of these times and increasing the possibility of overtopping. It is thus recommended that silt traps be installed upstream of all RWD. These silt traps will should be regularly cleaned and maintained in fully working order at all times.			for a minimum of 200m upstream and downstream of the ash dams and RWD.
Traffic Impact Assessment	There are two roads that may be affected by the proposed FAD 6 development. The R546, which is under the Mpumalanga Department of Public Works, Roads and Transport jurisdiction, and the D714 which is under the Govan Mbeki Local Municipality Jurisdiction. The R546 road is a Provincial road linking Kinross, Evader, Secunda (to the north) and Standerton (to the south). The traffic volumes are in the order of 400 vehicles per hour during the AM peak hour and 900 vehicles per hour during	The existing D714/R546 intersection should be retained to provide direct access to the FAD 6. The proposed access should only be used by the workforce for operations and for maintenance purposes.	The minimum sight distance on a roadway should be sufficient to enable a vehicle travelling at the design speed on a wet pavement to stop before reaching a stationery object in its path. The available sight distance from the proposed intersection (R546 / Proposed Branddrift Road) position is at least 400m towards the southern side and 500m towards the northern side, GIS co-ordinate: Long:29°06' 45.33"E, Lat:-26°34'40.72"S. The recommended stopping sight distance for the design speed of 120km/h is 270m according to "Geometric Design Guidelines". Therefore, sufficient stopping sight distance is available from this proposed road. It can then be concluded that no		No findings relevant to the closure activities were identified within the Traffic Impact Assessment. It is assumed that the roads will not be decommissioned, although continuously maintained and monitored.	Along the R546, gravel shoulder lanes are maintained and should be kept as such by the relevant road authority, in recognition of the fact that the road is carrying heavy vehicles. Construction of an additional through left lane, on the southern approach and an exclusive right lane, on the northern approach. The exclusive lanes should be constructed according to Provincial standards, 60m long

Specialist study	Current Environment	Key Findings				Recommendations
		Pre-Construction	Construction	Operation	Closure	
	the PM peak hour (both directions). This road is a tarred, Single Carriageway (1.5m gravel shoulder, 0.3m tarred shoulder and 3.7m lane for both directions) road. The D714 is a Municipal road that provides access to the local farms. It runs on the east-west direction across the farms on the Remainder of Portions 2, 3, 6, 8, 9 and 10 and the remainder of the farm Rietvley 320IS. The road serves as a link between the R546 and the R50. The current peak hour traffic volumes on this 2-lane road are in the order of 10 to 20 vph (both directions). The road is tarred for a distance of 200m from R546 and from R50; the rest of the section is gravel road.		safety issues are envisaged in respect of stopping distance provided normal road rules are obeyed by the motorists. Currently there are no intersections located within 600m from the proposed new intersection (Proposed Branddrift Road/ R546). According to the "Road Access Management" (RAM) (COTO, 2005), the required access spacing along a class 3 arterial road is more than 600m. The nearest intersections from the proposed intersection are situated approximately 1,07km to the north and 1,60km to the south (the existing D714/R546 intersection). Therefore, access spacing is sufficient and no safety issues are envisaged, provided normal road rules are obeyed by the motorists. Typically travel time surveys are carried out over a section of the road network to identify the causes and locations of traffic congestion as well as to measure the before and after impacts on the road network given a traffic management or a physical improvement. Emergency Spillage Clean up procedure should be implemented and tested,			and a 60m tapper. Provision of light at sufficient standards at the intersection of the R546 and the proposed Branddrift Road. No on-street pick-up/drop-offs at the intersection of the R546 and the proposed Branddrift Road should be permitted.

Specialist study	Current Environment	Key Findings				Recommendations
		Pre-Construction	Construction	Operation	Closure	
			should significant pollution risk arise from vehicles utilizing the road. The road should also be continuously maintained and inspected for degradation.			

12 Assessment of Environmental Impacts

12.1 Introduction

This section contains the assessment of potentially significant positive and negative environmental impacts associated with the project. Specific emphasis was placed on the relevant environmental, social and economic impacts raised by the stakeholders as well as the significant impact identified from the specialist studies and professional judgement of the EAP team. The objectives of the specialist studies and further investigation by SRK of each of the potential environmental impacts identified was to determine their significance and to promote mitigation measures to reduce the impacts to an acceptable level where required.

Each of the identified impacts is assessed in a separate section. Considering the general nature of the proposed project each section will take cognisance of the construction and operational phases as well as the different Alternatives. This is intended to:

- Allow the comparison of the various alternatives of the proposed project, facilitate the comparison of the alternatives and to identify the preferred alternative during the decision making process of the MDEDET and DEA; and
- Enable stakeholders to understand the potential impact of the project in their specific area.

All potential environmental impacts have been addressed in this section, according to the adopted methodology for assessing impacts as described in Section 9.

12.2 Environmental Issues identified for the project

Key positive and negative environmental issues relating to the proposed project were identified based on the finding from the specialist studies, I&AP's responses from the Screening and Scoping studies, as well as the professional judgement from the Environmental team conducting the EIA. The following potentially significant environmental issues relating to the proposed development were identified:

- **Socio – Economic Impact:** Impact on economic status due to the prolonged activities of Sasol Group of Companies as well as maintaining the current employment statistics.

The positive impact resulting in the construction of the FAD 6 relates to the continual operation of the SSIC and associated mines. Ash generated at the SSIC is required to be stored of in a safe manner in order to maintain optimal production and operation. Without the construction of an additional facility for the disposal of fine ash, the SSIC and associated mines will be faced with compulsory closure due to the inability to operate.

- **Surface Water Quality:** Possible deterioration of surface water in the surrounding area as a result of:
    - Sedimentation caused by an increase in runoff from the cleared areas or from topsoil stockpiles;
    - Poor lateral drainage of access roads and FAD 6 base preparation where stormwater may pond alongside roads and preliminary construction berms;
    - Soil compaction, causing an increase in runoff during rainstorm events; and
    - Discharge from the RWD, CAE and FAD.

- **Ground Water Quality:** Possible deterioration of ground water in the surrounding area as a result of:
    - Seepage of water through the FAD6 and RWD to the underlining aquifer; and
    - Contaminated runoff decanting into the groundwater table.
- **Waste Impacts:** Potential pollution resulting from waste generated on the FAD 6 site as well as the waste water streams running to and from the FAD 6.
- **Air Pollution**: Potential deterioration of Air Quality due to the generation and dispersion of dust caused by construction activities, as well as during operation phase due the nature of the ash and the percentage of this that will remain dry.
- **Visual Impact**: Potential deterioration of the visual quality of the site during construction and life time of the FAD 6. The visual quality of the landscape can further be altered through the generation of dust during construction and operation.
- **Cultural and Heritage Impacts:** Potential deterioration of cultural artefacts, buildings and graves within the footprint of the proposed FAD 6. Construction activities may overturn currently unidentified historical artefacts.
- **Noise Impact:** Possible increase in noise levels due to the presence of construction vehicles and additional activities taking places within the immediate surroundings.
- **Topography Impact:** The impact on the topography of the area is evident as a result of the construction of the FAD 6 to a maximum height of 40 m.
- **Agricultural Impact:** Impact of the loss of agricultural lands due to the construction of the FAD 6 on land with some agricultural potential.
- **Floral Impact**: Potential loss of indigenous vegetation as a result of construction activities and loss of land relating to the construction of the FAD 6.
- **Faunal Impact**: Potential disturbances and loss of habitat as a result of construction activities of the FAD 6 and the overall replacement of land.
- **Wetland Impact:** Possible loss of wetland areas as well as associated ecosystem habitats. With the diversion of the streams around the FAD 6 and the mitigation of potential water pollution, it is expected that the ecosystems and wetland areas will re define themselves as a result of the undulating topography in the area.
- **Traffic Impact:** Potential impacts due to the increase in traffic volumes along the R546 and re - aligned D417 as a result of construction activities and continual maintenance of the FAD and associated infrastructure.
- **Geological Impact:** The possible impact on the geological formations in the area, however this is expected to be low as a result of the undermining activities that have taken place beneath the footprint.
- **Dam Safety and Undermining Impact:** The possible impact on the undermining activities in the area resulting in subsidence of the topography leading to dam failure.

12.3 Specialist Studies Undertaken

A number of specialist studies were employed to inform the EIA / EMP during the assessment of the FAD 6. The studies that were commissioned for the assessment were the following:

- Surface Water Assessment - Dr. Andrew Wood.
- Hydrogeological Assessment - Grant Theu.
- Air Quality Assessment - Vis Ready / Dhiren Naidoo.
- Heritage Assessment - Francois Coetzee.
- Vegetation Assessment - Professor GJ Bredenkamp.
- Mammal Assessment - IL Rautenbach.
- Avifaunal Assessment - AC Kemp.
- Herpetofauna Assessment - JCP van Wyk.
- Wetland Assessment - Dieter Kassier.
- Traffic Assessment - Pieter Pretorius.

Each of the specialist studies assessed the impacts of both the location alternatives as well as the "No – Go" option. All specialists were required to rate the significance of the anticipated impacts and to recommend mitigation measures.

12.4 Socio – Economic Impacts

In the absence of FAD 6 the SSIC would not be able to continue in operation, with associated major socio-economic consequences to the local region and nationally in South Africa. It is planned that the SSIC will continue as primary coal gasification and integrated organic chemicals plant for at least the next 25 years, and will therefore require facilities to store of the waste ash generated by the coal gasification and associated boiler operations. Due to the nature of the fine ash, there are engineering limitations on suitable disposal facilities, and new facilities are required to accommodate on-going fine ash production.

12.4.1 Impact on Employment

Synfuels employ a large number of people, leading to the establishment of the town of Secunda. Without the operation of the construction of the FAD 6, Synfuels operations will ceases following FAD 6 4 and 5 reaching its capacity. The Govan Mbeki is currently sitting with a 40% unemployment rate, which will drastically increase should the FAD 6 not commence.

Impact Rating and Mitigation – Construction and operation

Although significant employment may be possible during construction, employment during operational activities will be limited. Operational crew from the current FAD 6 sites will be utilized during operation. This impact will have a positive influence during construction.

The severity of this impact will be positively significant with a local spatial extent. The duration of the impact will be only during construction, therefore only for a period of between one and ten years.

The frequency of the activity will be temporary. The frequency of the impact will regularly. This impact has LOW MEDIUM rating pre mitigation. With the implementation of mitigation measures this impact can be positively rated as MEDIUM HIGH. The details of this rating are stipulated in Table 12-1.

Table 12-1: Impact on Employment

Impact Alternative 1 and 2: Impact on Employment		
Severity	**Spatial extent**	**Duration of impact**
3	3	3
4	4	3
Consequence rating: 9 (unmitigated)		
Consequence rating: 11 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
3	4	
3	4	
Likelihood rating: 7 (unmitigated)		
Likelihood rating: 7 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 63 – LOW MEDIUM		
SIGNIFANCE RATING (UNMITIGATED): 77 – MEDIUM HIGH		
Comments/mitigation: • Encourage the local employment for the following: o Employment opportunities for local contractors during site clearance, preparation, construction and decommissioning; o Secondary service provision of food, toilet hires, and equipment; and o Appointment of contractors as drivers, cleaners and security personnel.		

12.5 Surface Water Impacts

Potential discharges to surface water systems could occur from breaches of the fine ash piping and drainage systems, and spillages during handling and transportation of the ash, return water and brine to/from the FAD 6. The FAD 6 will be engineered to meet compliance with regulations and established engineering practices, including the segregation of clean and dirty water areas, capture of seepage and surface run-off and recovery into the Synfuels process water circuit. Pump stations are located in bunded areas draining to sumps from where any spillage can be recovered within the process. There is little likelihood of any significant water or waste from the FAD 6 entering surface water systems.

Secunda is a water scarce area and there is reportedly no surface water available for any new industrial developments in the area and inter-basin transfers are the only viable means to ensure sufficient water supplies to the region.

Raw water for the SSIC is obtained from the Bosjesspruit Dam immediately adjacent to the SSIC which forms part of the DWA supply infrastructure to Synfuels. Supply to the Bosjesspruit Dam is through the Grootdraai Dam and the new VRESAP supply from the Vaal river system.

The recent VRESAP supply to Bosjesspruit Dam has been provided by DWA to supplement the water supply to the SSIC. The VAALSAP water supply will allow Synfuels to reduce the water allocation from Rand Water and Grootdraai Dam.

The main activities identified during the construction phase that have potential to impact surface water resources include:

- Site clearance;

- Establishment of site access roads and perimeter fencing;
- Establishment of contractors camp and lay-down areas;
- Removal of the vegetation and redundant current infrastructure;
- Removal and stockpiling of the topsoil;
- Earthworks and excavation of foundations for infrastructure e.g. roads, power lines, pipelines etc;
- Provision of clean and dirty stormwater management measures, including diversion of resident minor non-perennial water courses;
- Construction of concrete structures, pump stations and laying of pipelines;
- Laying of water and fine ash pipelines;
- Construction of the process water dam Phase 1 and FAD 6; and
- Rehabilitation of disturbed areas after general site construction is completed.

12.5.1 Impact on Surface water quality due to runoff from cleared areas

Surface water quality in the catchment may be impacted upon during site clearing and construction of the FAD 6 infrastructure and FAD 6 itself, with associated process water and CAE dams:

- Sedimentation caused by an increase in runoff from the cleared areas or from topsoil;
- Stockpiles which are high in suspended solids;
- Poor lateral drainage of access roads and FAD 6 base preparation where storm water may pond alongside roads and preliminary construction berms; and
- Soil compaction, causing an increase in runoff during rainstorm events.

Impact Rating and Mitigation – Construction and Operation

Sedimentation and increase in turbidity due to soil erosion and runoff from FAD 6 and cleared areas will continue from the construction and operational phase thus will be addressed as a single impact throughout both phases of the project.

The boundaries of the study area for FAD 6 are situated approximately 5 kilometres away from the Grootspruit and Trichardt Spruit and >15 km from the Waterval River. The overall topography is generally flat with local drainage lines within the FAD 6 footprint area. Water tends to pond and soaks away on flat areas and flows away where drainage courses exist.

Water runoff from the access roads may result in contamination due to dust suppression resulting in sedimentation and ponding of water. The impact will have a low significance as the impact will be contained to the immediate site; it will be for the duration of the project but will be reversible once mining activities stop.

Therefore the probability that contaminated runoff from the FAD 6 operational area will reach the Grootspruit, Trichardt Spruit or Waterval River via surface water drainage channels during the construction phase is considered possible, if not appropriately mitigated. The primary impact will be contained to the immediate area of the FAD 6 footprint. Although the impact will be of short duration during a storm event and sometime thereafter it will continue throughout the project thus the impact is considered for the duration of the project.

Should the impact materialise it will deteriorate the functionality of the surface water which could make it unfit for use by any other water user. This may be the case during the dry winter months

when the site drainage courses are dry and the water reaching the water courses will be the only source. The potential impact will further be easily reversible since the NWA requires that appropriate clean and dirty water segregation.

The overall impact has been rated as having MEDIUM LOW significance and can be mitigated to a LOW MEDIUM as illustrated in Table 12-2. The probability that the impact may occur remains likely particularly associated with the need to divert existing water courses around the FAD 6 footprint.

Table 12-2: Impact on Surface water Quality – Construction and Operation

Impact Alternative 1 and 2: Impact on Surface water quality due to increased runoff.		
Severity	**Spatial extent**	**Duration of impact**
4	3	4
2	3	4
Consequence rating: 11 (unmitigated)		
Consequence rating: 9 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
4	4	
3	4	
Likelihood rating: 8 (unmitigated)		
Likelihood rating: 7 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 88 – MEDIUM – HIGH		
SIGNIFANCE RATING (MITIGATED): 63 – LOW MEDIUM		
Comments/mitigation: • Ensure the clean and dirty water segregation as per the NWA requirements; • Clean stormwater will be diverted away from the FAD 6 operational areas by cut-off channels and diversion berms designed to handle the 1:50 year storm event; • Water containment facilities (process water dam and clear ash effluent dam, FAD 6, drainage systems etc.) will be designed, constructed, operated and maintained to have a minimum freeboard of 0.8 metres above full supply level; • Contaminated runoff water, generated during rainstorm events, on the operational footprint area will be contained in specifically designed structures to enable sedimentation and desilting of the runoff; • FAD 6 will be provided with an engineered base as provided for the current FAD 6 5 extension, as a minimum, as a barrier to excessive infiltration to groundwater, with provision of under-drainage; • Maintain current monitoring and management of the overall WADS system.		

12.5.1 Impact on Surface water quality due to spillages

As a result of construction and operation activities, there is a potential that spillages may occur on or nearby the site. This may result in the contamination of surface water runoff, with a consequence of deteriorating the water quality of nearby water courses. The probability that spillages and runoff from the bunded area within the contractors laydown and vehicle maintenance areas will result in the contamination of surface water is unlikely. Contaminated water will be contained on site; spillages are expected to be remediated immediately therefore the impact will be for a short duration although the impact is considered for the duration of the construction phase.

Impact Rating and Mitigation – Construction and Operation

Surface water quality may be impacted on by the FAD 6 development activities due to accidental spillages of hazardous substances. Should the impact occur it will reduce the functionality of the surface water but it will still be able to function in its modified way, thus having a moderate intensity potential. This impact will be carried over from the construction phase, and therefore addressed for both phases of the project.

The severity of the impact may be considered to be potentially harmful with a local site specific spatial scale. The duration of the impact will continue throughout the construction phase and be reduced during operation and closure.

With the construction of the FAD 6 the likelihood of the impact will be increased due to the increase in usage of hydrocarbon substances from earth moving and construction equipment as well as the transport thereof. Other possible sources of hydrocarbon spillages may result for the transport of personnel to and from the site, storage of hazardous substances on site (included chemical toilets) as well as the possible ammonia nitrate originating from blasting activities. The frequency of the activity is considered to be infrequent, and the frequency of the impact to be seldom. The overall significance of impacts associated with spillages was considered to be LOW as depicted in Table 12-3.

The impact of spillages on the surface water quality in the area is considered to be manageable and can be contain to the site through immediate remediation.

Table 12-3: Impact on Surface water Quality due to spillages – Construction and Operation

Impact Alternative 1 and 2: Impact on Surface water quality due to spillages		
Severity	**Spatial extent**	**Duration of impact**
2	2	3
2	1	3
Consequence rating: 7 (unmitigated)		
Consequence rating: 6 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
2	3	
2	2	
Likelihood rating: 5 (unmitigated)		
Likelihood rating: 4 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 35 – LOW		
SIGNIFANCE RATING (MITIGATED): 24 – VERY LOW		
Comments/mitigation: • Spill kits to be made available at areas of possible spillages of hazardous substances; • Remediation of spillages must be conducted on a continual basis; • Contaminated runoff will be contained and re used where necessary; and • Maintain current monitoring and management of the overall WADS system.		

12.5.1 Impact on Surface Water Quality by Stormwater Management

Activities taking place during the construction and operation phase of the project will result in the volume increase of dirty water that needs to be managed. This impact can be sufficiently managed as long as sufficient containment areas are provided.

Impact Rating and Mitigation – Construction

Stormwater management is one of the key issues that must be addressed in the surface water control. Due to the clearing of land of vegetation and topsoil for construction purposes, construction of access roads, construction camps and the FAD 6 area and the compaction of soil, contaminated runoff from these areas will definitely increase resulting in an increase of the volume of contaminated water that needs to be handled on the FAD 6 footprint. This water will be concentrated and either flow away or pond until it evaporates. Prior to construction the runoff would have infiltrated to the groundwater therefore this is not available to the groundwater anymore thus resulting in an impact with a moderate high intensity potential. The impact will be contained to site due to natural conditions that promotes ponding rather than flowing away of water provided there is not a continuous flow of water from site. This impact will occur throughout the life time of the project. The impact was rated as having an overall significance of MEDIUM – HIGH and can be mitigated to a LOW MEDIUM as set out in Table 12-4.

Table 12-4: Impact on Water Quality by Stormwater management – Construction

Impact Alternative 1 and 2: Impact on Water Quality by Stormwater management		
Severity	**Spatial extent**	**Duration of impact**
4	2	4
3	2	4
Consequence rating: 10 (unmitigated)		
Consequence rating: 9 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
4	5	
4	4	
Likelihood rating: 9 (unmitigated)		
Likelihood rating: 8 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 90 – MEDIUM – HIGH		
SIGNIFANCE RATING (MITIGATED): 72 – LOW MEDIUM		
Comments/mitigation: • Ensure the clean and dirty water segregation as per the NWA requirements; • Clean stormwater will be diverted away from the FAD 6 operational areas by cut-off channels and diversion berms designed to handle the 1:50 year storm event; • Water containment facilities (process water dam and clear ash effluent dam, FAD 6, drainage systems etc) will be designed, constructed, operated and maintained to have a minimum freeboard of 0.8 metres above full supply level; • Contaminated runoff water, generated during rainstorm events, on the operational footprint area will be contained in specifically designed structures to enable sedimentation and desilting of the runoff; • Stormwater will be concentrated and either flow away or pond until evaporated; and • Maintain current monitoring and management of the overall WADS system.		

Impact Rating and Mitigation – Operation

The rainfall water within the designated dirty water area of FAD 6 that forms part of the MAR to the local water courses will be removed from the catchment this will result in a low intensity potential on the local surface water resource. The probability that the impact will be contained to the site, and will occur for the duration of the project is definite. Therefore this impact is rated as having a MEDIUM –

HIGH significance rating. This impact cannot be mitigated to a lower significance because the probability that the impact will manifest remains definitely as described in Table 12-5.

Table 12-5: Impact on stormwater management by the removal of water from the catchment

Impact Alternative 1 and 2: Impact on stormwater management by the removal of water from the catchment		
Severity	**Spatial extent**	**Duration of impact**
4	2	4
4	2	4
Consequence rating: 10 (unmitigated)		
Consequence rating: 10 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
4	4	
4	4	
Likelihood rating: 8 (unmitigated)		
Likelihood rating: 8 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 80 – MEDIUM – HIGH		
SIGNIFANCE RATING (MITIGATED): 80 – MEDIUM - HIGH		
Comments/mitigation: • Maintain effective management		

Table 12-6: Positive impact on the reduction in MAR

Impact Alternative 1 and 2: Positive impact on the reduction in MAR		
Severity	**Spatial extent**	**Duration of impact**
5	3	5
5	3	5
Consequence rating: 13 (unmitigated)		
Consequence rating: 10 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
4	4	
4	4	
Likelihood rating: 8 (unmitigated)		
Likelihood rating: 8 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 104 – HIGH		
SIGNIFANCE RATING (MITIGATED): 104 – HIGH		
Comments/mitigation: • Maintain effective management.		

Stormwater management is a key concern in the management of surface water on the FAD 6 footprint, although it is recognised that legislative requirements and licence conditions will ensure that the FAD 6 water management systems will be designed and operated to mitigate such risks. The operational area will be developed in phases and rehabilitated on an on-going basis therefore

keeping the cleared areas as small as possible. Although the impact is contained to site the probability that the impact will occur is definite and will occur for the life of FAD 6, thus having an impact with an overall MEDIUM HIGH significance. The probability that the impact will occur is likely, because the design and operation of FAD 6 will be controlled by legislative and licence conditions.

12.5.1 Impact as a result of lack of stormwater management

As a result of operational activities associated with the FAD 6 development the control of stormwater originating on site is of utmost importance.

Impact Rating and Mitigation – Operation

The potential could exist, should the proposed mitigation and management not be implemented, that excess water cannot be contained on site and will need to be discharged to the environment. This would have a moderate high potential intensity should the water reach the Grootspruit, Trichardt Spruit or Waterval River resulting in the deterioration of the functionality of the surface water which makes it unfit for use by any other water user. The impact will be contained to site and the duration of the impact will be of short duration although it can reoccur throughout the life of the mine. The overall impact is therefore rated as an impact with a MEDIUM HIGH impact. This impact can be mitigated to a lower rating of LOW MEDIUM considering the mitigations measures are implemented. The significance rating is depicted in Table 12-7.

Table 12-7: Impact as a result of lack of stormwater management

Impact Alternative 1 and 2: Impact as a result of lack of stormwater management		
Severity	**Spatial extent**	**Duration of impact**
4	3	4
2	2	4
Consequence rating: 11 (unmitigated)		
Consequence rating: 8 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
4	4	
4	3	
Likelihood rating: 8 (unmitigated)		
Likelihood rating: 7 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 88 – MEDIUM – HIGH		
SIGNIFANCE RATING (MITIGATED): 56 – LOW MEDIUM		
Comments/mitigation: • Ensure the clean and dirty water segregation as per the NWA requirements; • Clean stormwater will be diverted away from the FAD 6 operational areas by cut-off channels and diversion berms designed to handle the 1:50 year storm event; • Water containment facilities (process water dam and clear ash effluent dam, FAD 6, drainage systems etc.) will be designed, constructed, operated and maintained to have a minimum freeboard of 0.8 metres above full supply level; • Contaminated runoff water, generated during rainstorm events, on the operational footprint area will be contained in specifically designed structures to enable sedimentation and desilting of the runoff; • FAD 6 will be provided with an engineered base as provided for the current FAD 6 5 extension, as a minimum, as a barrier to excessive infiltration to groundwater, with provision of under-		

drainage; and

- Maintain current monitoring and management of the overall WADS system.

12.5.1 Impact on Assurance of supply

The availability of water for construction purposes is of low significance. FAD 6 will be integrated into the existing WADS system, and construction water demands are low.

Impact Rating and Mitigation – Construction and Operation

This impact is rated as an impact with LOW significance. Temporary bouser water supply for construction purposes can be available from the existing WADS system, and bottled potable water supply for construction workers. Therefore the impact remains of LOW significance. During operations water for the ashing process and dust suppression will be available from the existing WADS system. The project will not increase the overall water demand for ash disposal, but will transfer the water demand from the current ash disposal to FAD 4 and 5 to FAD 6. The dirty water contained within the FAD 6 footprint will be reused to ensure that makeup water is kept to a minimum. This impact has an initial rating of LOW as illustrated in Table 12-8.

Table 12-8: Impact assurance of supply – Construction and Operation

Impact Alternative 1 and 2: Impact on assurance of Supply		
Severity	**Spatial extent**	**Duration of impact**
2	3	4
2	3	4
Consequence rating: 9 (unmitigated)		
Consequence rating: 9 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
2	2	
2	2	
Likelihood rating: 4 (unmitigated)		
Likelihood rating: 4 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 36 – LOW		
SIGNIFANCE RATING (MITIGATED): 36 – LOW		
Comments/mitigation: • Temporary bouser water supply for construction purposes can be available from the existing WADS system, and bottled potable water supply for construction workers.; • During operations water for the ashing process and dust suppression will be available from the existing WADS system. The project will not increase the overall water demand for ash disposal, but will transfer the water demand from the current ash disposal to FAD 4 and 5 to FAD 6; • The dirty water contained within the FAD 6 footprint will be reused to ensure that makeup water is kept to a minimum; and • Maintain current monitoring and management of the overall WADS system.		

12.5.1 Impact on Surface water due to overflow of process and CAE dams

Contaminated runoff water from the FAD 6 operational area during a rainstorm event will be contained in the process water and CAE dam system. Should the dam/s overflow during a storm

event in excess of a 1:50 storm event the water will enter the environment but it is unlikely that the water will reach the Grootspruit, Trichardt Spruit or Waterval River at material levels due to the engineering controls provided for the FAD 6 system.

Spillage from the process water and CAE dams during storm events may result in erosion and sedimentation transfer to the receiving environment.

Impact Rating and Mitigation –Operation

These incidents can occur throughout the life of the FAD 6 and therefore the impact is considered for the operations phase. The environmental impact on the surface water quality will have a low significance, since the receiving environment would also be in flood under such circumstances that the dams overflow and the direct impact will be mitigated.

Continuous overflow from process water and CAE dams which contains contaminated water can result in the formation of channels and the formation of drainage lines and resulting in the water reaching the Grootspruit, Trichardt Spruit or Waterval River. Should this happen the impact will have a moderate high intensity potential resulting in the deterioration of the functionality of the surface water which makes it unfit for use by any other water users. This impact will be contained to site, that is within 10 km of the source, and may occur throughout the life of the project. The probability that the pollution control dams can overflow is likely in extreme rainfall events. The overall significance of the impact is rated as being MEDIUM – HIGH.

The impact will be contained on site due to the natural conditions which promotes ponding of water rather than flowing away. This impact may re-occur during the duration of the operational phase. The probability that erosion will occur is unlikely due to the legislated requirements for FAD 6 design and operation and the overall impact on surface water quality due to the over flowing of the process water and CAE dams can be mitigated to an overall rating of LOW considering the mitigations measures are implemented as illustrated in Table 12-9.

Table 12-9: Impact on contamination of surface water overflow of the process water and CAE dams – Operation

Impact Alternative 1 and 2: Impact on contamination of surface water overflow of the process water and CAE dams		
Severity	**Spatial extent**	**Duration of impact**
4	3	4
2	2	4
Consequence rating: 11 (unmitigated)		
Consequence rating: 8 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
4	3	
2	2	
Likelihood rating: 7 (unmitigated)		
Likelihood rating: 4 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): – 77 MEDIUM – HIGH		
SIGNIFANCE RATING (MITIGATED): 32 LOW		
Comments/mitigation: • Ensure the clean and dirty water segregation as per the NWA requirements; • Clean stormwater will be diverted away from the FAD 6 operational areas by cut-off channels		

and diversion berms designed to handle the 1:50 year storm event;

- Water containment facilities (process water dam and clear ash effluent dam, FAD 6, drainage systems etc) will be designed, constructed, operated and maintained to have a minimum freeboard of 0.8 metres above full supply level;
- Contaminated runoff water, generated during rainstorm events, on the operational footprint area will be contained in specifically designed structures to enable sedimentation and desilting of the runoff; and
- Maintain current monitoring and management of the overall WADS system.

12.5.1 Impact on leachate generated from the FAD 6

Leachate generated from FAD 6 and the water systems as well as the runoff from these systems can have an impact on the surface water. The potential impact will occur for the duration while the FAD 6 is in development and subsequently when the FAD 6 is decommissioned and closed.

Impact Rating and Mitigation –Operation

The primary impact will be contained on site and will have a moderate intensity potential should the impact manifest with a probability of being moderate likelihood. Therefore the impact was rated as MEDIUM HIGH and can be sufficiently mitigated to LOW considering the mitigations measures are implemented. The details of the ratings are provided in Table 12-10.

Table 12-10: Impact on leachate generated from the FAD 6

Impact Alternative 1 and 2: Impact on leachate generated from the FAD 6		
Severity	**Spatial extent**	**Duration of impact**
4	3	4
2	2	4
Consequence rating: 11 (unmitigated)		
Consequence rating: 8 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
4	3	
2	2	
Likelihood rating: 7 (unmitigated)		
Likelihood rating: 4 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): – 77 MEDIUM – HIGH		
SIGNIFANCE RATING (MITIGATED): 32 LOW		
Comments/mitigation: • The FAD 6 system is to be operated to ensure that the accumulation of water in the pool area does not present a stability risk and that drainage of pool water accommodates the 1:50 year flood event; • The process water control dam is to be operated to ensure that the 1:50 year flood event is contained plus free-board at full operating level of 0.8 m; • The process water control dam and the clean ash effluent dam (return water dam) are to be provided with a formal engineered liner system appropriate to the containment of impacted waters for reuse purposes; • The FAD 6 will be provided with formal engineered drainage and seepage collection systems appropriate to the collection of impacted waters for reuse purposes; • The FAD 6 system will be compliant to Regulation 704 in diverting clean water from the upper catchment area around the site to the natural environment, and containing dirty water within the FAD 6 water management system;		

- The clean ash effluent/return water dam is to be operated to ensure that the 1:50 year flood event is contained plus free-board at full operating level of 0.8 m in balance with appropriate drainage control from the pen-stock and recovery of water to the SSIC; and
- CAE will be recycled to the SSIC.

