ISCOR VANDERBIJLPARK STEEL

ENVIRONMENTAL MONITORING SYSTEM

USER MANUAL

BY
JASPER MÜLLER ASSOCIATES

DOCUMENT IVS/OR/013(a)
DECEMBER 2002

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FINAL

ISCOR VANDERBIJLPARK STEEL

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IVS/OR/13a

USER MANUAL

DATE: DECEMBER 2002

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APPENDICES

1. INTRODUCTION

This report was compiled by JMA for ISCOR VANDERBIJLPARK STEEL (IVS) in fulfilment of the list of required deliverables for the Integrated Environmental Master Plan Project. However, although originally scoped as part of the Master Plan Project, the development and commissioning of the system was handled as a separate entity from the Master Plan Project.

The end objective of all the actions which will be initiated as a result of the Master Plan developed for IVS, is to facilitate an integrated Environmental Management Plan. Environmental monitoring is perhaps the most fundamental component of Integrated Environmental Management.

During the Master Plan, several data capture programs were commissioned in order to generate data required to describe and quantify the origin, migration mechanisms and impact manifestation of IVS impacting activities, covering a wide range of environmental components.

A well designed, structured environmental monitoring program was developed and commissioned for IVS.
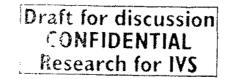
This report - Environmental Monitoring System, User Manual, gives fulfilment to the first part of the project in as far as it represents the documentation related to the design and implementation of the system. Full commissioning of the system is envisaged in the project proposal, to comprise a first commissioning year (2002), during which the system described in this report will be commissioned as a joint venture between the OFT Team and IVS Environmental Division. The intention of this joint implementation period is to facilitate refinement of the system where required, as well as to ensure that IVS personnel would be fully trained to perform all tasks related to data capture, information generation, reporting and management of the system. The first joint monitoring year will culminate in the compilation of the first Environmental Monitoring Annual Report, compiled by JMA on behalf of the OFT Team for IVS - to be submitted in April 2003..

All aspects comprising the first monitoring year (2002), including the compilation of the first annual report, is therefore a joint responsibility of the OFT Team and IVS Environmental Division.

2. MONITORING REQUIREMENTS/PHILOSOPHY

Effective integrated environmental management requires not only a fundamental understanding of all activities and processes which could impact on the environment, but more importantly the transient development of the impacts associated with these processes, needs to be understood to such a degree, that their future development and response to management, remedial and/or rehabilitation measures, can be predicted. Furthermore, upon commissioning of these management, remedial and/or rehabilitation measures, the efficiency of these measures to attain their objectives, must be measured through environmental monitoring. The system therefore needs to support both compliance and performance monitoring objectives.
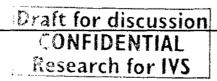
Several data capture programs and monitoring systems will be commissioned during the Master Plan studies, which will contribute towards a significant data volume. In order to manage this huge amount of data, a structured, computerized data base of high integrity, which will facilitate seamless communication with, and data transfer to, information generation technologies such as GIS and Environmental Modeling Software, was commissioned as part and parcel of the Environmental Monitoring System.

The computerized data base and information generation technologies lie at the heart of effective, integrated environmental management, as they facilitate dynamic management of the environment, based on recent monitoring results. Without a sound data base, coupled to interactive information systems, neither the management measures, nor the monitoring systems, will function effectively. It should be noted that management of the monitoring systems, the maintenance of the database, and generation of information, would require dedicated facilities and human resources. The effort and money to be expended on these systems should not be under estimated. Care should be taken during the design and commissioning of these systems to optimize them in terms of cost effective information yield.

In terms of the requirements of a structured environmental monitoring system it would consist of the following main components:

- Determination of the legal/statutory environmental monitoring requirements as may be prescribed in acts, bylaws, regulations, permits, licenses, etc.

- Commissioning of monitoring infrastructure. This relates to the selection, siting and construction of sampling/monitoring points where observations/samples are taken to obtain data on aspects related to soil, meteorology, vegetation, animal life, surface water, groundwater, etc. The selection of the localities and the technical specifications for the monitoring/sampling points are critical, as they need to supply data of high integrity, which will support impact assessment, related to the various environmental components being monitored.

- Data capture protocols need to be developed for the various environmental components. Aspects such as sampling technique, sampling equipment, sampling frequency, sample preservation, analyzing technique, and variables to be analyzed for, need to be formalized and documented, to ensure that the information generation protocols required to turn the data into impact assessment information, are supported.

- Once the data has been generated, structured data storage in a computerized data base of high integrity, which will facilitate the seamless utilization of advanced information generating technologies such as GIS and modeling software. All the aforementioned are important components to turn such a data capture program as described above, into an effective environmental monitoring system, as required for integrated environmental management.

- Reporting of the monitoring results need to be structured in such away, as to optimize the utilization of the generated information, for effective and dynamic integrated environmental management.

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- The corrective action request system is specified in terms of the ISO 14001 Environmental Management Standard. Amongst various other requirements, compliance with ISO 14001 is demonstrated when it can be proven that a corrective action system exists within a company's environmental management system, to ensure a means for the raising of corrective action requests, and the consequent generation of action plans in order to remediate the wrongful action/situation. Ultimately, it must be proven that the originator of the corrective action is informed when the wrongful action has been corrected, thereby closing the loop and ensuring continual improvement. This manual does not offer a procedural description of the corrective action request of this company, nor does this manual intend to describe how to implement such a system, however, it fully supports the principle of corrective action as described by the ISO 14001 standard of environmental management in that it highlights non-conformance in terms of certain compliance standards (e.g. the South African Drinking Water Standard - ground water). It is the intention of this manual to advocate that where monitoring indicates a non-conformance, the company generates a corrective action to remedy the situation.

A wealth of monitoring/sampling localities were established at IVS prior to and during the Master Plan studies. Although some of these localities were only used for investigative monitoring purposes, others will remain as monitoring points for future monitoring. It is therefore absolutely essential that a structured monitoring system, comprising all the components discussed above, be developed around these monitoring localities.

However, additional monitoring localities might also be required, depending on the outcome of the Master Plan Studies.

3. MONITORING SYSTEM ENVIRONMENTAL COMPONENTS

A comprehensive environmental monitoring system, aimed at giving full compliance with the principles of Integrated Environmental Management, would consist of a number of environmental components. The current monitoring system compiled for IVS, however, only contains a selection of these components. In order to place the current system into perspective, the full list of components will be listed, followed by a synoptic discussion of the components included/active in the current system.

3.1 GENERIC ENVIRONMENTAL COMPONENTS

The followings list of environmental and related components, believed to be relevant aspects within a comprehensive environmental monitoring system, was compiled from various guidelines related to environmental processes, e.g. Department of Water Affairs and Forestry's Minimum Requirements, Department of Minerals and Energy EMPR's and Department of Agriculture and Environment EIA guidelines.

The following components, together with their respective sub-groups, are, in a more or lesser degree of significance, believed to be relevant. The acronyms used to identify the different monitoring localities are given in brackets (**bold**).

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The colour code distinguish between components measured for investigative objectives during the Master Plan study (RED), but which are not included for routine monitoring, and components included in the routine monitoring system (GREEN). The rest of the components did not receive attention and are not included in the current monitoring system (BLACK).

Source Characterization (SC)
- Waste Streams - Solids/Sludges
  - Physical/Dry Chemical Analyses (SCP)
  - Leachate Analyses (Total/TCLP/Acid Rain) (SCL)
- Sediments (SCD)
- Liquids
  - Effluent Analyses (SCE)
  - Seepage Analyses (SCS)

Meteorology (MG)
- Rainfall (MGR)
- Humidity (Rel) (MGH)
- Air Temperature (MGT)
- Wind Speed & Direction (MGD)

Topography (TP)
- Excavations (TPE)
- Fill/Heap/Stockpiles/Dumps (TPF)

Soils (SL)
- Classification (SLS)
- Contamination (SLT)

Land Capability and Land Use (LU)

Natural Vegetation and Plant Life (PL)

Animal Life (AL)

Aquatic Ecosystems (AE)

Geology (GG)
- Physical/Chemical Disturbances (GGC)
- Structural Disturbances (GGS)

Ground Water (GW)
- External Users (GWE)
- Fountains (GWEF)
- Perched Aquifer (GWP)
- Shallow Weathered Zone Aquifer (GWW)
- Deeper Fractured Aquifer (GWF)
- Mine Workings (GWM)
- Borehole Abstraction (GWA)

Surface Water   (SW)
  •   Rivers/Streams   (SWR)
  •   Dams/Pans   (SWD)
  •   Canals   (SWC)
  •   Feed Water   (SWF)

Air Quality   (AQ)
  •   Particulate Fallout
    –   Insoluble   (AQI)
    –   Soluble   (AQS)
  •   Gases/Fine Particulate
    –   Ambient Air   (AQA)
    –   Stack Emissions   (AQE)

Noise   (NS)

Archeology/Cultural Interest   (AC)

Visual Aspects   (VA)

Public Consultation - IAP's   (PC)

Enviro-Legal Aspects   (EL)

3.2   IVS - ACTIVE ENVIRONMENTAL COMPONENTS

In the monitoring system developed for IVS under the current OFT/JMA appointment, the following components will be active for routine monitoring purposes:

Source Characterization   (SC)
  •   Waste Streams - Solids/Sludges
    –   Physical/Dry Chemical Analyses   (SCP)
    –   Leachate Analyses (Total/TCLP/Acid Rain)   (SCL)
  •   Liquids
    –   Effluent Analyses   (SCE)
    –   Seepage Analyses   (SCS)

Meteorology   (MG)
  •   Rainfall   (MGR)
  •   Humidity (Rel)   (MGH)
  •   Air Temperature   (MGT)
  •   Wind Speed & Direction   (MGD)

Topography   (TP)
  •   Excavations   (TPE)
  •   Fill/Heap/Stockpiles/Dumps   (TPF)

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Land Capability and Land Use	(LU)	
Natural Vegetation and Plant Life	(PL)	
Animal Life	(AL)	
Aquatic Ecosystems	(AE)	

Ground Water   (GW)
- External Users   (GWE)
- Fountains   (GWEF)
- Perched Aquifer   (GWP)
- Shallow Weathered Zone Aquifer   (GWW)

Surface Water   (SW)
- Rivers/Streams   (SWR)
- Dams/Pans   (SWD)
- Canals/Sumps   (SWI)
- Feed Water   (SWF)

Air Quality   (AQ)
- Particulate Fallout
  - Insoluble   (AQI)
  - Soluble   (AQS)
- Gases/Fine Particulate
  - Ambient Air   (AQA)
  - Stack Emissions   (AQE)

Noise	(NS)	
Archeology/Cultural Interest	(AC)	
Public Consultation - IAP's	(PC)	
Enviro-Legal Aspects	(EL)	

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4. STRUCTURE OF USER MANUAL

The Monitoring System User Manual will be structured according to a modular format, to facilitate easy upgrading/expansion to accommodate not only future component additions, but also to streamline the up-grading process which may become necessary for individual components.

For each environmental component and it's associated sub-groups, a chapter will be compiled, containing the following headings:

- **Statutory Monitoring Requirements**

    – **Formal Compliance**

    The formal or procedural aspects of sampling are strictly controlled in terms of the authorisation-, permit-, license- and even exemption conditions issued in terms of current legislation. These conditions are integrated in the procedures of this protocol and failure to adhere thereto in the strictest sense, directly results in formal – (as well as indirect material) non-compliance with the relevant legislation.

    – **Material Compliance**

    Inadequate, periodic monitoring or even marginal deviance from monitoring procedures, produces unreliable data, straining the controlling authorities' capacity to monitor material legal compliance. Failure to produce comprehensive and accurate data will not only result in IVS failure to illustrate due diligence in terms of current environmental legislation, but also implies material non-compliance by default.

    Material compliance essentially relates to measurable environmental components for which fixed compliance criteria and or guidelines are available, e.g. the SA Drinking Water Standard for ground water, etc.

- **Monitoring Infrastructure/Sites/Localities**

    In future all monitoring localities will be registered with governing authorities and therefore all monitoring sites need to be carefully selected and formalized.

- **Data Capture Protocols**

    – Sampling Frequency
    – Sampling Technique
    – Sampling Equipment
    – Sampling Procedure
    – Sample Preservation
    – Analyses Protocol/Variables
    – Data Base Entry
    – Data Backup

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- **Information Generation Protocols**

  - Reporting Frequency
  - Report Content

- **Management Protocols**

  - Daily
  - Weekly
  - Two-weekly
  - Monthly
  - Quarterly
  - Six-Monthly
  - Annual

It is for obvious reasons that the above structure will not apply to Public Consultation (*IAP's*) and the Enviro-Legal Aspects components of the Monitoring System. These two components would be structured separately to accommodate the relevant aspects as related to these components.

5. SITE SPECIFIC MONITORING SPECIFICATIONS

For each of the active environmental components in the routine Monitoring System at IVS, full details will now be given.

5.1 SOURCE CHARACTERIZATION

5.1.1 STATUTORY/REGULATORY REQUIREMENTS

Formal Compliance

There are no specific formal monitoring requirements for source characterization at the IVS site. However, this information is required for the impact assessment on air, surface water and ground water in terms of the applicable statutory/regulatory monitoring requirements for these components.

Material Compliance

The applicable material compliance criteria for the waste stream monitoring group of the source characterization is DWAF's Minimum Requirements' for Waste Classification. This is used to classify the waste streams and to calculate the total load and risk to the environment. Further material compliance criteria will most probably be defined in the CRMF permit, once it has been issued.

5.1.2 MONITORING INFRASTRUCTURE/SITES/LOCALITIES

The following sites have been selected for Source Characterization monitoring:

Waste Streams - Solids/Sludges

Physical Dry Chemical Analyses   *(SCP)*
Leachate Analyses   *(SCL)*

Map No:	Description:
SCP/L-1	Vaal Dam Water Treatment Plant
SCP/L-2	Candy Water Treatment Plant
SCP/L-3	Sinter CG1 00
SCP/L-4	Coke Oven (Bricket plant)
SCP/L-5	Foundry (Casting)
SCP/L-6	DR Oven
SCP/L-7	DR Material
SCP/L-8	DR Product Separation
SCP/L-9	DR Product Separation
SCP/L-10	DR Product Separation
SCP/L-11	DR Oven
SCP/L-12	EAF

SCP/L-13	EAF Ladle Furnace No1
SCP/L-14	EAF Ladle Furnace No2
SCP/L-15	EAF Hecketts Plant 85
SCP/L-16	Blast Furnace C
SCP/L-17	Blast Furnace D
SCP/L-18	Blast Furnace C & D
SCP/L-19	Blast Furnace Hecketts plant 72
SCP/L-20	Blast Furnace
SCP/L-21	Blast Furnace C
SCP/L-22	Blast Furnace D
SCP/L-23	BOF Secondary East & West
SCP/L-24	BOF Secondary No3 De-gassing
SCP/L-25	BOF Mud
SCP/L-26	BOF Grid
SCP/L-27	BOF 1,2 & 3 Slag
SCP/L-28	Blast Furnace C (tap floor)

Sediments (SCD)   -   *In active*

Liquids

Effluent Analyses (SCE)

Map No:	Database No:	Source:
SCE-1	DAMS 1 - 4	Evaporation Dams 1 - 4
SCE-2	DAM 10	Dam 10
SCE-3	MP-1	Maturation Pond 1
SCE-4	MP-2	Maturation Pond 2
SCE-5	MP-3	Maturation Pond 3
SCE-6	CETP DAM	CETP Dam
SCE-7	KIEWIET	Kiewiet Quarry/Irrigation
SCE-8	TETP DAM	TETP Dam
SCE-9	TETP D2	TETP Pump Station

Seepage Analyses (SCS)

Map No:	Description:
SCS-1	Sinter Mixing Bed
SCS-2	CETP Old Sludge Dams
SCS-3	Hattingh Canal (top)
SCS-4	Coal Stacking Area
SCS-5	CETP Sludge Dams
SCS-6	Vaaldam Canal
SCS-7	NWAK
SCS-8	Heckett/Steelserv
SCS-9	Arc Furnace/BOF Slag
SCS-10	Du Preez Corner
SCS-11	Dams 1 - 4 : Seepage Canal
SCS-12	MP Ponds : Seepage Canal

The active routine source characterization sampling localities are shown on the map depicted in **FIGURE I - APPENDIX I**.

5.1.3 DATA CAPTURE PROTOCOLS

Sampling Frequency

Waste Streams - Solids/Sludges

Physical Dry Chemical Analyses (SCP)	-	**Annual**
Leachate Analyses (TCLP Acid Rain) (SCL)	-	**Quarterly**
Sediments (SCD)	-	*In active*

Suggested months for annual sampling run is June/July.

Liquids

Effluent Analyses (SCL)	-	**Quarterly**
Seepage Analyses (SCS)	-	**Quarterly**

Suggested months for quarterly sampling runs are March, June, September and November.

Sampling Technique

Waste Streams - Solids/Sludges

The sampling procedure/technique for the sampling of the Waste Streams is described in the following standard; ISO 1988- 1975E (the equivalent is available in final draft format: ISO/FDIS 13909).

An analytical result can only be accurate if the portion of the material taken as a sample has the same composition as the bulk of the material. Representative sampling is therefore crucial when the waste streams are being sampled.

The sampling plan drawn up, have two objectives:

- to collect samples that allow for accurate measurement of the chemical properties of the waste. This emphasizes the closeness of the sample value to the true value and is normally accomplished by some form of statistically correct random sampling; and

- to collect samples that allow for precise measurement of the chemical properties of the waste. This ensures the closeness of repeated sample values.

A minimum volume/mass of 100 g should be submitted for Semi-VOC analysis in wide mouth glass jars with TEFLON lined screw caps.

A separate volume/mass of minimum 100 g should be submitted for VOC analysis in wide mouth glass jars with TEFLON lined screw caps.

Liquids

Inorganic sampling:

The effluent- and seepage analyses group samples, are to be taken by means of a sampler or bottle/scoop and poured directly into laboratory pre-washed 1000 *ml* bottles. An extra sample should be taken in a laboratory prepared preservation sample bottle (250 *ml*), if this is required by the laboratory.

Organic sampling:

Adequate 40 *ml* **in duplicate** glass bottles for VOC samples with teflon lined screw caps.

Adequate 1000 *ml* glass bottles for Semi-VOC samples with teflon lined screw caps.

Sampling Equipment

Waste Streams - Solids/Sludge

The following equipment is needed for a routine monitoring sampling run:

- Monitoring field form/clipboard and pen/pencil.
- Marking pen.
- Masking tape and isolation tape.
- Adequate sample bags for the solid waste sampling.
- Plastic container with 10 *liter* demineralized water.
- Paper towel roll.
- Small bottle with dish washing liquid.
- Roll of cheese cloth.
- Plastic dustbin bag.
- Location map of the sampling localities.

Liquids

The following equipment is needed for a routine monitoring sampling run:

- Monitoring field form/clipboard and pen/pencil.
- Marking pen.
- Masking tape and isolation tape.

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Inorganic sampling:

— Adequate pre-washed laboratory plastic bulk sample bottles (1000 *ml*).
— Adequate laboratory prepared preservation sample bottles 250 *ml* (optional, see sample preservation).

Organic sampling:

— Adequate 40 *ml* glass bottles, for duplicate samples, for VOC samples with teflon lined screw caps.
— Adequate 1000 *ml* glass bottles for Semi-VOC samples with teflon lined screw caps.
— 2% MAO_3 soap and water solution to wash sampler/scoop bucket.

Both organic and inorganic sampling:

• Stainless steel or teflon sampler scoop bucket with handline.
• Adequate cooler boxes (25 *litre*).
• Plastic container with 10 *litre* demineralized water.
• Paper towel roll.
• Small bottle of dish washing liquid.
• Roll of cheese cloth.
• Plastic dustbin bag.
• Location map of the sampling localities.

Sampling Procedure

Waste Streams - Solids/Sludge:

The following sampling procedure should be followed as close as possible to ensure that representative samples and field information are collected.

The sampling procedure for the sampling of the Waste Streams should be done according to the procedure described to in the following standard; ISO 1988- 1975E (the equivalent is available in final draft format: ISO/FDIS 13909).

• Note the sample number, date of sampling and time of sampling on the sample bag.
• Note the sample number, date of sampling, time of sampling, as well as any comments on the provided monitoring field form, attached in **APPENDIX II**.
• Rinse the sampler/scoop bucket using the demineralised water.
• Dry the sampler scoop bucket using the paper towels.
• Wash and dry hands if necessary.
• Dispose the paper towels in the black plastic dustbin bag.
• Move to the next sampling locality.

- The sampling procedure is to be standardized and kept to as far as possible.
- The samples for analysis are to be handed in at the laboratory at the end of each consecutive day of sampling before closing time.
- An accompanying letter with instructions to the designated laboratory is to be drafted and forwarded. The instructions should include the following:
    - The type and list of variables to be analysed for as indicated in **APPENDIX III**.
    - A copy of the monitoring field form is to be attached to the letter of instructions to the designated laboratory.
    - All macro/micro analysis results should be accompanied by *anion/cation balancing*.
- The original field form is to be filed and stored locally.
- Make arrangements for the next bach of sample bottles well in advance of the next monitoring run.

Liquids:

The following sample procedure should be followed as close as possible to ensure that representative samples and field information are collected.

- Note the sample number, date of sampling and time of sampling on sample bottle.
- Note the sample number, date of sampling, time of sampling, dam level status were applicable as well as any comments on the provided monitoring field form, attached in **APPENDIX II**.
- Take the sample directly below the water surface with a clean sampler/ scoop bucket.
- Pour the sample taken, directly into the pre-marked sample bottles.
- The bottles are to be filled to the brim, squeezed slightly while the lid is screwed on tightly in order to expel all the air from the bottles.
- Replace the full sample bottles in the cool box. If preservation is indicated store the samples separately.
- Rinse the sampler/scoop bucket using the demineralised water.
- Dry the sampler scoop bucket using the paper towels.
- Wash and dry hands if necessary.
- Dispose the paper towels in the black plastic dustbin bag.
- Move to the next sampling locality.
- The sampling procedure is to be standardized and kept to as far as possible.
- Always follow the same sampling route.
- The samples for analysis are to be handed in at the laboratory at the end of each consecutive day of sampling before closing time.
- An accompanying letter with instructions to the designated laboratory is to be drafted and forwarded. The instructions should include the following:

- The list of variables to be analysed for, is indicated in **APPENDIX III**.
- A copy of the monitoring field form is to be attached to the letter of instructions to the designated laboratory.
- All macro/micro analysis results should be accompanied by *anion/cation balancing*.
- The original field form is to be filed and stored locally.
- Make arrangements for the next bach of sample bottles well in advance of the next monitoring run.

Sample Preservation

Detailed specifications pertaining to sample preservation are stated in the "Minimum Requirements for Monitoring at Waste Management Facilities". However, it is stated that samples analyzed within 6 hours of sampling need not be preserved in the field. Sample preservation methods are intended to retain the collected sample as close as possible to its original state.

Sample preservation (organic & inorganic) shoald, however, always be done in consaltation with the analytical laboratory responsible for the analyses.

Analyses Protocol/Variables

The necessity for chemical analyses of high scientific integrity can not be over-emphasized.

The list of variables to be analyzed for, was compiled subject to site specific chemical composition of waste dumps and aqueous waste streams, information generation requirements, as well as DWAF requirements. The list of recommended variables to be analysed for, is given below and is also attached in **APPENDIX III**.

Waste Streams - Solids/Sludge: (*Annual*)

INORGANIC		ORGANIC	SPECIAL
pH	Cl	VOC	TCLP/Acid Rain
EC	SO_4	Semi-VOC	
TDS	NO_3		
Ca	F		
Mg	Al		
Na	Fe		
K	Mn		
Si	Pb		
T-Alk	NH_4		
CN	Cr^{6+}		
Cd	Zn		

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Liquids: (*Quarterly*)

INORGANIC (*Quarterly*)		**ORGANIC** (*Six monthly*)
pH	Cl	VOC (List in APPENDIX III)
EC	SO_4	Semi-VOC (List APPENDIX III)
TDS	NO_3	
Ca	F	
Mg	Al	
Na	Fe	
K	Mn	
Si	Pb	
T-Alk	NH_4	
CN	Cr^{6+}	
Cd	Zn	

This list is by no means a comprehensive set of hazardous substances as proposed in the "Minimum Requirements", but will undoubtedly support identification and quantification of impacts associated with IVS activities.

Recommended Independent Laboratory

IVS has specified that all analyses of the environmental monitoring program should be analysed at the following laboratory (organic analyses will be analysed at IVS as soon as the organic laboratory is in operation);

INORGANIC:
ISCOR VANDERBIJLPARK LABORATORY
P.O. BOX 2
VANDERBIJLPARK
1900
TEL:(016) - 889 3226
FAX:(016) - 889 3502

ORGANIC:
ISCOR VANDERBIJLPARK LABORATORY
P.O. BOX 2
VANDERBIJLPARK
1900
TEL:(016) - 889 3226
FAX:(016) - 889 3502

Data Base Entry

After the commissioning of the source monitoring infrastructure, all the information pertaining to the investigative sampling localities and sources were computerized into the AQUABASE data base system.

Although not a minimum requirement of DWAF, usage of this data base is strongly recommended, as it not only allows for structured data storage, but also facilitates optimal information generation and GIS integration.

- Storage of source related data:

  1. Basic Site Information - data entered only once.
  2. Source - Chemistry - chemistry data entered after each sampling run.
  3. Dam/Pond Level - level of data entered after each sampling run.

The sampling localities were computerized under site-unique Site Identification Numbers. These site identification numbers are attached in **APPENDIX IV** as **DATA SET IV-1**.

The following data bases were configured and commissioned for the Site Id's in AQUABASE:

- Basic Information
- Hydro-Chemistry
- Dam/Pond Level

The Basic Site Information is only updated when new sites are included in the monitoring system. The rest of the data base is updated after each sampling run.

Data Backup

Backup of all data should be made on a regular interval on a separate computer or disk. This would avoid any data loss during a computer failure or any technical failure. Backup data should be stored in a safe.

5.1.4 INFORMATION GENERATION PROTOCOLS

Reporting Frequency

The following table summarizes the frequency of reporting:

Frequency	Type of Report
Six Monthly Report	Data Report to Authorities
Annual Environmental Report	Annual status/audit report

Report Content

Six-Monthly Report (six-monthly submission of monitoring results)

The six-monthly report is complied for both the solids and liquid source characterization monitoring points and consist of the following components:

- Historical source characterization chemistry report.
- Dam/Pond level status report.
- Historical/Present source chemistry compliance report.
- Piper/Durov diagrams.
- Time dependent graphs for the selected water quality variables.

Annual Environmental Report (annual submission of monitoring results)

The annual report consists of all the environmental components and for the chapter on source characterization the following components should be included:

- System Audit

    - Statutory/Regulatory Requirements
    - Monitoring Infrastructure
    - Data Capture
    - Information Generation
    - Management of System

- Data Audit

    - Compliance criteria
        - Solids - MR Waste Classification criteria
        - Liquids - Most Stringent Water Qaulity criteria
    - Validation of the data

- Interpretation of data for compliance

    - Present and historical waste classification for all waste streams
    - Calculation of the Total Load and Risk to the environment
    - Historical waste stream chemistry report
    - Dam/Pond level status report
    - Historical source chemistry compliance report
    - Piper and Durov diagrams
    - Compliance Map

- Waste Streams interpretation of classification for trend

  - Time dependant graph illustrating change in classification

- · Effluent/Seepage interpretation of hydro-chemical data for trend

  - Time dependant graphs for selected water quality variables
  - Trend Map

- Compliance and trend assessment/status report must be compiled by a knowledgeable professional

5.1.5 MANAGEMENT PROTOCOLS

The following table summarizes the management protocols relating to the sampling- and reporting frequency of the Source Characterization monitoring sites included in the routine monitoring system.

	Sampling Frequency				Reporting Frequency			
	SCP	SCL	SCE	SCS	SCP	SCL	SCE	SCS
Daily								
Weekly								
Two - weekly								
Monthly								
Quarterly		X	X	X				
Six - Monthly						X	X	X
Annually	X				X	X	X	X

Acronyms:
Source Characterization (SC):
        (SCP) - Physical/Dry Chemical Analyses.
        (SCL) - Leachate Analyses
        (SCE) - Effluent Analyses
        (SCS) - Seepage Analyses

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5.2 METEOROLOGY

5.2.1 STATUTORY/REGULATORY REQUIREMENTS

Formal Compliance

No specific monitoring requirements are stipulated by any of the environmental statutory acts or in any of the permits, issued to IVS, in accordance with these acts.

The necessity for climatic data can, however, not be overlooked. For more information please refer to:

- *APPENDIX F* of the "Minimum Requirements for Monitoring Requirements at Waste Management Facilities".
- *SECTION 1* of the "Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste".
- *SECTION 3* and *SECTION 11* of the "Minimum Requirements for Waste Disposal by Landfill".

Material Compliance

No specific monitoring standards or guidelines are stipulated for the active components in this chapter.

5.2.2 MONITORING INFRASTRUCTURE/SITES/LOCALITIES

The following parameters are monitored at different sites that form the Meteorological monitoring sites:

- *Rainfall*   *(MGR)*
- *Humidity (Rel)*   *(MGH)*
- *Air Temperature*   *(MGT)*
- *Wind speed & Direction*   *(MGD)*

The full list of meteorological monitoring sites are:

Map No:	Monitored at Site:	Position:
MG-1	• Ambient Air Quality • Air temperature • Wind speed & direction RM YOUNG Anemometer at 5 *m*	East of the environmental management offices in open veld area.

MG-2	• Wind speed & direction RM YOUNG Anemometer at 10m • Temperature • Relative humidity • Rainfall	East of the gas storage area near the south gate
MG-3	• Rainfall (continuous monitoring)	The Steelserv Sump (south-east corner)
MG-4	• Rainfall (continuous monitoring)	The Terminal Effluent Treatment Plant (south-west corner)
MG-5	• Rainfall (continuous monitoring)	North Works (north-east corner)
MG-6	• Rainfall	Dam 10
MG-7	• Rainfall	Du Preez Dam
MG-8	• Rainfall	Vaal treatment works (VSA)
MG-9	• Rainfall	Main Administrative Building (HG)
MG-10	• Rainfall	Leeuwspruit Sump (LS Dam)

The Meteorology monitoring localities are shown on the map depicted in **FIGURE 2 - APPENDIX I**.

5.2.3 DATA CAPTURE PROTOCOLS

<u>Sampling Frequency</u>

Rainfall (MG)   - **Continuous/Daily**

For the daily rainfall values a responsible person designated by the Manager: Water IVS, will obtain the 24 hour rainfall value at 06:00 each day.

For the continuous monitors, data recordings are made incrementally for every 0.2 *mm* of rainfall that falls. Rainfall measurements are therefore only taken during rainfall events and the frequency of these recordings is determined by the intensity and duration of the rainfall events.

Humidity (Rel) (MGH)   -   **Continuous**
Air Temperature (MGT)   -   **Continuous**
Wind speed & Direction (MGD)   -   **Continuous**

Sampling Technique

Rainfall

The rainfall depth in the rain gauge will be measured by ensuring that the observer's eye level corresponds with the water level, and the middle of the meniscus will be observed.

The continuous monitoring rainfall equipment installed operates utilizing an electronically measured "tipper-bucket" technique.

Humidity (Rel)

Humidity is derived from wet and dry bulb temperature measured at the monitoring caravan near the Environmental Department inside the IVS Works. Measurements are taken real time *(every five minutes)*.

Air Temperature

Both wet and dry bulb air temperature are monitored real time (every five minutes) at the monitoring caravan near the Environmental Department inside the IVS Works.

Wind speed & Direction

Real time monitoring, at the monitoring caravan near the Environmental Department inside the IVS Works.

Sampling Equipment

Rainfall

The continuous monitoring equipment utilized is the Global Water Continuous Rain gauge system. The details are as follows:

- Global Water 800-876-1172
- Model Number: RG200
- Serial Numbers of the three systems at Vanderbijlpark: 8246; 8247; 8248.
- Powered by Ultra life lithium 9V batteries

A laptop with the "Ezrain" software and a serial point link is required for the downloading of the data.

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The daily 24 hour rainfall gauge for the measurement of precipitation will be of the South African Standard type (height: 1,22 m; orifice diameter: 127 mm). Siting of the rain gauge should be such that:

- wind speed at the gauge orifice level is minimal;
- gauge surroundings are modified to facilitate horizontal airflow;
- there should be protection of the rain gauge at an angle of 30° to 45°;
- slopes are avoided;
- the standard height (1,22 m) is utilized;
- very hard ground surfaces should be avoided to eliminate splashing;
- isolated protection that could cause turbulence of airflow should be avoided.

Humidity(relative)

- RM YOUNG.

Air Temperature

- RM YOUNG.

Wind Speed & Direction

- RM YOUNG.

Sampling Procedure

Rainfall

The continuous rainfall monitoring system is fully automated. Rainfall enters the conical chute and is guided down to a central point where the water passes through a hole. This water falls into a tipper bucket that, upon filling one portion of the bucket with a volume that equates to a rainfall volume of 0,2 *mm*, the bucket tips and empties, moving the other bucket into place in order to be filled. When the bucket tips a pulse is sent to the data logger and a rainfall reading is registered.

The conical chute must be inspected on a *two weekly* basis for debris, excessive dust or bird fouling. It will be ensured that when the conical chute is removed the tipper mechanism is not interfered with in any way. Any such material will be completely cleared from the conical chute. Ultra life lithium 9V batteries will be replaced every three months. This maintenance action will coincide with an inspection of all components for corrosion or damage. It will be ensured that the keys for the rain gauge units are retained by the responsible person at the Environmental Management Department.

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For the daily rainfall values a responsible person designated by the Manager: Water, will at 06:00 obtain the rainfall depth for the previous 24 hours. The rainfall depth in the rain gauge will be measured by ensuring that the observer's eye level corresponds with the water level, and the middle of the meniscus will be observed. After observance of the water level, the rain gauge will be removed and inverted a minimum of three times to ensure complete emptying of accumulated water. The rain gauge will be cleared of debris, excessive dust or bird fouling. The rain gauge will be replaced in its position, and it will be ensured that the orifice is horizontal and at a height of 1,22 *m* above the ground level.

Humidity (Relative)

Data is collected on a continuous basis. The responsible person at the Environmental Department at IVS should at least once a week down load the data on a computer disk, to be imported into the database.

Air Temperature

Data is collected on a continuous basis. The responsible person at the Environmental Department at IVS should at least once a week down load the data on a computer disk. The data should then be imported into the database for formal storage.

Wind Speed & Direction

Data is collected on a continuous basis. The responsible person at the Environmental Department at IVS should at least once a week down load the data on a computer disk. The data should then be imported into the database for formal storage.

Sample Preservation

Rainfall

No sample preservation is necessary since no sample is retained for water quality analysis purposes.

Humidity (Relative)

Not applicable.

Air Temperature

Not applicable.

Wind Speed & Direction

Not applicable.

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Analyses Protocol/Variables

Daily rainfall depth (*mm*) is measured at the five rain gauges, while incremental rainfall depth (*mm*) is recorded at the three continuous monitoring stations.

Data Base Entry

Rainfall

For the continuous monitors the rainfall data is stored electronically in a data logger. This data must be down loaded by means of a laptop on a monthly basis, and transferred to the computer of the Manager: Water IVS. The output files are ASCII (*.dat) files. These files must stored in the appropriate project directory. The files will be named "vdb 824* dd-mm-yy.dat" where the serial number is denoted by the first portion of the naming, and the date of the down loading of data in the second portion of the file name.

The 24 hour daily rain gauge information is compiled on a standard monthly data form on a daily basis. This information is then compiled on a spreadsheet by the Manager: Water IVS.

Although somewhat of a duplication, certain processed data pertaining to the abovementioned environmental components will be imported into AQUABASE on an annual basis to make it all inclusive and complete in respect of the quantitative attributes of the identified environmental components at IVS.

A Borland Database Engine (*BDE*) has been installed as part of the custom AQUABASE installation, thus enabling remote database data access directly from AQUABASE using linked tables.

The sampling localities were computerized under AQUABASE site-unique Site Identification Numbers, attached as **DATASET IV-2, APPENDIX IV**.

The following data bases were configured and commissioned for the Site Id's in AQUABASE:

- •   Basic Information   -   Rainfall
  -    -   Humidity(relative)
  -    -   Air Temperature
  -    -   Wind Speed & Direction

The Basic Site Information is only updated when new sites to be monitored are included in the monitoring system. The rest of the data base is updated after each sampling interval.

Data Backup

Backup of all data must be made on a monthly basis on separate disk or computer. This will avoid data loss during a computer failure or any technical failure.

5.2.4 INFORMATION GENERATION PROTOCOLS

Reporting Frequency

The following table summarizes the frequency of reporting.

Frequency	Type of Report
Six-Monthly Report	Data Report to Authorities
Annual Report	Annual status/audit report

Report Content

Six-Monthly Report *(Six-monthly submission of monitoring results)*

This report consists of the following measured parameters:

- **Rainfall**
  - Historical mean monthly rainfall report

- **Humidity(relative)**
  - Historical mean monthly humidity report
  - Time dependant graph for mean monthly humidity

- **Air Temperature**
  - Average hourly temperature monthly report
  - Time dependant graphs for daily minimum and maximum temperatures

- **Wind Speed & Direction**
  - Average wind speed and direction monthly reports (frequency table)
  - Monthly frequency table and wind rose graph

Annual Report *(Annual submission of monitoring results)*

The annual report consists of the following components:

- System Audit
  - Statutory/Regulatory Requirements
  - Monitoring Infrastructure
  - Data Capture
  - Information Generation
  - Management of System

- Data Audit
  - Compliance criteria
  - Validation of the data
  - Interpretation of meteorological data

- Interpretation of Meteorological Data

Rainfall

- Historical mean monthly rainfall report
- Time dependant graph for mean monthly rainfall

Humidity(relative)

- Historical mean monthly humidity report
- Time dependant graph for mean monthly humidity

Air Temperature

- Daily minimum, maximum and average monthly report
- Time dependant graphs for daily minimum and maximum temperatures

Wind Speed & Direction

- Average wind speed and direction monthly reports (frequency table)
- Monthly frequency table and wind rose graph
- Status report compiled by knowledgeable professional

The meteorological assessment/status report must be compiled by a knowledgeable professional

5.2.5 MANAGEMENT PROTOCOLS

The following table summarizes the management protocols relating to the sampling- and reporting frequency of the active Meteorology monitoring sites.

