water affairs
Department:
Water Affairs
REPUBLIC OF SOUTH AFRICA

NCWABENI: OFF-CHANNEL STORAGE DAM

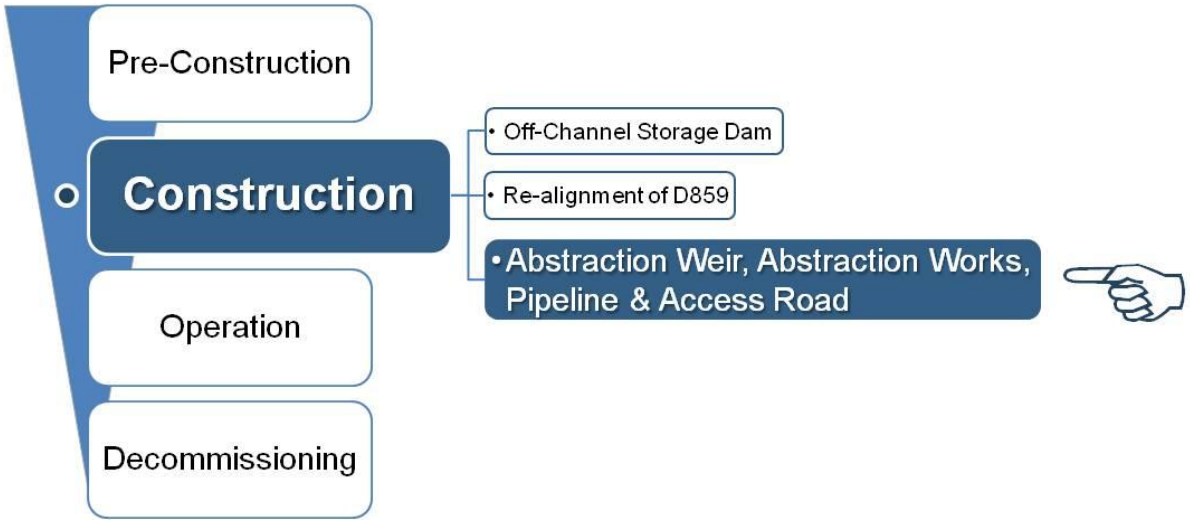
ENVIRONMENTAL MANAGEMENT PROGRAMME

ABSTRACTION WEIR, ABSTRACTION WORKS, PIPELINE & ACCESS ROAD

DRAFT

April 2013

[NEAS Ref No: DEA/EIA/0000586/2011; DEA Ref. No: 12/12/20/2468]



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LIST OF ACRONYMS & ABBREVIATIONS

DEA	Department of Environmental Affairs
DMR	Department of Mineral Resources
DWA	Department of Water Affairs
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
EMC	Environmental Monitoring Committee
EWR	Ecological Water Requirements
GN	Government Notice
km	Kilometre
KZN	KwaZulu-Natal
m^3/s	Cubic metre per second
MSDS	Material Safety Data Sheet
OCS	Off-Channel Storage
SANS	South African National Standards

DEFINITIONS OF KEY TERMS

Construction Area	*Immediate site influenced by specific construction activities, as approved by the Project Manager.*
Construction Domain	*Entire footprint required for the construction of the overall project components.*
Dam	*Any barrier dam and any other form of impoundment used for the storage of water.*
Environment	*The surroundings in which humans exist and which comprise:* • *The land, water and atmosphere of the earth.* • *Micro-organisms, plant and animal life.* • *Any part or combination of a) and b) and the interrelationships among and between them.* • *The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that can influence human health and well-being.*
Environmental Aspect	*Those components of the company's activities, products and services that are likely to interact with the environment.*
Environmental Feature	*Elements and attributes of the biophysical, economic and social environment.*
Environmental Impact	*The change to the environment resulting from an environmental aspect, whether desirable or undesirable. An impact may be the direct or indirect consequence of an activity.*
Environmental Management Programme (EMPr)	*A detailed plan of action prepared to ensure that recommendations for enhancing positive impacts and/or limiting or preventing negative environmental impacts are implemented during the life-cycle of a project.*
Environmental Objective	*Overall environmental goal pertaining to the management of environmental features.*
Environmental Target	*Performance requirement that arises from the environmental objectives and that needs to be set and met in order to achieve those objectives.*
Sensitive environmental features	*Environmental features protected by legislation (e.g. heritage resources), or identified during the EIA as sensitive through specialists' findings and input received from Interested and Affected Parties.*
Watercourse	*A geomorphological feature characterized by the presence of a streamflow channel, a floodplain and a transitional upland fringe seasonally or permanently conveying surface water. According to the National Water Act (Act 36 of 1998), a watercourse constitutes a river or spring, a natural channel in which water flows regularly or intermittently, a wetland, lake or dam into which, or from which, water flows, and any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.*
Weir	*An overflow structure built across an open channel to raise the upstream water level and/or to measure the flow of water. A measuring or gaging weir is calibrated for depth of flow over the crest. A weir generally consists of a rectangular, trapezoidal, triangular, or other shaped notch, located in a vertical, thin plate over which water flows.*

1. INTRODUCTION

This document serves as the Draft Environmental Management Programme (EMPr) for the abstraction weir, abstraction works, pipeline and access road as part of the overall Ncwabeni off-channel storage (OCS) Dam project, where the Department of Water Affairs (DWA) is acting as the project proponent.

Note that this EMPr is regarded as a sub-programme to the overall EMPr for the OCS Dam and should thus not be read in isolation. The EMPr for the OCS Dam (separate document) reflects how the programme aims to satisfy the requirements stipulated in section 24N of the National Environmental Management Act (No. 107 of 1998) (NEMA), and the associated regulation 33 of Government Notice (GN) No. R. 543 (18 June 2010).

1.1 Project Background

The Mzimkhulu Water Supply System (MWSS), which forms part of the KwaZulu Natal (KZN) Lower South Coast System, supplies water to all urban coastal towns from Hibberdene to Ramsgate, as well as to many rural inland settlements such as Fairview, Kwa-Madlala, Louisiana, Bhoboyi, Murchison, KwaNdwalane, Izontsha, Kwa Mavundla, Gamalakhe, etc, with a total estimated present rural population size of about 152 450. A significant growth in the water requirements for the system has been predicted through various previous studies, and a substantial portion of that growth can be associated with the increase of the level of service for the rural population as well as the planned extension of the system to cover additional rural areas, which are not presently supplied with water from the scheme.

DWA conducted various studies to determine the best options for providing the water requirements of all user sectors, including the Reserve. It was found that the construction of an off-channel storage (OCS) dam in one of the tributaries to the Mzimkhulu River should be considered. The reservoir can be filled from its incremental catchment, supplemented by pumping from the Mzimkhulu River during times of high river flows. During times of low flows water can be released back into the Mzimkhulu River for

abstraction downstream at the existing St. Helen's Rock abstraction works. From the various options investigated it was established that the D3A site on the Gugamela River and the D2 site on the Ncwabeni River were more favourable in terms of the location of the OCS Dam (see map contained in **Figure 1**).