12.5.2 Impact on the spillage of ash and/or process and return clear ash effluent

Operational activities of the FAD 6 will include a piped system transferring effluent from the FAD 6, process water and CAE dams. This increases the risk of spillages from the piped system during the life of operation of the FAD 6.

Impact Rating and Mitigation –Operation and Closure

Contamination due to spillages of ash and/or process and return CAE from the piped transfer systems was rated as MEDIUM HIGH significance as the flow could be significant in terms of the non-perennial nature of local water courses. Spillage external to the controlled area of FAD 6 could occur for the duration of the project and it is likely that the contamination may reach the receiving water environment. Should this occur the functionality of the surface water will be reduced but will continue in a modified way. This impact rating of this impact is illustrated in Table 12-11.

Table 12-11: Impact on leachate generated from the FAD 6

Impact Alternative 1 and 2: Impact on leachate generated from the FAD 6		
Severity	**Spatial extent**	**Duration of impact**
4	4	4
3	3	4
Consequence rating: 12 (unmitigated)		
Consequence rating: 10 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
5	2	
5	2	
Likelihood rating: 7 (unmitigated)		
Likelihood rating: 7 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): – 84 MEDIUM – HIGH		
SIGNIFANCE RATING (MITIGATED): 70 LOW – MEDIUM		
Comments/mitigation: • The FAD 6 system is to be operated to ensure that the accumulation of water in the pool area does not present a stability risk and that drainage of pool water accommodates the 1:50 year flood event; • The process water control dam is to be operated to ensure that the 1:50 year flood event is contained plus free-board at full operating level of 0.8 m; • The process water control dam and the CAE dam (RWD) are to be provided with a formal engineered liner system appropriate to the containment of impacted waters for reuse purposes; • The FAD 6 will be provided with formal engineered drainage and seepage collection systems appropriate to the collection of impacted waters for reuse purposes; • The FAD 6 system will be compliant to Regulation 704 in diverting clean water from the upper catchment area around the site to the natural environment, and containing dirty water within the FAD 6 water management system; • The CAE/RWD is to be operated to ensure that the 1:50 year flood event is contained plus free-board at full operating level of 0.8 m in balance with appropriate drainage control from the pen-		

stock and recovery of water to the SSIC; and

- CAE will be recycled to the SSIC.

12.5.3 Impact due to the change of hydrology in a water course

Operational activities of the FAD 6 will include a piped system transferring effluent from the FAD 6, process water and CAE dams. This increases the risk of spillages from the piped system during the life of operation of the FAD 6.

Impact Rating and Mitigation –Operation

Several non-perennial water courses exist within the footprint area of FAD 6 which captures water during rainfall events, but most of the time they are dry. The hydrology of these water courses will have to change to allow the development of FAD 6, and clean water diversions will be required to route catchment water around FAD 6. The impact will have a moderate impact on the functionality of the local surface water courses and reduce overall flow volumes. The impact will be localised but will remain throughout the life of FAD 6. The probability that local water courses will be diverted and will not carry the water falling directly on the FAD 6 footprint and considered dirty water, is definite. Thus the overall significance of the impact is rated as an overall MEDIUM HIGH. The impacts could be mitigated to LOW significance considering the mitigations measures are implemented where the clean water diversions continue to route the majority of catchment water into the local water courses. This impact rating is illustrated in Table 12-12.

Table 12-12: Impact on the change of hydrology in a water course

Impact Alternative 1 and 2: Impact on the change of hydrology in a water course		
Severity	**Spatial extent**	**Duration of impact**
4	4	4
2	2	4
Consequence rating: 12 (unmitigated)		
Consequence rating: 8 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
5	2	
4	2	
Likelihood rating: 7 (unmitigated)		
Likelihood rating: 6 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): – 84 MEDIUM – HIGH		
SIGNIFANCE RATING (MITIGATED): 48 LOW		
Comments/mitigation: • Water courses will be diverted as per the WUL conditions therefore will not carry the water falling on the FAD 6, which is considered dirty water; and • Clean water diversions will be constructed in order to route the majority of catchment water into the local water courses.		

12.5.4 Closure Phase of the FAD 6 and associated infrastructure

During the closure and decommissioning phase of FAD 6 the CAE dams lining and associated infrastructure will be removed and the footprint area rehabilitated as with the FAD 6 being vegetated to manage on-going dust generation and erosion. FAD 6 will remain in-situ.

The surface water quality should not be further impacted by any of the closure and decommissioning activities of FAD 6 as it will be restricted to the already disturbed area.

Spillages of hazardous substances (e.g. hydrocarbons and oils) from earthmoving equipment and sedimentation and increase in turbidity are impacts that could occur during the decommissioning and closure of FAD 6, but the impact was rated as having a LOW significance.

12.6 Geohydrology Impacts

Potential discharges to ground surface, and subsequently impact on the groundwater system, could occur from breaches of the piping and drainage systems, and spillages during handling and transportation of the wastes to/from FAD 6, and potentially from seepage through the disposal site.

The FAD 6 will be engineered to meet compliance with regulations and established engineering practices, including appropriate management of potential seepage and leachate collection, segregation of clean and dirty water areas, capture of seepage and surface run-off and recovery into the Synfuels process water circuit. Pump stations are located in bunded areas draining to sumps from where any spillage can be recovered within the process.

There is a likelihood of water or waste from the FAD 6 coming into contact with ground, and subsequently impacting on groundwater. Spill containment and management measures will be in place to contain leakages and spills and quickly remove their potential risk to soil and groundwater contamination. No serious impacts are anticipated during the operation phase but appropriate measures have been put in place to monitor the groundwater quality.

Groundwater in a geological aspect of a site is typically associated with weathered bedrock and the presence of dykes and faults. As groundwater moves closer to a stream or wet areas, the water may be associated with the presence of alluvial deposits.

There are two main aquifers underlying the area, namely:

- Shallow weathered aquifer at a depth of between 12 and 35 m.b.g.l. At FAD 6, the depth of weathering is 25 m.b.g.l, but was noted to be dry; and
- Deep fractured aquifer has been reported at depths of between 60 and 80 m.b.g.l. This zone was not targeted for the FAD 6 investigation due to the under mining that takes place beneath some portions of FAD 6.

12.6.1 Seepage impact on groundwater quality

During the operational phase of the FAD 6, there will be a steady load of ash slurry discharged to FAD 6 with potential to infiltrate into the groundwater systems. It is expected that over the life of FAD 6, the production procedure and the quality of the ash transport media will remain the same. Synfuels are however investigating the potential to reduce the pollution potential of the ash along its course of disposal.

Impact Rating and Mitigation – Construction and operation

Constructional and operation activities pose a risk that saline, metal rich seepage will occur impacting on groundwater quality. This will be in contravention of the licence requirements.

The severity of the impact is considered to be great as a decrease in groundwater quality in the area may lead to health impacts as well as impacting the quality of the Grootspruit. The spatial scope of the impact may be considered regional as groundwater quality may further impact the regional area whereby a number of water users may be present. The duration of the impact will be during the life of operation. As long as ash is stored of on top of the dam will there be a possibility of saline and metal rich seepage, if not appropriately mitigated and managed.

The frequency of the activity will be infrequent and the frequency of the impact will be possible. This impact has an initial rating of MEDIUM HIGH which can be mitigated to LOW considering the mitigations measures are implemented. The impact rating of this impact is illustrated in Table 12-13.

Table 12-13: Seepage Impact on groundwater quality – Construction and Operation

Impact Alternative 1 and 2: Seepage Impact on groundwater quality		
Severity	**Spatial extent**	**Duration of impact**
4	4	4
2	2	3
Consequence rating: 12 (unmitigated)		
Consequence rating: 7 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
3	4	
3	4	
Likelihood rating: 7 (unmitigated)		
Likelihood rating: 7 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 84 MEDIUM – HIGH		
SIGNIFANCE RATING (MITIGATED): 49 – LOW		
Comments/mitigation: • Reduce infiltration rates into the underlying aquifer through a combination of engineered mitigation and management measures to reduce seepage rate to the underlying aquifer; • Installation and operation of seepage interception trenches at the toe of FAD 6 to reduce plume migration and prevent plume from day lighting in the Grootspruit; • Continual groundwater monitoring program to include the FAD 6 footprint; and • Utilising the available storage facilities to manage the water intercepted at the toe of FAD 6.		

Impact Rating and Mitigation – Closure

Once ash is no longer discharged to FAD 6 at the end of life, the site will be decommissioned and closed in terms of the legislative requirements. In terms of risk posed by FAD 6, the risk will be reduced over time as the potential contaminants are diluted and or naturally attenuated over time. With management options in place, the risk is expected to reduce even further.

This impact relates to the risk that saline, metal rich seepage impacts on groundwater quality, in contravention of the licence requirements, potentially exposing groundwater users to health impacts and impacting on the quality of the Grootspruit. This risk will reduce when disposal is no longer taking place at the end of life.

The severity of the impact is considered to be great as a decrease in groundwater quality in the area may lead to health impacts as well as impacting the quality of the Grootspruit. The spatial scope of the impact may be considered regional as groundwater quality and the quality of the Grootspruit may

further impact the regional area whereby a number of water users may be present. The duration of the impact will be during the life of operation. As long as ash is stored of on top of the dam will there be a possibility of saline and metal rich seepage.

The frequency of the activity will be infrequent and the frequency of the impact will be possible. This impact has an initial rating of MEDIUM HIGH which can be mitigated to LOW considering the mitigations measures are implemented as illustrated in Table 12-14.

Table 12-14: Seepage Impact on groundwater quality – Closure

Impact Alternative 1 and 2: Seepage Impact on groundwater quality		
Severity	**Spatial extent**	**Duration of impact**
4	4	3
2	2	3
Consequence rating: 11 (unmitigated)		
Consequence rating: 8 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
3	4	
3	4	
Likelihood rating: 7 (unmitigated)		
Likelihood rating: 7 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 77 MEDIUM – HIGH		
SIGNIFANCE RATING (MITIGATED): 48 – LOW		
Comments/mitigation: • Reduce infiltration rates into the underlying aquifer through a combination of engineered mitigation and management measures to reduce seepage rate to the underlying aquifer; • Installation and operation of seepage interception trenches at the toe of FAD 6 to reduce plume migration and prevent plume from day lighting in the Grootspruit; and • Utilising the available storage facilities to manage the water intercepted at the toe of FAD 6.		

12.6.2 Impact of runoff on the Grootspruit

This impact relates to the risk that seepage from the FAD 6 may contain salts and heavy metals, which if discharged from the FAD 6 and water management infrastructure could impact on the quality of the Grootspruit. Saline, metal rich seepage runoff may potentially impact on Grootspruit water quality.

Impact Rating and Mitigation – Construction and Operation

The severity of the impact is considered to be great as a decrease in groundwater quality in the area may lead to health impacts as well as impacting the quality of the Grootspruit. The spatial scope of the impact may be considered regional as groundwater quality may further impact the regional area whereby a number of water users may be present. The duration of the impact will be during the life of operation. As long as ash is stored of on top of the dam will there be a possibility of saline and metal rich seepage.

The frequency of the activity will be infrequent and the frequency of the impact will be possible. This impact has an initial rating of MEDIUM HIGH which can be mitigated to LOW MEDIUM. This impact rating is illustrated in Table 12-15.

Table 12-15: Impact of runoff on the Grootspruit – Construction and Operation

Impact Alternative 1 and 2: Impact of runoff on the Grootspruit		
Severity	**Spatial extent**	**Duration of impact**
4	4	4
3	3	4
Consequence rating: 12 (unmitigated)		
Consequence rating: 10 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
3	4	
3	4	
Likelihood rating: 7 (unmitigated)		
Likelihood rating: 7 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 84 - MEDIUM – HIGH		
SIGNIFANCE RATING (MITIGATED): 70 – LOW MEDIUM		
Comments/mitigation: • Reduce infiltration rates into the underlying aquifer through a combination of engineered mitigation and management measures to reduce seepage rate to the underlying aquifer; • Installation and operation of seepage interception trenches at the toe of FAD 6 to reduce plume migration and prevent plume from day lighting in the Grootspruit; • Utilising the available storage facilities to manage the water intercepted at the toe of FAD 6; and • Construct cover material on FAD 6 so that natural vegetation can be established to provide a non-contaminating surface for runoff.		

Impact Rating and Mitigation – Closure

Once ash is no longer discharged to FAD 6 at the end of life, the site will be decommissioned and closed in terms of the legislative requirements. In terms of risk posed by FAD 6, the risk will be reduced over time as the potential contaminants are diluted and or naturally attenuated over time. With management options in place, the risk is expected to reduce even further.

This impact relates to the risk that seepage runoff from the FAD 6 may contain salts and heavy metals, which if discharged from the FAD 6 and water management infrastructure could impact on the quality of the Grootspruit. Saline, metal rich runoff may impact on the Grootspruit water quality.

The severity of the impact is considered to be great as a decrease in groundwater quality in the area may lead to health impacts as well as impacting the quality of the Grootspruit. The spatial scope of the impact may be considered regional as groundwater quality and the quality of the Grootspruit may further impact the regional area whereby a number of water users may be present. The duration of the impact will be during the life of operation. As long as ash is stored of on top of the dam will there be a possibility of saline and metal rich seepage.

The frequency of the activity will be infrequent and the frequency of the impact will be possible. This impact has an initial rating of MEDIUM HIGH which can be mitigated to LOW considering the mitigations measures are implemented as illustrated in Table 12-16.

Table 12-16: Impact of runoff on the Grootspruit– Closure

Impact Alternative 1 and 2: Impact of Runoff on the Grootspruit		
Severity	**Spatial extent**	**Duration of impact**
4	4	3
2	2	3
Consequence rating: 11 (unmitigated)		
Consequence rating: 8 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
3	4	
3	4	
Likelihood rating: 7 (unmitigated)		
Likelihood rating: 7 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 77 MEDIUM – HIGH		
SIGNIFANCE RATING (MITIGATED): 48 – LOW		
Comments/mitigation: • Reduce infiltration rates into the underlying aquifer through a combination of engineered mitigation and management measures to reduce seepage rate to the underlying aquifer; • Installation and operation of seepage interception trenches at the toe of FAD 6 to reduce plume migration and prevent plume from day lighting in the Grootspruit; • Utilising the available storage facilities to manage the water intercepted at the toe of FAD 6; and • Construct cover material on FAD 6 so that natural vegetation can be established to provide a non-contaminating surface for runoff.		

12.7 Waste Impacts

FAD 6 will be designed and operated according to best international practice for the effective management of fine ash wastes generated by the SSIC, in accordance with the existing WADS license conditions, and amendments as may be applied for the extension of the WADS license to include FAD 6.

12.7.1 Impact of waste water streams of the FAD 6

The FAD 6 will be continuously receiving waste water to be recycled back into the Synfuels plant. The potential of these dams to overflow therefore increases. This will result in the contamination of surface and possible groundwater in the area. The groundwater in the area currently contains a 2 km radium pollution plume, whereby groundwater may not be utilized.

Stormwater diversion control areas pose a risk to overflow or failure during heavy storm events. This will result in the inability of the FAD 6 site to separate clean and dirty water around the site. Storage of fine ash in the form of a FAD will result in the seepage, contaminating surface and groundwater systems in the area. The majority of these impacts have been addressed in Section 12.6, 12.5, and 12.14.

Impact Rating and Mitigation Operation

Construction of the FAD 6 will require the upgrading of the waste water streams of the WADS. This will include the construction of RWD's, seepage collection systems, and stormwater diversion infrastructure. Failure of these systems to applicable legislation and safety standards will ultimately

result in the contamination of ground and surface water eventually endangering local aquatic / terrestrial ecosystems in the local context.

The severity of this impact will be harmful, as the survival of local ecosystems in the area will be threatened. The spatial extent of the impact will be regional. The duration of the activity will be throughout the life of operation. As long as ash is being deposited on the FAD 6, this impact has the potential to materialize.

The frequency of the activity will be during the life of operation and the frequency of the impact will be highly likely. This impact is rated HIGH which can be mitigated to LOW MEDIUM significance considering mitigation and management measures are implemented as illustrated in Table 12-17.

Table 12-17: Impact of waste water streams of the FAD 6

Impact Alternative 1 and 2: Impact of waste water streams of the FAD 6		
Severity	**Spatial extent**	**Duration of impact**
5	4	4
3	4	2
Consequence rating: 13 (unmitigated)		
Consequence rating: 9 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
4	5	
4	3	
Likelihood rating: 9 (unmitigated)		
Likelihood rating: 7 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 117– HIGH		
SIGNIFANCE RATING (UNMITIGATED): 63 – LOW MEDIUM		
Comments/mitigation: • Stormwater diversion control measures must be able to accommodate all storm water runoff for a period of 24 hours in the case of a a:50 year flood; • Surface and / or deep soil seepage interception and / or blanket drains must be constructed to effectively intercept and drain all surface and sub-surface seepage generated from the FAD 6; • Stormwater toe paddocks and RWD must be constructed of such a capacity as to maintain a free board of half a meter, and to accommodate all contaminated runoff which could be expected as a result of a 1:50 year storm event; • RWD's must be designed to contain in addition to the half a meter freeboard the following: o All contaminated stormwater runoff, which could be expected as a result of the 1: 50 year flood; o All seepage expected to arise on site; • RWD 's must be lined according to the specifications of the DWAF Minimum Requirements for Waste Disposal by Landfill; • The slopes of the walls of the FAD 6 must not be steeper than 1:3; • Maximum height of the FAD 6 will be 40 meters.		

12.7.2 Impact of waste generated on site

During construction activities, waste will be generated by contractors working in the vicinity. General and hazardous waste will accumulate on site. The generation of waste on site has the potential to detrimentally pollute the environment within the vicinity of the FAD 6 and associated infrastructure.

Impact Rating and Mitigation – Construction

As a result of construction activities waste will be stored on site for a period of time. This waste will require an effective waste management plan in order to promote separation and recycling of waste generated on the FAD 6 site. Potential waste generated at the FAD 6 site will include the following:

- Sewerage generated from the chemical toilets;
- General and domestic waste;
- Oils, grease, contaminated materials; and
- Polluted soil originating from hydrocarbon spills.

Sewerage will be stored in chemical toilets and removed by an accredited contractor. The disposal of sewerage generated on site will be requiring safe disposal certificates issued by the appointed contractor. Domestic and contaminated waste will be stored / stored of separately. Safe disposal certificate will be required from the contractors appointed for waste removal. Ineffective management of waste could result in surface, ground water and air contamination as well as ecological and health impacts. Given the nature of the proposed FAD 6 and associated infrastructure minimal waste will be generated on site, although the potential for pollution remains.

This impact has a severity of being slightly harmful with a spatial scope of within the boundaries of the FAD 6 site. The duration of this impact will remain only during construction as limited activities and personnel will be on site during operation and closure.

The frequency of the activity will be daily as waste will be generated on a daily basis. The frequency of the impact will be seldom. This impact is rated LOW MEDIUM which cannot be mitigated to a lower significance; however the rating can be reduced from 64 to 56 as illustrated in Table 12-18.

Table 12-18: Impact of waste generation on site

Impact Alternative 1 and 2: Impact of waste generation on site		
Severity	**Spatial extent**	**Duration of impact**
3	2	3
2	2	3
Consequence rating: 8 (unmitigated)		
Consequence rating: 7 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
5	3	
5	3	
Likelihood rating: 8 (unmitigated)		
Likelihood rating: 8 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 64– LOW MEDIUM		
SIGNIFANCE RATING (UNMITIGATED): 56 – LOW MEDIUM		
Comments/mitigation: • Develop and implement a Waste Management Plan for the FAD 6 site; • Obtain safe disposal certificates for the disposal of hazardous waste from the FAD 6 site; • Obtain safe disposal certificates for the disposal of sewerage from the chemical toilets; • Prior to the start of a shift on a daily bases, vehicles must be checked for potential leaks and ground / soil pollution (hydrocarbon spillages). Action must be taken as soon as spillages have		

been identified; and

- Monitor the sewerage facilities for spillages, and handle any spillages as hazardous waste.

12.8 Impacts on Air Quality

The air emissions associated with the WADS will be primarily from dust and volatile emissions that may be associated with the water phase transporting the slurries ash to the FAD 6 site, including the returned brine where stored to the FAD 6 assisting with dust suppression and consolidation of the ash. Attention is taken to ensure the FAD 6 does not present unacceptable Occupational Health and Safety (OHS) risks. Impact on the air quality is cumulative to emissions from other facilities in the wider WADS, the SSIC, and surrounding area. Sensitive receptors located within 10 km of the WADS include the Embalenhle Township and the town of Secunda.

Baseline data was collected and analyses for PM10. This data was collected for a six year period from January 2005 to December 2010. The PM10 monitor is located at Langverwacht, which is one of the monitoring stations for the SSIC. PM10 levels above the standards and guidelines were experienced and may be the result of dust generating activities such as vehicle entrainment of dust or dust blown of FAD 6's that occur on-site or off-site activities such as dust blown off tailings dams or waste rock dumps from neighbouring mining activities. The South African standard of 75 µg/m^3, which will come into effect on 1 January 2015, was exceeded twice in 2005 (June and July), twice in 2006 (June and July) and once in 2010 (September).

The SSIC is the main industrial facility and also the largest in the Secunda area. It is one of the largest sources of gas emissions in the area. The release and movement of the gases may have an impact on the air quality in the area which may impact on the environment, human health and animals. There is also the possibility that secondary pollutant (mainly particulate matter) from in the atmosphere by chemical reactions of the primary pollutants. Windblown dust off the FAD 6's is another source of emissions. Dust can easily be transported to towns within close proximity of the FAD 6 and the size of the dust particles can have adverse effects on humans (respiratory tract infections), animals and plants. There are other industrial operations in the area, namely, Lafarge which is ± 10.5 km northwest of Synfuels and Harmony (Winkelhaak Mines) which is 5.5 km northwest. Any dust generated at these facilities, through activities such as blasting, windblown dust of waste dumps or tailings facilities can be easily transported into the nearby towns.

12.8.1 Impacts on air quality as a result of PM10

PM10 will not exceed the current PM10 standard (120 µg/m³) and the proposed 2015 PM10 standard (75 µg/m³) beyond the boundaries of the FAD 6 complex for both mitigated and unmitigated scenarios.

Impact Rating and Mitigation (Alternative 1) –Construction and Operation

The severity of the impact is significant because the concentration of PM10 generated during the operational phase may be harmful to receptors as contributions from the proposed development to ambient concentrations in the Embalenhle Township are in the range of 10- 40 µg/m³ which is below the South African standards and World Bank guidelines. The concentrations decrease away from the township to the northwest. PM10 concentrations in Secunda are in the range 5-10 µg/m³. The threshold limit will occasionally be exceeded but only within the project area. The impact will be local as PM10 concentrations 2 km away from the source are below 40 µg/m³ and decreases significantly

away from the operational activities. The duration of the impact will be permanent as there may still be erodible surfaces where dust can be blown from after operations have ceased at FAD 6.

The activity will occur on a regular basis. The loading schedule of fine ash on the FAD 6 is unknown but may be expected to be on a regular basis. The fine ash is expected to be dry during this scenario and can be easily transported as dust. The impact will happen daily because the FAD 6 will be dry making it easier for fine ash to be transported by wind. The impact is considered to be of MEDIUM-HIGH significance before management and can be mitigated to a MEDIUM LOW significance considering the mitigations measures are implemented as illustrated in Table 12-19.

Table 12-19: Impact on air quality as a result of PM10 – Construction and Operation

Impact Alternative 1: Impact on air quality as a result of PM10		
Severity	**Spatial extent**	**Duration of impact**
3	3	5
2	3	4
Consequence rating: 11 (unmitigated)		
Consequence rating: 9 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
4	5	
4	4	
Likelihood rating: 9 (unmitigated)		
Likelihood rating: 8 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): – 99 MEDIUM – HIGH		
SIGNIFANCE RATING (MITIGATED): 72 LOW – MEDIUM		
Comments/mitigation: • In places of high vehicular traffic, dust suppression measures on the roads may be implemented to reduce dust levels from the entrainment of dust. These measures will range from watering of roads, application of a chemical dust suppressant and/or paving of roads; • Reduce vehicle speeds on roads to less than 40 km/h within the project area; • During the operational phases for FAD 6 any bare ground surrounding the main operational area but within the boundaries of the facility must be covered with suitable indigenous vegetation that will be able to grow in the area; • Whilst in operation the area of the dry beach portion of the FAD 6 should be kept to a minimum and the area or covering the moist or water pooling portions of the FAD 6 must be maximised in order to minimise windblown dust from this source; and • If possible a chemical dust suppressant should be used to suppress dust emissions from the dams when it is not practical to maintain stable moisture content over a long period of time.		

Impact Rating and Mitigation (Alternative 1) –Closure

The impact is considered to be of very low significance after closure. The severity of the impact is considered to be small because the concentration of PM10 generated during the closure phase is expected to be low as dust emissions from FAD 6 are expected to be managed. The impact will be local as PM10 concentrations in the area decrease significantly away from FAD 6 after the introduction of management measures. The duration of the impact will be one day to a month, because with the introduction of management measures, it is expected that after the closure phase the emissions from the dams will be managed to the point where the emissions are low to negligible.

The activity will occur annually. This is a result of the implementation of management measures from the start of the closure phase to minimise emissions from the dam. The impact is highly unlikely because the dam will be grassed or rock clad and very seldom dust emissions will be expected from this source. This impact has VERY LOW significance as illustrated in Table 12-20.

Table 12-20: Impact on air quality as a result of PM10 – Closure

Impact Alternative 1: Impact on air quality as a result of PM10		
Severity	**Spatial extent**	**Duration of impact**
2	3	1
2	3	1
Consequence rating: 6 (unmitigated)		
Consequence rating: 6 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
1	2	
1	2	
Likelihood rating: 3 (unmitigated)		
Likelihood rating: 3 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): – 18 VERY LOW		
SIGNIFANCE RATING (MITIGATED): 18 VERY LOW		
Comments/mitigation: • Rock cladding, grassing or any other form of dust suppression of the side walls and the top of the FAD 6 at closure.		

Impact Rating and Mitigation (Alternative 2) –Construction and operation

PM10 will exceed the current PM10 standard (120 µg/m³) and the proposed 2015 PM10 standard (75 µg/m³) beyond the boundaries of the FAD 6 complex for the unmitigated scenario, but will be below the PM10 standard of 120 µg/m³ for the mitigated scenario. The severity of the impact is great because the concentration of PM10 generated during the operational phase is above all standards and guidelines. The high dust fallout concentration emitted may be harmful to the potential receptors close to the site. The PM10 concentration range from 20-50 µg/m³ at the Embalenhle Township and are below 30 µg/m³ at Secunda. The threshold limit will always be exceeded in the project areas. The impact will be local as PM10 concentrations in the area decrease away from the operational activities. The duration of the impact will be evident during the post closure phase.

The activity will occur on a permanent basis; and will be highly likely. This impact has an initial rating of HIGH which can be mitigated to LOW MEDIUM significance considering the mitigations measures are implemented as illustrated in Table 12-21.

Table 12-21: Impact on air quality as a result of PM10 – Construction and Operation

Impact Alternative 2: Impact on air quality as a result of PM10		
Severity	**Spatial extent**	**Duration of impact**
4	3	5
3	3	4
Consequence rating: 12 (unmitigated)		
Consequence rating: 10 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
5	4	
4	3	
Likelihood rating: 9 (unmitigated)		
Likelihood rating: 7 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 108 – HIGH		
SIGNIFANCE RATING (MITIGATED): 70 – LOW MEDIUM		
Comments/mitigation: • In places of high vehicular traffic, dust suppression measures on the roads may be implemented to reduce dust levels from the entrainment of dust. These measures will range from watering of roads, application of a chemical dust suppressant and/or paving of roads; • Reduce vehicle speeds on roads to less than 40 km/h within the project area; • During the operational phases for FAD 6 any bare ground surrounding the main operational area but within the boundaries of the facility must be covered with suitable vegetation that will be able to grow in the area; • Whilst in operation the area of the dry beach portion of the FAD 6 should be kept to a minimum and the area or covering the moist or water pooling portions of the dam must be maximised in order to minimise windblown dust from this source; and • If possible a chemical dust suppressant should be used to suppress dust emissions from the dams when it is not practical to maintain stable moisture content over a long period of time.		

Impact Rating and Mitigation (Alternative 2) –Closure

The impact is considered to be of very low significance after closure. The severity of the impact is considered to be small because the concentration of PM10 generated during the closure phase is expected to be low as dust emissions from FAD 6 are expected to be managed. The impact will be local as PM10 concentrations in the area decrease significantly away from FAD 6 after the introduction of management measures. The duration of the impact will be one day to a month, because with the introduction of management measures, it is expected that after the closure phase the emissions from the FAD 6 will be managed to the point where the emissions are low to negligible. The activity will occur annually. This is a result of the implementation of management measures from the start of the closure phase to minimise emissions from the dam. The impact is highly unlikely because the dam will be grassed or rock clad and very seldom dust emissions will be expected from this source. This impact has VERY LOW significance as depicted in Table 12-22

Table 12-22: Impact on air quality as a result of PM10 – Closure

Impact Alternative 2: Impact on air quality as a result of PM10		
Severity	**Spatial extent**	**Duration of impact**
2	3	1
2	3	1
Consequence rating: 6 (unmitigated)		
Consequence rating: 6 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
1	2	
1	2	
Likelihood rating: 3 (unmitigated)		
Likelihood rating: 3 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): – 18 VERY LOW		
SIGNIFANCE RATING (MITIGATED): 18 VERY LOW		
Comments/mitigation: • Rock cladding, grassing or any other form of dust suppression of the side walls and the top of the FAD 6 at closure.		

12.8.1 Impacts on air quality as a result of Dust Fall Out (DFO)

Dust fallout concentrations will also not exceed the SANS 1929:2005 target limit of 300 mg/m^2/day beyond the boundaries of the FAD 6 complex. DFO will decrease further away from the sources. However, with management, the DFO footprint will decrease and be localised mainly around the operational conditions in the project area.

Impact Rating and Mitigation (Alternative 1) – Construction and Operation

The severity of the impact is insignificant because the concentrations of DFO generated for Alternative 1 during the operational phase is low and are below the SANS 1929:2005 standards. The impacts are closer to operational activities and decrease further away. Secunda, Embalenhle township and surrounding farms are in range of the operational activities but will not be impacted significantly as the levels of dust fallout are not harmful. The impact will be activity specific as the maximum predicted DFO concentrations occur around the source but decrease significantly away from the operational activities. As long as there are no mitigation measures, dust fallout emissions from FAD 6 will be permanent and after the closure of the FAD 6.

The activity will occur on a permanent basis as there will always be an exposed area on the dam that will allow dust to be emitted into the atmosphere; and the impact will be almost impossible because the low levels that are currently observed are well below the standards. This impact cannot be mitigated to a lower significance level of LOW: however the rating can be reduced from 42 to 30 as stipulated in Table 12-23.

