ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

FINAL ENVIRONMENTAL IMPACT REPORT

THE PROPOSED EDEN REGIONAL WASTE DISPOSAL FACILITY.

DEA&DP REFERENCE NUMBER: EG12/2/3/2-D6/27-1286/09

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Volume I

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PROJECT DETAILS

DEA&DP Reference number: EG12/2/3/2-D6/27-1286/09

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Report Status: Final Environmental Impact Report

Reviewed by: Eden District Municipality and PD Naidoo Consulting Engineers (PTY) Ltd.

EXECUTIVE SUMMARY

Introduction

Anél Blignaut Environmental Consultants (ABEC) was appointed by PD Naidoo & Associates Consulting Engineers (Pty) Ltd on behalf of the Eden District Municipality (EDM) to undertake an Environmental Impact Assessment for the proposed new regional waste disposal site.

Within the Eden District are situated the municipalities of Bitou, George, Hessequa, Kannaland, Knysna, Mossel Bay and Oudtshoorn. A new regional waste disposal facility is needed as the contract for the disposal of the solid waste from George, Gouritsmond, Knysna and Mossel Bay at the PetroSA waste disposal site near Mosselbay will be expiring, as PetroSA needs the facility for the disposal of their own waste. The size of the PetroSA site has been reduced due to the construction of the Gourikwa Power Station and the extension of the waste disposal site is therefore problematic. PetroSA also indicated to the Eden District Municipality that they do not want to allow the continued disposal of general waste at their site as this is not their responsibility but the responsibility of the Municipality.

A negative mapping report and consultation with the proponent has resulted in the identification of three potential sites for the waste disposal facility. The suitability of each site for the disposal of solid waste will be investigated through the Environmental Impact Assessment Process.

Need and Desirability

The need and desirability of the proposed project has been considered in detail in this EIR. The Municipalities of Bitou, George, Hessequa (Albertina and Gouritsmond), Knysna and Mossel Bay all suffer from a lack of appropriate waste disposal sites to serve in the needs of the community. The individual Municipalities have indicated the need for a regional waste disposal facility. The waste that is currently disposed at the PetroSA waste disposal site cannot continue as stated above due to mainly capacity constraints and also that the responsibility of waste disposal in the region lies with the Municipalities and not with PetroSA. No suitable sites were found east of PetroSA.

Project Description

The proposed waste disposal facility will serve the Municipalities of Bitou, George, Hessequa (Albertinia and Gouritsmond), Knysna and Mossel Bay and will have a lifetime of approximately 50 years. It is proposed that both general waste and hazardous waste will be disposed on the landfill site. All hazardous waste disposed of at the site will have a low to medium hazard rating. Examples of hazardous waste with low hazard ratings would be solvents and paints generated by the mechanical and metal industries in the area, as well as waste from the port and fishing industry such as ballast. Sewage sludge from the sewage works may also be disposed of at the site. Provision has been made for a future materials recovery facility, a composting area and an area for the processing of construction and demolition waste (builders' rubble). Other infrastructure includes roads, storm water pipelines, a leachate storage dam, a contaminated storm water dam, offices, a laboratory, and a weighbridge and security infrastructure.

The footprint of the waste site will cover an approximate area of 130-200ha (depending on the site that is selected) and the landfill site itself will reach a maximum height of 12m. Individual cells will be excavated and filled sequentially. Each cell will be designed to last approximately 5 years, depending on the success rate of waste reduction. After about 2-3 years the construction of the following cell will commence. The site will be excavated to a depth of 6m below natural ground level and the landfill will reach a height of 12m above natural ground level.

The site will be fenced to prohibit unauthorized entry and to control windblown litter. Unpolluted storm water will be diverted away from the site through a storm water cutoff trench.

The landfill cells will be constructed in line with the DWAF's Minimum Requirements for Waste Disposal by Landfill specified for an H:h and a G:L:B- site. H:h refers to the section of the site that will receive hazardous waste where G:L:B- refers to the section of the site that will receive general waste. The "L" refers to a large site and the "B-" to the negative water balance of the site, which broadly indicates that no significant leachate production is expected.

Alternatives

The identification and consideration of alternatives is recognised as required practice in environmental assessment procedures globally. Regulatory requirements in the NEMA EIA Regulations stipulate that "*alternatives to the proposed activity that are feasible and reasonable*" be considered during the EIA process, at the earliest proposal development stage.

The Scoping Phase therefore screens alternatives to derive reasonable and feasible project alternatives to focus the EIA phase in the EIA process.

Environmental and technical factors were considered during the site selection process and also the design layout of each of the three proposed sites.

The criteria used to provisionally eliminate areas from further consideration were based on the identification of areas with inherent Fatal Flaws as defined in the Department of Water Affairs and Forestry's (DWAF) Minimum Requirements document (DWAF, 1998). These include the following:

- Areas in proximity to significant surface water bodies;
- Sensitive ecological and/or historical areas;
- Catchment areas for important water resources such as dams;
- Areas overlying or adjacent to important or potentially important aquifers;
- Areas overlying or adjacent to major fault zones;
- Areas with highly permeable soils;
- Areas associated with steep slopes; and
- Areas in close proximity to land uses, which are incompatible with waste disposal.

Taking the above-mentioned factors into consideration a composite map was compiled which indicates areas suitable for a regional waste disposal site. Subsequent to the completion of the Waste Disposal Site “Window” Identification a site reconnaissance of the areas potentially suitable for a waste disposal site was conducted. The site reconnaissance led to the identification of a number of scenarios for the waste disposal by the EDM.

These scenarios needed further investigation in order to determine the economic feasibility of the different transport arrangements for delivering municipal solid waste to the various new regional landfill sites proposed for the Eden District.

The study recommended the following:

i) That as the existing waste disposal arrangement cannot continue and as one or other of the three alternatives must be implemented, that the development of a new landfill site at Site 1 is the best choice for the Municipalities of Mossel Bay, George, Knysna and Bitou.
ii) That waste from Hessequa Municipality should be transported to the potential future site B, with the exception of waste from Albertinia and Gouritzmond which should be transported to Site 1; and
iii) That the waste from Calitzdorp should be transported to the upgraded landfill site at Oudtshoorn.

Other options that were considered were the co-disposal of general waste with hazardous waste compared to the separate disposal of general and hazardous waste. The objective of the co-disposal of General Waste and Hazardous Waste is to absorb, dilute and neutralize any liquids and to provide a source of biodegradable material in order to encourage microbial activity that will assist in the degradation of hazardous substances. Where co-disposal is properly managed, the landfill surface has more area on which traffic (trucks) can drive. It is proposed to co-dispose liquid and low to moderate level hazardous wastes with general dry wastes on the landfill site. Research has shown that a properly controlled co-disposal operation would be a safe and efficient disposal option for hazardous and liquid wastes.

The no-go option was also considered and serves as a baseline against which the Alternatives presented in this report can be evaluated. The concept of a regional waste disposal site compared to maintaining the status quo with disposal at PetroSA was discussed under the no-go or no development option. It is however impossible to continue with the no-go option due to the fact that the contract for the disposal of the solid waste from George, Gouritsmond, Knysna and Mossel Bay at the PetroSA waste disposal site near Mossel Bay will be expiring, as PetroSA needs the facility for the disposal of their own waste. The size of the PetroSA site has been reduced due to the construction of the Gourikwa Power Station and the extension of the waste disposal site is therefore problematic. PetroSA also indicated to the Eden District Municipality that they do not want to allow the continued disposal of general waste at their site as this is not their responsibility. The no-go option also implies that the existing agricultural landuse on the respective properties is likely to continue.

It was concluded that Sites 1-3 should be considered in the EIR phase as alternatives to be investigated in greater detail for the establishment of a Regional waste disposal site. Waste from the Bitou, George, Knysna and Mossel Bay Municipalities should be transported to the site as well as waste from the towns of Albertinia and Gouritsmond. The waste from Kannaland and Oudtshoorn should be transported to the upgraded Oudtshoorn site, whilst the waste from Hessequa apart from Albertinia and Gouritsmond will be transported to the current Riversdale landfill site. The Uniondale/Haarlem area will have its own landfill site in Uniondale. It is therefore concluded that the described transport arrangement be accepted as the preferred arrangement and that the other options be screened out.

Both technical options presented for the separate disposal of hazardous and general waste and the co-disposal of general and hazardous waste was carried forward to the EIR phase for assessment. Finally, the no-go option will be considered as the baseline option throughout the process.
The traffic impact assessment identified access alternatives to Sites 2 and 3 that were also investigated in the EIA process. Finally, the layouts on the alternative sites have been refined in an iterative manner in order to address the environmental constraints as presented at each sites and to implement the recommendations and mitigation measures as indicated by the specialist and governmental stakeholders.

Site location and affected environment

The study area falls within the Riversdale Plain bioregion, which lies within the Fynbos biome and the Cape Floristic Region. All three the proposed sites fall within close proximity to Mossel Bay and Herbertsdale.

Site 1

Site 1 lies immediately north of the N2, approximately 1 km west of PetroSA and 13 km west of Mossel Bay. A house exists on Site 1 that will have to be demolished when the site is developed.

Property details:

Portion 9 of the Farm Drie Fonteinen Nr 243

Portion 1 of the Farm Patrysfontein Nr 228

Remainder of Farm 310

The current use of the site is for sowing and stock grazing. The site is located at the juncture of agricultural and industrial landscapes. Industrial developments have taken place immediately to the east of the proposed site and include the PetroSA waste disposal site, Eskom's Open Cycle Gas Turbine (OCGT) Power Plant, the PetroSA facility and Mossindustria.

Site 2

Site 2 lies just south of the R327 (leading to Herbertsdale), approximately 20 km (direct line) north-west of Mossel Bay, 16.5 km (direct line) south-east of Herbertsdale, which is the closest town, and 6.5 km north of the N2.

Property details:

Remainder of the Farm Zuur-Rug No. 207.

The Proteus substation is located immediately to the north of the R327, approximately 1.5 km northwest of the site. Many areas located to the south of the R327 are used for agriculture, mostly grazing. The site itself and surrounding farms supports large areas of fynbos. The Gondwana Nature Reserve is in close proximity to the site.

Site 3

Site 3 lies approximately 2.5 km to the south of the R327, just east of the gravel road that connects the R327 with the Cooper train station. It lies approximately 26 km (direct line) north-west of Mossel Bay, 13 km (direct line) south-south-east of Herbertsdale, which is the closest town, and 7.5 km north of the N2.

Property details:

Portion 1 of the Farm Kruisvallei Nr 232

Portion 2 (Portion of Portion 1) of the Farm Kruisvallei Nr 232

Farm 232 – access of this property is required, however the landowner has not provided consent for the use and upgrade of the existing access road.

N2/MR341 intersection: turning lanes on the N2 within the existing road reserve are required at this intersection.

The site itself and surrounding farms are used for agricultural purposes and consist mainly of cultivated lands and pastures. Almost no indigenous vegetation remains on the site itself and very little indigenous vegetation on the surrounding farms.

Public Participation Process

A comprehensive Public Participation Process was undertaken during the Scoping phase of the EIA process. The Public Participation Process consisted of the following activities:

1. Notification of the EIA process and availability of the Background Information Document (BID) in local and national newspapers, site notices, and written notification to identified stakeholders including affected landowners and neighbours and posters on well-frequented places.
2. Registration of I&APs and maintenance of the register.
3. Compilation of an Issues and Response Table detailing the issues raised by I&APs and providing responses thereto. The I&R table was distributed to all registered I&APs.
4. A focus group meeting was held on 14-4-2010. The notes of the meeting were distributed to all the organizations and/or individuals that attended the meeting.
5. The Draft and Final Scoping Reports and Plan of Study for EIA were made available for comment to registered I&APs.
6. Issues and Responses was collated into an Issues and Response table and distributed to all registered I&APs.
7. The Final Scoping Report was submitted to the DEA&DP and the registered I&APs were informed of the commencement of the draft EIR phase of the process.
8. Notification of additional I&APs and changes to the register took place in the EIR phase.
9. The registered I&APs were once again informed of the availability of the Draft and Final EIR for comment and was invited to an Open House and public meeting. Certain I&APs were invited to a focus group meeting.
10. The availability of the Draft EIR and the Open House and public meeting was advertised in the press.
11. An issues and response report was compiled which includes the comments received on the Draft EIR and responses to the comments. Any comments received on the Final EIR will not be responded to but submitted to the DEA&DP for their consideration.
12. Registered I&APs will be notified of the outcome of the decision and their right to appeal.

Environmental Process

The Eden DM is required to submit an integrated application to the Department of Environmental Affairs and Development Planning (DEA&DP) for environmental authorization under the National Environmental Management Act (NEMA), (Act 107 of 1998), as amended and a licence application under the NEMA: Waste Act, 2008 (Act 59 of 2008).

Anél Blignaut Environmental Consultants has been appointed as independent Environmental Consultants to conduct the Environmental Impact Assessment (EIA) process for the integrated application in terms of the above legislation on behalf of the Eden DM.

The Environmental Impact Reporting phase of the EIA process has commenced. An application form has been completed and submitted to the DEA&DP. The Final Scoping Report and Plan of Study for EIA have been approved by the DEA&DP.

The Environmental Impact Report includes the assessment of the issues and concerns identified during the Scoping Phase that may have a potential significant impact on the environment. Specialist studies include the following: Heritage including archaeology, palaeontology and visual impacts, Freshwater ecological inputs, Avifuanal investigation, Geohydrology, Traffic Impact Assessment, Botanical, Socio-economic assessment and Air Quality.

The Public Participation Process is an important element of the EIA process. Interested and Affected Parties (I&APs) have been invited to register and provide initial concerns or comments relating to the proposed development. Information was provided in the Scoping and EIA phases and I&APs are being provided with an opportunity to comment on the proposed development at each phase. At each phase the I&APs will be provided with at least a 40-day period in which to submit their comments and/or concerns on the draft reports. A further 21-day comments period will be provided for the final reports of each phase.

Potential impacts identified

The issues and concerns raised by the project team, specialists, governmental stakeholders, the applicant and during the Public Particiption process on the draft EIR phase of the EIA process are briefly listed below.

This report assesses the potentially significant impacts of the proposed waste disposal facility on the biophysical, social and economic environment. Suggestions are made on potential mitigation measures that would ameliorate any potential negative impacts or enhance any potential benefits. Impacts that may occur during both the construction phase and operational phase of the proposed waste disposal facility are discussed and mitigation measures are recommended where negative impacts cannot be avoided.

The following potential impacts have been identified and are addressed in the EIR and broadly summarized in this executive summary:

- Potential impacts on indigenous vegetation;
- Impact on the avi-fauna;
- Potential impacts on groundwater;
- Potential impacts on surface water systems;
- Potential air quality impacts such as dust and odours;
- Potential social impacts which include but are not limited to health and safety, incompatible landuse, traffic, noise and litter;

- Potential economic impacts which include but are not limited to local economic impacts in terms of other waste disposal activities such as recycling and waste composting, potential impacts on tourism, impacts of site activities on surrounding agricultural land, litter;
- Potential visual impacts and sense of place;
- Archaeology, palaeontological and heritage impacts;
- Impacts on traffic and road conditions;
- Cost of the proposed facility on Municipal budgets.

Key findings are briefly summarized below:

Botany

- The Botanical assessment indicated a slight preference towards Site 3, but indicated that Site 1 would also be suitable if the required mitigation measures are implemented.
- Site 1 and 3 presents few botanical or ecological constraints to the proposed development
- At least 80% of Site 2 is considered to be of high botanical sensitivity and is not suitable for the proposed development from a Botanical perspective. Site 2 should not be authorised as the botanical impacts of development on this site would be high negative, and cannot be mitigated to any significant extent.

Freshwater ecology

- While there are a number of fresh water features on Site 1 that only two of significance is the seasonal stream that forms part of the Blinderivier system and the seasonal pan/wetland area.
- This assessment confirms the need to protect these freshwater ecosystems from a biodiversity point of view.
- The other water features are artificially created freshwater bodies that have little ecological importance.
- The buffer area recommended to mitigate the impacts of the surrounding activities on both the seasonal wetland as well as the stream would need to be at approximately 50m wide for the stream and 75m wide for the seasonal wetland
- The drainage line on Site 2 will have to be piped under the site due to engineering constraints
- The eastern drainage line on Site 3 could be avoided but the western drainage line required diversion around the site.

Avi-faunal impacts

From an avi-faunal perspective Site 1 is the preferred alternative as the habitat is already transformed, displaced birds have ample adjoining similar habitat, and the small peripheral wetland can be protected.

Site 3 is similar, provided the stream that it incorporates is protected. The avifaunal specialist indicated that the least appropriate site is Site 2 due the significant amount of natural vegetation on the site.

Geohydrological impacts

The geohydrological impact assessment indicated a preference for Site 3 mainly due to the deep groundwater levels and clay at site 3 which would in addition to the liner prohibit any pollution entering groundwater. The geohydrological specialist also indicated that Site 1 may be used as the local groundwater is of low yield potential, naturally poor quality and there is a well developed unsaturated zone that would attenuate any leachate. The geohydrologiocal assessment indicated that the highly conductive sediments and shallow water table makes Site 2 a less environmentally favourable option.

Roads and traffic impacts

- The specialist indicated that the impacts related to an increase in traffic, road safety and geometric issues are negligible for Site 1. A moderate impact is expected on the road pavement conditions of the N2 due to a natural growth in waste volumes and the addition of the waste from the Bitou Municipality.
- Both Sites 2 and 3 requires partial reconstruction of public roads. In the case of Site 2 it is DR1549 and in the case of Site 3 it is DR1549 or MR341.
- For Site 2 a right turn lane will have to be constructed on the N2 westbound and an acceleration lane will have to be provided on the N2 eastbound at the DR1549 intersection. Access to Site 3 requires a short dedicated right turn lane on the N2 westbound and an acceleration lane on the N2 eastbound at either the DR1549 or MR341 intersection if either of these routes is selected.
- Site 2 would require the construction of a new road over private property. The existing access off the MR342 is too steep for heavy vehicles.
- The preferred Access route to Site 3 is from the N2 onto the MR341 northwards to Site 3 where access via an existing road over private property needs to be obtained to gain access to the site. As mentioned earliet the landowner of Farm 232 over which access is required did not provide consent to gain access over the said property.

Visual impacts

From a visual impact perspective the specialist indicated that none of the proposed sites are considered to have an outright fatal flaw, however a preference was indicated for Site 1. Due to the lower visual quality, moderate visual absorption capacity, high visual integrity and lower viewer sensitivity of Site 1, which to some extent outweigh the higher visual exposure and visibility of the site, the visual impact of a landfill development on Site 1 was considered by the specialist to have the lowest overall magnitude amongst the three proposed alternative sites.

Air Quality Impacts

No fatal flaws associated with any of the three alternative sites were identified from an Air Quality perspective. A comparison of the predicted air pollution impacts indicates that Site 2 is marginally better than Site 1 and Site 3. It was predicted that Site 3 would result in the highest air pollution impact, unless the access road is treated to reduce fugitive dust emissions. Site 2 was shown to potentially result in an odour impact zone that extends furthest when compared to the other two sites. Since Sites 2 and 3 would be accessed by significantly longer gravel roads than Site 1, the cumulative impact would be higher with the former alternatives. Since Site 1 is relatively close to the PetroSA site, there may be a slight increase in air impacts at this location in the future; mainly odour. The Air Pollution Impact Assessment indicated that Site 1 be selected as the environmentally preferred site with respect to air pollution.

Socio-economic impacts

The Socio-economic Impact Assessment indicated that the overall impacts at all three the proposed sites would be positive and the overall impact for the no-go option would be neutral.

Although construction of the facility at alternatives 1, 2 or 3 will have the same overall impact, alternative 1 will have the least negative impact on the surrounding environment and is complementary to the surrounding land use activities (PetroSA facility located to east of site).

Archaeological impacts

With regard to the proposed development of a regional waste disposal facility near Mossel Bay, the archaeological assessment has shown that each of the proposed candidate sites is suitable for development. No significant impacts to pre-colonial archaeological material that will need to be mitigated prior to proposed development activities has been identified on Sites 2 and 3. The development of a regional landfill site at Site 1 will possibly impact on potentially important archaeological remains and mitigation measures have been recommended to minimize these impacts.

Palaeontological impacts

The palaeontological assessment indicated that all three candidate sites for the Eden District Municipality Regional Waste Disposal Site or Sites are considered to be of *low to very low* palaeontological sensitivity.

Heritage Impacts

The Heritage Impact Asssessment concluded that the overall heritage significance of the three sites is low and that the proposed development of a regional landfill facility may proceed on any of them.

The option of having a dedicated General waste cell and a separate Hazardous waste cell (H:h), where co-disposal of hazardous and general waste may take place depending on the nature of the hazardous waste received is the preferred option.

With regard to the availability of investment capital Eden DM has undertaken a study in terms of Section 78 of the Municipal Systems Act in order to determine appropriate mechanisms to design, build, operate and manage the proposed new landfill site. The study concluded that the best external service delivery option for Eden DM for the development of this landfill site would be a Build, Operate and Transfer (BOT) contract. The study found that a BOT contract would present a cost saving on an internal delivery mechanism and would therefore provide improved value for rate payers.

The new landfill site, including the waste treatment facilities (MRF, composting, builders rubble processing), hazardous cell and the additional transport costs would increase the municipal budgets by approximately 1.6%.

The no-go option was also assessed throughout this EIA process. The no-go option is partly the continuation of the waste disposal that is currently taking place at the PetroSA waste disposal facility and also the continuation of the mainly agricultural landuse of the alternative sites. The no-go option is not a feasible option to pursue. The PetroSA waste disposal facility does not have the capacity to receive the waste from the Municipalities as indicated earlier. Furrthermore as indicated in various sections of this report there is a need for a long-term waste disposal site for the Eden District Municipality. The no-go option is therefore not considered a feasible or reasonable alternative and can therefore not be pursued.

Conclusions and Recommendations

This Environmental Impact Report has assessed the relative environmental acceptability of the proposed alternative options for the proposed new Regional Waste Disposal Facility for the Eden District Municipality.

The assessment has taken into account the economic, environmental and social factors. The No-go option as well as potential cumulative impacts was also considered.

After consideration of the information received during the public participation process of the EIA process as well as the assessments and findings of the various specialists, Site 1 is recommended as the preferred Alternative for the proposed waste disposal facility. The overall potential environmental impacts can be mostly avoided and where it cannot be avoided, mitigated most effectively on Site 1 when compared to the other site alternatives. The proposed activity will provide in the waste disposal needs of the community.

Given the information provided as part of the EIA process, it is recommended that Site 1 with the layout as provided in the EIR would be the best practical environmental option with the least amount of potential negative impacts on the environment should the recommendations in this report and the EMP be effectively implemented. If the recommendations made in this report are effectively implemented, many of the identified environmental impacts can be avoided. There are however certain impacts that cannot be avoided and that will have to be mitigated. Where the impacts cannot be avoided, mitigation measures have been recommended to minimise the risk of the potential environmental impacts. It can be concluded that with the implementation of the required mitigation measures, the implementation of the EMP and effective management of the facility that the proposed facility on Site 1 can be recommended for approval.

Key mitigation measures are briefly summarized below:

- Survey, mapping and collection of archaeological material are recommended on Site 1. Test excavations for sub-surface archaeological remains must be undertaken.
- Visual screening of the site is required through berms or other screening structures including but not limted to the planting of indigenous vegetation.
- Lightning should be kept to a minimum and the facility should be integrated into the landscape
- Dust should be controlled during construction and operation. Dust control measures include but are not limited to watering of roads,, paving of roads, mimimising exposed surfaces, speed limits must be maintained etc.
- Windblown litter must be control through example daily covering of waste, compaction of waste, clearing of wind-blown litter, covering of trucks transporting waste etc.
- Minimise potential noise impacts through for example the regular maintenance of vehicles
- Ensure communication and education with regards to the site's operation with local communities.
- The buffer area recommended on Site 1 to mitigate the impacts of the surrounding activities on both the seasonal wetland as well as the stream would need to be at approximately 50m wide for the stream and 75m wide for the seasonal wetland.
- A buffer area is required around the drainage line on Site 3.
- "Clean" stormwater must be diverted around the waste disposal site
- Leachate and contaminated runoff from the landfill site should be managed on site to reduce the risk of contamination of the freshwater ecosystems.
- Bird carcasses found on site should be removed or quickly buried to prevent the potential spread of pathogens. A single bird carcass may be incidental but if two or more carcasses are found at one time the freshest carcass should be sent to the state veterinary for assessment of the cause of death.
- Maintain good housekeeping and sanitation on the site
- Install monitoring boreholes on the 'upstream' and 'downstream' sides of the landfill area. Sample these boreholes on a quarterly basis (if groundwater is present) for analysis The data should be evaluated by a hydro geologist on a regular basis;
- Establish a surface water sampling point immediately downstream of the site. Obtain at least one sample prior to construction as flow conditions allow.

- Line the waste disposal area with appropriate materials as per the Minimum Requirements
- Adopt the Buffer Zone, which was delineated exclusively on the basis of health impact, to minimise unnecessary human exposure to potentially toxic gaseous and particulate compounds.
- Adopt the Management Zone, which is indicative of the odour and dust impact areas, with reductions in the extent of such impact areas requiring the implementation of emission reduction measures.
- The designation of the area should be seen to necessitate the EDM Landfill to undertake the following:
  - develop and implement a site-specific odour assessment and management plan for the zone
  - re-evaluate the potential for impacts and the extent of management/mitigation required given changes in land use in the adjacent area
  - odours must be combated by good cover application and maintenance
- It is recommended that an odour management plan be implemented using resident data, meteorological data and site operator knowledge to investigate any odour complaints or potential odour complaints and implement remedial action using a developed common sense strategy.
- It is recommended that a meteorological station be erected and that the risk of gas explosion (CH_4) must be continually monitored
- The environmental management programme must be implemented.

The Way Forward

Registered I&APs were notified of the availability of the draft EIR for their perusal and comments. The registered I&APs were provided with a minimum of 40 days in which to submit their comments for inclusion in the Final EIR. A public Open House and meeting were held to present the findings of the draft EIR. Registered I&APs were notified of the meeting and notices were also placed in the press. A focus group meeting was also held.

The comments received on the draft EIR were addressed and included in the Final EIR. The Final EIR are available to registered I&APs for comment for a minimum period of 21 days.

The Final EIR and any comments received on the Final EIR will be submitted to the DEA&DP for their consideration. Should an Environmental authorization be issued, all registered I&APs will be notified of the outcome and their right to appeal the decision.

UITVOERENDE OPSOMMING

Inleiding

Anél Blignaut Omgewingskonsultante (ABOK) is aangestel deur PD Naidoo & Associates Consulting Engineers (Edms) Bpk. om namens die Eden Distriksmunisipaliteit (EDM) ‘n Omgewingsimpakstudie vir die voorgestelde nuwe streeksafvalstortingsterrein te onderneem.

Die Eden Distriksmunisipaliteit sluit in: Bitou, George, Hessequa, Kannaland, Knysna, Mosselbaai en Oudtshoorn.

'n Nuwe streeksafvalwegdoenfasiliteit is nodig aangesien PetroSA, waar die afval van George, Gouritsmond, Knysna en Mosselbaai munisipaliteite tans gestort word, kennis gegee het dat die PetroSA-stortingsterrein nie meer beskikbaar gaan wees nie. Die kontrak vir die storting van die vaste afval by die PetroSA-afvalstortingsterrein naby Mosselbaai gaan verval, aangesien PetroSA die fasiliteit benodig vir die storting van hul eie afval. Die grootte van die PetroSA terrein is verklein as gevolg van die konstruksie van die Gourikwa Kragstasie en die uitbreiding van die afvalstortingsterrein is dus problematies. PetroSA het uitgelig aan die Eden Distriksmunisipaliteit dat hulle nie voortgesette storting van algemene afval wil toelaat nie aangesien dit nie hul verantwoordelikheid is nie, maar dié van die Munisipaliteit.

’n Negatiewe karteringsverslag en konsultasie met die Munisipaliteit het gelei tot die indentifisering van drie moontlike terreine vir die konstruksie van ’n vaste afvalstortingsterrein. Die geskiktheid van die onderskeie terreine sal deur die Omgewingsimpakstudieproses ondersoek word.

Behoefte en wenslikheid

Die behoefte en wenslikheid van die voorgestelde projek was oorweeg in detail in hierdie konsep Omgewingsinvloedverslag. Die Munisipaliteite van Bitou, George, Hessequa (Albertina en Gouritsmond), Knysna en Mosselbaai ly almal aan 'n gebrek aan toepaslike afval stortingsterrein om in die behoeftes van die gemeenskap te voorsien. Die individuele munisipaliteite het aangedui dat daar ‘n behoefte bestaan vir 'n streeksafvalwegdoenfasiliteit. Die afval wat tans by die PetroSA afvalstortingsterrein weggedoen word kan nie voortgaan nie, soos hierbo genoem, te danke aan hoofsaaklik kapasiteitsbeperkinge en ook dat die verantwoordelikheid van die afval in die streek wat by die munisipaliteite lê en nie met PetroSA nie. Geen geskikte terrein oos van PetroSA kon gevind word nie.

Projek Beskrywing

Die voorgestelde fasiliteit sal die munisipaliteite van Bitou, George, Hessequa, Knysna en Mosselbaai bedien en 'n leeftyd van ongeveer 50 jaar hê. Daar word voorgestel dat beide gevaarhoudende en algemene afval by die terrein gestort word. Alle gevaarhoudende afval wat op die terrein gestort word sal dus 'n lae to medium risiko klassifikasie moet hê. Voorbeelde van gevaarhoudende afval met 'n lae risiko klassifikasie sluit in oplosmiddels en verf gegenereer deur die meganiese en metaal nywerhede in die gebied, asook afval van die hawe- en vis-industrië, soos bv. ballas. Gedroogde rioolslyk vanaf rioolwerke mag ook gestort word op die terrein. Voorsiening is gemaak vir 'n herwinnings-aanleg,' n komposterings gebied en 'n area vir die verwerking van die konstruksie-en sloopafval (bou rommel). Ander infrastrukture sluit in: paaie, stormwater pype, 'n loogsel opgaardam,' n besoedelde stormwater dam, kantore, 'n laboratorium,' n weegbrug en sekuriteit infrastruktuur.

Die voetspoor van die stortingsterrein sal 'n area van ongeveer 130- 200 hektaar beslaan (afhanged van die terrein wat geselekteer word) en die afvalhoop sal 'n maksimum hoogte van 12 meter bereik. Individuele selle sal een vir een uitgegrawe en gevul word. Elke sel sal ontwerp word met 'n leeftyd van ongeveer vyf jaar, afhangend van die effektiwiteit van afval vermindering en tydens die begin fase totdat die basis van die terrein bedek is, sal die konstruksie van die volgende sel begin na ongeveer elke 2-3 jaar. Die terrein sal uitgegrawe word tot 'n diepte van 6 meter onder die natuurlike grondvlak en die stortingsterrein sal 'n hoogte van 12 meter bo die natuurlike grondvlak bereik.

Die terrein sal omhein word om ongemagtigde toegang te verhoed en om wind verwaaide rommel te beheer. Ongekontamineerde stormwater sal van die terrein weggelei word deur 'n stormwater afvoerpyp.

Die stortingsterrein selle sal gebou word in ooreenstemming met die Departement Waterwese se minimum vereistes vir die storting van afval soos gespesifiseer vir 'n H:h en 'n G: L: B-terrein. H: h verwys na die gedeelte van die terrein waar gevaarhoudende afval gestort word en G: L: B-verwys na die deel van die terrein waar algemene afval gestort word. Die "L" verwys na 'n groot terrein en die "B" na die negatiewe water balans van die terrein, wat breedweg dui daarop dat daar geen beduidende loog geproduseer sal word nie.

Alternatiewe

Die identifisering en oorweging van alternatiewe word herken as 'n vereiste in die omgewingsimpak-assessering prosedures wêreldwyd. Reëls en regulasies in die NEMA Omgewingsimpakbepalingsregulasies vereis dat *"alternatiewe wat uitvoerbaar en billik is vir die voorgestelde aktiwiteit "* oorweeg moet word tydens die OIE-proses, teen die vroegste ontwikkeling stadium moontlik.

Die Omgewingsomvangsbepaling fase ontwikkel dus redelike en haalbare projek alternatiewe wat tydens die Omgewingsimpakstudie fase van die proses, ondersoek sal word. Omgewings-en tegniese faktore was in ag geneem tydens die terrein keuringsproses, asook die ontwerp en uitleg van elk van die drie voorgestelde terreine.

Die kriteria wat gebruik was om areas voorlopig uit te skakel van verdere oorweging was gebaseer op die identifisering van gebiede met 'n inherente “Fatal Flaws“ soos omskryf in die Departement van Waterwese en Bosbou (DWB) se minimum vereistes dokument (DWB, 2005). Dit sluit die volgende in:

- gebiede naby betekenisvolle oppervlak water liggame;
- sensitiewe ekologiese en / of historiese gebiede;
- opvanggebiede vir belangrike waterbronne soos damme;
- Gebiede aangrensend of gebiede met belangrike of potensieel belangrike waterdraers (aquifers)
- Gebiede oorliggend of langs fout sones (major fault zones);
- Gebiede met hoogs deurlaatbare gronde;
- Gebiede geassosieer met steil hellings, en
- Gebiede in die nabyheid van grondgebruike wat onverenigbaar is met afval.

Hierdie faktore is in ag geneem en ’n kaart is saamgestel wat areas aandui wat geskik sal wees vir die konstruksie van ’n streeksafvalstortingsterrein.

Na afloop van die voltooiing van die afvalstortinsgterrein “venster” identifiseringsverslag is ‘n terrein verkenning van potensiële gebiede wat geskik is vir die kostruksie van ’n stortingsterrein uitgevoer. Die terrein verkenning het gelei tot die identifisering van ’n paar opsies vir die verwydering van afval vir die EDM.

Hierdie alternatiewe benodig verdere studies om die ekonomiese uitvoerbaarheid van die verskeidenheid vervoer opsies vir die vervoer van munisipale vaste afval na die verskillende voorgestelde terreine vir die Eden Distriksmunisipaliteit streeksafvalstortingsterrein, te bepaal.
Die studie het die volgende aanbeveel:

- Dat die huidige afvalwegdoening praktyke nie kan voortgaan nie en dat een van die drie alternatiewe, of ander, toegepas moet word,
- dat die ontwikkeling van 'n nuwe stortingsterrein op Terrein 1 die voorkeur keuse vir die munisipaliteite van Mosselbaai, George, Knysna en Bitou is.
- Dat afval van Hessequa Munisipaliteit vervoer moet word na ‘n moontlike toekomstige terrein B, met die uitsondering van afval van Albertinia en Gouritzmond wat na terrein 1 vervoer moet word, en

- Dat die afval van Calitzdorp vervoer moet word na die opgegradeerde stortingsterrein op Oudtshoorn.

Ander opsies wat oorweeg was, was die gesamentlike wegdoening van algemene- en gevaarhoudende afval in vergelyking met die afsonderlike wegdoening van algemene- en gevaarhoudende afval. Die doel van die gesamentlike wegdoening van algemene- en gevaarhoudende afval is om enige vloeistowwe te absorbeer, verdun en neutraliseer om 'n bron van bio-afbreekbare materiaal en sodoende mikrobiese aktiwiteite te verskaf wat sal help om die afbreek van gevaarhoudende stowwe aan te moedig. Waar die gesamentlike wegdoening van algemene- en gevaarhoudende afval effektief bestuur word, laat dit toe vir ’n groter oppervlakte waarop die trokke kan beweeg. Daar word voorgestel om vloeistowwe en droë gevaarhoudende afval met ’n lae tot matige vlak van gevaar gesamentlik weg te doen op die stortingsterrein. Navorsing toon dat 'n goed-bestuurde gesamentlike wegdoening sisteem ’n veilige en doeltreffende opsie vir gevaarhoudende en vloeibare afval storting is.

Die “Geen-Ontwikkeling“opsie was ook oorweeg en dien as 'n basis waarteen die Alternatiewe wat in hierdie verslag voorgestel is geëvalueer kan word. Die konsep van 'n plaaslike afvalstortingsterrein in vergelyking met die handhawing van die status quo met die storting van afval by PetroSA is bespreek onder die “no-go” of geen-ontwikkeling opsie. Dit is egter onmoontlik om voort te gaan met die “Geen-Ontwikkeling“ opsie as gevolg van die feit dat die kontrak vir die storting van die vaste afval van George, Gouritsmond, Knysna en Mosselbaai by die PetroSA afvalstortingsterrein naby Mosselbaai sal verval. PetroSA benodig die fasiliteit vir die storting van hul eie afval. Die grootte van die PetroSA terrein is verminder as gevolg van die konstruksie van die Gourikwa Kragstasie en die uitbreiding van die huidige afvalstortingsterrein is dus ‘n probleem.

PetroSA het ook aan die Eden Distriksmunisipaliteit laat blyk dat hulle nie die voortgesette storting van algemene afval wil toelaat op hulle terrein nie aangesien dit nie hulle verantwoordelikhied is nie. Die geen ontwikkelingsopsie dui ook daarop dat die huidige landbou gebruik van die onderskeie terrein in alle waarskynlikheid sal voortgaan.

Dit was die gevolgtrekking dat terrein 1-3 in ag geneem moet word en in diepte ondersoek moet word tydens die Omgewingimpakbepalingsfase as alternatiewe vir die vestiging van ’n streeks-afvalstortingsterrein. Afval van die Bitou, George, Knysna en Mosselbaai Munisipaliteite moet vervoer word na die terrein, asook dié van die dorpe Albertinia en Gouritsmond. Die afval van Kannaland en Oudtshoorn moet vervoer word na die opgegradeerde terrein te Oudtshoorn, terwyl die afval van Hessequa, afgesien van Albertinia en Gouritsmond vervoer moet word na die huidige Riversdal stortingsterrein. Die Uniondale/Haarlem gebied het hul eie stortingsterrein op Uniondale. Dit is dus die gevolgtrekking dat die voorgestelde vervoer reëling aanvaar moet word as die voorkeur-reëling en dat die ander opsies nie verder ondersoek moet word nie. Beide die opsies vir die aparte wegdoening asook die gesamentlike wegdoening van gevaarhoudende en algemene afval was oorweeg as alternatiewe in die Omgewingimpakbepalingsfase. Ten slotte, gaan die “Geen Ontwikkleing“ opsie deurgans as ’n basis gebruik word in die proses.

Die verkeer impakstudie het toegang alternatiewe vir Terreine 2 en 3 in die Omgewingsimpakstudieproses geïdentifiseer. Laastens was die uitlegte op die alternatiewe terreine in 'n herhalende wyse aangepas en verfyn ten einde die omgewing beperkinge aan te spreek en die aanbevelings en versagtende maatreëls soos aangedui deur die spesialiste, regeringsinstansies en belanghebbendes te implementeer.

Terrein ligging en omgewing

Die studie area val binne die Riversdal Plain biostreek, wat lê binne die Fynbos-bioom en die Kaapse Floristiese Streek. Al drie die voorgestelde terreine val binne die nabyheid van Mosselbaai en Herbertsdale.

Terrein 1

Terrein 1 lê net noord van die N2, ongeveer 1 km wes van PetroSA en 13 km wes van Mosselbaai. Die Huis op Terrein 1 sal gesloop moet word.

<u>Eiendom besonderhede:</u>

Gedeelte 9 van die plaas Drie Fonteinen Nr 243

Gedeelte 1 van die Plaas Patrysfontein Nr 228

Restant van Plaas 310

Die huidige gebruik van die terrein is landbou doeleindes en spesifiek is vir weiding en saai gewasse. Die terrein is geleë by ‘n ineenvloeing van landbou-en industriële landskappe. Industriële ontwikkeling het plaasgevind onmiddellik na die ooste van die voorgestelde terrein en sluit die PetroSA afval stortingsterrein, Eskom se oop siklus Gasturbine (OSGT) kragstasie, die PetroSA terrein en Mossindustria. Die gebruik van landbougrond sluit ongeploegde land, koringlande en weiding en renosterveld oorblyfsels in.

Terrein 2

Terrein 2 lê net suid van die R327 (wat lei tot Herbertsdale), ongeveer 20 km (direkte lyn) noord-wes van Mosselbaai, 16,5 km (direkte lyn) suid-oos van Herbertsdale, wat die naaste dorp is en 6,5 km noord van die N2.

<u>Eiendom besonderhede</u>:

Restant van die Plaas Zuur-Rug No 207.

Die Proteus substasie is onmiddellik na die noorde van die R327 geleë, ongeveer 1,5 km noordwes van die terrein. Baie gebiede wat geleë is aan die suide van die R327 is vir landbou, meestal weiding gebruik. Die terrein self en omliggende plase ondersteun groot gebiede van fynbos. Die Gondwana-natuurreservaat is in die nabyheid van die terrein geleë.

Terrein 3

Terrein 3 lê ongeveer 2,5 km tot by die suide van die R327, net oos van die grondpad wat die R327 verbind met die Cooper-stasie. Dit lê ongeveer 26 km (direkte lyn) noord-wes van Mosselbaai, 13 km (direkte lyn) suid-suid-oos van Herbertsdale, wat die naaste dorp is en 7,5 km noord van die N2.

Eiendom besonderhede:

Gedeelte 1 van die Plaas Kruisvallei Nr 232

Gedeelte 2 ('n Gedeelte van Gedeelte 1) van die plaas Kruisvallei Nr 232

Plaas 232: toegang oor hierdie eiendom word benodig en dus die verbreding van die bestaande toeganspad. Die eienaar het nie goedkeuring hiervoor verleen nie.

Interseksie N2/MR341: Draailane binne die bestaande padreserwe van die N2 word benodig by hierdie interseksie.

Die terrein self en omliggende plase word gebruik vir landbou doeleindes en bestaan hoofsaaklik uit bewerkte landerye en weiding. Daar is baie min inheemse plantegroei op die terrein self self asook die omliggende plase.

Openbare Deelname Proses

'n Omvattende Openbare Deelname Proses was onderneem tot op hede.

Die aktiwiteite wat onderneem is as deel van die proses tot op hede asook die daaropvolgende aktiwiteite word kortliks gelys:

1. Kennisgewing van die Omgewingimpakbepalingsproses en die beskikbaarheid van die Agtergrond-inligtingsdokument (AID) in die plaaslike en provinsiale koerante, kennisgewingsborde, skriftelike kennisgewing aan geïdentifiseerde belanghebbendes, insluitende die geaffekteerde grondeienaars en bure en plakkate op gereeld-besoekte plekke.
2. Registrasie van Belanghebbende en Geaffekteerde Partye (B & GP'e) en die register word op datum hou.
3. Samestelling van 'n Kommentaar-en-Antwoordverslag met die kwessies gelig deur B & GP'e en die verskaffing van antwoorde daarop. Die Kommentaar-en-Antwoordverslag is gestuur aan alle geregistreerde B & GP’e.
4. 'n Fokusgroep vergadering is gehou op die 14 April 2010. Die notas van die vergadering is gestuur aan al die organisasies en / of individue wat die vergadering bygewoon het.
5. Die Konsep-en Finale Omvangsbepalingsverslag en Plan vir Studie vir die Omgewingsimpakbepalingsfase was beskikbaar gestel aan geregistreerde B & GP’e vir kommentaar.
6. Probleme en antwoorde was ingesluit in 'n Kommentaar en Antwoordverslag en versprei word aan alle geregistreerde B & GPe.
7. Die Finale Omvangsbepalingsverslag was ingedien by die DEA & DP en die geregistreerde B & GP’e was in kennis gestel van die aanvangs van die Omgewingsimpakbepalingsfase van die proses.

8. Addisionele Belanghebbende en Geaffekteerde persone was in kennis gestel en veranderinge is gemaak aan die register gedurende die Omgewingsinvloedbepalingsfase.
9. Die geregistreerde B & GPe was weer in kennis gestel van die beskikbaarheid van die Konsep-en Finale Omgewingsinvloedbepalingsverslae vir kommentaar en was genooi om 'n openbare opedag en vergadering by te woon.
10. Die beskikbaarheid van die Konsep Omgewingsinvloedbepalingsverslag en die Openbare opedag en vergadering was in die pers geadverteer.
11. 'n Kommentaar en Antwoordverslag was saamgestel wat die kommentaar op die Konsep Omgewingsinvloedbepalingsverslag insluit asook die antwoorde op die kommentaar. Enige kommentaar wat op die Finale Omgewingsinvloedbepalingsverslag ontvang word, sal nie beantwoord word nie, maar aan die DEA & DP voorgelê word vir hul oorweging.
12. Geregistreerde B & GPe sal in kennis gestel word van die uitkoms van die besluit en hul reg om te appelleer.

Omgewingsimpakstudie proses

Daar word vereis dat die Eden DM ‘n geïntegreerde aansoek by die Departement van Omgewingsake en Ontwikkelingsbeplanning (DEA & DP) indien vir omgewingsmagtiging onder die Nasionale Omgewingsbestuurswet (NEMA), (Wet 107 van 1998), soos gewysig en ‘n lisensie aansoek onder die NEMA:. Afval Wet, 2008 (Wet 59 van 2008).

Anél Blignaut Environmental Consultants is aangestel as onafhanklike omgewingskonsultante om die Omgewingsimpakstudieproses uit te voer vir die geïntegreerde aaansoek in terme van die bogenoemde wetgewing namens die Eden DM.

Ons is nou in die Omgewingsimpakbepalings-fase van die proses. 'n Aansoek vorm is voltooi en ingedien by die Departement van Omgewingsake en Ontwikkelingsbeplanning. Die Konsep Omvangbepalingsverslag en Studieplan vir die Omgewingsimpakbepalingsverslag was goedgekeur deur die Departement van Omgewingsake en Ontwikkelingsbeplanning. Hiermee nooi ons u om kommentaar te lewer op hierdie konsep Omgewingsimpakstudie verslag.

Die Omgewingsimpakbepalingsverslag sal die probleme en bekommernisse wat gedurende die Omvangsbepalingsfase geïdentifiseer is in detail aanspreek. Die verslag sal spesialis ondersoeke, soos Erfenis, argeologie, paleontologie, visuele impakte, verkeer, sosio-ekonomie, varswater ecologie, voëlkunde, Geohidrologie, Lugkwaliteit en Plantkunde insluit.

Die Openbare Deelname Proses is 'n belangrike element van die proses. Belanghebbende en Geaffekteerde Partye word uitgenooi om te registreer en voorlopige kwessies of kommentaar met betrekking tot die voorgestelde ontwikkeling te lewer.

Inligting sal verskaf word regdeur die aansoekproses en geregistreerde Belanghebbende en Geaffekteerde Partye sal voorsien word van 'n geleentheid om kommentaar op die voorgestelde ontwikkeling op elke fase te lewer.

Tydens elke fase sal die geregistreerde Belanghebbende en Geaffekteerde Partye voorsien word met ten minste 'n 40-dae tydperk waarin hulle kommentaar en/ of kwessies op die konsep verslae kan lewer. 'n Verdere 21-dag kommentaar periode sal toegelaat word vir die finale verslae van elke fase.

Kwessies gelig en impakte geïdentifiseer

Die verwagte impakte op die omgewing en die probleme wat kan ontstaan was geidentifiseer deur die projekspan, regeringsinstansies, die aansoeker en gedurende the openbare deelname proses tot op hede.

Hierdie verslag evalueer die potensiële beduidende impakte van die voorgestelde vaste afval stortingsterrein op die biofisiese, sosiale en ekonomiese omgewing. Voorstelle word gemaak op die potensiële maatreëls wat die potensiële negatiewe impakte sal versag of die potensiëlle positiewe impakte sal versterk. Impakte wat mag voorkom tydens beide die konstruksie-en bedryfsfase van die voorgestelde afvalwegdoenfasiliteit word bespreek en versagtende maatreëls word aanbeveel waar negatiewe impakte nie vermy kan word nie.

Hierdie kwessies word breedweg gelys in die uitvoerende opsomming van die Omgewingsimpakstudieverslag.

Die volgende moontlike impakte is geïdentifiseer:

- Potensiële invloede op inheemse plantegroei;
- Impak op die voëls;
- Potensiële impakte op grondwater;
- Potensiële impakte op oppervlak water sisteme;
- Potensiële impakte op die kwaliteit van die lug bv. stof en reuke;
- Potensiële sosiale impakte wat insluit maar nie beperk is tot die volgende nie: gesondheid en velighied, onverenigbare grondgebruike, verkeer, geraas en rommel;
- Potensiële ekonomiese impakte wat insluit maar nie beperk is tot die volgende nie: plaaslike ekonomiese impakte met betrekking tot ander afvalbestuursaktiwiteite soos herwinning en kompostering, potensiële impakte op toerisme, impakte van terrein aktiwiteite op die omringende landbougrond en rommel;
- Potensiële visuele impakte;
- Argeologiese, palaeontologiese en erfenis impakte;
- Verkeersimpakte en impakte op die toestand van die pad;
- Impak van die koste van die voorgestelde fasiliteit op die Munisipale begroting.

Sleutelbevindinge word as volg opgesom:

Plantkunde

- Die Botaniese studie toon 'n effense voorkeur vir Perseel 3, maar het aangedui dat Terrein 1 is ook geskik sou wees indien die vereiste versagtende maatreëls ingestel word.
- Terreine 2 en 3 hou beide min botaniese of ekologiese beperkings in vir die voorgestelde ontwikkeling
- Ten minste 80% van Terrein 2 word beskou as van hoë botaniese sensitiwiteit te wees en is nie geskik is vir die voorgestelde ontwikkeling nie. Uit ‘n botaniese perspektief moet Terrein 2 nie goedgekeur word nie aangesien die botaniese impak van ontwikkeling op hierdie terrein sal lei tot hoë negatiewe impakte en dit kan nie in enige beduidende mate versag word nie.

Varswater Ekologie

- Daar is 'n aantal van vars water liggame wat op Terrrein 1 voorkom maar net twee wat van belang is naamlik die seisoenale stroom wat deel vorm van die Blinderivier-stelsel en die seisoenale pan / vleiland gebied.
- Hierdie assessering bevestig die behoefte om hierdie varswater ekostelsels te beskerm vanuit 'n biodiversiteit oogpunt.
- Die ander oppervlak waterliggame is kunsmatig geskep en is van min ekologiese belang.
- Die buffer wat aanbeveel word om die impak van die omringende aktiwiteite op beide die seisoenale vleiland, sowel as die stroom te versag sal ongeveer 50m breed moet wees vir die stroom en 75m breed vir die seisoenale vleiland
- Die dreineringslyn op terrein 2 sal onder die terrein gepyp moet word as gevolg ingenieurswese beperkings wat hierdie terrein bied.
- Die oostelike dreineringslyn op die terrein 3 kan vermy word, maar die westelike dreineringslyn sal rondom die terrein weggelei moet word.

Avi-fauna impak

Van 'n avi-fauna perspektief is Terrein 1 die voorkeur alternatief aangesien die habitat reeds omskep is, en voëls genoeg aangrensende soortgelyke habitat beskikbaar het, en die klein perifere vleiland beskerm kan word. Terrein 3 is soortgelyk, op voorwaarde dat die stroom wat dit insluit beskerm word. Die voëllewe spesialis het aangedui dat Terrein 2 die minste geskikte terrein is as gevolg van die aansienlike hoeveelheid natuurlike plantegroei wat voorkom op die terrein.

Geohidrologiese impak

Die geohidrologiese impakstudie het 'n voorkeur aangedui vir Terrein 3 hoofsaaklik te danke aan die diep grondwater en klei op Terrein 3 voorkom wat benewens die belyning besoedeling van grondwater sal beperk. Die geohidrologiese spesialis het ook aangedui dat Terrein 1 gebruik kan word aangesien die plaaslike grondwater oor ‘n lae opbrengspotensiaal beskik, natuurlik van swak gehalte is en daar is 'n goed ontwikkelde onversadigde sone wat loging sal attenueer. Die geohidrologiese beoordeling het aangedui dat die hoogs geleidende sedimente en 'n vlak watertafel Terrein 2 'n minder omgewings gunstige opsie maak.

Paaie en verkeersinvloede

- Die spesialis het aangedui dat die impak wat verband hou met 'n toename in verkeer, padveiligheid en geometriese kwessies weglaatbaar klein is vir Terrein 1. 'n Matige impak op die toestand van die padplaveisel van die N2 word verwag as gevolg van 'n natuurlike groei in die hoeveelhede afval en die byvoeging van die afval van die Bitou Munisipaliteit.
- Beide Terreine 2 en 3 vereis die gedeeltelike rekonstruksie van die openbare paaie. In die geval van Terrein 2, is dit die DR1549 en in die geval van Terrein 3 is dit die DR1549 of MR341.
- Vir Terrrein 2 sal 'n regsdraai baan gebou word op die N2 weswaarts en 'n versnellingsbaan sal voorsien moet word op die N2 ooswaarts by die kruising van DR1549. Toegang tot Perseel 3 vereis 'n kort toegewyde regsdraai baan op die N2 weswaarts en 'n versnellingsbaan op die N2 by óf die DR1549 of MR341 kruising as een van hierdie roetes gekies word.
- Terrein 2 sal die konstruksie van 'n nuwe pad oor private eiendom vereis. Die bestaande toegang vanaf die MR342 is te steil vir swaar voertuie.
- Die voorkeur toegangsroete na Terrein 3 is vanaf die N2 op die MR341 noordwaarts na Terrein 3 waar toegang via 'n bestaande pad oor private eiendom verkry moet word om toegang tot die terrein te verkry. Soos reeds genoem het die grondeienaar van die Plaas 232 waaroor wat toegang verlang word nie toestemming gegee om toegang te verkry oor die genoemde eiendom nie.

Visuele impak

Uit 'n visuele impak perspektief het die spesialis aangedui dat geeneen van die voorgestelde terreine noodlottige foute inhou nie, maar 'n voorkeur is vir Terrein 1 aangedui. As gevolg van die laer visuele gehalte, matige visuele absorpsie kapasiteit, hoë visuele integriteit en laer kyker sensitiwiteit van Terrein 1, wat tot 'n sekere mate die hoër visuele blootstelling en die sigbaarheid van die terrein uitoorlê. Die visuele impak van die ontwikkeling van 'n stortingsterrein op die terrein 1 was deur die spesialis aangedui as die terrein met die laagste oorhoofse impak van die drie terreine.

Lugkwaliteit Impakte

Geen fatale foute wat verband hou met enige van die drie alternatiewe terreine is geïdentifiseer uit 'n lugkwaliteit perspektief nie. 'n Vergelyking van die voorspelde lugbesoedeling impak dui aan dat Terrein 2 is effens beter as Terrein 1 en Terrein 3. Dit is voorspel dat die ontwikkeling van Terrein 3 sal lei tot die hoogste lugbesoedeling impak, tensy die toegangspad behandel word om om stof emissies te verminder. Die potensiële reukimpaksone van Terrein 2 sal die verste strek in vergelyking met die ander twee terreine. Aangesien toegang tot Terreine 2 en 3 verkry word deur beduidend langer grondpaaie as Terrein 1, sal die kumulatiewe impak hoër wees op Terreine 2 en 3 weens stofbesoedeling. Aangesien Terrein 1 relatief naby aan PetroSA geleë is word daar voorsien dat daar 'n effense toename in die impak op lugkwaliteit in die toekoms sal wees by hierdie terrein. Dit sal hoofsaaklik reuk impakte wees. . Die lugkwaliteit invloedbepaling het aangedui dat Terrein 1 gekies word as die voorkeurterrein met betrekking tot lugbesoedeling.

Sosio-ekonomiese impakte

Die sosio-ekonomiese invloedbepaling het aangedui dat die algehele impak op al drie die voorgestelde terreine positief sal wees en die algehele impak vir die geen ontwikkelings-opsie sou neutraal wees.

Alhoewel die konstruksie van die fasiliteit op alternatiewe Terreine 1, 2 of 3 dieselfde algehele impak sal hê, sal Alternatief 1 die minste negatiewe impak op die omliggende omgewing hê en is aanvullend tot die omliggende grondgebruik (PetroSA fasiliteit geleë oos van die terrein).

Argeologiese impak

Met betrekking tot die voorgestelde ontwikkeling van 'n plaaslike afvalwegdoenfasiliteit naby Mosselbaai, het die argeologiese invloedbepaling getoon dat elkeen van die voorgestelde kandidaat-terreine geskik is vir die voorgestelde ontwikkeling. Geen beduidende impakte op pre-koloniale argeologiese materiaal wat versag moet word word verwag by Terreine 2 en 3 nie. Die ontwikkeling van 'n streekstortingsterrein op Terrein 1 sal moontlik 'n impak op die potensieel belangrike argeologiese oorblyfsels hê en versagtingsmaatreëls word aanbeveel om hierdie impakte tot die minimum te beperk.

Paleontologiese impak

Die paleontologiese invloedbepaling het aangedui dat al drie kandidaat-terreine vir die Eden Distriksmunisipaliteit streekstortingsterrein beskou word as lae tot baie lae paleontologiese sensitiwiteit.

Erfenisimpakte

Die Erfenis invloedbepaling het tot die gevolgtrekking gekom dat die totale erfenis betekenis van die drie terreine laag is en dat die voorgestelde ontwikkeling van 'n streekstortingsterrein op enige van hulle kan voortgaan.

Die opsie van 'n toegewyde sel vir algemene afval en 'n aparte sel vir gevaarhoudende afval (H: h), waar storting van gehoudende en algemene afval kan plaasvind, afhangende van die aard van die gevaarlike afval is die voorkeur-opsie.

Met betrekking tot die beskikbaarheid van beleggingskapitaal het die Eden DM 'n studie in terme van Artikel 78 van die Munisipale Stelsels Wet onderneem ten einde gepaste meganismes te bepaal vir die bou, bedryf en bestuur van die voorgestelde nuwe stortingsterrein. Die studie het bevind dat die beste opsie vir Eden DM ‘n eksterne dienslewering opsie sal wees vir die ontwikkeling van die stortingsterrein om 'n bou bedryf en Oordrag kontrak in werking te stel. Die studie het bevind dat so 'n kontrak 'n kostebesparing sal toon in vergelyking met 'n interne leweringsmeganisme en sal dus beter waarde toon vir belastingbetalers.

Die nuwe stortingsterrein, insluitend die afval behandeling (die herwinninsaanleg, komposteringsaanleg, bourommelverwerkingsaanleg), sel vir die storting van gevaarhoudende afval en die addisionele vervoerkoste sal die munisipale begroting laat toeneem met ongeveer 1,6%.

Die invloed van die "geen ontwikkelings-opsie is ook bepaal gedurende hierdie Omgewingsinvloedbepalingsproses. Die ontwikkelings-opsie behels deels die voortsetting van die afvalstorting wat tans plaasvind by die PetroSA afvalwegdoenfasiliteit en ook die voortsetting van die hoofsaaklik landbou grondgebruik van die alternatiewe terreine. Die " geen ontwikkelings-opsie is nie 'n haalbare opsie om na te streef nie. Die PetroSA afvalwegdoenfasiliteit het nie die vermoë om die afval te ontvang van die Munisipaliteite nie. Verder soos aangedui in die verskillende afdelings van hierdie verslag is daar 'n behoefte aan 'n langtermyn-afval stortingsterrein vir die Eden Distrik Munisipaliteit. Die geen ontwikkelings-opsie is dus nie beskou as 'n haalbare of redelike alternatief nie en kan dus nie voortgesit word nie.

Gevolgtrekkings en Aanbevelings

Hierdie Omgewingsinvloedbepalingsverslag het die relatiewe omgewings-aanvaarbaarheid van die voorgestelde alternatiewe opsies vir die voorgestelde nuwe streeks afvalstortingsterrein vir die Eden Distriksmunisipaliteit, ondersoek.

Hierdie ondersoek het die ekonomiese, omgewings-en sosiale faktore in ag geneem. Die "Geen-Ontwikkeling" opsie was ook oorweeg.

Na oorweging van die inligting wat ontvang is tydens die proses van openbare deelname sowel as die bepalings en die bevindinge van die verskillende spesialiste betrokke word Terrein 1 aanbeveel as die voorkeur terrein vir die voorgestelde afvalstortingsfasiliteit. Die potensiële omgewingsimpakte kan op die mees effektiewe manier op Terrein 1 vermy of versag word wanneer dit vergelyk word met die ander tween terreine. Die voorgesteld aktiwiteit sal kan voorsien in die behoeftes van die gemeenskap. Gegewe die inligting wat verskaf is as deel van die omgewingsimpakstudie proses, word dit aanbeveel dat Terrein 1 die beste prakties uitvoerbare opsie met die minste hoeveelheid potensiële negatiewe impakte op die omgewing sal wees mits die aanbevelings in hierdie verslag en die Omgewingsbestuursplan effektief geïmplementeer word. As die aanbevelings wat in hierdie verslag gemaak is, doeltreffend geïmplementeer word, kan die meeste van die geïdentifiseerde omgewingsimpakte vermy word. Daar is egter sekere impakte wat nie vermy kan word nie en dit sal verminder moet word. Waar die impak nie vermy kan word nie, word versagtingsmaatreëls aanbeveel om die risiko van die potensiële omgewingsimpakte te verminder.

Ter opsomming word daar voorgestel dat die afvalstortingsterrein op Terrein 1 aanbeveel word vir goedkeuring mits die vereiste versagtende maatreëls, die implementering van die omgewingsbestuursprogram en die effektiewe bestuur van die fasiliteit toegepas word.
Sleutel versagtende maatreëls word kortliks hieronder opgesom:

- Opname, kartering en die versameling van argeologiese materiaal word aanbeveel op die Terrein 1. Toets uitgrawings vir sub-oppervlak argeologiese oorblyfsels moet onderneem word.
- Visuele impakte van terrein 1 moet versag word deur grondwalle of ander strukture wat ook kan insluit maar nie beperk is tot die plant van inheemse plantegroei.

- Beligting van die terrein moet tot 'n minimum te beperk word en die fasiliteit moet geïntegreer word in die landskap.
- Stof moet beheer word tydens konstruksie en bedryf. Stof beheermaatreëls sluit in maar is nie beperk tot natmaak van paaie, plavei van paaie, die beperking van die grootte van blootgestelde oppervlakkes, spoedgrense moet geimplementeer word ens.
- Wind gewaaide rommel moet beheer word deur byvoorbeeld daagliks die afval te bedek, kompaktering van afval, die skoonmaak van die wind verwaaide rommel, bedekking van vragmotors wat afval vervoer, ens.
- Verlaag potensiële geraasimpak deur byvoorbeeld die gereelde instandhouding van voertuie
- Maak seker dat kommunikasie en opvoeding plaasvind van plaaslike gemeenskappe met betrekking tot die terrein se bedryf.
- Die buffer area wat aanbeveel word by Terrein 1 om die potensiële impakte van die terrein op die seisoenake vleiland en stroom te beperk moet om en by 50m wees vir die stroom en 75m vir die seisonale vleiland.
- 'n Buffer word vereis rondom die natuurlike afloop op terrein 3.
- "Skoon" stormwater moet weggelei word rondom die afvalstortingsterrein
- Loog en besoedelde stormwater wat ontstaan op die terrein moet bestuur word om te versker dat die varswater ekosisteme nie besoedel word nie.
- Voël karkasse wat gevind word op die perseel moet verwyder word of vinnig begrawe word om die moontlike verspreiding van patogene te voorkom. 'n Enkele voël karkas mag toevallig wees, maar indien twee of meer karkasse gevind word op 'n bepaalde tydstip moet die varste karkas na ‘n staatsveearts gestuur word vir die bepaling van die oorsaak van die dood.
- Handhaaf goeie huishouding en sanitasie op die terrein.
- Installeer moniteringsboorgate "stroom-op" en "stroom-af" van die stortingsterrein. Neem watermonsters van hierdie boorgate op 'n kwartaallikse basis (as grondwater teenwoordig is) en analiseer die monsters. Die data moet geëvalueer word deur 'n hidro-geoloog op 'n gereelde basis;
- Bewerkstelling 'n oppervlakwater steekproefpunt direk stroomaf van die terren. Neem ten minste een watermonster voor konstruksie begin indie die vloeitoestande dit toelaat.
- Belyn die stortingsterrein soos aangedui in die Minimum vereistes vir die wegdoening van afval.
- Implementeer die buffersone, wat uitsluitlik op die basis van gesondheid impak afgebaken is om die onnodige blootstelling van mense aan potensieel giftige gasse en partikels tot die minimum te beperk.
- Implementeer die bestuursone wat ‘n aanduiding is van die reuk en stof impak gebiede. Dit sal die vermindering van die grootte van die impak areas wat aksies om emissies te beperk beteken.
- Die aanwysing van die gebied moet gesien word om om EDM stortingsterrein te noodsaak om die volgende stappe te neem:

- Ontwikkel en implementeer ‘n terrein spesifieke reukbepaling en bestuursplan vir die bestuursone.
- her-evalueer die potensiaal vir impakte en die mate van beheer / versagting wat vereis word soos veranderinge in grondgebruik in die aangrensende gebiede plaasvind.
- reuke moet bestry word deur goeie beddekking van die afval en instandhouding

- Dit word aanbeveel dat 'n reukbestuursplan geïmplementeer word met behulp van plaaslike data, weerkundige data en die kennis van die terreinoperateur om sodoende enige klagtes met betrekking tot reuke te ondersoek en regstellende aksies te implementeer.
- Dit word aanbeveel dat 'n meteorologiese stasie opgerig word en dat die risiko van gas ontploffing (CH4) voortdurend gemonitor moet word.
- Die omgewingsbestuurprogram moet geimplementeer word.

Die pad vorentoe

Geregistreerde B & GPe is in kennis gestel van die beskikbaarheid van die Konsep Omgewingsimpakstudie verslag vir hul insae en kommentaar. Die geregistreerde B & GP's was ‘n minimum van 40 dae gegun waarin hul kommentaar kon lewer vir insluiting in die Finale Omgewingsimpakstudie verslag. ‘n Openbare dag en vergadering was gehou waarin die bevindinge van die Konsep Omgewingsimpakstudie verslag voorgelê was. Geregistreerde partye was in kennis gestel van die vergadering en kennisgewings het ook in die media verskyn. Daar was ook ‘n fokusgroep vergadering gehou.

Die kommentaar ontvang op die konsep verslag was aangespreek en ingesluit in die Finale Omgewingsimpakstudie verslag. Die Finale Omgewingsimpakstudie verslag was beskikbaar gestel aan geregistreerde B&GPe vir ’n minimum periode van 21 dae. Die Finale Omgewingsimpakstudie verslag en enige kommentare wat ontvang word sal aan die Departement van Omgewingsake en Ontwikkelingsbeplanning gestuur word vir oorweging. Indien ‘n omgewingsgoedkeuring ontvang word, sal alle B&GP’e in kennis gestel word van die besluit en hulle reg tot appél.

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LIST OF ABBREVIATIONS

Abbreviation	Meaning
ABEC	Anél Blignaut Environmental Consultants
BGIS	Biodiversity Graphical Information System (of SANBI)
BID	Background Information Document
BPEO	Best Practicable Environmental Option
CC	Close Corporation (a business legal entity)
DEA&DP	Department of Environmental Affairs and Development Planning (Western Cape provincial department)
DEAT	Department of Environmental Affairs and Tourism (National Department – old name)
DMA	District Management Area
DSR	Draft Scoping Report
DWAF	Department of Water Affairs and Forestry (National Department – old name)
DWEA	Department of Water and Environmental Affairs (National Department – new name)
EC	Electronic conductivity
ECA	Environment Conservation Act
EIA	Environmental Impact Assessment
draft EIR	Environmental Impact Report
EMP	Environmental Management Plan
ESKOM OCGT	ESKOM Open Cycle Gas Turbine
FEL	Front End Loader
FSR	Final Scoping Report
GRA-II	Groundwater Resource Assessment Phase 2 Project: An initiative by DWAF in 2003-2005 which sought to quantify the groundwater resources of South Africa on a national scale. Algorithms have been developed for the estimation of aquifer storage, recharge, baseflow and the groundwater Reserve.
ha	Hectares (unit of area = 10 000 square meters).
HIA	Heritage Impact Assessment
HWC	Heritage Western Cape
I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
IWM	Integrated Waste Management
JPCE	Jan Palm Consulting Engineers
LUPO	Land Use Planning Ordinance Use Planning Ordinance, Ordinance 15 of 1985.

Abbreviation	Meaning
mamsl	Metres above mean sea level
mbgl	Meters below ground level
MRF	Materials Recovery Facility
N2	National Road no 2.
NEM:WA	National Environmental Management: Waste Act (No 59 of 2008)
NEMA	The National Environmental Management Act (107 of 1998)
NGDB	National Groundwater Database
NGL	Natural Ground Level
NGO	Non-Governmental Organisation
NHRA	National Heritage Resources Act, 1999 (Act 25 of 1999)
NSBA	National Spatial Biodiversity Assessment by SANBI
NWA	The National Water Act 1998 (Act 36 of 1998)(NWA)
OHSA	Occupational Health and Safety Act (Act 85 of 1993)
PoSEIA	Plan of Scoping for Environmental Impact Assessment
PPP	Public Participation Process
EA	Environmental authorisation
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
ToR	Terms of Reference
VAC	Visual absorption capacity

CHAPTER 1: INTRODUCTION

1.1 Introduction

Anél Blignaut Environmental Consultants (ABEC) was appointed by PD Naidoo Consulting Engineers (Pty) Ltd on behalf of the Eden District Municipality (EDM) to undertake an Environmental Impact Assessment for the proposed new regional waste disposal facility.

Within the Eden District are situated the municipalities of Bitou, George, Hessequa, Kannaland, Knysna, Mossel Bay and Oudtshoorn. A new regional waste disposal facility is needed as the contract for the disposal of the solid waste from George, Gouritsmond, Knysna and Mossel Bay at the PetroSA waste disposal site near Mosselbay will be expiring, as PetroSA needs the facility for the disposal of their own waste. The size of the PetroSA site has been reduced due to the construction of the Gourikwa Powerstation and the extension of the waste disposal site is therefore problematic. PetroSA also indicated to the Eden District Municipality that they do not want to allow the continued disposal of general waste at their site as this is not their responsibility but the responsibility of the individual Municipalities. It is proposed that the the Municipalities of Bitou, George, Hessequa (only Albertinia and Gouritsmond), Knysna and Mossel Bay dispose of their waste at a new regional waste disposal facility.

A negative mapping report and consultations with the proponent has resulted in the identification of three potential sites for the waste disposal facility. The suitability of each site for the disposal of solid waste will be investigated through the Environmental Impact Assessment Process.

A Public Participation Process was conducted as part of the Scoping Study in order to identify and address the issues and concerns of Interested and Affected Parties (I&APs). The Final Scoping Report included the comments of the I&APs and responses to the comments. The Final Scoping Report was made available to registered Interested and Affected Parties. Any comments received on the Final Scoping Report were forwarded to the DEA&DP for consideration.

The DEA&DP accepted the Final Scoping Report on 26 September 2011. Subsequently, the specialist investigations and the Draft Environmental Impact Report (Draft EIR) completed. Comments received on the Draft EIR have been addressed in this Final EIR and responded to in the form of a comments and response report included under Appendix D.

1.2 Relevant Experience of Environmental Assessment Practitioner

Anél Blignaut Environmental Consultants (ABEC) was appointed by PD Naidoo Consulting Engineers (Pty) Ltd on behalf of the Eden District Municipality (EDM) to undertake an Environmental Impact Assessment for the proposed new regional waste disposal facility.

ABEC has been practicing in the field of Waste Management and Environmental Impact Assessment since 2002. ABEC has undertaken a number of waste related Basic Assessments and EIAs. A summary of the qualifications and experience of Anél Blignaut is included below. Anél Blignaut's curriculum vitae is included in Appendix H.

Anél Blignaut

Qualifications: B.Sc. Agric (Animal Physiology, Zoology, Nature Conservation); M.Sc. Conservation Ecology

Professional Registration: Pr.Sci.Nat.

Experience:

Anél Blignaut has been involved with Environmental Consulting since 2002 covering a broad range of projects which included Environmental Impact Assessments, Risk Assessments, Environmental Management Plans, Environmental Management Systems, Environmental auditing, Integrated Environmental Management Plans, Waste Awareness programs, Forestry Certification, Agricultural Certification and Ecological Restoration Projects.

Anél's experience was gained mostly within South Africa, but also in the United Arab Emirates and Tanzania.

1.3 Terms of Reference for the EIA process

Anél Blignaut Environmental Consultants (ABEC) was appointed by PD Naidoo Consulting Engineers (Pty) Ltd on behalf of the Eden District Municipality (EDM) to undertake the Environmental Impact Assessment in terms of the National Environmental Management Act (NEMA), (Act 107 of 1998), which includes a Scoping and EIR phase.

The environmental work entails the following:

- Compilation and submission of the EIA application to DEA&DP in terms of NEMA (Act No. 107 of 1998), the NEMA: EIA Regulations (2006) and the National Environmental Management: Waste Act (Act No. 58 of 2008)
- Undertaking the public participation process (PPP)
- Compilation and submission of a draft and final Scoping Reports and EIA Reports to the DEA&DP.

The Waste Management Licence application was added to the Terms of Reference due to the promulagation of the NEMA: Waste Act in June 2009.

1.4 Application Details

Applicant	Eden District Municipality		
Property Location	Site 1 Adjacent to the PetroSA waste disposal site just off the N2, Mossel Bay. Site 2 Located off the Herbertsdale Road (R327). Site 3 Located off the Herbertsdale Road (R327).		
Farm/Erf name & number including portion	Site 1: Portion 9 of the Farm Drie Fonteinen Nr 243 Portion 1 of the Farm Patrysfontein Nr 228 Remainder of Farm 310 Site 2: Remainder of the Farm Zuurug No. 207 Site 3: Portion 1 of the Farm Kruisvallei Nr 232 Portion 2 (Portion of Portion 1) of the Farm Kruisvallei Nr 232 Farm 232 – access to be gained over this property. The landowner did not provide consent. Intersection N2 with the MR341 close to Cooper station. The construction of turning lanes within the road reserve.		
Site 1: Coordinates: Latitude (S)	34^0	10‘	22.66“
Longitude (E)	21^0	57‘	06.73“
Site 2: Coordinates: Latitude (S)	34^0	06‘	56.24“
Longitude (E)	21^0	53‘	51.94“
Site 3: Coordinates: Latitude (S)	34^0	07‘	49.08“
Longitude (E)	21^0	48‘	51.77“
Site 3: Intersection N2/MR341 Coordinates: Latitude (S)	34^0	11‘	46.69“
Longitude (E)	21^0	48‘	17.92“
DEA&DP NEMA EIA Reference number	EG12/2/3/2/D6/27/1286/09		

1.5 Report Structure

This Environmental Impact Report consists of the sections as outlined in Table 1.1 below.

Chapter	Description
1 Introduction	Provides background information to the proposed development, the purpose and structure of this document.
2 Legal requirements	Describes the legislative framework and guiding principles for the EIA.
3 Study Approach and Methodology	Describes the methodology used to assess the significance of the potential environmental impacts.

Chapter	Description
4 Project Description	Provides a description of the proposed regional landfill site and a design for the site.
5. Affordability, need and desirability.	Addresses the need and desirability of the proposed regional waste disposal facility and also indicates the costs involved with the facility and how it affects Municipal budgets.
6 Consideration of Alternatives	A description of alternative sites or other options identified.
7 Affected Environment	Provides a description of the biophysical, heritage and socio-economic environment of each of the alternatives that may be affected by the proposed regional landfill site.
8 Public Participation Process	Describes the procedure followed during the Public Participation Process.
9 Findings of the specialist assessments and Impact assessment	Documents the findings of the specialist assessments including recommendations and mitigation measures. The Alternatives are also comparatively assessed.
10. Monitoring and control	Provides a summary of the aspect covered in the EMP pertaining to the monitoring and control of the waste disposal facility.
11 Conclusions and Recommendations	Summarises the key findings and recommended mitigation measures. A statement is made on the preferred alternative that should be considered for approval.
References	A list of references used in compiling this report is provided.
Appendices	Includes communication with authorities, interested and affected parties, media coverage, photographs, site plans etc. as listed in the table for Appendices.

Table 1.1: Environmental Impact Report Structure.

CHAPTER 2: LEGAL REQUIREMENTS

2.1 Introduction

The applicant needs to conform to a number of regulatory requirements at local, provincial and national level.

The principal pieces of environmental legislation that focus this assessment in order to protect the environment and ensure that proposed new Eden Regional Waste Disposal site is constructed in an environmentally responsible manner, are as follows:

- National Environmental Management Act, 1998 (Act No.107 of 1998) (NEMA) as amended.
- The Environment Conservation Act, 1989 (Act No. 73 of 1989)
- The National Water Act, 1998 (Act No.36 of 1998)(NWA).
- National Heritage Resources Act, 1999 (Act No. 25 of 1999)(NHRA).
- National Environmental Management: Waste Act (Act No 59 of 2008) (NEM:WA).
- National Environmental Management: Air Quality Act (Act No. 39 of 2004)
- National Environmental Management: Biodiversity Act (Act No.1 0 of 2004)

These Acts and other relevant legislation and policy are discussed in more detail below. This EIA process is aimed to meet the specific requirements of the NEMA EIA Regulations promulgated on 21 April 2006 and the amendments to listed activities published on 3 July 2009. It aims to concurrently meet the requirements of the National Environmental Management: Waste Act (No 59 of 2008), and the list of waste management activities published on 3 July 2009.

2.2. The Constitution of South Africa Act No. 108 of 1996

2.2.1 The Environmental Clause – Section 24

The “environmental guarantee” clause in the Bill of Rights section of the Constitution of South Africa, Section 24, states that

“Every person shall have the right -

a.) to an environmental that is not harmful to their health nor well being; and

b.) to have that environment protected for the benefit of present and future generations, through reasonable legislative and other measures, which:

i.) Prevent pollution and ecological degradation;

ii.) Promote conservation; and

iii.) Secure justifiable economic and social development and use of natural resources while promoting justifiable economic and social development.”

2.2.2 Access to Information

Section 32 provides that everyone has the right of access to any information held by the State or another juristic person, and that is required for the exercise or protection of any rights.

2.2.3 Just Administrative Action

Section 33 of the Constitution entrenches the right to lawful, reasonable and procedurally fair administrative action, as well as written reasons for administrative actions that have adversely affected a person's rights.

2.3. National Environmental Management Act, 1998 (Act No. 107 of 1998)

NEMA provides the legislative framework to encourage, promote and create parameters for enforcement for environmental protection, management and compliance, with the ultimate goal of realising sustainable development. The EIA Regulations (2006) promulgated in terms of Chapter 5 of NEMA, deal specifically with development and identify certain activities (GN No R 385 of 21 April 2006) that require authorisation from the competent environmental authority before commencement. **This application has been submitted and will be processed under the NEMA: EIA Regulations, 2006 and the associated listed activities under Government Notices R386 and 387.** Activites listed under R386 requires a Basic Assessment Process to be followed and those under R387 requires that a Scoping and Environmental Impact Process be followed.