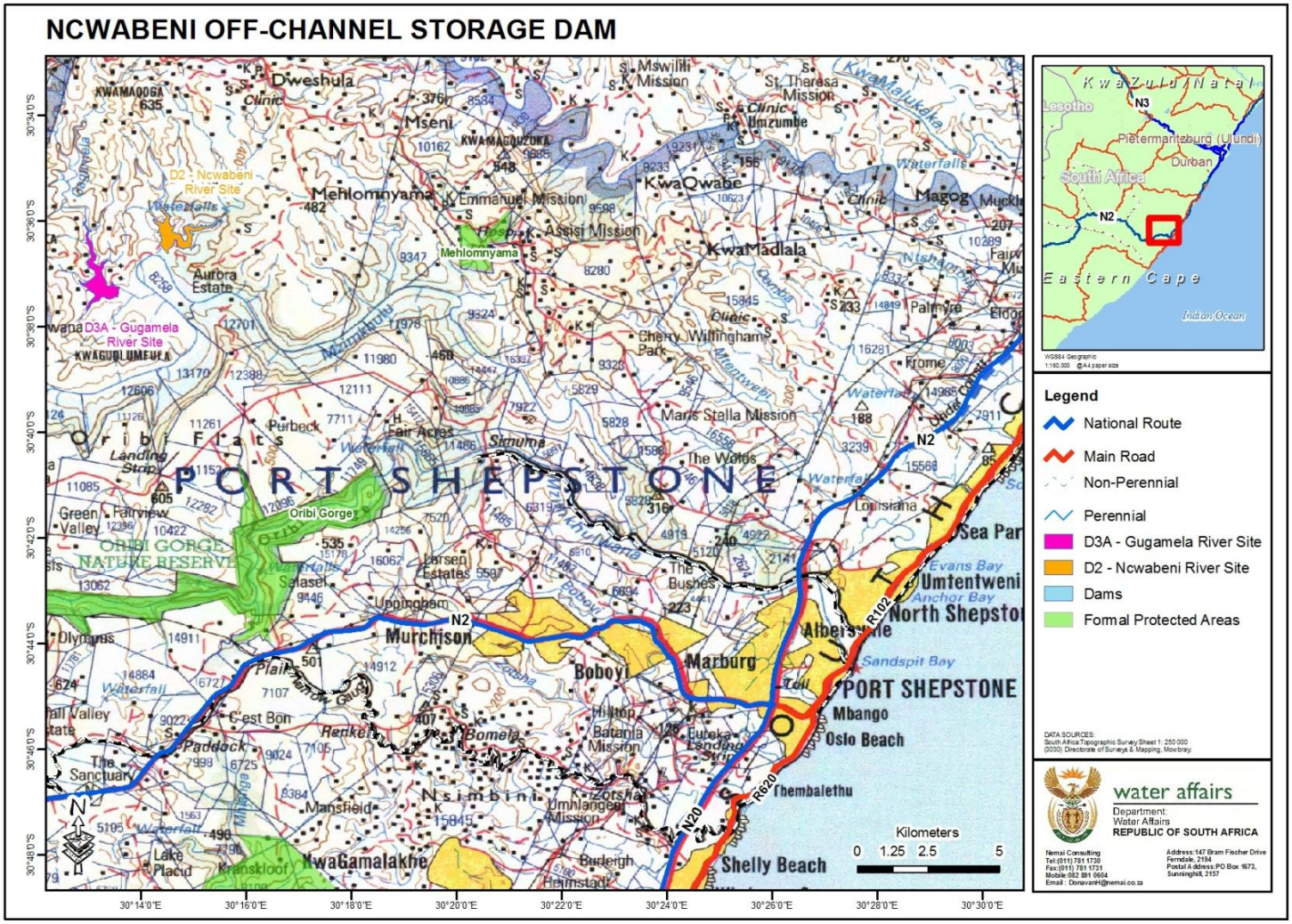


Figure 1: Regional Locality Map (site D2 – preferred site)

The project required authorisation from the Department of Environmental Affairs (DEA) in terms of NEMA, and the Environmental Impact Assessment (EIA) was undertaken in accordance the EIA Regulations (18 June 2010) contained in Government Notice (GN) No. R. 543, R. 544, R. 545 and R. 546. Based on the comparative analysis of the two alternative sites, as conducted as part of the EIA, site D2 was identified as the preferred option.

1.2 Overall Project Components

The proposed Ncwabeni OCS Dam project will consist of the following components (refer to layout map contained in **Appendix A**):

1. An OCS dam on the Ncwabeni River (site D2 – preferred site);
2. An abstraction / gauging weir on the Mzimkhulu River;
3. An abstraction works with a mechanism to remove silt;
4. A pump station and pipeline to deliver water to the dam; and
5. An outlet infrastructure to make measured releases back to the Mzimkhulu River.

1.3 EMPr Framework

Due to the extent of the overall project, the following suite of EMPrs was developed to deal with the various key components of the project:

1. Pre-Construction EMPr;
2. Construction EMPrs -
   a. OCS Dam;
   b. Re-alignment of D859; and
   c. **Abstraction weir, abstraction works, pipeline and access road** (focus of this document).

The EMPrs need to be updated to incorporate any conditions stipulated in the Environmental Authorisation issued in terms of NEMA and it should also take cognisance of further discussions with stakeholders affected by the proposed project.

The following EMPrs will be developed as further information becomes available during the implementation of the project:

1. Search, Rescue and Relocation Management Plan for red data, protected and endangered species, medicinal plants, heritage resources and graves;
2. Ncwabeni OCS Dam Impoundment EMPr;
3. Rehabilitation Management Plan for disturbed areas outside of the dam inundation area; and
4. Operational EMPr.

1.4 Overview of Abstraction Weir, Abstraction Works, Pipeline and Access Road

The abstraction / diversion weir, abstraction works, pipeline and access road to the abstraction works are part of the OCS Dam scheme. Refer to the layout contained in **Appendix B**.

1.4.1 Abstraction Weir

The main purposes of the abstraction weir, which is situated on the Mzimkhulu River at the abstraction works, include the following:

- Divert water from the Mzimkhulu River to fill the planned Ncwabeni OCS Dam for supply to Port Shepstone;
- Regulate the required releases for the Ecological Water Requirements (EWR);
- Ensure accurate flow measurement in the River.

The weir must provide sufficient head for flushing the gravel and sand traps and to ensure sufficient suction head for the pumps during low flow conditions. The weir was designed with a low notch (average 2,3 m high) of 25 m long adjacent to the abstraction works to direct water towards the inlet weir of the abstraction works' gravel trap. The level of the low notch was designed to accommodate the hydraulic gradient of flowing water through the abstraction works towards the downstream area of the river. The remaining section of the weir towards the right bank is on a level 300 mm higher than the low notch and will be approximately 67 m long.

The weir will also serve as a flow measurement structure and a crump weir was thus selected as the diversion weir. The low notch will measure lower flows accurately and is instrumental in directing river flows at higher power in front of the intake of the gravel trap canal to the abstraction works. The power of the water for this layout will draw the sediment over the low notch of the diversion weir.

The abstraction weir will make provision for a fishway to allow for the migration of aquatic biota (fish and invertebrates).

1.4.2 Abstraction Works

The main purpose of the abstraction works is to remove sediment from the Mzimkhulu River, which carries large amounts of sediment. Water can only be pumped to the Ncwabeni OCS Dam once the sediment is removed.

The abstraction works consists of the following components:

- A gravel and sand trap, with downstream radial gates to control gravel and sand;
- A hopper with jet pumps to control finer silt particles; and
- Two service pumps and one standby pump at the left side of the hopper.

The design of the abstraction works is based on a low maintenance design with a high assurance of supply.

The river diversion for the abstraction weir will be constructed in two stages, namely:

- The one stage will be a coffer wall to construct the abstraction works and low notch of the diversion weir; and
- The other stage will be a coffer wall to construct the higher notch section of the diversion weir.

1.4.3 Pump station and Pipeline

The pump station will be located on the left-hand bank (northern bank) of the abstraction weir. Water will be pumped from the abstraction works to the dam via a rising main pipeline. The pump station will deliver up to 1 m^3/s of water.

The pipeline will be routed alongside the slipway chute of the dam to reduce impacts on the surrounding landscape. The pipeline will be approximately 600 m long and 900 m in diameter. The pipeline will spill the water into the dam approximately 200 m upstream of the dam wall to avoid interfering with the dam wall.

1.4.4 Access Road

Approximately 1000 m of new road will be built to divert the D859 around the downstream side of the dam embankment (covered in a separate EMPr). A further additional 800 m of

road will also be built to provide access to the abstraction weir and abstraction works. The access road will be 6 m wide and will include a stormwater drain.

2. OVERVIEW OF THE EMPr

This EMPr provides performance criteria required to address potential environmental impacts during the construction phase of the abstraction weir, abstraction works, pipeline and access road, as part of the overall Ncwabeni OCS Dam project. This Report must be read in conjunction with the Ncwabeni OCS Dam EIA Report and overall EMPr for the construction of the OCS Dam.

The scope of the EMPr is as follows:

- Establish management objectives during the construction of the abstraction weir, abstraction works, pipeline and access road in order to enhance benefits and minimise adverse environmental impacts;
- Provide targets for management objectives, in terms of desired performance;
- Describe actions required to achieve management objectives;
- Outline institutional structures and roles required to implement the EMPr; and
- Provide legislative framework.

3. ENVIRONMENTAL ACTIVITIES, ASPECTS AND IMPACTS

3.1 Project Activities and Environmental Aspects

The construction activities associated with the abstraction weir, abstraction works, pipeline and access road are tabulated below.

