AIRPORTS COMPANY
SOUTH AFRICA

SCOPE OF WORK- ANNEXURE B

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SOUTH AFRICA

1. Background of the Business Case

King Shaka International Airport (KSIA) is required to maintain the regulatory requirements as listed in the Record of Decision (RoD), for the construction and operation of the Airport, issued by the Department of Environmental Affairs in 2008 which was split in July 2020. One of the conditions requires KSIA to develop and implement a stormwater and groundwater monitoring plan to ensure compliance with the RoD. These Plans were approved by the Department of Water and Sanitation. Monitoring and the results of the annual monitoring reports are submitted to the Department in compliance with RoD requirements as well as to meet the requirements of the National Water Act (Act 36 of 1998).

Airports Company South Africa, therefore, wishes to appoint a service provider to undertake surface water and ground water quality monitoring at KSIA for a period of 09 months. Surface water is to be monitored quarterly while biomonitoring and ground water is to be done every 6 months. The method of specific monitoring to be undertaken is specified below.

2. Detailed specifications or scope of Works or Quantities

The following outlines the scope of work for the quarterly stormwater (surface water) quality monitoring:

Surface water

There is a total of twenty-three routine (23) sampling sites along watercourses associated with KSIA operations including DTPC. Samplings must be done from the natural watercourses, as well as at the storm water outflow. There are eight (8) reactive sites which aims at determining the nature and source of pollution identified during routine monitoring. They must be initiated following emergency situations such as spillages, incidents etc. There are six (6) routine monitoring sites established for monitoring the water leaving the car rental depots. There is also a point at the discharge where treated effluent is discharge to the environment and the similar point can also be used for passive sampling. The twenty-three routine (23) sampling sites need to be monitored on quarterly basis.

The table below show the details of the routine sampling points.

Site ID	Description	Latitude (WGS84)	Longitude (WGS84)
Natural Watercourse Monitoring Points			
SW-A01	Northern Outfall in the Hlawe River sub catchment	-29.595300°	31.127300°
SW-A02	Hlawe River downstream of the trade zone confluence	-29.591960°	31.118100°
SW-A03	Western Outfall immediately below northern WWTW	-29.599050°	31.111610°
SW-A04	Hlawe River upstream of the trade zone confluence	-29.601940°	31.103938°
SW-A05	Downstream of chainage 1736	-29.605244°	31.105958°
SW-A06	Tributary of Hlawe draining ACSA property and support zone	-29.606301°	31.100221°
SW-A07	Hlawe River downstream of the Fuel Storage Depot	-29.612569°	31.088066°
SW-A08	Tributary draining ACSA property and support zone	-29.628352°	31.087541°
SW-A09	Downstream of fuel pipeline, KSIA and support zone	-29.624110°	31.090323°
SW-A10	Downstream of fuel pipeline, KSIA and support zone	-29.622144°	31.095264°
SW-A11	Upstream of Lake Victoria wetland	-29.630193°	31.088557°
SW-A12	Watercourse draining KSIA, support zone and runway	-29.626253°	31.101726°
SW-A13	Upstream of Froggy Pond wetland	-29.633343°	31.094058°

SW-A14	Sub catchment draining to Froggy Pond wetland	-29.638789°	31.097509°
SW-A15	Drainage channel, upstream of the Northern WWTWs.	-29.604033°	31.114576°
DTA3	Downstream of AgriZone, along the Hlawe river	-29.605389	31.098639
DT02	Hlawe River / Tongaat Estuary site boundary exit	-29.587750	31.123472
Car Rental Depot Monitoring Points			
SW- C01	Car Rental Depots- Europcar	-29.610492°	31.107760°
SW- C02	Car Rental Depot- First and Hertz	-29.611288°	31.108558°
SW- C03	Car Rental Depot- Bidvest	-29.614958°	31.105483°
SW- C04/C05/C06	Car Rental Depot- Avis - Budget	-29.614481°	31.104593°

Sampling of all monitoring points and field data collection for the site must be conducted as follows:

Surface water sampling is to be conducted on routine sites on quarterly basis. All field work conducted is based on the updated protocol, specifications and code of practice contained in the SABS International Organization for Standardization (ISO) 5667:1-15. These standards address all aspects of the programme design, sampling methods as well as sample preservation.

For quality purposes and as a minimum, sampling is undertaken in accordance with the following publications:

- ISO 5667–1: 2008 Part 1: Guidance on the design of sampling programs and sampling techniques.
- ISO 5667-3: 2012 Part 3: Guidance on preservation and handling of samples.
- ISO 5667-6: 2014 Part 6: Guidance on sampling of rivers and streams; and
- SABS ISO 5667: 2009 Part 11: Guidance on sampling of groundwater.
- DWAF Best Practice Guidelines Series G3: General Guidelines for Water Monitoring Systems.

Certain sampling procedures need to be followed to ensure that correct and representative samples are collected.

Suitable vessels (glass, plastic and sterilised) as provided or acceptable by the laboratory prior to each sampling event must be used.

If water is present at the site, samples must be taken according to the following procedure as a minimum:

- The sample vessel is selected based on the determinant being tested and rinsed with water from the source.
- Surface water samples are collected from just below the surface, avoiding any surface scum and debris. When taking the sample directly into the sample vessel, the sampler must face upstream and collect the sample without disturbing the bottom sediments. When the sample point cannot be accessed, the sample can be taken using a bailer or a bucket attached to a long rope.
- In order to minimise the presence of air bubbles in the sample, excessive turbulence is avoided when filling the bottle. Stagnant water is avoided where possible. The cap is tightly closed to avoid leakage.
- In situ field measurements are taken for each sample using a multi-parameter probe. The pH, Electrical Conductivity (EC), Total Dissolved Solids (TDS) and temperature measurements are recorded at all sites whilst Dissolved Oxygen (DO) and free chlorine are measured at specified sites only.