	Sampling Frequency				Reporting Frequency			
	MGR	MGH	MGT	MGD	MGR	MGH	MGT	MGD
Continuous	X	X	X	X				
Daily	X							
Weekly								
Two-weekly								
Monthly								
Quarterly								
Six-Monthly					X	X	X	X
Annually					X	X	X	X

Acronyms:
Meteorology (MG):
      (MGR) - Rainfall
      (MGH) -Humidity (relative)
      (MGT) - Air Temperature
      (MGD) - Wind Speed & Direction

5.3 TOPOGRAPHY

5.3.1 STATUTORY/REGULATORY REQUIREMENTS

Formal Compliance

In terms of the Minimum Requirements for Waste Disposal by Landfill (Second Edition 1998, Department of Water Affairs and Forestry), the following requirements are set out for the monitoring of landfill operations:

- The method of waste recording must be appropriate to the nature and the volume of the wastes entering the site.
- Records must be kept of all waste entering the site.
- Waste must be categorized by the number of loads (defined by volume or mass), the type of waste and the source. Hazards must be defined in terms of hazard rating (1, 2, 3 or 4).
- Records must be kept on both a daily and a cumulative basis.
- A database must be established and maintained at the landfill site.
- In the case of hazardous waste landfills the database must be extended to the recording of the position of all hazardous waste disposed on the site (in terms of both plan and elevation).
- In the case of the encapsulation of the waste (with a Hazardous Rating of 1), the exact coordinates of the encapsulation cells must be recorded.
- For the purpose of volumetric surveying, the entire site must be surveyed prior to commencement of waste disposal and annually thereafter.

Material Compliance

No specific monitoring standards or guidelines are stipulated for the active components in this chapter.

5.3.2 MONITORING INFRASTRUCTURE/SITES/LOCALITIES

The following sites have been identified as monitoring sites for this component:

Fill/Heap/Stockpiles/Dumps

- Existing Waste Dump

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5.3.3 DATA CAPTURE PROTOCOLS

Sampling Frequency

Topography

Fill Heap Stockpiles Dumps - **Annually**

Suggested time for the annual survey is during the winter months of each year **(June/July)**.

Volume determinations - **Continuous**

Data recordings of the mass of the vehicles transporting slag and other residue materials are made at the weigh bridge (situated to the south-west of Dam 10). A recording of the mass of the vehicles is measured when the container goes to off load on the waste dump and a subsequent mass is determined for the vehicle when it returns.

Sampling Procedure

Topography *(Heap Stockpiles Dumps)*

An annual survey of the dumps is required in terms of DWAF - Minimum Requirements. This activity must take place during the winter months of each year **(June/July)** to ensure that clear skies are available for photographic purposes. This data will facilitate the determination of volumes within the Consolidated Residue Management Facility. The aerial survey will as a minimum include the Consolidated Residue Management Facility. The aerial photography should be performed to the following specifications:

- DWG files with 0.5 *m* contours with 3D poly-lines and 3D spot heights;
- 15 *m* x 15 *m* DTM with break lines in ASCII format;
- One Tiff image of the entire target area with a pixel size of 0.25*m*;
- Geo-referencing data in ASCII format.

Volume determinations

The classification of the waste is indicated by a tag on the vehicle which is registered by the weigh station. The mass of the vehicle going to and subsequently returning from the site is determined electronically. The difference in mass indicates the total mass of waste material deposited on the dump. The volume is derived from this value.

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Sampling Equipment

The aerial photography work will be contracted out to specialists. The specialist used during the Master Plan Baseline Studies was:

Cor van der Walt Lugopmeting
P.O. Box 1214
Silverton
0127

Tel: 012-803-5679
Fax: 012-803-6059
E-mail: geodigit@global.co.za.

Sample Preservation

No sample preservation is applicable.

Analyses Protocol/Variables

Refer to the waste stream classification under source characterization.

Data Base Entry

Aerial photographs will be stored both in electronic format and as hard copies by the Environmental Management Department. Separate copies will be retained in a building other than the aforementioned building for data safety purposes.

The waste classification, source and volume data obtained from the weigh bridge will be entered, maintained and stored by the Materials Handling Department. Every file saved will have at the end of its file name the date in the form "dd-mm-yy" to ensure that the data is managed in an effective manner.

Data Backup

Backup of all data must be made on a bi-weekly basis on a CD or disk. Two copies of each set of data must be stored in a building other than the Environmental Management Department, in order to avoid any data loss during a computer failure or any technical failure. Hard copies of all data must be stored by the Environmental Management Department.

5.3.4 INFORMATION GENERATION PROTOCOLS

Reporting Frequency

The following table summarizes the frequency of reporting.

Frequency	Type of Report
Six -Monthly Report	Routine monthly report – material deposited on residue facility
Annual Report	Annual status/audit report – volume calculations using aerial photography

Report Content

Six -Monthly Report

A data report containing information on:

Daily and monthly volumes of residue deposited, including waste classification and source data obtained from the data at the weight bridge.

Annual Report

An annual report on the foot print and volume status of the dump must be generated. The annual aerial photography images and contour data should be utilized to provide:

- The difference in volume on and within, the various units of the Consolidated Residue Management Facility since the last aerial photography was undertaken.
- The remaining volume available within the various units constituting the Consolidated Residue Management Facility.
- Rehabilitation status.
- Surface water management system.

5.3.5 MANAGEMENT PROTOCOLS

The following table summarizes the management protocols relating to the sampling- and reporting frequency of the monitoring sites for Topography:

	Sampling Frequency	Reporting Frequency
	TP	*TP*
Continuous	X	
Daily		
Weekly		
Monthly		
Quarterly		
Six-Monthly		X
Annual	X	X

Acronyms:
Topography: (TP)

5.4 SOILS *(In- active)*

Soils are not included in this Monitoring System for routine monitoring purposes. Results for surveys that have been done during the compilation of the Master Plan Study are reflected in the Base Line Study Reports.

5.4.1 STATUTORY/REGULATORY REQUIREMENTS

NEW WATER LICENCE NUMBER - **10016047**

5.4.2 MONITORING INFRASTRUCTURE/SITES/LOCALITIES

According to the NEW WATER LICENCE NUMBER - **10016047**, section 4.2.5..."Should any development, upgrading or extensions be done in areas where there is no contamination, such developments must be reported. to the Regional Director, and soil samples, reflecting overall soil quality conditions prior to disturbance throughout the total area to be affected, shall be taken and analysed and thereafter twice per annum, by a competent soil scientist."

5.4.3 DATA CAPTURE PROTOCOLS

Sampling Frequency

In-active

Sampling Technique

In-active

Sampling Equipment

In-active

Sampling Procedure

In-active

Sample Preservation

In-active

Analyses Protocol/Variables

In-active

Data Base Entry

In-active

Data Backup

In-active

5.4.4 INFORMATION GENERATION PROTOCOLS

Reporting Frequency

In-active

5.4.5 MANAGEMENT PROTOCOLS

In-active

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5.5 LAND CAPABILITY AND LAND USE

5.5.1 STATUTORY/REGULATORY REQUIREMENTS

Formal Compliance

No specific monitoring requirements are stipulated by any of the environmental statutory acts or in any of the permits issued to IVS, in accordance with these acts for routine monitoring of the land capability and land use at IVS.

In terms of DWAF - MR For Waste Disposal by Landfill - *Section 2* and *Appendix 4.3* it is stipulated as a minimum requirement that throughout the operation of the landfill facility, agreed buffer zones must be maintained. Existing land-use and any developments must thus be carefully monitored and strictly controlled.

Material Compliance

No specific monitoring standards or guidelines are stipulated for the active components in this chapter.

5.5.2 MONITORING INFRASTRUCTURE/SITES/LOCALITIES

The land use and zoning of IVS, and the surrounding area that would constitute a buffer zone.

The land use/capability monitoring localities are shown on the map depicted in **FIGURE 3, APPENDIX I**.

5.5.3 DATA CAPTURE PROTOCOLS

The current land use at and around IVS should be monitored annually to ensure control of all developments at and around IVS.

Sampling Frequency

Land use and Land capability   -   **Annually**

Suggested month for the Land Use assessment is **SEPTEMBER.**

Sampling Technique

Land use assessment by suitably qualified professional person. This person should update the existing land use plan for the site.

Sampling Equipment

The following equipment is needed for a routine assessment of the current Land Use:

* Location map of the area with the different zoning and land uses of the area indicated on the map.
* Pen and notebook.
* Camera.

Sampling Procedure

Annual field visit and assessment of the current land use should be verified during the field visit.

Sample Preservation

Not applicable to this component.

Analyses Protocol/Variables

Not applicable to this component.

Recommended Independent Laboratory

Not applicable to this component.

Data Base Entry

Not applicable to this section.

Data Backup

A hard copy of the report, as well as an electronic and CD copy of the file will be retained by the Environmental Management department. A copy of the file on CD will be stored in a building other than that of the Environmental Management department for backup purposes.

5.5.4 INFORMATION GENERATION PROTOCOLS

Reporting Frequency

A professional statement on the current land capability and land use at and around IVS should be included in the annual report.

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The following table summarizes the frequency of reporting.

Frequency	Type of Report
Annual statement	Annual status statement

Report Content

The annual report consists of all the environmental components and for the chapter on Land Use, the following should be included:

- Statement on the current land capability and land use at and around IVS.
- In the event of new classification of land use at IVS, it must be documented and included in the Annual Monitoring Report.

These classifications must be done by a knowledgeable and professional person.

5.5.5 MANAGEMENT PROTOCOLS

The following table summarizes the management protocols relating to the sampling- and reporting frequency of the Land Use and Land Capability at and around IVS.

	Sampling Frequency	Reporting Frequency
	LU	*LU*
Daily		
Weekly		
Two - weekly		
Monthly		
Quarterly		
Six -Monthly		
Annually	X	X

Acronyms:
Land Capability and Land Use (LU):

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5.6 NATURAL VEGETATION AND PLANT LIFE

5.6.1 STATUTORY/REGULATORY REQUIREMENTS

Formal Compliance

No specific monitoring requirements are stipulated by any of the environmental statutory acts or in any of the permits, issued to IVS, in accordance with these acts for routine monitoring of the natural vegetation and plant life at IVS.

However, routine monitoring of the natural vegetation and plant life is sound environmental management practice and for this reason it has been included in the routine monitoring for the site.

Material Compliance

No specific monitoring standards or guidelines are stipulated for the active components in this chapter.

5.6.2 MONITORING INFRASTRUCTURE/SITES/LOCALITIES

The following monitoring localities were identified during the Master Plan Study:

MAP NUMBER	X-COORD	Y-COORD
PL-1	2951912.79	-81824.48
PL-2	2951740.41	-82582.19
PL-3	2949249.33	-85235.06
PL-4	2948800.79	-85432.25
PL-5	2947989.43	-84528.47
PL-6	2947080.15	-84664.85
PL-7	2946602.77	-84687.58
PL-8	2946170.86	-84733.04
PL-9	2945966.26	-84096.54
PL-10	2947061.94	-84096.55
PL-11	2944928.56	-83914.42
PL-12	2950615.93	-79126.76
PL-13	2949942.00	-78936.81
PL-14	2947306.34	-79493.92
PL-15	2946564.78	-78013.63
PL-16	2945711.59	-79087.56
PL-17	2945555.36	-80502.85
PL-18	2951973.78	-78853.51
PL-19	2953021.88	-77034.35
PL-20	2951041.37	-74159.24
PL-21	2948484.35	-74961.80
PL-22	2945201.94	-79093.71

MAP NUMBER	X-COORD	Y-COORD
PL-23	2945064.02	-81990.07
PL-24	2944400.00	-86200.00
PL-25	2945693.40	-83096.32
PL-26	2947034.00	-82232.51
PL-27	2948125.80	-82255.25
PL-28	2948785.00	-82209.79
PL-29	3949739.00	-79936.59
PL-30	2948900.00	-79500.00
PL-31	2945201.94	-79093.71
PL-32	2946776.20	-85236.70
PL-33	2946300.00	-81000.00

The plant life monitoring localities are shown on the map depicted in **FIGURE 4 - APPENDIX I.**

5.6.3   DATA CAPTURE PROTOCOLS

The environmental variables, which influence the suitability of the environment for the vegetation currently occurring at IVS, can at any stage change, causing a replacement of current species and possibly even communities with species or communities more adapted to the changed environment. In the case where the environment becomes more polluted, more tolerant species will replace the more sensitive species. These tolerant species are often weeds or exotic species, which will effectively lower the quality of the veld.

Monitoring of the environmental variables are therefore necessary to prevent this degradation taking place. This monitoring can be done by a vegetational survey conducted *once a year*, in which a species list is compiled as well as the abundance of each of the specific species.

The findings of the monitoring report should then be evaluated. Management decisions should then be made.

Sampling Frequency

Natural Vegetation and Plant Life   -   **Annually**

Monitoring of this component should be done during the growth season between **November to February**. During the course of the year, any irregularities in the floral regime should be noted i.e. patches of dead vegetation, veld fires, or areas of denudation.

Sampling Technique

The survey will be conducted using the standard Braun-Blanquet vegetation survey techniques, of the Mont Pellier school of thought.

Sampling Equipment

The following sampling equipment will be used:

- Pencil, Marking pen
- Notebook
- Field form
- Masking tape
- Plastic bags
- Labels
- Measuring tape
- Marking rods
- Camera

Sampling Procedure

The survey will be conducted using the standard Braun-Blanquet vegetation survey techniques, of the Mont Pellier school of thought.

A number of quadrants within the study area and a number of reference sites in the surrounding area, of 25 m^2 each must be selected. These quadrants must be arranged in a predetermined pattern to ensure objectivity.

For an undisturbed area, a vegetation map should be compiled.

After selecting the quadrants, these quadrants should be marked and the physical conditions clearly noted on the field form. A site description should be made as detailed as possible, if possible a photograph should be taken of the sampling locality.

The following information should be contained in the Site Description:

The site should first be classified as one of the following:

- Wetland
- Grassland
    - Wet- or Terrestrial, Dry-, Mixed, Rocky-
- Cultivated lands, old lands or pastures
    - Primary crop
- Bottom land communities
    - Streams
    - Ecological quality
    - Characteristics
    - Plant species
- Drainage lines
    - Types of drainage lines
    - Value of drainage line vegetation

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Each of the Site types should then be described in terms of the following:

- Location
- Characteristics
- Importance
- Function i.e. habitat for certain species, buffer zone
- Coverage of study area

For each sampling quadrant the following data should be collected during each field visit:

- Dominant species or plant form
- Other species present
- Threatened and protected taxa (Endangered species)
- List of protected plant species which may occur in study area
- Invader or exotic species
- No of plant taxa per category present
- Ecological quality of the community
- Nature of habitat
- Role of water in the habitat
- Nature of physical landscape i.e. soil, topography...
- Utilization of land
- Identification method
- Regional description
- Vegetation type
- Dominant veld type; Dominant species
- Species composition

The flora found in these quadrants should then be identified, the abundance of each species withing the quadrant should also be noted.

When a species can not be identified, a representative sample of that species should be taken, this sample should be clearly marked with the following information:

- Sampling Quadrant number
- Reference number
- Date
- Time
- Growth type
- Height of plant
- If possible a sketch or photograph of the entire plant.

Sample Preservatioo

Samples taken should be pressed and labeled with the following:

- Sample reference
- Sampling locality
- Description of physical characteristics of sampling locality
- Sampling date
- Sample description
- Description of plant from which sample was taken including:
  - height
  - growth form
  - any significant characteristics
  - Crown width
  - leaf density
  - leaf texture

- If available, fruits or flowers of sampled plant
- In case of tree, a representative sample of bark, where available

Aoalyses Protocol/Variables

Samples not identified in the field should be sent to the National Botanical Institute for identification.

Recommended Independent Laboratory

Recommended Independent Institute for identification:

National Botanical Institute
2 Cussonia Ave
Pretoria

Data Base Entry

Not applicable - not classified as a measurable data base component. Data generated should be contained in the annual report compiled under the section of *Natural Vegetation and Plant Life*.

Data Backup

Backup of data and reports relating to Plant Life should be kept in a safe.

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5.6.4 INFORMATION GENERATION PROTOCOLS

Reporting Frequency

The following table summarizes the frequency of reporting.

Frequency	Type of Report
Annual Report	Annual status/audit report

Report Content

The following information should be contained in the annual Natural Vegetation and Plant Life Monitoring Report:

- Methodology

- Data capture protocols

- Site classification
  - Description of sampling localities
    - Location
    - Characteristics
    - Importance
    - Coverage of study area
  - Vegetation description
    - Dominant species or plant form
    - Other species present
    - Threatened and protected taxa (Endangered species)
    - List of protected plant species which may occur in study area
    - Invader or exotic species
    - Ecological quality of the community
    - Nature of habitat
    - Role of water in the habitat
    - Nature of physical landscape i.e. soil, topography...
    - Utilization of land
    - Regional description
    - Vegetation type
    - Dominant veld type; Dominant species
    - Species composition
    - Irregularities observed during monitoring season.

- Management objectives

- Management measures

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5.6.5 MANAGEMENT PROTOCOLS

The following table summarizes the management protocols relating to the sampling- and reporting frequency of the Natural Vegetation and Plant Life monitoring sites.

	Sampling Frequency	Reporting Frequency
	PL	*PL*
Daily		
Weekly		
Two - weekly		
Monthly		
Quarterly		
Six -Monthly		
Annually	X	X

Acronyms:
Natural Vegetation and Plant Life (PL):

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5.7 ANIMAL LIFE

5.7.1 STATUTORY/REGULATORY REQUIREMENTS

Formal Compliance

No specific monitoring requirements are stipulated by any of the environmental statutory acts or in any of the permits, issued to IVS, in accordance with these acts for routine monitoring of the animal life at IVS.

However, routine monitoring of the animal life is sound environmental management practice and for this reason it has been included in the routine monitoring for the site.

Material Compliance

No specific monitoring standards or guidelines are stipulated for the active components in this chapter.

5.7.2 MONITORING INFRASTRUCTURE/SITES/LOCALITIES

The following monitoring localities were identified during the Master Plan Study:

MAP NUMBER	X-COORD	Y-COORD
AL-1	2951912.79	-81824.48
AL-2	2951740.41	-82582.19
AL-3	2949249.33	-85235.06
AL-4	2948800.79	-85432.25
AL-5	2947989.43	-84528.47
AL-6	2947080.15	-84664.85
AL-7	2946602.77	-84687.58
AL-8	2946170.86	-84733.04
AL-9	2945966.26	-84096.54
AL-10	2947061.94	-84096.55
AL-11	2944928.56	-83914.42
AL-12	2950615.93	-79126.76
AL-13	2949942.00	-78936.81
AL-14	2947306.34	-79493.92
AL-15	2946564.78	-78013.63
AL-16	2945711.59	-79087.56
AL-17	2945555.36	-80502.85
AL-18	2951973.78	-78853.51
AL-19	2953021.88	-77034.35
AL-20	2951041.37	-74159.24
AL-21	2948484.35	-74961.80

MAP NUMBER	X-COORD	Y-COORD
AL-22	2945201.94	-79093.71
AL-23	2945064.02	-81990.07
AL-24	2944400.00	-86200.00
AL-25	2945693.40	-83096.32
AL-26	2947034.00	-82232.51
AL-27	2948125.80	-82255.25
AL-28	2948785.00	-82209.79
AL-29	3949739.00	-79936.59
AL-30	2948900.00	-79500.00
AL-31	2946300.00	-81000.00
AL-32	2945201.94	-79093.71
AL-33	2946776.20	-85236.70

The animal life monitoring localities are shown on the map depicted in **FIGURE 5 - APPENDIX I**.

5.7.3 DATA CAPTURE PROTOCOLS

The environmental variables, which influence the suitability of the environment, for the animals currently occurring in the study area, can at any stage change, causing a replacement of current species and possibly even communities with species or communities more adapted to the changed environment. In the case where the environment becomes more polluted, more tolerant species will replace the more sensitive species.

The species diversity will decrease as the environment harshens and the interspecies connections will bear more strain. With a decreased species diversity, the local ecosystem may become unstable, when the environment undergoes further change, whole ecosystems may collapse.

Monitoring of the environmental variables are therefore necessary to prevent this degradation taking place. This monitoring can be done by a faunal survey conducted *once a year*, in which a species list is compiled as well as the abundance of each of the specific species. Throughout the year, any occurrence of animal deaths should be reported immediately, as well as signs of sickness or deformity in sighted animals.

The findings of the monitoring report should then be evaluated. Management decisions should then be made. Site visits should co-inside with the rainy season and should therefore be done between **November and February** each year.

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Sampling Frequency

Animal Life - **Annually**

The suggested time frame for the monitoring of the animal life is **November to February**. During the course of the year any irregularities in the faunal regime should be noted i.e. unusual behaviour, unnatural deaths.

Sampling Technique

See Sampling Procedure.

Sampling Equipment

The following sampling equipment will be used:

- Pencil, Marking pen
- Notebook
- Field form
- Masking tape
- Plastic bags
- Labels
- Measuring tape
- Camera

Sampling Procedure

During the animal survey any material found should be identified, or if identification is not possible, a sample thereof should be taken and clearly marked and the following information given:

- Reference number
- Date
- Time
- Amount of material
- Locality found
- Comments

Any faecal material collected, should be analysed to determine the species from which it came. Footprints found should also be identified and documented. If possible a photograph should be taken. The photograph should include a scale.

All animals observed during the field visit should be identified and if possible photographed.

The following information should be documented while observing the animal:

- Species
- Sex of the animal
- Habitat found
- Stage of development i.e. adult, juvenile etc.
- Size
- Behaviour
- Physical condition
- Significant features i.e. scars
- When more than one animal of a species is found, the size of the herd, the ratio of males to females, and general condition of the herd should also be noted.

Methods of identification and confirmation should be noted.

The following overview information should be recorded:

- Description of Birds
  - Species list
  - Red data species
  - Important species i.e. uncommon species or species with specialized habitat requirements
- Type of birds i.e. grassland birds
- Tabulate priority birds
- Description of Mammals:
  - Species list
  - Red data species
  - Important species i.e. uncommon species or species with specialized habitat requirements
- Tabulate priority Mammals

Spp previously recorded	Present day occurrence	Observed on site	Conservation Status

- Description of Reptiles and Amphibians:
  - Important species
  - No of taxa found
- Tabulate

Species	Frequency of recording in Study site	Adjacent cells

- Butterflies
- Threatened Species

Sample Preservation

Samples taken should be clearly marked and kept in a refrigerator. Samples that cannot be identified should, together with the sample information, be sent to the Transvaal Museum for identification.

Analyses Protocol/Variables

No analyses is proposed, only that the sample is identified, if not identified in the field.

Recommended Independent Laboratory

Recommended Independent Institute for identification:

Transvaal Museum for Identification.
Paul Kruger Street
Pretoria

Data Base Entry

Not applicable - not classified as a measurable data base component. Data generated should be contained in the annual report compiled for Animal Life.

Data Backup

Backup of data and report relating to Animal Life should be kept in a safe.

5.7.4 INFORMATION GENERATION PROTOCOLS

Reporting Frequency

The following table summarizes the frequency of reporting.

Frequency	Type of Report
Annual Report	Annual status report

Report Content

The following information should be contained in the annual Animal Life Monitoring Report:

- Methodology

- Data capture protocols

- Site classification

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- Description of sampling localities
  - Location
  - Characteristics
  - Importance
  - Coverage of study area

- Species description:
  - Dominant species
  - Other species present
  - Threatened and protected species (Endangered species)
  - List of protected animal species which may occur in study area
  - Invader or exotic species
  - Ecological quality of the community

- Irregularities observed during monitoring season.

- Management objectives

- Management measures

5.7.5 MANAGEMENT PROTOCOLS

The following table summarizes the management protocols relating to the sampling- and reporting frequency of the Animal Life monitoring sites.

	Sampling Frequency	Reporting Frequency
	AL	*AL*
Daily		
Weekly		
Two - weekly		
Monthly		
Quarterly		
Six -Monthly		
Annually	X	X

Acronyms:
Animal Life (AL):

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5.8 AQUATIC ECOSYSTEMS

5.8.1 STATUTORY/REGULATORY REQUIREMENTS

Formal Compliance

The National Water Act (*No 36 of 1998*) requires protection of the aquatic ecosystems. This requires monitoring of the ecological integrity of water resources. Biological monitoring requirements are, however, site specific and the conditions may be specified in the water use license.

Material Compliance

No specific monitoring standards or guidelines are stipulated for the active components in this chapter.

5.8.2 MONITORING INFRASTRUCTURE/SITES/LOCALITIES

Eighteen sampling sites were chosen along the Leeuwspruit and Rietspruit Catchments, associated with inter alia IVS. The following is a list of the sampling points sampled during the baseline study, and applicable to the routine monitoring of the aquatic ecosystem:

Aquatic Eco Sampling Site:	Surface Water Sampling Site	Description:
AE-1	(RS0)	Rietkuilspruit on Golden Highway downstream from southern industries
AE-2	(RS1)	Rietkuilspruit on Golden Highway downstream from ISCOR Plant
AE-3	(RS2)	Rietkuilspruit downstream from Farm Dam
AE-4	(RS3)	Rietkuilspruit downstream from Farm Dam
AE-5	(RS4)	Rietkuilspruit downstream from RS3 on secondary road
AE-6	(RS5)	Rietkuilspruit upstream from canal on gravel road
AE-7	(RS6)	Rietspruit upstream from confluence (Rietkuilspruit & Canal) on R54
AE-8	(RS7)	Downstream section of canal just upstream from confluence with Rietkuilspruit
AE-9	(RS8)	Approximately 100m downstream from canal confluence
AE-10	(RS9)	Approximately 5km downstream from Rietkuilspruit/Rietspruit confluence in Rietspruit
AE-11	(RS10)	Approximately 5km downstream from R59 on Rietspruit at weir

Aquatic Eco Sampling Site:	Surface Water Sampling Site	Description:
AE-12	(LS1)	Tributary of Leeuwspruit on southeastern side of the works
AE-13	(LS2)	Tributary of Leeuwspruit draining from Boitshepi dumping site
AE-14	(LS3)	Tributary of Leeuwspruit draining from Ditonville
AE-15	(LS4)	Leeuwspruit downstream from tributaries LS1- LS3
AE-16	(LS5)	Leeuwspruit upstream from confluence with Vaal River
AE-17	(LS6)	Vaal River at the R59 road
AE-18	(LS7)	Vaal River downstream from the Leeuwspruit confluence

The Bio-monitoring localities are indicated on **FIGURE 6, APPENDIX I**.

5.8.3 DATA CAPTURE PROTOCOLS

Sampling Frequency

The following frequencies are specified for the different components of aquatic ecosystems monitoring for IVS:

- Whole Effluent Toxicity (WET) testing on effluents/receiving waters is to be conducted every *second month*. **(Suggested months - February, April, June, August, October, December)**
- A general habitat assessment, the Invertebrate Habitat Assessment System (IHAS), aquatic macro-invertebrate assessment (SASS version 5) and *in situ* water quality measurements should be conducted *six-monthly*, during intermediate low-high and high-low flow conditions. **(Suggested months -May/June and November/December)**
- An assessment of the contaminant concentration in sediments, bio-accumulation, fish health assessment, the Fish Assemblages Integrity Index (FAII) and Riparian Vegetation Index (RVI) should be conducted *Annually*. **(Suggested month - November)**

Sampling Technique

Whole Effluent Toxicity (WET) Testing:

Throughout the sampling procedure care must be taken to obtain a sample that meets the requirements of the sampling program. It must be handled in such a way that it does not deteriorate or become contaminated before it reaches the laboratory.

- Glass or plastic bottles can be used to collect toxicity test samples
- Before filling the sample bottle, rinse the bottle two to three times with the sample being collected, unless the bottle contains a preservative or de-chlorinating agent
- Fill the container to the top
- In rivers, grab samples should be collected at midstream and at mid depth if accessible
- Avoid surface scum when collecting a sample from surface waters
- If the sample collected has been chlorinated, the total residual chlorine must be measured immediately following sample collection
- When relevant, state whether or not the sample has been filtered
- Information can be printed on disposable bottles or use a label or tag. Record sufficient information to provide positive sample identification at a later date (e.g. sample number), including the name of the sampler, the date and hour of collection, as well as the exact location and any other data that may be needed for correlation, such as weather conditions, water level, stream flow and post sample handling. Provide space on the label for the initials of those assuming sample custody and for the time and date of receipt in the laboratory
- Aeration during collection and transfer of samples should be minimized to reduce the loss of volatile substances. All the sample containers must be filled completely, leaving no head space between the constituents and the lid
- Sufficient sample must be collected to perform the required toxicity test. The minimum volumes required are stated below:
    - *Vibrio fischeri* bioluminescent toxicity test = 1 *liter*
    - Algal toxicity test = 1 *liter*
    - *Daphnia pulex* acute toxicity test = 1 *liter*
    - *Poecilia reticulata* acute toxicity test = 2 *liter*
- Samples collected for off-site toxicity testing are to be chilled and shipped to the testing laboratory. Sufficient ice or ice-packs should be placed with the sample in the shipping container to ensure that ice/ice packs will still be cold when the sample arrives at the laboratory

General Habitat Assessment and Invertebrate Habitat Assessment System (IHAS):

Habitat in aquatic systems, including surrounding topographical features, is a major determinant of aquatic community potential. Assessment of physical habitat quality is therefore an integral component of the final evaluation of any impairment. The assessment that must be performed includes a general description of the site (Global Positioning Satellite [GPS] reading; photographs for future identification of major changes and documentation of habitat conditions and watershed features; video footage of each site; physical characterization). These parameters are pertinent to the characterization of an aquatic system and will provide valuable insight as to the ability of these systems to support a healthy aquatic community. The Invertebrate Habitat Assessment System (IHAS) score sheet must be

completed. The monitoring of habitat condition is to be co-ordinated with the water quality monitoring program in order to describe the presence of chemical stressors. Water quality data must be integrated with biological data during interpretation of results.

Aquatic Macro invertebrate Assessment (SASS):

Benthic macro-invertebrates are to be collected from all distinguishable biotype at each of the sampling sites using a net with a pore size of 1000 *micron*, mounted on a 300 *mm* square frame. In stony bottomed flowing water biotype (rapids, riffles, runs, etc.) the net is rested on the bottom and the area immediately upstream of the net is disturbed by kicking the stones over and against each other to dislodge benthic invertebrates. Sandy and muddy bottom and stones-out-of-current are sampled by stirring the bottom and sweeping the net through the water over the disturbed area to catch dislodged organisms. Marginal and aquatic vegetation is sampled by sweeping the net back and forth through the biotype to cover from 1-2 *meters*. Identification of the organisms should be done to family level. The most recent SASS procedure must be applied (currently SASS5).

In situ water quality measurements:

In situ water quality measurements (TDS, pH, Dissolved Oxygen, Temperature, Flow Velocity) should be determined on site with field equipment. These results are important to assist in the interpretation of biological results because of the direct influence water quality has on aquatic life forms. Although these measurements only provides a "snapshot" it can sometimes provide valuable insight into the characteristics of a specific sampling site.

Sediment contaminant concentrations:

Samples are collected with a coring apparatus capable of sampling sediments up to 1 *meter* in depth. The core sampler must be pushed into the sediment until it becomes unyielding or until the maximum sampling depth of the corer is reached. A core of sediment should then be extracted. The difference between layers in the sediment should be visually assessed and distinguished by using color (to distinguish between primary layers) and texture (to distinguish between secondary layers). Each identified layer should then be collected in a separate plastic bag and labeled. The samples are to be chilled and shipped to the testing laboratory. Sufficient ice or ice-packs should be placed with the sample in the shipping container to ensure that ice/ice packs will still be cold when the sample arrives at the laboratory.

Bio-accumulation:

Crabs must be collected with baited traps (±5 specimens per site). Collected specimens must be placed in individual plastic bags and labeled. The samples are to be chilled and shipped to the testing laboratory. Sufficient ice or ice-

packs should be placed with the sample in the shipping container to ensure that ice/ice packs will still be cold when the sample arrives at the laboratory.

Fish Health Assessment and Fish Assemblages Integrity Index:

Fish sampling to be conducted by means of:

- Electro shocker: 40 min total or 150 *m* stream length whichever comes first, representing different flow classes and cover types. Specimens should be released unharmed where possible
- Seine net (10 *m* x 1.5 *m*, 9 *mm* mesh): five attempts total at each site, representing as many flow classes and cover types present, not more than two attempts in the same flow/cover type
- Seine net (50 *m* x 2 *m*, 9 *mm* mesh): two attempts total at each site, representing as many of the flow classes and cover types present, not more than two attempts in the same flow/cover type
- Gill nets: series of gill nets in impounded areas (depth > 1,5 *m*)

The health assessment is conducted in such a way as to derive numeric values, which reflect the status of fish health. The percentage fish with externally evident disease or other anomalies must be used in the scoring of this metric, according to the method described by Kleynhans (1999).

The following procedure must be followed to score the health of individual species at a site:

- Frequency of affected fish >5%, score = 1
- Frequency of affected fish 2-5%, score = 3
- Frequency of affected fish <2%, score = 5

This approach is based on the principle that even under unimpaired conditions, a small percentage of individuals can be expected to exhibit some anomalies.

Riparian Vegetation Index:

An assessment of the current status of the aquatic and riparian vegetation in the study area (to include wetland areas) must be conducted annually. Diversity and composition must be identified. The Riparian Vegetation Index (RVI) developed by Kemper (2000) must be applied. This index considers the extent of vegetation coverage of the riparian zone, the structural intactness of the riparian zone, the percentage cover of indigenous riparian species, as well as the regeneration of indigenous species. The RVI was developed as part of the National River Health Program to provide a rapid, relative simple method for evaluation of the condition and ecological integrity of the riparian vegetation along rivers and streams.

Sampling Equipment

The following equipment is needed for a routine monitoring sampling run:

- 2 *l* Glass or plastic sampling bottles
- Pencil, Marking Pen
- Notebook
- Field data sheets
- Masking tape
- *In situ* TDS meter
- pH meter
- Thermometer
- Dissolved Oxygen Meter
- Flow Meter
- Geographical Positioning System (GPS)
- Camera/Video Camera
- 1:50 000 topographical maps
- Sampling net with a pore size of 1000 *micron*, mounted on a 300 *mm* square frame
- Specimen containers
- Magnifying Glass Buckets (x3)
- Forceps Sampling tray (light colour)
- Formalin/Ethanol
- Waders
- Electro-shocker
- Seine net (10 *m* x 1.5 *m*, 9 *mm* mesh)
- Seine net (50 *m* x 2 *m*, 9 *mm* mesh)
- Gill nets
- Traps
- Plastic Bags
- Cooler
- Ice/ice packs

Sampling Procedure

A combination of ecological indicators must be assessed at each site (indicated below).

Site	In situ Water Quality	Algal Biomass	General Habitat Assessment	IAHS	Habitat Integrity	SASS5	FAII	Riparian and Aquatic	RVI	Sediment	Bioaccumulation
TS1	x	x	x	x	x	x	x	x	x	x	
RS1	x	x	x	x	x	x	x	x	x	x	x
RS2	x	x	x	x	x	x	x	x	x	x	
RS3	x	x	x	x	x	x	x	x	x	x	

Site	In situ Water Quality	Algal Biomass	General Habitat Assessment	IAHS	Habitat Integrity	SASS5	FAII	Riparian and Aquatic	RVI	Sediment	Bioaccumulation
RS4	X	X	X	X	X	X	X	X	X	X	
RS5	X	X	X	X	X	X	X	X	X	X	X
RS6	X	X	X	X	X	X	X	X	X	X	X
RS7	X	X	X	X	X	X	X	X	X	X	
RS8	X	X	X	X	X	X	X	X	X	X	X
RS9	X	X	X	X	X	X	X	X	X	X	X
RS10	X	X	X	X	X	X	X	X	X	X	X
LS1	X	X	X	X	X	X	X	X	X	X	
LS2	X	X	X	X	X	X	X	X	X	X	
LS3	X	X	X	X	X	X	X	X	X	X	
LS4	X	X	X	X	X	X	X	X	X	X	X
LS5	X	X	X	X	X	X	X	X	X	X	X
LS6	X	X	X	X	X	X	X	X	X	X	X
LS7	X	X	X	X	X	X	X	X	X	X	X

Whole Effluent Toxicity (WET) testing is to be conducted on selected effluent/receiving water points.

Sample Preservation

Samples for Whole Effluent Toxicity (WET) testing, sediment contaminant concentrations and bio-accumulation assessments should be placed in a cooler with ice/ice packs.

The sampler may need to take aquatic macro-invertebrate and fish samples for verification of identity. These should be preserved in 10% formalin or 80% ethanol.

Analyses Protocol/Variables

Not applicable.

Recommended Independent Laboratory

The independent laboratory used during the Master Plan baseline studies was:

ECOSUN
P O BOX 2131
Florida Hills
1716

Tel: (011) 672-0666
Fax: (011) 672-0666

Data Base Entry

Not applicable - all data will be reflected in the annual report.

Data Backup

All data must be stored on a CD or separate computer/disk to prevent any data lost during computer failure or any other technical failure.

5.8.4 INFORMATION GENERATION PROTOCOLS

Reporting Frequency

The following table summarizes the frequency of reporting.

Frequency	Type of Report
Two-monthly report	Data report
Six-monthly (during intermediate low-high and high-low flow conditions)	Six-monthly - Data Report
Annual Report	Annual status/audit report

Report Content

Two-monthly report

The two-monthly report is a data report were data of the previous sampling run is reported. The following information should be contained in this report:

- Results of the Whole Effluent Toxicity (*WET*) testing on effluents/receiving waters
- Locality map of the monitoring localities

Six-monthly report

The six-monthly report is a data report were data of the previous sampling runs is reported. The following information should be contained in this report:

- Results of the Whole Effluent Toxicity (*WET*) testing on effluents/receiving waters
- Results of the general Habitat Assessment, the Invertebrate Habitat Assessment System (*IHAS*), aquatic macro invertebrate assessment (*SASS-5*) and in situ water quality
- Locality map of the monitoring localities

Annual Report

The following information should be contained in the annual Aquatic Ecosystems Monitoring Report:

- System Audit
  - Status of monitoring system
  - Efficiency and design

- Data Audit
  - Compliance criteria
  - Validation of the data

- Interpretation of data for compliance and trend
  - The current situation
  - Site classification
  - Description of sampling localities
    - Location
    - Characteristics
    - Importance
  - Ecosystem description:
    - Dominant species
    - Other species present
    - Threatened and protected taxa (Endangered species)
    - List of protected species which may occur in study area
    - Invader or exotic species
    - Ecological quality of the community measured against the following parameter:
      - Habitat Quality Index
      - Habitat Assessment Matrix (*HAM*),
      - South African Scoring System (*SASS version 5*) for aquatic invertebrates
      - Fish Health Assessment Index (*FHAI*)
      - Fish Assemblage Integrity Index (*FAII*)
  - Irregularities observed during monitoring season.

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5.8.5 MANAGEMENT PROTOCOLS

The following table summarizes the management protocols relating to the sampling- and reporting frequency of the Aquatic Ecosystem monitoring sites.

	Sampling Frequency	Reporting Frequency
	AE	*AE*
Daily		
Weekly		
Two- Weekly		
Two- Monthly	X	X
Quarterly		
Six-Monthly	X	X
Annually	X	X

Acronyms:
Aquatic Ecosystem (AE):

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5.9 GEOLOGY

Geology is not included in this Monitoring System for routine monitoring purposes. Results for surveys that have been done during the compilation of the Master Plan Study are reflected in the base line study reports.

