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DRAFT BASIC ASSESSMENT REPORT
TUGELA FERRY IRRIGATION SCHEME UPGRADE
MSINGA LOCAL MUNICIPALITY
TUGELA FERRY AGRICULTURE CO-OP
EIA REF NO: DC24/001/2019

EVP1084

This report was prepared by EnviroPro Environmental Consulting in terms of Appendix 1 to GNR 982

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Executive Summary

The existing Tugela Ferry Irrigation Scheme is located within Wards 3, 4 and 5 of the Msinga Local Municipality and Umzinyathi District Municipality. The irrigation scheme has been in operation since the 1800s, however due to poor maintenance and the age of the scheme parts of the canal network and related facilities has fallen into disrepair. Therefore, in order to ensure the longevity of the scheme the Tugela Ferry Agriculture Co-Op who have obtained financial backing of the Department of Rural Development and Land Reform (DRDLR) has proposed a number of new works associated with the canal network. The entire Tugela Ferry Irrigation Scheme is broken down into 7 blocks with the focus of this application being new infrastructure only in Blocks 1 and 6. Work which is being proposed is a new siphon crossing the Tugela River Tributary within Block 1 and a new abstraction point in the Tugela River within Block 6.

The following key impacts and mitigation measures were assessed:

- **Damage to the Tugela River and its tributary from the construction activities:** Caution must be exercised when working near and within the Tugela River and its tributary. Construction materials must be stockpiled more than 32m from the Tugela River and its tributary. Heavy vehicles must be kept at least 32m away from the Tugela River and its tributary except where needed for the construction process. The footprint of the siphon and abstraction point must not be larger than is necessary.
- **Encroachment of alien vegetation into areas disturbed during the construction activities:** Alien vegetation must not be allowed to encroach onto both the sites and must be continually removed during construction. Construction must not promote further alien plant disturbances in the surrounding area.
- **Damage to surrounding properties, services, and businesses:** The construction activities could disrupt the local community and existing services. All services must be identified prior to construction and all stakeholders must be notified prior to any service disruptions.
- **Improved water security for the Tugela Ferry Irrigation Scheme:** The proposed siphon and abstraction point will guarantee water supply into the scheme throughout the year.

These impacts can be mitigated by following the recommendations in this report and EMPr. Construction activities will be monitored and controlled through the implementation of the Environmental Management Programme (EMPr).

Both site and technology alternatives for both the Block 1 siphon and Block 6 abstraction point were considered in this application. Ultimately the decision on selecting the preferred alternatives were based on the available budget, reduced environmental impact and ability to secure water supply through the year.

Taking into consideration the above impacts and mitigation measures, it is the EAP's opinion that there are no significant environmental impacts associated with the proposal which cannot be mitigated. Therefore, it is recommended that the preferred site and technology alternatives be authorised for the Tugela ferry Irrigation Scheme upgrades.

Contents

Appendices

Section 1: Scope of Work and Location of Activity

1.1 Project Title

Tugela Ferry Irrigation Scheme upgrade.

1.2 A Description of the Activities to Be Undertaken Including Associated Structures and Infrastructure As per Section 3(d) (ii)

The existing Tugela Ferry Irrigation Scheme is located within Wards 3, 4 and 5 of the Msinga Local Municipality and Umzinyathi District Municipality. The irrigation scheme has been in operation since the 1800s, however due to poor maintenance and the age of the scheme parts of the canal network and related facilities has fallen into disrepair. Therefore, in order to ensure the longevity of the scheme the Tugela Ferry Agriculture Co-Op who have obtained financial backing of the Department of Rural Development and Land Reform (DRDLR) has proposed a number of new works associated with the canal network. The entire Tugela Ferry Irrigation Scheme is broken down into 7 blocks with the focus of this application being new infrastructure only in Blocks 1 and 6.

The following is a description of the proposed works in Blocks 1 and 6:

- Works being proposed within Block 1, include the construction of a new siphon underneath the Tugela River Tributary. The new Block 1 siphon is located approximately 8.9km west of Tugela Ferry Town (as the crow flies) at the following point location, 28°45'8.96"S; 30°21'5.67"E. Currently there is an existing siphon running underneath the Tugela River Tributary. However due to the age of this siphon the structure has been damaged and is leaking water into the Tugela River Tributary. The canal feeding this siphon has also been severally damaged due to the ongoing erosion of the embankments which support the canal. The engineer has determined that refurbishing the existing siphon and embankments would only be a temporary fix due to the nature of the environment and such a new siphon bypassing this area has been proposed. The new siphon will tie into the existing canal on either side of the Tugela River Tributary at the following points, inlet - 28°45'8.14"S 30°21'4.35"E, outlet - 28°45'14.84"S 30°21'5.21"E. The siphon consists of no working parts. To work the siphon relies on the water level in the canal near the inlet being at a higher level than the water level in the canal near the outlet. This allows for the water to flow without the need for mechanical input.

  The siphon will comprise of two 825mm diameter concrete pipes laid 500mm apart. Both concrete pipes will be encased in concrete, the total width of the concrete encasement will be 3192mm while the height will be 1246mm. A 300m thick reno mattress will be placed on top of the concrete encasement which will be a level of the river bed. The entire length of the siphon will be 244m, however only 101m of this siphon is located within 32m of the Tugela River Tributary, please refer to Figure 3.

- Works being proposed within Block 6, include the construction of a new abstraction point within the Tugela River. The new Block 6 abstraction point is located approximately 3.6km west of Tugela Ferry Town (as the crow flies) at the following point location, 28°45'15.35"S 30°24'21.63"E. There is an existing abstraction facility located at the following point location, 28°45'11.88"S 30°25'41.62"E. however due to the nature of the Tugela River at this point i.e. multiple channels, water is not always available at this point along the river bank. Due to this poor abstraction placement the facility has been vandalised and vital equipment and machinery has been stolen. The engineer has determined that instead of refurbishing the existing abstraction point a new facility is required due to the lack of availability of water.

  The bulk of the abstraction facility will not be located within the Tugela River but within 32m. The abstraction facility which will be completely fenced will include a 2500mm x 2500mm x 6650mm (width, length, height) pump chamber below ground which will sit on a 650mm deep concrete base. Located at the bottom of this chamber will be 4 pumps in parallel with a combined duty of 220 ℓ/s and a head of 15m. The intake pipe, diameter of 500mm, will be located within the Tugela River 1m below the surface of the river. This pipe (30m) will feed into the pump chamber at a depth of 6250mm below the ground. The pump chamber will be connected to the 500mm outlet pipe by means of a 10000mm long flanged steel pipe which will pass through the valve chamber. The valve chamber will be 5000mm x 3480mm x 1500mm (width, length, height) below ground. The valve chamber will include the resilient seal valve to stop the flow of water when required. The 500mm outlet pipe will tie into the existing dam which will enable irrigation of the entire area of Block 6.

The Tugela Ferry Irrigation Scheme upgrade will have a positive impact for Tugela Ferry Agriculture Co-Op. currently there is no agriculture taking place in Block 6 due to the lack of water, therefore the proposed abstraction will enable community members to once again practice agriculture in this block. Although the existing Block 1 siphon is working the long-term security of water provision to the remainder of the blocks

cannot be guaranteed. The proposed new Block 1 siphon will ensure this water provision is secured into the future.

1.2.1 Construction Methodology

The proposed construction methodology for Block 1 siphon can be summarised as follows.

- Necessary clearing and grubbing of the site for access and construction of the works will be done. This will include the clearing and cleaning of any vegetation within the construction footprint of the site which will also include a 2m construction servitude on either side of the siphon's footprint.
- There is very limited vegetation within and adjacent to the watercourse that is to be cleared. No vegetation of conservation importance will be removed. The vast majority of the siphon will be located within the existing agriculture lands associated with Block 1.
- Clearing and grubbing of the site will be undertaken by heavy machinery i.e. a TLB. Bulk earthwork will take place once the site has been prepared.
- Heavy machinery i.e. a TLB will be used to excavate soil this will be along the entire length of the siphon. Bedding material will then be compacted into this excavation in preparation for the concrete to be cast.
- Ready-mixed concrete will be brought to site and used to cast the lower level of the encasement.
- The two concrete pipes will be placed side by side on top of this concrete, whereby ready-mixed concrete will be pored around these pipes to form the encasement.
- The reno mattress will then be constructed on top of the encasement to form the final levels.
- The siphon will be constructed in portions to allow for the natural flow of the river to be maintain through the construction phase. Sand bags will be used to protect the work zone i.e. divert water around the active construction site.
- Finally, rehabilitation / re-vegetation of all areas affected by the construction activities will be undertaken.

The proposed construction methodology for Block 6 abstraction point can be summarised as follows.

- Necessary clearing and grubbing of the site for access and construction of the works will be done. This will include the clearing and cleaning of any vegetation within the construction footprint of the site.
- No vegetation of conservation importance will be removed. The vast majority of the abstraction point facility will be located within the disturbed area associated with the dirt track running around Block 6.
- Clearing and grubbing of the site will be undertaken by heavy machinery i.e. a TLB. Bulk earthwork will take place once the site has been prepared.
- Heavy machinery i.e. a TLB will be used to excavate soil this will be along the entire length of the inlet pipe, pump chamber and valve chamber. Bedding material will then be compacted into the pump and valve chamber excavations in preparation for the concrete to be cast.
- Ready-mixed concrete will be brought to site and used to cast the base slabs for both chambers.
- Eight precast manhole rings will be used to form the pump chamber while the valve chamber will be completely cast in concrete.
- The inlet pipe will be laid into the river and connected into the pump chamber. A sluice gate will be installed to prevent any water from entering the chamber.
- All pump and pipe work will be fitted and installed.
- The fence will be installed to encompass the entire facility.
- Finally, rehabilitation / re-vegetation of all areas affected by the construction activities will be undertaken.

1.3 Description of Feasible Alternatives as Per Section 3(h)(i)

Site Alternatives

Block 1 Siphon Alternative 1 (Preferred Alternative)

Site Alternative 1 for the Block 1 siphon will involve the construction of a new siphon directly downstream from the existing siphon across the Tugela River Tributary. The entire length of the siphon will be 244m, however only 101m of this siphon is located within 32m of the Tugela River Tributary.

Block 1 Siphon Alternative 2

Site Alternative 2 for the Block 1 siphon will involve the refurbishment of the existing siphon across the Tugela River Tributary. This alternative will require extensive work within the watercourse to support the canal embankments. The existing siphon would also need to be excavated to repair all the damaged along the route.

Block 6 Abstraction Alternative 1 (Preferred Alternative)
Site Alternative 1 for the Block 6 abstraction point will involve the construction of a new abstraction point along the bank of the Tugela River. The abstraction facility which will be completely fenced and will include a pump and valve chamber and intake pipe.

Block 6 Abstraction Alternative 2
Site Alternative 2 for the Block 6 abstraction point will involve the refurbishment of the existing abstraction point along the bank of the Tugela River. This availability of water at this point is limited due to the nature of the river at this point, therefore water supply cannot be guaranteed.

Technology Alternatives
Block 1 Siphon Alternative 1 (Preferred Alternative)
The preferred technology alternative is to construct new Block 1 siphon. The siphon will be constructed below the Tugela River Tributary and will link the canals on either side of the river.

Block 1 Siphon Alternative 2
Alternative 2 would be to construct a pier canal bridge across the Tugela River Tributary. The structure will be supported by concrete piers along the length of the bridge. Due to the topography of the area the bridge will need to be constructed along the entire length between the two canals thus this alternative would be extremely costly and thus is not a feasible alternative when considering the available budget.

Block 6 Abstraction Alternative 1 (Preferred Alternative)
The preferred technology alternative is to construct new Block 6 abstraction point. The main abstraction facility will not be located within the Tugela River but rather only the inlet pipe will be located in the river. The inlet pipe will then be connected the pump chamber approximately 30m away.

Block 6 Abstraction Alternative 2
Alternative 2 would be to construct a Block 6 abstraction point within the Tugela River. The entire facility will be located within the river, with the pump chamber being submersed into the river.

The No Go Alternative
The proposed construction of Block 1 siphon and Block 6 abstraction point will not take place Therefore, the current situation will remain, i.e. no water supply to Block 6 and limited water security across the Tugela River Tributary.

See Appendix A for Engineering Drawings.