- Samples are kept below 4ºC in a dark container and submitted to a South African National Accreditation System (SANAS) accredited laboratory for analysis as soon as possible, preferably within 48 hours of sampling. Shorter holding times are required for microbiological analyses.

Water Quality Guidelines and Determinants

The water quality results for the natural watercourses are compared to the DWAF, 1998 Aquatic Ecosystem and Domestic Use Guidelines as well as the DWAF General Limit Values (GLVs) as set out inSection 39 of the

National Water Act, 1998. The GLVs provide a means for discussing potential wastewater runoff qualities. None of the receiving water resources are 'listed water resources' as defined by the Act and thedischarge is not considered a 'Complex Industrial Wastewater', therefore the GLVs are considered applicable for the potential wastewater that may be produced by the site.

The car rental depots' water quality must be compared to the General Value Limits (GLVs) as specified in the Record of Decision or as required by the latest applicable regulations.

Sampling of the chemical and biological water quality determinants involves collection of a water sample for subsequent laboratory analysis. The sample sites need to be tested for different suites of determinants as detailed in table below except for total oils and greases that might not need to be tested during the contract.

Determinants	Chemical water quality determinants									Biological water quality determinants			Physico-chemical water quality determinants								
	SRP	Nitrate	Nitrite	Ammonia	TPH Banded C10-C40 Range	BTEX	Total Oil and Grease	Dissolved Iron	Dissolved Manganese	*E. coli*	Faecal Coliforms	Total Coliforms	pH	EC	TDS	TSS	DO	COD	Temp	BOD	Free Chlorine
Units	mg/l	mg/l	mg/l	mg/l	mg/l	µg/l	mg/l	mg/l	mg/l	CFU/ 100 ml	CFU/ 100 ml	CFU/100 ml		mS/m	mg/l	mg/l	%	mg/l	°C	mg/l	mg/l
SW-A01	X	X	X	X	X	X		X	X				X	X	X	X	X	X	X		
SW-A02	X	X	X	X	X	X		X	X	X	X		X	X	X	X	X	X	X		
SW-A03	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
SW-A04	X	X	X	X				X	X				X	X	X	X	X	X	X		
SW-A05	X	X	X	X	X	X		X	X	X	X		X	X	X	X	X	X	X		
SW-A06	X	X	X	X				X	X				X	X	X	X	X	X	X		
SW-A07	X	X	X	X	X	X		X	X				X	X	X	X	X	X	X		
SW-A08	X	X	X	X				X	X				X	X	X	X	X	X	X		
SW-A09	X	X	X	X	X	X		X	X				X	X	X	X	X	X	X		
SW-A10	X	X	X	X	X	X		X	X				X	X	X	X	X	X	X		
SW-A11	X	X	X	X	X	X		X	X				X	X	X	X	X	X	X		
SW-A12	X	X	X	X	X	X	X	X	X		X		X	X	X	X	X	X	X		
SW-A13	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
SW-A14	X	X	X	X				X	X	X	X		X	X	X	X	X	X	X		
SW-A15	X	X	X	X			X	X	X	X	X		X	X	X	X	X	X	X		
DTA3	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	
DT02	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X
1996 DWAF Aquatic Ecosystem Guidelines	105.84	0.48	0.5	15 (Chronic Effect), 100 (Acute Effect)	-	-	-	No baseline available	0.18	-	-	-	7.25 - 8.02	108.75	No baseline available	No baseline available	<60% (Sub Lethal), >40% (Lethal)	-	-	-	-
1996 DWAF Domestic Use Guidelines	-	6	6	1	-	-	-	0.1	0.05	0	0	5	6.0 - 9.0	70	450	n/s	-	-	-	-	-
DWAF GLV Limits	10	15	-	3	-	-	2.5	0.3	0.1	1000	1000	-	5.5-9.5	250	-	25	<75	75	-	-	-

Integrated water quality determinants for the car rental depots

Determinants	Chemical water quality determinants				Biological water quality determinants	Physico-chemical water quality determinants				
	SRP	Nitrate	Ammonia	Alkalinity	*E. coli*	pH	EC	TSS	COD	Temp
Units	mg/l	mg/l	mg/l	mg/l	CFU/100 ml		mg/l	mg/l	mg/l	°C
Car Rental Depots Monitoring Points										
SW- C01	X	X	X	X	X	X	X	X	X	X
SW- C02	X	X	X	X	X	X	X	X	X	X
SW- C03	X	X	X	X	X	X	X	X	X	X
SW- C04/ C05/C06	X	X	X	X	X	X	X	X	X	X
DWAF GLV Limits	<10	15	<3	n/s	<1000	>5.5 - <9.5	<150	<25	<75	-
DWAF SLV Limits	<2.5	<1.5	<2	n/s	0	>5.5 - <7.5	<100	<10	<30	-

The water quality determinants measured fall into five (5) broad categories, with required procedural action:

a. Chemical Water Quality:

- Sampling and laboratory analysis.

b. Biological Water Quality:

- E coli and total coliforms.

c. Bio-monitoring water quality:

- Benthic diatoms are to be collected in situ according to standard procedures, and laboratory analyses.
- Soil and wet testing.
- River aquatic health measurement using the South African Scoring System Version 5 (SASS5 hereafter), based on invertebrate sampling.

d. Physico-Chemical Water Quality:

- Analysed in situ.

e. Biophysical Quality:

i. The KSIA storm water quality-monitoring plan includes a biophysical monitoring component to assess the condition of key physical components of the receiving catchment that are likely to result in a direct deterioration of riparian and aquatic habitats, and catchment water quality.

ii. There are six elements of biophysical monitoring which include:

- Soil erosion: monitoring of the impacts on watercourses and riparian habitat from stormwater flows and WWTW discharges
- Soil deposition: sediment deposition
- Wetland habitat: the monitoring of impacts on wetland habitat from stormwater flows such as damage to the wetland vegetation, erosion head cuts and excessive sedimentation of wetland habitat
- Aquatic weeds: the growth of aquatic weeds within the water bodies must be monitored and mitigation measures determined
- Invasive alien plants: the presence and spread of alien plants within the catchment areas of KSIA
- Solid waste: the presence of solid waste within watercourses, both natural and stormwater must be monitored and reported accordingly.