5.9.1 STATUTORY/REGULATORY REQUIREMENTS

Geology in-active.

5.9.2 MONITORING INFRASTRUCTURE/SITES/LOCALITIES

Geology in-active.

5.9.3 DATA CAPTURE PROTOCOLS

Geology in-active.

5.9.4 INFORMATION GENERATION PROTOCOLS

Geology in-active.

5.9.5 MANAGEMENT PROTOCOLS

Geology in-active.

5.10 GROUND WATER

5.10.1 STATUTORY/REGULATORY REQUIREMENTS

Formal Compliance

The new water licence is the applicable Regulatory Requirement. *(NEW WATER LICENCE NUMBER 10016047)*. DWAF - Minimum Requirements For Monitoring at Waste Management Facilities is an additional applicable Regulatory Requirement - subject to CRMF permit.

Material Compliance

Ground water should be evaluated in terms of the Most Stringent Water Quality criteria **(MSWQ)** developed for the Master Plan Study at IVS. Acceptable Environmental Risk values are not available for the full list of water quality variables relevant to the IVS system in general, and therefore a combination of the following water quality management guidelines are proposed as management objectives for ground water at the IVS Site:

- SABS Drinking Water Standard   -   **SABS.**
- South African Drinking Water Standard   -   **SADWS.**
- Acceptable Environmental Risk Value in "MR"-   **MRAER**

Mainly due to the fact that guideline values do not exist for all the water quality variables, in the different sets of guidelines, the OFT team submit the following combination as a proposed Most Stringent Water Quality management objective **(MSWQ)** for the IVS site.

	SABS/SADWS	MRAER	MSWQ
pH	6<pH<9	N/S	6<pH<9
EC *(mS/m)*	70	N/S	70
TDS *(mg/l)*	490	N/S	490
Ca *(mg/l)*	150	N/S	150
Mg *(mg/l)*	70	N/S	70
Na *(mg/l)*	100	N/S	100
K *(mg/l)*	200	N/S	200
Si *(mg/l)*	N/S	N/S	N/S
T-Alk *(mg/l)*	N/S	N/S	N/S
Cl *(mg/l)*	100	N/S	100
SO_4 *(mg/l)*	200	N/S	200
NO_3 *(mg/l)*	5	N/S	5
F *(mg/l)*	1	N/S	1
Al *(mg/l)*	0.15	0.390	0.150
Fe *(mg/l)*	0.10	9.000	0.100
Mn *(mg/l)*	0.05	0.300	0.050
Cd *(mg/l)*	0.01	0.031	0.01
Pb *(mg/l)*	0.05	0.100	0.05
Zn *(mg/l)*	1.00	0.700	0.700
CN *(mg/l)*	0.30	0.0053	0.0053

5.10.2 MONITORING INFRASTRUCTURE/SITES/LOCALITIES

The following sites have been selected as Ground Water monitoring sites.

External Users (GWE)

Drakeville:

Map No:	Database No:	Status:
GWE-1	DV-2A	Not in use
GWE-2	DV-3	Not in use
GWE-3	DV-4	Not in use
GWE-4	DV-5	Not in use
GWE-5	DV-6	Not in use
GWE-6	DV-7	Not in use
GWE-7	DV-8	Not in use
GWE-8	DV-9	Not in use
GWE-9	DV-10	Not in use
GWE-10	DV-11	Not in use
GWE-11	DV-12	Not in use
GWE-12	DV-13	Not in use
GWE-13	DV-14	Not in use
GWE-14	DV-2B	Not in use

Cyferpan:

Map No:	Database No:	Status:
GWE-15	RKL-D1	Not in use
GWE-16	RKL-D2	Not in use
GWE-17	RKL-D3	Not in use
GWE-18	WEERSTAS	Not in use
GWE-19	VAALDAM	Not in use
GWE-20	BH-D	Not in use
GWE-21	RL-1	Not in use
GWE-22	RS-1	Not in use
GWE-23	CP-6/1	In use
GWE-24	CP-7/1	In use
GWE-25	CP-7/2	In use
GWE-26	CP-7/3	Not in use
GWE-27	CP-8/1	Not in use
GWE-28	CP-10/1	In use
GWE-29	CP-10/2	Not in use
GWE-30	CP-11/1	In use
GWE-31	CP-11/2	Not in use
GWE-32	CP-16/1	In use
GWE-33	QF-1	In use
GWE-34	QF-2	Not in use
GWE-35	QF-3	Not in use
GWE-36	QF-4	Not in use
GWE-37	QF-5	Not in use

Map No:	Database No:	Status:
GWE-38	BPT-3	In use
GWE-39	BG-2	Not in use
GWE-40	BG-3	Not in use

Lamont Park:

Map No:	Database No:	Status:
GWE-41	MP-1	Not in use
GWE-42	LMP-2	Not in use
GWE-43	LMP-3	Not in use
GWE-44	LMP-4	Not in use
GWE-45	LMP-5	Not in use
GWE-46	LMP-6	Not in use
GWE-47	LMP-7	Not in use
GWE-48	LMP-8	Not in use
GWE-49	LMP-9	Not in use
GWE-50	LMP-10	Not in use
GWE-51	LMP-11	Not in use
GWE-52	LMP-12	Not in use
GWE-53	LMP-13	Not in use
GWE-54	LMP-14	Not in use
GWE-55	LMP-15	Not in use
GWE-56	LMP-16	Not in use
GWE-57	LMP-17	Not in use
GWE-58	LMP-18	Not in use
GWE-59	LMP-19	Not in use
GWE-60	LMP-20	Not in use
GWE-61	LMP-21	Not in use
GWE-62	LMP-22	Not in use
GWE-63	LMP-23	Not in use
GWE-64	LMP-24	Not in use
GWE-65	LMP-25	Not in use
GWE-66	LMP-26	Not in use
GWE-67	LMP-27	Not in use
GWE-68	LMP-28	Not in use
GWE-69	LMP-29	Not in use
GWE-70	LMP-30	Not in use
GWE-71	LMP-31	Not in use
GWE-72	LMP-32	Not in use
GWE-73	LMP-33	Not in use
GWE-74	LMP-34	Not in use
GWE-75	LMP-35	Not in use
GWE-76	LMP-36	Not in use
GWE-77	LMP-37	Not in use
GWE-78	LMP-38	Not in use
GWE-79	LMP-39	Not in use
GWE-80	LMP-40	Not in use
GWE-81	LMP-41	Not in use
GWE-82	LMP-42	Not in use

Map No:	Database No:	Status:
GWE-83	LMP-43	Not in use
GWE-84	LMP-44	Not in use
GWE-85	LMP-45	Not in use
GWE-86	LMP-46	Not in use
GWE-87	LMP-47	Not in use
GWE-88	LMP-48	Not in use
GWE-89	LMP-50	Not in use
GWE-90	LMP-3B	Not in use
GWE-91	LMP-21B	Not in use

Linkholm:

Map No:	Database No:	Status:
GWE-92	LH-1	Not in use
GWE-93	LH-20	Not in use
GWE-94	LH-21	Not in use
GWE-95	LH-24	Not in use
GWE-96	LH-25	Not in use
GWE-97	LH-26	Not in use
GWE-98	LH-27	Not in use
GWE-99	LH-28	Not in use
GWE-100	LH-29	Not in use
GWE-101	LH-30	Not in use
GWE-102	LH-31	Not in use
GWE-103	LH-32	Not in use
GWE-104	LH-33	Not in use
GWE-105	LH-34	Not in use
GWE-106	LH-35	Not in use
GWE-107	LH-36	Not in use
GWE-108	LH-37	Not in use
GWE-109	LH-38	Not in use
GWE-110	LH-40	Not in use
GWE-111	LH-41	Not in use
GWE-112	LH-56	Not in use
GWE-113	LH-57	Not in use
GWE-114	LH-58A	Not in use
GWE-115	LH-59	Not in use
GWE-116	LH-62	Not in use
GWE-117	LH-63	Not in use
GWE-118	LH-64	Not in use
GWE-119	LH-65	Not in use
GWE-120	LH-66	Not in use
GWE-121	LH-67	Not in use
GWE-122	LH-68A	Not in use
GWE-123	LH-69A	Not in use
GWE-124	LH-70	Not in use
GWE-125	LH-71	Not in use
GWE-126	LH-72A	Not in use
GWE-127	LH-73	Not in use

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Map No:	Database No:	Status:
GWE-128	LH-74	Not in use
GWE-129	LH-76	Not in use
GWE-130	LH-81	Not in use
GWE-131	LH-82	Not in use
GWE-132	LH-83	Not in use
GWE-133	LH-84	Not in use
GWE-134	LH-85	Not in use
GWE-135	LH-86A	Not in use
GWE-136	LH-87A	Not in use
GWE-137	LH-88	Not in use
GWE-138	LH-90	Not in use
GWE-139	LH-91A	Not in use
GWE-140	LH-93	Not in use
GWE-141	LH-94	Not in use
GWE-142	LH-95	Not in use
GWE-143	LH-96	Not in use
GWE-144	LH-97	Not in use
GWE-145	LH-98	Not in use
GWE-146	LH-99	Not in use
GWE-147	LH-100	Not in use
GWE-148	LH-101A	Not in use
GWE-149	LH-102	Not in use
GWE-150	LH-103	Not in use
GWE-151	LH-104	Not in use
GWE-152	LH-107	Not in use
GWE-153	LH-108	Not in use
GWE-154	LH-109A	Not in use
GWE-155	LH-110	Not in use
GWE-156	LH-111	Not in use
GWE-157	LH-113	Not in use
GWE-158	LH-114	Not in use
GWE-159	LH-115	Not in use
GWE-160	LH-116	Not in use
GWE-161	LH-117	Not in use
GWE-162	LH-118	Not in use
GWE-163	LH-119	Not in use
GWE-164	LH-120	Not in use
GWE-165	LH-122	Not in use
GWE-166	LH-123	Not in use
GWE-167	LH-124	Not in use
GWE-168	LH-126	Not in use
GWE-169	LH-127A	Not in use
GWE-170	LH-128	Not in use
GWE-171	LH-129	Not in use
GWE-172	LH-130	Not in use
GWE-173	LH-131A	Not in use
GWE-174	LH-132	Not in use
GWE-175	LH-133	Not in use
GWE-176	LH-134	Not in use

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Map No:	Database No:	Status:
GWE-177	LH-135	Not in use
GWE-178	LH-136	Not in use
GWE-179	LH-138	Not in use
GWE-180	LH-139	Not in use
GWE-181	LH-140	Not in use
GWE-182	LH-141A	Not in use
GWE-183	LH-58B	Not in use
GWE-184	LH-68B	Not in use
GWE-185	LH-69B	Not in use
GWE-186	LH-72B	Not in use
GWE-187	LH-86B	Not in use
GWE-188	LH-87B	Not in use
GWE-189	LH-91B	Not in use
GWE-190	LH-101B	Not in use
GWE-191	LH-109B	Not in use
GWE-192	LH-127B	Not in use
GWE-193	LH-131B	Not in use
GWE-194	LH-133B	Not in use
GWE-195	LH-141B	Not in use
GWE-196	LH-69C	Not in use
GWE-197	LH-61C	Not in use
GWE-198	LH-62C	Not in use
GWE-199	LH-69C	Not in use
GWE-200	LH-70C	Not in use
GWE-201	LH-101C	Not in use

Louisrus:

Map No:	Database No:	Status:
GWE-202	LR-1	Not in use
GWE-203	LR-2	Not in use
GWE-204	LR-3	Not in use
GWE-205	LR-4	Not in use
GWE-206	LR-5	Not in use
GWE-207	LR-6	Not in use
GWE-208	LR-7	Not in use
GWE-209	LR-8	Not in use
GWE-210	LR-9	Not in use
GWE-211	LR-10	Not in use
GWE-212	LR-11	Not in use
GWE-213	LR-12	Not in use
GWE-214	LR-13	Not in use
GWE-215	LR-14	Not in use
GWE-216	LR-15	Not in use
GWE-217	LR-16	Not in use
GWE-218	LR-17	Not in use
GWE-219	LR-18	Not in use
GWE-220	LR-19	Not in use
GWE-221	LR-20	Not in use

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Map No:	Database No:	Status:
GWE-222	LR-21	Not in use
GWE-223	LR-22	Not in use
GWE-224	LR-23	Not in use
GWE-225	LR-24	Not in use
GWE-226	LR-25	Not in use
GWE-227	LR-26	Not in use
GWE-228	LR-27	Not in use
GWE-229	LR-28	Not in use
GWE-230	LR-29	Not in use
GWE-231	LR-30	Not in use
GWE-232	LR-31	Not in use
GWE-233	LR-32	Not in use
GWE-234	LR-33	Not in use
GWE-235	LR-34	Not in use
GWE-236	LR-35	Not in use
GWE-237	LR-36	Not in use
GWE-238	LR-37	Not in use
GWE-239	LR-38	Not in use
GWE-240	LR-39	Not in use
GWE-241	LR-40	Not in use
GWE-242	LR-41A	Not in use
GWE-243	LR-42	Not in use
GWE-244	LR-43	Not in use
GWE-245	LR-44	Not in use
GWE-246	LR-45A	Not in use
GWE-247	LR-46A	Not in use
GWE-248	LR-47	Not in use
GWE-249	LR-48A	Not in use
GWE-250	LR-49	Not in use
GWE-251	LR-50A	Not in use
GWE-252	LR-51	Not in use
GWE-253	LR-52	Not in use
GWE-254	LR-53	Not in use
GWE-255	LR-54	Not in use
GWE-256	LR-55	Not in use
GWE-257	LR-56	Not in use
GWE-258	LR-57	Not in use
GWE-259	LR-58A	Not in use
GWE-260	LR-59	Not in use
GWE-261	LR-60	Not in use
GWE-262	LR-61	Not in use
GWE-263	LR-62	Not in use
GWE-264	LR-63	Not in use
GWE-265	LR-64	Not in use
GWE-266	LR-65	Not in use
GWE-267	LR-66	Not in use
GWE-268	LR-67	Not in use
GWE-269	LR-68A	Not in use
GWE-270	LR-69	Not in use

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Map No:	Database No:	Status:
GWE-271	LR-70	Not in use
GWE-272	LR-71A	Not in use
GWE-273	LR-72A	Not in use
GWE-274	LR-73A	Not in use
GWE-275	LR-74	Not in use
GWE-276	LR-75	Not in use
GWE-277	LR-76	Not in use
GWE-278	LR-77	Not in use
GWE-279	LR-78	Not in use
GWE-280	LR-79	Not in use
GWE-281	LR-80	Not in use
GWE-282	LR-81	Not in use
GWE-283	LR-82	Not in use
GWE-284	LR-83	Not in use
GWE-285	LR-84	Not in use
GWE-286	LR-85	Not in use
GWE-287	LR-86	Not in use
GWE-288	LR-87	Not in use
GWE-289	LR-88	Not in use
GWE-290	LR-89	Not in use
GWE-291	LR-90	Not in use
GWE-292	LR-91	Not in use
GWE-293	LR-92	Not in use
GWE-294	LR-93	Not in use
GWE-295	LR-94	Not in use
GWE-296	LR-95	Not in use
GWE-297	LR-96	Not in use
GWE-298	LR-97	Not in use
GWE-299	LR-98	Not in use
GWE-300	LR-99	Not in use
GWE-301	LR-100	Not in use
GWE-302	LR-101	Not in use
GWE-303	LR-102	Not in use
GWE-304	LR-103	Not in use
GWE-305	LR-104	Not in use
GWE-306	LR-105	Not in use
GWE-307	LR-106	Not in use
GWE-308	LR-107	Not in use
GWE-309	LR-108	Not in use
GWE-310	LR-109	Not in use
GWE-311	LR-110	Not in use
GWE-312	LR-111	Not in use
GWE-313	LR-112	Not in use
GWE-314	LR-113	Not in use
GWE-315	LR-114	Not in use
GWE-316	LR-115	Not in use
GWE-317	LR-116	Not in use
GWE-318	LR-117	Not in use
GWE-319	LR-118	Not in use

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Map No:	Database No:	Status:
GWE-320	LR-119	Not in use
GWE-321	LR-120	Not in use
GWE-322	LR-121	Not in use
GWE-323	LR-122	Not in use
GWE-324	LR-126	Not in use
GWE-325	LR-130	Not in use
GWE-326	LR-131	Not in use
GWE-327	LR-133	Not in use
GWE-328	LR-134	Not in use
GWE-329	LR-135	Not in use
GWE-330	LR-136	Not in use
GWE-331	LR-137	Not in use
GWE-332	LR-138	Not in use
GWE-333	LR-140	Not in use
GWE-334	LR-141A	Not in use
GWE-335	LR-142	Not in use
GWE-336	LR-143A	Not in use
GWE-337	LR-145	Not in use
GWE-338	LR-146	Not in use
GWE-339	LR-147	Not in use
GWE-340	LR-148	Not in use
GWE-341	LR-149	Not in use
GWE-342	LR-150	Not in use
GWE-343	LR-151	Not in use
GWE-344	LR-153	Not in use
GWE-345	LR-154	Not in use
GWE-346	LR-155	Not in use
GWE-347	LR-156A	Not in use
GWE-348	LR-157	Not in use
GWE-349	LR-158	Not in use
GWE-350	LR-159	Not in use
GWE-351	LR-161	Not in use
GWE-352	LR-162	Not in use
GWE-353	LR-163	Not in use
GWE-354	LR-164	Not in use
GWE-355	LR-165	Not in use
GWE-356	LR-167	Not in use
GWE-357	LR-168	Not in use
GWE-358	LR-169	Not in use
GWE-359	LR-172	Not in use
GWE-360	LR-173	Not in use
GWE-361	LR-174	Not in use
GWE-362	LR-176	Not in use
GWE-363	LR-177	Not in use
GWE-364	LR-178A	Not in use
GWE-365	LR-6B	Not in use
GWE-366	LR-12B	Not in use
GWE-367	LR-14B	Not in use
GWE-368	LR-41B	Not in use

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Map No:	Database No:	Status:
GWE-369	LR-41C	Not in use
GWE-370	LR-41D	Not in use
GWE-371	LR-46B	Not in use
GWE-372	LR-48B	Not in use
GWE-373	LR-48C	Not in use
GWE-374	LR-50B	Not in use
GWE-375	LR-58B	Not in use
GWE-376	LR-68B	Not in use
GWE-377	LR-71B	Not in use
GWE-378	LR-72B	Not in use
GWE-379	LR-72D	Not in use
GWE-380	LR-73B	Not in use
GWE-381	LR-73C	Not in use
GWE-382	LR-92B	Not in use
GWE-383	LR-94B	Not in use
GWE-384	LR-108B	Not in use
GWE-385	LR-119B	Not in use
GWE-386	LR-141B	Not in use
GWE-387	LR-143B	Not in use
GWE-388	LR-156B	Not in use
GWE-389	LR-167B	Not in use
GWE-390	LR-178B	Not in use

Rosashof:

Map No:	Database No:	Status:
GWE-391	RH-2	Not in use
GWE-392	RH-3	Not in use
GWE-393	RH-4	Not in use
GWE-394	RH-5	Not in use
GWE-395	RH-6	Not in use
GWE-396	RH-7	Not in use
GWE-397	RH-10	Not in use
GWE-398	RH-12	Not in use
GWE-399	RH-13	Not in use
GWE-400	RH-14	Not in use
GWE-401	RH-15	Not in use
GWE-402	RH-16	Not in use
GWE-403	RH-17	Not in use
GWE-404	RH-18	Not in use
GWE-405	RH-19	Not in use
GWE-406	RH-20	Not in use
GWE-407	RH-21	Not in use
GWE-408	RH-22	Not in use
GWE-409	RH-23	Not in use
GWE-410	RH-24	Not in use
GWE-411	RH-25	Not in use
GWE-412	RH-26	Not in use
GWE-413	RH-27	Not in use

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Map No:	Database No:	Status:
GWE-414	RH-28	Not in use
GWE-415	RH-29	Not in use
GWE-416	RH-30	Not in use
GWE-417	RH-32	Not in use
GWE-418	RH-33	Not in use
GWE-419	RH-37	Not in use
GWE-420	RH-38	Not in use
GWE-421	RH-39	Not in use
GWE-422	RH-40	Not in use
GWE-423	RH-42	Not in use
GWE-424	RH-43	Not in use
GWE-425	RH-44	Not in use
GWE-426	RH-46	Not in use
GWE-427	CP-1	Not in use
GWE-428	RH-46B	Not in use

Vanderbijlpark Town Northern Suburb:

Map No:	Database No:	Status:
GWE-429	VBP-1	In use
GWE-430	VBP-2	In use
GWE-431	VBP-3	In use
GWE-432	VBP-4	In use
GWE-433	VBP-5	In use
GWE-434	VBP-6	In use
GWE-435	VBP-7	In use
GWE-436	VBP-8	In use
GWE-437	VBP-9	In use
GWE-438	VBP-10	In use
GWE-439	VBP-11	In use
GWE-440	VBP-12	In use
GWE-441	VBP-13	In use
GWE-442	VBP-14	In use
GWE-443	VBP-15	In use
GWE-444	VBP-16	In use
GWE-445	VBP-17	In use
GWE-446	VBP-18	In use
GWE-447	VBP-19	In use
GWE-448	VBP-20	In use
GWE-449	VBP-21	In use
GWE-450	VBP-22	In use
GWE-451	VBP-23	In use
GWE-452	VBP-24	In use
GWE-453	VBP-25	In use
GWE-454	VBP-26	Not in use
GWE-455	VBP-27	In use
GWE-456	VBP-28	In use
GWE-457	VBP-29	In use
GWE-458	VBP-30	In use

Map No:	Database No:	Status:
GWE-459	VBP-31	Not in use
GWE-460	VBP-32	In use
GWE-461	VBP-33	In use
GWE-462	VBP-34	In use
GWE-463	VBP-35	In use
GWE-464	VBP-36	In use
GWE-465	VBP-37	In use
GWE-466	VBP-38	In use
GWE-467	VBP-39	In use
GWE-468	VBP-40	In use
GWE-469	VBP-41	In use
GWE-470	VBP-42	In use
GWE-471	VBP-43	In use
GWE-472	VBP-44	In use
GWE-473	VBP-45	In use
GWE-474	VBP-46	In use
GWE-475	VBP-47	In use
GWE-476	VBP-48	In use
GWE-477	VBP-49	In use
GWE-478	VBP-50	In use
GWE-479	VBP-51	In use
GWE-480	VBP-52	In use
GWE-481	VBP-53	In use
GWE-482	VBP-54	In use
GWE-483	VBP-55	In use
GWE-484	VBP-56	In use
GWE-485	VBP-57	In use
GWE-486	VBP-58	In use
GWE-487	VBP-59	In use
GWE-488	VBP-60	In use
GWE-489	VBP-61	In use
GWE-490	VBP-62	In use

Steelpark

Map No:	Database No:	Status:
GWE-491	SP1	Not in use
GWE-492	SP2	Not in use
GWE-493	SP3	Not in use
GWE-494	SP4	Not in use
GWE-495	SP5	Not in use
GWE-496	SP6	Not in use
GWE-497	SP6B	Not in use

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Steelvalley:

Map No:	Database No:	Status:
GWE-498	SV-1	Not in use
GWE-499	SV-2	Not in use
GWE-500	SV-3A	Not in use
GWE-501	SV-4	Not in use
GWE-502	SV-5	Not in use
GWE-503	SV-6	Not in use
GWE-504	SV-7	Not in use
GWE-505	SV-8A	Not in use
GWE-506	SV-9	Not in use
GWE-507	SV-10A	Not in use
GWE-508	SV-11	Not in use
GWE-509	SV-12	Not in use
GWE-510	SV-13	Not in use
GWE-511	SV-14	Not in use
GWE-512	SV-15	Not in use
GWE-513	SV-16	Not in use
GWE-514	SV-17A	Not in use
GWE-515	SV-18A	Not in use
GWE-516	SV-19A	Not in use
GWE-517	SV-20	Not in use
GWE-518	SV-21	Not in use
GWE-519	SV-22	Not in use
GWE-520	SV-24	Not in use
GWE-521	SV-25	Not in use
GWE-522	SV-26	Not in use
GWE-523	SV-27	Not in use
GWE-524	SV-28A	Not in use
GWE-525	SV-29A	Not in use
GWE-526	SV-30	Not in use
GWE-527	SV-33	Not in use
GWE-528	SV-35	Not in use
GWE-529	SV-36	Not in use
GWE-530	SV-37	Not in use
GWE-531	SV-39	Not in use
GWE-532	SV-40	Not in use
GWE-533	SV-42	Not in use
GWE-534	SV-44	Destroyed
GWE-535	SV-45A	Not in use
GWE-536	SV-46A	Not in use
GWE-537	SV-47	Not in use
GWE-538	SV-48	Not in use
GWE-539	SV-49	Not in use
GWE-540	SV-50	Not in use
GWE-541	SV-52	Not in use
GWE-542	SV-53	Not in use
GWE-543	SV-54	Not in use
GWE-544	SV-55A	Not in use

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Map No:	Database No:	Status:
GWE-545	SV-56	Not in use
GWE-546	SV-57	Not in use
GWE-547	SV-58	Not in use
GWE-548	SV-59	Not in use
GWE-549	SV-60	Not in use
GWE-550	SV-61	Not in use
GWE-551	SV-62	Not in use
GWE-552	SV-63	Not in use
GWE-553	SV-64A	Not in use
GWE-554	SV-65A	Not in use
GWE-555	SV-66	Not in use
GWE-556	SV-67	Not in use
GWE-557	SV-68A	Destroyed
GWE-558	SV-69	Not in use
GWE-559	SV-3B	Not in use
GWE-560	SV-8B	Not in use
GWE-561	SV-10B	Not in use
GWE-562	SV-17B	Not in use
GWE-563	SV-18B	Not in use
GWE-564	SV-19B	Not in use
GWE-565	SV-28B	Not in use
GWE-566	SV-29B	Not in use
GWE-567	SV-45B	Not in use
GWE-568	SV-46B	Not in use
GWE-571	SV-55B	Not in use
GWE-572	SV-64B	Not in use
GWE-573	SV-65B	Not in use
GWE-574	SV-67B	Not in use
GWE-575	SV-68B	Not in use
GWE-576	SV-68C	Not in use

aquitards (GWEF)

Map No:	Database No:	Status
GWEF-1	BPT-F1	Not in use

Perched Aquifer (GWP)

Map No:	Database No:	Source:
GWP-1	IVB-S1	North Works Open Area
GWP-2	IVB-S2	Open Area Coopers Hill
GWP-3	IVB-S3	Maturation Ponds
GWP-4	IVB-S4	Coke Stockpile Area
GWP-5	IVB-S5	Solid Waste Dump
GWP-6	IVB-S6	Coke Stockpile Area
GWP-7	IVB-S7	Coal Stacking
GWP-8	IVB-S8	Open Areas "heaps"
GWP-9	IVB-S9	Open Areas "heaps"
GWP-10	IVB-S10	Open Areas "heaps"

Map No:	Database No:	Source:
GWP-11	IVB-S11	Bio Plant/Open Areas
GWP-12	IVB-S12	Open Areas
GWP-13	IVB-S13	Stacking & Reclaiming
GWP-14	IVB-S14	Bio Plant
GWP-15	IVB-S15	North Works
GWP-16	IVB-S16	North Works Open Areas
GWP-17	IVB-S17	Maturation Ponds
GWP-18	IVB-S18	Evaporation Dams 1 - 4
GWP-19	IVB-S19	Evaporation Dams 1 - 4
GWP-20	IVB-S20	Kiewiet Area
GWP-21	IVB-S21	Kiewiet Area
GWP-22	IVB-S22	Kiewiet Area
GWP-23	IVB-S23	Kiewiet Area
GWP-24	IVB-S24	Kiewiet Area
GWP-25	IVB-S25	Kiewiet Area
GWP-26	IVB-S26	Kiewiet Area
GWP-27	IVB-S27	Kiewiet Area
GWP-28	IVB-S28	Kiewiet Area
GWP-29	IVB-S29	Casting & Mill Plant
GWP-30	IVB-S30	Siding Area
GWP-31	IVB-S31	Hecketts Slag Plant
GWP-32	IVB-S32	Construction Store Yard
GWP-33	IVB-S33	Blast Furnace
GWP-34	IVB-S34	Blast Furnace
GWP-35	IVB-S35	Open Area/Coil Storage
GWP-36	IVB-S36	Slab Storage Yard
GWP-37	IVB-S37	Slabbing Mill
GWP-38	IVB-S38	Oxygen Plant/P.H.
GWP-39	IVB-S39	Blast Furnace/TETP Area
GWP-40	IVB-S40	BOF Plant/Truck Repair
GWP-41	IVB-S41	North Works/Open Areas
GWP-42	IVB-S42	Evaporation Dams 1 - 4
GWP-43	IVB-S43	Open Areas
GWP-44	IVB-S44	Casting & Mill Plant
GWP-45	IVB-S45	CETP Sludge Dams
GWP-46	IVB-S46	Sludge Dams (dry dams)
GWP-47	IVB-S47	Direct Reduction Plant
GWP-48	IVB-S48	Direct Reduction Plant
GWP-49	IVB-S49	TETP Plant Area
GWP-50	IVB-S50	Direct Reduction Plant
GWP-51	IVB-S51	Direct Reduction Plant
GWP-52	IVB-S52	Solid waste dumps
GWP-53	IVB-S53	Dam 10 / BF sludge dams
GWP-54	IVB-S54	Dam 10 / BF sludge dams
GWP-55	IVB-S55	Dam 10 / BF sludge dams
GWP-56	IVB-S56	Dam 10 / BF sludge dams
GWP-57	IVB-S57	Slag dump
GWP-58	IVB-S58	Dam 10 / BF sludge dams
GWP-59	IVB-S59	Dam 10 / BF sludge dams

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Map No:	Database No:	Source:
GWP-60	IVB-S60	Sludge Dams (dry dams)
GWP-61	IVB-S61	Maturation Ponds
GWP-62	IVB-S62	Casting & Mill plant
GWP-63	IVB-S63	Electro Slag Area
GWP-64	IVB-S64	Open Area
GWP-65	IVB-S65	Dam 10/BF Sludge dams
GWP-66	IVB-S66	Dam 10/BF Sludge dams
GWP-67	IVB-S67	Dam 10/BF Sludge dams
GWP-68	IVB-S68	West Boundary/Dam 10
GWP-69	IVB-S69	Farmland/West Boundary
GWP-70	IVB-S70	Evaporation Dams 1 - 4
GWP-71	IVB-S71	Coal Stacking
GWP-72	IVB-S72	Coal Stacking
GWP-73	IVB-S73	Old Fuel Depot
GWP-74	IVB-S74	Slag Dump
GWP-75	IVB-S75	Slag Dump
GWP-76	IVB-S76	Fuel Station/BOF Plant
GWP-77	IVB-S77	Open Areas
GWP-78	IVB-S78	Open Area/Electro Slag
GWP-79	IVB-S79	Kiewiet Area
GWP-80	IVB-S80	Solid Waste Dump
GWP-81	IVB-S81	Coke Breeze Stockpile
GWP-82	IVB-S82	Kiewiet Area
GWP-83	IVB-S83	Kiewiet Area
GWP-84	IVB-S84	Kiewiet Area
GWP-85	IVB-S85	Kiewiet Area
GWP-86	IVB-S86	Siding Area
GWP-87	IVB-S87	Open Area
GWP-88	IVB-S88	Hecketts Area/BOF Slag
GWP-89	IVB-S89	Secondary Industries
GWP-90	IVB-S90	Open Areas
GWP-91	IVB-S91	Hecketts Area/BOF Slag
GWP-92	IVB-S92	Hecketts Area/BOF Slag
GWP-93	IVB-S93	Coke Breeze Stockpile
GWP-94	IVB-S94	Kiewiet Area
GWP-95	IVB-S95	Farmland/TETP Plant
GWP-96	IVB-S96	Farmland/TETP Plant
GWP-97	IVB-S97	West Boundary/Dam 10
GWP-98	IVB-S98	Steelvalley/West Boundary
GWP-99	IVB-S99	Steelvalley/West Boundary
GWP-100	IVB-S100	North Works Open Area
GWP-101	IVB-S101	Evaporation Dams 1 - 4
GWP-102	IVB-S102	Steelvalley/West Boundary
GWP-103	IVB-S103	Steelvalley/West Boundary
GWP-104	IVB-S104	Slag Dump
GWP-105	IVB-S105	Electro Slag Area
GWP-106	IVB-S106	Hecketts Area/BOF Slag
GWP-107	IVB-S110	TETP Plant Area
GWP-108	IVB-S111	TETP Plant Area

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Map No:	Database No:	Source:
GWP-109	IVB-S112	TETP Plant Area
GWP-110	IVB-S113	TETP Plant Area
GWP-111	IVB-S114	Direct Reduction Plant
GWP-112	IVB-S115	Farmland/West Boundary
GWP-113	IVB-S116	West Boundary/Dam 10
GWP-114	IVB-S117	West Boundary/Dam 10
GWP-115	IVB-S118	West Boundary/Dam 10
GWP-116	IVB-S119	West Boundary/Dam 10
GWP-117	IVB-S120	Steelvalley/West Boundary
GWP-118	IVB-S121	Steelvalley/West Boundary
GWP-119	IVB-S122	West Boundary/Dam 10
GWP-120	IVB-S123	West Boundary/Dam 10
GWP-121	IVB-S124	Maturation Ponds
GWP-122	IVB-S125	CETP Sludge Dams
GWP-123	IVB-S126	Kiewiet Area
GWP-124	IVB-S127	Kiewiet Area
GWP-125	IVB-S128	Kiewiet Area
GWP-126	IVB-S129	Kiewiet Area
GWP-127	IVB-S130	Kiewiet Area
GWP-128	IVB-S131	Electro Slag Area
GWP-129	IVB-S132	VANDERBIJLPARK
GWP-130	IVB-S133	Steelserv Offices
GWP-131	IVB-S134	Hecketts Area/BOF Slag
GWP-132	IVB-S135	Open Area/Hecketts Area
GWP-133	IVB-S136	South-Eastern Boundary
GWP-134	IVB-S137	South-Eastern Boundary
GWP-135	IVB-S138	South-Eastern Boundary
GWP-136	IVB-S139	South-Eastern Boundary
GWP-137	IVB-S140	South-Eastern Boundary
GWP-138	IVB-S141	South-Eastern Boundary
GWP-139	IVB-S142	Coke Ovens
GWP-140	IVB-S143	Casting & Mill Plant
GWP-141	IVB-S144	Coke Ovens
GWP-142	IVB-S145	Coke Ovens
GWP-143	IVB-S146	Coke Ovens
GWP-144	IVB-S147	**No hole for this number**
GWP-145	IVB-S148	Suprachem
GWP-146	IVB-S149	Casting & Mill Plant
GWP-147	IVB-S150	West Boundary/BOF
GWP-148	IVB-S160	North Eastern Boundary
GWP-149	IVB-S161	Northern Boundary
GWP-150	IVB-S162	Northern Boundary
GWP-151	IVB-S163	North Eastern Boundary
GWP-152	IVB-S164	North Plant/Fault Zone
GWP-153	IVB-S165	Kiewiet Area
GWP-154	IVB-S166	Kiewiet Area
GWP-155	IVB-S167	Kiewiet Area
GWP-156	IVB-S168	Electro Slag Area
GWP-157	IVB-S169	Boipatong/Hecketts

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Map No:	Database No:	Source
GWW-1	IVB-D1	North Works Open Areas
GWW-2	IVB-D2	Open Area Coopers Hill
GWW-3	IVB-D3	Maturation Ponds
GWW-4	IVB-D4	Coke Stockpile Area
GWW-5	IVB-D5	Solid Waste Dump
GWW-6	IVB-D6	Coke Stockpile Area
GWW-7	IVB-D7	Coal Stacking
GWW-8	IVB-D8	Open Areas "heaps"
GWW-9	IVB-D9	Open Areas "heaps"
GWW-10	IVB-D10	Open Areas "heaps"
GWW-11	IVB-D11	Bio Plant/Open Areas
GWW-12	IVB-D12	Open Areas
GWW-13	IVB-D13	Stacking & Reclaiming
GWW-14	IVB-D14	Bio Plant
GWW-15	IVB-D15	North Works
GWW-16	IVB-D16	North Works Open Areas
GWW-17	IVB-D17	Maturation Ponds
GWW-18	IVB-D18	Evaporation Dams 1 - 4
GWW-19	IVB-D19	Evaporation Dams 1 - 4
GWW-20	IVB-D20	Kiewiet Site
GWW-21	IVB-D21	Kiewiet Site
GWW-22	IVB-D22	Kiewiet Site
GWW-23	IVB-D23	Kiewiet Site
GWW-24	IVB-D24	Kiewiet Site
GWW-25	IVB-D25	Kiewiet Site
GWW-26	IVB-D26	Kiewiet Site
GWW-27	IVB-D27	Kiewiet Site
GWW-28	IVB-D28	Kiewiet Site
GWW-29	IVB-D29	Casting & Mill Plant
GWW-30	IVB-D30	Siding Area
GWW-31	IVB-D31	Hecketts Slag Plant
GWW-32	IVB-D32	Construction Store Yard
GWW-33	IVB-D33	Blast Furnace
GWW-34	IVB-D34	Blast Furnace
GWW-35	IVB-D35	Open Area/Coil Storage
GWW-36	IVB-D36	Slab Storage Yard
GWW-37	IVB-D37	Slabbing Mill
GWW-38	IVB-D38	Oxygen Plant/P.H.
GWW-39	IVB-D39	Blast Furnace/TETP Area
GWW-40	IVB-D40	BOF Plant/Truck Repair
GWW-41	IVB-D41	North Works Open Areas
GWW-42	IVB-D42	Evaporation Dams 1 - 4
GWW-43	IVB-D43	Open Areas
GWW-44	IVB-D44	Mill Plant/Uncoated/Lurgi
GWW-45	IVB-D45	CETP Sludge Dams
GWW-46	IVB-D46	CETP Sludge Dams
GWW-47	IVB-D47	DR Plant Area & OHP