On 18 June 2010 the Minister of Water and Environmental Affairs promulgated regulations in terms of Chapter 5 of the National Environmental Management Act, 1998 (Act No. 107 of 1998)("NEMA"), viz., the Environmental Impact Assessment ("EIA") Regulations 2010 (Government Notice No. R. 543, R511, R.545, R. 546 and R. 547 in Government Gazette No. 33306 of 18 June 2010). These regulations came into effect on 02 August 2010 (Government Notice No. R660, R.661, R. 662, R.663, R.664 and R. 665 in Government Gazette no. 33411 of 02 August 2010). The EIA regulations 2010 replace the EIA regulation that were promulgated in 2006 as well as regulations regarding environmental management frameworks.

However, this application was pending on the date of effect of the EIA Regulations, 2010 and in terms of the transitional arrangements as stipulated in Chapter 9 of the NEMA EIA Regulations this application may be processed as if the EIA Regulations 2006 were not repealed.

An assessment of the EIA Regulations 2010 was done in order to determine whether there are any newly listed activities or any potential impacts that are not covered by the EIA Regulations 2006.

Please note that potentially listed activities were identified at the beginning of the EIA process when the application form was submitted to the Deparment of Environmental Affairs and Development Planning.

The initial application form was amended due to amendments made to Government Notices nos. R.386 and R. 387 of 2006 and the promulagation of the listed activities under the NEM: Waste Act (59/2008) as listed in Government Notice nr. 718.

As the EIA process progressed and more detailed information became available the listed activities under both the NEMA EIA Regulations 2006 and 2010 as well as the NEM: Waste Act was refined.
The activities that apply to the application in terms of the NEMA: EIA Regulations and Government Notices R. 386 and 387 as amended together with similarly or newly listed activities as listed under the NEMA: EIA Regulations, 2010 in listing notices 1, 2 and 3 are described below.

The listed activities under the **NEMA: EIA Regulations, 2006** in the proposed project which trigger the EIA process are the following:

Government Notice R386 for Basic Assessment, Activity No(s):
1(k), (m), 4, 7, 12, 13, 15, 16, 18, 19, 23

1 (k) the bulk transportation of sewage and water, including storm water, in pipelines with -(i) an internal diameter of 0,36 meters or more; or (ii) a peak throughput of 120 liters per second or more;
Comment: This activity refers to pipelines and channels on the site and along roads.
1 (m) any purpose in the one in ten year flood line of a river or stream, or within 32 metres from the bank of a river or stream where the flood line is unknown, excluding purposes associated with existing residential use, but including - (i) canals; (ii) channels; (iii) bridges; (iv) dams; and (v) weirs;

4 The dredging, excavation, infilling, removal or moving of soil, sand or rock exceeding 5 cubic meters from a river, tidal lagoon, tidal river, lake, in-stream dam, floodplain or wetland.
7 The above ground storage of a dangerous good, including petrol, diesel, liquid petroleum gas or paraffin, in containers with a combined capacity of more than 30 cubic meters but less than 1 000 cubic meters at any one location or site.
12 The transformation or removal of indigenous vegetation of 3 hectares or more or of any size where the transformation or removal would occur within a critically endangered or an endangered ecosystem listed in terms of section 52 of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004).
Comment: This activity relates to the removal of indigenous vegetation for the establishment of the waste disposal facility.
13 The abstraction of groundwater at a volume where any general authorisation issued in terms of the National Water Act, 1998 (Act No. 36 of 1998) will be exceeded.

15 The construction of a road that is wider than 4 meters or that has a reserve wider than 6 meters, excluding roads that falls within the ambit of another listed activity or which are access roads of less than 30 meters long.

16 The transformation of undeveloped, vacant or derelict land to – (a) establish infill development covering an area of 5 hectares or more, but less than 20 hectares; or (b) residential, mixed, retail, commercial, industrial or institutional use where such development does not constitute infill and where the total area to be transformed is bigger than 1 hectare.

18 The subdivision of portions of land 9 hectares or larger into portions of 5 hectares or less.

19 The development of a new facility or the transformation of an existing facility for the conducting of manufacturing processes, warehousing, bottling, packaging, or storage, which, including associated structures or infrastructure, occupies an area of 1 000 square meters or more outside an existing area zoned for industrial purposes.

Comment: This activity relates to the proposed materials recovery facility, the garden waste storage and chipping area and the builder's rubble crushing and storage area.

23 The decommissioning of existing facilities or infrastructure, other than facilities or infrastructure that commenced under an environmental authorisation issued in terms of the Environmental Impact Assessment Regulations, 2006 made under section 24(5) of the Act and published in Government Notice No. R. 385 of 2006, for -

(c) industrial activities where the facility or the land on which it is located is contaminated or has the potential to be contaminated by any material which may place a restriction on the potential to re-use the site for a different purpose;

Comment: This activity has been included; however this application is not for the closure of the proposed facilities, but for the construction of new facilities. When the site has reached its capacity a closure application must be submitted in terms of the NEM:WA which may also trigger listed activities under Listing Notices 1, 2 and 3 depending on the nature of the closure design.

<u>Government Notice R387 for EIA, Activity No(s):</u>

1 (q), (s), 2

1 (q) the incineration, burning, evaporation, thermal treatment, roasting or heat sterilisation of waste or effluent, including the cremation of human or animal tissue;

1.(s) rail transportation, excluding railway lines and sidings in industrial areas and underground railway lines in mines, but including -

railway lines;

stations; or

shunting yards;

2 Any development activity, including associated structures and infrastructure, where the total area of the developed area is, or is intended to be, 20 hectares or more.

Comment: This activity is triggered as more than 20 hectares will be required for the construction of the proposed waste disposal facility.

An assessment of the EIA Regulations 2010 was done in order to determine whether there are any newly listed activities or any potential impacts that are not covered by the EIA Regulations 2006. The table below lists the activities that apply to the application in terms of the EIA Regulations 2010 and comments are made whether these activities were considered thus far in the process.

Listing Notice 1 (No. R. 544)	Activity 9: *The construction of facilities or infrastructure exceeding 1000 metres in length for the bulk transportation of water, sewage or storm water – with an internal diameter of 0.36 meters or more; or with a peak throughput of 120 liters per second or more, excluding where: such facilities or infrastructure are for bulk transportation of waster, sewage or storm water drainage inside a road reserve; or where such construction will occur within urban areas but further than 32metres from a watercourse, measured from the edge of the watercourse.* **Comment:** This activity has been covered in the assessment and also in the listing of Activity 1(k) of Government Notice 386. It refers to the storm water pipelines and channels that will be constructed on the site.

	Activity 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 metres in size; (ix) slipways exceeding 50 square metres in size; (x) buildings exceeding 50 square metres in size; or (xi) infrastructure or structures covering 50 square metres or more where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line
	Comment: This activity is covered in Activity 1(m) of Government Notice nr. 386.
	Activity nr. 13:
	The construction of facilities or infrastructure for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 cubic meters.
	Comment: This activity is covered in this assessment and also included in Activity 7 of Government Notice nr. 386. A fuel storage tank of 4000 litres will be required.
	Activity nr. 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 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 or moving (i) is for maintenance purposes undertaken in accordance with a management plan agreed to by the relevant environmental authority; or (ii) occurs behind the development setback line. **Comment:** This activity is covered in Activity 4 of Government Notice nr. 386.
	Activity nr. 22
	The construction of a road, outside urban areas, (ii) where no reserve exists where the road is wider than 8 meters
	Comment: This activity is covered in this assessment and also included in Activity 15 of Government Notice nr. 386.

	Activity 23: The transformation of undeveloped, vacant or derelict land to residential, retail, commercial, recreation, industrial or institutional use, outside an urban area and where the total area to be transformed is bigger than 1 hectare but less than 20 hectares; -except where such transformation takes place for (i) linear activities or (ii) for the purposes of agriculture or afforestation in which case Activity 16 of Notice No. R. 545 applies.
	Comment: This activity is discussed here, but does not apply as the development footprint is larger than 20ha and therefore activity 15 of listing notice 2 applies.
	Activity 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. Comment: expansion of stormwater facilities may be needed for the upgrade of public roads. This activity is covered in Activity 1(k) of Government Notice nr. 386.
	Activity 39: The expansion of (i). canals; (ii). channels; (iii). bridges; (iv). weirs; (v). bulk storm water outlet structures; (vi). marinas; within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, where such expansion will result in an increased development footprint but excluding where such expansion will occur behind the development setback line. **Comment:** This activity is covered in Activity 1(m) of Government Notice nr. 386.
	Activity 47: The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre- (i) Where the existing reserve is wider than 13.5 metres; or (ii) Where no reserve exists, where the existing road is wider than 8 metres-excluding widening or lengthening occurring inside urban areas. **Comment:** This activity is covered in Activity 15 of Government Notice nr. 386.

Listing Notice 2 (No. R. 545)	**Activity 5:** The construction of facilities or infrastructure for any process or activity which requires a permit or license in terms of national or provincial legislation governing the generation or release of emissions, pollution 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, 2008 (Act No. 59 of 2008) in which case that Act will apply. **Comment:** The proposed facility is included in the list of waste management activities.
	Activity nr. 15:
	Physical alteration of undeveloped, vacant 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 alteration takes place for: (i) linear development activities; or (ii) agriculture or afforestation where activity 16 in this Schedule will apply
	Comment: This activity is covered in this assessment and also included in Activity 2 of Government Notice nr. 387.
	Activity 26: Commencing of an activity, which requires an atmospheric emission license in terms of section 21 of the National Environmental Management: Air Quality Act, 2004 (Act. No. 39 of 2004), except where Activity 28 in Notice No. R 544 of 2010 applies. **Comment:** The Air Quality Impact Assessment indicated that atmospheric emission licence is not required.
Listing Notice 3 (No. R. 546)	**Activity nr. 4 (d) (ii)**
	The construction of a road wider that 4 metres with a reserve less than 13.5 metres. (d) (ii) All areas outside urban areas.
	Comment: This activity is covered in this assessment and also included in Activity 15 of Government Notice nr. 386.
	Activity 10 (e) (ii)
	The construction of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres. (e) In Western Cape: (ii) All areas outside urban areas.
	Comment: This activity is covered in this assessment and also included in Activity 7 of Government Notice nr. 386. A fuel storage tank of 4000 litre will be required.

	Activity12 (a) & (b)
	The clearance of an area of 300 square metres or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation. (a) Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004. (b) Within critical biodiversity areas identified in bioregional plans.
	Comment: This activity is covered in this assessment and also included in Activity 12 of Government Notice nr. 386. A detailed botanical assessment has been included in the EIR. The clearance of indigenous vegetation will however be assessed throughout the EIA process.
	Activity 13: The clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation, except where such removal of vegetation is required for (1) the undertaking of a process or activity included in the list of waste management activities published in terms of section 19 of the National environmental Management: Waste Act, 2008 (Act No. 59 of 2008), in which case the activity is regarded to be excluded from this list.
	Comment: This activity is covered in this assessment and also included in Activity 12 of Government Notice nr. 386. A detailed botanical assessment has been included in the EIR. However, it is not relevant to this application as the proposed activity has been included in the list of waste management activities and is therefore regarded as excluded.
	Activity 14 The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation, except where such removal of vegetation is required for (2) the undertaking of a process or activity included in the list of waste management activities published in terms of section 19 of the National environmental Management: Waste Act, 2008 (Act No. 59 of 2008), in which case the activity is regarded to be excluded from this list.
	Comment: This activity is covered in this assessment and also included in Activity 12 of Government Notice nr. 386. A detailed botanical assessment has been included in the EIR. However, it is not relevant to this application as the proposed activity has been included in the list of waste management activities and is therefore regarded as excluded.

	Activity 16: The construction of (i) jetties exceeding 10 square metres in size; (ii) slipways exceeding 10 square metres in size; (iii) buildings with a footprint exceeding 10 square metres in size; or (iv) infrastructure covering 10 square metres or more where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line. Comment: This activity is covered in Activity 1(m) of Government Notice nr. 386.
	Activity 19: The widening of a road by more than 4 metres, or the lengthening of a road by more than 1 kilometre. **Comment:** This activity is covered in Activity 15 of Government Notice nr. 386.
	Activity 24 The expansion of a) jetties where the jetty will be expanded by 10 square metres in size or more; b) slipways where the slipway will be expanded by 10 square metres or more; c) buildings where the buildings will be expanded by 10 square metres or more in size; orn (d) infrastructure where the infrastructure will be expanded by 10 square metres or more where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line. **Comment**: This activity is covered in Activity 1(m) of Government Notice nr. 386.

The initial list of activities was updated as the Environmental Impact Assessment process progressed and information were made available by the relevant specialists and the technical engineering design has been refined.

Due to the activities listed above, a Scoping and EIA process has been undertaken. The National Environmental Management Act, (Act 107 of 1998), provides for co-operative environmental governance by establishing principles for decision making on matter affecting the environment, institutions that will promote co-operative governance and procedures for co-coordinating environmental functions exercised by organs of state and to provide for matters connected therewith. The principles set out in NEMA; Section 2 has particular relevance to the proposed development as stated below:

2(3) development must be socially, environmentally and economically sustainable.

2(4)(a) Sustainable development requires the consideration of all relevant factors including the following:

i) that the disturbance of ecosystems and loss of biodiversity are avoided or, where they cannot be altogether avoided, are minimized and remedied;

ii) that pollution and degradation of the environment are avoided, or where they cannot be altogether avoided, are minimized and remedied;

iii) that the disturbance of landscapes and sites that constitute the nation's cultural heritage is avoided, or where it cannot be altogether avoided, is minimized and remedied;

iv) that a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions;

v) that negative impacts on the environment and on people's environmental rights be anticipated and prevented and where they cannot be altogether prevented, are minimized and remedied;

2(4)(b) Environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated, and it must take into account the effects of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable environmental option.

Section 28(1) states that "every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring". If such pollution cannot be prevented, then appropriate measures must be taken to minimize or rectify such pollution.

The Eden District Municipality has a responsibility that the proposed activity and the EIA process conform to the principles of NEMA. EDM is obliged under Section 28 to take actions to prevent pollution or degradation of the environment.

It is required to indicate how the proposed waste disposal site complies with the principles set out in NEMA, Section 2. The waste disposal facility must also meet the requirement of sustainable development. Furthermore the general objectives of Integrated Environmental Management as set out in Section 23 of the NEMA have also been taken into account in this EIA process. The manner in which Section 2 and 23 of the NEMA have been taken into account is briefly discussed below.

NEMA: Section 2.

(2) Environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably.

(3) Development must be socially, environmentally and economically sustainable.

Taken into account in the following manner: This EIA process has taken into account social, economic and environmental aspects of the proposed waste management facility. Some of these aspects that could potentially have significant negative impacts required specialist investigation and the specialist reports are summarised in the EIR and the complete reports attached to the EIR.

(4) *(a)* Sustainable development requires the consideration of all relevant factors including the following:

(i) That the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied;

(ii) that pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied;

(iii) that the disturbance of landscapes and sites that constitute the nation's cultural heritage is avoided, or where it cannot be altogether avoided, is minimised and remedied;

Taken into account in the following manner: Potential impacts and risks have been identified during the Scoping phase and reported on. Certain potential impacts required specialist input and/or assessment. The specialists' assessments are summarised in this EIR and the reports are attached to the EIR. Mitigation measures are included in the EIR based on information obtained during the process in order to avoid and, where it cannot be avoided, to minimise potential negative impacts.

(iv) that waste is avoided, or where it cannot be altogether avoided, minimised and re-used or recycled where possible and otherwise disposed of in a responsible manner;

Taken into account in the following manner: The investigation of other waste reduction initiatives that are ongoing within the Eden District Municipality will form part of separate EIA processes when and if required. This application is for the activities as detailed in the project description. This waste management facility must be constructed and managed in a responsible manner as prescribed by the Minimum Requirement for Waste Disposal by Landfill (DWAF, 1998) and any other conditions that the DEA&DP or DEA may impose through the Waste Management Licence.

(v) that the use and exploitation of non-renewable natural resources is responsible and equitable, and takes into account the consequences of the depletion of the resource;

(vi) that the development, use and exploitation of renewable resources and the ecosystems of which they are part do not exceed the level beyond which their integrity is jeopardised;

Taken into account in the following manner: Potential impacts and risks have been identified during the Scoping phase and reported on. Certain potential impacts required specialist input and/or assessment. The specialists' assessments are summarised in this EIR and the reports attached to the EIR. Mitigation measures are included in the EIR based on information obtained during the process in order to avoid and where it cannot be avoided to minimise potential negative impacts.

(vii) that a risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions; and

Taken into account in the following manner: The assumptions and limitations of the study are reported on in this EIR.

(viii) that negative impacts on the environment and on people's environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimised and remedied.

Taken into account in the following manner: Potential impacts and risks have been identified during the Scoping phase and reported on. Certain potential impacts required specialist input and/or assessment. The specialists' assessments are summarised in this EIR and the reports attached to the EIR. Mitigation measures are included in the EIR based on information obtained during the process in order to avoid and where it cannot be avoided to minimise potential negative impacts.

(b) Environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated, and it must take into account the effects of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable environmental option.

Taken into account in the following manner: Throughout this report the aim is to report on all interrelated aspects of the environment and where required specialist assessments were performed. The aim is to integrate the findings of the specialist reports and the information obtained during the public participation process in order to reach the best practicable environmental option

(c) Environmental justice must be pursued so that adverse environmental impacts shall not be distributed in such a manner as to unfairly discriminate against any person, particularly vulnerable and disadvantaged persons.

Taken into account in the following manner: The aim of the public participation process throughout the process has been to conduct the process in a manner that is fair and transparent providing I&AP's with opportunities to register in the process and raise concerns related to the proposed waste management facility.

(d) Equitable access to environmental resources, benefits and services to meet basic human needs and ensure human well-being must be pursued and special measures may be taken to ensure access thereto by categories of persons disadvantaged by unfair discrimination.

Taken into account in the following manner: The Eden District Municipality Integrated Waste Management Plan (IWMP) indicates the need for a regional waste disposal facility. Apart from the Eden DM IWMP the individual Municipalities' IWMP's except for the Hessequa Municipality's IWMP indicates the establishment of a regional waste disposal facility by the Eden DM as one of the options. The Regional waste disposal facility will therefore serve in the needs of the ratepayers to ensure waste disposal facility that if <u>well managed</u> in accordance with the EMP and recommendations in this report is likely to provide a facility that will minimize the risk of environmental degradation.

(e) Responsibility for the environmental health and safety consequences of a policy, programme, project, product, process, service or activity exists throughout its life cycle.

Taken into account in the following manner: A draft Environmental Management Programme has been included in the EIR.

(f) The participation of all interested and affected parties in environmental governance must be promoted, and all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, and participation by vulnerable and disadvantaged persons must be ensured.

Taken into account in the following manner: The public participation process has been conducted in a manner that is fair and transparent providing I&AP's with opportunities to register in the process and raise concerns related to the proposed waste management facility and responses to the comments were provided. The Public Participation report is included in Appendix D (and will be updated during the process) and details how this EIR phase of the EIA process ensured active participation in the process.

(g) Decisions must take into account the interests, needs and values of all interested and affected parties, and this includes recognising all forms of knowledge, including traditional and ordinary knowledge.

Taken into account in the following manner: The public participation process has been conducted in a manner that is fair and transparent providing I&AP's with opportunities to register in the process and raise concerns related to the proposed waste management facility and responses to the comments were provided. The Public Participation report is included in Appendix D and details how this EIR phase of the EIA process ensured active participation in the process.

(h) Community wellbeing and empowerment must be promoted through environmental education, the raising of environmental awareness, the sharing of knowledge and experience and other appropriate means.

Taken into account in the following manner: Sharing of knowledge of current waste management best practices as well as knowledge of waste avoidance, reduction and recycling was shared throughout the EIA process via the information provided during the public participation process.

(i) The social, economic and environmental impacts of activities, including disadvantages and benefits, must be considered, assessed and evaluated, and decisions must be appropriate in the light of such consideration and assessment.

Taken into account in the following manner: Potential impacts and risks have been identified during the Scoping phase and reported on. Certain potential impacts required specialist input and/or assessment. The specialists' assessments are summarised in this EIR and the reports attached to the EIR. Mitigation measures are included in the EIR based on information obtained during the process in order to avoid and where it cannot be avoided to minimise potential negative impacts.

(j) The right of workers to refuse work that is harmful to human health or the environment and to be informed of dangers must be respected and protected.

Taken into account in the following manner: The EMP addresses health and safety issues pertaining to the construction and operation of the waste disposal site. Templates for an environmental complaints register as well as an Environmental Health and Safety Incidents Report have been included in the EMP. The applicant must ensure the effective implementation of the EMP.

(k) Decisions must be taken in an open and transparent manner, and access to information must be provided in accordance with the law.

Taken into account in the following manner: The public participation process has been conducted in a manner that is fair and transparent providing I&AP's with opportunities to register in the process and raise concerns related to the proposed waste management facility and responses to the comments on the Background Information Document and Draft reports were provided. The Public Participation report is included in Appendix D and details how this EIR phase of the EIA process ensures active participation in the process.

(l) There must be intergovernmental co-ordination and harmonisation of policies, legislation and actions relating to the environment.

Taken into account in the following manner: This report provides a summary of the policies and legislation that were considered. The relevant government departments were also given an opportunity to provide inputs into the process. The inputs received are included in Appendix D.

(m) Actual or potential conflicts of interest between organs of state should be resolved through conflict resolution procedures.

Taken into account in the following manner: Up to date no such conflicts with direct relevance to this project have been reported.

(n) Global and international responsibilities relating to the environment must be discharged in the national interest.

Taken into account in the following manner: The Stockholm Convention on persistent organic pollutants aims to eliminate or restrict the production and use of persistent organic pollutants. One of the key elements is to dispose of persistent organic pollutants in an environmentally sound manner. South Africa is a signatory of the Stockholm convention and the Department of Environmental Affairs implements the convention. The main objectives of the Basel Convention, of which South Africa is a signatory, are to encourage the reduction of production of hazardous waste and to minimise the movement of such waste between countries. It also seeks to encourage the disposal of hazardous waste in an environmentally safe and responsible way. This project will be in line with the Basel Convention in that it will make provision for the safe disposal of hazardous waste.

(o) The environment is held in public trust for the people, the beneficial use of environmental resources must serve the public interest and the environment must be protected as the people's common heritage.

Taken into account in the following manner: Potential impacts and risks have been identified during the Scoping phase and reported on. Certain potential impacts required specialist input and/or assessment. The specialists' assessments are summarised in this EIR and the reports attached to the EIR. Mitigation measures are included in the EIR based on information obtained during the process in order to avoid and where it cannot be avoided to minimise potential negative impacts. Furthermore, the public participation process has been conducted in a manner that is fair and transparent providing I&AP's with opportunities to register in the process and raise concerns related to the proposed waste management facility and responses to the comments on the Background Information Document and Draft reports were provided. The Public Participation report is included in Appendix D and details how this EIR phase of the EIA process ensures active participation in the process.

(p) The costs of remedying pollution, environmental degradation and consequent adverse health effects and of preventing, controlling or minimising further pollution, environmental damage or adverse health effects must be paid for by those responsible for harming the environment.

Taken into account in the following manner: The applicant has the responsibility to implement the EMP attached to this document as well as the conditions of approval that will be included in the licence and to ensure that environmental degradation does not take place. The communities who produce the waste will be paying for disposal and associated costs, including environmental.

(q) The vital role of women and youth in environmental management and development must be recognised and their full participation therein must be promoted.

Taken into account in the following manner: The public participation process has been conducted in a manner that is fair and transparent providing I&AP's with opportunities to register in the process and raise concerns related to the proposed waste management facility and responses to the comments on the Background Information Document and Draft reports were provided. The Public Participation report is included in Appendix D and details how this EIR phase of the EIA process ensures active participation in the process.

(r) Sensitive, vulnerable, highly dynamic or stressed ecosystems, such as coastal shores, estuaries, wetlands, and similar systems require specific attention in management and planning procedures, especially where they are subject to significant human resource usage and development pressure.

Taken into account in the following manner: Potential impacts and risks have been identified during the Scoping phase and reported on. Certain potential impacts required specialist input and/or assessment. The specialists' assessments are summarised in this EIR and the reports attached to the EIR. Mitigation measures are included in the EIR based on information obtained during the process in order to avoid and where it cannot be avoided to minimise potential negative impacts. More specifically, a Botanical Impact Assessment was compiled. The project design and management measures taken are detailed in this report.

Section 23 of the NEMA: General objectives.

(2) The general objective of integrated environmental management is to-

(a) promote the integration of the principles of environmental management set out in section 2 into the making of all decisions which may have a significant effect on the environment;

Taken into account in the following manner: This EIA process has taken into account social, economic and environmental aspects of the proposed waste management facility. Some of these aspects that could potentially have significant negative impacts required specialist investigation and the specialist reports are summarised in the EIR and the complete reports attached to the EIR. The preceding section indicated in detail how the principles of section 2 have been taken into account.

(b) identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage, the risks and consequences and alternatives and options for mitigation of activities, with a view to minimising negative impacts, maximising benefits, and promoting compliance with the principles of environmental management set out in section 2;

Taken into account in the following manner: Potential impacts and risks have been identified during the Scoping phase and reported on. Certain potential impacts required specialist input and/or assessment. The specialists' assessments are summarised in this EIR and the reports attached to the EIR. Mitigation measures are included in the EIR based on information obtained during the process in order to avoid and where it cannot be avoided to minimise potential negative impacts.

(c) ensure that the effects of activities on the environment receive adequate consideration before actions are taken in connection with them;

Taken into account in the following manner: Potential impacts and risks have been identified during the Scoping phase and reported on. Certain potential impacts required specialist input and/or assessment. The specialists' assessments are summarised in this EIR and the reports attached to the EIR. Mitigation measures are included in the EIR based on information obtained during the process in order to avoid and where it cannot be avoided to minimise potential negative impacts. A monitoring and audit protocol has been included in the Environmental Management Programme to address future unforeseen impacts.

(d) ensure adequate and appropriate opportunity for public participation in decisions that may affect the environment;

Taken into account in the following manner: The public participation process has been conducted in a manner that is fair and transparent providing I&AP's with adequate and appropriate opportunities to register in the process and raise concerns related to the proposed waste management facility and responses to the comments on the Background Information Document and Draft reports were provided. The Public Participation report is included in Appendix D and details how this EIR phase of the EIA process ensures active participation in the process.

(e) ensure the consideration of environmental attributes in management and decision-making which may have a significant effect on the environment; and

Taken into account in the following manner: This EIR considers the potential environmental impacts and rates the significance of these impacts through the use of amongst others specialist assessment and input, the information gathered during the public participation process and other available information provided by the project team. Recommendations are made on the required mitigation measures that should be implemented. The competent authority needs to take the information as presented in this report into consideration. Comment from relevant other authorities would be instrumental in this decision.

(f) identify and employ the modes of environmental management best suited to ensuring that a particular activity is pursued in accordance with the principles of environmental management set out in section 2.

Taken into account in the following manner: The preceding section indicated in detail how the principles of section 2 have been taken into account. The specifications as set out in the Environmental Management Programme is regarded to be best suited for this particular project.

The Eden District Municipality has a responsibility that the proposed activity and the EIA process conform to the principles of NEMA. The Eden District Municipality is obliged under Section 28 to take actions to prevent pollution or degradation of the environment.

2.4. The Environment Conservation Act, 1989 (Act No. 73 of 1989)

The Environment Conservation Act (ECA) previously controlled both Environmental Impact Assessment of major projects and the licensing of waste sites. These functions of the ECA have been replaced by the NEMA and NEM:WA legislation respectively. In particular, Section 20 of the ECA, which governed waste disposal sites has been repealed.

2.5 National Water Act, 1998 (Act No.36 of 1998)

Section 19 of the NWA deals with landowners and users involved in any activity or process which causes, has caused or is likely to cause pollution of water resources. Such landowners and users are obliged to take all reasonable measures to prevent any such pollution from occurring, continuing or recurring. This includes measures to comply with any prescribed waste standard or management practice. Furthermore, the NWA requires anyone who intends undertaking a water use, as defined, to obtain a licence. The water uses that have been defined and are relevant for this EIA are:

- discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit; and
- disposing of waste in a manner which may detrimentally impact on a water resource.

The required water use licences will be applied for separately from this EIA process. At this stage a water use licence would be required for the seasonal wetland on Site 1 as the development will take place within 500m of the wetland and for the for the drainage channel on Site 3 as it requires diversion. The decision to grant a waste management licence in respect of a waste disposal facility is subject to the concurrence of the Minister responsible for Water Affairs (DEA&DP, 2009).

2.6 National Environmental Management: Biodiversity Act (Act no. 10 of 2004)

In terms of the Biodiversity Act, the applicant has a responsibility for:

- The conservation of species and ecosystems that need national protection and restriction of activities according to the categorization of the area.
- Promote the application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all development within the area are in line with ecological sustainable development and protection of biodiversity.
- Limit further loss of biodiversity and conserve endangered ecosystems.

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

The National Environmental Management: Waste Act (NEM:WA) came into effect on 1 July 2009, replacing the function of Section 20 of the Environment Conservation Act. On 3 July 2009, the Minister of Water and Environmental Affairs published a list of waste management activities – Category A, which required a Basic Assessment process and Category B, which requires an Impact Assessment process. On the same day, the list of activities requiring Basic Assessment and Impact Assessment processes in terms of the National Environmental Management Act was amended to exclude waste management activities.

The practical result of these legislative actions was that the licensing of a waste management site now falls mostly under the waste management activities under the new NEM:WA law, but also still triggers some of the listed activities of the NEMA: EIA Regulations. Accordingly the Environmental Impact Assessment process is undertaken as one integrated application in terms of both Acts concurrently.

The activities triggered under the **NEMA: Waste Act** are:

Category A(3):

1, 5, 7, 8, 9, 13, 14, 18

1. The storage, including the temporary storage, of general waste at a facility that has the capacity to store in excess of 100m^3 of general waste at any one time, excluding the storage of waste in lagoons.

Comment: Storage will take place at the materials recovery facility, garden waste chipping areas and builder's rubble crushing area.

5. The sorting, shredding, grinding or bailing of general waste at a facility that has the capacity to process in excess of one ton of general waste per day.

Comment: These activities will take place at the materials recovery facility, the chipping of garden waste and the crushing of builder's rubble.

7. The recycling or re-use of general waste of more than 10 tons per month.

Comment: The recycling or re-use of waste may take place if the builder's rubble is used for road construction on site or as cover material or if chipped garden waste is used for composting and rehabilitation purposes. The possibility also remains that other waste materials recovered at the Materials Recovery Facility may be re-used.

8. The recovery of waste including the refining, utilisation, 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 500kg of hazardous waste per day, excluding recovery that takes place as an integral part of an internal manufacturing process within the same premises.

Comment: This activity may refer to the recovery that takes within the Materials Recovery facility, the crushing of builder's rubble and the chipping and composting of garden waste.

9. The biological, physical or physico-chemical treatment of general waste at a facility that has the capacity to process in excess of 10 tons of general waste per day.

Comment: This activity may refer to the crushing of builder's rubble and the chipping and composting of garden waste.

13. The extraction, recovery or flaring of landfill gas.

Comment: This activity was previously listed but it is now clear that due to the negative water balance of the site as it is unlikely that any significant amount of landfill gas will be formed and therefore it is unlikely that the extraction, recovery or flaring of landfill gas will take place.

14. The disposal of inert waste in excess of 25 tons and with a total capacity of 25 000 tons, excluding the disposal of such waste for the purposes of leveling and building which has been authorised by or under other legislation.

Comment: This activity relates to the disposal of builder's rubble on the site.

18. The construction of facilities for activities listed in Category A of this Schedule (not in isolation to associated activity).

Comment: The construction of the activities as listed above.

Category B (4):

9, 10, 11

9 The disposal of any quantity of hazardous waste to land.

Comment: The proposed activity will result in the disposal of hazardous waste to land.

10. The disposal of general waste to land covering an area in excess of $200m^2$.

Comment: The proposed activity will result in the disposal of waste exceeding an area of $200m^2$.

11. The construction of facilities for activities listed in Category B of this Schedule (not in isolation to associated activity).

Comment: The construction of the activities as listed above.

2.7.1 National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) National Domestic Waste Collection Standards

The NEM:WA also stipulates that standards are required to "give effect to the right to an environment that is not harmful to health and well-being" and that this right has to be applied "uniformly throughout the Republic". In order to give affect to this requirement, the National Waste Collection Standards came into effect on 1 February 2011.

The Standards have been compiled to ensure that acceptable, affordable and sustainable waste services are provided to everybody in South Africa. The standards were based on the following principles:

- Equity
- Affordability and availability of resources within municipalities
- Clarity and ease at which the standards can be implemented
- Practicality; and
- Community participation in design applicable and appropriate collections systems

Standards are set for separation at source, collection of recyclable waste, receptacles for the collection of waste, bulk containers, communal collection points and frequency of collection. Furthermore standards are set for the following:

- Drop-off centers for recyclables,
- Collection vehicles,
- Health and safety, communication, awareness creation and complaints, and
- Waste collection customer service standards for kerbside collection.

2.7.2 Principles of the NEM:Waste Act

The principles of waste management as set out in section 16 of National Environment Management: Waste Act, 2008 (Act No. 59 of 2008) have been taken into account in this EIA Process in the following manner:

16(1) a holder of waste must within the holder's power take all reasonable measure to-

- avoid the generation of waste and where such generation cannot be avoided, to minimise the toxicity and amount of waste that are generated;
- reduce, re-use, recycle and recover waste;
- where waste must be disposed of, ensure that the waste is treated and disposed of in an environmentally sound manner;
- manage the waste in such a manner that it does not endanger health or the environment or cause a nuisance though noise, odour or visual impacts;
- prevent any employee or any person under his or her supervision from contravening this Act; and
- prevent the waste from being used for an unauthorised purpose.

The Eden District Municipality is currently investigating options for the implementation of alternative technologies for the reduction of waste prior to disposal throughout the region. The various Municipalities within the Eden District have also implemented actions towards implementation of the waste hierarchy. These action plans are however not included in the current Integrated Waste Management Plans (IWMPs), but the Eden District Municipality has indicated that the IWMPs will be updated and actions plans will be included.

The specific project has made provision for the recovery and recycling of waste from the waste stream through a Materials Recovery Facility, the crushing of builder's rubble and the chipping and composting of garden waste. These activities will mimimise the amount of waste in need of disposal. As part of the EIA process an Environmental Management Programme was developed that covers the Construction and Operational phases of the proposed development. The appropriate design, that is in line with the DWAF Minimum Requirements for Waste Disposal by Landfill in combination with the effective implementation of the EMP as well as compliance with the conditions of authorisation of the licence, is likely to ensure that the landfill is managed in a manner that does not endanger the health of the environment of cause nuisances.

2.7.3 Other requirements of the NEM:WA that have been complied with or addressed

The Eden District Municipality is currently investigating options for the implementation of alternative technologies for the reduction of waste prior to disposal throughout the region. The various Municipalities within the Eden District have also implemented actions towards implementation of the waste hierarchy. These action plans are however not included in the current Integrated Waste Management Plans (IWMPs), but the Eden District Municipality has indicated that the IWMPs will be updated and actions plans will be included.

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

The purpose of the National Heritage Resources Act (NHRA) is to protect and promote good management of South Africa's heritage resources, and to encourage and enable communities to nurture and conserve their legacy so it is available to future generations. Section 38 of the National Heritage Resources Act of 1999 (Act 25) is administered by Heritage Western Cape, the provincial heritage office based with the Department of Arts, Culture Science and Sport of the Provincial Government.

The extent of the proposed development (which will change the character of a site greater than 5 000 m^2 in extent) is captured in terms of Section 38 of the National Heritage Resources Act and falls within the requirements to notify the provincial heritage authority. A Heritage Impact Assessment, Archaeological Impact Assessment, Palaeontological Impact Assessment and Visual Impact Assessment have been included in this EIR in order to address the potential impacts of the proposed waste disposal facility on Heritage resources. The findings of these assessments are included under Chapter 9 and the complete reports are included under Appendix G.

2.9 The Operational Health and Safety Act (Act No. 85 of 1993)

The Operational Health and Safety Act (No. 85 of 1993) is relevant, because it provides for the health and safety of persons at work, in relation to the use of plant and machinery and from hazards to health.

This Act will be relevant to the construction phase and the operational phase of the project.

2.10 The National Environmental Management: Air Quality Act (Act No.39 of 2004)

It is stated in the National Environmental Management: Air Quality Act that the purpose of the Act is to regulate and protect the environment by providing reasonable measures for the prevention of pollution and ecological degradation. It is furthermore stated that ecologically sustainable development must be secured while promoting justifiable economic and social development. The act provides for national norms and standard regulating air quality monitoring, management and control by all spheres of government, for specific air quality measures.

A number of listed activities and associated minimum emission standards identified in terms of Section 21 of the National Environmental Management: Air Quality Act, 2004 were published in the Government Gazette on 31 March 2010.

The National Ambient Air Quality Standards (NAAQS), which were promulgated as part of the National Environmental Management: Air Quality Act (NEMAQA), 2004 (Act No. 39 of 2004) serve as basis for compliance of criteria pollutants (Airshed Planning Professionals, 2012).

The effect that the proposed waste disposal site may have on the air quality was determined through an Air Quality Impact Assessment of which the main findings are summarized in Chapter 9 and the complete assessment is attached under Appendix G. The specialist indicated that since there is no intention to utilise the landfill gas for combustion at this stage, none of the Listed Activities apply to the waste disposal facility. It is therefore not expected to apply for an Atmospheric Emission Licence.

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

In terms of the National Environmental Management: Biodiversity Act (NEM:BA), the applicant has a responsibility for:

- The conservation of species and ecosystems that need national protection and restriction of activities according to the categorization of the area.
- Promoting the application of appropriate environmental management tools in order to ensure integrated environmental management of activities thereby ensuring that all development within the area is in line with ecological sustainable development and protection of biodiversity.
- Limiting further loss of biodiversity and conserving endangered ecosystems.

A national list of ecosystems that are threathened and in need of protection has been published in terms of section 52(1) of the NEM:BA on 9 December 2011. Although this application was submited prior to the publication of this list the impacts on threatened ecosystems have been considered in this EIA process through a Botanical Impact Assessment.

2.12 The Conservation of Agricultural Resources Act (CARA) (No 43 of 1983)

The Conservation of Agricultural Resources Act (CARA) No 43 of 1983 and its regulations make various provisions to conserve agricultural land including provisions to stop the spread of invasive plants, soil erosion, loss of water sources and regulating the various measures used to control these such as burning, biological controls and pesticides.

The regulations apply to control of runoff from the site including flash floods. Since all of the proposed sites are located in agricultural areas, these regulations are relevant. The Deparment of Agriculture indicated during the Scoping phase that diversions of run-off on the proposed sites must be surveyed and plans provided for perusal and approval in terms of the CARA. During the EIR phase the Department of Agriculture supported Site 1.

2.13 Sub-Division of Agricultural Land Act (No 70 of 1970)

Sub-Division of Agricultural Land Act 70 of 1970 was intended to prevent the subdivision of farms into agriculturally non-viable entities. The consent of the Minister of Agriculture is thus needed before a farm could be subdivided. The Department of Agriculture indicated in their comments during the Scoping phase that they will comment to the relevant authorities in terms of the Subdivision of Agricultural Land Act 70 of 1970 and the Land Use Planning Ordinance 15 of 1985.

2.14 Guidelines, policies, standards and forward planning documents

2.14.1 DWAF Waste Management Series

DWAF has published a Waste Management Series consisting of Minimum Requirements (DWAF, 1998) that represent the lowest acceptable standards for:

1. The handling, classification and disposal of hazardous waste;
2. Waste disposal by landfill; and
3. The monitoring of water quality at waste management facilities.

The Minimum Requirements guidelines provide standard criteria to landfill developers, owners and operators in accordance with which the relevant landfill site should pose the lowest level of threat to the surrounding environment.

The Minimum Requirements will guide both DEAT or DEA&DP and DWAF in their decision-making for the establishment of a new regional site for Eden District Municipality. The Minimum Requirements are not however legally binding documents. Where there is an inconsistency between the Minimum Requirements and legislated requirements, for example in the public participation process described, the latter will be followed.

2.14.2 DEAT and DEA&DP Guideline documents

This EIA will be undertaken in compliance with the guideline documents for EIA processes and Public Participation, as produced by DEA&DP and draft guidelines will also be taken into consideration. The DEAT Information Series will also be considered during this process.

DEA&DP guidelines:

- Guidelines for Environmental Management Plans (DEA&DP, 2005)
- Guidelines for Involving Specialists in EIA Processes (2005)
- Guideline for Determining the Scope of Specialist Involvement in EIA Processes (2005)

- Guideline for the Review of Specialist Input into the EIA Process (2005)
- Guideline for Involving Biodiversity Specialists in EIA Processes (2005)
- Guideline for Involving Heritage Specialists in EIA Processes (2005)
- Guideline for Involving Hydrogeologists in EIA Processes (2005)
- Guideline for Involving Social Assessment Specialists in EIA Processes (2005)
- Guideline for Involving Economists in EIA Processes (2005)
- Guideline for Involving Visual and aesthetic specialists in EIA processes (2005)
- Guideline on Need and Desirability (2011)
- Guideline on Alternatives (2010 and 2011)
- Guideline on Public Participation (DEA&DP 2010 & 2011)

DEAT Information Series: Integrated Environmental Management

- Scoping
- Stakeholder Engagement
- Specialist Studies
- Impact Significance
- Cumulative Effects Assessment
- Environmental Management Plans
- Environmental Reporting
- Environmental Impact Reporting
- Biodiversity Assessment

2.14.3 Integrated Waste Management Plans

The Integrated Waste Management Plans (IWMPs) of the individual Municipalities (Bitou, George, Hessequa, Knysna and Mossel Bay) within the District as well as the Eden District Municipality were briefly reviewed to determine whether the recommendations within the IWMP's are inline with the proposed regional waste disposal facility. The IWMPs were dated as follows: Bitou (June 2006), George (November 2005), Hessequa (June 2006), Knysna (June 2006) and Mossel Bay (June 2006).
It was clear from the IWMPs of Bitou, Mossel Bay, Knysna and George that there is a need for a new disposal site as the site for Bitou Municipality is reaching the end of its capacity and the contract for disposal with PetroSA is nearing the end of its validity period. The Hessequa Municipality's IWMP indicates that certain upgrades of existing landfill sites are required.

The IWMPs of Bitou, George, Knysna and Mossel Bay all included amongst other recommendations, the option of a regional waste disposal site.

2.14.4 Eden Spatial Development Framework

The Municipal Systems Act, 2000 (Act 32 of 2000) makes statutory provision for the drafting of an Integrated Development Plan (IDP) for holistic forward planning of development in defined areas of jurisdiction. The Act also requires municipalities to prepare a Spatial Development Framework (SDF) to supplement, or to form the basis of the IDP. In the past, various plans such as guide plans, structure plans, spatial plans, etc. were prepared. Presently one definition and a mutually accepted format are used namely a Spatial Development Framework. An SDF does not grant any rights pertaining to land use, nor take any rights away.

The SDF has also identified strategic spatial issues that need attention, which includes the establishment of a regional waste disposal site. In its sustainable building policy the SDF placed emphasis on the source separation of waste in order to minimize waste disposal at landfill. Suggestions were made on potential strategies that may be implemented in order to make source separation of waste as easy as possible for residents.

A number of studies, investigations, plans, projects and initiatives have been identified to help to achieve the long term vision expressed in the conceptual framework and applied in the spatial development framework. Detailed terms of reference have been developed for each of these projects. There are a number of initiatives underway in the District that has direct implications for the SDF. As far as possible proposed actions, projects and initiatives should utilise or build on existing initiatives. The investigation into a regional waste disposal site is one of these initiatives (MCA, 2009).

2.14.5 Mossel Bay Integrated Development Plan and Spatial Development Framework

The Mossel Bay Spatial Development Framework (SDF) forms an integral part of the Integrated Development Plan (IDP), covers the whole of the municipal area and is prepared in compliance with Section 26(e) of the Municipal Systems Act (Act No. 32 of 2000).

While the IDP identifies the spatial needs of a community, the SDF attempts to provide for the integration of those spatial needs, so as to ensure that the general well-being of the community as well as the orderly planning of the area is promoted in a sustainable manner.

Once approved in terms of Section 30 of the Municipal Systems Act, the SDF becomes part of the IDP. The SDF is aligned with the strategies and objectives reflected in the SDF's and IDP's prepared at National and Provincial level, as well as with the District and adjoining Local Municipal SDF's and IDP's (TV3, 2008).

The Mossel Bay Municipal IDP vision is based on the following points of departure:

- Good and accessible basic municipal services are to be provided for all within a dynamic, growing economy.

- Poverty is to be addressed by creating access to land and housing; job opportunities and health thereby creating a community where disadvantaged groups are participating actively in society and the economy.
- A vibrant society where people participate actively in the affairs of the municipality and their community must be encouraged.
- The municipality must function as an excellent municipal service provider, which operates with a culture of transparency and accountability which can be trusted.
- All areas in the Mossel Bay Municipality must be improved to form part of an attractive, safe, clean and healthy place, sought after by its many visitors and investors, and thereby creating a quality of life that is recognised as a secure and appealing place to live work, holiday and invest.

The priorities underpinning the IDP are as follows:

- Priority to the basic needs of the community.
- Community participation and involvement in development.
- The creation of integrated, liveable and compact urban settlements (formal and informal).
- Affordability and sustainability
- Poverty alleviation, gender equity and special needs groups' attention.
- Environmental soundness and sustainability.
- Economic growth and job creation.

The broad spatial implications, challenges and priorities arising from the IDP vision, objectives, strategies and key challenges provide the context for and form the basis of the SDF.

The following key spatial challenges were identified in the IDP:

- Redirecting growth and development towards the previous disadvantaged areas and areas of economic opportunity while focusing on the redevelopment of deteriorating areas within the Municipal Area;
- Capitalising on the established urban-rural linkages;
- Integrating urban areas and introducing higher density developments and mixed uses;
- Addressing the issue of land ownership and land reform;
- Alleviating poverty and creating economic opportunities;
- Ensuring the sustainable use of resources and the integration of environmental, land use and transport management systems;
- The impact of HIV/AIDS and planning timeously for the social and economic problems associated with it;

- The quality of municipal services in some areas is a problem, particularly infrastructure to enable the use of technology.

Spatial development objectives

The spatial development objectives in the SDF that have particular relevance to the proposed Regional Waste Disposal site are the following:

- Provision of affordable and sustainable levels of housing, services and infrastructure.
- Ensuring alignment of the Mossel Bay SDF with other national, provincial and local policies and SDF's.
- Encouragement of appropriate development in the Mossel Bay region, but within the confines of acceptable environmental impact (TV3, 2008).

In the spatial development policy section of the SDF it is stated that non-agricultural development could be considered in agricultural areas on condition that such development will significantly contribute to promote environmental sustainability and or serve to stabilise the agricultural practice itself (TV3, 2008). This policy has relevance to all three of the proposed sites as all three sites fall within agricultural areas and are zoned as Agriculture. Site 1 has a slight exception in that it is bordered by a combination of agricultural land uses as well as industrial land uses.

The natural environment policy guidelines include, but are not limited to the following:

- To prevent development from taking place on geological unstable formations
- To protect the natural and heritage qualities / features contributing towards aesthetic quality, identity and sense of place from indiscriminate development.
- To protect sensitive vegetation habitats (TV3, 2008).

These policy guidelines have been considered in the site selection process and during the Scoping phase and have been investigated in greater detail during the EIR phase through specialist investigation.

Under the proposals for Community facilities in the Mossel Bay SDF it was indicated that current planning dictates the provision of a system of waste transfer station and the provision of regional based landfill waste facilities. It was also proposed that other strategies should include the separation of various types of waste, as well as recycling of waste material (TV3, 2008).

In order to contextualize the proposed sites, proposals are listed, arising from the Mossel Bay SDF (Volume I: Proposals: Section E Spatial Development Proposals: Paragraph 9: Urban land use proposals) prepared for the Eden District Municipality, which include, but are not limited to the following:

- Establishing Mossel Bay as the industrial core of the Garden Route / Southern Cape;
- Capitalising on the existence of infrastructure such as the Mossel Bay Harbour, railway line, N2-route and George airport;
- The strengthening of existing linkages and the planning of new linkages between the three main industrial development focus points namely PetroSA (Mossgas), Mossel Bay harbour and the Voorbaai industrial area. This includes the investigation into establishing a heavy goods vehicle route link between Voorbaai and PetroSA as well as the establishment of Louis Fourie Road as a freight access and heavy goods vehicle route between Mossel Bay harbour and Voorbaai; and
- The development of an industrial corridor between Voorbaai and Moss Industria based on the existing railway link as well as the proposed heavy goods vehicle route link.

The above recommendation with regard to the development of an industrial corridor between PetroSA and Voorbaai is tied to the future viability of PetroSA (Mossgas) (TV3, 2008).

As there is a proposal to establish Mossel Bay as the industrial core of the Garden Route, the proposed Regional Waste Disposal Sites within the Mossel Bay Municipality would be in line with the SDF. It is further proposed that Site 1 may have a locational advantage above Sites 2 and 3 due to its proximity to the proposed vehicle linkages and industrial corridor between PetroSA, Mossel Bay harbour and the Voorbaai industrial area.

In terms of the urban land use proposals in the SDF and specifically the community facilities, current planning dictates the provision of a system of waste transfer stations and the provision of a regional based landfill site.

The SDF further emphasizes the importance of the gateway to the Garden Route where the N2 changes direction at the Louis Fourie interchange and where the first view of the coastline is established (TV3, 2008). The SDF also proposes protection of the N2 against intrusive land uses which may obstruct views of natural features and the coastline (SRK, 2012). Site 1 is located before this point however it is still very important that the proposed waste disposal facility does not have highly significant negative visual impacts. A visual impact assessment was performed in order to assess the potential visual impacts of the proposed regional waste disposal site.
The three sites proposed for a Regional waste disposal facility are all located outside the urban edge.

Site 1 is located to the west of PetroSA. The SDF indicates potential growth of the Industrial area to the east of PetroSA, therefore the use of Site 1 as a waste disposal site will not impact on the growth of the industrial node. The Eden District Municipality: Strategic Planning Services also indicated that the Guide Plan for the Mossel Bay/Riversdale Subregion (1994) still remains relevant. This document indicates that the area surrounding PetroSA has been indicated as industrial landuse. To the west of PetroSA the industrial landuse extends to approximately just before the turn-off to Vlees Bay from the N2. A landuse planning application will have to follow the EIA process.

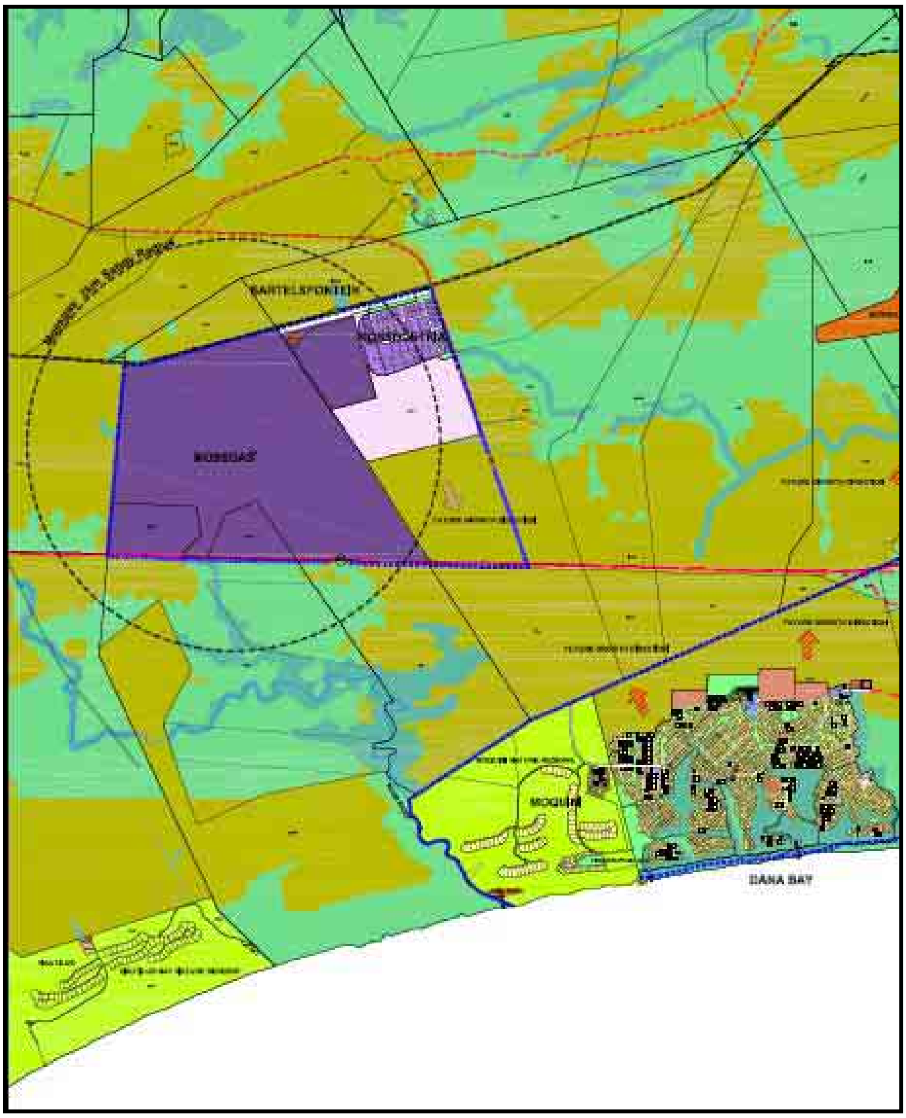

Figure 2.1 Extract from the Mossel Bay SDF documents (TV3, 2008), indicating the future industrial growth direction close to PetroSA with the pink arrow.

2.14.6 Provincial Spatial Development Framework (PSDF)

The Western Cape Provincial Spatial Development Framework is a very broad scale, provincial policy document. The report encourages the practices of recycling, composting and waste minimisation (CNdV Africa 2005).

Objective 9 of the PSDF (2009) addresses the consumption of scarce environmental resources and this objective has particular relevance to waste management in the Province. A number of policies have been compiled under this objective relating to waste management, which reads as follows:

RC32: All municipalities should follow an integrated hierarchical approach to waste management i.r.o. avoidance, reduction, reuse,

RC34: Material recovery facilities should be established at all transfer stations.

RC36: Every urban settlement should have a transfer station within a maximum of 5km from the town centre, inside the urban edge. These transfer stations should be properly managed according to best practice so as to minimise nuisance to surrounding neighbours. They should also be open after hours and on weekends and their locations should be well publicised so as to ensure that they are used by the community. Furthermore, charges should not be levied on loads brought to transfer stations. Micro enterprises wanting to process waste and trade second hand materials on site should be encouraged.

RC37: Every municipality should have waste management facilities located and operated according to DWAF's minimum requirements that will service the transfer stations in the urban settlements in that municipality. These sites may or may not be located within the urban edge of urban settlements. The main criteria for their location will be to meet satisfactory environmental and transport requirements.

RC27 specifically advocates the promotion of re-use of materials. The builder's rubble crushing, materials recovery facility and composting area that are proposed will be in line with RC27.

The proposed regional disposal facility is in line with RC32 in terms of the recovery of recyclable items at the MRF, the composting of waste, the crushing of construction and demolition waste for re-use as road building material and finally providing in landfill airspace for final disposal. Eden District Municipalities will encourage the local Municipalities to meet the requirements of the waste hierarchy and in general there is pressure on the local Municipalities to reduce the amount of waste that is disposed at landfill in order to limit the transport costs.

2.15 Competent Authorities for Decision

The competent authority for the decision in terms of the National Environmental Management Act (NEMA), (Act 107 of 1998), and the National Environmental Management Waste Act (NEMWA), 2008 (Act 59 of 2008) is the National Department of Environmental Affairs (DEA). It has been agreed by the National Department of Environmental Affairs and the Provincial Department of Environmental Affairs and Development Planning (DEA&DP) that the DEA&DP will process this application and will send their recommendations and draft environmental authorisation to the DEA for final decision-making. These agreements were reached due to the fact that the application was submitted prior to the promulgation and coming into effect of the listed activities under the NEMWA. As the application includes hazardous waste activities the National Department of Environmental Affairs is the competent authority that should issue the licence, although the application will be processed by the DEA&DP. The agreement was reached during August and September 2009 and confirmed with the Department in October 2012.

The competent authority for the decision in terms of the National Heritage Resources Act (Act 25 of 1999) is Heritage Western Cape.

The Department of Water Affairs will play a commenting role in the NEM:WA process and their conditions must be included in the licence. The National Department of Water Affairs will issue and ROD for inclusion in the environmental authorization.

CHAPTER 3: STUDY APPROACH AND METHODOLOGY

3.1 Introduction

There are distinct phases in the EIA process, as required in terms of NEMA, namely the Initial Application, the Scoping Report and the EIA Report phases. A process flow diagram of the EIA process is presented in Figure 3.1.

3.1.1. Initial Application Phase

The Initial Application phase entails the submission of the Application Form under both the NEMA: EIA Regulations as well as the NEM:WA to the DEA&DP. The acknowledgement letter of the application from the DEA&DP, with a reference number, is attached in Appendix F.

The objective of this phase is to inform the DEA&DP of the proposed project and to consult with the Department to ensure that the correct application process is followed.

3.1.2. Scoping Phase

The Scoping phase of the study aims at identifying of the potential environmental impacts resulting from the implementation of the proposed activity. Once these potential impacts are identified, those impacts that require further investigation in the EIR phase are described.

The Scoping phase furthermore aims at identifying feasible alternatives related to the proposed activity. Finally the Scoping phase must provide reasonable opportunity for I & APs to be involved in the process and also to ensure that the relevant authorities can make well-informed, transparent and accountable decisions.

This report is the outcome of the Scoping phase.

The Draft Scoping Report was published for a 40-day period for comment by I&APs and a notification letter was sent to all registered I & APs to inform them of the release of the Draft Scoping Report and where the report can be reviewed. After closure of the comment period and consideration of the comments, the report was updated into a Final Scoping Report. Comments received on the Draft Scoping Report were incorporated into a Comment and Response Report that was appended to the report. The Final Scoping Report was made available to the registered I & APs for a minimum period of 21 days. The comments received during this period will be submitted to DEA&DP for consideration.

Scoping Phase

Compile Application Forms and submit to the DEA&DP. Receive acknowledgement letter.

Advertise the proposed development, distribute BID for review & invite registration & comment of I & APs. 40 day comment period.

Assimilate comments on BID and respond the registered I & APs.

Prepare Draft Scoping Report (DSR) & Draft Plan of Study for draft EIR (PoSdraft EIR).

Notify registered I & APs & relevant authorities of the availability of the DSR & Draft PoSdraft EIR for review (minimum 40 days).

Assimilate comments on DSR & Draft PoSdraft EIR & respond to registered I & APs. Prepare FSR & PoSdraft EIR.

Notify registered I & APs & relevant authorities of the availability of the FSR and PoSdraft EIR for 21 days.

Assimilate comments on the FSR & PoSdraft EIR.
Submit to the DEA&DP for acceptance.

Environmental Impact Reporting Phase

Commission specialist studies.

Compile Draft draft EIR. Notify registered I & APs & relevant authorities of the availability of the Draft draft EIR for 40 days. Host information sharing meeting.

Assimilate comments on Draft draft EIR & respond to registered I & APs. Prepare Final draft EIR

Notify registered I & APs & relevant authorities of the availability of the Final draft EIR for 21 days

Assimilate comments on the Final draft EIR. Submit to the DEA&DP for decision-making.

Distribute the DEA&DP decision to registered I & APs.

Appeal period.

Figure 3.1: Process flow diagram of the EIA process.

Activities undertaken	Date
Site selection process.	2008
Prior to the start of the EIA process the Eden District Municipality placed notices in both Afrikaans and English in the Mossel Bay Advertiser, the George Herald, the Knysna-Plett Herald, the Oudtshoorn Courant and the Riversdal Forum in which the Eden District Municipality informed the public of their intent to investigate potential sites for waste disposal. Potential Interested and Affected Parties (I & APs) were invited to forward their details to the Eden District Municipality.	2-6 June 2008
Submission of the Application form to the DEA&DP.	6 May 2009
Acknowledgement letter from the DEA&DP	19 June 2009
Meeting with the DEA&DP: Directorate Integrated Environmental Management and Directorate: Waste Management.	9 July & 8 September 2009
Correspondence with the National Department of Water and Environmental Affairs.	19 August 2009
The proposed activity was advertised in the following newspapers: Die Burger, The Cape Times, Knysna-Plett Herald and The Mossel Bay Advertiser.	17 – 18 September 2009
Site notices were placed on the individual sites.	16 September 2009
Notices were placed at Albertinia and Gouritsmond Public Libraries.	16 September 2009
The Background Information Document (BID) was placed in the following Public Libraries: Albertinia, George, Gouritsmond, Knysna, Mossel Bay, Plettenberg Bay and Riversdale.	16 September 2009
The Background Information Document (BID) was placed in the following Municipal offices: Bitou, George, Knysna, and Mossel Bay.	16 September 2009
The BID was also placed on the following website: www.pdna.co.za	16 September 2009
40 day comment period	21 September 2009 – 30 October 2009
Compilation of Issues and Response table	December 2009 – January 2010
Distribution of Issues and Response table	31 March 2010
Stakeholder meeting	14 April 2010
Notes on the meeting were sent to all that attended the meeting.	3 May 2010
Compilation of the Draft Scoping Report and Plan of Study for Environmental Impact Assessment.	January – June 2010
Release of Draft Scoping Report and Plan of Study for Environmental Impact Assessment for comment	5 July – 23 August 2010
Facilitate comments from authorities	September 2010
Compilation of Issues and Response table	October 2010
Compilation of Final Scoping Report and Plan of Study for Environmental Impact Assessment	November 2010
Release of Final Scoping Report and Plan of Study for Environmental Impact Assessment for comment	10 May 2011
Submission of Final Scoping Report and Plan of Study for Environmental Impact Assessment to DEA&DP	19 May 2011
Second notification of availability of Final Scoping Report	27 June 2011

Submission of comments received to DEA&DP	2 August 2011
Acceptance of Final Scoping Report and Plan of Study for Environmental Impact Assessment	26 September 2011
Completion of Specialist Assessments and reports	Jan - April 2012
Request preliminary inputs from the Department of Water Affairs and CapeNature	6 December 2011
Update registered I&APs of the progress	21 January 2012
Finalise site layouts and other technical information	April – May 2012
Finalise draft EIR and associated documentation	June 2012
Notification and registration of additional I&APs	Throughout the EIA process.
Notify Registered I&APs of availability of the Draft EIR and invitation to open house and meeting. Attach the Executive summary of the Draft EIR with the notification letter.	16-20 July 2012
Send out invitations to focus group meeting	16 July 2012
Advertise availability of draft EIR and Open House Meeting in the press (Die Burger, Mossel Bay Advertiser, Knysna/Plett Herald).	12 & 13 July 2012
The Draft EIR was available at the following locations: 1. Libraries: Albertinia, Mossel Bay, George, Knysna, Plettenberg Bay 2. Websites: www.pdna.co.za, www.jpce.co.za 3. Electronic versions on request from the EAP	
Host Open House Meeting and focus group meeting	31 July 2012
Send out reminder to authorities that the closing date for comments is due.	20 August 2012
Official closing date for comments: 3 September although certain I&APs were granted an extension of this date.	3 September 2012
Follow-up on late authority comments	3-19 September 2012
Last comments on DEIR received	20 September 2012
Address comments in the form of an issues and response table	1 October – 19 October 2012
Compile Final EIR	8-26 October 2012
Final approvals from project consultant, engineers and applicant and printing	26 Oct – 7 November 2012
Placement of Final EIR in libraries and website	8-16 November 2012
Notify Registered I&APs and release Final EIR for comment	
Submit Final EIR and comments to the DEA&DP	January 2013

Table 3.1: Tasks undertaken to date and expected future activities.

3.1.3. Environmental Impact Report Phase

During the EIR phase of the process, the environmental impacts of the practical and feasible alternatives that were carried forward from the Scoping phase are comparatively assessed. The assessment of Alternatives includes the "No-Go" or no development option.

The environmental impacts that required further investigation was assessed through specialist studies. Environmental impacts identified that required further investigation by Specialists are the following:

- Botanical Impact Assessment
- Freshwater Ecological inputs
- Avi-faunal inputs
- Heritage Impact Assessment
- Visual Impact Assessment
- Archaeological Impact Assessment
- Palaeontological Impact Assessment
- Geohydrological Impact Assessment
- Socio-economic Impact Assessment
- Roads and Traffic Impact Assessment
- Air Quality Impact Assessment

The Terms of Reference for these studies are included in Appendix G. A recognised methodology was applied to assess the significance of the potential environmental impacts of the proposed Regional Waste Disposal Site.
The EIA process has identifed and assessed the impacts arising from the construction and operation of the proposed activity. The findings of the impact assessment phase are now presented in the Environmental Impact Report (EIR). The specialist studies are included as Appendices to the EIR.

The Draft EIR were made available for a 40-day I & AP comment period and a notification letter was sent to all registered I & APs to inform them of the release of the Draft EIR and where the report can be reviewed. After closure of the comment period, the report was updated into a Final EIR. Comments received on the draft EIR were incorporated into a Comment and Response Report is appended to the Final EIR. The Final EIR will then be made available for further comment by the registered I & APs for a period of 21 days. The comments received during this period will be submitted to DEA&DP for consideration and decision-making. The decision taken by DEA&DP will be forwarded to the National Department of Environmental Affairs for final approval and registered I&APs will be notified of the decision and their right to appeal.

3.1.3.1 Methodology

This section outlines the proposed method for assessing the significance of the potential environmental impact. The potential environmental impacts include cumulative, operational- and construction phase impacts.

For each of the two project phases (construction and operation), the potential future impacts (both positive and negative) associated with the proposed development must be indicated using the criteria provided below in the tabular format.

Scale

Scale is an indication of the physical and spatial size of the impact. This is classified on the following scale:

Local	The impacted area extends only as far as the activity itself, e.g. a footprint
Site	The impact could affect the whole, or a measurable portion of the site.
Off-site	The impact could affect the area surrounding the development, including the neighbouring properties.
Regional	The impact would affect the broader region (e.g. neighbouring towns) beyond the boundaries of the adjacent properties.
National	The impact would affect the whole country (if applicable)

Table 3.2: Definitions of the ratings for scale.

Duration

Duration refers to the time frame over which the impact is expected to occur, which is measured in relation to the lifetime of the proposed project.

Short term	The impact will either disappear with mitigation or will be mitigated through a natural process in a period shorter than 2 years.
Medium term	The impact will last up to the end of the construction phase, where after it will be entirely negated.
Long term	The impact will continue for the entire operational lifetime of the development, but will be mitigated by direct human action or by natural processes thereafter.
Permanent	This is the only class of impact that will be non-transitory. Such impacts are regarded to be irreversible, irrespective of what mitigation is applied.

Table 3.3: Definitions of the ratings for duration.

Intensity

Intensity refers to the degree or extent to which the impact alters the functioning of an element of the environment or a life-support service that is provided by the environment. Intensity is classified on the following scale:

Low	The impact alters the environment in such a way that the natural processes or functions can continue with virtually no affect.
Medium	The affected environment is altered, but functions and processes continue, albeit in a modified way.
High	Functions or processes of the affected environment are disturbed to the extent where they cease completely.

Table 3.4: Definitions of the ratings for Intensity.

Probability

Probability describes the likelihood of the impacts actually occurring (based on previous experience with similar projects or based on professional judgement). The probability classes are rated on the following scale:

Improbable	The possibility of the impact occurring is very low, due either to the circumstances, design or experience.
Probable	There is a possibility that the impact will occur to the extent that provisions must therefore be made.
Highly probable	It is most likely that the impacts will occur at some stage of the development. Plans must be drawn up to mitigate the activity before the activity commences.
Definite	The impact will take place regardless of any prevention plans.

Table 3.5: Definitions of the ratings for Probability.

Determination of significance - without mitigation

Significance is determined through a synthesis of the above impact characteristics, and is an indication of the overall importance of the impact. The significance of the impact "without mitigation" is the prime determinant of the nature and degree of mitigation required and is one of the most important factors to take into account during decision-making. Significance is rated on the following scale:

No significance	The impact is not substantial and does not require any mitigation action.
Low	The impact is of little importance, but may require limited mitigation.
Medium	The impact is of importance and is therefore considered to have a negative impact. Mitigation is required to reduce the negative impacts to acceptable levels.
High	The impact is of great importance. Failure to mitigate, with the objective of reducing the impact to acceptable levels, could render the entire development option or entire project proposal unacceptable. Mitigation is therefore essential

Table 3.6: Definitions of the ratings for Significance without mitigation.

In deciding on the significance, the specialist must take into account all the impact criteria including scale, duration, intensity and probability. When taking into account the influence of scale on significance, it must be borne in mind that an impact with a small scale does not necessarily imply that the impact can be regarded as insignificant. In spite of small scale, some impacts, by their nature or intensity, must be still be regarded as highly significant.

Determination of significance - with mitigation

This is the predicted significance of the impact after the successful implementation of the suggested mitigation measures. Significance with mitigation is rated on the following scale:

No significance	The impact will be mitigated to the point where it is regarded to be insubstantial.
Low	The impact will be mitigated to the point where it is of limited importance.
Medium	Notwithstanding the successful implementation of the mitigation measures, the impact will remain of significance. However, taken within the overall context of the project, such a persistent impact does not constitute a fatal flaw
High	Mitigation of the impact is not possible on a cost-effective basis. The impact continues to be of great importance, and, taken within the overall context of the project, is considered to be a fatal flaw in the project proposal

Table 3.7: Definitions of the ratings for Significance with mitigation.

Confidence

Confidence describes the level of certainty that specialists have in the accuracy of their predictions with respect to any of the assessment criteria (and by implication, with respect to significance). Should there be any factors that could bring into doubt the accuracy of the predictions (e.g. red data species searches undertaken outside of the flowering season or key research data being unavailable) this compromises the level of confidence in the assessment of an impact. Confidence must be indicated according to the following scale:

Low	The prediction is made in the absence of key information. There is a high degree of uncertainty associated with the prediction of the impact.
Medium	The majority of the necessary information for predicting the impact was available. There is some uncertainty associated with the prediction of the impact.
High	Virtually all the necessary information for predicting the impact was available, with exception of insignificant pieces of information that would not materially affect the outcome of the prediction.
Definite	All necessary information was available for the prediction of the impact. There is no uncertainty associated with the prediction of the impact.

Table 3.8: Definitions of the ratings for confidence.

3.2 Assumptions and Limitations

This Environmental Impact Assessment Report is based on site visits, consultation with and information provided by interested and affected parties, the applicant, the project engineers and the specialist reports and communication with specialists.

A brief overview is given below of assumptions and limitations that may have an impact on the environmental impact assessment process:

- It is assumed that information regarding the technical and specialist information provided to Anél Blignaut Environmental Consultants, is based on the latest available data, is as accurate as possible and is made available timeously. This EIR is limited by the information made available to Anél Blignaut Environmental Consultants at the time of writing.
- The EAP is not a planning professional and therefore the Department Strategic Planning Services of the Eden Districty Municipality was requested to review and confirm that the information pertaining to the local planning documents contained in this Environmental Impact Report is correct.
- It is assumed that the Eden District Municipality will appoint a responsible professional management operator to manage the waste site that will implement good waste management practice in general and the recommendations of this Impact Assessment and Environmental Management Programme in particular. Some waste sites in the Western Cape are managed in a compliant and responsible manner and many not. The significance of impacts with mitigation in this report will only hold provided that the operator actually consistently implements the recommended mitigation.
- It is assumed that all the Registered Interested and Affected Parties have submitted their comments within the specified timeframes for consideration in this report.
- It is assumed that the information provided by the Eden District Municipality regarding the landowners and occupants of the proposed sites and the adjacent properties to the alternative sites is correct and up to date.
- The study is limited by the available information contained in the specialist reports. Specifically, the assessment of the upgrades of access roads to Site 2 was limited to the available information as contained in this report. The upgrade of the Provincial and District roads as well as the construction of new roads over privately owned land were not included in the detailed assessments as Site 2 is not the preferred option for the reasons as explained in this EIR and also the upgrade of existing roads and construction of new roads to this site is expected to make it even less favourable and therefore it is argued that no detailed assessment is required. The access to the Sites 1, 2 and 3 were however assessed in the Traffic Impact Assessment. Please refer to the arguments in this regard under paragraph 9.14.

- It is assumed that the closest residential area to Site 1 is a development called Nautilus Bay and the closest residential areas to Sites 2 and 3 are the residential areas in the town of Herbertsdale. The distances to the residential areas presented in this report are estimates only.

The specialists also indicated specific assumptions and limitations in their respective reports, which are listed below (directly extracted from the respective reports).

3.2.1 Archaeological Impact Assessment

Assumptions

- The archaeological scoping assessment is based on background information supplied by PD Naidoo & Associates Consulting Engineers (Pty) Ltd.
- The maps and aerial photographs supplied by PD Naidoo & Associates Consulting Engineers (Pty) Ltd are assumed to be correct.

Constraints and limitations

More than 98% of the receiving environment in Eden 1 and Eden 3 comprises transformed agricultural lands and therefore access to the two candidate sites was very easy. Archaeological visibility on the ground was also high.

It should be noted that the boundary for Eden 3 has since been expanded (refer to Figure 30). The expanded area has not been searched for archaeological remains.

Much of Eden 2 (Elandsdans No. 206/2), however, is covered in thick natural veld while the southern portion is infested with alien vegetation, resulting in extremely poor archaeological visibility. The botanical assessment (Helme 2009) has identified the farm as having high botanical sensitivity and that the site should not be considered as a potential landfill site.

It should also be noted that Eden 2 has, since the 2009 study, been moved further to the east and expanded (refer to Figure 17). The original Eden 2 site has therefore been screened out of the proposed development. The proposed new site was not searched for archaeological remains and this can also been seen as a limitation to the study.

3.2.2 Palaeontological desktop study

In inferring the palaeontological sensitivity of rock units underlying a development from field and other data obtained outside the study area it is assumed that fossil heritage is fairly uniformly distributed throughout the outcrop area of a given formation. Experience shows that this assumption does not always hold. This is because the original depositional setting across a formation that may extend over hundreds of square kilometres may vary significantly, with palaeo-ecological implications (*e.g.* from a shallow to deeper water environment), while fossils are often patchy in their occurrence. Furthermore, the levels of tectonic deformation (folding, cleavage development *etc*), as well as the intensity and nature of metamorphism and weathering experienced by a given formation may change markedly across its outcrop area. These factors may seriously compromise the preservation of fossil remains present within the original sedimentary rock.

Limitations

The accuracy and reliability of palaeontological desktop studies as components of heritage impact assessments are generally limited by the following constraints:

1. Inadequate database for fossil heritage for much of the RSA, given the large size of the country and the small number of professional palaeontologists carrying out fieldwork here. Most development study areas have never been surveyed by a palaeontologist.
2. Variable accuracy of geological maps which underpin these desktop studies. For large areas of terrain these maps are largely based on aerial photographs alone, without ground-truthing. The maps generally depict only significant ("map able") bedrock units as well as major areas of superficial "drift" deposits (alluvium, colluvium) but for most regions give little or no idea of the level of bedrock outcrop, depth of superficial cover (soil etc.), degree of bedrock weathering or levels of small-scale tectonic deformation, such as cleavage. All of these factors may have a major influence on the impact significance of a given development on fossil heritage and can only be reliably assessed in the field.
3. Inadequate sheet explanations for geological maps, with little or no attention paid to palaeontological issues in many cases, including poor locality information;
4. The extensive relevant palaeontological "grey literature" - in the form of unpublished university theses, impact studies and other reports (*e.g.* of commercial mining companies) - that is not readily available for desktop studies;
5. Absence of a comprehensive computerized database of fossil collections in major RSA institutions which can be consulted for impact studies.

In the case of palaeontological desktop studies without supporting field assessments these limitations may variously lead to either:

(a) *underestimation* of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or

(b) *overestimation* of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by tectonism or weathering.

Since most areas of the RSA have not been studied palaeontologically, a palaeontological desktop study here usually entails *inferring* the presence of buried fossil heritage within the study area from relevant fossil data collected from similar or the same rock units elsewhere, sometimes at localities far away. Where substantial exposures of bedrocks or potentially fossiliferous superficial sediments are present in the study area, the reliability of a palaeontological impact assessment may be significantly enhanced through field assessment by a professional palaeontologist.

3.2.3 Visual Impact Assessment

As is standard practice, the visual specialist study is based on a number of assumptions and is subject to certain limitations, which should be borne in mind when considering information presented in this report:
Visual impact assessment is not, by its nature, a purely objective, quantitative process and depends to some extent on subjective judgments. Where subjective judgments are required, appropriate criteria and motivations have been clearly stated.
The available background information on the proposed sites and development was very limited.

The boundaries of some of the proposed sites changed subsequent to the site visit conducted by the specialist. The boundaries of Site 3 expanded, while Site 2 was moved to the east and expanded. As such, observations obtained during the site visit might not entirely cover issues related to the expanded / enlarged sites. However, it is believed that the site visit did provide sufficient information to adequately assess the revised location of the sites.

The assessment is based on the drawings supplied by PDNA. These indicate the general layout and maximum height of the landfill and some associated structures. Detailed design and operational aspects have therefore not been considered in the assessment. The viewshed calculation was undertaken using 5 m contour intervals and was based on the indicated maximum landfill height of 12 m. The viewshed indicates the area from which the proposed landfill is likely to be visible. It does not take local undulations and man-made structures into account.
This means that the proposed landfill will not be visible from everywhere within the viewshed, i.e. from some places, the landfill may be obscured by vegetation or local variations in topography. It therefore indicates a "worst case" scenario.

This specialist study does not provide motivation for or against the proposed landfill site, but rather seeks to give insight into the visual character and quality of the area, its visual absorption capacity and the potential significance of the visual impacts created by the proposed development in order to evaluate these impacts from a visual perspective. However, in the event that unacceptable visual impacts are identified, this will be clearly indicated in the report.

3.2.4 Traffic Impact Assessment

None listed.

3.2.5 Socio-economic Impact Assessment

None indicated.