Biomonitoring

Conduct the aquatic assessment to determine the potential impacts on the receiving environments, i.e. Umdloti, Froggy pond, and Tongaat/ Hlawe River. The following must be done as a minimum:

- Conduct the environmental impact assessment when required, to determine the effect of environmental contamination.
- Conduct biannual biomonitoring of the river quality.
- Measure Benthic diatoms at the South Wastewater Treatment Works sampling point, and quarterly at the outflow of the Froggy Pond.
- Conduct river aquatic health measurement using the South African Scoring System Version 5 (SASS5 hereafter), based on invertebrate sampling.
- Biannual monitoring of all species dependent on the Froggy Pond
- Present the study to the relevant stakeholders as and when required.

The scope of work and methodology focus on the below components:

- In situ water quality variables.
- Sediment analyses.
- Integrated Habitat Assessment System (IHAS), Index of Habitat Integrity (IHI) and visual assessment ofimpacts.
- Aquatic invertebrate assessment (South African Scoring System vers. 5 [SASS5] Protocol).
- Diatom analyses.
- Frog monitoring using a Song Meter.
- Fish Response Assessment Index (FRAI).
- Barn Swallows and
- Whole Effluent Toxicity (WET) testing.

The current monitoring network comprises 17 sample sites, the co-ordinates of these sites are provided in the table below:

Monitoring network for the biomonitoring programme:

Site ID	Description	Latitude (WGS84)	Longitude (WGS84)
SW-A01	Northern Outfall in the Hlawe River sub catchment	-29.595300°	31.127300°
SW-A02	Hlawe River downstream of the trade zone confluence	-29.591960°	31.118100°
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SW-A14	Sub catchment draining to Froggy Pond wetland	-29.638789°	31.097509°
SW-A15	Drainage channel, upstream of the Northern WWTWs.	-29.604033°	31.114576°
H1	Hlawe river, 200 m South of M43, North of KSIA. Decant ultimately flows into the Thongati River upstream.	-29.584457°	31.12658°
H2	Located along the Hlawe River, approximately 670 m downstream of AgriZone.	- 29.60257°	31.10264°

Frequency

The biomonitoring programme for the site need to comprise of biannual biomonitoring assessment and aquatic assessment.

Assessment type	Site	Monitoring procedure		
		Biannually	**Biannually**	**Annually**
Biomonitoring	SW-A01	-	Diatoms	-
	SW-A02	SASS5, IHAS	WET Testing	Sediment
	SW-A03	-	Diatoms	-
	SW-A04	-	Diatoms	-
	SW-A05	-	Diatoms	-
	SW-A06	-	Diatoms	-
	SW-A07	-	Diatoms	-
	SW-A08	-	Diatoms	-
	SW-A09	-	Diatoms	-
	SW-A10	-	Diatoms	-
	SW-A11	SASS5, IHAS	WET Testing	Sediment
	SW-A12	-	Diatoms	-
	SW-A13	SASS5, IHAS, Frog	WET Testing	Sediment
	SW-A14	-	Diatoms	-
	SW-A15	-	Diatoms	-
Aquatic	SW-A02	-	Diatoms, IHI	-
	SW-A11	-	Diatoms, IHI	-
	SW-A13	-	Diatoms, IHI	-
	H1	-	SASS5, Diatoms, FRAI, IHI, IHAS	-
	H2	-	SASS5, Diatoms, FRAI, IHI, IHAS	-

Guidelines

As a minimum the following sections describe the guidelines that can be followed to assess the ecological state of the biomonitoring sites based on in situ water quality, habitat, and biotic integrity.

In Situ Water Quality

Water quality refers to the general appearance, physical, chemical, and biological characteristics of a water resource and serves as an essential descriptor of river health and habitat integrity (DWAF, 1996b). In situ measurements taken at the time of biological sampling reflect the prevailing aquatic 'living' conditions and thus correlate with type of organisms captured. Water quality data therefore provides valuable information for the interpretation of community assessment data. A Hanna HI 9811-5 EC/TDS/pH meter and HI 9147 DO, and Temperature Meter are to be used to record temperature, pH, EC, TDS and DO.

The in-situ water quality results be compared against the Target Water Quality Ranges (TWQRs) in terms of the South African Water Quality Guidelines (SAWQG) for Aquatic Ecosystems, Vol. 7 (DWAF, 1996)

Sediment Analyses

Sediment data is an important element to consider when conducting an aquatic survey as it can reveal short-term or past-pollution events, which are not reflected by other analyses. Metals which have been released into an ecosystem tend to accumulate in sediments through various adsorption and precipitation processes, thus remaining available for reintroduction into the water.

Sediment characteristics determine the fate of toxic substances that settle in the aquatic environment. The higher the percentage of small grain sizes (very fine sand and mud) and organic content, the greater the capacity is to sequester or take hold of contaminants.

Habitat Integrity

Habitat integrity is a critical component of river ecology as it governs the suitability of a river for inhabitation by aquatic organisms. Knowledge of the existing habitats and their quality is therefore important in evaluations of riverine health. Habitat integrity can be assessed in terms of ecosystem impacts and habitat conditions at each site and is useful for the interpretation of the biological community data collected.

- The IHI assessment considers the impacts on the riparian and the instream habitats and describes their present ecological state (PES). The severity of each impact is ranked using a six-point scale and the estimated impact of each criterion is calculated. The estimated impacts of all criteria are summed, expressed as a percentage and subtracted from 100 to arrive at an assessment of habitat integrity for the instream and riparian components respectively.
- IHAS version 2 is used to assess the specific habitat suitability for the survival of aquatic macro-invertebrates and aid in the interpretation of the SASS5 results. The diversity and quality of the three habitat biotypes (Stone, Vegetation and Gravel-Sand-Mud) is recorded, assessed, and calculated for each site.