Map No:	Database No:	Source
GWW-48	IVB-D48	DR Plant Area & OHP
GWW-49	IVB-D49	TETP Plant Area
GWW-50	IVB-D50	West Boundary/BOF
GWW-51	IVB-D51	West Boundary/Effluent
GWW-52	IVB-D52	West Boundary/Effluent
GWW-53	IVB-D53	West Boundary/Effluent
GWW-54	IVB-D54	West Boundary/BF Sludge
GWW-55	IVB-D55	West Boundary/BF Sludge
GWW-56	IVB-D56	West Boundary/BF Sludge
GWW-57	IVB-D57	West Boundary/BF Sludge
GWW-58	IVB-D58	West Boundary/BF Sludge
GWW-59	IVB-D59	West Boundary/BF Sludge
GWW-60	IVB-D60	Solid Waste Dump
GWW-61	IVB-D61	Maturation Ponds
GWW-62	IVB-D62	Mill Plant/Lurgi
GWW-63	IVB-D63	Hecketts/Electro Slag
GWW-64	IVB-D64	At Leeuwspruit Dam
GWW-65	IVB-D65	West Boundary/BF Sludge
GWW-66	IVB-D66	West Boundary/BF Sludge
GWW-67	IVB-D67	West Boundary/BF Sludge
GWW-68	IVB-D68	Farmland/West Boundary
GWW-69	IVB-D69	Farmland/West Boundary
GWW-70	IVB-D70	Evaporation Dams 1 - 4
GWW-71	IVB-D71	Coal Stacking
GWW-72	IVB-D72	Coal Stacking
GWW-73	IVB-D73	Old Fuel Depot
GWW-74	IVB-D74	Slag Dump
GWW-75	IVB-D75	Slag Dump
GWW-76	IVB-D76	Fuel station/BOF Plant
GWW-77	IVB-D77	Open Areas
GWW-78	IVB-D78	Open Area/Electro Slag
GWW-79	IVB-D79	Kiewiet Site
GWW-80	IVB-D80	Solid Waste Dump
GWW-81	IVB-D81	Coke Breeze Stockpile
GWW-82	IVB-D82	Kiewiet Site
GWW-83	IVB-D83	Kiewiet Site
GWW-84	IVB-D84	Kiewiet Site
GWW-85	IVB-D85	Kiewiet Site
GWW-86	IVB-D86	Siding Area
GWW-87	IVB-D87	Open Area
GWW-88	IVB-D88	Hecketts/BOF Slag/Scrap
GWW-89	IVB-D89	Secondary Industries
GWW-90	IVB-D90	Open Areas
GWW-91	IVB-D91	Hecketts/BOF Slag/Scrap
GWW-92	IVB-D92	Hecketts/BOF Slag/Scrap
GWW-93	IVB-D93	Coke Breeze Stockpile
GWW-94	IVB-D94	Kiewiet Site
GWW-95	IVB-D95	Farmland/TETP Plant
GWW-96	IVB-D96	Farmland/TETP Plant

Map No:	Database No:	Source
GWW-97	IVB-D97	West Boundary/Dam 10
GWW-98	IVB-D98	West Boundary/Dam 10
GWW-99	IVB-D99	Steelvalley/West Boundary
GWW-100	IVB-D100	North Open Areas
GWW-101	IVB-D101	Evaporation Dams 1 - 4
GWW-102	IVB-D102	Steelvalley/West Boundary
GWW-103	IVB-D103	Steelvalley/West Boundary
GWW-104	IVB-D104	Slag Dump
GWW-105	IVB-D105	Electro Slag Area
GWW-106	IVB-D106	Hecketts/BOF Slag/Scrap
GWW-107	IVB-D107	Linkholm/Waste Dump
GWW-108	IVB-D108	Linkholm/Waste Dump
GWW-109	IVB-D109	Linkholm/Waste Dump
GWW-110	IVB-D110	TETP Plant Area
GWW-111	IVB-D111	TETP Plant Area
GWW-112	IVB-D112	TETP Plant Area
GWW-113	IVB-D113	TETP Plant Area
GWW-114	IVB-D114	DR Plant
GWW-115	IVB-D115	Farmland/West Boundary
GWW-116	IVB-D116	Farmland/West Boundary
GWW-117	IVB-D117	Farmland/Du Plessis
GWW-118	IVB-D118	Farmland/West Boundary
GWW-119	IVB-D119	Farmland/West Boundary
GWW-120	IVB-D120	Western Boundary
GWW-121	IVB-D121	Farmlands/BF Sludge
GWW-122	IVB-D122	South Water Point/SV 68
GWW-123	IVB-D123	Farmland/BF Sludge Dams
GWW-124	IVB-D124	Maturation Ponds
GWW-125	IVB-D125	CETP Sludge Dams
GWW-126	IVB-D126	Kiewiet Site
GWW-127	IVB-D127	Kiewiet Site
GWW-128	IVB-D128	Kiewiet Site
GWW-129	IVB-D129	Kiewiet Site
GWW-130	IVB-D130	Kiewiet Site
GWW-131	IVB-D131	Hecketts/Electro Slag
GWW-132	IVB-D132	Hecketts Area
GWW-133	IVB-D133	Boeredienste
GWW-134	IVB-D134	Open Area/Hecketts
GWW-135	IVB-D135	Open Area/Hecketts
GWW-136	IVB-D136	South-Eastern Boundary
GWW-137	IVB-D137	South-Eastern Boundary
GWW-138	IVB-D138	South-Eastern Boundary
GWW-139	IVB-D139	South-Eastern Boundary
GWW-140	IVB-D140	South-Eastern Boundary
GWW-141	IVB-D141	South-Eastern Boundary
GWW-142	IVB-D142	DR Plant/OHP
GWW-143	IVB-D143	Mill Plant/Lurgi
GWW-144	IVB-D144	Coke Plant
GWW-145	IVB-D145	Coke Plant

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Map No:	Database No:	Source
GWW-146	IVB-D146	Coke Plant
GWW-147	IVB-D147	West Boundary/Dam 10
GWW-148	IVB-D148	Suprachem
GWW-149	IVB-D149	Mill Plant/Lurgi
GWW-150	IVB-D150	West Boundary/BF Sludge
GWW-151	IVB-D151	North Works
GWW-152	IVB-D152	Slag Dump
GWW-153	IVB-D153	Sludge Dams (dry dams)
GWW-154	IVB-D154	Kiewiet Site
GWW-155	IVB-D155	Kiewiet Site
GWW-156	IVB-D156	West Boundary
GWW-157	IVB-D157	West Boundary/Dam 10
GWW-158	IVB-D158	West Boundary/Dam 10
GWW-159	IVB-D159	West Boundary/Dam 10
GWW-160	IVB-D160	North Eastern Boundary
GWW-161	IVB-D161	Northern Boundary
GWW-162	IVB-D162	Northern Boundary
GWW-163	IVB-D163	North Eastern Boundary
GWW-164	IVB-D164	North Plant/Fault Zone
GWW-165	IVB-D165	Kiewiet Site
GWW-166	IVB-D166	Kiewiet Site
GWW-167	IVB-D167	Kiewiet Site
GWW-168	IVB-D168	Electro Slag
GWW-169	IVB-D169	North Works Open Areas
GWW-170	IVB-D170	West Boundary/Dam 10
GWW-171	IVB-D171	West Boundary/Dam 10
GWW-172	IVB-D172	West Boundary/Dam 10
GWW-173	IVB-D173	West Boundary/Dam 10
GWW-174	IVB-D174	West Boundary/Dam 10
GWW-175	IVB-D175	West Boundary/Dam 10
GWW-176	IVB-D176	West Boundary/Dam 10
GWW-177	IVB-D177	West Boundary/Dam 10

The ground water sampling localities are shown on the maps depicted in
FIGURE 7-1, FIGURE 7-2 and **FIGURE 7-3** attached in **APPENDIX 1**

5.10.3 DATA CAPTURE PROTOCOLS

Sampling Frequency

External Users (GWE and GWEF) - **Annually**

Suggested months **October and November**

Perched Aquifer (GWP) - **Six-monthly**
Shallow Weathered Zone Aquifer (GWW) - **Six-monthly**

Suggested months **April/May and October/November**

Sampling Technique

The indicated sampling technique for IVS is that of stratified sampling. This technique entails the taking of a small volume sample, by means of a disposable, bailer sampler, from a prescribed sampling horizon, based on an electrical conductivity profile of the water column in the borehole, subject to conditions of hydrodynamic geohydrological equilibrium.

Sampling horizon selection for stratified sampling at IVS was based on the following information:

- Geological stratigraphy - rock type/fracturing/weathering
- Geohydrological stratigraphy - water intersections
- Hydro-chemical stratigraphy - conductivity profile of water column

Information on geology and geohydrology was gathered during the drilling programme, while the conductivity profile of the water column was obtained through geophysical resistivity profiling of the water column in each borehole, after a stabilization period subsequent to drilling.

The sampling depths of the boreholes are indicated on the field forms

Sampling Equipment

The sampling equipment to sample at the Ground Water sampling localities is the same except for the External Users where the boreholes are equipped with pumps. At these monitoring localities the borehole is pumped for 15 minutes before a sample is taken at the pump outlet. Boreholes equipped with windmills and hand pumps must similarly be sampled after 5 minutes of being pumped.

Inorganic sampling:

Equipment that is needed for a routine monitoring sampling run at the Ground Water monitoring localities namely the **External Users (GWE/GWEF)**, **Perched Aquifer (GWP)** and the **Shallow Weathered Zone Aquifer (GWW)**, are as follows:

- Monitoring field form/clipboard and pen/pencil
- Marking pen
- Masking tape and isolation tape
- Laboratory pre-washed plastic sample bottles - 750 *ml*
- Laboratory prepared preservation sample bottles - 250 *ml* (Optional, see sample preservation)
- Disposable bailer, single or double valved
- Water level metre
- Cooler boxes - 25 *litre*
- Plastic container with 10 *litre* demineralized water
- Paper towel roll
- Small bottle of dish washing liquid

- Roll of cheese cloth
- Plastic dustbin bag

Organic sampling:

- Monitoring field form/clipboard and pen/pencil
- Marking pen
- Masking tape and isolation tape
- Adequate disposable hand gloves
- Adequate glass bottles for organic sapling:
  - Semi-VOC samples - 500 *ml* glass bottles with glass or Teflon stoppers
  - PHENOL samples - 40 *ml* glass bottles with teflon lined screw caps
  - VOC samples - 40 *ml* glass bottles with teflon lined screw caps
- MAO_3 soap to wash sampler
- Disposable teflon bailer or stainless steel sampler
- Water level metre
- Adequate cooler boxes - 25 *litre*
- Plastic container with 20 *litre* water
- Plastic container with 20 *litre* demineralized water
- Paper towel roll
- Small bottle of dish washing liquid
- Roll of cheese cloth
- Plastic dustbin bag

Sampling Procedure

Inorganic sampling:

For equipped boreholes to be sampled, the same procedure is to be followed as described below, except to ensure that the borehole is discharging for at least 15 minutes before filling the sample bottle at pump outlet. Note the time after the start of the pump when a sample is taken. Standardize as far as possible on 15 minutes.

External Users, Perched Aquifer, Shallow Weathered Zone Aquifer (Open Boreholes)

- Measure the static water level in the borehole prior to sampling, and note it on the monitoring field form.
- Remember to clean the water level instrument between borehole by rinsing it with distilled water.
- Note the borehole number, date of sampling and time of sampling on the sample bottle.
- Note the sample number/borehole number, depth of sampling, date of sampling, time of sampling, dam level status were applicable, as well as any comments on the monitoring field form, attached in **APPENDIX II**.

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- Take the water sample with a disposable bailer/sampler at prescribed horizon.
- Pour the sample taken, directly into the pre-marked sample bottles.
- The bottles are to be filled to the brim, squeezed slightly while lid is screwed on tightly in order to expel all the air from the bottles.
- Replace the full sample bottles in the cooler box. If preservation is indicated store the samples separately.
- Dispose the bailer in the black plastic dustbin bag.
- If a stainless steel bailer is use for sampling the sampler must be washed.
- Make notes of the method used for decontamination of the bailer at each borehole.
- Wash and dry hands if necessary.
- Dispose any other waste e.g. paper towels in the black plastic dustbin bag.
- Move to the next sampling locality.
- The sampling procedure is to be standardized and kept to as far as possible.
- Always try to follow the same sampling route.
- Hand the samples in at the designated Laboratory, if possible at the end of each consecutive day of sampling before closing time.
- An accompanying letter with instructions to the designated laboratory is to be drafted and forwarded. The instructions should include the following:
  - The list of variables to be analysed for as indicated in **APPENDIX III**.
  - A copy of the monitoring field form is to be attached to the letter of instructions to the designated laboratory.
  - All macro/micro analysis results should be accompanied by *anion/cation balancing*.
- The original field form is to be filed and stored locally.
- Make arrangements for the next bach of sample bottles well in advance of the next monitoring run.

Organic sampling:

Perched Aquifer and Shallow Weathered Zone Aquifer

Trip- and Field Blank samples to check for cross-contamination should be included during the sampling of the organic samples in accordance with the designated laboratory's specifications.

- *Trip Blank*: A trip blank is a set of sample vessels filled with blank water (water, which is free of contaminants that may interfere with the analyses to be conducted) at the beginning of a sampling day and carried around in the field under exactly the same conditions as the samples. It servers as a check on sample contamination originating from sample transport, shipping and from the site conditions.
- *Field Blank*: A field blank is a sample of blank water (water, which is free of contaminants that may interfere with the analyses to be

conducted), which is transferred from one sample bottle to another sample bottle at the sample point. It serves as a check on reagent and environmental contamination.

- When sampling for VOC the organic sample must be sampled before the inorganic sample.

The following sampling procedure should be followed in the field:

- Measure the static water level in the borehole prior to sampling, and note it on the monitoring field form.
- Note the borehole number, date of sampling and time of sampling on the sample bottle.
- Note the sample number/borehole number, depth of sampling, date of sampling, time of sampling, dam level status were applicable, as well as any comments on the monitoring field form, attached in **APPENDIX II**.
- The person responsible for organic sampling should be using disposable hand gloves when sampling.
- Take the water sample with a disposable teflon bailer/stainless steel sampler at the prescribed horizon.
- Pour the sample taken, slowly with minimal turbulence into the pre-marked sample bottles.
- The bottles are to be filled to the brim. Ensure that no air is captured in the sample bottle.
- Place the full sample bottles in the cooler box. If preservation is indicated by the laboratory ensure that the correct procedure for the preservation is followed.
- Dispose the bailer and hand gloves in the black plastic dustbin bag.
- If a stainless steel bailer is use for sampling the sampler must be washed in the 2% MAO$_3$ soap and water solution.
- This step is followed by a thorough rinse of the sampler in clean water and finally distilled water.
- Wash and dry hands if necessary.
- Dispose any other waste e.g. paper towels in the black plastic dustbin bag.
- Move to the next sampling locality.
- The sampling procedure is to be standardized and kept to as far as possible.
- Always try to follow the same sampling route.
- Hand the samples in at the designated Laboratory, at the end of each consecutive day of sampling before closing time.
- An accompanying letter with instructions to the designated laboratory is to be drafted and forwarded. The instructions should include the following:
    - The list of variables to be analysed for as indicated in **APPENDIX III**.
    - A copy of the monitoring field form is to be attached to the letter of instructions to the designated laboratory.
- The original field form is to be filed and stored locally.

- Make arrangements for the next bach of sample bottles well in advance of the next monitoring run.

Sample Preservation

Detailed specifications pertaining to sample preservation are stated in the "Minimum Requirements for Monitoring at Waste Management Facilities".

It is stated that samples analysed within 6 hours of sampling need not be preserved in the field.

Sample preservation (organic & inorganic) should, however, always be done in consultation with the analytical laboratory responsible for the analyses.

Analyses Protocol/Variables

The necessity for all chemical analyses to be of high scientific integrity cannot be over-emphasized.

The list of water quality variables to be analyzed for, was compiled subject to site specific hydro-chemistry composition of effluents, information generation requirements, as well as DWAF requirements. The list of recommended water quality variables to be analyzed for, is given below and is also attached in **APPENDIX III**.

INORGANIC:		**ORGANIC:**
pH	Cl	VOC
EC	SO_4	Semi-VOC(includes PAH)
TDS	NO_3	
Ca	F	
Mg	Al	
Na	Fe	
K	Mn	
Si	Pb	
T-Alk	NH_4	
Zn	Cd	
PO_4	Cr^{6-}	
CN		

This list is by no means a comprehensive set of water quality variables as proposed in the "Minimum Requirements", but will undoubtedly support identification and quantification of macro chemistry impacts associated with IVS activities.

Scaling down of the number of variables to be analysed, should only be considered after the initial two year sampling period.

Recommended Independent Laboratory

IVS has specified that all analyses of the environmental monitoring program should be analysed at the following laboratory;

Inorganic:

ISCOR VANDERBIJLPARK
LABORATORY
P.O. BOX 2
VANDERBIJLPARK

TEL:(016) - 889 3226
FAX:(016) - 889 3502

Organic:

ISCOR VANDERBIJLPARK
LABORATORY
P.O. BOX 2
VANDERBIJLPARK

TEL:(016) - 889 3226
FAX:(016) - 889 3502

Data Base Entry

During the commissioning of the ground water monitoring infrastructure performed by JMA at IVS, all the information pertaining to the above listed sampling localities was computerized into the AQUABASE data base system.

Although not a minimum requirement of DWAF, usage of this data base is strongly recommended, as it not only allows for structured data storage, but also facilitates optimal information generation and GIS integration.

The following data bases were initiated for the active Ground Water Monitoring localities in AQUABASE:

- Basic Information:
- Hydro chemistry:
- Ground water: - Borehole logs:
                       - Construction:
                       - Water level:
                       - Geophysics: (EC-profile)

The data base facilitates optimal information generation and is fully GIS integrated and data contained in the data base can be exported and plotted on maps to create visual information.

The sampling localities were computerized under AQUABASE site-unique Site Identification Numbers. The site identification number are attached in **APPENDIX IV** as **DATA SET IV-3**.

Data Backup

Backup of all data should be made on a regular interval on a separate computer or disk. This will avoid any data loss during a computer failure or any technical failure.

5.10.4 INFORMATION GENERATION PROTOCOLS

Reporting Frequency

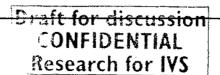The following table summarizes the frequency of reporting.

Frequency	Type of Report
Six-Monthly Report	Data Report to Authorities
Annual Report	Annual status/audit report

Report Content

Six-Monthly Report (six-monthly submission of monitoring results)

The six-monthly report must be submitted to **DWAF** and consist of the following components:

- Water level status report
- Historical/Present chemistry compliance report for the boreholes
- Piper/Durov diagrams
- Time dependent graphs for the selected water quality variables

These reports are generated with AQUABASE from the report menu.

Annual Report (annual submission of monitoring results)

The annual report consists of the following components:

- System Audit
  - Statutory/Regulatory Requirements
  - Monitoring Infrastructure
  - Data Capture
  - Information Generation
  - Management of System

- Data Audit
  - Compliance criteria
  - Validation of the data

- Interpretation of hydro-chemical data for compliance
  - Water level status report
  - Historical source chemistry compliance report
  - Piper and Durov diagrams
  - Compliance Map

- Interpretation of hydro-chemical data for trend
  - Time dependant graphs for selected water quality variables
  - Trend Map

- Compliance and trend assessment/status report compiled by knowledgeable professional.

5.10.5 MANAGEMENT PROTOCOLS

The following table summarizes the management for the Ground Water monitoring localities. This enables the Environmental Manager to control the sampling program to ensure that representative data is gathered in the field during sampling runs.

	Sampling Frequency						Reporting Frequency					
	GWE	GWEF	GWP	GWW	GWF	GWM	GWE	GWEF	GWP	GWW	GWF	GWM
Daily												
Weekly												
Two - weekly												
Monthly												
Quarterly												
Six - Monthly			X	X					X	X		
Annually	X	X					X	X	X	X		

Acronyms:
Ground Water - (GW)
*   (GWE) External Users*
*   (GWP) Perched Aquifer*
*   (GWW) Shallow Weathered Zone Aquifer*
*   (GWEF) External Users Fountain*
*   (GWF) Deeper Fractured Aquifer*
*   (GWM) Mine Workings*

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5.11 SURFACE WATER

There are two components that form part of the surface water monitoring program at IVS, namely the:

- Continuous Monitoring Program
- Grab Sampling Program

5.11.1 STATUTORY/REGULATORY REQUIREMENTS

Formal Compliance

The new water licence is the applicable Regulatory Requirement (NEW WATER LICENCE NUMBER 10016047).

DWAF - Minimum Requirements For Monitoring at Waste Management Facilities are a further applicable Regulatory Requirement.

Material Compliance

Inadequate, periodic monitoring or even marginal deviance from monitoring procedures, produces unreliable data, straining the controlling authorities capacity to monitor material legal compliance.

With reference to the New Water License, the following target water quality objectives are applicable for surface water leaving the IVS property:

	Leeuwspruit	Rietkuilspruit
EC (mS/m)	70	170
Ca (mg/l)	80	160
Mg (mg/l)	17	40
Na (mg/l)	50	100
K (mg/l)	46	46
Cl (mg/l)	80	300
SO_4 (mg/l)	100	200
NO_3 (mg/l)	5	5
F (mg/l)	1.0	2.5
Fe (mg/l)	0.1	0.3
Mn (mg/l)	0.05	0.4
Zn (mg/l)	0.3	5
Sn (mg/l)	1.0	1.0
Cr (mg/l)	0.5	0.5
P (mg/l)	0.1	1.0
Total ammonia (mg/l)	5	10
Phenol (mg/l)	0.1	0.1
Suspended Solids (mg/l)	25	25
Oil (mg/l)	1.0	2.5

5.11.2 MONITORING INFRASTRUCTURE/SITES/LOCALITIES

The following monitoring points are monitored as part of the Surface Water Monitoring System at IVS:

Number on Map:	Database number:	Description
SWR-1	RS-0	Origin of Storm water canal at Southern Industries
SWR-2	RS-1	Rietkuilspruit
SWR-3	RS 2	Rietkuilspruit
SWR-4	RS 3	Rietkuilspruit
SWR-5	RS 4	Rietkuilspruit
SWR-6	RS 5	Rietkuilspruit
SWR-7	RS 6	Rietspruit
SWR-8	RS 7	Rietkuilspruit Canal
SWR-9	RS 8	Rietskuilpruit
SWR-10	RS 9	Rietspruit
SWR-11	RS 10	Rietspruit
SWR-12	LS 1	Leeuwspruit
SWR-13	LS 2	Leeuwspruit
SWR-14	LS 3	Leeuwspruit
SWR-15	LS 4	Leeuwspruit
SWR-16	LS 5	Leeuwspruit
SWR-17	LS 6	Leeuwspruit

The following canals and sumps are monitored on a continuous basis utilizing radio communication (*these points form part of the IVS environmental and water management system and the data is transferred directly to the Energy Control Center*):

Number on Map:	Description
SWI-1	End of North Works Blowdown Canal (Direct Reduction)
SWI-2	Vaaldam Canal
SWI-3	North Works Runoff Canal
SWI-4	Air Products Canal
SWI-5	Coke Ovens Canal (after Suprachem)
SWI-6	Hot Mills South Canal
SWI-7	North Works Blowdown (CMGM)
SWI-8	Burnes Memorial Canal (new)
SWI-9	Analyses House 1
SWI-10	Analyses House 2
SWI-11	Analyses House 3
SWI-12	Analyses House 5

The surface water sampling localities are shown on the map depicted in **FIGURE 8, APPENDIX I.**

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5.11.3 DATA CAPTURE PROTOCOLS

Sampling Frequency

Rivers Streams (SW)	-	**Weekly** (Rietkuilspruit/Rietspruit)
	-	**Two-Weekly** (Leeuwspruit)
	-	**Daily** (SWR-11 : Leeuwspruit, grab sample only when the weir is overflowing
Storm Sumps (SW)	-	**Continuous** (maximum interval = 0.5 hours)
Dam Levels (SWL)	-	**Weekly**

It is the responsibility of IVS to ensure that a manage system is in place to assure that all data is captured at a prescribed frequency. For any failure in complying with this, the reason should be noted and kept on record as reference to the event.

Sampling Equipment

The following equipment is needed for a Rivers and Streams, and Storm Water monitoring sampling run:

- Monitoring field form/clipboard and pen/pencil
- Marking pen
- Masking tape and isolation tape
- Laboratory pre-washed plastic bulk sample bottles 1000 *ml*
- Laboratory prepared plastic preservation sample bottles 250 *ml*
- Sampler bottle > 1250 *ml*
- Sampler scoop bucket with handline
- Cooler boxes 25 *liter* (x 3)
- Plastic container with 10 *liter* demineralized water
- Paper towel roll
- Small bottle of dish washing liquid
- Roll of cheese cloth
- Plastic dustbin bag

Sampling Procedure

Rivers and Streams

- Note sample number, date of sampling and time of sampling on both sample bottles, namely the bulk sample bottle and the preservation sample bottle, stored and transported in separate cooler boxes.
- Note sample number, date of sampling, time of sampling, weir reading were applicable, as well as any comments on provided monitoring field form, attached in **APPENDIX II**.

- Take sample directly below surface with a clean sampler bottle that is also stored and transported in a separate cooler box.
- Pour the sample taken, directly into the pre-marked bulk and preservation sample bottles.
- The bottles are to be filled to the brim, squeezed slightly while lid is screwed on tightly in order to expel all the air from the bottles.
- For bacteriological samples leave +/- 2 *cm* space under the cap. Do not touch the inside of the bottle or the cap. Tighten the cap, making sure that the water does not leak out.
- Replace the full sample bottles in the individual cooler boxes.
- Rinse the sampler bottle and scoop bucket using the demineralised water.
- Dry the sampler bottle and scoop bucket using the paper towels and replace them in the cooler box kept for their transportation.
- Wash and dry hands if necessary.
- Dispose the paper towels in the black plastic dustbin bag.
- Move to the next sampling locality.
- The sampling procedure is to be standardized and kept to as far as possible.
- Always follow the same sampling route.
- The sealed cooler boxes are to be appropriately marked with fragile, handle with care, and this side up, stickers.
- The samples taken are to be handed in at the laboratory at the end of each consecutive day of sampling before closing time.
- An accompanying letter with instructions to the designated laboratory is to be drafted and forwarded. The instructions should include the following:
  - The list of variables to be analysed for as indicated in **APPENDIX III**.
  - All macro/micro analysis results should be accompanied by *anion/cation balance*.
  - A copy of the monitoring field form is to be attached to the letter of instructions to the designated laboratory.

- The original field form is to be filed and stored locally.
- Make arrangements with the Laboratories for the next bach of sample bottles well in advance of the next monitoring run.

Canals/Sumps

The following equipment is required for a continuous monitoring system:

- A water quality instrument capable of monitoring electrical conductivity.
- A water quality instrument capable of monitoring pH.
- An ultrasonic instrument capable of monitoring height of water above a specific datum level.
- A water quality instrument capable of monitoring any other parameters that are required at that specific continuous monitoring station, e.g. F, Cl, SO_4, NO_3, CN, Mn, Phenols, Na, NH_4, COD.

- A data logger with associated housing cabinet, circuitry and surge protection.
- A power supply.
- A communication system (either laptop link, cell phone, radio).
- A master station capable of downloading data from remote stations (or to view the monitoring parameters real time).

The following table describes the variables that are analyzed by the analyzers contained within the analyzing houses (i.e. the systems that do not utilize water quality probes), and equipment that is utilized to analyze it:

Variables Analyzed	Analyzing Equipment
Flow	Milltronics Multi Ranger
pH, Electrical Conductivity	Foxboro Analyzer
F, SO$_4$, NO$_3$, NH$_3$, Phenol, CN, Cl, Na, Mn.	Tytronics Sentinel Meters

There are two types of analyzers: Probe Analyzers and Colorometric Analyzers. The former utilizes a reference probe and a measuring electrode and measures fluorides, chlorides, nitrates and sodium. Colorometric analyzers are utilized to analyze for phenol, manganese, ammonia, sulphate and cyanide.

Analyzing House 4 is calibrated on a daily basis, whilst the other stations are calibrated on a weekly basis (unless it is determined that a more regular calibration is required for a specific period). The analyzers are calibrated according to the calibration fluid with an accuracy of 95%.

For those continuous monitors that monitor the water quality by means of probes, no sample is taken, and the water quality is monitored in-situ.

For the systems that utilize enclosed analyzers, water is extracted from the canal at the specific analyzing house and pumped to a settling tank on the roof of the analyzing house. Filters are fitted at the pipe inlet in the canal, at the pump inlet, and at the inlet to the settling tank (three filters in total). Water flows by means of gravitational flow through the system where water can be extracted by the various analyzers. Water that is not utilized for the purposes of analysis, enters a drain which exits into the canal. The pump circulates the water on a continuous basis.

Sample Preservation

Detailed specifications pertaining to sample preservation are stated in the "Minimum Requirements for Monitoring at Waste Management Facilities".

It is stated that samples analyzed within 6 hours of sampling need not be preserved in the field.

Sample preservation (organic & inorganic) should, however, always be done in consultation with the analytical laboratory responsible for the analyses.

Analyses Protocol/Variables

The necessity for all chemical analyses to be of high scientific integrity, cannot be over-emphasized. All macro/micro analytical results are to be accompanied by anion/cation balancing.

The list of water quality variables to be analysed for, was compiled subject to site specific hydro-chemistry composition of effluents, information generation requirements, as well as DWAF requirements. The list of recommended water quality variables to be analysed for, is given below and is also attached in **APPENDIX III**.

Inorganic:			*Special:*
pH	Cl	Mn	Phenol
EC	SO_4	Al	
TDS	NO_3	Pb	
Ca	F	Cr^{6-}	
Mg	PO_4		
Na	CN		
K	Cd		
Si	Fe		
T-Alk	Zn		

Recommended Independent Laboratory

IVS has specified that all analyses of the environmental monitoring program should be analysed at the following laboratory;

Inorganic:

ISCOR VANDERBIJLPARK
LABORATORY
P.O. BOX 2
VANDERBIJLPARK
1900

TEL:(016) - 889 3226
FAX:(016) - 889 3502

Organic:

ISCOR VANDERBIJLPARK
LABORATORY
P.O. BOX 2
VANDERBIJLPARK
1900

TEL:(016) - 889 3226
FAX:(016) - 889 3502

This list is by no means a comprehensive set of water quality variables as proposed in the "Minimum Requirements", but will undoubtedly support identification and quantification of macro chemistry impacts associated with IVS activities

Scaling down of the number of variables to be analysed, should only be considered after the initial one year sampling period.

Data Base Entry

For the radio communication systems, the results of the analysis of samples are output electronically from the individual analyzers by means of a 4 – 20 *mA* analog signal. This output is transferred from the analyzer to the REMCOM system which converts the analog signal into a radio signal and transmits it. This signal is received at the Energy Control Center (ECC), and the radio signal is converted back to an analog signal and displayed on a computer screen. Data is therefore entered and stored electronically in the ECC.

For the systems that transfer data by means of cellular phone communication, the Master Stations at the Water Manager's office are able to dial in via a modem and either download data from the outstations, or read the monitoring results real-time.
This download of data from the outstations can occur on a pre-programmed basis, or on an ad hoc basis, as decided by the Water Manager. The data must be captured at a least on a **monthly** basis.

The depth readings in the various dam facilities is downloaded electronically by means of a laptop.

During the commissioning of the Surface Water monitoring infrastructure, all the information pertaining to the above listed sampling localities were computerized into the AQUABASE data base system.

The following data bases were configured and commissioned for the Site Id's in AQUABASE:

- Basic Information
- Hydro chemistry
- Surface Hydrology   -   Stage Height at Peak Flow
    -    Stream Discharge/Flow Velocity
    -    Peak Flow

The Basic Site Information is only updated when new sites to be monitored are included in the monitoring system. The rest of the data base is updated after each sampling interval.

The sampling localities were computerized under AQUABASE site-unique Site Identification Numbers. These site identification numbers are attached in **APPENDIX IV** as **DATA SET IV-4**.

Data Backup

Backup of all data must be made on a monthly basis on a CD or disk. Two copies must be made, with the second copy being retained at a location other than the Environmental Management offices. Hard copies of the water quality results must be stored by the Environmental Management Department. This will avoid any data loss during a computer failure or any technical failure.

5.11.4 INFORMATION GENERATION PROTOCOLS

Reporting Frequency

The following table summarizes the frequency of reporting.

Frequency	Type of Report
Six-Monthly Report	Data Report to Authorities
Annual Report	Annual status/audit report

Report Content

Six-Monthly Report (*Six-monthly submission of monitoring results*)

The six-monthly report must be submitted to **DWAF** and consist of the following components:

- Stream level/flow status report
- Dam level status
- Time dependent graphs for the dam level
- Historical/Present chemistry compliance report for the streams
- Historical/Present chemistry compliance report for the canals/sumps

- Piper/Durov diagrams
- Time dependent graphs for the selected water quality variables

These reports are generated by making use of AQUABASE.

Annual Report (*Annual submission of monitoring results*)

The annual report consists of the following components:

- System Audit
  - Statutory/Regulatory Requirements
  - Monitoring Infrastructure
  - Data Capture
  - Information Generation
  - Management of System

- Data Audit
  - Compliance criteria
  - Validation of the data

- Interpretation of flow and hydro-chemical data for compliance
  - Stream level/flow status report
  - Dam levels status
  - Time dependent graphs for dam levels
  - Historical/Present chemistry compliance report for the streams
  - Historical/Present chemistry compliance report for the canals/sumps
  - Piper/Durov diagrams
  - Compliance Map

- Interpretation of hydro-chemical data for trend
  - Time dependant graphs for selected water quality variables
  - Trend Map

- Compliance and trend assessment/status report compiled by knowledgeable professional

5.11.5 MANAGEMENT PROTOCOLS

The following table summarizes the management protocols relating to the sampling- and reporting frequency of the Surface Water monitoring sites.

	Sampling Frequency			Reporting Frequency		
	SWR	*SWI*	*SWL*	*SWR*	*SWI*	*SWL*
Continuous		X				
Daily *(Leeuwspruit SWR-11 only when the weir is overflowing)*	X		X			
Weekly *(Rietspruit and Rietkuilspruit)*	X					
Two-Weekly *(Leeuwspruit)*	X					
Monthly						
Quarterly						
Six -Monthly				X	X	X
Annually				X	X	X

Acronyms:
Surface Water- (SW)

(SWR) Rivers-Streams
(SWI) Canals-Sumps
(SWL) Dam Level

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5.12 AIR QUALITY

5.12.1 STATUTORY/REGULATORY REQUIREMENTS

Formal Compliance

No monitoring requirements are specified by any of the regulating authorities with regard to South Africa's Atmospheric Pollution Act (*No. 45*) of 1965 as amended by Amendment Act (*No. 17*) of 1973, or in any of the permits, issued to IVS, in accordance with the Act.

The permits issued to IVS in accordance with South Africa's Atmospheric Pollution Act (*No. 45*) of 1965 as amended by Amendment Act (*No. 17*) of 1973, do, however, specify certain compliance conditions. Monitoring in order to ensure compliance is seen as part of routine IVS management monitoring.

Certificates in terms of the Atmospheric Pollution Prevention Act of 1965 (*Act 45 of 1965*), have been issued for all the Stacks. The following is a list of the certificates, and dates on which they were issued:

Certificate 89/3	Blast Furnace D	5 October 1977
Certificate 89/4	BOF	19 November 1986
Certificate 89/5	Arc Furnace 1, 2 & 3	28 June 1994
Certificate 89/6	Coke Ovens 4, 8 & 9	30 April 1992
Certificate 89/7	Coke Oven Gas Stripping	26 September 1986
Certificate 89/8	V1 & V2	30 April 1982
Certificate 89/9	Pickling & Lurgi Recovery	5 October 1977
Certificate 89/10	Tin Recovery	30 April 1982
Certificate 89/11	BOF	19 November 1986
Certificate 89/12	BOF 3	9 April 1976
Certificate 89/16	Pickling Plant & Lurgi Recovery	30 April 1982
Certificate 89/18	Sinter Strand I	31 December 2001
Certificate 89/19	Sinter Strand II	31 December 2001
Certificate 89/20	DR Plant	22 January 1993
Certificate 89/23	Blast Furnace C	17 August 1998
Certificate 89/24	Foundry	6 January 1986
Certificate 89/25	Coke Ovens 2 & 3	31 December 2001
Certificate 89/26	Coke Ovens 6 & 7	31 December 2001
Certificate 89/28	Tin Plant	4 August 1987
Certificate 89/29	RH-OB and Pan Furnace	22 January 1993
Certificate 89/30	Sinter Mixing-Bed	22 January 1993
Certificate 89/31	Coal	29 January 1994
Certificate 89/32	Ladle Furnace I (Before Concast V3)	7 December 1992
Certificate 89/33	Ladle Furnace II (Before Concast V3)	12 November 1996
Certificate 89/34	Blast Furnace Coal/Mill	29 May 1997
Certificate 89/35	Ladle Furnace 2 at BOF	1 March 2000

Certificate 89/36   P Line Incinerator   21 September 2000

Suprachem:

A1010/2   Ferrite plant   1 December 2000

Material Compliance

No monitoring standards are provided. A comparison of the results can be made with the guidelines provided by the Chief Air Pollution Control Officer.

The guidelines for dust deposition(fall out) are:

- less than 0,25 *gm m² day*   - slight   - residential
- 0,25 to 0,50 *gm m² day*   - moderate   - commercial
- 0,50 to 1,20 *gm m² day*   - heavy   - industrial
- more than 1,20 *gm m² day*   - very heavy

The guideline of 0.25 *gm m² day* for residential and rural areas is considered conservative and will be used.

Ambient Air Monitoring:

The following selection of air quality guidelines, made available by the *Chief Air Pollution Control Officer* that was used to evaluate the ambient air is summarized in the following table:

Pollutant	1 Hour microgram/m³	24 Hour microgram/m³	1 Month microgram/m³	Year microgram/m³
Sulphur Dioxide	730	365	112	67
Total Oxides of Nitrogen	600	300	-	150
Particulates	-	300	-	100

5.12.2 MONITORING INFRASTRUCTURE/SITES/LOCALITIES

Particulate Fallout

The following sites have been selected for Dust Fallout (AQP) monitoring sites:

Dust Fallout (AQP)

Map No:	Area/Zone:
AQP-1	CRMF
AQP-2	CRMF
AQP-3	CRMF
AQP-4	CRMF
AQP-5	CPA
AQP-6	CPA
AQP-7	CPA
AQP-8	CPA
AQP-9	CRMF
AQP-10	CRMF
AQP-11	CPA
AQP-12	CRMF
AQP-13	CRMF
AQP-14	CPA
AQP-15	CPA
AQP-16	CPA
AQP-17	CPA
AQP-18	CPA
AQP-19	SSPA-SW
AQP-20	CPA
AQP-21	CPA
AQP-22	CPA
AQP-23	CPA
AQP-24	CPA
AQP-25	OVA-SE
AQP-26	SSPA-SE
AQP-27	CPA
AQP-28	CPA

Acronyms:

CRMF	Consolidated Residue Management Facility
CPA	Consolidated Plant Area
SSPA-SW	Southern Slag Processing Area - South West
SSPA-SE	Southern Slag Processing Area - South East
OVA-SE	Open Veld Area - South East

Gas Monitoring localities

The following sites have been selected for *Ambient Air (AQA)* and *Stack Emissions (AQS)* monitoring sites:

Ambient Air (AQA)

Map No:	Area/Zone:
AQA-1	Caravan near the Environmental Management Office.
AQA-2	Weather station near the South gate.