1.4 All Listed and Specific Activities to Be Triggered and Being Applied for As Per Section 3(d) (i)

Table 1: All Listed and Specific Activities to Be Triggered and Being Applied.

GNR	Activity Number	Activity as per the legislation	Activity as it applies to the proposal
Listing Notice 1; 4th December 2017 as amended	12	*The development of—* *(i) dams or weirs, where the dam or weir, including infrastructure and water surface area, exceeds 100 square metres; or* *(ii) infrastructure or structures with a physical footprint of 100 square metres or more;* *where such development occurs—* *(a) within a watercourse;* *(b) in front of a development setback; or* *(c) if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse; —* *excluding—*	The construction of Block 1 siphon and Block 6 abstraction will result in both infrastructure and structures with a combined area of 100m^2 within 32m of both the Tugela River and its tributary.

		(aa) the development of infrastructure or structures within existing ports or harbours that will not increase the development footprint of the port or harbour; *(bb) where such development activities are related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies;* *(cc) activities listed in activity 14 in Listing Notice 2 of 2014 or activity 14 in Listing Notice 3 of 2014, in which case that activity applies;* *(dd) where such development occurs within an urban area;* *(ee) where such development occurs within existing roads, road reserves or railway line reserves; or* *(ff) the development of temporary infrastructure or structures where such infrastructure or structures will be removed within 6 weeks of the commencement of development and where indigenous vegetation will not be cleared.*	
Listing Notice 1; 4th December 2017 as amended	19	*The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse;* *but excluding where such infilling, depositing, dredging, excavation, removal or moving—* *(a) will occur behind a development setback;* *(b) is for maintenance purposes undertaken in accordance with a maintenance management plan;* *(c) falls within the ambit of activity 21 in this Notice, in which case that activity applies;* *(d) occurs within existing ports or harbours that will not increase the development footprint of the port or harbour; or* *where such development is related to the development of a port or harbour, in which case activity 26 in Listing Notice 2 of 2014 applies.*	There will be the infill and removal of material within the Tugela River Tributary due to excavation and construction of Block 1 siphon. There will also be the removal of material from the Tugela River due to the excavation required for the abstraction point.

1.5 Location of Activity as per Section 3 (b)(i)-(iii)

Table 2: Location of Activity

District Municipality	Umzinyathi District Municipality																			
Local Municipality	Msinga Local Municipality																			
Wards	Wards 3, 4 and 5																			
Area / Town / Village	Block 1 siphon: 8.9km west of Tugela Ferry Town (as the crow flies) Block 6 abstraction: 3.6km west of Tugela Ferry Town (as the crow flies)																			
Co-ordinates:	**Latitude**										**Longitude**									
Block 1 Siphon Start:	28°45'08.14"S										30°21'04.35"E									
Block 1 Siphon End:	28°45'14.84"S										30°21'05.21"E									
Block 6 Abstraction:	28°45'15.35"S										30°24'21.63"E									
Property Description:	Remainder of Impafana Location No. 4677 Portion 25 of Klip River Native Location No. 4665																			
21 Digit Surveyor General no.	N	0	G	T	0	0	0	0	0	0	0	0	4	6	7	7	0	0	0	0	0
	N	0	G	T	0	0	0	0	0	0	0	0	4	6	6	5	0	0	0	2	5

Figure 2: 1:50 000 Map Indicating the locations of the siphon and abstraction point

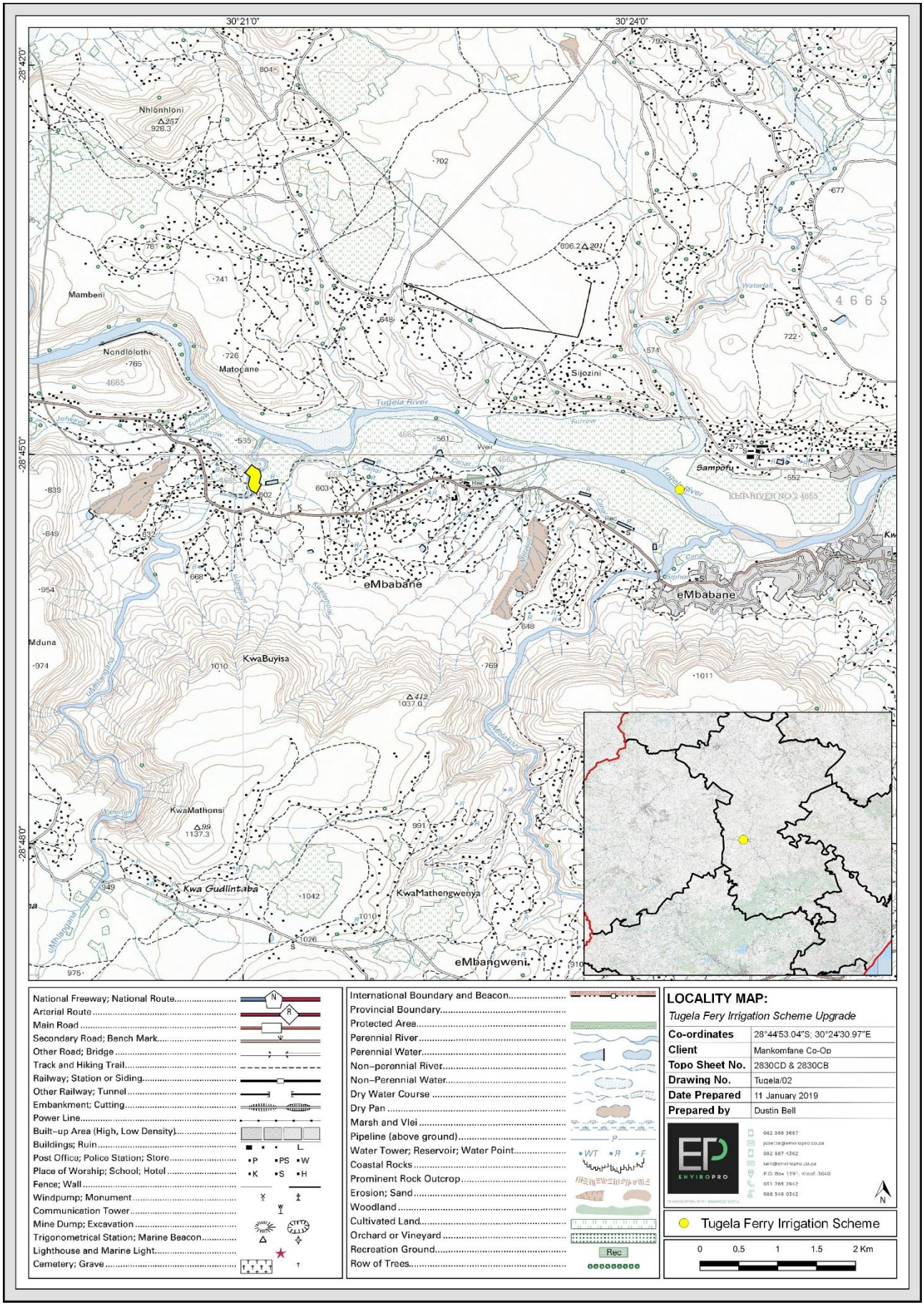


Figure 2: Aerial photograph showing an overview of the Tugela Ferry Irrigation Scheme Upgrades.

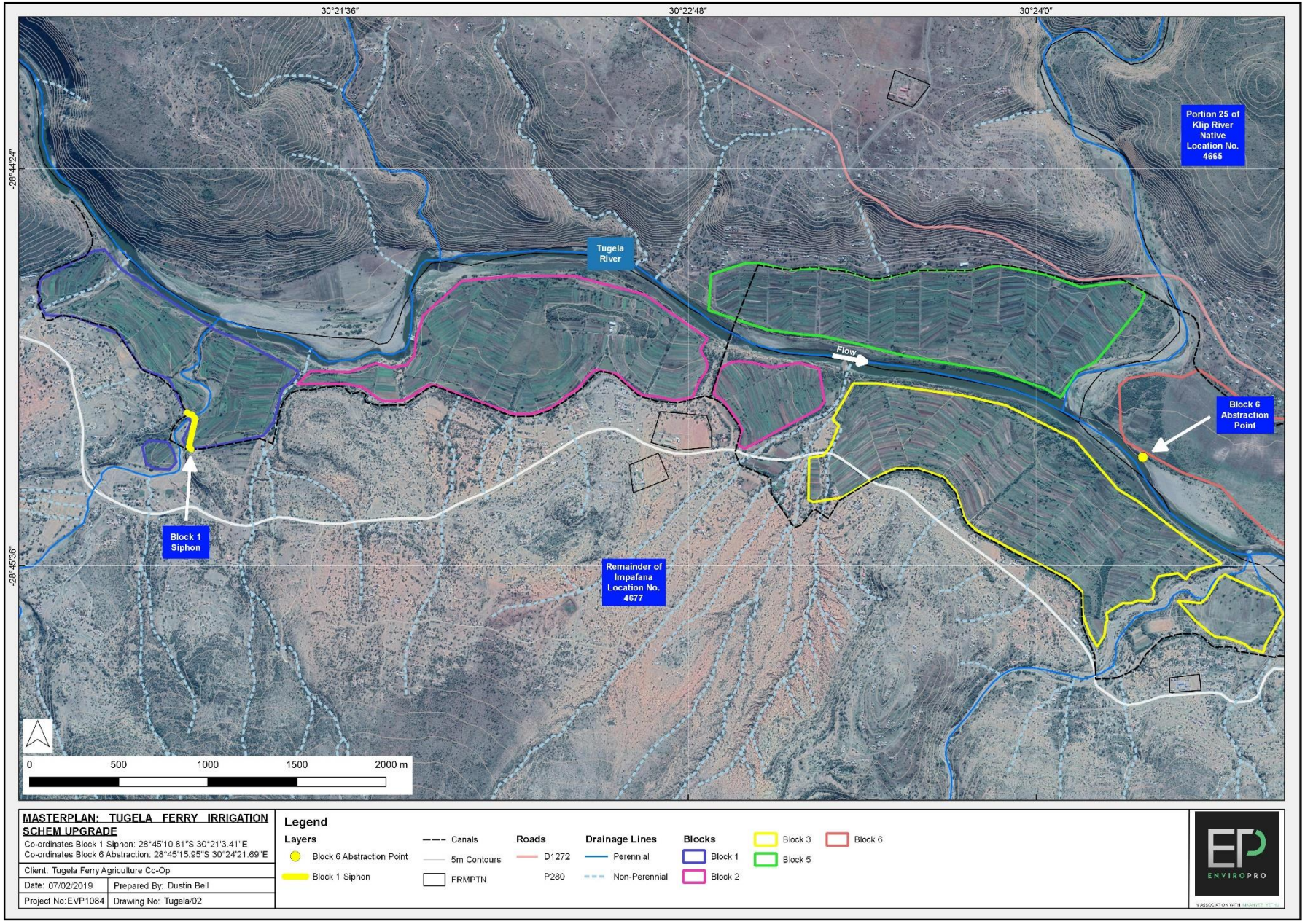
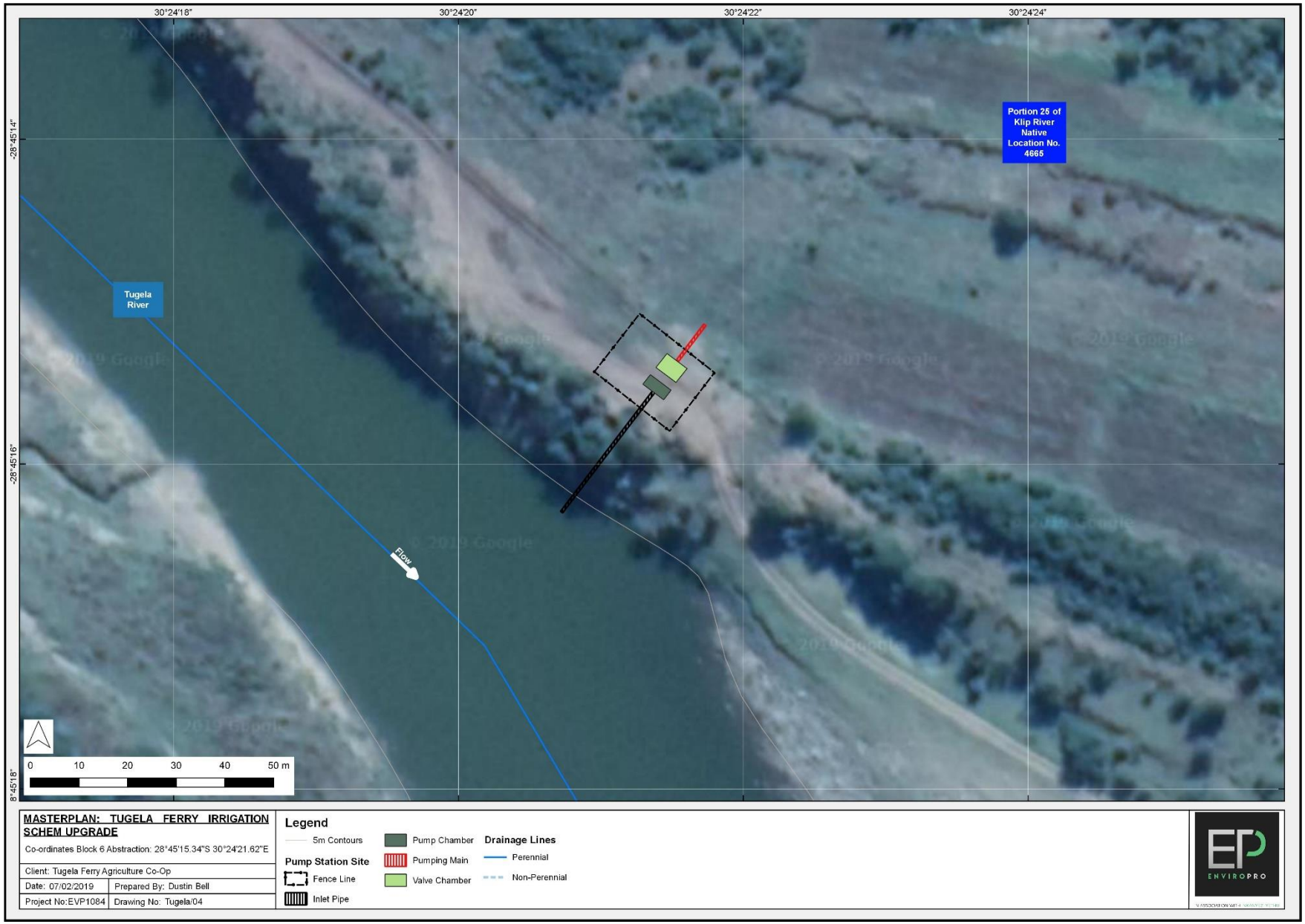