3.2.6 Botanical Impact Assessment

The study area maps provided were not aerial images with clearly defined site boundaries (see Figure 1), and thus it was assumed that a certain degree of latitude (approximately 50m) was acceptable in interpretation of these boundaries on the ground. In certain instances these appeared to correspond with fencelines, in which case the boundary was assumed to follow the existing fencelines. No indication was given prior to this study of where possible access roads would be located, and it was thus assumed that all new roads would be located within the development footprints provided. It is also assumed that any and all other infrastructure associated with the landfill construction and operational requirements would be located within the designated study areas.

The site visit was undertaken during a very dry season (late May 2009), and consequently very little was flowering, and few bulbs or annuals were evident. Certain bulbs were however evident, at least in early leaf stage. Along with my previous experience in the area (see References) it was thus assumed that it was possible, using a habitat based approach, supplemented by the available species information and conservation planning products (see References), to make a sufficiently accurate assessment of vegetation conservation value on the three alternative sites.

The No Go alternative was not defined by the development team, other than to note that it was not a feasible option in its current form, which is waste disposal at PetroSA, as the site is needed by the landowner and the waste disposal contract will not be renewed (Anel Blignaut Environmental Consultants 2011). As there is no usable definition of the No Go alternative for this project it is thus largely impossible to assess the likely botanical impacts thereof, and it is thus assumed that normal agricultural activities (mainly livestock grazing) would be likely under this scenario. Similarly, no definition was provided of what exactly is meant by cumulative impacts in the context of this project, as there are no other regional waste site proposals.

3.2.7 Freshwater ecological inputs

None listed

3.2.8 Avi-faunal inputs

None listed

3.2.9 Hydrogeological Impact Assessment

Assumptions

The following assumptions are made:

- Information gained from drilling is representative of the general site conditions;

- No unidentified aquifers are present; and
- No significant seasonal differences in groundwater occurrence, quality or levels occur.

Limitations

The following limitations were identified which play a role in the decision making process:

- A limited number of boreholes were drilled, two at Site 1 and one each at Site 2 and 3;
- The site boundaries for Sites 2 and 3 have been revised since the initial fieldwork was conducted. The geophysical survey and borehole drilling was based on the old boundaries, but the work was still conducted inside the new boundaries. It is assumed that the results are representative of the new boundaries; and
- Very little geohydrological information exists for Sites 2 and 3.

3.2.10 Air quality Impact Assessment

Assumptions

Baseline Conditions

The weather monitoring station at the PetroSA refinery was assumed to adequately reflect the meteorological conditions at the three alternative sites. Topographical information was included in the dispersion simulations to accommodate the potential affect it may have on the dispersion process.

Landfill design

The air pollution impacts predicted in this assessment assumes that the waste disposal facility would be operated and managed in a responsible manner. The following operational conditions were assumed:

• site will be classified as an H:h site;

• lifetime of approximately 50 years;

• whilst still to be confirmed, it was assumed that co-disposal of general waste and hazardous waste will take place;

• all hazardous waste disposed of at the site will have a low hazard rating, e.g. solvents and paints, waste from the port and fishing industry such as ballast, as well as dried sewage sludge from the sewage works;

• the site will be excavated to a depth of 6 m below natural ground and will reach a maximum height of 12 m; and

• individual cells will be excavated and filled sequentially (designed to last approximately 5 years)

It is assumed that LFG generated, and not collected, is in equilibrium and will be emitted from the landfill cap or liner at a steady state, i.e. the GasSim model does not consider transient storage of LFG. Since it is not possible to compute actual day-to-day operations on the landfill, annual average throughputs were used. Operational locations and periods were selected to reflect the representative worst case scenarios. This is considered to be a conservative approach.

Since it is common practice to control fugitive dust emissions from unpaved roads through regular watering of the road surface, it was assumed that the control would be at least 50% effective.

The assessment was undertaken with the layout proposals dated January 2011 (Revision A). These have since then changed slightly for Site 1 and Site 3 (Revision E, February 2012). With Site 1, the Builders Rubble and Crushing Area, Composting Area and Material Recovery Facility have been moved from the north-eastern corner of the proposed layout to the southern boundary, with the result that the H:h landfill has been moved toward the north-eastern corner. Site 3 had minor changes, none of which would change the air pollution predictions. Due to the relatively small location difference in the composting facility with Site 1, the difference in air pollution impacts for this site would mainly be nearby the facility. Air pollution impacts further away would remain the same. The conclusions and predicted buffer zones would remain the same.

Emission estimation methods

The hydrogen sulphide module in the landfill gas simulation model, GasSim, assumes that the production of hydrogen sulphide is controlled by the quantity of degraded organic material and the available calcium sulphate and iron. However, actual observed sub-surface hydrogen sulphide concentrations, made at other local landfill operations were used, assuming that this would provide a more realistic initial condition.

Dispersion model

The UK's ADMS was assumed to be applicable to the study area due to its ability to accommodate topography and the potential development of the thermal internal boundary layer at the coast.

Impact assessment

The study assumed a maximum possible exposure of the pollution generated at the landfill, i.e. public exposures for 24-hours a day over a 70-year lifetime. This exposure was assumed to occur immediately beyond the fence line. This is a conservative assumption, which would more likely result in an over- rather than under-predict of impact potentials. In the event that health risks are flagged as being unacceptable it may trigger a comprehensive health risk assessment, in which actual exposure potentials are quantified (e.g. though conducting time and activity studies in adjacent neighbouring areas). Alternatively, it could be advised that emissions be restricted through the application of additional control measures.

Limitations

Baseline conditions

Although the short ambient air monitoring campaign of one month could be seen as a limitation, this is only really applicable to ambient particulate air concentrations. Gases emissions are not considered to be as sensitive to seasonal variations as particulate emissions. Airborne particulates are expected to originate mainly from fugitive sources such as vehicle-entrained dust, agricultural activities and areas exposed and prone to wind erosion. Dry and windy seasons would therefore result in higher particulate air concentrations than wet seasons. However, rainfall in Mossel Bay is relatively evenly distributed throughout the year, with no specific month with exceptionally low or high averages. Conditions during the monitoring (March and April 2011) are therefore considered to be a reasonable, reflection of the conditions throughout the year.

Emission estimation methods

In the quantification of fugitive dust emissions use was made of emission factors which associate the quantity of a pollutant to the activity associated with the release of that pollutant. Due to the absence of locally generated emission factors, use was made of the comprehensive set of emission factors published by the US-EPA in its AP- 42 Compilation. Gaseous emissions from the landfill were estimated using the GasSim model. The GasSim model has the following restrictions: can only be used to assess the risk of exposure from LFG and cannot be used to assess exposure from soils or ground waters;

- the model operates at steady state with a minimum time interval of one year;
- migration of gas is not modelled in the saturation zone;
- the model does not determine the pressure generated by the landfill and to simplify the model, pressure has been excluded from all modules;
- LFG is only abstracted from the capped area of the landfill and gas generated from the operational area is emitted directly to atmosphere;
- lateral migration is determined using a conservative one dimensional advection and diffusion equation. The diffusivity is determined for the diffusivity of the gas in air, which is corrected for the porosity and moisture content of the medium. Methane is not included in this module;
- The hydrogen sulphide module assumes that the production of hydrogen sulphide is controlled by the quantity of degraded organic material and the available calcium sulphate and iron. However by supplying initial measured concentrations, this module is overridden;
- The biological methane oxidation module assumes that all fissures/discrete features emit the same quantity of gas and that these emissions are not reduced by methane oxidation.

In order to complete a detailed impact assessment, each construction activity with associated equipment would be required. Detailed construction schedules and activities were not available. Furthermore, exact locations of storage piles (e.g. topsoil) were not known. Representative conditions were assumed to illustrate the impact zone and to help quantify the level of mitigation.

Air concentration prediction uncertainty

The simulation of ambient air pollutant concentrations and dust deposition due to the landfill facility emissions was undertaken through the application of the UK's ADMS. There will always be some error in any geophysical model, but it is desirable to structure the model in such a way to minimise the total error. A model represents the most likely outcome of an ensemble of experimental results. The total uncertainty can be thought of as the sum of three components: (i) the uncertainty due to errors in the model physics; (ii) the uncertainty due to data errors; and (iii) the uncertainty due to stochastic processes (turbulence) in the atmosphere. The stochastic uncertainty includes all errors or uncertainties in data such as source variability, observed concentrations, and meteorological data. Even if the field instrument accuracy is excellent, there can still be large uncertainties due to unrepresentative placement of the instrument (or taking of a sample for analysis). Model evaluation studies suggest that the data input error term is often a major contributor to total uncertainty. At best the source emissions are known with an uncertainty of only ±5%. It is more common to have uncertainties in emissions data of ±10% and process variations of up to ±50%. These variations translate directly into a minimum error of that magnitude in

the model predictions. It is also well known that wind direction errors are the major cause of poor agreement, especially for relatively short-term predictions (minutes to hourly) and long downwind distances. All of the above factors contribute to the inaccuracies not even associated with the mathematical models themselves. ADMS4 is currently used in many countries worldwide and users of the model include Environmental Agencies in the UK and Wales, the Scottish Environmental Protection Agency (SEPA) and regulatory authorities including the UK Health and Safety Executive (HSE). It has also been the subject of a number of inter-model and tracer experiment comparisons; one conclusion of which is that it tends to provide conservative values under unstable atmospheric conditions in that, in comparison to the older regulatory models, it predicts higher concentrations close to the source. Over flat terrain, a receptor-based comparison of predicted and observed concentrations revealed that the model performed similar to the US EPA Industrial Source Complex (ISC) and AERMOD models. Reported model accuracies vary from application to application, but it was generally shown that between 50 and 70% of the predictions were within a factor of 2. Complex topography with a high incidence of calm wind conditions, produce predictions within a factor of 2 to 10 of the observed concentrations. A comparison of maximum predicted and observed concentrations, not taking into account the exact coinciding locations, the ratios of modelled to observed were found to be as high as 0.95 (hourly), 1.17 (3-hourly) and 0.83 (24-hourl); to as low as 0.60 (hourly), 0.51 (3-hourly) and 0.56 (24-hourly). The accuracy improves with fairly strong wind speeds and during neutral atmospheric conditions.

Impact assessment

The dispersion simulations undertaken for particulate and gaseous emissions facilitate a preliminary assessment of the health implications of the proposed Eden District Municipality waste site's emissions, through the comparison of simulated concentrations with local and international ambient air quality guidelines and standards. For pollutants for which no ambient guidelines are available, use is made of health and odour thresholds from the general literature with preference being given to refereed sources, e.g. US-EPA Integrated Risk Information System (IRIS) data base. In instances where predicted ambient concentrations and/or deposition levels exceed permissible levels, frequencies of exceedance are estimated and recommendations made as to alternative and/or additional measures which may be

adopted to curb emissions. The assessment therefore does not include a site-specific health risk assessment, but rather adopts the “highest-exposed individual” as a worst case scenario.
Health risk can occur due to exposures through inhalation, ingestion and dermal contact. The scope of the study will be confined to the quantification of impacts due to exposures via the inhalation pathway only. Predicted air pollution impacts only include those air emissions associated with the proposed landfill only.

3.2.11 Heritage Impact Assessment

A much smaller (96ha) footprint was proposed for the site 2 alternative in 2009, but this has been amended. At the time of this assessment (as well as that of the AIA), the revised site information was not available and the new footprint was therefore not assessed. This is a definite constraint to this HIA.

3.3 The Project team

Organisation	Name of contact person	Field of expertise
PD Naidoo and Associates	Peter Silbernagl Pr Eng, Pr CPM, CEng	Project Management, waste management planning.
Jan Palm Consulting Engineers	Jan Palm Pr Eng, MEng	All aspects of solid waste management
Hannelie Naudé Transport Economist	Hannelie Naudé	Transport Economist
SRK	Peter Rosewarne	Identification of Potential waste disposal sites.
Anél Blignaut Environmental Consultants	Anél Blignaut Pr.Sci.Nat.	Environmental Impact Assessment, Environmental Management.
Nick Helme Botanical Surveys	Nick Helme	Botanist
SRK	Leon Groenwald	Hydrogeological specialist
SRK	Sue Reuther	Visual impact specialist
Airshed Planning Professionals (Pty) Ltd	Dr Lucian Burger	Air quality specialist
Agency for Cultural Resource Mangement	Jonathan Kaplan	Archaeologist
Urban-Econ	Ilse van Schalkwyk	Socio-economic impact
Ron Martin Heritage Consultancy	Ron Martin	Heritage Impact Assessment
African Insights	Dr. A.J. Williams	Avi-fuanal specialist
Toni Belcher	Toni Belcher	Freshwater ecology

ICE-Group	Liezl du Plooy	Traffic Impact Assessment
Agency for Cultural Resource Managment	Jonathan Kaplan	Archaeological Impact Assessment
John Almond	John Almond	Palaeontological Impact Assessment

Table 3.9: The Project team.

This Environmental Impact Assessment Process has been guided by the legislation as discussed in the previous paragraphs and through the integration of environmental factors into the development proposal.

The EIA Regulations define the EIA process in detail. This report forms part of the Environmental Impact Reporting Phase of this process.

The EIR phase will be conducted in accordance with the approved Plan of Study for Environmental Impact Assessment as approved by the DEA&DP on 28 September 2011.

CHAPTER 4: PROJECT DESCRIPTION

4.1 Project Description and Background

The proposed waste disposal facility will serve the Municipalities of Bitou, George, Hessequa, Knysna and Mossel Bay and will have a lifetime of approximately 42 year (Site 1), 48 years (Site 2) and 31 years (Site 3). The differences in the lifetimes of the respectives sites are due to the available size of the site. It is proposed that the co-disposal of general waste and hazardous waste will take place on the H:h cell of the site, whilst the greatest portion of the site will serve as a general waste disposal site. All hazardous waste disposed of at the site will have a low and medium hazard rating. Examples of hazardous waste with low hazard ratings would be solvents and paints generated by the mechanical and metal industries in the area, as well as waste from the port and fishing industry such as ballast. Sewage sludge from the sewage works may also be disposed of at the site. Provision has been made for a materials recovery facility, a composting area and an area for the processing of construction and demolition waste (builders' rubble). Other infrastructure includes roads, storm water pipelines and channels, water pipelines, leachate storage dam, a contaminated storm water dam, offices, ablution facilities, a laboratory, a weighbridge and security infrastructure.

The footprint of the waste site is detailed in Table 4.1 below. The landfill site will reach a maximum height of 12m above the natural ground level. Individual cells will be excavated and filled sequentially. Each cell will be designed to last approximately 5 years, however depending on the success rate of waste reduction and initially until the base is covered, after about 2-3 years the construction of the following cell will commence. The site will be excavated to a depth of 6m below natural ground level and the landfill will reach a height of 12m above natural ground level.

The site will be fenced to prohibit unauthorized entry and to control windblown litter. Unpolluted storm water will be diverted away from the site through a storm water cutoff trench.

The landfill cells will be constructed in line with the DWAF's Minimum Requirements for Waste Disposal by Landfill specified for a G:L: B- and H:h site. The Draft National Standard for Disposal of Waste to Landfill has also been taken into consideration.

4.1.1 Site parameters: Size and airspace requirements

The proposed new waste disposal site will require an area of approximately 185ha(site1), 200ha(site2) and 140ha(site3), which will comprise the landfill site, a materials recovery facility (MRF), a composting plant and an area allocated for the crushing of building and demolition waste and associated infrastructure.

The table below indicates the approximate area that will be used for the landfill, MRF, composting plant, area for the crushing of construction and demolition waste, the entrance facility complex as well as the storm water and leachate ponds. The areas differ for each site.

Item	**Approximate size**
Site 1	
Landfill	147 ha
Materials recovery facility	2ha
Composting plant	4ha
Area for crushing of building and demolition waste	4ha
Access control and entrance facility complex	2ha
Storm water and leachate ponds	5ha
Site 2	
Landfill	149.5 ha
Materials recovery facility	2ha
Composting plant	5ha
Area for crushing of building and demolition waste	5ha
Access control and entrance facility complex	3.5ha
Storm water and leachate ponds	4ha
Site 3	
Landfill	108.9 ha
Materials recovery facility	2ha
Composting plant	5ha
Area for crushing of building and demolition waste	5ha
Access control and entrance facility complex	4ha
Storm water and leachate ponds	3ha

Table 4.1: Approximate area required for the waste disposal site.

The landfill site will be constructed through the excavation of a series of cells that allows for the disposal of waste for a period of approximately 5 years each. As each cell is excavated, it will be lined in compliance with the DWAF's minimum requirements.

4.2 The landfill site

The philosophy of the design is to construct a landform with covered, compacted waste. The construction project is carried out over a period of time, using waste as building material and incorporating appropriate measures for environmental protection.

The key objectives of the design include the following:

- Environmental acceptability of the design in terms of the receiving environment.
- Cost effectiveness.
- Simple but practical land building.

The philosophy of the landfill development is to design and establish five-year cells. Once the first five-year cell is constructed, the closure and rehabilitation of the existing disposal area will commence. The current volumes of waste that are disposed per day are approximately 430 tons, which require an area of approximately 12.25ha as a single cell with a lifetime of 5 years.

4.2.1 Liner design

The DWAF's Minimum Requirements for waste disposal at a landfill prescribes the composition of a liner for an H:h site as well as a general waste site. The Draft National Standard for Disposal of Waste to Landfill has also been taken into consideration. The proposed lining of the H:h cell is detailed below and also included in the drawings under Appendix B.

The proposed lining of the **general waste** cell consists of the following:

Liner

- Under drainage and monitoring system in base preparation layer
- Geotextile filter layer
- 600mm compacted clay liner in four layers of 150mm each
- 1.5mm geomembrane
- 100mm protection layer of silty sand or geotextile of similar performance
- 150mm stone leachate collection system
- geotextile
- Waste body

The proposed lining of the **H:h waste** cell consists of the following:

Liner

- 150mm base preparation layer
- 200mm compacted clay liner
- 2mm geomembrane

- 100mm protection layer of silty sand or geotextile of equivalent performance
- 150mm leakage detection and collection layer
- Geotextile filter layer
- 600mm compacted clay liner in four layers of 150mm each
- 2mm geomembrane
- 100mm protection layer of silty sand or geotextile of similar performance
- 200mm stone leachate collection layer
- Geotextile layer
- Waste body

4.2.2 Cell Building

The waste cells will be constructed using the ramp method. An outer berm of builder's rubble or similar inert construction material must be constructed first. This berm must form part of the 1:3 sloped berms in 5m vertical steps. The 5 m steps will have on top a 1m wide negative 1:10 slope with a storm water flow path against the inner edge for erosion control.

This berm should be constructed as a complete three or four sided box to act as a windbreak and aesthetic feature. In the event of the wind eroding the berm material, tyres should be used to stabilize the berm material on the windward side.

Once the whole area of Cell1 has been covered with two 1.5m layers of waste, the second lift berm can be constructed, similar to the first lift berm. This sequence is repeated until the final height of 12m has been reached.

Cells are constructed in a general downwind direction, depending on the main direction of the seasonal winds. These daily cells are protected from excessive wind and therefore windblown litter is reduced.

4.2.3 Cover Applications

4.2.3.1 Daily cover

A daily cover of 150 mm compacted soils is used as a minimum. The advantages of using daily cover are primarily in preventing windblown litter and odours, deterring scavengers, birds and vermin as well as improving the site's visual appearance. Crushed builder's rubble may also be used as cover material.

4.2.3.2 Intermediate and Final Cover

A cover of 300mm compacted soil, used as an intermediate cover, needs to be used to avoid paper, plastic and other materials to be seen from close proximity.

Final cover must conform to the thickness and to the profile of the cover design. The purpose of the final cover is to ensure maximal drainage of precipitation, to reduce infiltration and to prevent surface ponding. The final cover must be maintained annually to compensate for settlement.

4.2.3.3 Compaction

A compaction density of 750 kg/m^3 is intended for the site, which will be easily achieved with the dedicated equipment.

4.2.3.4 Final Layer

The final layer or capping layer for a 'class H:h' site is detailed in the Minimum Requirements and typical layers would be as follows:

- Compacted waste body
- 150mm foundation and gas drainage layer
- Geotextile layer
- 3 x 150mm layers of compacted clayey soil
- 200mm Topsoil

The proposed capping of the general waste cell consists of the following:

- Two layers of 150mm compacted clayey soil
- 200mm top soil capping layer

This final capping layer's primary function is to keep water out of the waste body but will be affected by the preferred cover material and technology.

4.2.4 Closure and rehabilitation

The final landform for the proposed landfill site is based on the surrounding terrain and the maximization of airspace from the available footprint at each site. The use of the site after completion of waste disposal activities has not been determined. A separate application must be submitted for authorization at the time of closure. This study will therefore not focus on the closure and end-use of the proposed site. It is proposed that the end-use of the site should be restricted to open space because of the type of waste disposed at the landfill. The closed and rehabilitated site could possibly be used for grazing. The end-use of the site should be determined in consultation with all relevant stakeholders.

Ongoing maintenance after closure of the site would be required. This would include repair of any cracks and erosion gullies, filling of any settlement depressions in the final cover and ongoing monitoring of vegetation, drainage systems and water quality.

4.3 Materials Recovery Facility

A Materials Recovery Facility (MRF) is a specialized plant, which separates recyclable items from collected Municipal waste. Recycled materials are then sent to the materials processor while remaining waste is deposited at a landfill site.

Sorting of material is done by a combination of hand picking and automatic sieving, screening, the use of magnets and electric fields to remove the metals. The advantage of sorting and recovery as a method of waste minimisation is not only job creation, but also the fact that less waste needs to be transported to the landfill site, which adds to minimising transport costs and disposal fees and saves landfill airspace.

The design layout of the MRF and the selection of equipment are primarily a function of the quantities and composition of the waste streams and the market specifications of the recovered products. Materials recovery processing facilities typically require substantial manual sorting. This is obviously a labour and time intensive activity. Although numerous mechanical means of separating mixed wastes are used worldwide, manual sorting by efficient labour can be more efficient for certain materials. Manual sorting also creates jobs, which is greatly needed in South Africa today.

Sorting efficiency is a function of the type and form of material as well as the degree of contamination. MRF's can recover up to 80 % of the marketable grades of metals, glass, plastics and paper if the waste stream consists of source separated materials. On the other hand MRF's, processing mixed Municipal solid waste usually recover only about 10-20% of recyclable items. This 10-20% is however extremely important and radically reduces waste transporting costs and saves landfill airspace.

All activities where waste is exposed will take place inside the building to minimize the possibility of windblown litter and environmental impacts such as odours or noise. The concept of waste minimization focuses on the recovery of materials of value before the quality of the material has been deteriorated as a result of its contact with other waste material.

The Materials Recover Facility (MRF) will cover an area of approximately 2 ha. The actual building will be approximately 1800m^2 in size and 12m high. Concrete flooring with power floated cement screed surfaces will be provided throughout and drains for floor washing will also be installed.

The wastewater resulting from cleaning operations (eg. Washing of floors) inside the MRF will be diverted via channels and drains in the design of the MRF, which will then be disposed off in the waste water conservancy tank (20m^3 capacity). This would ensure that no ground- or surface water contamination takes place.

4.4 Composting site

Composting is seen as a method of waste minimization. Composting is the process whereby organic material is biologically decomposed into a humus like soil conditioner.

It is proposed at this stage that the composting will be practiced in the form of windrows in which the compost is exposed to the climatic elements and decreases the risk of odours and flies.
It is envisaged that only garden waste will be composted. The garden waste will be delivered to the site and any contaminants such as plastic bags will be removed from the waste and disposed of at the landfill site. The garden waste will then be chipped and composted.

Excellent site operation can eliminate odour generation and fly breeding problems.

Criteria for a composting site:

- The site must be large enough to receive the projected volumes of garden waste,
- An adequate buffer zone to protect the neighbours from the impacts of site activity;
- A flat slope (2-3%);
- A central, accessible area with good traffic flow;
- A water source for wetting compost piles;
- Prevailing winds should blow away from sensitive neighbours;

The composting site will cover an area of approximately 5ha. The composting will take place on an impermeable clay layer with a sub base cover. The area will be shaped to allow the collection of the composting windrow liquid in canals from where it will be contained in a tank. The collected liquid will be used for the irrigation of the compost as the moisture content of the compost must be maintained.

4.5 Crushing of construction and demolition waste

The site used for the crushing of construction and demolition waste will cover an area of approximately 5ha. When the construction and demolition waste is offloaded at the site, the contaminants will be removed and placed in a skip. These contaminants will then either be recycled or disposed on the landfill site. Contaminants may include but are not limited to: paint tins, wood, steel reinforcement, paintbrushes, plastic, etc.

The waste such as concrete, bricks, tiles, etc. will then be crushed and could either be used as a cover material on the landfill site, as G7 fill material for road building or when mixed with clay it can also be used as a G5 fill material.

In general there is a shortage of fill material for road building therefore a build up of crushed material is not expected.

4.6 Entrance facility complex

Access to the landfill site is via a fenced-off entrance complex with gated controlled access. The general public does not have access to the actual landfill area. Road access to the landfill site is via an access road from the main road. Incoming vehicles are visually inspected at a gatehouse building for the type of waste being delivered, i.e. low to medium level hazardous or general. Based on the types and amounts of waste, the gatehouse personnel would direct vehicles to the appropriate waste disposal areas. Hazardous waste will be classified in the on site laboratory prior to acceptance. The entrance would be guarded on a 24 hours basis and would also be locked after working hours. A notice board will be erected, stating the name and contact details of the operator and/or responsible person, hours of operation and emergency telephone numbers, amongst other important information that must be displayed.

The administration buildings are located within the entrance complex and contain the reception area, the site manager’s office, tea kitchen, laboratory, meeting room and public toilet facilities.

4.6.1 Weighbridges

An above-ground weighbridge will be installed on the road between the entrance facility and the landfill working face. The quantities and types of incoming waste are recorded at the weighbridge. After data capturing at the weighbridge, vehicles are then permitted to enter the landfill area.

4.6.2 Roads and fences

It is a key requirement on a landfill site to move waste effectively and safely to the disposal face. All roads are constructed and maintained to ensure that waste can reach the working face with the minimum of inconvenience in wet weather conditions. Two-way traffic must also be possible in all weather conditions.

The landfill site will typically have three road types, listed below:

- The access road: This road links the main road to the site with the landfill entrance.
- Temporary site roads: These roads lead from the access road to the working face and therefore have a short life. The roads are typically made from builders rubble and construction material delivered to the disposal site.
- The perimeter road: This is a permanent road but need not be of high standard. The width can be as little as 4m and does not need to be surfaced. The main purpose of the perimeter road is to inspect the status of the perimeter fence and stormwater drains.

4.6.3 Water and power supply

Potable water for the entrance complex is piped from the nearest regional water mains in the case of Site 1 as indicated on the layout plans. In the case of sites 2 and 3 water will be stored in tanks on site to allow for 1 week's water supply. This would require a supply of 15 kilolitres that can be easily contained in aboveground tanks. The potential use of borehole water on these sites is also not excluded, but can only be determined when drilling on these sites. The power supply for Site 1 will be obtained from the existing 11kVA line on the site. The power supply for Site 2 and 3 will be brought in from the nearest 11kVA line to the entrance facility complex. In the case of Site 2 the nearest line is approximately 2.5km from the site, whilst in the case of Site 3 the nearest 11kVA line is 4.5km from the site.

4.6.4 Sewage

Sewage will be stored in conservancy tanks and removed to a wastewater treatment works for treatment. The Mossel Bay Municipality has confirmed that adequate capacity exists for the treatment of the sewage generated at the site.

4.7 Drainage Systems and Leachate Management

Landfill site drainage systems would be implemented to manage three aspects of drainage. These are discussed below.

1. Uncontaminated run-off from higher-lying areas

All uncontaminated run-off would be diverted away from waste to prevent contamination and to minimize leachate generation within the landfill. A cut-off drain feeding into a natural drainage system would be provided to prevent surface run-off from reaching the landfill area and becoming contaminated.

2. Contaminated run-off from the landfill itself

All surface run-offs from uncovered waste on the landfill are considered contaminated. The run-off will be diverted into a contaminated storm water pond that will be lined and sized in accordance with the DWAF's Minimum Requirements.

3. Leachate that is generated within the landfill

Minimum Requirements require that leachate may not enter any natural watercourses without prior treatment and/or purification. A comprehensive leachate management system would consist of three main components, namely:

- A liner beneath the landfill to prevent infiltration into the groundwater;
- A collection system to collect and drain leachate from the landfill area into a leachate storage dam;

- A leachate detection layer as part of the liner that would detect any leachate that may reach the groundwater.

On-site drainage at the working faces of the landfill operations would be developed and adapted continuously as the landfill develops.

At this stage it is envisaged that an area of approximately 3-5ha will be used for the construction of a series of contaminated storm water and leachate dams. These dams will be approximately 2.5-3m in depth (2.5m storage depth and 0.5m freeboard) and will allow for the evaporation of the leachate and contaminated storm water without leading to anaerobic conditions. The volumes of the dams are typically calculated as 5% of the annual rainfall on the footprint of the site, which should allow for adequate storage capacity. However, should unusual circumstances lead to a shortage of capacity in the dams, the water will be pumped out by a tanker and disposed of at a wastewater treatment works for treatment.

The liner of the leachate pond will consist of the following:

- 150mm base preparation layer
- 300mm compacted clay liner
- 1mm geomembrane
- 100mm protection layer of silty sand or geotextile of equivalent performance
- 150mm leakage detection and collection layer
- Geotextile filter layer
- 600mm compacted clay liner (in 4x150mm layers)
- 2mm geomembrane
- 100mm protection layer

The liner of the contaminated stormwater dam will consist of the following:

- Under drainage and monitoring system in base preparation layer
- Geotextile filter layer
- 600mm compacted clay liner (in 4x150mm layers)
- 1.5mm geomembrane
- 100mm protection layer

The contaminated storm water will be collected in a contaminated storm water dam and may be used for dust suppression on the waste disposal site itself.

The site is classified as a B- site, which means it has a negative water balance and therefore significant leachate production is not expected. A leachate storage dam is therefore constructed as a precautionary measure. The liquid will evaporate from the dam and no treatment of the leachate is necessary, however should unusual rainfall events cause that the leachate cannot evaporate, the excess leachate will be removed by a tanker and disposed of at a wastewater treatment facility for treatment.

4.8 Gas Management

The objectives of landfill gas management are:

- To minimize the risk of gas migration beyond the site perimeter.
- To avoid unnecessary air in the body of waste within the landfill and to minimize the risks of underground fires.
- To minimize the damage to soils and vegetation within the restored landfill.
- To minimize the impact of air quality and global effect of greenhouse gasses.

If gas is suspected to cause a problem such as odour complaints, possible fire hazards or lateral subsurface migration, the methane content must be determined. If the methane content is above the standards specified in the Minimum Requirements or other relevant standards, a gas monitoring and/or extraction system must be implemented when required.

Landfill gas can be monitored and if enough gas is generated to allow for the cost of extraction of the gas, vertical pipes could be placed in the landfill site. One could also decide to place the pipes in the landfill site horizontally between two layers of clay as part of the normal construction of each cell. Horizontal pipes are more effective than the vertical pipes in gas extraction and the cost is also reduced in comparison to drilling holes into the landfill to install the vertical pipes afterwards.

Landfill gas can only be generated when organic material decomposes without the presence of oxygen. The only way to ensure that no oxygen is present is to saturate the waste with water to form a type of a seal, otherwise there will always be oxygen present within the landfill. General waste in the Western Cape has a typical moisture content of 28% and a field capacity of 42% which means that 14% of the waste volume is required in the form of liquids to exceed the field capacity. Only then will moisture be released in the form of leachate. Landfill gas will start to form at approximately 55%.

In the case of a B- site (negative water balance) where the evaporation during the rainy season is higher than the rainfall, it is almost impossible to increase the moisture content by the required percentage to allow landfill gas to form (*Perscom* Jan Palm, 2012).

Typically, in South Africa, the generation of landfill gas is monitored and should there be a need, vertical pipes are installed into the waste body for the extraction of the gas.

4.9 Staff and Equipment

A site manager is responsible for the daily operation of the overall facility. This includes the waste acceptance area and the landfill operation. The site manager also ensures that all the landfill permit conditions and applicable Minimum Requirements are complied with.

4.10 Aesthetics

An earth berm of 5m in height will be used to screen Site 1. The berm will be planted with locally indigenous vegetation. Aesthetics on all three the proposed sites would have to be maintained through the daily covering of waste and through he implementation of the EMP and recommendations made in the EIR.

4.11 Waste acceptance and Special waste disposal

4.11.1 Waste and Landfill Classification

The DWAF's Minimum Requirements for the disposal of waste at a landfill, lists criteria for the classification of a landfill site. The minimum design, operating and management requirements will be determined as a result of the site's classification. The classification of the site is determined by the type of waste; the size of the waste stream and the potential for leachate generation.

The Eden District Municipality's new regional waste disposal site will be classified as both G:L:B^- and H:h. A brief explanation of landfill site classification is provided below:

G = Landfill accepts general waste only
L = Large landfill site (> 500 tons per day)
M = Medium landfill site (150 – 500 tons per day)
B+ = Means that the landfill generates significant leachate
B- = Means that the landfill does not generate significant leachate
H:H = Landfill that accepts hazardous and toxic waste
H:h = Landfill that accept low hazardous, nontoxic waste.

4.11.2 Waste type

Waste is generally classified as either "general" waste or "hazardous" waste. Hazardous waste can be defined as follows: "an inorganic or organic element or compound that, because of its toxicological, physical, chemical or persistency properties, may exercise detrimental acute or chronic impacts on the human health and the environment. It can be generated from a wide range of commercial, industrial, agricultural and domestic activities and may take the form of liquid, sludge or solid. These characteristics contribute not only to degree of hazard, but are also of great importance in the ultimate choice of a safe and environmentally acceptable method of disposal" (DWAF, 1998). As this is a very broad definition and waste can vary substantially in nature, composition and degree of harmfulness, hazardous wastes are grouped into four Hazard Ratings that differentiate between wastes that are fairly or moderately hazardous and those that are very or extremely hazardous. Hazardous landfill sites (class H) are classified according to the Hazard Ratings of the hazardous wastes that can safely be accepted for disposal at a particular site, i.e. H:H or H:h. A system for classifying and ranking Hazardous waste according to the degree of hazard they present has been developed. This is based on Mammalian Acute and Chronic Toxicity, Eco toxicity and Environmental Fate (DWAF, 1998). Based on this, Hazardous waste is classified in either one of the four classes presented in Figure 5.1 below.

The proposed disposal of hazardous waste with low to moderate hazard ratings would then result in the classification of a portion of the site as H:h in order to accommodate waste with a low to moderate hazard rating. Design standards for hazardous waste sites are higher than for general waste landfill sites and include the separation of waste from the groundwater by means of a liner and leachate collection system. Hazardous waste from sources outside the Eden district will not be allowed at the proposed waste disposal site.

There are four ratings for hazardous waste products:

Hazard Rating 1 (extreme risk)
Hazard Rating 2 (high risk) = H:H landfills

Hazard Rating 3 (moderate risk)
Hazard Rating 4 (low risk) = H:h landfills

Figure 4.1: Hazard Ratings and hazardous landfill classifications

Other examples of wastes with Hazard Ratings 3 and 4 are the following:

- Asbestos lagging that is used as an isolator around pipes at power stations. If this material is removed in a dry state and placed in bags that could potentially allow the release of asbestos fibers into the environment, then the waste could be rated as Hazard Rating 3. However, if it is wet and in bags, it would be given a Hazard Rating of 4.
- Biologically degradable fats in wash water can be co-disposed with General waste and could be rated as Hazard Rating 3.
- Dried sewage sludge from the sewage works.
- Solvents and paints generated by the mechanical and metal industries in the area.
- Waste from the port and fishing industry such as ballast.

The DWAF's Minimum Requirements (1998) defines medical waste as waste generated from such places as hospitals, clinics, doctors' rooms, laboratories, pharmacies, and research facilities. Domestic waste is defined as waste emanating, typically, from homes and offices. Although classified as General Waste, this waste contains organic substances and small volumes of hazardous substances.

No medical waste will be disposed of at the new Eden Regional Waste disposal site, however as mentioned in the definition of Domestic Waste (DWAF1998), household waste may contain small items that may be considered as hazardous or medical waste. The quantities and qualities of hazardous substances in domestic waste are sufficiently small to be disregarded as a potential risk (DWAF, 1998).

The disposal of sewage sludge from wastewater treatment works is only intended to take place if no beneficial use for the sludge can reasonably be found. In the event that sewage sludge needs to be disposed of at the proposed waste disposal facility, it would need to go through a delisting process in terms of the Minimum Requirements. It is anticipated that the following volumes of sewage sludge will be disposed at the proposed waste disposal facility (2009 volumes):
Bitou Municipality: Approximately 200m^3 per year
Knysna Municipality: Approximately 220m^3 per year
George Municipality: Approximately 5650m^3 per year
Mossel Bay Municipality: Approximately 1750m^3 per year
It is not intended to process or treat the sewage sludge at the waste disposal facility in any manner. It should be noted that, depending on the processes and technology used, the sewage sludge to be disposed may come from several processes, e.g. secondary sludge from drying beds or secondary sludge from belt presses or primary sludge.

The type of sludge from wastewater treatment works (also known as sewage works) depends on the processes and technology used for treating this sewage sludge at the wastewater treatment works. Sludge that could be expected for disposal at the proposed waste disposal facility may be sludge from drying beds (approx. 50% dry solids), dewatered secondary sludge (approx. 15% dry solids) and primary and digested sludges (approx. 30% dry solids). The dewatered secondary sludge is spadable but jelly-like and not suitable as cover material, and should preferably be trenched. The digested sludges and sludges from drying beds could be considered as cover material, failing which it can also be trenched. Secondary sludge can be disposed at a waste disposal facility, primarily in one of two ways: either it can be used as a daily cover material or it can be disposed within the existing waste body through the method of trenches which are then covered again with waste, depending on the type of sludge that is received. Primary sludge, if it is received, can only be disposed by trenching. There is therefore no specific intent or need to prevent rain contact with sewage sludge or to keep the sewage sludge dry in general.

4.11.3 Procedure for the acceptance of waste

The landfill facility would not be designed for and would not accept hazardous waste with Hazard Ratings 1 and 2 (extreme and high hazard waste). Such waste would represent a safety hazard for the operators and workers at the landfill and also an environmental hazard and therefore must be pre-treated and delisted at source before it would be accepted at the landfill site. This includes waste such as high pH wastes (e.g. caustic sludges) and low pH and malodorous wastes such as acid-oil sludges, phenols and volatile organic compounds (VOCs).

Highly hazardous wastes such as PCBs, mercury wastes, insecticides and pesticides would not be accepted.

Hazardous waste would have to undergo laboratory assessment at source to determine the need for any pre-treatment and/or special handling and disposal cost at the landfill site. All hazardous waste consignments would require waste manifest documentation that includes laboratory assessment information. Each waste consignment would be checked visually and chemically to ensure that the waste matches that which was quoted for. A laboratory would be established on site in order to undertake checks on incoming waste.

Waste would not be accepted at the landfill facility if it does not conform to the accompanying manifest documentation and/or if further chemical analyses would be required. If the waste is not acceptable (did not conform to its documentation or the waste acceptance criteria), the consignment would be returned to the generator.

When the waste load cannot be verified, the vehicle is parked near the offices and the load inspected. The contractor and/or generator of the waste must be contacted by the site operator/manager to provide the required information. If the site operator/manager is not satisfied, the following options can be considered:

- The return of the vehicle to the waste generator.
- Partial or total disposal of the load in a designated area, separate from the working face. This separate discharge allows for a more detailed visual check of the waste for conformity. Once the waste has been inspected and a decision reached, the waste may:

1. Be taken to the working face for disposal.
2. The cargo re-loaded and returned to the generator
3. An acceptable environmentally safe option for both the generator and disposal contractor must be negotiated.

4.11.4 Access control

Collection vehicles will enter the site through a dedicated entrance and will be directed towards an off-loading area where the waste is discharged. No recovery from the waste site will be allowed. No unauthorized entrance will be allowed on site.

CHAPTER 5: AFFORDABILITY, NEED AND DESIRABILITY

5.1 Feasibility and affordability

The section on the feasibility and affordability wsa compiled by PD Naidoo Consulting engineers (PTY) Ltd with inputs from the Eden District Municiaplity and Jan Palm Consulting Engineers. Acknowledgement is therefore given to the respective parties for the information contained in this section.

The feasibility of the proposed development depends on several factors.

These include:

- A technical feasibility
- Social acceptance
- Environmental acceptance and
- Financial viability

The social and environmental acceptance will not be considered under this section as this is largely the subject of the remainder of this document. With regard to the technical feasibility, the proposed development is based on conventional tried and tested design approaches and technologies.
The technical aspects under consideration would include the linings for the landfill site, cell development operation and closure, litter and dust management, materials recovery and composting. The landfill itself is specifically designed to conform to the Minimum Requirements and is based on the considerable experience of the consulting engineers designing the landfill and the associated infrastructure. As a result, the remaining technical risks, if any, are at a minimum and no significant technical issues are anticipated.

The financial viability is dependent on the availability of investment capital or funding and the ability to service the monthly operating costs and to make provision for capital redemption or asset replacement.

With regard to the availability of investment capital Eden DM has undertaken a study in terms of Section 78 of the Municipal Systems Act in order to determine appropriate mechanisms to design, build, operate and manage the proposed new landfill site. This study commenced in 2011 and consists of three phases.

In the 1st phase it investigated the internal delivery mechanism i.e. if the Eden DM were to undertake the development, operation and management of the proposed facility itself. The Eden DM, as a result of the findings under the 1st phase, decided to proceed to the 2nd phase of the study in terms of Section 78.

The 2nd phase investigated the options available and their suitability for Eden DM to provide the service through an external service delivery mechanism. These external service delivery mechanisms, also known as municipal service partnerships, include public private partnerships in a variety of forms. The study concluded that the best external service delivery option for Eden DM for the development of this landfill site would be a Build, Operate and Transfer (BOT) contract. The study found that a BOT contract would present a cost saving on an internal delivery mechanism and would therefore provide improved value for rate payers.

The recommendations include that the concession contract for the development and operation of the landfill must include that the private partner provides all capital that is required to acquire the site and to construct, operate and maintain all the required facilities.

The Eden District Council has approved the recommendation to go ahead with the Build, Operate and Transfer external service delivery mechanism and to go ahead with the 3rd and final phase to conduct a feasibility study after which the procurement phase will follow.

Hence with regard to the aspect on the provision of investment capital for the development, this aspect will be covered through the BOT agreement (concession contract) with the PPP partner.

The question concerning the ability to pay the monthly operating and maintenance costs, including the provision of interest and capital redemption or provision for the replacement of assets, is really a question of affordability, that is, whether the residents and businesses that pay for these services are able to afford these costs? In evaluating the affordability of the proposed landfill site for the residents and businesses there are two approaches.

The one approach would be to determine the increase that the cost of the new facility (as managed and operated by the BOT contractor) would have on the municipal budgets and the other would be to determine what increase the new landfill site would have on the waste budget.

In consideration of the latter approach, such an increase will not necessarily directly reflect an increase in waste tariffs of the individual municipalities. The reason for this is that the cost of waste management is recovered in municipalities sometimes through waste management tariffs and municipal rates and taxes, while for others the costs are recovered through rates and taxes only i.e. there are no specific waste management tariffs for residents (although there may be some for businesses).

In Table 5.1 a summary is provided of the anticipated capital costs for all three sites. The cost of the environmental authorisation has not been included.

Item	Site 1	Site 2	Site 3
Landfill cells: (in R mill)			
Cell 1	58.9	65.9	51.9
Cell 2 (escalated – future cost) *	82.7	86.0	60.4
Cell 3 (escalated – future cost) *	114.0	118.7	76.7
Cell 4 (escalated – future cost) *	157.5	164.0	98.0
Cell 5 (escalated – future cost) *	217.9	227.0	124.0
Infrastructure:			
Entrance & buildings	6.2	6.2	6.2
Provincial & district roads upgrades	0.3	16.9	22.1
Access road	10.6	11.4	2.0
Site Roads	8.5	9.5	8.5
Fencing	7.8	8.7	6.4
Leachate dam	1.7	1.8	1.2
Stormwater & dam	19.1	27.0	9.5
Dozer & compactor	6.8	6.8	6.8
Rehabilitation (escalated - future cost) *	211.7	222.5	137.5
Post closure cost *	0.4	0.4	0.4
Total for landfill site *	**61**	**88.3**	**62.7**
MRF – excl equipment	10.4	10.4	10.4
MRF – equipment	5.2	5.2	5.2
Composting facilities	3.9	3.9	3.9
Hazardous cell	29.3	29.3	29.3
Total other facilities	**48.8**	**48.8**	**48.8**
Land costs	**5.6**	**6.0**	**4.2**
Total initial cost (2012)*	**174.3**	**209.0**	**167.6**

** Excludes future cells and rehabilitation, etc*

Table 5.1: Cost of new landfill site

These capital costs would then be redeemed over various investment periods as shown in Table 5.2, using the costs for Site 1 from Table 5.1.

Interest and Capital redemption for New Landfill site				
Site 1	Capital cost estimate 2012	Cost (interest & redemption) pa	Assumptions	
	R mill	R mill	Period in years	Rate per year
New cell	R 58.9	R 9.13	8.4	6%
Entrance & buildings	R 6.2	R 0.49	25	6%
Provincial & district roads	R 0.3	R 0.03	15	6%
Access road	R 10.6	R 1.09	15	6%
Site roads	R 8.5	R 1.15	10	6%
Fencing	R 7.8	R 0.61	25	6%
Leachate dam	R 1.7	R 0.13	25	6%
Stormwater & dam	R 19.1	R 1.49	25	6%
Dozer & Compactor	R 6.8	R 0.92	10	6%
Rehab (future cost)		R 0.00	42	6%
Post closure cost		R 0.00	42	6%
Total for landfill site		**R 15.05**		
MRF excl equipment	R 10.4	R 0.81	25	6%
MRF - Equipment	R 5.2	R 0.71	10	6%
Composting facilities	R 3.9	R 0.31	25	6%
Hazardous cell	R 29.3	R 1.92	42	6%
Total excl landfill site		**R 3.75**		
Land cost at R30 000/ha	R5.6	R0.36	42	6%
TOTAL interest and capital redemption		**R 19.17**	**mill per year**	

Estimated Operating cost (per ton)	**R 38**	Excludes rental of any equipment, as this is shown separately

Additional transport costs (beyond current location)	**R 2**	per tonne/km	Extra distance = 1 km

Table 5.2: Interest and Capital Redemption for new landfill site

The operating costs for the landfill site have been estimated at R38 per ton (Jan Palm Consulting Engineers, pers. com. April 2012). This estimate for operating costs excludes the rental of any equipment or the operating costs of the materials recovery facility and composting facility, for reasons explained later in this section.

The quantities of waste currently disposed by the municipalities at PetroSA have been estimated as shown in Table 5.:

Tonnes disposed (2012)	
George	32,000
Mosselbay	26,000
Knysna	17,000
Bitou	15,000

Table 5.3: Quantities of waste disposed at PetroSA

It is recognised that Bitou Municipality does not currently dispose of any waste at PetroSA although this situation is about to change. Thus the amount for Bitou Municipality is not based on actuals delivered to PetroSA in the past year but rather on the best estimates available from Bitou Municipality. As a result the operating costs, the costs of interest and redemption of capital and the additional transport costs are allocated as in Table 5.4.

Cost contribution						
Site 1	Tonnes disposed (2012) tpa	Operating costs R mill/year	Interest & redemption R mill/yr	Additional transport costs	Total R mill/yr	Total cost/t
George	32,000	R 1.2	R 6.8	R 0.1	R 8.1	R 252.98
Mosselbay	26,000	R 1.0	R 5.5	R 0.1	R 6.6	R 252.98
Knysna	17,000	R 0.6	R 3.6	R 0.0	R 4.3	R 252.98
Bitou	15,000	R 0.6	R 3.1	R 0.0	R 3.8	R 252.98
Total	**90,000**	**R 3.4**	**R 19.2**	**R 0.2**	**R 22.8**	**R 252.98**

Table 5.4: Allocation of cost of new landfill to municipalities

The impact of these costs on the municipal budgets and waste management budgets is given in Table 5.5.

Increase in municipal budgets and waste budgets due to disposal at new landfill site							
Site 1	**Municipal budget 2010/2011** **R mill**	**Waste Management budget** **R mill**	**PetroSA disposal costs** **R mill/yr**		**New landfill site disposal, treatment & additional transport costs** **R mill/yr**	**% increase in Waste Management budget**	**% increase in Municipal budget**
George	R 997.4	R 41.8	R 3.9		R 8.1	10.1%	0.4%
Mosselbay	R 596.9	R 26.9	R 2.0		R 6.6	17.0%	0.8%
Knysna	R 426.0	R 18.5	R 1.5		R 4.3	15.1%	0.7%
Bitou*	R 229.4	n/a	R 0.0	#	R 3.8	n/a**	1.0%
TOTAL	**R 2,249.7**				**R 22.8**	**n/a**	**1.0%**

* draft budget
**No comparable figures as Bitou does not currently dispose at PetroSA
assume Bitou has no current disposal costs

Table 5.5: Contribution of cost of new landfill site to municipal budgets

The result is that on average the municipal budgets are expected to increase by approximately 1% due to the cost of the new landfill site. The above calculations have not made provision for the eventual rehabilitation costs. These are costs that will be incurred at the end of the life of the landfill which is anticipated to occur more than 40 years after commencement. Since these costs are large, one-off costs to close and rehabilitate the landfill site after receiving waste for some 40 years, they are considerable costs and have a considerable impact on the costs per ton and on the whole municipal budget. The calculations showing the impact of the provision for closure and rehabilitation are given in Tables 5.6, 5.7 and 5.8.

Interest and Capital redemption for New Landfill site				
Site 1	**Capital cost estimate 2012**	**Cost (interest & redemption) pa**	**Assumptions**	
	R mill	**R mill**	**Period in years**	**Rate per year**
New cell	R 58.9	R 9.13	8.4	6%
Entrance & buildings	R 6.2	R 0.49	25	6%
Provincial & district roads	R 0.3	R 0.03	15	6%
Access road	R 10.6	R 1.09	15	6%
Site roads	R 8.5	R 1.15	10	6%
Fencing	R 7.8	R 0.61	25	6%
Leachate dam	R 1.7	R 0.13	25	6%
Stormwater & dam	R 19.1	R 1.49	25	6%
Dozer & Compactor	R 6.8	R 0.92	10	6%
Rehab (future cost)	R 211.7	R 13.91	42	6%
Post closure cost	R 0.4	R 0.03	42	6%
Total for landfill site		**R 28.99**		
MRF excl equipment	R 10.4	R 0.81	25	6%
MRF - Equipment	R 5.2	R 0.71	10	6%
Composting facilities	R 3.9	R 0.31	25	6%
Hazardous cell	R 29.3	R 1.92	42	6%
Total excl landfill site		**R 3.75**		
TOTAL interest and capital redemption		**R 33.10**	**mill per year**	

Estimated Operating cost (per ton)	**R 38**	Excludes rental of any equipment, as this is shown separately	
Additional transport costs (beyond current location)	**R 2**	per tonne/km	Extra distance = 1 km

Table 5.6: Interest and Capital Redemption for new landfill site: with provision for rehabilitation

Cost contribution						
Site 1	**Tonnes disposed (2012)**	**Operating costs**	**Interest & redemption**	**Additional transport costs**	**Total**	**Total cost/t**
	tpa	**R mill/year**	**R mill/yr**		**R mill/yr**	
George	32,000	R 1.2	R 11.8	R 0.1	R 13.0	R 407.78
Mosselbay	26,000	R 1.0	R 9.6	R 0.1	R 10.6	R 407.78
Knysna	17,000	R 0.6	R 6.3	R 0.0	R 6.9	R 407.78
Bitou	15,000	R 0.6	R 5.5	R 0.0	R 6.1	R 407.78
Total	**90,000**	**R 3.4**	**R 33.1**	**R 0.2**	**R 36.7**	**R 407.78**

Table 5.7: Allocation of cost of new landfill to municipalities: with provision for rehabilitation

By way of comparison it is noted that the costs for disposal (which the above exercise effectively calculates) amounts to approximately R407.78/t, whereas it was recorded in a report accepted by the

City of Cape Town (Executive Summary, S.78 (3) report March 2011), that the cost of disposal was estimated at approximately R400/t.

Increase in municipal budgets and waste budgets due to disposal at new landfill site							
Site 1	Municipal budget 2010/2011 R mill	Waste Management budget R mill	PetroSA disposal costs R mill/yr		New landfill site disposal, treatment & additional transport costs R mill/yr	% increase in Waste Management budget	% increase in Municipal budget
George	R 997.4	R 41.8	R 3.9		R 13.0	22.0%	0.9%
Mosselbay	R 596.9	R 26.9	R 2.0		R 10.6	32.0%	1.4%
Knysna	R 426.0	R 18.5	R 1.5		R 6.9	29.3%	1.3%
Bitou*	R 229.4	n/a	R 0.0	#	R 6.1	n/a**	2.7%
TOTAL	**R 2,249.7**				**R 36.7**	**n/a**	**1.6%**

* draft budget
**No comparable figures as Bitou does not currently dispose at PetroSA
assume Bitou has no current disposal costs

Table 5.8: Contribution of cost of new landfill site to municipal budgets: with provision for rehabilitation

The costs for Site 2 (should it not be ruled out) and Site 3 are slightly higher as summarised in Tables 5.9 and 5.10. The detailed calculations are shown in Appendix F.

	Cost of new landfill site, disposal, treatment & additional transport costs	% increase in Municipal budget
	R mill/year	
Site 1	22.8	1.0%
Site 2	27.3	1.2%
Site 3	28.4	1.3%

Table 5.9: Cost comparison for Sites 1, 2 & 3: without provision for rehabilitation

	Cost of new landfill site, disposal, treatment & additional transport costs R mill/year	% increase in Municipal budget
Site 1	36.7	1.6%
Site 2	41.5	1.8%
Site 3	38.3	1.7%

Table 5.10: Cost comparison for Sites 1, 2 & 3: with provision for rehabilitation

It is concluded that the new landfill site, including the waste treatment facilities (MRF, composting, builders rubble processing), hazardous cell and the additional transport costs would increase the municipal budgets by approximately 1.6%.

5.2 Need and Desirability

The Eden District Municipality is made up of the Municipalities of Bitou, Knysna, George, Mossel Bay, Hessequa, Kannaland and Oudtshoorn. The Municipalities of Bitou, Knysna, George, Mossel Bay and Hessequa (Albertinia and Gouritsmond) suffer from a lack of long-term capacity at their waste disposal sites which, in the case of Knysna, George, Mossel Bay and Hessequa (Albertinia and Gouritsmond) is the PetroSA site. A site suitable for the establishment of a long-term waste disposal facility in the Eden District Municipality is required that caters for general waste as well as hazardous waste with low hazard ratings. Since waste disposal by landfill is considered to be the least favorable option in the waste hierarchy, other innovative, but sustainable, measures to reduce the volume of waste disposed at landfill should also be investigated by the individual Municipalities.

When discussing the "Need and Desirability" of the proposed waste disposal facility, there are two perspectives that should be considered. Firstly, the "Need and Desirability" of a Regional Waste Disposal Site and secondly the "Need and Desirability" should be considered on a site level. Both of these perspectives will be discussed in the paragraphs below. During the Scoping Phase the consideration of need and desirability consisted of a preliminary description of the relevant considerations in relation to the feasible and reasonable alternatives. During the Environmental Impact Reporting phase the final assessment of need and desirability is undertaken including specialist input as required.

The approach to the description of the "Need and Desirability" will be to answer the questions included in the Guideline on Need and Desirability (DEA&DP, 2011).

1. *Is the land use (associated with the activity being applied for) considered within the timeframe intended by the existing approved Spatial Development Framework (SDF) agreed to by the relevant environmental authority? (i.e. is the proposed development in line with the projects and programmes identified as priorities within the credible IDP).*

The Mossel Bay IDP Vision states "good and accessible basic municipal services are to be provided for all within a dynamic, growing economy". In the proposals section of the Mossel Bay SDF it was indicated that in terms of community facilities current planning dictates the provision of a system of waste transfer stations and the provision of regional landfill sites. A proposal has been included in the proposals section of the Mossel Bay SDF (TV3, 2008) to establish Mossel Bay as the industrial core of the Garden Route. Therefore the establishment of a regional waste disposal site within the Mossel Bay

Municipality will not detract from the planning proposal to establish Mossel Bay as the industrial core of the Garden Route.

The Eden District Municipality is currently underway with an investigation under the Municipal Systems Act (nr. 32 of 2000) as amended, where a public private partnership is investigated as Council do not have the required funds for the project. The Eden IDP recognizes the need for a regional waste disposal site and has allocated funds in its implementation plan for 2011/12 for the Environmental Impact Assessment Process and associated specialist studies.

The Eden District Municipality's SDF has established a number of principles that should be carried forward and implemented in the local Municipality's SDF's.

All of the three properties proposed for the use as a waste disposal facility are zoned for Agricultural use. The Mossel Bay Municipality Spatial Development Framework (SDF) has not catered for the proposed Regional Waste Disposal Site in its current planning framework and all three proposed properties fall outside the urban edge.

The SDF allows the growth of industries to the east of PetroSA and Industrial growth to the West of PetroSA was not included in the planning framework. The proposed sites will therefore not inhibit industrial development. The Guide plan for the Mossel Bay/Riversdale subregion also indicated the industrial landuse in the vicinity of PetroSA which extends to approximately the turn-off to Vleesbaai to the west of PetroSA. The location of Site 1 adjacent to PetroSA and to the West of PetroSA could therefore be seen as supplementary to the existing landuse at PetroSA as it is located adjacent to the PetroSA waste disposal facility that currently serves as a Regional Waste Disposal Site. No sites that could be potentially suitable for us as a regional waste disposal facility could be found to the east of PetroSA.

Site 2 is currently used for agriculture and grazing and is surrounded by properties used for Agricultural purposes and are not directly in conflict with these land uses if the waste disposal site is managed effectively. No agriculture projects or economic development strategies have been identified to take place at or in the vicinity of this site (Urban-Econ, 2012).

Site 3 is currently used for agriculture and grazing and is surrounded by properties used for Agricultural purposes and are not directly in conflict with these land uses if the waste disposal site is managed effectively. This land has been identified as high potential agriculture land (with sufficient irrigation) and also serves as a corridor for movement of cattle between farms. No municipal projects or strategies have been identified at this site (Urban-Econ, 2012).

2. *Should development, or if applicable, expansion of the town/area concerned in terms of this land use (associated with the activity being applied for) occur here at this point in time?*

Yes, the development should be allowed to occur in this point of time for the following reasons:

- Funds for the EIA process and associated specialist studies has been included in the Eden District Municipality IDP 2011/2012 and the need for a regional waste disposal site has been indicated in the proposals that form part of the Mossel Bay SDF;
- The Municipalitties of Bitou, George, Knysna, Hessequa (Albertinia and Gouritsmond) and Mossel Bay suffer from a lack of long-term capacity at their waste disposal sites and therefore the development of new landfill sites is critical.
- population growth is creating demand for more landfill space
- irrespective of what alternatives are used for waste minimisation, recycling and volume reduction, some of the waste cannot be processed in this way and thus landfilling is the only alternative available for this remaining fraction, at this stage.

3. *Does the community/area need the activity and the associated land use concerned (is it a societal priority)? This refers to the strategic as well as local level (e.g. development is a national priority, but within a specific local context it could be inappropriate).*

On a local and regional level, both the Eden District Municipality and the Mossel Bay Municipality SDF have identified the need of adequate service delivery as well as the need for a regional waste disposal site. As indicated above there is a need for a waste disposal site for the Bitou, Knysna, George, Mossel Bay and parts of Hessequa (Gouritsmond and Albertinia) Municipalities. Knysna, George, Mossel Bay and Gouritsmond's are already transported to the PetroSA facility. The Eden District Municipality indicated that the Bitou waste disposal facility has also reached capacity and in all likelihood Bitou Municipality will also be transporting their waste to PetroSA within 2012. PetroSA has indicated that they are not willing to extend the contracts for waste disposal as they need the site for their own purposes. The proposed regional landfill site is therefore a societal priority to ensure effective service delivery and prevent the potential pollution of the environment through the provision of an engineered landfill site.

As mentioned above population growth and economic growth is creating demand for more landfill space and irrespective of the alternatives that are used for waste minimisation, recycling and volume reduction, some of the waste cannot be processed in this way and thus landfilling is the only alternative available for this remaining fraction, at this stage.

At a national level, South Africa has a history where every town, village or settlement had its own dump, where waste was (and still is) very badly managed, using unacceptable practices such as burning.

Often these small dumps were located near watercourses or wetlands or aquifers, to name but a few of the common errors in the many existing dump sites in South Africa. The Southern Cape is an area of particularly high environmental quality, with large tracts of environmental sensitivity. No potentially suitable sites could be found to the east of PetroSA.

The modern requirements for the development, operation and maintenance of a properly engineered and managed landfill site require a certain minimum investment in infrastructure (entrance facilities, weighbridges, compactors, etc.) Having several smaller sites therefore increases the unit cost considerably. In addition there is a scarcity of personnel with the required skills to manage landfill sites, as is evident from the quality or the standards witnessed at the many small dumps. An audit of most, if not all, landfill sites in the Western Cape conducted by DEA&DP in 2007/2008 found that the larger landfill sites were in general much better managed than the smaller ones.

The **total impact** of the construction of the proposed Eden Regional Landfill site on the creation of new employment opportunities for **alternative 1 is 5, 272**; for construction of **alternative site 2 it is 5, 309**; and for construction of **alternative site 3 it is 5, 28**8. It must be emphasised that these costs pertain to and are distributed over the proposed 50 year life span of the site. As with production and new business sales, the **No-Go alternative** will have no impact on employment generation as this construction will not take place in this alternative, no labour will be needed and thus will not generate any new employment opportunities. The No-Go however does represent and display the opportunity cost with regards to employment, if the facility is not constructed. Employment creation has been identified as a growing need by communities (wards) in Herbertsdale and Mossel Bay (Urban-Econ, 2012).

4. *Are the necessary services with adequate capacity currently available (at the time of application), or must additional capacity be created to cater for the development?*

The services that will be required for the proposed waste disposal facility are electricity, water and sewage disposal. Potable water for the entrance complex is piped from the nearest regional water mains in the case of Site 1 as indicated on the layout plans. The Mossel Bay Municipality has indicated that water is available to draw from this line. The line will however have to be moved to the cadastral boundary of Site 1. In the case of sites 2 and 3 water will be stored in tanks on site to allow for 1 week's water supply. This would require a supply of 15 kilolitres that can be easily contained in aboveground tanks. The potential use of borehole water on these sites is also not excluded, but can only be determined when drilling on these sites. The power supply for Site 1 will be obtained from the existing 11kVA line on the site. The power supply for Site 2 and 3 will be brought in from the nearest 11kVA line to the entrance facility complex. In the case of Site 2 the nearest line is approximately 2.5km from the site, whilst in the case of Site 3 the nearest 11kVA line is 4.5km from the site. ESKOM has indicated that they can supply power to the sites, however the cost for the extension of the powerlines in the case of Sites 2 and 3 will be for the applicant.

Sewage will be stored in conservancy tanks and removed to a wastewater treatment works for disposal. The Mossel Bay Municipality has indicated that the local wastewater treatment works will be able to accommodate the sewage generated at the facility. They have also confirmed that should an excess leachate be generated under unusual circumstances they will also be able to treat the leachate.

5. *Is this development provided for in the infrastructure planning of the municipality, and if not what will the implication be on the infrastructure planning of the municipality (priority and placement of services and opportunity costs)?*

The Eden District Municipality is currently underway with an investigation under the Municipal Systems Act (nr. 32 of 2000) as amended, where a public private partnership is investigated as Council do not have the required funds for the project. The Eden IDP recognizes the need for a regional waste disposal site and has allocated funds in its implementation plan for 2011/12 for the Environmental Impact Assessment Process and associated specialist studies.

6. *Is this project part of a national programme to address an issue of national concern or importance?*

This project is not part of a national programme, however it does address an issue of national concern and importance as South Africa has a legacy of poorly managed landfills sites and a number of municipalities do not have capacity to dispose of solid waste and cannot provide in the community's needs for adequate waste disposal service delivery.

Space for waste disposal sites in the country as a whole is limited and therefore it is of national concern that the waste hierarchy be followed, with avoidance being the most favourable and disposal the least favourable option. The proposed regional waste disposal site will assist with the implementation of this strategy on a regional level in that it will not only provide facilities for the recovery of recyclable items, but it will also encourage individual municipalities to place greater emphasis on waste reduction and specifically the reduction of waste to landfill as the transport cost of the waste could potentially be reduced if less waste is disposed.

7. *Is the development the best practicable environmental option for this land/site?*

The three sites proposed to serve as a potential site for a regional waste disposal facility are all currently used for agricultural purposes. A number of specialist investigations were conducted in the EIR phase of the process and the three sites has been comparitevly assessed in this EIR. The proposal for the best practicable environmental option for a site requires the consideration of various factors as addressed in the mentioned specialist assessments, but also importantly the inputs that has been received throughout the process from I&APs as well as governmental stakeholders. These issues are discussed throughout this EIR and only a brief summary is given for each site below, but should not be read in isolation to the rest of this document.

Site 1: This site is next to the current PetroSA Landfill site and as such no additional negative impacts will emanate that are likely to impact the communities of Herbertsdale and Mossel Bay. The location of the development at site 1 is the best practicable use of this land as one of the adjoining properties is currently used for identical purposes as those of the proposed development. The site also has relatively few ecological constraints and is likely to have a low impact on the biophysical environment is all the mitigation measures are effectively implemented. Out of a heritage resources perspective this site was also found to be suitable with the required mitigation measures. The Department of Agriculture also indicated in its comments that they have no objection to the preferred Site 1.

Site 2: Negative impacts of the proposed development at site 2; include the release of windblown litter into land currently used for agricultural grazing, which could result in the death and loss of livestock for farmers in the immediate vicinity. Access to the site is also problematic as the existing access from the Herbertsdale road (MR 342) is too steep and access needs to be obtained from DR1549. This requires the partial reconstruction of DR1549 and a right turn lane will have to be constructed on the N2 westbound and an acceleration lane will have to be provided on the N2 eastbound at the DR1549 intersection. The access to Site 2 from DR1549 will have to be over private property. The botanical assessment also indicated that the vegetation on the site is of high sensitivity and forms part of an ecological corridor. A further negative aspect out of an agricultural perspective as indicated by the Department of Agriculture during the Scoping Phase is that the location of Site 2 is far from existing development in the rural area and is therefore not favourable. Due to the access and ecological constraints it is not recommended that the proposed waste disposal facility is the best practicable environmental option for this site.

Site 3: Agricultural land at site 3 has been identified as high potential agricultural land and serves as a corridor for the movement of cattle and livestock between farms in the area for grazing. The location of the development at site 3 is likely to disrupt farming activity as well result in the negative impacts listed for site 2 above. Thus the establishment of the landfill at site 3 is not the best practicable use of the land from a social and environmental perspective (Urban-Econ, 2012). Partial reconstruction of either DR1549 of MR 341 is required to provide access to the site and depending on the route that is selected a portion of private property will have to accessed. A short dedicated right turn lane will be required on the N2 westbound and an acceleration lane on the N2 eastbound at either the DR1549 or MR341 intersection if either of these routes is selected. Site 3 is not considered of high ecological value, however the eastern most drainage line on the property will be affected through the diversion of this drainage line. A relatively small potion of indigenous vegetation falling within an identified CBA may be affected due to the widening of the access road that links the site with the MR341. The Department of Agriculture also indicated during the Scoping phase that from an Agricultural perspective that this site is the least preferred site due to the location and agricultural capability.

8. *Would the approval of this application compromise the integrity of the existing approved and credible municipal IDP and SDF as agreed to by the relevant authorities.*

No, the approval will not compromise the integrity of the municipal IDP and SDF. All three sites are located outside the urban edge. Site 1 is located adjacent to the PetroSA waste disposal site. It is indicated in the Mossel Bay SDF that the growth of the Industrial node at PetroSA is planned to the east and not to the west, where Site 1 is located.

As the IDP and SDF highlight no intended use of the land at the respective sites and current land activities do not feature in any of the municipality's strategies (IDP) for refuse removal, economic development or agriculture, the location of the development at any of the proposed sites will not compromise strategies and initiatives of the local Mossel Bay municipality (Urban-Econ, 2012).

9. *Would the approval of this application compromise the integrity of the existing environmental management priorities for the area (e.g. as defined in EMFs), and if so, can it be justified in terms of sustainability considerations?*

The following information is drawn from the specialist assessments as contained in Chapter 9 and included under Appendix G. The Botanical Impact Assessment and inputs from the freshwater ecologist and avi-fuanal specialist has particular relevance.

Site 1: The site presents relatively few botanical or ecological constraints to the proposed development, as due to the intensive agriculture relatively little natural vegetation remains on site (Helme, 2012). Although it has been indicated that Site 1 consists mainly of areas of very low botanical sensitivity, some areas of ecological sensitivity and critically biodiversity areas has been identified. These mainly involve a seasonal wetland and stream. With the inputs of the botanist, freshwater ecologist, CapeNature and the Department of Water Affairs changes in the layout of the site, which allows for buffer zones for areas in need of protection, has reduced the potential impacts on these features to acceptable levels. It is therefore considered unlikely that the approval of the application will compromise the integrity of the existing environmental management priorities in the area.

Site 2:

It was indicated by the Botanist that Site 2 contains large areas of high botanical sensitivity and form part of a regionally important ecological corridor and about 70% of the site is a designated Critical Biodiversity Area in terms of the regional Fine Scale Conservation Plan. It is likely that the approval of the proposed development on this site may compromise the integrity of the existing environmental management priorities in the area.

Site 3:

There is essentially no remaining natural vegetation on most of this heavily agricultural site, as the entire site (except for the drainage lines) has been ploughed, and all of it is heavily grazed. The botanical sensitivity of all but the drainage lines is consequently Very Low. (Helme, 2012). The site presents no real botanical or ecological constraints to the proposed development, apart from the presence of two drainage lines, as due to the intensive agriculture no significant natural vegetation remains on site. No major designated critical biodiversity areas occur on site (Helme, 2012), however the proposed access road transects a section of the critical biodiversity area and the widening of this road will have a negative impact on the CBA, although this section was described as heavily trampled and grazed. It is therefore considered unlikely that the approval of the application will compromise the integrity of the existing environmental management priorities in the area.

10. *Do location factors favour this land use (associated with the activity applied for) at this place? (this relates to the contextualisation of the proposed land use on this site within its broader context).*

A Waste Disposal Site "Window" identification report was compiled with available information on geology, land use, ground and surface water, topography and environmentally sensitive areas (e.g. RAMSAR sites, conservation areas, National Parks, Heritage sites). The information was used to build up a composite map showing areas that are potentially **not suitable** for the location of a waste disposal site in the Eden District Municipality.

The criteria used to provisionally eliminate areas from further consideration were based on the identification of areas with inherent Fatal Flaws as defined in the Department of Water Affairs and Forestry's (DWAF) Minimum Requirements document (DWAF, 2005). These include the following:

- Areas in proximity to significant surface water bodies;
- Sensitive ecological and/or historical areas;
- Catchment areas for important water resources such as dams;
- Areas overlying or adjacent to important or potentially important aquifers;
- Areas overlying or adjacent to major fault zones;
- Areas with highly permeable soils;
- Areas associated with steep slopes; and
- Areas in close proximity to land uses, which are incompatible with waste disposal.

Taking the above-mentioned factors into consideration a composite map was compiled which indicates areas potentially suitable for a regional waste disposal site. The composite map is included in this report as Figure 6.1.

Subsequent to the completion of the Waste Disposal Site "Window" Identification a site reconnaissance of the areas potentially suitable for a waste disposal site was conducted. The site reconnaissance led to the identification of a number of scenarios for the waste disposal by the EDM. Certain areas that were identified as potentially suitable for a waste disposal site on the composite map, where excluded after the site reconnaissance. Factors that led to the exclusion of certain areas include but are not limited to:

- The surface water profile which is difficult to manage in order to avoid surface water contamination,
- Roads that are elevated above the potential sites, which leads to certain sites being highly visible and therefore hard to mitigate the visual impacts due to the elevated road,
- Some of the potential sites included a number of smallholdings, which results in many different land uses that will be affected by a landfill site.

No potentially suitable sites were identified to the east of PetroSA.

As mentioned in the previous paragraphs, Site 1 has certain benefits in terms of location due to its proximity to the existing PetroSA solid waste disposal site that currently serves as a Regional Waste Disposal Site. The road infrastructure also provides ease of access. There are a number of constraints pertaining to Sites 2 and 3 that have been described in earlier paragraphs due to the required partial reconstruction of roads to carry heavy vehicles and the geometric changes that are required. The socio-economic specialist indicated that the area adjacent to Site 1 has an industrial nature and thus the location of the development at this site will not impact the sense of place and will complement the surrounding land uses (Urban-Econ, 2012).

Sites 2 and 3 provide locational benefits due to their location away from any urban settlements that will minimise the potential impacts on residential areas but on the other hand these two sites has locatinal disadvantages due to the impact that the proposed facility will have on the rural environment and agriculture. Due to its location in a flat area that has been significantly impacted by agriculture and industrial development, the visual quality of Site 1 is considered to be the lowest of the three proposed sites. Site 2, located in an area with many hills and valleys that retains a large proportion of the indigenous vegetation, has the highest visual quality. Site 3 has a visual quality that is considered to fall in between that of Sites 1 and 2, as it is situated in a somewhat hilly agricultural area not as stimulating and diverse as the surroundings of Site 2 (SRK, 2012).

11. How will the activity or the land use associated with the activity applied for, impact on sensitive natural and cultural areas (built and rural/natural environment)?

The size and nature of the proposed regional waste disposal facility may result in potential impacts on natural and cultural areas. These impacts have been adequately addressed throughout this report and specifically in the findings of the specialist assessments as presented in Chapter 9. The Heritage, archaeological and palaeontological assessments indicated that any of the three sites will be suitable for the use of a waste disposal facility and made recommendations for mitigations of the potential impacts. The potential visual impacts have also been addressed. The potential visual impacts may also impact on the natural and cultural environment, but the specialist found that although none of the three proposed sites are considered to have an outright fatal flaw from a visual perspective, Site 1 is considered to result in the lease significant visual impacts if the mitigation measures are effectively implemented.

12. *How will the development impact on people's health and wellbeing (e.g. in terms of noise, odours, visual character and sense of place, etc.)?*

The nature of the proposed activity results that there are potential impacts on people's health and wellbeing.

Site 1: Noise and odours from the site is unlikely to impact the closest residential areas as the site is located a fair distance from residential development. It is thus purported that the location of the landfill at site 1 will not impact residential property values and due to the industrial nature of the surrounding land uses will not impact tourist activities in the area as it is not located on any tourist trails or in the vicinity of any tourist related activities (Urban-Econ, 2012). It is therefore unlikely to result in the loss of employment of those employed in the tourism sector of the local economy.

- **Site 2**: this site is not likely to have an impact on the health and safety of communities in the Mossel Bay area due to the sheer distance between the two. Construction of the site at this location will also not result in job loss on the farm on which it will be

Site 3: similar to site two, however with the sale of this land and the subsequent halting of farming activities will result in the loss of at least 2 jobs, which will have an impact on these household income.

The air quality impacts have been described in detail in Chapter 9 and the Air Qaulity Impact Assessment attached under Appendix G. No fatal flaw associated with any of the three alternative sites was identified out of an Air Quality perspective. A comparison of the predicted air pollution impacts indicates that Site 2 is marginally better than Site 1 and Site 3. It was predicted that Site 3 would result in the highest air pollution impact, unless the access road is treated to reduce fugitive dust emissions. The main air pollution impacts were identified to be associated with health risk (carcinogens and PM_{10}) and odours. The recommendations are therefore geared towards minimising the impact and/or potentially eliminating air pollution from sources generating these emissions. The health risk can be reduced through design specifications, operational procedures and applying a Buffer Zone. The latter minimises the exposure, whereas the former actions reduce or eliminate the emissions. The Air Quality Impact Assessment recommended that since no fatal flaws were identified, and since the impact can be minimised to near *Low* impacts through the appropriate mitigation measures, it is recommended that the project should be authorised.

13. *Will the proposed activity or the land use associated with the activity applied for, result in unacceptable opportunity costs?*

Opportunity cost is defined by the DEA&DP Guideline on Need and Desirability (2011) as follows: "The net benefit that would have been yielded by the next best alternative (for example, if farming is the next best alternative for a piece of land, then the foregone benefit of losing the farming option will be the opportunity cost of any other land use, or if not proceeding with the activity, then the foregone benefits of the proposed activity is the opportunity cost of not proceeding".

The three proposed properties are all used mainly for agricultural purposes and situated outside the urban edge. It is likely that these properties will only be used for agricultural purposes in the foreseeable future.

Site 1: is currently used for the PetroSA landfill site, which reduces the opportunity cost associated with potential economic land uses at the site. The only opportunity cost associated with this site is the portion of land, which is currently used for agriculture (Urban-Econ, 2012).
Site 2: This portion of land is currently used for agricultural grazing and farming. The opportunity costs associated with construction of the landfill at this development is not limited to the foregoing of this land use and loss of Biodiversity, but the potential impacts of windblown litter causing livestock death, increase the opportunity cost to farmers in the area (Urban-Econ, 2012).
Site 3: the opportunity cost attached to the construction of the landfill at this site is the highest. The current land use at this site is for farming and grazing, and as with site two, windblown litter will further increase the opportunity cost to farmers in the area. In addition the land proposed to be used for the landfill has been identified as high potential agriculture land, which could be used for the cultivation of other crops such as wheat. The current drought has however reduced the fertility and usability of this land. With increased rainfall this land could become high yielding land and thus increase the opportunity cost to unacceptable levels (Urban-Econ, 2012).

14. Will the proposed land use result in unacceptable cumulative impacts?
From a social perspective the main cumulative impacts foreseen for the site are the occurrence of the nuisance factors, especially windblown litter, odour and flies. At all three proposed sites this maypose a problem over time to the farmers on the surrounding land. Mitigation measures, most notably the erection of litter fences and the daily compaction of waste will reduce the impact of these factors.
Sites 1 and 3 would both have Very Low to Low negative cumulative botanical impacts, and Site 2 would have a High negative cumulative botanical impact (Helme, 2012).

From a groundwater perspective the cumulative impact between the Petro SA waste site and Site 1 is rated as low due to the following:

- Petro SA waste site is lined and should have a low if any impact on surrounding groundwater:
- The migratory action of lining Site 1 should also result in a low to no impact on groundwater; and
- Groundwater levels at the sites are between 9 and 23, which would naturally attenuate leachate constituents (SRK, 2012).