Table 12-23: Impact on air quality as a result of DFO – Construction and Operation

Impact Alternative 1: Impact on air quality as a result of DFO		
Severity	**Spatial extent**	**Duration of impact**
1	1	5
1	1	4
Consequence rating: 7 (unmitigated)		
Consequence rating: 6 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
5	1	
4	1	
Likelihood rating: 6 (unmitigated)		
Likelihood rating: 5 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): – 42 LOW		
SIGNIFANCE RATING (MITIGATED): 30 LOW		
Comments/mitigation: • In places of high vehicular traffic, dust suppression measures on the roads may be implemented to reduce dust levels from the entrainment of dust. These measures will range from watering of roads, application of a chemical dust suppressant and/or paving of roads; • Reduce vehicle speeds on roads to less than 40 km/h within the project area; • During the operational phases for FAD 6 any bare ground surrounding the main operational area but within the boundaries of the facility must be covered with suitable vegetation that will be able to grow in the area; • Whilst in operation the area of the dry beach portion of the FAD 6 should be kept to a minimum and the area or covering the moist or water pooling portions of the FAD 6 must be maximised in order to minimise windblown dust from this source; • If possible a chemical dust suppressant should be used to suppress dust emissions from the dams when it is not practical to maintain stable moisture content over a long period of time.		

Impact Rating and Mitigation (Alternative 1) –Closure

The severity of the impact is considered to be insignificant because the concentration of DFO generated during the closure phase is expected to be low to negligible as dust emissions from FAD 6 is expected to be managed. The impact will be activity specific as DFO concentrations in the area decrease significantly away from FAD 6 after the introduction of management measures. The duration of the impact will be one day to a month, because with the introduction of management measures, it is expected that after the closure phase the emissions from the dams will be managed to the point where the emissions are low to negligible.

The activity will occur annually. This is a result of the implementation of management measures from the start of the closure phase to minimise emissions from the FAD 6 . The impact is almost impossible because the FAD 6 will be grassed or rock clad and dust emissions will almost never be expected from this source. This impact is considered to have VERY LOW significance as illustrated in Table 12-24.

Table 12-24: Impact on air quality as a result of DFO – Closure

Impact Alternative 2: Impact on air quality as a result of DFO		
Severity	**Spatial extent**	**Duration of impact**
1	1	1
1	1	1
Consequence rating: 3 (unmitigated)		
Consequence rating: 3 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
1	1	
1	1	
Likelihood rating: 2 (unmitigated)		
Likelihood rating: 2 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): – 6 VERY LOW		
SIGNIFANCE RATING (MITIGATED): 6 VERY LOW		
Comments/mitigation: • Rock cladding, grassing or any other form of dust suppression of the side walls and the top of the FAD 6 at closure.		

Impact Rating and Mitigation (Alternative 2) –Construction and Operation

DFO concentrations will also not exceed the SANS 1929:2005 target limit of 300 mg/m^2/day beyond the boundaries of the FAD 6 complex for Alternative 2.

The severity of the impact is insignificant because the concentration of DFO generated during the operational phase may not be harmful to receptors, and the highest concentrations which are below the SANS standards, are closer to operational activities and decrease further away. Secunda, Embalenhle Township and surrounding farms are in range of the operational activities but will not be significantly impacted. The threshold limits may not be exceeded. The impact will be activity specific as PM10 concentrations in the area decrease significantly away from the operational activities. The highest concentrations are at the source, whilst concentrations are in the range of 1-5 mg/m^2/day at the receptors. The duration of the impact will be permanent and the activity will occur throughout the life of the operation on a regular basis.

The impact will seldom happen due to low DFO concentrations. Any exceeded thresholds will probably be the result of an anomalous event. This impact was initially rated with a LOW significance which cannot be further mitigated to a lower significance level. However the rating can be reduced from 42 to 30 after mitigation as illustrated in

Table 12-25.

Table 12-25: Impact on air quality as a result of DFO – Closure

Impact Alternative 2: Impact on air quality as a result of DFO		
Severity	**Spatial extent**	**Duration of impact**
1	1	5
1	1	4
Consequence rating: 7 (unmitigated)		
Consequence rating: 6 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
5	1	
4	1	
Likelihood rating: 6 (unmitigated)		
Likelihood rating: 5 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): – 42 LOW		
SIGNIFANCE RATING (MITIGATED): 30 LOW		
Comments/mitigation: • In places of high vehicular traffic, dust suppression measures on the roads may be implemented to reduce dust levels from the entrainment of dust. These measures will range from watering of roads, application of a chemical dust suppressant and/or paving of roads; • Reduce vehicle speeds on roads to less than 40 km/h within the project area; • During the operational phases for FAD 6 any bare ground surrounding the main operational area but within the boundaries of the facility must be covered with suitable vegetation that will be able to grow in the area; • Whilst in operation the area of the dry beach portion of the FAD 6 should be kept to a minimum and the area or covering the moist or water pooling portions of the dam must be maximised in order to minimise windblown dust from this source; and • If possible a chemical dust suppressant should be used to suppress dust emissions from the dams when it is not practical to maintain stable moisture content over a long period of time.		

Impact Rating and Mitigation (Alternative 2) –Closure

The severity of the impact is considered to be insignificant because the concentration of DFO generated during the closure phase is expected to be low to negligible as dust emissions from FAD 6 is expected to be managed. The impact will be activity specific as DFO concentrations in the area decrease significantly away from FAD 6 after the introduction of management measures. The duration of the impact will be one day to a month, because with the introduction of management measures, it is expected that after the closure phase the emissions from the FAD 6 will be managed to the point where the emissions are low to negligible.

The activity will occur annually. This is a result of the implementation of management measures from the start of the closure phase to minimise emissions from the FAD 6. The impact is almost impossible because the dam will be grassed or rock clad and dust emissions will almost never be expected from this source. This impact is considered to have VERY LOW significance considering mitigation and management measures are implemented as illustrated in Table 12-26.

Table 12-26: Impact on air quality as a result of DFO – Closure

Impact Alternative 2: Impact on air quality as a result of DFO		
Severity	**Spatial extent**	**Duration of impact**
1	1	1
1	1	1
Consequence rating: 3 (unmitigated)		
Consequence rating: 3 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
1	1	
1	1	
Likelihood rating: 2 (unmitigated)		
Likelihood rating: 2 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): – 6 VERY LOW		
SIGNIFANCE RATING (MITIGATED): 6 VERY LOW		
Comments/mitigation: • Rock cladding, grassing or any other form of dust suppression of the side walls and the top of the FAD 6 at closure.		

12.9 Topography and Visual Impacts

The topography of the proposed FAD 6 consists of a mixture of uncultivated grasslands and ploughed fields. The site area is located on a ridge / watershed approximately 1600 – 1640 m.a.s.l. The topography of this area is moderately undulating across the whole project area. The project area has a gradient slanting from the south of the proposed footprint to a north westerly direction.

12.9.1 Impact on the change in topography

The proposed FAD 6 will affect the topography of the site through the construction of the FAD 6 and associated infrastructure. These changes in topography will not necessary significantly affect the aesthetics of the site and surrounding areas considering the extensive mining and industrial operations conducted in the immediate surroundings. The impact on topography is however expected to persist thorough the life span of the FAD 6. The most significant impact will be evident through all phase. The topography will remain affected even after rehabilitation and decommissioning has completed.

Impact Rating and Mitigation – Construction / Operation and Closure

Construction activities associated with the FAD 6 will permanently alter the topography of the site. The construction of the FAD 6 will raise the topography in the immediate surrounding resulting in a visual impact for the surrounding communities. The power lines to be relocated as well as the realignment of the road will result in a topographic change. The power lines and road realignment will however replace a known with a known impact resulting in minimal visual damage. Activities relating to the construction of the FAD 6 and associated infrastructure resulting in a material topographic and visual impact may relate to the stripping of top soil, laydown of building materials and movement of vehicles during construction, open and rehabilitated landscape scaring, and layout of construction workers camp.

As a result of the construction of the FAD 6, the severity of this impact will be small. The spatial scope is considered to be within the local area, as the FAD 6 will be visible from a distance and the

human visual perception has the ability to perceive images to a 5 km radius. The significance of this is however reduced as a result current FAD built as part of Synfuels WADS facility and the local and regional mining land uses. The duration of the impact is rated as being permanent as the impact will remain past closure.

The frequency of the activity will be annually or less considering the impact will occur once and remain permanent. The frequency of the impact has been considered as definite, considering the construction of the dam will remain a necessity for future operation at Synfuels. As the site is visible from the local communities in the area, the likelihood of the impact to occur is high. This impact has an initial rating of LOW MEDIUM which can be mitigated to LOW considering the mitigations measures are implemented. Table 12-27 illustrates the impact ratings for this impact.

Table 12-27: Visual impact and the Impact on change in topography – Construction Operation and Closure.

Impact Alternative 1 and 2: Visual Impact on the change in topography		
Severity	**Spatial extent**	**Duration of impact**
2	3	5
1	2	5
Consequence rating: 10 (unmitigated)		
Consequence rating: 7 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
1	5	
1	5	
Likelihood rating: 6 (unmitigated)		
Likelihood rating: 6 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 60 LOW – MEDIUM		
SIGNIFANCE RATING (MITIGATED): 42 – LOW		
Comments/mitigation: • Side walls of the FAD 6 will be rehabilitated on an on-going basis during construction as far as practical and monitored for effectiveness during operation; • Servitudes of the re aligned road and power lines will be monitored for rehabilitation after construction of the roads; and • The FAD 6 design, operation and rehabilitation planning will ensure that the slopes remain stable and are of an acceptable gradient to allow for rehabilitation.		

12.9.1 Visual impact as a result of Dust generation

The potential deterioration visual quality of the landscape may be contributed by the construction and operation activities associated with the FAD 6, power line and re - aligned road. Construction activities will generate dust at the construction site but is not expected to protrude along a significant diameter from the construction sites.

Impact Rating and Mitigation – Construction

Constructional activities resulting in the decreased visual quality of the landscape may be a result of the stripping and stockpiling of topsoil, exposed surfaces and movement of vehicles along dirt roads.

The severity of this impact is considered potentially harmful as the dust generated will be in the context of the FAD 6 site footprint size. The spatial scope of the impact will be within the local area, and if not mitigated, dust generation may spread over a relatively large distance. The duration of the

impact will be between one to ten years. The FAD 6 will be built in phases thus lengthening the construction phase of the project.

The frequency of the activity will be during the life of the operation. As long as the FAD 6 is in operation, it is expected that one third of the FAD 6 will remain dry at any time, therefore exposing the ash surface to wind. The frequency of the impact will be regularly considering the exposed surface to wind as well as the frequency of wind in the area. This impact has an initial rating of LOW MEDIUM which can be mitigated to a LOW significance considering the mitigations measures are implemented. Table 12-28 illustrates the impact rating of this impact.

Table 12-28: Visual impact as a result of windblown dust – Construction

Impact Alternative 1 and 2: Visual Impact as a result of dust generation		
Severity	**Spatial extent**	**Duration of impact**
2	3	3
1	2	3
Consequence rating: 8 (unmitigated)		
Consequence rating: 6 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
4	4	
4	2	
Likelihood rating: 8 (unmitigated)		
Likelihood rating: 6 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 64 LOW – MEDIUM		
SIGNIFANCE RATING (MITIGATED): 36 – LOW		
Comments/mitigation: • Dust suppression will be conducted on construction sites where surface areas have been exposed; • All areas denuded from vegetation will be rehabilitated to resemble the pre-construction landscape as far as feasible; and • Should dust suppression methods prove to be ineffective to reduce dust generated on site, alternative chemical measures will be sought.		

Impact Rating and Mitigation – Operation

Operational activities resulting in the decreased visual quality of the landscape may be a result of the exposed surface area of the dam, other exposed surfaces and movement of vehicles along dirt roads. The process of wet - ashing is predicted to be utilized at the FAD 6 disposal system, which in turn will reduce the susceptible for dust generation at the top of the dam to wind

The severity of this impact is considered potentially harmful as the dust generated will be in the context of the FAD 6 site footprint size. The spatial scope of the impact will be within the local area, and if not mitigated, dust generation may spread over a relatively large distance. The duration of the impact will be during the life of operation.

The frequency of the activity will be during the life of operation. As long as the FAD 6 is in operation, it is expected that one third of the dam will remain dry at any time, therefore exposing the ash surface to wind. The frequency of the impact will be regularly considering the exposed surface to wind as well as the frequency of wind in the area. This impact has an initial rating of LOW MEDIUM

which can be mitigated to LOW significance considering the mitigations measures are implemented. Table 12-29 illustrates the impact assessment of this impact.

Table 12-29: Visual impact as a result of windblown dust –Operation.

Impact Alternative 1 and 2: Visual Impact as a result of dust generation		
Severity	**Spatial extent**	**Duration of impact**
2	3	4
1	2	4
Consequence rating: 9 (unmitigated)		
Consequence rating: 7 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
4	2	
4	2	
Likelihood rating: 6 (unmitigated)		
Likelihood rating: 6 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 72 LOW – MEDIUM		
SIGNIFANCE RATING (MITIGATED): 42 – LOW		
Comments/mitigation: • Dust suppression will be conducted on an ad hoc basis on the surface of the dam and surrounding areas; • All areas denuded from vegetation will be rehabilitated to resemble the pre-construction landscape as far as feasible; and • Should dust suppression methods prove to be ineffective to reduce dust generated on site, alternative chemical measures will be sought.		

Impact Rating and Mitigation – Closure

No significant visual impact as a result of dust generation should materialize during the closure of the dam. All areas will be rehabilitated and disposal of ash to the dam would have ceased. The area on top of the FAD 6 will be rehabilitated in order to reduce risk of future erosion and dust generation.

The severity of the impact may be considered insignificant considering the minimal activities that will take place. The spatial scope of the impact will be activity specific and the duration one day to one month.

The frequency of the activity will be considered weekly as the FAD 6 and associated infrastructure will remain in the areas and still be susceptible to wind. The frequency of the impact will be regarded as very seldom. This impact has a rating of LOW. Table 12-30 illustrates the impact rating of this impact.

Table 12-30: Visual impact as a result of windblown dust –Closure.

Impact Alternative 1 and 2: Visual Impact as a result of dust generation		
Severity	**Spatial extent**	**Duration of impact**
1	1	1
1	1	1
Consequence rating: 3 (unmitigated)		

Consequence rating: 3 (mitigated)	
Duration of Activity / aspect	**Frequency of impact**
4	1
4	1
Likelihood rating: 5 (unmitigated)	
Likelihood rating: 5 (mitigated)	
SIGNIFANCE RATING (UNMITIGATED): 30 LOW	
SIGNIFANCE RATING (MITIGATED): 30 – LOW	
Comments/mitigation: • Surface and side walls of the dam will be rehabilitated to a satisfactory level as to reduce the risk of the generation of windblown dust.	

12.10 Heritage Impacts

A total of eleven cultural heritage sites were identified during the survey. Please note that although some farm (modern) houses were noted in the area they were not regarded as older than 60 years and are therefore not included in the survey report. The recorded sites were used to determine the various impacts.

12.10.1 Impact on the destruction of cultural and heritage findings

The findings of these sections were sourced from the heritage assessment conducted by Francoise Coetser.

One site comprises a graveyard which consists of roughly 40 graves. Most of the graves are demarcated by packed stones, cement and brick bases and headstones. The graveyard is partially fenced and relatives still live in the area. Two other sites comprise historical structures which are probably older than 60 years and are therefore protected by the NHRA. A brick building was identified as being used as a school and was known as the Driehoek School. Extensive alterations and additions have been made to the original structure. Sections of the corrugated iron roof could still be seen. The structure is probably structurally unsound and should be recorded before it deteriorates further.

Although most areas were fenced, no severe physical restrictions were encountered. A major assumption for this study is that the areas adjacent to the road reserve and associated with agricultural fields are severally disturbed and therefore highly unlikely to yield heritage settlements. However, care should be taken not to over generalise this aspects.

Impact Rating and Mitigation – Construction

It should be kept in mind that archaeological deposits usually occur below ground level. Should archaeological artefacts or skeletal material be revealed in the area during development activities, such activities should be halted, and a university or museum notified in order for an investigation and evaluation of the find(s) to take place.

This impact has a severity of slightly harmful as this impact may result in the loss of historical information of ancestral beings in the area. The spatial scope of this impact is within the FAD 6 boundaries as this historical impact will not proceed beyond the boundaries of Synfuels. The

duration of the impact will be one month to one year. The largest impact will result during site clearance and excavation of the foundations of FAD 6 and associated infrastructure.

The duration of the activity as well as the frequency of the impact will be infrequent. As soon as site clearance and foundations have been constructed, the archaeological remains will be permanently destroyed. This impact has an initial significance rating of LOW MEDIUM, which can be mitigated to LOW considering mitigation and management measures are implemented as illustrated in Table 12-31.

Table 12-31: Impact on the destruction of cultural and heritage findings – Construction

Impact Alternative 1 and 2: Impact on the destruction of cultural and heritage findings		
Severity	**Spatial extent**	**Duration of impact**
3	2	4
2	2	2
Consequence rating: 9 (unmitigated)		
Consequence rating: 6 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
3	3	
3	3	
Likelihood rating: 6 (unmitigated)		
Likelihood rating: 6 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): – 54 LOW – MEDIUM		
SIGNIFANCE RATING (MITIGATED): 36 LOW		
Comments/mitigation: • Fence off archaeological findings in close proximity to the FAD 6 to prevent further illegal destruction; • Vehicles and human movement should be prohibited in the fenced off area; • Conduct a full grave relocation initiative; • Conduct a Phase 2 Investigation for all recorded sites; • Effort must also be made to identify all buried individuals and to contact their relatives and descendants; • Although applications for destruction permits must be submitted for all the other affected sites; and • Should graves, fossils are any historical artefacts be identified during construction, activities must cease and the local museum or university must be notified in order to conduct a full investigation on the findings.		

Impact Rating and Mitigation – Operation

As a result of operational activities, the major impact will focus on graves and historical findings in close proximity to the FAD 6. It must be noted that most archaeological deposits occur below ground level. Care must be taken to corner off all archaeological sites in close proximity to the FAD 6 during construction and operational phases.

The severity of this impact was considered to be slightly harmful as during operational phases the chanced of discovering new finding is limited. The existing historical structures and graves need to be protected during the life of the FAD 6. The spatial scope of this impact is site specific as no

archaeological finding are anticipated to be destroyed beyond the FAD 6 footprint as a result of FAD 6 operation activities. The duration of the impact will be one year to ten years. As soon as the FAD 6 is constructed and procedures formalized, the archaeological findings in close proximity to the FAD 6 will be protected.

The duration of the activity and its associated impact is considered to be infrequent. Archaeological findings not within the FAD 6 footprint are not in a close enough range to be threatened by operational activities. This impact has been given a significance rating of LOW which can be mitigated to a VERY LOW rating considering mitigation and management measures are implemented as illustrated in Table 12-32.

Table 12-32: Impact on the destruction of cultural and heritage findings – Operation

Impact Alternative 1 and 2: Impact on the destruction of cultural and heritage findings		
Severity	**Spatial extent**	**Duration of impact**
3	2	3
1	2	2
Consequence rating: 8 (unmitigated)		
Consequence rating: 5 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
3	3	
3	2	
Likelihood rating: 6 (unmitigated)		
Likelihood rating: 5 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): – 48 LOW		
SIGNIFANCE RATING (MITIGATED): 25 VERY LOW		
Comments/mitigation: • Fence off archaeological findings in close proximity to the dam to prevent further illegal destruction; • Vehicles and human movement should be prohibited in the fenced off area; • Conduct a full grave relocation initiative; • Conduct a Phase 2 Investigation for all recorded sites; • Effort must also be made to identify all buried individuals and to contact their relatives and descendants; • Although applications for destruction permits must be submitted for all the other affected sites; and • Should graves, fossils are any historical artefacts be identified during construction, activities must cease and the local museum or university must be notified in order to conduct a full investigation on the findings.		

Impact Rating and Mitigation – Closure

Closure of the FAD 6 will result in minimal impacts on archaeological findings. Mitigation measures implemented during the construction and operation activities will result in the protection of existing structures.

The severity of this impact is considered insignificant contributed by activity specific spatial extent of the impact. The duration of the impact will be minimal as closure of the FAD 6 will be done as a continual process through operation of the FAD 6.

The duration of the activity is temporary with a frequency of the impact being almost impossible. This impact is rated as VERY LOW, and no mitigation measure are thus proposed for this stage of the development. The rating is illustrated in Table 12-33.

Table 12-33: Impact on the destruction of cultural and heritage findings – Closure

Impact Alternative 1 and 2: Impact on the destruction of cultural and heritage findings		
Severity	**Spatial extent**	**Duration of impact**
1	1	1
1	1	1
Consequence rating: 3 (unmitigated)		
Consequence rating: 3 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
2	1	
2	1	
Likelihood rating: 3 (unmitigated)		
Likelihood rating: 3 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 9 – VERY LOW		
SIGNIFANCE RATING (MITIGATED): 25 – VERY LOW		
Comments/mitigation: • Maintain current management.		

12.11 Noise Impacts

The FAD 6 and associated infrastructure should ideally not be located in close proximity to residential, commercial or ecologically sensitive areas that could be unduly disturbed by noise associated with the construction and operation of the FAD 6.

Noise will be associated with the FAD 6 during construction at a higher degree that which is expected during operational and closure phases. During construction the noise impacts will be high due to construction vehicles and machinery, whereas during operation this impact will be reduced although for an extended period of time. Noise impact can range from a nuisance to nearby residents and ecology to health and safety risks in the nearby vicinity. However noise pollution is not expected to be a significant issue considering the closest community in the area is approximately 500 – 100 m away from the FAD 6 site.

12.11.1 Impact as a result of noise from vehicles

The occurrence of construction vehicles during the construction phase will lead to an increase in noise related issues which incur increased discomfort for the local inhabitants (human and fauna), and pose a risk to onsite workers. Considering the current operations in the vicinity of the FAD 6

footprint the noise impacts during construction will be to a degree hindered by the current noise pollution from Synfuels operations.

Impact Rating and Mitigation – Construction

A number of vehicles and equipment will be required during the construction phase of the project. The severity of the construction noise impacts on the surrounding communities will result in being slightly harmful. The spatial extent of the impact will be limited to local area and immediate environment. The duration of the activity will be one month to one year. The construction contribution to the noise impact will cease as soon as construction activities cease.

The frequency of the activity will be temporary as the life span of the construction activities is short. The frequency of the impact will be likely as minimal mitigation measures are available to minimize the noise impact to the surrounding communities. This impact has a significance of LOW MEDIUM, which can be mitigated to a LOW significance considering mitigation and management measures are implemented. Table 12-34 illustrates the ratings determined for this impact.

Table 12-34: Impact as a result of noise from vehicles – Construction

Impact Alternative 1 and 2: Impact as a result of noise from vehicles		
Severity	**Spatial extent**	**Duration of impact**
3	3	2
2	3	2
Consequence rating: 8 (unmitigated)		
Consequence rating: 7 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
3	4	
3	4	
Likelihood rating: 7 (unmitigated)		
Likelihood rating: 7 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 56 – LOW MEDIUM		
SIGNIFANCE RATING (MITIGATED): 49 – LOW		
Comments/mitigation: • Public site notices should be given to all local inhabitants to inform them of the construction timeframes; • Correct PPE must be worn at all times by the personnel on the construction site; • Stockpiling of top soil / sub soil must be strategically placed in order to act as a buffer between the Embalenhle community and the FAD 6; • Establish noise abatement measures for construction vehicles and activities.		

Impact Rating and Mitigation – Operation

Operation related impacts of noise through vehicle at the FAD 6 site have a low significance. Vehicles will only be travelling to the FAD 6 site for maintenance and monitoring purposes. Fine ash is transported to the FAD 6 through an extensive piping system. From the FAD 6 a penstock directs the dirty water flow from the dam to the dirty water system (i.e. RWD and CEA dams). Therefore no minimal trucking activity will be conducted during the operational and closure phases.

Operational activities contributing to the noise impacts will have a severity of insignificant with a spatial extent of within the boundaries of the FAD 6. The duration of this impact will be during the life of operation, although it is expected that the noise generated during operational activities will be far lower than that from construction activities, but remain a nuisance to the local communities.

The duration of this activity will be infrequent with a frequency of this impact being seldom. This impact has an initial significance rating of LOW, which can be mitigated to VERY LOW considering mitigation and management measures are implemented as illustrated in Table 12-35.

Table 12-35: Impact as a result of noise from vehicles – Operation

Impact Alternative 1 and 2: Impact as a result of noise from vehicles		
Severity	**Spatial extent**	**Duration of impact**
1	2	4
1	2	4
Consequence rating: 7 (unmitigated)		
Consequence rating: 7 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
2	3	
1	2	
Likelihood rating: 5 (unmitigated)		
Likelihood rating: 3 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 35 – LOW		
SIGNIFANCE RATING (MITIGATED): 21 – VERY LOW		
Comments/mitigation: • Correct PPE must be worn at all times by the personnel on the construction site; and • Establish noise abatement measures for operational vehicles and Activities.		

12.11.2 Impact as a result of noise from machinery

This impact will initiate during the construction phase of the project and continue throughout the operation phase of the FAD 6. During construction activities numerous machines will be brought to site in order to construct the FAD 6 and associated infrastructure. The machinery will increase the ambient noise levels in the area to a higher degree that the operational phase, however this impact will be for a short duration compared to the extended impact during operation.

Impact Rating and Mitigation – Construction

A number of machines will be required during the construction phase of the project. The severity of the construction noise impacts on the surrounding communities will result in being harmful. The spatial extent of the impact will be limited to local area and immediate environment. The duration of the activity will be one month to one year. The construction contribution to the noise impact will cease as soon as construction activities cease.

The frequency of the activity will be temporary as the life span of the construction activities is short. The frequency of the impact will be likely as minimal mitigation measures are available to minimize the noise impact to the surrounding communities. This impact has a significance of LOW MEDIUM,

which can be mitigated to a LOW significance considering mitigation and management measures are implemented. Table 12-36 illustrates the ratings determined for this impact.

Table 12-36: Impact as a result of noise from machinery – Construction

Impact Alternative 1 and 2: Impact as a result of nose from machinery		
Severity	**Spatial extent**	**Duration of impact**
4	3	2
2	3	2
Consequence rating: 9 (unmitigated)		
Consequence rating: 7 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
3	4	
3	4	
Likelihood rating: 7 (unmitigated)		
Likelihood rating: 7 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 63 – LOW MEDIUM		
SIGNIFANCE RATING (MITIGATED): 49 – LOW		
Comments/mitigation: • Public site notices should be given to all local inhabitants to inform them of the construction timeframes; • Correct PPE must be worn at all times by the personnel on the construction site; • Stockpiling of top soil / sub soil must be strategically placed in order to act as a buffer between the Embalenhle community and the FAD 6; • Establish noise abatement measures for construction vehicles and activities.		

Impact Rating and Mitigation – Operation

Operation related impacts of noise through machinery at the FAD 6 site have a low significance. The only machinery posing a threat to noise pollution will be the pump stations commissioned for the non-gravitational pipelines at the RWD. Minimal noise will be generated by the vehicles will only be travelling to the FAD 6 site for maintenance and monitoring purposes. Fine ash is transported to the FAD 6 through an extensive piping system. From the FAD 6 a penstock directs the dirty water flow from the FAD 6 to the dirty water system (i.e. RWD and CEA dams). Therefore no minimal trucking activity will be conducted during the operational and closure phases.

Operational activities contributing to the noise impacts will have a severity of insignificant with a spatial extent of within the boundaries of the FAD 6. The duration of this impact will be during the life of operation, although it is expected that the noise generated during operational activities will be far lower than that from construction activities, but remains a nuisance to the local communities.

The duration of this activity will be infrequent with a frequency of this impact being seldom. This impact has an initial significance rating of LOW, which can be mitigated to VERY LOW considering mitigation and management measures are implemented as depicted in Table 12-37.

Table 12-37: Impact as a result of noise from machinery – Operation

Impact Alternative 1 and 2: Impact as a result of noise from machinery		
Severity	**Spatial extent**	**Duration of impact**
1	2	4
1	2	4
Consequence rating: 7 (unmitigated)		
Consequence rating: 7 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
2	3	
1	2	
Likelihood rating: 5 (unmitigated)		
Likelihood rating: 3 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 35 – LOW		
SIGNIFANCE RATING (MITIGATED): 21 – VERY LOW		
Comments/mitigation: • Correct PPE must be worn at all times by the personnel on the construction site; • Establish noise abatement measures for operational vehicles and activities.		

12.12 Soils Land Capability and Land Use impacts

The current land use within the area is mainly utilized for agricultural purposes by nearby farmers. With the construction of the FAD 6 and associated infrastructure the land capability and land use of these areas will be drastically minimized. The land will be permanently occupied by the FAD 6; however the site exists within the current FAD's. The construction of the FAD 6 and associated infrastructure will require the stripping of the topsoil for construction. This will result in the loss of soil potential ending in the sterilization of soils if not adequately mitigated.

The FAD 6 will be engineered to meet compliance with regulations and established engineering practices, including appropriate management of potential seepage and leachate collection, segregation of clean and dirty water areas, capture of seepage and surface run-off and recovery into the Synfuels process water circuit. Pump stations are located in bunded areas draining to sumps from where any spillage can be recovered within the process.

The footprint area of the FAD 6 site will be directly impacted. The potential for external soil contamination and erosion is minimised by effective stormwater management at FAD 6.

12.12.1 Impact on the sterilization of soils

Sterilization of soils will result in the complete denuding of the FAD 6 footprint and related topsoil. Topsoil is defined as the top section of the soil profile which is fertile and able to sustain microbial growth. This soil contains large amounts of nutrients sustains growth of vegetation.

Impact Rating and Mitigation – Construction

Construction activities will require the stripping of topsoil. This impact will have a severity of slightly harmful and a spatial extent of within the boundaries of the constructed FAD 6. The duration of this activity will occur during the first few phases of construction, whereby it will cease.

The duration of the activity is considered to be temporary and the frequency of the impact likely. This impact is rated as LOW and cannot be mitigated to a lower significance. The rating however can be reduced from 42 – 36 as illustrated in Table 12-38.

Table 12-38: Impact on sterilization of soils

Impact Alternative 1 and 2: Impact on sterilization of soils		
Severity	**Spatial extent**	**Duration of impact**
3	2	2
2	2	2
Consequence rating: 7 (unmitigated)		
Consequence rating: 6 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
2	4	
2	4	
Likelihood rating: 6 (unmitigated)		
Likelihood rating: 6 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 42 – LOW		
SIGNIFANCE RATING (MITIGATED): 36 – LOW		
Comments/mitigation: • Construction of an additional through left lane, on the southern approach and an exclusive right lane, on the northern approach; • The exclusive lanes should be constructed according to Provincial standards, 60m long and a 60m tapper; • Provision of light at sufficient standards at the intersection of the R546 and the proposed D714; and • No on-street pick-up/drop-offs at the intersection of the R546 and the proposed D714 should be permitted.		

12.12.1 Impact on the loss of land capability and land use potential

The land use of the current FAD 6 site is located mainly on agricultural farming land. The dominant land capability class involved that of grazing and agricultural activities. This land is farmed by local farming communities. The land is categorized by cattle grazing and subsistence farming. The soils in the areas are categorized by vertic and sandy soils. Due to the placement the FAD 6 and associated infrastructure, the current land use and land potential will be lost, and will not support cultivation and minimal grazing opportunities.

Impact Rating and Mitigation – Construction and operation

Construction activities will inherently alter the land capability and land use to that of industrial use. Considering the FAD 6 will not be decommissioned and moved from the site, this impact is permanent and the land use and land capability will be perpetually changed. .

The severity of this impact will be harmful considering the permanent change. The spatial extent of the impact will be specific to the footprint of the FAD 6. The duration of the impact will be permanent considering the material change in the land use.

The frequency of the activity and impact will be infrequent. The clearing of vegetation and construction of the FAD 6 impacting on the land use and land capability will occur during the initial stages of construction. This impact is rated to have a LOW MEDIUM significance rating and cannot be mitigated to a lower rating or significance as illustrated in Table 12-39.