Aquatic biomonitoring of river benthic invertebrates utilises a semi-quantitative sampling approach, where the relative abundances of stipulated aquatic invertebrate taxa are recorded within a specific time limit. All samplings must be undertaken by an accredited SASS5 practitioner. All three biotypes, if available, must be sampled at each site. Samples are to be cleaned/cleared of as much unnecessary material as possible prior

to invertebrate identification.

Aquatic Macro-Invertebrate Integrity Assessment

The monitoring of the macro-invertebrate community of an aquatic ecosystem forms an integral part in monitoring of integrity of the ecosystem. The SASS5 index was designed specifically for the evaluation of streams and rivers and is not suitable for assessment of impoundments, isolated pools, wetlands, or pans (Dickens & Graham, 2001). In the current study, the standard SASS5 sampling methodology is applied. Organisms are identified to family level (Thirion et al., 1995; Davies & Day, 1998; and Dickens & Graham, 2001).

The endpoint of any biological or ecosystem assessment is a value expressed either in the form of measurements (data collected) or in a more meaningful format by summarising the measurements into one or several index values. The endpoints used for this study are the total SASS5 score and the Average Score Per Taxa (ASPT), indicating the average community sensitivity. All sites are rated according to these scores. The SASS5 results are evaluated against the prescribed ecological state categories according to the SASS5 Data Interpretation Guidelines (Dallas, 2007) for the North Eastern Coastal ecoregion

Diatom Analysis

Diatom laboratory procedures are carried out according to the methodology described by Taylor et al. (2005). Diatom samples are prepared for microscopy by using the hot hydrochloric acid and potassium permanganate method. Approximately 300 to 400 diatom valves are identified and counted to produce semi-quantitative data for analysis. Prygiel et al. (2002) found that diatom counts of 300 valves and above were necessary to make correct environmental inferences. The taxonomic guide by Taylor et al. (2007b) and Cantonati et al. (2017) is consulted for identification purposes. Where necessary, Krammer & Lange-Bertalot(1986, 1988, 1991 a,b) are used for identification and confirmation of species identification. Environmental preferences are inferred from Taylor et al. (2007b), Cantonati et al. (2017) and various other literature sources to describe the environmental water quality at each site.

The Specific Pollution Sensitivity Index (SPI; CEMAGREF, 1982) is used in the diatom assessment. According to De la Rey et al. (2004) the European numerical diatom index, SPI reflects certain elements of water quality with a high degree of accuracy due to the broad species base of the SPI. The SPI has been extensively tested in a broad geographical region and integrates impacts from organic material, electrolytes, pH, and nutrients. The limit values and associated ecological water quality classes adapted from Eloranta & Soininen (2002), in conjunction with the new adjusted class limits (Taylor and Koekemoer, in press) used for interpretation of the SPI scores. The SPI index is based on a score between 0 – 20, where a score of 20 indicates no pollution and a score of 0 indicates an increasing level of pollution or eutrophication.

Frog and Barn Swallow Monitoring

Frog monitoring must be conducted in the Froggy Pond sub catchment to monitor frog populations biannually. A Song Meter must be installed during monitoring period in the sub catchment. Data must be collected and analysed on a biannual basis and compiled in the biomonitoring report. The Barn Swallows activity must also be monitored.

Fish Response Assessment Index

The fish response assessment index (Kleynhans, 2007) must be used to quarterly determine the fish

community integrity at KSIA. The use of fish communities in the monitoring of aquatic ecosystems has been

widely used to determine the overall condition of aquatic ecosystems.

The RHP (Mangold, 2001) and FRAI (Kleynhans, 2007) sampling methodologies are used to assess the fish populations and electroshocking is used as the sampling technique (Meador et al., 1993; Barbour et al., 1999). A Samus battery operated electroshocking apparatus can be used to sample fish in the available habitat at each site. The electroshocking technique is carried out for 20 to 30 minutes depending on the site and habitat availability. All fish caught will be identified and returned. When a fish cannot be identified on site, it will be preserved in 10 % formalin for identification in the laboratory. The FRAI index has different metrics and sub-metrics to calculate the ecological category. The approach of using various metrics helps with both the development of a more consistent index of the fish community and with the mathematical integration of the metrics.

Whole Effluent Toxicity Testing

Acute toxicological screening of water samples is conducted within environmental control rooms on four trophic levels using Vibrio fischeri (bacteria), Selenastrum capricornutum (algae), Daphnia magna (macro-invertebrates) and Poecilia reticulata (Guppy) as test organisms. The Organisation for Economic Co- operation and Development (OECD) Guideline 201 (1984) is adhered to for the Selenastrum capricornutum growth inhibition test and the European Standard (EN ISO 11348-3, 1998) is performed for the Vibrio fischeri bioluminescent test (Table 4-13). The United States Environmental Protection Agency (US EPA) (1993) protocol is performed for the Daphnia magna acute toxicity test and the US EPA (1996) protocol is performed for the Poecilia reticulata acute toxicity test

Ground water

The purpose of the sampling is to provide KSIA with a mechanism to detect impacts in the groundwater relating directly to leaks and spillages from fuel storage and fuel handling facilities, as well as other sources of contamination. To this end, this monitoring plan does not purport to be a comprehensive environmental monitoring strategy for all Chemicals of Potential Concern (CoPC) associated with the airport activities. This means that boreholes are not built in all fuel areas but along Jet A1 areas.

Boreholes along fuel areas must be sampled twice a year. Sampling is to be done in the following ACSA fuel and effluent sensitive areas:

- Jet A1 receiving fuel depot
- The underground fuel pipelines
- Forward fuel depot
- ACSA refueling station
- Sasol garage
- Wastewater treatment works
- Car rental depots (new points might need to be added)
- Underground generators (new points might need to be added)

Some of the boreholes and soil vapour probes are already installed in the vicinity of the fuel storage and handling facilities, their co-ordinates and positions are as shown below.