Stack Emissions (AQS)

Arc Furnace:

Map No:	Source:
AQS-1	Arc Furnace Oven No1
AQS-2	Arc Furnace No2
AQS-3	Arc Furnace No3
AQS-4	Arc Laddle No1
AQS-5	Arc Laddle No2

Basic Oxygen Furnace:

Map No:	Source:
AQS-6	BOF Furnace No1
AQS-7	BOF Furnace No2
AQS-8	BOF Furnace No3
AQS-9	BOF Bagfilter No1 (Oos)
AQS-10	BOF Bagfilter No2 (Wes)
AQS-11	BOF Bagfilter No3 (Kawasaki)
AQS-12	BOF Laddle Furnace and Rhob Degassing
AQS-13	BOF Laddle Furnace No.2
AQS-14	BOF Casting 1 and 2

Sinter Plant:

Map No:	Source:
AQS-15	Sinter AG-100
AQS-16	Sinter BG-100
AQS-17	Sinter CG-100
AQS-18	Sinter Gruisbed (Olifant)
AQS-19	Sinter Mixing Bed Screen
AQS-20	Sinter Mixing Bed Side

Coke Ovens:

Map No:	Source:
AQS-21	Coke Oven No1
AQS-22	Coke Oven No2
AQS-23	Coke Oven No3
AQS-24	Coke Oven No4
AQS-25	Coke Oven No6

AQS-26	Coke Oven No7
AQS-27	Coke Oven No8
AQS-28	Coke Oven No9

Direct Reduction:

Map No:	Source:
AQS-29	Direct Reduction Oven No1
AQS-30	Direct Reduction Oven No2
AQS-31	Direct Reduction Oven No3
AQS-32	Direct Reduction Oven No4
AQS-33	Direct Reduction Product Separation
AQS-34	Direct Reduction Cyclone Raw Materials

Foundry:

Map No:	Source:
AQS-35	Foundry Bagfilter
AQS-36	Foundry Cyclone

Blast Furnace:

Map No:	Source:
AQS-37	Blast Furnace Tap C
AQS-38	Blast Furnace Raw Materials C Bagfilter
AQS-39	Blast Furnace Electro Filter C

Coal Pulverising:

Map No:	Source:
AQS-40	Coal Pulverising No1
AQS-41	Coal Pulverising No2

Blast Furnace:

Map No:	Source:
AQS-42	BF Raw Material D
AQS-43	BF Electro Filter No D

Lurgi Plant:

Map No:	Source:
AQS-44	Lurgi Plant No1
AQS-45	Lurgi Plant No2
AQS-46	Lurgi Plant No3

Washer:

Map No:	Source:
AQS-47	Washer North
AQS-48	Washer South

Ferriet Plant:

Map No:	Source:
AQS-49	Ferriet Plant

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The active routine source characterization sampling localities are shown on the map depicted in **FIGURE 9, APPENDIX I.**

5.12.3 DATA CAPTURE PROTOCOLS

Sampling Frequency

ust Fall-out (AQP)	**Two monthly.**

Suggested months to retrieve the bucket and replace the bucket with new buckets are, **January, March, May, July, September and November.**

Ambient Air Quality Monitoring (AQA)	**Real time (five minute intervals)**
Stack Monitoring (AQS)	**Real time (five minute intervals)**

Sampling Technique

Dust Fall-out Monitoring Sites (AQP)

The sampling technique is based on ASTM Designation: D1739-82 - Standard Method for: Collection and analysis of dust fall.

Ambient Air Quality Monitoring (AQA)

Ambient Air Pollution Monitoring Station instrument operating and maintenance manuals are kept on site by the Environment Department.

Stack Monitoring (AQS)

Typically a SICK or CODEL monitor is placed in a duct where the flow is most laminar, the standard being 7 pipe diameters downstream and 3 pipe diameters upstream of any flow disturbance (elbows, fans, etc.). The actual position of the SICK monitors varies from stack to stack, but this guideline is adhered to as far as possible.

Sampling Equipment

Dust Fall-out Monitoring Sites (AQP)

Three piece deposition gauge consisting of:

- PVC bucket
- Steel pole and combined bird ring and bucket frame
- Steel toe piece

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The critical parameters are:

- Height of bucket rim 2 *m* above ground level.
- Bucket depth no less than 2.5 times the diameter (to ensure what is collected, remains inside).
- Bucket diameter as large as practical (for maximum sample).
- Bird ring (for obvious reasons).
- Placement away from trees, buildings or other obstructions.

Ambient Air Quality Monitoring (AQA)

API Model 101A H_2S/SO_2 analyser
API Model 200A NOx analyser
Model F701 PM10 analyser
RM Young anometer at 5 *m* and 10 *m*
Relative humidity
Temperature

Stack Monitoring (AQS)

Coke Oven 3	-	Codel optical monitor
Coke Oven 4	-	Codel optical monitor
Coke Oven 6	-	Codel optical monitor
Coke Oven 7	-	Codel optical monitor
Coke Oven 8	-	Codel optical monitor
Coke Oven 9	-	Codel optical monitor
ESP No.1	-	Sick RM41 monitor
ESP No.2	-	Sick RM41 monitor
ESP No.3	-	Sick RM41 monitor
ESP No.4	-	Sick RM41 monitor
Sinter ESP AG	-	Sick monitor
Sinter ESP BG	-	Sick FW56 monitor
Sinter ESP CG	-	Sick FW56 monitor
Bag House No.1	-	Sick RM41 monitor
Bag House No.2	-	Sick RM41 monitor
Bag House No.3	-	Sick RM41 monitor
BOF (AAF)	-	Sick RM41 monitor
BOF Laddle Furnace	-	Sick RM41 monitor
Blast Furnace C	-	Codel opacity 1 monitor
Blast Furnace D	-	Codel opacity monitor
BFC	-	Sick FW56 monitor

Sampling Procedure

Dust Fall-out Monitoring Sites (AQP)

- Appropriately marked, pre-washed sampling buckets are filled in the laboratory with a 500 *ml* of demineralised water.
- After one month, the water is made up to 500 *ml* if there was not enough rain to fulfill this function.

- The buckets are replaced with a second set after a convenient period (*60 days*) and the exposed buckets transported to the laboratory (covered with plastic lids or plastic bags).
- Note the following information on monitoring field form:

  - Sampling point number: e.g. AQP-1
  - Date of placement: e.g. 20020116
  - Date of retrieval: e.g. 20020316

- At the laboratory the contents of each of the retrieved buckets is filtered through pre-washed glass fibre filters by suction. Obvious large pieces of extraneous material may be removed by tweezers with careful washing.
- The filtered liquid is made up to 1 *liter* before chemical analysis. Accuracy of results should be portrayed by anion/cation balancing.
- The filters are dried, weighed and compared to the original filter weight. The results are calculated to *milligram/m²/day* for interpretation.

Ambient Air Quality Monitoring (AQA)

Ambient Air Pollution Monitoring Station instrument operating and maintenance manuals are kept on site by the Environment Department. Data is down loaded on a weekly basis and data stored at the Environment Department.

Stack Monitoring (AQS)

Stack Monitoring Station instrument operating and maintenance manuals are kept on site by the Environment Department. The data is downloaded on a weekly basis. The data is stored at the Environment Department.

For the stacks without continuous monitoring equipment the responsible person at the Environmental Department will take a sample on a monthly basis. The samples would be taken according to the BS 893-1978 and BS 3405 standards.

Sample Preservation

Dust Fall-out Monitoring Sites

Not applicable, as the buckets are exposed for periods of 60 days at a time. The pre-washed sampling buckets, however, are filled in the laboratory with 500 *ml* of demineralised water.

Ambient Air Quality Monitoring

Not applicable.

Stack Monitoring

Not applicable.

Analyses Protocol/Variables

The list of water quality variables to be analysed for, was compiled subject to site specific chemical composition of waste dumps and aqueous waste streams, information generation requirements, as well as DWAF requirements. The list of recommended water quality variables to be analysed for, is given below and is also attached in **APPENDIX III**.

Inorganic:

EC	SO_4
TDS	NO_3
Ca	F
Mg	Cl
Na	K
Mn	Zn
Cr	

This list is by no means a comprehensive set of water quality variables as proposed in the "Minimum Requirements", but will undoubtedly support identification and quantification of macro chemistry impacts associated with IVS activities.

Ambient Air Quality Monitoring

Solids	PM_{10}'s (respirable dust smaller than 10 *micron*)
SO_2	Sulphur Dioxide
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NO_x	Total Oxides of Nitrogen

Stack Monitoring

Dust load (*mg Nm³*)

Recommended Independent Laboratory

IVS has specified that all analyses of the environmental monitoring program should be analysed at the following laboratory;

Inorganic:

ISCOR VANDERBIJLPARK
LABORATORY
P.O. BOX 2
VANDERBIJLPARK
1900

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TEL:(016) - 889 3226
FAX:(016) - 889 3502

Data Base Entry

The sampling localities were computerized under AQUABASE site-unique Site Identification Numbers. These site identification numbers are attached in **APPENDIX IV** as **DATA SET IV-5**.

All real time data, including both ambient air quality and stack monitoring, will be stored at the Environmental Department on site. AQUABASE makes provision for all the air quality parameters monitored by both systems.

However, reporting and specialized information generation, require data to be incorporated into AQUABASE at least once a year.

The following data bases were configured and commissioned for the Site Id's in AQUABASE:

- Basic site information
- Air quality - chemistry
- Other parameters: (Meteorology)
    - Wind speed
    - Wind direction

The Basic Site Information is only updated when new sites to be monitored are included in the monitoring system. The rest of the data base is updated after each sampling interval.

Data Backup

Backup of all data should be made on a regular interval on a separate computer or disk. This would avoid any data loss during a computer failure or any technical failure.

5.12.4 INFORMATION GENERATION PROTOCOLS

Reporting Frequency

The following table summarizes the frequency of reporting.

Frequency	Type of Report
Six-Monthly Report	Six-monthly data report
Annual Report	Annual status/audit report

Report Content

Six-Monthly Report (*Six-monthly submission of monitoring results*)

The following should be included in the six-monthly report:

Dust Fall-out Monitoring Sites:

- Historical concentrations of fall-out material report, insoluble and soluble components.

Ambient Air Quality Monitoring:

- Average Hourly concentrations at receptors monthly reports
- Cumulative deposition at receptors monthly reports
- Monthly time dependant graphs for average hourly concentrations at receptors.

Stack Monitoring:

- Average hourly concentrations at stack monitoring sites monthly reports
- Monthly time dependant graphs for average hourly concentrations at stack monitoring sites

Annual Report (*Annual submission of monitoring results*)

- System Audit
    - Statutory/Regulatory Requirements
    - Monitoring Infrastructure
    - Data Capture
    - Information Generation
    - Management of System

- Data Audit
    - Compliance criteria
    - Validation of the data

- Interpretation of data
    - Historical concentrations of fall-out material report, insoluble and soluble components
    - Time dependant graphs for insoluble component and selected soluble variables
    - Contour and Compliance maps insoluble component
    - Average Hourly concentrations at receptors monthly reports
    - Cumulative deposition at receptors monthly reports
    - Monthly time dependant graphs for average hourly concentrations at receptors.
    - Average hourly concentrations at stack monitoring sites monthly reports

– Monthly time dependant graphs for average hourly concentrations at stack monitoring sites

Compliance and trend assessment/status report compiled by knowledgeable professional.

5.12.5 MANAGEMENT PROTOCOLS

The following table summarizes the management protocols relating to the sampling- and reporting frequency of the active Air Quality monitoring sites.

	Sampling Frequency			Reporting Frequency		
	AQP	*AQA*	*AQS*	*AQP*	*AQA*	*AQS*
Continuous		X	X			
Daily						
Weekly						
Two - weekly						
Two- Monthly	X					
Quarterly						
Six - Monthly				X	X	X
Annually				X	X	X

Acronyms:
Air Quality- (AQ)

Particulate Fallout
—   Dust Fallout   (AQP)
Gases
—   Ambient Air   (AQA)
–   Stack Emissions   (AQS)

5.13 NOISE

5.13.1 STATUTORY/REGULATORY REQUIREMENTS

Formal Compliance

No specific monitoring requirements are stipulated by any of the environmental statutory acts or in any of the permits issued to IVS, in accordance with these acts, for routine monitoring of noise at IVS. All equipment used on site must conform to the local authority's by-laws concerning noise levels and hours of operation. In the absence of by-laws, national regulations on noise control must be complied with.

Material Compliance

No specific monitoring standards or guideline criteria are stipulated by any of the environmental statutory acts, or in any of the permits issued to IVS. The criteria against which the noise impact is measured is whether the ambient noise level is increased above the noise zone noise level allocated to the area by the local authority, as stipulated by the Gauteng Noise Regulations published under the Environmental Conservation Act in 1999. If a noise zone level has not been allocated, the typical ambient noise levels for different types of residential areas listed in SABS 0103 may be used instead. For *Industrial Districts* the typical ambient noise levels are specified as 70 dBA, 65 dBA and 60 dBA during respectively the day (06:00 to 18:00), the evening (18:00 to 24:00), and night (00:00 to 06:00).

5.13.2 MONITORING INFRASTRUCTURE/SITES/LOCALITIES

The ambient noise level shall be monitored on the perimeter of the IVS property at IVS Vanderbijlpark. The monitoring points are chosen to be representative of the ambient noise climate on the IVS border. The ambient noise levels shall be monitored at the following positions:

Number on Map:	X- Coord:	Y-Coord:
NS-1	80199.329	-2951339.115
NS-2	80719.083	-2951291.437
NS-3	81644.149	-2951300.986
NS-4	82755.179	-2951353.440
NS-5	83098.503	-2951396.361
NS-6	83751.767	-2950752.638
NS-7	83112.793	-2949961.081
NS-8	84233.362	-2949851.415
NS-9	84176.130	-2948611.632
NS-10	83022.154	-2945412.030
NS-11	80652.283	-2946832.990

The noise monitoring localities are shown on a map in **FIGURE 10, APPENDIX 1.**

5.13.3 DATA CAPTURE PROTOCOLS

Sampling Frequency

Noise (N)   -   **Six-Monthly** (In order to capture both summer and winter conditions for the propagation of noise)

Suggested months for the noise monitoring: **June** and **December**.

Sampling Technique

All measurements shall be conducted in accordance with the procedures specified in SABS 0103.

Sampling Equipment

The sampling equipment shall conform with the requirements specified in Section 5.1 and 5.2 in SABS 0103.

Sampling Procedure

The following procedure shall be used to sample the ambient noise levels:

- Ambient noise levels shall be sampled at each of the monitoring positions during representative periods of the day (06:00 to 18:00), evening (18:00 to 24:00) and night (00:00 to 06:00).
- The duration of each measurement sample shall be long enough to ensure that the measurement is representative of the ambient noise level. The minimum duration of a measurement sample shall be 15 minutes.
- During each measurement the subjective impressions of the ambient noise climate at the monitoring point shall be noted by the measurement officer. Particular attention shall be given to the audible noise contributions from IVS.
- The ambient noise levels at the monitoring points shall be sampled in a sequential manner. It is suggested that not more than 4 monitoring points be sampled during one day, evening and night.

Each measurement sample shall be recorded on a data sheet in writing in the following columnar format:

- Date of the measurement sample.
- Monitoring point number.
- Starting and ending time of the measurement sample.
- The noise level measured in accordance with SABS 0103.
- Prevalent weather conditions during the measurement sample, i.e. wind direction and strength, temperature and cloud cover.
- Comments on the audible noise contributions from IVS and the presence of other significant noise sources.

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The data sheets shall be filed under an appropriate numbering system for future reference purposes.

Sample Preservation

Not applicable.

Data Base Entry

Not applicable - not classified as a measurable data base component. Data generated should be contained in the annual report compiled under the section of *Noise* in the annual report.

The measurement samples will be entered into an Excel spreadsheet in the specified column format. The spreadsheet shall be identified by the year and month of the IVS Noise Monitoring operation.

Data Backup

A backup copy of the measurement sample data for each year shall be provided to the client on a recordable CD. Backup of data and reports relating to Noise monitoring will be stored at the Environmental Department.

5.13.4 INFORMATION GENERATION PROTOCOLS

Reporting Frequency

The following table summarizes the frequency of reporting.

Frequency	Type of Report
Six-monthly	Six-monthly data report
Annual Report	Annual status report

Report Content

Six-Monthly Report (*Six-monthly submission of monitoring results*)

The report shall at least have the following contents:

- Date of the sampling measurements.
- Name and contact of the noise measurement officer.
- A list of the measurement equipment and calibration details.
- The sampling results in the specified column format.
- Detailed remarks on any significant changes in the measured noise levels and presence of major contributing noise sources.

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Annual Report (*Annual submission of monitoring results*)

- System Audit

    - Statutory/Regulatory Requirements
    - Monitoring Infrastructure
    - Data Capture
    - Information Generation
    - Management of System

- Data Audit

    - Compliance criteria
    - Validation of the data

- The report shall at least have the following contents:

    - Date of the sampling measurements.
    - Name and contact of the noise measurement officer.
    - A list of the measurement equipment and calibration details.
    - The sampling results in the specified column format.
    - Detailed remarks on any significant changes in tbe measured noise levels and presence of major contributing noise sources.

- Interpretation of data

    - Historical noise level report for all monitoring localities
    - Time dependant graphs for historical noise level recordings at all monitoring localities

- Management measures and objectives

- Compliance and trend assessment/status report compiled by knowledgeable professional.

5.13.5 MANAGEMENT PROTOCOLS

The following table summarizes the management protocols relating to the sampling- and reporting frequency of the Noise component.

	Sampling Frequency	Reporting Frequency
	NS	*NS*
Daily		
Weekly		
Two-Weekly		
Monthly		
Quarterly		
Six-Monthly	X	X
Annually	X	X

Acronyms
Noise   (NS):

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5.14 ARCHEOLOGY/CULTURAL INTEREST

5.14.1 STATUTORY/REGULATORY REQUIREMENTS

Formal Compliance

The National Heritage Resources Act (*Act No.25 of 1999*) outlines various categories of significant objects and places that qualify as national heritage sites. This Act requires all developers to undertake impact assessment studies whenever any development activities are undertaken. The law also provides guidelines for impact assessment studies to be done whenever cultural resources may be destroyed by development activities.

The Environmental Conservation Act (*Act No 73 of 1989*) makes provision for the drawing up of reports concerning the impact on the environment of activities identified and prohibited in terms of *Section 21 and 22* respectively. These reports must evaluate the impact that development may have on natural and human-made environment, and this includes archeological sites.

Material Compliance

The National Heritage Resources Act (*Act No.25 of 1999*) outlines various categories of significant objects and places that qualify as national heritage sites and protect these sites under different sections of the Act:

- Graves younger that 60 years - Section 2(1)
- Graves older that 60 years but younger that 100 years - Section 36
- Graves older that 100 years (*Act No.25 of 1999*)
- Infrastructure older that 60 years

5.14.2 MONITORING INFRASTRUCTURE/SITES/LOCALITIES

The following monitoring sites have been identified:

NUMBER ON MAP:	LAT:	LONG:
AC-1	26,39.314050	27,47.271683
AC-2	26,39.114383	27,47.215317
AC-3	26,39.860817	27,47.156067
AC-4	26,39.443483	27,47.025033
AC-5	26,39.73548	27,47.03952
AC-6	26,32.7241	27,49.636752

The archeology routine monitoring localities are shown on the map depicted in **FIGURE 11, APPENDIX I.**

5.14.3 DATA CAPTURE PROTOCOLS

Sampling Frequency

Archeology/Cultural Interest (AC) — **Annually**

The suggested month for the field visit at the monitoring sites is **August.**

Sampling Technique

The site monitoring visit should be carried out by a knowledgeable professional.

Sampling Equipment

For the annual field visit to the sites identified, the following equipment is needed:

- A locality map of all sites of Archeology/Cultural Interest at and around IVS
- Historical description of all the monitoring sites
- Camera
- Pen/pencil
- Notebook

Sampling Procedure

The sampling or observation procedure would include the following:

- Note the site name as shown on the field map
- Note the date and time of visit to site
- Describe the current status of the site
- Take photographs form different directions of the site

Sample Preservation

Not applicable to this component.

Data Base Entry

Not applicable – not classified as a measurable data base component. Data generated should be contained in the annual report compiled for Archeology/Cultural Interest.

Data Backup

Backup of all reports and field notes should be kept in a safe. Report should be stored in electronic format on a separate disk or computer to assure no data loss during technical failure.

5.14.4 INFORMATION GENERATION PROTOCOLS

Reporting Frequency

The following table summarizes the frequency of reporting.

Frequency	Type of Report
Annual Report	Annual status report

Report Content

The following information should be contained in the annual Archeology/Cultural Interest Monitoring Report:

- Current description of the site
- Comparison of the previous photographs in terms of the status of the site
- Management measures for each site

5.14.5 MANAGEMENT PROTOCOLS

The following table summarizes the management protocols relating to the sampling- and reporting frequency of the Archeology/Cultural Interest component.

	Sampling Frequency	Reporting Frequency
	AC	AC
Daily		
Weekly		
Two-Weekly		
Monthly		
Quarterly		
Six-Monthly		
Annually	X	X

Acronyms:
Archeology/Cultural Interest(AC):

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5.15 VISUAL ASPECTS

The results of the Master Plan Base Line Study, are contained in the Visuals Specialist Report compiled by the OFT team. Routine ongoing monitoring for this component is not currently a requirement.

5.15.1 STATUTORY/REGULATORY REQUIREMENTS

In active.

5.15.2 MONITORING INFRASTRUCTURE/SITES/LOCALITIES

In active.

5.15.3 DATA CAPTURE PROTOCOLS

In active.

5.15.4 INFORMATION GENERATION PROTOCOLS

In active.

5.15.5 MANAGEMENT PROTOCOLS

In active.

5.16 PUBLIC CONSULTATION - IAP's

5.16.1 STATUTORY/REGULATORY REQUIREMENTS

Formal Compliance

Three sets of pertinent requirements have been taken into account, namely:

- DWAF - Minimum Requirements for a landfill site
- Gauteng DACEL - EIA Guidelines for listed activities
- Town and Regional Planning legislation, as may be applicable

Material Compliance

No specific guidelines or standards for monitoring requirements are stipulated by any of the environmental statutory acts or in any of the permits, (to be) issued to IVS, in accordance with these acts, for routine monitoring of the Public Consultation (IAP) process at IVS.

5.16.2 MONITORING INFRASTRUCTURE/SITES/LOCALITIES

The current Consolidated Residue Management Facility (CRMF)
EIA work for the Rehabilitation and Pollution Control of the Works

5.16.3 DATA CAPTURE PROTOCOLS

The frequency of meetings during the Master Plan investigation and planning phase, the construction phase, the implementation phase and the monitoring/ maintenance phase is provisionally set to be **quarterly**.

The suggested months for these actions are **January, April, August and December.**

The purpose of these meetings would be as follows:

- To facilitate communication between IVS and members of the committee with regard to progress made to date
- Audit with regard to the implementation of design specifications and standards
- Facilitate the internal management of any conflict that may arise
- Provide an ongoing foundation for discussion and scoping of any new EIA's that may become necessary (scheduled and/or listed activities)
- To provide an open channel of communication between the Works Management, Regulatory Authorities and representatives of the public, including as necessary, issues not obviously related to environmental impacts, as may be caused by IVS (e.g. upstream spills of contaminants from other industries - DWAF, or unacceptable levels of air pollution - DEAT).

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Similarly, the decommissioning phase would also require continual and intensive monitoring by such a committee. The frequency would be the same as for the construction phase as described above, namely three to four times a year.

Where an individual (sub-) project involves an ongoing operational phase and where there are no deviations planned from the design specifications that have been agreed to by the committee, a frequency of two meetings a year should suffice.

The frequencies recommended above on the construction, operational and/or decommissioning phases are based on effective communication of activities that have been predetermined collaboratively, and agreed to. The frequencies are, at this point in time, provisional, and will be finalized in consultation with the relevant stakeholders (Authorities and Interested and Affected Public).

Any deviation from the norm would require an ad hoc meeting to be called with the specific agenda item of discussing the issues that had been proposed to be changed and recorded on schedule of activities.

5.16.4 INFORMATION GENERATION PROTOCOLS

Reporting Frequency

The following table summarizes the frequency of reporting.

Frequency	Type of Report
Quarterly	Note for the record
Annual Report	Annual Status Statement in the annual report

Report Content

Quarterly reporting

A note for the record should be compiled after every meeting held. The note for the record should give full details on the discussions of the meeting and matters to be followed up. This document is distributed in draft format and comments regarding it should be made within two weeks to the facilitating officer. Thereafter, it is the final and official document for the particular meeting.

Annual reporting

The annual report should be a status report describing all Public Consultations and the relevant follow-ups and actions that there have been during the year.

5.16.5 MANAGEMENT PROTOCOLS

The following table summarizes the management protocols relating to the meeting- and reporting frequency of the Public Consultations.

	Meeting Frequency	Reporting Frequency
	PC	PC
Daily		
Weekly		
Two-Weekly		
Monthly		
Quarterly	X	X
Six-Monthly		
Annually		X

Acronyms:
Public Consultation (PC);

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5.17   ENVIRO-LEGAL ASPECTS

Authority scrutiny of quality monitoring from both an accuracy and diligence perspective has substantially increased over the past few years.

When an industry is authorised, permitted or licensed to undertake an activity that poses a threat to the environment, however marginal, it is done so conditionally. There is not a single effluent or emission producing activity at IVS which is not subject to strict legal regulation. So, for instance, are all air emissions from the Works regulated by registration certificates in terms of the Atmospheric Pollution Prevention Act 54 of 1965, solid waste disposal by section 20 the Environment Conservation Act (ECA), surface water quality be various sections of the National Water Act 36 of 1998 (NWA) and National Environmental Management Act 107 of 1998 (NEMA) and process water by *inter alia*, section 21 (4) of the Water Act 54 of 1956 and in future by section 21 of the NWA.

All aspects of monitoring from sample collection to the generation of data serve essentially the purpose of reflecting the level of compliance with environmental legislation.

Formal Compliance

The formal or procedural aspects of sampling are strictly controlled in terms of the authorisation-, permit-, license- and even exemption conditions issued in terms of the above legislation.

These conditions are integrated in the procedures of this protocol and failure to adhere thereto in the strictest sense directly results in formal (as well as indirect material) non-compliance with the relevant legislation.

Material Compliance

Inadequate, sporadic monitoring or even marginal deviance from monitoring procedure produces unreliable data, straining the controlling authorities capacity to monitor material legal compliance. Failure to produce comprehensive and accurate data will not only result in IVS's failure to illustrate due diligence in terms of current environmental law, but also implies material non-compliance by default.

Haphazard compliance with monitoring and sampling procedure may result in various forms of common law as well as criminal liability to attach to IVS, its directors, managers and employees in terms of new and onerous environmental legislation. To illustrate the possible consequences of non-adherence to monitoring procedure, legislative provisions applying to monitoring requirements are quoted below and their interaction illustrated. Various similar examples exist in current South African Environmental Law.

Section 151 NWA

"(1) No person may -...

 (c) fail to comply with any condition attached to a permitted water use under this Act;...

 (f) fail ...to...give data or information, or give false or misleading data...

*(2) Any person who contravenes any provision of subsection (1) is guilty of an offence and liable...to a **fine or imprisonment for a period not exceeding five years**, or to both a fine and such imprisonment and, in the case of a second or subsequent conviction, to **a fine or imprisonment for a period not exceeding ten years** or to both a fine and such imprisonment."*

Section 29(4) ECA

*"Any person who contravenes a provision of section 20(1)... or fails to comply with a condition of a permit, permission, authorization or direction...shall be guilty of an offence and liable on conviction to a fine not exceeding **R100 000** or to **imprisonment for a period not exceeding 10 years** or to both such fine and such imprisonment..."*

Section 34 NEMA (applying *inter alia* to Sec. 29(4) of the ECA above)

"(4) ...the court convicting such person may...order such person to pay the reasonable costs incurred by the public prosecutor and the organ of state...

*(5) Whenever any **manager, agent or employee does or omits to do an act which it had been his or her task to do**...because the employer failed to take all reasonable steps to prevent the act or omission in question, **then the employer shall be guilty** of the said offence...and proof of such act or omission by a manager, agent or employee shall constitute prima facie evidence that the employer is guilty...*

*(6) Whenever any **manager, agent or employee** does or omits to do an act which it had been his or her task to do or to refrain from doing...**he...shall be liable to be convicted and sentenced** in respect thereof **as if he or she were the employer.***

*(7) Any person who is or was a **director** of a firm at the time of the commission by that firm of an offence shall himself or herself be guilty of the said offence and liable on conviction to the penalty specified...if the offence in question resulted from the failure of the director to take all reasonable steps that were necessary under the circumstances to prevent the commission of the offence:...**proof of the said offence by the firm shall constitute prima facie evidence that the director is guilty under this subsection.***

*(8) Any such **manager, agent, employee** or director may be so **convicted and sentenced in addition to the employer or firm.**"*

It is evident from the above that non-compliance with procedural and material aspects relating to monitoring of effluent and emissions may hold dire legal consequences for the works itself, as well as its directors, managers and employees in terms of statutory law.

Further, Environmental Management Principles in terms of South African legislation provide that any industry that cannot conduct its business in an environmental friendly and responsible manner will not be allowed to operate. In addition, industrial operations are scrutinized by the general public having legal access to environmental compliance profiles. Any industry failing to comply with its statutory obligations therefore not only face possible applications for closure, but also a myriad of common law claims aggravated by statutory imprudence.

IVS should therefore acquire an **annual** professional statement regarding to the changes in the environmental law related to the environmental components monitored at IVS.

The following table summarizes the management protocols relating to the Enviro-Legal aspects.

	Reassessment Frequency	Reporting Frequency
	EL	*EL*
Daily		
Weekly		
Two-Weekly		
Monthly		
Quarterly		
Six-Monthly		
Annually	X	X

Acronyms:
Enviro-Legal Aspects: (EL)

6. MONITORING AND MANAGEMENT SUMMARY

We are confident that the monitoring network commissioned, will facilitate an accurate assessment of the environmental evaluation at IVS.

All procedures used and proposed, are of high scientific integrity and should also be in fulfilment of ISO 14000 requirements.

A summary on the monitoring- and reporting frequencies is tabled in **APPENDIX V**.

Respectfully submitted

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(Associate - Geohydrology)

Prj1747

Draft for discussion
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Research for IVS

APPENDIX 1

MAPS SHOWING MONITORING LOCALITIES

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Research for IVS

Scale: 1: 33 000

Client: ISCOR Vanderbijlpark Steel
Project: Environmental Monitoring System
Map Status: Final
Compiled by: G. Cloete
Checked by: R. Grobbelaar

JASPER MÜLLER ASSOCIATES CC

Project no:	Date:
10193	November 2002

FIGURE 1

Source Characterization
Sampling Localities

LEGEND

IVS Works Area

Agricultural Activities

Small Holdings

Residential Areas

Industrial Activities

Draft for discussion
CONFIDENTIAL
Research for IVS

Scale: 1: 50 000

FIGURE 3

Land Capability
and Land Use

FIGURE 4

Plant life Monitoring Areas

Draft for discussion
CONFIDENTIAL
Research for IVS

Scale: 1: 62 000

Client: ISCOR Vanderbijlpark Steel
Project: Environmental Monitoring System
Map Status: Final
Compiled by: G. Cloete
Checked by: R. Grobbelaar

JASPER MÜLLER ASSOCIATES CC

Project no:	Date:
10193	November 2002

FIGURE 6

Aquatic Ecosystem Monitoring
Areas

Draft for discussion
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Research for IVS

Scale: 1:50 000

Project no:	Date:
10193	November 2002

FIGURE 7-2

Ground Water Sampling Localities:
Perched Aquifer (GWP)

LEGEND

SWR River /Stream
 sampling localities

SWI Canals and Sumps
 sampling localities

**Draft for discussion
CONFIDENTIAL
Research for IVS**

Scale: 1: 62 000

Client: ISCOR Vanderbijlpark Steel
Project: Environmental Monitoring System
Map Status: Final
Compiled by: G. Cloete
Checked by: R. Grobbelaar

JASPER MÜLLER ASSOCIATES CC

Project no:	Date:
10193	November 2002

FIGURE 8

Surface Water Sampling
Localities

LEGEND

AQP △   Dust fall out monitoring localities

AQA △   Ambient Air monitoring localities

Draft for discussion
CONFIDENTIAL
Research for IVS

Scale: 1: 30 000

Client: ISCOR Vanderbijlpark Steel
Project: Environmental Monitoring System
Map Status: Final
Compiled by: G. Cloete
Checked by: R. Grobbelaar

JASPER MÜLLER ASSOCIATES CC

Project no:	Date:
10193	November 2002

FIGURE 9-1

Air Quality Monitoring Localities:
Dust Fallout & Ambient Air
(AQP & AQA)

AQS Stack Monitoring
△ Localities

Draft for discussion
CONFIDENTIAL
Research for IVS

Scale: 1: 30 000

Client: ISCOR Vanderbijlpark steel
Project: Environmental Monitoring System
Map Status: Final
Compiled by: G. Cloete
Checked by: R. Grobbelaar

JASPER MÜLLER ASSOCIATES CC

Project no:	Date:
10193	November 2002

FIGURE 9-2

Air Quality Monitoring Localities:
Stack Emissions (AQS)

NS-10

NS-11

NS-9

NS-7   NS-8

NS-6

NS-1   NS-2   NS-3   NS-4   NS-5

2946000
2948000
2950000
2952000
2954000

Draft for discussion
CONFIDENTIAL
Research for IVS

Scale: 1: 50 000

Client: ISCOR Vanderbijlpark Steel
Project: Environmental Monitoring System
Map Status: Final
Compiled by: G. Choete
Checked by: R. Grobbelaar

JASPER MÜLLER ASSOCIATES CC

Project no:	Date:
10193	November 2002

FIGURE 10

Noise Monitoring Localities

APPENDIX II

MONITORING FIELD FORMS

FOR THE

WEEKLY
TWO-WEEKLY
TWO-MONTHLY
QUARTERLY
SIX-MONTHLY
AND
ANNUAL

SAMPLING RUNS

WEEKLY SAMPLING RUN

ISCOR VANDERBIJLPARK MONITORING FIELD FORM
SURFACE WATER MONITORING

MONITORING NUMBER	DATABASE NUMBER	DATE SAMPLED	TIME	COMMENTS
SWR-1	RS 0			
SWR-2	RS 1			
SWR-3	RS 2			
SWR-4	RS 3			
SWR-5	RS 4			
SWR-6	RS 5			
SWR-7	RS 6			
SWR-8	RS 7			
SWR-9	RS 8			
SWR-10	RS 9			
SWR-11	RS 10			

TWO-WEEKLY SAMPLING RUN

ISCOR VANDERBIJLPARK MONITORING FIELD FORM
SURFACE WATER MONITORING

MONITORING NUMBER	DATABASE NUMBER	DATE SAMPLED	TIME	COMMENTS
SWR-1	RS 0			
SWR-2	RS 1			
SWR-3	RS 2			
SWR-4	RS 3			
SWR-5	RS 4			
SWR-6	RS 5			
SWR-7	RS 6			
SWR-8	RS 7			
SWR-9	RS 8			
SWR-10	RS 9			
SWR-11	RS 10			
SWR-12	LS 1			
SWR-13	LS 2			
SWR-14	LS 3			
SWR-15	LS 4			
SWR-16	LS 5			
SWR-17	LS 6			

TWO-MONTHLY SAMPLING RUN

ISCOR VANDERBIJLPARK MONITORING FIELD FORM
AIR QUALITY MONITORING

MONITO-RING NUMBER	DATABASE NUMBER	DATE SAMPLED	TIME	COMMENTS
AQP-1	Buckett 1			
AQP-2	Buckett 2			
AQP-3	Buckett 3			
AQP-4	Buckett 7			
AQP-5	Buckett 11			
AQP-6	Buckett 15			
AQP-7	Buckett 16			
AQP-8	Buckett 17			
AQP-9	Buckett 18-A			
AQP-10	Buckett 19			
AQP-11	Buckett 20			
AQP-12	Buckett 21			
AQP-13	Buckett 22			
AQP-14	Buckett 24			
AQP-15	Buckett 25			
AQP-16	Buckett 26			
AQP-17	Buckett 27			
AQP-18	Buckett 28			
AQP-19	Buckett 29			
AQP-20	Buckett 30			
AQP-21	Buckett 31			
AQP-22	Buckett 32			
AQP-23	Buckett 33			
AQP-24	Buckett 34			
AQP-25	Buckett 35			
AQP-26	Buckett 36			
AQP-27	Buckett 37			
AQP-28	Buckett 38			

QUARTERLY SAMPLING RUN

ISCOR VANDERBIJLPARK MONITORING FIELD FORM
SOURCE MONITORING

MONITO-RING NUMBER	DESCRIPTION	DATE SAMPLED	TIME	COMMENTS
SCS-1	Sinter mixing Bed			
SCS-2	CETP Old Sludge Dams			
SCS-3	Hattingh Canal (Top)			
SCS-4	Coal Stacking Area			
SCS-5	CETP Sludge dams			
SCS-6	Vaaldam Canal			
SCS-7	NWAK			
SCS-8	Hecketts/Steelserv			
SCS-9	Arc Furnace / BOF Slag			
SCS-10	Du Preez corner			
SCS-11	Dam1-4 - Seepage Canal			
SCS-12	Maturation Ponds - Seepage Canal			