Table 12-39: Impact on the loss of land capability and land use potential

Impact Alternative 1 and 2: Impact on the loss of land capability and land use potential		
Severity	**Spatial extent**	**Duration of impact**
4	2	4
4	2	4
Consequence rating: 10 (unmitigated)		
Consequence rating: 6 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
3	3	
3	3	
Likelihood rating: 6 (unmitigated)		
Likelihood rating: 6 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 60 – LOW MEDIUM		
SIGNIFANCE RATING (UNMITIGATED): 60 – LOW MEDIUM		
Comments/mitigation: • The FAD 6 should be sloped so as to ensure the successful vegetation of the side slopes; • Vegetated side slopes will bind the soil and slow down run-off, reducing erosion; • The side slopes should be terraced, to allow for the slowing down of flows on the side slopes and the creation of depositional zones on the side slopes; • Topsoil must be stripped from the FAD 6 footprint and stockpiled for further use in rehabilitation. Should sub soil be stripped this must be stored separately, and used to backfill excavations prior to the levelling with top soil; • Silt traps must be installed upstream of all RWD. These silt traps will should be regularly cleaned and maintained in fully working order at all times; • To minimise the risk of erosion, the extent of disturbed vegetation and soil should be kept to a minimum; • It is recommended that prior to the commencement of construction activities that the entire construction servitude, including lay down areas and stock pile areas etc., be fenced off and clearly demarcated; • All construction activity should be contained within this demarcated servitude; • The construction process should be phased so as to limit the extent of exposed areas at any one time, and so that for any specific area, the time between initial disturbance and completion of construction is as short as possible; • Construction Activities should take place within the dry season. As construction could possibly extend across more than just one dry season, it is recommended that the wetland crossings be constructed in the dry season and that any work done during the wet season should focus on the terrestrial areas; and • Following the completion of construction activities the disturbed areas should be ripped, scarified, landscaped to the original landscape profile, and re-vegetated with suitable indigenous grass species that will aid in soil stabilisation..		

12.12.1 Impact on the contamination of soils

During all phases of the project there will be constant vehicular traffic to and from the FAD 6 as well as along the re - aligned D714 and relocated powerline. During construction activities, a quantity of hazardous substances will be stored on site. As with any project of this nature there is the potential for spillage of oil, fuels and chemicals during construction, operation and closure phases. This may result in significant soil contamination, specifically during construction activities when the soils are exposed. This impact may subsequently contaminate surface and groundwater within the area.

Impact Rating and Mitigation – Construction and operation

The construction phase of the project will involve the storage of hazardous substances and the possible contamination of soil through spillages and leaks of hydrocarbons from construction vehicles and machinery. This potential of hydrocarbon spillage increases the potential of contaminated runoff into surrounding watercourses.

The severity of this impact is considered slightly harmful with a spatial extent of site specific of the FAD 6 and associated infrastructure. The duration of this activity will be infrequent as hydrocarbon spill will not continuously be spilled on site, and no servicing of vehicles will take place on site.

The frequency of the activity and impact will be infrequent. This impact will have an initial rating of LOW, which can be mitigated to a significance rating of VERY LOW considering mitigation and management measures are implemented. The details of this rating are stipulated in Table 12-40.

Table 12-40: Impact on the contamination of soils

Impact Alternative 1 and 2: Impact on the contamination of soils		
Severity	**Spatial extent**	**Duration of impact**
3	2	2
2	1	2
Consequence rating: 7 (unmitigated)		
Consequence rating: 5 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
3	3	
3	2	
Likelihood rating: 6 (unmitigated)		
Likelihood rating: 5 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 42 – LOW		
SIGNIFANCE RATING (UNMITIGATED): 25 – VERY LOW		
Comments/mitigation: • Develop a stormwater management plan; and • Develop spillage remediation measures.		

12.13 Biodiversity Impacts

This section is based on the assessment conducted by Eco Agent. In a few cases SRK's opinion differs from that of the specialist assessment. In such cases it will be clearly indicated and a justification provided to substantial the rating. Generic holistic rating were conducted by the specialist on vegetation, therefore SRK have rated individual vegetation impacts.

12.13.1 Direct loss of vegetation of conversational concern

Four plant communities and agricultural fields were identified. Five red data species may occur on the site, due to suitable habitat, but only one was recorded in the Moist Grasslands associated with the proposed project area. This red data specie, *Crinum bulbispermum,* is easily replanted within a suitable habitat. A number of alien invasive species have also identified within the footprint (Bredenkamp, G.J., et al. 2011).

The vegetation within the footprint of the FAD 6 has already been degraded through the development of agricultural lands. The footprint of the FAD 6 will fall largely on agricultural lands thereby reducing the impact on pristine vegetation species (Bredenkamp, G.J., et al. 2011).

The predominant impacts on fauna and flora will occur during the construction phase of the project. All new infrastructure (including the FAD 6) and realignment of the D714 and power lines in the vicinity will result in the loss of some natural vegetation and biodiversity. In the absence appropriate mitigation and management measures an increase in stormwater runoff due to the road realignment and construction of the FAD 6 and compaction from earth moving activities, together with the increase in dust generation and increase in soil erosion could contribute to an impact on riverine environments to the east and west of the site location. The increase in vehicle movement during construction and the subsequent use of the re aligned road, opens an opportunity for spillage of hazardous substances during construction activities as well as during operational activities on the re - aligned D714 road (Bredenkamp, G.J., et al. 2011).

Impact Rating and Mitigation – Construction

Construction activities associated with the FAD 6 and associated infrastructure includes the clearance of vegetation from the footprint. Floral species of conservational concern may need to be replanted in a suitable habitat for its type. Construction activities and moving of heavy machinery and trucks may threaten the destruction of local biodiversity beyond the project footprint.

The proposed construction of FAD 6 and its associated infrastructure will destroy the current ecosystems associated with the direct footprint area. While the ecosystems would be destroyed by the proposed construction of FAD 6, these are of little scientific importance or conservation value in a local regional or national context.

Considering the percentage of the footprint that will be located on land with some agricultural potential, this impact will only occur in areas that have been classified as highly sensitive. This impact may extend beyond the footprint of the proposed FAD 6 should mitigation measures not be enforced and project personnel not made aware of the EMP and awareness plan.

The severity of this impact is considered slightly harmful as a result of agricultural activities taking place within the area as well as minimal endangered species that were identified during the biodiversity assessment. The spatial scope of the impact is considered local. The impact on the removal of vegetation should only take place in designated areas. Only within the footprint of the FAD 6 associated infrastructure and the construction of the aligned road will vegetation be removed. The duration of the impact will be between one to ten years, as the sidewalls and footprint area of FAD 6 and associated infrastructure will be receive some rehabilitation during the operation phase.

The frequency of the activity will be infrequent as once site clearance has been complete no additional clearance will be conducted. The frequency of the impact is considered as regularly as this impact will be definitely performed during the construction of FAD 6. The construction of the FAD 6 will be conducted in phases, thus the activity will be conducted a number of times. The loss of biodiversity in these areas will not significantly alter the biodiversity in a national context. This impact has an initial rating of LOW MEDIUM which can be mitigated to a LOW rating considering the mitigations measures are implemented. The impact rating is illustrated in Table 12-41.

Table 12-41: Impact of the loss of vegetation species – Construction

Impact Alternative 1 and 2: Direct loss of vegetation of conversational concern.		
Severity	**Spatial extent**	**Duration of impact**
3	3	3
2	2	3
Consequence rating: 9 (unmitigated)		
Consequence rating: 7 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
3	5	
2	5	
Likelihood rating: 8 (unmitigated)		
Likelihood rating: 7 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 72 LOW MEDIUM		
SIGNIFANCE RATING (MITIGATED): 49 LOW		
Comments/mitigation measures: • Vegetation clearance will only be conducted within the site footprint, and disturbance will be minimized as far as feasible; • No fires are allowed on the site, unless in areas demarked and managed for this purposes; • Existing roads will be used wherever possible; • Erosion will be monitored on a regular basis at the disturbed areas at the FAD 6 and associated Activities as well as along the re - aligned road and power lines and remedial measure put in place should this be deemed a problem; • New roads should be aligned so as to remain on the flattest terrain for as long as possible; • The re - aligned D714 road and powerlines should not be constructed within a wetland, dry watercourse or within the 1:100 year floodline of any of these unless there is no alternative and the Water Use license is granted and the conditions adhered to; • All declining vegetation species and endangered faunal species identified within the project areas as well as those that may possible be found in the areas will be eradicated from the FAD 6 footprint and re-established in a suitable habitat. Monitoring or re growth of these plants will be monitoring for 5 years following their relocation. • Demarcate areas that may not be disturbed especially sensitive areas associated with drainage lines to the east and west of FAD 6; • Alien vegetation must be cleared from the footprint of the FAD 6 prior to construction and follow up monitoring and removal programs should be initiated once construction is complete. • No direct discharge of polluted water to the environment is to be permitted, other than may be provided for in the WUL, and under appropriate control in terms of the WUL; • Sensitive vegetation (wetlands and primary grasslands) that should not be impacted by construction activities should be cordoned off throughout the construction periods to restrict the movement of vehicles and any other development into such areas; • No project infrastructure will occur within the 1:100 year floodline or within 100 m of any non-perennial watercourses, except where authorized in the WUL; and • Ensure natural indigenous vegetation is used for rehabilitation purposes.		

Impact Rating and Mitigation – Operation

Operational activities associated with the operation of the FAD 6 and associated infrastructures may lead to vegetation impact if not effectively mitigated and managed. Disturbance of soils are one of the leading factors that is conducive to the spread of invasive alien plants. A large quantity of soils will be removed and stockpiled for rehabilitation purposes. However alien invasive vegetation should be monitored on a regular basis and eradicated should this be deemed necessary. Indigenous plants

and animal ecosystems are not suited to survive in the presence of alien plant species. These species in turn reduce the availability of favourable conditions for indigenous plants. Activities resulting in dust generation, increased stormwater runoff and erosion are assumed to emanate during construction activities and progress during operational activities.

The severity of this impact is considered potentially harmful as a result of potential loss of vegetation and faunal species through the invasion of alien species during operation phases. The spatial scope of the impact is within at least 5km from the FAD 6 boundaries as alien invasive species have the potential to spread over a wide area. The duration of this impact is considered between one to ten years, until all invasive species are eradicated. The operation of the FAD 6 should not lead to the significant loss of further vegetation since the site footprint will have been established during the construction phase, other than potential discharges from the system in water or dust affecting external vegetation, although this can be mitigated if all contractors and Synfuels personnel adhere to the conditions in the EMP.

The frequency of the activity leading to the destruction of vegetation will occur during the life of the operation as there will always be activities taking place within around the dam which pose a threat to vegetation loss. The frequency of the impact will be regular prior to mitigation measures vegetation loss will continuously be threatened. This impact has an initial significance rating of LOW MEDIUM which can be mitigated to VERY LOW considering the mitigations measures are implemented. The impact rating is found in Table 12-42.

Table 12-42: Impact of the loss of faunal and floral species – Operation

Impact Alternative 1 and 2: Direct Impact due to destruction of sensitive vegetation types as well as protected plant and animal species.		
Severity	**Spatial extent**	**Duration of impact**
2	3	3
2	2	2
Consequence rating: 8 (unmitigated)		
Consequence rating: 6 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
4	4	
2	2	
Likelihood rating: 8 (unmitigated)		
Likelihood rating: 4 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 64 LOW MEDIUM		
SIGNIFANCE RATING (MITIGATED): 24 – VERY LOW		
Comments/mitigation: • Existing roads will be used wherever possible; • Vegetation along the re - aligned D714 may only be mowed as long as the vision is impaired leading to a safety risk, and no other vegetation may be altered; • Alien vegetation must be monitoring and removal programs should be initiated during operation of the FAD 6; • No direct discharge of polluted water to the environment is permitted, other than may be provided for in the Water Use Licence, and under appropriate control in terms of the Water Use Licence; • Erosion will be monitored on a continual basis at the disturbed areas at the FAD 6 and associated Activities as well as along the re aligned road and power lines; • The FAD 6 and associated infrastructure will be fenced off in order to prevent unauthorized		

access and subsequent vegetation deterioration;

- Bio monitoring to be conducted on surface water resources in accordance with the WUL;
- The dam will be monitored under the Dam Safety regulation issued by the DWA;
- Incorporate an adequate mitigation and management plan to address spills and incidents in terms of the WUL;
- Should the dam overflow, remedial measure should be implemented in accordance with the DWA;
- Rehabilitation of the disturbed areas will be conducted during operation to re – introduce indigenous vegetation in the immediate vicinity of the FAD 6;
- Side walls of the FAD 6 will be re vegetated on an on – going basis, as far as technically practical;
- Establish a buffer zone between the FAD 6 system and watercourses to protect the aquatic ecosystems within these sensitive areas; and
- No go areas (wetlands and primary grasslands) will be demarcated.

Impact Rating and Mitigation – Closure

After the life span of the FAD 6 has been reached the closure of the dam will include rehabilitation of the FAD 6 system and surrounding affected areas. It is expected that no further negative impacts will result from the closure phase on the loss of faunal and floral species. The re - vegetation and subsequent re habitation of faunal and flora species within the project areas will be a direct result of the closure phase.

The severity of this impact is considered non harmful as the biodiversity in the immediate area will increase as a result of rehabilitation and decreased human activity in the area. The spatial scope of the impact at this stage is considered activity specific. The duration of the impact is considered between one day and one month, as the minimal activity will be conducted on the site during rehabilitation. The duration of the activity is considered low and the impact of the activity is almost never. This impact is rated as VERY LOW. Table 12-43 illustrates the rating of this impact at the closure phase of the project.

Table 12-43: Impact of the loss of Faunal and Floral species – Closure

Impact Alternative 1 and 2: Direct Impact due to destruction of sensitive vegetation types as well as protected plant and animal species.		
Severity	**Spatial extent**	**Duration of impact**
1	1	1
1	1	1
Consequence rating: 3 (unmitigated)		
Consequence rating: 3 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
1	1	
1	1	
Likelihood rating: 2 (unmitigated)		
Likelihood rating: 2 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 6 VERY LOW		
SIGNIFANCE RATING (MITIGATED): 6 – VERY LOW		
Comments/mitigation: • Maintain proposed closure rehabilitation and management measures.		

12.13.2 Direct loss of habitat and indirect loss of habitat quality

A number of habitats were identified in the biodiversity assessment. Vegetation habitats range from Grasslands to Vlei – Wetland areas. Faunal habitats include wetlands and terrestrial areas. From an avifaunal point of view three habitat areas were identified namely: Natural Grasslands, Watercourses and Crop lands. All these habitats are of equal importance therefore assessed as a consolidated habitat. As a result of agricultural activities, runoff patterns have altered, forming a series of marsh pans and wetlands within the vicinity of the FAD 6 footprint. These have in turn established habitats for a number of species (Bredenkamp, G.J., et al. 2011).

Impact Rating and Mitigation – Construction

The most significant impacts on habitat loss and quality come as a result from construction activities. When infrastructure is built on undeveloped land, the result is a permanent loss of habitat. Temporary lay down areas and contractors camp will result in the temporary loss of habitat, assuming rehabilitation of the areas are effectively carried out. Considering the current disturbance of the areas, mostly common hardy species occur on site, which are highly tolerant to disturbance. The formation of drainage courses within the area have resulted in the formation of ideal habitats for the Giant Bull Frog (*Pyxicephalus adspersus*).

The use of heavy machinery, mixing of cement and use of hazardous substances on site may lead to the pollution of soil and groundwater. Polluted water can move beyond the construction site, reaching wetlands or watercourses, which in turn affect the potential for future rehabilitation. Dust generated by construction activities will drift onto neighbouring vegetation and wetlands, causing the degradation of habitats, with temporary localize negative impacts on animals using those habitats.

Soil disturbance is one of the contributing factors to invasive alien species in any area. The soil disturbance associated with the FAD 6 construction as well as the road re alignment will be extensive within the footprint of the construction activities. Alien grasses, herbs and shrubs may invade the disturbed areas, if not managed. This will have an indirect effect on habitat loss of indigenous biodiversity. These impacts can be effectively mitigated (Bredenkamp, G.J., et al. 2011).

During construction of the FAD 6 it is expected that the severity of the impact will be slightly harmful in the local context, as a national impact the loss of habitat and habitat quality will not be significantly impacted on. The spatial scope of this impact is thus rated as within the site specific area, as a decrease in habitat quality can be experienced in the immediate vicinity. The duration of the impact will be between one to ten years, as following this period a number of rehabilitation measure will be implemented and terrestrial ecosystems would have had a chance to re-establish.

The frequency of the activity is considered to be infrequent as the habitat loss as a result of construction activities of the FAD 6 and associated infrastructure can by mitigated over time. The frequency of the impact is considered as seldom. Habitat destruction will continue within the footprint of the proposed activity over the period of construction. The possibility exists that additional areas may be impacted on, should management controls not be enforced. With the incorporation of management measures the significance of this impact is VERY LOW considering the mitigations measures are implemented. The impact rating is illustrated in Table 12-44.

Table 12-44: Impact of the loss of habitat and habitat quality – Construction

Impact Alternative 1 and 2: Direct loss of habitat and indirect loss of habitat quality		
Severity	**Spatial extent**	**Duration of impact**
3	2	3
2	2	2
Consequence rating: 8 (unmitigated)		
Consequence rating: 6 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
4	4	
2	2	
Likelihood rating: 8 (unmitigated)		
Likelihood rating: 4 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 72 LOW MEDIUM		
SIGNIFANCE RATING (MITIGATED): 24 – VERY LOW		
Comments/mitigation: • Existing roads will be used wherever possible; • Alien vegetation must be cleared from the footprint of the FAD prior to construction and follow up monitoring and removal programs should be initiated during operation; • No direct discharge of polluted water to the environment is permitted, other than may be provided for in the Water Use Licence, and under appropriate control in terms of the Water Use Licence; • Erosion will be monitored on a continual basis at the disturbed areas at the FAD and associated Activities as well as along the re aligned road and power lines; • The FAD 6 and associated infrastructure will be fenced off in order to prevent unauthorized access; • New access roads must be aligned so as to remain on the flattest terrain for as long as possible; • The use of herbicides must be limited and may only be used under strict control and when no other alternative exists; • Establish a buffer zone between the FAD 6 system and watercourses; • The construction site for the FAD 6, road realignment and power line relocation should be inspected for the occurrence of erosion. Appropriate remedial Action must be taken should erosion become a problem; • Where a road / pipeline/ power line is to traverse a wetland, measures are required to ensure that the road / pipeline/ power line has minimal effect on the flow of water through the wetland, e.g. by using a high level clear span bridge or box culverts rather than pipes; • Outside lighting should be designed to minimize impacts on fauna; and • Include a comprehensive surface runoff and storm water management plan, indicating how all surface runoff and seepage generated as a result of the development (during both the construction and operational phases) will be managed (e.g. artificial wetlands / storm water and flood retention ponds) prior to entering any natural drainage system or wetland and how surface runoff will be retained outside of any demarcated buffer/flood zones and subsequently released to simulate natural hydrological conditions.		

Impact Rating and Mitigation – Operation

Operation activities of the FAD 6 and associated infrastructure threaten remaining biodiversity habitats at a smaller degree. This is due to minimal human activities taking place in the vicinity. However the overflowing of the dam or failure of the dam walls will result in the decrease in habitat quality in and around the area, as could , the use of the re - aligned road phase of the project.

Operational activities of the FAD 6 construction may result in the deterioration of nearby habitats. Alien invasive species, if not correctly controlled, may invade the surrounding areas, which in turn could eradicate species richness in the area. Should the RWD or FAD 6 accidently overflow, habitats in the immediate surrounding will be impacted on. The quality of these habitats, if not permanent, will be temporarily negatively altered.

The use of the re - aligned D714 road, may affect the surrounding habitats through the increased use of the road as well as through the runoff of oil spills on the road into the surrounding areas.

Operational activities associated with the FAD 6 could be considered as being slightly harmful. Although habitats will be permanently destroyed in the area, the operational activities will provide minimal activities resulting in the loss of habitat and habitat quality. The spatial scope of this impact will be limited to the site of the FAD 6 footprint and will not materially affect habitats further away from the site. The duration of the impact is rated as being between one to ten years, as the impact will extend during the entire construction period. Habitat loss in the area will be permanently lost. The ecological reconstruction performed after the areas has been decommissioned and relieved from its regular function, it will not be able to retrieve the initial ecological balance of the area.

The frequency of the activity is rated as being during the life of the operation. As long as the FAD 6 is in operation the possibility of habitat deterioration will exist. Habitat loss through the establishment of the FAD 6, may lead to a change in specie composition in the area. The frequency of the impact is considered seldom. The impact of operation on the loss of habitat is not expected to be experienced in frequent intervals. The potential risk of failure of the dam wall or overflowing will be taken cognisance of during the design of the FAD 6. This impact is not expected to materialize in the future. This impact has an initial rating of LOW MEDIUM which can be mitigated to a LOW significance considering the mitigations measures are implemented. Table 12-45 illustrates the ratings for this impact.

Table 12-45: Impact of the loss of habitat and habitat quality – Operation

Impact Alternative 1 and 2: Direct loss of habitat and indirect loss of habitat quality		
Severity	**Spatial extent**	**Duration of impact**
3	2	3
2	2	3
Consequence rating: 8 (unmitigated)		
Consequence rating: 7 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
5	3	
4	2	
Likelihood rating: 8 (unmitigated)		
Likelihood rating: 6 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 64 LOW MEDIUM		
SIGNIFANCE RATING (MITIGATED): 42 –LOW		
Comments/mitigation: • Existing roads will be used wherever possible; • Alien vegetation must be cleared from the footprint of the FAD prior to construction and follow up monitoring and removal programs should be initiated during operation; • No direct discharge of polluted water to the environment is permitted, other than may be provided for in the Water Use Licence, and under appropriate control in terms of the WUL;		

- Erosion will be monitored on a regular basis at the disturbed areas at the FAD 6 and associated activities as well as along the re aligned road and power lines;
- The FAD 6 and associated infrastructure will be fenced off in order to prevent unauthorized access;
- New access roads must be aligned so as to remain on the flattest terrain for as long as possible;
- The use of herbicides must be limited and may only be used under strict control and when no other alternative exists;
- Establish a buffer zone between the FAD 6 system and watercourses;
- The FAD 6, road realignment and power line relocation should be inspected for the occurrence of erosion. Appropriate remedial action must be taken should erosion become a problem;
- Where a road / pipeline/ power line is to traverse a wetland, measures are required to ensure that the road / pipeline/ power line has minimal effect on the flow of water through the wetland, e.g. by using a high level clear span bridge or box culverts rather than pipes;
- Outside lighting should be designed to minimize impacts on fauna; and
- Include a comprehensive surface runoff and storm water management plan, indicating how all surface runoff and seepage generated as a result of the development (during both the construction and operational phases) will be managed (e.g. artificial wetlands / storm water and flood retention ponds) prior to entering any natural drainage system or wetland and how surface runoff will be retained outside of any demarcated buffer/flood zones and subsequently released to simulate natural hydrological conditions.

Impact Rating and Mitigation – Closure

After the life span of the FAD 6 has been reached the closure of the dam will include rehabilitation of the dam and surrounding areas. It is expected that no further negative impacts will result from the closure phase on the loss of habitat and habitat quality. Although the construction of the FAD 6 will result in the permanent loss of habitats in the area, no addition impact will be associated with the closure phase. The re - vegetation and subsequent re - habitation of faunal and flora species within the project areas will be a direct result of the closure phase.

The severity of this impact is considered non harmful as the biodiversity and habitat diversity in the immediate area will increase as a result of rehabilitation and decreased human activity in the area. The spatial scope of the impact at this stage is considered activity specific. The duration of the impact is considered between one day and one month, as minimal disturbance activities will be conducted on the site during rehabilitation. The duration of the activity is considered low and the impact of the activity is almost never. This impact has a rating of VERY LOW. Table 12-46 illustrates the rating of this impact at the closure phase of the project.

Table 12-46: Impact of the loss of habitat and habitat quality – Closure

Impact Alternative 1 and 2: Impact of the loss of habitat and habitat quality.		
Severity	**Spatial extent**	**Duration of impact**
1	1	1
1	1	1
Consequence rating: 3 (unmitigated)		
Consequence rating: 3 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
1	1	
1	1	
Likelihood rating: 2 (unmitigated)		
Likelihood rating: 2 (mitigated)		

SIGNIFANCE RATING (UNMITIGATED): 6 VERY LOW
SIGNIFANCE RATING (MITIGATED): 6 – VERY LOW
Comments/mitigation: • Maintain effective management ;

12.13.1 Direct loss of faunal species of conservational concern

The biodiversity assessment identified a number of species of conservational concern. The drainage lines formed as a result of the agricultural activities in the area have naturally developed habitats which could support the Giant Bull Frog. This species prefers seasonal wet areas to breed. As a result of conversational activities this specie has altered its classification from near threatened to least concern (Carruthers et al. 2011). From an avifaunal perspective a number of frequent near threatened and vulnerable species are expected to occur on the site. The near threatened Secretary bird and vulnerable African Grass owl and White-bellied Korhaan are expected to be found on the site from time to time. The biodiversity assessment deduced that a number of species of conservational value will be found on the site. These species are the African marsh rat (*Dasymys incomtus)*, and the near threatened Southern African hedgehog (*Atelerix frontalis*).

Impact Rating and Mitigation – Construction

Construction related impact may result in the deterioration of species richness of conserved faunal species. These species will be permanently expelled from the proposed footprint. Construction activities include the site clearance of the FAD 6 and associated infrastructure. Ecological disturbance will be experience from earth moving machinery and heavy vehicles. Sensitive environmental habitats will in close vicinity of the construction activities will be threatened. Noise generated during construction will in turn affect the faunal species in the area. The construction activities will destroy the natural biodiversity in the area, which will in turn prevent species from re colonizing the area. This may lead to species becoming rare in the local context if not mitigated.

Table 12-47 illustrates the impact rating of this impact during construction. During construction the species identified by the biodiversity assessment will need to be relocated to a suitable habitat should these species be found.

All phases of the project will influence species of conservational concern to an extent. The severity of the impact is considered to be slightly harmful as these species of conservational concern as assumed to be present in the areas, yet were not identified by the biodiversity assessment. The spatial scope of this impact is rated as being site specific. No species extending from the FAD 6 activities will be affected.

Should water bodies be polluted during the phases of the FAD 6, species downstream may be affected, however this impact will be minimal as farming activities have already impacted on the surrounding environments. The duration of the impact will be one to ten years, as the impact within the footprint will remain as long as construction activities are conducted.

The frequency of the activity will be infrequent as the possibility of watercourse pollution or removal of the species richness will initially occur during construction activities where the highest risk will be portrait. The frequency of the impact is considered to be highly likely as the ecological damage occurred during construction activities can't be revived to its initial biological balance as the evolution of the bio system has been irreversible modified. This impact has an initial rating of LOW MEDIUM which can be mitigated to VERY LOW significance considering the mitigations measures are implemented.

Table 12-47: Impact of the loss faunal species of conservation concern – Construction

Impact Alternative 1 and 2: Direct loss of faunal species of conservational concern		
Severity	**Spatial extent**	**Duration of impact**
3	3	3
2	1	2
Consequence rating: 9 (unmitigated)		
Consequence rating: 5 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
3	5	
3	2	
Likelihood rating: 8 (unmitigated)		
Likelihood rating: 5 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 72 LOW MEDIUM		
SIGNIFANCE RATING (MITIGATED): 25 – VERY LOW		

Comments/mitigation:

- Existing roads will be used wherever possible;
- Alien vegetation must be cleared from the footprint of the FAD 6 prior to construction and follow up monitoring and removal programs should be initiated during operation;
- No direct discharge of polluted water to the environment is permitted, other than may be provided for in the Water Use Licence, and under appropriate control in terms of the WUL;
- Erosion will be monitored on a regular basis at the disturbed areas at the FAD 6 and associated Activities as well as along the re aligned road and power lines;
- No poaching will be permitted during all phase of the project;
- Sensitive environments will be demarcated as no go areas, and protected.
- The FAD 6 and associated infrastructure will be fenced off in order to prevent unauthorized access;
- New access roads must be aligned so as to remain on the flattest terrain for as long as possible;
- The use of herbicides must be limited and may only be used under strict control and when no other alternative exists;
- Establish a buffer zone between the FAD 6 system and watercourses;
- Where a road / pipeline/ power line is to traverse a wetland, measures are required to ensure that the road / pipeline/ power line has minimal effect on the flow of water through the wetland, e.g. by using a high level clear span bridge or box culverts rather than pipes;
- Outside lighting should be designed to minimize impacts on fauna;
- Species of conservational concern will be removed from the vicinity of construction Activities and relocated to suitable habitats. Contractors will be educated to recognize these species and relocate them if necessary; and
- Include a comprehensive surface runoff and storm water management plan, indicating how all surface runoff and seepage generated as a result of the development (during both the construction and operational phases) will be managed (e.g. artificial wetlands / storm water and flood retention ponds) prior to entering any natural drainage system or wetland and how surface runoff will be retained outside of any demarcated buffer/flood zones and subsequently released to simulate natural hydrological conditions.

Impact Rating and Mitigation – Operation

Operation related impact may result in the decrease in faunal species of conservational concern; this may be a direct result of noise generated within the vicinity as well as the possibility of polluting the direct environment. The realignment of the D714 crossing a watercourse in the south west of the

footprint, may induce an increase in road kill. The frequency of this must be monitored, and signage put in place should this become a problem.

Poaching of faunal species might become a problem on the site during all phase of the project, and needs to be discouraged. Inappropriate management of stormwater run-off, erosion and air emissions may result in the negative impact of the ecology of the wetlands and streams in the vicinity.

Operational activities may extend beyond the footprint of the FAD 6 whereby additional species will be threatened. These need to be managed and all areas of concern will be demarcated as no go areas. These areas may include wetlands, and sensitive habitats in the area.

All phases of the project will influence species of conservational concern to an extent. The severity of the impact is considered to be slightly harmful as these species of conservational concern as assumed to be present in the areas, yet were not identified by the biodiversity assessment. The spatial scope of this impact is rated as being site specific. No species extending from the FAD 6 activities will be affected.

Should water bodies be polluted during the phases of the FAD 6, species downstream may be affected, however this impact will be minimal as farming activities have already impacted on the surrounding environments. The duration of the impact will be during the life of operation, as the possibility of impacting these species of concern will remain as long as the dam is in operation.

The frequency of the activity will be infrequent as the possibility of watercourse pollution or removal of the species richness will initially occur during construction activities where the highest risk will be portrait. The frequency of the impact is considered to be regularly as the risk of pollution and species degradation will be continual during ash deposition operations. This impact has an initial rating of LOW MEDIUM which can be mitigated to LOW significance considering the mitigations measures are implemented. The impact rating of this impact is illustrated in Table 12-48.

Table 12-48: Impact of the loss faunal species of conservation concern – Operation

Impact Alternative 1 and 2: Direct loss of faunal species of conservational concern		
Severity	**Spatial extent**	**Duration of impact**
3	2	4
2	1	4
Consequence rating: 9 (unmitigated)		
Consequence rating: 7 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
4	3	
4	2	
Likelihood rating: 7 (unmitigated)		
Likelihood rating: 6 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 63 LOW MEDIUM		
SIGNIFANCE RATING (MITIGATED): 42 LOW		
Comments/mitigation: • As per Table 12-47, including the following; • Road kill will be monitored and signage boards erected should this become a problem; • No direct discharge of polluted water to the environment is permitted, other than may be provided for in the Water Use Licence, and under appropriate control in terms of the WUL;		

- Implement an Ecological Management Plan which must be audited on an annual basis by a specialist registered in terms of the Natural Scientific Professions Act (No. 27 of 2003) in the field of Ecological Science; and
- Outside lighting should be designed to minimize impacts on fauna. All outside lighting should be directed away from sensitive areas as indicated in Figure 6-14 . Fluorescent and mercury vapour lighting should be avoided and sodium vapour (yellow) lights should be used wherever possible.