Table 1: Construction activities associated with the abstraction weir, abstraction works, pipeline and access road

CONSTRUCTION PHASE
Project Activities
• *Grading and building of new access road*
• *Site clearing at tie-in point of riverbanks for abstraction weir, at abstraction works and pump station*
• *River diversion for abstraction weir*
• *Delivery of construction material*
• *Transportation of equipment, materials and personnel*
• *Storage and handling of material*
• *Excavation*
• *Blasting*
• *River diversion for construction of abstraction weir*
• *Concrete Works*
• *Steel works*
• *Construction of abstraction weir, pump station and sediment exclusion works*
• *Installation of pumps*
• *Build pump house*
• *Electrical supply*
• *Clearing along pipeline route*
• *Trenching*
• *Construction of rising main*
• *Construct valve and access chambers*
• *Cut and cover activities*
• *Stockpiling (fill material, road material)*
• *Waste and wastewater management*
• *Reinstatement and rehabilitation of construction domain (outside of inundation area, as necessary)*

Environmental aspects are regarded as those components of an organisation's activities, products and services that are likely to interact with the environment and cause an impact. The following environmental aspects have been identified for the proposed construction of the abstraction weir, abstraction works, pipeline and access road, which are linked to the project activities (note that only high-level aspects are provided):

Table 2: Environmental Aspects associated with the abstraction weir, abstraction works, pipeline and access road

CONSTRUCTION PHASE
Environmental Aspects
• *Lack of environmental awareness creation*
• *Poor consultation with affected parties*
• *Indiscriminate site clearing*
• *Poor management of access and use of access roads*
• *Poor transportation practices*

• *Inadequate provisions for working on steep slopes*
• *Disturbance of topsoil*
• *Inadequate storage and handling of material*
• *Inadequate storage and handling of hazardous material*
• *Lack of equipment maintenance*
• *Poor management of labour force*
• *Pollution from ablution facilities*
• *Poor waste management practices*
• *Poor management of pollution generation potential*
• *Damage to significant flora*
• *Damage to significant fauna*
• *Influence to the Mzimkhulu River from river diversion, in-stream works, temporary river crossing and activities in the riparian zone (and a buffer area of 50m)*
• *Environmental damage of sensitive areas*
• *Disruption of archaeological and cultural features*
• *Poor reinstatement and rehabilitation*

3.2 Potential Significant Environmental Impacts

Environmental impacts are the change to the environment resulting from an environmental aspect, whether desirable or undesirable. Refer to **Table 3** for the potential significant impacts associated with the preceding activities and environmental aspects.

Table 3: Potential Significant Environmental Impacts associated with the abstraction weir, abstraction works, pipeline and access road

CONSTRUCTION PHASE	
Feature	**Potential Impact**
Geology and Soil	• *Impacts associated with the sourcing of construction material* • *Soil erosion (land clearance, construction activities on steep slopes)* • *Blasting-related impacts*
Topography	• *Visual impact in river valley* • *Erosion of affected areas on steep slopes*
Surface Water	• *Adverse effects to resource quality (i.e. flow, in-stream and riparian habitat, aquatic biota and water quality) of the Mzimkhulu River associated with working in-stream and alongside the watercourse* • *Impacts to drainage line traversed by the access road*
Flora	• *Loss of vegetation of conservation significance* • *Proliferation of exotic vegetation in disturbed areas* • *Loss of medicinal plants* • *Loss of firewood*
Fauna	• *Damage / clearance of habitat of conservation importance* • *Loss of fauna species of conservation significance*

Feature	Potential Impact
Socio-economic	• *Nuisance from dust and noise* • *Damage to livestock* • *Influence to community members trying to take water directly from the river*
Air Quality	• *Excessive dust levels*
Archaeological and Cultural Features	• *Damage to heritage resources and graves*
Infrastructure	• *Influence to downstream hydropower scheme at Camro Estates*
Transportation	• *Construction-related traffic on D859*
Aesthetics	• *Reduction in visual quality of area*

4. IMPLEMENTATION PROGRAMME

The framework for the subsequent management measures consists of the following:

- **Management objectives** – i.e. desired outcome of management measures for mitigating negative impacts and enhancing the positive impacts related to project activities and aspects (i.e. risk sources);
- **Targets** – i.e. level of performance to accomplish management objectives; and
- **Management actions** – i.e. practical actions aimed at achieving management objectives and targets;
- **Responsibilities**; and
- **Monitoring requirements**.

4.1 Construction Site Planning and Layout

Management Objective:

Planning and layout of construction site to ensure protection of sensitive environmental features.

Target:

No impacts to sensitive environmental features as a result of construction site planning and layout.

Management Actions:

- Conduct pre-construction survey of area to be affected by the abstraction weir, abstraction works, pipeline and access road (refer to requirements contained in the Pre-Construction EMPr).
- Suitable specialist(s) to identify sensitive environmental features (including fauna, flora and heritage sites) where special care needs to be taken and implement suitable mitigation measures to safeguard these features (e.g. barricading, signage and awareness creation).
- Suitable specialist to identify protected plants and trees. Any protected plants or trees in proximity to the construction area that will remain, should be marked clearly and must not be disturbed, defaced, destroyed or removed, unless otherwise specified by the Project Manager. Acquire the necessary permits under the National Forests Act (No. 84 of 1998) if avoidance of protected trees is not possible.
- Contractor to produce a site plan for the approval of the Project Manager prior to the establishment of the site, which aims to identify construction activities, facilities and structures in relation to sensitive environmental features. This plan will serve as a spatial tool that facilitates the execution of the construction phase with due consideration of sensitive environmental features.

Responsibilities:

- Proponent - acquire permits.
- Project Manager and ECO - checking.
- Contractor to implement management actions.

Monitoring Requirements:

- Photographic record of pre-construction survey of area to be affected by the re-abstraction weir, abstraction works, pipeline and access road.
- Approved site plan.
- Barricading and signage.
- Records of awareness creation.

4.2 Site Clearing

Management Objective:

- Manage environmental impacts associated with site clearing required for the construction of the abstraction weir, abstraction works, pipeline and access road.

Target:

No damage to sensitive environmental features outside of construction area, including marked and barricaded heritage resources, protected trees, watercourses, structures and infrastructure.

Management Actions:

- Restrict site clearing activities to construction servitude for the D859.
- Method Statement to be developed, which will provide the details of how site clearing will be executed. Where possible, clearing by hand is recommended in order to create employment opportunities.
- Maintain barricading around sensitive environmental features.
- Avoid any disturbance to demarcated sensitive environmental features.
- Suitably experienced personnel (relevant to the potentially affected environmental features) to monitor the clearing activities, with particular focus on heritage resources and graves, as well as protected fauna and flora species.

Responsibilities:

- Project Manager and ECO - checking.
- Contractor to implement management actions.

Monitoring Requirements:

- No clearing outside of construction domain.
- Intact barricading.
- Public complaints register.
- Contractor’s method statement.

4.3 Site Establishment

Management Objective:

Minimise environmental impacts associated with site establishment.

Target:

1. No deviations from agreements made with individual landowners and community members.
2. No damage to sensitive environmental features outside construction footprint during site establishment.
3. No access or encroachment into no-go areas.
4. No justifiable complaints regarding general disturbance and nuisance received from the affected landowners and community members.

Management Actions:

- Positioning of the storage and lay-down areas for the abstraction weir, abstraction works, pipeline and access road should aim to minimise visual impacts.
- Maintain barricading around sensitive environmental features until the cessation of construction works.
- Facilities and structures shall be located according to the terrain and geographical features of the project site.
- Control the movement of all vehicles and plant (including suppliers), such that they remain on designated routes and comply with relevant agreements.
- Ensure noise levels are within their lawfully acceptable limits as per SANS 10103.
- Liaise with land owners to ensure that existing infrastructure is recorded and any damage repaired or compensated for.
- Construction activities must not impact on the farming practices at Camro Estates.
- Land to be affected by the abstraction weir on the southern bank of the Mzimkhulu River to be legally acquired prior to commencement of construction activities.

Responsibilities:

- Project Manager and ECO - checking.

- Contractor to implement management actions.

Monitoring Requirements:

- Intact barricading.
- Public complaints register.
- Contractor's method statement.

4.4 Management of Access and Traffic

Management Objective:

- Ensure that all construction vehicles use only dedicated access routes to construction sites, with the D859 as the main road.
- Ensure proper access control.
- Prevent unlawful access to construction domain.
- Adhere to agreements made with individual landowners and community members regarding access.

Target:

1. No reports of construction vehicles using other unauthorised routes.
2. No complaints regarding blocking of access to dwellings in tribal area.
3. No direct harm to livestock and wild animals due to inadequate access control.
4. No carrying of unsafe loads. Obtain a permit from the KZN Department of Transport for abnormal loads.
5. No speeding.
6. No accidents.

Management Actions:

- Undertake negotiations and confirm arrangements with the Cele K Tribe regarding the use of the D859 and traffic arrangements.
- No access to the site of the abstraction weir is allowed via the entrance to Camro Estates, unless a suitable agreement has been entered into in this regard.

- Any clearing for access or haul roads outside the demarcated works area shall only be undertaken after approval from the Project Manager.
- Temporary access roads outside of dam basin to be suitably rehabilitated.
- Speed limit of 40km/h on public and other roads within the project area to be adhered to.
- Ensure appropriate traffic safety measures are implemented to make provision for blind rises and sharp bends on the D859.
- Permission required from the Project Manager for the movement of any vehicles and/or personnel outside of designated working areas.
- Access roads to be maintained in a suitable condition.
- Suitable erosion protective measures to be implemented for access roads during the construction phase.
- Traffic safety measures (e.g. traffic warning signs, flagmen) to be implemented.
- Clearly demarcate all access roads.
- Clearly mark pedestrian-safe access routes.
- Proper access control to be maintained to prevent livestock from accessing construction area.
- All fences erected for construction purposes (e.g. fences around camp sites, fencing around trenches, etc.) should be inspected on a daily basis to detect whether any damage has occurred. Damaged fences / barricading to be repaired immediately.