Figure 3: Aerial photograph showing the Block 1 siphon

Figure 4: Aerial photograph showing the Block 6 abstraction point.



Section 2: Site Description and Surrounding Land Use as per section 3(h)(iv) and (k)

2.1 Topography and Physical Characteristics of Site

The following applies to the area surrounding the Tugela Ferry Irrigation Scheme Upgrades as per the Figures 1-4 above.

The gradient of the sites are as follows:

Table 3: Gradient

Gradient	Description
Flat	N/A
1:50 – 1:20	Both sites can be described as having a gentle gradient
1:20 – 1:15	N/A
1:15 – 1:10	N/A
1:10 – 1:7,5	N/A
1:7,5 – 1:5	N/A
Steeper than 1:5	N/A

The topographical features and landforms of the site and surrounding area are as follows:

Table 4: Topographical features and landforms

Topographical Feature	Description
Ridgeline	N/A
Plateau	N/A
Side slope of hill/mountain	N/A
Closed valley	N/A
Open valley	The sites are located in open valleys
Plain	N/A
Undulating plain/low hills	N/A
Dune	N/A
Sea-front	N/A

2.2 Climate

The project falls within a summer rainfall climate with occasional rainfall in the winter months. The Mean Annual Precipitation (MAP) ranges between 700 – 1100mm. Frost is not frequent in the area; however, may be found in low lying areas. The maximum temperature for the area is expected to be 38.2 ºC and the minimum temperature is -0.2 ºC (source: The Biodiversity Company, 2018).

2.3 Soils

The geology of the area is sandstone of the Vryheid Formation, Ecca Group, with small areas of dolerite. According to the land type database (Land Type Survey Staff, 1972 - 2006) the development falls within the Fc308, Fc310 and Fc319 land type. The dominant soil types are Glenrosa and Mispah soil forms. Lime is present throughout the entire landscape. Most of the area is developed with roads, crop cultivation and residential housing. The land type characteristic is presented in Table 5.

Table 5: The land type data

Broad Land Type Class	Description
Fc308	Glenrosa and/or Mispah forms (other soils may occur); Lime generally present in the entire landscape
Fc310	
Fc319	

2.4 Surface Water and Ground Water

The project area is situated in the quaternary catchment V60G and V60H, within the Pongola to Mtamvuna Water Management Area (WMA 4). It is noted that the Water Management Area was previously known as Thukela WMA, which was amalgamated into the Pongola to Mtamvuna WMA (NWA, 2016) (source: The Biodiversity Company, 2018). The project area is drained by the Tugela River and its tributaries. The Block 1 siphon is located on a tributary while the abstraction point is located on the Tugela River.

2.4.1 Drainage Lines

As result of the footprint area and the topography of the project area the aquatic survey identified sites that would represent the reach and focused the in-field aquatic survey to these identified sites. These points are located along the Tugela River at the following point locations S1 (28°44'55.22"S 30°22'57.90"E) and S2 (28°45'33.76"S 30°24'43.20"E).

2.4.1.1 *In situ* Water Quality

Considering the results of the *in-situ* water quality assessment, no negative effects to local aquatic ecology can be anticipated. However, it is anticipated that diffuse agricultural runoff has altered the nutrient loads of the Thukela River system. See Table 6 below.

Table 6: Water Quality Results

Site	pH	Conductivity (µS/cm)	DO (mg/l)	Temperature (°C)
TWQR*	6.5-9.5	-	>5.00	5-30
S1	7.5	180	6.5	17
S2	7.4	181	6.5	20
***TWQR – Target Water Quality Range**				

2.4.1.2 Intermediate Habitat Integrity Assessment

The results of the instream and riparian integrity assessment derived a class B (largely natural) status for the instream habitat of the watercourse considered in this assessment. The riparian zone was determined to be class C (moderately modified) from reference conditions. See Table 7 below.

Table 7: Intermediate Habitat Integrity Assessment

Total Instream Score	74
Instream Category	class B
Total Riparian Score	60
Riparian Category	class C

2.4.1.3 Aquatic Macroinvertebrates

The watercourses assessed in this study were assigned a slope class E, indicating a lowland reach river system with typical lowland river features. The ecological classes according to Dallas (2007) was found to be class A for the sites assessed. The results of the MIRAI assessment indicates that a largely natural invertebrate community was present in the Thukela River system.

2.4.1.4 Fish Assessment

A total of 8 fish species were sample, the eight sampled species represent 47% of the total expected fish community. Two listed species were expected, with one observed during the survey. The listed species includes *Anguilla bengalensis* and *Oreochromis mossambicus.* The results of the Fish Response Assessment Index derived a largely natural (class B) fish community structure.

2.4.1.5 Riverine Present Ecological Status

The results of the PES assessment are provided in the Table 7 below. The results of the PES assessment derived moderately modified (class C) conditions in the river reach considered in this assessment. The modified conditions were largely attributed to cumulative habitat level impacts which have resulted in the modification of riparian conditions.

Table 8: Present Ecological Status of the river reach

Aspect Assessed	Ecological Category
Instream Ecological Category	74
Riparian Ecological Category	60
Aquatic Invertebrate Ecological Category	81
Fish Ecological Category	81
Ecostatus	Class C

2.4.1.6 Aquatic Ecological Importance and Sensitivity

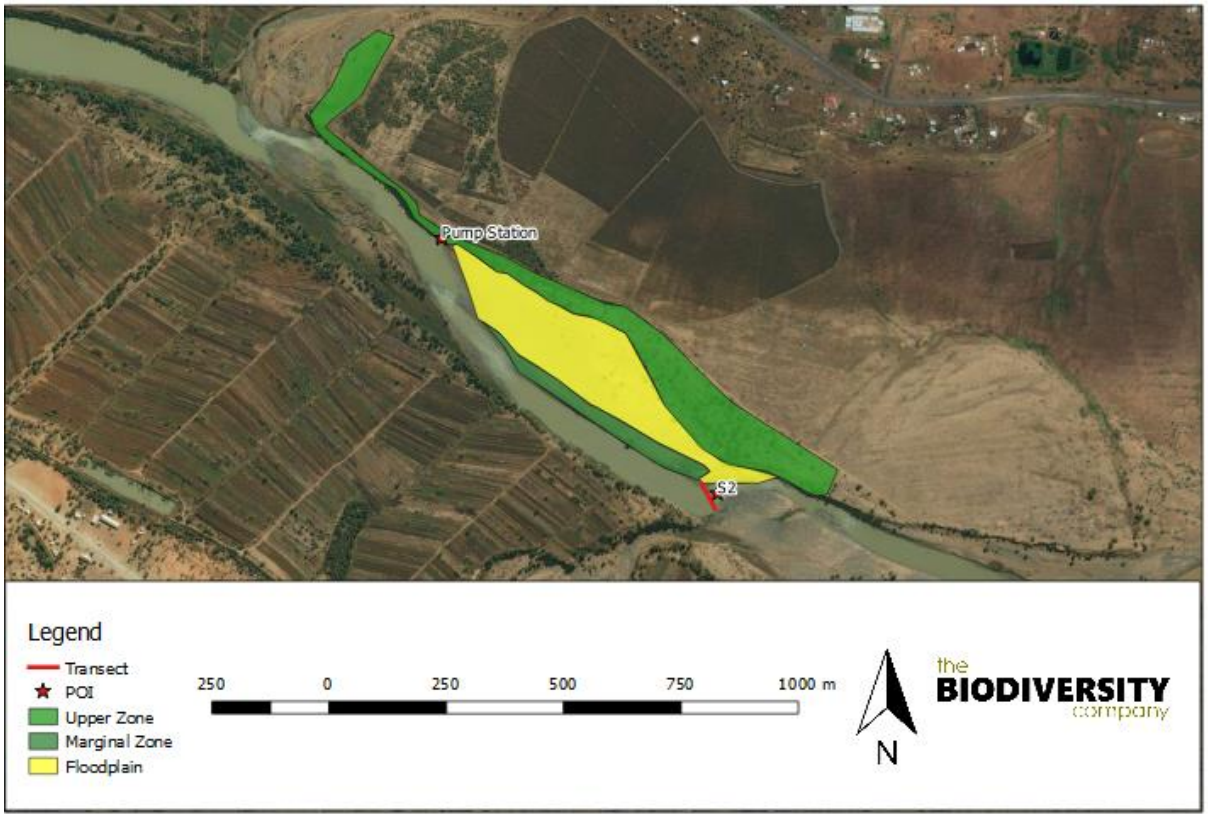
The overall Ecological Importance and Sensitivity (EIS) of the river reach in this study was assessed according to Kleynhans (1999). The results of the EIS assessment derived a very high EIS for the river reach assessed.

2.4.1.7 Rapid Habitat Assessment Model and River Morphology

The dominant velocity depth class at the site was determined to be the fast-shallow velocity depth class. Substrate consisted largely of boulders, cobbles and GSM. The river zonation (morphology) and gradient conforms to the class E geoclass (lowland river) and therefore the project area is within a depositional zone. However, cobbled substrates with bedrock boulders were observed within the project area indicating that some rejuvenation may occur within the proposed project area. Overall discharge measured at the site was 5.4 m^3/s, this was within range of the established discharges in the Instream Flow Requirements Study (DWAF, 2000).

The riparian zone consisted of a river floodplain complex with limited marginal zones and an extensive floodplain zone. The upper riparian zone was confined to be macro channel and was dominated by *Vachellia* karoo (Sweet thorn). The delineation of the riparian areas in relation to the proposed abstraction site is provided in Figure 4. The riparian zone of the drainage lines was limited to their immediate river banks.