Impact Rating and Mitigation – Closure

After the life span of the FAD 6 has been reached the closure of the dam will include rehabilitation of the dam and surrounding affected areas. It is expected that no further negative impacts will result from the closure phase on the loss of faunal species. Although the construction of the FAD 6 will result in the permanent loss of habitats in the area, no addition impact will be associated with the closure phase. The re - vegetation and subsequent re habitation of faunal and flora species within the project areas will be a direct positive result of the closure phase.

The severity of this impact is considered non harmful as the biodiversity in the immediate area will increase as a result of rehabilitation and decreased human activity in the area. The spatial scope of the impact at this stage is considered activity specific. The duration of the impact is considered between one day and one month, as the minimal activity will be conducted on the site during rehabilitation. The duration of the activity is considered low and the impact of the activity is almost never. This impact has an initial rating of VERY LOW. Table 12-49 illustrates the rating of this impact at the closure phase of the project.

Table 12-49: Direct loss of faunal species of conservational concern – Closure

Impact Alternative 1 and 2: Direct loss of faunal species of conservational concern		
Severity	**Spatial extent**	**Duration of impact**
1	1	1
1	1	1
Consequence rating: 3 (unmitigated)		
Consequence rating: 3 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
1	1	
1	1	
Likelihood rating: 2 (unmitigated)		
Likelihood rating: 2 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 6 VERY LOW		
SIGNIFANCE RATING (MITIGATED): 6 – VERY LOW		
Comments/mitigation: • Maintain appropriate management.		

12.14 Impacts on Wetland Systems

The impact relating to wetland systems as a result of the FAD 6 were sourced from the Wetland Specialist report.

The presence of wetlands in the landscape can be linked to the presence of both surface water and perched groundwater. Wetland types are differentiated based on their Hydro-Geomorphic (HGM)

characteristics; i.e. on the position of the wetland in the landscape, as well as the way in which water moves into, through and out of the wetland systems.

A number of wetland systems were identified within the study area associated with unnamed tributaries of the Kleinspruit (draining north east off the site) and the Waterval River (draining west off the site) respectively. The wetlands cover a total of 88.1 hectares, which includes 6 dams totalling 1.9 hectares. These dams are manmade structures that were presumably put in place to ensure/extend the availability of surface water for livestock watering.

In addition to the wetlands and dams, a further three quarries were identified on site. At least two of the quarries represent artificial low points within the landscape in which water accumulates following rainfall, and thus represent artificial wetland areas. Some seepage from localised perched water tables might also contribute to water within the quarries. The quarries appear isolated from surrounding wetland systems, though some discharge is possible following heavy rainfall. The three quarries cover roughly 4.8 hectares.

12.14.1 Impact on the loss of wetland vegetation and habitat

The current proposed location and size of the FAD 6 will result in the permanent destruction of approximately 32.9 hectares of wetland habitat in the case of Alternative 1, and 37.2 hectares in the case of Alternative 2, while the three proposed RWD will necessitate the further destruction of 3.6 hectares of wetlands that fall within the direct footprint of the developments. Destruction of the wetlands will result in the loss or displacement of biodiversity associated with the affected reach of the wetlands, while indirect negative impacts will also accrue to the downstream reaches of the affected wetlands through altered flow volumes and quality.

Impact Rating and Mitigation –Construction

The construction activities of the FAD 6 will result in the loss of wetland habitat. Wetland habitats that are located immediately adjacent to the development footprints are likely to be substantially disturbed during the construction process through increased and uncontrolled movement of heavy machinery and people on site.

The Severity of this impact is considered to be significant. Wetland vegetation and habitat will be definitely destroyed. The only way to avoid the loss of wetland habitat is to locate the dams in such a way that no wetlands fall within the footprint of the dams. Given the size of the dams required and the extent of wetlands on the Mpumalanga Highveld, it is unlikely that such sites would be found in close proximity to the SSIC. The currently proposed location of the FAD 6 on mostly vertic soils is also preferred to any possible alternative location on sandy soils, as wetlands are likely to be more extensive on sandy soils. In addition, the less permeable nature of clayey soils is likely to reduce the seepage of water out of the FAD 6 and RWD. The spatial rating thus this impact will be site specific. The duration of the impact will be during the life of operation of the dam as the destruction of wetland vegetation within the footprint of the dam can be effectively mitigated, however not to the pristine original state.

The duration of the activity will be permanent and the frequency of the impact will be defiantly as long as the dam is constructed in the proposed position. This impact can be mitigated to a lower significant rating from MEDIUM HIGH to MEDIUM LOW considering the mitigations measures are implemented. This impact rating is illustrated in Table 12-50.

Table 12-50: Impact on the loss of wetland vegetation and habitat

Impact Alternative 1 and 2: Impact on the loss of wetland vegetation and habitat		
Severity	**Spatial extent**	**Duration of impact**
4	2	5
2	1	4
Consequence rating: 11 (unmitigated)		
Consequence rating: 7 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
5	5	
5	5	
Likelihood rating: 10 (unmitigated)		
Likelihood rating: 10 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): – 88 MEDIUM – HIGH		
SIGNIFANCE RATING (MITIGATED): 70 LOW MEDIUM		
Comments/mitigation: • The construction servitude for each of the propose developments should be clearly defined and fenced off prior to the arrival of construction machinery on site; • No movement of vehicular or human traffic should be allowed in any wetlands falling outside the defined construction servitude; • Construction workers should be informed on the location of the wetland habitats and their sensitivity as part of the induction process prior to starting work on site as indicated in Figure 6-16; • Following completion of construction activities a clean-up and rehabilitation program should be implemented for all wetlands located adjacent to the construction servitudes, for a minimum of 200m upstream and downstream of the ash dams and RWD; • Disturbed areas should be ripped and scarified (if necessary) and re-vegetation should be encouraged and monitored to ensure success; • If rapid vegetation establishment does not occur these areas will need to be seeded with an appropriate seed mix; • The road design should ideally cross the wetlands via the shortest possible route perpendicular to the direction of flow; • Locate all laydown areas, material stockpiles, temporary construction camps and support infrastructure and heavy machinery parking areas outside any of the delineated wetland areas; and • Such areas should be clearly demarcated and all associated activities restricted to the demarcated area.		

12.14.1 Impact on the increased sediment movement off the site

During the construction process the entire footprint of the proposed FAD 6 and RWD will be cleared of vegetation and the topsoil removed to a depth of around 200mm. Removal of vegetation and the disturbance of the soil profile will expose the soils to erosion by wind (dust) and water (from surface run-off). Eroded soil is likely to enter downstream wetland areas, increasing sedimentation within these wetlands and leading to changes in vegetation composition and aquatic fauna. Erosion is likely to be highest during the summer months when high intensity storm events are likely to result in significant surface runoff. While the vertic clay soils are fairly resistant to erosion in the undisturbed state, once disturbed they will pose a significant erosion risk. As a consequence of the increased erosion, increased sediment is likely to be transported into the downslope and adjacent wetlands. This will lead to increased turbidity within the receiving water resources, while deposited sediment

will lead to changes to the vegetation within the receiving environment, while in open water habitats, increased sedimentation can lead to a change in the substrate characteristics with resultant negative impacts to biodiversity.

Impact Rating and Mitigation –Construction Operation and Closure

This impact will originate during construction and will continue throughout operation and closure phase. The severity of this impact will be great resulting in the increased sedimentation in downstream watercourses. The disturbance of the soils in the vicinity, exposing the surface to erosion will be significant during the summer months as during this time temperature and strong winds will increase the erosion potential of the area. The spatial extent of the area will be site specific within the boundaries of SSIC. The duration of the impact will be one to ten years. As soon as re vegetation and rehabilitation is conducted on site during construction and operation activities the erosion potential will decrease and sedimentation to downstream watercourses will be minimized. Limiting erosion will ultimately limit the source of sediments.

The duration of the activity will be regularly and the frequency of the impact is considered to be often. I degree of sedimentation will be evident considering the size of the area proposed to be cleared. This impact receives a MEDIUM HIGH significance rating which can be mitigated to a LOW rating considering the mitigations measures are implemented. The impact rating of this impact is illustrated in Table 12-51.

Table 12-51: Impact on Increased sediment movement off the site

<table>
<tr><td colspan="3">Impact Alternative 1 and 2:
Impact on the Increased sediment movement off the site.</td></tr>
<tr><td>Severity</td><td>Spatial extent</td><td>Duration of impact</td></tr>
<tr><td>4</td><td>2</td><td>3</td></tr>
<tr><td>3</td><td>2</td><td>3</td></tr>
<tr><td colspan="3">Consequence rating: 9 (unmitigated)</td></tr>
<tr><td colspan="3">Consequence rating: 8 (mitigated)</td></tr>
<tr><td colspan="2">Duration of Activity / aspect</td><td>Frequency of impact</td></tr>
<tr><td colspan="2">4</td><td>4</td></tr>
<tr><td colspan="2">3</td><td>3</td></tr>
<tr><td colspan="3">Likelihood rating: 8 (unmitigated)</td></tr>
<tr><td colspan="3">Likelihood rating: 6 (mitigated)</td></tr>
<tr><td colspan="3">SIGNIFANCE RATING (UNMITIGATED): – 72 LOW MEDIUM</td></tr>
<tr><td colspan="3">SIGNIFANCE RATING (MITIGATED): 48 LOW</td></tr>
<tr><td colspan="3">Comments/mitigation:
• Erosion of sediment from the development footprints should be minimised;
• Limit the aerial extent of the disturbance to the exact footprint of the proposed development;
• Constructing the various developments in phases rather than all at once should also be considered if practically possible;
• Construction, or at a minimum all the major earthworks, should strive to be timed to coincide with the dry season where erosion due to rainfall run-off is minimised;
• The construction of a low, shallow berm at the downslope side of the cleared construction footprint should also be considered to create a depositional zone outside of the wetland areas to trap sediments;
• Following completion of construction activities in an area, disturbed soils should be stabilised through re-vegetation as soon as possible;</td></tr>
</table>

- Rehabilitation of disturbed areas should not only be undertaken following the completion of all construction activities, but should be undertaken throughout the construction process whenever Activities in a certain section of the site have been completed; and
- Where construction takes place within wetlands or immediately adjacent to wetlands, hay bales or sediment nets should be stacked in rows downslope of construction activities to trap any sediment washed off these areas by surface run-off.

12.14.1 Impact on altered flows within wetland areas

The construction of the proposed FAD 6 will require the installation of water management infrastructure to separate clean and dirty water, with clean water being diverted around the dam. In addition, the FAD 6 will isolate portions of the catchment of various wetlands as rainfall falling within the dam footprint will be diverted via the dirty water management system. All of these activities will result in altered flow patterns within the downslope wetlands, specifically also in decreased flows where a significant portion of the wetlands catchment will now be occupied by the proposed dams. Decreased flows within the downslope wetlands will result in a decreased wetland extent and decreased vegetation vigour as wetland species are replaced by dry land species, increasing the risk of erosion especially during flood events. Where the clean water systems discharge into downstream receiving wetlands, flows are also likely to be more concentrated and of higher velocity, increasing the likelihood of erosion and channel incision within the wetlands.

During operation the trapping of debris against road culverts could result in flow obstruction leading to concentration of flows or impoundment of flows upstream of the obstruction. Concentrated flows lead to an increase in erosion risk, while impoundment of flows will lead to deposition of sediments, with deposited sediments likely to be colonised by pioneer species or reeds, resulting in changes to the wetland habitat.

Impact Rating and Mitigation –Construction Operation and Closure

This impact will commence in the construction phase but persist for the duration of the operational phase as well. This impact cannot be avoided if the proposed developments are constructed as planned.

The severity of this impact will be great resulting in the increased sedimentation in downstream watercourses. The disturbance of the soils in the vicinity, exposing the surface to erosion will be significant during the summer months as during this time temperature and strong winds will increase the erosion potential of the area. The spatial extent of the area will be site specific within the boundaries of SSIC. The duration of the impact will be one to ten years. As soon as re vegetation and rehabilitation is conducted on site during construction and operation activities the erosion potential will decrease and sedimentation to downstream watercourses will be minimized.

The duration of the activity will be regularly and the frequency of the impact is considered to be often. A degree of sedimentation will be evident considering the size of the area proposed to be cleared. This impact receives a MEDIUM HIGH significance rating which can be mitigated to a MEDIUM LOW rating considering the mitigations measures are implemented. The impact rating is illustrated in Table 12-52.

Table 12-52: Impact on altered flows within wetland areas

Impact Alternative 1 and 2: Impact on altered flows within wetland areas.		
Severity	**Spatial extent**	**Duration of impact**
4	3	4
3	2	3
Consequence rating: 11 (unmitigated)		
Consequence rating: 8 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
4	4	
3	4	
Likelihood rating: 8 (unmitigated)		
Likelihood rating: 7 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): – 88 MEDIUM – HIGH		
SIGNIFANCE RATING (MITIGATED): 56 MEDIUM – LOW		
Comments/mitigation: • To minimise the impact of reduced flows within the downslope wetlands, the area excluded from the wetlands catchment by the FAD 6 and associated dirty water management area should be kept as small as possible; • Flows that are released back into downslope wetlands from river diversions and clean water management infrastructure should aim to mimic natural flows within the systems and should not result in concentrated high velocity flows; • Suitable erosion protection measures should also be put in place should erosion initiate; • The required river diversion should be sensitively designed and appropriately vegetated with local, indigenous vegetation. • Bi annual monitoring of the river diversion (aquatic invertebrates, diatoms, vegetation, structural integrity etc.) should be undertaken by independent specialists; • Culverts should avoid high velocity discharges, and flows under regular return events should ideally not differ significantly from natural flows within the wetland; • Discharge points should also be protected by erosion control measures and energy dissipaters in the form of rock packed mattresses radiating out from the culverts at 45 degrees; • Regular inspections and maintenance of all bridges and culverts should be undertaken along the route; and • As a minimum, all bridge piers and culverts should be cleared of debris at the start of the rainy season (September every year) and during the middle of the rainy season (January). In addition, inspections and, if required, maintenance should be undertaken after every significant flood event.		

12.14.1 Impact on Wetland Quality deterioration

During the construction phase of the project, water quality deterioration will result as a consequence of increased sediment loads within the downslope wetlands, as well as through pollutants derived from spillage, leakage and incorrect disposal of hazardous substances on site. Incorrect waste management and disposal is also likely to contribute further to water quality deterioration.

Impact Rating and Mitigation – Construction

This impact will commence in the construction phase but persist for the duration of the operational phase as well. Construction activities on site utilizing hydrocarbons pose a risk to water quality as a result of spillages and contaminated runoff. The severity of this impact will be slightly harmful and

limited to the boundaries of SSIC. The duration of the impact will be one to ten years. Once construction activities have ceased, the operational activities will pose minimal treat to water quality deterioration relating to hydrocarbon contamination.

The duration of the impact will be daily with a highly likely frequency of the activity. Considering the continual use of construction vehicles and equipment utilizing substances with hydrocarbon content, these activities will proceed through the construction activities of FAD 6. Waste generated on site as well as increase sediment loads downstream of the construction activities will continue throughout the construction phase: however these impacts can be mitigated from a rating of MEDIUM HIGH to a LOW significance considering the mitigations measures are implemented. This impact rating is illustrated in Table 12-53.

Table 12-53: Impact on Wetland Quality deterioration due to hydrocarbon spillages

Impact Alternative 1 and 2: Impact on Wetland Quality deterioration due to hydrocarbon spillages		
Severity	**Spatial extent**	**Duration of impact**
3	2	3
2	1	3
Consequence rating: 8 (unmitigated)		
Consequence rating: 6 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
5	5	
5	3	
Likelihood rating: 10 (unmitigated)		
Likelihood rating: 8 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): – 80 MEDIUM – HIGH		
SIGNIFANCE RATING (MITIGATED): 48 LOW		
Comments/mitigation: • Use of potentially polluting and hazardous substances on site should be strictly controlled; • Use of polluting substances should only be allowed in clearly demarcated areas on site under constant supervision of suitably trained personnel; • Spill response procedures must be clearly defined and well known by all construction staff. Sufficient quantities of spill response equipment and products (e.g. Drizit) should always be available on site; • Sufficient spill absorbent material will be kept on site to deal with small spills; • A detailed waste management plan must also be put in place that clearly defines the different categories of waste and how each must be handled and stored of; • To prevent spillages, no diesel or oil should be stored on site, other than what is required for work undertaken during the course of 1 day; • Such diesel and oil should be stored in a way that will allow any spillages to be easily and quickly isolated (e.g. stored on plastic sheeting).. Absorbent material and contaminated soil should be stored of at a registered hazardous waste site; • Should cement be used on site, the following guidelines apply: o Carefully control all on-site operations that involve the use of cement and concrete; o Use plastic trays or liners when mixing cement and concrete: Do not mix cement and concrete directly on the ground; and o Store of all visible remains of excess cement and concrete after the completion of tasks. Store of in the approved manner (solid waste concrete may be treated as inert construction rubble, but wet cement and liquid slurry, as well as cement powder must be treated as hazardous waste).		

Impact Rating and Mitigation – Operation

Seepage or leakage of polluted water out of the FAD 6 and into adjacent wetlands is likely to result in a significant deterioration of water quality within the receiving water resources. Decreasing water quality within the wetlands is likely to have a deleterious effect on biodiversity supported by the wetlands, as well as making the water less fit for use for downstream water users. Downstream water users at a local scale include farmers using the water for livestock watering and irrigation, while further downstream the polluted water would enter the Waterval and the Vaal River.

During the operational phase of the proposed road, stormwater runoff from the road surface will lead to water quality deterioration within the receiving wetlands and water resources. Stormwater runoff is expected to be sediment rich, and to potentially contain some contaminants, including hydrocarbons and metals, derived from regular use of the road by motor vehicles (e.g. oil leaks etc.). Spills of hazardous substances during road accidents present a further source of pollutants to adjacent wetlands and water resources.

It is however important to remember that the proposed road is a re-alignment of an existing road and could thus be seen as the displacement of an existing pollution source rather than the creation of an entirely new pollution source.

Seepage of polluted water is considered to pose a significant risk in those areas characterised by a perched water table. A perched water table is expected to occur in localised areas on site, with water movement occurring in the sub-surface along the contact between the vertic soils and the underlying sandstones. Such a perched aquifer could provide a conduit for pollutants to move out of the FAD 6 and into downslope wetlands if the pollutants are allowed to come into contact with the perched aquifer. This impact can be mitigated from a HIGH to a LOW – MEDIUM significance considering the mitigations measures are implemented. This impact rating is illustrated in Table 12-54.

Table 12-54: Impact on wetland Quality deterioration due to seepage - Operation

Impact Alternative 1 and 2: Impact on Wetland Quality deterioration due to seepage		
Severity	**Spatial extent**	**Duration of impact**
4	4	4
3	3	4
Consequence rating: 12 (unmitigated)		
Consequence rating: 10 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
5	4	
3	3	
Likelihood rating: 9 (unmitigated)		
Likelihood rating: 6 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): – 108 HIGH		
SIGNIFANCE RATING (MITIGATED): 60 LOW MEDIUM		
Comments/mitigation: • FAD 6 and return water dams must be lined with a suitable engineered liner; • Dirty water management infrastructure should ensure that any seepage water out of the ash dam that might still occur in spite of the liner be captured and conveyed to the RWD; • No dirty water should be allowed to enter any water resource or wetland untreated, and dirty		

water management infrastructure should comply fully with GN704 at all times;

- Stormwater off the road surface should be discharged into vegetated swales protected against erosion rather than directly into adjacent wetland or water resources. The vegetation within the swales will also serve to trap sediments;
- Emergency response to spillages of hazardous substances along the route should also be well defined and tested regularly to ensure rapid response to, containment of, and neutralisation of any spillages along the route; and
- All emergency services (i.e. police, ambulances, tow trucks etc.) should be made aware of the responsible authority to contact in the case of spillages.

12.14.1 Impact on alien vegetation

Disturbances to the vegetation and wetlands on site will provide opportunity for invasion by alien and weedy species. Species such as *Bidens fromosa* (Cosmos) are already prevalent on site and likely to increase, to the detriment of indigenous species.

Impact Rating and Mitigation –Construction Operation and Closure

Clearing of indigenous vegetation opens the opportunity for the invasion of alien species. Alien species have the potential to destruct indigenous habitats, resulting in the eradication of indigenous faunal species relevant to the specific habitat. This impact has a severity rating of harmful with a spatial extent of being within the activity specific area. The duration of this impact will be during the life of operation should insufficient eradication of alien invasive species occur and rehabilitation measures implemented.

The duration of the activity is considered during the life of operation with a frequency of the impact being often. This impact has been rated with a MEDIUM HIGH significance which can be mitigated to a LOW significance considering the mitigations measures are implemented. This impact rating is illustrated in Table 12-55.

Table 12-55: Impact on alien invasive vegetation - Construction Operation and Closure

Impact Alternative 1 and 2: Impact on alien invasive vegetation.		
Severity	**Spatial extent**	**Duration of impact**
4	2	4
3	1	3
Consequence rating: 10 (unmitigated)		
Consequence rating: 7 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
4	4	
4	3	
Likelihood rating: 8 (unmitigated)		
Likelihood rating: 7 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): – 80 MEDIUM – HIGH		
SIGNIFANCE RATING (MITIGATED): 49 LOW		
Comments/mitigation: • Prior to the start of construction activities on site an alien vegetation management plan should be compiled for implementation throughout the construction and operational phase; • The management plan should be continually revisited and revise, as required; and • In addition, the disturbance of wetland areas outside the direct footprint of the proposed		

developments should be minimised by clearly defining the construction servitude and excluding and vehicular or human traffic from all areas falling outside the construction servitude.

12.14.1 Impact on erosion

The steep side slopes of the FAD 6 will be prone to erosion, increasing sediment loads in adjacent wetlands. The clearance of the topsoil from the FAD 6 and associated infrastructure will result in the increase in erosion potential. Topsoil stockpiles will be stored; exposing bares surfaces to wind and rain, thus being susceptible to erosion. However the surface area of the proposed FAD 6 has gently sloping topography, thus reducing erosion susceptibility.

Impact Rating and Mitigation – Construction, Operation and Closure

The side slopes of the FAD 6 will originally be exposed to wind and water erosion on site. Erosion sediments originating from the side slopes of the FAD 6 will be captured in the downstream RWD and dirty water management systems. This will over time decrease the storage capacity of these FAD 6 and RWD's and therefore increase the possibility of overflowing to the immediate environment. Disturbance of vegetation and soil during the construction process will significantly increase the risk of erosion. The compaction of soil surfaces will increase the volumes and velocities of surface run-off, further increasing erosion risk. Use of heavy machinery on site is also likely to result in the formation of well-worn tracks and ruts that act as preferential flows paths to surface run-off. Concentrated surface run-off will lead to erosion, with likely gully formation. Erosion may result in the loss of topsoil ash material from the slopes of the FAD 6 walls.

The potential for soil erosion will be the highest during construction activities, when the area has been cleared and exposed and there is significant activities taking place. During the operation phase the topsoil stockpiles will need to be protected against early stages of erosion. Appropriate management of the stockpile will ensure sufficient rehabilitation of the FAD 6 and supplementary areas cleared for associated infrastructure. Constant rehabilitation and vegetation of the side walls of the FAD 6 should be conducted throughout the life span of the FAD 6. Runoff from the site could have a significant impact on aquatic environments to the south west of the project site. Care will need to be taken in order to prevent the silt runoff to the drainage areas in the vicinity of the FAD 6 and associated infrastructure during construction and operation activities.

The severity of this impact will have a slightly harmful effect with a spatial scope of within the boundaries of SSIC. The duration of the activity will continue throughout the life of operation if not effectively mitigated.

The duration of the activity will be daily, as long as erosion elements are present. This impact will be infrequent as once the side wall have been erected a period of time will pass prior to the raising of the dam walls. This impact has an initial rating of MEDIUM HIGH which can be mitigated to a LOW significance considering the mitigations measures are implemented. The impact rating of this impact is illustrated in

Table 12-56.

Table 12-56: Impact on erosion

Impact Alternative 1 and 2: Impact on erosion.		
Severity	**Spatial extent**	**Duration of impact**
3	2	5
3	1	5
Consequence rating: 10 (unmitigated)		
Consequence rating: 9 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
4	4	
3	3	
Likelihood rating: 8 (unmitigated)		
Likelihood rating: 6 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): – 80 MEDIUM – HIGH		
SIGNIFANCE RATING (MITIGATED): 54 LOW		
Comments/mitigation: • The ash dam should be sloped so as to ensure the successful vegetation of the side slopes; • Vegetated side slopes will bind the soil and slow down run-off, reducing erosion; • The side slopes should be terraced, to allow for the slowing down of flows on the side slopes and the creation of depositional zones on the side slopes; • Topsoil must be stripped from the FAD 6 footprint and stockpiled for further use in rehabilitation. Should sub soil be stripped this must be stored separately, and used to backfill excavations prior to the levelling with top soil; • Silt traps must be installed upstream of all RWD. These silt traps will should be regularly cleaned and maintained in fully working order at all times; • To minimise the risk of erosion, the extent of disturbed vegetation and soil should be kept to a minimum; • It is recommended that prior to the commencement of construction activities that the entire construction servitude, including lay down areas and stock pile areas etc., be fenced off and clearly demarcated; • All construction activity should be contained within this demarcated servitude; • The construction process should be phased so as to limit the extent of exposed areas at any one time, and so that for any specific area, the time between initial disturbance and completion of construction is as short as possible; • Construction activities should take place within the dry season. As construction could possibly extend across more than just one dry season, it is recommended that the wetland crossings be constructed in the dry season and that any work done during the wet season should focus on the terrestrial areas; and • Following the completion of construction activities the disturbed areas should be ripped, scarified, landscaped to the original landscape profile, and re-vegetated with suitable indigenous grass species that will aid in soil stabilisation.		

12.14.1 Impact on concentration and impoundment of flow

Two wetland crossings of valley bottom wetlands have been identified along the proposed road re-alignment.

Impact Rating and Mitigation –Construction and Operation

The crossings will likely lead to concentration of flows, with concentrated high velocity flows resulting in erosion and channel incision downstream of the proposed crossing, with impoundment of flows and sediment deposition upslope of the crossings. Channel incision in the wetland will lead to localised desiccation of the wetland and increased sediment loads in the downstream wetland. Impoundment of flows and sediment deposition upslope of the crossing will likely lead to the establishment and head ward expansion of a reed bed within the wetland. This impact was initially rated with a MEDIUM HIGH significance which can be mitigated to a LOW significance considering the mitigations measures are implemented. This impact rating is illustrated in Table 12-57.

Table 12-57: Impact on concentration and impoundment of flow

Impact Alternative 1 and 2: Impact on concentration and impoundment of flow.		
Severity	**Spatial extent**	**Duration of impact**
4	2	4
3	1	4
Consequence rating: 10 (unmitigated)		
Consequence rating: 8 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
4	4	
3	3	
Likelihood rating: 8 (unmitigated)		
Likelihood rating: 6 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): – 80 MEDIUM – HIGH		
SIGNIFANCE RATING (MITIGATED): 48 LOW		
Comments/mitigation: • Crossing should be designed so as to have a minimal impact on the natural flows within the wetlands; • Under normal flow events (up to 1:10 year events) no concentration of flows should take place and no impoundments of flows upstream of the crossing; • Sufficient box culverts should also be utilised to ensure that the entire wetness front of the wetland remains wetted; and • The crossings should also be suitable protected against erosion. Construction of the crossings should be undertaken during the low flow season.		

12.14.1 Impact on habitat fragmentation

This impact relates specifically to the construction of linear infrastructure. Construction across the wetland systems along the route will lead to habitat fragmentation as infrastructure may pose an obstacle to movement of species associated with the wetlands. Especially longitudinal systems such as valley bottom wetlands and rivers act as important ecological corridors.

Impact Rating and Mitigation –Construction and Operation

Minimal mitigation measures are available for this impact. The severity of this impact is significant with a spatial scope of within the boundaries of the FAD 6. The duration of the impact will be permanent as the linear infrastructure is not expected to decommission, and the possibility of this impact will continually remain.

The duration of the activity will be permanent and the frequency of the impact will be daily. The impact cannot be mitigated do a lower significance rating, however can be reduced from a MEDIUM HIGH rating of 100 to 90 as depicted in Table 12-58.

Table 12-58: Impact on habitat fragmentation

Impact Alternative 1 and 2: Impact on habitat fragmentation.		
Severity	**Spatial extent**	**Duration of impact**
3	2	5
2	2	5
Consequence rating: 10 (unmitigated)		
Consequence rating: 9 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
5	5	
5	5	
Likelihood rating: 10 (unmitigated)		
Likelihood rating: 10 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): – 100 MEDIUM – HIGH		
SIGNIFANCE RATING (MITIGATED): 90 MEDIUM HIGH		
Comments/mitigation: • Use of sufficiently sized box culverts across the width of the wetland should be ensured.		

12.15 Traffic Impacts

The majority of the findings within this section were sourced from the traffic assessment conducted for the realignment of the D714 road. Access to the FAD 6 will need to be provided through access roads to the FAD 6 site to accommodate vehicles entering and exiting the FAD 6 site during construction and operation. It is expected that the access roads will be provide access to the site from the provincial R546 road. The D714 road located to the north of the FAD 6 footprint will need to be re aligned a further southern position. The re alignment of the road may result in increased traffic impacts due to the necessity of the intersection to the R546.

Only maintenance, inspection and delivery/collection traffic will come to site on intermittent basis hence traffic impacts on public roads during the operation phase will be very minimal. There is little potential for incidents at loading and offloading point and spillages along the road during transport of maintenance teams and operational staff and equipment to and from FAD 6.

12.15.1 Impact on dust generation, congestion of public roads and noise pollution

The FAD 6 construction and operational activities may result in the congestion on the R546 due to the increased traffic activity that will be taking place at the FAD 6 site. Dust will be generated from the travelling along the re aligned D714 road, should this road not be tarred. Noise from vehicle activities to the FAD 6 during construction as well as for maintenance during operation may result in material change in noise pollution within the surrounding areas.

Impact Rating and Mitigation – Construction and Operation

The increased occurrence of construction and operational vehicles during these periods may lead to congestion, noise and dust related issues which will incur increased discomfort of local communities. This impact will have a severity rating of slightly harmful. The spatial extent will be within the boundaries of the Synfuels operations considering the close proximity of the FAD 6 to SSIC. The duration of the impact will be during the life of operation as once construction ceases operations begin.

The duration of the activity is expected to be temporary and the frequency of the impact very seldom. This impact therefore received a LOW MEDIUM significance which can be mitigated to a significance of LOW considering mitigation and management measures are implemented as illustrated in Table 12-59.

Table 12-59: Impact on dust generation, congestion of public roads and noise pollution – Construction and Operation

Impact Alternative 1 and 2: Impact on dust generation, congestion of public roads and noise pollution		
Severity	**Spatial extent**	**Duration of impact**
3	2	4
2	2	4
Consequence rating: 9 (unmitigated)		
Consequence rating: 8 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
4	2	
4	2	
Likelihood rating: 6 (unmitigated)		
Likelihood rating: 6 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 54 – LOW MEDIUM		
SIGNIFANCE RATING (MITIGATED): 48 – LOW		
Comments/mitigation: • Appropriate road marking are to be applied at the re aligned D714 during construction; • Speed limits will be reduced to 40 km/h on the D714 to reduce dust and noise generation; • Public notices are to be provided to local communities, informing them of the construction Activities to take place, and advise alternative routes where possible; • Dust can be controlled by the regular wetting of the gravel road surfaces; • Tar dirt roads to minimize dust generation as well as to be aesthetically pleasing; and • Noise impact in the immediate environment can be mitigated through the correct use of PPE.		