Responsibilities:

- Project Manager and ECO - checking.
- Contractor to implement management actions.

Monitoring Requirements:

- Public complaints register.
- Signage displayed.
- Contractor’s method statement.

4.5 Management of Labour Force

Management Objective:

- Ensure suitable management of labour force to prevent security-related issues or disturbance to landowners and community members.
- Optimise use of local labourers and SMMEs.
- Provide a work environment that is conducive to effective labour relations.

Target:

1. No complaints from landowners and community members regarding trespassing or misconduct by construction workers.
2. All unskilled labour to be sourced from local communities.

Management Actions:

- Prevent trespassing of construction workers on private property (Camro Estates).
- Construction workers to clearly identifiable.
- Make suitable provision for accommodation of workforce. Onsite accommodation to be arranged in consultation with the Cele K Tribe.
- Provision to be made for families of employed workers during the construction phase.
- Creating nuisances and disturbances in or near communities shall be prohibited.
- Machine / vehicle operators shall receive clear instructions to remain within demarcated access routes and construction areas.
- Designated smoking areas should be provided, with special bins for discarding of cigarette butts.
- Establish a ‘labour and employment desk’, which is not to be situated at the site.
- Create opportunities for the employment of women.
- Where possible use labour-intensive methods of construction.
- Use local labour as far as possible.
- Develop a community labour agreement with targets for employment and for progression.
- Training of labour to benefit individuals beyond completion of the project.

- Implement an STD and HIV/AIDS awareness and prevention programme amongst labourers.

Responsibilities:

- Proponent – employment targets.
- Project Manager and ECO - checking.
- Contractor to implement management actions.

Monitoring Requirements:

- Public complaints register.
- Labour-related targets.

4.6 Management of Ablution Facilities

Management Objective:

- Minimise environmental impacts associated with ablution facilities.

Target:

1. No environmental contamination associated with ablution facilities.
2. Minimise visual impact associated with ablution facilities.

Management Actions:

- Provide sufficient ablution facilities (e.g. mobile / portable / VIP toilets), at the construction areas for the abstraction weir, abstraction works, pipeline and access road, which conform to all relevant health and safety standards and codes.
- Toilets may not be situated within 100 meters of any water body or within the 1:100 year flood line.
- A sufficient number of toilets shall be provided to accommodate the number of construction workers. Toilets may not be further than 100m from this area.
- Toilet facilities supplied by the Contractor for the workers shall occur at a maximum ratio of 1 toilet per 15 workers.

- All temporary / portable / mobile toilets shall be secured to the ground to prevent them from toppling over due to wind or any other cause.
- Ensure utilisation, maintenance and management of toilet, wash and waste facilities.
- Toilet facilities to be maintained in a hygienic state and serviced regularly.
- Toilet paper to be provided.
- The Contractor will ensure that no spillage occurs when the toilets are cleaned or emptied and that a licensed service provider removes the contents from site. Disposal of such waste is only acceptable at a licensed waste disposal facility.

Responsibilities:

- Project Manager and ECO - checking.
- Contractor to implement management actions.

Monitoring Requirements:

- Public complaints register.
- Maintenance register for ablution facilities.
- Disposal certificates.
- Contractor's method statement.

4.7 Management of Topsoil

Management Objective:

- Ensure suitable removal, storage, transportation of topsoil for reuse during rehabilitation.

Target:

1. >95% of recovered topsoil from area disturbed by the construction activities to be stored for future use.
2. No visual evidence of erosion from topsoil stockpiles.
3. No visual evidence of erosion from areas where topsoil has been reinstated.

Management Actions:

- Determine the average depth of the topsoil prior to construction activities.
- Identify suitable areas to store topsoil.
- Remove topsoil from areas to be affected by construction activities for the abstraction weir, abstraction works, pipeline and access road.
- Prevent mixing of topsoil with subsoil.
- Topsoil to be adequately protected from contamination from construction activities and material.
- Protect stored topsoil from compaction.
- Wind and water erosion-control measures to be implemented to prevent loss of topsoil.
- Following the construction phase, the topsoil should be placed in the areas affected by the construction activities as the final soil layer prior to seeding.

Responsibilities:

- Project Manager and ECO - checking.
- Contractor to implement management actions.

Monitoring Requirements:

- Topsoil stockpiles.
- Dust monitoring.
- Rehabilitated areas along the new sections of the D859.
- Contractor’s method statement.

4.8 Management of Excavations

Management Objective:

- Minimise environmental impacts associated with excavations.

Target:

1. No damage to sensitive environmental features outside construction area during excavations.

Management Actions:

- Construction activities to remain within the construction footprint.
- Subsoil and overburden should be stockpiled separately to be returned for backfilling in the correct soil horizon order.
- Suitable barricading to be erected around open excavations / trenches, as per the Construction Regulations (2003). Provide signage as a warning of open excavations.
- Divert runoff away from excavations, where necessary.
- Trench lengths will be kept as short as practically possible.
- Trench walls are to be stabilised using battering, shoring and bracing or similar techniques depending on the stability of the trench sides.
- Inspect open trenches at least daily basis to ensure that animals have not become trapped. Such animals will be removed and released. Special equipment for handling of venomous snakes should be available on site to ensure safe removal.
- Filing of trenches to make provision for subsidence.

Responsibilities:

- Project Manager and ECO - checking.
- Contractor to implement management actions.

Monitoring Requirements:

- Barricading of excavations.
- Excavation register.
- Contractor’s method statement.

4.9 Management of Storage and Handling of Non-Hazardous Material

Management Objective:

- Effective and safe management of materials in the construction area for the abstraction weir, abstraction works, pipeline and access road, in order to minimise the impact of non-hazardous materials on the environment.

Target:

1. No pollution due to handling, use and storage of non-hazardous material.

Management Actions:

- Materials to be suitably stored to prevent environmental contamination and visual impacts. Storage requirements to be determined based on chemical qualities of material and Material Safety Data Sheets (MSDS).
- Where required, stored material to be protected from rain and run-off to avoid environmental contamination.
- Materials to be appropriately transported to avoid environmental contamination. Loose loads (e.g. sand, stone chip, refuse, paper and cement) to be covered.
- Suitable remedial measures, depending on the nature of the contaminant and the receiving environment, to be instituted for spillages.
- Materials to be suitably used to prevent environmental contamination.

Responsibilities:

- Project Manager and ECO - checking.
- Contractor to implement management actions.

Monitoring Requirements:

- Evidence of spillages.
- MSDS register.
- Contractor’s method statement.

4.10 Management of Storage and Handling of Hazardous Material

Management Objective:

- Ensure the protection of the natural environment and the safety of personnel in the construction area for the abstraction weir, abstraction works, pipeline and access road, by the correct management and handling of hazardous substances.

Target:

1. No pollution due to handling, use and storage of hazardous material.
2. In the event of a spill, appropriate containment, clean up and disposal of contaminated material. Spills to be cleaned within 24 hours.

Management Actions:

- Hazardous substances must be stored and handled in accordance with the appropriate legislation and standards, which include the Hazardous Substances Act (Act No. 15 of 1973), the Occupational Health and Safety Act (No. 85 of 1993), relevant associated Regulations, and applicable SANS and international standards.
- Storage and use of hazardous materials will be strictly controlled to prevent environmental contamination, and must adhere to the requirements stipulated on the MSDS.
- Where flammable liquids are being used, applied or stored the workplace must be effectively ventilated.
- No person may smoke in any place in which flammable liquid is used or stored.
- Install an adequate number of fire-fighting equipment in suitable locations around the flammable liquids store.
- Where flammable liquids are decanted, the metal containers must be are bonded or earthed.
- No flammable material (e.g. paper, cleaning rags or similar material) may be stored together with flammable liquids.
- Staff that will be handling hazardous materials must be trained to do so.
- Any hazardous materials (apart from fuel) must be stored within a lockable store with a sealed floor. Suitable ventilation to be provided.

- All storage tanks containing hazardous materials must be placed in bunded containment areas with impermeable surfaces. The bunded area must be able to contain 110% of the total volume of the stored hazardous material.
- MSDSs, which contain the necessary information pertaining to a specific hazardous substance, must be present for all hazardous materials stored on the site.
- Spill kits must be available for the cleanup of hazardous material spillages.
- Provide secondary containment where a risk of spillage exists.
- Drip trays to be placed under parked heavy vehicles, equipment and other receptacles of hazardous material to prevent spillages.
- In the event of spillages of hazardous substances the appropriate clean up and disposal measures are to be implemented.
- Hazardous materials will be disposed of at registered sites or handed to registered hazardous waste disposal facilities for disposal / recycling.
- Proper and timeous notification of any pollution incidents associated with hazardous materials.

Responsibilities:

- Project Manager and ECO - checking.
- Contractor to implement management actions.