Figure 4: Riparian delineation for the proposed pump-station



In terms of the Block 1 siphon short term impacts can be anticipated during the construction phase. These impacts will include the disturbance of river banks and sedimentation. It is however anticipated that these impacts will be limited to the construction phase with the conditions stabilising and improving following the completion of the construction phase. During operation the siphon will be completely buried underneath the river thus there are no anticipated negative impacts. The current negative impacts associated with the existing siphon will no longer be evident, these impacts include artificial water input into the system due to the leaking

siphon and the potential collapse of the canal embankments resulting in a complete failure of the entire irrigation scheme. The results of the risk assessment indicate that the Block1 siphon component of the proposed project would not result in any significant long terms impact to the watercourse. As per the specialist's findings the construction of the abstraction point was determined to be directly within the established upper riparian zone. However as per the latest design the vast majority of the abstraction facility is now located outside upper riparian zone. The only portion of the abstraction facility which would be within the upper riparian zone is the 30m long inlet pipe, this pipe would also extend into the overall macro channel in order to pump water. Although there will be impacts associated with the abstraction point these impacts would be mainly be associated with the construction phase as deep excavations would be required. However, during operation, the facility is inert and located below the surface and outside the upper riparian zone. Therefore, if all provided mitigation measure are implemented there should be no lasting impacts on the either the Tugela River or its tributary.

2.4.2 Wetlands

There are no wetlands within 32m of either the Block 1 siphon or the Block 6 abstraction point.

2.5 Fauna and Flora

The site is located within a rural area, which is populated by homesteads and being used for agriculture purposes. The fauna and flora found within the area can be described as follows:

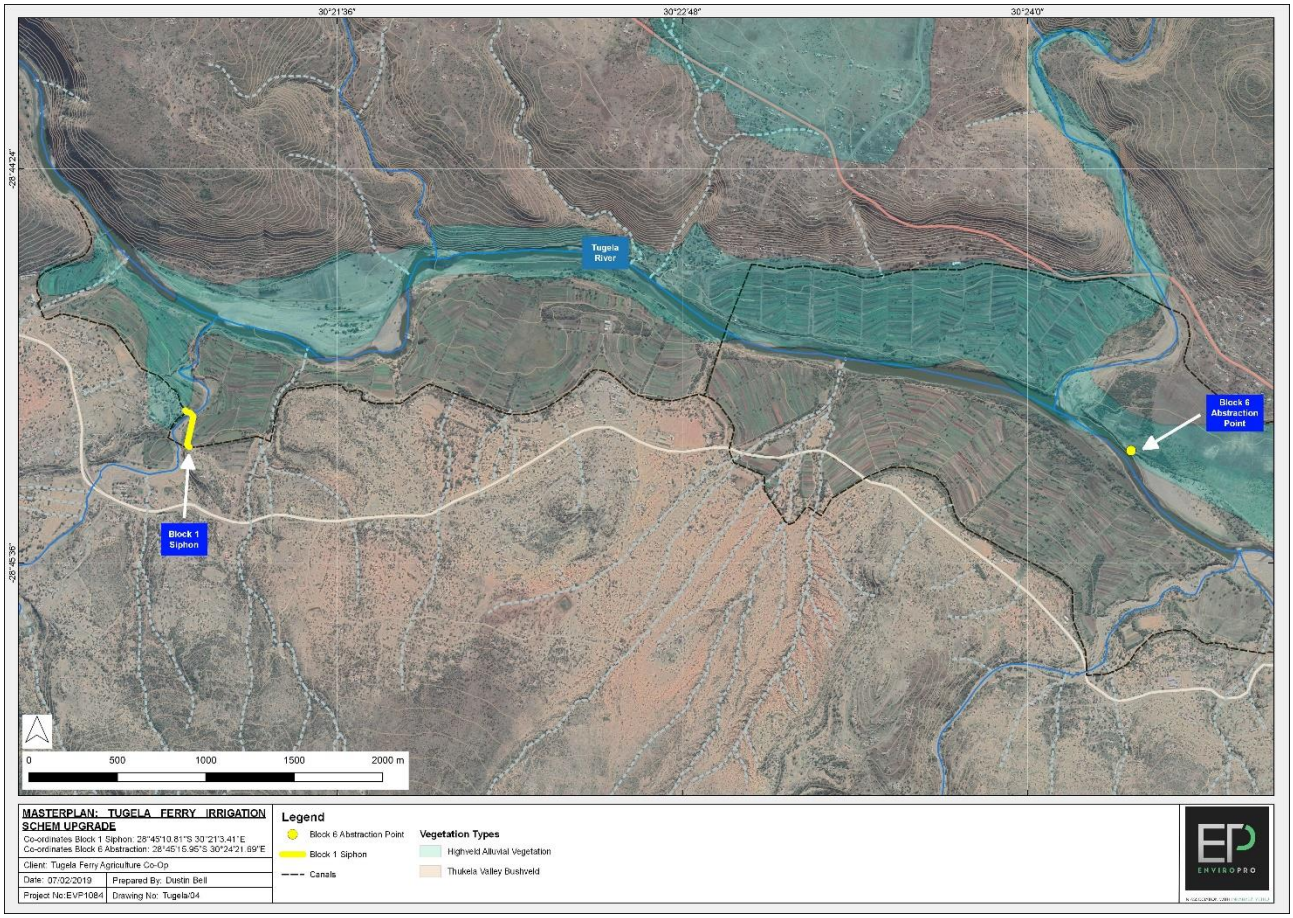
- Ecosystem Type: None.
- Block 1 Siphon Vegetation Type: Thukela Valley Bushveld (SVs 1) vegetation type:
- Distribution
    - KwaZulu-Natal Province: Central Thukela River basin upstream of Jameson's Drift, past Tugela Ferry to about 20 km southeast of Ladysmith. Also in valleys of several major tributaries, such as the lower Mooi, Bushmans, Buffels and Sundays Rivers. Altitude about 350–1 000 m
- Vegetation & Landscape Features:
    - Often rocky rugged slopes and terraces mainly with deciduous trees of short to medium height (and many large shrubs) including *Acacia tortilis*, *A. nilotica* and *A. natalitia* and prominent evergreen species such as *Olea europaea* subsp. *africana*, *Boscia albitrunca* and *Euclea crispa* in places. Succulent plants, mainly species of *Euphorbia* and *Aloe* occur on shallow and eroded soils. Relatively limited areas are dominated by succulents such as *E. tirucalli* (some hillsides south of the Thukela) and *E. ingens* on steep slopes, but also commonly on the valley floor.
- Conservation
    - Least threatened. Target 25%. Statutorily conserved (less than 200 ha) in the Weenen Game Reserve. This vegetation unit has undergone considerable degradation over almost its entire area. In the many eroded areas, prolonged continuous overgrazing has led to the complete destruction of the grass cover. Often the only ground cover is found under *Acacia tortilis* trees where their root systems retain soil, the trees act as nutrient pumps and provide shade. Erosion very variable, ranging from very low to very high. Alien plants include the widely scattered *Opuntia imbricata*.
- Vegetation noted on site:
    - There was very limited vegetation evident on site. The site was dominated by heavy overgrazed grass with the vast majority of the are having been left bare. A portion of the siphon outside 32m from the watercourses is aligned through an agriculture area associated with Block 1. This area is completely transformed and does not represent any nature vegetation.
    - Numerous alien invasive plant species were evident throughout the site.
    - Therefore, although the site would have historically represented the Thukela Valley Bushveld (SVs 1) vegetation type, the current vegetation on site is in a degraded and transformed state due to previous clearing for agriculture activities.
    - No species of conservation significance were evident during the site visit.
- Fauna
    - No terrestrial fauna was evident around the site besides livestock.

- Block 6 Abstraction Vegetation Type: Highveld Alluvial Vegetation (AZa 5) vegetation type:
- Distribution
- Free State, North-West, Mpumalanga and Gauteng Provinces as well as in Lesotho and Swaziland:
    - Alluvial drainage lines and floodplains along rivers embedded within the Grassland Biome and marginal (eastern) units of the Kalahari (Savanna Biome), such as along upper Riet, Harts, upper Modder, upper Caledon, Vet, Sand, Vals, Wilge, Mooi, middle and upper Vaal Rivers etc. and their numerous tributaries. Altitude ranging from 1 000–1 500 m.

- Vegetation & Landscape Features:
    - Flat topography supporting riparian thickets mostly dominated by *Acacia karroo*, accompanied by seasonally flooded grasslands and disturbed herblands often dominated by alien plants.
- Conservation
    - Least threatened. Target 31%. Nearly 10% statutorily conserved in the Barberspan (a Ramsar site), Bloemhof Dam, Christiana, Faan Meintjes, Sandveld, Schoonspruit, Soetdoring and Wolwespruit Nature Reserves. More than a quarter has been transformed for cultivation and by building of dams (Bloemhof, Erfenis, Krugersdrif, Mockes and Vaalharts Dams). The highveld alluvia are prone to invasion by a number of weeds, obviously encouraged by the high nutrient status of soils and ample water supply. Woody plants such as *Salix babylonica, Schinus molle, Melia azedarach, Celtis sinensis, Morus alba, Populus x canescens, Nicotiana glauca and N. longiflora* and forbs such as *Argemone ochroleuca, Chenopodium strictum, Conyza canadensis, Datura stramonium, Melilotus alba Oenothera indecora,* Paspalum dilatatum, P. urvillei, Pennisetum clandestinum, Tagetes minuta, Verbena bonariensis, *Xanthium strumarium agg*. and *Zinnia peruviana* often dominate either the riverine thickets or grasslands or form ruderal communities in disturbed habitats. The undergrowth of the alluvial riparian thickets and the accompanying grasslands suffer from heavy overgrazing in many places.
- Vegetation noted on site:
    - The area was dominated by *Vachellia* karoo (Sweet thorn).
    - Numerous alien invasive plant species were evident throughout the site.
    - The area where the main abstraction facility will be located comprises of a severely eroded dirt track.
    - Although the site would have historically represented the Highveld Alluvial Vegetation (AZa 5) vegetation type vegetation type.
    - No species of conservation significance were evident during the site visit.
- Fauna
    - No terrestrial fauna was evident around the site besides livestock.

The state of the vegetation at both sites are highly disturbed. Necessary clearing and grubbing of the site for access and construction of the works will be required around at the site. However, this vegetation clearing will be restricted to only what is necessary i.e. construction footprint. The location of the site camp must be approved by the ECO and must be on land that is previously disturbed. All vegetation clearing will take place under the supervision of the ECO and Engineer. Although there will be vegetation clearing, nothing of conservation significance will be removed. Therefore, the construction of Block 1 siphon and Block 6 abstraction point is expected to have little impact on the fauna and flora provided the mitigation measures provided in this report and EMPr are followed.

Figure 5: Vegetation types on site



2.6 Heritage and Cultural Aspects

No items of archaeological were noted within the immediate area of the site associated with the both the Block 1 siphon and Block 6 abstraction. Construction workers will be cautioned to operate with care on the site and should any unidentified archaeologically or culturally sensitive aspects be discovered on site, construction activities are to stop immediately and the issue assessed and the authorities (AMAFA) notified if need be. Please note as per the National Heritage Resources Act (Act 25 of 1999) Section 38 Heritage resources management no activities will be taking place on site which will require a permit from the local heritage resources office.

2.7 Socio Economic Environment

This is a 'low income area'. The Tugela Ferry Irrigation scheme provides water for all local community-based agriculture activities in the area. The proposed projects sole purpose is to maintain the supply of water into the area and such will positively impact the community. Should there be a need for the relocation of any infrastructure, an agreement must be made with the contractor and the relevant stakeholder.

2.8 Surrounding Environment and Land Uses

The land uses surrounding the site is as follows:

- Located within a rural area.
- The houses within the area are sparse and positioned apart from one another.
- The land surrounding the two sites consists of:
    - Community agriculture lands.
    - Open unused land.

The figures below provide photographs of the site taken in 5th June 2018 and the 22nd August 2018.

Figure 5: (a): The disturbed dirt track where the main abstraction facility will be located. **(b):** View from the position of the main abstraction facility looking downstream. **(c):** Photograph showing the approximate location of the inlet pipe.

Figure 6: (a): Photographer showing the old dilapidated abstraction point. **(b):** View look along the length of the Block 1 siphon from the inlet. **(c):** View of the river at the Block 1 siphon site.

Figure 7: (a): View of the existing canal embankment near the Block 1 siphon site. **(b):** Evidence of erosion damage to the existing canals. **(c):** The existing siphon on the site to be replaced.