12.15.1 Impact on road degradation

With the increase in construction and operational vehicles, comes an increased potential for road degradation of the road network in the vicinity. These roads utilized for the purposes of the FAD 6 will need to be regularity monitored and maintained during construction and operational activities. Cooperation will need to be established with the local roads agency to fix damage to the roads timeously, to combat the degradation of the roads and eliminate potholes posing a safety risk to users of the road.

Impact Rating and Mitigation – Construction and Operation

The increased occurrence of construction and operational vehicles during the construction period may lead the degradation of the existing and re - aligned D714 roads. This impact will have a severity rating of slightly harmful. The spatial extent will be within the boundaries of the Synfuels operations considering the close proximity of the FAD 6 to SSIC. The duration of the impact will be during the life of operation as once construction ceases operations begin

The duration of the activity is expected to be temporary and the frequency of the impact very seldom. This impact therefore received a LOW MEDIUM significance which can be mitigated to a significance of LOW considering mitigation and management measures are implemented. The impact rating of this impact is illustrated in Table 12-60.

Table 12-60: Impact on road degradation

Impact Alternative 1 and 2: Impact on road degradation		
Severity	**Spatial extent**	**Duration of impact**
3	2	4
2	2	4
Consequence rating: 9 (unmitigated)		
Consequence rating: 8 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
4	2	
4	2	
Likelihood rating: 6 (unmitigated)		
Likelihood rating: 6 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 54 – LOW MEDIUM		
SIGNIFANCE RATING (MITIGATED): 48 – LOW		
Comments/mitigation: • Speed limits will be reduced to 40 km/h on the D714; • Roads must be continually maintained and monitored for safety and deterioration; and • Communication must be established between the local roads agency and Synfuels in order to rectify problems with the roads in a timeous manner.		

12.15.2 Impact on Road Safety

With the increase in construction and operational Activities, comes the increase in the potential of accidents. The re - aligned D714 intersection with the R546 needs to be securely engineered according to mitigation measure proposed in order to minimize the potential of road accidents.

Impact Rating and Mitigation – Construction and Operation

The intersection layout of the R546 and D714 might impose a safety risk if exclusive turning lanes are not provided on the R546. This impact was a severity rating of potentially harmful with a spatial scope of being within the local area of the SSIC. The duration of this impact will be during the life of operation of the FAD 6. The re-alignment of the D714 road will not have a significant impact on the surrounding external road network given the mitigating measures recommended are implemented.

The duration of the activity will be during the life of the operation, while the frequency of the impact will be seldom. This impact receives a significance of LOW MEDIUM and cannot be mitigated to a lower significance; however the rating can be mitigated from 72 – 64 as illustrated in Table 12-61.

Table 12-61: Impact on road safety – Construction and Operation

Impact Alternative 1 and 2: Impact on road safety		
Severity	**Spatial extent**	**Duration of impact**
2	3	5
1	3	5
Consequence rating: 9 (unmitigated)		
Consequence rating: 8 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
5	3	
5	3	
Likelihood rating: 8 (unmitigated)		
Likelihood rating: 8 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 72 – LOW MEDIUM		
SIGNIFANCE RATING (MITIGATED): 64 – LOW MEDIUM		
Comments/mitigation: • Construction of an additional through left lane, on the southern approach and an exclusive right lane, on the northern approach; • The exclusive lanes should be constructed according to Provincial standards, 60m long and a 60m tapper; • Provision of light at sufficient standards at the intersection of the R546 and the proposed D714; and • No on-street pick-up/drop-offs at the intersection of the R546 and the proposed D714 should be permitted.		

12.16 Geology Impacts

The geology of the area comprises sandstones, siltstones and shales of the Vryheid Formation of the Karoo Super Group sequence, which comprises a succession of alternating layers of sandstone and siltstones, intruded by dolerite sills and dykes. A coal seam is present at a depth of

approximately 100 m below surface. Sasol Coal has currently undermined portions of this coal seam beneath the proposed FAD 6 footprint as summarized below:

- Bord and pillar mining with a fraction of total extraction on Portion 3 and 8 of the Farm Rietspruit 320 IS;
- Long Wall mining on the northern parts of Portion 2,9 and 10 of the farms Rietspruit 320 IS; and
- Total extraction bord and pillar on the southern areas of Portions 2, 9 and 10 of the farm Rietspruit 320 IS up to the dolerite dyke.

In areas where there is mining, the hydraulic characteristics of the aquifers could be significantly altered with groundwater possible flowing preferentially towards the mine void. Mining operations could also have an impact on groundwater quality due to oxidation/reduction processes. However, Sasol Coal will manage the water in the compartment as part of the Brandspruit underground water handling system to prevent decanting.

12.16.1 Impact on site stability due to undermining activities

Sasol Coal previously mined the coal seam situated beneath the proposed FAD 6 footprint. Although the undermining activities have ceases during the last few years, risks are still associated with the construction of the dam above these areas. The highest risks are those associated with total extraction mining. Placement of the FAD 6 above undermined areas should be limited as far as feasible. Structural support may need to be provided in areas where the dam is located on undermined areas.

Impact Rating and Mitigation – Construction

Construction activities may take place above undermined areas. These activities may pose a safety risk to the dam during construction. Subsistence is not evident in the area, however as construction commences this may protrude. It is assumed that the geotechnical constraints could have the potential to be detrimentally affected by the geotechnical conditions of the site.

Construction activities on the undermined areas pose a risk, if not mitigated accordingly, to collapse and instability of the site. During initial construction phases this impact is considered to be significant, as only once the FAD 6 is in full operation should this impact materialize. The spatial scope of the impact will be within the local area as the communities and Synfuels itself may experience negative effects of this impact. Although construction activities are considered a short term basis, the duration of this impact will continue for the life of the operation of FAD 6.

The frequency of the activity will be regular. As construction progresses, the higher the risk will be on the stability of the ground. This will peak during full operational phases of the project. The frequency of the impact will be likely as the undermining activities will not be rehabilitated in the future and this impact will continually be viable. This impact has an initial rating of MEDIUM HIGH which can be mitigated to LOW considering the mitigations measures are implemented. Table 12-62 illustrates the rating of this impact during construction activities.

Table 12-62: Impact site stability due to undermining activities – Construction

Impact Alternative 1 and 2: Impact on site stability due to undermining activities		
Severity	**Spatial extent**	**Duration of impact**
3	3	4
2	1	4
Consequence rating: 10 (unmitigated)		
Consequence rating: 7 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
4	4	
4	2	
Likelihood rating: 8 (unmitigated)		
Likelihood rating: 6 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 80 MEDIUM HIGH		
SIGNIFANCE RATING (MITIGATED): 42 –LOW		
Comments/mitigation: • Implement stability controls within the design parameters of the FAD 6; • The design and operation of the FAD 6 will adhere to the Dam Safety Regulations and will be audited as per legislative requirements; and • Toe drains will be constructed to collect any over flow or seepage from the FAD 6.		

Impact Rating and Mitigation – Operation

Operational activities, relating to the deposition of ash on the FAD 6 the continuous construction of day walls will be threatened by the instability of the surface above undermined areas. The impact during operational activities will logarithmically increase as the deposited on the FAD 6 increases in volume.

Operational activities are considered to have a great / harmful severity. As deposition to the FAD 6 increases, so will the risk of instability due to mining activities. The spatial scope of the impact is within the local area, as the impact of stability will influence the surrounding communities as well as that of Synfuels itself. The duration of the impact will be during the life of operation; however the rating will decrease during closure and rehabilitation phases.

The frequency of the activity is considered to be permanent. The risk of instability effects will remain as long the FAD 6 exists. The frequency of the impact will be regularly, as with each increase in volume (i.e. Height) of the FAD 6 the impact will have a higher risk. The risk associated with the operational activities of the FAD 6 can be managed and mitigated during the design phase of the project. This impact has an initial rating of MEDIUM HIGH which can be mitigated to a LOW significance considering the mitigations measures are implemented. Table 12-63 illustrates the risk rating associated with the instability effects of the FAD 6.

Table 12-63: Impact site stability due to undermining Activities – Operation

Impact Alternative 1 and 2: Impact on site stability due to undermining activities		
Severity	**Spatial extent**	**Duration of impact**
3	3	4
2	1	4

Consequence rating: 10 (unmitigated)	
Consequence rating: 7 (mitigated)	
Duration of Activity / aspect	**Frequency of impact**
4	4
4	2
Likelihood rating: 8 (unmitigated)	
Likelihood rating: 6 (mitigated)	
SIGNIFANCE RATING (UNMITIGATED): 80 MEDIUM HIGH	
SIGNIFANCE RATING (MITIGATED): 42 –LOW	
Comments/mitigation: • Implement stability controls within the design parameters of the FAD 6; • The design and operation of the FAD 6 will adhere to the Dam Safety Regulations and will be audited as per legislative requirements; and • Toe drains will be constructed to collect any over flow or seepage from the FAD 6.	

Impact Rating and Mitigation – Closure

Closure activities are not expected to significantly influence the current rating during the operation and closure phases. Closure will typically include rehabilitation of the side walls and surface covering of the FAD 6. The impact of instability and subsistence underneath the FAD 6 will remain.

The severity of this impact during closure will be small, as the FAD 6 will be stabilized for operational activities and no decommissioning of the FAD 6 will take place. The spatial scope of the impact will be local, as any geotechnical impact will not extend beyond the local area. The duration of the impact will be permanent. Only rehabilitation of the FAD 6 will take place during closure. The ash stored in the FAD 6 may be used in the future for alternative manufacturing processes, like cement and bricks. This slight reduction in volume will only have a positive effect on the stability of the dam.

The frequency of the activity will be annually or less. Reduced activity will be conducted at the FAD 6 after closure. The frequency of the impact will be almost never as again no ash deposition will be conducted after closure. This impact has an rating of VERY LOW. Table 12-64 illustrated the rating of this activity during closure.

Table 12-64: Impact site stability due to undermining activities – Closure

Impact Alternative 1 and 2: Impact on site stability due to undermining activities		
Severity	**Spatial extent**	**Duration of impact**
2	3	5
1	1	4
Consequence rating: 10 (unmitigated)		
Consequence rating: 7 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
1	1	
1	1	
Likelihood rating: 2 (unmitigated)		
Likelihood rating: 2 (mitigated)		
SIGNIFANCE RATING (UNMITIGATED): 20 VERY LOW		

SIGNIFANCE RATING (MITIGATED): 14 –VERY LOW
Comments/mitigation: • Maintain appropriate management.

12.17 Health and Safety Impacts

The safety, health and environmental objectives of the WADS are to minimise the potential for injuries, overall property and environmental damage, and related business interruption. The WADS is subject to the Occupational Health and Safety Act with Regulations, Act No 85 of 1993 (OHS Act). All equipment and installations will at least meet the requirements of the OHS Act. Synfuels is certified in terms of:

- ISO 14001: with additional Synfuels specific requirements (environmental);
- OSHAS 18001 or Seveso III directives: (health and safety, including process safety); and
- Responsible Care (if not included in ISO 14001 or OSHAS 18001).

12.17.1 Impact on Pollution from dust generation and odours

With the construction of the FAD 6 additional dust and PM10 molecules will be generated from the clearance of vegetation as well as the continual movement of vehicles along gravel roads. The construction of the re aligned D714 road and power lines will result in the denuding of area, resulting in the generation of dust. During the operational phase of the project, these areas will be rehabilitated and minimal dust will be generated from this source. The surface area of the FAD 6 at operational phase is assumed to be one third dry and exposed to wind sources dust. This impact will be on-going during the life span of the project. This impact has been assessed in Section 12.8 from an environmental and health perspective.

12.17.2 Impact on Dam safety

The FAD 6 once complete will exceed the storage volume of 50 000 m^3, thus posing a dam safety risk as per Dam Safety Regulations of the NWA. Depending on the volume of the RWD, these dams may in addition trigger a dam safety risk.

Impact Rating and Mitigation –Operation

As the FAD 6 definitely poses a Dam Safety Risk, the severity of this impact will be disastrous. The spatial extent will be regional, as should the dam walls fail the excessive amount of water and slurry store on the dam will have the potential to affect a large area. The duration of this activity will be during the life span of the FAD 6.

The frequency of the activity and impact will be during the life of the operation. This impact has initially been rated as HIGH which can be mitigated to MEDIUM HIGH significance. The rating of this impact is stipulated in Table 12-65.

Table 12-65: Impact on Dam safety

Impact Alternative 1 and 2: Impact on Dam safety		
Severity	**Spatial extent**	**Duration of impact**
5	4	4
2	3	4
Consequence rating: 13 (unmitigated)		

Consequence rating: 9 (mitigated)	
Duration of Activity / aspect	**Frequency of impact**
4	3
4	4
Likelihood rating: 8 (unmitigated)	
Likelihood rating: 7 (mitigated)	
SIGNIFANCE RATING (UNMITIGATED): 104 – HIGH	
SIGNIFANCE RATING (UNMITIGATED): 63 – LOW MEDIUM	
Comments/mitigation: • Adhere to the Dam Safety Regulations published in Government Notice R. 1560 of 25 July 1986) and now effective in terms of the NWA; • Develop a dam safety monitoring program which will be audited as per legislative requirements; and • The monitoring program should include regular inspections and maintenance requirements.	

12.17.3 Impact on Safety due to increased vehicular movements

Only maintenance, inspection and delivery/collection traffic will come to site on intermittent basis hence traffic impacts on public roads during the operation phase will be very minimal. There is little potential for incidents at loading and offloading point and spillages along the road during transport of maintenance teams and operational staff and equipment to and from FAD 6.

Impact Rating and Mitigation –Construction and Operation

With the onset of construction activities, comes an increase in vehicular movements in the vicinity by construction vehicles and plant. During operational activities this impact will be reduced as minimal traffic will pass through the area.

The severity of this impact is rated as potentially harmful within the spatial extent of the FAD 6 site itself. The duration of the activity will continue throughout the life of operation.

The frequency of the activity will be during the life of operation and the frequency of the impact unlikely. This impact has been rated as LOW MEDIUM, which can be mitigated to a LOW significance rating considering mitigation and management measures are implemented. The rating of this impact is stipulated in Table 12-66.

Table 12-66: Impact on Safety due to increased vehicular movements

Impact Alternative 1 and 2: Impact on Safety due to increased vehicular movements		
Severity	**Spatial extent**	**Duration of impact**
3	2	4
2	2	4
Consequence rating: 9 (unmitigated)		
Consequence rating: 8 (mitigated)		
Duration of Activity / aspect	**Frequency of impact**	
4	3	

4	2
Likelihood rating: 7 (unmitigated)	
Likelihood rating: 6 (mitigated)	
SIGNIFANCE RATING (UNMITIGATED): 63– LOW MEDIUM	
SIGNIFANCE RATING (UNMITIGATED): 48 – LOW	
Comments/mitigation: • Speed limits of 20km/hr or less should be set for on-site traffic; • If spillages occur, the material should be removed as soon as possible; • Inspect haul roads for integrity and repair if required; • Provide hard-standing areas for vehicles and regularly inspect and clean these areas; • Reduce mud/dirt carry-out onto paved roads by washing trucks before they leave site; • Cover loads with tarpaulins to prevent dust re-entrainment from trucks; • Limit load size to reduce spillage; • Sufficient signage should be placed along the roads; and • Personnel should be educated on the importance of adherence to this signage.	

12.17.4 Impact of fires on the surrounding areas

Veld fires on the FAD 6 area could spread to surrounding farm areas, and potentially the wider WADS area. Fires within the WADS would pose a danger to transfer pipelines, equipment, the environment and human life. The WADS is designed and operated with stringent consideration of fire prevention and control measures implemented. The Sasol Emergency management Department also serves the WADS.

Impact Rating and Mitigation –Construction and Operation

With the storage of hazardous and flammable liquids on site, the possibility of the initiation of fires is evident. Fires initiated on the FAD 6, may result in the destruction of sections of the SSIC to the north east of the proposed FAD 6. These fires are likely to start as a result of negligence of staff members or the public.

Should a fire start on the Sasol FAD 6 property, any person who observes the fire must report it to the fire brigade immediately and then to their supervisor.

The severity of this impact will be slightly harmful with a local spatial extent limited to a 5km radius. The duration of the activity will be on day to one month.

The frequency of the activity will be temporary and the frequency of the impact will be very seldom. This impact is rated LOW which can be mitigated to VERY LOW significance considering mitigation and management measures are implemented as illustrated in Table 12-67.

Table 12-67: Impact of fires on the surrounding areas

Impact Alternative 1 and 2: Impact of fires on the surrounding areas		
Severity	**Spatial extent**	**Duration of impact**
3	3	1
2	3	1
Consequence rating: 7 (unmitigated)		
Consequence rating: 6 (mitigated)		

Duration of Activity / aspect	Frequency of impact
2	2
2	2
Likelihood rating: 4 (unmitigated)	
Likelihood rating: 4 (mitigated)	
SIGNIFANCE RATING (UNMITIGATED): 28– LOW	
SIGNIFANCE RATING (UNMITIGATED): 24 – VERY LOW	
Comments/mitigation: • No fires will be permitted at the FAD 6 development site, unless in designated areas will effective control measures; • Fire hydrants will be placed in conspicuous places, in close vicinity to areas posing high fire risks.	

13 Cumulative Impacts

13.1 Introduction

Incomparable activities can result in a number of complex effects on the natural biophysical and social environment. These impacts are mainly identified as direct and immediate effects on the environment by a single entity affecting a variable of the environment. These direct impacts have the potential to combine and interact with other activities, depending on the surrounding environmental state and land use. These impacts may aggregate or interact with other impacts to cause additional effects, not easily quantified when assessing an individual entity.

The NEMA, 2010, specifically requires that cumulative impacts are to be assessed; however no prescribed methodology or manner is stipulating by which these impacts should be assessed. For the purpose of this report, cumulative impacts will be defined as direct and indirect impacts acting together with current or envisaged impacts result from activities on certain resources and / or receptors.

The effects are mostly adequately captured in Section 12, where direct and indirect impacts are assessed, although these terms may not be specifically used. This section provides a description and analysis of the potential cumulative effects of the proposed FAD 6 development, and past and present projects hereby considering the effects of any changes on the:

- Biophysical; and
- Socio – Economic conditions.

For the analysis of cumulative effects to be utilized as a useful tool for decision makers and stakeholders, it must be limited to the effects that can be meaningfully evaluated, rather that expanding on resources or receptors that are no longer affected by the development or are not of interest to the stakeholders. Two important aspects require consideration prior to the evaluation of cumulative effects:

- The determination of an appropriate spatial and temporal boundaries for evaluation of cumulative effects of the project; and
- The evaluation of relevant projects for consideration in the cumulative effects analysis.

Spatial and temporal boundaries for analysis of cumulative effects are dependent on a number of factors, including:

- The size and nature of the project and its potential effects;
- The size, nature and location of past and (known) future projects and activities in the area,
- The aspect of the environment impacted by the cumulative effect; and
- The period of occurrence of effects.

The spatial extent of the cumulative impact analysis is generally aligned with the zone of influence of the project and other projects in the vicinity. Most impact will be localized; however others may be experienced on a regional scale. This is taken into consideration during the assessment of cumulative impacts. It is reasonably straightforward to identify significant past and present projects and activities that may interact with the FAD 6 development to produce cumulative impacts, and in many respects, these are taken into account in the descriptions of the biophysical and socio-economic baseline.

13.2 Cumulative Hydrological and Surface Water Impacts

The potential groundwater and surface water quality impact associated with the FAD 6 development relates to the potential contamination as a result of mismanagement of materials stored and waste water streams to and from the FAD 6. Mitigation measures have been proposed for the adverse impacts on ground water and surface water contamination. It is expected that with the implementation of the mitigation measures this impact will be reduced to an acceptable level.

As the land use of up and downstream of the FAD 6 specifically relate to the industrial activities of the SSIC and agricultural activities, it is likely that pollutants will enter the environment from these sources, whereby affecting the baseline water quality

Mismanagement of materials stored on site as well as the waste water streams associated with the FAD 6 development, may lead to an increase in the cumulative effect of potential contamination of groundwater and surface water quality downstream of the development area.

The groundwater within the FAD 6 development area is currently contains a pollution plume, whereby not groundwater is utilized. However groundwater pollution remains a significant concern, as the pollution plume will have the potential to expand the pollution plume whereby effecting human health and ecological systems associated with the developments. Considering the implementation of the mitigation measures proposed, the cumulative impact on the surrounding areas would be lower than originally expected.

13.3 Cumulative Air Quality Impacts

The potential air quality impacts associated with the FAD development relate to the potential generation of PM10 and fugitive dust emissions as a result of site clearance, vehicular movements, and the surface area of the FAD 6 exposed to wind erosion and dust generation during operation

Mitigation measures have been proposed to mitigate these adverse impacts. It is expected that the implementation of these mitigation measures will reduce this impact to an acceptable standard.

The majority of the land use in the vicinity of the FAD 6 development is mostly industrial and mining in nature; it is known that pollutants also enter the environment from these sources. Mismanagement of dust generation sources at the FAD development may lead to an increase in the

cumulative effect of Air Quality contamination in the atmosphere surrounding the FAD 6 development.

Although it is expected that the air quality around the SSIC is significantly impacted on by the industrial activities taking place in the vicinity, further emissions from new developments is potentially significant, as additional contaminants will have the potential to affect human health.

However, given the proposed mitigation measures, the cumulative impact on the surrounding area can be mitigated to an acceptable standard. It must be noted that once the FAD 6 is fully operational the current FAD 4 and FAD 5 will have undertaken closure, and have been rehabilitated. The emissions currently originating from FAD 4 and FAD 5 will have ceased assuming correct rehabilitation takes place.

14 Assumptions, uncertainties and gaps in knowledge

14.1 Assumptions

Technical data and information provided by external specialists to SRK were checked and reviewed for quality assurance by SRK. All the data and information is assumed to be accurate and up to date. It is also assumed that the applicant will comply with all legislation pertaining to the activities of this proposed project and that all permits and license that may be required will be identified and applied for prior to commencement of construction activities.

The public involvement process has been sufficiently effective in identifying the critical issued needing to be addressed in the EIA / EMP through specialist investigations and by the EAP. Specialist inputs have been appropriately scoped to address any issues and or concerns raised by the public. The public involvement process has sought to involve key stakeholders and individual landowners. Wherever possible the information requested and comments raised by I&AP's during the scoping and impact Assessment phase has been sufficiently addressed and incorporated into the Final EIA / EMP report for perusal and comment. These requests and any further comments will be tracked and recorded in the Comments and Response Report contained in Appendix E.

SRK assumes that Synfuels will implement the measures contained in the EMP, and will adhere to any monitoring procedures. A monitoring and evaluation system, including auditing, will be established and operationalized to track the implementation of the EMP ensuring that management measures are effective to avoid, minimize and mitigate impacts and that corrective action is being undertaken to address shortcomings and / or non-conformances.

14.2 Limitations

Limitations relevant to each specialist study can be found in Appendix D. As the FAD 6 development is currently still undergoing feasibility studies, final design drawing so of the dam are not available. SRK were informed by Sasol that the FAD 6 will be construction using the same principle as the authorized FAD 5 designs and recent process water dam.

The EIA for the FAD 6 was limited to seven specialist studies that were employed to assess the significant environmental impacts. Any additional impact on the environment will have a minimal effect and was assessed using the professional judgement of the SRK project team.

14.3 Gaps in knowledge

The final location and design of the FAD 6 and associated infrastructure, road and power line re alignments have not been finalized. Minor deviations may occur, taking into account of the following:

- Specific location, extent and functioning of wetlands;
- Grave sites and cultural resources; and
- The location of sensitive ecological ecosystems.

As a result of the EIA/EMP findings the current locations should not be significantly deviated from. Technical engineering aspects have been taken into account upon deciding on the location of all infrastructures. The current locations do not pose a significant environmental risk, however certain aspects as mentioned above will need to be taken cognisance of when determining the linear infrastructure routes and proposed mitigation measures. Wetland, sensitive ecosystems and cultural and heritage sites must be avoided as far as practically feasible and mitigated if unavoidable.

Assumptions and gaps in knowledge relative to the specialist assessments conducted for this project can be found in Appendix D.

14.4 Assumptions and limitations of this initial assessment

The Scoping Phase of this project highlighted a number of potential issues and concerns. It is assumed that all comments and concerns received by the I&AP's has been informed and considered.

All key issues pertaining to the project including, hydrology, geohydrology, biodiversity, wetlands, traffic, heritage, and air quality, has been assessed in this Final EIA / EMP. Additional issued raised during the Final EIA / EMP process have been addressed and included within this Report.

Areas of high risk will be avoided as far as practically feasibly. These may include:

- Undermined areas; and
- Proximity to the Sasol Gas pipelines in the vicinity of the proposed FAD and associated infrastructure.

The design and engineering of the proposed FAD should incorporate stability mitigation measures where board and pillar, and total extraction mining methods have been utilized.

Synfuels will adopt a process of continual improvement when managing and mitigating negative environmental impacts arising from the project. The EMP will be used as the basis of environmental management and will regularly be improved and refined where necessary to FAD 6 operations.

15 Opinion and conditions on Authorization

Synfuels converts coal into value added synthetic fuels and chemicals through the unique Fischer – Tropsch technology. It is planned that the SSIC will continue as primary coal gasification and integrated organic chemicals plant for at least the next 25 years. The proposed FAD and associated infrastructure aims to function for ash depositing originating from the coal gasification and associated boiler operations. Currently Synfuels has two operating FAD's (FAD 4 and FAD 5). These dams are reaching their full capacity, resulting in the need for Synfuels to investigate additional storage capacity. It is critical that Sasol Synfuels constructs a FAD to handle the factory loads of ash produced from the gasifiers and steam plants. Sasol have therefore investigated the construction of an additional FAD 6 to finally replace the current FAD 4 and FAD 5 respectively. Without this facility Synfuels will be required to continually use the FAD 4 and FAD 5 for ash disposal, risking the overflow and possible failure of the dam due to overloading. It is inevitable that for Synfuels to continue operations a new FAD will be required. FAD 4 and FAD 5 currently have a limited life span. Should the FAD 6 not be authorized Synfuels will be forced to close down as a result of incapability to store fine ash. Highly negative socio economic impact will result from this occurrence, relating to the impact on South African economy as well as on the Govan Mbeki municipality which currently is sitting with a 40% unemployment rate.

The continuation of this project will result in maintenance of the current socio – economic state of the province as well as increase the availability of temporary employment opportunities for local residents. Benefits will be largely notices during construction activities. Minimal employment opportunities will be required during the operation and rehabilitation phases.

The majority of the negative environmental impact will be experienced during the construction and operation phases. The majority of these impacts will have a VERY LOW to LOW MEDIUM significance with a number of impacts ranging up to MEDIUM HIGH. It is envisaged that these impacts can be mitigated and satisfactorily managed. During the operational phase, a continual concern carrying weight is that of safety. Dam Safety Regulations will be adhered to and, therefore envisaged that this impact can be effectively managed.

The management of the impacts identified in the EIA for the construction, operation and closure phase is through a comprehensive range of programmes and plans contained in the EMP. Implementation of these plans and programmes together with mitigation measures stipulate in the EMP will be institutionalized through regular monitoring and auditing. Based on the assumption that these programmes and plans incorporating contingency planning for incident management will be effectively implemented on the FAD and associated infrastructure developments in accordance with national and regional industry standards, it is the opinion of the EAP that this activity should be authorized.

16 Environmental Impact Statement

This section of the report presents the outline of:

- The key findings of the EIA; and
- A comparative assessment of the positive and negative implications of the proposed development and identified alternatives.

16.1 Summary of key findings of the EIA

The EIA has been presented in detail in Section 12 and 17 and outlined below:

- Key issues identified in the scoping phase, which have been assessed with mitigation measures, resulting in a VERY LOW to LOW significance;
- The key negative impacts (defined as those impacts that are rated as LOW – MEDIUM after mitigation); and
- The key positive impacts (defined as those impacts rated as LOW MEDIUM or above after mitigation).

16.1.1 Key scoping issues with very low to low negative impacts after mitigation

Aspects which were identified during the Scoping Phase of this project together with issues raised by I&AP's as issues of concern, which were assessed to have a very low to low negative impact potential after the incorporation of mitigation measures are the following:

Construction phase

- Change in the topography of the area;
- Loss of available topsoil;
- Soil erosion;
- Impact on groundwater quality;
- Change in natural surface water flow;
- Loss of biodiversity in the area;
- Destruction of natural habitat;
- Increase in noise;
- Disturbance of Historical sites;
- Disturbance of Graves;
- Visual impact on nearby residents;
- Economic advantages;
- Safety of local communities; and
- Health of communities.

Operation phase

- Soil erosion;
- Impact on groundwater quality;
- Change in natural surface water flow;
- Loss of biodiversity in the area;
- Destruction of natural habitat;
- Increase in noise;
- Disturbance of Historical sites;
- Disturbance of Graves;
- Visual impact on nearby residents;

Closure phase

- Loss of available topsoil;
- Soil erosion;

- Impact on groundwater quality;
- Visual impact on nearby residents;

16.1.2 Key Negative Impacts after mitigation

The major findings of the negative impacts on the proposed FAD 6 development were the following:

- The highest negative impact was determined to be MEDIUM HIGH significance after mitigation. No HIGH or VERY HIGH negative impacts after mitigation were determined for the proposed development;
- The following LOW MEDIUM and higher rated negative impacts after mitigation were determined for the construction, operation and closure phase.

Construction phase

Impact of Runoff on the Grootspruit

This impact relates to the risk that runoff from the facility may contain salts and heavy metals, which if decanted from the water management infrastructure could impact on the quality of the Grootspruit. Saline, metal rich runoff may impact on the Grootspruit water quality. This impact will be initiated during construction and will proceed during operation activities.

Impact on surface water quality

Sedimentation and increase in turbidity due to soil erosion and runoff from FAD 6 and cleared areas will continue from the construction phase throughout the operational phase.

The boundaries of the study area for FAD 6 are situated approximately 5 kilometres away from the Grootspruit and Trichardt Spruit and >15 km from the Waterval River. The overall topography is generally flat with local drainage lines within the FAD 6 footprint area. Water tends to pond and soak away on flat areas and flows away where drainage courses exist.

Water runoff from the access roads may result in contamination due to dust suppression resulting in sedimentation and ponding of water. The impact will have a low significance as the impact will be contained to the immediate site; it will be for the duration of the project but will be reversible once mining activities stop.

Therefore the probability that contaminated runoff from the FAD 6 operational area will reach the Grootspruit, Trichardt spruit or Waterval River via surface water drainage channels during the construction phase is considered possible, if not appropriately mitigated.

Impact on Stormwater management

Stormwater management is one of the key issues that must be addressed in the surface water assessment. Due to the clearing of land of vegetation and topsoil for construction purposes, construction of access roads, construction camps and the FAD 6 area and the compaction of soil, contaminated runoff from these areas will definitely increase resulting in an increase of the volume of contaminated water that needs to be handled on the FAD 6 footprint. This water will be concentrated and either flow away or pond until it evaporates. Prior to construction the runoff would have infiltrated to the groundwater therefore this is not available to the groundwater anymore thus resulting in an impact with a moderate high intensity potential.

Impact on the loss of wetland vegetation and habitat

The construction activities of the FAD will result in the loss of wetland habitat. Wetland habitats that are located immediately adjacent to the development footprints are likely to be substantially

disturbed during the construction process through increased and uncontrolled movement of heavy machinery and people on site.