The Air pollution Impact Assessment has indicated that the current PM10 concentrations were shown to be more significant, with a number of exceedances of the NAAQS limit value. The relatively high PM10 concentrations are expected to be due to nearby farming activities. The landfill operation would add to the existing particulate air concentrations and, unless adequately mitigated, result in further violations of the daily average NAAQS. Since Sites 2 and 3 would be accessed by significantly longer gravel roads than Site 1, the cumulative impact would be higher (Airshed Planning Professionals, 2012).

The proposed project continues the process of the visual transformation of this area, in that it introduces a potentially visually incongruent facility into the landscape. This is most pronounced for Sites 2 and 3, which are located in an agricultural or largely natural setting. As no other significant developments are located near those sites, the landfill would detract from the existing sense of place, but would not be part of a larger cumulative impact based on already existing or anticipated future developments at these sites. From a visual point of view, however, this means the activity will be more visible as the surrounding landscape is less able to absorb the new development and may thus be less desirable. At Site 1, the landfill would have a cumulative impact over and above that of existing industrial development. It may thus accelerate the process of transforming this area wholly from an agricultural to an industrial area. From a visual point of view, however, this means that the existing visually compatible activities are able to absorb the visual impact of the new landfill to some extent, which may be preferable. The landfill itself is not considered likely to trigger new future development in the area, which would further add to the cumulative impact, as it addresses an existing need for disposal of waste generated by the surrounding residential, commercial and industrial areas (SRK, 2012).

The archaeological report indicated that any of the three sites are suitable for the proposed facility. It did however rate the potential cumulative impact on Site 1 as high and that on Sites 2 and 3 as being low.

It is therefore concluded that with effective operational control and the effective implementation of the recommended mitigation measure and the EMP, unacceptable cumulative impacts are not expected on Sites 1 and 3. Out of a botanical and ecological perspective the cumulative impacts on Site 2 due to the loss of critical biodiversity areas and regionally important ecological corridors may lead to unacceptable cumulative impacts.

CHAPTER 6: CONSIDERATION OF ALTERNATIVES

6.1 Introduction

The identification and consideration of alternatives is recognised as required practice in environmental assessment procedures globally. Regulatory requirements in the NEMA EIA Regulations stipulate that "*alternatives to the proposed activity that are feasible and reasonable*" be considered during the EIA process, at the earliest proposal development stage.

The Scoping Phase therefore screens alternatives to derive reasonable and feasible project alternatives to focus the EIA phase in the EIA process. This section includes all the alternatives that have been considered thus far in the EIA process, but only those alternatives that were carried forward to the EIR phase of the EIA process are assessed in this report.

All waste treatment and disposal activities will have some impact on the environment. There is currently no method of waste treatment or disposal that does not have some adverse environmental effects. Therefore, a balance needs to be struck between measures to reduce or eliminate adverse environmental impacts and the costs of handling, treatment and disposal. One needs to determine the best practicable environmental option (BPEO) for managing waste. The BPEO concept incorporates three further principles that need to be taken into account when making waste management decisions.

- The Waste Hierarchy
- The Proximity Principle
- Regional Self Sufficiency

The **proximity principle** advocates that treatment and disposal of hazardous waste take place at the closest possible location to its source in order to minimize the risks involved in its transport. Waste should therefore be disposed of (or otherwise managed) close to the point at which it is generated, thus aiming to achieve responsible self-sufficiency at a regional/or sub regional level. Where this is not possible priority should be given to transportation by rail or water. The proximity principle also helps to raise awareness in local communities that the waste they produce is their problem, of which they should take ownership.

The capacity of a Hazardous Waste landfill to safely accept a certain substance must be determined. This is termed the Total Load. The Total Load capacity of a landfill site will be influenced by the inherent hazardousness of the waste, by the mobility (leach ability) of the waste, and by the landfill design (leachate collection system). The Total Load is calculated by using the Estimated Environmental Concentration (EEC). The EEC represents exposure by a hazardous substance in the waste, should it enter the environment (air, water and soil). The EEC represents the worst-case scenario, that is, it assumes total concentration, as if all of the substance was to leach out of the waste and enter the environment (DWAF, 1998).

In all cases the Total load principle must be taken into consideration to ensure the protection of the environment against the leaching of contaminants.

6.2 Previous studies

A number of studies have been completed during the period 1991 to 1998 for the Bitou, Knysna and George Municipalities that considered options for waste disposal. Furthermore, an investigation for a Waste Management Strategy for the South Cape was completed in January 1999. Please note that these studies were not reviewed in detail and it is not the purpose of this EIA process to include a literature review of previous solid waste management investigations in the area. Some of the previous studies are however mentioned in this section with the purpose to provide a historical context of some of the investigations into waste disposal options. The current EIA process is based on the findings of the Waste Disposal "Window" Identification Report that was included in the Scoping Report and discussed under paragraph 6.4.1.

This information is provided in order to show that the Eden District Municipality and certain Local Municipalities have since approximately 1993 investigated various options and sites for the disposal of their waste.

Previous studies date back as early as 1993 and include, but are not limited to the following:

- Bergman Ingerop. 1999. Investigation for a Waste Management Strategy for the South Cape.
- Bergman Ingerop. 1998. Prefeasibility Investigation into the suitability of a proposed waste site on Farm 464, George.
- Bergman Ingerop. 1995. Plettenberg Bay - Regional waste disposal - Report on Analysis of Options.
- Bergman Ingerop. 1993. Investigation into the development of a class 2 regional waste disposal site at Gansevallei, Plettenberg Bay - Feasibility Report.
- Bergman, B.S. & Partners INC. 1994. Investigation into the development of a Class II Regional Waste Disposal Site at Knysna. Feasibility Report.

A number of geological, geohydrological and geophysical investigations were included in the reports listed above. The Waste Management Strategy for the South Cape (Bergman Ingerop, 1999) stated in the section dealing with regional landfills that the eastern side of the region stretching from Mossel Bay and Plettenberg Bay is a very sensitive coastal area and it was proposed that the site at PetroSA

(Mossgas) should be utilized as a regional waste disposal site, serving this part of the region. It was furthermore proposed that the waste from Heidelberg to Albertinia should be disposed of at the Riversdale site which should be developed into a regional facility (Bergman Ingerop, 1999).

6.3 Strategic Alternatives

Specific factors that were considered in siting and designing the layout for each site included the following:

6.3.1 Environmental factors

- Drainage and surface water bodies on and around the sites;
- Groundwater regimes on and around the sites;
- Sensitive and/or conservation-worthy ecosystems on the sites (vegetation types, wetland areas, etc.);
- Cultural heritage value of the site and heritage resources (e.g. buildings, etc.);
- Visibility from the surrounding areas; and
- Distance from residences and residential areas.

6.3.2 Technical factors

- The gradient of the landfilling area. The DWAF requires a 5% gradient for leachate collection drains in the base of the landfill area and the amount of excavation required is therefore determined by the gradient of the land;
- The amount of cover material that would be made available from excavation of the landfill area;
- The location of the railway line;
- The location of road access to the area and the requirement to place the landfill area as close as possible to the access point; and
- Other existing and planned land uses on or near the site area.

6.4 Site alternatives

Three site alternatives have been identified as feasible and reasonable site alternatives for the proposed Eden District Municipality Regional Waste Disposal Site. A comprehensive process was followed that led to the identification of the proposed three sites. This process culminated in the compilation of a report, namely the Eden District Municipality: Waste Disposal Site "Window" Identification.

This report is briefly discussed below, but not included in this EIR as it has been included in the Scoping Report.

6.4.1 Eden District Municipality: Waste Disposal Site "Window" Identification

During the compilation of this report available information on geology, land use, ground and surface water, topography and environmentally sensitive areas (e.g. RAMSAR sites, conservation areas, National Parks, Heritage sites) was used to build up a composite map showing areas that are potentially not suitable for the location of a waste disposal site in the Eden District Municipality. After consultation with Interested and Affected Parties (I&APs) these areas may be modified.

The following sources of information were used in the desk study to demarcate areas potentially incompatible with the establishment of a waste disposal site:

- Colour composite LANDSAT image at 1:250,000 scale;
- 1:50 000 scale topographic maps
- 1:250 000 scale topocadastral maps
- 1:250 000 geological map series
- 1:500 000 hydrogeological map series
- Eden District Municipality Spatial Development Framework (2003)

The criteria used to provisionally eliminate areas from further consideration were based on the identification of areas with inherent Fatal Flaws as defined in the Department of Water Affairs and Forestry's (DWAF) minimum requirements document (DWAF, 2005). These include the following:

- Areas in proximity to significant surface water bodies;
- Sensitive ecological and/or historical areas;
- Catchment areas for important water resources such as dams;
- Areas overlying or adjacent to important or potentially important aquifers;
- Areas overlying or adjacent to major fault zones;
- Areas with highly permeable soils;
- Areas associated with steep slopes; and
- Areas in close proximity to land uses, which are incompatible with, waste disposal.

Taking the above-mentioned factors into consideration a composite map was compiled which indicates areas potentially suitable for a regional waste disposal site. The composite map is included in this report as Figure 6.1.

Subsequent to the completion of the Waste Disposal Site “Window” Identification a site reconnaissance of the areas potentially suitable for a waste disposal site was conducted. The site reconnaissance led to the identification of a number of scenarios for the waste disposal of the EDM. Certain areas that were identified as potentially suitable for a waste disposal site on the composite map, where excluded after the site reconnaissance. Factors that led to the exclusion of certain areas include but are not limited to:

- The surface water profile which is difficult to manage in order to avoid surface water contamination,
- Roads that are elevated above the potential sites, which leads to certain sites being highly visible and therefore hard to mitigate the visual impacts due to the elevated road,
- Some of the potential sites included a number of smallholdings, which results in many different land uses that will be affected by a landfill site.

Please note that no potentially suitable site was identified to the east of PetroSA. These scenarios needed further investigation in order to determine the economic feasibility of the different transport arrangements for delivering municipal solid waste to the various new regional landfill sites proposed for the Eden District. The different scenarios are described in paragraph 6.5. Each of the proposed landfill sites will be briefly described in the following paragraphs, but for the detailed description of the three sites please refer to Chapter 7.

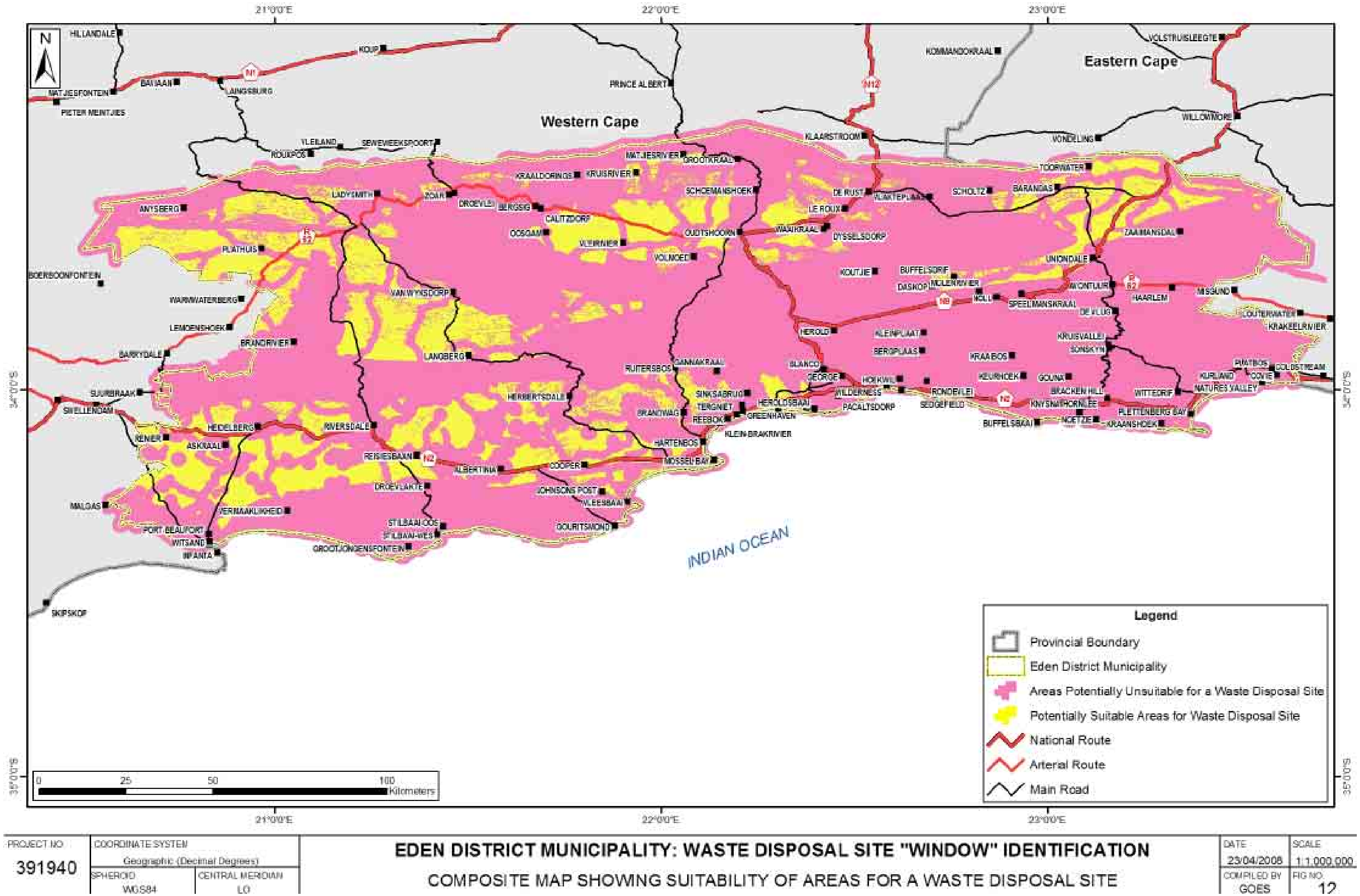

Figure 6.1: Composite map that identifies areas that is potentially suitable for a waste disposal site (Source: SRK Consulting Engineers, 2008).

6.4.1.1 Location of Site 1

Site 1 lies immediately north of the N2, approximately 1 km west of PetroSA and 13 km west of Mossel Bay. Dana Bay is located approximately 8 km southwest of the site and Nautilus Bay is located approximately 4 km from the site (measured on a Google Earth Aerial image, direct line). Please refer to the location map in Appendix A. It should be noted that some of the specialist reports (Air Pollution Impact Assessment, Visual Impact Assessment, Birds) used Dana Bay as reference point for the either the closest residential development or closest town, however Nautilus Bay is in fact the closest residential development to Site 1. The specialist were alerted to this and confirmed that it does not affect the findings of their assessments.

<u>Property details:</u>

Portion 9 of the Farm Drie Fonteinen Nr 243

Portion 1 of the Farm Patrysfontein Nr 228

Remainder of Farm 310

6.4.1.2 Location of Site 2

Site 2 lies just south of the R327 (leading to Herbertsdale), approximately 20 km (direct line) north-west of Mossel Bay, 16.5 km (direct line) south-east of Herbertsdale, which is the closest town, and 6.5 km north of the N2. Please refer to the location map in Appendix A.

<u>Property details:</u>

Remainder of the Farm Zuur-Rug No. 207.

6.4.1.3 Location of Site 3

Site 3 lies approximately 2.5 km to the south of the R327, just east of the gravel road that connects the R327 with the Cooper train station. It lies approximately 26 km (direct line) north-west of Mossel Bay, 13 km (direct line) south-south-east of Herbertsdale, which is the closest town, and 7.5 km north of the N2. Please refer to the location map in Appendix A.

<u>Property details:</u>

Portion 1 of the Farm Kruisvallei Nr 232

Portion 2 (Portion of Portion 1) of the Farm Kruisvallei Nr 232

Farm 232 – access of this property is required, however the landowner has not provided consent for the use and upgrade of the existing access road.

N2/MR341 intersection: turning lanes on the N2 within the existing road reserve are required at this intersection.

6.5 Waste Transport Alternatives

For each Municipality, a number of alternative scenarios for landfill sites have been considered (Naudé, 2008). The information contained in this section has been obtained from the report compiled by Naudé (2008) and full acknowledgement of the information provided in this section is given to H. Naudé (2008). Some of the scenarios include intermediate destinations such as new refuse transfer stations (denoted by RTS). Please note that the numbering system used in the economic evaluation changed subsequent to the compilation of the report. The table below will clarify the names of the various sites.

Name used in Economic evaluation	Name used in subsequent reports
Site D	Site 1
Site E	Site 2
Site F	Site 3

Table 6.1: Names used to describe the proposed sites.

The following alternatives have been assessed for each Municipality:

Seven potential waste disposal sites were considered during the economic evaluation of the different transport arrangements of the waste. The sites are labeled A – H in Figure 6.2 below. Sites A & C were found to be unsuitable and were therefore not included in the economic evaluation, whilst Site G near Uniondale was identified as a potential site to serve the Uniondale/Haarlem Area. Site H was identified as a potential local site for the Kannaland Municipality and Site B as a potential local site for the Hessequa Municipality excluding the waste from Albertinia and Gouritsmond as the distance to the proposed Regional Waste disposal facility at sites 1, 2 or 3 would be shorter than to transport the waste to Site B.

Figure 6.2: Location of sites.

6.5.1 The transport of waste by road: various scenarios for each Municipality.

Hessequa Municipality

The alternative landfill scenarios, i.e. H1 – H4 for the Hessequa Municipality and the distances between the various towns and the landfill sites for each scenario are shown in Table 2.1:

Hessequa				
Scenario H1: All waste to Site B(refer to Figure 6.2 for the location of the site)				
	Origin	**Intermediate Destination**	**Ultimate Destination**	**One-way Dist. (km)**
H1	Albertinia		Site B	30.6
	Witsand		Site B	85.9
	Gouritzmond		Site B	65.4
	Heidelberg		Site B	48.8
	Slangrivier		Site B	62.9
	Riversdale		Site B	18.5
	Stilbaai		Site B	26.6
Scenario H2: 3 new RTS, the rest to site D (1)				
H2	Albertinia		Site D	34.9
	Witsand	New RTS Heidelberg	Site D	145
	Gouritzmond		Site D	33.4
	Heidelberg	New RTS Heidelberg	Site D	103
	Slangrivier	New RTS Heidelberg	Site D	122
	Riversdale	New RTS Riversdale	Site D	72.3
	Stilbaai	New RTS Stilbaai	Site D	88.4
Scenario H3: All waste to Site D (1)				
H3	Albertinia		Site D	34.9
	Witsand		Site D	140
	Gouritzmond		Site D	33.4
	Heidelberg		Site D	103
	Slangrivier		Site D	117
	Riversdale		Site D	72.3
	Stilbaai		Site D	88.4
Scenario H4: Albertinia and Gouritzmond to Site D (1), rest to Site B				

	Albertinia		Site D	34.9
	Witsand		Site B	85.9
	Gouritzmond		Site D	33.4
H4	Heidelberg		Site B	48.8
	Slangrivier		Site B	62.9
	Riversdale		Site B	18.5
	Stilbaai		Site B	26.6

Table 6.2: Scenarios evaluated for the Hessequa Municipality

Mossel Bay Municipality

For Mossel Bay Municipality, the alternative scenarios are that all waste goes either to Site D (Scenario M1), Site E (Scenario M2) or Site F (Scenario M3), as shown in Table 2.2.

Mossel Bay Scenarios			
Scenario	**Origin**	**Final destination**	**One-way distances**
M1	Mossel Bay	Site D	19.0
M2	Mossel Bay	Site E	29.5
M3	Mossel Bay	Site F	34.6

Table 6.3: Scenarios evaluated for the Mossel Bay Municipality

George Municipality

The alternative scenarios for George Municipality are that all waste goes from the existing transfer station at Gwaing either to Site D (Scenario G1), Site E (Scenario G2) or Site F (Scenario G3), as shown in Table 2.3.

George Scenarios			
Scenario	**Origin**	**Final Destination**	**One-way distances**
G1	Gwaing TS	Site D	57.8
G2	Gwaing TS	Site E	68.3
G3	Gwaing TS	Site F	73.4

Table 6.4: Scenarios evaluated for the George Municipality

Knysna Municipality

The scenarios for Knysna Municipality are similar to those of the George Municipality in that all waste goes from the existing Spoornet transfer station in Knysna to either Site D (Scenario K1), Site E (Scenario K2) or Site F (Scenario K3), as shown in Table 2.4.

Knysna Scenarios			
Scenario	**Origin**	**Final destination**	**One-way distances**
K1	Knysna Spoornet TS	Site D	118
K2	Knysna Spoornet TS	Site E	128
K3	Knysna Spoornet TS	Site F	133

Table 6.5: Scenarios evaluated for the Knysna Municipality

Bitou Municipality

For the Bitou Municipality, the scenarios provide for all waste to be transported to a new refuse transfer station (RTS) just outside Knysna and from there either to Sites D, E or F. Scenario B4, in which all waste was to be moved directly to the Spoornet transfer station at Knysna from where it would be shipped via rail to a new landfill site, was initially added, but later removed as a scenario. See paragraph 2.8.

Bitou Scenarios				
Scenario	**Origin**	**Intermediate destination**	**Ultimate destination**	**One-way dist. (km)**
B1	Plet	New RTS	Site D	154.0
B2	Plet	New RTS	Site E	165.0
B3	Plet	New RTS	Site F	170.0
B4	Plet	Knysna	Via rail to Site D	32.7

Table 6.6: Scenarios evaluated for the Bitou Municipality

Oudtshoorn Municipality

Oudtshoorn				
Oudtshoorn Scenarios				
Scenario	**Origin**	**Intermediate destination**	**Ultimate destination**	**One-way dist. (km)**
O1	Oudtshoorn		Upgraded landfill	
O2	Oudtshoorn	New RTS	Site D	119.0
O3	Oudtshoorn	New RTS	Site E	130.0
O4	Oudtshoorn	New RTS	Site F	135.0
O5	O1 + Calitzdorp		Upgraded landfill	55.1

Table 6.7: Scenarios evaluated for the Oudtshoorn Municipality

Kannaland Municipality

The alternative waste transport scenarios shown in Table 2.7 have initially been considered for the Kannaland Municipality.

Kannaland				
Scenario Ka2: Waste from Calitzdorp goes to Oudtshoorn, other to Site H (Please refer to Figure 6.2 for the location of the site)				
Scenario	**Origin**	**Intermediate destination**	**Ultimate destination**	**One-way dist. (km)**
	Calitzdorp		Oudtshoorn	55.1
KA1	Zoar		Site H	37.6
	Ladismith		Site H	19.9
Scenario Ka2: All waste via intermediate destination, to Site D				
	Calitzdorp	Oudtshoorn	Site D	174.1
KA2	Zoar	RTS Ladismith	Site D	174.7
	Ladismith	RTS Ladismith	Site D	162.8
Scenario Ka3: All waste via intermediate destinations, to Site E				
	Calitzdorp	Oudtshoorn	Site E	185.1
KA3	Zoar	RTS Ladismith	Site E	198.7
	Ladismith	RTS Ladismith	Site E	186.8
Scenario Ka4: All waste via intermediate destinations, to Site F				
	Calitzdorp	Oudtshoorn	Site F	190.1
KA4	Zoar	RTS Ladismith	Site F	184.7
	Ladismith	RTS Ladismith	Site F	172.8
Scenario Ka5: All waste go to Site H				
	Calitzdorp		Site H	67.8
KA5	Zoar		Site H	37.6
	Ladismith		Site H	19.9

Table 6.8: Scenarios considered for the Kannaland Municipality

6.5.2 Transfer of Waste by rail

Waste from Knysna

The existing landfill site near PetroSA, some 10 km west of Mossel Bay, receives waste from Knysna by road, although for some eight years all waste from Knysna was transported by rail to the site over a rail distance of approximately 160 rail-kilometres. That arrangement came to an end when sections of the railway line were washed away during floods in 2007. For twelve months in 2009, 16 230 tons of waste were transported from Knysna by road to PetroSA, amounting to, on average, 96 containers per month.

Waste from Plettenberg Bay

As there will soon be no more landfill space available in Plettenberg Bay, it is assumed that all general domestic waste from Bitou Municipality (Plettenberg Bay and surrounds), needs to be trucked away.

Although there are currently no definite plans to repair the damage or rebuild parts of the railway from Knysna, the supporting and complementary services to transport waste by rail are still in place. The containers currently in use to transport the waste to PetroSA are designed to be used for both road and rail services.

With the rail service again operational, waste could be trucked by road from Plettenberg Bay and surrounds directly to the Spoornet transfer station at Knysna, from where it could be transported by rail to the new landfill site at D. Given the predicted waste volumes, this alternative scenario, applicable for both the Knysna and Bitou Municipalities, needs further investigation, if it becomes evident that the railway from Knysna will be repaired.

Comparison of cost by road and rail

Currently the cost to transport the waste containers by road to PetroSA is R2 050 per container (Naudé, 2008). In 2005, the railage rate to transport such containers by rail was R2 011. Inflated to current prices, using the Producer Price Index, that would amount to approximately R 2 878, i.e. railage would amount to an extra R954 000 annually for 1152 containers per annum. (It should be noted that "railage" refers to the charges for rail services – not the cost to Transnet.)

Waste is low-rated traffic, carried on existing railways only when the marginal cost is covered by the revenue – usually the revenue is adequate to cover the estimated direct cost of haulage plus a small (if any) contribution towards the indirect costs (including infrastructure costs). Furthermore, branch railways for freight traffic are seldom financially viable if their full costs are taken into account, i.e. their continued operations remain worthwhile if no provision is made for the replacement of the assets. When such replacement becomes necessary for whatever reason (e.g. as a result of washaways), services are usually withdrawn. That is the business policy of Transnet. (The Transnet Heritage Foundation stated that it lost R10million per annum on the line during the years it was in operation.)

Internal subsidization

It is consequently most unlikely that Transnet will undertake the investment needed to restore and re-open the railway for traffic unless guarantees to ensure its financial viability or ***external*** subsidies (e.g. as a social benefit provided by the central or provincial government) to cover losses are forthcoming. The likelihood that Transnet will resort to internal subsidization, as in the past, is remote. The high-rated rail traffic lost to road transport since the closure of the railway will not be regained if the railway is re-opened, as the hauliers will be able to price their services in a manner that ensures lower total costs to the users. It needs to be borne in mind that the railage is only a portion of those costs when the rail services are used – other costs include road haulage to and from the premises of rail users, transshipment costs, special packaging required for handling, insurance, and extra inventory costs. Road transport usually involves direct door-to-door services in trucks without the need for secure packaging, while the services can readily be co-coordinated to minimize inventory costs. Only low-valued bulk traffic, in which road hauliers have little interest, is likely to be available for transport by railway, but that will yield a return far less than that required to justify re-opening the line.

Passenger service

The railway might succeed financially as a passenger line for tourists, provided it is operated solely for that purpose and crossing or permissive train movements are not allowed. Freight traffic could not be allowed without raising the operating costs substantially in order to ensure safe trains operation, although it might be feasible to run a freight train safely at night if all passenger services are then withdrawn. However, that would reduce the attraction of the rail tours and probably be unacceptable to the operators of tours.

Conclusion

The notion that the rail service for waste could be reinstated at the former rail rates if the infrastructure is restored (allowing for inflation) is thus not valid. If the line were to be reconstructed in places and freight services re-introduced, the costs of doing so would need to be recovered in full from the traffic (including the infrastructure costs over periods, equivalent to the economic lifetimes of the assets) in accordance with ordinary business principles. The prospect of that happening seems to be remote.

6.5.3 Calculation of costs and processing of data

All the costs associated with the development of the new landfill sites, including the costs of constructing entrance roads, as well as the opportunity costs of the alternative use of the sites, are regarded as common to all alternatives and have been omitted from the evaluation.

Logistics model

A logistics model contained in a spreadsheet was used to apply a similar algorithm to each distance-waste tonnage pair in order to estimate the lowest R/tons cost for the vehicles in each class and the appropriate vehicle class was then selected for each town. The calculations involved the following methodology:

i) The daily tonnage is divided by the carrying capacity of each vehicle class in order to estimate the number of trip cycles required to move the waste to the landfill sites

. (1)

ii) The time taken for a single trip cycle is estimated as a function of distance, average speed and turn-around time, which was assumed to be the same for each trip cycle.
(2)

iii) The product of the number of trip cycles and the time of a single trip cycle equals the total vehicle-time required on a daily basis. (1) * (2) = (3)

The total vehicle time is then used to estimate the number of vehicles required in the appropriate vehicle class in order to transport the waste. That number is then applied in order to estimate the daily and annual fixed costs. (4)

Similarly, the total distance to be travelled determines the variable vehicle costs. (5)

The sum of the fixed and variable costs equals the cost of the service for each vehicle class. The total tonnage of waste to be moved is then divided by the capacity of single vehicles in each class in order to calculate the number of vehicles of each class that would be required and the costs that would be incurred. The cost combinations are then compared in order to derive the optimal vehicle mix.

6.5.4 Transport costs for each scenario

The total annual transport cost streams for each Municipality for each scenario, are shown in Tables 3.2 – 3.7, based on constant market prices (as at July 2008).

	Total transport costs (Rm) ***Scenario***			
Year	***H1***	***H2***	***H3***	***H4***
0	2.615	4.272	4.111	2.592
1	2.615	4.272	4.111	2.592
2	2.702	4.272	4.111	2.680
3	2.702	4.272	4.155	2.680
4	2.702	4.272	4.155	2.680
5	2.702	4.272	4.155	2.680
6	2.702	4.657	4.155	2.680
7	2.748	4.657	4.155	2.725
8	2.795	4.657	4.155	2.772
9	2.795	4.657	4.155	2.772
10	2.795	4.657	4.155	2.772

11	2.807	4.712	4.166	2.784
12	2.807	4.712	4.166	2.784
13	2.807	4.712	4.166	2.784
14	2.857	4.735	4.243	2.833
15	2.896	4.735	4.243	2.872
16	2.948	4.794	4.303	2.931
17	2.948	4.794	4.732	2.931
18	3.080	4.794	4.732	3.064
19	3.080	4.794	4.732	3.064
20	3.080	4.794	4.732	3.064

Table 6.9: Hessequa Municipality: Transport cost for each scenario

	Total transport costs (Rm) **Scenario**		
	M1	***M2***	***M3***
Year	***Site D***	***Site E***	***Site F***
0	1.143	1.323	2.229
1	1.143	1.323	2.229
2	1.143	1.323	2.229
3	1.143	1.323	2.229
4	1.143	1.323	2.229
5	1.225	2.268	2.377
6	1.225	2.268	2.377
7	1.225	2.268	2.377
8	1.225	2.268	2.377
9	1.225	2.268	2.377
10	1.225	2.268	2.377
11	2.124	2.394	2.525
12	2.124	2.394	2.525
13	2.124	2.394	2.525
14	2.124	2.394	2.525
15	2.124	2.394	2.525
16	2.124	2.394	2.525
17	2.205	2.520	2.673
18	2.205	2.520	2.673
19	2.205	2.520	2.673
20	2.205	2.520	2.673

Table 6.10: Mossel Bay Municipality: Transport cost for each scenario

	Total transport costs (Rm) ***Scenario***		
	G1	***G2***	***G3***
Year	***Site D***	***Site E***	***Site F***
0	3.939	5.027	5.158
1	3.939	5.027	5.158
2	3.939	5.027	5.158
3	3.939	5.027	5.158
4	5.005	5.320	5.473
5	5.005	5.320	5.473
6	5.005	5.320	5.473
7	5.005	5.320	5.473
8	5.252	6.430	6.605
9	5.252	6.430	6.605
10	5.252	6.430	6.605
11	5.500	6.723	6.919
12	5.500	6.723	6.919
13	5.500	6.723	6.919
14	6.565	7.833	8.052
15	6.565	7.833	8.052
16	6.565	7.833	8.052
17	6.813	8.126	8.366
18	6.813	8.126	8.366
19	7.879	9.236	9.498
20	7.879	9.236	9.498

Table 6.11: George Municipality: Transport cost for each scenario

	Total transport costs (Rm)		
	K1	***K2***	***K3***
Year	***Site D***	***Site E***	***Site F***
0	3.970	4.099	4.163
1	3.970	4.099	4.163
2	3.970	4.099	4.163
3	3.970	4.099	4.163
4	3.970	4.099	4.163
5	3.970	4.099	4.163
6	3.970	4.099	4.163

7	3.970	4.099	4.163
8	3.970	4.099	4.163
9	5.293	5.465	5.551
10	5.293	5.465	5.551
11	5.293	5.465	5.551
12	5.293	5.465	5.551
13	5.293	5.465	5.551
14	5.293	5.465	5.551
15	5.293	5.465	5.551
16	5.293	5.465	5.551
17	5.293	5.465	5.551
18	6.617	6.831	6.938
19	6.617	6.831	6.938
20	6.617	6.831	6.938

Table 6.12: Knysna Municipality: Transport cost for each scenario

	Total transport costs (Rm)		
	B1	***B2***	***B3***
Year	***Site D***	***Site E***	***Site F***
0	3.773	3.867	3.910
1	3.773	3.867	3.910
2	3.773	3.867	3.910
3	5.251	5.392	5.456
4	5.251	5.392	5.456
5	5.251	5.392	5.456
6	5.251	5.392	5.456
7	6.728	6.917	7.003
8	6.728	6.917	7.003
9	6.728	6.917	7.003
10	6.728	6.917	7.003
11	8.206	8.442	8.549
12	8.206	8.442	8.549
13	9.684	9.966	10.913
14	9.684	9.966	10.913
15	9.684	9.966	10.913
16	12.639	13.834	14.005
17	12.639	13.834	14.005

18	12.639	13.834	14.005
19	12.639	13.834	14.005
20	12.639	13.834	14.005

Table 6.13: Bitou Municipality: Transport cost for each scenario.

	Total transport costs (Rm			
	O2	***O3***	***O4***	***O5***
Year	***Site D***	***Site E***	***Site F***	***Oudtshoorn* 1)**
0	5.311	5.499	5.585	0.360
1	5.311	5.499	5.585	0.360
2	5.311	5.499	5.585	0.360
3	5.311	5.499	5.585	0.360
4	5.311	5.499	5.585	0.360
5	5.311	5.499	5.585	0.360
6	5.311	5.499	5.585	0.360
7	5.311	5.499	5.585	0.360
8	5.311	5.499	5.585	0.380
9	5.311	5.499	5.585	0.380
10	5.311	5.499	5.585	0.380
11	5.311	5.499	5.585	0.380
12	5.311	5.499	5.585	0.380
13	5.311	5.499	5.585	0.380
14	5.311	5.499	5.585	0.380
15	5.311	5.499	5.585	0.431
16	5.311	5.499	5.585	0.431
17	5.311	5.499	5.585	0.431
18	5.311	5.499	5.585	0.431
19	5.311	5.499	5.585	0.431
20	5.311	5.499	5.585	0.431

Table 6.14: Oudtshoorn Municipality: Transport cost for each scenario

Note: 1) Including the waste from Calitzdorp. In Scenario O1 all waste will be taken to the upgraded landfill site at Oudtshoorn.

Waste to Oudtshoorn Municipality

The cost to transport the waste from Oudtshoorn Municipality to either of the proposed new landfill sites (at Sites D, E and F), proves to be too expensive. A choice thus has to be made between Scenario O1 (all waste to an upgraded landfill at Oudtshoorn) and Scenario O5 (which is similar to O1, but with the inclusion of all the waste from Calitzdorp). No further analysis regarding the analysis of waste from Oudtshoorn could thus be undertaken.

Waste from Calitzdorp

The waste from Calitzdorp can either be trucked to Site H (in Kannaland Municipality) or to the upgraded landfill site in Oudtshoorn. The total costs to transport the waste to those alternative sites, are shown in Table 7.15.

Year	***To Oudtshoorn***	***To Site H***
	Rand	***Rand***
0	359,599	381,281
1	359,599	381,281
2	359,599	381,281
3	359,599	381,281
4	359,599	381,281
5	359,599	381,281
6	359,599	381,281
7	359,599	381,281
8	379,849	457,787
9	379,849	457,787
10	379,849	457,787
11	379,849	457,787
12	379,849	457,787
13	379,849	457,787
14	379,849	457,787
15	431,438	457,787
16	431,438	457,787
17	431,438	457,787
18	431,438	457,787
19	431,438	457,787
20	431,438	457,787

Table 6.15: Comparison of costs to transport waste from Calitzdorp

It is thus evident that it will be cheaper to transport the waste from Calitzdorp to the landfill site (to be upgraded) in Oudtshoorn.

6.5.5 Economic evaluation

The economic evaluation is intended to determine the best of the three alternatives sites based upon the following assumptions:

(i) That the existing arrangements for disposing of waste cannot continue;

(ii) That there is no option but to establish a new landfill site;

(iii) That the location of the new landfill site will be located as D, E or F (see Figure 1), serving the municipalities of Hessequa (partly), Mossel Bay, George, Knysna and Bitou (with the exception of Oudtshoorn and Kannaland);

(iv) That the transport of refuse directly to one of the new sites is the basic arrangement; and

(v) That the alternatives to be tested are those corresponding to the new sites identified.

It has been furthermore assumed that:

(i) All the costs included in the evaluation should be based on estimated prices at 2008.

(ii) That the base year is 2007 and the analysis period must be 20 years as it would be futile to expand the analysis to 50 years as originally requested (that would not have altered the results);

(iii) That the construction costs for the landfill sites reflect costs as estimated in the preliminary design phase;

(iv) That all the transport costs as well as the operating costs at the transfer stations should be expressed in R/tonne; and

(v) That a Social Time Preference Rate of 10% p.a. is appropriate in South Africa.

(vi) That the cost implications of refuse removal in the towns in the municipalities are not taken into account in the analysis as the costs are assumed to be common to all the alternatives under consideration.

<u>Present Value of Costs</u>

In order to make a comparison of the total costs of all the alternative sites (D, E and F), the Present Values (PV) of (i) site specific (infrastructure and construction) and (ii) transport costs for a period of twenty years for the Mossel Bay, George, Knysna and Bitou Municipalities respectively has been calculated. To arrive at these values, the costs have been discounted at a Social Time Preference Rate of 10%.

The Present Values of Costs (PVOC) are the lowest for Site D for all the municipalities. Although the total transport costs to move the refuse to Site F is always higher (although it does not differ by much) than the alternative to transport the waste to Site E, the site specific infrastructure costs are lower for Site F. There is however, little to choose between these two alternatives, as reflected in the PVOC.

The comparative results of the economic evaluation are shown in Table 6.16:

Municipality	**PRESENT VALUE OF COSTS (PVOC) (Rm)**					
Town	**Site D**	**Site E**	**Site F**	**Site B**	**Site H**	**Oudtshoorn**
Hessequa	26.0[1)]			26.2[2)]		
Mossel Bay	15.5	25.2	26.0			
George	49.4	63.6	61.5			
Knysna	44.6	51.2	48.2			
Bitou	62.7	70.3	68.1			
Calitzdorp					3.9	3.6

1) All waste to Site B, but Albertinia and Gouritzmond to Site D

2) All waste to Site B

3) Upgraded landfill at Oudtshoorn

Table 6.16: Results of the economic evaluation

The PVOC is the lowest for Site D for the Municipalities of Mossel Bay, George, Knysna and Bitou. The PVOC, based on transport costs only, for the Municipality of Hessequa is lowest for Site D (See Note 1.) The waste from the town of Calitzdorp has the lowest PVOC because the waste is transported to Oudtshoorn.

<u>*Unaccounted and external costs*</u>

The following costs have not been estimated for the purposes of the transport study:

- Site specific costs associated with the prevention or mitigation of ground water and atmospheric impacts, noise, odour and traffic impacts, landfill post-closure monitoring and remediation costs; and
- External costs resulting from, *inter alia,* the underestimation of the value of virgin natural resources utilised, opportunity costs of landfill sites and the consequences of creating transport corridors.

<u>*Rail options*</u>

As savings in the time of road users and the costs of road maintenance could be realized if the transport of the waste were to be transferred to rail, (although the railage is likely to be higher than the cost of road haulage), it does not seem to be likely at present that the rail line will be repaired.

6.5.6 Recommendations

The transport economic evaluation recommended:

i) That as the existing waste disposal arrangement cannot continue and as one or other of the three alternatives must be implemented, that the development of a new landfill site at Site D is the best choice for the Municipalities of Mossel Bay, George, Knysna and Bitou and that Site D should be chosen.

ii) That waste from Hessequa Municipality should be carried to site B, with the exception of waste from Albertinia and Gouritzmond which should be carried to Site D; and

iii) That the waste from Calitzdorp should be carried to the upgraded landfill site at Oudtshoorn.

6.6 Alternative Engineering design and method of disposal

Under this paragraph two methods of disposal will be discussed. The co-disposal of hazardous waste with general waste will be compared with the option of disposing the general waste separately from the hazardous waste.

6.6.1 Co-disposal of general waste and hazardous waste

Co-disposal refers to the mixing of liquid and dry wastes or to the mixing of general and hazardous wastes.

The objective of the co-disposal of General Waste and Hazardous Waste is to absorb, dilute and neutralize any liquids and to provide a source of biodegradable material in order to encourage microbial activity that will assist in the degradation of hazardous substances. Co-disposal also improves trafficability within the landfill site (DWAF, 1998).

The ratio of Hazardous Waste to General Waste required to absorb liquids and obtain an appropriate dilution of the hazardous waste is calculated as prescribed by the Minimum requirements through the determination of the water content of the incoming waste and its field capacity as well as the height lift of the landfill above the landfill base or nearest intermediate cover layer. The rainfall and/or precipitation and A-pan evaporation are also taken into account.

It is proposed to co-dispose liquid and low to moderate level hazardous wastes with general dry wastes on the landfill site. Research has shown that a properly controlled co-disposal operation would be a safe and efficient disposal option for hazardous and liquid wastes.

Liquid wastes may be co-disposed by end tipping into trenches excavated into the waste body, or into engineered cells containing predominantly solid waste. The co-disposed waste is subsequently covered with dry general waste.

The benefits of co-disposal is that there is an increased moisture content in the waste which allows the site to function as a bioreactor and allows the generation of landfill gas that could potentially be harvested.

Co-disposal ratios must be determined to prevent moisture on the liner and to prevent a hydrostatic head on the liner. However, as a precautionary measure the liner will have a leachate detection and collection layer.

6.6.2 Separate disposal of hazardous and general waste

The landfill site could be divided into sections that deal with either hazardous waste or general waste. This would result in cells with either a classification as a general waste site or a hazardous waste site.

The option of separate disposal is complicated by a number of factors. The volumes and types of hazardous waste that will be disposed of at the site are unknown. If the exact types of hazardous waste that can be expected at the site were known, one could prepare different cells and/or lagoons for the liquid waste. It is important to mention that one cannot mix various kinds of hazardous waste as it has the potential to cause an adverse reaction, which could be potentially dangerous to human and environmental health and safety. The disposal of hazardous waste in a number of dedicated lagoons therefore requires careful management and training of staff to ensure the correct disposal of the waste load. The risk of human error is therefore increased. It is also unlikely that the option of a number of different ponds would be viable as the volumes of hazardous waste would not be high enough.

It is expected that the hazardous waste received from the Eden District Municipality will be mainly petroleum based and include substances such as grease and oils. These substances can be easily co-disposed with general waste. One could consider a lined pond for the oil wastes, but ponds for oily waste are difficult to manage.

The liner design of the hazardous waste cells and the general waste cells would therefore differ in their composition.

6.7 Access route options

The traffic impact assessment conducted by the iCE Group identified alternatives pertaining to the access to sites 2 and 3. The options investigated for these sites are described below. Please refer to Figures 9.10, 9.11 and 9.12 for a visual presentation of the access options discussed below.

Site 1:

Access to Site 1 is obtained via the existing entrance to the PetroSA waste disposal facility from the N2. A portion of the existing access road that runs behind the PetroSA waste disposal site will have to be upgraded and lengthened to provide access to Site 1. Please refer to the site layout included under Appendix B.

Site 2:

Access to the farm where Alternative 2 is situated is currently taken off Main Road 342 (R327), but due to the steep gradient from Main Road 342 to the proposed landfill site, this access road will not be suitable for the heavy vehicles transporting waste. It has been proposed that an alternative access to this site should be provided off Divisional Road 1549, where the gradient is flatter (iCE Group, 2012). This will require the construction of a new road over a long section of private property as indicated in the maps attached under Appendix B. It was indicated in the Traffic Impact Assessment that DR1549, which is a gravel road, has not been built to carry heavy vehicles on a regular basis. It is expected that a sub base of G5-material and a base course of G4-material will have to be added to the layer works on the road in order to accommodate the expected increase in E80 axle loads on this gravel road. Storm water accommodation may have to be improved and the road may have to be widened to accommodate regular heavy vehicle traffic (iCE Group, 2012).

The provision of a landfill site at Alternative 2 will have a large impact on the pavement condition of DR1549, to such an extent that partial reconstruction of the road will be required (iCE Group, 2012). It was furthermore indicated in the traffic impact assessment that a right turn lane will have to be constructed on the N2 westbound and an acceleration lane will have to be provided on the N2 eastbound at the DR1549 intersection. These improvements will ensure that the road safety impact of Alternative 2 is minimal (iCE Group, 2012).

Site 3:

Three potential site access options were suggested for Site 3. They are as follows:

a) Via Divisional Road 1549, this is a gravel road. This access road will however have to traverse a large section of privately owned land. This route measures approximately 15 kilometres from Alternative 1 and is the preferred route for Site 3 in terms of distance (iCE Group, 2012).
b) Via the N2 to Main Road 341 (Cooper Station turnoff). This route measures approximately 23 kilometres from the Alternative 1 site at PetroSA. The disadvantage of this route is that it is a gravel road with a number of tight bends and a relatively steep pass, which will not be ideal for heavy vehicles (iCE Group, 2012). Access will have to be gained over private property.
c) Travel north-westwards along Main Road 342 to the Main Road 341 and proceed southwards on Main Road 341 to Site 3. This route will be approximately 30 kilometres longer than the route to Site 1 for traffic coming from the east. The Main Road 342 alternative route is mainly surfaced, with only about 8 kilometres of gravel road, but the gravel section includes a short mountain pass en route to the site (iCE Group, 2012). Access will have to be gained over private property.

Alternative 3 will have the same traffic impact as Alternative 2 if the DR1549 route is selected. Existing traffic volumes on the two alternative routes are low and therefore the roads and intersections associated with the second and third route alternatives will continue to operate at good service levels with the addition of traffic to and from the landfill site. DR1549 will have to be rebuilt to accommodate the number of heavy vehicles that will be generated by the landfill site. Although Main Road 341 is a higher order road, the existing pavement structure will also need attention if more heavy vehicles are to make use of this road. Due to the steep gradients on sections of the road, these sections may have to be surfaced to prolong the life of the road (iCE Group, 2012).

It was indicated in the Traffic Impact Assessment that there is sufficient sight distance at the N2/DR1549 intersection. There is also sufficient sight distance at the N2 / MR341 and MR341 / MR342 intersections. A short dedicated right turn lane will be required on the N2 westbound and an acceleration lane on the N2 eastbound at either the DR1549 or MR341 intersection if either of these routes is selected. No lanes will be required on MR342 at the MR341 intersection if that route is selected (iCE Group, 2012).

6.8 Changes to site layouts

The site layouts on the alternative sites as presented during the Scoping phase have been refined in an iterative manner in order to address the environmental constraints as presented on the alternative sites, where practically possible. The constraints addressed includes issues raised by governmental stakeholders and organs of state, the I&APs, specialists and project team.

The main layout changes took place on Sites 1 and 3. These changes were made to address the ecological contraints presented on these sites in order to protect freshwater features with the required bufferzones as recommended by the Freshwater Ecologist and botanist and also where practically possible to avoid the 1:100 floodline of drainage channels and streams. In the case of Site 3 one drainage channel could be excluded from the development but the other drainage channel although of low conservation significance and at the head of the catchment had to be diverted.
The drainage channel on Site 2 could not be avoided as it would reduce the available size of the site as the size has already been reduced due to the presence of powerline servitudes. If a buffer is allowed for around the drainage channel it will also significantly complicate the access to the site which includes increased excavations and costs for road building. It is proposed that the drainage line be piped under the site as indicated in the drawings included under Appendix B. According to the design engineers the drainage line cannot be easily diverted around the site as the estimated volume of water where the line enters the site is too high, which will require a very large canal with the associated excavations into the slope.

Visual impacts were also addressed through the inclusion of a soil berm on site 1.

6.9 No-go option

The no-go or no development option refers to the status quo as it pertains to waste management and more specifically final disposal in the Eden District Municipality. A full account of the existing arrangements has been given in the Final Scoping Report and is therefore not repeated in this report.

A brief summary of the existing waste disposal arrangements for the following Municipalities is however provided: Bitou, Knysna, George, Mosselbay and Hessequa.

Bitou Municipality:

The waste disposal site for the Bitou Municipality has reached capacity and the intention is to dispose of their waste at the existing PetroSA waste disposal site. The Bitou waste disposal site is located approximately 149 kilometers from the PetroSA waste disposal facility (iCE Group (Pty) Ltd, 2012).

Knysna Municipality:

The collected waste is currently transported to the municipal transfer station and is then transported to the existing PetroSa waste disposal site over a distance of approximately 115 kilometers. Two such trips are made each day by a truck carrying three containers, weighing 9-10 tons each. (iCE Group (Pty) Ltd, 2012).

George Municipality:

Refuse collected in the municipal area is transported to the George transfer station. From here, one truck carrying two containers and one truck carrying three containers each does three daily trips to the PetroSA landfill site near Mossel Bay. Three more daily trips are done during the summer holiday period. The distance from the George transfer station to the PetroSA site is approximately 54 kilometres.

Mossel Bay Municipality:

All waste is transported to the landfill site west of PetroSA: the waste collected by the municipality by compactor truck and the private collections by truck or bakkie. Waste records provided by PetroSA show that an average of 4 truck trips, 7 compactor trips and 2 bakkie trips are made to the site each day in the off-season.

Hessequa Municipality:

The waste of Gouritsmond is currently disposed at the PetroSA waste disposal site. The rest of the collected waste in the Hessequa Municipality is disposed of at the Riversdale waste disposal site.

The no-go option serves as a baseline against which the Alternatives presented in this report can be evaluated. Although the no-go option serves as a baseline against which the alternatives presented in this report can be evaluated, it is impossible to continue with the no-go option due to the fact that the contract for the disposal of the solid waste at the PetroSA waste disposal site near Mossel Bay will be expiring, as PetroSA needs the facility for the disposal of their own waste. The size of the PetroSA site has been reduced due to the construction of the Gourikwa Power Station and the extension of the waste disposal site is therefore problematic. PetroSA also indicated to the Eden District Municipality that they do not want to allow the continued disposal of general waste at their site as this is not their responsibility.

The no-go option also implies that the existing land use on the three proposed sites remains unchanged. The specialists are required to consider the no-go option in their assessments.

6.9 Conclusions

A number of strategic options for the disposal of the Eden District Municipality's waste were considered. It has been provisionally decided that the following arrangements would be the best practical environmental options:

1. Hessequa Municipality: The waste of Gouritsmond and Albertinia will be transported to one of the proposed regional waste disposal sites (Sites 1, 2 and 3). The rest of the waste generated in the Hessequa Municipality will be disposed of at the existing Riversdale landfill site and consideration will be given in future to a new site indicated as Site B in Figure 6.2.
2. Oudtshoorn and Kannaland Municipalities: The waste generated in these Municipalities will be disposed of at the existing Oudtshoorn site that will be upgraded in future. Alternatively a new site may be investigated at Site H near Van Wyksdorp.
3. The Municipalities of Bitou, George, Knysna, Mossel Bay, Hessequa (Gouritsmond and Albertinia only): The waste generated in these Municipalities will be transported to either one of the proposed regional waste disposal facilities at Sites 1,2 or 3.

Strategically it was decided that three sites are considered as potentially suitable as a waste disposal site for the Eden District Municipality. The three proposed sites where either co-disposal of general and hazardous waste will take place or separate disposal of hazardous and general waste was taken forward to the EIR Phase of the process. Additional access route alternatives were identified as part of the EIR phase and assessed in the traffic impact assessment. The alternatives site options have been assessed by the relevant specialists and are reported on in Chapter 9. Based on the information provided by the specialists, relevant authorities and inputs from I&APs a preferred site is recommended in this EIR.

CHAPTER 7: THE AFFECTED ENVIRONMENT

7.1 Site location and description

The study area falls within the Riversdale Plain bioregion, which lies within the Fynbos biome and the Cape Floristic Region. The Riversdale Plain bioregion has experienced extensive agricultural development in the last century (Helme, 2009).

From a visual perspective the three proposed sites lies close to Mossel Bay, which is often considered to be the gateway to the Garden Route. Travellers driving on the N2 from Cape Town eastwards catch the first view of the coastline at the change of direction of the N2 at the Louis Fourie interchange on the outskirts of Mossel Bay. The Mossel Bay Municipality SDF classifies this gateway to be of significant importance from a local and regional perspective (TV3, 2008).

7.1.1 Site 1

Site 1 lies immediately north of the N2, approximately 1 km west of PetroSA and 13 km west of Mossel Bay. The nearest residential area is Nautilus Bay, which is located approximately 4 km (measured as a direct line from the N2 on a Google Earth aerial image) south of the site. Please refer to the location map in Appendix A. A house exists on Site 1 that will have to be demolished when the site is developed.

<u>Property details:</u>

Portion 9 of the Farm Drie Fonteinen Nr 243

Portion 1 of the Farm Patrysfontein Nr 228

Remainder of Farm 310

The current use of the site is for sowing and stock grazing. The portion of the site belonging to PetroSA contains the existing waste disposal facility and open areas that are not used for any specific purpose. Electrical servitudes are present on the property and an agreement is in place with ESKOM to move the servitude to the boundary of the property. Communication with ESKOM in this regard in included under Appendix D.

7.1.2 Site 2

Site 2 lies just south of the R327 (leading to Herbertsdale), approximately 20 km (direct line) north-west of Mossel Bay, 16.5 km (direct line) south-east of Herbertsdale, which is the closest town, and 6.5 km north of the N2. Please refer to the location map in Appendix A.

<u>Property details:</u>

Remainder of the Farm Zuur-Rug No. 207.

The current use of the site is for agricultural purposes and large sections of indigenous vegetation remains on the site. Electrical servitudes are present on the property and the proposed waste disposal facility has avoided the servitudes as detailed in the site layouts included in Appendix B.

7.1.3 Site 3

Site 3 lies approximately 2.5 km to the south of the R327, just east of the gravel road that connects the R327 with the Cooper train station. It lies approximately 26 km (direct line) north-west of Mossel Bay, 13 km (direct line) south-south-east of Herbertsdale, which is the closest town, and 7.5 km north of the N2. Please refer to the location map in Appendix A.

Property details:

Portion 1 of the Farm Kruisvallei Nr 232

Portion 2 (Portion of Portion 1) of the Farm Kruisvallei Nr 232

Farm 232 – access of this property is required, however the landowner has not provided consent for the use and upgrade of the existing access road.

N2/MR341 intersection: turning lanes on the N2 within the existing road reserve are required at this intersection.

The current use of the site is for agricultural purposes. Electrical servitudes are present on the property and the proposed waste disposal facility has avoided the servitudes as detailed in the site layouts included in Appendix B.

7.2 Surrounding land use

7.2.1 Site 1

The site is located at the juncture of agricultural and industrial landscapes. Industrial developments have taken place immediately to the east of the proposed site and include the PetroSA waste disposal site, Eskom's Open Cycle Gas Turbine (OCGT) Power Plant, the PetroSA facility and Mossindustria. The Agricultural land use includes unploughed land, cultivated wheat lands and pastures and renosterveld remnants. The adjacent property is used by Petro SA and has a hazardous waste site, which is licensed by the DWAF and has been in existence since 1992. South of the site lies the N2 highway and beyond this land uses include unploughed land, cultivated wheat lands and pastures. A number of residential developments whih includes conservancies exists along the coast to the south of Site 1. North West and west of the site is primarily agriculture land uses which includes unploughed land, cultivated wheat lands and pastures, and renosterveld remnants.

7.2.2 Site 2

The Proteus substation is located immediately to the north of the R327, approximately 1.5 km northwest of the site. Many areas located to the south of the R327 are used for agriculture, mostly grazing. The site itself and surrounding farms supports large areas of fynbos. The Gondwana Nature Reserve is in close proximity to the site.

7.2.3 Site 3

The site itself and surrounding farms are used for agricultural purposes and consists mainly of cultivated lands and pastures. Almost no indigenous vegetation remains on the site itself. Critical Biodiversity areas has been identified in the vicinity of the site. The proposed access route to the site over private property is located within a Critical Biodiversity Area.

7.3 Biophysical environment

7.3.1 Climate

Rainfall

The Eden District has a moderate climate. Rainfall occurs throughout the year and varies from 300mm in the Little Karoo to more than 1000 mm in the Outeniqua Mountains. The rainfall of the Outeniqua sub-region (Garden Route and George) averages between 700 and 1200 mm per annum. The Little Karoo is the driest region with an annual rainfall of less than 400mm (Eden SDF, 2003).

A rainfall station named Hartbeeskuil Dam, approximately 10 km north-east of Site 1 indicates that the average rainfall for this area is 467mm/annum for the period 1973 to 1993. Rainfall occurs throughout the year with the highest rainfall during April and lowest during December (SRK, 2012).

The GRAII data (DWAF, 2005) indicates the following yearly rainfall for the three sites:

Site 1 – 500-550 mm/annum

Site 2 – 500-550 mm/annum

Site 3 – 500-525 mm/annum

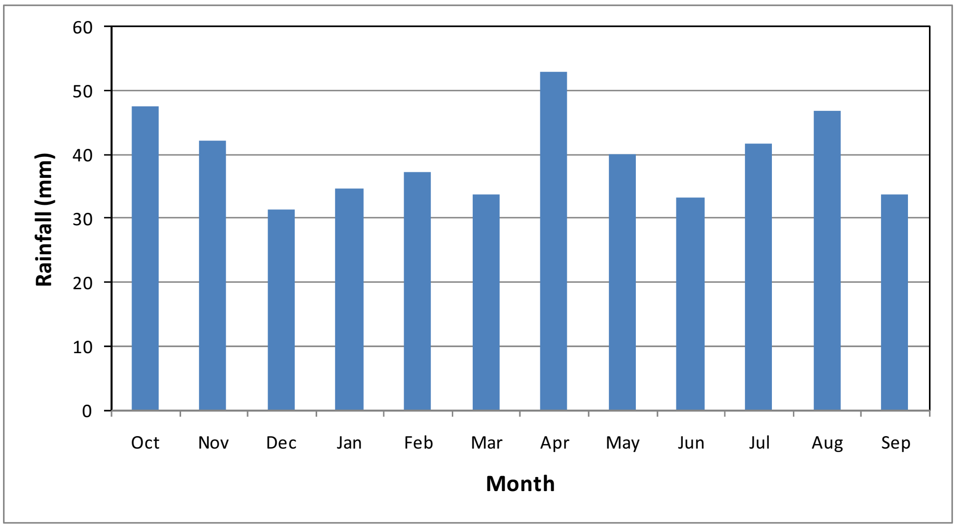

Figure 7.1: Average monthly rainfall (Source: SRK, 2012).

The abovementioned weather station was used to calculate the Climatic Water Balance (CWB) as described in the DWAF's Minimum Requirements document (DWAF, 1998). The CWB is calculated with the following formula:

B = R – E

Where;

B is the climatic water balance in mm of water;

R is the rainfall in mm; and

E is the evaporation from a soil surface, taken as 0.8 x S-pan evaporation in mm.

Evaporation data downloaded from the DWAF website cover the years 1973 to 1993. Presented in **Table 7.1** is the CWB calculation for the ten wettest years. The CWB is usually calculated for the six wettest months of a year. The average yearly rainfall does not show a well-defined wet period and therefore the CWB was calculated for both six month periods of the year. Based on the results, the water balance is negative for nine of the years and indicates that, provided dry waste is disposed of, only sporadic leachate will be generated (SRK, 2012).

Year	Rainfall Nov - Apr	Evap Nov -Apr	B	Rainfall May - Oct	Evap May - Oct	B
1980/81	591.40	891	-192.68	359.70	473.2	-18.86
1984/85	396.10	947.1	-437.35	292.20	499.3	-107.24
1973/74	282.00	845.6	-462.13	174.10	535.2	-254.06
1971/72	265.00	917.4	-542.31	188.40	507.3	-217.44
1981/82	247.50	909.1	-552.51	275.20	466.2	-97.76
1978/79	240.20	906	-557.08	202.90	486.5	-186.3
1986/87	232.70	917.1	-574.35	165.40	516.2	-247.56
1977/78	229.70	939.9	-597.41	174.60	491	-218.2
1991/92	227.40	868	-536.44	366.80	376.4	65.68
1989/90	223.00	908	-576.04	187.20	406.9	-138.32

Table 7.1: Climatic water balance results for the ten wettest years (Source: SRK, 2012)

Temperatures

The temperatures experienced in the Eden District are generally moderate with the sea helping to moderate temperatures in the coastal zone and coastal platform, but temperatures drop with altitude in the mountains. The Karoo is hotter and shows greater variation in temperature and berg wind conditions in summer can often result in very hot days (Eden SDF, 2003).

Air temperature is important, both for determining the effect of plume buoyancy (the larger the temperature difference between the plume and the ambient air, the higher the plume is able to rise), and determining the development of the mixing and inversion layers. Long-term average maximum, mean and minimum temperatures for Mossel Bay for the period 1920-1984 are given in Table 7.2 (Schulze, 1986).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Maximum	23.9	23.8	22.8	21.4	20.2	19.4	18.6	18.6	18.9	19.6	21.1	22.8
Mean	21.0	21.0	20.0	18.3	16.8	15.7	14.9	14.9	15.4	16.5	18.1	19.9
Minimum	18.0	18.2	17.1	15.1	13.3	12.0	11.1	11.1	12.1	13.5	15.2	16.9

Table 7.2: Long-term minimum, maximum and mean temperature for Mossel Bay (Schulze, 1986; Airshed Planning Professionals, 2012).

The monthly temperatures indicate a very mild condition with limited seasonal variations. The minimum monthly average temperatures during winter is about 11 °C (July and August) and the maximum during summer is about 24 °C (January and February).

Wind

It is less windy in the eastern and central regions than in the western parts. Southwest and southeast are the predominant wind direction, with strong south-easterly winds being relatively common (Eden SDF, 2003).

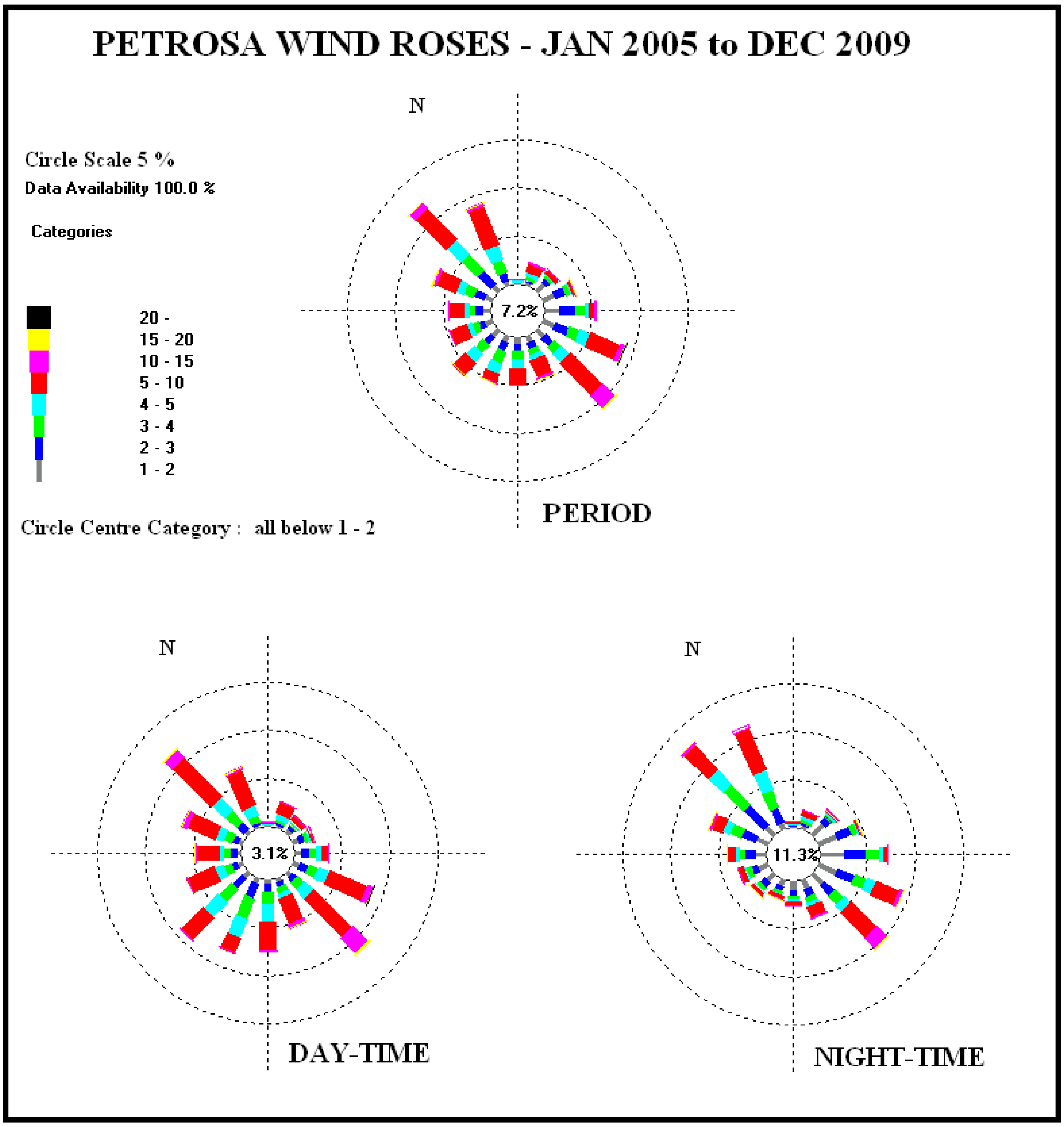

Figure 7.2: Wind roses for PetroSA for the period 2005 to 2009 (Source: Airshed Planning Professionals, 2012)

Period, day-time and night-time average wind roses are depicted in Figure 15. Wind roses represent wind frequencies for the 16 cardinal wind directions. Frequencies are indicated by the length of the shaft when compared to the circles drawn to represent a 5% frequency of occurrence. The figure given in the centre of the circle described the frequency with which calms occurred, i.e. periods during which the wind speed was below 1 m/s.

Diurnal wind variations due to the influence of land-sea breeze circulations on the airflow of the region is clearly evident in the night-time and day-time wind fields. Land-sea breeze circulation arises due to the differential heating and cooling of land and water surfaces. During the day, the land is heated more rapidly than the sea surface, a horizontal pressure gradient develops with surface convergence and ascent over the land and descent and surface divergence over the sea. Sea breezes therefore characterise the daytime surface circulation. By night, land cools more quickly than the sea surface resulting in a reversal of the daytime sea breeze and upper air returns currents and the onset of land breezes at the surface. Night-times are characterised by an increase in the number of calms (11.3 %) as is typical of the night-time flow regime in most regions, and by the predominance of winds from the north-westerly sector.

During the day-time, winds from the north-western and south-eastern sectors predominate. Increased wind velocities are noted for day-time hours. South-easterly winds are predominant, especially in summer. The wind in winter (June to August) blows mainly from a north-westerly direction. The windiest season is mid-winter (July) to spring (September), which has an average wind speed of 20 km/hr. The average wind speed in summer is 15 km/hr (Airshed Planning Professionals, 2012).

7.3.2 Topography

The EDM is characterised by a variety of topographical forms, which together with their associated geology, determine the broad vegetation types of the area. The coastal platform is relatively flat or undulating, but deeply incised by river valleys. This zone rises from sea level to an average altitude of 230m. The topography consists of coastal platforms, river valleys, mountain foothills, with upper plateaus up to 400m above sea level and mountain ranges, which form a large part of the northern part of the study area. Four types of coastal geomorphology characterize the coast of the Eden District. These include fine-grained sandy beaches, wave-cut rocky platforms, exposed rocky headlands, and pebble / shingle beaches. These characteristics often create a highly diverse interface between the ocean and the terrestrial area. The coastline is characterised by a number of estuaries, river mouths and lagoons. The importance of the Outeniqua and Langeberg ranges in terms of how they divide the area into different regions is emphasised by elevation and slope maps. There is an extensive coastal platform ranging from 5 – 40 km wide, linking the coastal zone to the foothills of the mountains. The mountains separate the coastal region from the Little Karoo and thus form a natural barrier between the Southern Cape and the interior. Deeply incised river valleys on the otherwise flat to undulating coastal platform inhibit transportation infrastructure.

There are six main topographic highs in the area:

- The Langeberg Mountain range extends from the Boosmansbos Wilderness Area (north of Heidelberg) in the west to Herbertsdale in the east.
- The Outeniqua Mountain range extend further east from north of Friemersheim to the area north of Karatara and Rheenendal.
- The Rooiberge extends from Ladismith in the west to Volmoed in the east.
- The Kammanassie Mountains extend from Dysselsdorp in the west to Uniondale in the east.

- The northern boundary of the Eden District is formed by the Klein and Groot Swartberg Mountain ranges.
- The Kouga Mountain range forms the eastern boundary of the Eden District (SRK, 2012).

The topography associated with the study area has an impact on the local wind climate. Site 2 is more sheltered from north-westerly winds compared to site 1 and 3.

7.3.2.1 Site 1

The site is relatively flat and is situated on the coastal platform. The site ranges from 172 mamsl in the south to 192 mamsl in the north. There is a small ridge in the middle with a height of 200mamsl (SRK, 2012).

7.3.2.2 Site 2

The site is situated just south of a small divide, which is also the quaternary catchment boundary. The site is characterised by deep drainage features and the general topography varies between 175 mamsl in the south to 270 mamsl in the north. The drainage channels are 15 m deep (SRK, 2012).

7.3.2.3 Site 3

The site is also situated just south of a quaternary catchment boundary. The general topography varies between 114 mamsl in the south to 157 mamsl in the north (SRK, 2012).

7.3.3 Geology

The most dominant formations in the area are:

- Kaaimans Group: This formation occurs in narrow strips in the coastal plains between Great Brak River and Knysna;
- Cape Granite Suite: This intrusive formation is found as a group of rocks confined to outcrops between the Great Brak River and George and also between the Wilderness and Karatara;
- Table Mountain Group: This formation presents a most important rock group in terms of geohydrological importance. The width of this group steadily increases from west to east and forms the bulk of the mountain ranges described above;
- Bokkeveld Group: The Bokkeveld Group is present in a very narrow fold belt along the coastal plateau;
- Uitenhage Group: The region where this formation is predominant includes the Knysna and Plettenberg Bay areas; and
- Tertiary and Quaternary sediments.

Potentially high permeability soils are associated with alluvium, which is restricted to narrow bands following drainage channels and sandy soils and undifferentiated coastal and inland deposits, which comprise unconsolidated to semi-consolidated sand and calcrete. These areas are deemed potentially unsuitable for a waste disposal site. Areas comprising arenaceous rocks, which include sandstone, feldspathic sandstone, arkose and sandstone becoming quartzitic in places, are also potentially unsuitable for a waste disposal site. This is at the regional scale and variations to these generalities may occur at the site-specific scale (SRK, 2012).

SITE 1

This site is underlain by Tertiary and Quaternary sediments and which are classified as loam and sandy loam soils. These sediments overlie rocks of the Ceres Subgroup of the Bokkeveld Group and Baviaanskloof and Skurweberg Formations of the TMG. The Ceres Subgroup consists of shale and sandy shale.

The Baviaanskloof Formation consists of feldspatic sandstone, feldspatic quartzitic sandstone and sandy shale. The Skurweberg formation consists of light-grey quarzitic sandstone with subordinate shale and pebble layers.

A hydrogeological study done for the then Mossgas Waste Disposal Site (SRK,1991) indicated that the site is underlain by 15 to 27 m of clayey sand, which was confirmed with the current drilling (SRK, 2012).

SITE 2

The site is underlain by Tertiary sediments (Grahamstown Formation) which consist of high level terrace gravel, soils and silcrete. The sediments overlie shales of the Ceres Subgroup of the Bokkeveld Group (SRK, 2012).

SITE 3

This site is underlain by shales of the Ceres Subgroup of the Bokkeveld Group (SRK, 2012).

7.3.4 Hydrogeology

7.3.4.1 Groundwater levels and flow direction

SITE 1

Two private boreholes exist at Site 1 and have measured water levels of 20 and 23 mbg (measured in 1990). For the two exploration boreholes drilled as part of the current study a water level could only be measured in BHS1b (13.7 mbg) as BH S1a was dry. Water level measurements received from the NGDB indicates the water table to be below 20 mbg. The minimum separation between waste and the water table should be 2 m (DWAF, 1998). At Site 1 the water table is ~ 13 mbg and this unsaturated zone is a thick layer of sand that can naturally attenuate leachate constituents. Water levels at the adjacent site (Petro SA) vary between 9 and 20 mbg and confirm current findings.

It is expected that groundwater flow in the superficial deposits will mimic the topography as they will represent unconfined conditions. A quaternary catchment boundary runs across the site and it is thus expected that groundwater on the eastern and northern side would flow in north-westerly and westerly directions towards a stream to the west of the Site. Groundwater on the western side of the Site would flow mainly southwards (SRK, 2012).

SITE 2 and 3

No boreholes listed in the NGDB are close to any of these two sites. The rest water level at Site 2 was measured at 7.35 mbg. A water level measurement could not be obtained at Site 3 as the borehole was dry. At site 3 there would be >50 m of dry soils between the waste and the water table.

Groundwater flow direction at site 2 is also expected to mimic topography. Two drainage channels are located to the west and east of the site and so on a local scale groundwater is expected to flow to the east and west but on a regional scale mainly in a southerly direction.

Groundwater flow at Site 3 is expected to be in a southerly direction. Although the geophysical survey indicated the possible existence of faults in the area, the borehole that was drilled was dry to 50 m and it is possible that any groundwater associated with them is deeper-seated (SRK, 2012).

7.3.4.2 Groundwater Quality

EC is a measure of the ability of water to conduct an electrical current. This ability is a result of the presence of ions in water such as bicarbonate, chloride, sulphate, nitrate, sodium, potassium, calcium and magnesium, all of which carry an electrical charge. Saline water may detrimentally affect animal health due to a refusal to consume water and hence a decline in productivity. Irrigation with water containing salt induces salt into the soil profile. Most crops are sensitive to soil salinity and the EC concentration of irrigation water provides an indication of the levels at which crop yield will be affected. The magnitude of the yield decrease is determined by the duration and level of exposure to salinity-induced water stress (SRK, 2012).

SITE 1

A number of NGDB boreholes with Electrical Conductivity (EC) data exist for this area. The EC range for the area is rather high and values range between 4 and above 1 000 mS/m. Except for the one measurement of 4 mS/m the rest of the measurements are above 100 mS/m. It is most likely that the reading of 4 mS/m is incorrect.

The lowest EC recorded in the NGDB for the study area is 109 mS/m (excluding the 4 mS/m) with the highest being 1 792 mS/m. Boreholes on the neighbouring property of Petro SA have high EC (>370 mS/m). Most of these boreholes are also shallow (<40m deep) and thus give an indication on the groundwater quality of the superficial sediments.

The high EC of groundwater in this area makes this water unsuitable for most uses (see above). This water can be used for flushing toilets and limited dust control. The intense use of groundwater with a very high EC could result in a salt building up and flushed into aquifer during heavy rains (SRK, 2012).

SITE 2 and 3

Only six boreholes from the NGDB with EC readings were located in the study area. The closest borehole is approximately 4 km from Site 2 and the closest to Site 3 is approximately 5 km. The average EC recorded is 292 mS/m with the lowest being 106 mS/m and highest 683 mS/m. The higher ECs correspond with groundwater from the Ceres Formation and the lower ECs are from boreholes drilled in high-level terrace gravels and soils (SRK, 2012).

7.3.4.3 Aquifer development

SITE 1

The aquifer at Site 1 is classified as a fractured rock aquifer. This aquifer only occurs at a depth of >25 mbg. The DWAF 1:500 000 hydrogeological map does not classify the coastal deposits as an aquifer. Expected median borehole yields are between 0.1 – 0.5 l/s for most of the site.

The drilling confirmed the above, with BHS1b having a very low blow yield of 0.02 l/s and BHS1a being dry. The results of drilling at Petro SA were similar with low yields (0.2 l/s) for both the superficial deposits and deeper bedrock (SRK, 2012).

SITE 2 and 3

According to the DWAF 1:500 000 hydrogeological map (DWAF, 1999), the aquifers at Site 2 and Site 3 are classified as fractured aquifers. Expected median borehole yields are between 0.1 – 0.5 l/s. This was confirmed by the exploratory drilling achieving low yields (dry for Site 3 and 0.3 l/s for Site 2) (SRK, 2012).

7.3.4.4 Groundwater use

Groundwater use data were obtained from the NGDB. A hydro census was conducted to verify the data and to establish the actual volumes of groundwater use for this area.

SITE 1

Two boreholes exist on Site 1 which is used for stock watering (SRK, 1999). Boreholes downstream of the site are used for stock watering and domestic water supply. The closest of these boreholes are some 750 m south of the site (SRK, 2012).

SITE 2 and 3

The NGDB does not show any boreholes close to the sites and the landowners indicated that they have no boreholes on the properties (SRK, 2012).

7.3.5 Flora

The description of the flora is based on the Botanical Impact Assessment performed by the botanist Nick Helme and attached in Appendix G. The study area falls within the Fynbos biome of the Cape Floristic Region (CFR). The southwestern Cape is a major national and global conservation priority due to the number of number of species that are threatened by extinction. This is mainly as a result of threats such as agriculture, urbanization and alien plants that reduce the habitat of these plant species to small fragments. Any development in this area therefore needs to take the importance of this habitat into account.

The Cape Action for People and the Environment (CAPE) has identified the Riversdale Plain bioregion as a priority for Fine Scale Conservation Planning (FSP), which was undertaken in 2007 and 2008. As part of this process Critical Biodiversity Areas (CBAs) were identified. These areas are known to support range restricted Red Data Book listed plant species and threatened habitat, and are also areas that form part of important ecological corridors. CBAs should generally be regarded as core conservation areas and should not be developed.

7.3.5.1 Site 1

The original vegetation on the preferred Site (Site 1) has been described by the South African Vegetation Map (Mucina & Rutherford 2006 cited in Helme 2012) as Albertinia Sand Fynbos. This description was erroneous as the soil on the site is a sandy shale-derived loam and therefore more likely to support a Renosterveld and Thicket mix. Vlok and de Villiers (2007 cited in Helme 2012) have classified the site more appropriately as PetroSA Fynbos Renosterveld.