SIX MONTHLY SAMPLING RUN

ISCOR VANDERBIJLPARK MONITORING FIELD FORM
GROUND WATER MONITORING: PERCHED AQUIFER
INORGANIC

Monitoring Number	Database Number	Alternative Nr	Sampling Depth (m)	Ssampling Method B=Bailer S=Sampler P=Pump	Date sampled YYYYMMDD	Time Sampled HHMM	Waterlevel (m)	Comments
GWP-1	NW-1S	IVB-S1	5.5					
GWP-2	FD-17S	IVB-S2	3.5					
GWP-3	FD-14S	IVB-S3	4					
GWP-4	FD-16S	IVB-S4	3.5					
GWP-5	FD-15S	IVB-S5	3.5					
GWP-6	FD-18S	IVB-S6	3					
GWP-7	FD-20S	IVB-S7	3.3					
GWP-8	NW-2S	IVB-S8	**					
GWP-9	FD-19S	IVB-S9	3.1					
GWP-10	NW-5S	IVB-S10	3					
GWP-11	NW-8S	IVB-S11	2.5					
GWP-12	CMS-5S	IVB-S12	3					
GWP-13	FD-23S	IVB-S13	**					
GWP-14	NW-7S	IVB-S14	3.5					
GWP-15	NW-4S	IVB-S15	4.5					
GWP-16	NW-6S	IVB-S16	3.6					
GWP-17	FD-13S	IVB-S17	4					
GWP-18	FD-11S	IVB-S18	3					
GWP-19	FD-2S	IVB-S19	3.5					
GWP-20	FD-10S	IVB-S20	**					
GWP-21	FD-9S	IVB-S21	5					
GWP-22	FD-8S	IVB-S22	**					
GWP-23	FD-7S	IVB-S23	**					
GWP-24	FD-5S	IVB-S24	**					
GWP-25	FD-4S	IVB-S25	**					
GWP-26	FD-3S	IVB-S26	**					
GWP-27	IPS-2	IVB-S27	7					
GWP-28	FD-12S	IVB-S28	4.2					
GWP-29	CMS-4S	IVB-S29	4.4					
GWP-30	NW-9S	IVB-S30	4					
GWP-31	H/S-14S	IVB-S31	4					
GWP-32	H/S-13S	IVB-S32	5					
GWP-33	CENT-1S	IVB-S33	4.3					
GWP-34	CAST-1S	IVB-S34	4					
GWP-35	CMS-3S	IVB-S35	**					
GWP-36	HMS-6S	IVB-S36	5.5					
GWP-37	HMS-5S	IVB-S37	4.25					
GWP-38	CENT-3S	IVB-S38	**					
GWP-39	CAST-2S	IVB-S39	5.3					
GWP-40	CENT-2S	IVB-S40	4.8					
GWP-41	NW-3S	IVB-S41	4					
GWP-42	FD-6S	IVB-S42	4					
GWP-43	ARC-2S	IVB-S43	3.5					
GWP-44	CMS-2S	IVB-S44	4.75					
GWP-45	CETP-1S	IVB-S45	3.5					
GWP-46	CETP-2S	IVB-S46	4					
GWP-47	DR-4S	IVB-S47	3.5					
GWP-48	DR-3S	IVB-S48	3.5					
GWP-49	TETP-1S	IVB-S49	3					
GWP-50	T-3S	IVB-S50	3.5					
GWP-51	YS-2S	IVB-S51	3.5					
GWP-52	YS-1S	IVB-S52	3					
GWP-53	TOM-3S	IVB-S53	3.5					
GWP-54	TOM-2S	IVB-S54	3.5					
GWP-55	T-3OS	IVB-S55	2.5					
GWP-56	T-1S	IVB-S56	3					
GWP-57	TOM-4S	IVB-S57	3					

Monitoring Number	Database Number	Alternative Nr	Sampling Depth (m)	Sampling Method B=Bailer S=Sampler P=Pump	Date sampled YYYYMMDD	Time Sampled HHMM	Waterlevel (m)	Comments
GWP-58	T-5S	IVB-S58	3.5					
GWP-59	T-8S	IVB-S59	3					
GWP-60	MSC-1S	IVB-S60	3					
GWP-61	MP-1S	IVB-S61	3.5					
GWP-62	HMS-4S	IVB-S62	--					
GWP-63	EAF-1S	IVB-S63	4					
GWP-64	H/S-6S	IVB-S64	--					
GWP-65	T-11	IVB-S65	--					
GWP-66	T-12	IVB-S66	--					
GWP-67	T-10S	IVB-S67	--					
GWP-68	RT-4S	IVB-S68	--					
GWP-69	RT-2S	IVB-S69	--					
GWP-70	FD-1S	IVB-S70	4					
GWP-71	FD-21S	IVB-S71	3					
GWP-72	FD-22S	IVB-S72	3					
GWP-73	P-19S	IVB-S73	4					
GWP-74	P-8S	IVB-S74	4					
GWP-75	P-9S	IVB-S75	4					
GWP-76	P-15S	IVB-S76	5.95					
GWP-77	P-12S	IVB-S77	4					
GWP-78	P-13S	IVB-S78	4					
GWP-79	P-25S	IVB-S79	--					
GWP-80	P-4S	IVB-S80	4.6					
GWP-81	P-5S	IVB-S81	3					
GWP-82	P-3S	IVB-S82	--					
GWP-83	P-25S	IVB-S83	--					
GWP-84	P-1S	IVB-S84	--					
GWP-85	P-2S	IVB-S85	--					
GWP-86	P-21S	IVB-S86	4					
GWP-87	P-20S	IVB-S87	5.5					
GWP-88	P-18S	IVB-S88	4.5					
GWP-89	P-14S	IVB-S89	3.45					
GWP-90	ARC-1S	IVB-S90	4					
GWP-91	P-17S	IVB-S91	4.5					
GWP-92	P-16S	IVB-S92	4.25					
GWP-93	P-6S	IVB-S93	--					
GWP-94	P-24S	IVB-S94	4					
GWP-95	PL-12S	IVB-S95	--					
GWP-96	PL-11S	IVB-S96	4					
GWP-97	PL-10S	IVB-S97	--					
GWP-98	PL-9S	IVB-S98	--					
GWP-99	PL-6S	IVB-S99	--					
GWP-100	P-22S	IVB-S100	--					
GWP-101	PL-5S	IVB-S101	3.5					
GWP-102	PL-8S	IVB-S102	--					
GWP-103	PL-7S	IVB-S103	--					
GWP-104	P-7S	IVB-S104	--					
GWP-105	PL-13S	IVB-S105	--					
GWP-106	PL-15S	IVB-S106	--					
GWP-107	P-11S	IVB-S110	3					
GWP-108	P-10S	IVB-S111	--					
GWP-109	TETP-3S	IVB-S112	--					
GWP-110	TETP-2S	IVB-S113	--					
GWP-111	TETP-4S	IVB-S114	3					
GWP-112	RT-1S	IVB-S115	--					
GWP-113	RT-3S	IVB-S116	--					
GWP-114	DIA-2S	IVB-S117	--					

Monitoring Number	Database Number	Alternative Nr	Sampling Depth (m)	Ssampling Method B=Bailer S=Sampler P=Pump	Date sampled YYYYMMDD	Time Sampled HHMM	Waterlevel (m)	Comments
GWP-115	RT-7S	IVB-S118	**					
GWP-116	RT-5S	IVB-S119	**					
GWP-117	RT-8S	IVB-S120	**					
GWP-118	TOM-6S	IVB-S121	**					
GWP-119	DIA-1S	IVB-S122	**					
GWP-120	TOM-7S	IVB-S123	**					
GWP-121	MP-2S	IVB-S124	**					
GWP-122	CETP-3S	IVB-S125	**					
GWP-123	IPS-1	IVB-S126	5					
GWP-124	IPS-3	IVB-S127	7					
GWP-125	IPS-4	IVB-S128	12					
GWP-126	IPS-5	IVB-S129	3					
GWP-127	IPS-6	IVB-S130	11					
GWP-128	H/S-1S	IVB-S131	**					
GWP-129	H/S-2S	IVB-S132	**					
GWP-130	H/S-3S	IVB-S133	12					
GWP-131	H/S-4S	IVB-S134	**					
GWP-132	H-S-5S	IVB-S135	17					
GWP-133	H/S-7S	IVB-S136	9					
GWP-134	H-/S-8S	IVB-S137	7					
GWP-135	H/S-9S	IVB-S138	6.5					
GWP-136	H/S-10S	IVB-S139	4					
GWP-137	H/S-11S	IVB-S140	**					
GWP-138	H/S-12S	IVB-S141	**					
GWP-139	DR-1S	IVB-S142	4					
GWP-140	CMS-1S	IVB-S143	**					
GWP-141	CO-1S	IVB-S144	2.5					
GWP-142	CO-2S	IVB-S145	4					
GWP-143	CO-3S	IVB-S146	3					
GWP-145	SC-2S	IVB-S148	**					
GWP-146	HMS-2S	IVB-S149	**					
GWP-147	T-6S	IVB-S150	**					
GWP-148	PL-2S	IVB-S160	7					
GWP-149	PL-4S	IVB-S161	**					
GWP-150	PL-3S	IVB-S162	**					
GWP-151	PL-1S	IVB-S163	**					
GWP-152	PL-17S	IVB-S164	**					
GWP-153	PL-19S	IVB-S165	**					
GWP-154	PL-18S	IVB-S166	**					
GWP-155	PL-20S	IVB-S167	**					
GWP-156	PL-14S	IVB-S168	**					
GWP-157	PL-16S	IVB-S169	**					

**Dry: Should be sampled at bottom when Waterlevel is observed

Monitoring Number	Database Number	Alternative Nr	Sampling Depth (m)	Date sampled	Time Sampled	Waterlevel (m)	Comments
GWW-1	NW-1D	IVB-D1	28				
GWW-2	FD-17D	IVB-D2	28				
GWW-3	FD-14D	IVB-D3	26				
GWW-4	FD-16D	IVB-D4	7				
GWW-5	FD-15D	IVB-D5	28				
GWW-6	FD-18D	IVB-D6	31				
GWW-7	FD-20D	IVB-D7	26				
GWW-8	NW-2D	IVB-D8	26				
GWW-9	FD-19D	IVB-D9	25				
GWW-10	FD-5D	IVB-D10	32				
GWW-11	NW-8D	IVB-D11	22				
GWW-12	CMS-5D	IVB-D12	17				
GWW-13	FD-23D	IVB-D13	30				
GWW-14	NW-7D	IVB-D14	32				
GWW-15	NW-4D	IVB-D15	22				
GWW-16	NW-6D	IVB-D16	28				
GWW-17	FD-13D	IVB-D17	19				
GWW-18	FD-11D	IVB-D18	29				
GWW-19	FD-2D	IVB-D19	19				
GWW-20	FD-10D	IVB-D20	18				
GWW-21	FD-9D	IVB-D21	23				
GWW-22	FD-8D	IVB-D22	23				
GWW-23	FD-7D	IVB-D23	25				
GWW-24	FD-5D	IVB-D24	25				
GWW-25	FD-4D	IVB-D25	19				
GWW-26	FD-3D	IVB-D26	8				
GWW-27	IPD-2	IVB-D27	22				
GWW-28	FD-12D	IVB-D28	23				
GWW-29	CMS-4D	IVB-D29	18				
GWW-30	NW-9D	IVB-D30	23				
GWW-31	H/S-14D	IVB-D31	16				
GWW-32	H/S-13D	IVB-D32	10				
GWW-33	CENT-1D	IVB-D33	10				
GWW-34	CAST-1D	IVB-D34	15				
GWW-35	CMS-3D	IVB-D35	25				
GWW-36	HMS-6D	IVB-D36	17				
GWW-37	HMS-5D	IVB-D37	36				
GWW-38	CENT-3D	IVB-D38	29				
GWW-39	CAST-2D	IVB-D39	19				
GWW-40	CENT-2D	IVB-D40	14				
GWW-41	NW-3D	IVB-D41	18				
GWW-42	FD-6D	IVB-D42	23.5				
GWW-43	ARC-2D	IVB-D43	20				
GWW-44	CMS-2D	IVB-D44	38				
GWW-45	CETP-1D	IVB-D45	22				
GWW-46	CETP-2D	IVB-D46	24				
GWW-47	DR-4D	IVB-D47	18				
GWW-48	DR-3D	IVB-D48	7				
GWW-49	TETP-1D	IVB-D49	24				
GWW-50	T-3D	IVB-D50	22				
GWW-51	YS-2D	IVB-D51	20				
GWW-52	YS-1D	IVB-D52	29				

Monitoring Number	Database Number	Alternative Nr	Sampling Depth (m)	Date sampled	Time Sampled	Waterlevel (m)	Comments
GWW-53	TOM-3D	IVB-D53	24				
GWW-54	TOM-2D	IVB-D54	24				
GWW-55	T-30D	IVB-D55	20				
GWW-56	T-1D	IVB-D56	20				
GWW-57	TOM-4D	IVB-D57	22				
GWW-58	T-5D	IVB-D58	16				
GWW-59	T-8D	IVB-D59	31				
GWW-60	MSC-1D	IVB-D60	20				
GWW-61	MP-1D	IVB-D61	28				
GWW-62	HMS-4D	IVB-D62	36				
GWW-63	EAF-1D	IVB-D63	30				
GWW-64	H/S-6D	IVB-D64	12				
GWW-65	T-11	IVB-D65	BLUE PIPES				
GWW-66	T-12	IVB-D66	BLUE PIPES				
GWW-67	T-10D	IVB-D67	33				
GWW-68	RT-4D	IVB-D68	35				
GWW-69	RT-2D	IVB-D69	23				
GWW-70	FD-1D	IVB-D70	31				
GWW-71	FD-21D	IVB-D71	29				
GWW-72	FD-22D	IVB-D72	30				
GWW-73	P-19D	IVB-D73	33				
GWW-74	P-8D	IVB-D74	16				
GWW-75	P-9D	IVB-D75	20.5				
GWW-76	P-15D	IVB-D76	20				
GWW-77	P-12D	IVB-D77	24				
GWW-78	P-13D	IVB-D78	25				
GWW-79	P23D	IVB-D79	19				
GWW-80	P4D	IVB-D80	24				
GWW-81	P5D	IVB-D81	18				
GWW-82	P-3D	IVB-D82	16				
GWW-83	P-25D	IVB-D83	19				
GWW-84	P-1D	IVB-D84	25				
GWW-85	P-2D	IVB-D85	34				
GWW-86	P-21D	IVB-D86	24				
GWW-87	P-20D	IVB-D87	13				
GWW-88	P-18D	IVB-D88	32				
GWW-89	P-14D	IVB-D89	19				
GWW-90	ARC-1D	IVB-D90	14				
GWW-91	P-17D	IVB-D91	30				
GWW-92	P-16D	IVB-D92	25				
GWW-93	P-6D	IVB-D93	30				
GWW-94	P-24D	IVB-D94	25				
GWW-95	PL-12D	IVB-D95	20				
GWW-96	PL-11D	IVB-D96	16				
GWW-97	PL-10D	IVB-D97	28				
GWW-98	PL-9D	IVB-D98	22				
GWW-99	PL-6D	IVB-D99	26				
GWW-100	PL-22D	IVB-D100	24				
GWW-101	PL-5D	IVB-D101	17				
GWW-102	PL-8D	IVB-D102	20				
GWW-103	PL-7D	IVB-D103	18				

Monitoring Number	Database Number	Alternative Nr	Sampling Depth (m)	Date sampled	Time Sampled	Waterlevel (m)	Comments
GWW-104	P-7D	IVB-D104	21				
GWW-105	PL-13D	IVB-D105	23				
GWW-106	PL-15D	IVB-D106	30				
GWW-107	GEO-4D	IVB-D107	17				
GWW-108	GEO-5D	IVB-D108	29				
GWW-109	GEO-6D	IVB-D109	26				
GWW-110	P-11D	IVB-D110	13				
GWW-111	P-10D	IVB-D111	15				
GWW-112	TETP-3D	IVB-D112	24				
GWW-113	TETP-2D	IVB-D113	14				
GWW-114	TETP-4D	IVB-D114	20				
GWW-115	RT-1D	IVB-D115					
GWW-116	RT-3D	IVB-D116	20				
GWW-117	DIA-2D	IVB-D117	24				
GWW-118	RT-7D	IVB-D118	23				
GWW-119	RT-5D	IVB-D119	16				
GWW-120	RT-8D	IVB-D120	29				
GWW-121	TOM-6D	IVB-D121	31				
GWW-122	DIA-1D	IVB-D122	25				
GWW-123	TOM-7D	IVB-D123	21				
GWW-124	MP-2D	IVB-D124	34				
GWW-125	CETP-3D	IVB-D125	16				
GWW-126	IPD-1	IVB-D126	28				
GWW-127	IPD-3	IVB-D127	24				
GWW-128	IPD-4	IVB-D128	28				
GWW-129	IPD-5	IVB-D129	18				
GWW-130	IPD-6	IVB-D130	30				
GWW-131	H/S-1D	IVB-D131	15				
GWW-132	H/S-2D	IVB-D132	12				
GWW-133	H/S-3D	IVB-D133	32				
GWW-134	H/S-4D	IVB-D134	16				
GWW-135	H/S-5D	IVB-D135	18				
GWW-136	H/S-7D	IVB-D136	12				
GWW-137	H/S-8D	IVB-D137	19				
GWW-138	H/S-9D	IVB-D138	25				
GWW-139	H/S-10D	IVB-D139	27				
GWW-140	H/S-11D	IVB-D140	17				
GWW-141	H/S-12D	IVB-D141	26				
GWW-142	DR-1D	IVB-D142	25				
GWW-143	CMS-1D	IVB-D143	22				
GWW-144	CO-1D	IVB-D144	12				
GWW-145	CO-2D	IVB-D145	8				
GWW-146	CO-3D	IVB-D146	26				
GWW-147	T1-13D	IVB-D147	30				
GWW-148	SC-2D	IVB-D148	17				
GWW-149	HMS-2D	IVB-D149	17				
GWW-150	T-6D	IVB-D150	21				
GWW-151	GEO-1D	IVB-D151	21				
GWW-152	GEO-2D	IVB-D152	26				
GWW-153	GEO-3D	IVB-D153	30				
GWW-154	GEO-7D	IVB-D154	17				

ISCOR VANDERBIJLPARK MONITORING FIELD FORM
GROUND WATER MONITORING: SHALLOW WEATHERED AQUIFER
INORGANIC

Monitoring Number	Database Number	Alternative Nr	Sampling Depth (m)	Date sampled	Time Sampled	Waterlevel (m)	Comments
GWW-155	GEO-8D	IVB-D155	30				
GWW-156	T1-1D	IVB-D156	10				
GWW-157	T1-2D	IVS-D157	26				
GWW-158	T1-3D	IVB-D158	21				
GWW-159	T1-4D	IVB-D159	23				
GWW-160	PL-2D	IVB-D160	19				
GWW-161	PL-4D	IVB-D161	21				
GWW-162	PL-3S	IVB-D162	35				
GWW-163	PL-1D	IVB-D163	17				
GWW-164	PL-17D	IVB-D164	34				
GWW-165	PL-19D	IVB-D165	24				
GWW-166	PL-18D	IVB-D166	20				
GWW-167	PL-20D	IVB-D167	22				
GWW-168	PL-14D	IVB-D168	19				
GWW-169	PL-16D	IVB-D169	21				
GWW-170	T1-5D	IVB-D170	23				
GWW-171	T1-6D	IVB-D171	33				
GWW-172	T1-7D	IVB-D172	42				
GWW-173	T1-8D	IVB-D173	34				
GWW-174	T1-9D	IVB-D174	27				
GWW-175	T1-10D	IVB-D175	20				
GWW-176	T1-11D	IVB-D176	36				
GWW-177	T1-12D	IVB-D177	30				

ANNUAL SAMPLING RUN

ISCOR VANDERBIJLPARK MONITORING FIELD FORM
SOURCE MONITORING

MONITORING NUMBER	DESCRIPTION	DATE SAMPLED	TIME	COMMENTS
SCP-1	Vaaldam water treatment plant			
SCP-2	Candy water treatment plant			
SCP-3	Sinter CG100			
SCP-4	Coke oven (Brikketplant)			
SCP-5	Foundary (casting)			
SCP-6	DR oven			
SCP-7	DR material			
SCP-8	DR product separation			
SCP-9	DR product separation			
SCP-10	DR product separation			
SCP-11	DR oven			
SCP-12	EAF			
SCP-13	EAF ladle furnace no1			
SCP-14	EAF ladle furnace no2			
SCP-15	EAF Hecketts plant 85			
SCP-16	Blast furnace C			
SCP-17	Blast furnace D			
SCP-18	Blast furnace C & D			
SCP-19	Blast furnace hecketts plant 72			
SCP-20	Blast furnace			
SCP-21	Blast furnace C			
SCP-22	Blast furnace D			
SCP-23	BOF secondary Oos & Wes			
SCP-24	BOF secondary no3 de-gassing			
SCP-25	BOF 1,2 & 3			
SCP-26	BOF			
SCP-27	BOF			
SCP-28	Blast furnace C (tap vloer)			

ISCOR VANDERBIJLPARK MONITORING FIELD FORM
GROUND WATER MONITORING: EXTERNAL USERS

Monitoring Number	Database Number	Sampling Depth (m)	Sampling Method B=Bailer S=Sampler P=Pump	Date sampled	Time Sampled	Waterlevel (m)	Comments
GWE-1	DV-2A						
GWE-2	DV-3						
GWE-3	DV-4						
GWE-4	DV-5						
GWE-5	DV-6						
GWE-6	DV-7						
GWE-7	DV-8						
GWE-8	DV-9						
GWE-9	DV-10						
GWE-10	DV-11						
GWE-11	DV-12						
GWE-12	DV-13						
GWE-13	DV-14						
GWE-14	DV-2B						
GWE-15	RKL-D1						
GWE-16	RKL-D2						
GWE-17	RKL-D3						
GWE-18	WEERSTAS						
GWE-19	VAALDAM						
GWE-20	BH-D						
GWE-21	RL-1						
GWE-22	RS-1						
GWE-23	CP-6/1						
GWE-24	CP-7/1						
GWE-25	CP-7/2						
GWE-26	CP-7/3						
GWE-27	CP-8/1						
GWE-28	CP-10/1						
GWE-29	CP-10/2						
GWE-30	CP-11/1						
GWE-31	CP-11/2						
GWE-32	CP-16/1						
GWE-33	QF-1						
GWE-34	QF-2						
GWE-35	QF-3						
GWE-36	QF-4						
GWE-37	QF-5						
GWE-38	BPT-3						
GWE-39	BG-2						
GWE-40	BG-3						
GWE-41	LMP-1						
GWE-42	LMP-2						
GWE-43	LMP-3						
GWE-44	LMP-4						
GWE-45	LMP-5						
GWE-46	LMP-6						
GWE-47	LMP-7						
GWE-48	LMP-8						
GWE-49	LMP-9						

Monitoring Number	Database Number	Sampling Depth (m)	Ssampling Method B=Bailer S=Sampler P=Pump	Date sampled	Time Sampled	Waterlevel (m)	Comments
GWE-50	LMP-10						
GWE-51	LMP-11						
GWE-52	LMP-12						
GWE-53	LMP-13						
GWE-54	LMP-14						
GWE-55	LMP-15						
GWE-56	LMP-16						
GWE-57	LMP-17						
GWE-58	LMP-18						
GWE-59	LMP-19						
GWE-60	LMP-20						
GWE-61	LMP-21						
GWE-62	LMP-22						
GWE-63	LMP-23						
GWE-64	LMP-24						
GWE-65	LMP-25						
GWE-66	LMP-26						
GWE-67	LMP-27						
GWE-68	LMP-28						
GWE-69	LMP-29						
GWE-70	LMP-30						
GWE-71	LMP-31						
GWE-72	LMP-32						
GWE-73	LMP-33						
GWE-74	LMP-34						
GWE-75	LMP-35						
GWE-76	LMP-36						
GWE-77	LMP-37						
GWE-78	LMP-38						
GWE-79	LMP-39						
GWE-80	LMP-40						
GWE-81	LMP-41						
GWE-82	LMP-42						
GWE-83	LMP-43						
GWE-84	LMP-44						
GWE-85	LMP-45						
GWE-86	LMP-46						
GWE-87	LMP-47						
GWE-88	LMP-48						
GWE-89	LMP-50						
GWE-90	LMP-3B						
GWE-91	LMP-21B						
GWE-92	LH-1						
GWE-93	LH-20						
GWE-94	LH-21						
GWE-95	LH-24						
GWE-96	LH-25						
GWE-97	LH-26						
GWE-98	LH-27						
GWE-99	LH-28						

ISCOR VANDERBIJLPARK MONITORING FIELD FORM
GROUND WATER MONITORING: EXTERNAL USERS

Monitoring Number	Database Number	Sampling Depth (m)	Sampling Method B=Bailer S=Sampler P=Pump	Date sampled	Time Sampled	Waterlevel (m)	Comments
GWE-100	LH-29						
GWE-101	LH-30						
GWE-102	LH-31						
GWE-103	LH-32						
GWE-104	LH-33						
GWE-105	LH-34						
GWE-106	LH-35						
GWE-107	LH-36						
GWE-108	LH-37						
GWE-109	LH-38						
GWE-110	LH-40						
GWE-111	LH-41						
GWE-112	LH-56						
GWE-113	LH-57						
GWE-114	LH-58A						
GWE-115	LH-59						
GWE-116	LH-62						
GWE-117	LH-63						
GWE-118	LH-64						
GWE-119	LH-65						
GWE-120	LH-66						
GWE-121	LH-67						
GWE-122	LH-68A						
GWE-123	LH-69A						
GWE-124	LH-70						
GWE-125	LH-71						
GWE-126	LH-72A						
GWE-127	LH-73						
GWE-128	LH-74						
GWE-129	LH-76						
GWE-130	LH-81						
GWE-131	LH-82						
GWE-132	LH-83						
GWE-133	LH-84						
GWE-134	LH-85						
GWE-135	LH-86A						
GWE-136	LH-87A						
GWE-137	LH-88						
GWE-138	LH-90						
GWE-139	LH-91A						
GWE-140	LH-93						
GWE-141	LH-94						
GWE-142	LH-95						
GWE-143	LH-96						
GWE-144	LH-97						
GWE-145	LH-98						
GWE-146	LH-99						
GWE-147	LH-100						
GWE-148	LH-101A						
GWE-149	LH-102						
GWE-150	LH-103						
GWE-151	LH-104						

ISCOR VANDERBIJLPARK MONITORING FIELD FORM
GROUND WATER MONITORING: EXTERNAL USERS

Monitoring Number	Database Number	Sampling Depth (m)	Sampling Method B=Bailer S=Sampler P=Pump	Date sampled	Time Sampled	Waterlevel (m)	Comments
GWE-152	LH-107						
GWE-153	LH-108						
GWE-154	LH-109A						
GWE-155	LH-110						
GWE-156	LH-111						
GWE-157	LH-113						
GWE-158	LH-114						
GWE-159	LH-115						
GWE-160	LH-116						
GWE-161	LH-117						
GWE-162	LH-118						
GWE-163	LH-119						
GWE-164	LH-120						
GWE-165	LH-122						
GWE-166	LH-123						
GWE-167	LH-124						
GWE-168	LH-126						
GWE-169	LH-127A						
GWE-170	LH-128						
GWE-171	LH-129						
GWE-172	LH-130						
GWE-173	LH-131A						
GWE-174	LH-132						
GWE-175	LH-133						
GWE-176	LH-134						
GWE-177	LH-135						
GWE-178	LH-136						
GWE-179	LH-138						
GWE-180	LH-139						
GWE-181	LH-140						
GWE-182	LH-141A						
GWE-183	LH-58B						
GWE-184	LH-68B						
GWE-185	LH-69B						
GWE-186	LH-72B						
GWE-187	LH-86B						
GWE-188	LH-87B						
GWE-189	LH-91B						
GWE-190	LH-101B						
GWE-191	LH-109B						
GWE-192	LH-127B						
GWE-193	LH-131B						
GWE-194	LH-133B						
GWE-195	LH-141B						
GWE-196	LH-69C						
GWE-197	LH-61C						
GWE-198	LH-62C						
GWE-199	LH-69C						
GWE-200	LH-70C						
GWE-201	LH-101C						

Monitoring Number	Database Number	Sampling Depth (m)	Ssampling Method B=Bailer S=Sampler P=Pump	Date sampled	Time Sampled	Waterlevel (m)	Comments
GWE-202	LR-1						
GWE-203	LR-2						
GWE-204	LR-3						
GWE-205	LR-4						
GWE-206	LR-5						
GWE-207	LR-6						
GWE-208	LR-7						
GWE-209	LR-8						
GWE-210	LR-9						
GWE-211	LR-10						
GWE-212	LR-11						
GWE-213	LR-12						
GWE-214	LR-13						
GWE-215	LR-14						
GWE-216	LR-15						
GWE-217	LR-16						
GWE-218	LR-17						
GWE-219	LR-18						
GWE-220	LR-19						
GWE-221	LR-20						
GWE-222	LR-21						
GWE-223	LR-22						
GWE-224	LR-23						
GWE-225	LR-24						
GWE-226	LR-25						
GWE-227	LR-26						
GWF-228	LR-27						
GWE-229	LR-28						
GWE-230	LR-29						
GWE-231	LR-30						
GWE-232	LR-31						
GWE-233	LR-32						
GWE-234	LR-33						
GWE-235	LR-34						
GWE-236	LR-35						
GWE-237	LR-36						
GWE-238	LR-37						
GWE-239	LR-38						
GWE-240	LR-39						
GWE-241	LR-40						
GWE-242	LR-41A						
GWE-243	LR-42						
GWE-244	LR-43						
GWE-245	LR-44						
GWE-246	LR-45A						
GWE-247	LR-46A						
GWE-248	LR-47						
GWE-249	LR-48A						
GWE-250	LR-49						
GWE-251	LR-50A						
GWE-252	LR-51						
GWE-253	LR-52						

ISCOR VANDERBIJLPARK MONITORING FIELD FORM
GROUND WATER MONITORING: EXTERNAL USERS

Monitoring Number	Database Number	Sampling Depth (m)	Ssampling Method B=Bailer S=Sampler P=Pump	Date sampled	Time Sampled	Waterlevel (m)	Comments
GWE-254	LR-53						
GWE-255	LR-54						
GWE-256	LR-55						
GWE-257	LR-56						
GWE-258	LR-57						
GWE-259	LR-58A						
GWE-260	LR-59						
GWE-261	LR-60						
GWE-262	LR-61						
GWE-263	LR-62						
GWE-264	LR-63						
GWE-265	LR-64						
GWE-266	LR-65						
GWE-267	LR-66						
GWE-268	LR-67						
GWE-269	LR-68A						
GWE-270	LR-69						
GWE-271	LR-70						
GWE-272	LR-71A						
GWE-273	LR-72A						
GWE-274	LR-73A						
GWE-275	LR-74						
GWE-276	LR-75						
GWE-277	LR-76						
GWE-278	LR-77						
GWE-279	LR-78						
GWE-280	LR-79						
GWE-281	LR-80						
GWE-282	LR-81						
GWE-283	LR-82						
GWE-284	LR-83						
GWE-285	LR-84						
GWE-286	LR-85						
GWE-287	LR-86						
GWE-288	LR-87						
GWE-289	LR-88						
GWE-290	LR-89						
GWE-291	LR-90						
GWE-292	LR-91						
GWE-293	LR-92						
GWE-294	LR-93						
GWE-295	LR-94						
GWE-296	LR-95						
GWE-297	LR-96						
GWE-298	LR-97						
GWE-299	LR-98						
GWE-300	LR-99						
GWE-301	LR-100						
GWE-302	LR-101						
GWE-303	LR-102						
GWE-304	LR-103						
GWE-305	LR-104						

ISCOR VANDERBIJLPARK MONITORING FIELD FORM
GROUND WATER MONITORING: EXTERNAL USERS

Monitoring Number	Database Number	Sampling Depth (m)	Sampling Method B=Bailer S=Sampler P=Pump	Date sampled	Time Sampled	Waterlevel (m)	Comments
GWE-306	LR-105						
GWE-307	LR-106						
GWE-308	LR-107						
GWE-309	LR-108						
GWE-310	LR-109						
GWE-311	LR-110						
GWE-312	LR-111						
GWE-313	LR-112						
GWE-314	LR-113						
GWE-315	LR-114						
GWE-316	LR-115						
GWE-317	LR-116						
GWE-318	LR-117						
GWE-319	LR-118						
GWE-320	LR-119						
GWE-321	LR-120						
GWE-322	LR-121						
GWE-323	LR-122						
GWE-324	LR-126						
GWE-325	LR-130						
GWE-326	LR-131						
GWE-327	LR-133						
GWE-328	LR-134						
GWE-329	LR-135						
GWE-330	LR-136						
GWE-331	LR-137						
GWE-332	LR-138						
GWE-333	LR-140						
GWE-334	LR-141A						
GWE-335	LR-142						
GWE-336	LR-143A						
GWE-337	LR-145						
GWE-338	LR-146						
GWE-339	LR-147						
GWE-340	LR-148						
GWE-341	LR-149						
GWE-342	LR-150						
GWE-343	LR-151						
GWE-344	LR-153						
GWE-345	LR-154						
GWE-346	LR-155						
GWE-347	LR-156A						
GWE-348	LR-157						
GWE-349	LR-158						
GWE-350	LR-159						
GWE-351	LR-161						
GWE-352	LR-162						
GWE-353	LR-163						
GWE-354	LR-164						
GWE-355	LR-165						
GWE-356	LR-167						
GWE-357	LR-168						

Monitoring Number	Database Number	Sampling Depth (m)	Sampling Method B=Bailer S=Sampler P=Pump	Date sampled	Time Sampled	Waterlevel (m)	Comments
GWE-358	LR-169						
GWE-359	LR-172						
GWE-360	LR-173						
GWE-361	LR-174						
GWE-362	LR-176						
GWE-363	LR-177						
GWE-364	LR-178A						
GWE-365	LR-6B						
GWE-366	LR-12B						
GWE-367	LR-14B						
GWE-368	LR-41B						
GWE-369	LR-41C						
GWE-370	LR-41D						
GWE-371	LR-46B						
GWE-372	LR-48B						
GWE-373	LR-48C						
GWE-374	LR-50B						
GWE-375	LR-58B						
GWE-376	LR-68B						
GWE-377	LR-71B						
GWE-378	LR-72B						
GWE-379	LR-72D						
GWE-380	LR-73B						
GWE-381	LR-73C						
GWE-382	LR-92B						
GWE-383	LR-94B						
GWE-384	LR-108B						
GWE-385	LR-119B						
GWE-386	LR-141B						
GWE-387	LR-143B						
GWE-388	LR-156B						
GWE-389	LR-167B						
GWE-390	LR-178B						
GWE-391	RH-2						
GWE-392	RH-3						
GWE-393	RH-4						
GWE-394	RH-5						
GWE-395	RH-6						
GWE-396	RH-7						
GWE-397	RH-10						
GWE-398	RH-12						
GWE-399	RH-13						
GWE-400	RH-14						
GWE-401	RH-15						
GWE-402	RH-16						
GWE-403	RH-17						
GWE-404	RH-18						
GWE-405	RH-19						
GWE-406	RH-20						

ISCOR VANDERBIJLPARK MONITORING FIELD FORM
GROUND WATER MONITORING: EXTERNAL USERS

Monitoring Number	Database Number	Sampling Depth (m)	Sampling Method B=Bailer S=Sampler P=Pump	Date sampled	Time Sampled	Waterlevel (m)	Comments
GWE-407	RH-21						
GWE-408	RH-22						
GWE-409	RH-23						
GWE-410	RH-24						
GWE-411	RH-25						
GWE-412	RH-26						
GWE-413	RH-27						
GWE-414	RH-28						
GWE-415	RH-29						
GWE-416	RH-30						
GWE-417	RH-32						
GWE-418	RH-33						
GWE-419	RH-37						
GWE-420	RH-38						
GWE-421	RH-39						
GWE-422	RH-40						
GWE-423	RH-42						
GWE-424	RH-43						
GWE-425	RH-44						
GWE-426	RH-46						
GWE-427	CP-1						
GWE-428	RH-46B						
GWE-429	VBP-1						
GWE-430	VBP-2						
GWE-431	VBP-3						
GWE-432	VBP-4						
GWE-433	VBP-5						
GWE-434	VBP-6						
GWE-435	VBP-7						
GWE-436	VBP-8						
GWE-437	VBP-9						
GWE-438	VBP-10						
GWE-439	VBP-11						
GWE-440	VBP-12						
GWE-441	VBP-13						
GWE-442	VBP-14						
GWE-443	VBP-15						
GWE-444	VBP-16						
GWE-445	VBP-17						
GWE-446	VBP-18						
GWE-447	VBP-19						
GWE-448	VBP-20						
GWE-449	VBP-21						
GWE-450	VBP-22						
GWE-451	VBP-23						
GWE-452	VBP-24						
GWE-453	VBP-25						
GWE-454	VBP-26						
GWE-455	VBP-27						

ISCOR VANDERBIJLPARK MONITORING FIELD FORM
GROUND WATER MONITORING: EXTERNAL USERS

Monitoring Number	Database Number	Sampling Depth (m)	Sampling Method B=Bailer S=Sampler P=Pump	Date sampled	Time Sampled	Waterlevel (m)	Comments
GWE-456	VBP-28						
GWE-457	VBP-29						
GWE-458	VBP-30						
GWE-459	VBP-31						
GWE-460	VBP-32						
GWE-461	VBP-33						
GWE-462	VBP-34						
GWE-463	VBP-35						
GWE-464	VBP-36						
GWE-465	VBP-37						
GWE-466	VBP-38						
GWE-467	VBP-39						
GWE-468	VBP-40						
GWE-469	VBP-41						
GWE-470	VBP-42						
GWE-471	VBP-43						
GWE-472	VBP-44						
GWE-473	VBP-45						
GWE-474	VBP-46						
GWE-475	VBP-47						
GWE-476	VBP-48						
GWE-477	VBP-49						
GWE-478	VBP-50						
GWE-479	VBP-51						
GWE-480	VBP-52						
GWE-481	VBP-53						
GWE-482	VBP-54						
GWE-483	VBP-55						
GWE-484	VBP-56						
GWE-485	VBP-57						
GWE-486	VBP-58						
GWE-487	VBP-59						
GWE-488	VBP-60						
GWE-489	VBP-61						
GWE-490	VBP-62						
GWE-491	SP1						
GWE-492	SP2						
GWE-493	SP3						
GWE-494	SP4						
GWE-495	SP5						
GWE-496	SP6						
GWE-497	SP6B						
GWE-498	SV-1						
GWE-499	SV-2						
GWE-500	SV-3A						
GWE-501	SV-4						
GWE-502	SV-5						
GWE-503	SV-6						
GWE-504	SV-7						

ISCOR VANDERBIJLPARK MONITORING FIELD FORM
GROUND WATER MONITORING: EXTERNAL USERS

Monitoring Number	Database Number	Sampling Depth (m)	Sampling Method B=Bailer S=Sampler P=Pump	Date sampled	Time Sampled	Waterlevel (m)	Comments
GWE-505	SV-8A						
GWE-506	SV-9						
GWE-507	SV-10A						
GWE-508	SV-11						
GWE-509	SV-12						
GWE-510	SV-13						
GWE-511	SV-14						
GWE-512	SV-15						
GWE-513	SV-16						
GWE-514	SV-17A						
GWE-515	SV-18A						
GWE-516	SV-19A						
GWE-517	SV-20						
GWE-518	SV-21						
GWE-519	SV-22						
GWE-520	SV-24						
GWE-521	SV-25						
GWE-522	SV-26						
GWE-523	SV-27						
GWE-524	SV-28A						
GWE-525	SV-29A						
GWE-526	SV-30						
GWE-527	SV-33						
GWE-528	SV-35						
GWE-529	SV-36						
GWE-530	SV-37						
GWE-531	SV-39						
GWE-532	SV-40						
GWE-533	SV-42						
GWE-534	SV-44						
GWE-535	SV-45A						
GWE-536	SV-46A						
GWE-537	SV-47						
GWE-538	SV-48						
GWE-539	SV-49						
GWE-540	SV-50						
GWE-541	SV-52						
GWE-542	SV-53						
GWE-543	SV-54						
GWE-544	SV-55A						
GWE-545	SV-56						
GWE-546	SV-57						
GWE-547	SV-58						
GWE-548	SV-59						
GWE-549	SV-60						
GWE-550	SV-61						
GWE-551	SV-62						
GWE-552	SV-63						
GWE-553	SV-64A						
GWE-554	SV-65A						