Impact on altered flows within wetland areas

The construction of the proposed FAD 6 will require the installation of water management infrastructure to separate clean and dirty water, with clean water being diverted around the FAD 6. In addition, the FAD 6 will isolate portions of the catchment of various wetlands as rainfall falling within the FAD 6 footprint will be diverted via the dirty water management system. All of these activities will result in altered flow patterns within the downslope wetlands, specifically also in decreased flows where a significant portion of the wetlands catchment will now be occupied by the proposed dams. Decreased flows within the downslope wetlands will result in a decreased wetland extent and decreased vegetation vigour as wetland species are replaced by dry land species, increasing the risk of erosion especially during flood events. Where the clean water systems discharge into downstream receiving wetlands, flows are also likely to be more concentrated and of higher velocity, increasing the likelihood of erosion and channel incision within the wetlands.

During operation the trapping of debris against road culverts could result in flow obstruction leading to concentration of flows or impoundment of flows upstream of the obstruction. Concentrated flows lead to an increase in erosion risk, while impoundment of flows will lead to deposition of sediments, with deposited sediments likely to be colonised by pioneer species or reeds, resulting in changes to the wetland habitat.

Impact on habitat fragmentation

This impact relates specifically to the construction of linear infrastructure. Construction across the wetland systems along the route will lead to habitat fragmentation as infrastructure may pose an obstacle to movement of species associated with the wetlands. Especially longitudinal systems such as valley bottom wetlands and rivers act as important ecological corridors.

Impact of waste generation on site

During construction activities, waste will be generated by contractors working in the vicinity. General and hazardous waste will accumulate on site. The generation of waste on site has the potential to detrimentally pollute the environment within the vicinity of the FAD and associated infrastructure.

Impact on the loss of land capability and land use potential

The land use of the current FAD 6 site is located mainly on agricultural farming land. The dominant land capability class involved that of grazing and agricultural activities. This land is farmed by local farming communities. The land is categorized by cattle grazing and subsistence farming. The soils in the areas are categorized by vetic and sandy soils. Due to the placement the FAD 6 and associated infrastructure, the current land use and land potential will be lost, and will not support cultivation and minimal grazing opportunities.

Impact on air quality as a result of PM10

The air emissions associated with the WADS will be primarily from dust and volatile emissions that may be associated with the water phase transporting the slurries ash to the FAD site, including the returned brine where stored to the FAD assisting with dust suppression and consolidation of the ash. Attention is taken to ensure the FAD does not present unacceptable OHS risks. Impact on the air quality is cumulative to emissions from other facilities in the wider WADS, the SSIC, and surrounding area. Sensitive receptors located within 10 km of the WADS include the Embalenhle Township and the town of Secunda.

Operation phase

Impact of Runoff on the Grootspruit

See description under the construction phase.

Impact on surface water quality

See description under the construction phase.

Impact on stormwater management

The rainfall water within the designated dirty water area of FAD 6 that forms part of the MAR to the local water courses will be removed from the catchment this will result in a low intensity potential on the local surface water resource. The probability that the impact will be contained to the site, and will occur for the duration of the project is definite.

The potential could exist, should the proposed mitigation and management not be implemented, that excess water cannot be contained on site and will need to be discharged to the environment. This would have a moderate high potential intensity should the water reach the Grootspruit, Trichardt Spruit or Waterval River resulting in the deterioration of the functionality of the surface water which makes it unfit for use by any other water user.

Impact on altered flows within wetland areas

See description under the construction phase.

Impact on habitat fragmentation

See description under the construction phase.

Impact on Dam safety

The FAD 6 once complete will exceed the storage volume of 50 000 m^3, thus posing a dam safety risk as per Dam Safety Regulations of the NWA. Depending on the volume of the RWD, these dams may in addition trigger a dam safety risk and will be licensed accordingly. .

Impact of waste water streams of the FAD 6

RDW will be continuously receiving waste water to be recycled back into the SSIC. The potential of these dams to overflow therefore increases. This will result in the contamination of surface and possible groundwater in the area. The groundwater in the area currently contains a 2km radium pollution plume, whereby groundwater may not be utilized.

Stormwater diversion control areas pose a risk to overflow or failure during heavy storm events. This will result in the inability of the FAD 6 site to separate clean and dirty water around the site. Storage of fine ash in the form of a FAD will result in the seepage, contaminating surface and groundwater systems in the area.

Impact on the loss of land capability and land use potential

See description under the construction phase.

Impact on Road Safety

With the increase in construction and operational activities, comes the increase in the potential of accidents. The re - aligned D714 intersection with the R546 needs to be securely engineered according to mitigation measure proposed in order to minimize the potential of road accidents.

Impact on air quality as a result of PM10

PM10 will exceed the current PM10 standard (120 µg/m³) and the proposed 2015 PM10 standard (75 µg/m³) beyond the boundaries of the FAD 6 complex for the unmitigated scenario, but will be

below the PM10 standard of 120 µg/m³ for the mitigated scenario. The severity of the impact is great because the concentration of PM10 generated during the operational phase is above all standards and guidelines. The high DFO concentration emitted may be harmful to the potential receptors close to the site. The PM10 concentration range from 20-50 µg/m³ at the Embalenhle Township and are below 30 µg/m³ at Secunda. The threshold limit will always be exceeded in the project areas. The impact will be local as PM10 concentrations in the area decrease away from the operational activities. The duration of the impact will be evident during the post closure phase.

Impact on wetland Quality deterioration due to seepage

Seepage or leakage of polluted water out of the ash dams and into adjacent wetlands is likely to result in a significant deterioration of water quality within the receiving water resources. Decreasing water quality within the wetlands is likely to have a deleterious effect on biodiversity supported by the wetlands, as well as making the water less fit for use for downstream water users. Downstream water users at a local scale include farmers using the water for livestock watering and irrigation, while further downstream the polluted water would enter the Waterval and the Vaal River.

Closure phase

Impact of Runoff on the Grootspruit

See description under the construction phase.

Impact on surface water quality

See description under the construction phase.

16.1.1 Key Positive Impacts after mitigation

The following section outlines the impacts which were determined to have a positive impact, either directly or through the spin – offs generated by the development and operation of the pipeline. These positive impacts are not listed per phase of the project, but as consolidated impacts during construction, operation and closure.

Construction, operation and closure phase

Synfuels employs a large number of people, leading to the establishment of the town of Secunda. Without the operation of the construction of the FAD, Synfuels operations will ceases following FAD 4 and 5 reaching its capacity. The Govan Mbeki is currently sitting with a 40% unemployment rate, which will drastically increase should the FAD 6 not commence.

During the construction phase of the project a number of employment opportunities will be made available and sourced from local communities within the area. These activities may relate to the following:

- Employment opportunities for local contractors during site clearance, preparation, construction and decommissioning;
- Secondary service provision of food, toilet hires, and equipment; and
- Appointment of contractors as drivers, cleaners and security personnel.

Operational activities will provide minimal job opportunities as the personnel currently responsible for the maintenance and workings of the FAD 4 and FAD 5 will be employed for FAD 6.

16.2 Comparison of positive and negative implications of the proposed Activity and alternatives.

The position of the proposed FAD 6 is largely constricted by the availability of space in close proximity to the SSIC. With increasing distance from the complex comes an increasing incessant fiscal cost. In addition to this, Sasol Coal planned for the installation of a conveyor cutting through the proposed site or relocating it through the northern side of the site. This constraint limits the possible location for the construction of the FAD 6. The project Alternatives that have been identified to date for assessment in the EIA include process and location alternatives and will be assessed.

16.2.1 Location Alternatives

Alternative 1: Single large Phased entity

This alternative is based on the conveyor alignment relocated to the north.

The size of the proposed site offers the possible construction of a Phased single FAD 6 directly south of the relocated conveyor alignments covering the majority of the proposed site. This dam will in turn have the capability to handle the factory loads from Synfuels. The cost implications of such a dam are more feasible than the construction of two individual dams.

The dam will be constructed in four phases. RWD's will be constructed west, north and north east of the dam for the various phases including a potential water storage facility at the western side as a first phase. The northern penstock will gravitate the water from the FAD 6 to the silt traps and the north RWD from where water will be transferred via a gravitational system to the CAE system. Penstocks located on the western and north eastern dams will decant water into RWD's and sumps from where it will be pumped to the CAE system due to the topographical difference between the RWD and CAE system. When the level of these dam sections have been raised sufficiently the bulk of the water can be gravitated to the CAE system

The relocation of the Sasol Mining conveyors to the northern side of the site has been investigated in conjunction with the Synfuels single future ash dam development south thereof. This alternative is a more financially and environmentally sound option. This will allow for minimal construction of associated infrastructure and will in turn allow for better management and maintenance. The only disadvantage of the construction of a single large dam is the greater surface area exposed to wind and environmental factors. The larger surface area of this alternative posed a threat to increased DFO and PM 10 pollution. Stringent mitigation measures will need to be put in place should this alternative be decided on. Figure 5-1 illustrates the layout of this alternative.

Alternative 2: North and South Dams

North Dam Phase 1

This alternative is based on the assumption that the currently planned Sasol Mining conveyor alignments cutting through the available land for FAD 6 development remains in position and that the dams are developed on both sides of the conveyors.

The northern dam will be constructed in three separate phases. Firstly the temporary water storage facility will be constructed where after the northern dam phase 1 should be constructed on portion 3 of the farm Rietvley 320 IS. Northern dam Phase 3 entails the conversion of phase 1 for receiving fine ash. The Phase 1 RWD will be constructed north of FAD6. The penstock located in the phase 1 dam will transport the water from the FAD 6 to the silt traps and the RWD from where water will be further transported via a gravitational system to the existing CAE system. Water from the water storage facility will be transported via a pipeline from the western RWD to the phase 1 RWD and to

the CAE system via a gravitational system. The northern dam will be constructed almost entirely on bord and pillar undermined areas or non-mined areas with a small area located on total extraction where strengthening of the substrata is required where FAD 6 walls are positioned. An Eskom power line runs across the area in a south west direction and has to be relocated to a position alongside the proposed relocation of a section of the provincial rural road west of the western boundary of the proposed dam site. The entire phase 1 northern dam is located on Portions 3 of the farm Rietvley 320 IS, with portion 8 serving as a buffer zone.

South Dam Phase 2 and 3

The southern dam phase two and three are located south of the proposed northern dam and conveyor routes on Portions 2, 9 and 10 of the farm Rietvley 320 IS. The return water from this FAD 6 will be routed towards the north eastern RWD's north east of the provincial road R546. The latter RWD's will initially be energy inefficient owing to the additional construction of a low head pump to transfer water to the CAE system. At a later stage when the dam level is raised beyond the water crest level the bulk of the water can be gravitated to the existing CAE system. The southern dam is located on a complex mining layout, with transition between long wall, total extraction, bord and pillar and un-mined dolerite dykes. The southern FAD 6 will function in assisting the northern FAD 6 to take on the factory loads of ash from Synfuels and should be constructed during the final decommissioning phases of FAD 5.

The construction of the FAD 6 as a segregated phased activity has potential disadvantages. The single northern dam does not have the capacity to handle two factory ash loads. Hence the construction of the southern dam is required once FAD 5 is finally decommissioned. Due to limited space available this alternative does not offer ash stacking capacity up to 2050 which may require the development of an alternative FAD 6 elsewhere at high cost which is a less feasible alternative. The reduced capacity, hence the reduced surface area of this alternative is more favourable from an Air Quality Perspective. With increasing surface area of the FAD 6 comes an increase in DFO and PM10 emissions. Figure 5-2 illustrates the layout for this alternative.

16.2.2 Process Alternatives

Dry Ashing

Synfuels is currently using predominantly dry conveyor system for the disposal of coarse ash, where dust generation is limited, and a wet ashing system to transfer and store the fine ash. Dry ashing of fine ash is not considered technically, environmentally or economically viable. Although the Dry Ashing system utilized minimal water, significant amount of dust is produced compared to the Wet Ashing system. Considering the proximity of the local communities in the area and the amount of activity currently taking place by Synfuels operations, DFO and PM10 concentrations are more likely to exceed legislative guidelines and affect the surrounding communities after the implementation of mitigation measures.

Wet Ashing

Ash is a natural constituent of coal. When coal is gasified or burned in the steam plant boilers the remaining residue is coarse and fine ash, which is segregated through a screening process, and ultimately needs to be stored of. Synfuels is currently using predominantly dry conveyor system for the disposal of coarse ash, where dust generation is limited, and a wet ashing system to transfer and store the fine ash, which has a higher dust generation potential. Wet ashing produces less dust in the vicinity of operations at Synfuels, thereby promoting health and personal wellbeing. The wet ashing system produced less dust but uses more water than the dry ashing system. The majority of this water is evaporated, trapped as interstitial water within the ash particles and finally recycled and

recovered for re-use within the process. The Wet Ashing system is currently used at Synfuels. The costs to retrofit a dry ashing system at Synfuels will not be financially viable. It is thus proposed the Synfuels continue with the wet ashing system.

16.2.3 No – Go Alternative

The final alternative assessed, is the No – Go alternative. The No Go alternative assesses the status quo of ash disposal at Synfuels.

It is planned that the SSIC will continue as primary coal gasification and integrated organic chemicals plant for at least the next 25 years, and will therefore require facilities to store of the waste ash generated by the coal gasification and associated boiler operations. Due to the nature of the fine ash there are engineering limitations on suitable disposal facilities, and new facilities are required to accommodate on-going fine ash production.

It is planned that the construction of the proposed FAD 6 will finally replace the existing FAD 4 which in turn will be decommissioned and rehabilitated, and subsequently take over from the existing FAD 5. Without the commencement of the new FAD 6, all operations at Synfuels will be completely terminated prior to year 2019. Operations will not proceed beyond the life span of the existing FAD's. The factory will need to be shut down due to the inability of the factories to deposit and transfer fine ash. Secunda is an urban town, primarily developed for the housing of Synfuels employees. A large percentage of the Secunda area is employed by Synfuels. Should the FAD 6 not commence and Synfuels forced to close down, a substantial amount of jobs will be lost in the process.

Whilst Synfuels is investigating opportunities for the re-use of fine ash, and coarse ash, and alternative technologies for the ashing process, there is currently no technically appropriate alternative disposal outlet for the fine ash generated by the SSIC. In the absence of FAD 6 the SSIC would not be able to continue in operation, with associated major socio-economic consequences to the local and national regional economy in South Africa.

16.3 Environmental considerations between Alternative One and Two

From the Impact Assessment and associated specialist studies, it is evident that no alternative is more preferred that the other from an environmental perspective. Alternative 2 may result in reduced PM10 and dust emissions as the surface area will be reduced. However it must be noted that with the reduction in surface area comes the reduction in final capacity, thus a new FAD 6 will be required at an earlier time than expected with the preferred alternative. The increased Air Quality issues can be mitigated considering the rehabilitation of FAD 4 prior to operation of FAD 6.

17 Environmental Management Plan

17.1 Introduction

17.1.1 Background

The purpose of the EMP is to ensure that social and environmental impacts, risks and liabilities identified during the EIA process are effectively managed during the construction, operations and closure of Synfuels proposed FAD 6 development and associated infrastructure. The EMP specifies the mitigation and management measures to which Synfuels is committed, and shows how the project will mobilise organizational capacity and resources to implement these measures. It also shows how management measures aimed at mitigation and enhancement will be scheduled.

17.1.2 Objectives of the management plan

The key objectives of the EMP are to:

- Formalize and disclose the programme for environmental and social management;
- Ensure that appropriate Environmental Management measures and requirements are implemented from the start of the project;
- Ensure compliance to environmental legislation;
- Manage identified impacts;
- Ensure precautions against damage and claims arising from damage are taken timeously; and
- Provide a framework for the implementation of environmental and social management initiatives.

Best practice principles require that every reasonable effort be made to reduce and preferably to prevent negative impacts, while enhancing positive benefits, especially within the communities most directly affected by the proposed project. These principles have guided the EIA process.

The EMP is a continuation of the EIA process that commenced in June 2010, and involved the application for environmental authorization, which was approved by the competent authority, (MDEDET and DEA). The scoping report and Plan of Study was also approved as per regulation 30 of GN 543 printed in terms of NEMA.

The EMP has been compiled on the basis of the outcome of work undertaken during the EIA and represents management commitments of Synfuels once approved by the competent authorities, whereby the EMP will be legally binding. The EIA process has involved concurrent and on-going data collection and public consultation activities to date:

Work underpinning the EMP, compiled in adherence to the EIA regulatory requirements includes the following:

- PPP as stipulated in regulation 54 – 57 of GN 543;
- Preparation, for comment by I&AP's, a scoping report in accordance with regulation 28 and 29;
- A Final EIAR (this report) of the proposed project, including specialist reports, that aims to:
    - List potential impacts and risk associated with the proposed project;
    - Identify mitigation measures relating to the potential negative environmental and social impacts identified during the EIA process; and

- Formulation of the EMP against the negative impacts.

The EMP covers information on the management and/or mitigation measures that will be taken into consideration to address impacts in respect of:

- Planning and design;
- Pre-construction and construction activities; and
- Operation; and closure, where relevant.

Before presenting the details of the EMP it is necessary to highlight that the EMP is a living document that will be periodically reviewed and updated. It will also be necessary to update the version presented in the Final EIAR during the detailed design phase, prior to the commencement of construction. As part of on-going implementation, this EMP will also be publicly disclosed during the PPP. An opportunity will be offered to participating stakeholders to comment on it.

17.1.3 Key definitions used in this EMP

Key definitions used in this EMP are listed in Table 17-1.

Table 17-1: Key definitions used in this EMP

Contractor	Any provider of services, goods or people to Sasol for the purposed of the FAD 6 development. These may directly or indirectly include contractors, sub-contractors, hired labour agencies and consultants.
Contractor Safety Officer	An individual nominated by the Project Manager to represent the contractor on site and to act on behalf of the Project Manager in matters concerning the day to day implementation and monitoring of the EMP and conditions of the Environmental Authorization.
DEA	Department of Environmental Affairs (Competent Authority for the Waste License)
Emergency	An undesired event that results in an environmental impact and requires the notification relevant statutory bodies and the Project Management Team.
Environment	As per definition in the NEMA
Environmental Consultant	An independent environmental consultant with experience in the management of construction contracts
Environmental Control Officer	The Environmental Control Officer (ECO) is the person responsible for ensuring that the registration and updating of all relevant EMP documentation is carried out. The ECO is informed of revisions and updates to the EMP by the Project Manager. A controlled document is official only if the issue/revision has been approved.
Environmental Impact	A change in the environment, weather adverse or beneficial, wholly or partly, resulting from an organizations activities, products or services
Environmental management	Dedicated Synfuels employee that deals with environmental considerations in the management cycle of the Project, i.e. policy, planning and design, implementation (preconstruction, construction and operation), monitoring and corrective action and review.
Incident	An undesired event that may result in a significant environmental impact, although can be managed through internal response and procedures.
MDEDET	Mpumalanga Department of Economic Development Environment and Tourism (Competent Authority for NEMA authorization)
Operational controls	Mechanisms used to effect the EMP requirements
Synfuels	Refers to Sasol Synfuels (Pty) Ltd

Plan	Sets out the intended method and/or specific measures required to mitigate and/or enhance the negative and positive impacts of the Project. A plan usually focuses on one project phase, i.e. pre-construction and construction, operation or closure.
Project Management Team	The responsibility of the EMP implementation resides on this team. This team includes a Project Manager and Section Leader.
Programme	Identifies a series of interrelated measures (often contained in detailed plans) for managing the environmental effects of the Project. A programme provides broad direction and covers more than one project phase.
Property line list	The list of special conditions over and above the master.
Safety, Health and Environmental Officer	A representative from each contractor, appointed as a Safety Health and Environmental Officer, assisting the construction manager on Safety, Health and Environmental aspects of the project on the construction site.
Wetlands	Include all areas where the soils were formed under seasonal or permanent saturation.

17.1.4 Authors of the EMP

This EMP was prepared by Andrew Caddick and Dr. Laetitia Coetser and reviewed by Dr. Andrew Wood. Mr Caddick is an Environmental Consultant with SRK. He has Honours in Environmental Management and Geography obtained from the North West University, and has over 3 years of project experience in environmental management. During this time Mr Caddick has both personally prepared and given input to various EMP's. Dr. Coetser is a Principal Environmental Consultant at SRK with over 15 years' experience. She has a PhD in Water Resource Management. During this time Dr Coetser has compiled a number of EMP's and associated amendments. Dr. Wood is a partner at SRK. He has a PhD in Pollution Control from the Manchester University in the United Kingdom. Dr. Wood has over 23 years' experience.

The project team therefore possess the core competence required to prepare the EMP for the Synfuels FAD 6 development. For more information pertaining to the qualifications and expertise of the project team, refer to Appendix B.

17.1.5 Approach to Environmental Impact Management

The responsibility of the EMP implementation will ultimately reside in the Project Management Team of the FAD 6 development. There will be links with other fundamental units such as Safety Health and Environmental (SHE) representatives of Synfuels, Operational and Maintenance services. The Sections that follow will outline the management cycle and responsibilities of the Project Management Team. Table 17-2 illustrates the range of approaches to be undertaken to manage potential project activities.

Table 17-2: Approach to Impact management

Avoidance	Avoiding activities that could result in adverse impacts and/or resources or areas considered sensitive
Prevention	Preventing the occurrence of negative environmental impacts and/or preventing such an occurrence having negative impacts
Preservation	Preventing any future actions that might adversely affect an environmental resource
Minimisation	Limiting or reducing the degree, extent, magnitude or duration of adverse impacts through scaling down, relocating, redesigning and/or realigning elements of the project
Mitigation	Measures taken to minimize adverse impacts on the environment
Enhancement	Magnifying and/or improving the positive effects or benefits of a project

Rehabilitation	Repairing affected resources, such as natural habitats or water resources
Restoration	Restoring affected resources to an earlier (possibly more stable and productive) state, typically 'background' or 'pristine' condition
Compensation	Compensating for lost resources, and where possible, the creation, enhancement or protection of the same type of resource at another suitable and acceptable location

17.2 Sasol Safety Health and Environmental Policy

Sasol's Environmental Policy states the following;

We, the people of Sasol, striving for excellence in all we do, recognize the impact that our activities can have on people and the environment. Safety, health and protection of the environment will from an integral part of our planning and decision making. We will manage our company, wherever we do business, in an ethical way that strikes an appropriate and well-reasoned balance between economic, social and environmental needs.

We are committed to:

- Conducting our business with respect and care for people and the environment;
- Responsible utilization of natural resources;
- Implementing responsible care for all Sasol's chemical and associated business. Non – chemical businesses will implement appropriate, recognizable codes of practise;
- Continually improving our safety, health and environment performance;
- Complying, as a minimum, with all applicable legal and other agreed requirements;
- Promoting dialogue with stakeholders about safety, health and environmental performance;
- A 'cradle to grave' approach to the products we develop, manufacture, and use, distribute and sell;
- Informing and appropriately training all employees and contractors on safety, health and environmental matters;
- Responding effectively to safety, health and environmental emergencies involving our operations and products;
- Engaging with relevant authorities and institutions on the formulation of legislation, standards and the implementation thereof;
- Benchmarking internationally on best safety, health and environmental practises;
- Sharing safety, health and environmental risk reduction best practises throughout Sasol;
- Providing appropriate resources required to implement the above.

We will achieve these by:

- Implementing internationally recognizable safety, health, environmental and quality management systems;
- Developing and implementing inherently safer and cleaner technologies.

Signed by: Pat Davis

Chief Executive. June 2007

17.3 Organizational Structure and Responsibilities

The Project Management Team will:

- Ensure that the Contractors are aware of the specifications, legal constraints and Sasol standards and procedures pertaining to activities taking place regarding the FAD 6 development;
- Ensure that all commitments in the EMP are communicated and adhered to by Synfuels employees and contractors involved with the FAD 6 development;
- Monitor the implementation of the EMP throughout the project, by means of site inspections and meetings; and
- Familiarize themselves with the EIA / EMP for this development, the conditions set out in the Environmental Authorization, and all relevant environmental legislation.

The Contractor (including sub-contractors) will be responsible for:

- Complying with the EMP commitments and any other legislative requirements;
- Adhering to any instructions issued by the project manager on advice of the Synfuels EIA specialist;
- Submitting an environmental report at each site meeting on the environmental incidents that have occurred within the period before the site meeting;
- Appoint a construction Safety Officer and SHE representative who will comply to the functions set out below; and
- Arrange that all employees and those of the subcontractors receive appropriate training prior to the commencement of construction, taking cognisance of this EMP and Environmental Authorization.

The Construction Safety Officer will:

- Fully understand the commitments in the EIA / EMP and Environmental Authorization;
- Familiarizer him / herself and ensure compliance will the relevant legislation applicable to the project and Sasol Safety Health and Environmental Policy and procedures;
- Communicate the contents of the EMP to the contractor and sub-contractor staff members. Training will be required to ensure all staff members are aware of the requirements of this document;
- Regularly undertake site inspections to assess compliance with the EMP and Environmental Authorization and take appropriate action to rectify non-conformances;
- Authorize the removal of personnel and / or equipment should they contravene the specifications of the EMP;
- Compile progress reports on a regular basis for submission to the Project Manager; and
- Establish a communication path with the Project Manager to discuss monitoring on the site.

The Environmental Control Officer will:

- Manage and report on the project's environmental performance;
- Be responsible for undertaking internal environmental audits and arrange / coordinate external environmental audits;

- Liaise with environmental statutory bodies, including MDALA, DEA, DWA, and Department of Mineral Resources (DMR) should this deem necessary;
- Conduct environmental training and awareness to employees;
- Advise top management on environmental issues and recommendations for the FAD 6 development; and
- Arrange for liaison with I&AP's on environmental issues of concern.

The Safety, Health and Environmental Representative will:

- Oversee all work done by the ECO;
- Ensure corrective actions are followed up and closed out; and
- Advise top management on environmental issues and recommendations for the FAD 6 development.

17.4 The FAD 6 Development Process

17.4.1 Planning and Design

Planning and design is necessary to ensure that the mitigation and impact management can be effectively implemented through the alternation and amendments of design bases to achieve a more environmentally friendly development. Planning may involve the following:

- Identifying and defining the environmental aspects and related positive and negative impacts that may result from Synfuels activities;
- Establish a procedure whereby legal and any other requirements applicable to Synfuels are identified; and
- Identifying and defining appropriate mitigation and management measures which can be incorporated into the conceptual design phase of the project.

The envisaged impacts to arise from the FAD 6 development have been detailed and rated in Section 12. The management measures presented in this EMP are developed in response to these impacts and their associated ratings.

17.4.2 Pre – Construction and Construction

The EMP has put in mitigation and management measures to avoid or minimize impacts and optimize the benefits arising from the positive impacts during pre-construction and construction activities (e.g. site clearance, excavation, establish access roads, etc.). The construction activities to take place have been detailed in Section 4.23 and Section 12. The primary focus on project management for the pre – construction and construction phase will include:

- Transportation of equipment and machinery to the site location;
- Development of the construction camp on site, taking into consideration of the proximity of residential areas, water resources, and the provision of adequate service needs;
- Fencing of the construction site;
- Development of temporary materials and waste storage and control measures;
- Stripping and removal of surface vegetation from site to an approved location;

- Stripping and stockpiling of topsoil from the site for later use for rehabilitation and landscaping;
- Excavation for pipe trenches, canals and base for the water retaining structures, pump stations and FAD 6;
- Excavation and development of toe and blanket drains for the water retaining structures and FAD 6;
- Construction of ash and water transfer pipework and canals, pump stations, RWD and started walls for the FAD 6;
- Establishment of affected watercourse diversions and stormwater control measures;
- Re-alignment of the D714 roads north of the proposed FAD 6 location, and modification of the intersection with the R546;
- Realignment of the power lines running the proposed footprint;
- Site rehabilitation following the construction phase, of areas that have been disturbed and are not part of the on-going operational phase of FAD 6, and
- Commissioning of the ash transfer, ash deposition and water recovery systems.

17.4.3 Operation

The primary operation of the FAD 6 development will involve the disposal of fine ash to the FAD 6 and subsequent water recovery from the dam back to be used by Synfuels operations (see Section 4 for full details).

For the purpose of this EMP there are three principle mechanisms that can be used for the implantation of management and mitigation measures. These include:

- Facilities – These relate to specific standalone functioning departments, like leak detection and maintenance services, that will need to be established during the operational phase of the project;
- Procedures – These relate to a dedicated function (i.e. Waste Management Procedures) which need to implemented during the operational phase of the project;
- Assignment of responsibilities of contractors – This is mostly important during construction phase, where contractors and sub – contractors will be used to construct the FAD and associated infrastructure. However during maintenance, contractors will further be required whereby they should be made aware of their responsibilities to adhere to the EMP and legislative requirements.

The mechanisms used for effectively implementing the EMP conditions during the operational phase are termed “operational controls”. These operational controls will require that a budget, implementation program and responsible party specifically be allocated to further enable and facilitate the successful implementation of the operational controls.

Roles and responsibilities need to be defined for the EMP. These roles include dedicated SHE management roles as well as the roles of the Synfuels personnel. To facilitate coordination and purposeful implementation, the EMP mitigation and management measures include programmes and plans.

During operation of the FAD, the following activities will take place:

- Deposition of ash on the FAD , with a rate of rise of approximately 3.5 m / annum;
- Recovery of ash water to the CAE dams for subsequent re – use within the SSIC and ashing processes;
- Transportation of vehicles to and from the FAD for maintenance;
- Monitoring of ash deposition, water recovery and quality and environmental parameters;
- FAD 6 operation, monitoring and maintenance, including on-going rehabilitation and vegetation of side slopes;
- Pump station and pipelines operation, monitoring and maintenance;
- Access roads and perimeter fencing and security;
- Air and Water Quality Monitoring (surface & groundwater); and
- Stormwater management infrastructure operation, monitoring and maintenance.

17.4.4 Closure

The primary focus during the closure phase of the FAD 6 will be the rehabilitation of the FAD 6 and demolition of the associated infrastructure. A rehabilitation plan will be required during the operational phase, which will extend throughout the closure phase of the development. In addition to this continual air and water quality monitoring will be required post – closure.

17.5 Checking and corrective Action

Checking and implementing corrective action, should it be required, forms an important component of the EMP management cycle. These ensure that:

- The required EMP management conditions are being implemented; and
- The desired outcomes are being achieved.

This component included four key activities:

- Monitoring selected environmental quality variables;
- On – going inspections of operational controls and general state of operation;
- Internal audits to assess the compliance to the EMP or to focus on a particular performance issue; and
- External audits to provide independent verification of the efficiency of the EMP.

There are several mechanisms for implementing corrective action both during construction and operational phases. The main instruments used to address non compliances are the following:

- Verbal instructions – Minor transgressions from an established procedure;
- Written instructions – Normally following an audit; and
- Contract Notice – Following a breech in contract.

17.6 Site documentation and reporting

All non-conformances will be recorded and reported to the responsible personnel. Considering the nature of construction, continual daily visual inspections will be conducted by the ECO or SHE representative.

The following documentation will be required on site:

- Record of Complaints;
- Disposal certificates of waste and sewage;
- Monitoring results;
- Non – conformance reports;
- Written corrective action instructions;
- Environmental Authorizations; and
- The EMP of this document.

The finding of all inspections and internal / external audits will be structured into instructive reporting providing information to all responsible personnel. Corrective actions must be clearly defined where required. Within the reporting function a structured review component must be enforced. This review function will assist in prescribing necessary corrective actions.

Water quality monitoring requirements will be stipulated in the WUL amendment. The conditions of the WUL, WL and Environmental Authorization will form part of the environmental management requirements on the FAD 6 development site.

The purpose of the review function is for senior project management to review the environmental management performance during all phases, and to proposed measures to improve performance focusing on continual improvement.