Monitoring Requirements:

- Evidence of spillages.
- MSDS register.
- Training register.
- Safe disposal certificates.
- Contractor's method statement.

4.11 Management of Waste

Management Objective:

- Minimise environmental impacts associated with waste in the construction area for the abstraction weir, abstraction works, pipeline and access road.

- Apply waste management principles of prevent, minimise, recycle or re-use, with disposal as a last option.

Target:

- No littering on construction site.
- Maintain a clean and tidy construction site.
- 100% record of all waste generated and disposed at waste disposal facilities.
- Valid disposal certificates for all waste disposed.
- Provision of adequate waste containers that are easily accessible and maintained.
- Waste bins to be removed and cleaned weekly.

Management Actions:

- Waste management activities must comply with the National Environmental Management: Waste Act (No. 59 of 2008).
- Vermin / weatherproof bins will be provided in sufficient numbers and capacity to store domestic waste. These bins must be kept closed to reduce odour build-up and emptied regularly to avoid overfilling and other associated nuisances.
- Where possible, waste must be separated at source (e.g. containers for glass, paper, metals, plastics, organic waste and hazardous wastes).
- Establish and monitor recycling targets.
- Provide waste skips at the construction areas. These skips should be sufficient in number, the skip storage area should be kept clean, skips should be emptied and replaced before overflowing or spillage occurs.
- Ensure suitable housekeeping. .
- The Contractor will ensure that no burying, dumping or burning of waste materials, vegetation, litter or refuse occurs. All waste will be disposed of at suitable licensed disposal sites, based on the waste type (general versus hazardous).
- Ensure that solid waste is transported so as to avoid waste spills en-route.

Responsibilities:

- Project Manager and ECO - checking.
- Contractor to implement management actions.

Monitoring Requirements:

- Public complaints register.
- Waste register.
- Waste disposal certificates.
- Recycling targets.
- Contractor's method statement.

4.12 Management of Blasting

Management Objective:

- Minimise environmental impacts associated with blasting.

Target:

1. Compliance with blasting-related legislation and standards.
2. No blasting-related impacts to private property, livestock or human health.

Management Actions:

- Prior to commencing with blasting activities, the blasting Contractor should submit a Method Statement which should comply with the Explosives Regulations (2003) and all relevant SANS standards and health and safety standards for mitigating blasting.
- The Contractor shall employ industry standard methods to control the impact of blasting and limit the risk of damage to buildings and structures by reducing blast vibrations induced in the rock mass, eliminating fly rock and limiting air-blast and noise to acceptable levels.
- Blast mats should be used wherever fly-rock may result in damage to any infrastructure or where it could result in death or injury of animals, or where damage could be caused to sensitive environmental features.
- Blasting operations should be controlled to ensure sound pressure levels are kept below the generally accepted 'no damage' level of 140 decibels.

- All explosives shall be transported, stored and handled in accordance with applicable laws and good design engineering and constructions practices.

Responsibilities:

- Project Manager and ECO - checking.
- Contractor to implement management actions.

Monitoring Requirements:

- Noise and vibration levels.
- Public complaints register.
- Contractor's method statement.

4.13 Management of Pollution Generation Potential

Management Objective:

- Ensure that all possible causes of pollution are mitigated as far as possible to minimise impacts to the surrounding environment.

Target:

1. No complaints regarding pollution.
2. No measurable signs of pollution.
3. Dust fallout -
    a. Fenceline sites = Industrial Band (600 to 1200 mg/m^2/day);
    b. Community sites = Residential Band (< 600 mg/m^2/day);
    c. Comply with ASTM D1739; SANS 1929, SANS 69.
4. Particulate matter (PM_{10}) -
    a. 24 hr = 120 µg/m^3 (more than four times a year);
    b. Annual = 50 µg/m^3;
    c. Comply with the National Ambient Air Quality Standards.
5. Noise -

a. L_{Aeq} (equivalent continuous sound level) during daytime hours (07:00 to 22:00) = 45 dBA;
b. L_{Aeq} during night-time hours (22:00 to 07:00) = 35 dBA;
c. Comply with SANS 10103:2008.

6. Water quality – construction activities may not cause an adverse impact that results in more than a 10% change in baseline values.

Management Actions:

- **Noise -**
  - The remote nature of the construction domain needs to be factored in to the mitigation of noise-related aspects.
  - The provisions of SANS 10103:2008 will apply to all areas at the perimeter of the site, within audible distance of residents.
  - Working hours to be agreed upon with Project Manager, so as to minimise disturbance to landowners and community members.
  - No amplified music will be allowed on the site. The use of radios, tape recorders, compact disc players, television sets etc. will not be permitted unless at a level that does not serve as an intrusion to adjacent land-owners.
  - Construction activities generating output levels of 85 dB or more will be confined to the hours during normal working hours.
  - The Contractor will take preventative measures (e.g. screening, muffling, timing, pre-notification of affected parties) to minimise complaints regarding noise and vibration nuisances from sources such as power tools.
- **Dust -**
  - Note that all dust suppression requirements should be based on the results from the dust monitoring and the proximity of construction activities to sensitive receptors.
  - Appropriate dust suppression measures or temporary stabilising mechanisms to be used when dust generation is unavoidable (e.g. dampening with water, chemical soil binders, straw, brush packs, chipping), particularly during prolonged periods of dry weather. Dust suppression to be undertaken for all bare areas, including construction area and access roads.
  - Speed limits to be strictly adhered to.

- The Contractor will take preventative measures to minimise complaints regarding dust nuisances (e.g. screening, dust control, timing, pre-notification of affected parties).

- **Lights -**
  - Prior to construction the position and type of lighting will be planned to ensure unnecessary light pollution will be eliminated.
  - All lighting installed on site must not lead to unacceptable light pollution to the surrounding community and natural environment (e.g. use of down-lighters).
- **Erosion -**
  - Protect areas of the construction site that are susceptible to erosion (e.g. steep sections along the access road and pipeline, crossing of drainage lines, tie-ins at river banks), through suitable measures (e.g. watering, planting, retaining structures, commercial anti-erosion compounds).
  - Any erosion channels caused by construction activities to be suitably stabilised and rehabilitated.
  - All efforts to prohibit ponding on surface and ensure stormwater runoff is channelled from the site must be made. The method used will be appropriate to the expected stormwater flows and the topography and geology of the site.
- **Cement and Concrete Batching -**
  - Cement mixing to take place on an impervious surface (e.g. cement mixing pit).
  - Batching operations to take place in a designated area, which will be kept clean at all times.
  - Location of batching plant to be approved by the Project Manager, with due consideration of the relevant management measures contained in the EMPr (see EMPr sections on *Site Clearing*, *Site Establishment*, *Management of Water*, *Management of Waste*, etc.).
  - Ensure separation of clean and dirty water from batching plant.
  - Wastewater from batching operations to be disposed in accordance with the EMPr section on *Management of Water*. Contaminated water will not be discharged to the environment. Prevent overflow from contaminated wastewater storage area.
  - Waste concrete and cement sludge to be removed on a regular basis (to prevent overflowing) and to be disposed of at a suitable facility.

- Unused cement bags will be stored in an area not exposed to the weather and packed neatly to prevent hardening or leakage of cement.
- Used cement bags will be stored so as to prevent windblown dust and potential water contamination. Used bags will be disposed of adequately at a licenced waste disposal facility.
- Concrete transportation will not result in spillage.
- Cleaning of equipment and flushing of mixers will not result in pollution, with all contaminated wash water entering the waste water collection system.
- To prevent spillage onto roads, ready mix trucks will rinse off the delivery shoot into a suitable sump prior to leaving the site.
- Suitable screening and containment will be in place to prevent windblown contamination from cement storage, mixing, loading and batching operations.
- All contaminated water and fines from exposed aggregate finishes will be collected and stored in sumps and will be adequately disposed of.
- All visible remains of excess concrete will be physically removed on completion of the plastering or concrete pouring and disposed of in an acceptable manner.

Responsibilities:

- Project Manager and ECO - checking.
- Contractor to implement management actions.
- Contractor to conduct environmental monitoring for air quality (dust and PM_{10}), noise and water quality.

Monitoring Requirements:

- Public complaints register.
- Evidence of pollution.
- Review periodic results from environmental monitoring (water quality, air and dust).
- Contractor's method statement.

4.14 Management of Flora

Management Objective:

- Preserve protected flora species outside of construction areas.
- Control alien plants and noxious weeds.