Small remnants of the original vegetation exist along some of the fence lines. These are mostly woody species such as *Rhus pallens, Asparagus africanus, Gymnosporia buxifolia* (pendoring) and *Lycium ferocissimum* (muisbos).

The only areas of any notable ecological sensitivity on site are the seasonal pan, the single milkwood (*Sideroxylon inerme*), the patch of *Aloe arborescens* and associated Thicket, and the single dam.

The milkwood is protected under the Forest Act of 1974 and may only be pruned or removed if the relevant permit has been obtained.

The dominant vegetation in the pan is *Cynodon dactylon* (fynkweek) and the pencil sedge (*Eleocharis limosa*), with *Centella asiatica* and *Gnaphalium declinatum*.

Gnaphalium declinatum is a small perennial daisy that is a typical member of the pan community in the Riversdale Plain, and has been Red Data Book listed as Near Threatened (Raimondo *et al* – in press cited in Helme 2012), as its habitat is both restricted and often impacted by agriculture or infilling. The population in this pan is relatively small, but is considered viable and important.

An impressive patch of *Aloe arborescens* (kraal aloe) is found on the property in the vicinity of the old homestead. When flowering, the aloes provide a popular and valuable food (mainly nectar) resource for bees and birds. In addition, both the aloes and the other indigenous Thicket species provide shelter for many birds, insects, and small animals, in an otherwise rather denuded landscape. The other Thicket species include *Asparagus africanus, Gymnosporia buxifolia* (pendoring), *Lycium ferocissimum*, and the bulb *Drimia capensis* (maerman).

7.3.5.2 Site 2

Site 2 supports significantly more natural vegetation than either of the other two alternative sites, and is part of a well vegetated plateau that is a regionally important ecological corridor. At least 80% of the site supports natural vegetation of High sensitivity, whilst the remainder is previously or currently cultivated land of Medium and Low sensitivity respectively.

The SA Vegetation Map (Mucina & Rutherford 2006 cited in Helme 2012) classifies the vegetation on the northern part of the site as Swellendam Silcrete Fynbos, and parts of the lower lying southern half as Mossel Bay Shale Renosterveld. Vlok and de Villiers (2007 cited in Helme 2012) mapped this area as Proteus Fynbos Renoster Thicket (in the far north) and most of the site as Cooper Thicket Fynbos Renosterveld. Both classifications reflect the stony nature of the northern areas (characterised by silcrete) and the more loamy shales of the southern section.

The National Spatial Biodiversity Assessment (NSBA; Rouget et al 2004 cited in Helme, 2012) has assessed Swellendam Silcrete Fynbos as an endangered vegetation type on a national basis, with only 57% of its original extent remaining, 4% protected, and a 30% conservation target. What remains is thus still vulnerable to transformation by quarrying and agriculture, although increasingly these natural areas support game farming operations. The national list of Threatened Ecosystems lists this vegetation type as Vulnerable (DEA 2011). The NSBA has determined that Mossel Bay Shale

Renosterveld is also an endangered vegetation type, with only 41% of its original extent remaining, 0% conserved, and a 27% national conservation target (Rouget *et al* 2004 cited in Helme 2012). The national list of Threatened Ecosystems also lists this vegetation type as Endangered (DEA 2011).The old fallow lands are dominated by the grass *Cynodon dactylon* (fynkweek), along with *Elytropappus rhinocerotis* (renosterbos), *Oedera genistiifolia*, *Metalasia pungens, Metalasia densa* (blombos), *Selago ciliata,* and aliens or indigenous invasive's such as *Plantago lanceolata* (ribwort), *Senecio pterophorus*, *Berkheya rigida* (dissel), *Solanum* sp. (bitterappel), and *Eragrostis curvula* (lovegrass). The High sensitivity areas on silcrete are characterised by *Erica versicolor, Leucadendron salignum* (geelbos), *Hermannia saccifera, Rhynchosia ciliata, Bobartia robusta* (blombiesie)*, Oedera capensis, Gerbera species, Babiana montana*, *Erica copiosa, Iscjhyrolepis triflorus, I.capensis, Calopsis burchellii, Cliffortia serpyllifolia, Protea lanceolata, Phylica purpurea*, and *Eriospermum* species. High sensitivity areas on shales are characterised by by *Aspalathus sp., Diospyros dichrophylla, Erica copiosa, Metalasia pungens, Rhus pallens* and *Tribolium hispidum*. *Aloe arborescens, Cassine peragua* (saffronwood) and *Otholobium* species are present in the gulleys. *Oxalis pendulifolia* (Plate 7) was the only Red Data Book listed species recorded in the Silcrete Fynbos, and is listed as Vulnerable (Raimondo *et al* in press cited in Helme, 2012) although there are likely to be others, which may include *Satyrium muticum*, which is a very rare ground orchid known from less than 1km away.

The seasonal pan is dominated by two creeping perennials (see Plate 6) - *Laurembergia repens* and *Gnaphalium declinatum*. The latter is Red Data Book listed as Near Threatened (Raimondo *et al* – in press, cited in Helme 2012), as its habitat is both restricted and often impacted by agriculture or infilling. The population in this pan is large, and is considered both viable and important.

Woody alien vegetation is not common on most of the site, but it is present in the eastern drainage line, where there is about 30% coverage in a 2ha area. The dominant alien species in this patch is rooikrans (*Acacia cyclops*).

7.3.5.3 Site 3

There is essentially no remaining natural vegetation on this heavily agricultural site, as the entire site has been ploughed and heavily grazed. The botanical sensitivity is consequently Very Low. The original natural vegetation in this area would have been Mossel Bay Shale Renosterveld (Mucina & Rutherford 2006 cited in Helme 2012). There is certainly no chance of finding any rare or localised plant species within this site, due to the intensive disturbance that has taken place. The only nearby patch of intact natural vegetation occurs some 400m west of the site, and is of High botanical sensitivity, even though it is quite heavily grazed and trampled. It is proposed that the existing road that runs through this patch of natural vegetation be used as access to Site 3. This access road requires widening and therefore the widening of the road may impact on the natural vegetation.

The site is situated on a low ridge and is thus something of a local watershed, much like Site 2. However, the wetlands and drainage lines both east and west of this site are heavily degraded by heavy grazing and trampling, and support very few plant species, and are dominated by *Cynodon dactylon* (fynkweek).

The traffic impact assessment has indicated that turning lanes will be required within the road reserve at the N2/MR341 intersection that is part of the route to Site 3. The Botanist was requested to comment on the vegetation in the road reserve that may be impacted on and to describe the vegetation and significance of the potential impacts. The original natural vegetation type in this area is Mossel Bay Shale Renosterveld, which is listed as an Endangered vegetation type (DEA 2011). Existing natural vegetation is present within the proposed expansion area east of the intersection, but in the area west of the intersection is dominated by invasive alien *Acacia*, due to previous soil disturbance (south of the N2). The total area of existing natural vegetation that will be lost is thus likely to be less than 0.2ha, and this portion of the road reserve is not likely to support significant populations of any plant Species of Conservation Concern. These particular strips of natural vegetation (east of the MR341) are narrow (12m wide), with cultivation taking place on either side, and they are thus not likely to support sustainable, viable plant populations (Helme, 2012b).

7.3.6 Freshwater environment

7.3.6.1 Site 1

The site is located within the upper catchment of a tributary of the Blinderivier, a small stream which discharges into Vlees Bay to the west of Mossel Bay. The natural vegetation cover has to a large extent been completely modified on the site by agricultural activities. Only small portions of natural vegetation remain, particularly within the river channel of the tributary of the Blinderivier.

A number of freshwater features exist on the site:

- The seasonal stream on the eastern border of the site is a tributary of the Blinderivier, a small stream which discharges into Vlees Bay to the west of Mossel Bay;
- A seasonal wetland/pan (green polygon in Figure 6);
- A number of isolated depression related wetland areas that are likely the result of past human related activities (light blue polygons in Figure 6).

These features are described in greater detail in the following section. Only the natural stream and wetland area appear to support birdlife (a grey heron Ardea cinerea, Egyptian geese Alopochen aegyptiaca and Blacksmith lapwings Vanellus armatus were observed at the features). Amphibians such as stream frogs Strongylopus sp. are also likely to occur in the more permanent water features such as the seasonal pan and the dam within the seasonal stream.

Figure 7.3. Google Earth image with the water features indicated on the site (green polygon indicates natural pan while pale blue polygons indicate water features that have resulted from human activities)

Unnamed tributary of the Blinderivier

The small seasonal stream has its channel along the eastern border of site. The riparian zone of approximately 50m wide is still intact and within the wetted area, sedges occur. There is a low levee constructed between the stream and site, which largely prevents drainage in the lower (south-eastern) portion of the site from entering the stream. There is visible runoff however from the site towards the stream. Within the stream channel the soils and vegetation shows indication of increased wettedness. Riparian vegetation along the stream consists of shrubs such as Warty Currant Rhus pallens, marsh lilies Bobartia sp., restio species and grasses such as Couch grass Cynodon dactylon. The upper reach of the stream is also fed from a storm water discharge from the PetroSA site.

Seasonal pan/wetland area

The seasonal pan occurs along the western border of the site. Within the site the pan consists primarily of abundant sedge growth (pencil sedge Eleocharis limosa) and some open water areas that are frequented by birds. The pan is transected by a road, a boundary fence and a water pipeline. On the other side of the pan (on adjacent property) the pan is utilized for livestock water for sheep and has little to no aquatic plants. The areas surrounding the dam has been ploughed and planted with grass for grazing purposes.

Artificial water features:

There are a number of relatively small water features that occur within the site that are the result of past human activities on the site (numbers correspond with numbers given in Figure 11):

1. A small excavated dam in the north western corner of the site with little aquatic ecosystem significance.
2. A small excavated dam in the centre of the site that is dominated by pencil sedge and has been dumped with stones - low aquatic ecosystem significance.
3. A small depression wetland that seems to have been created together with a wind pump and borehole north of the depression - low aquatic ecosystem significance.
4. Large dam that has been constructed with raised walls around it in the lower centre of the site. There was very little water within the dam at the time of the survey. In the wetted zone, pencil sedges dominate. The walls of the dam are covered with grass, some bulbs and shrubs - low aquatic ecosystem significance.
5. Small in stream dam within the seasonal stream which is likely to contain water for longer periods of time than other water features on the site due to its location within the stream and the possible storm water discharge from PetroSA. The habitat consists largely of open water with sedges and rushes in the marginal riparian zone. This feature is more likely to provide suitable habitat for biota and is placed within the stream corridor so is considered to be of a more significant value to aquatic biota than the other artificial water features on the site.

Figure 7.4. Artificial water features occurring on site

7.3.6.2 Site 2

Drainage lines arising on site support seasonal wetlands, which are considered sensitive from a botanical and ecological point of view. Woody alien vegetation is not common on most of the site, but it is present and a problem in the main drainage line, where there is about 30% coverage in a 10ha area. The dominant alien species in this patch is rooikrans (*Acacia cyclops*) (Helme, 2012).

7.3.6.2 Site 3

The site contains two drainage lines. The western drainage line is the most disturbed and is of Low botanical sensitivity, but the eastern drainage line is in better condition and is of Medium botanical sensitivity (Helme, 2012).

7.3.7 Avifuana

When visited, both the two cropland sites had a few Blue Cranes. This is South Africa's designated national bird species. A southern African endemic species the Blue Crane is considered Vulnerable [to extinction] (Barnes 2000). This crane has adapted to the open transformed wheat fields of the region and there remains ample habitat. Use of the cropland site beside the PetroSA landfill would not fragment the species potential habitat but the more distant cropland site would place the landfill in the middle of habitat suitable for this species which is undesirable.

<u>*Boundary Pond*</u>

A small pond exists on the western boundary of Site 1. The avi-faunal specialist indicated that the pond was full at the time of his site visist and was being used by several species of water birds. As one of the few areas of still natural water in the area it probably serves as a locally important water resource for birds.

All three proposed alternative landfill sites are within a short bird flight of the existing PetroSA landfill. Each would be used by the same species as at the PetroSA site and birds are likely to commute between that site, with its access to water, and the new site with its greater quantities of organic refuse.

Adjacent to the PetroSA site are a number of open, artificial, water storage pools some deep and with water all year and one (or more) sludge ponds which have a very shallow muddy surface. These water bodies enable birds to drink, bathe and roost close to the landfill. In particular they have enabled two species of gulls – the Hartlaub's and Grey-headed Gulls – to breed. The Hartlaub's Gulls have also bred on open ground away from water within the main PetroSA industrial complex. Numerous young gulls, distinguishable by their plumage, were at the landfill. The local populations of these birds are likely to increase once larger amounts of organic refuse are deposited at the Eden landfill, even if this is situated some kilometres distant from PetroSA. Thought should be given to the desirability of increased numbers of birds at the PetroSA site and if undesirable how numbers are to be reduced. This was not part of the remit for the present report.

Birds at PetroSA

All three proposed alternative sites for the Eden landfill are near the existing PetroSA landfill and so will share the same suite of opportunist bird species. Three bird species occurred in large numbers at the PetroSA landfill during the brief site visit. These were the Hartlaub's and Grey-headed Gulls and the African Sacred Ibis. Four other species were present in far smaller numbers – Kelp Gull, Grey Heron and Yellow-billed Kite and Pied Crow. Staff agreed that this was the key suite of species that used the site with in addition some Cattle Egrets. A range of other species has been recorded, including a Marabou Stork and a few Great White Pelicans, but only as individuals or in very small numbers and only on one or a few occasions.

Bird conservation status:

None of the species regularly recorded at the PetroSA landfill is currently classed as threatened in southern Africa (Barnes 2000) and the populations of most of the key species have increased as a result of human habitat alterations and subsidy through the provision of food at landfills. The global population of the Hartlaub's Gull, a normally coastal species which is endemic to south-western Africa, was estimated to be only 12,000 pairs in the late 1980s (Williams et al. 1990). In terms of its global population, this is the world's tenth rarest gull species. Formerly this gull was restricted to the Benguela marine ecosystem with its eastern limit near Cape Agulhas. Almost certainly as the result of food made available by humans, this gull is increasingly recorded east to Port Elizabeth. There is a small population which breeds either in the main PetroSA works or next to artificial water bodies within the overall PetroSA landfill site. The Grey-headed Gull breeds in largely freshwater situations across large tracts of South America and Africa. Previously it has occurred within the range of the Hartlaub's Gull in only small numbers. A small population apparently breeds with Hartlaub's Gulls on the PetroSA site. This gull has only one other known regular breeding locality in the Western Cape – at the Paarl sewage works. These two gulls are closely related and in some incidences may hybridise (Sinclair 1977, Williams 1989). Conservation authorities need to decide whether such hybridisation is a cause of concern whilst populations are still small enough for control if this is deemed necessary.

Bird of prey contamination

It has been suggested by local "Interested and Affected Parties" that there is potentially contamination of raptors through feeding on rodents or birds contaminated as a result of feeding at the proposed landfill. Most raptorial birds seek appropriate live prey and are easily disturbed by human activities, and so do not frequent landfill sites. Despite the high level of interest in raptors, the only diurnal species which are regularly reported at landfills are established scavengers – vultures and kites. Vultures have not been recorded at landfills in the Western Cape Province but Yellow-billed Kites, a summer visitor, regularly occur in small numbers. The literature contains no reports of concern about the use of landfills by kites other than the rare occurrence of entanglement in artefacts (Blanco1994 cited by Williams, 2011) specifically reported that toxic materials were not ingested by kites.

The comments received from an Interested and Affected Party on the Draft EIR indicated that a waste disposal facility at Site 2 may impact on slope soaring birds like the critically endangered black harrier due to their flight and predatory characteristics.

Rodents and owls:

Given the high level of vehicle and human disturbance where the freshest food is deposited rodents at landfills should be confined to peripheral and inactive areas of the landfill site by day but move to the active zones by night when the shallowly buried food would be easily available. Questioned about potential rodent activity at night the managers of the two visited landfills had no information as they have no need to visit the site after the daily dumping has ceased. However, at both sites managers warned about the presence of poisonous snakes. The noticeable presence of such snakes is indicative of reasonably numerous rodents. It may be supposed, though there seems to be no published evidence, that there might be elevated numbers of owls near landfills feeding either on rodents or on large insects. These owls would be the birds of prey most at potential risk of contamination and potentially poisoning through bio-accumulation. The avi-fuanal specialist suggested that at PetroSA, and the Eden Site if developed, installation of owl breeding boxes at the periphery of the landfill, and of raised wooden perches on inactive parts of the site. This could lead to an increase in owl predation and so act as a means of reducing rodent numbers. Owls regurgitate pellets and those obtained from owl boxes or roosts would provide a means of monitoring rodent diversity and availability. The success, or failure, of owl chicks in the boxes would give an indication of food availability through the growth rate and number of chicks, and carcasses of dead chicks could be used to assess contamination levels.

Hazardous wastes:

In relation to birds there are two types of hazardous waste that are generally treated apart from general refuse. These hazardous materials are bulk organic material – butchery and poultry farm waste, especially when the material has been condemned as unfit for human use - and inorganic waste. The organic waste has the potential to infect birds with disease, and the inorganic materials may to lead to pollution of birds. In any landfill birds should be kept away from these hazardous wastes.

Bulk organic waste is normally disposed of in specially dug trenches and, once the entire batch has been deposited, it is covered with a thicker layer of earth than that used to cover domestic refuse. Nevertheless, there may be a period in which the organic material is exposed and can be accessed by birds. Usually the delivery of hazardous organic waste will be irregular and infrequent. During the period of bulk organic waste exposure one or several means of bird hazing should be used to deter birds. To further reduce bird access this waste should be treated in a designated area well away from that used for general dumping and the waste thoroughly buried as soon as possible. This is especially critical given the local importance of ostrich farming.

Hazardous inorganic waste is generally kept in discrete and fixed areas of a landfill and not subject to the same repeated change location as is the area of general refuse dumping. Because the hazardous waste areas are fixed, and smaller than the general dumping area, it is feasible to use the pole and overhead line as a means of deterrent to prevent, or severely limit, bird access to these wastes.

The PetroSA landfill is a designated regional hazardous waste site. Re-allocation of domestic waste from the PetroSA site to the Eden site should reduce the risk of birds visiting the hazardous waste areas at the PetroSA landfill. However, if the Eden landfill will house designated hazardous waste a pole and wire grid deterrence system should be installed before any waste is deposited.

Future reduction in organic refuse:

The avifaunal specialist indicated that the report has been written as though the landfill will receive domestic refuse containing the present level of organic waste. It can be expected that, over the estimated 50-year working span of the proposed landfill, there will be changes in refuse taken to landfills. Increasingly materials are being pre-sorted for recycling. It is likely that there will be pressure for the public to use their organic waste material in domestic composting. Overall it is likely that the quantity of organic food available for scavenging birds will be reduced. This is to be encouraged but will have a negative impact on the local populations of those species, which regularly scavenge at the regional landfill.

Populations of key scavenger species may be seriously affected if the availability of organic refuse is greatly reduced (Bellbaum et al. 2000 cited by Williams, 2011). This is already happening in some countries and in one study after an 80% reduction in edible waste, following the installation of a refuse incinerator, the local gull population laid fewer eggs which were of smaller size, had reduced hatching success and a 46% reduction in fledging success relative to the situation when ample refuse was available (Pons 1992 cited by Williams, 2011). The smaller clutch and egg size was attributed largely to female gulls being out-competed by males for access to refuse with resultant reduced protein levels. In Florida on the closure of one landfill thousands of gulls moved to other regional landfill sites (Patton 1988 cited by Williams, 2011). In the absence of landfill refuse, if alternative food sources are not available, the survival of scavenging birds is likely to be reduced and populations, previously inflated by the abundant un-natural food, should return to pre-landfill levels (Patton 1988 cited by Williams, 2011). However, in Britain the number of large gulls continued to increase for several years after an apparent decline in food availability following more efficient refuse disposal (Harris 1970 cited by Williams, 2011).

7.3.8 Fauna

The Eden District comprises unique coastal, marine, estuarine, freshwater and terrestrial habitats. Specific reference is made in the Eden District Municipality SDF (Dennis Moss Partnership, 2003) to *inter alia* endangered species such as the Knysna seahorse (*Hippocampus carpensis*), which occurs in the Knysna lagoon, and the Cape Mountain Zebra (*Equus zebra zebra*), which occurs in the Kammanassie Mountains (Dennis Moss Partnership, 2003).

The Knysna forest is also known as the last home of the Knysna elephants. These elephants belong to the same species, *Loxodonta africana,* as all the bush or savanna elephants of Africa, but their life-style has modified their habits, causing them to resemble those of one of the two sub-species of African elephant – the forest elephant, *Loxodonta africana cyclotis,* whose habitat is the equatorial forests of West and Central Africa (Reader's Digest, 1990).

Few of the region's reptiles and amphibians are endangered, and most have been recorded within local nature reserves. However, the drastic clearing of valley bushveld vegetation is destroying the habitat of many species, particularly Tasman's girdled lizard, which is endemic to the region. A number of montane forms associated with the Cape Fold Mountains occur in the study area, for example, the ghost frog (*Heleophryne regis*), the Cape mountain lizard (*Tropidosaura gularis*), the Rock Agama and the Cape crag lizard (*Pseudocordylus m. microlepidotus*). Only a single species of the minute leaf-folding frog (*Afrixalus knysnae*) occurs in the region where it is endemic to reed beds around the lakes along the Garden Route. The nature and distribution of the terrestrial invertebrates found along the coast is dependent, to a large degree, upon the nature of the terrain and the extent and composition of the ground cover. Damara Terns breed in small numbers in the coastal sand dunes. This region is one of only a few breeding areas of the Damara Tern in South Africa (Dennis Moss Partnership, 2003).

The Duivenhoks, Goukou, Gourits and Hartenbos Rivers are all seen as important habitats for birdlife, especially waders. Both the Little and Great Brak Rivers are home to a number of waders, while the Little Brak River is also the breeding ground of a group of *c* 35 Ethiopian Snipe. A number of African Black Oyster-catchers occur at Vleespunt. Seal island in Mossel Bay, supports large colonies of roosting cormorants, while White-Breasted Cormorants breed on the coastal cliffs (Dennis Moss Partnership, 2003).

The most common bird in the Swartvlei region, however, is the Red-knobbed Coot with over 15 000 birds occurring in the region. Over 170 species have been recorded in the Goukamma Reserve and river. The Brenton Blue, which is described as *one of the rarest butterflies in the world,* exclusively occurs in coastal fynbos on south facing slopes at Brenton-on-Sea. A reserve has been established for this species by the Endangered Wildlife Trust, the Green Trust and the Lepidopterists' Society in partnership with the Wildlife and Environment Society of South Africa. The survival of this butterfly is largely determined by the presence of the host plant, *Indigofera erecta,* upon which its larvae exclusively feed (Dennis Moss Partnership, 2003).

The Eastern and Southern Cape coasts have a diverse and fascinating marine fish fauna. Many of these species are endemic, including catsharks, several seabreams, and the clinids (Smale & Buxton, 1998 cited in Dennis Moss Partnership, 2003). Four of the five sea turtle species found in South African waters occur along the coastline of the EDM. Because it feeds in shallow waters on algae and sea grasses, the green turtle (*Chelonia mydas*) is regularly found in calm estuaries (Smale & Buxton, 1998 cited in Dennis Moss Partnership, 2003).

The Southern Right Whale (*Eubalaena australis*) often comes inshore to calve and can be seen all along the coastline of the EDM. The breeding season lasts from May until November, with a peak in September/October. Apart from whales, the Bottlenose dolphin (*Tursiops truncatus*), Common dolphin (*Delphinus delphinus*) and Humpback dolphin (*Sousa chinensis*) can be found in coastal areas throughout the South-eastern Cape. The best spotting locality on the coast is probably Plettenberg Bay, where large schools can regularly be seen from Robberg (Cockcroft, 1998 cited in Dennis Moss Partnership, 2003).

Only one species of seal, the Cape Fur Seal (*Arctocephalus pusillus*), inhabits this area, although a number of others occur as vagrants. Other than large feeding aggregations at sea, the only large breeding colony of seals can be seen at Seal Island in Mossel Bay (Dennis Moss Partnership, 2003).

Although 34 freshwater fish species occur in the region, the communities in the coastal habitats are generally small and usually comprise a few species only. The more common or widespread species or those likely to be caught by anglers include the eels (*Anguilla* spp.), smallmouth yellowfish (*Barbus aeneus*), carp (*Cyprinus carpio*), moggel (*Labeo umbratus*), sharptooth catfish (*Clarias gariepinus*), rainbow trout (*Oncorhynchus mykiss*), bluegill (*Lepomis macrochirus*) and largemouth bass (*Micropterus salmoides*) (Skelton, 1998 cited in Dennis Moss Partnership, 2003).

Some of the world's most primitive beetle species (*Colophon* spp.) occur on the high peaks of the Swartberg Mountains in the vicinity of Meiringspoort (Dennis Moss Partnership, 2003).

During the public participation process an I&AP indicated that the Gondwana Game Reserve and surrounding areas contains a thriving population of African wildcat. The species has been pushed near to extrinction due to in-breeding with domestic feral cats. The I&AP furthermore indicated that the traits of the wildcat population around the proposed Site 2 shows that of pure genetic breed. The increase of domestic feral cats may have a detrimental impact on the wildcat population within the region.

7.3.9 Air quality

The immediate area around all three proposed sites is sparsely populated. The existing land-use on Site 1 is mainly agricultural. The surrounding land is also used for agricultural purposes, apart from PetroSA and the Gourikwa Power Station that are located to the east of the site. PetroSA would contribute volatile organic compounds, sulphur dioxide, nitrogen dioxide, carbon monoxide and particulate matter (PM10) emissions. The Gourikwa Power Station also contributes sulphur dioxide, nitrogen dioxide, carbon monoxide and particulate matter (PM10) emissions, however only nitrogen dioxide is considered significant (Airshed Planning Professionals, 2012).

Site 2 is mostly covered in indigenous vegetation with a relatively small area disturbed for agricultural purposes. The surrounding land is predominantly agriculture. Site 3 and the surrounding properties are used for agricultural purposes. Airborne particulates are expected to be released during the cultivation of land, livestock activity and wind erosion of exposed areas. This would be more significant during drier periods. Dust is generated by vehicle traffic along the unpaved roads near Site 3. When dry, this also becomes a source of fugitive dust. The characterisation of existing air quality is required for assessing the potential for cumulative impacts (Airshed Planning Professionals, 2012).

The only long-term ambient air pollution monitoring has been conducted at various locations at and around PetroSA. The pollutants included in their monitoring network are sulphur dioxide (SO2), nitrogen dioxide (NO2) and volatile organic compounds (VOC), specifically benzene. These observations were all done using passive diffusion sampler techniques and reported as monthly averages. The annual averages of the measured monthly SO_2 concentrations at the refinery boundary are all below the SA annual standard of 50 µg/m³. The average of all the measurements is approximately 10 µg/m³ (8.92 to 11.14 µg/m³).

The annual averages of the NO_2 measurements at the refinery boundary, as supplied by PetroSA, are all below the SA annual standard of 40 µg/m³. The average of all the measurements is approximately 5 µg/m³ (5.05 to 5.99 µg/m³).

Eskom have also measured ambient NO2 concentrations at Dana Bay between 31 July 2009 and 31 January 2010. The average NO2 concentration for that period was 3.8 µg/m³. The average benzene at all the boundary locations for 2009 was 1.4 µg/m³, which is lower than the SA limit value of 10 µg/m³ applicable until 2014 (from 2015 the limit is 5 µg/m³).

A 1-month sampling campaign (two, 2-weekly back-to-back) at each of the three sites was also completed for the period 9 March 2011 to 7 April 2011. Very low concentrations of SO2, NO2 and hydrogen sulphide (H2S) were observed. The monitoring campaign also included VOCs, but was all found to be below the respective detection limits. The March/April campaign also included ambient particulate (PM10) concentration measurements at Site 1. This site was selected since it was expected to observe the highest values of the three sites due to its relative location close to PetroSA and farming activities. The results were relatively high when compared to the SA limit value for PM10 of 120 and 75 µg/m³ for compliance. During the month, there were four incidences of exceeding the 120 µg/m³ value, and seven exceeding the 75 µg/m³ value. On one occasion, there was a veld fire caused by lightning, which contributed to the high reading. Since the monitor had to be located in a secure place, nearby a farmhouse and the readings may have been influenced by the farming activities. The average for the monitoring period was 72µg/m³ (Airshed Planning Professionals, 2012).

7.4 Demographic and settlement profile

This section summarizes the demographic and settlement profile of the affected environment but also aims at explaining the relevance of the data to the proposed project. This section provides a summary of the information contained in the specialist assessment compiled by Urban-Econ (2012) and therefore acknowledgement for the information contained in this section is given to Urban-Econ.

7.4.1 Population growth rates

The population growth rates provide an indication as to the future needs for refuse removal amongst the identified municipal areas. The Socio-Economic Impact Assessment indicated that the Mossel Bay municipality has the highest recent population growth rate (2001-2009) and it is purported to have the highest demand in terms of future refuse removal and disposal, thus making the site of the development appropriate to the future demand. The low growth rates across the other municipal areas indicates that future quantities of waste originating from these areas will stay relatively constant, and will have positive implications for future transport costs associated with the new site (Urban-Econ, 2012). Please see Table 7.3 for the figures on the growth rates of the individual Municipalities.

Municipality	Population Total (2009)	Average growth rate (1995-2009)	Recent Growth Rates (2001-2009)	Percentage makeup of Eden Total
Hessequa	40 484	0.20%	-0.75%	7.75%
George	140 447	1.74%	0.67%	26.89%
Kannaland	24 830	1.30%	1.02%	4.95%
Bitou	39 242	5.84%	4.00%	7.51%
Knysna	65 495	3.03%	2.91%	12.54%
Mossel Bay	116 603	4.76%	5.71%	22.32%

(Source: Urban-Econ Calculations, Quantec EasyData, 2010 cited by Urban-Econ, 2012).

Table 7.3: Population figures of the municipalities within the Eden District.

7.4.2 Age profile

The relative young age of the population across the Eden District has positive implications, as the greater number of dependents and larger households are purported to generate greater amounts of general waste than smaller families. This requires the establishment of new larger landfill sites across the Eden District and signifies the need for the Eden Regional Landfill site to cater for future waste disposal (Urban-Econ, 2012).

7.4.3 Education levels

The skills profile of the population has a significant impact on the skills levels of the individuals living in the area, which in turn impacts the employment opportunities that are available to them and thus the income levels that they can obtain.

The majority of the population having obtained some form of primary or secondary schools, as well as low percentages that has obtained some form of tertiary education (none of the displayed municipal areas have above a 10% ratio of its population with some form of tertiary education). Another notable trend is the low percentage of the populations that have a matric certificate, which in the current economic and employment environment is obligatory in order to obtain a fair wage in the market place. All the municipal regions also show high levels of their population that have attended no formal schooling in their lives till the year 2007 (Urban-Econ, 2012).

7.4.4 Household data

There is a dominance of middle to low income households among the identified municipal areas, with the percentage and number of households in the Low and Middle income categories far outweighs those of the high income categories.

The relatively low household growth rates will have similar implications for the development as the population growth rates, with the low growth rates signifying a more stable supply of waste, especially from municipal regions such as George, Knysna and Oudtshoorn (Urban-Econ, 2012).

7.4.5 Type of dwelling

Type of dwelling can be used in accordance with household income to establish the level of community development. As such, middle to low and high-income households typically occupy a house or brick structure on a separate stand. The second largest percentage of households in both the Eden District and the Mossel Bay municipality occupy an informal dwelling/shack, with 11.29% of the Mossel Bay municipality and 12.94% of the Eden District households living in such structures. Low-income households and especially those in the lower income brackets (R1 – R19, 200) traditionally occupy such structures and confirm that a large percentage of households in the area are low income (Urban-Econ, 2012).

7.4.6 Employment

Both the Mossel Bay municipality and the Eden District have a relatively high employment rate, with approximately ~50% of the working population in Mossel Bay being employed and 48% of the Eden District working population being employed. Correspondingly, relatively low levels of unemployment are experienced in both regions, with only 11% of the Eden District population being unemployed and only 12% of the Mossel Bay municipality. Both municipal areas do however; have a very high percentage of its populations that are economically inactive (41% in the Eden District and 34% in the Mossel Bay municipal area). All the identified municipal areas show relatively high employment levels amongst the populations; low levels of unemployment; and a high number of economically inactive individuals. Of the identified municipal areas, Mossel Bay has the highest employment percentage amongst its population, with a 53.59% employment rate. The Knysna Municipality shows the lowest unemployment rate with only 8.82% of its population being classified as unemployed. The Hessequa Municipality has the largest number of economically inactive individuals (54.71%) and thus the highest percentage of dependents among its population. The Bitou municipality has the lowest number of dependents with only 32.87% of its population being classified as economically inactive (Urban-Econ, 2012).

7.4.7 Refuse removal

Municipalities in the Eden District cater highly efficiently for their respective communities in disposal of waste which is indicated by the large percentage of refuse which is removed by the various local authorities on a weekly basis and in addition municipalities such as Knysna, George and Mossel Bay have highly effective and developed recycling operations that are undertaken in the area, for the recycling of general household waste and garden refuse.

Indicator	Eden District	Mossel Bay Municipality
Social Economic Impact		
Population Total	522, 345	116, 603
Population Growth Rate (2001-2009)	1.18%	5.71%
Household total	131, 864	26, 100
Household growth Rate (2001-2009)	1.29%	2.95%
Age: Young Economically Active Retiree’s	 28.11% 65.20% 6.69%	 27.14% 66.34% 6.53%
Gender: Male Female	 49.13% 50.87%	 51.32% 48.68%
Employment status: Employed Unemployed Not economically active	 47.58% 11.42% 40.99%	 53.59% 12.17% 34.25%
Household Income: High Middle Low No Income	 4.16% 40.58% 51.12% 4.14%	 3.42% 37.13% 55.23% 4.22%
Type of dwelling: House or brick structure on a separate stand	 73.49%	 73.28%

Informal dwelling/shack Town/cluster/semi-detached	16.18% 2.58%	14.35% 4.64%
Refuse removal: Local Authority at least once a week Own Refuse dump No rubbish disposal	 83.57% 12.73% 2.04%	 90.44% 7.53% 0.60%
Economic profile		
Total GGP	R34, 940 million	R10, 053 million
GGP Growth Rate (2001-2009)	13.57%	18.67%
GGP Contributions Per Sector: Primary Secondary Tertiary	 7.27% 26.01% 66.73%	 5.18% 33.69% 61.12%
GGP Contributions Per Industry: Finance and Business Services Manufacturing Wholesale, retail trade and accommodation	 26.74% 14.71% 16.37%	 27.13% 19.39% 14.54%
Employment Per Sector: Primary Secondary Tertiary	 8.29% 26.23% 65.48%	 5.97% 30.11% 63.92%
Employment Per Industry: Wholesale, retail trade and accommodation Construction Finance, Real Estate and Business services Community and personal Services	 22.75% 14.34% -- 13.91%	 21.54% 17.88% 14.37% --

Table 7.4: A summary of the economic and social profile of the Eden District and the Mossel Bay municipal area (Source: Urban-Econ, 2012).

7.5 Economic profile

The Economic Profile sub-section in the Socio-Economic Impact Assessemnt (attached in Appendix G) presents the economic trends and characteristics of the identified municipal areas. This section provides a summary of the information contained in the specialist assessment compiled by Urban-Econ (2012) and therefore acknowledgement for the information contained in this section is given to Urban-Econ.

7.5.1 Gross Geographic Production

Gross Geographic Production (GGP) is commonly defined as the total value of final goods and services that are produced within the boundaries of a certain area (such as a municipal area, or within the boundaries of a country), over a certain period of time, usually a year. GGP in addition to measuring the value of production can also be used as an indicator of income, as all goods and services produced and sold generate income for households within the specified geographic area. The economies and municipalities situated in the Garden Route (Mossel Bay, Knysna, Bitou and George) have shown healthy GGP growth rates, both on average and in more recent times. The two municipalities that are situated outside the Garden Route (Hessequa and Kannaland) have displayed positive growth trends, however these growth rates are relatively low (average growth rates of 1.51% and 5.34% respectively). In more recent times (2001-2009) the Mossel Bay municipality and the Knysna municipality are the only economies that have shown any significant increase in GGP growth (Mossel Bay from 6.60% to 7.27% and Knysna from 5.27% to 6.36%), with the Bitou and Hessequa municipalities showing a significant drop in growth. These continued rises in GGP growth rates can be attributed to the continued importance of the manufacturing sectors in the respective economies that both contribute over 20% to the total production across the various industries, within the regions.

7.5.2 Resources

The activities to be undertaken at the landfill site will require both skilled and semi- or unskilled workers. Unemployment has been highlighted in the Mossel Bay municipality Integrated Development Plan (IDP) as an issue which need to be addressed. Although the landfill site is not labour intensive, it will provide employment for unskilled labourers and the potential establishment of spin-off industries complementary to the landfill site should further increase the employment opportunities that will be generated through the landfill operations. As the Eden district is dominated by semi- or unskilled workers and skilled workers, labour resources can be sourced within the local population and will not require the migration of labour to supplement a lack of skills for the operation and running of the landfill site.

7.5.3 GGP per sector and Industry Contributions

The most important and significant contributor to total GGP in the Mossel Bay economy is the Finance, Insurance and Business Services sector (24.43% of total GGP); however the secondary sector plays an equally important role to production, being the second largest contributor with 24.04% of total production; and finally the Wholesale and Retail, Catering and Accommodation industry represents the third largest or most significant contributor to total production (15.08%). In the Eden District as with the Mossel Bay economy, the Finance, Insurance and Business services sector is the largest contributing sector to total GGP with 23.12% of total production. The second most significant contributor is the Wholesale and Retail Trade, Catering and Accommodation industry with 17.01% of total production, and finally the manufacturing sector 16.89% of total production in the district. The importance of the secondary sector in both economies is noteworthy, and shows a relatively well developed industrial and manufacturing sectors within both economies. The presence and operations of the PetroSA plant just outside the town of Mossel Bay attributes for the significant contribution of the secondary sector (manufacturing within this economy). In the Eden District as a whole, the George and Knysna municipalities have relatively well developed industrial sectors, which have traditionally been rooted in the agricultural, forestry and manufacturing industries. However, the dominance of the tertiary sector is still evident.

The service industry is purported to generate less waste per annum than larger manufacturing and construction industries. As businesses account for a large percentage of the overall waste generation within a municipal area, the increased importance and contribution of the tertiary sector thus means that lower levels of waste will be generated by industry especially in economies such as George and Mossel Bay, which traditionally are regarded as more industrially developed economies.

The population growth rate and the GGP growth rates are the most reliable measures of future waste disposal needs, and although the populations of many of the identified municipalities have on average been growing at a slow rate and in some cases have been more or less stagnant, it shows households and individuals are still immigrating to the area, and as such will generate a demand for waste disposal. Waste generated by businesses accounts for a large portion of total waste and with GGP or production growth rates averaging over 10% across the various municipalities, trends indicate a continued and possible increase of waste from this source (Urban-Econ, 2012).

7.6 Heritage context

7.6.1 Archaeology

Apart from early archaeological investigations of the Cape St. Blaize Cave in Mossel Bay (Leith 1888; Goodwin & Malan 1935 cited in Kaplan 2009b) and the mapping of known archaeological sites in the coastal zone (Kaplan 1993 cited in Kaplan 2009b) very little systematic archaeological work has been carried out in the Mossel Bay area. It has taken several archaeological impact assessments, particularly at Pinnacle Point, to focus attention on the importance of the area in the study of early modern humans in Southern Africa (Marean & Nilssen 2002 cited in Kaplan 2009b). Baseline studies in the surrounding area have documented relatively large numbers of Early Stone Age (ESA) and Middle Stone Age (MSA) tools at Paradise Beach in Dana Bay (Kaplan 2003 cited in Kaplan 2009b), Pinnacle Point (Kaplan 1997 cited in Kaplan 2009b), as well as on the Farm Droogfontein in Dana Bay (Kaplan 2007 cited in Kaplan 2009b). More than 70 000 ESA tools have also been collected during monitoring of bulk earthworks at the Pinnacle Point Golf Estate (Nilssen 2007 cited in Kaplan 2009b). More recently, medium-low density scatters of mainly MSA tools were documented on the farm Outeniquasbosch situated directly alongside (i.e. east of) the farm Hartenbos (Kaplan 2007 cited in Kaplan 2009b), while a rare ESA/MSA quarry site was recently documented on the Farm Hartenbos (Kaplan 2009a cited in Kaplan 2009b).

<u>*Site 1:*</u>

The northern and south eastern portions have lain fallow for several years and are covered in thick Kweek grass. Little surface stone occurs in this portion of the farm, but some Koffieklip is scattered about and several large piles of Koffieklip occur in places alongside the railway line. Farm 310, situated directly alongside the N2, is also covered in Kweek grass and has been heavily grazed and there is very little surface stone here as well. There is, however, a large and fairly extensive scatter of quartzite and some Koffieklip in the southern portion of the property, centered around, an old seasonal pan. A farmhouse and outbuildings also occurs on the property. The original farmhouse, now extensively altered and modernized, apparently once housed the Local District post office.

Site 2:

There are no significant landscape features occurring on the proposed site. There are some fairly (low) outcroppings of a silcrete-like material in the central portion of the property, where the surrounding area has been burnt. Where there are open spaces, there appears to be very little surface stone on the site.

Site 3:

It is estimated that more than 99% of the proposed site comprises agricultural lands that have been intensively ploughed and contoured over many years, for the production of wheat and cereal crops. There is effectively no natural vegetation on the proposed site. There are no significant landscape features on the proposed site. There is some surface stone on the site, but this is spread very thinly and unevenly over the surrounding landscape.

7.6.2 Palaeontology

Study Site 1 is mantled with Late Caenozoic superficial sediments (soils, possible buried gravels) of very low palaeontological sensitivity. Underlying Palaeozoic bedrocks of the Bokkeveld Group or Table Mountain Group are likely to be deeply-weathered and/or cleaved with little or no preserved fossil heritage.

Study Site 2 is situated on an old Tertiary land surface cut into marine sediments of the Lower Bokkeveld Group of Devonian age. This surface is extensively mantled by ancient river gravels and siliceous pedocretes (cemented soils) called silcretes. The Bokkeveld Group rocks were originally highly fossiliferous (*e.g.* rich assemblages of marine shells), but their fossil heritage has been largely destroyed by profound chemical weathering and tectonic deformation (*e.g.* cleavage development). The overlying superficial sediments (gravels, silcretes *etc*) are of very low palaeontological sensitivity.

Study Site 3 (Kruis Vallei 232) is entirely underlain by Devonian marine sediments of the Lower Bokkeveld Group that, as for the previous site, are now of low palaeontological sensitivity.

7.6.1 Visual context

Visual character

The existing landfill and three alternative sites considered for the potential development of a new regional landfill for the Eden District Municipality are located to the west of Mossel Bay, the 'gateway to the Garden Route'. This area is not considered to have a particularly distinctive visual character, although the individual sites have relatively unique identities. The existing landfill and proposed Site 1 have a predominantly industrial character, as it is located next to the PetroSA and Eskom power generation facilities along the N2. Site 2 is located within an important ecological corridor adjacent to the R327 and has a distinct natural to semi-natural character, while Site 3 is located in an agricultural area adjacent to the gravel road connecting the R327 and Cooper train station.

Due to its location in a flat area that has been significantly impacted by agriculture and industrial development, the visual quality of Site 1 is considered to be the lowest of the three proposed sites.

Site 2, located in an area with many hills and valleys that retains a large proportion of the indigenous vegetation, has the highest visual quality. Site 3 has a visual quality that is considered to fall in between that of Sites 1 and 2, as it is situated in a somewhat hilly agricultural area not as stimulating and diverse as the surroundings of Site 2.

Site 1 is located in a relatively flat and visually impacted landscape, at the juncture of agricultural and industrial landscapes. The visual character of this site is determined by the flat topography with hills in the background, the mostly sparse, planted and brownish-coloured low vegetation and the prominent industrial structures adjacent to the site.

Site 2: Distracting from this scenic character, however, are two 400 kV transmission lines that cross the site and are highly visible as they traverse the landscape from the PetroSA site towards the Proteus substation (This is not visible from the site). Other large power lines can be seen in the background towards the east and west of the site. The visual character of this site is determined by the more undulating topography, with higher hills in the background towards the north and wide-reaching views particularly towards the south, the relatively dense bushy indigenous vegetation with foliage of varying colours and the prominent power lines traversing the landscape nearby the site.

Site 3: The site is located in a very gently undulating landscape characterised by cultivated areas interspersed with bushes and some small trees. The site offers far-reaching views of a mostly uniform landscape that is traversed by a power transmission line running east to west and touching the south-eastern border of the site. The visual character of this site is determined by the very gently undulating to flat topography which allows extensive views of a relatively uniform landscape that is (at this time of the year) dominated by the brown and red-brown shades of uncovered soil and interspersed by greener lines and areas of bushes and grass demarcating borders and pastures, as well as the prominent power lines traversing the landscape nearby the site (SRK, 2012).

Visual Quality

Existing landfill and Site 1

As the existing landfill and Site 1 are located adjacent to each other, the visual quality of the landscape in which the two sites are located is essentially the same. Despite being located a short distance before Mossel Bay, the 'gateway to the Garden Route', the visual quality of the area in which the sites are located is to a significant extent compromised by:

- The particularly flat (and thus uniform) terrain of the area in the foreground, with hills being located far in the background;
- The significant extent to which the man-made landscape, consisting of pastures, fence lines and more importantly, industrial developments adjacent to the site, dominates the natural landscape, particularly in the foreground;
- The relatively uniform pattern of pastures, which are only interrupted by occasional tree lines and bushes that grow mostly along infrastructure lines (such as roads and railway line); and
- The disjuncture of adjacent land uses in the area, consisting of industrial development, agricultural lands and large power transmission lines traversing these (SRK, 2012).

Site 2

The visual quality of the area surrounding Site 2 is considered to be relatively high due to the following landscape elements that enhance the quality:

- The undulating topography, falling away towards the south to the (fairly distant) Indian Ocean and rising towards the north to the Langeberg Mountain range;
- The relatively large proportion of natural vegetation, particularly towards the south and extending across most of the landscape north of the R327, leading to a diverse pattern of bushes and grasslands;
- The lower proportion of man-made landscapes clearly visible in this area; and
- The compatibility of most of the land uses in this area, consisting mostly of grazing, natural areas and some cultivation. Elements that detract from the visual quality of the general area are the power transmission lines and the Proteus substation located to the north of the R327 (SRK, 2012).

Site 3

The visual quality of this area is enhanced by several elements, such as:

- The gently undulating topography and mountains clearly visible in the background;
- The presence of occasional farm dams;
- The patterns in the landscape created by bush and tree lined boundaries and paths that dissect agricultural lands; and

- The high compatibility of surrounding land uses, which are mostly related to various forms of agriculture (cultivation, grazing, ostrich farming etc.).
- Elements that detract from the visual quality of the area are the power transmission lines and the general dominance of man-made over natural landscape (SRK, 2012).

Sense of place

The existing landfill site and Site 1 can be described as having a strong identity in the context of the adjacent and easily recognisable facilities belonging to PetroSA and the Eskom OCGT Plant. These give the site a distinct industrial flavour and identity (SRK, 2012).

Site 2 is not considered to be particularly distinctive, but falls within the scenic R327 route and a regionally important ecological corridor (Helme, 2009) that has remained within an often highly transformed landscape. As such, the corridor within which Site 2 lies can be considered to have a distinct sense of place and natural identity (SRK, 2012).

Site 3 is also not considered to be particularly distinctive, as it is an agricultural site within an agricultural area. Due to the consistent neighbouring land uses, the area can be described as having some sense of place and agricultural identity. However, it is not considered to be particularly unique or have a particularly strong sense of place within the wider region (SRK, 2012).

7.7 Road and traffic conditions

7.7.1 Existing traffic conditions

Traffic counts were done on Thursday 7 October 2010 at the following intersections:

N2 / R327 (Main Road 342)

N2 / PetroSA Landfill entrance road

N2 / Cooper Station Road (Main Road 341)

R327 (Main Road 342) / Heuningklip Road (Divisional Road 1563)

Traffic counts for the N2 / Kleinberg Station Road (Divisional Road 1549) intersection were obtained from the Western Cape Provincial Government. These intersections were analysed by means of the SIDRA computer program. SIDRA Version 5.0 does not give intersection service levels for one- or two-way stop controlled intersections, but the analysis did indicate that all movements at all of the analysed intersections operate at a level of service C or better. Service levels are based on the delay that vehicles experience at intersections. A level of service A represents the least delays, with a level of service F representing excessive delays. A level of service D is the lowest satisfactory service level (iCE Group, 2012).

Additional traffic counts were obtained from Syntell courtesy of SANRAL at positions on the N2 just west of the R327 Herbertsdale turnoff and just east of the secondary PetroSA access. These records date from 2003 to 2009 and, interestingly, the counts indicate a 0% growth rate in Average Daily Traffic (ADT) volumes for this period (iCE Group, 2012).

Data from the SANRAL counting station east of Plettenberg Bay was obtained in order to measure the impact that Bitou waste transport will have once the waste starts to be transported to the PetroSA landfill site (iCE Group, 2012).

7.7.2 Existing pavement conditions

Pavement information was obtained from SANRAL and the Provincial Government of the Western Cape: Department of Transport and Public Works.

The SANRAL report shows that the section of the N2 between Gouritsmond and Mossel Bay was resurfaced in 2002 and that the pavement is still in good condition. The condition of the N2 between Mossel Bay and Plettenberg Bay is within acceptable standards. Pavement design is based on the number of equivalent 80 kN (E80) axle loads that a road is expected to carry during its design lifetime. Pavement design refers to the structural layers required in road construction, and does not necessarily mean that roads have to be surfaced to carry heavy vehicles. Gravel roads with sufficient layer works can carry heavy loads. The available traffic information indicates that the N2 at PetroSA currently carries approximately 1450 E80 loads per day, with the highest number of loads per eastbound lane beingabout 540 and the highest number of loads per westbound lane being about 660 (iCE Group, 2012).

7.7.3 Traffic safety

The geometrical design of the N2 / PetroSA Landfill access conforms to SANRAL's geometric design standards, with turning lanes provided on both approaches and sufficient sight distance to the east and west (iCE Group, 2012).

CHAPTER 8: PUBLIC PARTICIPATION PROCESS

8.1 Introduction

The aim of the Public Participation Process is to ensure that all stakeholders have adequate opportunity to provide input into the EIA. In the Scoping Process Interested and Affected Parties (I & APs) were identified and informed of the proposed development. I & APs were provided with an opportunity to identify issues and concerns with the proposed development and recommend mitigation measures to be implemented. This EIR phase continues and builds on the Public Participation Process that commenced during the Scoping Phase.

8.2 Approach

The Public Participation Process was undertaken in accordance with the requirements of the NEMA EIA Regulations and the Guideline for Public Participation issued by the DEA&DP. The activities that were undertaken are listed below.

8.2.1 Identification of stakeholders

8.2.1.1 Identification of potential stakeholders

A number of activities were undertaken to identify potential Interested and Affected Parties as listed below:

- Prior to the start of the EIA process the Eden District Municipality placed notices in both Afrikaans and English in the Mossel Bay Advertiser, the George Herald, the Knysna-Plett Herald, the Oudtshoorn Courant in the week of 2-6 June 2008 in which the Eden District Municipality informed the public of their intent to investigate potential sites for waste disposal. Potential Interested and Affected Parties (I & APs) were invited to forward their details to the Eden District Municipality.
- A number of potential stakeholders were identified prior to the start of the Public Participation Process and they were notified of the activity via registered mail. These stakeholders included but were not limited to: Environmental and Agricultural Organisations/Forums; Ratepayers Associations; Tourist related organizations; Business chambers.
- Landowners within 100 metres of the boundaries of the proposed sites were notified via registered mail. The notice sent to the landowners provided a description of the activity, an invitation to register in the process and comment, the availability of the Background Information Document (BID) and the timeframes in which they were required to submit their comments as well as the contact details of the Environmental Consultant.

- The landowners of the potential site were notified via registered mail and their consent was obtained. The notice sent to the landowners provided a description of the activity, an invitation to register in the process and comment, the availability of the BID and the timeframes in which they were required to submit their comments as well as the contact details of the Environmental Consultant.
- Site notices were placed on the proposed sites. The notices provided a description of the activity, an invitation to register in the process and comment, the availability of the BID and the timeframes in which the I&APs were required to submit their comments as well as the contact details of the Environmental Consultant.
- Notices were placed in the following newspapers (the dates are indicated in brackets): Die Burger (18-9-2009), The Cape Times (18-9-2009), Knysna-Plett Herald (17-9-2009) and The Mossel Bay Advertiser (18-9-2009). The notices provided a description of the activity, an invitation to register in the process and comment, the availability of the BID and the timeframes in which the I&APs were required to submit their comments as well as the contact details of the Environmental Consultant.
- Notices were placed at Albertinia and Gouritsmond Public Libraries. The notices provided a description of the activity, an invitation to register in the process and comment, the availability of the BID and the timeframes in which the I&APs were required to submit their comments as well as the contact details of the Environmental Consultant.
- The Background Information Document (BID) was placed in the following Public Libraries: Albertinia, George, Gouritsmond, Knysna, Mossel Bay, Plettenberg Bay and Stil Bay. The Background Information Document (BID) was placed in the following Municipal offices: Bitou, George, Knysna, and Mossel Bay.
- The BID was also placed on the following website: www.pdna.co.za

8.2.1.2 Identification of governmental stakeholders and organizations

The following governmental stakeholders and organs of state were being consulted during the Scoping process:

Government Departments: National and Provincial and organs of state

- The Provincial Department of Environmental Affairs and Development Planning: Waste Management
- The National Department of Environmental Affairs
- The Department of Water Affairs: Regional Office
- Provincial Government of the Western Cape:The Department of Agriculture

- The Department of Agriculture, Forestry and Fisheries
- Provincial Government of the Western Cape: Department of Health
- Provincial Government of the Western Cape :Department of Transport and Public Works: Road Network Management
- South African National Roads Agency
- CapeNature
- Heritage Western Cape

Regional and Local government

- Eden District Municipality and individual Municipalities within the District

8.2.1.3 Register of Interested and Affected Parties (I&APs)

A register is kept from the start of the process of all registered I & APs. As the scoping phase progressed, I&APs were added to the list of registered I&APs as registration requests and comments were received. I&APs will continue to be added to the database throughout the project. All I&APs on the **registered list** will be kept informed of developments going forward into the EIA process, and project correspondence will continue to be forwarded to the registered I&APs.

8.2.1.4 Compilation and distribution of the Background Information Document

Notification of the availability of a Background Information Document (BID) was distributed to potential I&APs on 15 September 2009. Potential I&APs were invited to register in the process and provide the Environmental Consultants with their comments. The closing date for comment was the 30 October 2009 and was extended on request of an I&AP to 26 November 2009. The BID aimed to inform I&APs about the proposed development and to promote participation by stakeholders in the EIA process.

8.2.1.5 Advertising in newspapers

Notices regarding the proposed activity appeared in the following local and regional newspapers: Die Burger (18-9-2009), The Cape Times (18-9-2009), Knysna-Plett Herald (17-9-2009) and The Mossel Bay Advertiser (18-9-2009). The notices appeared in both Afrikaans and English in the Knysna-Plett Herald and the Mossel Bay Advertiser. The notice appeared in Afrikaans only in Die Burger and in English only in the Cape Times.

8.2.1.6 Public Notices

Notices were also placed at the following locations

- On the proposed sites and
- Albertinia and Gouritsmond Public Libraries.

8.2.2 Issues and response tables

A record of stakeholder comments, whether questions or concerns, has been compiled in issues and response tables, which record the comment, the name of the commentator and the response thereto. The Issues and response table as well as the individual comments were appended to the Draft Scoping Report.

The Issues and Response Report was distributed to the registered I&APs on 31 March 2010. A focus group meeting was held to address some of the concerns raised in addition to the Issues and Response Report. The meeting was held on 14 April 2010.

An Issues and Response Report was compiled from comments received on the Draft Scoping Report and Draft Plan of Study for Environmental Impact Assessment. The Issues and Response Report was included in the Final Scoping Report, which was made available to registered I&APs.

8.2.3 Comment on the Draft Scoping Report (DSR)

The following tasks were undertaken to allow for comment on the Scoping Report:

8.2.4 Lodging of Draft Scoping Report (DSR) for Comment

The DSR was lodged in the following public libraries for comment: George, Knysna, Mossel Bay, Plettenberg Bay and Albertinia. The DSR was also placed on the following website: www.pdna.co.za.

8.2.5 Notification of registered I&APs of the availability of the DSR

All registered I&APs were informed of the availability of the DSR. A copy of the Executive Summary was appended. Notices were also placed at the following libraries informing potential I&APs of the availability of the DSR: Albertinia, George, Gouritsmond, Knysna, Mossel Bay, and Plettenberg Bay.

The Final Scoping Report contained a copy of the letters that were sent out as well as proof of the Notices. I&APs were afforded a period of 50 days to submit their written comments on the DSR.

8.2.6 Notification of registered I&APs of the availability of the FSR

Cognizance has been taken of all comments received up to date when compiling the Final Scoping report, and comments, together with relevant responses, were appended to the report.

The concerns raised by registered I&APs were addressed in the Final Scoping Report. The Final Scoping Report was made available to registered I&APs for a minimum period of 21 days. All comments received on the Final Scoping Report were submitted to the DEA&DP.

8.3 Draft EIR Phase

Registered I&APs were informed of the progress with the EIA process on 21 January 2012. The letter and proof of notification is included under Appendix D. During the EIR phase additional I&APs were identified and notified of the proposed waste disposal facility and provided with an opportunity register and comment in the process. The tasks as detailed below were undertaken to allow comment on the Draft and Final EIR.

8.3.1 Lodging of draft EIR for Comment

The draft EIR was lodged in the following public libraries for comment: George, Knysna, Mossel Bay, Plettenberg Bay and Albertinia and also placed on the following websites: www.pdna.co.za and www.jpce.co.za. The draft EIR was also made available from the EAP on request in electronic form.

The following government departments and/or organs of state were provided with a copy of the Draft EIR and requested to comment:

- Department of Transport and Public Works: Road Network Management
- District Road Engineer
- SANRAL
- Department of Health
- CapeNature
- Heritage Western Cape
- Department of Agriculture, Forestry and Fisheries
- Department of Water Affairs Gouritz/Breede WMA
- Municipal Manager, Municipal Council of Mossel Bay
- Department of Environmental Affairs & Development Planning Deputy Director: Waste Management Governance
- Department of Environmental Affairs & Development Planning DEADP Directorate: Pollution Management & Air Quality
- Department of Agriculture: Land Use Management

8.3.2 Notification of I&APs of availability of the draft EIR, focus group meeting, Open House and public meeting

Registered I&AP's were informed of the 40 day commenting period available as well as the open house and public meeting 16-20 July 2012. The availability of the Draft EIR and associated comment period as well as the open house and public meeting was advertised in the Die Burger (12 July 2012), Mossel Bay advertiser (13 July 2012) and the Knysna-Plett Herald (12 July 2012).

The open house and public meeting was held on 31 July 2012 in the Dana Bay Community Hall. An open house was held from 3pm to allow for one-to-one engagement between I&APs and the EAP, project consultants and the applicant. A formal presentation was held at 6pm in which inter alia the EIA process, findings and recommendations of the Environmental Impact Report was summarized. Opportunity for questions from I&APs was provided. Certain I&APs were also invited to a focus group meeting that was also held on 31 July 2012. Notes of these meetings are included under Appendix D.

Although I&APs were requested to inform the EAP of changes to their contact details, many I&APs neglected to inform the EAP of changes. In cases where the EAP became aware of changes in contact details through undelivered electronic mail communication, I&APs were contacted through other means in order to confirm contact details. It is however the responsibility of registered I&APs to notify the EAP of changes in their contact details if the wish to be updated and provided with comment opportunities throughout the EIA process.

Comments received on the Draft EIR were addressed and summarized in an Issues and Response Report that is included in the Final Environmental Impact Report under Appendix D.

8.3.3 Lodging of final EIR

The Final EIR was placed in the following public libraries for comment: George, Knysna, Mossel Bay, Plettenberg Bay and Albertinia and also be placed on the following websites: www.pdna.co.za and www.jpce.co.za. The final EIR is also available from the EAP on request in electronic format.

8.3.4 Notification of I&APs of availability of the final EIR

Registered I&AP's were informed of the minimum of 21 day commenting period available on the Final EIR which will include the response to the comments received during the draft EIR phase of the process in the form of an Issues and Response report.

8.4 The Way Forward

The concerns raised by registered I&APs up to date are addressed in this Final Environmental Impact Report. The Final EIR has been compiled and is now available for comment to registered I&APs for a period of at least 21 days. All comments received on the Final EIR will not be addressed but submitted to the Department of Environmental Affairs and Development Planning for their consideration.

8.5 Summary of Key Issues identified in the Public Participation Process

The Final Scoping Report included the issues and response tables compiled from the comments received on the Background Information Document as well as the Draft Scoping Report and is therefore not included again in the Environmental Impact Assessment Report. The key project related issues identified in the public participation process <u>during the EIR phase</u> of the process are broadly summarized below. The specific comments and also an Issues and Response report is included in Appendix D. Much of the information presented in this report is of a fairly technical nature. An attempt has been made to present the information in an easily understandable format without losing the technical and scientific rigour of the information. Some aspects may still be challenging to understand

and the I&APs are encouraged to inform the Environmental Consultants if they require assistance with the interpretation of the information.

8.5.1 Agricultural potential

- The owner of a portion of Site 3 indicated that the use of Site 3 for a waste disposal facility will have a very negative impact on his farming operations as high potential agricultural land is irreplaceable.
- One of landowners of Site 3 indicated that they are against the proposed development on their property.
- The Department of Agriculture indicated that they have no objection against the use of Site 1 as a waste disposal facility.

8.5.2 Importance of the project

- Mossel Bay Municipality indicated that they feel that this is a high priority project interms of service delivery and commitment to the community of Mossel Bay and supported the project.

8.5.3 Proposed site options

- Concerns regarding potential pollution risks.
- Loss of high potential agricultural soil.
- Impacts on indigenous vegetation
- Visual impacts
- One of the landowners of Site 3 indicated that they are against the development on their property.
- Objections to the suitability of site 1 in relation to residential areas.

8.5.4 Services infrastructure, roads and transport

- Impact on the roads
- It was stated that the route on unpaved roads to the sites are too long and inadequate.
- SANRAL indicated that they have no objection to the inclusion of the N2/MR341 intersection upgrade in the EIA process. They however supported the use of Site 1 as the preferred site option. If Sites 2 or 3 is selected the respective intersections with the N2 will require an upgrade and the costs will be for the applicant's account.
- The Department of Transport and Public Works supported Site 1 as the preferred site option and objected to the use of Sites 2 and 3 in the light of the traffic impact on the existing proclaimed roads.

- The Mossel Bay Municipality confirmed that the required capacity exists at their wastewater treatment works to accept and treat sewage from the waste disposal facility. In the unlikely scenario that the treatment of leachate from the site may be required, the Mossel Bay Municipality also confirm that the waste water treatment works will be able to accept and treat the leachate if the required toxicity tests have been performed.
- Transnet has indicated that they have no objection to any of the proposed sites.
- Comments were made during the focus group meeting regarding the consideration of rail transportation of the waste versus road transport of the waste. Concerns were raised in this regard pertaining to the deterioration of the N2, additional noise caused by traffic and the overall negative impact on tourism. Questions pertaining the potential cost if the N2 becomes a toll road were also raised. The viability or otherwise of rail is however beyond the scope of the current EIA. Please refer to the notes of the focus group meeting under Appendix D for the discussion in this regard.

8.5.5 Economic and cost impacts

- Impacts on tourism and real estate on Gondwana Game Reserve. It was argued that the reserve is one of the largest employers within the Mossel Bay district and that the presence of a waste disposal facility on Site 2 will have a significant impact on the economic viability of the reserve. It will result in the introduction of an industrial impact to the region. It was stated that should Site 2 be selected it will also impact on the residential estate which will affect the economic contribution that they make to the reserve and its staff and that the current staff compliment may not be sustained. Impacts that may lead to tourism and residential complaints were listed as the following: Visual, traffic, impact on the road through large tyrucks, sound industrial feel and ecological.
- A comment was made on the public meeting with regards to the inclusion of the price of land in the cost calculations. It was also requested that the increase in municipal budgets be checked as it may be lower than indicated.

8.5.6 Ecological impacts

- Pollution risks
- The negative effect on avi-fauna and specific slope soaring species at Site 2.
- The potential negative effects on seagulls.
- The effect on the indigenous vegetation present on Site 2 and the Sellendam Silcrete Fynbos which has been listed as vulnerable, and the Mossel Bay Shale Renosterveld which has been listed as endangered in the national list of Threatened Ecosystems.
- Objections against the use of Sites 2 and 3 out of an ecological perspective and preference in this regard for Site 1.

- Concerns regarding the critical biodiversity areas on Site 2 and the importance of the ecological corridor on Site 2 and the considerable extent of the indigenous vegetation on this site.
- The endangered status of the indigenous vegetation that exists on Site 2.
- The attraction of feral animals to the waste disposal facility and in the case of Site 2 the attraction of domestic feral cats that may negatively impact on the African wildcat population in the vicinity of Site 2 that are threatened near to extinction due to interbreeding with domestic cats.
- Off-site ecological impacts
- Freshwater ecological impacts on Site 1 and the requirement for buffer zones around the wetland on the western boundary and the stream on the eastern boundary.
- Cape Nature indicated that they are satisfied with the layout of Site 1 and do not object to the use of Site 1 as a waste disposal facility. They however objected to the use of sites 2 and 3.

8.5.7 Visual impacts

- Concerns raised with regards to the visual impact relates to the impact that it may have on tourism.
- It was stated by an I&AP that Site 2 will be significantly harder to conceal due to the R327 that is elevated above the site.

8.5.8 Water Quality

- The waste disposal site should be located outside the 1:100 year floodline.
- Contaminated stormwater used for dust suppression may only be used directly on the landfill.
- High quality potable municipal water may not be used for dust suppression.
- Leachate must be contained on site. The treatment of leachate must be transported to a facility accredited to conduct this level of treatment.
- The Department of Water Affairs (DWA) indicated that a water use licence will be required.
- The DWA indicated that they are in favour of sites 1 and 3 from a groundwater perspective and that the designs for the proposed waste disposal facility are acceptable.
- One of the landowners of Site 3 indicated that there is a lot of runoff during high rainfall years which could potentially be polluted by the waste disposal facility.

8.5.9 Waste types, classification and site management

- Comments were made regarding the potential temporary storage of mercury containing waste such as fluorescent tubes and batteries.

- Concerns were raised on the focus group meeting with regards to access control and unauthorized persons entering the site.
- Questions on how the MRF will influence the amount of waste to be disposed were raised at the public meeting. It was explained that separation-at-source or through a MRF would reduce the amount of waste going to landfill and would hence effectively increase the life of the site.
- The frequency of audits that will take place on the site and how it will be ensured the waste will be covered on a daily basis.

8.5.10 Air quality and dust impacts

- Concerns were raised regarding the origin of the water that will be used for dust suppression. It was stated that high quality potable municipal waste may not be used for the purpose of dust suppression.

8.5.11 Health, Safety and Environmental Risk Management and Environmental Management Programme

- It was recommended that the Eden District Municipality takes note of the National Veld and Forest Fire Act and requirement to be a member of the Southern Cape Fire Protection Association. A fire management plan must be drafted for the property.
- Speed limits must be indicated in the EMP and displayed at the weighbridge.
- It was indicated that the EMP must address the following aspects:
  1. The management of leaks from the main waste body that are not captured by the drainage system.
  2. Nuisance management (vectors, odours and noise) must be detailed.
  3. Operating hours and site access must be detailed especially with regard to waste dumping around the facility that takes place after normal operating hours.
  4. The management of abattoir and other “hazardous” wastes arriving at the facility.
  5. The inclusion of a waste manifest system supported by a weighbridge to quantify the waste volumes received.
  6. The control of emergency incidents such as explosions, fires and flooding etc.
  7. The operational plan must avoid activities that would compromise the use of the site upon closure.
  8. It must be ensured that hazardous waste must not be temporarily stored on unlined areas that would compromise the future rehabilitation of the site.
  9. The recording and management of complaints.

8.5.12 Heritage Impacts

- Heritage Western Cape indicated in their decision that Site 1 is the preferred site for the waste disposal facility. The following decisions were made: 1.) The Palaeontological Study indicated that it is unlikely that palaeontology would be impacted. However, should any fossil remains be found the ECO should safeguard these and inform HWC and a palaeolontologist. 2.) Survey, mapping and collection of the Earlier Stone Age artefact being affected is required by an Earlier Stone Age specialist and bulk earthworks must be monitored by a professional archaeologist. A report must be submitted to HWC. 3.) The visual mitigation measures proposed for screening, lightning, integration into the landscape, dust, litter and rehabilitation are endorsed.

8.5.13 Design aspects

- Cover material must be readily available.

8.5.14 General

- Certain I&APs indicated their support for the project specifically on Site 1.
- It was indicated by certain I&APs that it is important that the Eden District Municipality commits themselves to the effective management of the site and the strict monitoring of the site.
- An I&AP that attended the focus group meeting asked whether the production of energy has been considered, for instance through incineration or through methane from gas extraction at a later stage. It was explained that Eden District is investigating waste-to-energy options but it is unlikely that all waste can be incinerated, and hence even if such a project does come off there will still be a need for a landfill site. It may then mean that the landfill site will have a longer life. With regard to gas extraction it was explained that due to the relatively dry climate it is unlikely that much methane will be generated. If it proves that gas is generated in enough quantities, a separate application for environmental authorisation for such a project would then be made.
- The importance of recycling at the local Municipalities was highlighted at the focus group meeting.

CHAPTER 9: FINDINGS OF SPECIALIST STUDIES AND IMPACT ASSESSMENT

9.1 Introduction

The expected environmental impacts and issues that could arise from the proposed development were identified during the Scoping study through:

- Review of the some of the previous studies conducted in the region
- Issues identified by I&APs and the project team through their knowledge of the area
- From background studies performed to determine the feasibility of the proposed development.

This section describes the potential impacts of the proposed waste disposal facility on the biophysical, social and economic environment during construction and operation. Suggestions will be made on potential mitigation measures that would ameliorate any potential negative impacts or enhance any potential benefits.

A summary of the findings of the specialist studies, conducted as a result of areas of potential significant impacts identified during the Scoping Phase, are presented below. The detailed reports are included as Appendix G to this EIA Report. The information contained in this chapter has been obtained from the relevant specialist studies and the specialists will also be notified of the availability of the EIR for comment. In certain instances the text were used directly from the specialist reports in order to avoid any interpretation errors or an under or overstatement of the information contained in the respective reports. Acknowledgement is therefore given to the authors at the start of each section.

9.2 Botanical Impact Assessment

9.2.1 Introduction

The Botanical Impact Assessment was undertaken by Nick Helme of the Nick Helme Botanical Surveys and has been attached as Appendix G. The Botanical Impact Assessment addresses potential impacts on the vegetation occurring on the alternative sites.

9.2.2 Botanical Impact Assessment Results

Direct impacts

The development of the proposed infrastructure would result in loss of intact natural vegetation in all areas except where the development takes place in areas of low or very low botanical sensitivity. In the case of the proposed development the operational and construction phases can be viewed as one and the same, as the phased approach that is likely to be followed during development of the facility will result in ongoing impacts throughout the life of the project (up to 50 years).

Direct impacts would include loss of natural vegetation and loss of parts of local subpopulations of various plant species of conservation concern.

Indirect impacts may include habitat fragmentation and associated ecological impacts, introduction of invasive alien vegetation (via the disturbance caused, and via the organic refuse), and impacts on identified critical biodiversity areas (mainly in parts of Site 2). All identified impacts related to the development of the facility will be negative in terms of their impacts on the vegetation.

Source of Impact: Clearance of land for construction of facilities and dumping areas				
	Site 1	**Site 2**	**Site 3**	**No-go option**
Nature of impact	Permanent loss of a large patch of Aloe arborescens; loss of 2 small patches of Critical Biodiversity Area	Permanent loss of at least 120ha of Swellendam Silcrete Fynbos and Mossel Bay Shale Renosterveld (both threatened vegetation types); loss of local populations of at least one plant Species of Conservation Concern; loss of significant portions of terrestrial and aquatic Critical Biodiversity Areas	Permanent loss of part of a disturbed drainage line	Ongoing dumping on another site (but PetroSA not feasible); grazing
Scale	Local	Local and Regional	Local	Local
Duration	Permanent	Permanent	Permanent	Possibly Long-term
Intensity	Medium	High	Low-medium	Depends on the site; Low at PetroSA
Probability	Definite	Definite	Definite	Unknown
Status	Negative	Negative	Negative	Neutral
Confidence	High	High	High	Low
Significance without mitigation	Medium	High	Low-Medium	Low
Significance with mitigation	Low	High	Low	Not applicable

Table 9.1: Direct Botanical impacts.

Table 9.1 summarises the direct botanical impacts of the proposed development in the three alternative sites.

The source of the impact is the primary construction, plus ongoing construction that may be related to phasing of the project (hence conflation of the construction and operational phases).

The nature of the impact is permanent loss of natural vegetation in good condition (mainly in Site 2), loss of the local subpopulation of at least 1 plant Species of Conservation Concern (Site 2 only), and in

the case of Site 2 the loss of areas that are designated terrestrial and aquatic Critical Biodiversity Areas. In Site 2 the vegetation lost would be Swellendam Silcrete Fynbos and Mossel Bay Shale Renosterveld, which are both listed as threatened vegetation types (Rouget et al. 2004 cited in Helme, 2012). At least one plant species of conservation concern (SCC) is likely to be present on Site 2, and the proposed development would thus result in the loss of the entire local (site) subpopulation of this species, although the species is probably also well represented in the region.
Rehabilitation of the affected areas once the landfill site is closed is not likely to adequately mitigate the impact of the original loss of the areas of pristine vegetation, as post-disturbance areas support less than 10% of the original species diversity, and are dominated by invasive alien vegetation that is better adapted to disturbed environments.

The significance of the impacts is derived from a combination (cumulative impact) of the negative effects of loss of natural habitat, loss of portions of local populations of SCC, and loss of designated CBAs.

Indirect impacts
The nature of the impact is fragmentation of existing natural habitat, plus possible introduction of invasive alien plants, and in the case of Site 2 potentially the loss or reduction of designated areas of critical biodiversity and associated ecological corridors (Pence 2008 cited in Helme 2012). Fragmentation of habitat means loss of existing ecological connectivity, and loss of the components of biodiversity that are currently resident in the area, and essentially it may result in a weakening of the ecological linkages in the area, which are all part of a viable, functioning ecosystem. The soil disturbance associated with the proposed development will create ideal conditions for the invasion of alien plants. These species are often better adapted to the disturbed soils than most of the indigenous species, and will dominate disturbed areas to the virtual exclusion of other species, leading to a loss of biodiversity. Reduction of designated CBAs and ecological corridors will occur as a result of the disturbance to the natural vegetation, and will mean a narrowing of ecological corridors, which is undesirable. CBAs are specifically designed to be the minimum required areas in order to achieve conservation targets for species and habitat types, and to provide ecological connectivity, and any reduction thus has ramifications elsewhere in the region (Maree & Vromans 2010 cited in Helme 2012).

Source of Impact: Clearance of land for construction of facilities and dumping areas				
	Site 1	**Site 2**	**Site 3**	**No-go option**
Nature of impact	Fragmentation of small areas of existing natural habitat; introduction of invasive alien vegetation; loss of 2 small Critical Biodiversity Area and the regional impact	Fragmentation of existing natural habitat; introduction of invasive alien vegetation; reduction of designated Critical Biodiversity Areas and associated	Minor fragmentation of existing natural habitat; introduction of invasive alien vegetation	Ongoing dumping on another site (but PetroSA not feasible); grazing

	thereof	ecological corridor		
Scale	Local and Regional	Local and Regional	Local and Regional	Local and possibly regional
Duration	Permanent	Permanent	Permanent	Possibly Long-term
Intensity	Low-Medium	High	Low	Depends on the site; Low at PetroSA
Probability	Highly probable	Highly probable	Highly probable	Unknown
Status	Negative	Negative	Negative	Neutral
Confidence	High	High	High	Low
Significance without mitigation	Low-Medium	High	Low	Low
Significance with mitigation	Low	High	Very Low	Not applicable

Table 9.2: Indirect Botanical impacts.

9.2.3 Cumulative Impacts

Cumulative impacts are usually deemed to be impacts associated with other, similar projects in the region. As there are no other known similar projects in the region it could be argued that there are no cumulative impacts. However, a more logical interpretation of cumulative impacts suggests that one should simply assess the likely loss of each vegetation type (whatever the source of loss) as the key cumulative impact, assessed at the regional scale. In this case Sites 1 and 3 would both have Very Low to Low negative botanical impacts, and Site 2 would have a High negative cumulative botanical impact.

9.2.4 Comparison of Alternatives

SITE 1

This site supports very little natural vegetation, and thus over 90% of the site is of Very Low botanical sensitivity and presents no constraints to the proposed development. A seasonal pan, a large milkwood tree, and a patch of Aloe arborescens are the only areas of botanical sensitivity on this site, and all should ideally be conserved. The latter could be successfully trans located. A single plant Species of Conservation Concern (SCC) is present on site, within the seasonal pan. The pan and the aloes are designated Critical Biodiversity Areas (CBAs), as determined by the Fine Scale Conservation plan for the Riversdale Plain (Pence 2008 cited in Helme 2012), as is a small, partly disturbed wetland in the southeast (of minor conservation value).

This site is suitable for the proposed development, provided that at least the pan can be avoided (with an adequate 75m buffer; both these requirements are met in the February 2012 layout), and the aloes translocated.

SITE 2

At least 80% of this site supports natural Swellendam Silcrete Fynbos and Mossel Bay Shale Renosterveld in very good condition, and both these vegetation types are regarded as Endangered vegetation types at a national level. At least 80% of the site is consequently of High botanical sensitivity, and the same area is a designated Critical Biodiversity Area (Pence 2008 cited in Helme 2012). At least one plant Species of Conservation Concern (SCC) was found in the high sensitivity area, and others are likely to occur on site. This site is consequently not suitable for the proposed development.