17.7 Monitoring

All programmes and plans will be subject to monitoring. Monitoring will have two elements namely: routine monitoring against set standards or performance criteria, and periodic review or evaluation. This will focus on the assessment of the effectiveness of the plan or programme. In some cases independent parties will undertake the monitoring, review and evaluation.

During the construction phase, Sastech will be responsible for monitoring and inspecting contractors written records to illustrate compliance with the EMP. This is fall under the inspection role of the independent ECO appointed by Sastech. This compliance monitoring is to verify that the responsible parties are adhering to the procedures, management conditions, and specifications contained in this EMP.

During the operational phase, monitoring will be undertaken to ensure compliance with the management measures contained in this EMP.

17.7.1 Programme monitoring

Synfuels will regularly monitor their programme implementation for the FAD 6 development. This will include the regular monitoring of:

- Erosion or soil within the construction footprint and along the walls of the FAD 6;

- Air Quality and ambient emissions. This will include dust and PM10 emissions during construction and operational activities;
- Waste Management Programmes used to manage the generation of waste on site, as well as the fine ash handled at the facility;
- Surface and groundwater quality. This monitoring will provide a baseline by which water quality can be measured; and
- Rehabilitation of the construction sites, post construction and continually during operation.

17.8 Training and Awareness

The ECO will be appointed by Sastech and will have the appropriate training in environmental management. The ECO will have the necessary skills to train all personnel involved in the construction, operation and closure phase of the project. Sastech together with their SHE representative and the ECO will ensure that all employees are adequately trained on the EMP requirements. The induction program will include the presentation of Environmental awareness. Records must be kept on all employee trained on the EMP and those who have undergone the Environmental Awareness induction and safely filed.

Training will be conducted in the language of the employees. The Environmental awareness induction presentation must include the following:

- The importance of adhering to the EMP and any other management plan compiled in response to this EMP;
- Clear understanding of the key environmental features of the construction site and surrounding environment;
- The significant potential and actual environmental impacts of their work activities;
- Environmental benefits of adhering to the EMP and continual improvement;
- Roles and responsibilities of individuals when carrying out their work activities;
- Consequences of deviating from set operating procedures; and
- Mitigation measures required to be implemented when carrying out their work activities.

17.9 Commissioning of tenders

All contractors and sub-contractors tendering for any aspect of the FAD and associated infrastructure development will be made aware of the contents of this EMP and the consequences and penalties resulting from non-conformances will be communicated to them. All appointed contractors and sub – contractors will be required to attend training and induction on this EMP.

17.10 General Requirements during Construction

- Ensure proper and continuous liaison between Synfuels and the contractor to make certain everyone is informed at all times;
- A physical access plan shall be compiled and the contractor shall adhere to this plan at all times;
- The adjacent landowners shall be informed of the starting date of construction as well as the phases in which the construction shall take place;
- The Contractor must adhere to all conditions of contract, including the EMP;

- Compile a plan for the construction process to allow for disruptions due to rain and very wet conditions;
- Proper site management and regular monitoring of site works;
- Proper documentation and record keeping of all complaints and actions taken;
- Regular site inspections and good control over the construction process throughout the construction period; and
- The Contractor shall not be released from site until the SHE Representative has signed off the release documentation and is satisfied with the contractor's adherence to the EMP and Environmental Authorization.

Table 17-3: Environmental Management Plan for the Proposed FAD 6 development

Objective	No	Mitigation and management measures and principles	Project Stage
Socio – Economic			
Increase Employment opportunities	1.	Encourage the local employment for the following : • Employment opportunities for local contractors during site clearance, preparation, construction and decommissioning; • Secondary service provision of food, toilet hires, and equipment; and • Appointment of contractors as drivers, cleaners and security personnel.	C/O/D
Surface Water			
Reduce the impact on surface water quality as a result of runoff from cleared areas.	2.	Ensure the clean and dirty water segregation is implemented as per the GN 704 of the NWA requirements.	C/O
	3.	Clean stormwater will be diverted away from the FAD 6 operational areas by cut-off channels and diversion berms designed to handle the 1:50 year storm event.	C/O
	4.	Water containment facilities (process water dam and CAE dam, FAD 6, drainage systems etc.) will be designed, constructed, operated and maintained to have a minimum freeboard of 0.8 metres above full supply level.	PC/C/O
	5.	Contaminated runoff water, generated during rainstorm events, on the operational footprint area will be contained in specifically designed structures to enable sedimentation and desilting of the runoff.	C/O
	6.	FAD 6 will be provided with an engineered base as provided for the current FAD 5 extension, as a minimum, as a barrier to excessive infiltration to groundwater, with provision of under-drainage.	PC/C/O
Reduce the impact on surface water quality as a result of hydrocarbon spillages	7.	All fuel, oil and other hydrocarbon storage areas will be bunded to contain 110% of the stored volume. Bunded areas will be constructed of a material impermeable to the hazardous substance stored within. The bunded areas will be constructed with an internal sump whereby spillages will easily flow and allow for easy clean up. The sump will not contain an exit value. Spill kits to be made available at areas of possible spillages of hazardous substances. Rainwater entering the bunded areas, will be considered hazardous and will be treated as so. Should the bunded areas be damaged, this will be immediately rectified.	C/O
	8.	Vehicle repairs will only take place in designated areas. Appropriate bunded areas on a concreted floor will be provided for this. The collection of any contaminated soil resulting from spills must be remediated.	C/O

	9.	Good housekeeping will be maintained to minimize the risk of pollution. A contamination clean-up plan will be developed to ensure all that any spills are cleaned as soon as possible and ensure disposal of contaminated material in an appropriate way. Synfuels will ensure that all equipment is well maintained and fully operational.	C/O
	10.	Contaminated runoff will be contained and re used where necessary.	C/O
	11.	An incident reporting system will be implemented in order to ensure incidents are closed out and appropriate measures are taken to prevent further incidents.	O
	12.	Synfuels will ensure that temporary toilet facilities do not cause water pollution or health hazards. Sufficient toilets need to be provided for the number of contractors that will be on site (1 toilet for 15 staff members).	C/D
	13.	Procedure manuals will be provided for drivers of both Synfuels and the Contractors mobile equipment, and will be trained on how to deal with accidents involving hydrocarbons and other potential contaminants.	PC/C/O/D
	14.	Any other areas posing a threat to soil contamination will be paved or appropriately lined.	C/O/D
	15.	Also see reference No. 107 on the use of herbicides.	C/O/D
	16.	Should cement be used on site, the following guidelines apply: • Carefully control all on-site operations that involve the use of cement and concrete; • Limit cement and concrete mixing to single sites where possible; • Use plastic trays or liners when mixing cement and concrete: Do not mix cement and concrete directly on the ground; Store all visible remains of excess cement and concrete after the completion of tasks. Store in the approved manner (solid waste concrete may be treated as inert construction rubble, but wet cement and liquid slurry, as well as cement powder must be treated as hazardous waste).	C/O
	17.	All fuel, oil and other hydrocarbon storage areas will be bunded to contain 110% of the stored volume. Bunded areas will be constructed of a material impermeable to the hazardous substance stored within. The bunded areas will be constructed with an internal sump whereby spillages will easily flow and allow for easy clean up. The sump will not contain an exit value. Spill kits to be made available at areas of possible spillages of hazardous substances. Rainwater entering the bunded areas, will be considered hazardous and will be treated as so. Should the bunded areas be damaged, this will be immediately rectified.	C/O
Minimize the impact resulting from	18.	Develop, implement and monitor a stormwater management plan for the FAD 6 and associated infrastructure development.	C/O

stormwater.	19.	Stormwater will be concentrated and either flow away or pond until evaporated.	C/O
	20.	Also See reference No. 2 and 3 on clean and dirty water segregation.	C/O
	21.	Also See reference No. 4, 5 and 6 on water containment facilities, surface runoff and infiltration.	PC/C/O
	22.	Stormwater off the road surface should be discharged into vegetated swales protected against erosion rather than directly into adjacent wetland or water resources. The vegetation within the swales will also serve to trap sediments.	C/O/D
Minimize the impact on surface water contamination due to overflow of the CAE dams and leachate from the FAD 6	23.	The FAD 6 system is to be operated to ensure that the accumulation of water in the pool area does not present a stability risk and that drainage of pool water accommodates the 1:50 year flood event.	PC/O
	24.	The process water control dam is to be operated to ensure that the 1:50 year flood event is contained plus free-board at full operating level of 0.8 m.	PC/O
	25.	The RWD and the CAE are to be provided with a formal engineered liner system appropriate to the containment of impacted waters for reuse purposes.	PC/C/O
	26.	The FAD 6 will be provided with formal engineered drainage and seepage collection systems appropriate to the collection of impacted waters for reuse purposes.	PC/C/O
	27.	The FAD 6 system will be compliant to Regulation 704 in diverting clean water from the upper catchment area around the site to the natural environment, and containing dirty water within the FAD 6 water management system.	C/O
	28.	The CAE/RWD is to be operated to ensure that the 1:50 year flood event is contained plus free-board at full operating level of 0.8 m in balance with appropriate drainage control from the pen-stock and recovery of water to the SSIC.	C/O
	29.	Clear ash effluent will be recycled to the SSIC.	O
		Synfuels current surface water monitoring system will be extended to incorporate the FAD 6 and associated infrastructure to monitor the water pollution in the area and act upon potentially harmful results. Should contamination or excessive flow be detected, Synfuels will immediately notify the relevant authorities. Synfuels will then: • Identify the source of the contamination; • Identify and implement measures for the prevention of this contaminant; and Determine if additional remedial measures are required.	PC/C/O/D
Minimize the spillage of ash and / or process return clear ash effluent	30.	Refer to the Objective to minimize the impact on surface water due to overflow of the CAE dams and leachate from the FAD 6.	PC/C/O
Reduce the impact caused by the change in hydrology of water course	31.	Water courses will be diverted as per the WUL conditions therefore will not carry the water falling on the FAD 6, which is considered dirty water.	C/O
	32.	Clean water diversions will be constructed in order to route the majority of catchment water into the local water courses.	C/O

	33.	During decommissioning the RWD and ponds will be emptied and backfilled if not to be used in the future.	D
Geohydrology			
Minimize the influence of seepage from the FAD 6 on groundwater quality.	34.	The Synfuels groundwater monitoring network will be expanded to include the FAD 6 and associated infrastructure footprint. Regular continual monitoring will be conducted as stipulated in the WUL.	O
	35.	Installation and operation of seepage interception trenches at the toe of FAD 6 to reduce plume migration and prevent plume from day lighting in the Grootspruit.	O
	36.	Utilising the available storage facilities to manage the water intercepted at the toe of FAD 6.	C/O
	37.	Ensure that the leachate collection and groundwater monitoring systems are continually maintained and monitored.	O
	38.	A suitable engineering liner will be installed underneath the FAD 6 system minimizing potential seepage.	C/O
	39.	Ensure that ponding is prohibited in any water conduits or unlined pools.	C/O
Reduce the runoff from the FAD 6 destining into the Grootspruit	40.	Construct cover material on FAD 6 so that natural vegetation can be established to provide a non-contaminating surface for runoff.	O/D
Waste Management			
Minimize the impact of waste streams to and from the FAD 6 on the environment	41.	Stormwater diversion control measures must be able to accommodate all storm water runoff for a period of 24 hours in the case of a 1:50 year flood.	PC/C
	42.	Stormwater toe paddocks and RWD must be constructed of such a capacity as to maintain a free board of 0.8 m, and to accommodate all contaminated runoff which could be expected as a result of a 1:50 year storm event.	O
	43.	RWD's must be designed to contain in addition to the freeboard the following: • All contaminated stormwater runoff, which could be expected as a result of the 1: 50 year flood; • All seepage expected to arise on site.	PC/C
	44.	RWD's must be lined according to the specifications of the DWAF Minimum Requirements for Waste Disposal by Landfill.	C/O
	45.	The slopes of the walls of the FAD must not be steeper than 1:3.	PC/C/O
	46.	Maximum height of the FAD 6 will be 40 metres.	C/O

Minimize the generation of waste on the site of the FAD 6 development	47.	Develop and implement a Waste Management Plan for the FAD 6 site.	C/O
	48.	Obtain safe disposal certificates for the disposal of hazardous waste from the FAD site.	C/D
	49.	Obtain safe disposal certificates for the disposal of sewerage from the chemical toilets.	C/D
	50.	Prior to the start of a shift on a daily bases, vehicles must be checked for potential leaks and ground / soil pollution (hydrocarbon spillages). Action must be taken as soon as spillages have been identified.	C/D
	51.	Monitor the sewerage facilities for spillages, and handle any spillages as hazardous waste.	C/D
Air Quality			
Minimize the impacts on air quality as a result of PM 10 and Dust Fall Out emissions.	52.	In places of high vehicular traffic, dust suppression measures on the roads may be implemented to reduce dust levels from the entrainment of dust. These measures will range from watering of roads, application of a chemical dust suppressant and/or paving of roads.	C/O
	53.	Reduce vehicle speeds on roads to less than 40 km/h within the project area.	C/O/D
	54.	During the operational phases for FAD 6 any bare ground surrounding the main operational area but within the boundaries of the facility must be covered with suitable indigenous vegetation that will be able to grow in the area.	O
	55.	Whilst in operation the area of the dry beach portion of the FAD should be kept to a minimum and the area or covering the moist or water pooling portions of the dam must be maximised in order to minimise windblown dust from this source;	O
	56.	If possible a chemical dust suppressant should be used to suppress dust emissions from the dams when it is not practical to maintain stable moisture content over a long period of time.	C/O/D
	57.	Rock cladding, grassing or any other form of dust suppression of the side walls and the top of the FAD at closure.	D
Topography			
Reduce the impact on the change of the topography in the area	58.	Side walls of the FAD 6 will be rehabilitated on an on-going basis during construction and monitored for effectiveness during operation.	C/O
	59.	Servitudes of the re aligned road and power lines will be monitored for rehabilitation after construction of the roads.	O
	60.	The FAD 6 design, operation and rehabilitation planning will ensure that the slopes remain stable and are of an acceptable gradient to allow for rehabilitation.	PC/C/O/D
Visual			

Reduce the visual impact	61.	During decommissioning, all aesthetically unacceptable buildings and other infrastructure not needed will be demolished and removed.	D
	62.	Dust suppression will be conducted on construction sites where surface areas have been exposed.	C/O
	63.	All areas denuded from vegetation will be rehabilitated to resemble the pre-construction landscape as far as feasible.	O/D
	64.	Should dust suppression methods prove to be ineffective to reduce dust generated on site, alternative chemical measures will be sought.	O/D
	65.	Surface and side walls of the dam will be rehabilitated to a satisfactory level as to prevent the generation of windblown dust.	D
Cultural and Heritage			
Prevent disturbance of cultural and heritage artefacts and graves.	66.	Fence off archaeological findings in close proximity to the dam to prevent further illegal destruction.	C/O
	67.	Vehicles and human movement should be prohibited in the fenced off area.	C/O
	68.	Conduct a full grave relocation initiative.	PC
	69.	Conduct a Phase 2 Investigation for all recorded sites.	PC
	70.	Effort must also be made to identify all buried individuals and to contact their relatives and descendants.	PC
	71.	Should graves, fossils are any historical artefacts are identified during construction, activities must cease and the local museum or university must be notified in order to conduct a full investigation on the findings.	C/O
Noise			
Minimize the increase in noise as a result of vehicular and machinery	72.	Public Notices should be given to inhabitants in close proximity to inform them of the construction timeframes.	C
	73.	Correct PPE must be worn at all times by the personnel on the construction site.	C
	74.	Stockpiling of top soil / sub soil must be strategically placed in order to act as a buffer between the Embalenhle community and the FAD 6.	C
	75.	Establish noise abatement measures for construction vehicles and activities.	PC/C

	76.	Stockpiling of top soil / sub soil must be strategically placed in order to act as a buffer between the Embalenhle community and the FAD 6.	PC/C
Soils, Land Capability and Land Use			
Prevent or minimize erosion of soils	77.	The FAD 6 should be sloped so as to ensure the successful vegetation of the side slopes.	PC/C/O
	78.	The side slopes should be terraced, to allow for the slowing down of flows on the side slopes and the creation of depositional zones on the side slopes. .	C/O
	79.	Topsoil must be stripped from the FAD 6 footprint and stockpiled for further use in rehabilitation. Should sub soil be stripped this must be stored separately, and used to backfill excavations prior to the levelling with top soil.	C/O/D
	80.	Silt traps must be installed upstream of all RWD. These silt traps will should be regularly cleaned and maintained in fully working order at all times.	C/O
	81.	As construction could possibly extend across more than just one dry season, it is recommended that the wetland crossings be constructed in the dry season and that any work done during the wet season should focus on the terrestrial areas.	PC/C
	82.	Following the completion of construction activities the disturbed areas should be ripped, scarified, landscaped to the original landscape profile, and re-vegetated with suitable indigenous grass species that will aid in soil stabilisation	O/D
Minimize contamination and sterilization of soil	83.	See section on the objectives to “Prevent or minimize erosion of soils”, and “Reduce the impact on surface water quality as a result of hydrocarbon spillages”.	C/O/D
	84.	Any hydrocarbon spills will be cleaned up immediately and stored of at an authorized site.	C/O
Biodiversity			
Minimize the loss of vegetation of conservation concern	85.	No Development should take place within the 1 in 100 year floodline of a stream unless authorized in the WUL.	PC/C
	86.	Plants of conservation importance will be protected or relocated as appropriate. This relates to the species *Crinum bulbispermum*.	PC/C
	87.	All declining vegetation species and endangered faunal species identified within the project areas and buffer zone, as well as those that may possible be found in the areas will be eradicated from the FAD 6 footprint and re-established in a suitable habitat. Monitoring of re growth of these plants will be monitoring for 5 years following their relocation.	PC/C/O
	88.	Vegetation clearance will only be conducted within the site footprint, and disturbance will be minimized as far as feasible.	C/O
	89.	Existing roads will be used wherever possible, and new roads will be aligned so as to remain on the flattest terrain for as long as possible.	C/D

	90.	Demarcate areas that may not be disturbed especially sensitive areas associated with drainage lines.	C/O/D
	91.	A programme must be compiled for the clearance of alien vegetation from the footprint of the FAD prior to construction and follow up monitoring and removal programs should be initiated once construction is complete. Continual monitoring will be conducted during the operational phase.	C/O/D
	92.	Re introduction of alien species will be prohibited.	O
	93.	Establish a buffer zone between the FAD 6 system and watercourses to protect the aquatic ecosystems within these sensitive areas.	C/O/D
	94.	No fires are allowed on the site, unless in areas demarked and managed for this purposes.	PC/C/O/D
	95.	All workers will be made aware of fire risks.	C/O/D
	96.	The FAD 6 will be fenced off in order to prevent unauthorized access.	C/O
	97.	Temporary access roads will be rehabilitated as soon as possible, in order to reduce the risk of erosion and further negative effects on fauna and flora.	C/O/D
	98.	No direct discharge of polluted water to the environment is permitted, other than may be provided for in the WUL, and under appropriate control in terms of the WUL.	O
	99.	Bio monitoring to be conducted on surface water resources in accordance with the WUL.	O
Minimize the loss floral habitats and habitat quality	100.	Include a surface runoff and storm water management plan, indicating how all surface runoff and seepage generated as a result of the development (during both the construction and operational phases) will be managed (e.g. artificial wetlands / storm water and flood retention ponds) prior to entering any natural drainage system or wetland and how surface runoff will be retained outside of any demarcated buffer/flood zones and subsequently released to simulate natural hydrological conditions.	C/O/D
	101.	Bio monitoring to be conducted on surface water resources in accordance with the WUL.	C/O/D
	102.	The use of herbicides must be limited and may only be used under strict control and when no other alternative exists.	C/O
	103.	The construction site for the FAD, road realignment and power line relocation should be inspected for the occurrence of erosion. Appropriate remedial action must be taken should erosion become a problem.	C/O
	104.	Where a road / pipeline/ power line is to traverse a wetland, measures are required to ensure that the road / pipeline/ power line has minimal effect on the flow of water through the wetland, e.g. by using a high level clear span bridge or box culverts rather than pipes.	C
	105.	Outside lighting should be designed to minimize impacts on fauna.	C/O

		All outside lighting should be directed away from sensitive areas. Fluorescent and mercury vapour lighting should be avoided and sodium vapour (yellow) lights should be used wherever possible.	
Minimize the impact on fauna	106.	No poaching will be permitted by contractors or employees.	C/O
	107.	Sensitive environments will be demarcated as no go areas, and protected.	C/O
	108.	Species of conservational concern will be removed from the vicinity of construction activities and relocated to suitable habitats. Contractors will be educated to recognize these species and relocate them if necessary.	C/O/D
	109.	The expertise of an Ecologist will be sought should any possible occurrence of the red data animals be are found during the construction phase. The Ecologist should advise on the catch and release of these mammals. Contractors will be educated on the appearance of these species.	C/O
	110.	The Location of the construction camp will be selected in consultation with the ECO. The camp must not be located within the 1: 100 year floodline or 100m from a watercourse. A temporary stormwater management system and erosion controls need to be implemented to contain the runoff from the camp.	C
	111.	Appropriate waste disposal facilities will be provided for all types of waste so that littering and other means of contaminating the environment will be avoided.	C
Wetlands			
Minimize the loss of wetland vegetation and habitat	112.	The construction servitude for each of the propose developments should be clearly defined and fenced off prior to the arrival of construction machinery on site.	PC/C
	113.	No movement of vehicular or human traffic should be allowed in any wetlands falling outside the defined construction servitude.	C/O
	114.	Construction workers should be informed on the location of the wetland habitats and their sensitivity as part of the induction process prior to starting work on site.	PC/C/O
	115.	Following completion of construction activities a clean-up and rehabilitation program should be implemented for all wetlands located adjacent to the construction servitudes, for a minimum of 200m upstream and downstream of the ash dams and RWD.	O/D
	116.	Disturbed areas should be ripped and scarified (if necessary) and re-vegetation should be encouraged and monitored to ensure success.	O/D
	117.	If rapid vegetation establishment does not occur these areas will need to be seeded with an appropriate seed mix.	D
	118.	The road design should ideally cross the wetlands via the shortest possible route perpendicular to the direction of flow.	PC/C

	119.	Locate all laydown areas, material stockpiles, temporary construction camps and support infrastructure and heavy machinery parking areas outside any of the delineated wetland areas. Such areas should be clearly demarcated and all associated activities restricted to the demarcated area.	PC/C
Minimize sediment movement off the site	120.	Limit the aerial extent of the disturbance to the exact footprint of the proposed development.	C
	121.	Construction, or at a minimum all the major earthworks, should strive to be timed to coincide with the dry season where erosion due to rainfall run-off is minimised.	C
	122.	The construction of a low, shallow berm at the downslope side of the cleared construction footprint should also be considered to create a depositional zone outside of the wetland areas to trap sediments.	C/O
	123.	Rehabilitation of disturbed areas should not only be undertaken following the completion of all construction Activities, but should be undertaken throughout the construction process whenever activities in a certain section of the site have been completed.	C/O/D
	124.	Where construction takes place within wetlands or immediately adjacent to wetlands, hay bales or sediment nets should be stacked in rows downslope of construction activities to trap any sediment washed off these areas by surface run-off.	PC/C
	125.	Contaminated runoff water, generated during rainstorm events, on the operational footprint area will be contained in specifically designed structures to enable sedimentation and desilting of the runoff.	C/O
Minimize the impact of altered flows within wetland systems	126.	To minimise the impact of reduced flows within the downslope wetlands, the area excluded from the wetlands catchment by the dams and associated dirty water management area should be kept as small as possible.	C/O
	127.	Flows that are released back into downslope wetlands from river diversions and clean water management infrastructure should aim to mimic natural flows within the systems and should not result in concentrated high velocity flows.	PC/C
	128.	The required river diversion should be sensitively designed and appropriately vegetated with local, indigenous vegetation.	C/O
	129.	Culverts should avoid high velocity discharges, and flows under regular return events should ideally not differ significantly from natural flows within the wetland.	C/O
	130.	Discharge points should also be protected by erosion control measures and energy dissipaters in the form of rock packed mattresses radiating out from the culverts at 45 degrees.	C/O
	131.	Regular inspections and maintenance of all bridges and culverts should be undertaken along the route.	C/O/D
	132.	As a minimum, all bridge piers and culverts should be cleared of debris at the start of the rainy season (September every year) and during the middle of the rainy season (January). In addition, inspections and, if required, maintenance should be undertaken after every significant flood event.	C/O/D
	133.	Crossing should be designed so as to have a minimal impact on the natural flows within the wetlands.	PC/C
Traffic			

Reduce dust generation, congestion and noise pollution on public roads.	134.	Appropriate road marking are to be applied at the re aligned D714 during construction and operation.	C/O
	135.	Speed limits will be reduced to 40 km/h on the D714 to reduce dust and noise generation.	C/O
	136.	Public notices are to be provided to local communities, informing them of the construction activities to take place, and advise alternative routes where possible.	C/O/D
	137.	Dust can be controlled by the regular wetting of the gravel road surfaces.	C/O
	138.	Tar dirt roads to minimize dust generation as well as to be aesthetically pleasing.	C
	139.	Noise impact in the immediate environment can be mitigated through the correct use of PPE.	C/O
	140.	Communication must be established between the local roads agency and Sasol in order to rectify problems with the roads in a timeous manner.	C/O
	141.	Roads must be continually maintained and monitored for safety and deterioration.	O
Minimize Safety issues	142.	Construction of an additional through left lane, on the southern approach and an exclusive right lane, on the northern approach.	PC/C
	143.	The exclusive lanes should be constructed according to Provincial standards, 60m long and a 60m tapper.	PC/C
	144.	Provision of light at sufficient standards at the intersection of the R546 and the proposed D714.	C/O
	145.	No on-street pick-up/drop-offs at the intersection of the R546 and the proposed D714 should be permitted.	C/O
Geology			
Maximize site stability due to undermining activities	146.	Implement stability controls within the design parameters of the FAD 6.	C
	147.	Toe drains will be constructed to collect any over flow or seepage from the Dam.	C/O
Health and Safety			
Minimize the health impacts as a result of dust generation and odour	148.	Also see section on Air quality.	C/O/D

Reduce the safety hazard of the FAD and RWD	149.	Adhere to the Dam Safety Regulations published in Government Notice R. 1560 of 25 July 1986) and now effective in terms of the NWA.	O
	150.	Develop a dam safety monitoring program which will be as per legislative requirements.	PC/O
Minimize the safety as a result of vehicular movements.	151.	Speed limits of 40 km/hr. or less should be set for on-site traffic.	C/O
	152.	If spillages occur, the material should be removed as soon as possible and stored of at an accredited hazardous landfill site.	C/O
	153.	Inspect haul roads for integrity and repair if required.	C/O
	154.	Cover loads with tarpaulins to prevent dust re-entrainment from trucks.	C/O/D

18 Environmental Awareness Plan

Environmental conditions will be included in the contracts issued to the contracts, making them aware of the potential environmental impacts and risks associated with the FAD 6 development. The importance of implementing the conditions in the EMP and the necessity of good housekeeping practices will be made known to the contractors and employees of Synfuels in order to prevent accidental spillages and avoid subsequent environmental impacts.

The Training pertaining to the environmental awareness will include the following:

- All personnel (contracts and Synfuels employees) will undergo induction, which as a minimum will include Safety, Health and Environmental awareness; and
- A training matrix will be compiled by the SHE representative from Synfuels, who will identify training requirements of all staff members relating to the project and populate the matrix with the training needs of all categorical staff.

A training programme will be developed whereby the following will be considered:

Awareness training

The SHE representative will be responsible for the development and in association with the ECO facilitation of the required training needs. The SHE representative and the ECO will develop the training material required for the FAD 6 development which will be integrated into the general induction programme. The awareness training must include the Sasol SHE Policy, explanation of environmental impacts and the importance in adhering to the EMP conditions.

A dedicated training personnel, with sufficient qualification will be responsible for conducting the training and keeping records of those who attended, indicating the organization, date and type of training received.

The SHE representative will ensure supervisors are made aware of the impact their work may have on the environment and will be required to communicate this through to the contractors on a continual basis.

18.2 Evaluation of trained personnel and re – training

The effectiveness of the environmental awareness training will be reflected in the amount of non – conformances to the EMP identified during internal and external audits. Should it be envisaged that re - training will be required the SHE representative will inform Synfuels managers of the training requirements and what additional actions will be undertaken.

19 Recommendations

The Final EIA / EMP for the Synfuels proposed FAD 6 and associated infrastructure is now being made available for the I&AP commenting period. The comments raised by the I&AP's will be incorporated into the EIA / EMP and subsequently sent to DEA and MDEDET for consideration.

Once MDEDET and DEA has reviewed the final EIA / EMP, they will need to determine whether the development may be undertaken and whether there is sufficient knowledge and information pertaining to the development is available and a decision can be made. Following the decision made by the competent authorities an Environmental Authorization will be issued which will detail the decision, the reason therefor and any conditions. This decision will be communicated to the I&AP's, stipulating the period available to appeal the decision in terms of the NEMA.

Should the project be approved, SRK advocate that the following recommendations summarized below be considered and adhered to:

- Where relevant, the mitigation measures as suggested in this EMP should be implemented during all phases of the proposed development; and
- The Final EMP for all phases, assuming approval by DEA and MDEDET should be implemented and audited by an independent auditor / environmental control officer to ensure compliance.

20 Conclusions

The project involved the construction of the FAD 6, associated infrastructure, D714 realignment and the relocation of the powerlines. With reference to the available information of the project cycle, the confidence in the environment assessment undertaken is regarded as acceptable for decision making purposes.

Following the Scoping Phase of the EIA and the subsequent Impact Assessment, it has come to light which indicates that from a financial perspective Alternative 1 is the most preferable site. However from an environmental perspective there is no material difference from each alternative.

SRK Consulting has undertaken a detailed assessment of this on the basis of impacts identified through the public involvement programme, specialist investigation and the professional judgement of the SRK project team. It can therefore be concluded there are no fatal flaws of the FAD 6 and associated infrastructure that have been identified. Impacts that have been identified will require careful mitigation and management. These impacts include the following:

- Impacts on fauna and flora;
- Impacts on surface and groundwater quality as a result from the FAD 6 activities;
- Air Quality impacts resulting from PM10 and DFO emissions;
- Traffic safety as a result of the re – alignment D714 and increased traffic;
- Noise levels during the construction and operation phase of the project; and
- Impact on the wetland areas.

An EMP has been developed as part of this EIA to ensure that mitigation and management measured are enforced. The EMP will guide all phases of the project to minimize possible negative impacts and assign responsibility for environmental controls. The detailed project specifications would also take cognisance of any conditions of approval as specified by DEA and MDEDET.

It is envisaged that it will be possible to effectively manage these impacts. A monitoring and auditing program will be developed by Synfuels to ensure that this is in fact the case. This report details the specialist studies conducted for this development. It is the opinion of the EAP that the impacts from the proposed development is acceptable when considering the advantages that the development will bring.

21 Way forward

The Final EIAR (this document), together with the appended Specialist Reports is available for viewing at the following venues:

• Secunda Public Library; and

• SRK website.

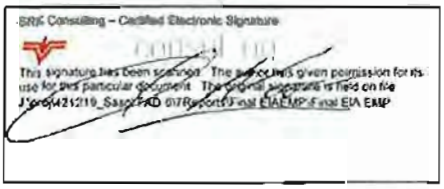
In addition, digital copies of the report without appendices may be emailed to I&AP's on request.

Prepared by

Andrew Caddick

Environmental Scientist

Reviewed by



Andrew Wood

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

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Appendices

Appendix A: Declaration of Interest

Appendix B: Curriculum Vitae of the Project Team

Appendix C: SRK Project Experience

Appendix D: Specialist Reports

Appendix E: Comments and Response Report

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SRK Report Distribution Record

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