Target:

1. No unpermitted disturbance to protected flora species.
2. Ongoing eradication of alien plants and noxious weeds.

Management Actions:

Note: *Refer to sections on construction site planning and layout, as well as site establishment for additional control measures for the protection of flora.*

- Comply with the requirements of the National Environmental Management: Biodiversity Act (No. 10 of 2004), National Forests Act (No. 84 of 1998) and Natal Nature Conservation Ordinance 15 of 1974.
- Compile and implement search, rescue and relocation plan for protected flora species.
- Search, rescue and relocation to be undertaken by a specialist.
- Ongoing identification of protected plants and trees.
- Any protected plants or trees in proximity to construction areas for the abstraction weir, abstraction works, pipeline and access road that will remain, should be clearly marked and must not be disturbed, defaced, destroyed or removed, unless permitted and otherwise specified by the Project Manager.
- Acquire the necessary permits under the National Forests Act (No. 84 of 1998) if avoidance of protected trees is not possible.
- Control of alien invasive species and noxious weeds for areas disturbed by the construction activities, in accordance with the requirements of the Conservation of Agricultural Resources Act (No. 43 of 1983). Eradication method to be approved by the Project Manager and ECO.
- Implement a monitoring programme for eradication of alien invasive plants and noxious weeds.

- Retain vegetation within the construction site (outside of dam basin), wherever possible.
- Where possible, transplant plant material to designated areas.
- Rehabilitation Management Plan to be developed for disturbed areas outside of the dam inundation area.
- No construction equipment, vehicles or unauthorised personnel will be allowed onto areas that have been rehabilitated outside of dam basin. Only persons / equipment required for maintenance thereof will be allowed to operate on rehabilitated areas.
- Removal of medicinal plants by construction workers will not be allowed. Programme to be implemented to source medicinal plants, in consultation with the relevant authorities and the Cele K Tribe.
- No trees to be felled for fuel purposes.
- Felled timber to be made available to the local community.
- Branches, leaves and non-useable wood to be chipped and used as mulch during rehabilitation.
- Contractor to test top 15 cm soil at predetermined distances for fertilizer requirements. All testing to occur at SANS 17025 (Agrilasa) laboratory.
- All reseeding activities will be undertaken at the end of the dry season (middle to end September) to ensure optimal conditions for germination and rapid vegetation establishment.
- The rehabilitated and seeded areas must be harrowed after spreading the topsoil and fertilizer uniformly.
- Inspect rehabilitated area at three monthly intervals during the first and second growing season to determine the efficacy of rehabilitation measures.
- Take appropriate remedial action where vegetation establishment has not been successful or erosion is evident.
- Only locally indigenous vegetation is to be used for rehabilitation.

Responsibilities:

- Proponent - acquire permits.
- Project Manager and ECO - checking.
- Contractor to implement management actions.

Monitoring Requirements:

- Permits.
- Search, Rescue and Relocation Plan.
- Barricading of protected flora species.
- Encroachment of alien invasive plants and noxious weeds.
- Successful rehabilitation.
- Contractor's method statement.

4.15 Management of Fauna

Management Objective:

- Ensure the protection of animals (including livestock).
- Adhere to agreements made with landowners and community members regarding animals.

Target:

1. No direct / indirect harm to animals from construction activities.
2. No deviations from agreements made with individual landowners and community members regarding animals.

Management Actions:

Note: *Refer to sections on construction site planning and layout, as well as site establishment for additional control measures for the protection of animals.*

- Comply with the requirements of the National Environmental Management: Biodiversity Act (No. 10 of 2004), Natal Nature Conservation Ordinance 15 of 1974 and Animal Protection Act (No. 71 of 1962).
- Compile and implement search, rescue and relocation plan for protected fauna species.
- Proper access control to be maintained to prevent livestock from accessing construction areas.
- Stringent and dedicated control of poaching.

- No fishing allowed.
- No wilful harm to any animals, unless a direct threat is posed to a worker's health or safety.
- Captured animals to be safely released to a similar habitat.
- Prepare emergency response procedure for dealing with snake bites, as venomous species such as green and black mamba occur in the area.

Responsibilities:

- Proponent - acquire permits.
- Project Manager and ECO - checking.
- Contractor to implement management actions.

Monitoring Requirements:

- Permits.
- Contractor's method statement.

4.16 Management of Watercourses

Management Objective:

- Ensure that the watercourses (including the Mzimkhulu River, Ncwabeni River, natural channels, drainage lines) are protected and incur minimal negative impact to resource quality (i.e. flow, water quality, riparian habitat and aquatic biota).

Target:

1. Unaltered downstream flow regime.
2. Downstream water quality to remain within acceptable ranges, as determined through baseline monitoring.
3. Ecological category not to be influenced by construction activities.

Management Actions:

- **Flow** -
  - Minimise construction footprint where the construction activities take place in-stream or in close proximity (< 50 m) to watercourses.
  - Prevent erosion on steep slopes.
  - Minimise influence to downstream flow regime when diverting and impeding flow for cofferdams, temporary river crossing or for any other purposes.
  - Do not hinder flow in natural drainage lines.
  - Construction activities not to interfere with the water abstraction point and hydropower scheme located downstream on the banks of the Mzimkhulu River, on the Farm Gibraltar 8258 (Camro Estates).
- **River morphology** -
  - Reinstate (shaping) and rehabilitate (indigenous riparian vegetation) areas of the river structure which have been affected by the abstraction weir, abstraction works and temporary river crossing.
  - Install suitable buttressing to prevent future erosion of the river structure, if required.
  - No illegal crossing of the watercourse with construction plant. Suitable temporary river crossing to be built. Select most appropriate crossing point based on geotechnical conditions, sensitivity of riparian habitat (e.g. protected trees, large trees that afford bank stabilisation) and instream habitat, depending on technical feasibility.
  - No construction facilities (including storage areas, containers, chemical toilets, etc.) to be located within natural drainage lines.
- **Water quality** -
  - Conduct water quality monitoring at suitable up- and downstream sites on the Ncwabeni and Mzimkhulu Rivers.
  - All diffuse pollution sources to be managed to prevent pollution of the watercourses in the project area.
  - Storage area and ablution facilities not to be located closer than 50m from edge of riparian habitat.
  - Where necessary, install instream silt traps during construction within the watercourse channel and along the riparian habitat. Instream silt traps are to be

maintained and serviced on a regular basis. The style of silt trap will depend on materials used and the water movement patterns. If silt traps are not deemed feasible, other suitable measures need to be taken to limit unnaturally high sediment volumes in the watercourses.

- Implement suitable stormwater measures during construction to manage ingress of runoff into watercourses.
- No waste water to be released to natural drainage lines.
- Ensure proper storage of material (including fuel, paint) that could cause water pollution. Ensure proper storage and careful handling of hazardous substances with spill prevention materials at hand.
- Reduce sediment loads in water from dewatering operations. All dewatering should be done through temporary sediment traps (e.g. straw bales). These are to be serviced regularly and removed when no longer in use. Materials can be re-used.

Responsibilities:

- Project Manager and ECO - checking.
- Contractor to implement management actions.

Monitoring Requirements:

- Review periodic results from water quality environmental monitoring.
- Erosion monitoring.
- Contractor's method statement.

4.17 Management of Archaeological and Cultural Features

Management Objective:

- Ensure that archaeological and cultural resources, as well as graves are protected.

Target:

1. No archaeological and cultural resources or graves to be damaged during construction.

Management Actions:

- Compile and implement search, rescue and relocation plan for graves.
- For any chance finds, all work will cease in the area affected and the Contractor will immediately inform the Project Manager. A registered heritage specialist must be called to site for inspection. The relevant heritage resource agency (i.e. Amafa aKwaZulu-Natali) must be informed about the finding.
- Permits to be obtained in terms of the KZN Heritage Act (Act No. 04 of 2008) if heritage resources are to be impacted on and for the removal of graves.
- Exhumation and relocation of graves once families and affected communities have been consulted and permission received for relocation. All cultural practices in terms of removal of graves as requested by family / community to be complied with.
- All homesteads and graves situated in close proximity to the construction areas to be protected by a 20m buffer in which no construction can take place. The buffer to be highly visible to construction crews.
- Prior to the construction of the abstraction weir in the Mzimkhulu River, the area on the southern bank of the river must be surveyed by an archaeologist. Second phase Heritage Assessment to be undertaken for the area to be affected.
- Under no circumstances may any heritage material be destroyed or removed from site.
- Should any remains be found on site that is potentially human remains, the South African Police Service should also be contacted.

Responsibilities:

- Proponent - acquire permits.
- Proponent - appoint archaeologist.
- Project Manager and ECO - checking.
- Contractor to implement management actions.

Monitoring Requirements:

- Permits.
- Contractor’s method statement.

4.18 Management of Emergency Procedures

Management Objective:

- Minimise environmental impacts associated with emergency procedures.

Target:

1. No site fires to be caused by construction activities and workers.
2. Approved emergency response procedures, where relevant.