SITE 3

This site supports almost no natural vegetation, and thus over 90% of the site is of Very Low botanical sensitivity and presents no constraints to the proposed development. Two seasonal drainage lines are present on site, one of Low to Medium sensitivity and the other of Medium sensitivity. No plant Species of Conservation Concern (SCC) were recorded on site, and none are likely to occur in this disturbed area. There are no important Critical Biodiversity Areas (CBAs) on site, although adjacent to the site on Farm 232 a Critical Biodiversity area exists. The proposed access route to Site 3 that links with the MR 341 passes through this area. It is an existing road, but it will have to be widened, thereby potentially impacting on this highly sensitive area, although described by the Botanist as heavily trampled and grazed.

The addition of turning lanes within the road reserve at the N2/MR341 intersection on route to Site 3 may impact on the existing natural vegetation in the road reserve which has bee listed as an Endangered vegetation type. However the Botanist has indicated in his letter dated 29 June 2012 that the vegetation that will be lost is likely to be less than 0.2ha and that the specific section of the road reserve is not likely to support significant populations of any plant Species of Conservation Concern. The significance of the loss of this vegetation is thus deemed to be Low negative at a regional scale, and thus does not alter the overall assessment of botanical impacts of the Site 3 alternative (which was Low negative, with basic mitigation). No special mitigation is suggested.

This site is suitable for the proposed development, provided that the eastern drainage line can be avoided (with an adequate buffer; this requirement has been met in the Feb 2012 layout).

NO GO ALTERNATIVE

The specialist indicated that it is technically not possible to fully and adequately assess the No Go alternative and its likely impacts. It is however, assumed that the disposal takes place within a currently disturbed area within the PetroSA grounds, and that the botanical impacts are at present fairly low. Presumably in all three alternative sites ongoing agricultural activities (primarily livestock grazing) would potentially take place, the impacts of which would usually be Neutral.

9.2.5 Recommended Mitigation Measures

As a general rule all developments should attempt to avoid or minimize impacts before any consideration is given to specific mitigation. This implies that development should ideally be placed into areas of low or medium sensitivity, and that high sensitivity areas should be avoided, where possible. The only sites investigated with sufficient areas of low sensitivity for the proposed development are Sites 1 and 3, which suggests that either of these two should be the preferred alternative.

- The most suitable site for the proposed development from a botanical perspective is Site 3, although Site 1 is also suitable with the currently proposed (Feb 2012) layout, which takes into account the presence of a seasonal pan and its required buffer. Overall botanical impacts of development on either Site 1 or Site 3 could be reduced to Low negative with mitigation.
- Site 2 should not be authorised as the botanical impacts of development on this site would be High negative, and cannot be mitigated to any significant extent.
- If Site 1 is authorised then the following mitigation should be required: the seasonal pan must have a buffer of at least 75m wide, as measured from its outer edge (this is already reflected in the Feb 2012 layout); the pan and its buffer must be fenced off with permanent fencing prior to any construction; the large patch of Aloe arborescens should be trans located to a suitable area nearby or even on site; it should be noted that milkwoods (Sideroxylon inerme) are a protected species and may only be pruned or removed with the relevant permit (which should be obtained subsequent to authorisation and prior to construction); any available intact topsoil should be stockpiled on site for eventual use when capping the landfill; invasive alien vegetation should be removed from the authorised site on an annual basis; landscaping and screening of the site should be with suitable locally indigenous vegetation; ongoing botanical monitoring of the site should not be necessary.
- If Site 3 is authorised then the following mitigation should be required: the easternmost seasonal drainage line must have a buffer of at least 32m wide, as measured from its outer edge (this is already reflected in the Feb 2012 layout); the drainage line and its buffer must be fenced off with permanent fencing prior to any construction; any available intact topsoil should be stockpiled on site for eventual use when capping the landfill; invasive alien vegetation should be removed from the authorised site on an annual basis; landscaping and screening of the site should be with suitable locally indigenous vegetation; ongoing botanical monitoring of the site should not be necessary.

9.2.6 Conclusions

Site 2 supports significant areas (which are also designated Critical Biodiversity Areas) of two threatened vegetation types, mostly in good condition, and should thus not be considered for development. Site 1 could accommodate the proposed development with an acceptable level of impact (Low negative) if some basic mitigation is undertaken to reduce the possible impact from Medium negative (this has been done in the Feb 2012 layout). Site 3 is marginally preferable to Site 1, and is thus the overall preferred alternative from a botanical point of view. Site 3 could accommodate the proposed development with an acceptable level of impact (Low negative) if some basic mitigation is undertaken to reduce the possible impact from Low - Medium negative (this has been done in the Feb 2012 layout).

The No Go alternative is technically not feasible and hence cannot be adequately assessed from a botanical perspective. If it is assumed that ongoing agricultural use will be made of all sites then the significance of the potential and likely impacts for the No Go is likely to be Neutral.

9.3 Freshwater ecologist inputs

During the specialist botanical investigation undertaken by Mr Nick Helme mention was made of wetland/pan areas that would require mitigation. CapeNature and DEA&DP supported this recommendation. The DEA&DP requested that inputs from a freshwater ecologist be obtained regarding the buffer zones around the water features that have been recognized as Critical Biodiversity Areas (CBAs). Sites 1 and 2 contains water features that is included in Critical Biodiversity Areas. A large percentage of Site 2 falls within Critical Biodiversity Areas which includes a drainage channel. These features on Site 2 could not be avoided and the design Engineers proposed the channeling of the drainage line under the site with pipes. As a result inputs on the buffer zones of the Critical Biodiversity Areas from a freshwater ecologist were only required on Site 1. The freshwater ecological report was compiled by Toni Belcher and full acknowledgement is given to her for the information contained in this section. This section also describes the water features present on Sites 2 and 3 as obtained from the information contained in the Botanical Impact Assessment compiled by Helme (2012).

9.3.1 Conservation Importance

A freshwater biodiversity assessment was conducted in the Riversdale Coastal Plain planning domain as part of the C.A.P.E Fine-Scale Planning project to identify spatial priorities for aquatic ecosystems (rivers, inland wetlands and estuaries). Critical Biodiversity Areas (Terrestrial and Aquatic), Ecological Support Areas (Critical and Other), Other Natural Remaining Areas and No Natural Remaining Areas were identified. The first two mentioned categories represent the biodiversity priority areas which should be maintained in a natural to near natural state. The last two mentioned categories are not considered as priority areas and a loss of biodiversity within these areas may be acceptable.

Figure 9.1 shows the results from that mapping exercise, where the wetland areas and the unnamed stream were identified as Critical Biodiversity Areas and/or Ecological Support Areas. The recommendations for the critical biodiversity areas is to maintain the natural areas, rehabilitate degraded areas to a natural or near natural condition and manage these areas to allow for no further degradation.

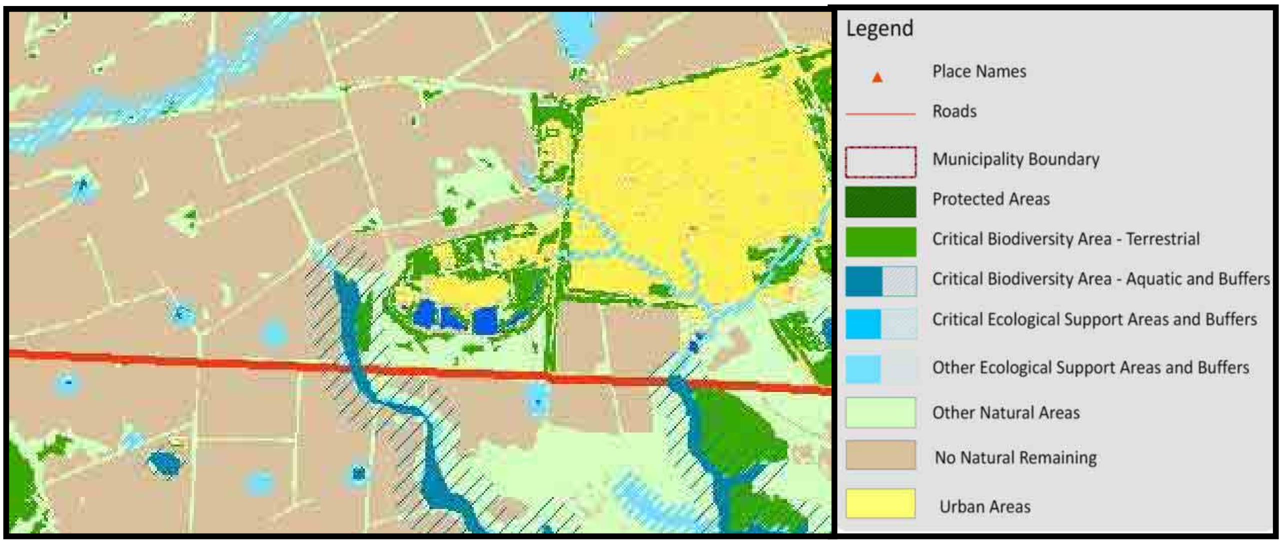

Figure 9.1. Critical Biodiversity Areas map for the area (SANBI Biodiversity database).

Similarly, the recently compiled Freshwater Ecosystem Priority Areas maps indicate the natural features (seasonal pan and Blinderivier system) as a FEPA wetland and river. FEPAs are strategic spatial priorities for conserving freshwater ecosystems and associated biodiversity. The areas were determined through a process of systematic biodiversity planning and were identified using a range of criteria for serving ecosystems and associated biodiversity of rivers, wetlands and estuaries.

9.3.2 Assessment of Ecological Condition of Seasonal Stream

From the Site Characterisation assessment, the geomorphological and physical characteristics of the stream can be classified as a typical non-confined valley bottom wetland system or a simple lower foothill tributary, of the Blinderivier in this instance.

Ecological Classification of the stream

In order to assess the condition and ecological importance and sensitivity of the river segment under study, it is necessary to understand how the river habitat characteristics and stream flow were under natural conditions (prior to direct and induced human modifications). This is achieved through classifying rivers according to what their ecological characteristics are in situ and extrapolating these characteristics in comparison with data derived reference conditions, or via professional judgment using catchments of similar physical and biological characteristics. Thus, by deducing ecological reference conditions, impacts on the site can be measured and classed to channel condition, riparian zone integrity, stream quality, as well as factors impacting with reference to the catchment as a whole.

River typing or classification involves the hierarchical grouping of rivers into ecologically similar units so that inter- and intra-river variation in factors that influence water chemistry, channel type, substratum composition and hydrology are best accounted for. This tool provides a framework for reference conditions of streams under study by comparing these conditions to streams that are similar. Thus, the classification of rivers provides the basis for assessing river condition to allow comparison between similar rivers (as a reference) and the river under study. The primary classification of rivers is a division into Eco regions. Rivers within an eco-region are further divided into sub-regions.

River	Ecoregion	Subregion
Unnamed tributary of the Blinderivier	Southern Coastal Belt	Lower foothill/Lowland river

Table 9.4. Classification of the stream assessed

Habitat Integrity

The evaluation of Habitat Integrity (HI) provides a measure of the degree to which a river has been modified from its natural state. The specialist found that the habitat integrity of the stream is considered to be moderately modified. The major impacts to the stream's habitat integrity are the small instream dam, the levees and the storm water discharge into the upper reach of the stream.

Ecological Importance and Sensitivity (EIS)

EIS considers a number of biotic and habitat determinants surmised to indicate either importance or sensitivity.

Biotic determinants	Unnamed stream
Rare and endangered biota	2
Unique biota	2
Intolerant biota	2
Species/taxon richness	2
Aquatic Habitat determinants	
Diversity of aqautic habitat types or features	2
Refuge value of habitat type	3
Sensitivity of habitat to flow changes	3
Sensitivity of flow related water quality changes	3
Migration route/corridor for instream & riparian biota	2
National parks, wilderness areas, Nature Reserves, Natural Heritages sites, Natural areas, PNEs	1
Ratings	**2.2**
EIS Category	**Moderate to High**

Table 9.5. Results of the EIS assessment

Overall Ecostatus and Recommended Ecological Management Category

The stream assessed lies within the quaternary K10A. According to the categories established for the Desktop Reserve determination for DWA quaternary catchment K10A, the ecological importance and sensitivity category is very high and the present ecological status category is C (Moderately modified). The Desired ecological status for K10A quaternary catchment is C (moderately modified). The overall ecostatus of the rivers in this assessment varies slightly from the Desktop Categories due to the fact that the Desktop Categories are for the entire quaternary catchment, while the assessment is for smaller streams.

9.3.3 Ecological Assessment of Wetland Areas

Only the seasonal wetland area is assessed in this section as the other features are highly artificial and retain little wetland functionality. The seasonal wetland/pan can be classified as an isolated depression (thicket renosterveld depression), which is likely to be linked to groundwater flow contribution as well as storm water drainage/surface water runoff from the surrounding catchment. A WET-Health assessment was undertaken to determine the integrity of the ecological processes for the wetland and a WET-EcoServices assessment was utilised to determine the benefits and services supplied by the wetland on-site.

a. Wetland Habitat Integrity

The Present Ecological Status (PES) Method (DWAF 2005) was used to establish the integrity of the seasonal wetland and was based on the modified Habitat Integrity approach developed by Kleynhans (DWAF, 1999; Dickens et al, 2003). Table 9.6 displays the criteria and results from the assessment of the habitat integrity of the wetlands. These criteria were selected based on the assumption that anthropogenic modification of the criteria and attributes listed under each selected criterion can generally be regarded as the primary causes of the ecological integrity of a wetland.

Criteria & Attributes	Relevance	Score
Hydrologic		
Flow modification	Consequence of abstraction, regulation by impoundments or increased runoff from human settlements or agricultural land. Changes in flow regime (timing, duration, frequency), volumes, velocity which affect inundation of wetland habitats resulting in floralistic changes or incorrect cues to biota. Abstraction of groundwater flows to the wetland	3.5
Permanent Inundation	Consequence of impoundment resulting in destruction of natural wetland habitat and cues for wetland biota.	3
Water Quality		
Water Quality Modification	From point or diffuse sources. Measure directly by laboratory analysis or assessed indirectly from upstream agricultural activities, human settlements and industrial	4

	activities. Aggravated by volumetric decrease in flow delivered to the wetland.	
Sediment Load Modification .	Consequence of reduction due to entrapment by impoundments or increase due to land use practices such as overgrazing. Cause of unnatural rates of erosion, accretion or infilling of wetlands and change in habitats	3
Hydraulic/Geomorphic		
Canalisation	Results in desiccation or changes to inundation patterns of wetland and thus changes in habitats. River diversions or drainage.	4
Topographic Alteration	Consequence of infilling, ploughing, dykes, trampling, bridges, roads, railway lines and other substrate disruptive activities that reduce or change wetland habitat directly in inundation patterns.	3
Biota		
Terrestrial Encroachment	Consequence of desiccation of wetland and encroachment of terrestrial plant species due to changes in hydrology or geomorphology. Change from wetland to terrestrial habitat and loss of wetland functions.	3.5
Indigenous Vegetation Removal	Direct destruction of habitat through farming activities, grazing or firewood collection affecting wildlife habitat and flow attenuation functions, organic matter inputs and increases potential for erosion.	2.5
Invasive Plant Encroachment	Affects habitat characteristics through changes in community structure and water quality changes (oxygen reduction and shading).	4
Alien Fauna	Presence of alien fauna affecting faunal community structure.	4.5
Over utilisation of Biota	Overgrazing, over fishing, etc.	3.5
Overall Score		3.5
Ecological Category		C (Moderately modified)

Table 9.6. Habitat integrity assessment criteria for palustrine wetlands (Dickens et al, 2003). A score of 0=critically modified and 5=unmodified

b. Ecosystem Services Supplied

The assessment of the ecosystem services supplied by the identified wetlands was conducted according to the guidelines as described by Kotze et al (2005 cited in Belcher 2011). An assessment was undertaken that examines and rates the ecosystem services. The characteristics were scored according to the general levels of services provided. It is important to manage the wetlands to ensure that they can continue to provide the valued goods and services if considered sufficiently important.

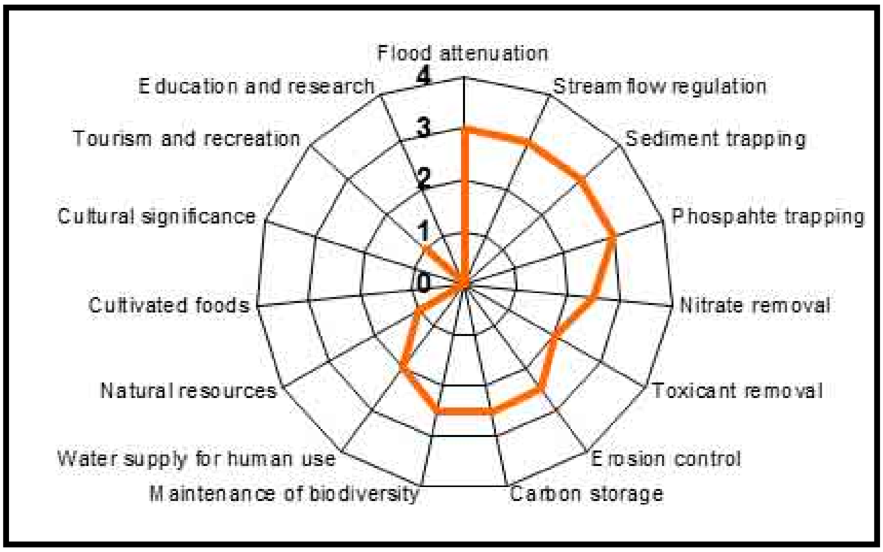

Figure 9.2. Ecosystem services provided by the pan/wetland area (where high =4 and low=0).

The key services provided by the wetland area that should be maintained relate to storm water management (water quality amelioration and flow regulation/flood attenuation and providing habitat for biota (primarily birds and amphibians).

9.3.4 Conclusions and recommendations

The findings of this freshwater assessment of the proposed site no. 1, for the Eden Municipality Landfill site indicate the following:

- That while there are a number of fresh water features on the proposed site that only two of significance is the seasonal stream that forms part of the Blinderivier system and the seasonal pan/wetland area.
- This assessment confirms the need to protect these freshwater ecosystems from a biodiversity point of view.
- The other water features are artificially created freshwater bodies that have little ecological importance.

The critical aspect in the consideration of the proposed activity is the level of protection, that would be the mitigation measures required, to ensure that the seasonal stream and wetland area retain their existing character and functionality while being sited adjacent to a landfill site otherwise there would be no point in trying to retain these ecosystems at all.

- As both systems are seasonal, it would be important to ensure that the hydrology (both surface and groundwater) feeding these systems does not change significantly in terms of its flow patterns and volumes. The ‘clean’ runoff water and sub-surface flows entering the landfill site from the upper catchment area should be diverted around the site and discharged to the freshwater systems on either side of the site.

- In addition, from a water quality point of view, the leachate and contaminated runoff from the landfill site should be managed on site to reduce the risk of contamination of the freshwater ecosystems. Contaminated storm water emanating from the site should as far as possible be collected and discharged into a storm water attenuation dam at the lowest point on the site. Any overflow from the attenuation dam should be discharged into the Blinderivier below the site.
- The intensity of any storm water discharge into the freshwater systems should be dissipated as far as possible to prevent any erosion from taking place.
- One would also need to make sure that no litter, rubble or sand is deposited within the freshwater systems and that there is no trampling of the riparian and wetland vegetation. Fencing around the recommended buffer areas is thus recommended.
- The buffer area recommended to mitigate the impacts of the surrounding activities on both the seasonal wetland as well as the stream would need to be at approximately 50m wide for the stream and 75m wide for the seasonal wetland as indicated by the yellow polygon in Figure 15. The sizes of the wetland and river buffer zones recommended are based on the natural topography and drainage on the site, where drainage occurring outside of the recommended buffer is likely to flow away from the water features.
- Drainage across the site appears to be from the north western portion of the site towards the south eastern corner. Drainage to the wetland area is thus from the adjacent farmland on the western border, while drainage to the seasonal stream has been historically diverted away from the stream by the existing constructed levee. The seasonal stream receives flow from the PetroSA storm water discharge.

Figure 9.3. Recommended buffer areas adjacent to the seasonal stream and wetland area (yellow polygons indicate buffer zones)

9.4 Specialist avifaunal inputs

Inputs from an avifaunal specialist were required due to potential impacts that were identified during the public participation process of the Scoping Phase of this EIA process. The specialist report addresses the potential impacts of the proposed waste disposal site on birds as welll the potential impacts that the birds using the waste disposal facility may have on humans and other fauna. Full acknowledgment is given to the specialist, Dr. A.J. Williams for the information contained in this section. A complete copy of the specialist report is attached under Appendix G.

9.4.1 General overview and impact identification

Landfill usage by birds:

From a bird perspective landfill sites can be divided into three zones: 1) the active dumping area – with the easiest access to the freshest food; 2) immediately adjacent areas where refuse of the previous few days is thinly covered by earth and food items are often exposed; and 3) the greater part of the site which is inactive and offers little or no food for birds. Zones 1 and 2 offer feeding opportunities and zones 2 and 3 offer areas where birds can loaf undisturbed between meals. Food availability for birds at landfills varies by day and season. The scavenging birds are day-light foragers, as food items are mostly small and need to be visually located. Towards dusk most birds fly from the landfill to safe roosts or breeding localities elsewhere. Refuse is dumped at landfills mostly during working hours and on a five-day week basis. In the summer the scavenger birds have several hours of daylight in which they can forage for natural food before refuse trucks begin to deposit their loads at the landfill. In the winter there may be little daylight before refuse is delivered at the landfill. It is in the winter, when natural foods are less readily available, that refuse is of greatest importance to scavengers, especially for young birds raised during the previous summer and which are less experienced feeders than adults, to which they are subordinate. The birds learn the rhythm of refuse deposition and time their use of the landfill accordingly being fewer in number on weekends and in the morning before refuse is delivered (Coulson *et al*. 1987). They readily habituate to human activities on site and may be quite brazen in seeking food close to active bulldozers.

Scavenging birds:

Human refuse at landfills is an important food for only a small number of species in any region. Globally, gulls, of various species, are the most numerous users of refuse at landfill sites within 100 km of the coast. Other important scavengers are vultures and kites, a variety of water-related birds – Marabous Storks, ibises, some egrets and pelicans – and corvids. Where they occur gulls are usually the most numerous birds at landfills. In natural conditions they dip down to snatch items off the water surface between waves. This ability to snatch and fly up enables them to feed close to the bulldozers. If two different sized gulls occur the lighter smaller, but more agile, gulls feed closest to the bulldozers (Greig & Coulson 1986, Bellebaum 2005). Birds' access to edible items is greatest either immediately after the waste has been dumped or after the bulldozer has flattened the material which results in most of the plastic refuse sacks being torn open and their contents spilt. The larger ibis and pelicans use their size to dominate other birds when the bulldozer pulls away. Kites and crows tend to forage over the wider landfill where conditions lead to exposure of potential food items.

Impacts on humans

There are three prime ways in which birds which regularly feed at landfills can have undesirable impacts on issues of human interests to the extent there may be a need to reduce their numbers at the landfill or associated sites.

- Risk to aircraft: Birds in general, but particularly scavengers, are a threat to in-flight aircraft.
- Contamination of water: After foraging at landfills birds, especially gulls and ibises, often move to water bodies where they drink and bathe to clean their plumage. Gulls from landfills are known to transfer *Salmonella*, and other pathogens potentially hazardous to human health, to the water where they bathe, if the water is used for human consumption there is the possibility of disease transmission from birds to humans though the risk is considered slight (Blokpoel & Tessier 1986, Southern 1987). *Salmonella* serotypes in gulls reflect those in the regional human population and probably most sources of infection are not from landfills but from birds which forage in sewage works.
- Contamination of livestock: Gulls may move from a landfill to roost on nearby farmland, especially pastures. The deposition of their faeces on grass which is then eaten by livestock can lead to the transmission of *Salmonella* and possibly other pathogens to the livestock.

Impacts of landfills on birds

Increase in local bird populations: The potential exist that populations of local bird species that feed on landfill sites may increase due to an increase in food supply and/or an increase in the energy and protein content of the food. The birds may also use less energy in search of food.

Wider ecology: the increased number of predators/ scavengers will have a negative effect on other bird species and may also negatively affect the flora and fauna at and around their breeding colonies, especially where these are islands which may support endemic species.

Artifact pollution: The infrequent ingestion of indigestible items may occasionally lead to the death of scavenging birds. Adult birds are generally capable of coping with indigestible items which they regurgitate. They may feed indigestible items to their offspring, which seem less able to rid themselves of these items by regurgitation and, as a result of accumulated indigestible items, may die.

Xenobiotics: Birds scavenging at refuse dumps may ingest some xenobiotic pollutants including cadmium, lead, mercury, and selenium (Hulse *et al*. 1980, Leonzio *et al*. 1986) which, even with minute doses, can lead to behavioural abnormalities (Fox *et al*. 1978). However birds that regularly feed at landfills may develop stronger enzymatic detoxification systems relative to those that feed predominantly on natural foods (Fossi *et al*. 1988). Accumulated xenobiotics may also be deposited into growing feathers and then shed during moult (Becker *et al*. 1994) so birds seldom experience long-term bio-accumulation to a level which is lethal.

Disease: Poultry products dumped at landfill sites can introduce diseases e.g. infectious bursa disease virus (IBDV) to birds. The more putrid the food eaten the more likely it is to contain disease organisms. The disease most associated with landfill sites is botulism.

Botulism: Birds feeding at refuse tips may be susceptible to, and die from, botulism a disease caused by toxins produced by the anaerobic bacteria *Clostridium botulinus.* Severe outbreaks of this disease are often linked to birds feeding at refuse tips. Birds are generally affected by sero-type C. This sero-type rarely affects humans who are more susceptible to sero-types A,B, E and F.

9.4.2 Site Assessments

Of the three proposed sites that next to the PetroSA landfill site (Site 1) is the most appropriate from an avifaunal perspective. The habitat is already transformed, displaced birds have ample adjoining similar habitat, and the small peripheral wetland can be protected. The other cropland site (Site 3) is similar provided the stream that it incorporates is protected. The least appropriate site is that which still retains natural vegetation (Site 2).

Affects on humans

1) Potential aircraft/ bird strikes. The PetroSA site is a designated no- fly zone so location of the Eden landfill adjacent to PetroSA will minimise any threat of collision between birds from the landfill and aircraft. There is no other nearby airfield. The water bodies beside the PetroSA landfill provide birds with local roost and breeding sites so there is little need for birds to move away from the combined landfill area. This again minimises risk of collisions with aircraft.

2) Water contamination risk: There are no open reservoirs in the area whose water is used for human consumption so there is minimal risk of disease transfer from birds to humans.
3) Nuisance: The landfill is 10-15 km distant from residential areas so there is little likelihood of birds from the landfill being a nuisance though they might become a nuisance in the designated, but currently undeveloped, industrial area.
4) Transfer of pathogens to livestock: There is a potential danger of disease transmission to livestock, especially farmed ostriches. Reduction of organic waste and tight control over bird access to hazardous organic waste should minimise this risk.

Risks to birds

The main risk is again of disease, particularly botulism. There is no published evidence of any major mortality of birds at landfills in southern Africa despite long periods of landfill usage. Fears for birds of prey seem unfounded.

Two of the three alternative sites proposed for the Eden landfill are currently arable land with totally transformed habitat. These croplands support few birds relative to natural vegetation. The third site has extensive “natural” vegetation (though by no means pristine). From an avifaunal perspective the third, vegetated, site is the most valuable and thus the least preferred for a landfill. Loss of this vegetated area would result in the displacement of more birds than from the already transformed croplands.

The pond on the western boundary of Site 1 should be retained and a buffer zone of < 20 m maintained around it. In particular special attention should be given to preventing any leakage of polluted material into the water.

9.4.3 EMP bird-related protocols

Whichever of the three sites is finally selected the Landfill Environmental Management Plan (EMP) should incorporate some protocols related to birds. These should establish how to deal with birds in specific situations e.g. deterrence from hazardous organic and inorganic waste, the need for the buffer around the boundary pond and protection for contamination of the pond’s water. Above all the EMP should document how to tackle potential disease situations – especially as these can have effects beyond the landfill either on humans or on livestock. Bird carcasses found on site should be removed or quickly buried to prevent the potential spread of pathogens. A single bird carcass may be incidental but if two or more carcasses are found at one time the freshest carcass should be sent to the state veterinary for assessment of the cause of death. Ideally any moribund (weak and easily caught) birds seen at the same time as the carcasses should be captured and a vet should be called in to take a blood serum sample for analysis as this is the best way to test for botulism (botulism cannot be properly determined from a dead bird). It is advisable to collect, and appropriately store, 20-30g samples of the site soil and water before dumping begins. These samples will provide a baseline level against which subsequent samples can be compared to assess changes in pollutants etc. It is not in the remit of this report to spell out protocols in detail. This should be done with a local (ideally state) veterinarian and, in terms of bird control, with an ornithologist.

9.5 Hydrogeological Impact Assessment

9.5.1 Introduction

The Hydrogeological Impact Assessment was prepared by SRK Consulting Engineers and Scientists and has been attached as Appendix G. The information in this section has mostly been compiled directly from the mentioned specialist report.

The impacts an activity could have on groundwater can broadly be grouped into the following:

- Impact on groundwater quality;
- Impact on yields of existing boreholes; and
- Impact on groundwater levels.

These impacts are assessed in the following paragraphs for both the construction and operational phases of the project on all three of the proposed sites as well as the no-go option.

9.5.2 Hydrogeological Impact Assessment Results

As mentioned earlier the no-go option or status quo presents two different aspects 1) the disposal of waste at the PetroSA waste disposal site and 2) the continued Agricultural use of the proposed three sites. Both options are evaluated from a hydrogeological viewpoint, but please note that certain potential impacts may not have relevance to the no-go option.

The current landfill site next to PetroSA is the Status Quo (No-go) option. The impact of the landfill on groundwater is rated below. Only the operation phase is rated. The landfill site was designed with a clay barrier to prevent leachate entering the groundwater and therefore a Significant rating of Low was given.

Also part of the no-go option is that all the sites remain in agricultural use. The ratings for all the sites are the same and are presented in Table 14. The activity that could have an impact on groundwater is the existing farming activities associated with stock farming.

Source of Impact: Clearance of land for construction and construction of landfill site.				
	Site 1	**Site 2**	**Site 3**	**No-go option**
Nature of impact	*Contamination of groundwater due to spillage of fuel used in heavy machinery*	*Contamination of groundwater due to spillage of fuel used in heavy machinery*	*Contamination of groundwater due to spillage of fuel used in heavy machinery*	N/A
Scale	Local	Local	Local	N/A
Duration	Short-term	Short-term	Short-term	N/A
Intensity	Low	Low	Low	N/A

Probability	Probable	Probable	Probable	N/A
Status	Negative	Negative	Negative	N/A
Confidence	High	High	High	N/A
Significance without mitigation	Low	Low	Low	N/A
Significance with mitigation	No significance	No significance	No significance	N/A

Table 9.10: Impact ratings for the clearance of land for construction and construction of landfill site.

Source of Impact: *Portable Toilets*				
	Site 1	**Site 2**	**Site 3**	**No-go option**
Nature of impact	*Contamination of groundwater due to leachate from toilets*	*Contamination of groundwater due to leachate from toilets*	*Contamination of groundwater due to leachate from toilets*	N/A
Scale	Local	Local	Local	N/A
Duration	Short-term	Short-term	Short-term	N/A
Intensity	Low	Low	Low	N/A
Probability	Probable	Probable	Probable	N/A
Status	Negative	Negative	Negative	N/A
Confidence	High	High	High	N/A
Significance without mitigation	Low	Low	Low	N/A
Significance with mitigation	No significance	No significance	No significance	N/A

Table 9.11: Impact ratings for Portable Toilets

Source of Impact: Leachate development from waste				
	Site 1	**Site 2**	**Site 3**	**No-go option**
Nature of impact	Impact on groundwater quality	Impact on groundwater quality	Impact on groundwater quality	Impact on groundwater quality
Scale	Off-site	Off-site	Local	Off-site
Duration	Long term	Long term	Long term	Long term
Intensity	Medium	Medium	Medium	Low
Probability	Highly probable	Highly probable	probable	Highly probable
Status	Negative	Negative	Negative	Negative
Confidence	Medium	Low	Medium	Medium
Significance without	High	High	Low	Low

mitigation				
Significance with mitigation	Low	Low	Low	No significance

Table 9.12: Impact ratings for Leachate development from waste

Source of Impact: Reduction in recharge due to lining of landfill site				
	Site 1	**Site 2**	**Site 3**	**No-go option**
Nature of impact	Impact on groundwater quality	Impact on groundwater quality	Impact on groundwater quality	Impact on groundwater quality
Scale	Local	Local	Local	Local
Duration	Permanent	Permanent	Permanent	Permanent
Intensity	Low	Low	Low	Low
Probability	Definite	Definite	Definite	Definite
Status	Negative	Negative	Negative	Negative
Confidence	High	High	High	High
Significance without mitigation	No significance	No significance	No significance	No significance
Significance with mitigation	No significance	No significance	No significance	No significance

Table 9.13: Impact ratings for Reduction in recharge due to lining of landfill site

<u>**No-go Option: Farming status quo**</u>

Source of Impact: Farming activities			
	Site 1	**Site 2**	**Site 3**
Nature of impact	Impact on Groundwater quality	Impact on Groundwater quality	Impact on Groundwater quality
Scale	Local	Local	Local
Duration	Long term	Long term	Long term
Intensity	Low	Low	Low
Probability	Improbable	Improbable	Improbable
Status	Negative to neutral	Negative to neutral	Negative to neutral
Confidence	Definite	Definite	Definite
Significance without mitigation	No significance	No significance	No significance
Significance with mitigation	No significance	No significance	No significance

Table 9.14: Impact ratings for the no-go option with farming as the status quo.

The main impacts expected during construction relate to potential hydrocarbon (oil, diesel, grease, petrol) spills from machinery and storage areas and on-site sanitation for the construction workers. The impacts of any such contamination will be low and site specific given the likely small quantities involved. This would only affect shallow groundwater, which is not present at the site. The significance of the potential construction related contamination of deep groundwater at Site 1 is very low.

The main possible impact of the site during operation would be possible seepage of leachate into the subsurface environment from the landfilled area. However, the area has been rated as B- with respect to climatic water balance. This broadly means that average evaporation exceeds average rainfall, i.e. it is unlikely that leachate will be produced. The main contaminants that could be introduced would be nitrate, chloride, potassium, ammonia, phosphate and heavy metals. An increase in Total Dissolved Solids, alkalinity and Chemical Oxygen Demand could also be expected. However, the local groundwater is of low yield potential, naturally poor quality and there is a well developed unsaturated zone that would attenuate any leachate.

9.5.3 Cumulative Impacts

The cumulative impact between the PetroSA waste site and Site 1 is rated as low due to the following:

- PetroSA waste site is lined and should have a low if any impact on surrounding groundwater:
- The migratory action of lining Site 1 should also result in a low to no impact on groundwater; and
- Groundwater levels at the sites are between 9 and 23 mbg, which would naturally attenuate leachate constituents.

9.5.4 Comparison of Alternatives

The highly conductive sediments and shallow water table makes Site 2 a less environmentally favourable option out of a hydrogeological perspective, whilst the favourable geology and lack of groundwater use makes Site 3 the more environmentally favourable alternative. It has been indicated by the specialist that Site 1 would also be suitable as use for a waste disposal site and the significance of the potential impacts with mitigation ranges from low to no significance.

When the no-go option is considered the existing agricultural use of the properties may potentially impact on groundwater quality through pollution from feedlots. The deep groundwater levels and clay at site 3 would prohibit any pollution entering groundwater. The presence of sand at site 2 and groundwater depth of 13.5 m would attenuate any small volume of pollution as it filters down to the water table. The potential construction related impacts would mainly affect the shallow groundwater, which is not present at Site 1. The possible seepage of leachate into the subsurface environment from the landfilled area at Site 1 is also considered of low significance with mitigation as the local groundwater is of low yield potential, naturally poor quality and there is a well developed unsaturated zone that would attenuate any leachate.

9.5.5 Recommended Mitigation Measures

Site 1and 3 can be used as a landfill, but with mitagatory measures, which should include:

- Maintain good housekeeping measures for on-site storage of hydrocarbon based products and clean up any spillages and waste on a daily basis. This material should be stored in appropriate containers in bunded area for removal and disposal;
- Supply on-site sanitation during construction;
- Carry out site construction during the dry summer months if possible, or at least avoid the normally 'wet' months;
- Install monitoring boreholes on the 'upstream' and 'downstream' sides of the landfill area. This should be done prior to construction of the waste site to establish background water quality;
- Sample these boreholes on a quarterly basis (if groundwater is present) for analysis for electrical conductivity, pH, chloride, nitrate, potassium, Chemical Oxygen Demand and Total Alkalinity. A full chemical analysis should be done prior to establishment of the Site to include the following additional determinants: sodium, calcium, magnesium, sulphate, phosphate, fluoride, lead, zinc, nickel, cadmium, Total Chromium, iron and manganese. The data should be evaluated by a hydro geologist on a regular basis;
- Establish a surface water sampling point immediately downstream of the site. Obtain at least one sample prior to construction as flow conditions allow. Analyse for the same constituents as above, plus suspended solids;
- Line the waste disposal area with appropriate materials as per the Minimum Requirements;
- Install a storm water control system to intercept 'clean' surface water run-off from upstream of and around the Site and divert into the natural drainage channel downstream of the Site.
- A further mitigatory factor is the presence of the Petro SA hazardous waste site on the adjacent property to the east. This has not had any reported negative impacts on groundwater in the area.

9.5.6 Conclusions

- The Climatic Water Balance is negative and the generation of leachate is therefore unlikely
- Site 1 is underlain by permeable sediments. The bedrock at the site is some 24 mbgl.
- Groundwater levels at Site 1 vary between 13 to 23 mbg which is above the minimum distance of 2 m (the distance between waste and water table);
- Groundwater quality at Site 1 is generally poor and EC ranges between 109 – 1 792 mS/m
- The aquifer at Site 1 is classified as a fractured rock aquifer which is deeper than 25 mbg and expected borehole yields are between 0.1 – 2 l/s.
- NGDB data and a hydro census indicate limited use of groundwater at the site for stock watering.
- Site 2 is underlain by Tertiary sediments which consist of high- level terrace gravel, soils and silcrete which are highly permeable.

- Site 3 is underlain by shales of the Ceres Formation of the Bokkeveld Group. These shales have been weathered to form a clay cover at least 18 m thick.
- No boreholes captured in the NGDB are close to any of the two alternative sites (Sites 2 and 3).
- Shallow groundwater levels exist at Site 2
- No groundwater was found during drilling at Site 3
- The average EC is 292 mS/m close to sites 2 and 3.
- Expected borehole yields are very low and range between 0.1 – 0.5 l/s.
- No groundwater is used at the alternative sites (Sites 2 and 3).
- The presence of clay and the deep water table at Site 3 makes this the favourable site in terms of impacts on groundwater.

9.6 Air quality Impact Assessment

9.6.1 Introduction

The Air Quality Impact Assessment was undertaken by Airshed Planning Professionals and has been attached as Appendix G. The Air Quality Impact Assessment addresses potential impacts on the air quality at the alternative sites as a result of the proposed waste disposal site. Full acknowledgement is given to Airshed Planning Professionals for the information contained in this section.

9.6.2 Air Quality Impact Assessment Results

To allow the calculation of significance of the predicted impacts, numerical values were assigned to each of the assessment criteria, as follows:

Pobability	**DURATION**
5 - Definite/don't know	5 – Permanent
4 - Highly probable	4 - Long-term
3 - Probable	3 - Medium-term (8-15 years)
1 - Improbable	1 - Short-term (0-2 years)
SCALE	**INTENSITY**
5 –National	10 - High/don't know
4 –Regional	5–Medium
3 –Off-site	2 - Low
2 –Site	
1 –Local	

Table 9.15: Numerical values for assessment criteria.

The significance of the two aspects, occurrence and severity, is assessed using the following formula:

SP (significance points) = (probability + duration + scale) x intensity

The maximum value is 150 significance points (SP). The impact significance will then be rated as summarised in Table 9.16.

Significant Points	Significance	Description
SP >75	**Indicates** high **environmental significance**	**An impact which could influence the decision about whether or not to proceed with the project regardless of any possible mitigation.**
SP 30 – 75	**Indicates** moderate **environmental significance**	**An impact or benefit which is sufficiently important to require management and which could have an influence on the decision unless it is mitigated.**
SP <30	**Indicates** low **environmental significance**	**Impacts with little real effect and which should not have an influence on or require modification of the project design.**
+	Positive **impact**	**An impact that is likely to result in positive consequences/effects.**

Table 9.16: Significance rating calculations.

	Source of impact	Nature of impact	Nature	Scale	Duration	Intensity	Probability	Confidence	Significance	
									Without mitigation	With mitigation
Construction	Site clearance, establishment of landfill terrain and roads and passage of vehicles on dirt roads	Various activities during site preparation require disturbing the soil to some degree through the use of construction machinery. Fugitive dust will be released from unpaved roads surfaces as well as exhaust emissions. Elevated PM_{10} air concentrations cause health impacts and dust fallout causes soiling of nearby environment.	Negative	Off-site	Short-term	Medium	Highly Probable	Medium	Medium	Low
		Unmitigated Score	*-1*	*3*	*1*	*5*	*4*	-	*-40*	
		Mitigated Score	*-1*	*3*	*1*	*3*	*4*	-		*-28*
Operation	Gaseous and particulate emissions are expected from the landfill and composting operations, whilst mainly fugitive dust is associated with the MRF and builder's rubble crushing operations. Fugitive dust emissions will occur from all vehicle movements	The potential hazards and amenity impacts from landfills include fire, birds, dust, odour, toxic gases, pests, vermin and litter. Each of these potential impacts may occur on-site or offsite. Gaseous emissions include irritants, which can cause reversible health impacts such as asthma, carcinogens, which has the potential to cause cancer, and odorants which is generally regarded as a nuisance, but may also cause health effects such as headaches and nausea. Thoracic particulates (PM_{10}) can cause health effects and the deposition of larger particles soiling of the environment. Vehicles leaving a landfill site must not distribute litter and site materials in surrounding streets.	Negative	Off-site	Long-term	Medium	Highly Probable	High	Medium	Low-Medium
		Unmitigated Score	*-1*	*3*	*4*	*6*	*4*	-	*-66*	
		Mitigated Score	*-1*	*3*	*4*	*3*	*4*	-		*-33*

Table 9.17: Environmental impact assessment matrixfor Site 1

	Source of impact	Nature of impact	Nature	Scale	Duration	Intensity	Probability	Confidence	Significance	
									Without mitigation	With mitigation
Construction	Site clearance, establishment of landfill terrain and roads and passage of vehicles on dirt roads	Various activities during site preparation require disturbing the soil to some degree through the use of construction machinery. Fugitive dust will be released from unpaved roads surfaces as well as exhaust emissions. Elevated PM_{10} air concentrations cause health impacts and dust fallout causes soiling of nearby environment.	Negative	Off-site	Short-term	Medium	Highly Probable	Medium	Medium	Low
		Unmitigated Score	*-1*	*3*	*1*	*7*	*4*	-	*-56*	
		Mitigated Score	*-1*	*3*	*1*	*4*	*4*	-		*-28*
Operation	Gaseous and particulate emissions are expected from the landfill and composting operations, whilst mainly fugitive dust is associated with the MRF and builder's rubble crushing operations. Fugitive dust emissions will occur from all vehicle movements	The potential hazards and amenity impacts from landfills include fire, birds, dust, odour, toxic gases, pests, vermin and litter. Each of these potential impacts may occur on-site or offsite. Gaseous emissions include irritants, which can cause reversible health impacts such as asthma, carcinogens, which has the potential to cause cancer, and odorants which is generally regarded as a nuisance, but may also cause health effects such as headaches and nausea. Inhalable particulates (PM_{10}) can cause health effects and the deposition of larger particles soiling of the environment. Vehicles leaving a landfill site must not distribute litter and site materials in surrounding streets.	Negative	Off-site	Long-term	Medium	Highly Probable	High	Medium	Low-Medium
		Unmitigated Score	*-1*	*3*	*4*	*5*	*4*	-	*-55*	
		Mitigated Score	*-1*	*3*	*4*	*3*	*4*	-		*-33*

Table 9.18: Environmental impact assessment matrix for Site 2

	Source of impact	Nature of impact	Nature	Scale	Duration	Intensity	Probability	Confidence	Significance	
									Without mitigation	With mitigation
Construction	Site clearance, establishment of landfill terrain and roads and passage of vehicles on dirt roads	Various activities during site preparation require disturbing the soil to some degree through the use of construction machinery. Fugitive dust will be released from unpaved roads surfaces as well as exhaust emissions. The site has to be accessed via a public gravel road. Elevated PM_{10} air concentrations cause health impacts and dust fallout causes soiling of nearby environment.	Negative	Off-site	Short-term	Medium	Highly Probable	Medium	Medium	Low-Medium
		Unmitigated Score	*-1*	*3*	*1*	*7*	*4*	-	*-56*	
		Mitigated Score	*-1*	*3*	*1*	*5*	*4*	-		*-32*
Operation	Gaseous and particulate emissions are expected from the landfill and composting operations, whilst mainly fugitive dust is associated with the MRF and builder's rubble crushing operations. Fugitive dust emissions will occur from all vehicle movements	The potential hazards and amenity impacts from landfills include fire, birds, dust, odour, pests, vermin and litter. Each of these potential impacts may occur on-site or offsite. Gaseous emissions include irritants, which can cause reversible health impacts such as asthma, carcinogens, which has the potential to cause cancer, and odorants which is generally regarded as a nuisance, but may also cause health effects such as headaches and nausea. Inhalable particulates (PM_{10}) can cause health effects and the deposition of larger particles soiling of the environment. Vehicles leaving a landfill site must not distribute litter and site materials in surrounding streets.	Negative	Off-site	Long-term	Medium	Highly Probable	High	Medium	Low-Medium
		Unmitigated Score	*-1*	*3*	*4*	*6*	*4*	-	*-66*	
		Mitigated Score	*-1*	*3*	*4*	*3*	*4*	-		*-33*

Table 9.19: Environmental impact assessment matrix for Site 3

Source of impact	Nature of impact	Nature	Scale	Duration	Intensity	Probability	Confidence	Significance
Gaseous emissions, mainly from PetroSA's GTL Refinery, east of the proposed locations for the landfill are currently impacting the sites. Site 1 is impacted the most due to its proximity. All three sites are also being impacted by particulate emissions from nearby activities resulting in the generation of airborne dust. Currently, there are no odour impacts, other than those emissions from livestock farming activities, mainly Site 3.	The current negative air quality impact due to gaseous pollutants is not very significant when compared to the NAAQS limit values. However, concentrations of thoracic particulates (PM10) have been observed to be high and have been shown to exceed the NAAQS.	Negative	Off-site	Short-term	Medium	Highly Probable	Medium	Low
	Score	*-1*	*2*	*4*	*3*	*3*	*-*	*-27*

Table 9.20: Environmental impact assessment matrix for No-go option

9.6.3 Buffer zone delineation

Air quality impact assessments conducted for large hazardous and general landfill sites in South Africa have generally indicated that:

- Significant health risks, given good landfill facility management, are restricted to within 500 m of the landfill boundary;
- Odour impact distances can vary from 200 m to 5 km depending on facility management, local topography and meteorological conditions; and
- Nuisance dust impacts are generally restricted to within the immediate boundary of the facility (Airshed Planning Professionals, 2012).

As defined by DWAF in their *Minimum Requirements for Waste Disposal by Landfill*, buffer zones are areas of land separating the registered surveyed boundaries of disposal sites from the registered surveyed boundaries of identified sensitive land use categories (both existing or proposed) such as residential, educational, health and social activities. A buffer zone must be approved by the relevant government departments, surveyed, registered in the office of the Surveyor General and the Registrar of Deeds by way of servitudes or subdivided portions of land. Such buffer zones are established to ensure that a landfill operation does not have an adverse impact on quality of life and/or public health (Airshed Planning Professionals, 2012).

The establishment and maintenance of buffer zones is enforceable in terms of the Health Act, 1997 (Act 63 of 1977), which makes provision for measures necessary to prevent any nuisance, unhygienic or offensive condition that is harmful to health (DWAF, 1998). Although the width of the buffer zone is prescribed for communal and small landfills, such zones need to be independently defined for all other landfills based on the classification of the landfill and on site-specific factors which may influence the landfill's impact on the environment (DWAF, 1998).

A distinction was made in the Air Quality Impact Assessment between Management zones and Buffer zones as follows:

- Management zones - indicative of the odour and dust impact areas, with reductions in the extent of such impact areas requiring the implementation of emission reduction measures at the landfill site.
- Buffer zones - delineated exclusively on the basis of health impact zones and of crucial importance in terms of determining land use potentials.

Figure 9.4 to 9.6 indicates the proposed buffer zones for the three alternative sites, whilst Figures 9.7 to 9.9 indicates the proposed management zones for the three alternatives sites.

In terms of the management zone, the landfill operator must undertake the following:

- develop and implement a site-specific odour assessment and management plan for the zone

- re-evaluate the potential for impacts and the extent of management/mitigation required given changes in land use in the adjacent area

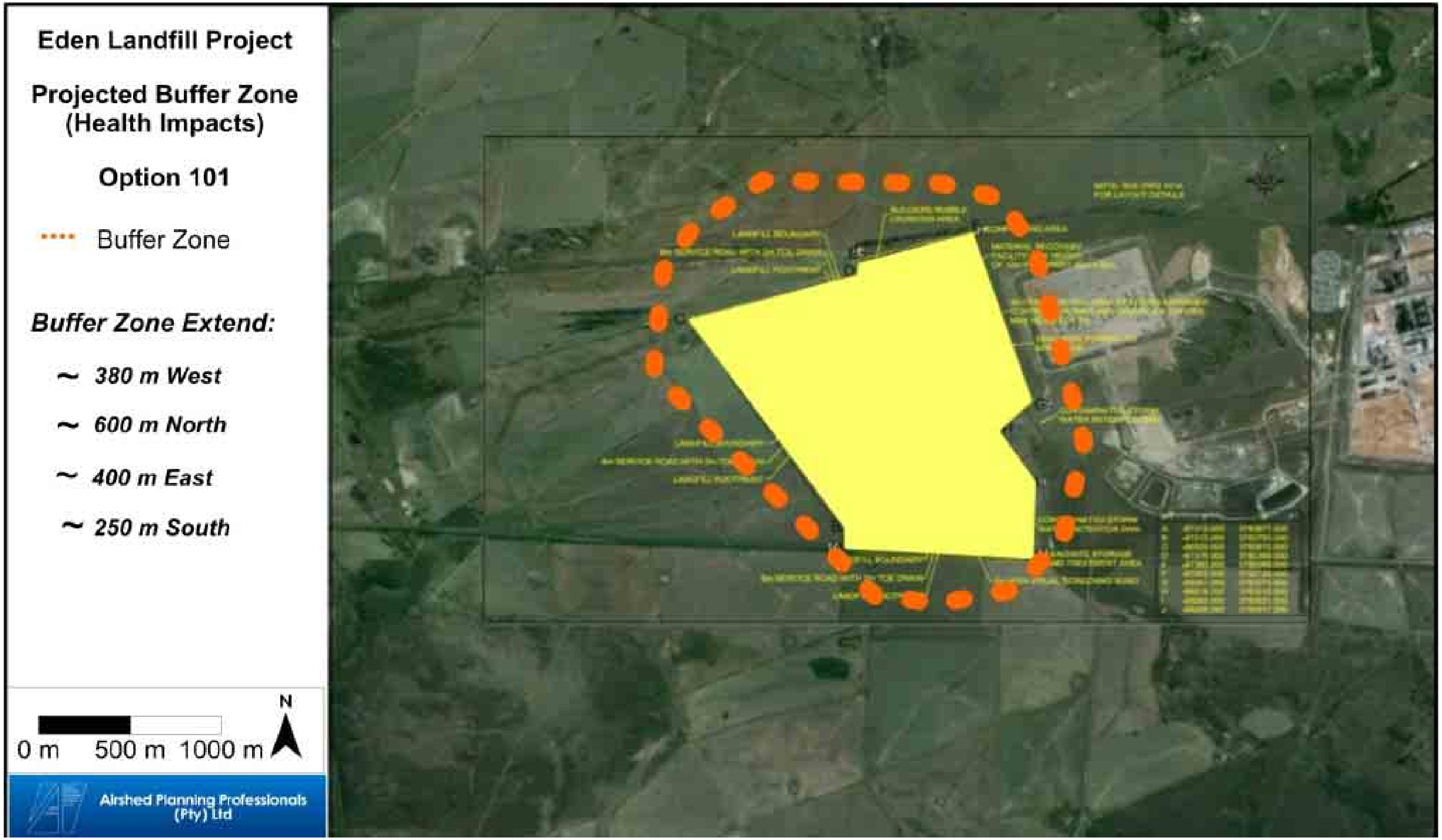

Figure 9.4: Predicted buffer zone delineation for Site 1. Source: Airshed Planning Professionals (Pty) Ltd.

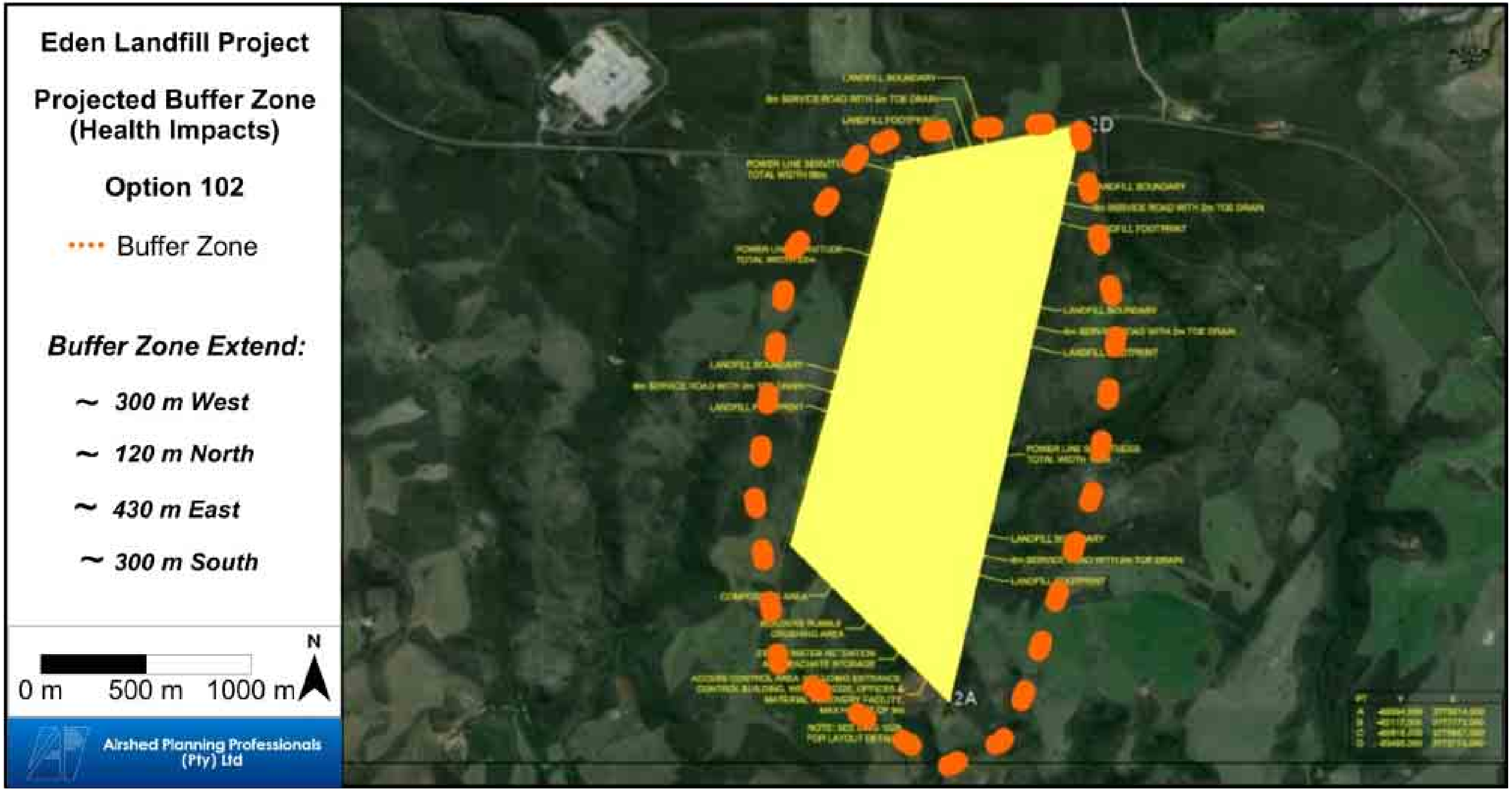

Figure 9.5: Predicted buffer zone delineation for Site 2. Source: Airshed Planning Professionals (Pty) Ltd.

Figure 9.6: Predicted buffer zone delineation for Site 3. Source: Airshed Planning Professionals (Pty) Ltd.

Figure 9.7: Predicted management zone delineation for Site 1. Source: Airshed Planning Professionals (Pty) Ltd.

Figure 9.8: Predicted management zone delineation for Site 2. Source: Airshed Planning Professionals (Pty) Ltd.

Figure 9.9: Predicted management zone delineation for Site 3. Source: Airshed Planning Professionals (Pty) Ltd.

9.6.4 Cumulative Impacts

Since Site 1 is the closest to the PetroSA GTL Refinery, it is expected to have a higher level of air pollution currently. However, actual measurements of SO2, NO2 and H2S were all observed to be relatively low when compared to the National Ambient Air Quality Standard (NAAQS) limit values. The maximum concentrations at the three alternative sites were 0.3 $\mu g/m^3$, 2.3 $\mu g/m^3$ and 1.1 $\mu g/m^3$, respectively.

Cumulatively therefore, any of these pollutants generated on site would be the main contributor and the cumulative predictions would therefore be marginally higher than the incremental predictions.

The predicted benzene impact from the landfills is low and would still be below the NAAQS limit when added to the highest concentrations observed at the refinery boundary.

Current PM10 concentrations, on the other hand, were shown to be more significant, with a number of exceedances of the NAAQS limit value. The relatively high PM10 concentrations are expected to be due to nearby farming activities. The landfill operation would add to the existing particulate air concentrations and, unless adequately mitigated, result in further violations of the daily average NAAQS. Since Sites 2 and 3 would be accessed by significantly longer gravel roads than Site 1, the cumulative impact would be higher (Airshed Planning Professionals, 2012).

9.6.5 Comparison of Alternatives

The air pollution impact from the three alternative sites, mainly differ as a result of topographical features and proximity to residential areas. The topography creates micro-climates which result in slightly different metrological conditions and therefore in slightly different dispersion potential and direction of impacts. Site 1 is characterised by relatively gentle topography, with heights varying between 170 m amsl) and 200 m amsl. Site 2 has the most complicated topography of the three sites, with the topography rising above 320 m amsl towards the north of the site and slopes down to the south (above 180m amsl). Site 3 is characterised by relatively gentle topography, but not as flat as Site 1, with the topography varying between 170 m amsl at the most northern point of the site and 114 m amsl on the southern boundary of the site. The topography associated with the study area has an impact on the local wind climate. Site 2 is more sheltered from north-westerly winds compared to Sites 1 and 3.

A comparison of the predicted air pollution impacts is provided in Table 9.21. According to these results, Site 2 is predicted to result in the lowest air pollution impact, followed by Site 1 and lastly, Site 3.

Alternative	GHG Potential as Ratio to Site 1	PM10 Impact Distance	Irritant Hazard Index	Maximum Exposed Individual Cancer Risk	Odour Impact (Maximum Odour Units)
Site 1	1.000	450 m	4	5 in a million	17
Site 2	1.001	450 m	1	4 in a million	4
Site 3	1.002	800 m	4	6 in a million	16

Table 9.21: Predicted air pollution impacts for the three alternative sites

However, Site 2 was shown to potentially result in an odour impact zone (Management Zone) that extends about 2 km, towards the south of the facility

If the waste disposal facility were not developed at one of the three identified sites, there would be no additional air pollution impact other than the existing pollution at Sites 2 and 3. Disposal of waste could continue at the PetroSA landfill up to 2020, when it is projected to have reached its capacity. Since Site 1 is relatively close to the PetroSA landfill site, there may be a slight increase in air impacts at this location in the future; mainly odour. Currently, the maximum annual SO_2 and NO_2 concentrations along the boundary of PetroSA's GTL refinery are less than 11µg/m³ and 6µg/m³, respectively. These concentrations are well below the NAAQS limit values of 50µg/m³ and 40µg/m³, respectively. Similarly, the annual average benzene concentration is currently less than 1.4 µg/m³, which is lower than the SA limit value of 10µg/m³ applicable until 2014 (from 2015 the limit is 5µg/m³). If the current operating practices continue are the PetroSA landfill, it is expected that the air pollution impacts would not increase significantly more beyond the refinery boundary.

Maximums of actual measurements of SO_2, NO_2 and H_2S at the three alternative sites were 0.3 µg/m³, 2.3 µg/m³ and 1.1 µg/m³, respectively. Current PM10 concentrations, on the other hand, were shown to be more significant, with a number of exceedances of the NAAQS limit value. The relatively high PM10 concentrations are expected to be due to nearby farming activities.
The second important difference between Site 3 and the other two sites is that a significant portion of the access road to Site 3 is unpaved. Since airborne dust generated by waste transportation on unpaved roads can potentially be a significant impact, this site would be associated with significantly more fugitive dust emissions.

9.6.6 Recommended Mitigation Measures

The main air pollution impacts were identified to be associated with health risk (carcinogens and PM_{10}) and odours. The recommendations are therefore geared towards minimising the impact and/or potentially eliminating air pollution from sources generating these emissions. The health risk can be reduced through design specifications, operational procedures and applying a Buffer Zone. The latter minimises the exposure, whereas the former actions reduce or eliminate the emissions. The recommendations are therefore as follows:

- Adopt the Buffer Zone, which was delineated exclusively on the basis of health impact, to minimise unnecessary human exposure to potentially toxic gaseous and particulate compounds. The extents of these zones are given in Figure 9.4 a (Site 1), Figure 9.5 (Site 2) and Figure 9.6 (Site 3), respectively. In general, no or only specified development may take place within the defined Buffer Zone, i.e., compatible land use adjacent to a landfill site. Agriculture or limited industrial developments may typically be found to be compatible with landfill operation.
- Adopt the Management Zone, which is indicative of the odour and dust impact areas, with reductions in the extent of such impact areas requiring the implementation of emission reduction measures. The extents of these zones are given in in Figure 9.7 (Site 1), in Figure 9.8 (Site 2) and in Figure 9.9 (Site 3), respectively. The designation of the area should be seen to necessitate the EDM Landfill to undertake the following:
- develop and implement a site-specific odour assessment and management plan for the zone
- re-evaluate the potential for impacts and the extent of management/mitigation required given changes in land use in the adjacent area

Taking the various components of the air impact assessment into consideration, it is recommended that

- Site 1 be selected is the environmentally preferred site with respect to air pollution.
- This is followed by Site 2 and then Site 3.

More specific mitigation recommendations include:

Airborne dust minimisation

1. Minimisation of vehicle entrainment dust generated along unpaved roads during both construction and operational phases:
   - As a minimum, apply regular water spraying on access roads. (More permanent surface improvements, including chemical treatment, paving with concrete or asphalt, or the addition of gravel or slag to the surface can be highly effective but is expensive and unsuitable for surfaces used by very heavy vehicles or subject to spillages of material in transport.)
   - Reduce the possibility of carry-out of mud and dirt from construction site onto public roads; by provide washing facilities at the exits including hose pipes, adequate water supply and pressure and mechanical wheel spinners or brushes.
   - Ensure that loading of materials is done with the lowest drop height and those vehicles carrying dusty materials are securely and properly covered before they leave the site.
   - Enter all information in a log book including all vehicles entering and leaving the site.
   - Sweeping tarred road entrances to reduce mud and dust carry through.

- Control of load size to avoid spillages.
- Limiting vehicle speeds. The control of vehicle tailpipe emissions may be achieved by ensuring that vehicles are in good working condition and to minimize idling of equipment when not in use.

2. Re-vegetation of exposed surfaces should be done wherever practicable, and other similar activities subject to on-going development.
3. It is recommended to mitigate windblown dust through the use of shelterbelts or temporary screening. (It may also be possible to make use of natural land features, or trees to provide a degree of wind protection)
4. Fugitive dust generated through materials handling operations (e.g. front-end loaders or mechanical grabs), are best addressed by minimising drop heights, and regular clean-up of any spillages
5. It is not recommended that misting systems be used constantly on active face/operational area as it may increase the moisture content of the waste and therefore proliferate anaerobic conditions. Mist system should only be used when appropriate. Instead, it is recommended to temporary cover using materials such as Hessian, mineral soil, clay cover or impermeable materials such as PVC
6. Consider the feasibility of fitting fabric filters on the crusher proposed for the builder's rubble crusher

Gaseous emissions

1. Emission controls
   - As stated in the Minimum Requirements for Waste Disposal by Landfill (DWAF 1998, DWAF 2005), odours must be combated by good cover application and maintenance. Furthermore, the prompt covering of malodorous waste to reduce odour problems is a Minimum Requirement.
   - A temporary cover using materials such as Hessian, mineral soil, clay cover and impermeable materials such as PVC could be used on active face/operational area. Similarly, exposed daily/weekly waste should be covered using Hessian//Polythene/soil on-site.
   - It is recommended that the stockpile should be adequate to meet the cover requirements of the landfill for at least three days (DWAF 2005) to two weeks.
   - Uncontrolled gas emissions from landfill are generally considered not to be a sustainable practice since landfills primarily produce methane and carbon dioxide, which, if not contained, can contribute to the greenhouse effect. Furthermore, landfill gas represents a useful source of energy. An effective manner to control landfill gas emissions is to include a subsurface gas extraction system, which would allow the captured gas to be flared or used in an engine. The proposed design does not include gas capturing; however, it is recommended that the options of this being sustainably utilised should be investigated.
   - According to Minimum Requirements for Waste Disposal by Landfill (DWAF 2005), Appendix 10.3, the operator is required to develop a Landfill Gas Management Plan and Air Quality Management Plan. In the development of these plans, it is recommended that the following items be included:

Management Plan

- The landfill owner must limit odour impacts by discouraging any development of sensitive receptors within the proposed Management Zone. This will minimise the requirement for other stringent odour controls.
- It is recommended that an odour management plan be implemented using resident data, meteorological data and site operator knowledge to investigate any odour complaints or potential odour complaints and implement remedial action using a developed common sense strategy.
- Windblown litter is a nuisance to the community in the vicinity of landfill sites and should be controlled by the following techniques:
  - Introduce procedures that prevent the unnecessary proliferation of litter, such as continuous compaction and use of litter fences.
  - Ensure that all wind-blown litter that leaves the site is retrieved.
  - All litter fences, perimeter fences and gates must be inspected and cleared of litter on a daily basis or as required.
  - Entry and exit signs need to advise transport operators that they can be fined for any litter on public roads resulting from their improper transportation of waste.
  - Vehicles using landfill sites will inadvertently collect mud and litter on their wheels as they proceed to and return from the active face. All mud and waste materials on vehicles that leave the site should be removed. The landfill operator should therefore provide a wheel-washing or wheel-cleaning facility for use by customers. The landfill operator should display signs advising customers that it is the vehicle operator's responsibility to ensure that the remnants of their load or the material stuck to the underside of the vehicle or the wheels does not litter public roads.
- Burning of waste is not allowed at the landfill, in accordance with the Minimum Requirements for Waste Disposal by Landfill.

Monitoring programme

- It is recommended that a meteorological station that monitors:
  - wind speed;
  - wind direction;
  - sigma theta (standard deviation of the horizontal fluctuation in the wind direction)
  - temperature
  - rainfall
  - atmospheric pressure
  - solar radiation.

- The risk of gas explosion (CH_4) must be continually monitored.
  - Landfill gas monitoring devices should be capable of detecting landfill gas in sufficiently low concentrations to ensure that landfill gas is not migrating off-site, and toxic air emissions are not a threat to the community.
  - These must be monitored at 3-monthly intervals during the operation and at the discretion of the Competent Authority after site closure. If the soil gas methane concentrations exceed 1% by volume at Standard Temperature and Pressure (STP), the Competent Authority must be informed.
  - If the methane levels are found to be between 0.5% and 5% in air (i.e., between 10% of the Lower Explosive Limit (LEL)) then regular monitoring of the boundary must be instituted. If the methane levels are found to be greater than 5% in gas probes around the boundary, then monitoring should be initiated and an investigation to determine lateral migration should be commissioned.
  - Depressions in the cover material or surface fissures away from the sampling grid nominated above must also be investigated for methane emissions.
- When significant landfill gas is present, samples must be taken at various positions at the landfill site, and characterised for volatile organic compounds. Sampling can be direct at gas wells, or using the techniques outlined in the Minimum Requirements for Waste Disposal by Landfill (Section 11.5.6).

9.6.7 Conclusions

The current air quality was estimated to be impacted mainly by airborne particulates at the three alternative sites. Gaseous air pollutants, which would typically be associated with the operation of landfills, were observed to be insignificant. The particulate emissions mainly originate from the nearby farming activities. Sources of potential air emissions, including gaseous and particulate pollutants were identified and quantified as far as possible with the available information.

The main air pollution sources included:

Construction Phase:

1. Vehicle entrainment along unpaved roads and construction site
2. Excavation and earthworks
3. Material handling operations
4. Wind erosion of exposed areas

Operational Phase:

1. Landfill
   - Vehicle entrainment along unpaved roads
   - Trenching
   - Waste material handling operations
   - Wind erosion of exposed areas

- Landfill gas generation

2. Material Recycling Facility
   - Vehicle entrainment along unpaved roads
   - Waste material handling operations
   - Wind erosion of exposed areas
3. Composting
   - Vehicle entrainment along unpaved roads
   - Waste and compost handling operations
   - Wind erosion of exposed areas
   - Gas generation
4. Builder's rubble
   - Vehicle entrainment along unpaved roads
   - Waste material handling operations
   - Crushing operation
   - Wind erosion of exposed areas

Pathogens are often associated with landfills. The distribution of pathogens and the predicted risk associated with pathogens at landfills is, however, not easily quantifiable. The limitations in quantifying these impacts are the lack of knowledge as to concentration of a pathogen that may be attached to windblown dust or simply blown from the landfill, as pathogens were not evenly distributed in the landfill waste.

Pathogens are mainly associated with discarded carcasses onsite.

Windblown litter has been identified as a problem at other landfill sites. With all three sites neighbouring farm areas, the risk of ingestion by grazing livestock possess a significant risk with respect to loss of income. The quantification of the amount of litter which could be blown from site was not possible. The main contributor to windblown litter results from the transport of waste to the site. To mitigate this impact it should be ensured that transportation vehicles are covered when on route to site.

No fatal flaws associated with any of the three sites were identified. A comparison of the predicted air pollution impacts indicates that Site 2 is marginally better than Site 1 and Site 3. It was predicted that Site 3 would result in the highest air pollution impact, unless the access road is treated to reduce fugitive dust emissions.

None of the operations proposed for the facility require an Air Emissions Licence, as defined in the *Listed Activities and Minimum National Emission Standards* of the National Environmental Management: Air Quality Act (Act No. 39 of 2004).

Since no fatal flaws were identified, and since the impact can be minimised to near *Low* impacts through the appropriate mitigation measures, it is recommended that the project should be authorised.

9.7 Socio-economic Impact Assessment

9.7.1 Introduction

The Socio-economic Impact Assessment was undertaken by Urban-Econ and has been attached under Appendix G. The Socio-economic Impact Assessment determines any possible impacts, which a regional landfill site could have on the regional community and economy if it was to be constructed and operated in the identified locations within the Mossel Bay local municipal area. This section is based on the report compiled by Urban-Econ (2012) and full acknowledgement is given to Urban-Econ for the information contained in this section.

Economic impacts can be defined as the effects (positive or negative) on the level of economic activity in a given area(s). The net economic impact is usually measured as the expansion or contraction of an area's economy, resulting from the changes in (i.e. opening, closing, expansion or contraction of) a facility, project or program. Importantly, the net economic impact is ultimately informed by the exogenous change to a particularly defined geographical area/entity.

The net economic impact of an exogenous change in the economy will be translated according to various direct and indirect economic effects, as are defined below:

Direct economic impacts: are the changes in local business activity occurring as a direct consequence of public or private business decision, or public programs and policies. Furthermore, increased user benefits lead to monetary benefits for some users and non-users (individuals and businesses) within the geographical area:

- *For affected businesses*, there may be economic efficiency benefits in terms of product cost, product quality or product availability, stemming from changes in labour market access, cost of obtaining production inputs and/or cost of supplying finished products to customers.
- *For affected residents*, benefits may include reduced costs for obtaining goods and services, increased income from selling goods and services to outsiders, and/or increased variety of work and recreational opportunities associated with greater location accessibility.

Indirect and induced impacts: Ultimately, the direct benefits to business and the residents of communities and regions may also have broader impacts, including:

- *Indirect business impacts* – business growth for suppliers to the directly- affected businesses
- *Induced business impacts* – business growth as the additional workers (created by direct and indirect economic impacts/effects) spend their income on food, clothing, shelter and other local goods and services. This business growth will also have implications for potential municipal income due to raised taxes and service levies.

9.7.2 Socio-economic Impact Assessment Results

A summation of the total impacts that the Eden Regional Waste Disposal Site will have during the construction or CAPEX phase of the development, on New Business Sales, Additional GGP and Employment is presented in Table 9.22 below.

Site Alternatives	New Business sales	Additional GGP	Employment
Site 1	R2, 487, 200, 000	R751, 000, 000	5, 272
Site 2	R2, 505, 000, 000	R756, 300, 000	5, 309
Site 3	R2, 496, 000, 000	R753, 700, 000	5, 288
No-Go (alternative 4)	R0.00	R0.00	R0.00

Table 9.22: Construction phase summation (source: Urban-Econ, 2012).

Site Alternatives	New Business sales	Additional GGP	Employment
Site 1	R678, 000, 000	R207, 400, 000	1, 430
Site 2	R663, 300, 000	R202, 300, 000	1, 401
Site 3	R664, 200, 000	R202, 500, 000	1, 403
No-Go (alternative 4)	R0.00	R0.00	R0.00

Table 9.23: Operational phase summation (source: Urban-Econ, 2012).

A summation of the total impacts that the Eden Regional Waste Disposal site will have during the operational or OPEX phase of the development, on New Business Sales, Additional GGP and Employment is presented in Table 9.23.

Table 9.22 shows that with regards to stimulation of new business sales, both directly and indirectly within the region, as well creation of additional production (GGP) and additional employment creation alternative site 2 will have the most significant benefits. These impacts will be both directly and indirectly are not limited to that business, service providers and stakeholders directly involved with the Eden Regional landfill site, but will also extend to suppliers and stakeholders that serve those stakeholders directly involved. Thus with regards to the most preferable alternative with respect to stimulation of the local and regional economy during the construction phase, Alternative site 2 is the most preferable.

Table 9.23 shows that during the operation phase with regards to stimulation of New Business Sales, creation of additional GGP and employment alternative site 1 is the most preferable and alternative site 2 is the least beneficial, however the difference in impacts on the three indicators between alternative site 2 and 3 during the operation phase is not significant and only varies slightly. This coupled with the location of site 1 being in close proximity to the PetroSA plant and current landfill site in Mossel Bay makes this the most preferred site.

The following section will display the extent of impacts that the various development alternatives will have in the local Mossel Bay municipal area and the Eden Region as a whole.

9.7.3 Impact of the development

A quantitative analysis was conducted on the potential impacts of the proposed waste disposal facility according to their impact on additional business sales and GGP (Gross Geographic Production); employment creation and losses within the economy; how the alternatives will affect investment expenditure in the area; the impact that the alternatives will have on the property market; and finally how tourism in the area will be affected.

Additional New Business sales

The Impact that the proposed Eden Regional Waste Disposal site will have on the new business sales in the local and regional context during the construction phase is rated in table 9.24.

	Site 1	Site 2	Site 3	No-go option
Spatial extent/scale	Regional	Regional	Regional	Regional
Duration	Short term	Short term	Short term	Short term
Intensity	Medium	Medium	Medium	Low
Probability	Highly probable	Highly probable	Highly probable	Highly probable
Status	Positive	Positive	Positive	Neutral
Confidence	High	High	High	High
Significance without mitigation	Medium	Medium	Medium	No impact
Significance with mitigation	Medium	Medium	Medium	No impact

Table 9.24: Impact on new business sales during the construction phase.

	Site 1	Site 2	Site 3	No-go option
Spatial extent/scale	Regional	Regional	Regional	Regional
Duration	Long term	Long term	Long term	Medium term
Intensity	High	High	High	Medium
Probability	Highly probable	Highly probable	Highly probable	Probable
Status	Positive	Positive	Positive	Neutral

Confidence	High	High	High	High
Significance without mitigation	High	High	High	High
Significance with mitigation	High	High	High	High

Table 9.25: Impact on new business sales during the operational phase.

Table 9.24 shows that all three alternatives that result in the construction of the waste disposal site (alternatives 1, 2 and 3) will have a positive impact on New Business Sales both in the local municipal area of Mossel Bay and the Eden District as a whole. **Table 9.25** shows that all alternatives 1, 2 and 3 will also have a positive impact on new business sales during the day-to-day operations of the plant and the No-Go alternative will have a neutral impact. Construction of the waste disposal facility will require building materials, supplies and labour, which is recommended by sourced from within the local (Mossel Bay) and regional (Eden District) economies. This will in turn stimulate demand for within the industries that manufacture and supply the required materials and services. This increased demand will result in increased sales not only for those businesses that will be directly involved in the construction phase, but also the suppliers and manufacturers whose sales will be increased through increased demand from those businesses that will be directly stimulated.

The positive implications and dynamics of the operations of the Waste Disposal facility will be similar to those of the construction phase, however the extent and value of these positive effects will be less than the construction phase, however as the operational implications will accumulate from year to year and the construction impact is a once off, the continued operations of the waste disposal site will have a far greater positive implication for business sales in the area.

Additional GGP

Table 9.26 illustrates the impact that the proposed Waste Disposal site will have on additional production (GGP) within the economy of Mossel Bay, as well as the Eden District during the construction phase.

	Site 1	**Site 2**	**Site 3**	**No-go option**
Spatial extent/scale	National	National	National	National
Duration	Medium term	Medium term	Medium term	Medium term
Intensity	Medium	Medium	Medium	Medium
Probability	Highly probable	Highly probable	Highly probable	Probable
Status	Positive	Positive	Positive	Neutral
Confidence	High	High	High	High
Significance	Medium	Medium	Medium	Medium

without mitigation				
Significance with mitigation	Medium	Medium	Medium	Medium

Table 9.26: The impact that the Waste Disposal site will have on additional production during the construction phase.