Section 3: Policy and Legislative Context

3.1 Identification of All Legislation, Policies, Plans, Guidelines, Spatial Tools, Municipal Development Planning Frameworks And Instruments As Per Section 3(e) (i) And Compliance Of Proposed Activity With Legislation And Policy 3(e) (ii)

Legislation	Compliance of Activity
National Environmental Management Act 1998	The National Environmental Management Act (Act 107 of 1998) (NEMA) is South Africa's overarching environmental legislation. It includes a set of principles that govern environmental management and against which all Environmental Management Programmes (EMPr) and actions are measured. These principles include and relate to sustainable development, protection of the natural environment, waste minimisation, public consultation, the right to an environment that is not harmful to one's health or wellbeing, and a general duty of care. The Environmental Impact Assessment (EIA) Regulations, 2014: GNR.982, R.983, and R.985 under Section 24 of the NEMA define the activities that require Environmental Authorisation and the processes to be followed to assess environmental impacts and obtain Environmental Authorisation. Environmental authorisation is required for the construction of the siphon and abstraction point therefore this application is in line with the requirements of NEMA.
National Water Act 1998	The site is will result in alterations to the bed and banks of a watercourses. Therefore, a water use authorisation will be required as per Section 21 (c) and (i) of the National Water Act. Due to the abstraction from the Tugela River a water use authorisation will be required as per Section 21 (a) of the National Water Act.
National Waste Management Act 2008	Reforms the law regulating waste management to prevent pollution and ecological degradation. Section 19 allows the Minister to publish a list of activities, which require a Waste Management License. The most recent list is published in Government Gazette 37083 Notice No. 921 dated 29 November 2013. It is unlikely that any activities carried out by the development will trigger a Waste Management Activity.
Environmental Conservation Act 1996	Makes provisions for the application of general environmental principles for the protection of ecological processes, promotion of sustainable development and the protection of the environment. This Act has mostly been repealed by NEMA.
National Environmental Management Biodiversity Act 2004	To provide the framework, norms, and standards for the conservation, sustainable use and equitable benefit-sharing of South Africa's biological resources. Section 52 allows for the publication of a list of threatened ecosystems in need of protection. The list was published in Government Gazette No. 34809 Notice No. 1002, dated 9 November 2011. The site is not located within a threatened ecosystem.
National Heritage Resources Act 25 of 1999	For the protection of South African Heritage to nurture and conserve communities legacy. No archaeological significant artefacts will be disturbed during this project therefore; no permits will be required from the provincial heritage authority, AMAFA.
Mineral & Petroleum Resources Development 28 of 2002	To provide for the sustainable development of the nation's mineral and petroleum resources which includes activities carried out for the winning of any mineral on, in or under the earth (i.e. the use of borrow pits). Any raw materials must be obtained from a licensed source.
Planning Frameworks	
Comprehensive Rural Development Programme (CRDP)	The CRDP aims to mobilise and empower rural communities to take initiatives aimed at control of their own destiny - with the support of government. The goal of the CRDP is to achieve social cohesion and development by ensuring improved access to basic services, enterprise development and village industrialisation. The CRDP implements broad

	based-agrarian transformation focussing on community organisation and mobilisation as well as strategic investment in economic and social infrastructure. The CRDP proposes an approach that addresses the needs of the person, household, community and space. It is built on the premise that rural areas in the country have the potential to be developed in a way that generates jobs and economic opportunities, thus providing an alternative to the urban centres, and contributing to the reduction in rural urban migration. Furthermore, although agriculture plays a significant role in rural development, the CRDP proposes diversification of the rural economy, according to conditions prevailing in different areas. The Tugela Ferry Irrigation Scheme upgrades falls in line with the objectives of the CRDP.

Section 4: Motivation, Need and Desirability

4.1 Need and Desirability as Per Section 3(F)

The following motivation explains the need for the Tugela Ferry Irrigation Scheme upgrades:

- The need for the Tugela Ferry Irrigation Scheme upgrade was identified by the local community.
- The Tugela Ferry Irrigation Scheme upgrade acts as an important irrigation service in the area whereby without the scheme community agriculture could not take place.
- Due to the age of the scheme and poor maintenance the canal network and related facilities has fallen into disrepair.
- Block 6 currently does not have access to any water as the old abstraction point is no longer in use. The siphon and canals servicing Block 1 are currently damaged and have the potential to completely fail in its current condition.
- The Tugela Ferry Irrigation Scheme upgrade will have a positive impact for Tugela Ferry Agriculture Co-Op.
- The proposed abstraction will enable community members to once again practice agriculture to its full potential in Block 6.
- The new Block 1 siphon will provide long-term security of water provision to the all agriculture blocks
- The improved irrigation infrastructure will promote growth in the area; and
- There may be temporary employment opportunities during the construction period.

4.2 Motivation for Preferred Site, Activity and Technology Alternative

4.2.1 Preferred Site Alternative

Block 1 Siphon Alternative 1 (Preferred Alternative)

Site Alternative 1 for the Block 1 siphon will involve the construction of a new siphon directly downstream from the existing siphon across the Tugela River Tributary is considered more suitable than undergoing the refurbishment of the existing siphon across the Tugela River Tributary.

- The existing siphon is damaged and thus is slowly leaking water into the tributary thus extensive work will need to take place along the entire length of the siphon. The entire length of the embankments will also need to be protected from erosion. This work will thus result in extensive work within the watercourse, with the area being larger than that of Alternative 1.
- For this reason, to avoid excessive work within the watercourse Site Alternative 1 is considered the preferred alternative.

Block 6 Abstraction Alternative 1 (Preferred Alternative)

Site Alternative 1 for the Block 6 abstraction point will involve the construction of a new abstraction point along the bank of the Tugela River is considered more suitable than undergoing the refurbishment of the existing abstraction point.

- The existing abstraction point along the bank of the Tugela River. However, the availability of water at this point is limited due to the nature of the river at this point i.e. the inlet pipe is not located within the maro channel and thus water supply cannot be guaranteed.
- Block 6 agriculture activities cannot occur without the artificial input of water for irrigation, thus a water supply that cannot be guaranteed year-round would severally impact the local farmers.
- For this reason, to maintain a steady water supply for irrigation Site Alternative 1 is considered the preferred alternative.

4.2.2 Preferred Technology Alternative

Block 1 Siphon Alternative 1 (Preferred Alternative)

The preferred technology alternative i.e. construct the new Block 1 siphon, is considered more suitable than constructing a pier canal bridge.

- A pier bridge will be supported by concrete piers along the length of the bridge. However due to the topography of the area the bridge will need to be constructed along the entire length between the two canals
- A pier structure of this nature will be extremely costly and thus is not a feasible alternative when considering the available budget, thus Technology Alternative 1 is considered the preferred alternative.

Block 6 Abstraction Alternative 1 (Preferred Alternative)

The preferred technology alternative is to construct new Block 6 abstraction point. The main abstraction facility will not be located within the Tugela River but rather only the inlet pipe will be located in the river. This alternative is considered more suitable than locating the pump chamber within the river.

- Locating the pump chamber within the river will require a much larger construction footprint within the river thus contributing to a larger array of impacts.
- A pump chamber within the river its self also has a significantly higher potential to be washed away during flood events.
- For this reason, to reduce the impacts on the Tugela River Technology Alternative 1 is considered the preferred alternative.

Section 5: Public Participation

5.1 Notification of Interested and Affected Parties

1) *fixing a notice board at a place conspicuous to and accessible by the public at the boundary, on the fence or along the corridor of-*
   - i. *the site where the activity to which the application or proposed application relates is or is to be undertaken; and*
   - ii. *any alternative site;*

Two noticeboards (isiZulu and English) were placed within the Tugela Ferry Irrigation Scheme on the 5th June 2018. The noticeboard detailed the KwaZulu-Natal Department of Transport's proposed plan to construct the bridge, subject to a basic assessment. See Appendix C – Proof of Placement of Notice Board.

2) *giving written notice, in any of the manners provided for in section 47D of the Act, to-*
   - i. *the occupiers of the site and, if the proponent or applicant is not the owner or person in control of the site on which the activity is to be undertaken, the owner or person in control of the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;*
   - ii. *the municipal councillor of the ward in which the site or alternative site is situated and any organisation of ratepayers that represent the community in the area;*
   - iii. *the municipality which has jurisdiction in the area;*
   - iv. *any organ of state having jurisdiction in respect of any aspect of the activity, and;*
   - v. *any other party as required by the competent authority;*

The following steps were followed during the public participation process.

- The Ward Councilors were suitably notified by means of email on the 18th Feburary 2019.
- The Ward Councilors were provided with information, which provides detail about the proposed project.
- The local agriculture Co-op representatives were notified on the 30th May 2018.
- The traditional councils (Inkhosi) were notified on the 29th May 2018 and 5th June 2018
- Two noticeboards detailing the proposed development were placed within the Tugela Ferry Irrigation Scheme on the 5th June 2018.
- An English and IsiZulu advert was placed in the Ilanga newspaper on the 17th February 2019.
- With regards to authority communications, all relevant authorities have been notified of the application and have been provided with copies of this BAR.

See Appendix D – Proof of Notification.

- i. *owners, persons in control of, and occupiers of land adjacent to the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;*

Email notifications to all I&APs were sent out on the 18th Feburary 2019. See Appendix D – Proof of Notification.

3) *placing an advertisement in-*
   i. *one local newspaper; or*
   ii. *any official Gazette that is published specifically for the purpose of providing public notice of applications or other submissions made in terms of these Regulations;*
4) *placing an advertisement in at least one provincial newspaper or national newspaper, if the activity has or may have an impact that extends beyond the boundaries of the metropolitan or district municipality in which it is or will be undertaken: Provided that this paragraph need not be complied with if an advertisement has been placed in an official Gazette referred to in paragraph (c)(ii);*

An English and IsiZulu advert was placed in the Ilanga newspaper on the 17th February 2019 detailing the proposed project, Basic Assessment and Water Use Authorisation requirements and to prove contact details of EnviroPro should anyone wish to register as an I&AP. See Appendix E – Proof of Advert Placement.

5.2 Registered Interested and Affected Parties

42. A proponent or applicant must ensure the opening and maintenance of a register of interested and affected parties and submit such a register to the competent authority, which register must contain the names, contact details and addresses of-

(a) all persons who, as a consequence of the public participation process conducted in respect of that application, have submitted written comments or attended meetings with the proponent, applicant or EAP;
(b) all persons who have requested the proponent or applicant, in writing, for their names to be placed on the register; and
(c) all organs of state which have jurisdiction in respect of the activity to which the application relates.

The contact details of all I&APs that have registered have been provided in the Registered I&AP list in Appendix F.

5.3 Comments

Comments of interested and affected parties to be recorded in reports and plans 44.

1) *The applicant must ensure that the comments of interested and affected parties are recorded in reports and plans and that such written comments, including responses to such comments and records of meetings, are attached to the reports and plans that are submitted to the competent authority in terms of these Regulations.*
2) *Where a person desires but is unable to access written comments as contemplated in subregulation (1) due to-*
   i. *a lack of skills to read or write;*
   ii. *disability; or*
   iii. *any other disadvantage;*
   iv. *reasonable alternative methods of recording comments must be provided for.*

All comments received from I&APs have been recorded in the comments and response table. The original comments provided have been provided together with the C&R table. This report has been provided to the Msinga Local Municipality and Umzinyathi District Municipality for comment. See Appendix G – Comments and Response table and Comments Received.

Section 6: Impact Assessment

6.1 Methodology to Determine and Rank Significance and Consequences of Impacts Associated With All Alternative as Per Section 3(h) (vi)

Impacts are assessed qualitatively and quantitatively, looking at the duration / frequency of the activity and likely impacts associated with that activity during both construction and operation. If the activity happens frequently, the risk of the associated impact occurring is much higher than if the activity happens less frequently. The geographical extent of the impact is assessed i.e. will the impact be restricted to the point of occurrence or will have it have a local or regional effect. Impacts are also reviewed looking at severity levels and consequences should the impact occur i.e. will the severity be low, medium or high and then probability of the impact occurring is taken into account.

Whether or not the impact can be mitigated and the extent to which it can be avoided, managed, mitigated, or reversed is assessed i.e. the probability of occurrence after mitigation has been applied. This also takes into account likelihood of human error based on construction and operational auditing experience i.e. even though

spills can be completely mitigated against and prevented, there is always a small chance that spills will still occur (residual risk). Based on all of these factors, the impact is then rated to determine its significance. For example an impact can have a regional affect with severe environmental implications, however the probability of it occurring is very low, and the implementation of the proposed mitigation measures means that the ultimate rating is medium or low.