Table below is a summary of Groundwater Monitoring Boreholes Installed around the Receiving Depot

Location	Borehole Number	Borehole Coordinates (WGS84)			Diameter of Piezometer (mm)	Piezometer Stick up above Ground Level (m)	Depth of Borehole (m)
		X	Y	Reference Elevation (mMSL1)			
Receiving Fuel Depot	D1	-8709	3277326	NS	90	-	27.00
	D2	Destroyed					41.75
	D3	-8848	3278145	NS	90	-	30.00
	S1	-8482	3277371	NS	90	-	7.73
	S2	-8844	3277074	NS	90	-	8.09
	S3	-8692	3277348	NS	90	-	7.66
	S4	-8667	3277379	NS	90	-	8.36
	S5	-8630	3277428	NS	90	-	7.94
	S6	-8816	3277559	NS	90	-	7.80
	FFM1	Not installed					
	FFM2	-8720.41	3277443.43	97.18	63	0.45	8.16
	FFM3	-8759.50	3277443.43	98.45	63	0.46	8.30

(1) - Reference Elevation – top of piezometer standpipe. NS – not surveyed

FUEL PIPELINE

The portion of the fuel pipeline included in this sampling plan is a dual underground pipeline used to convey fuel from the Jet A1 fuel receiving depot to the forward fuel depot with the positions of the groundwater monitoring boreholes installed along this portion of the pipeline. The construction details of the boreholes are summarized in table below.

Summary of Groundwater Monitoring Boreholes Installed along the Fuel Pipeline

Location	Borehole Number	Borehole Coordinates (WGS84)			Piezometer Stick up above Ground Level (m)	Diameter of Piezometer (mm)	Depth of Borehole (m)
		X	Y	Reference Elevation (mMSL1)			
Fuel Pipeline	D4	-9100	3278181	NS	-	90	31.61
	D5	-9327	3278714	NS	-	90	23.79
	D6	-9817	3276637	NS	-	90	12.95
	S7	-8846	3277668	NS	-	90	8.08

	S8	-8892	3278137	NS	-	90	6.08
	S9	-9264	3278186	NS	-	90	8.40
	FHL1	-8616.43	3277457.49	92.4	0.26	63	4.25
	FHL2	-8808.86	3277700.98	92.15	0.38	63	20.12
	FHL3	-8932.27	3277815.27	85.49	0.31	63	7.80
	FHL4	-9021.26	277971.65	73.28	0.20	63	6.16
	FHL5	-9042.67	3278017.95	70.78	0.43	63	8.04
	FHL6	-9184.86	3278017.95	70.26	0.30	63	8.58
	FHL7	-9258.17	3278187.91	64.27	0.34	63	4.50
	FHL8	-9298.86	3278080.91	70.22	0.28	63	19.50
	FHL9	-9465.27	3278118.16	81.17	0.26	63	17.00
	FHL10	-9600.00	3278184.05	81.09	0.16	63	24.25
	FHL11	-9700.34	3278267.89	80.75	0.27	63	18.14
	FHL12	-9800.57	3278387.84	79.72	0.31	63	10.01
	FHL13	-9925.52	3278374.64	80.24	0.28	63	12.20

(1) - Reference Elevation – top of piezometer standpipe. NS – not surveyed

FORWARD FUEL DEPOT (FFD) AND SERVICE STATION

FFD facility includes an above ground fuel storage tank (AST), and an underground slop tank (UST). The service station facility also includes 2 underground storage tanks (UST's) for diesel and gasoline. The layout of the facility is shown on Drawing No. 272270-001, together with the approximate locations of the groundwater monitoring boreholes installed around the facility. The construction details of the boreholes are summarized in the table below.

Summary of Groundwater Monitoring Boreholes and Soil Vapor Probes (SVP's) Installed at Forward Fuel Depot and Service Station

Location	Installation Type	Ref. Number	Borehole Coordinates (WGS84)			Piezometer Stick up above Ground Level (m)	Diameter of Piezometer (mm)	Depth of Borehole (m)
			X	Y	Reference Elevation (mMSL1)			
Down Gradient of Forward Fuel Depot	Standpipe	S11	-9906	3278481	NS	-	90	7.83
	Standpipe	FFD1	-9954.57	3278464.10	70.88	0.29	63	13.20
	Standpipe	FFD2A	-9941.44	3278497.70	66.52	0.32	63	8.04
	Standpipe	FFD2B	- 9940.24	3278496.52	66.90	0.39	63	3.50

	Standpipe	FFD3	-9916.43	3278501.83	67.07	0.15	63	4.30
Forward Fuel Depot Slops Tank	Standpipe	FS1	110mm dia. Standpipe Sealed					
	Standpipe	FS2	NS	NS	NS	-	63	4.12
	Standpipe	FS3	NS	NS	NS	-	63	3.95
	Standpipe	FS4	NS	NS	NS	-	63	3.76
Forward Fuel Depot Service Station Area	Standpipe and Soil Vapour Probe	FS5	NS	NS	NS	-	32 16	3.84
	Standpipe and Soil Vapour Probe	FS6	NS	NS	NS	-	32 16	3.84
	Standpipe	FS7	110mm dia. Standpipe Sealed					
	Standpipe and Soil Vapour Probe	FS8	NS	NS	NS	-	32 16	4.03
	Standpipe	FS9	110mm dia. Standpipe Sealed					
	Standpipe and Soil Vapour Probe	FS10	NS	NS	NS	-	32 16	3.89
	Standpipe and Soil Vapour Probe	FS11	NS	NS	NS	-	32 16	3.69
	Standpipe and Soil Vapour Probe	FS12	NS	NS	NS	-	32 16	3.62

(1) - Reference Elevation – top of piezometer standpipe. NS – not surveyed

EFFLUENT TREATMENT WORKS

One borehole, designated borehole WWTW1, is located down gradient of the wastewater treatment works. The construction details of the borehole are summarized in the table below.