	Site 1	Site 2	Site 3	No-go option
Spatial extent/scale	Regional	Regional	Regional	Regional
Duration	Long term	Long term	Long term	Long term
Intensity	Medium	Medium	Medium	High
Probability	Highly probable	Highly probable	Highly probable	Probable
Status	Positive	Positive	Positive	Neutral
Confidence	High	High	High	High
Significance without mitigation	Medium	Medium	Medium	Low to very low
Significance with mitigation	High	High	High	Low to very low

Table 9.27: The impact that the Waste Disposal site will have on additional production during the operational phase.

Table 9.26 shows that the construction of alternatives 1, 2 and 3 will all have a positive impact on additional production (GGP). The extent of this additional production stimulation will be national as it is assumed that a number of the materials and processes that will be required for the construction of the plant will be sourced and manufactured outside the Eden District, due to the nature of this type of activity and the activities proposed to be undertaken at the site (composting, materials recovery facility etc). Where these materials can be sourced within the local economy of Mossel Bay and the Eden district it is recommended that they should be utilised to maximise the potential positive benefits of the waste disposal site to the local Mossel Bay municipal area. Additional GGP stimulation during both the construction and operational phases will be directly and indirectly stimulated through the increased business sales that will result from the increased demand for the relevant building materials and supplies. These increased business sales will stimulate increased production of supplies to meet the demand.

Table 9.27 shows that alternatives 1, 2 and 3 will all have a positive impact on additional GGP during the operational phase of the Eden Regional Waste Disposal site and a neutral impact on the No-Go alternative.

Employment Creation and loss

Table 9.28 illustrates the impact that the Eden Regional Waste Disposal site will have on the creation and loss of employment within the local Mossel Bay municipal area, as well as the Eden District during the construction phase.

	Site 1	Site 2	Site 3	No-go option
Spatial extent/scale	Regional	Regional	Regional	Regional
Duration	Short term	Short term	Short term	Short term
Intensity	Medium	Medium	Medium	Medium
Probability	Highly probable	Highly probable	Highly probable	Probable
Status	Positive	Positive	Positive	Neutral
Confidence	High	High	High	High
Significance without mitigation	Medium	Medium	Medium	Low to very low
Significance with mitigation	Medium	Medium	Medium	Low to very low

Table 9.28: Impact on employment creation and loss during the Construction Phase

	Site 1	Site 2	Site 3	No-go option
Spatial extent/scale	Regional	Regional	Regional	Local
Duration	Long term	Long term	Long term	Medium term
Intensity	High	High	High	Medium
Probability	Highly probable	Highly probable	Highly probable	Probable
Status	Positive	Positive	Positive	Negative
Confidence	High	High	High	High
Significance without mitigation	High	High	High	Medium
Significance with mitigation	Very high	Very high	Very high	High

Table 9.29: Impact on employment creation and loss during the Operational Phase

Table 9.29 shows the impact the Waste Disposal site will have on employment creation and loss during the operational phase.

Table 9.28 shows that the construction of alternative 1, 2 and 3 will all have a positive impact on employment. While the No-Go alternative will have a neutral impact. **Table 9.29** shows that during the operations of the Eden Regional Waste Disposal site, alternative 1, 2 and 3 will all have a positive impact on employment, especially within the local municipal area of Mossel Bay and the No-Go alternative will have a negative impact.

The increased production (GGP) through the increased business sales will require additional labour to ensure the supply of materials and equipment meets the demand. This effect will result in the creation of new employment opportunities. During the construction phase employment will created on site in the form of construction related activities and development of the site. In addition new employment will be created within the businesses providing the relevant materials for construction through the stimulation of their business sales and the increased demand from the various construction activities. A number of new, permanent jobs will be provided for at the site itself, within the composting, Materials Recovery facility and the other undertakings of the site.

Investment expenditure

Table 9.30 shows the impact that the Eden Waste Disposal site will have on the local economy of the study area in relation to its effect on investment expenditure during the construction phase.

	Site 1	**Site 2**	**Site 3**	**No-go option**
Spatial extent/scale	Local	Local	Local	Local
Duration	Short term	Short term	Short term	Short term
Intensity	Medium	Medium	Medium	Medium
Probability	Probable	Probable	Probable	Probable
Status	Positive	Positive	Positive	Neutral
Confidence	High	High	High	High
Significance without mitigation	High	High	High	Medium
Significance with mitigation	High	High	High	Medium

Table 9.30: Impact on investment expenditure during the construction phase

	Site 1	**Site 2**	**Site 3**	**No-go option**
Spatial extent/scale	Regional	Regional	Regional	Local
Duration	Long term	Long term	Long term	Medium term
Intensity	Medium	Medium	Medium	Medium
Probability	Probable	Probable	Probable	Probable
Status	Positive	Positive	Positive	Neutral
Confidence	High	High	High	High
Significance without mitigation	Medium	Medium	Medium	Low to very low

Significance with mitigation	Very high	Very high	Very high	Very high

Table 9.31: Impact on investment expenditure during the operational phase

Table 9.30 shows that the construction of the Eden Regional Waste Disposal site will have a positive impact on investment expenditure in the local municipal area of Mossel Bay.

Table 9.31 shows that the operations of the facility will also have a positive impact on investment expenditure during the operational phase. The construction of the facility and the relevant composting and materials recovery facility will require an initial capital investment into the municipal area, as well as for the associated infrastructure. In addition a number of feasible opportunities will be created through the operations of the waste disposal site, such as waste transportation and collection as well as the establishment of recycling facilities within the other municipalities (George, Bitou, Knysna, Oudtshoorn and Hessequa). As the Waste Disposal site will be an Integrated Waste Management (IWM) site, a number of alternative uses of the waste will be encouraged and as such will provide a number of opportunities for potential entrepreneurs to capitalise on these alternate uses.

Property market

Table 9.32 shows the impact the waste disposal site will have on the value of property in the local market during the construction phase.

	Site 1	**Site 2**	**Site 3**	**No-go option**
Spatial extent/scale	Local	Local	Local	Local
Duration	Short term	Short term	Short term	Short term
Intensity	Low	Low	Low	Low
Probability	Highly Probable	Highly Probable	Highly Probable	Highly Probable
Status	Neutral	Neutral	Neutral	Neutral
Confidence	High	High	High	High
Significance without mitigation	Low to very low	Low to very low	Low to very low	No impact
Significance with mitigation	Low to very low	Low to very low	Low to very low	No impact

Table 9.32: Impact on property market during the construction phase

	Site 1	**Site 2**	**Site 3**	**No-go option**
Spatial extent/scale	Local	Local	Local	Local
Duration	Medium term	Medium term	Medium term	Medium term

Intensity	Low	Low	Low	Low
Probability	Highly Probable	Highly Probable	Highly Probable	Highly Probable
Status	Negative	Negative	Negative	Neutral
Confidence	High	High	High	High
Significance without mitigation	Low to very low	Low to very low	Low to very low	No impact
Significance with mitigation	No impact	No impact	No impact	No impact

Table 9.33: Impact on property market during operational phase

Table 9.32 shows that the construction of alternatives 1, 2 or 3 will have a neutral impact on the value of property in the local market, while

Table 9.33 shows that the operations of the waste disposal facility will have a negative impact on property values in the local market.

Odours and other nuisance vectors that will be generated by the operations of the site are the most likely to cause a negative impact on property values, however as the site is located some distance (> 5km) from the urban-edge of Mossel Bay and Dana Bay, these vectors are unlikely to cause a notable negative impact on property values. At each of the alternative sites the operations and construction of the site is unlikely to have an impact, however if such an impact does occur it will have a negative impact, however this will only be marginal.

<u>**Tourism and tourism industry**</u>

Table 9.34 illustrates the impact the Eden Regional Waste Disposal site will have on the local tourism economy of the study area in relation to facilitation of movement by tourists to the area during the construction phase.

	Site 1	**Site 2**	**Site 3**	**No-go option**
Spatial extent/scale	Local	Local	Local	Local
Duration	Medium term	Medium term	Medium term	Medium term
Intensity	Low	Low	Low	Low
Probability	Highly Probable	Highly Probable	Highly Probable	Highly Probable
Status	Negative	Negative	Negative	Neutral
Confidence	High	High	High	High
Significance without mitigation	Low to very low	Low to very low	Low to very low	No impact
Significance with mitigation	No impact	Low to very low	Low to very low	No impact

Table 9.34: Impact on tourism during the construction phase

	Site 1	Site 2	Site 3	No-go option
Spatial extent/scale	Local	Local	Local	Local
Duration	Medium term	Medium term	Medium term	Medium term
Intensity	Low	Low	Low	Low
Probability	Highly Probable	Highly Probable	Highly Probable	Highly Probable
Status	Negative	Negative	Negative	Neutral
Confidence	High	High	High	High
Significance without mitigation	Low to very low	Low to very low	Low to very low	No impact
Significance with mitigation	No impact	Low to very low	Low to very low	No impact

Table 9.35: Impact on tourism and tourism industry during operational phase

Table 9.34 shows that the construction of the waste disposal facility will have a neutral impact on tourist activities and attractions in the immediate area.
Table 9.35 shows that the operations of the site will have a negative impact on tourism in the region. The Garden Route (especially George to Plettenberg Bay) is renowned for its natural surroundings and environment, which plays a large role in the tourism market of the area. The required transportation of waste from the various municipal areas to the Waste disposal site may result in the escape of refuse from the trucks, which will affect the scenery of the environment, especially in regions such as Knysna, Wilderness and Sedgefield. Thus the operations of the waste disposal site are most likely to have a negative impact on the tourism industry. All landfill sites impact the surrounding environment (whether this be through leachate or windblown waste) and thus will impact tourism in the immediate area and as such will have a negative impact as the Mossel Bay and Dana Bay tourist markets rely heavily on the natural environment, both flora and fauna.

9.7.4 Cumulative Impacts

From a social perspective the main cumulative impacts foreseen for the site are the occurrence of the nuisance factors, especially windblown litter, odour and flies. At all three proposed sites this may pose a problem over time to the farmers on the surrounding land. Mitigation measures, most notably the erection of litter fences and the daily compaction of waste will reduce the impact of these factors. In addition the development will consist of 5 cells, which will be constructed every 5 years. Once a cell has reached the end of its life, it will be compacted and rehabilitation of the area will be undertaken. This will prevent the accumulation of negative impacts that may arise from the cell, which is not in use. Rehabilitation of the site needs to be undertaken effectively and properly in order to ensure that no new impacts arise which may have a social bearing or result in additional cost for the Eden Municipality.

9.7.5 Comparison of Alternatives

In order to limit the extent of the impact of nuisance factors on property values and tourist activities, the site should be located in an area where surrounding land uses complement the nature of the waste disposal site. Location of the landfill at site 1 (PetroSA), not only fits in with the industrial nature of the area, but is a complementing activity. In addition due to the industrial nature of the area, no tourist routes or activities that incorporate local flora and fauna, are located here and will thus have no economic bearing on tourism and tourist activities.

- All three alternative locations are situated at least 4-5km from the closest residential area and thus nuisance factors are unlikely to permeate to the surrounding communities and unlikely to have bearing on residential property.
- At alternative site 1, the PetroSA landfill can be found and although the new Eden Regional Waste disposal site will be significantly larger than the site currently used, the operations of the PetroSA landfill have no reported negative impacts on the surrounding communities with regards to health and safety and no reported impact on property values in either Mossel Bay or Dana Bay. It is thus purported that if the landfill were located at site 1 it will have no negative economic or social bearing on the surrounding communities.
- Land use and zoning of land on northern side of N2 (where PetroSA is located) has been zoned for agriculture and industrial. The industrial activities and pollutants, as well as the 5km of zoned agricultural land is too great a distance to impact communities and odours are unlikely to impact farming activities.
- Effective management of windblown litter needs to be assured, as the surrounding land uses at all three sites are used for agriculture. Litter has been highlighted by farmers in the area, as the main potential threat to their activities and may result in the death of livestock which will have an economic bearing on them. These also have the potential to result in the loss of employment on the farms, which will affect these households economically and socially.

<u>Additional New Business Sales</u>

It has been shown that all three alternatives that result in the construction of the waste disposal site (alternatives 1, 2 and 3) will have a positive impact on New Business Sales both in the local municipal area of Mossel Bay and the Eden District as a whole.

Alternatives 1, 2 and 3 will also have a positive impact on new business sales during the day-to-day operations of the plant and the No-Go alternative will have a neutral impact. Construction of the waste disposal facility will require building materials, supplies and labour, which is recommended by sourced from within the local (Mossel Bay) and regional (Eden District) economies. This will in turn stimulate demand for within the industries that manufacture and supply the required materials and services. This increased demand will result in increased sales not only for those businesses that will be directly involved in the construction phase, but also the suppliers and manufacturers whose sales will be increased through increased demand from those businesses that will be directly stimulated.

The “No-Go” alternative represents the opportunity cost if the Eden District Landfill does not go ahead. Currently the 3 other alternative sites (alternatives 1, 2 and 3) are used for agricultural purposes as a baseline for the land use on the sites. Depending on which site is ultimately decided upon the agricultural produce that would have been generated and the labour that such activities support will be forfeited for the landfill and vice versa represents the agricultural produce and labour that will is generated if the landfill is not undertaken.

The positive implications and dynamics of the operations of the Waste Disposal facility will be similar to those of the construction phase, however the extent and value of these positive effects will be less than the construction phase. As the operational implications will accumulate from year to year and the construction impact is a once off, the continued operations of the waste disposal site will have a far greater positive implication for business sales in the area.

Additional GGP

The construction of the waste disposal facility on Site alternatives 1, 2 and 3 will all have a positive impact on additional production (GGP). The extent of this additional production stimulation will be national as it is assumed that a number of the materials and processes that will be required for the construction of the plant will be sourced and manufactured outside the Eden District, due to the nature of this type of activity and the activities proposed to be undertaken at the site (composting, materials recovery facility etc). Where these materials can be sourced within the local economy of Mossel Bay and the Eden district it is recommended that they should be utilised to maximise the potential positive benefits of the waste disposal site to the local Mossel Bay municipal area. The “No-Go” alternative will have a neutral impact on additional GGP generation.

Additional GGP stimulation during both the construction and operational phases will be directly and indirectly stimulated through the increased business sales that will result from the increased demand for the relevant building materials and supplies. These increased business sales will stimulate increased production of supplies to meet the demand.

It has been found that Site alternatives 1, 2 and 3 will all have a positive impact on additional GGP during the operational phase of the Eden Regional Waste Disposal site and the No-Go alternative will have a neutral impact.

Employment creation and loss

The construction of the proposed waste disposal facility on Site alternatives 1, 2 or 3 will all have a positive impact on employment while the No-Go alternative will have a neutral impact. During the operations of the Eden Regional Waste Disposal site, alternative 1, 2 and 3 will all have a positive impact on employment, especially within the local municipal area of Mossel Bay and the No-Go alternative will have a negative impact.

The increased production (GGP) through the increased business sales will require additional labour to ensure the supply of materials and equipment meets the demand. This effect will result in the creation of new employment opportunities. During the construction phase employment will created on site in the form of construction related activities and development of the site. In addition new employment will be created within the businesses providing the relevant materials for construction through the stimulation of their business sales and the increased demand from the various construction activities.

A number of new, permanent jobs will be provided for at the site itself, within the composting, Materials Recovery facility and the other undertakings of the site.

Investment Expenditure

The construction of the waste disposal facility on Site alternatives 1, 2 and 3 will have a positive impact on investment expenditure in the local municipal area of Mossel Bay, while the “No-Go” will have a neutral impact.

The operation of the facility (alternatives 1, 2 and 3) will also have a positive impact on investment expenditure, while the “No-Go” alternative will have a neutral impact. The construction of the facility and the relevant composting and materials recovery facility will require an initial capital investment into the municipal area, as well as for the associated infrastructure. In additional number of feasible opportunities will be created through the operations of the waste disposal site, such as waste transportation and collection as well as the establishment of recycling plants within the other municipalities (George, Bitou, Knysna, Oudtshoorn and Hessequa). As the Waste Disposal site will be a Integrated Waste Management (IWM) site, a number of alternative uses of the waste will be encouraged and as such will provide a number of opportunities for potential entrepreneurs to capitalise on these alternate uses.

Property market

The construction of the waste disposal facility on Site alternatives 1, 2 and 3 will have a neutral impact on the value of property in the local market; while the “No-Go” alternative will have a neutral impact. The operation of the waste disposal facility (alternative 1, 2 and 3) will have a negative impact on property values in the local market, and as with the construction phase, the “No-Go” alternative will have a neutral impact.

Odours and other nuisance vectors that will be generated by the operations of the site are the most likely to cause a negative impact on property values, however as the site is located some urban-edge of Mossel Bay and Dana Bay, these vectors are unlikely to cause a notable negative on impact property values. At each of the alternative sites the operations and construction of the site is unlikely to have an impact, however if such an impact does occur it will have a negative impact, however this will only be marginal.

Toursim and Tourism Industry

The construction of the waste disposal facility on Site alternatives 1, 2 and 3 will will have a neutral impact on tourist activities and attractions in the immediate area, as well as the "No-Go" alternative.

The operation of the site (alternative 1, 2 and 3) will have a negative impact on tourism in the region, while the "No-Go" will have a neutral impact.

The Garden Route (especially George to Plettenberg Bay) is renowned for its natural surroundings and environment, which plays a large role in the tourism market of the area. The required transportation of waste from the various municipal areas to the Waste disposal site may result in the escape of refuse from the trucks, which will affect the scenery of the environment, especially in regions such as Knysna, Wilderness and Sedgefield. Thus the operations of the waste disposal site are most likely to have a negative impact on the tourism industry. All landfill sites impact the surrounding environment (whether this be through leachate or windblown waste) and thus will impact tourism in the immediate area and as such will have a negative impact as the Mossel Bay and Dana Bay tourist markets rely heavily on the natural environment, both flora and fauna.

The construction of the waste disposal facility on Site alternatives 1, 2 and 3 will have a positive impact within the local and regional economies, while the No-Go alternative (alternative 4) will have a neutral impact.

Although construction of the facility at alternatives 1, 2 or 3 will have the same overall impact, alternative 1 will have the least negative impact on the surrounding environment and iscomplementary to the surrounding land use activities (PetroSA facility located to east site).Thus it will not be a notable visible intrusion on the surrounding landscape. In addition, the primary access route (however not the only access route) to alternatives 2 and 3 is via the R327 to Herbertsdale, which runs past the Gondwana Game Reserves located to the north of the respective sites. As alternative 1 is located along the N2, waste that is lost during transportation will have a less adverse impact on tourist activities and the natural scenery and environment, than at alternatives 2 and 3 where such waste could make its way into the reserve and therefore impact tourist activities.

9.7.6 Recommended Mitigation Measures

Three main groups of impacts purported to result from the operation and construction of the landfill site, were identified. These main impacts are:

- Nuisance Impacts
- Potential Noise Impacts
- Potential social impacts (Economic opportunities, health and safety, traffic, economic aspects and agriculture.

Mitigation measures were recommended by the socio-economic specialist to maximise the positive impact that the landfill may have (socially and economically) and to reduce the extent of the negative impacts.

Nuisance impacts:

Nuisance impacts can be prevented or mitigated by implementing the following measures:

- Immediate compaction and daily covering of waste to reduce breeding of flies and rodents.
- Immediate compaction and daily covering of waste to prevent escape of windblown litter
- Litter screens will be implemented to prevent escape of waste
- Where possible cells will be aligned at right angles to prevailing wind directions
- Education and Communication of potential impacts to communities:
  This should involve workshops or information sessions to present and inform surrounding communities of the landfill waste disposal concept. This should include presenting and an explanation of the potential negative impacts that could result from the operations of the site, and how these may impact the surrounding communities socially (health and safety concerns) and economically (impact on property values and potential tourist activities). The opportunities that may result from the operations of the waste disposal site must also be communicated. This links with the municipalities Entrepreneurs Initiative and should encourage local communities to get more involved in the municipalities Waste Minimisation strategy.

Noise Impacts

Two main types of potential noise sources have been identified, that will result from the construction and operations of the Eden Regional Waste Disposal site. These impacts are; Noise created by heavy vehicles delivering waste; and noise created by heavy vehicles spreading and compacting waste

These noise impacts in connection with the nuisance impacts could impact property values in the surrounding communities, and at alternative site 2 and 3, the increased noise emanation from the increased use of the R327 by heavy trucks to deliver waste may have an impact on the sense of place, which is mainly used for agriculture and the Gondwana Nature Reserve are also located to the north of these sites. Thus the noise impacts could potentially impact tourist activities in the Herbertsdale area.

The noise impacts will only have a local impact within the Mossel Bay municipal area. Measures proposed to be taken to limit the extent of this impact by the Eden Municipality are:

- All equipment at the site will be fitted with the correct exhaust systems to minimise noise;
- Will be regularly maintained to limit noise; and

- The establishment of an appropriate buffer with regards to location of the site to the surrounding communities.
- Purchase/leasing of new waste disposal vehicles
  This links with the strategies of the Mossel Bay municipality to replace its ageing fleet, which experience a greater number of breakdowns and emanate a greater amount of noise. The standard of the delivery vehicles with regards to noise will have a greater impact at site 2 and 3, along the R327, which currently has a limited usage by heavy vehicles. Thus the increased use of the road to deliver the waste will significantly impact noise levels in the area and with an ageing, ill-maintained fleet will only accentuate this negative impact.
- Outsourcing of Waste Disposal Collection Service
  This links with municipalities' initiative regarding waste disposal collection and transportation. Two main services can be distinguished at this point; collection of waste from households to transfer station and the transport of waste from transfer station to landfill site. Through the outsourcing of these services the municipality will be promoting its Entrepreneurs initiative and will enable these individuals make use of this opportunity to provide a valuable, necessary service; increase the efficiency of the service; locate alternate sources of leasing the vehicles used for waste disposal; and create employment opportunities within the local economy.

Social impacts
Potential social impacts include the following:

- Local Economic Opportunities:
  A number of economic and employment opportunities will be created through the operations and construction of the Eden Regional Waste Disposal Site, in addition employment will be maintained within the other municipalities the site will cater for, such as recycling companies and outsourced waste collection services.
- Health and Safety:
  Health and safety concerns associated with the construction and operation of the Eden Regional Waste Disposal site will emanate from the nuisance factors (odours, flies, rodents and litter). The extent of these negative impacts can be reduced and will be reduced via the location of the site. With its location in the vicinity of the PetroSA site, which is some 9km from the urban edge of Mossel Bay, these nuisance factors are unlikely to raise health and safety concerns, however with ineffective management of the site this may become a notable problem to the surrounding land use activities and if located at site 1 may create a negative sense of place for natural areas to the west of the Mossel Bay and the site, with regards to tourism.
- Incompatible Land Use:

This involves location of the site in an area where it does not compliment the surrounding land use activities and thus may have a negative impact, such as locating the site adjacent to land used for residential purposes.

- Economic Aspects:
  This is in regards to the potential impact, both positive and negative, that the establishment and operations of the site may have on surrounding economic activities and economic prospects in the greater Mossel Bay area. It refers in particular to its potential impact on agricultural activities in the area, its potential impact on property values and tourism as the most notable negative impacts.
  However the operations of the landfill site, in particular the MRF and composting activities, will have a positive impact for local communities, from which complementing economic ventures and opportunities are available. The presence and availability of these opportunities tie in with the local municipalities drive and strategy to encourage entrepreneurship provision and enabling activities within the local region.
- Agriculture:
  This relates primarily to the vectors (odours, flies, rodents and litter). If these are not controlled effectively at the site these vectors may cause negative impacts for farming activities on the surrounding portions of land. The most notable negative impacts being
  - Reductions in produce sales
  - Reduction in quality of produce
  - Death and disease of livestock; and
  - Fires.
- Health and safety of the site users, employees, visitors and surrounding communities is the responsibility of the site operator. In accordance, health and safety reporting structures and procedures for the site must be drawn up according to the OHSA Act of 1993 and the legal policies of the Mossel Bay and Eden municipalities.
- Erection of fences to filter litter and prevent illegal entry into the site and erection of warning signs.
- Daily compacting of waste and litter to prevent prevalence of nuisance factors.
- Effective management of the site is essential.
- In relation to any economic opportunities, which may arise from the development of the landfill site, these as well as any employment opportunities should be sourced to and within the local economy of the Mossel Bay area. This will enable the benefits, which will arise from the development, to be maximised and to reduce the negative perceptions of landfill activities and construction. Waste disposal is regarded as essential service however landfill sites have the stigma of being nothing more than environmental hazards and social hindrances. A number of economic opportunities are however stimulated through these activities and if the bulk of these opportunities accrue within the

local economy (where any negative impacts are likely to felt the worst) positive benefits of waste disposal will greatly reduce the negative impacts which are experienced.

- The establishment of complementing waste disposal and recycling business ventures. Often waste disposed of at a landfill site can serve as inputs into a number of alternate business operations. An example stated in chapter 4 (waste disposal trends) of the company Wastewise is an example of how waste can be used to produce and manufacture usable goods, fit for resale into the market. This opportunity is made even more feasible by the Materials Recovery Facility, which sorts waste, keeping usable materials and disposing of unusable goods which are not sorted at its source. In addition, Mossdustria is located approximately 3 km from the site, which is an area zoned by the municipality for industrial use, this currently is standing vacant due to the lack of demand for industrial activities in the area. These include warehouses and existing facilities which can be used for the operations of these economic activities and as the landfill is located so close, reduces cost implications regarding transport and inputs into these production processes. Such activities are also labour intensive and require hands-on application, which will stimulate employment opportunities and will include the portion.
- Waste collection and transport from transfer stations is another opportunity, which exists from the landfill activities. In the municipal IDP it states the desire to outsource these activities to local entrepreneurs, which will also stimulate employment opportunities and ensure an effective and creative means of waste transportation and collection in the area.
- The disposal of garden refuse provides opportunities within the district for vermiculture or composting. This involves the use of specially bred earthworms to aerate the soil and convert organic matter into compost. Small-scale vermiculture farming has become increasingly popular of late as the advantages of this type of farming and its environmental benefits are becoming increasingly recognised. The end product of this type of farming is compost or liquid compost, which can be used for farming (providing a ready supply to the surrounding farmlands at the sites), landscaping, and making worm tea or for sale in the nationally economy. Materials for this type of farming are readily available at the site thus the cost implications for potential entrepreneurs and farmers is low.
- Education and full transparency of the sites operations need to be communicated to the local communities. This will enable local communities to have a full understanding of the potential negative and positive impacts of the site, which will allow potential business and entrepreneurial opportunities to be identified and capitalised on.
- In order to reduce the potential negative impact of nuisance vectors on the surrounding farming activities, a monitoring and regulation committee or initiative should be established whose responsibility will include monitoring the escape of litter into the neighbouring farmlands and assess the extent of this occurrence. In addition such a committee or activity could help identify new

methods or alternate methods to prevent the escape of wind blown litter and its impact on farming activities.

9.7.7 Conclusion

Evaluation criteria	Site 1	Site 2	Site 3	No-go option
New business sales	Positive	Positive	Positive	Neutral
Additional GGP	Positive	Positive	Positive	Neutral
Employment creation and loss	Positive	Positive	Positive	Neutral/negative
Investment expenditure	Positive	Positive	Positive	Neutral
Property markets	Negative	Negative	Negative	Neutral
Toursim and Tourist industry	Neutral/negative	Neutral/negative	Neutral/negative	Neutral
Overall impact	Positive	Positive	Positive	Neutral

Table 9.36: Synthesis

Table 9.36 shows that the construction of the Eden Regional Waste Disposal site at all three the proposed alternatives 1, 2 and 3 will have a positive impact within the local and regional economies, while the No-Go alternative (alternative 4) will have a neutral impact.

Although construction of the facility at alternatives 1, 2 or 3 will have the same overall impact, alternative 1 will have the least negative impact on the surrounding environment and is complementary to the surrounding land use activities (PetroSA facility located to east of site). Thus it will not be a notable visible intrusion on the surrounding landscape. In addition alternatives 2 and 3 can only be accessed via the R327 to Herbertsdale, which runs past the Gondwana Game Reserves located to the north of the respective sites. As alternative 1 is located along the N2, waste that may be lost during transportation will have a less adverse impact on tourist activities and the natural scenery and environment, than at alternatives 2 and 3 where such waste could make its way into the reserve and therefore impact tourist activities.

9.8 Visual Impact Assessment

9.8.1 Introduction

The Visual Impact Assessment was undertaken by SRK and has been attached as Appendix G. The information in this section has been obtained from the specialist visual impact assessment compiled by

SRK (2012). The Visual Impact Assessment assessed the following visual issues and potential impacts of the landfill at the various sites:

- Visibility of construction activities, such as vegetation clearing, stockpiling of removed material and construction material, machinery and dust generation; and
- Visibility of the landfill during operation, including additional cell construction, waste delivery and disposal and lighting.

9.8.2 Visual Impact Assessment Results

The magnitude or intensity of the overall visual impact that is expected to result from the proposed landfill at the alternative sites has been rated in Tables xx to xx. The magnitude (or intensity) of the visual impact of the existing landfill site is rated as low. This takes into account all mitigating measures, especially the berm, that is currently in place. The intensity of the proposed alternatives for a new landfill has been rated without mitigation measures in place. They rather reflect the visibility of the site itself. Site 1 is expected to have the lowest magnitude (or intensity) of overall visual impact, while the overall visual impact of the landfill on Sites 2 and 3 is expected to be higher. The intensity ratings derived in the tables below will feed into the impact assessment tables to inform the overall rating of the visual impacts of locating a landfill at each of the alternative sites.

Criteria	Descriptor	Impact magnitude/intensity
Visual quality	Low	Low
Visual exposure	Medium	Medium
Visibility	Highly visible(berm)/Not visible (landfill)	Low
Visual absorption capacity	Moderate	Medium
Visual integrity	High	Low
Viewer sensitivity	Low-moderate	Low
Overall magnitude	**N/A**	**low**

Table 9.37: Magnitude of overall visual impact: Existing landfill site at PetroSA.

Criteria	Descriptor	Impact magnitude/intensity
Visual quality	Low	Low
Visual exposure	High	High
Visibility	Visible-marginally visible	Medium
Visual absorption capacity	Moderate	Medium
Visual integrity	High	Low
Viewer sensitivity	Low-moderate	Low
Overall magnitude	**N/A**	**Medium**

Table 9.38: Magnitude of overall visual impact: Site 1.

Criteria	Descriptor	Impact magnitude/intensity
Visual quality	High	High
Visual exposure	Medium	Medium
Visibility	Visible-not visible	Low
Visual absorption capacity	Moderate	Medium
Visual integrity	Low	High
Viewer sensitivity	Low-moderate	Low
Overall magnitude	**N/A**	**High**

Table 9.39: Magnitude of overall visual impact: Site 2.

Criteria	Descriptor	Impact magnitude/intensity
Visual quality	Moderate	Medium
Visual exposure	Medium	Medium
Visibility	Visible-marginally visible	Medium
Visual absorption capacity	Low	High
Visual integrity	Low	High
Viewer sensitivity	Low-moderate	Low
Overall magnitude	**N/A**	**High**

Table 9.40: Magnitude of overall visual impact: Site 3.

Construction phase: Visual impacts

The construction phase is, for the purpose of this assessment, considered to comprise the activities undertaken to initially establish the landfill. The construction of subsequent cells, which it is assumed will be undertaken once the earlier cells start reaching capacity, is deemed to fall within the operational phase of the landfill.

Construction activities related to establishing the landfill include removal of vegetation, excavation of the initial landfill cells and establishment of any ancillary infrastructure that is required. Most of these activities will require the use of heavy machinery. Visual disturbances and scarring of the landscape during the construction phase are created by machinery moving on the site, the exposure of bare soil in an otherwise vegetated area following vegetation stripping, generation of dust (particularly as this is a dry region) and stockpiling of excavated material.

Source of Impact: Clearance and excavation of land and establishment of landfill infrastructure				
	Site 1	**Site 2**	**Site 3**	**No-go option**
Nature of impact	Visual disturbance of the landscape through vegetation removal, heavy machinery on site, dust generation and stockpiling of excavated material	Visual disturbance of the landscape through vegetation removal, heavy machinery on site, dust generation and stockpiling of excavated material	Visual disturbance of the landscape through vegetation removal, heavy machinery on site, dust generation and stockpiling of excavated material	N/A
Scale	Regional	Off-site	Regional	N/A
Duration	Medium term	Medium term	Medium term	N/A
Intensity	Medium	High	High	N/A
Probability	Highly probable	Highly probable	Highly probable	N/A
Status	Negative	Negative	Negative	N/A
Confidence	Low-medium	Low-medium	Low-medium	N/A
Significance without mitigation	Medium	Medium	High	N/A
Significance with mitigation	Low	Medium	Medium	N/A

Table 9.41: Visual impacts: Construction phase.

Operational phase: Visual impacts

The operational phase is, for the purpose of this assessment, considered to comprise all activities at the landfill after the facility's initial establishment, e.g. including construction of subsequent cells once the early cells reach capacity. A range of operational activities are expected to have a visual impact. These include:

- Construction of subsequent landfill cells, including removal of vegetation, excavation and preparation (e.g. lining) of the cells – This activity creates visual disturbances and scarring of the landscape through heavy machinery moving on the site, the visibility of exposed soil in an otherwise vegetated area following vegetation stripping, generation of dust (particularly as this is a dry region) and stockpiling of excavated material;
- Depositing waste in landfill cells – This activity creates visual disturbances in the landscape, as heavy machinery is moving on the site, delivering waste to the cells and compacting it. The waste cells will also be visually distinct from the surrounding areas in colour and composition.
- "Building" landfill cells - Depositing the waste alters the landscape by raising the ground level of the cell areas (whose size is unknown) to up to 12 m above current ground level, creating a visually intrusive entity;

- Lighting of the landfill – It is assumed that the landfill will only be very minimally lit at night; and
- Delivery of waste by trucks – It is assumed that waste will be delivered by trucks to the landfill. Trucks may have a visual impact, if they use roads that are less frequented by trucks at the moment and that are not paved (creating dust) and if litter gets blown off the trucks.

Source of Impact: Landfill cells and operational activities, including lighting.				
	Site 1	**Site 2**	**Site 3**	**No-go option**
Nature of impact	Visual disturbance of the landscape through visibility of fences, waste, heavy machinery and trucks, glow from lighting (at night)	Visual disturbance of the landscape through visibility of fences, waste, heavy machinery and trucks, glow from lighting (at night)	Visual disturbance of the landscape through visibility of fences, waste, heavy machinery and trucks, glow from lighting (at night)	Visual disturbance of the landscape through visibility of berm, waste, heavy machinery and trucks, glow from lighting (at night)
Scale	Regional	Regional	Regional	Off-site
Duration	Long term	Long term	Long term	Long term
Intensity	Medium	High	High	Low
Probability	Highly probable	Highly probable	Highly probable	Highly probable
Status	Negative	Negative	Negative	Negative
Confidence	Low-medium	Low-medium	Low-medium	High
Significance without mitigation	Medium	High	High	N/A
Significance with mitigation	Low	Medium	Medium	Low

Table 9.42: Visual impacts: Operational phase.

9.8.3 Cumulative Impacts

The visual character of the area has been significantly transformed since the arrival of the first settlers, mainly due to the establishment of agricultural and residential areas in the stretch between the coast and the mountain range. More recent industrial developments of a different visual character have taken place close to the N2 near the entrance to Mossel Bay, as described in Chapter 7. The proposed project continues the process of the visual transformation of this area, in that it introduces a potentially visually incongruent facility into the landscape. This is most pronounced for Sites 2 and 3, which are located in an agricultural or largely natural setting. As no other significant developments are located near those sites, the landfill would detract from the existing sense of place, but would not be part of a larger cumulative impact based on already existing or anticipated future developments at these sites. From a visual point of view, however, this means the activity will be more visible as the surrounding landscape is less able to absorb the new development and may thus be less desirable. At Site 1, the landfill would have a cumulative impact over and above that of existing industrial development. It may thus accelerate the process of transforming this area wholly from an agricultural to an industrial area. From a visual point of view, however, this means that the existing – visually compatible – activities are able to absorb the visual impact of the new landfill to some extent, which may be preferable. The landfill itself is not considered likely to trigger new future development in the area, which would further add to the cumulative impact, as it addresses an existing need for disposal of waste generated by the surrounding residential, commercial and industrial areas.

9.8.4 Comparison of Alternatives

Based on the above analysis, none of the three proposed sites are considered to have an outright fatal flaw from a visual perspective.

Due to the lower visual quality, moderate VAC, high visual integrity and lower viewer sensitivity of Site 1, which to some extent outweigh the higher visual exposure and visibility of the site, the visual impact of a landfill development on Site 1 is considered to have the lowest overall magnitude amongst the three proposed alternative sites. Coupled with the fact that certain operational activities at the landfill are expected to have a lower visual impact than at other sites, specifically lighting (as neighbouring facilities are already lit) and truck delivery of waste (as roads are paved and access is via existing busy routes), this site is considered to be the preferred location for the establishment of the regional landfill. The significance after mitigation of locating the landfill at Site 1 is expected to be similar to that of the existing landfill (which has effectively been rated with all existing mitigation in place). The overall magnitude of the visual impact of a landfill is expected to be higher at Sites 2 and 3 due to their higher visual quality, lower visual absorption capacity, lower visual integrity and higher viewer sensitivity relative to Site 1. In addition, certain operational activities at the landfill are expected to have a higher visual impact at these sites than at Site 1, specifically lighting (as the sites are located in largely undeveloped and unlit areas) and truck delivery of waste (as access roads to the sites are less busy at present and partly unpaved). Although not considered to be fatally flawed, these sites are deemed less suitable for the establishment of the proposed landfill than Site 1. Site 3 is marginally preferred over Site 2.

When compared to the existing landfill site at PetroSA the landfill is enclosed by a berm that effectively screens the activities inside from the public's view, with the exception of trucks driving to and on elevated parts in the landfill. The berm is of sufficient height, vegetated and has a relatively gentle slope and, as a result, effectively screens all activities and blends into the surrounding environment. It is expected that most people passing the site will hardly notice the berm, and, if they do, not associate it with a landfill, especially due to the multitude of other industrial activities taking place nearby. The effective mitigation measures that have been implemented results in the overall significance of the operation of the existing landfill being rated as low in terms of the visual impacts. The visual impact of the existing site serves as a baseline to compare the proposed new site with. The new site will have a larger footprint but as indicated by the visual impact assessment the overall significance of the visual impact may be reduced to low in the case of Site 1 (with effective mitigation measures in place). On Sites 2 and 3 the overall significanceof the visual impact may also be reduced with the required mitigation measures in place to a significance rating of medium.

9.8.5 Recommended Mitigation Measures

To minimize visual impacts identified and assessed in this study, mitigation measures were recommended that cover a range of aspects:

Screening:

Maintain and supplement natural vegetation on and along the borders of the site as far as possible to maintain existing and provide additional screening (in line with the requirements of the Mossel Bay Municipality SDF).

Create visual screens that hide the activities at the landfill from public view. Make these screens appear as natural as possible (e.g. by imitating slopes in the surrounding area in the case of berms and vegetating berms / fences).

- Plant screening structures with local indigenous species and grasses to minimize the need for irrigation and maintenance and maximise visual approximation to the naturally occurring landscape in the area.
- Position buildings and other infrastructure to maximise natural screening provided by topography.
- Plant additional vegetative screening around buildings and other infrastructure, where possible.

Site 1*:* Avoid the creation of a visible ‘gap’ between the PetroSA and Eskom facilities and the new landfill as far as possible, to maximise the screening and visual absorption effect of existing facilities.

Site 1: Create berms or other screening structures on the south-eastern and southwestern boundaries of the landfill, as these are the portions that will be most visible from the N2.

Site 2: Create berms or other screening structures on the eastern and southern boundaries of the landfill, as these are the portions that will be most visible from the surrounding landscape.

Site 3: Create berms or other screening structures on the north-eastern and southwestern boundaries of the landfill, as these are the portions that will be most visible from the surrounding landscape.

Site 2 and 3: Do not place any structures and buildings on the upper slopes or on ridge lines (in line with the requirements of the Mossel Bay Municipality SDF). The measures regarding the location of buildings, infrastructure and screening structures require consideration at the detailed design stage. The recommended maintenance of existing and planting of new screening vegetation requires special attention during construction and the subsequent periods until firm establishment of plants has been confirmed.

Lighting:

Keep all lighting to a minimum within the legal and operational requirements. Opt for low-level and shielded lighting to reduce light pollution. Minimum lighting requirements, positioning of lights and type of lighting should be considered and specified at the detailed design stage.

Integration into landscape:

- Use diamond wire mesh fencing in a natural colour (that blends in with the surroundings) around the site instead of palisade fencing or a solid wall, especially on Sites 2 and 3.
- Design and paint infrastructure such as buildings and security gates to blend into the landscape and any adjacent structures (in the case of Site 1).
- Construct new landfill cells only when the cells are needed (e.g. when operational cells reach capacity).
- Keep external signage to a minimum.

Detailed design and operational measures related to these mitigation measures need to be considered during the design stage and implemented particularly during construction.

Dust control:

- Control dust generation during the construction and operational stages of the landfill, e.g. by paving internal and external access roads and spraying water to wet sources of dust (such as stockpiles of excavated material, unpaved roads etc) when required by windy and dry weather conditions.
- Service waste trucks regularly and ensure speed limits are maintained at all times
- *Site 3:* Pave access roads to the landfill to avoid dust generation by trucks.

Wetting of dust generation sources is an ongoing requirement that needs to start as soon as the first construction activity is taking place and must be maintained throughout the operation of the landfill. Paving of roads must be considered and costed at the detailed design stage. As paving of access roads particularly for Site alternative 3 could be extensive, the cost thereof has to be specified and integrated into the overall consideration of the financial feasibility of locating the landfill at this site.

Litter control:

- Cover working faces of active waste cells each day to minimise the visual impact of the waste, prevent litter from being blown away by wind and minimise the attraction of birds.
- Install effective catching mechanisms or other management measures to prevent wind blown litter from leaving the immediate confines of the working (disposal) area.
- Regularly clear wind-blown litter that gathers along fencing.
- Cover all waste on the trucks.

Installations that are required to effect these mitigation measures need to be integrated into the design of the landfill. Management measures need to be implemented continuously throughout the operational life of the landfill.

Rehabilitation:

Prepare a rehabilitation plan before the site is developed to enable progressive rehabilitation during the operational lifespan of the site.

Rehabilitate full cells as soon as possible after closure to minimise the visual footprint and impact of the overall landfill. Use indigenous vegetation in the rehabilitation of closed cells.

All of the mitigation measures listed above should be integrated into an Environmental Management Plan that forms part and is a requirement of the approval of the development.

9.8.6 Conclusions

The visually preferred alternative is locating the landfill at Site 1, followed by Site 3, with Site 2 considered the least suitable. It is expected that visual impacts of establishing a landfill at Site 1 could be mitigated to be of low significance, while the significance of visual impacts at Sites 2 and 3 would remain medium after mitigation.

9.9 Archaeological Impact Assessment

9.9.1 Introduction

The Archaeological Assessment was undertaken by Jonathan Kaplan of the Agency for Cultural Resource Management and has been attached under Appendix G. The aim of the study is to locate and map archaeological occurrences that may be impacted by the proposed development, to assess the significance of the potential impacts, to nominate a suitable candidate site for development, and to propose measures to mitigate any archaeological impacts. Please also note as stated in the assumptions and limitation of this study, that the boundaries of the sites has been more precisely defined and some of the earlier fieldwork that had been done for this archaeological investigation and certain areas of the proposed site alternatives have not been searched for archaeological remains.

9.9.2 Archaeological Impact Assessment Results

Eden 1: Large numbers of Early Stone Age tools were documented in Eden 1. Middle Stone Age tools were also recorded, but these occur in much smaller numbers. A finely retouched Later Stone Age chalcedony blade was also found. The majority of tools are concentrated around a seasonal pan in the southern portion of the site. It is, however, estimated that more than 98% of the receiving environment has been transformed through many years of agricultural activities and as a result, many of the stone tools occur in a disturbed and compromised context.

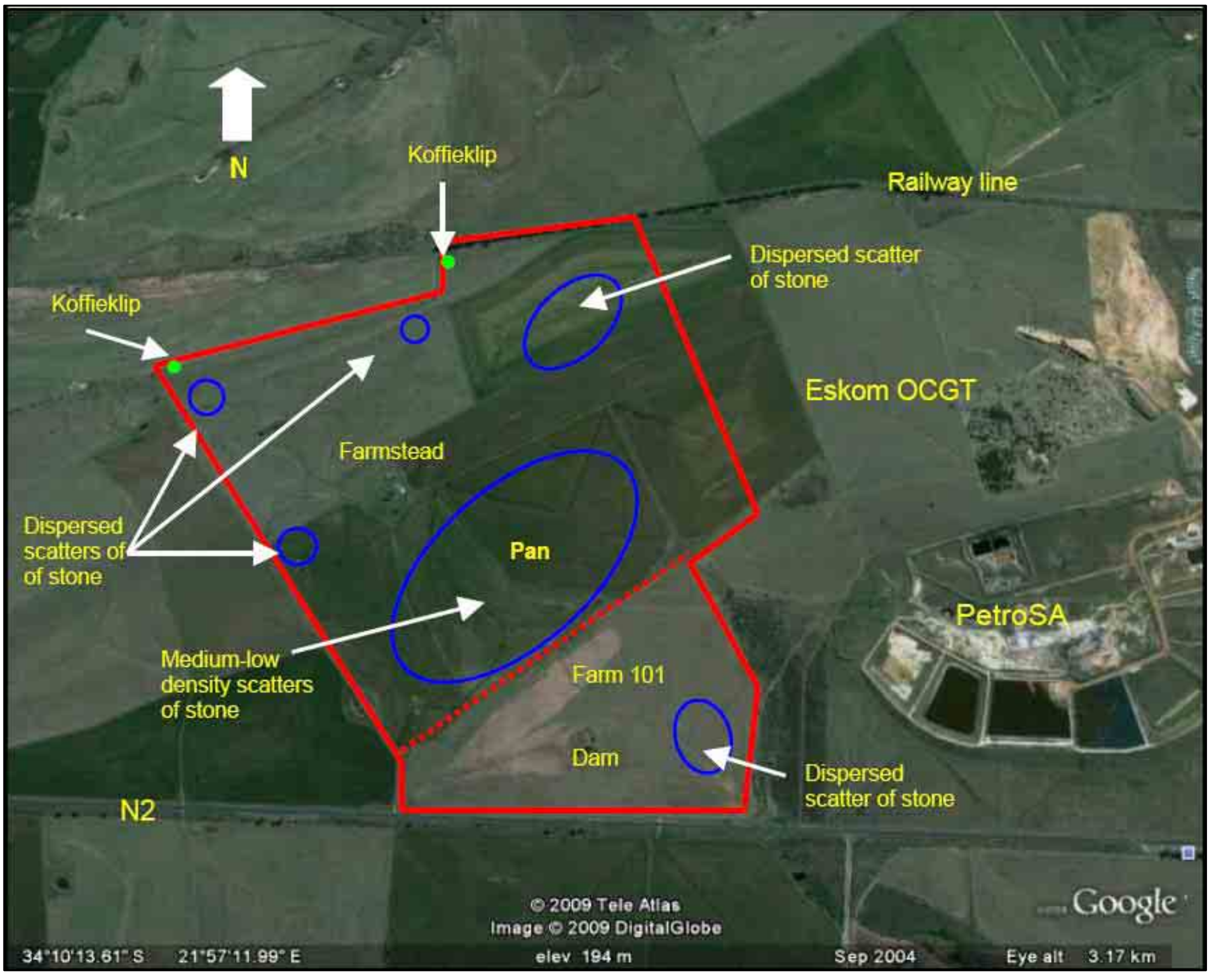

Figure 9.10: Aerial photograph of site 1 indicating archaeological resources present on the site.

Eden 2: Two Early Stone Age implements were found in Eden 2. The proposed site comprises old agricultural lands, much of which has reverted to natural veld. The southern portion is infested with alien vegetation, resulting in very low archaeological visibility.

It must be noted, however, that a new, larger site, situated to the east of the original proposed site, has since been identified for a regional waste disposal facility.

Eden 3: Mostly single, isolated and dispersed Middle Stone Age flake tools were documented in Eden 3. The majority of the tools occur in the higher lying eastern portion of the site, on west facing slopes. A few Early Stone Age tools were found, while no Later Stone Age tools were documented. It is estimated that more than 98% of the receiving environment has already been transformed through many years of ploughing (for cereal crops) and contouring, and the stone tools clearly occur in a disturbed context.

The Archaeological Impact Assessment has identified no significant impacts to pre-colonial archaeological material that will need to be mitigated in Eden 2, or Eden 3, prior to any proposed development activities. Although low density and dispersed scatters of artefacts were documented in

Eden 2, the remains occur in a highly disturbed context. The proposed construction of a regional landfill site at Eden 1 will likely impact negatively on large numbers of ESA tools centered, around a seasonal pan in the southern portion of the site. It is also possible that Early and Middle Stone Age tools, and possibly organic remains such as bone, shellfish and ostrich eggshell may be exposed below the surface during proposed construction activities.

Nature of the impact: Impact on archaeological remains	**With mitigation**	**Without mitigation**	**`No-Go' Option**
Scale	Local	Local	Local
Duration	Short term	Permanent	Permanent
Intensity	Low	High	Low
Probability	Improbable	Probable	Low
Significance	Low	Medium	Low
Confidence	Definite	Definite	N/A
Status of the impact	Positive	Negative	Potentially negative

Table 9.43. Archaeological impact assessment: Site 1

Nature of the impact: Impact on archaeological remains	**With mitigation**	**Without mitigation**	**`No-Go' Option**
Scale	Local	Local	Permanent
Duration	Permanent	Permanent	Low
Intensity	Low	Low	Low
Probability	Improbable	Improbable	Low
Significance	Low	Low	N/A
Confidence	Definite	Definite	Definite
Status of the impact	Neutral	Neutral	Neutral

Table 9.44. Archaeological impact assessment: Site 2

Impact on archaeological remains	**With mitigation**	**Without mitigation**	**`No-Go' Option**
Scale	Local	Local	Permanent
Duration	Permanent	Permanent	Low
Intensity	Low	Low	Low
Probability	Improbable	Improbable	Low
Significance	Low	Low	N/A
Confidence	Definite	Definite	Definite
Status of the impact	Neutral	Neutral	Neutral

Table 9.45. Archaeological impact assessment: Site 3

9.9.3 Cumulative Impacts

The potential cumulative impact of the proposed project on Eden 1 is rated as being high.

The potential cumulative impact of the proposed project on Eden 2 is rated as being low.

The potential cumulative impact of the proposed project on Eden 3 is rated as being low.

9.9.4 Comparison of Alternatives

Site 1: Despite the disturbed context in which they occur, the concentration of large numbers of stone implements around the remains of the old seasonal pan suggests some kind of focused human activity that might include, for example, the manufacture of stone implements, or the processing of hunted/scavenged game. As a result the archaeological remains in Eden 1 have been rated as having potentially medium-high significance.

Eden 2: The archaeological remains have been rated as having low significance.

Eden 3: The small numbers and the fact that all the tools occur in an isolated and disturbed context means that the archaeological remains have been rated as having low significance.

No-go option: The no-go option of the status quo landuse remaining unchanged for Site 1 would mean a potentially negative impact through the eventual loss of the potentially important archaeological remains centered round the seasonal pan. It can be argued that the proposed development of Eden will therefore have a positive impact, as it will allow for a more detailed study of the site, and the recovery of important information of the poorly understood Early Stone Age in southern Africa. Site 1 also has the potential to reveal important information of ESA tool making technologies and possibly subsistence activities as well. The No-Go option is therefore not supported for Site 1. There are no positive or negative impacts should Site 2 and 3 retain their agriculture landuse.

9.9.5 Recommended Mitigation Measures

With regard to the proposed identification and development of a regional waste disposal facility near Mossel Bay, the following recommendations are made.

Eden 1. Survey and mapping of the stone artefact scatters around the seasonal pan must be undertaken by a professional archaeologist who is also an Early Stone Age expert, after which the material could be collected for analysis and storage. No archaeological material may be disturbed or collected without a permit issued by Heritage Western Cape. Survey and mapping must be initiated prior to implementation of the proposed project and before any earthworks commence

Test excavations must also be undertaken around the seasonal pan in order to determine the presence/absence of sub-surface archaeological remains. Should significant sub-surface archaeological deposits be encountered, further excavations may be required. No excavations may be carried out without a permit issued by Heritage Western Cape. Trial excavations must be initiated prior to implementation of the proposed project.

Bulk earthworks and excavations must be monitored by a professional archaeologist. A monitoring plan must also be presented to Heritage Western Cape for approval.

Eden 2. The archaeological impact assessment has identified no significant impacts to pre-colonial archaeological material that will need to be mitigated prior to proposed development activities. Bulk earthworks and excavations must however be monitored by a professional archaeologist. A monitoring plan must also be presented to Heritage Western Cape for approval.

Eden 3. The archaeological impact assessment has identified no significant impacts to pre-colonial archaeological material that will need to be mitigated prior to proposed development activities. Bulk earthworks and excavations must however, be monitored by a professional archaeologist. A monitoring plan must also be presented to Heritage Western Cape for approval.

9.9.6 Conclusions

With regard to the proposed development of a regional waste disposal facility near Mossel Bay, the archaeological assessment has shown that each of the proposed candidate sites is suitable for development.

While the development of a regional landfill site at Eden 1 will possibly impact on potentially important archaeological remains centered around the seasonal pan, mitigation of these remains also presents opportunities for generating information for research, which otherwise might be lost due to ongoing ploughing, farming operations and clearing of stone from the affected lands. The Early Stone Age in southern Africa is quite elusive, given the antiquity of the time period involved, and any opportunity to better understand, and comprehend this period, should be seized. It is possible, for example, that with more detailed contextual and fine scale mapping and analysis of implements around the pan, activity areas (such as butchering/scavenging, and/or manufacturing areas), could potentially be identified. The fact that large numbers of cores occur on the site suggests that intensive flaking did take place.

Buried tools and organic remains such as bone may also be exposed during the deep excavations necessary for the development of large landfill site. Cut marks and modification of bone may also yield information on hunting/butchering and food processing techniques.

9.10 Palaeontological Impact Assessment

9.10.1 Introduction

The Palaeontological Impact Assessment was undertaken by Dr. John Almond and is attached under Appendix G. Full acknowledgement is given to Dr Almond for the information contained in this section. This specialist report provides an assessment of the observed or inferred fossil heritage within the study areas, with recommendations for specialist palaeontological mitigation where this is considered necessary.

9.10.2 Palaeontological Impact Assessment Results

Construction phase

Source of Impact: Excavation of potentially fossiliferous bedrocks and superficial sediments during preparation of initial cells to receive waste				
	Site 1	**Site 2**	**Site 3**	**No-go option**
Nature of impact	Destruction, disturbance or sealing-in of fossil heritage preserved within bedrocks and superficial sediments	Destruction, disturbance or sealing-in of fossil heritage preserved within bedrocks and superficial sediments	Destruction, disturbance or sealing-in of fossil heritage preserved within bedrocks and superficial sediments	N/A
Scale	Local	Local	Local	N/A
Duration	Permanent	Permanent	Permanent	N/A
Intensity	Low	Low	Low	N/A
Probability	Improbable	Improbable	Improbable	N/A
Status	Negative	Negative	Negative	N/A
Confidence	High	High	High	N/A
Significance without mitigation	No significance	No significance	No significance	N/A
Significance with mitigation	No significance	No significance	No significance	N/A

Table 9.46: Potential construction phase impacts on palaeontological resources: Destruction, disturbance or sealing-in of fossil heritage preserved within bedrocks and superficial sediments.

Source of Impact: Excavation of potentially fossiliferous bedrocks and superficial sediments during preparation of initial cells to receive waste				
	Site 1	**Site 2**	**Site 3**	**No-go option**
Nature of impact	Previously buried fossils are exposed and made available for scientific recording / collection	Previously buried fossils are exposed and made available for scientific recording / collection	Previously buried fossils are exposed and made available for scientific recording / collection	N/A
Scale	Local	Local	Local	N/A
Duration	Permanent	Permanent	Permanent	N/A
Intensity	Low	Low	Low	N/A
Probability	Improbable	Improbable	Improbable	N/A
Status	Positive	Positive	Positive	N/A

Confidence	High	High	High	N/A
Significance without mitigation	Low significance	Low significance	Low significance	N/A
Significance with mitigation	No significance	No significance	No significance	N/A

Table 9.47: Potential construction phase impacts on palaeontological resources: Excavation of potentially fossiliferous bedrocks and superficial sediments.

Operational phase

Source of Impact: Further excavation of potentially fossiliferous bedrocks and superficial sediments to prepare new cells to receive waste				
	Site 1	**Site 2**	**Site 3**	**No-go option**
Nature of impact	Destruction, disturbance or sealing-in of fossil heritage preserved within bedrocks and superficial sediments	Destruction, disturbance or sealing-in of fossil heritage preserved within bedrocks and superficial sediments	Destruction, disturbance or sealing-in of fossil heritage preserved within bedrocks and superficial sediments	N/A
Scale	Local	Local	Local	N/A
Duration	Permanent	Permanent	Permanent	N/A
Intensity	Low	Low	Low	N/A
Probability	Improbable	Improbable	Improbable	N/A
Status	Negative	Negative	Negative	N/A
Confidence	High	High	High	N/A
Significance without mitigation	No significance	No significance	No significance	N/A
Significance with mitigation	No significance	No significance	No significance	N/A

Table 9.48: Potential Operational phase impacts on palaeontological resources: Destruction, disturbance or sealing-in of fossil heritage preserved within bedrocks and superficial sediments

Source of Impact: Further excavation of potentially fossiliferous bedrocks and superficial sediments to prepare new cells to receive waste				
	Site 1	**Site 2**	**Site 3**	**No-go option**
Nature of impact	Previously buried fossils are exposed and made available for scientific recording /	Previously buried fossils are exposed and made available for scientific recording /	Previously buried fossils are exposed and made available for scientific recording /	N/A

	collection	collection	collection	
Scale	Local	Local	Local	N/A
Duration	Permanent	Permanent	Permanent	N/A
Intensity	Low	Low	Low	N/A
Probability	Improbable	Improbable	Improbable	N/A
Status	Positive	Positive	Positive	N/A
Confidence	High	High	High	N/A
Significance without mitigation	Low significance	Low significance	Low significance	N/A
Significance with mitigation	No significance	No significance	No significance	N/A

Table 9.49: Potential Operational phase impacts on palaeontological resources: Previously buried fossils are exposed and made available for scientific recording / collection.

The specialist indicated that the no-go option will result in a negative impact in the sense that there will be no opportunityfor new palaeontological discoveries. The significance of this impact was indicated as low.

The construction and operational phases of the Eden District Municipality Regional Waste Disposal Site or Sites will entail successive, substantial excavations into the superficial sediment cover as well as the underlying bedrock to a depth of 6m below the natural ground level and over an area of some 200 hectares. Smaller volumes of bedrock will be excavated or sealed-in by construction of ancillary infrastructure such as roads, storm water pipelines, a leachate storage dam, a contaminated storm water dam, offices, a possible laboratory, a weighbridge and security infrastructure. All these developments may adversely affect potential fossil heritage within the study site by destroying, disturbing or permanently sealing-in fossils that are then no longer available for scientific research or other public good.

The expected impacts will only affect local palaeontological heritage and will be of low intensity since similar fossils are expected to occur within the fossiliferous rock units concerned (*e.g.* formations) both elsewhere within the study areas as well as over an extensive outcrop area outside. Losses of fossil heritage to development are generally, but not invariably, permanent; the deep excavations involved here will probably destroy near-surface fossil material. However, the rock units concerned at all three sites are either generally of low palaeontological sensitivity with sparse, low-diversity fossil assemblages (*e.g.* alluvium, silcretes, gravels, soils), or their once-rich fossil heritage has been largely obliterated by tectonic deformation such as cleavage development and by deep chemical weathering (*e.g.* Bokkeveld Group). Significant impacts on fossil heritage at any of the sites under consideration are improbable. Levels of confidence for this impact assessment are high since it is based on reliable, detailed geological maps (1: 50 000 scale) and the author's recent field experience of the study region.

It is concluded that, even without mitigation, impacts of the proposed waste disposal site or sites on local fossil heritage are not significant.

Should substantial fossil assemblages be exposed during excavation, they would contribute usefully to our limited knowledge of fossil heritage on the southern coastal plain. Provided that mitigation is followed through under these (albeit unlikely) circumstances, the exposure of previously unknown fossil heritage during construction and / or operation of the waste disposal site(s) would constitute a *positive* impact of this development. Failure to mitigate previously unknown fossil heritage exposed by development would constitute a negative impact of low significance. The no-go option (no waste disposal site) would not threaten local fossil heritage but would also forgo the opportunity for palaeontologists to record and sample previous buried fossil remains.

9.10.3 Cumulative Impacts

No cumulative impacts have been identified by the specialist.

9.10.4 Comparison of Alternatives

All three candidate sites for the Eden District Municipality Regional Waste Disposal Site or Sites are considered to be of *low to very low* palaeontological sensitivity.

The superficial soils at **Study Site 1** are of low palaeontological sensitivity. Fossil remains within Tertiary gravels or silcretes that might underlie these soils are likewise very sparse. The same applies to any Bokkeveld or Table Mountain Group mudrocks at depth, which are likely to be highly weathered, cleaved and essentially unfossiliferous. The significance of impacts of the proposed Eden Regional Waste Disposal Site on palaeontological heritage at Study Site 1 is consequently *very low*.

The Palaeozoic bedrocks of the Bokkeveld Group as well as the Tertiary to Quaternary drift deposits (*e.g.* Tertiary terrace gravels, silcretes) at **Study Site 2** are of low palaeontological sensitivity, based on a review of the literature as well as field studies in the area. The inferred significance of impacts of the proposed Eden Regional Waste Disposal Site on palaeontological heritage at Study Site 2 is consequently *low*.

Given the low expectation of well-preserved fossils within the highly-weathered and pervasively-cleaved sediments of the Bokkeveld Group in the **Study Site 3** region, as well as any superficial deposits (*e.g.* alluvium, soils) in the area, the inferred significance of impacts of the proposed Eden Regional Waste Disposal Site on palaeontological heritage at Study Site 3 is *low*.

The no-go option (no waste disposal site) would not threaten local fossil heritage but would also forgo the opportunity for palaeontologists to record and sample previous buried fossil remains.

9.10.5 Recommended Mitigation Measures

Since the proposed development does not entail significant impacts on fossil heritage, no specialist mitigation measures are necessary here.

Should any substantial fossil remains (*e.g.* concentrations of fossil shells, wood, vertebrate remains) be exposed during excavations at the waste disposal site, the responsible ECO should safeguard these, preferably *in situ*, and alert Heritage Western Cape as soon as possible so that appropriate mitigation measures may be considered and implemented. Mitigation in the form of fossil recording and judicious sampling by a professional palaeontologist will have a positive impact on our appreciation of local fossil heritage. This recommendation should be incorporated into the EMP for this development.

9.10.6 Conclusions

It is concluded that the proposed development does not pose a significant threat to local fossil heritage, irrespective of which site or sites are chosen, since all the rock units directly affected by excavations and ancillary infrastructure for the waste disposal site are of low to very low palaeontological sensitivity. Professional palaeontological mitigation is therefore not necessary for this project. In terms of fossil heritage conservation, there is very little to choose between the three candidate sites, with a slight preference for Study Site 1, which has the lowest inferred palaeontological sensitivity.
No moderately or highly significant impacts on fossil heritage are expected at any of the three sites, and there are no fatal flaws precluding consideration of any of the alternative sites for the proposed waste disposal project.

9.11 Heritage Impact Assessment

9.11.1 Introduction

The Heritage Impact Assessment was undertaken by Ron Martin of Ron Martin Heritage Consultancy and has been attached under Appendix G. Full acknowledgement is given to Ron Martin Heritage Consultancy for the information contained in this section.

The purpose of this report is to assist the competent authorities in making a decision as to:

- whether the development of the landfill site may proceed as proposed; or
- whether the sites have sufficient intrinsic heritage value to warrant their retention in their present undeveloped state.

9.11.2 Heritage Impact Assessment Results

The heritage indicators applicable to this application are summarized as follows:

Aesthetic/Architectural significance

Eden 1 has medium to low architectural/aesthetic value, especially when viewed from the N2. The landscape within a ± 6km radius comprises a severely altered one, with industrial developments having taken place immediately to the east of the proposed site. These include the PetroSA waste disposal site, Eskom's Open Cycle Gas Turbine (OCGT) Power Plant, the PetroSA facility and the Mossdustria Industrial Area. These developments are clearly visible from the N2 and the R327, giving this area north of the N2 a strongly industrial visual character.

The modern farmstead is proposed for demolition. In addition, two 400 kV transmission lines run from PetroSA to the Proteus substation, past the northern boundary of Site 1. The Kleinberg-Mossdustria railway line is located on the northern boundary of the site, partly shielded by a row of alien Eucalyptus trees growing alongside it.

Eden 2 has medium aesthetic significance. The site is used for grazing but retains significant stands of original fynbos vegetation. The site also offers scenic views in all directions, particularly to the south where the landscape, characterised by low hills and shallow valleys are used for grazing and wheat cultivation. Distracting from this scenic character, however, are two 400 kV transmission lines that cross the site and are highly visible as the lines traverse the landscape from the PetroSA site towards the Proteus substation (which is not visible from the site). Other large power lines can be seen in the background towards the east and west of the site.

Eden 3 has medium to low aesthetic significance and comprises undulating, hilly farmland. It is estimated that more than 99% of the proposed site comprises agricultural lands that have been intensively ploughed and contoured over many years, for the production of wheat and cereal crops. There is effectively no natural vegetation or any significant landscape features on the proposed site. Several small farm dams occur just outside the western boundary of the site. The same Eskom powerline and servitude as occurs on Eden 2 cuts across the property in the southern portion. Surrounding land use comprises agricultural lands (Ron Martin Heritage Consultancy, 2012).

Historical significance

The historical significance of the three proposed sites are all linked to the history of agricultural development in the immediate area, therefore of some local heritage significance (Ron Martin Heritage Consultancy, 2012). The much-altered and modernised farmstead on Eden 1 is said to have housed the regional post office at some point (Kaplan, 2009b).

Scientific/Technological significance

The scientific or technological significance of the three sites relate to the result of the Archaeological Impact Assessment as reported on in paragraph 9.9 of this EIR. Site inspections coupled with available documentary evidence has revealed no instances of historic irrigation watercourses/furrows on the sites (Ron Martin Heritage Consultancy, 2012).

Social/Spiritual/Linguistic Significance

The general area has a strong association with the Outeniqua and Gouriqua tribes of the Khoi-khoi who occupied the area pre-1652. The descendants of these tribal peoples still thrive in the area.

HWC had indicated in previous related cases that significance related to tribal peoples are not important and they would not support any memorialisation or similar celebration of said significance (Ron Martin Heritage Consultancy, 2012).

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Cultural Landscape as an indicator

The sites collectively form part of a landscape that qualifies as a “cultural landscape” in accordance with both categories 1 & 2, as per definition, in that it represents a landscape that resulted from a deliberate intervention by man (agricultural and industrial activity) influenced by the elements of nature. It can be more specifically defined as being a “continuing” cultural landscape, still in its process of evolution/layering. The significance of this value as an indicator can be considered to be **low**, in that it only partially defines a cross-section of heritage indicators associated with it, including visual, socio-historical (agricultural) and scientific (archaeological). No mitigation measures are specifically proposed in terms of this indicator.

Archaeological significance

The Archaeological Impact Assessment by Agency of Cultural resource Management concluded that there are no significant impacts to pre-colonial archaeological material that will need to be mitigated in Eden 2, or Eden 3, prior to any proposed development activities. Although low density and dispersed scatters of artifacts were documented in Eden 2, the remains occur in a highly disturbed context.

Recommendation by Heritage impact practitioner:

The recommendations/mitigation measures that are included in the Archaeological Impact Assessment were proposed and are also described under paragraph 9.9.

The proposed construction of a regional landfill site at Eden1 will likely impact negatively on large numbers of ESA tools centered, around a seasonal pan in the southern portion of the site. It is also possible that Early and Middle Stone Age tools, and possibly organic remains such as bone, shellfish and ostrich eggshell may be exposed below the surface during proposed construction activities.

Visual impact

The Heritage impact assessment practitioner included the findings and recommendations of the visual impact assessment as described under paragraph 9.8 in his report. It was indicated that the visually preferred alternative is Site 1.

9.11.3 Cumulative Impacts

No cumulative impacts were identified by the specialist. Please however refer to the cumulative impacts identified by the Archaeological Impact Assessment and the Visual Impact Assessment.

9.11.4 Comparison of Alternatives

The Heritage Impact Assessment concluded that the overall heritage significance of the three sites is low and that the proposed development of a regional landfill facility may proceed on any of the sites. However, the visually preferred alternative is locating the landfill at Eden 1, followed by Eden 2, with Eden 3 considered the least suitable. It is expected that visual impacts of establishing a landfill at Eden 1 could be mitigated to be of low significance, while the significance of visual impacts at Eden 2 and 3 would remain medium after mitigation.

9.11.5 Recommended Mitigation Measures

Specific recommendations as per the specialist studies annexed hereto are as follows:

Eden 1

- Survey and mapping of the stone artifact scatters around the seasonal pan in Eden 1 must be undertaken by a professional archaeologist who is also an Early Stone Age (ESA) expert, after which the material may be collected for analysis and storage. No archaeological material may be collected without a permit issued by Heritage Western Cape. Survey and mapping must be initiated prior to implementation of the proposed project and before any earthworks commence.
- Trial excavations must be undertaken around the seasonal pan in order to determine the presence/absence of below ground archaeological occurrences. No excavations may be carried out without a permit issued by Heritage Western Cape.
- Bulk earthworks and excavations must be monitored by a professional archaeologist. A monitoring plan must also be presented to Heritage Western Cape for approval.

Eden 2

The archaeological impact assessment has identified no significant impacts to pre-colonial archaeological material that will need to be mitigated prior to proposed development activities.

- Bulk earthworks and excavations must however be monitored by a professional archaeologist. A monitoring plan must also be presented to Heritage Western Cape for approval.

Eden 3

The archaeological impact assessment has identified no significant impacts to pre-colonial archaeological material that will need to be mitigated prior to proposed development activities.

- Bulk earthworks and excavations must however, be monitored by a professional archaeologist. A monitoring plan must also be presented to Heritage Western Cape for approval.

Specific mitigation measures as recommended by the VIA and included in the Heritage Impact Assessment are listed below.

Screening:

- Maintain and supplement natural vegetation on and along the borders of the site as far as possible to maintain existing and provide additional screening (in line with the requirements of the Mossel Bay Municipality SDF).
- Create visual screens that hide the activities at the landfill from public view. Make these screens appear as natural as possible (e.g. by imitating slopes in the surrounding area in the case of berms and vegetating berms / fences).
- Plant screening structures with local indigenous species and grasses to minimize the need for irrigation and maintenance and maximise visual approximation to the naturally occurring landscape in the area.
- Position buildings and other infrastructure to maximise natural screening provided by topography.
- Plant additional vegetative screening around buildings and other infrastructure, where possible.
- *Eden 1:* Avoid the creation of a visible 'gap' between the PetroSA and Eskom facilities and the new landfill as far as possible, to maximise the screening and visual absorption effect of existing facilities.
- *Eden 1:* Create berms or other screening structures on the south-eastern and south-western boundaries of the landfill, as these are the portions that will be most visible from the N2.
- *Eden 2:* Create berms or other screening structures on the eastern and southern boundaries of the landfill, as these are the portions that will be most visible from the surrounding landscape.
- *Eden 3:* Create berms or other screening structures on the north-eastern and south-western boundaries of the landfill, as these are the portions that will be most visible from the surrounding landscape.
- *Eden 2 and 3:* Do not place any structures and buildings on the upper slopes or on ridge lines (in line with the requirements of the Mossel Bay Municipality SDF).

The measures regarding the location of buildings, infrastructure and screening structures require consideration at the detailed design stage. The recommended maintenance of existing and planting of new screening vegetation requires special attention during construction and the subsequent periods until firm establishment of plants has been confirmed.

Lighting:

- Keep all lighting to a minimum within the legal and operational requirements. Opt for low-level and shielded lighting to reduce light pollution.

Minimum lighting requirements, positioning of lights and type of lighting should be considered and specified at the detailed design stage.

Integration into landscape:

- Use diamond wire mesh fencing in a natural colour (that blends in with the surroundings) around the site instead of palisade fencing or a solid wall, especially on Eden 2 and 3.
- Design and paint infrastructure such as buildings and security gates to blend into the landscape and any adjacent structures (in the case of Eden 1).
- Construct new landfill cells only when it is needed (e.g. when operational cells reach capacity).
- Keep external signage to a minimum.

Detailed design and operational measures related to these mitigation measures need to be considered during the design stage and implemented particularly during construction.

Dust control:

- Control dust generation during the construction and operational stages of the landfill, e.g. by paving internal and external access roads and spraying water to wet sources of dust (such as stockpiles of excavated material, unpaved roads etc.) when required by windy and dry weather conditions.
- Service waste trucks regularly and ensure speed limits are maintained at all times
- *Eden 3:* Pave access roads to the landfill to avoid dust generation by trucks.

Wetting of dust generation sources is an ongoing requirement that needs to start as soon as the first construction activity is taking place and must be maintained throughout the operation of the landfill.

Paving of roads must be considered and costed at the detailed design stage. As paving of access roads particularly for Eden 3 could be extensive, the cost thereof has to be specified and integrated into the overall consideration of the financial feasibility of locating the landfill at this site.

Litter control:

- Cover working faces of active waste cells each day to minimise the visual impact of the waste, prevent litter from being blown away by wind and minimise the attraction of birds.
- Install effective catching mechanisms or other management measures to prevent windblown litter from leaving the immediate confines of the working (disposal) area
- Regularly clear wind-blown litter that gathers along fencing.
- Cover all waste on the trucks.

Installations that are required to affect these mitigation measures need to be integrated into the design of the landfill. Management measures need to be implemented continuously throughout the operational life of the landfill.

Rehabilitation:

- Prepare a rehabilitation plan before the site is developed to enable progressive rehabilitation during the operational lifespan of the site.

- Rehabilitate full cells as soon as possible after closure to minimise the visual footprint and impact of the overall landfill. Use indigenous vegetation in the rehabilitation of closed cells.

All of the mitigation measures listed above should be integrated into an Environmental Management Plan that forms part and is a requirement of the approval of the development.

9.11.6 Conclusions

The Heritage Impact Assessment concluded that the overall heritage significance of the three sites is low and that the proposed development of a regional landfill facility may proceed on any of the sites. However, the visually preferred alternative is locating the landfill at Eden 1, followed by Eden 2, with Eden 3 considered the least suitable. It is expected that visual impacts of establishing a landfill at Eden 1 could be mitigated to be of low significance, while the significance of visual impacts at Eden 2 and 3 would remain medium after mitigation.

The Heritage Impact Assessment practitioner therefore proposed that the development of the proposed regional landfill facility is located on site alternative Eden 1, provided that the mitigation measures and other recommendations as underpinned by the heritage indicators are applied.

Consequently, the Heritage Impact Assessment report concluded:

That Heritage Western Cape (HWC) can endorse this report as having satisfied the requirements of the National Heritage Resources Act (NHRA): Section 38(3)(a)(b)(c)(d)(e)(f) and (g).

9.12 Traffic Impact Assessment

9.12.1 Introduction

The Traffic Impact Assessment was undertaken by Liezl du Plooy of iCE Group (Pty) Ltd and has been attached as Appendix G. The Traffic Impact Assessment addresses potential impacts on trip generation and distribution, traffic impact, impact on road pavements and road safety and geometry.

9.12.2 Traffic Impact Assessment Results

No-go Alternative

The traffic impact of No-go option will be brought about by the natural growth in background traffic and the increased number of trips resulting from annual increases in waste volumes. The only other new traffic will be new trips from the Bitou municipal area.

The SANRAL traffic counts indicate that there was a 0% growth in off-season traffic volumes on the N2 between 2003 and 2008, but a 1% annual growth in traffic was allowed in order to obtain a conservative 2020 background traffic volume estimate. Jan Palm Consulting Engineers, who are assisting PDNA with the landfill site design and the calculation of waste volumes, indicated that an annual waste volume growth rate of 4,3% per annum was used in their calculations.

The expected 2020 background traffic volumes were analysed by means of the SIDRA computer program. The analysis indicates that the nearby intersections on the N2 will continue to function at acceptable service levels up to 2020. Peak hour trips generated by No-go option are negligible when compared to the background traffic volumes on the N2

It can be concluded that the increased number of trips generated by No-go option will have a negligible traffic impact. In the case of No-go option, only the N2 will be affected by additional loads. Based on the information gathered from the various municipalities, it was calculated that approximately 527 tons of waste is currently being transported to the PetroSA Landfill site on a daily basis. This volume will increase to approximately 960 tons by the year 2020. The N2 has been designed to carry heavy vehicles, and the existing pavement structure is therefore sufficient to carry the waste disposal vehicles. The additional number of E80 axle loads will, however, expedite the deterioration of the N2's structure. Based on the percentage increase in the number of axle loads, it is estimated that the increased operations at the PetroSA Landfill site (No-go option) will reduce that section of the N2's life by 7,5%.

It can be concluded that the addition of new waste loads as per No-go option will have a moderate impact on the pavement lifetime of the N2 east of the PetroSA landfill site. The access to the PetroSA landfill site is safe in terms of geometric design and sight distance. The additional trips generated by No-go option are expected to have a negligible impact on road safety. The PetroSA Landfill access has been designed according to SANRAL's standards and no geometric improvements will be required for No-go option.

Site 1:

The site for Alternative 1 is located directly adjacent to the PetroSA Landfill site. If developed, Site 1 will obtain access from the N2 via the extension of the existing PetroSA Landfill access road. For Alternative 1, as for No-go option, additional trips will be contributed by a natural growth in waste volumes and the addition of trips from the Bitou municipal area. Most new trips will originate from the west, with only a small number of trips from Gouritsmond coming from the east. The same assumptions that were made for the traffic impact of No-go option will be valid for Alternative 1. The number of new AM peak hour trips by 2020 will be 1, and the number of additional PM peak hour trips will be 3. During the summer holiday period 2 new trips will be added in the morning and 5 new trips will be added during the afternoon peak hour.

It can be concluded that Alternative 1 will have a negligible traffic impact due to very low trip generation during the morning and afternoon peak hours.