Please see below a description of the scoring. The full impact scoring tables detailing how the significance rating was calculated can be found in Appendix H.

Scoring of Impacts	
Duration / Frequency of activity likely to cause impact	0 = No impact 1 = short term / once off 2 = medium term / during operation 3 = long term / permanent
Geographical Extent	0 = No impact 1 = point of impact / restricted to site 2 = local / surrounding area 3 = regional
Severity (level of damage caused) if impact were to occur	0 = No impact 1 = minor 3 = medium 5 = major
Probability of impact without mitigation	1 - 5 = low. 6 -10 = medium. 11 -14 = high.
Significance before application of Mitigation Measures	A score of between 1and 5 is rated as low. A score of between 6 and 10 is rated as medium. A score of between 11 and 14 is rated as high.
Will activity cause irreplaceable loss of resources?	10 = Yes 0 = No
Mitigation measures	0 = No impact - 5 = can be fully mitigated - 3 = can be partially mitigated -1 = unable to be mitigated
Probability of impact after mitigation	0 = No impact 1 = Low 2 = Medium 3 = High
Significance after application of Mitigation Measures	A score of between 1and 5 is rated as low. A score of between 6 and 10 is rated as medium. A score of between 11 and 14 is rated as high.

6.2 Preferred Site and Technology Alternative

Block 1 Siphon (Site specific)

See Appendix H for the full impacts scoring matrix, which assesses the impacts on the above system. The below impacts relate to the site-specific preferred site and technology alternatives.

No.	Nature and Consequences of impact	Sig. rating of impacts[1]:	Proposed mitigation and Extent to which impact can be reversed / avoided, managed or mitigated:	Sig. rating of impacts after mitigation:
Construction				
Direct Impacts				
1.	There is the potential for erosion to take place within the Tugela River Tributary resulting in downstream sedimentation of this eroded material due to clearing and the operation of the construction site within the Tugela River Tributary.	6 (Medium)	The following measures must be carried out to mitigate against erosion on the Block 1 siphon site: • The areas of the Tugela River Tributary that are not within the direct project footprint must be demarcated as 'no-go' areas. • All construction activities occurring within the Tugela River Tributary must be done so with extreme care	2 (Low)

[1] See Appendix H for more details.

No.	Nature and Consequences of impact	Sig. rating of impacts[1]:	Proposed mitigation and Extent to which impact can be reversed / avoided, managed or mitigated:	Sig. rating of impacts after mitigation:
			to avoid any erosion taking place in the watercourse. • All areas upstream and downstream of construction footprint must be demarcated as a 'no-go' zone for the duration of the construction process. No site staff are permitted to enter these areas. • Areas exposed to erosion must be protected through the use of sand bags, berms and efficient construction processes i.e.: limiting the extent (footprint) and duration period that areas are exposed. • The contractor must limit in-stream work to minimize streambank and bed disturbance. • Construct siphon in the dry season. • No excavated material or fill material may be stored within the Tugela River Tributary or within 32m of the Tugela River Tributary. • Bedding material that will be used must not be stored within 32m of the Tugela River Tributary before it is used.	
2.	The habitat for fauna living within the construction footprint will be modified due to the excavation and construction activities taking place within the Tugela River Tributary.	6 (Medium)	The following measures must be carried out to mitigate against excessive habitat destruction on the Block 1 siphon: • Erosion prevention and sediment control measures must be implemented. Temporary and permanent erosion control methods may include silt fences, interceptor ditches, seeding and sodding, riprap of exposed embankments, and mulching; • The project footprint must be kept as small as possible; • Direct impacts to Tugela River Tributary substrate/habitat outside the construction footprint must be avoided by ensuring the Tugela River Tributary outside the construction footprint is demarcated as a 'no go' zone during construction. • Heavy machinery must not be permitted to move beyond the demarcated footprint; • Sand and aggregate for concrete must not be obtained from within the riverbed or riparian zone but must be sourced from a permitted source; • A spill containment plan is required to be in place prior to construction to minimize the potential impacts of spills or leaks of hazardous substances; • Contamination of the river system with unset cement or Tugela River Tributary must be prevented as it is detrimental to aquatic biota.	2 (Low)
3.	Clearing of the Block 1 siphon site resulting in the loss of vegetation within the Thukela Valley Bushveld vegetation type.	6 (Medium)	The following measures must be carried out to mitigate against excessive vegetation clearing on the Block 1 siphon site: • This impact cannot be fully mitigated as it will result in the loss of indigenous vegetation found	6 (Medium)

No.	Nature and Consequences of impact	Sig. rating of impacts[1]:	Proposed mitigation and Extent to which impact can be reversed / avoided, managed or mitigated:	Sig. rating of impacts after mitigation:
			within the Thukela Valley Bushveld vegetation type. • The vegetation that will be cleared must be restricted to the construction footprint of the Block 1 siphon. No vegetation may be cleared within the Tugela River Tributary other than that required for access to the site or for the construction activities associated with the construction of the siphon. • Contractors must avoid damaging any vegetation that is not within the construction footprint; • The ECO must be consulted should a tree or any vegetation require clearing outside of the designated construction footprint area.	
4.	Removal of alien invasive vegetation found within the Block 1 siphon construction site.	0 (Positive)	This is a positive impact.	0 (Positive)
5.	Careless operation by the contractor within the Tugela River Tributary resulting in damage to the Tugela River Tributary i.e. the riverbed, banks and riparian zones within the construction footprint and adjacent areas	5 (Medium)	The following measures must be carried out to mitigate against potential damage to the Tugela River Tributary during construction: • Areas of the Tugela River Tributary not within the construction footprint must be demarcated as no-go areas; • Heavy vehicles must avoid working near the Tugela River Tributary as far as possible; • A 32m buffer must be imposed on the rest of the Tugela River Tributary with no traffic, vehicles or storage permitted within this buffer zone; • Vehicles may not cross the Tugela River Tributary at any other point than the construction footprint of siphon; • Non-essential equipment and vehicles are to remain at least 32m from the Tugela River Tributary at all times.	1 (low)
6.	Disturbance of the Block 1 siphon site due to construction activities resulting in the encroachment of alien vegetation into disturbed areas i.e. Castor Oil.	4 (Medium)	There is currently alien vegetation located within the surrounding area. • Alien vegetation must not be allowed to encroach onto the site and must be continually removed during construction. • Construction must not promote further alien plant disturbances in the surrounding area	0 (Low)
Indirect Impacts				
7.	Positive impacts for the community include potential for local employment.	0 (Positive)	This is a positive impact.	0 (Positive)
Operation				
Direct Impacts				
8.	Long-term erosion within the Tugela River Tributary and damage to watercourse banks where siphon has been placed.	12 (High)	The siphon will be designed as per the engineering drawings: • The siphon will be encased with concrete underneath the river. • Reno mattresses will also be included in the design to stabilize the banks and prevent erosion of the banks during high flow events. • The trench must also be rehabilitated effectively before contractors leave the site.	8 (Medium)

No.	Nature and Consequences of impact	Sig. rating of impacts[1]:	Proposed mitigation and Extent to which impact can be reversed / avoided, managed or mitigated:	Sig. rating of impacts after mitigation:
			• Soil adjacent to the siphon must be compacted effectively to the same level or slightly higher than the surrounding land to prevent settling which could create depressions for water to travel along, creating erosion funnels and exposing the siphon.	
9.	Potential alteration of flow dynamics within the Tugela River Tributary due to poor placement of the siphon.	10 (Medium)	The following measures must be carried out to avoid potential alteration of flow dynamics within the Tugela River Tributary: • The contractor must build the siphon as per the approved design (D33340.00-100-01), as the siphon has been designed to ensure that the natural flow of the Tugela River Tributary is not interrupted • Conduct regular inspections and maintenance must be conducted on the Tugela River Tributary when required.	6 (Medium)
10.	The siphon bursting resulting in localised flooding and erosion.	11 (High)	The following measures must be carried out to avoid a potential failure the Block 1 siphon: • The contractor must build the siphon as per the approved design (D33340.00-100-01), as the siphon has been designed to ensure that the natural flow of the Tugela River Tributary is not interrupted • Conduct regular inspections and maintenance must be conducted on the Tugela River Tributary when required.	7 (Medium)
Indirect Impacts				
11.	Maintain the supply of irrigation water to the Tugela Ferry Co-Op	0 (Positive)	This is a positive impact.	0 (Positive)
Cumulative				
12.	Maintenance will be required for the Block 1 siphon meaning workmen will need to enter the Tugela River Tributary.	6 (Medium)	The maintenance of the Block 1 siphon must only be conducted when required and for short periods of time.	2 (Low)

Block 6 Abstraction (Site specific)

See Appendix H for the full impacts scoring matrix, which assesses the impacts on the above system. The below impacts relate to the site-specific preferred site and technology alternatives.

No.	Nature and Consequences of impact	Sig. rating of impacts[2]:	Proposed mitigation and Extent to which impact can be reversed / avoided, managed or mitigated:	Sig. rating of impacts after mitigation:
Construction				
Direct Impacts				
1.	There is the potential for erosion to take place within the Tugela River resulting in downstream sedimentation of this eroded material due to clearing and the operation of the construction site within the Tugela River.	8 (Medium)	The following measures must be carried out to mitigate against erosion on the Block 6 abstraction site: • The areas of the Tugela River that are not within the direct project footprint must be demarcated as 'no-go' areas. • All construction activities occurring within the Tugela River must be done so with extreme care to avoid any erosion taking place in the watercourse. • All areas upstream and downstream of construction	4 (Low)

[2] See Appendix H for more details.

No.	Nature and Consequences of impact	Sig. rating of impacts[2]:	Proposed mitigation and Extent to which impact can be reversed / avoided, managed or mitigated:	Sig. rating of impacts after mitigation:
			footprint must be demarcated as a 'no-go' zone for the duration of the construction process. No site staff are permitted to enter these areas. • Areas exposed to erosion must be protected through the use of sand bags, berms and efficient construction processes i.e.: limiting the extent (footprint) and duration period that areas are exposed. • The contractor must limit in-stream work to minimize streambank and bed disturbance. • Construct the abstraction facility in the dry season. • No excavated material or fill material may be stored within the Tugela River or within 32m of the Tugela River. • Bedding material that will be used must not be stored within 32m of the Tugela River before it is used.	
2.	The habitat for fauna living within the construction footprint will be modified due to the excavation and construction activities taking place within the Tugela River and with 32m of the river.	8 (Medium)	The following measures must be carried out to mitigate against excessive habitat destruction on the Block 6 abstraction site: • Erosion prevention and sediment control measures must be implemented. Temporary and permanent erosion control methods may include silt fences, interceptor ditches, seeding and sodding, riprap of exposed embankments, and mulching; • The project footprint must be kept as small as possible; • Direct impacts to Tugela River substrate/habitat outside the construction footprint must be avoided by ensuring the Tugela River outside the construction footprint is demarcated as a 'no go' zone during construction. • Heavy machinery must not be permitted to move beyond the demarcated footprint; • Sand and aggregate for concrete must not be obtained from within the riverbed or riparian zone but must be sourced from a permitted source; • A spill containment plan is required to be in place prior to construction to minimize the potential impacts of spills or leaks of hazardous substances; • Contamination of the river system with unset cement must be prevented as it is detrimental to aquatic biota.	4 (Low)
3.	Clearing of the Block 6 abstraction site resulting in the loss of vegetation within the Highveld Alluvial Vegetation type.	8 (Medium)	The following measures must be carried out to mitigate against excessive vegetation clearing on the Block 6 abstraction site: • This impact cannot be fully mitigated as it will result in the loss of indigenous vegetation found within the Highveld Alluvial Vegetation type. • The vegetation that will be cleared must be restricted to the construction footprint of the Block	8 (Medium)