Management Actions:

- **Fire** -
  - Comply with the National Veld and Forest Fire Act (No. 101 of 1998).
  - Work closely with the local fire protection association. Determine requirements and add to list of emergency telephone numbers. Keep a fire danger index displayed on site and comply with requirements. Fire breaks are to be agreed with neighbours and the local fire protection association.
  - Proper emergency response procedure to be in place for dealing with fires.
  - Burning of waste is not permitted.
  - Suitable precautions will be taken (e.g. suitable fire extinguishers, water bowsers, welding curtains) when working with welding or grinding equipment.
  - All fire control mechanisms (fire fighting equipment) will be routinely inspected by a qualified investigator for efficacy thereof and be approved by local fire services.
  - All staff on site will be made aware of general fire prevention and control methods, and the name of the responsible person to alert to the presence of a fire.
  - No fires are allowed on site, unless in dedicated areas approved by the Project Manager.
  - Firebreaks to be made for construction areas, as required.
  - Dedicated smoking areas to be provided. Sigarette butts may not be disposed of onsite.
- **Accidental Leaks and Spillages** -
  - Proper emergency response procedure to be in place for dealing with spills and leaks.

- Ensure that the necessary materials and equipment for dealing with spills and leaks are available on site, where practicable.
- Remediation of the spill areas will be undertaken to the satisfaction of the Project Manager.
- In the event of a hydrocarbon spill, the source of the spillage will be isolated and contained. The area will be cordoned off and secured. The Contractor will ensure that there is always a supply of an appropriate absorbent material readily available to absorb, breakdown and where possible, encapsulate a minor hydrocarbon spillage.
- All staff on site will be made aware of actions to be taken in case of a spillage.
- Provide contact details of person to be notified in a case of spillages – signage to be displayed at strategic points within the construction domain (e.g. workshop, fuel storage area, hazardous material containers).

Responsibilities:

- Project Manager and ECO - checking.
- Contractor to implement management actions.

Monitoring Requirements:

- Approved Emergency Response Plan.
- Signage displayed.
- Training and awareness creation records.
- Contractor's method statement.

4.19 Management of Health and Safety

Management Objective:

- Provide a safe working environment to construction workers and the public.

Target:

1. Approved Health and Safety Plan.
2. No incidents.

3. Compliance with the Occupational Health and Safety Act (Act No. 85 of 1993), Construction Regulations (2003) and other relevant regulations.

Management Actions:

- Contractor to submit a Health and Safety Plan, prepared in accordance with the Health and Safety Specification, for approval prior to the commencement of work.
- Fencing and barriers will be in place in accordance with the Occupational Health and Safety Act (Act No. 85 of 1993).
- Applicable notice boards and hazard warning notices will be put in place and secured. Night hazards will be indicated suitably (e.g. reflectors, lighting, traffic signage).
- Emergency contact details will be prominently displayed.
- Two-Way Radio Systems should be used where cell phone coverage is poor.
- All construction personal must be clearly identifiable. All employees must also be issued with employee cards for identification purposes.
- All workers will be supplied with the required Personal Protective Equipment as per the Occupational Health and Safety Act (Act No. 85 of 1993).
- Maintain access control to prevent access of the public to the construction areas, as far as practicable.
- Use approved communication channels to inform the Cele K Tribe and Camro Estates of Occupational Health and Safety measures to prevent incidents involving the public.

Responsibilities:

- Project Manager and ECO - checking.
- Dedicated Occupational Health and Safety system to be implemented by Contractor's Safety Officer. To be monitored and audited by the Client's Safety Agent, in terms of the Construction Regulations (2003).
- Contractor to implement management actions.

Monitoring Requirements:

- Occupational Health and Safety system – checked by Safety Agent.

4.20 Management of Reinstatement and Rehabilitation

Note: *Reinstatement and rehabilitation only refer to areas outside of the dam basin that will not be inundated or used for operational purposes.*

Management Objective:

- Adequate reinstatement and concurrent or progressive rehabilitation of construction areas disturbed by the abstraction weir, abstraction works, pipeline and access road (outside of areas to be utilised for operational purposes).

Target:

1. Complete site cleanup.
2. Reinstate and rehabilitate areas disturbed by construction activities associated with the abstraction weir, abstraction works, pipeline and access road.

Management Actions:

- **Removal of structures and infrastructure**
  - After the construction phase, the areas disturbed by the abstraction weir, abstraction works, pipeline and access road must be rehabilitated by appropriate landscaping, levelling, topsoil dressing, land preparation, alien plant eradication and vegetation establishment.
  - Clear and completely remove from site all construction plant, equipment, storage containers, temporary fencing, temporary services, and fixtures.
  - Ensure that all access roads utilised during construction which are outside of the dam basin and not earmarked for use during the operational phase, are returned to a usable state and/or a state no worse than prior to construction.
- **Inert waste and rubble**
  - Clear the site of all inert waste and rubble, including surplus rock, foundations and batching plant aggregates. After the material has been removed, the site shall be re-instated and rehabilitated.
  - Load and haul excess spoil and inert rubble to fill in borrow pits/dongas or to dump sites indicated/approved by the Project Manager.
  - Remove from site all domestic waste and dispose of in the approved manner at a registered waste disposal site.

- **Hazardous waste and pollution control**
  - Remove from site all pollution containment structures.
  - Remove from site all temporary sanitary infrastructure and waste water disposal systems. Take care to avoid leaks, overflows and spills and dispose of any waste in the approved manner.
  - Comply with relevant provisions under the following EMPr sections: *Management of Storage and Handling of H*azardous *Material*, *Management of Water*, *Management of Waste*, *Management of Pollution Generation Potential*.
- **Final shaping**
  - In general, no slopes steeper than 1(V):3(H) are permitted in cut-and-fill areas (outside dam basin), unless otherwise specified by the Project Manager. Steeper slopes require protection. New slopes must mimic the natural slopes and topography, where possible.
  - Programme the backfill of excavations so that subsoil is deposited first, followed by the topsoil. Compact in layers for best results.
  - Monitor backfilled areas for subsidence (as the backfill settles) and fill depressions using available material.
  - Shape all disturbed areas to blend in with the surrounding landscape, where possible.
  - Ensure that no excavated material or stockpiles are left on site (outside of the dam basin) and that all material remaining after backfill is landscaped to blend in with the surrounding landscape.
- **Topsoil replacement and soil amelioration**
  - Execute top soiling activity prior to the rainy season or any expected wet weather conditions.
  - Execute topsoil placement only after all construction work has ceased.
  - Replace and redistribute stockpiled topsoil together with herbaceous vegetation, overlying grass and other fine organic matter in all disturbed areas of the construction site, including temporary access routes. Replace topsoil to the original depth.
  - Place topsoil in the same area from where it was stripped. If there is insufficient topsoil available from a particular soil zone to produce the minimum specified depth, topsoil of similar quality may be brought from other areas of similar quality.

- The suitability of substitute material will be determined by means of a soil analysis addressing soil fraction, fertility, pH and drainage.
- Do not use topsoil suspected to be contaminated with the seed of alien vegetation (e.g. black wattle). Alternatively, the soil is to be appropriately treated.
- Ensure that storm water run-off is not channelled alongside the gentle mounding, but that it is taken diagonally across it.
- Shape remaining stockpiled topsoil not utilised elsewhere in an acceptable manner so as to blend in with the local surrounding area.
- After topsoil placement is complete, spread available stripped vegetation randomly by hand over the top-soiled area.

- **Ripping and scarifying**
  - Rip and/or scarify all areas following the application of topsoil to facilitate mixing of the upper most layers. Whether ripping and/or scarifying is necessary will be based on the site conditions immediately before these works begin.
  - Rip and/or scarify all disturbed (and other specified) areas of the construction site (outside of the dam basin), including temporary access routes and roads, compacted during the execution of the works.
  - Rip and/or scarify along the contour to prevent the creation of down-slope channels.
  - Do not rip and/or scarify areas under wet conditions, as the soil will not break up.
- **Planting**
  - *Transplanted plants*
    - All planting work is to be undertaken by suitably experienced personnel, making use of the appropriate equipment.
    - Transplanting entails the removal of plant material and replanting the same plants in another designated position.
    - Transplant trees and shrubs into designated positions.
    - Establish further specifications for transplanted plants.
  - *Nursery plants*
    - All planting work is to be undertaken by suitably experienced personnel, making use of the appropriate equipment.
    - Plant all trees, shrubs and individual plants in designated positions.
    - Planting should preferably be done during the rainy season.