ISCOR VANDERBIJLPARK MONITORING FIELD FORM
GROUND WATER MONITORING: EXTERNAL USERS

Monitoring Number	Database Number	Sampling Depth (m)	Sampling Method B=Bailer S=Sampler P=Pump	Date sampled	Time Sampled	Waterlevel (m)	Comments
GWE-555	SV-66						
GWE-556	SV-67						
GWE-557	SV-68A						
GWE-558	SV-69						
GWE-559	SV-3B						
GWE-560	SV-8B						
GWE-561	SV-10B						
GWE-562	SV-17B						
GWE-563	SV-18B						
GWE-564	SV-19B						
GWE-565	SV-28B						
GWE-566	SV-29B						
GWE-567	SV-45B						
GWE-568	SV-46B						
GWE-571	SV-55B						
GWE-572	SV-64B						
GWE-573	SV-65B						
GWE-574	SV-67B						
GWE-575	SV-68B						
GWE-576	SV-68C						
GWEF-1	BPT-F1						

NR ON MAP	S_ HORIZON	DATE	TIME	WL	INORG STRAT	DEEP SURFACE VOC	DEEP STRAT VOC	DEEP START PAH	DEEP STRAT PHENOL	DEEP BOTTOM PAH	SHALLOW SURFACE VOC	SHALLOW STRAT PHENOL	COMMENTS
ARC- 1(S)	4												
ARC- 2(S)	3.5												
ARC-1(D)	14												
ARC-2(D)	20												
CAST- 1(S)	4												
CAST- 2(S)	5.3												
CAST-1(O)	15												
CAST-2(D)	19												
CENT- 1(S)	4.3												
CENT- 2(S)	4.8												
CENT- 3(S)													
CENT-1(D)	10												
CENT-2(D)	14												
CENT-3(D)	29												
CETP- 1(S)	3.5												
CETP- 2(S)	4												
CETP- 3(S)													
CETP-1(D)	22												
CETP-2(O)	24												
CETP-3(D)	16												
CMS- 1E(D)	22												
CMS- 1E(S)													
CMS- 2E(O)	38												
CMS- 2E(S)	4.75												
CMS- 3(O)	25												
CMS- 3(S)	DRY												
CMS- 4(D)	18												
CMS- 4(S)	4.4												
CMS- 5(D)	17												
CMS- 5(S)	3												
CO-1(O)	12												
CO-1(S)	2.5												
CO-2(D)	8												
CO-2(S)	4												
CO-3(D)	26												
CO-3(S)	3												

NR ON MAP	S_HORIZON N	DATE	TIME	WL	INORG STRAT	DEEP SURFACE VOC	DEEP STRAT VOC	DEEP START PAH	DEEP STRAT PHENOL	DEEP BOTTOM PAH	SHALLOW SURFACE VOC	SHALLOW STRAT PHENOL	COMMENTS
DIA-1(D)	25												
DIA-1(S													
DIA-2(D)	24												
DIA-2(S	4.5												
DR- 1(D)	25												
DR- 1(S)	4												
DR- 3(D)	7												
DR- 3(S)	3.5												
DR- 4(D)	18												
DR- 4(S)	3.5												
EAF- 1(S)	4												
EAF-1(D)	30												
FD- 1(D)	31												
FD- 1(S)	4												
FD- 2(D)	19												
FD- 2(S)	3.5												
FD- 3(D)	8												
FD- 3(S)													
FD- 4(D)	19												
FD- 4(S)													
FD- 5(D)	25												
FD- 5(S)													
FD- 6(D)													
FD- 6(S)	4												
FD- 7(D)	25												
FD- 7(S)													
FD- 8(D)	23												
FD- 8(S)													
FD- 9(D)	23												
FD- 9(S)	5												
FD-10(D)	18												
FD-10(S)													
FD-11(D)	29												
FD-11(S)	3												
FD-12(D)	23												
FD-12(S)	4.2												

NR ON MAP	S_ HORIZON	DATE	TIME	WL	INORG STRAT	DEEP SURFACE VOC	DEEP STRAT VOC	DEEP START PAH	DEEP STRAT PHENOL	DEEP BOTTOM PAH	SHALLOW SURFACE VOC	SHALLOW STRAT PHENOL	COMMENTS
FD-13(D)	19												
FD-13(S)	4												
FD-14(D)	26												
FD-14(S)	4												
FD-15(D)	28												
FD-15(S)	3.5												
FD-16(D)	7												
FD-16(S)	3.5												
FD-17(D)	28												
FD-17(S)	3.5												
FD-18(D)	31												
FD-18(S)	3												
FD-19(D)	25												
FD-19(S)	3.1												
FD-20(D)	26												
FD-20(S)	3.3												
FD-21(D)	29												
FD-21(S)	3												
FD-22(D)	30												
FD-22(S)	3												
FD-23(D)	30												
FD-23(S)													
GEO-1(D)	32												
GEO-2(D)	26												
GEO-3(D)	30												
GEO-4(D)	17												
GEO-5(D)	29												
GEO-6(D)	26												
GEO-7(D)	17												
GEO-8(D)	30												
HMS- 2(D)	17												
HMS- 2(S)													
HMS- 4EP(D)	36												
HMS- 4EP(S)													
HMS- 5(D)	36												
HMS- 5(S)	4.25												

NR ON MAP	S_ HORIZON	DATE	TIME	WL	INORG STRAT	DEEP SURFACE VOC	DEEP STRAT VOC	DEEP START PAH	DEEP STRAT PHENOL	DEEP BOTTOM PAH	SHALLOW SURFACE VOC	SHALLOW STRAT PHENOL	COMMENTS
HMS- 6(D)	17												
HMS- 6(S)	5.5												
HS- 1(D)	15												
HS- 1(S)													
HS- 2(D)	12												
HS- 2(S)													
HS- 3(D)	32												
HS- 3(S)	12												
HS- 4(D)	16												
HS- 4(S)													
HS- 5(D)	18												
HS- 5(S)	17												
HS- 6(D)	12												
HS- 6(S)													
HS- 7(D)	12												
HS- 7(S)	9												
HS- 8(D)	19												
HS- 8(S)	7												
HS- 9(D)	25												
HS- 9(S)	6.5												
HS-10(D)	27												
HS-10(S)	4												
HS-11(D)	17												
HS-11(S)	4												
HS-12(D)	26												
HS-12(S)	5												
HS-13(D)	10												
HS-13(S)	5												
HS-14(D)	16												
HS-14(S)	4												
IPD-1	28												
IPD-2	22												
IPD-3	24												
IPD-4	28												
IPD-5	18												
IPD-6	30												

NR ON MAP	S_HORIZON	DATE	TIME	WL	INORG STRAT	DEEP SURFACE VOC	DEEP STRAT VOC	DEEP START PAH	DEEP STRAT PHENOL	DEEP BOTTOM PAH	SHALLOW SURFACE VOC	SHALLOW STRAT PHENOL	COMMENTS
IPS-1	5												
IPS-2	7												
IPS-3	7												
IPS-4	DRY												
IPS-5	3												
IPS-6	11												
MP- 1(D)	28												
MP- 1(S)	3.5												
MP- 2(D)	34												
MP- 2(S)													
MSC- 1(D)	20												
MSC- 1(S)	3												
NW- 1(D)	28												
NW- 1(S)	5.5												
NW- 2(D)	26												
NW- 2(S)													
NW- 3(D)	18												
NW- 3(S)	4												
NW- 4(D)	22												
NW- 4(S)	4.5												
NW- 5(D)	32												
NW- 5(S)	3												
NW- 6(D)	28												
NW- 6(S)	3.6												
NW- 7(D)	32												
NW- 7(S)	3.5												
NW- 8(D)	22												
NW- 8(S)	2.5												
NW- 9(D)	23												
NW -9(S)	4												
P- 1(D)	25												
P- 1(S)	DRY												
P- 2(D)	34												
P- 2(S)	DRY												
P- 3(D)	16												
P- 3(S)	DRY												

NR ON MAP	S_HORIZON	DATE	TIME	WL	INORG STRAT	DEEP SURFACE VOC	DEEP STRAT VOC	DEEP START PAH	DEEP STRAT PHENOL	DEEP BOTTOM PAH	SHALLOW SURFACE VOC	SHALLOW STRAT PHENOL	COMMENTS
P- 4(D)	24												
P- 4(S)	4.6												
P- 5(D)	18												
P- 5(S)	3												
P- 6(D)													
P- 6(S)													
P- 7(D)	21												
P- 7(S)													
P- 8(D)	16												
P- 8(S)	4												
P- 9(D)	20.5												
P- 9(S)	4												
P-10(D)	15												
P-10(S)													
P-11(D)	13												
P-11(S)	3												
P-12(D)	24												
P-12(S)	4												
P-13(D)	25												
P-13(S)	4												
P-14(D)	19												
P-14(S)	3.45												
P-15(D)	20												
P-15(S)	DRY												
P-16(D)	25												
P-16(S)	4.25												
P-17(D)													
P-17(S)	30												
P-18(D)	32												
P-18(S)	4.5												
P-19(D)	33												
P-19(S)	4												
P-20(D)	13												
P-20(S)	5.5												
P-21(D)	24												
P-21(S)	4												

Draft for discussion
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Research for IVS

NR ON MAP	S_ HORIZON	DATE	TIME	WL	INORG STRAT	DEEP SURFACE VOC	DEEP STRAT VOC	DEEP START PAH	DEEP STRAT PHENOL	DEEP BOTTOM PAH	SHALLOW SURFACE VOC	SHALLOW STRAT PHENOL	COMMENTS
P-22(D)	24												
P-22S													
P-23(D)	19												
P-23(S)	DRY												
P-24(D)	25												
P-24(S)	4												
P-25(D)	19												
P-25(S)	DRY												
PL- 1(D)	17												
PL- 1(S)													
PL- 2(D)	19												
PL- 2(S)													
PL- 3(D)	35												
PL- 3(S)													
PL- 4(D)	21												
PL- 4(S)	4.5												
PL- 5(D)	17												
PL- 5S	3.5												
PL- 6(D)	26												
PL- 6(S)													
PL- 7(D)	18												
PL- 7S	DRY												
PL- 8(D)	20												
PL- 8S	DRY												
PL- 9(D)	22												
PL- 9(S)													
PL-10(D)	28												
PL-10(S)	4.82												
PL-11(D)	16												
PL-11(S)	4												
PL-12(D)	20												
PL-12(S)	5												
PL-13(D)	23												
PL-13(S)													
PL-14(D)	19												
PL-14(S)													

NR ON MAP	S_ HORIZON	DATE	TIME	WL	INORG STRAT	DEEP SURFACE VOC	DEEP STRAT VOC	DEEP START PAH	DEEP STRAT PHENOL	DEEP BOTTOM PAH	SHALLOW SURFACE VOC	SHALLOW STRAT PHENOL	COMMENTS
PL-15(D)	26												
PL-15(S)													
PL-16(D)	21												
PL-16(S)	3.5												
PL-17(D)	34												
PL-17(S)													
PL-18(D)	20												
PL-18(S)	4												
PL-19(D)	24												
PL-19(S)	3.5												
PL-20(D)	22												
PL-20(S)													
RT-1(D)													
RT-1(S)													
RT-2(D)	23												
RT-2(S)	DRY												
RT-3(D)	20												
RT-3(S)	4.5												
RT-4(D)	35												
RT-4(S)	5.2												
RT-5(D)	16												
RT-5(S)													
RT-7(D)	23												
RT-7(S)	5.4												
RT-8(D)	29												
RT-8(S)	5.38												
SC-2(D)													
SC-2(S)													
T- 1(D)	20												
T- 1(S)	3												
T- 3(D)	22												
T- 3(O)	2.5												
T- 3(O)	20												
T- 3(S)	3.5												
T- 5(D)	16												
T- 5(S)	3.5												

NR ON MAP	S_ HORIZON	DATE	TIME	WL	INORG STRAT	DEEP SURFACE VOC	DEEP STRAT VOC	DEEP START PAH	DEEP STRAT PHENOL	DEEP BOTTOM PAH	SHALLOW SURFACE VOC	SHALLOW STRAT PHENOL	COMMENTS
T- 6(D)	21												
T- 6(S)	7												
T- 8(D)	31												
T- 8(S)	3												
T-10(D)	33												
T-10(S)													
T-11(D)													
T-11(S)													
T-12(D)													
T-12(S)													
TETP- 1(S)	3												
TETP-1(D)	24												
TETP-2(D)	14												
TETP-2(S)													
TETP-3(D)	24												
TETP-3(S)													
TETP-4(D)	20												
TETP-4(S)	3												
TI- 1(D)	10												
TI- 2(D)	26												
TI- 3(D)	TAR												
TI- 4(D)	23												
TI- 5(D)	23												
TI- 6(D)	33												
TI- 7(D)	42												
TI- 8(D)	34												
TI- 9(D)	TAR												
TI-10(D)	20												
TI-11(D)	36												
TI-12(D)	30												
TI-13(D)	30												
TOM- 2(D)	24												
TOM- 2(S)	3.5												
TOM- 3(D)	24												
TOM- 3(S)	3.5												
TOM- 4(D)	22												
TOM- 4(S)	3												
TOM- 6(D)	31												
TOM- 6(S)	5.4												
TOM- 7(D)	21												
TOM- 7(S)	5												
YS- 1(S)	3												
YS- 2(S)	3.5												
YS- 1(D)	29												
YS- 2(D)	20												

ISCOR VANDERBIJLPARK MONITORING FIELD FORM
PLANT LIFE MONITORING

(Description of Physical environment)

Date:_____

Plot nr: _____   Coordinates   : Lat: _____

                                                       Long:_____

Locality: _____

Veld type: _____

Physiognomy (i.e.Grassland): _____

Dominant / common plant species: _____

Surface Erosion:_____
None (1) Plate erosion (2) Dongas (3)

Extent of trampling: _____
None (1) Medium (2) High (3)

Biotic influences: _____

_____

Notes:

ISCOR VANDERBIJLPARK MONITORING FIELD FORM
PLANT LIFE MONITORING

(Species List)

Plot nr:

Scientific Name	Common Name	Occurance	Status

Occurance:
r – one individual; + - uncommon, crown coverage (CC) <1%; 1 – common CC 1-5%; 2a - CC 5-12%; 2b - CC 12-25%; 3 - CC 25-50%;
4 – CC 50-75%; 5 – CC > 75%

ISCOR VANDERBIJLPARK MONITORING FIELD FORM
ANIMAL LIFE MONITORING

(Description of Physical environment)

Date:_____

Plot nr: _____   Coordinates   : Lat: _____

Long:_____

Locality: _____

Veld type: _____

Physiognomy (i.e.Grassland): _____

Dominant / common plant species: _____

Surface Erosion:_____
None (1) Plate erosion (2) Dongas (3)

Extent of trampling: _____
None (1) Medium (2) High (3)

Biotic influences: _____

_____

Notes:

(Species List)

Plot nr:

Scientific Name	Common Name	Status	Comments

APPENDIX III

LIST OF WATER QUALITY VARIABLES
TO BE ANALYZED FOR DURING EACH
SAMPLING RUN

Groundwater:

INORGANIC: *(Six-monthly)*

pH	Cl
EC	SO_4
TDS	NO_3
Ca	F
Mg	Al
Na	Fe
K	Mn
Si	Pb
T-Alk	NH_4
Zn	Cd
PO_4	Cr^{6+}
CN	

ORGANIC: *(Annually)*

VOC
Semi-VOC(includes PAH)

Surface water:
(RS: Weekly, LS: Two-weekly)

INORGANIC:

pH	Cl	Mn
EC	SO_4	Al
TDS	NO_3	Pb
Ca	F	Cr^{6+}
Mg	PO_4	
Na	CN	
K	Cd	
Si	Fe	
T-Alk	Zn	

SPECIAL:

Phenol

Air Buckets: *(Two-monthly)*

INORGANIC:

EC	SO_4
TDS	NO_3
Ca	F
Mg	Cl
Na	K
Mn	Zn
Cr	

Source Characterization:
Waste Streams - Solids/Sludge: (*Annual*)

INORGANIC		ORGANIC	SPECIAL
pH	Cl	VOC	TCLP/Acid Rain
EC	SO_4	Semi-VOC	
TDS	NO_3		
Ca	F		
Mg	Al		
Na	Fe		
K	Mn		
Si	Pb		
T-Alk	NH_4		
CN	Cr^{6+}		
Cd	Zn		

Source Characterization:
Liquids:

INORGANIC (*Quarterly*)		ORGANIC (*Six monthly*)
pH	Cl	VOC (List in APPENDIX III)
EC	SO_4	Semi-VOC (List APPENDIX III)
TDS	NO_3	
Ca	F	
Mg	Al	
Na	Fe	
K	Mn	
Si	Pb	
T-Alk	NH_4	
CN	Cr^{6+}	
Cd	Zn	

VOC & Semi-VOC consists of the following:

VOC	SVOC
Dichlorodifluoromethane	N-Nitrosodimethylamine
Vinyl chloride	bis(2-Chloroethyl)ether
Bromomethane	Phenol
Trichlorofluoromethane	2-Chlorophenol
1,1-Dichloroethene	1,3-Dichlorobenzene
Dichloromethane	1,4-Dichlorobenzene
trans-1,2-Dichloroethene	1,2-Dichlorobenzene
1,1-Dichloroethane	bis(2-chloroisopropyl)ether
cis-1,2-Dichloroethene	2-Methylphenol
2,2-Dichloropropane	Hexachloroethane
Bromochloromethane	N-Nitroso-di-n-propylamine
Chloroform	4-Methylphenol
1,1,1-Trichloroethane	Nitrobenzene
1,1-Dichloropropene	Isophorone
Carbon tetrachloride	2-Nitrophenol
1,2-Dichloroethane	2,4-Dimethylphenol
Benzene	bis(2-Chloroethoxy)methane
Trichloroethene	2,4-Dichlorophenol
1,2-Dichloropropane	1,2,4-Trichlorobenzene
Dibromomethane	Naphthalene
Bromodichloromethane	4-Chloroaniline
Toluene	Hexachlorobutadiene
1,1,2-Trichloroethane	4-Chloro-3-methylphenol
1,3-Dichloropropane	2-Methylnaphthalene
Tetrachloroethene	Hexachlorocyclopentadiene
Dibromochloromethane	2,4,6-Trichlorophenol
1,2-Dibromoethane	2,4,5-Trichlorophenol
Chlorobenzene	2-Chloronaphthalene
1,1,1,2-Tetrachloroethane	2-Nitroaniline
Ethylbenzene	Acenaphthylene
m,p-Xylene	Dimethylphthalate
o-Xylene	2,6-Dinitrotoluene
Styrene	Acenaphthene
Bromoform	3-Nitroaniline
Isopropylbenzene	2,4-Dinitrophenol
1,1,2,2-Tetrachloroethane	Dibenzofuran
1,2,3-Trichloropropane	2,4-Dinitrotoluene
Bromobenzene	4-Nitrophenol
n-propylbenzene	Fluorene
2-Chlorotoluene	4-Chlorophenyl-phenylether
1,3,5-Trimethylbenzene	Diethylphthalate
4-Chlorotoluene	4-Nitroaniline
tert-Butylbenzene	4,6-Dinitro-2-methylphenol
1,2,4-Trimethylbenzene	Azobenzene
sec-Butylbenzene	4-Bromophenyl-phenylether
4-Isopropyltoluene	Hexachlorobenzene
1,3-Dichlorobenzene	Pentachlorophenol
1,4-Dichlorobenzene	Phenanthrene
n-Butylbenzene	Anthracene
1,2-Dichlorobenzene	Carbazole
1,2-Dibromo-3-chloropropane	Di-n-butylphthalate
1,2,4-Trichlorobenzene	Fluoranthene
Hexachlorobutadiene	Pyrene
Naphthalene	Butylbenzylphthalate
1,2,3-Trichlorobenzene	Benzo[a]anthracene
	Chrysene
	bis(2-Ethylhexyl)phthalate
	Di-n-octylphthalate
	Benzo[b]+[k]fluoranthene
	Benzo[a]pyrene
	Indeno[1,2,3-cd]pyrene
	Dibenz[a,h]anthracene
	Benzo[g,h,i]perylene

APPENDIX IV

AQUABASE SITE IDENTIFICATION NUMBERS

DATA SET IV-1

Aquabase Site Identification Numbers for Source Characterization

WASTE STREAMS

Physical/Dry Chemical Analyses
Leachate Analyses

MONITORING NO:	DATABASE NO:	SITE ID NUMBER:
SCP-1	Vaaldam water treatment plant	2627DB00001
SCP-2	Candy water treatment plant	2627DB00002
SCP-3	Sinter CG100	2627DB00003
SCP-4	Coke oven (Brikketplant)	2627DB00004
SCP-5	Foundary (casting)	2627DB00005
SCP-6	DR oven	2627DB00006
SCP-7	DR material	2627DB00007
SCP-8	DR product separation	2627DB00008
SCP-9	DR product separation	2627DB00009
SCP-10	DR product separation	2627DB00010
SCP-11	DR oven	2627DB00011
SCP-12	EAF	2627DB00012
SCP-13	EAF ladle furnace no1	2627DB00013
SCP-14	EAF ladle furnace no2	2627DB00014
SCP-15	EAF Hecketts plant 85	2627DB00015
SCP-16	Blast furnace C	2627DB00016
SCP-17	Blast furnace D	2627DB00017
SCP-18	Blast furnace C & D	2627DB00018
SCP-19	Blast furnace hecketts plant 72	2627DB00019
SCP-20	Blast furnace	2627DB00020
SCP-21	Blast furnace C	2627DB00021
SCP-22	Blast furnace D	2627DB00022
SCP-23	BOF secondary Oos & Wes	2627DB00023
SCP-24	BOF secondary no3 de-gassing	2627DB00024
SCP-25	BOF MUD	2627DB00025
SCP-26	BOF GRID	2627DB00026
SCP-27	"BOF1,2,3 SLAG"	2627DB00027
SCP-28	Blast furnace C (tap vloer)	2627DB00028

Effluent Analyses

MONITORING NO:	DATABASE NO:	SITE ID NUMBER:
SCE-1	Dam1-4	2627DB00001
SCE-2	Dam10	2627DB00005
SCE-3	MP1	2627DB00006
SCE-4	MP2	2627DB00007
SCE-5	MP3	2627DB00008
SCE-6	CETP	2627DB00009
SCE-7	Kiewiet Qu	2627DB00013
SCE-8	TETP DAM	2627DB00014
SCE-9	TETP D2	2627DB00015

Seepage Analyses

MONITORING NO:	DATABASE NO:	SITE ID NUMBER:
SCS-1	SINTER MIXING BED - Burnes Mem	2627DB00001
SCS-2	CETP OLD SLUDGE DAMS	2627DB00002
SCS-3	HATTINGH CANAL (TOP)	2627DB00003
SCS-4	COAL STACKING AREA	2627DB00004
SCS-5	CETP SLUDGE DAMS - CANAL	2627DB00005
SCS-6	VAALDAM CANAL	2627DB00006
SCS-7	NWAK	2627DB00007
SCS-8	HECKETTS/STEELSERV	2627DB00008
SCS-9	HECKETTS SLAG COOLING	2627DB00009
SCS-10	DU PREEZ CORNER	2627DB00010
SCS-11	DAM1-4 - SEEPAGE CANAL	2627DB00011
SCS-12	MP PONDS - SEEPAGE CANAL	2627DB00012

DATA SET IV-2

Aquabase Site Identification Numbers for Meteorology

Meteorology Monitoring Localities

MAP NO:	DATABASE NO:	SITE ID NUMBER:
MG-1	WEERSTASIE 1	2627DB00001
MG-2	WEERSTASIE 2	2627DB00002
MG-3	RAINFALL	2627DB00003
MG-4	STEELSERV SUMP	2627DB00004
MG-5	NORTH WORKS	2627DB00005
MG-6	TETP	2627DB00006
MG-7	DU PREEZ DAM	2627DB00007
MG-8	VAAL DAM CLARIFICATI	2627DB00008
MG-9	ENIVIRONMENTAL MANAG	2627DB00009
MG-10	Leeuspruit Sump	2627DB00010

DATA SET IV-3

Aquabase Site Identification Numbers for Ground Water

GROUND WATER

External Users (GWE)

Drakeville:

MAP NO:	DATABASE NO:	SITE ID NUMBER:
GWE-1	DV-2A	2627DB20002
GWE-2	DV-3	2627DB20003
GWE-3	DV-4	2627DB20001
GWE-4	DV-5	2627DB20005
GWE-5	DV-6	2627DB20006
GWE-6	DV-7	2627DB20007
GWE-7	DV-8	2627DB20008
GWE-8	DV-9	2627DB20009
GWE-9	DV-10	2627DB20010
GWE-10	DV-11	2627DB20011
GWE-11	DV-12	2627DB20012
GWE-12	DV-13	2627DB20013
GWE-13	DV-14	2627DB20014
GWE-14	DV-2B	2627DB21002

Cyferpan:

MAP NO:	DATABASE NO:	SITE ID NUMBER:
GWE-15	RKL-D1	2627DB90002
GWE-16	RKL-D2	2627DB90003
GWE-17	RKL-D3	2627DB90004
GWE-18	WEERSTAS	2627DB90005
GWE-19	VAALDAM	2627DB90006
GWE-20	BH-D	2627DB90007
GWE-21	RL-1	2627DB90008
GWE-22	RS-1	2627DB90009
GWE-23	CP-6/1	2627DB90010
GWE-24	CP-7/1	2627DB90011
GWE-25	CP-7/2	2627DB90012
GWE-26	CP-7/3	2627DB90013
GWE-27	CP-8/1	2627DB90014
GWE-28	CP-10/1	2627DB90015
GWE-29	CP-10/2	2627DB90016
GWE-30	CP-11/1	2627DB90017
GWE-31	CP-11/2	2627DB90018
GWE-32	CP-16/1	2627DB90019

MAP NO:	DATABASE NO:	SITE ID NUMBER:
GWE-33	QF-1	2627DB90020
GWE-34	QF-2	2627DB90021
GWE-35	QF-3	2627DB90022
GWE-36	QF-4	2627DB90023
GWE-37	QF-5	2627DB90024
GWE-38	BPT-3	2627DB91001
GWE-39	BG-2	2627DB91003
GWE-40	BG-3	2627DB91004

Lamont Park:

MAP NO:	DATABASE NO:	SITE ID NUMBER:
GWE-41	LMP-1	2627DB70001
GWE-42	LMP-2	2627DB70002
GWE-43	LMP-3	2627DB70003
GWE-44	LMP-4	2627DB70004
GWE-45	LMP-5	2627DB70005
GWE-46	LMP-6	2627DB70006
GWE-47	LMP-7	2627DB70007
GWE-48	LMP-8	2627DB70008
GWE-49	LMP-9	2627DB70009
GWE-50	LMP-10	2627DB70010
GWE-51	LMP-11	2627DB70011
GWE-52	LMP-12	2627DB70012
GWE-53	LMP-13	2627DB70013
GWE-54	LMP-14	2627DB70014
GWE-55	LMP-15	2627DB70015
GWE-56	LMP-16	2627DB70016
GWE-57	LMP-17	2627DB70017
GWE-58	LMP-18	2627DB70018
GWE-59	LMP-19	2627DB70019
GWE-60	LMP-20	2627DB70020
GWE-61	LMP-21	2627DB70021
GWE-62	LMP-22	2627DB70022
GWE-63	LMP-23	2627DB70023
GWE-64	LMP-24	2627DB70024
GWE-65	LMP-25	2627DB70025
GWE-66	LMP-26	2627DB70026
GWE-67	LMP-27	2627DB70027
GWE-68	LMP-28	2627DB70028
GWE-69	LMP-29	2627DB70029
GWE-70	LMP-30	2627DB70030

MAP NO.	DATABASE NO.	SITE ID NUMBER
GWE-71	LMP-31	2627DB70031
GWE-72	LMP-32	2627DB70032
GWE-73	LMP-33	2627DB70033
GWE-74	LMP-34	2627DB70034
GWE-75	LMP-35	2627DB70035
GWE-76	LMP-36	2627DB70036
GWE-77	LMP-37	2627DB70037
GWE-78	LMP-38	2627DB70038
GWE-79	LMP-39	2627DB70039
GWE-80	LMP-40	2627DB70040
GWE-81	LMP-41	2627DB70041
GWE-82	LMP-42	2627DB70042
GWE-83	LMP-43	2627DB70043
GWE-84	LMP-44	2627DB70044
GWE-85	LMP-45	2627DB70045
GWE-86	LMP-46	2627DB70046
GWE-87	LMP-47	2627DB70047
GWE-88	LMP-48	2627DB70048
GWE-89	LMP-50	2627DB70050
GWE-90	LMP-3B	2627DB71003
GWE-91	LMP-21B	2627DB71021

Linkholm:

GWE-92	LH-1	2627DB30001
GWE-93	LH-20	2627DB30020
GWE-94	LH-21	2627DB30021
GWE-95	LH-24	2627DB30024
GWE-96	LH-25	2627DB30025
GWE-97	LH-26	2627DB30026
GWE-98	LH-27	2627DB30027
GWE-99	LH-28	2627DB30028
GWE-100	LH-29	2627DB30029
GWE-101	LH-30	2627DB30030
GWE-102	LH-31	2627DB30031
GWE-103	LH-32	2627DB30032
GWE-104	LH-33	2627DB30033
GWE-105	LH-34	2627DB30034
GWE-106	LH-35	2627DB30035
GWE-107	LH-36	2627DB30036
GWE-108	LH-37	2627DB30037
GWE-109	LH-38	2627DB30038
GWE-110	LH-40	2627DB30040
GWE-111	LH-41	2627DB30041

MAP NO:	DATABASE NO:	SITE ID NUMBER:
GWE-112	LH-56	2627DB30056
GWE-113	LH-57	2627DB30057
GWE-114	LH-58A	2627DB30058
GWE-115	LH-59	2627DB30059
GWE-116	LH-62	2627DB30062
GWE-117	LH-63	2627DB30063
GWE-118	LH-64	2627DB30064
GWE-119	LH-65	2627DB30065
GWE-120	LH-66	2627DB30066
GWE-121	LH-67	2627DB30067
GWE-122	LH-68A	2627DB30068
GWE-123	LH-69A	2627DB30069
GWE-124	LH-70	2627DB30070
GWE-125	LH-71	2627DB30071
GWE-126	LH-72A	2627DB30072
GWE-127	LH-73	2627DB30073
GWE-128	LH-74	2627DB30074
GWE-129	LH-76	2627DB30076
GWE-130	LH-81	2627DB30081
GWE-131	LH-82	2627DB30082
GWE-132	LH-83	2627DB30083
GWE-133	LH-84	2627DB30084
GWE-134	LH-85	2627DB30085
GWE-135	LH-86A	2627DB30086
GWE-136	LH-87A	2627DB30087
GWE-137	LH-88	2627DB30088
GWE-138	LH-90	2627DB30090
GWE-139	LH-91A	2627DB30091
GWE-140	LH-93	2627DB30093
GWE-141	LH-94	2627DB30094
GWE-142	LH-95	2627DB30095
GWE-143	LH-96	2627DB30096
GWE-144	LH-97	2627DB30097
GWE-145	LH-98	2627DB30098
GWE-146	LH-99	2627DB30099
GWE-147	LH-100	2627DB30100
GWE-148	LH-101A	2627DB30101
GWE-149	LH-102	2627DB30102
GWE-150	LH-103	2627DB30103
GWE-151	LH-104	2627DB30104
GWE-152	LH-107	2627DB30107
GWE-153	LH-108	2627DB30108
GWE-154	LH-109A	2627DB30109
GWE-155	LH-110	2627DB30110

MAP NO:	DATABASE NO:	SITE ID NUMBER:
GWE-156	LH-111	2627DB30111
GWE-157	LH-113	2627DB30113
GWE-158	LH-114	2627DB30114
GWE-159	LH-115	2627DB30115
GWE-160	LH-116	2627DB30116
GWE-161	LH-117	2627DB30117
GWE-162	LH-118	2627DB30118
GWE-163	LH-119	2627DB30119
GWE-164	LH-120	2627DB30120
GWE-165	LH-122	2627DB30122
GWE-166	LH-123	2627DB30123
GWE-167	LH-124	2627DB30124
GWE-168	LH-126	2627DB30126
GWE-169	LH-127A	2627DB30127
GWE-170	LH-128	2627DB30128
GWE-171	LH-129	2627DB30129
GWE-172	LH-130	2627DB30130
GWE-173	LH-131A	2627DB30131
GWE-174	LH-132	2627DB30132
GWE-175	LH-133	2627DB30133
GWE-176	LH-134	2627DB30134
GWE-177	LH-135	2627DB30135
GWE-178	LH-136	2627DB30136
GWE-179	LH-138	2627DB30138
GWE-180	LH-139	2627DB30139
GWE-181	LH-140	2627DB30140
GWE-182	LH-141A	2627DB30141
GWE-183	LH-58B	2627DB31058
GWE-184	LH-68B	2627DB31068
GWE-185	LH-69B	2627DB31069
GWE-186	LH-72B	2627DB31072
GWE-187	LH-86B	2627DB31086
GWE-188	LH-87B	2627DB31087
GWE-189	LH-91B	2627DB31091
GWE-190	LH-101B	2627DB31101
GWE-191	LH-109B	2627DB31109
GWE-192	LH-127B	2627DB31127
GWE-193	LH-131B	2627DB31131
GWE-194	LH-133B	2627DB31133
GWE-195	LH-141B	2627DB31141
GWE-196	LH-69C	2627DB31169
GWE-197	LH-61C	2627DB32061
GWE-198	LH-62C	2627DB32062
GWE-199	LH-69C	2627DB32069

MAP NO:	DATABASE NO:	SITE ID NUMBER:
GWE-200	LH-70C	2627DB32070
GWE-201	LH-101C	2627DB32101

Louisrus:

GWE-202	LR-1	2627DB10001
GWE-203	LR-2	2627DB10002
GWE-204	LR-3	2627DB10003
GWE-205	LR-4	2627DB10004
GWE-206	LR-5	2627DB10005
GWE-207	LR-6	2627DB10006
GWE-208	LR-7	2627DB10007
GWE-209	LR-8	2627DB10008
GWE-210	LR-9	2627DB10009
GWE-211	LR-10	2627DB10010
GWE-212	LR-11	2627DB10011
GWE-213	LR-12	2627DB10012
GWE-214	LR-13	2627DB10013
GWE-215	LR-14	2627DB10014
GWE-216	LR-15	2627DB10015
GWE-217	LR-16	2627DB10016
GWE-218	LR-17	2627DB10017
GWE-219	LR-18	2627DB10018
GWE-220	LR-19	2627DB10019
GWE-221	LR-20	2627DB10020
GWE-222	LR-21	2627DB10021
GWE-223	LR-22	2627DB10022
GWE-224	LR-23	2627DB10023
GWE-225	LR-24	2627DB10024
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GWE-227	LR-26	2627DB10026
GWE-228	LR-27	2627DB10027
GWE-229	LR-28	2627DB10028
GWE-230	LR-29	2627DB10029
GWE-231	LR-30	2627DB10030
GWE-232	LR-31	2627DB10031
GWE-233	LR-32	2627DB10032
GWE-234	LR-33	2627DB10033
GWE-235	LR-34	2627DB10034
GWE-236	LR-35	2627DB10035
GWE-237	LR-36	2627DB10036
GWE-238	LR-37	2627DB10037
GWE-239	LR-38	2627DB10038
GWE-240	LR-39	2627DB10039

MAP NO:	DATABASE NO:	SITE ID NUMBER:
GWE-241	LR-40	2627DB10040
GWE-242	LR-41A	2627DB10041
GWE-243	LR-42	2627DB10042
GWE-244	LR-43	2627DB10043
GWE-245	LR-44	2627DB10044
GWE-246	LR-45A	2627DB10045
GWE-247	LR-46A	2627DB10046
GWE-248	LR-47	2627DB10047
GWE-249	LR-48A	2627DB10048
GWE-250	LR-49	2627DB10049
GWE-251	LR-50A	2627DB10050
GWE-252	LR-51	2627DB10051
GWE-253	LR-52	2627DB10052
GWE-254	LR-53	2627DB10053
GWE-255	LR-54	2627DB10054
GWE-256	LR-55	2627DB10055
GWE-257	LR-56	2627DB10056
GWE-258	LR-57	2627DB10057
GWE-259	LR-58A	2627DB10058
GWE-260	LR-59	2627DB10059
GWE-261	LR-60	2627DB10060
GWE-262	LR-61	2627DB10061
GWE-263	LR-62	2627DB10062
GWE-264	LR-63	2627DB10063
GWE-265	LR-64	2627DB10064
GWE-266	LR-65	2627DB10065
GWE-267	LR-66	2627DB10066
GWE-268	LR-67	2627DB10067
GWE-269	LR-68A	2627DB10068
GWE-270	LR-69	2627DB10069
GWE-271	LR-70	2627DB10070
GWE-272	LR-71A	2627DB10071
GWE-273	LR-72A	2627DB10072
GWE-274	LR-73A	2627DB10073
GWE-275	LR-74	2627DB10074
GWE-276	LR-75	2627DB10075
GWE-277	LR-76	2627DB10076
GWE-278	LR-77	2627DB10077
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GWE-280	LR-79	2627DB10079
GWE-281	LR-80	2627DB10080
GWE-282	LR-81	2627DB10081
GWE-283	LR-82	2627DB10082
GWE-284	LR-83	2627DB10083

MAP NO:	DATABASE NO:	SITE ID NUMBER:
GWE-285	LR-84	2627DB10084
GWE-286	LR-85	2627DB10085
GWE-287	LR-86	2627DB10086
GWE-288	LR-87	2627DB10087
GWE-289	LR-88	2627DB10088
GWE-290	LR-89	2627DB10089
GWE-291	LR-90	2627DB10090
GWE-292	LR-91	2627DB10091
GWE-293	LR-92	2627DB10092
GWE-294	LR-93	2627DB10093
GWE-295	LR-94	2627DB10094
GWE-296	LR-95	2627DB10095
GWE-297	LR-96	2627DB10096
GWE-298	LR-97	2627DB10097
GWE-299	LR-98	2627DB10098
GWE-300	LR-99	2627DB10099
GWE-301	LR-100	2627DB10100
GWE-302	LR-101	2627DB10101
GWE-303	LR-102	2627DB10102
GWE-304	LR-103	2627DB10103
GWE-305	LR-104	2627DB10104
GWE-306	LR-105	2627DB10105
GWE-307	LR-106	2627DB10106
GWE-308	LR-107	2627DB10107
GWE-309	LR-108	2627DB10108
GWE-310	LR-109	2627DB10109
GWE-311	LR-110	2627DB10110
GWE-312	LR-111	2627DB10111
GWE-313	LR-112	2627DB10112
GWE-314	LR-113	2627DB10113
GWE-315	LR-114	2627DB10114
GWE-316	LR-115	2627DB10115
GWE-317	LR-116	2627DB10116
GWE-318	LR-117	2627DB10117
GWE-319	LR-118	2627DB10118
GWE-320	LR-119	2627DB10119
GWE-321	LR-120	2627DB10120
GWE-322	LR-121	2627DB10121
GWE-323	LR-122	2627DB10122
GWE-324	LR-126	2627DB10126
GWE-325	LR-130	2627DB10130
GWE-326	LR-131	2627DB10131
GWE-327	LR-133	2627DB10133
GWE-328	LR-134	2627DB10134