No.	Nature and Consequences of impact	Sig. rating of impacts[2]:	Proposed mitigation and Extent to which impact can be reversed / avoided, managed or mitigated:	Sig. rating of impacts after mitigation:
			6 abstraction facility. No vegetation may be cleared within the Tugela River other than that required for access to the site or for the construction activities associated with the construction of the Block 6 abstraction facility. • Contractors must avoid damaging any vegetation that is not within the construction footprint; • The ECO must be consulted should a tree or any vegetation require clearing outside of the designated construction footprint area.	
4.	Removal of alien invasive vegetation found within the Block 6 abstraction facility.	0 (Positive)	This is a positive impact.	0 (Positive)
5.	Careless operation by the contractor within the Tugela River resulting in damage to the Tugela River i.e. the riverbed, banks and riparian zones within the construction footprint and adjacent areas	8 (Medium)	The following measures must be carried out to mitigate against potential damage to the Tugela River during construction: • Areas of the Tugela River not within the construction footprint must be demarcated as no-go areas; • Heavy vehicles must avoid working near the Tugela River as far as possible; • A 32m buffer must be imposed on the rest of the Tugela River with no traffic, vehicles or storage permitted within this buffer zone; • Vehicles may not cross the Tugela River at any other point than the construction footprint of Block 6 Abstraction Site; • Non-essential equipment and vehicles are to remain at least 32m from the Tugela River at all times.	4 (low)
6.	Disturbance of the Block 6 abstraction site due to construction activities resulting in the encroachment of alien vegetation into disturbed areas i.e. Castor Oil.	6 (Medium)	There is currently alien vegetation located within the surrounding area. • Alien vegetation must not be allowed to encroach onto the site and must be continually removed during construction. • Construction must not promote further alien plant disturbances in the surrounding area	2 (Low)
Indirect Impacts				
7.	Positive impacts for the community include potential for local employment.	0 (Positive)	This is a positive impact.	0 (Positive)
Operation				
Direct Impacts				
8.	Flood events along the Tugela River damaging the facility	10 (Medium)	The abstraction point has been designed so that the main facility is located outside the channel of the river. This will ensure that during sever flood events the main facility will be protected from the flood high velocity waters. • The contractor must build the abstraction point as per the approved design (D33340.00-201-02). • Conduct regular inspections and maintenance must be conducted on the abstraction point when required.	8 (Medium)
9.	Potential alteration of flow dynamics within the Tugela River due to poor placement of the inlet pipe.	10 (Medium)	The following measures must be carried out to avoid potential alteration of flow dynamics within the Tugela River: • The contractor must build the abstraction point as per the	8 (Medium)

No.	Nature and Consequences of impact	Sig. rating of impacts[2]:	Proposed mitigation and Extent to which impact can be reversed / avoided, managed or mitigated:	Sig. rating of impacts after mitigation:
			approved design (D33340.00-201-02). • Conduct regular inspections and maintenance must be conducted on the abstraction point when required.	
10.	Utilisation and storage of hydrocarbons in close proximity to the Tugela River	8 (Medium)	In order to service the abstraction point hydrocarbons will need to be utilised within the facility: • All hydrocarbons must be stored off site and only brought to site when required. • Any storage of hydrocarbons within 32m of the Tugela River is prohibited.	4 (Low)
Indirect Impacts				
11.	The new Block 6 abstraction point will improve water supply to support agriculture activities in the area.	0 (Positive)	This is a positive impact.	0 (Positive)
Cumulative				
12.	Maintenance will be required for the Block 6 abstraction point meaning workmen entering the Tugela River.	6 (Medium)	The maintenance of the Block 6 abstraction point must only be conducted when required and for short periods of time.	2 (Low)
13.	Abstraction of water from the Tugela River putting pressure on lower Thukela River Reserve	6 (Medium)	The abstraction was determined to be a limited impact on the overall established Reserve. Considering this, the overall cumulative impact of the abstraction will be limited should the Reserve be maintained. • Only abstract volumes of water that is required. • Maintain a daily register of the volumes of water that were abstracted.	2 (Low)

Standard Construction Impacts

See Appendix H for the full impacts scoring matrix, which assesses the impacts on the above system. The below impacts relate to the preferred site and technology alternatives – Generic Impacts.

No.	Nature and Consequences of impact	Sig. rating of impacts[3]:	Proposed mitigation and Extent to which impact can be reversed / avoided, managed or mitigated:	Sig. rating of impacts after mitigation:
Construction				
Direct Impacts				
No generic direct impacts				
Indirect Impacts				
1.	The increased risk to pedestrians and livestock due to construction activities.	6 (Medium)	The construction activity will pose an increased risk to pedestrians and livestock. • Appropriate construction safety signage must be erected to notify of construction activities and potential hazards on site; • Appropriate barriers must be used to cordon off construction excavations, hazardous areas, and areas undergoing construction. • Flagmen must be in attendance to direct traffic where required.	1 (Low)
2.	On site erosion due to improper management of stormwater by the contractor during construction.	5 (Low)	Areas exposed to erosion must be protected. The following apply to erosion control on site:	1 (Low)

[3] See Appendix H for more details.

No.	Nature and Consequences of impact	Sig. rating of impacts[3]:	Proposed mitigation and Extent to which impact can be reversed / avoided, managed or mitigated:	Sig. rating of impacts after mitigation:
			• Sand bags, berms, stone pitching must be used to control erosion from forming during construction. • No excavated material or fill material may be stored within the watercourses or within 32m of the watercourses. • Bedding material that will be re-worked may not be stored within 32m of the watercourses before it is used. • Temporary stormwater measures should be implemented to ensure that material does not wash off the surface into any watercourse during construction.	
3.	Dusty conditions generated during the construction activities.	5 (Low)	There will be increased dust generated during the construction phase; however, this will be on a temporary basis i.e. the site will be worked continuously for a few months until construction is completed. Further to this: • Vehicle speed limits must be reduced to 40km/hr to reduce the amount of dust raised along the gravel roads to and from the site. • The material being transported to the site in the back of the trucks must be covered. • Water carts must be used on site should dust levels elevate to a nuisance level. • Shade cloth is must be utilised for stockpiled materials where required. • The applicant must comply with the National Dust Regulations (Government Notice R827, 2013) with regards to dust levels produced on site.	1 (Low)
4.	Increase in heavy truck traffic along the local roads as construction vehicles travel to the site for construction activities, impacting existing traffic conditions and pedestrians.	6 (Medium)	This cannot be avoided as traffic will increase during the construction phase temporarily (for a few months) until construction is completed. • All drivers associated with the construction must operate within the speed limits and due caution must be exercised especially when pedestrians are on the road. • All drivers must be appropriately licenced and trained.	1 (Low)
5.	Impact on any unidentified existing services on site.	8 (Medium)	No services identified on the site that will be impacted on: • As a standard construction practice the engineer and contractor must identify any potential existing services that may be affected prior to construction. • Any infrastructure that is removed must be replaced and any damage caused from construction must be repaired. • Should any new power lines be placed on site prior to construction, a 10m buffer must be placed between the existing power lines and the road.	4 (Low)
6.	Emissions from construction vehicles associated with the construction activities.	7 (Medium)	The construction phase of the project will see the increase in vehicles moving through the area which will result in the	5 (Low)

No.	Nature and Consequences of impact	Sig. rating of impacts[3]:	Proposed mitigation and Extent to which impact can be reversed / avoided, managed or mitigated:	Sig. rating of impacts after mitigation:
			increase of emissions into the atmosphere. • All construction vehicles operating on the site must be fitted with the appropriate silencers and exhausts in order to reduce the emissions and noise into the atmosphere.	
7.	Temporary increase in waste and litter due to the construction process associated with the construction activities.	7 (Medium)	The construction phase of the project will see an increase in construction staff on site and therefore an increase in waste on site. • Littering will not be permitted on site; • Designated waste storage areas with appropriate waste receptacles must be set up within the construction site camp; • Waste must be removed from site and disposed of at a registered waste disposal site; • Safe disposal slips for the disposal of all waste must be obtained and kept on site as proof of safe disposal.	2 (Low)
8.	Insufficient number of toilet facilities on site.	9 (Medium)	The increase in construction personnel during the construction phase will require an appropriate number of toilet facilities for the site. • Appropriate and sufficient toilet facilities (1 toilet per 15 employees) must be provided by the contractor; • All toilet facilities must be checked on a daily basis; • All toilet facilities must be emptied and cleaned on a weekly basis.	4 (Low)
9.	Inappropriate disposal of toilet waste resulting in the contamination of the environment.	6 (Medium)	The following mitigation measures must be adhered to: • All toilet facilities on site utilised by the construction personnel must be checked on a daily basis and emptied on a weekly basis by the contactor. • A registered waste removal contractor must remove sewage waste from site or sewage waste must be disposed of at a permitted Waste Water Treatment Site; • Safe disposal slips for the disposal of effluent waste must be obtained and kept on site as proof of safe disposal.	1 (Low)
10.	Generation of noise associated with the construction.	6 (Medium)	The construction phase of the project will see the increase in vehicles moving through the area which will result in the increase of noise. • All construction vehicles operating on site must be fitted with standard silencers to reduce the noise levels produced.	1 (Low)
11.	Damage to property, fences, or cultivated land during construction.	7 (Medium)	The following mitigation measures must be adhered to: • All services must be identified prior to construction through notifying surrounding stakeholders prior to any potential traffic congestion; • The contractor must create alternative access routes to the properties where required;	3 (Low)

No.	Nature and Consequences of impact	Sig. rating of impacts[3]:	Proposed mitigation and Extent to which impact can be reversed / avoided, managed or mitigated:	Sig. rating of impacts after mitigation:
			• The contractor must be aware of the stakeholders' movements and where possible, disruptive activities must be scheduled outside of peak traffic hours; • Surrounding land owners and stakeholders must be notified prior to disruptive activities during construction; • Any infrastructure that gets removed must be replaced and any damage caused from construction must be repaired.	
12.	Unsustainable sourcing of raw materials such as gravel, sand, water etc. which could result in the promotion of illegal mining operations which can cause significant damage to the environment.	10 (Medium)	The construction activities will require raw materials to be sourced and brought to site. • Contractors must provide proof of sustainable sourcing of materials i.e. permits for quarries and sand winning operations from which stone and sand have been obtained.	5 (Low)
13.	Positive impacts due to potential for local employment.	0 (Positive)	This is a positive impact.	0 (Positive)
Operation				
Direct Impacts				
No generic direct impacts				
Indirect Impacts				
14.	Positive impacts for the community include potential for local employment.	0 (Positive)	This is a positive impact.	0 (Positive)
Cumulative				
15.	Improved water supply for the irrigation scheme	0 (Positive)	This is a positive impact.	0 (Positive)

6.3 Site and Technology Alternative 2

Block 1 Siphon (Site specific)

See Appendix H for the full impacts scoring matrix, which assesses the impacts on the above system. The impacts relating to the Alternative 1 and Alterative 2 are very similar, therefore the impacts below include the impacts which differentiate the most between the two alternatives.

No.	Nature and Consequences of impact	Sig. rating of impacts[4]:	Proposed mitigation and Extent to which impact can be reversed / avoided, managed or mitigated:	Sig. rating of impacts after mitigation:
Construction				
Direct Impacts				
1.	There is a greater potential for erosion to take place within the Tugela River Tributary as work will need to take place along the entire length of the existing siphon and along the embankments supporting the canal.	8 (Medium)	The following measures must be carried out to mitigate against erosion on the site: • The areas of the Tugela River Tributary that are not within the direct project footprint must be demarcated as 'no-go' areas. • All construction activities occurring within the Tugela River Tributary must be done so with extreme care to avoid any erosion taking place in the watercourse. • All areas upstream and downstream of construction footprint must be demarcated as a 'no-go' zone for the duration of the construction process. No site staff are permitted to enter these areas. • Areas exposed to erosion must be protected through the use of sand bags, berms and efficient	4 (Medium)

[4] See Appendix H for more details.