Summary of Groundwater Monitoring Boreholes Installed around the Effluent Treatment works

Location	Borehole Number	Borehole Coordinates (WGS84)			Piezometer Stick up above Ground Level (m)	Diameter of Standpipe (mm)	Depth of Borehole (m)
		X	Y	Reference Elevation (mMSL1)			
Effluent Treatment Works	WWTW1	- 9319.48	3278963.14	36.69	0.18	63	18.00

(1) - Reference Elevation – top of piezometer standpipe.

CAR RENTAL DEPOT BOREHOLES

The car rental depots include underground storage tanks (UST's) for diesel and gasoline, as well as on-site service stations and associated underground pipework. Monitoring of the UST's for leaks is the responsibility of the car rental operators and is not included in the scope of this sampling plan. However, three boreholes, designated boreholes CDR1 to CDR3, have been installed in the car rental depots to monitor the general quality of the groundwater. The approximate locations of the boreholes are summarized in table below.

Summary of Groundwater Monitoring Boreholes Installed in the Car Rental Depot Area

Location	Borehole Number	Borehole Coordinates (WGS84)			Piezometer Stick up above Ground Level (m)	Diameter of Standpipe (mm)	Depth of Borehole (m)
		X	Y	Reference Elevation (mMSL1)			
Car Rental Depots	CRD1	-9983.31	3277374.65	89.21	0.32	63	9.72
	CRD2	-10208.64	3277281.57	90.60	0.38	63	20.04
	CRD3	-10403.35	3276994.52	89.53	0.26	63	8.45
	Europ1	- 29.610503	31.106485				
	Europ2	- 29.609683	31.108115				
	Europ3	- 29.611861	31.106054				
	TOW4	- 29.610985	31.107268				

(1) - Reference Elevation – top of piezometer standpipe. Sampling Plan

Selected boreholes and soil vapour probes will be monitored at the specified frequency according to the following sampling plan.

Compounds of potential concern (copc)

All groundwater samples collected shall be submitted for the relevant suites of laboratory analyses, as summarised in Table below.

Summary of Compounds of Potential Concern (COPC) Selected for Monitoring

	COPC Selected for Monitoring		
Sampling Location	**BTEXN1**	**Gasoline and Diesel Range Organics (GRO: DRO)**	**Effluent Suite2**
Receiving Fuel Depot	√	√	
Fuel Pipeline	√	√	
Forward Fuel Depot (Slops Area)	√	√	
Sasol Filing Station	√	√	
Effluent Treatment Works			√
Car Rental Depots	√	√	

Note:

1 BTEXN – benzene, toluene, ethyl benzene, xylene and napthalene

2 Effluent Suite:

pH EC

Nitrate and Nitrite Total Phosphate As, Fe and Mn Sulphate - soluble Chloride

Chemical Oxygen Demand (COD)

Ecoli and Total Coliforms

The scope of this sampling plan is restricted to the detection of fuel leaks from the above-mentioned fuel handling and storage infrastructure, as well as the detection of effluent leaks from the water treatment works. Should leaks ever be confirmed, then the list of COPC must be reviewed to include relevant fuel additives and associated COPC.

Monitoring and sampling requirements

Groundwater levels shall be measured in all the boreholes prior to groundwater sampling using an electronic oil- water interface meter. The interface meter used shall be capable of measuring a minimum of 2mm of light non aqueous phase liquid (LNAPL) floating on the groundwater. The stickup of each borehole shall be measured every time it is sampled, and groundwater shall be recorded as a depth of the groundwater interface below the top of the piezometer (reference level). In addition, the depth of each borehole shall be measured during every sampling event. All groundwater levels and borehole depths shall be made to an accuracy of 1mm.

Sampling in accordance with US EPA Low Flow Sampling Procedure or modified US EPA Low Flow Sampling Procedure as given below:

- Prior to sampling, the LNAPL thickness and groundwater level is measured in each borehole using and electronic oil/water interface probe
- If the selected pump requires the use of drop tubes, then such drop tubes shall comprise dedicated pipes installed in each monitoring well, consisting of an approved inert material. Whenever the water levels and construction of the boreholes permit it, then pumps shall be installed in the centre of the screened area of each well and drop tubes shall be placed in the centre of the screened area or at

least 0,50m from the bottom of the well.

- Purging shall be undertaken using a low flow pump setting at a constant rate of between 0,25 and 0,75 litres/min.
- Drawdown may not exceed 0,1m at any time. If the drawdown exceeds 0,25m, the sampling will be stopped, and new sampling will be started at a lower pumping rate.
- At least 3 borehole volumes must be purged.
- A flow through cell and calibrated multimeter shall be used for the sampling of all boreholes. Prior to sample collection, 3 consecutive measurements of the following parameters must be made with the multimeter ensure that the parameters are within the limits shown. This shall be done in the flow through cell, using a multimeter fitted with pH, EC, and Redox probes.
  - pH $\pm$0.1
  - Conductivity $\pm$3%
  - Redox Potential $\pm$10mV
  - The time between each measurement will equal the time to purge 1 borehole volume, or not less than 5 minutes.
  - All measurements of the above-mentioned parameters including flow rate and the time intervals must be recorded on a site sampling sheet.
- Samples of adequate volume shall be taken from each borehole, directly into sample bottles supplied or specified by the laboratory.
- All samples must be labelled and temporarily stored in a portable refrigerator or cooler box with ice bricks, prior to being transferred to a refrigerator off-site.

This scope is restricted to the detection of fuel leaks from the above-mentioned fuel handling and storage infrastructure, as well as the detection of effluent leaks from the water treatment works. Should leaks everbe confirmed, then the list of Chemicals of Potential Concern must be reviewed to include relevant fuel additives and associated COPC.