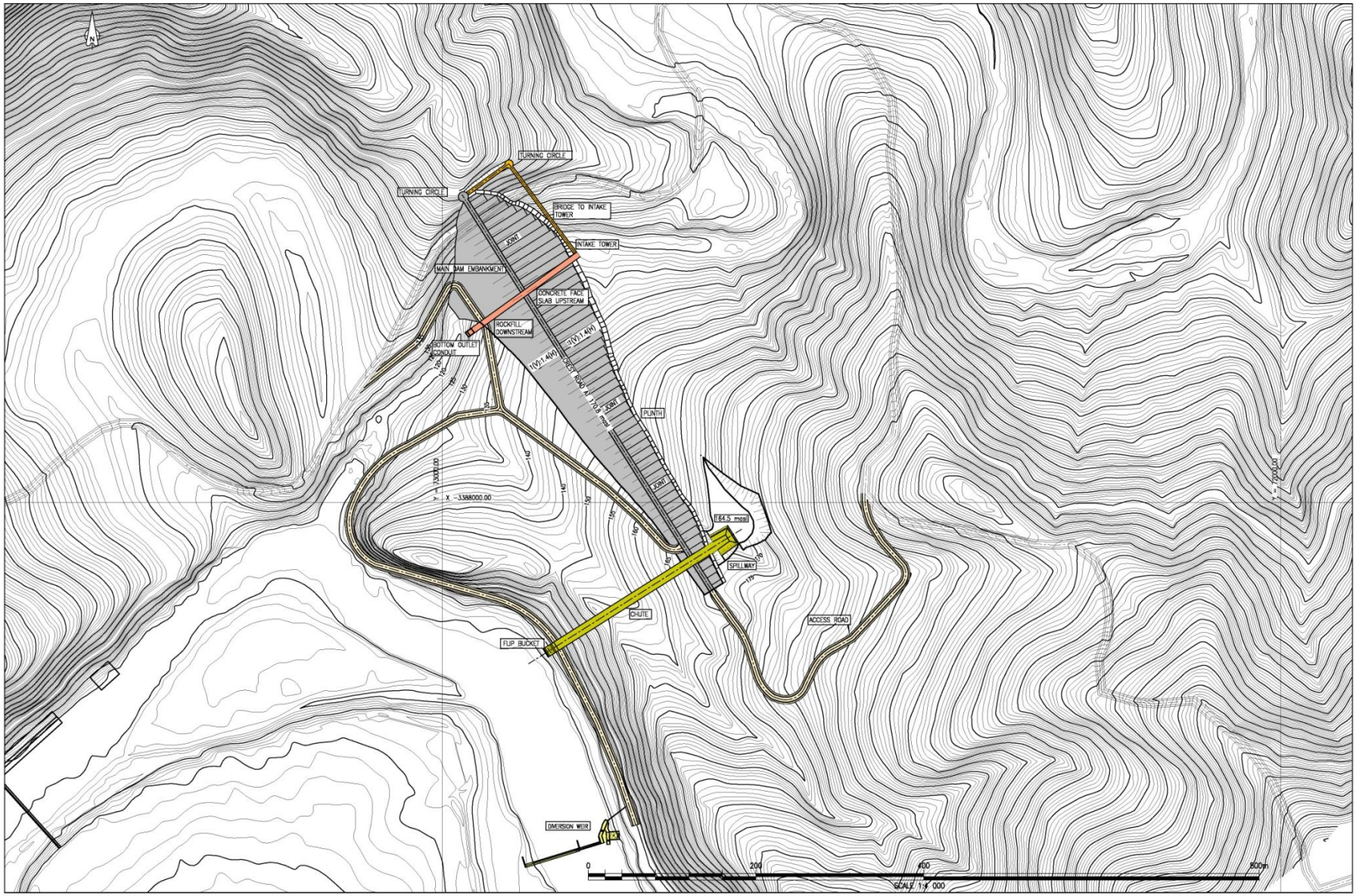
- After planting, each plant must be well watered, adding more soil upon settlement if necessary.
- Establish further specifications for nursery plants.

- *Seeds and seedlings*
  - All planting work is to be undertaken by suitably experienced personnel, making use of the appropriate equipment.
  - Tree seedling material should be fresh and of local origin. Resist using plants from far afield as they may not be best suited to local climatic or soil conditions.
  - Small seedlings are likely to transplant more successfully than will large ones. These should be potted and kept under nursery conditions until they are large enough to plant out.
  - Establish further specifications for seeds and seedlings.

- **Grassing**
  - Suitably trained personnel must undertake grassing by making use of the appropriate equipment and grass species as specified by the terrestrial ecologist.
  - Sodding may be done at any time of the year, but seeding must be done during the summer when the germination rate is better.
  - Hydroseeding with a winter mix will only be specified where regrassing is urgent, and cannot wait for the summer.
  - Establish further specifications for sods, runners and hand seeding.
- **Maintenance**
  - Monitor the re-growth of invasive vegetative material (outside of the dam basin).
  - Cordon off areas that are under rehabilitation as no-go areas.
  - Revegetation must match the vegetation type, which previously existed, unless otherwise indicated by a suitable specialist.
  - Control invasive plant species and noxious weeds by means of extraction, cutting or other approved methods.
  - For planted areas that have failed to establish, replace plants with the same species as originally specified.
  - Establish further specifications for maintenance.

APPENDIX A

GENERAL LAYOUT MAP

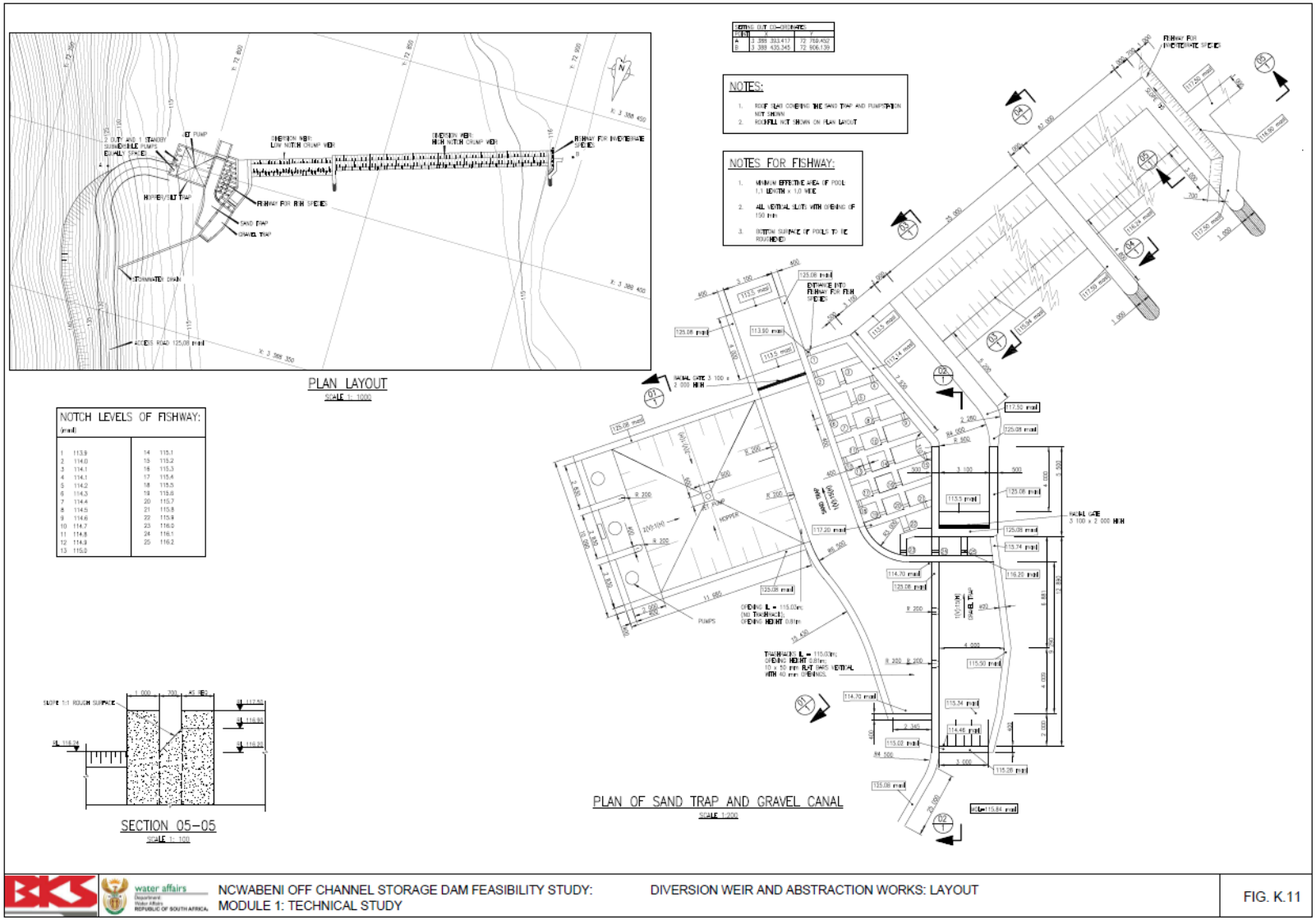


NCWABENI FEASIBILITY STUDY | GENERAL LAYOUT | FIG. K.1

GENERAL LAYOUT – MAIN DAM EMBANKMENT AT SITE D2

APPENDIX B

LAYOUT – ABSTRACTION WEIR, ABSTRACTION WORKS, PIPELINE AND ACCESS ROAD



LAYOUT – ABSTRACTION WEIR, ABSTRACTION WORKS, PIPELINE AND ACCESS ROAD
(Note: To be updated with final design)