Alternative 1 will have the same impact as No-go option, which means that Alternative 1 will add approximately 110 new daily E80 axle loads onto the N2.

The addition of new waste loads as per Alternative 1 will have a moderate impact on the pavement lifetime of the N2 east of the PetroSA landfill site.

Alternative 1 will have the same access as the No-go option. The turning lanes and acceleration lane on the N2 at the PetroSA Landfill access are sufficient to accommodate additional trips generated by Alternative 1 and traffic safety will therefore not be compromised. No geometric improvements will be required.

Site 2:

Access to the farm where Alternative 2 is situated is currently taken off Main Road 342 (R327), but due to the steep gradient from Main Road 342 to the proposed landfill site, this access road will not be suitable for the heavy vehicles transporting waste. Eden District Municipality has proposed that an alternative access to this site should be provided off Divisional Road 1549, where the gradient is flatter.

Alternative 2 will attract both existing year 2010 waste trips and the expected future trips generated by a growth in waste volumes and the addition of Bitou trips, as well as waste trips generated by PetroSA. This means that approximately 70 daily two-way trips will be made to Site 2 by 2020.

The east: west trip distribution ratio will remain the same, but traffic will have to travel along a new route. Traffic from the east will now continue along the N2 to the Divisional Road (DR) 1549 (Kleinberg Station) turnoff and from there northwards along DR 1549 to Site 2. For trips to and from the west, this route will be approximately 11 kilometres longer than the route to Site 1. The trip to Site 2 will be approximately 5 kilometres longer for trips from the east.

Site 3:

Alternative 3 will attract the same number of trips as Alternative 2, which is approximately 70 daily two-way trips by the year 2020. The shortest access route to Alternative 3 is via Divisional Road 1549 (also gravel) as for Site 2, but then the access road to the site will traverse a large section of privately owned land. This route measures approximately 15 kilometres from the Alternative 1 site. This is the preferred route in terms of distance.

One alternative route is via the N2 to Main Road 341 (Cooper Station turnoff) and from there in a northbound direction to the proposed site. This route measures approximately 23 kilometres from the Alternative 1 site at PetroSA. The disadvantage of this route is that it is a gravel road with a number of tight bends and a relatively steep pass, which will not be ideal for heavy vehicles.

The third alternative is to travel north-westwards along Main Road 342 to the Main Road 341 turnoff and from there proceed southwards along Main Road 341. This route will be approximately 30 kilometres longer than the route to Site 1 for traffic coming from the east. The Main Road 342 alternative route is mainly surfaced, with only about 8 kilometres of gravel road, but the gravel section includes a short mountain pass en route to the site.

Figure 9.11: Proposed access route to Site 1.

Figure 9.12: Proposed access route to Site 2.

Figure 9.13: Access options to Site 3.

9.12.3 Cumulative Impacts

No cumulative impacts were identified by the specialist other than the natural growth in background traffic and the annual increase in waste volumes.

9.12.4 Comparison of Alternatives

Alternative	No-go	Site 1	Site 2	Site 3
Location	At PetroSA	Next to PetroSA	Off DR1549	Off DR1549 or MR341 or MR 342 and MR341
Access route	Via existing PetroSA access off N2	Via existing PetroSA access off N2	Via N2 and DR1549 (+/- 10km on gravel)	Via N2 and DR1549 (± 13 km on gravel) or via N2 and MR341 (± 10 km on gravel) or via MR342 and MR341(± 8 km on gravel)
Additional daily trips generated by the year 2020	17x2=34	17x2=34	175x2=350 (new to DR1549)	175x2=350 (new to DR1549 or MR341)
Additional daily peak hour trips: AM / PM	1/3	1/3	18/52	18/52
Additional daily E80 axle loads	110	110	253	253
Traffic impact	Negligible	Negligible	Low	Low
Road pavement impact	Moderate	Moderate	High	High
Geometric changes required	None	None	High (turning lanes on N2)	High (turning lanes on N2)
Road safety impact	Negligible	Negligible	Low with improvements in place	Low with improvements in place
Status of the impact	Neutral	Neutral	Negative	Negative
Ranking in terms of preference	0 (not sustainable)	1	2	3

Table 9.50: Comparision of alternative sites in term of the road and traffic impact assessment results.

The data presented in the table above clearly indicated that the potential impacts on traffic operations; pavement conditions, traffic safety and the road improvements required that Site 1 is the preferred Alternative. For both sites 2 and 3 road improvements and geometric changes are required. No geometric changes are required for Site 1 or the no-go option whilst only moderate impacts are expected on the road pavement.

9.12.5 Recommended Mitigation Measures

Site 1

None required.

Site 2

- A right turn lane will have to be constructed on the N2 westbound and an acceleration lane will have to be provided on the N2 eastbound at the DR1549 intersection. These improvements will ensure that the road safety impact of Alternative 2 is minimal.
- Partial reconstruction of DR1549 is required.

Site 3

- Partial reconstruction of either DR1549 or MR 341 is required.
- A short dedicated right turn lane will be required on the N2 westbound and an acceleration lane on the N2 eastbound at either the DR1549 or MR341 intersection if either of these routes is selected.

9.12.6 Conclusions

The three alternative sites and the no-go option (No-go option) were compared for the year 2020 in its impact on traffic operations, pavement conditions, traffic safety and the road improvements required. The report focused mainly on off-peak volumes, but the analysis of affected intersections with expected holiday traffic volumes indicate that these intersections will operate at a level of service C or better with the addition of holiday traffic if improvements are implemented as recommended. The proposed improvements associated with each site will also ensure that holiday period traffic can be accommodated safely.

9.13 Summary of potential cumulative Impacts

The archaeological report is the only specialist assessment that rated the potential cumulative impact as high on Site 1, although a positive impact was identified for Site 1 if the archaeological mitigation measures are implemented. The potential cumulative impacts for Sites 2 and 3 were rated as low.

The visual character of the area has been significantly transformed since the arrival of the first settlers, mainly due to the establishment of agricultural and residential areas in the stretch between the coast and the mountain range. More recent industrial developments of a different visual character have taken place close to the N2 near the entrance to Mossel Bay, as described in Chapter 7. The proposed project continues the process of the visual transformation of this area, in that it introduces a potentially visually incongruent facility into the landscape. This is most pronounced for Sites 2 and 3, which are located in an agricultural or largely natural setting. As no other significant developments are located near those sites, the landfill would detract from the existing sense of place, but would not be part of a larger cumulative impact based on already existing or anticipated future developments at these sites. From a visual point of view, however, this means the activity will be more visible as the surrounding landscape is less able to absorb the new development and may thus be less desirable. At Site 1, the landfill would have a cumulative impact over and above that of existing industrial development. It may thus accelerate the process of transforming this area wholly from an agricultural to an industrial area. From a visual point of view, however, this means that the existing – visually compatible – activities are able to absorb the visual impact of the new landfill to some extent, which may be preferable. The landfill itself is not considered likely to trigger new future development in the area, which would further add to the cumulative impact, as it addresses an existing need for disposal of waste generated by the surrounding residential, commercial and industrial areas (SRK, 2012).

From a social perspective the main cumulative impacts foreseen for the site are the occurrence of the nuisance factors, especially windblown litter, odour and flies.

Since Site 1 is the closest to the PetroSA GTL Refinery, it is expected to have a higher level of air pollution currently. However, actual measurements of SO2, NO2 and H2S were all observed to be relatively low when compared to the National Ambient Air Quality Standard (NAAQS) limit values. The maximum concentrations at the three alternative sites were 0.3 µg/m³, 2.3 µg/m³ and 1.1 µg/m³, respectively.
Cumulatively therefore, any of these pollutants generated on site would be the main contributor and the cumulative predictions would therefore be marginally higher than the incremental predictions.
The landfill operation would add to the existing particulate air concentrations. Since Sites 2 and 3 would be accessed by significantly longer gravel roads than Site 1, the cumulative impact would be higher (Airshed Planning Professionals, 2012).

The cumulative impact between the PetroSA waste site and Site 1 was rated as low from a Hydrogeological perspective due to the following:

- Petro SA waste site is lined and should have a low if any impact on surrounding groundwater:
- The migratory action of lining Site 1 should also result in a low to no impact on groundwater; and
- Groundwater levels at the sites are between 9 and 23, which would naturally attenuate leachate constituents.

Out of a botanical perspective, Sites 1 and 3 would both have Very Low to Low negative botanical impacts, and Site 2 would have a High negative cumulative botanical impact due to the loss of indigenous vegetation on this site, wich will cumulatively add to the loss of vegetation on a regional scale.

9.14 Overall comparison of Alternatives, key findings and impact statement

The alternatives applicable to each specialist field have been compared in the preceding sections. This section provides an overall summary and comparision of the alternatives presented in this report. It should not be read in isolation to the detailed comparisons of the alternatives presented in the preceding sections.

Impact description		"No-Go" Option	Site 1	Site 2	Site 3	Site preference
Traffic Impact	Traffic impact: Increased trips	Negligible	Negligible	Low -	Low -	Site 1
	Road Pavement	Moderate	Moderate	High -	High -	
	Road Safety	Negligible	Negligible	Low with improvements in place -	Low with improvements in place -	
	Geometric issues	None	None	High - (turning lanes on N2)	High - (turning lanes on N2)	
Visual impact	Construction phase	N/A	Low -	Medium -	Medium -	Site 1
	Operational phase	Low -	Low -	Medium -	Medium -	
Botanical Impacts	Direct	N/A	Low -	High -	Low -	Site 1 or Site 3
	Indirect	N/A	Low -	High -	Very low -	
Air quality Impacts	Construction		Low -	Low -	Low-Medium -	Site 1
	Operation		Low-medium -	Low-medium -	Low-Medium -	

	Gaseous emissions, mainly from PetroSA's GTL Refinery, east of the proposed locations for the landfill are currently impacting the sites. Site 1 is impacted the most due to its proximity. All three sites are also being impacted by particulate emissions from nearby activities resulting in the generation of airborne dust. Currently, there are no odour impacts, other than those emissions from livestock farming activities, mainly Site 3.	Low -	---	---	---	
Geohydrology Impacts	Clearance of land for construction and construction of landfill site.	N/A	No significance	No significance	No significance	Site 1 or 3
	Portable Toilets	N/A	No significance	No significance	No significance	
	Leachate development from waste	No significance	Low -	Low -	Low -	
	Reduction in recharge due to lining of landfill site	No significance	No significance	No significance	No significance	
	Farming activities	No significance	No significance	No significance	No significance	
Freshwater Ecological	The inputs obtained from the freshwater ecologist proposed mitigation measures to ensure the protection of the two ecologically important freshwater features on Site 1.					---
Avi-faunal	Potential impacts on avi-fuana and related impacts on humans and other fauna	N/A	Preferred	Least preferred	Also suitable	Site 1

Socio- Economic Impacts	Construction phase: new business sales	No impact	Medium +	Medium +	Medium +	Site 1
	Operational phase: new business sales	High (neutral)	High +	High +	High +	
	Construction phase: Additional GGP	Medium (neutral)	Medium +	Medium +	Medium +	
	Operational phase: Additional GGP	Low to very low (Neutral)	High +	High +	High +	
	Construction phase: creation and loss of employment	Low to very low (Neutral)	Medium +	Medium +	Medium +	
	Operational phase: creation and loss of employment	High -	Very high +	Very high +	Very high +	
	Construction phase: investment expenditure	Medium (neutral)	High +	High +	High +	
	Operational phase: investment expenditure	Very high (neutral)	Very high +	Very high +	Very high +	
	Construction phase: property market	No impact	Low to very low (Neutral)	Low to very low (Neutral)	Low to very low (Neutral)	
	Operational phase: property market	No impact	No impact	No impact	No impact	
	Construction phase: tourism and tourism industry	No impact	No impact	Low to very low -	Low to very low -	
	Operational phase: tourism and tourism industry	No impact	No impact	Low to very low -	Low to very low -	
Archaeological impact	Impact on archaeological remains	N/A for site 2 and 3 Site 1: Low -	Low +	Low (neutral)	Low (neutral)	No site preference indicated.
Palaeontological impacts	Construction phase: Destruction, disturbance or sealing-in of fossil heritage preserved within bedrocks and superficial sediments	N/A	No significance-	No significance-	No significance-	Site 1

	Construction phase: Previously buried fossils are exposed and made available for scientific recording / collection	N/A	No significance+	No significance+	No significance+	
	Operational phase: Destruction, disturbance or sealing-in of fossil heritage preserved within bedrocks and superficial sediments	N/A	No significance-	No significance-	No significance-	
	Operational phase: Previously buried fossils are exposed and made available for scientific recording / collection	N/A	No significance +	No significance+	No significance+	
Heritage impacts		N/A	Low	Low	Low	Site 1
Overall preferred site	**Site 1**					

Table 9.51: Comparison of site alternatives and significance ratings with mitigation measures in place. The Site preference indicated in the table is based on the recommendations by the relevant specialist. Negative impacts are indicated by "-" and positive impacts by "+".

It is clear from the summary presented above that Site 1 has the lowest overall potential impacts provided that the required mitigation measures are implemented. The following specialists have indicated a preference for Site 1: Traffic, Socio-economic, Avi-faunal, Visual, Palaeontological, Heritage and Air Quality.

Botanical Impacts

The Botanical assessement indicated a slight preference towards Site 3, but indicated that Site 1 would also be suitable if the required mitigation measures are implemented. The Botanist indicated that Site 3 is only marginally preferable to Site 1 from a Botanical perspective. The preference for Site 3 as indicated by the Botanist is due to the fact that the site has been almost completely modified through the agricultural land use and no significant natural vegetation remains on the site. The only remaining indigenous vegetation that is also included in a CBA occurs to the west of the site along the proposed access route. The upgrade of this access route is likely to impact negatively on the sensitive vegetation and therefore impacts on this patch of indigenous vegetation would be considered as a highly significant negative impact, although it was stated by the Botanist that the area has been heavily trampled and grazed. The Botanist furthermore indicated that impacts on the natural vegetation along the route to Site 3 at the N2/MR341 intersection will be experienced but the expected impact on the indigenous vegetation within the road reserve is low negative at a regional scale and does not alter the overall assessment of the botanical impacts for Site 3. Similarly the Botanist indicated that Site 1 also presents few botanical or ecological constraints to the proposed development as, due to the intensive agriculture, relatively little natural vegetation remains on site. The Botanist indicated that the botanical impacts on both Sites 1 and 3 can be mitigated to result in an impact with a low negative significance rating. In terms of Site 2 the Botanist indicated that at least 80% of Site 2 is considered to be of high botanical sensitivity and is not suitable for the proposed development from a Botanical perspective. It supports significant areas (which are also designated critical biodiversity areas) of two threatened vegetation types, mostly in good condition, and should thus not be considered for development. The National Spatial Biodiversity Assessment (NSBA; Rouget et al 2004 cited in Helme 2012) has assessed Swellendam Silcrete Fynbos as an endangered vegetation type on a national basis, with only 57% of its original extent remaining, 4% protected, and a 30% conservation target. What remains is thus still vulnerable to transformation by quarrying and agriculture, although increasingly these natural areas support game farming operations. The national list of Threatened Ecosystems lists this vegetation type as Vulnerable (DEA 2011). The NSBA has determined that Mossel Bay Shale Renosterveld is also an endangered vegetation type, with only 41% of its original extent remaining, 0% conserved, and a 27% national conservation target (Rouget *et al* 2004 cited in Helme 2012). The national list of Threatened Ecosystems also lists this vegetation type as Endangered (DEA 2011). Site 2 should not be authorised as the botanical impacts of development on this site would be high negative, and cannot be mitigated to any significant extent. The development of site 2 will lead to a reduction of designated CBAs and ecological corridors will occur as a result of the disturbance to the natural vegetation, and will mean a narrowing of ecological corridors, which is undesirable. CBAs are specifically designed to be the minimum required areas in order to achieve conservation targets for species and habitat types, and to provide ecological connectivity, and any reduction thus has ramifications elsewhere in the region (Helme, 2012). The proposed layout of Site 1 has already taken the botanical and other ecological constraints in consideration through the creation of buffer zones that will exclude the development of sensitive areas on Site 1.

Freshwater Ecological Impacts

The ecological constraints to the freshwaster environment could be adequately addressed for Site 1 as recommended by the freshwater ecological assessment. The recommended buffer zones were incorporated into the design in consultation with the Department of Water Affairs and CapeNature. On review of the amended site layout, which incorporated the required buffer zones, CapeNature accepted these mitigation measures as adequate for Site 1. The 1:100 year floodline was determined for the easternmost seasonal drainage line on Site 3 and development was excluded from this area as indicated in the site layout plans. Should this Alternative be considered for approval it must be ensured that development does not take place closer than 32m from the edge of the watercourse or within the 1:100 floodline whichever is the longer distance from the drainage line. The western drainage line could however not be protected due to design constraints on the site and the availability of sufficient land to accommodate the proposed waste management facility. This drainage line has therefore been diverted around the site. The drainage line on Site 2 could also not be avoided due to to a combination of factors which include the following:

- An appropriate buffer around the drainage line will have large impacts on the layout of the site and the size of the site, thereby reducing the size of the site and associated lifetime of the site.
- It will complicate the access to the site and it has been indicated by the design engineers that it will result in more excavations for the construction of the proposed access route and will lead to a further increase in cost.
- The drainage line could also not be diverted around the site as in the case of the eastern drainage line on Site 3 due to the volume of water that is expected at the point where the drainage line enters the site. The diversion of the drainage line will require a very large channel with the resulting excavations and increased costs that will be required to contain the estimated volume of water.
- The option that was proposed for Site 2 is to pipe the water from the drainage channel under the site.

The piping or diversion of the drainage line is likely to result in negative impacts on the vegetation and freshwater environment.

Avi-faunal and faunal impacts

From an avi-faunal perspective Site 1 is the preferred alternative as the habitat is already transformed, displaced birds have ample adjoining similar habitat, and the small peripheral wetland can be protected. Site 3 is similar, provided the stream that it incorporates is protected. The avi-fuanal specialist indicated that the least appropriate site is Site 2 due the significant amount of natural vegetation on the site. The PetroSA site is a no-fly zone and if the waste disposal facility is located on Site 1 it will minimize the risk of birds and aircraft.

The presence of African wild cat on Gondwana and surrounding areas was noted from information provided by an I&AP during the public participation process. It is acknowledged that feral cats are a very important threat to the African wild cat due to interbreeding and that the waste disposal facility may attract feral cats. This issue serves as a further motivation as to why Site 2 is not the best practical environmental option for the proposed waste disposal facility. It is however important that feral animals do not visit the landfill site and this aspect must be addressed in the EMP. Measures that are currently recommended to deter and manage fauna at the waste disposal facility are the daily covering and compaction of the waste to avoid the availability of a potential food source to fauna. Access to stray cats and/or dogs must be prevented as far as possible and if found at the waste disposal facility must be removed with the help of the local animal welfare society.

Geohydrological impacts

The geohydrological impact assessment indicated a preference for Site 3 mainly due to the deep groundwater levels and clay at site 3 which would in addition to the liner prohibit any pollution entering groundwater. The geohydrological specialist also indicated that Site 1 may be used as the local groundwater is of low yield potential, naturally poor quality and there is a well developed unsaturated zone that would attenuate any leachate. The geohydrologiocal assessment indicated that the highly conductive sediments and shallow water table makes Site 2 a less environmentally favourable option.

Roads and traffic impacts

In terms of the traffic impact and access to the sites, Site 1 has been indicated as the preferred Alternative. The specialist indicated that the impacts related to an increase in traffic, road safety and geometric issues are negligible for Site 1. A moderate impact is expected on the road pavement conditions of the N2 due to a natural growth in waste volumes and the addition of the waste from the Bitou Municipality. Both Sites 2 and 3 requires partial reconstruction of public roads. In the case of Site 2 it is DR1549 and in the case of Site 3 it is DR1549 or MR341. The cost involved in the reconstruction of these roads is high and there is the complicating factor of whether the applicant or the Department of Transport and Public Works should carry these costs. The applicant is also not the landowner of these roads and therefore agreements should be put in place for the proposed mitigation measures on these roads. The Department of Transport and Public Works indicated in their comments on the Draft EIR that they do not support the use of Sites 2 and 3 in the light of the traffic impact either of the sites will have on the existing proclaimed roads. They however indicated that they support the outcome of the Roads and Traffic report prepared by ICE Group (Boland) which indicates clearly that alternative Site 1 is best located from a traffic point of view.

For Site 2 a right turn lane will have to be constructed on the N2 westbound and an acceleration lane will have to be provided on the N2 eastbound at the DR1549 intersection. Access to Site 3 requires a short dedicated right turn lane on the N2 westbound and an acceleration lane on the N2 eastbound at either the DR1549 or MR341 intersection if either of these routes is selected. The same argument as presented for the partial reconstruction of the roads is relevant to the construction of additional lanes on these roads. The applicant is not in a position to apply for funding for the partial reconstruction and addition of lanes to these roads and is also not the landowner of these roads. Site 2 would require the construction of a new road over private property as indicated in the drawings included under Appendix B. The existing access off the MR342 is too steep for heavy vehicles. The proposed new access route to Site 2 has not been included in the assessments of this EIA process as Site 2 already has significant constraints against the development of a waste disposal site and the construction of a new access route over private property will only add to these constraints. The access road will not only increase the cost (construction and acquisition of land) of development of a landfill site on Site 2 but may also impact on sensitive vegation and CBAs in the vicinity of Site 2.

The preferred Access route to Site 3 is from the N2 onto the MR341 northwards to Site 3 where access via an existing road over private property needs to be obtained to gain access to the site. As mentioned earlier the landowner of Farm 232 over which access is required did not provide consent to gain access over the said property. The widening of this road may however trigger listed activities and a portion of the road is located within a CBA. The Botanical Impact Assessment stated that although the vegetation in this area is grazed and trampled it is still considered highly sensitive.

This route was chosen as the preferred option as it was stated in the Traffic Impact Assessment that the MR341 is a higher order road than the DR1549. The intersection at the N2 and DR1549 also requires the construction of turning lanes but it is more complicated than the Intersection at the N2/MR341 due to another access being located off the N2 approximately 60metres from the N2/DR1549 intersection (*Pers comm. Ice Group, 2012*). The route via the MR342 was not selected to site 3 as the Department of Transport and Public Works indicated in their comments during the Scoping Phase that the long-term impact on the road pavement of the MR342 is a concern as it has not been designed for the long term axle load. This route is also the longest being measuring approximately 30km longer is measured from Site 1.

Sites 2 and 3 are therefore not desirable options for the use as a waste disposal facility from a traffic impact assessment viewpoint.

Visual impacts

From a visual impact perspective the specialist indicated that none of the proposed sites are considered to have an outright fatal flaw, however a preference was indicated for Site 1. Due to the lower visual quality, moderate VAC, high visual integrity and lower viewer sensitivity of Site 1, which to some extent outweigh the higher visual exposure and visibility of the site, the visual impact of a landfill development on Site 1 was considered by the specialist to have the lowest overall magnitude amongst the three proposed alternative sites. Coupled with the fact that certain operational activities at the landfill are expected to have a lower visual impact than at other sites, specifically lighting (as neighbouring facilities are already lit) and truck delivery of waste (as roads are paved and access is via existing busy routes), this site is considered to be the preferred location for the establishment of the regional landfill. The significance after mitigation of locating the landfill at Site 1 is expected to be similar to that of the existing landfill (which has effectively been rated with all existing mitigation in place). Site 2 is located within a visually very appealing and fairly easily accessible landscape, and a 12 m high landfill is expected to be visible from a wide area. This is the least preferred site. Site 3 is less accessible and visually slightly less stimulating than Site 2. However, the site is also highly visible from areas surrounding the proposed development. This site is marginally preferred to Site 2 but considered significantly less suitable than Site 1.

Air Quality Impacts

No fatal flaws associated with any of the three alternative sites were identified from an Air Quality perspective.

The air pollution impact from the three alternative sites, mainly differ as a result of topographical features and road access to the property. The topography creates micro-climates which result in slightly different meteorological conditions and therefore in slightly different dispersion potential and direction of impacts. Site 2 is predicted to result in the lowest air pollution impact, followed by Site 1 and lastly, Site 3. However Site 2 was shown to potentially result in an odour impact zone that extends about 2km, toward the south of the facility. Site 2 is more sheltered from north-westerly winds compared to Sites 1 and 3.

Site 1 has the added difference that access to the site would be along mainly a tarred road, whereas the other two sites would be along mostly gravel roads. Site 3 has a significantly longer stretch of gravel road than Site 2. A comparison of the predicted air pollution impacts indicates that Site 2 is marginally better than Site 1 and Site 3. It was predicted that Site 3 would result in the highest air pollution impact, unless the access road is treated to reduce fugitive dust emissions. Site 2 was shown to potentially result in an odour impact zone that extends furthest when compared to the other two sites. Since Sites 2 and 3 would be accessed by significantly longer gravel roads than Site 1, the cumulative impact would be higher with the former alternatives. Since Site 1 is relatively close to the PetroSA site, there may be a slight increase in air impacts at this location in the future; mainly odour. The Air Pollution

Impact Assessment indicated that Site 1 be selected as the environmentally preferred site with respect to air pollution.

Socio-economic impacts

The Socio-economic Impact Assessment indicated that the overall impacts at all three the proposed sites would be positive and the overall impact for the no-go option would be neutral.

Although construction of the facility at alternatives 1, 2 or 3 will have the same overall impact, alternative 1 will have the least negative impact on the surrounding environment and is complementary to the surrounding land use activities (PetroSA facility located to east of site). Thus it will not be a notable visible intrusion on the surrounding landscape. It was indicated by the specialist that the location of the waste disposal facility at Site 1 may have less of a negative impact on tourism than when located at Sites 2 or 3. Comments from I&APs pertaining to Site 2 indicated that the development of a waste disposal facility at Site 2 may negatively impact tourism, residences and employment in the Gondwana Game Reserve.

Archaeological impacts

With regard to the proposed development of a regional waste disposal facility near Mossel Bay, the archaeological assessment has shown that each of the proposed candidate sites is suitable for development.

While the development of a regional landfill site at Eden 1 will possibly impact on potentially important archaeological remains centered around the seasonal pan, mitigation of these remains also presents opportunities for generating information for research, which otherwise might be lost due to ongoing ploughing, farming operations and clearing of stone from the affected lands. This could therefore be seen indirectly as a potential positive impact of the proposed development. No significant impacts to pre-colonial archaeological material that will need to be mitigated prior to proposed development activities has been identified on Sites 2 and 3.

Palaeontological impacts

The palaeontological assessment indicated that all three candidate sites for the Eden District Municipality Regional Waste Disposal Site or Sites are considered to be of *low to very low* palaeontological sensitivity. The specialist indicated that in terms of fossil heritage conservation, there is very little to choose between the three candidate sites, with a slight preference for Study Site 1 which has the lowest inferred palaeontological sensitivity. No moderately or highly significant impacts on fossil heritage are expected by the specialist at any of the three sites, and no fatal flaws precluding consideration of any of the sites for the proposed waste disposal project has been identified.

Heritage Impacts

The Heritage Impact Asssessment concluded that the overall heritage significance of the three sites is low and that the proposed development of a regional landfill facility may proceed on any of them. However, the visually preferred alternative is locating the landfill at Eden 1, followed by Eden 2, with Eden 3 considered the least suitable. It is expected that visual impacts of establishing a landfill at Eden 1 could be mitigated to be of low significance, while the significance of visual impacts at Eden 2 and 3 would remain medium after mitigation. Site 1 was therefore indicated as the preferred Alternative from an overall Heritage Resources perspective.

Co-disposal compared to separate disposal of hazardous and general waste

Two separate cells have been included in the design of the proposed landfill site. Within one cell only General waste will be disposed and the design of the cell and liners has been provided according to the requirements for a General waste cell as described in Chapter 4 and presented in the design drawings included in Appendix B. A hazardous waste cell has also been included in the design. The hazardous waste cell requires specific liners as described in Chapter 4 and included in the design drawings included in Appendix B. Mainly hazardous waste will be disposed within this cell, however co-disposal of hazardous waste and general waste may also take place within the designated hazardous waste cell. A pioneering layer of general waste will be required on the hazardous waste cell prior to the disposal of the general waste. The reasons for the co-disposal of hazardous waste and general waste within the hazardous waste cell depend largely on the nature of the hazardous waste that is received. Hazardous waste with a high liquid content may be received and would require co-disposal with the drier general waste. It must be ensured that the liquid: solid ratio never exceeds 1:10.

Whether co-diposal or separate disposal of hazardous waste takes place, there will not be any additional impacts as the site is appropriately designed for the type of waste that is received and managed accordingly. The Air Quality Impact Assessment (Airshed Planning Professionals, 2012) specifically stated that the conclusions of the assessment would not differ in the event that co-disposal does not take place.

The option of co-disposal of hazardous waste and general waste over the whole site will however have cost implications as the liners of the hazardous waste cell is more costly. The option of having a dedicated General waste cell and a separate Hazardous waste cell (H:h), where co-disposal of hazardous and general waste may take place depending on the nature of the hazardous waste received is therefore the preferred option.

Cost and landfill capacity considerations

The cost of developing and operating the waste disposal facility has been discussed in detail under paragraph 5.1. If the costs for the waste disposal facility with provision for rehabilitation is considered as indicated under paragraph 5.1, it is clear that the cost of development inclusive of rehabilitation costs of Site 1 is the lowest (R36.7 million), followed by Site 3 (R38.3 million) and lastly Site 2 (R41.5 million).

These figures should be considered in conjuction with the available size of the respective sites and the associated lifetime of the sites. Site 1 has an expected lifetime of 42 years, Site 2 an expected lifetime of 48 years and Site 3 and expected lifetime of 31 years. The cost of development of Site 3 for example is the lowest but it also has the smallest available area for the development of the landfill site and the shortest expected lifetime. The lower cost is due to the smaller area that is available to develop.

The power supply for Site 1 will be obtained from the existing 11kVA line on the site. The power supply for Site 2 and 3 will be brought in from the nearest 11kVA line to the entrance facility complex. In the case of Site 2 the nearest line is approximately 2.5km from the site, whilst in the case of Site 3 the nearest 11kVA line is 4.5km from the site. ESKOM has indicated that they can supply power to the sites, however the cost for the extension of the powerlines in the case of Sites 2 and 3 will be for the applicant. This will add additional costs to the development on Sites 2 and 3 where an existing line provides electricity to Site 1.

No-go option

The no-go option was also assessed throughout this EIA process. The no-go option is partly the continuation of the waste disposal that is currently taking place at the PetroSA waste disposal facility and also the continuation of the mainly agricultural landuse of the alternative sites. In terms of job creation it was indicated in the Social impact assessment that Alternative site 1 will have the largest and most significant total impact on employment locally and regionally with a total of 1, 430 new employment opportunities. Alternative site 3 will have the second largest total impact on employment with 1, 403; and alternative site 2 the least significant total impact of the three alternatives with a total of 1, 401 employment opportunities. Alternative 1 is thus the most preferred alternative with regards to employment creation, new business sales and additional GGP stimulated. The No-Go alternative will not have any additional impact on employment during the operational phase of the Eden Regional Waste Disposal site, as the no-go implies that the landfill will not be developed and thus operational expenditure at the facility will not occur and no positive or negative impacts will be generated within the local Mossel Bay economy. It should be noted however that the no-go alternative will represent an opportunity cost for the region, as the total impacts of the preferred site (whether it be site 1, 2 or 3) will be lost and the employment that is likely to be generated through the operations of the Waste Disposal Facility. The no-go option will have a neutral impact on new business sales. However if the agricultural landuse is retained on the alternative sites agricultural produce that would have been generated and the labour that such activities support will be forfeited for the landfill and vice versa represents the agricultural produce and labour that will be generated if the landfill is not undertaken. The no-go option will furthermore have a neutral impact on the investment expenditure in the local Municipal area of Mossel Bay, tourist activities and the local and regional economies.

From an Air Quality perspective the no-go option will lead to no additional impacts on the air quality of the environment, however the existing impacts relating to the farming activities and the emission of particulate matter is likely to continue but is likely to have a low impact on the air quality.

The no-go option may however lead to a potentially negative impact through the eventual loss of the potentially important archaeological remains centered around the seasonal pan. It can be argued that the proposed development of Eden will therefore have a positive impact, as it will allow for a more detailed study of the site, and the recovery of important information of the poorly understood Early Stone Age in southern Africa. Site 1 also has the potential to reveal important information of ESA tool making technologies and possibly subsistence activities as well. The No-Go option is therefore not supported for Site 1. There are no positive or negative impacts should Site 2 and 3 retain their agriculture landuse. The no-go option (no waste disposal site) would not threaten local fossil heritage but would also forgo the opportunity for palaeontologists to record and sample previous buried fossil remains.

From a visual impact perspective the existing PetroSA waste disposal facility was used as a baseline to assess the potential visual impact of the proposed waste disposal facility. The visual impacts associated with the PetroSA waste disposal site was rated as low and can also serve as an example of how effective the mitigation measures as recommended for Site 1 can be implemented.
The hydrogeological impact assessment rated the potential impacts of the no-go option as low both in terms of the use of the PetroSA waste disposal site as well as the continuation of the Agricultural practices. If the ongoing agricultural practices takes place on the three Alternative sites it is expected that the impacts of the no-go option will be neutral if no large-scale removal of indigenous vegetation takes place on Site 2.
The potential impacts of the No-go option should the proposed properties continue to be used for Agricultural purposes would be Neutral (Helme, 2012). Once again this is the case if no large scale clearance of indigenous vegetation on Site 2 takes place for agricultural purposes.

The no-go option will also have no new additional impact on traffic and road conditions.

Although the potential impacts associated with the no-go option is mostly neutral, the no-go option is not a feasible option to pursue. The PetroSA waste disposal facility does not have the capacity to receive the waste from the Municipalities as indicated earlier. Furthermore as indicated in various sections of this report there is a need for a long-term waste disposal site for the Eden District Municipality. The need was also identified by the Bitou, Knysna, George, Mossel Bay and Hessequa (Albertinia and Gouritsmond) Municipalities. As reported in detail in the Scoping Phase there is limitation in the availability of land for waste disposal throughout the Eden District due to the sensitve environmental nature of this area.

The no-go option is therefore not considered a feasible or reasonable alternative and can therefore not be pursued.

CHAPTER 10: MONITORING AND CONTROL

10.1. Introduction

An Environmental Management Programme (EMP) has been compiled as part of this EIA process and has been included Appendix E. The EMP includes the recommendations and mitigation measure that must be implemented should the proposed waste disposal facility be approved. It is aimed at avoiding potential environmental impacts and also provides for mitigation measures where environmental impacts could not be avoided. The purpose of this Chapter is to only highlight some of the aspects covered by the EMP that are generally of concern. It is not intended to summarize the complete EMP but rather serves to provide an understanding to those I&APs that may not be familiar with the implementation of an EMP.

The EMP stipulated the responsible party for the implementation of the various mitigation and/or avoidance actions that are required. It also stipulates the frequency that these actions should be taking place.

10.2 Water quality monitoring

A long-term water quality monitoring programme will be implemented on the landfill site according to DWAF's Minimum Requirements and the licence conditions. The water quality monitoring programme will be designed to detect and quantify the effect of any escape of leachate into the surrounding environment and serve as an early warning system for potential pollution problems.

Water monitoring begins before the commissioning of a landfill and continues throughout and beyond its operation. Since post-closure water monitoring may continue for up to 30 years after the site is closed, it can be seen to represent the final step in the landfill process.

The objectives of water quality monitoring are:

- To indicate the escape of any leachate into the water environment.
- To serve as an early warning system, so that any pollution problems that arise can be identified and corrected.
- To quantify any effect that the landfill has on the water regime.

There are various types of water quality monitoring during a site's operation and closure. The types of monitoring and frequency are determined by the conditions of authorization specified in the licence.

Clean surface/storm water must be diverted away from the waste body by upslope diversion drains. Clean stormwater must also be diverted away from the composting area and MRF to avoid contamination.

The EMP currently includes the recommendations that were made by the specialists in this EIA process and any additional requirements as stipulated in the Environmental authorization must be included in the EMP.

10.3 Landfill gas monitoring

Gas monitoring on site will be undertaken as per the DWAF Minimum Requirements for Waste Disposal by Landfill (1998). Due to the negative water balance of the site it is highly unlikely that significant amounts of landfill gas will be generated. A subsurface gas extraction system will thus not be installed. However, the generation of landfill gas must be monitored and should there be a need, vertical pipes will be installed into the waste body for extraction of gas.

Where breaches in the cover from which significant volumes of landfill gas escape are identified by their odour, a proper investigation must be undertaken as per the Minimum Requirements. This may be followed by properly Project Managed passive or active gas venting and flaring to alleviate odour problems. Where a gas management system exists at a site, it must be correctly operated, maintained and monitored to ensure that any landfill gas emanating from the site is properly managed. Landfill gas generation must be monitored every three months. If the soil gas concentrations exceed 1% by volume of Standard Temperature and Pressure (STP) the DWA must be informed immediately.

Methane concentration in the atmosphere inside buildings on or near the site must not exceed 1% (by volume) in air, i.e. 20% of the Lower Explosive Limit (LEL). If the methane levels are found to be between 0,1% and 1% in air (i.e. between 2% and 20% of the LEL) then regular monitoring must be instituted. If levels above 1% (i.e. 20% of LEL) are detected, then the building must be evacuated and trained personnel consulted. Methane levels on landfill boundaries must not exceed 5% in air (i.e. the LEL). This must apply to the air above the surface and also to the air in a hole dug into the earth on the boundary. Where significant landfill gas is present, samples must be taken at various positions at the landfill site and characterised for VOCs. Monitoring wells must be installed on the perimeter of the site at intervals sufficiently small to detect any potential off-site migration. A subsurface gas-monitoring program must be implemented at least bi-anually to monitor gas-migration (Airshed Planning Proffessionals, 2012). The number and location of the gas monitoring wells can only be determined once the site is in operation (*Pers. comm.* Burger, 18 October 2012).

10.3 Control over nuisance factors and disease vectors

Typical nuisance factors include but are not limited dust, noise, odcours, flies and wind-blown litter. Disease vectors may include flies, rodents and birds. The EMP addresses these aspects in detail and specifies control meganisms to avoid the potential impacts and mitigation measures for those impacts that cannot be avoided.

Much of the nuisance factors can be avoided through effective site operation which includes daily cover and compaction of the landfill site and progressive rehabilitation of the site. Disease vectors can also be controlled through the daily covering and compaction of the waste as many of these vectors are attracted to the waste disposal site due to the potential food source. However, the daily covering and compaction of waste may not be the only measures that are required and additional measures may need to be implemented as stipulated in the EMP.

10.4 Record keeping, surveys and auditing

Accurate and comprehensive records of all waste entering the site must be kept. Waste is to be categorised by mass, type, origin and the number of loads. Records would also be kept of meteorological data, including rainfall, evaporation and wind. This data would be used with leachate and run-off data to calculate and manage the site water balance and co-disposal ratios. Annual surveys would be undertaken according to the Minimum Requirements. Surveys would be used to calculate airspace usage, compaction ratios and remaining site life and are used as a tool to monitor that progress complies with the development plan and the planned final landform.

Environmental Monitoring is the continuous evaluation of the status and condition of environmental elements. It aims to detect change in the environment over time and consists of measuring and recording of physical, social and economic variables associated with development and operational impacts. Acceptable standards of operation and compliance with the development plan would be ensured through regular external auditing of the site, both during operation and after final closure.

During the operational phase the Responsible Person on site will monitor the landfill operations according to the operational monitoring plan specifications, Minimum Requirements and permit/licence conditions. This will include but are not limited to the monitoring of the effectiveness of waste disposal, climatic data, airspace utilisation, dam levels, leachate and contaminated stormwater flows, co-disposal ratios, site loading, leakage detection systems, liner integrity and performance, stability, landfill gas and monitoring of complaints relating to the operation.

For external audits an audit protocol should be submitted and discussed with management and a formal date set for the audit. On the day of the audit a pre-audit and post-audit meeting is held with the management and supervisory staff. Relevant site personnel must be present during the audit. An audit report will be submitted to the site management, which must be added by management as an operational tool to highlight area of concern and areas of excellence. Audit suggestions and implementations must be discussed in the pre-audit meeting of the following audit. The post auditing meetings is to discuss broad-brush findings.

Internal auditing can be done by managerial staff on a monthly basis. Internal audits are internal self-evaluations. A more detailed list of records that should be kept is conained in the EMP.

10.5 Landfill Monitoring Committee

The establishment of a Landfill Monitoring Committee is stipulated in the Minimum Requirements (DWAF, 1998).

A formal structure that can be used as a forum to resolve disputes and address complaints must be put in place. The Landfill Monitoring Committee would normally consist of representatives of the:

- Permit holder;
- Relevant local authority;
- Landfill contractor;
- Surrounding landowners and communities;
- General public;
- DWA; and
- DEA&DP.

A Constitution, acceptable to all members, would be developed for the Landfill Monitoring Committee. Typically, meetings would take place following every external audit and formal minutes would be circulated. A public open day, during which the committee visits the site, could be held once a year. The landfill monitoring committee aims to enable the community to participate in and monitor the operation, rehabilitation and closure of the landfill site and allows the concerns of the community to be discussed and addressed.

10.6 Conclusions

It is the Applicant's responsibility to ensure that the EMP is included in all contract documentation and made binding. The Contractor must familiarize himself with the requirements of the EMP, and must appoint an Environmental Liaison Officer to oversee the implementation thereof on a daily basis.

CHAPTER 11: CONCLUDING STATEMENTS AND RECOMMENDATIONS

11.1 Concluding statements

This Final Environmental Impact Report has assessed the relative biophysical, economic and social acceptability of the proposed alternatives for the establishment of a new regional waste disposal facility for the Eden District Municipality.

The Public Participation Process conducted up to date has given registered I&APs the opportunity to assist in the identification of potential impacts and also the information that should be incorporated into the assessment. The comments received on the draft EIR was collated into an Issues and Response report is included under Appendix D of the Final EIR. Copies of the correspondence received from I&APs is included under Appendix D.

The Final EIR was made available to registered Interested and Affected Parties and any comments received will be sent to the DEA&DP for consideration.

This report is a culmination of the EIA process to date, which has aimed at providing all the required information to the competent authority to allow them to make an informative decision on the application. Potential impacts of the proposed activity were identified by I&APs, Governmental stakeholders, specialists the project engineers, the EAP and the applicant. Ways of minimizing the potential impacts and maximizing the benefits has been considered and recommendations have been made.
The recommendations and mitigation measures of the specialists were incorporated in the site layouts where practically possible and the majority of their recommendations included in the Environmental Management Programme. The site layout was therefore refined in an iterative manner during the EIA process to ensure that the recommendations made by the specialists, I&APs including governmental stakeholders and the project engineers could be incorporated.

Through the comparative evaluation and consideration of the findings of the specialists, the inputs from I&APs including governmental stakeholders to date and inputs from the project engineers it is concluded that Site 1 will be the site option on which the potential environmental impacts can be either avoided the most effectively and those impacts that cannot be avoided mitigated as per the recommendations that was presented during this EIA process. The other site alternatives and the No-Go option **are not** considered as the best practicable environmental option when compared to the development of a new regional waste disposal facility on Site 1. The site layout for Site 1 as presented in this Final EIR is considered as the preferred layout that is responsive to the recommendations made by the specialists, I&APs including governmental stakeholders and the inputs from the project engineers. In combination with Site 1 the option of separate disposal on the general waste cell and co-disposal on the hazardous waste cell was selected as the preferred technical option for the reasons as detailed under paragraph 9.14.

This environmental impact assessment, including the various independent specialist impact assessments, did not identify any unacceptable impacts with the proposed alternative.
This chapter therefore includes the recommended mitigation measures as extracted from the specialist reports for Site 1 only.

11.2 Archaeological

Eden 1. Survey and mapping of the stone artefact scatters around the seasonal pan must be undertaken by a professional archaeologist who is also an Early Stone Age expert, after which the material could be collected for analysis and storage. No archaeological material may be disturbed or collected without a permit issued by Heritage Western Cape. Survey and mapping must be initiated prior to implementation of the proposed project and before any earthworks commence

Test excavations must also be undertaken around the seasonal pan in order to determine the presence/absence of sub-surface archaeological remains. Should significant sub-surface archaeological deposits be encountered, further excavations may be required. No excavations may be carried out without a permit issued by Heritage Western Cape. Trial excavations must be initiated prior to implementation of the proposed project.

Bulk earthworks and excavations must be monitored by a professional archaeologist. A monitoring plan must also be presented to Heritage Western Cape for approval.
Heritage Western Cape required survey, mapping and collection of the Earlier Stone Age aretefacts being affected by an Earlier Stone Age specialist and bulk earthworks must be monitored by a professional archaeologist. A report must be submitted to the Heritage Western Cape.

11.3 Palaeontological

Since the proposed development does not entail significant impacts on fossil heritage, no specialist mitigation measures are necessary here.

Should any substantial fossil remains (*e.g.* concentrations of fossil shells, wood, vertebrate remains) be exposed during excavations at the waste disposal site, the responsible ECO should safeguard these, preferably *in situ*, and alert Heritage Western Cape as soon as possible so that appropriate mitigation measures may be considered and implemented. Mitigation in the form of fossil recording and judicious sampling by a professional palaeontologist will have a positive impact on our appreciation of local fossil heritage. This recommendation should be incorporated into the EMP for this development.

11.4 Visual Impact

To minimize visual impacts identified and assessed in this study, mitigation measures were recommended that cover a range of aspects:

Screening:

Maintain and supplement natural vegetation on and along the borders of the site as far as possible to maintain existing and provide additional screening.

Create visual screens that hide the activities at the landfill from public view. Make these screens appear as natural as possible (e.g. by imitating slopes in the surrounding area in the case of berms and vegetating berms / fences).

- Plant screening structures with local indigenous species and grasses to minimize the need for irrigation and maintenance and maximise visual approximation to the naturally occurring landscape in the area.
- Position buildings and other infrastructure to maximise natural screening provided by topography.
- Plant additional vegetative screening around buildings and other infrastructure, where possible.

Site 1*:* Avoid the creation of a visible 'gap' between the PetroSA and Eskom facilities and the new landfill as far as possible, to maximise the screening and visual absorption effect of existing facilities.

Site 1: Create berms or other screening structures on the south-eastern and southwestern boundaries of the landfill, as these are the portions that will be most visible from the N2.

Lighting:

Keep all lighting to a minimum within the legal and operational requirements. Opt for low-level and shielded lighting to reduce light pollution. Minimum lighting requirements, positioning of lights and type of lighting should be considered and specified at the detailed design stage.

Integration into landscape:

- Use diamond wire mesh fencing in a natural colour (that blends in with the surroundings) around the site instead of palisade fencing or a solid wall.
- Design and paint infrastructure such as buildings and security gates to blend into the landscape and any adjacent structures.
- Construct new landfill cells only when it is needed (e.g. when operational cells reach capacity).
- Keep external signage to a minimum.

Detailed design and operational measures related to these mitigation measures need to be considered during the design stage and implemented particularly during construction.

Dust control:

- Control dust generation during the construction and operational stages of the landfill, e.g. by paving internal and external access roads and spraying water to wet sources of dust (such as stockpiles of excavated material, unpaved roads etc) when required by windy and dry weather conditions.
- Service waste trucks regularly and ensure speed limits are maintained at all times

Wetting of dust generation sources is an ongoing requirement that needs to start as soon as the first construction activity is taking place and must be maintained throughout the operation of the landfill. Paving of roads must be considered and costed at the detailed design stage. As paving of access roads particularly for Site alternative 3 could be extensive, the cost thereof has to be specified and integrated into the overall consideration of the financial feasibility of locating the landfill at this site.

Litter control:

- Cover working faces of active waste cells each day to minimise the visual impact of the waste, prevent litter from being blown away by wind and minimise the attraction of birds.
- Install effective catching mechanisms or other management measures to prevent wind blown litter from leaving the immediate confines of the working (disposal) area.
- Regularly clear wind-blown litter that gathers along fencing.
- Cover all waste on the trucks.

Installations that are required to effect these mitigation measures need to be integrated into the design of the landfill. Management measures need to be implemented continuously throughout the operational life of the landfill.

Rehabilitation:

Prepare a rehabilitation plan before the site is developed to enable progressive rehabilitation during the operational lifespan of the site.

Rehabilitate full cells as soon as possible after closure to minimise the visual footprint and impact of the overall landfill. Use indigenous vegetation in the rehabilitation of closed cells.

All of the mitigation measures listed above should be integrated into an Environmental Management Plan that forms part and is a requirement of the approval of the development.

11.5 Heritage

The recommendations made by the Heritage Impact Practitioner concurred with the recommendations made by the Archaeologist, Palaeontologist and Visual Impact Assessment.

11.6 Socio-economic

Nuisance impacts:

Nuisance impacts can be prevented or mitigated by implementing the following measures:

- Immediate compaction and daily covering of waste to reduce breeding of flies and rodents.
- Immediate compaction and daily covering of waste to prevent escape of windblown litter
- Litter screens will be implemented to prevent escape of waste
- Where possible cells will be aligned at right angles to prevailing wind directions
- Education and Communication of potential impacts to communities:
  This should involve workshops or information sessions to present and inform surrounding communities of the landfill waste disposal concept. This should include presenting and an explanation of the potential negative impacts that could result from the operations of the site, and how these may impact on surroundging communities, socially (health and safety concerns) and economically (impact on property values and potential tourist activities). The opportunities that may result from the operations of the waste disposal site must also be communicated. This links with the municipalities Entrepreneurs Initiative and should encourage local communities to get more involved in the municipalities Waste Minimisation strategy.

Noise Impacts

Two main types of potential noise sources have been identified, that will result from the construction and operations of the Eden Regional Waste Disposal site. These impacts are; Noise created by heavy vehicles delivering waste; and noise created by heavy vehicles spreading and compacting waste
These noise impacts in connection with the nuisance impacts could impact property values in the surrounding communities, and at alternative site 2 and 3, the increased noise emanation from the increased use of the R327 by heavy trucks to deliver waste may have an impact on the sense of place, which is mainly used for agriculture and the Gondwana Nature Reserve are also located to the north of these sites. Thus the noise impacts could potentially impact tourist activities in the Herbertsdale area.

The noise impacts will only have a local impact within the Mossel Bay municipal area. Measures proposed to be taken to limit the extent of this impact by the Eden Municipality are:

- All equipment at the site will be fitted with the correct exhaust systems to minimise noise;
- Will be regularly maintained to limit noise; and
- The establishment of an appropriate buffer with regards to location of the site to the surrounding communities.
- Purchase/leasing of new waste disposal vehicles

This links with the strategies of the Mossel Bay municipality to replace its ageing fleet, which experience a greater number of breakdowns and emanate a greater amount of noise. The standard of the delivery vehicles with regards to noise will have a greater impact at site 2 and 3, along the R327, which currently has a limited usage by heavy vehicles. Thus the increased use of the road to deliver the waste will significantly impact noise levels in the area and with an ageing, ill-maintained fleet will only accentuate this negative impact.

- Outsourcing of Waste Disposal Collection Service
  This links with municipalities' initiative regarding waste disposal collection and transportation. Two main services can be distinguished at this point; collection of waste from households to transfer station and the transport of waste from transfer station to landfill site. Through the outsourcing of these services the municipality will be promoting its Entrepreneurs initiative and will enable these individuals make use of this opportunity to provide a valuable, necessary service; in case the efficiency of the service; locate alternate sources of leasing the vehicles used for waste disposal; and create employment opportunities within the local economy.

Social impacts

Potential social impacts include the following:

- Local Economic Opportunities:
  A number of economic and employment opportunities will be created through the operations and construction of the Eden Regional Waste Disposal Site, in addition employment will be maintained within the other municipalities the site will cater for, such as recycling companies and outsourced waste collection services.
- Health and Safety:
  Health and safety concerns associated with the construction and operation of the Eden Regional Waste Disposal site will emanate from the nuisance factors (odours, flies, rodents and litter). The extent of these negative impacts can be reduced and will be reduced via the location of the site. With its location in the vicinity of the PetroSA site, which is some 9km from Mossel Bay, these nuisance factors are unlikely to raise health and safety concerns, however with ineffective management of the site this may become a notable problem to the surrounding land use activities and if located at site 1 may create a negative sense of place for natural areas to the west of the Mossel Bay and the site, with regards to tourism.
- Incompatible Land Use:
  This involves location of the site in an area where it does not compliment the surrounding land use activities and thus may have a negative impact, such as locating the site adjacent to land used for residential purposes.
- Economic Aspects:

This is in regards to the potential impact, both positive and negative, that the establishment and operations of the site may have on surrounding economic activities and economic prospects in the greater Mossel Bay area. It refers in particular to its potential impact on agricultural activities in the area, its potential impact on property values and tourism as the most notable negative impacts.

However the operations of the landfill site, in particular the MRF and composting activities, will have a positive impact for local communities, from which complementing economic ventures and opportunities are available. The presence and availability of these opportunities ties in with the local municipalities drive and strategy to encourage entrepreneurship provision and enabling activities within the local region.

- Agriculture:
  This relates primarily to the vectors (odours, flies, rodents and litter). If these are not controlled effectively at the site the vectors may cause negative impacts for farming activities on the surrounding portions of land. The most notable negative impacts being
  - Reductions in produce sales
  - Reduction in quality of produce
  - Death and disease of livestock; and
  - Fires
- Health and safety of the site users, employees, visitors and surrounding communities is the responsibility of the site operator. In accordance, health and safety reporting structures and procedures for the site must be drawn up according to the OHSA Act of 1993 and the legal policies of the Mossel Bay and Eden municipalities.
- Erection of fences to filter litter and prevent illegal enter into the site and erection of warning signs
- Daily compacting of waste and litter to prevent prevalence of nuisance factors
- Effective management of the site is essential
- In relation to any economic opportunities, which may arise from the development of the landfill site, these as well as any employment opportunities should be sourced to and within the local economy of the Mossel Bay area. This will enable the benefits, which will arise from the development, to be maximised and to reduce the negative perceptions of landfill activities and construction. Waste disposal is regarded as essential service however landfill sites have the stigma of being nothing more than environmental hazards and social hindrances. A number of economic opportunities are however stimulated through these activities and if the bulk of these opportunities accrue within the local economy (where any negative impacts are likely to felt the worst) positive benefits of waste disposal will greatly reduce the negative impacts which are experienced.
- The Establishment of complementing waste disposal and recycling business ventures. Often waste disposed of at a landfill site can serve as inputs into a number of alternate business operations. This opportunity is made even more feasible by the Materials Recovery Facility, which sorts waste,

keeping usable materials and disposing of unusable goods, which are not sorted at its source. In addition, Mossdustria is located approximately 3 km from the site, which is an area zoned by the municipality for industrial use, this currently is standing vacant due to the lack of demand for industrial activities in the area. These include warehouses and existing facilities which can be used for the operations of these economic activities and as the landfill is located so close, reduces cost implications regarding transport and inputs into these production processes. Such activities are also labour intensive and require hands-on application, which will stimulate employment opportunities and will include the portion.

- Waste collection and transport from transfer stations is another opportunity, which exists from the landfill activities. In the municipal IDP it states the desire to outsource these activities to local entrepreneurs, which will also stimulate employment opportunities and ensure an effective and creative means of waste transportation and collection in the area.
- The disposal of garden refuse provides opportunities within the district for vermiculture or composting. This involves the use of specially bred earthworms to aerate the soil and convert organic matter into compost. Small-scale vermiculture farming has become increasingly popular in of late as the advantages of this type of farming and its environmental benefits are becoming increasingly recognised. The end product of this type of farming is compost or liquid compost, which can be used for farming (providing a ready supply to the surrounding farmlands at the sites), landscaping, and making worm tea or for sale in the nationally economy. Materials for this type of farming are readily available at the site thus the cost implications for potential entrepreneurs and farmers is low.
- Education and full transparency of the sites operations need to be communicated to the local communities. This will enable local communities to have a full understanding of the potential negative and positive impacts of the site, which will allow potential business and entrepreneurial opportunities to be identified and capitalised on.

In order to reduce the potential negative impact of nuisance vectors on the surrounding farming activities, a monitoring and regulation committee or initiative should be established whose responsibility will include monitoring the escape of litter into the neighbouring farmlands and assess the extent of this occurrence. In addition such a committee or activity could help identify new methods or alternate methods to prevent the escape of wind blown litter and its impact on farming activities.

11.7 Traffic

None required for Site 1.

11.8 Botanical

If Site 1 is authorised then the following mitigation should be required: the seasonal pan must have a buffer of at least 75m wide, as measured from its outer edge (this is already reflected in the Feb 2012 layout); the pan and its buffer must be fenced off with permanent fencing prior to any construction; the large patch of Aloe arborescens should be trans located to a suitable area nearby or even on site; it should be noted that milkwoods (Sideroxylon inerme) are a protected species and may only be pruned or removed with the relevant permit (which should be obtained subsequent to authorisation and prior to construction); any available intact topsoil should be stockpiled on site for eventual use when capping the landfill; invasive alien vegetation should be removed from the authorised site on an annual basis; landscaping and screening of the site should be with suitable locally indigenous vegetation; ongoing botanical monitoring of the site should not be necessary.

11.9 Freshwater ecological

- That while there are a number of fresh water features on the proposed site that only two of significance is the seasonal stream that forms part of the Blinderivier system and the seasonal pan/wetland area.
- This assessment confirms the need to protect these freshwater ecosystems from a biodiversity point of view.
- The other water features are artificially created freshwater bodies that have little ecological importance.
- The critical aspect in the consideration of the proposed activity is the level of protection that would be the mitigation measures required to ensure that the seasonal stream and wetland area retain their existing character and functionality while being sited adjacent to a landfill site otherwise there would be no point in trying to retain these ecosystems at all.
- As both systems are seasonal, it would be important to ensure that the hydrology (both surface and groundwater) feeding these systems does not change significantly in terms of its flow patterns and volumes. The ‘clean’ runoff water and sub-surface flows entering the landfill site from the upper catchment area should be diverted around the site and discharged to the freshwater systems on either side of the site.
- In addition, from a water quality point of view, the leachate and contaminated runoff from the landfill site should be managed on site to reduce the risk of contamination of the freshwater ecosystems. Contaminated storm water emanating from the site should as far as possible be collected and discharged into a storm water attenuation dam at the lowest point on the site. Any overflow from the attenuation dam should be discharged into the Blinderivier below the site.
- The intensity of any storm water discharge into the freshwater systems should be dissipated as far as possible to prevent any erosion from taking place.

- One would also need to make sure that no litter, rubble or sand is deposited within the freshwater systems and that there is no trampling of the riparian and wetland vegetation. Fencing around the recommended buffer areas is thus recommended.
- The buffer area recommended to mitigate the impacts of the surrounding activities on both the seasonal wetland as well as the stream would need to be at approximately 50m wide for the stream and 75m wide for the seasonal wetland as indicated by the yellow polygon in Figure 15. The sizes of the wetland and river buffer zones recommended are based on the natural topography and drainage on the site, where drainage occurring outside of the recommended buffer is likely to flow away from the water features.
- Drainage across the site appears to be from the north western portion of the site towards the south eastern corner. Drainage to the wetland area is thus from the adjacent farmland on the western border, while drainage to the seasonal stream has been historically diverted away from the stream by the existing constructed levee. The seasonal stream receives flow from the PetroSA storm water discharge.

11.10 Avi-faunal

Bird carcasses found on site should be removed or quickly buried to prevent the potential spread of pathogens. A single bird carcass may be incidental but if two or more carcasses are found at one time the freshest carcass should be sent to the state veterinary for assessment of the cause of death. Ideally any moribund (weak and easily caught) birds seen at the same time as the carcasses should be captured and a vet should be called in to take a blood serum sample for analysis as this is the best way to test for botulism (botulism cannot be properly determined from a dead bird). It is advisable to collect, and appropriately store, 20-30g samples of the site soil and water before dumping begins. These samples will provide a baseline level against which subsequent samples can be compared to assess changes in pollutants etc. It is not in the remit of this report to spell out protocols in detail. This should be done with a local (ideally state) veterinarian and, in terms of bird control, with an ornithologist.

11.11 Geohydrological

- Maintain good housekeeping measures for on-site storage of hydrocarbon based products and clean up any spillages and waste on a daily basis. This material should be stored in appropriate containers in bunded area for removal and disposal;
- Supply on-site sanitation during construction;
- Carry out site construction during the dry summer months if possible, or at least avoid the normally ‘wet’ months;
- Install monitoring boreholes on the ‘upstream’ and ‘downstream’ sides of the landfill area. This should be done prior to construction of the waste site to establish background water quality;

- Sample these boreholes on a quarterly basis (if groundwater is present) for analysis for electrical conductivity, pH, chloride, nitrate, potassium, Chemical Oxygen Demand and Total Alkalinity. A full chemical analysis should be done prior to establishment of the Site to include the following additional determinants: sodium, calcium, magnesium, sulphate, phosphate, fluoride, lead, zinc, nickel, cadmium, Total Chromium, iron and manganese. The data should be evaluated by a hydro geologist on a regular basis;
- Establish a surface water sampling point immediately downstream of the site. Obtain at least one sample prior to construction as flow conditions allow. Analyse for the same constituents as above, plus suspended solids;
- Line the waste disposal area with appropriate materials as per the Minimum Requirements;
- Install a storm water control system to intercept ‘clean’ surface water run-off from upstream of and around the Site and divert into the natural drainage channel downstream of the Site.
- A further migratory factor is the presence of the Petro SA hazardous waste site on the adjacent property to the east. This has not had any reported negative impacts on groundwater in the area.

11.12 Air Quality

The main air pollution impacts were identified to be associated with health risk (carcinogens and PM_{10}) and odours. The recommendations are therefore geared towards minimising the impact and/or potentially eliminating air pollution from sources generating these emissions. The health risk can be reduced through design specifications, operational procedures and applying a Buffer Zone. The latter minimises the exposure, whereas the former actions reduce or eliminate the emissions. The recommendations are therefore as follows:

- Adopt the Buffer Zone, which was delineated exclusively on the basis of health impact, to minimise unnecessary human exposure to potentially toxic gaseous and particulate compounds. The extents of these zones are given in Figure 9.4 (Site 1). In general, no or only specified development may take place within the defined Buffer Zone, i.e., compatible land use adjacent to a landfill site. Agriculture or limited industrial developments may typically be found to be compatible with landfill operation.
- Adopt the Management Zone, which is indicative of the odour and dust impact areas, with reductions in the extent of such impact areas requiring the implementation of emission reduction measures. The extents of these zones are given in in Figure 9.7 (Site 1). The designation of the area should be seen to necessitate the EDM Landfill to undertake the following:
- develop and implement a site-specific odour assessment and management plan for the zone
- re-evaluate the potential for impacts and the extent of management/mitigation required given changes in land use in the adjacent area

Buffer zones

Airborne dust minimisation

1. Minimisation of vehicle entrainment dust generated along unpaved roads during both construction and operational phases:
   - As a minimum, apply regular water spraying on access roads. (More permanent surface improvements, including chemical treatment, paving with concrete or asphalt, or the addition of gravel or slag to the surface can be highly effective but is expensive and unsuitable for surfaces used by very heavy vehicles or subject to spillages of material in transport.)
   - Reduce the possibility of carry-out of mud and dirt from construction site onto public roads; by provide washing facilities at the exits including hose pipes, adequate water supply and pressure and mechanical wheel spinners or brushes.
   - Ensure that loading of materials is done with the lowest drop height and those vehicles carrying dusty materials are securely and properly covered before they leave the site.
   - Enter all information in a log book including all vehicles entering and leaving the site.
   - Sweeping tarred road entrances to reduce mud and dust carry through.
   - Control of load size to avoid spillages.
   - Limiting vehicle speeds. The control of vehicle tailpipe emissions may be achieved by ensuring that vehicles are in good working condition and to minimize idling of equipment when not in use.

7. Re-vegetation of exposed surfaces should be done wherever practicable, and other similar activities subject to on-going development.
8. It is recommended to mitigate windblown dust through the use of shelterbelts or temporary screening. (It may also be possible to make use of natural land features, or trees to provide a degree of wind protection)
9. Fugitive dust generated through materials handling operations (e.g. front-end loaders or mechanical grabs), are best addressed by minimising drop heights, and regular clean-up of any spillages
10. It is not recommended that misting systems be used constantly on active face/operational area as it may increase the moisture content of the waste and therefore proliferate anaerobic conditions. Mist system should only be used when appropriate. Instead, it is recommended to temporary cover using materials such as Hessian, mineral soil, clay cover or impermeable materials such as PVC
11. Consider the feasibility fitting fabric filters on the crusher proposed for the builder’s rubble crusher

Gaseous emissions

1. Emission controls

- As stated in the Minimum Requirements for Waste Disposal by Landfill (DWAF 1998, DWAF 2005), odours must be combated by good cover application and maintenance. Furthermore, the prompt covering of malodorous waste to reduce odour problems is a Minimum Requirement.
- A temporary cover using materials such as Hessian, mineral soil, clay cover and impermeable materials such as PVC could be used on active face/operational area. Similarly, exposed daily/weekly waste should be covered using Hessian//Polythene/soil on-site.
- It is recommended that the stockpile should be adequate to meet the cover requirements of the landfill for at least three days (DWAF 2005) to two weeks.
- Uncontrolled gas emissions from landfill are generally considered not to be a sustainable practice since landfills primarily produce methane and carbon dioxide which, if not contained, can contribute to the greenhouse effect. Furthermore, landfill gas represents a useful source of energy. An effective manner to control landfill gas emissions is to include a subsurface gas extraction system, which would allow the captured gas to be flared or used in an engine. The proposed design does not include gas capturing; however, it is recommended that the options of this being sustainably utilised should be investigated.
- According to Minimum Requirements for Waste Disposal by Landfill (DWAF 2005), Appendix 10.3, the operator is required to develop a Landfill Gas Management Plan and Air Quality Management Plan. In the development of these plans, it is recommended that the following items be included:

Management Plan

- The landfill owner must limit odour impacts by discouraging any development of sensitive receptors within the proposed Management Zone. This will minimise the requirement for other stringent odour controls.
- It is recommended that an odour management plan be implemented using resident data, meteorological data and site operator knowledge to investigate any odour complaints or potential odour complaints and implement remedial action using a developed common sense strategy.
- Windblown litter is a nuisance to the community in the vicinity of landfill sites and should be controlled by the following techniques:
    - Introduce procedures that prevent the unnecessary proliferation of litter, such as continuous compaction and use of litter fences.
    - Ensure that all wind-blown litter that leaves the site is retrieved.

- All litter fences, perimeter fences and gates must be inspected and cleared of litter on a daily basis or as required.
- Entry and exit signs need to advise transport operators that they can be fined for any litter on public roads resulting from their improper transportation of waste.
- Vehicles using landfill sites will inadvertently collect mud and litter on their wheels as they proceed to and return from the active face. All mud and waste materials on vehicles that leave the site should be removed. The landfill operator should therefore provide a wheel-washing or wheel-cleaning facility for use by customers. The landfill operator should display signs advising customers that it is the vehicle operator's responsibility to ensure that the remnants of their load or the material stuck to the underside of the vehicle or the wheels does not litter public roads.

▪ Burning of waste is not allowed at the landfill, in accordance with the Minimum Requirements for Waste Disposal by Landfill.

Monitoring programme

▪ It is recommended that a meteorological station that monitors:
  - wind speed;
  - wind direction;
  - sigma theta (standard deviation of the horizontal fluctuation in the wind direction)
  - temperature
  - rainfall
  - atmospheric pressure
  - solar radiation.

▪ The risk of gas explosion (CH_4) must be continually monitored.
  - Landfill gas monitoring devices should be capable of detecting landfill gas in sufficiently low concentrations to ensure that landfill gas is not migrating off-site, and toxic air emissions are not a threat to the community.
  - These must be monitored at 3-monthly intervals during the operation and at the discretion of the Competent Authority after site closure. If the soil gas methane concentrations exceed 1% by volume at Standard Temperature and Pressure (STP), the Competent Authority must be informed.
  - If the methane levels are found to be between 0.5% and 5% in air (i.e., between 10% of LEL and LEL) then regular monitoring of the boundary must be instituted. If the methane levels are found to be greater than 5% in gas probes around the boundary, then monitoring should be initiated and an investigation to determine lateral migration should be commissioned.
  - Depressions in the cover material or surface fissures away from the sampling grid nominated above must also be investigated for methane emissions.

- When significant landfill gas is present, samples must be taken at various positions at the landfill site, and characterised for volatile organic compounds. Sampling can be direct at gas wells, or using the techniques outlined in the Minimum Requirements for Waste Disposal by Landfill (Section 11.5.6):
    - Direct measurement technologies
    - Indirect measurement technologies
    - Fenceline monitoring and modelling technologies
    - Predictive emission modelling

Direct measurement using a surface emission isolation flux chamber is the preferred technique for characterising area source facilities with hazardous fugitive emissions. The location and number of test points must be adequate to enable calculation of the emission rates of substances from the toal area. Sampling and analysis must cover the complete range of substances that are relevant to the source. The data must then be used in a mathematical dispersion model to predict exposure levels for quantifying occupational and environmental health risks. Monitoring wells should be installed around the perimeter of the site. These wells should be placed at intervals sufficiently small to be able to detect any potential offsite migration. The depth, spacing and design of these wells should be determined based on a site investigation. A subsurface gas monitoring program should be implemented on a regular basis (at least bi-annually) to demonstrate that gas is not migrating offsite. It is also recommended that hydrogen sulphide gas be measured as an indicator odorant and to better quantify odour emissions. The testing should be conducted in situ using a properly maintained, zeroed and calibrated field instrument (Airshed Planning Professionals (Pty) Ltd, 2012). The number and location of monitoring wells can only be determined once the site is in operation *(Pers comm*. Burger, October 2012).

11.13 General recommendations and Environmental Management Programme

It is recommended that the Eden District Municipality appoint a responsible and experienced professional management operator to manage the waste site with a contract that may be renewed after a set period depending on the performance of the operator. The Environmental Management Programme and Operating Plan that has been compiled and attached to this report includes the required mitigation and monitoring measures. It is therefore recommended that the EMP be implemented in order to minimise the risk of potential environmental pollution and degradation. It is important that high quality potable Municipal water may not be used for the purposes of dust suppression. A fire management plan must be compiled and implemented and the Eden District Municipality must maintain their membership with the Southern Cape Fire Protection Association.

11.14 The way forward

The Public Participation Process conducted up to date has given I&APs the opportunity to assist with the identification of potential impacts that the proposed waste disposal facility may have and comment on the Draft EIR. The comments received on the Draft EIR have been collated into a comments and responses report that has been included under Appendix D of the Final EIR.

Further opportunity has been provided to registered I&APs to comment on the Final Environmental Impact Report.

Copies of the Final Environmental Impact Report were made available for public viewing at the following locations:

1. The main public libraries in George, Knysna, Mossel Bay, Plettenberg Bay and Albertinia, and
2. The Final EIR can also be downloaded from the following websites: www.pdna.co.za; www.jpce.co.za.
3. Electronic copies are available from the Consultants on request.

The registered I&APs were notified of the availability of the Final Environmental Impact Report and provided with a minimum comment period of 21 days. Any comments received on the Final EIR will be submitted to the DEA&DP for consideration.

Interested and Affected Parties now have opportunity to comment on this Final Environmental Impact Report including the Specialist studies and Environmental Management Programme.

Comment periods are indicated on the covering letter to this report.

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REFERENCES

Airshed Planning Professionals (Pty) Ltd. 2012. Environmental Impact Assessment: Identification of Regional landfill site and Licence application for Eden District Municipality: Air Pollution Impact Assessment.

Almond, J.E. 2011. Palaeontological desktop study. Cape Town.

Belcher, T. 2011. Freshwater Assessment for the proposed Eden Municipality Landfill Sie at Mossel Bay.

Bergman Ingerop. 1999. Investigation for a Waste Management Strategy for the South Cape.

Bergman Ingerop. 1998. Prefeasibility Investigation into the suitability of a proposed waste site on Farm 464, George.

Bergman Ingerop. 1995. Plettenberg Bay - Regional waste disposal - Report on Analysis of Options.

Bergman, B.S. & Partners INC. 1994. Investigation into the development of a Class II Regional Waste Disposal Site at Knysna. Feasbility Report.

Bergman Ingerop. 1993. Investigation into the development of a class 2 regional waste disposal site at Gansevallei, Plettenberg Bay - Feasibility Report.

Chittenden Nicks and De Villiers. 2002. Garden Route Klein Karoo (GRKK) Integrated Development Plan and Spatial Development Framework.

Chittenden Nicks and De Villiers. 2005. Western Cape Provincial Spatial Development Framework by CNdV Africa, 2005.

DEAT. 2004. Cumulative Effects Assessment, Integrated Environmental Management, Information Series 7, Department of Environmental Affairs and Tourism (DEAT), Pretoria.

Dennis Moss Partnership. 2003. Eden District Municipality. Spatial Development Framework. Dennis Moss Partnership, Stellenbosch.

Department of Water Affairs and Forestry (2005). *Waste Management Series. Minimum Requirements for Waste Disposal by Landfill.* Third Edition.

Department of Water Affairs and Forestry 1998a. **Waste Management Series. Minimum Requirements for Waste Disposal by Landfill.** Second Editions

Department of Water Affairs and Forestry. 1998b. **Waste Management Series. Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste**. Second Editions.

Goodwin, A.J.H. and Malan, B.D. 1935. Archaeology of the Cape St. Blaize Cave and raised beach, Mossel Bay. Annals of the South African Museum 34:111-14-

Helme, N. 2009. Nick Helme Botanical Surveys. Environmental Impact Assessment: Identification of Regional Landfill Site and Permit Application for Eden District Municipality. Botanical Baseline (Scoping Phase) Assessment.

Helme, N. 2012. Nick Helme Botanical Surveys. Environmental Impact Assessment: Identification of Regional Landfill Site and Licence Application for Eden District Municipality. Botanical Impact Assessment.

ICE Group (Pty) Ltd. 2012. Eden Districtc Municipality: Identification of Regional Landfill Site: Roads and Traffic Report.

Kaplan, J. 1993. The state of archaeological information in the coastal zone from the Orange River to Ponta do Ouro. Report prepared for the Department of Environment Affairs and Tourism. Agency for Cultural Resource Management.

Kaplan, J. 1997. Archaeological study, Pinnacle Point, Mossel Bay. Report prepared for CODEV. Agency for Cultural Resource Management.

Kaplan, J. 2003. Phase 1 Archaeological Impact Assessment Portion 1 of the Farm Droogfontein No. 245 Mossel Bay. Report prepared for Johan Neethling Environmental Services. Agency for Cultural Resource Management

Kaplan, J. 2007a. Phase 1 Archaeological Impact Assessment proposed development on the remainder of the Farm Droogfontein No. 245 Mossel Bay. Report prepared for Envirocor Management Services (Pty) Ltd. Agency for Cultural Resource Management.

Kaplan, J. 2007b. Phase 1 Archaeological Impact Assessment Proposed development Outeniquasbosch Safari Park Outeniquasbosch 149 and Hartenbos 217 Mossel Bay. Report prepared for Hilland Associates. Agency for Cultural Resource Management.

Kaplan, J. 2009a. Archaeological Impact Assessment of the proposed expansion of the Kleingeluk Quarry on Portion 11 of the Farm Hartenbosch No. 217 Mossel Bay. Report prepared for Site Plan Consulting. Agency for Cultural Resource Management

Kaplan, J. 2009b. Archaeological Impact Assessment for the proposed Regional Waste Disposal Facility and licence application for Eden District Municipality. Report prepared for PD Naidoo & Associates Consulting Engineers (Pty) Ltd. Agency for Cultural Resource Management.

Kwezi V3 Engineers. 2005. Integrated Waste Management Plan for the Mossel Bay Local Muncipality.

Leith, G. 1898. On the caves, shell mounds and stone implements of South Africa. Journal of the Royal Anthropological Institute. 28:258-274

Marean, C.W. and Nilssen, P.J. 2002. Background and results from test excavations of Middle Stone Age sites at Pinnacle Point, Mossel Bay. Final report for the South African Heritage Resources Agency (SAHRA) and the National Research Foundation (NRF).

MCA. 2009. Eden District Municipality: Spatial Development Framework.

Mucina, L. and M. Rutherford. *Eds.* 2006. Vegetation map of South Africa, Lesotho, and Swaziland. *Strelitzia 19*. South African National Biodiversity Institute, Pretoria.

Naudé, H. 2008. Proposed New Regional Landfill Sites. Economic Evaluation of Alternative Waste Disposal Arrangement in Eden District Municipality. Project No. 070745.

Nilssen, P.J. 2005. Development at Pinnacle Point, Mossel Bay. Archaeological monitoring of vegetation clearing and all earthmoving activities. Progress Report. Report prepared for Heritage Western Cape. Mossel Bay Archaeology Project.

Raimondo, D., L. Agenbag, W. Foden, J. Victor, N. Helme and R. Turner. *In press.* Red Data Book of threatened plants of South Africa. *Strelitzia*. To be published by the South African National Biodiversity Institute, Pretoria.

Reader's Digest. 1990. Illustrated Guide to Southern Africa. 4th Edition. Reader's Digest Association South Africa (Pty) Limited.

Ron Martin Heritage Consultancy. 2012. Heritage Impact Assessment. Proposed Eden Landfill Site, Mossel Bay District.

Rouget, M., Reyers, B., Jonas, Z., Desmet, P., Driver, A., Maze, K., Egoh, B. & Cowling, R.M. 2004. *South African National Spatial Biodiversity Assessment 2004: Technical Report. Volume 1:Terrestrial Component.* Pretoria: South African National Biodiversity Institute.

SRK Consulting. 2008. Eden District Municipality: Waste Disposal Site "Window" Identification. Report No. 391940.

SRK Consulting. 2012. Environmental Impact Assessment: Identification of Regional landfill site and Licence application for Eden District Municipality: Hydrogeological Impact Assessment.

SRK Consulting. 2012. Environmental Impact Assessment: Identification of Regional landfill site and Licence application for Eden District Municipality: Visual Impact Assessment.

Taylor Van Rensburg Van der Spuy (TV3) 2008. Mossel Bay Spatial Development Framework.

Taylor Van Rensburg Van der Spuy (TV3) 2005. Mossel Bay Spatial Development Framework.

Urban-Econ.2012. Eden Regional Landfill Site – Socio-Economic Impact Analysis. Urban-Econ, George.

Vlok, J. and R. de Villiers. 2007. Vegetation mapping component of Fine Scale Mapping Project for Riversdale Plain. Unpublished report for CapeNature, as part of the C.A.P.E. programme. Regalis Environmental Services, Oudtshoorn.

Williams, A.J. 2011. Avifuanal Report on the proposed Eden Municipalisty Regional Waste Disposal Site near Mossel Bay.