Monitoring

- The condition of the borehole must be inspected including all visible olfactory signs of contamination. Groundwater levels shall be measured in all the boreholes prior to sampling using an appropriate dip meter or latest and similar equipment.
- The equipment to be used shall be capable of measuring a minimum of 2mm of light non aqueous phase liquid (LNAPL) floating on the groundwater.
- The groundwater monitoring shall be conducted according to recent approved plan by the Department of Water and Sanitation.
- The purging protocol (3 x times the volume of the saturated portion of the borehole column is removed from the borehole prior to monitoring) must be adhered to when sampling the boreholes. Measurements shall be recorded at depths of 0,1 and 0,5m in each borehole. All samples must be collected in laboratory approved containers; labelled and stored in a required temperature prior to being transferred to the laboratory.
- All details of the in-situ measurements, including but not limited to the details of the sampler, date and time of sampling, weather conditions, groundwater levels, equipment used, and test results shall be

recorded on formal field recording sheet and submitted with the report. Equipment used must be decontaminated and cleaned to prevent cross contamination where borehole contamination is suspected or evident. Contaminated groundwater purged from the boreholes shall be contained and be safely disposed at the appropriate dump site.

Soil vapour Probes

- Probes are to be monitored using a MiniRae 2000 Photo Ionization detector (PID), or similar portable electronic device which offers either equal or better detection capabilities in terms of detection limits and the range of VOC's detected. The apparatus shall be calibrated prior to use, using 100ppm Isobutylene gas.
- Groundwater levels must be monitored in the adjacent 32mm diameter open standpipe piezometers prior to taking VOC measurements. Should water be detected in the standpipes, the water must be removed until there is less than 150mm of water in the standpipes.

SAMPLING FREQUENCY

Sampling of groundwater monitoring boreholes and monitoring of SVP's shall be carried out once every 6 months, with events planned to coincide with the wet and dry seasons. The boreholes and SVP to be monitored and sampled are summarised in tables below. **Note**: AVGAS facility is not to be monitored.

Sample Plan for Soil Vapour Probes

Location	Standpipe and SVP Number	Biannual Monitoring of Soil Vapour Probes using PID	Biannual Monitoring of Groundwater Levels with Interface Meter
Forward Fuel Depot Service Station	FS5	√	√
	FS6	√	√
	FS8	√	√
	FS10	√	√
	FS11	√	√
	FS12	√	√

Sampling Plan for Groundwater Monitoring Boreholes

Location	**Borehole Number**	**Biannual Monitoring of Groundwater Levels with Interface Meter**	**Biannual in Situ Measurement of Hydrocarbon Concentrations**	**Biannual Sampling and Laboratory Testing**
Forward Fuel Depot	S11	√	√	
	FFD1	√	√	√
	FFD2A	√	√	
	FFD2B	√	√	√
	FFD3	√	√	√

Forward Fuel Depot Slops Tank	FS2	√	√	
	FS3	√	√	√
	FS4	√	√	
Fuel Pipeline	D4	For water extraction		
	D5	√	√	
	D6	√	√	
	S7	√	√	
	S8	√	√	
	S9	√	√	
	FHL1	√	√	√
	FHL2	√	√	√
	FHL3	√	√	√
	FHL4	√	√	√
	FHL5	√	√	√
	FHL6	√	√	√
	FHL7	√	√	√
	FHL8	√	√	√
	FHL9	√	√	√
	FHL10	√	√	√
	FHL11	√	√	√
	FHL12	√	√	√
	FHL13	√	√	√
Effluent Treatment Works	WWTW1	√	√	√
Receiving Fuel Depot	D1	√	√	
	D2	Destroyed		
	D3	For water extraction		
	S1	√	√	
	S2	√	√	
	S3	√	√	
	S4	√	√	√
	S5	√	√	√
	S6	√	√	
	FFM2	√	√	√
	FFM3	√	√	√
Car Rental Depots	CRD1	√	√	√
	CRD2	√	√	√

	CRD3	√	√	√
	Europ1	√	√	√
	Europ2	√	√	√
	Europ3	√	√	√
	TOW4	√	√	√
QA/QC	Duplicate	-	-	2
	Rinsate			4

Environmental Impact Assessment (Ad-hoc):

Upon notification by ACSA the service provider is to take emergency samples if emergency arises. In case of significant spillages, i.e. with impact on the natural environment, the Service Provider will be required to conduct an environmental impact assessment to determine the effect of the spill to the receiving environment. The environmental impact assessment will include:

- Conduct soil sampling and vegetation assessment to determine the extent of contamination.
- Sample and analyse water quality in and around the area of spillage, i.e. using reactive sampling points.
- The service provider must provide qualified specialists to conduct impact assessment following an incident. An investigation report with the mitigation measures to minimize the negative environmental impact must be provided.

Laboratory Accreditation and Quality Control

i. Only a laboratory that is SANAS accredited shall be used for this project. A copy of accreditation to be attached.

ii. The laboratory must be accredited for 60%, as a minimum, of the prescribed list of analysis required for this project. A letter of confirmation, in this regard, from the Lab must be included in the proposal.

iii. Quality control must always be ensured during the collection, transport and laboratory analysis of chemical and biological water quality samples.

iv. Personnel collecting samples (Technicians/Sampling Officers) must be fully trained in the correct procedures and techniques for water quality sample collection, handling and transportation.

v. An appropriately accredited SASS5 Practitioner must undertake biological monitoring. Proof of accreditation to be included in this proposal.

vi. The entire project must be conducted in line with the Department of Water and Sanitation South African Water Quality Guidelines (latest revision to be utilised).

vii. Samples are to be submitted for analysis to an analytical laboratory with existing ISO/IEC17025 accreditation for all the specific organic analyses to be carried out.

Reporting

Data management and efficient reporting is important to ensure that the data is stored in a usable format, which can be analysed, and tracked when required.