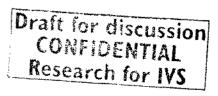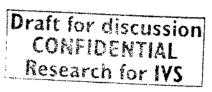| MAP NO:	DATABASE NO:	SITE ID NUMBER:
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GWE-332	LR-138	2627DB10138
GWE-333	LR-140	2627DB10140
GWE-334	LR-141A	2627DB10141
GWE-335	LR-142	2627DB10142
GWE-336	LR-143A	2627DB10143
GWE-337	LR-145	2627DB10145
GWE-338	LR-146	2627DB10146
GWE-339	LR-147	2627DB10147
GWE-340	LR-148	2627DB10148
GWE-341	LR-149	2627DB10149
GWE-342	LR-150	2627DB10150
GWE-343	LR-151	2627DB10151
GWE-344	LR-153	2627DB10153
GWE-345	LR-154	2627DB10154
GWE-346	LR-155	2627DB10155
GWE-347	LR-156A	2627DB10156
GWE-348	LR-157	2627DB10157
GWE-349	LR-158	2627DB10158
GWE-350	LR-159	2627DB10159
GWE-351	LR-161	2627DB10161
GWE-352	LR-162	2627DB10162
GWE-353	LR-163	2627DB10163
GWE-354	LR-164	2627DB10164
GWE-355	LR-165	2627DB10165
GWE-356	LR-167	2627DB10167
GWE-357	LR-168	2627DB10168
GWE-358	LR-169	2627DB10169
GWE-359	LR-172	2627DB10172
GWE-360	LR-173	2627DB10173
GWE-361	LR-174	2627DB10174
GWE-362	LR-176	2627DB10176
GWE-363	LR-177	2627DB10177
GWE-364	LR-178A	2627DB10178
GWE-365	LR-6B	2627DB11006
GWE-366	LR-12B	2627DB11012
GWE-367	LR-14B	2627DB11014
GWE-368	LR-41B	2627DB11041
GWE-369	LR-41C	2627DB11042
GWE-370	LR-41D	2627DB11043
GWE-371	LR-46B	2627DB11046
GWE-372	LR-48B	2627DB11048

MAP NO:	DATABASE NO:	SITE ID NUMBER:
GWE-373	LR-48C	2627DB11049
GWE-374	LR-50B	2627DB11050
GWE-375	LR-58B	2627DB11058
GWE-376	LR-68B	2627DB11068
GWE-377	LR-71B	2627DB11071
GWE-378	LR-72B	2627DB11072
GWE-379	LR-72D	2627DB11073
GWE-380	LR-73B	2627DB11074
GWE-381	LR-73C	2627DB11075
GWE-382	LR-92B	2627DB11092
GWE-383	LR-94B	2627DB11094
GWE-384	LR-108B	2627DB11108
GWE-385	LR-119B	2627DB11119
GWE-386	LR-141B	2627DB11141
GWE-387	LR-143B	2627DB11143
GWE-388	LR-156B	2627DB11156
GWE-389	LR-167B	2627DB11167
GWE-390	LR-178B	2627DB11178

Rosashof:

MAP NO:	DATABASE NO:	SITE ID NUMBER:
GWE-391	RH-2	2627DB80002
GWE-392	RH-3	2627DB80003
GWE-393	RH-4	2627DB80004
GWE-394	RH-5	2627DB80005
GWE-395	RH-6	2627DB80006
GWE-396	RH-7	2627DB80007
GWE-397	RH-10	2627DB80010
GWE-398	RH-12	2627DB80012
GWE-399	RH-13	2627DB80013
GWE-400	RH-14	2627DB80014
GWE-401	RH-15	2627DB80015
GWE-402	RH-16	2627DB80016
GWE-403	RH-17	2627DB80017
GWE-404	RH-18	2627DB80018
GWE-405	RH-19	2627DB80019
GWE-406	RH-20	2627DB80020
GWE-407	RH-21	2627DB80021
GWE-408	RH-22	2627DB80022
GWE-409	RH-23	2627DB80023
GWE-410	RH-24	2627DB80024
GWE-411	RH-25	2627DB80025
GWE-412	RH-26	2627DB80026
GWE-413	RH-27	2627DB80027

MAP NO:	DATABASE NO:	SITE ID NUMBER:
GWE-414	RH-28	2627DB80028
GWE-415	RH-29	2627DB80029
GWE-416	RH-30	2627DB80030
GWE-417	RH-32	2627DB80032
GWE-418	RH-33	2627DB80033
GWE-419	RH-37	2627DB80037
GWE-420	RH-38	2627DB80038
GWE-421	RH-39	2627DB80039
GWE-422	RH-40	2627DB80040
GWE-423	RH-42	2627DB80042
GWE-424	RH-43	2627DB80043
GWE-425	RH-44	2627DB80044
GWE-426	RH-46	2627DB80046
GWE-427	CP-1	2627DB81001
GWE-428	RH-46B	2627DB81046

Vanderbijlpark suburb:

GWE-429	VBP-1	2627DB60001
GWE-430	VBP-2	2627DB60002
GWE-431	VBP-3	2627DB60003
GWE-432	VBP-4	2627DB60004
GWE-433	VBP-5	2627DB60005
GWE-434	VBP-6	2627DB60006
GWE-435	VBP-7	2627DB60007
GWE-436	VBP-8	2627DB60008
GWE-437	VBP-9	2627DB60009
GWE-438	VBP-10	2627DB60010
GWE-439	VBP-11	2627DB60011
GWE-440	VBP-12	2627DB60012
GWE-441	VBP-13	2627DB60013
GWE-442	VBP-14	2627DB60014
GWE-443	VBP-15	2627DB60015
GWE-444	VBP-16	2627DB60016
GWE-445	VBP-17	2627DB60017
GWE-446	VBP-18	2627DB60018
GWE-447	VBP-19	2627DB60019
GWE-448	VBP-20	2627DB60020
GWE-449	VBP-21	2627DB60021
GWE-450	VBP-22	2627DB60022
GWE-451	VBP-23	2627DB60023
GWE-452	VBP-24	2627DB60024
GWE-453	VBP-25	2627DB60025
GWE-454	VBP-26	2627DB60026

MAP NO.	DATABASE NO.	SITE ID NUMBER
GWE-455	VBP-27	2627DB60027
GWE-456	VBP-28	2627DB60028
GWE-457	VBP-29	2627DB60029
GWE-458	VBP-30	2627DB60030
GWE-459	VBP-31	2627DB60031
GWE-460	VBP-32	2627DB60032
GWE-461	VBP-33	2627DB60033
GWE-462	VBP-34	2627DB60034
GWE-463	VBP-35	2627DB60035
GWE-464	VBP-36	2627DB60036
GWE-465	VBP-37	2627DB60037
GWE-466	VBP-38	2627DB60038
GWE-467	VBP-39	2627DB60039
GWE-468	VBP-40	2627DB60040
GWE-469	VBP-41	2627DB60041
GWE-470	VBP-42	2627DB60042
GWE-471	VBP-43	2627DB60043
GWE-472	VBP-44	2627DB60044
GWE-473	VBP-45	2627DB60045
GWE-474	VBP-46	2627DB60046
GWE-475	VBP-47	2627DB60047
GWE-476	VBP-48	2627DB60048
GWE-477	VBP-49	2627DB60049
GWE-478	VBP-50	2627DB60050
GWE-479	VBP-51	2627DB60051
GWE-480	VBP-52	2627DB60052
GWE-481	VBP-53	2627DB60053
GWE-482	VBP-54	2627DB60054
GWE-483	VBP-55	2627DB60055
GWE-484	VBP-56	2627DB60056
GWE-485	VBP-57	2627DB60057
GWE-486	VBP-58	2627DB60058
GWE-487	VBP-59	2627DB60059
GWE-488	VBP-60	2627DB60060
GWE-489	VBP-61	2627DB60061
GWE-490	VBP-62	2627DB60062

Steelpark:

GWE-491	SP1	2627DB50001
GWE-492	SP2	2627DB50002
GWE-493	SP3	2627DB50003
GWE-494	SP4	2627DB50004
GWE-495	SP5	2627DB50005

MAP NO:	DATABASE NO:	SITE ID NUMBER:
GWE-496	SP6	2627DB50006
GWE-497	SP6B	2627DB51006

Steelvalley:

MAP NO:	DATABASE NO:	SITE ID NUMBER:
GWE-498	SV-1	2627DB40001
GWE-499	SV-2	2627DB40002
GWE-500	SV-3A	2627DB40003
GWE-501	SV-4	2627DB40004
GWE-502	SV-5	2627DB40005
GWE-503	SV-6	2627DB40006
GWE-504	SV-7	2627DB40007
GWE-505	SV-8A	2627DB40008
GWE-506	SV-9	2627DB40009
GWE-507	SV-10A	2627DB40010
GWE-508	SV-11	2627DB40011
GWE-509	SV-12	2627DB40012
GWE-510	SV-13	2627DB40013
GWE-511	SV-14	2627DB40014
GWE-512	SV-15	2627DB40015
GWE-513	SV-16	2627DB40016
GWE-514	SV-17A	2627DB40017
GWE-515	SV-18A	2627DB40018
GWE-516	SV-19A	2627DB40019
GWE-517	SV-20	2627DB40020
GWE-518	SV-21	2627DB40021
GWE-519	SV-22	2627DB40022
GWE-520	SV-24	2627DB40024
GWE-521	SV-25	2627DB40025
GWE-522	SV-26	2627DB40026
GWE-523	SV-27	2627DB40027
GWE-524	SV-28A	2627DB40028
GWE-525	SV-29A	2627DB40029
GWE-526	SV-30	2627DB40030
GWE-527	SV-33	2627DB40033
GWE-528	SV-35	2627DB40035
GWE-529	SV-36	2627DB40036
GWE-530	SV-37	2627DB40037
GWE-531	SV-39	2627DB40039
GWE-532	SV-40	2627DB40040
GWE-533	SV-42	2627DB40042
GWE-534	SV-44	2627DB40044
GWE-535	SV-45A	2627DB40045
GWE-536	SV-46A	2627DB40046

MAP NO:	DATABASE NO:	SITE ID NUMBER:
GWE-537	SV-47	2627DB40047
GWE-538	SV-48	2627DB40048
GWE-539	SV-49	2627DB40049
GWE-540	SV-50	2627DB40050
GWE-541	SV-52	2627DB40052
GWE-542	SV-53	2627DB40053
GWE-543	SV-54	2627DB40054
GWE-544	SV-55A	2627DB40055
GWE-545	SV-56	2627DB40056
GWE-546	SV-57	2627DB40057
GWE-547	SV-58	2627DB40058
GWE-548	SV-59	2627DB40059
GWE-549	SV-60	2627DB40060
GWE-550	SV-61	2627DB40061
GWE-551	SV-62	2627DB40062
GWE-552	SV-63	2627DB40063
GWE-553	SV-64A	2627DB40064
GWE-554	SV-65A	2627DB40065
GWE-555	SV-66	2627DB40066
GWE-556	SV-67	2627DB40067
GWE-557	SV-68A	2627DB40068
GWE-558	SV-69	2627DB40069
GWE-559	SV-3B	2627DB41003
GWE-560	SV-8B	2627DB41008
GWE-561	SV-10B	2627DB41010
GWE-562	SV-17B	2627DB41017
GWE-563	SV-18B	2627DB41018
GWE-564	SV-19B	2627DB41019
GWE-565	SV-28B	2627DB41028
GWE-566	SV-29B	2627DB41029
GWE-567	SV-45B	2627DB41045
GWE-568	SV-46B	2627DB41046
GWE-571	SV-55B	2627DB41055
GWE-572	SV-64B	2627DB41064
GWE-573	SV-65B	2627DB41065
GWE-574	SV-67B	2627DB41067
GWE-575	SV-68B	2627DB41068
GWE-576	SV-68C	2627DB42068

Perched Aquifer (GWP)

GWP-1	IVB-S1	2627DB00001
GWP-2	IVB-S2	2627DB00002
GWP-3	IVB-S3	2627DB00003

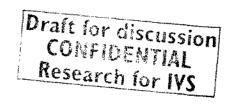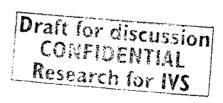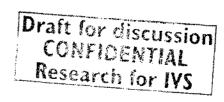| MAP NO:	DATABASE NO:	SITE ID NUMBER:
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GWP-5	IVB-S5	2627DB00005
GWP-6	IVB-S6	2627DB00006
GWP-7	IVB-S7	2627DB00007
GWP-8	IVB-S8	2627DB00008
GWP-9	IVB-S9	2627DB00009
GWP-10	IVB-S10	2627DB00010
GWP-11	IVB-S11	2627DB00011
GWP-12	IVB-S12	2627DB00012
GWP-13	IVB-S13	2627DB00013
GWP-14	IVB-S14	2627DB00014
GWP-15	IVB-S15	2627DB00015
GWP-16	IVB-S16	2627DB00016
GWP-17	IVB-S17	2627DB00017
GWP-18	IVB-S18	2627DB00018
GWP-19	IVB-S19	2627DB00019
GWP-20	IVB-S20	2627DB00020
GWP-21	IVB-S21	2627DB00021
GWP-22	IVB-S22	2627DB00022
GWP-23	IVB-S23	2627DB00023
GWP-24	IVB-S24	2627DB00024
GWP-25	IVB-S25	2627DB00025
GWP-26	IVB-S26	2627DB00026
GWP-27	IVB-S27	2627DB00027
GWP-28	IVB-S28	2627DB00028
GWP-29	IVB-S29	2627DB00029
GWP-30	IVB-S30	2627DB00030
GWP-31	IVB-S31	2627DB00031
GWP-32	IVB-S32	2627DB00032
GWP-33	IVB-S33	2627DB00033
GWP-34	IVB-S34	2627DB00034
GWP-35	IVB-S35	2627DB00035
GWP-36	IVB-S36	2627DB00036
GWP-37	IVB-S37	2627DB00037
GWP-38	IVB-S38	2627DB00038
GWP-39	IVB-S39	2627DB00039
GWP-40	IVB-S40	2627DB00040
GWP-41	IVB-S41	2627DB00041
GWP-42	IVB-S42	2627DB00042
GWP-43	IVB-S43	2627DB00043
GWP-44	IVB-S44	2627DB00044
GWP-45	IVB-S45	2627DB00045
GWP-46	IVB-S46	2627DB00046
GWP-47	IVB-S47	2627DB00047

MAP NO:	DATABASE NO:	SITE ID NUMBER:
GWP-48	IVB-S48	2627DB00048
GWP-49	IVB-S49	2627DB00049
GWP-50	IVB-S50	2627DB00050
GWP-51	IVB-S51	2627DB00051
GWP-52	IVB-S52	2627DB00052
GWP-53	IVB-S53	2627DB00053
GWP-54	IVB-S54	2627DB00054
GWP-55	IVB-S55	2627DB00055
GWP-56	IVB-S56	2627DB00056
GWP-57	IVB-S57	2627DB00057
GWP-58	IVB-S58	2627DB00058
GWP-59	IVB-S59	2627DB00059
GWP-60	IVB-S60	2627DB00060
GWP-61	IVB-S61	2627DB00061
GWP-62	IVB-S62	2627DB00062
GWP-63	IVB-S63	2627DB00063
GWP-64	IVB-S64	2627DB00064
GWP-65	IVB-S65	2627DB00065
GWP-66	IVB-S66	2627DB00066
GWP-67	IVB-S67	2627DB00067
GWP-68	IVB-S68	2627DB00068
GWP-69	IVB-S69	2627DB00069
GWP-70	IVB-S70	2627DB00070
GWP-71	IVB-S71	2627DB00071
GWP-72	IVB-S72	2627DB00072
GWP-73	IVB-S73	2627DB00073
GWP-74	IVB-S74	2627DB00074
GWP-75	IVB-S75	2627DB00075
GWP-76	IVB-S76	2627DB00076
GWP-77	IVB-S77	2627DB00077
GWP-78	IVB-S78	2627DB00078
GWP-79	IVB-S79	2627DB00079
GWP-80	IVB-S80	2627DB00080
GWP-81	IVB-S81	2627DB00081
GWP-82	IVB-S82	2627DB00082
GWP-83	IVB-S83	2627DB00083
GWP-84	IVB-S84	2627DB00084
GWP-85	IVB-S85	2627DB00085
GWP-86	IVB-S86	2627DB00086
GWP-87	IVB-S87	2627DB00087
GWP-88	IVB-S88	2627DB00088
GWP-89	IVB-S89	2627DB00089
GWP-90	IVB-S90	2627DB00090
GWP-91	IVB-S91	2627DB00091

MAP NO:	DATABASE NO:	SITE ID NUMBER:
GWP-92	IVB-S92	2627DB00092
GWP-93	IVB-S93	2627DB00093
GWP-94	IVB-S94	2627DB00094
GWP-95	IVB-S95	2627DB00095
GWP-96	IVB-S96	2627DB00096
GWP-97	IVB-S97	2627DB00097
GWP-98	IVB-S98	2627DB00098
GWP-99	IVB-S99	2627DB00099
GWP-100	IVB-S100	2627DB00100
GWP-101	IVB-S101	2627DB00101
GWP-102	IVB-S102	2627DB00102
GWP-103	IVB-S103	2627DB00103
GWP-104	IVB-S104	2627DB00104
GWP-105	IVB-S105	2627DB00105
GWP-106	IVB-S106	2627DB00106
GWP-107	IVB-S107	2627DB00107
GWP-108	IVB-S108	2627DB00108
GWP-109	IVB-S109	2627DB00109
GWP-110	IVB-S110	2627DB00110
GWP-111	IVB-S111	2627DB00111
GWP-112	IVB-S112	2627DB00112
GWP-113	IVB-S113	2627DB00113
GWP-114	IVB-S114	2627DB00114
GWP-115	IVB-S115	2627DB00115
GWP-116	IVB-S116	2627DB00116
GWP-117	IVB-S117	2627DB00117
GWP-118	IVB-S118	2627DB00118
GWP-119	IVB-S119	2627DB00119
GWP-120	IVB-S120	2627DB00120
GWP-121	IVB-S121	2627DB00121
GWP-122	IVB-S122	2627DB00122
GWP-123	IVB-S123	2627DB00123
GWP-124	IVB-S124	2627DB00124
GWP-125	IVB-S125	2627DB00125
GWP-126	IVB-S126	2627DB00126
GWP-127	IVB-S127	2627DB00127
GWP-128	IVB-S128	2627DB00128
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GWP-131	IVB-S131	2627DB00131
GWP-132	IVB-S132	2627DB00132
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GWP-135	IVB-S135	2627DB00135

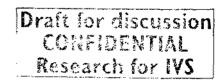| MAP NO:	DATABASE NO:	SITE ID NUMBER:
GWP-136	IVB-S136	2627DB00136
GWP-137	IVB-S137	2627DB00137
GWP-138	IVB-S138	2627DB00138
GWP-139	IVB-S139	2627DB00139
GWP-140	IVB-S140	2627DB00140
GWP-141	1VB-S141	2627DB00141
GWP-142	IVB-S142	2627DB00142
GWP-143	1VB-S143	2627DB00143
GWP-144	IVB-S144	2627DB00144
GWP-145	IVB-S145	2627DB00145
GWP-146	IVB-S146	2627DB00146
GWP-147	IVB-S147	2627DB00147
GWP-148	IVB-S148	2627DB00148
GWP-149	IVB-S149	2627DB00149
GWP-150	IVB-S150	2627DB00150
GWP-151	IVB-S151	2627DB00151
GWP-152	IVB-S152	2627DB00152
GWP-153	IVB-S153	2627DB00153
GWP-154	IVB-S154	2627DB00154
GWP-155	IVB-S155	2627DB00155
GWP-156	IVB-S156	2627DB00156
GWP-157	IVB-S157	2627DB00157

Shallow Weathered Zone Aquifer (GWW)

GWW-1	IVB-D1	2627DB01001
GWW-2	IVB-D2	2627DB01002
GWW-3	1VB-D3	2627DB01003
GWW-4	IVB-D4	2627DB01004
GWW-5	IVB-D5	2627DB01005
GWW-6	IVB-D6	2627DB01006
GWW-7	IVB-D7	2627DB01007
GWW-8	IVB-D8	2627DB01008
GWW-9	IVB-D9	2627DB01009
GWW-10	IVB-D10	2627DB01010
GWW-11	IVB-D11	2627DB01011
GWW-12	IVB-D12	2627DB01012
GWW-13	IVB-D13	2627DB01013
GWW-14	IVB-D14	2627DB01014
GWW-15	1VB-D15	2627DB01015
GWW-16	IVB-D16	2627DB01016
GWW-17	IVB-D17	2627DB01017
GWW-18	IVB-D18	2627DB01018
GWW-19	IVB-D19	2627DB01019

MAP NO:	DATABASE NO:	SITE ID NUMBER:
GWW-20	IVB-D20	2627DB01020
GWW-21	IVB-D21	2627DB01021
GWW-22	IVB-D22	2627DB01022
GWW-23	IVB-D23	2627DB01023
GWW-24	IVB-D24	2627DB01024
GWW-25	IVB-D25	2627DB01025
GWW-26	IVB-D26	2627DB01026
GWW-27	IVB-D27	2627DB01027
GWW-28	IVB-D28	2627DB01028
GWW-29	IVB-D29	2627DB01029
GWW-30	IVB-D30	2627DB01030
GWW-31	IVB-D31	2627DB01031
GWW-32	IVB-D32	2627DB01032
GWW-33	IVB-D33	2627DB01033
GWW-34	IVB-D34	2627DB01034
GWW-35	IVB-D35	2627DB01035
GWW-36	IVB-D36	2627DB01036
GWW-37	IVB-D37	2627DB01037
GWW-38	IVB-D38	2627DB01038
GWW-39	IVB-D39	2627DB01039
GWW-40	IVB-D40	2627DB01040
GWW-41	IVB-D41	2627DB01041
GWW-42	IVB-D42	2627DB01042
GWW-43	IVB-D43	2627DB01043
GWW-44	IVB-D44	2627DB01044
GWW-45	IVB-D45	2627DB01045
GWW-46	IVB-D46	2627DB01046
GWW-47	IVB-D47	2627DB01047
GWW-48	IVB-D48	2627DB01048
GWW-49	IVB-D49	2627DB01049
GWW-50	IVB-D50	2627DB01050
GWW-51	IVB-D51	2627DB01051
GWW-52	IVB-D52	2627DB01052
GWW-53	IVB-D53	2627DB01053
GWW-54	IVB-D54	2627DB01054
GWW-55	IVB-D55	2627DB01055
GWW-56	IVB-D56	2627DB01056
GWW-57	IVB-D57	2627DB01057
GWW-58	IVB-D58	2627DB01058
GWW-59	IVB-D59	2627DB01059
GWW-60	IVB-D60	2627DB01060
GWW-61	IVB-D61	2627DB01061
GWW-62	IVB-D62	2627DB01062
GWW-63	IVB-D63	2627DB01063

MAP NO:	DATABASE NO:	SITE ID NUMBER:
GWW-64	IVB-D64	2627DB01064
GWW-65	IVB-D65	2627DB01065
GWW-66	IVB-D66	2627DB01066
GWW-67	IVB-D67	2627DB01067
GWW-68	IVB-D68	2627DB01068
GWW-69	IVB-D69	2627DB01069
GWW-70	IVB-D70	2627DB01070
GWW-71	IVB-D71	2627DB01071
GWW-72	IVB-D72	2627DB01072
GWW-73	IVB-D73	2627DB01073
GWW-74	IVB-D74	2627DB01074
GWW-75	IVB-D75	2627DB01075
GWW-76	IVB-D76	2627DB01076
GWW-77	IVB-D77	2627DB01077
GWW-78	IVB-D78	2627DB01078
GWW-79	IVB-D79	2627DB01079
GWW-80	IVB-D80	2627DB01080
GWW-81	IVB-D81	2627DB01081
GWW-82	IVB-D82	2627DB01082
GWW-83	IVB-D83	2627DB01083
GWW-84	IVB-D84	2627DB01084
GWW-85	IVB-D85	2627DB01085
GWW-86	IVB-D86	2627DB01086
GWW-87	IVB-D87	2627DB01087
GWW-88	IVB-D88	2627DB01088
GWW-89	IVB-D89	2627DB01089
GWW-90	IVB-D90	2627DB01090
GWW-91	IVB-D91	2627DB01091
GWW-92	IVB-D92	2627DB01092
GWW-93	IVB-D93	2627DB01093
GWW-94	IVB-D94	2627DB01094
GWW-95	IVB-D95	2627DB01095
GWW-96	IVB-D96	2627DB01096
GWW-97	IVB-D97	2627DB01097
GWW-98	IVB-D98	2627DB01098
GWW-99	IVB-D99	2627DB01099
GWW-100	IVB-D100	2627DB01100
GWW-101	IVB-D101	2627DB01101
GWW-102	IVB-D102	2627DB01102
GWW-103	IVB-D103	2627DB01103
GWW-104	IVB-D104	2627DB01104
GWW-105	IVB-D105	2627DB01105
GWW-106	IVB-D106	2627DB01106
GWW-107	IVB-D107	2627DB01107

MAP NO:	DATABASE NO:	SITE ID NUMBER:
GWW-108	IVB-D108	2627DB01108
GWW-109	IVB-D109	2627DB01109
GWW-110	IVB-D110	2627DB01110
GWW-111	IVB-D111	2627DB01111
GWW-112	IVB-D112	2627DB01112
GWW-113	IVB-D113	2627DB01113
GWW-114	IVB-D114	2627DB01114
GWW-115	IVB-D115	2627DB01115
GWW-116	IVB-D116	2627DB01116
GWW-117	IVB-D117	2627DB01117
GWW-118	IVB-D118	2627DB01118
GWW-119	IVB-D119	2627DB01120
GWW-120	IVB-D120	2627DB01121
GWW-121	IVB-D121	2627DB01122
GWW-122	IVB-D122	2627DB01123
GWW-123	IVB-D123	2627DB01124
GWW-124	IVB-D124	2627DB01125
GWW-125	IVB-D125	2627DB01126
GWW-126	IVB-D126	2627DB01127
GWW-127	IVB-D127	2627DB01128
GWW-128	IVB-D128	2627DB01129
GWW-129	IVB-D129	2627DB01130
GWW-130	IVB-D130	2627DB01131
GWW-131	IVB-D131	2627DB01132
GWW-132	IVB-D132	2627DB01131
GWW-133	IVB-D133	2627DB01133
GWW-134	IVB-D134	2627DB01134
GWW-135	IVB-D135	2627DB01135
GWW-136	IVB-D136	2627DB01136
GWW-137	IVB-D137	2627DB01137
GWW-138	IVB-D138	2627DB01138
GWW-139	IVB-D139	2627DB01139
GWW-140	IVB-D140	2627DB01140
GWW-141	IVB-D141	2627DB01141
GWW-142	IVB-D142	2627DB01142
GWW-143	IVB-D143	2627DB01143
GWW-144	IVB-D144	2627DB01144
GWW-145	IVB-D145	2627DB01145
GWW-146	IVB-D146	2627DB01146
GWW-147	IVB-D147	2627DB01147
GWW-148	IVB-D148	2627DB01148
GWW-149	IVB-D149	2627DB01149
GWW-150	IVB-D150	2627DB01150
GWW-151	IVB-D151	2627DB01151

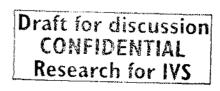| MAP NO:	DATABASE NO:	SITE ID NUMBER:
GWW-152	IVB-D152	2627DB01152
GWW-153	IVB-D153	2627DB01153
GWW-154	IVB-D154	2627DB01154
GWW-155	IVB-D155	2627DB01155
GWW-156	IVB-D156	2627DB01156
GWW-157	IVB-D157	2627DB01157
GWW-158	IVB-D158	2627DB01158
GWW-159	IVB-D159	2627DB01159
GWW-160	IVB-D160	2627DB01160
GWW-161	IVB-D161	2627DB01161
GWW-162	IVB-D162	2627DB01162
GWW-163	IVB-D163	2627DB01163
GWW-164	IVB-D164	2627DB01164
GWW-165	IVB-D165	2627DB01165
GWW-166	IVB-D166	2627DB01166
GWW-167	IVB-D167	2627DB01167
GWW-168	IVB-D168	2627DB01168
GWW-169	IVB-D169	2627DB01169
GWW-170	IVB-D170	2627DB01170
GWW-171	IVB-D171	2627DB01171
GWW-172	IVB-D172	2627DB01172
GWW-173	IVB-D173	2627DB01173
GWW-174	IVB-D174	2627DB01174
GWW-175	IVB-D175	2627DB01175
GWW-176	IVB-D176	2627DB01176
GWW-177	IVB-D177	2627DB01177

DATA SET IV-4

Aquabase Site Identification Numbers for Surface Water

Rivers and Streams:

MAP NO:	DATABASE NO:	SITE ID NUMBER:
SWR-1	RS-1	2629DB90001
SWR-2	RS-2	2629DB90002
SWR-3	RS-3	2629DB90003
SWR-4	RS-4	2629DB90004
SWR-5	RS-5	2629DB90005
SWR-6	RS-6	2629DB90006
SWR-7	RS-7	2629DB90007
SWR-8	RS-8	2629DB90008
SWR-9	RS-9	2629DB90009
SWR-10	RS-10	2629DB90010
SWR-11	LS-11	2629DB90011
SWR-12	LS-12	2629DB90012
SWR-13	LS-13	2629DB90013
SWR-14	LS-14	2629DB90014
SWR-15	LS-15	2629DB90015
SWR-16	LS-16	2629DB90016

Canals/Sumps:

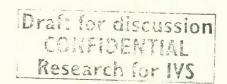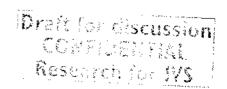| MAP NO:	DATABASE NO:	SITE ID NUMBER:
SWI-1	DIRECT REDUCTION	2627DB00001
SWI-2	VAAL DAM	2627DB00002
SWI-3	NWAK	2627DB00003
SWI-4	AIR PRODUCTS	2627DB00004
SWI-5	COKE OVENS	2627DB00005
SWI-6	HOT MILLS SOUTH	2627DB00006
SWI-7	CMGM DRAIN	2627DB00007
SWI-8	HATTINGH CANAL	2627DB00008
SWI-9	ANALYSIS HOUSE 1	2627DB00009
SWI-10	ANALYSIS HOUSE 2	2627DB00010
SWI-11	ANALYSIS HOUSE 3	2627DB00011
SWI-12	ANALYSIS HOUSE 4	2627DB00012

DATA SET IV-5

Aquabase Site Identification Numbers for Air Quality

Dust Fall-out Monitoring Sites (AQP)

MAP NO	DATABASE NO	SITE ID NUMBER
AQP-1	Buckett 1	2627DB00001
AQP-2	Buckett 2	2627DB00002
AQP-3	Buckett 3	2627DB00003
AQP-4	Buckett 7	2627DB00007
AQP-5	Buckett 11	2627DB00011
AQP-6	Buckett 15	2627DB00015
AQP-7	Buckett 16	2627DB00016
AQP-8	Buckett 17	2627DB00017
AQP-9	Buckett 18-A	2627DB00019
AQP-10	Buckett 19	2627DB00020
AQP-11	Buckett 20	2627DB00021
AQP-12	Buckett 21	2627DB00022
AQP-13	Buckett 22	2627DB00023
AQP-14	Buckett 24	2627DB00025
AQP-15	Buckett 25	2627DB00026
AQP-16	Buckett 26	2627DB00027
AQP-17	Buckett 27	2627DB00028
AQP-18	Buckett 28	2627DB00029
AQP-19	Buckett 29	2627DB00030
AQP-20	Buckett 30	2627DB00031
AQP-21	Buckett 31	2627DB00032
AQP-22	Buckett 32	2627DB00033
AQP-23	Buckett 33	2627DB00034
AQP-24	Buckett 34	2627DB00035
AQP-25	Buckett 35	2627DB00036
AQP-26	Buckett 36	2627DB00037
AQP-27	Buckett 37	2627DB00038
AQP-28	DIRECT REDUC	2627DB00039

Ambient Air Quality Monitoring (AQA)

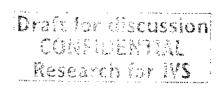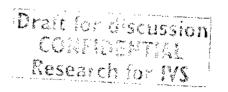| MAP NO	DATABASE NO	SITE ID NUMBER
AQA-1	Weatherstation 2	2627DB00001
AQA-2	Weatherstation	2627DB00002

Stack Monitoring (AQS)

MAP NO:	DATABASE NO:	SITE ID NUMBER:
AQS-1	ARC OVEN 1	2627DB00001
AQS-2	ARC OVEN 2	2627DB00002
AQS-3	ARC OVEN 3	2627DB00003
AQS-4	ARC LADDLE 1	2627DB00004
AQS-5	ARC LADDLE 2	2627DB00005
AQS-6	BOF PRIM. 1	2627DB00006
AQS-7	BOF PRIM. 2	2627DB00007
AQS-8	BOF PRIM. 3	2627DB00008
AQS-9	BOF BAGF. 1	2627DB00009
AQS-10	BOF BAGF. 2	2627DB00010
AQS-11	BOF BAGF. 3	2627DB00011
AQS-12	BOF LAD. 1	2627DB00012
AQS-13	BOF LAD. 2	2627DB00013
AQS-14	BOF CAST 1/2	2627DB00014
AQS-15	SINT AG	2627DB10001
AQS-16	SINT BG	2627DB10002
AQS-17	SINT CG	2627DB10003
AQS-18	SINT GRUIS.	2627DB10004
AQS-19	SINT SCREEN	2627DB10005
AQS-20	SINT SIDE	2627DB10006
AQS-21	CO 1	2627DB20001
AQS-22	CO 2	2627DB20002
AQS-23	CO 3	2627DB20003
AQS-24	CO 4	2627DB20004
AQS-25	CO 6	2627DB20005
AQS-26	CO 7	2627DB20006
AQS-27	CO 8	2627DB20007
AQS-28	CO 9	2627DB20008
AQS-29	DR OVEN 1	2627DB30001
AQS-30	DR OVEN 2	2627DB30002
AQS-31	DR OVEN 3	2627DB30003
AQS-32	DR OVEN 4	2627DB30004
AQS-33	DR PROD. SEP	2627DB30005
AQS-34	DR CYCLONE	2627DB30006
AQS-35	FOUNDRY BAG.	2627DB40001
AQS-36	FOUND. CYCLO	2627DB40002
AQS-37	BF TAP C	2627DB50001
AQS-38	BF MATER. C	2627DB50002
AQS-39	BF ELECTR. C	2627DB50003
AQS-40	PCI 1	2627DB50004
AQS-41	PCI 2	2627DB50005
AQS-42	BF MATER. D	2627DB50006
AQS-43	BF ELECTR. D	2627DB50007
AQS-44	LURGI 1	2627DB60001
AQS-45	LURGI 2	2627DB60002
AQS-46	LURGI 3	2627DB60003

MAP NO:	DATABASE NO:	SITE ID NUMBER:
AQS-47	WASS. NORTH	2627DB60004
AQS-48	WASS. SOUTH	2627DB60005
AQS-49	FERRIET	2627DB60006

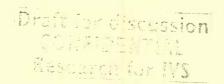**APPENDIX V**

MANAGEMENT TABLE SUMMARY

Environmental Monitoring Quantitative Attributes - Management Summary

SAMPLING FREQUENCY

	SCP	SCL	SCE	SCS	MGR	MGH	MGE	MGT	MGD	SLS	SLT	GWE	GWEF	GWP	GWW	GWF	SWR	SWL	SWI	AQP	AQA	AQS
Continuous					X	X		X	X										X		X	X
Daily					X												X	X				
Weekly																	X					
Two- Weekly																	X					
Monthly																						
Two-Monthly																				X		
Quarterly		X	X	X																		
Six- Monthly														X	X							
Annual	X											X	X									

REPORTING FREQUENCY

	SCP	SCL	SCE	SCS	MGR	MGH	MGE	MGT	MGD	SLS	SLT	GWE	GWEF	GWP	GWW	GWF	SWR	SWD	SWI	AQP	AQA	AQS
Continuous																						
Daily																						
Weekly																						
Two- Weekly																						
Monthly																						
Two- Monthly																						
Quarterly																						
Six- Monthly		X	X	X	X	X		X	X					X	X		X	X	X	X	X	X
Annually	X	X	X	X	X	X		X	X			X	X	X	X		X	X	X	X	X	X

Acronyms:

Source Characterization (SC):
(SCP) - Physical/Dry Chemical Analyses
(SCL) - Leachate Analyses
(SCE) - Effluent Analyses
(SCS) - Seepage Analyses

Meteorology (MG)
(MGR) - Rainfall
(MGH) - Humidity (rel)
(MGE) - Pan Evaporation
(MGT) - Air Temperature
MGD) - Wid speed & Direction)

Soils (SL)
(SLS) - Classification
(SLT) - Contamination

Ground water (GW)
(GWE) - External Users
(GWEF) - External Users Fountains
(GWP) - Perched Aquifer
(GWW) - Shallow Weathered Zone Aquifer
(GWF) - Deeper Fractured Aquifer
(GWM) - Mine Workings

Surface Water- (SW)
(SWR) - Rivers/Streams
(SWL) - Dams Level
(SWI) - Sump/Interceptors

Air Quality- (AQ)
Particulate Fallout :
Dust Fallout (AQP)
Gases:
Ambient Air (AQA)
Stack Emissions (AQS)

Environmental Monitoring Qualitative Attributes - Management Summary

SAMPLING FREQUENCY											
	TPE	TPF	LU	PL	AL	AE	NS	AC	VA	PC	EL
Continuous		X									
Weekly											
Two- Monthly						X					
Monthly											
Quarterly										X	
Six- Monthly						X	X				
Annual		X	X	X	X	X	X	X			X

REPORTING FREQUENCY											
	TPE	TPF	LU	PL	AL	AE	NS	AC	VA	PC	EL
Continuous											
Weekly											
Two- Monthly						X					
Monthly											
Quarterly										X	
Six- Monthly		X				X	X				
Annual		X	X	X	X	X	X	X		X	X

Acronyms:

Topography (TP)
(TPE) - Excavations
(TPF) - Fill/Heap
(TPS) - Subsidence
Land Capability and Land Use (LU)
Natural Vegetation and Plant Life (PL)
Animal Life (AL)
Aquatic Ecosystems (AE)
Noise (NS)
Archeology/Cultural Interest (AC)
Visual Aspects (VA)
Public Consultation - IAP's (PC)
Enviro-Legal Aspects (EL)

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