The following reports are required for this project:

- Quarterly report: which includes the results of sampling, site inspection and recommendations based on the monitoring activities of all water quality conducted in that specific period.
- Separate quarterly car rental depot memo for Car Rental sites including the analysis results, presented in a graphical and tabular format, and a detailed discussion of non-compliances.
- Update and submit to the relevant authorities an integrated surface, biomonitoring and storm water management plan as and when needed, e.g. submit an updated Water Quality Monitoring Programme and a motivation to the Department of Water and Sanitation for approval detailing the reasons for changes in the monitoring protocol.
- All supporting documentation and evidence collected, in terms of photographs etc., to be attached to the report.
- Final project report: Detailed report including the trends, (presented in graphic and tabular format) incidents and emerging threats. This report will include the review of the monitoring protocol
- The final report must include detailed results for the entire site including Car Rental sites, biomonitoring and aquatic assessment report.
- The report must list all the findings, recommendations as well as status of implementation of mitigation measures for minimizing pollution reaching the watercourses.
- It must contain the summary of all work done for the duration of the contract.
- The format of presenting the report must be an agreed and compatible with ACSA KSIA systems such as Microsoft office, Oracle and GIS.
- Report must be clearly presented and include an Executive Summary.

Note:

- The service provider is responsible to represent ACSA to the authorities to discuss or submit relevant water issues, this must be done in consultation and agreements with ACSA.
- Reports must be submitted electronically.
- Final report must be submitted in both electronic format and hard copies (x 2), with an accompanying USB (or equivalent) with the relevant files, including the raw data that were used for the analyses.
- Reports must contain all information related to the monitoring or observation results as well as recommendations.
- Include all records of the sampling and original copies of the supporting documentation.
- All reports must be reviewed and signed off by the qualified Professional Natural Scientist (Pri.Sci.Nat.). The copy of the final report must be submitted to ACSA on completion of each sampling event and to relevant authorities as and when required.
- All original documents pertaining to the contract must be submitted at the end of the contract, both electronically and physically on the agreed method between ACSA and a with the successful bidder.
- Monitoring frequency is subject to change during the contract depending on the authorities or applicable requirements.

Equipment and Protective Clothing

- The bidder must have a vehicle suitable for off road terrain that is not more than 7 years. The vehicle will need to be branded and undergo the safety checks for airside monitoring.
- Employees need to be physically and medically fit while conducting work at KSIA site. An ACSA permit application process will need to be followed which includes security clearance verification. ACSA will provide permit cost once every two years for Samplers and Biomonitoring Specialist.
- The team is required to provide themselves with appropriate protective clothing and equipment for the advertised bid.
- The successful Service Provider must submit a Health and Safety Plan to the Occupational Health and Safety Manager for approval prior to commencement of work.

Personnel

The team must be responsible for the following:

- To make use of the recent regulated technology/equipment as required for laboratories to collect samples.
- To monitor vegetation status and provide photographic evidence must be taken at the same point (fixed point photographs) for each sampling point on each sampling occasion.
- To dispose suspected contaminated water in an environmentally friendly manner.
- To report on the biophysical properties of the site and observable water quality and flow properties.
- To ensure the analysis of samples are done by SANAS-accredited laboratory within the applicable legislated time frames.
- To record all samplings, accordingly, submit to laboratory, as well as to manage the whole process of sample transmission.
- Compare the water quality results for the natural watercourses to relevant standards.
- Update KSIA water quality database on a quarterly basis.
- Conduct a detailed investigation/root-cause analysis to determine the causes of pollution.
- Identify and engage with the parties contributing to the causes of pollution and facilitate the implementation of the mitigation measures.
- The Service Provider must respond within 24 hours to conduct emergency sampling when required.
- A Project Manager is required to manage the project processes, ensuring planning and execution of the scope of work.
- The project Manager is also required to liaise with ACSA, communicate and submit applicable submissions to the authorities/ any other relevant parties.
- Project Manager must ensure all reports are accurate and signed off before submission. S/He is required to prepare/update the documents for submission to the authorities/ relevant parties and to attend meetings as when required.
- Project Manager is required to monitor the execution of all field work, supervise the work done by the field workers. Verify or review the work done by the staff doing the samplings. To engage with all relevant parties to discuss issues raised because of sampling/monitoring. S/He is required to ensure quality execution of the project including the sampling report finalisation before it is signed off. Facilitate all administration required for the project and ensure the equipment required is available.

Biomonitoring Specialist is required to conduct the river quality assessment in line with the SASS5 process, and Field Samplers for collecting field data are required to process the samples in a legislated manner.

4. Key Contractual Concerns

Item	Description	Rate per single unit	Rate for the duration of the contract
1.	Meetings (max of 2)		
2.	Surface water sampling fee – field work (max of 3 samplings)		
3.	Ground water sampling fee – field work (max of 2 samplings)		
4.	Disposal of contaminated water (once off)		
5.	Biomonitoring work – field work (max of 2 samplings)		
6.	Additional / emergency sampling per site		
	• Ground		
	• Surface		
7.	Reports		
	• Quarterly (max of 3)		
	• Biannual (max of 2)		
8.	Personnel		
	• Project Manager – quarterly fee		
	• Biomonitoring Specialist - biannually fee		
	• Field Sampler - quarterly fee		
9.	Disbursement		
	• Travel		

	• Induction training (once off payable by ACSA upon proven cost)		
	• Construction of borehole		
	• Laboratory fees		
10.	Safety file		
	Total costs excluding VAT		
	VAT		
	Total costs including VAT		

a) Identified Risks

Potential Risk	Mitigation strategy	Responsibility
Additional work subsequent to report from the service provider	Include the contingency or apply for additional funding.	ACSA
Reduction of scope	Contract amendment	ACSA/Contractor
Personnel changes	Appoint equally qualified replacement	Contractor
Timelines not met due to unforeseen circumstances	Engage all relevant parties and get agreements reached	Contractor