No.	Nature and Consequences of impact	Sig. rating of impacts[4]:	Proposed mitigation and Extent to which impact can be reversed / avoided, managed or mitigated:	Sig. rating of impacts after mitigation:
			construction processes i.e.: limiting the extent (footprint) and duration period that areas are exposed. • The contractor must limit in-stream work to minimize streambank and bed disturbance. • Construct the repair works within in the dry season. • No excavated material or fill material may be stored within the Tugela River Tributary or within 32m of the Tugela River Tributary.	
2.	Due to a bigger construction footprint a larger habitat will be modified due to the excavation and construction activities taking place within the Tugela River Tributary.	8 (Medium)	The following measures must be carried out to mitigate against excessive habitat destruction on the Block 1 siphon: • Erosion prevention and sediment control measures must be implemented. Temporary and permanent erosion control methods may include silt fences, interceptor ditches, seeding and sodding, riprap of exposed embankments, and mulching; • The project footprint must be kept as small as possible; • Direct impacts to Tugela River Tributary substrate/habitat outside the construction footprint must be avoided by ensuring the Tugela River Tributary outside the construction footprint is demarcated as a 'no go' zone during construction. • Heavy machinery must not be permitted to move beyond the demarcated footprint; • Sand and aggregate for concrete must not be obtained from within the riverbed or riparian zone but must be sourced from a permitted source; • A spill containment plan is required to be in place prior to construction to minimize the potential impacts of spills or leaks of hazardous substances; • Contamination of the river system with unset cement or Tugela River Tributary must be prevented as it is detrimental to aquatic biota.	4 (Low)
3.	Due to a bigger construction footprint there will more vegetation lost within the Thukela Valley Bushveld vegetation type.	8 (Medium)	The following measures must be carried out to mitigate against excessive vegetation clearing on the Block 1 siphon site: • This impact cannot be fully mitigated as it will result in the loss of indigenous vegetation found within the Thukela Valley Bushveld vegetation type. • The vegetation that will be cleared must be restricted to the construction footprint of the Block 1 siphon. No vegetation may be cleared within the Tugela River Tributary other than that required for access to the site or for the construction activities associated with the construction of the siphon. • Contractors must avoid damaging any vegetation that is not within the construction footprint;	8 (Medium)

No.	Nature and Consequences of impact	Sig. rating of impacts[4]:	Proposed mitigation and Extent to which impact can be reversed / avoided, managed or mitigated:	Sig. rating of impacts after mitigation:
			• The ECO must be consulted should a tree or any vegetation require clearing outside of the designated construction footprint area.	
Indirect Impacts				
Indirect Impacts will remain as per Alternative 1				
Operation				
Direct Impacts				
4.	Piers impeding flow of the Tugela River Tributary, resulting in changes to the flow dynamics of the river	10 (Medium)	The following measures must be carried out to avoid potential changes to the Tugela River Tributary flow dynamics: • The bridge must be constructed as per the approved design. • The number of piers within the channel of the river must be limited. • Conduct regular inspections and maintenance must be conducted on the bridge when required.	6 (Medium)
Indirect Impacts				
5.	The construction of a pier bridge will require an additional funding as the cost of a pier structures is significant.	14 (High)	This impact is unavoidable due to the nature of the construction activities required.	16 (High)
Cumulative				
Cumulative Impacts will remain as per Alternative 1				

Block 6 Abstraction (Site specific)

See Appendix H for the full impacts scoring matrix, which assesses the impacts on the above system. The impacts relating to the Alternative 1 and Alterative 2 are very similar, therefore the impacts below include the impacts which differentiate the most between the two alternatives.

No.	Nature and Consequences of impact	Sig. rating of impacts[5]:	Proposed mitigation and Extent to which impact can be reversed / avoided, managed or mitigated:	Sig. rating of impacts after mitigation:
Construction				
Direct Impacts				
1.	There is a greater potential for erosion to take place within the Tugela River due to the positioning of the pump chamber within the Tugela River.	8 (Medium)	The following measures must be carried out to mitigate against erosion on the Block 6 abstraction site: • The areas of the Tugela River that are not within the direct project footprint must be demarcated as 'no-go' areas. • All construction activities occurring within the Tugela River must be done so with extreme care to avoid any erosion taking place in the watercourse. • All areas upstream and downstream of construction footprint must be demarcated as a 'no-go' zone for the duration of the construction process. No site staff are permitted to enter these areas. • Areas exposed to erosion must be protected through the use of sand bags, berms and efficient construction processes i.e.: limiting the extent (footprint) and duration period that areas are exposed. • The contractor must limit in-stream work to minimize	5 (Low)

[5] See Appendix H for more details.

No.	Nature and Consequences of impact	Sig. rating of impacts[5]:	Proposed mitigation and Extent to which impact can be reversed / avoided, managed or mitigated:	Sig. rating of impacts after mitigation:
			streambank and bed disturbance. • Construct the abstraction facility in the dry season. • No excavated material or fill material may be stored within the Tugela River or within 32m of the Tugela River. • Bedding material that will be used must not be stored within 32m of the Tugela River before it is used.	
2.	There is a greater potential for careless operations by the contractor within the Tugela River resulting in damage to the Tugela River i.e. the riverbed, banks and riparian zones within the construction footprint and adjacent areas	8 (Medium)	The following measures must be carried out to mitigate against potential damage to the Tugela River during construction: • Areas of the Tugela River not within the construction footprint must be demarcated as no-go areas; • Heavy vehicles must avoid working near the Tugela River as far as possible; • A 32m buffer must be imposed on the rest of the Tugela River with no traffic, vehicles or storage permitted within this buffer zone; • Vehicles may not cross the Tugela River at any other point than the construction footprint of Block 6 Abstraction Site; • Non-essential equipment and vehicles are to remain at least 32m from the Tugela River at all times.	5 (low)
Indirect Impacts				
Indirect Impacts will remain as per Alternative 1				
Operation				
Direct Impacts				
3.	The potential for flood events along the Tugela River to damage the facility is greatly increased due to the pump station being located within the river.	11 (High)	The abstraction point (pump house) will be located within the Tugela River. • The contractor must build the abstraction point as per the approved design. • Conduct regular inspections and maintenance must be conducted on the abstraction point when required.	10 (Medium)
4.	Potential alteration of flow dynamics within the Tugela River due to poor placement of the pump house	10 (Medium)	The following measures must be carried out to avoid potential alteration of flow dynamics within the Tugela River: • The contractor must build the abstraction point as per the approved design. • Conduct regular inspections and maintenance must be conducted on the abstraction point when required.	9 (Medium)
Indirect Impacts				
5.	Due to the poor placement of the existing abstraction point a steady supply of water to the irrigation scheme cannot be guaranteed.	14 (High)	This impact is unavoidable.	16 (High)
Cumulative				
Cumulative Impacts will remain as per Alternative 1				

Standard Construction Impacts

Generic impacts for the Tugela Ferry Irrigation Scheme upgrades will be same for both alternatives.

6.4 Environmental Impact Statement as per section (l)

The key impacts associated with the construction of the Block 1 siphon and Block 6 abstraction point relate to those during the construction period. Issues such as damaging the Tugela River and its tributary the management of erosion, and clearing of vegetation need to be addressed. These can be best managed by minimising the clearing of vegetation to the construction footprint, treating the Tugela River and its tributary as a sensitive no-go area and by implementing effective stormwater management measures. During operation all impacts can be prevented provided that regular inspections take place.

A number of positive impacts may result from the construction of the Block 1 siphon and Block 6 abstraction point these relate to improve public water supply within the irrigation scheme. All construction activity must be confined to the proposed construction footprint area. Should a large tree or section of indigenous vegetation require clearing, the ECO must be consulted before clearing takes place. Once construction is complete there should be no significant impacts related to the operation of the siphon and abstraction point as depicted in Figure 8 and 9 below.

Taking into consideration the above impacts and mitigation measures, it is the EAP's opinion that the construction of preferred site and technology alternatives for the Block 1 siphon and Block 6 abstraction point be authorised.

Figure 8: Aerial photograph showing the Block 1 siphon

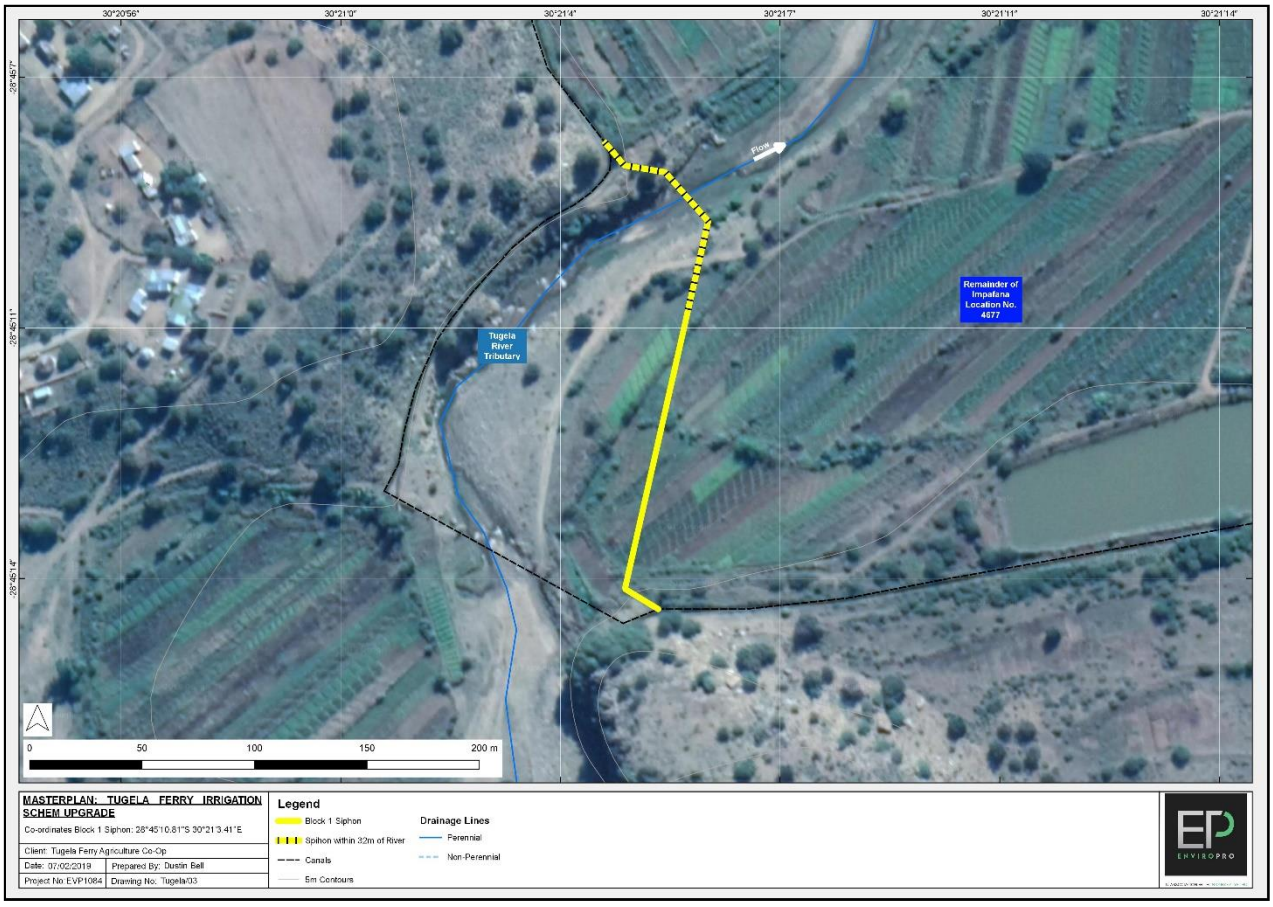


Figure 9: Aerial photograph showing the Block 6 abstraction point

6.5 Impact Management Objectives and Outcomes for the Development for Inclusion in the EMPr as Per Section 3(m)

The following objectives and outcomes must be considered for this project:

- Objectives:
  - For there to be no lasting negative impacts on the environment once construction is complete, specifically within the Tugela River and it tributary.
  - To practice responsible construction, 'best practice' with regards to housekeeping on site during construction (outlined within the EMPr) and enforce the polluter pays principle. The applicant / contractor must be responsible for their actions on site during construction and the rehabilitation of the site post construction.
- Outcomes:
  - To promote sustainable development. Create infrastructure and an environment that is healthy and sustainable for future generations to come.

6.6 Assumptions, Uncertainties and Gaps in Knowledge Relating To the Assessment and Mitigation Measures Proposed As Per Section 3(o)

No vegetation studies have been conducted on site to inform this assessment of the vegetation species surrounding the site. Given the minimal clearing of vegetation required for the project and the disturbed nature of both sites specialist input with regards vegetation was not deemed necessary for this assessment.

6.7 Period for Which Authorization Is Required, Proposed Monitoring and Auditing and Post Construction Requirement's

Environmental authorisation is required for the construction of the Block 1 siphon and Block 6 abstraction point within 2019 for the Tugela Ferry Agriculture Co-Op, therefore the authorization would need to be valid for a period of five years, within which time construction would need to commence.

Given the nature of this project, it is recommended that **monthly** ECO audits be carried out for the duration of the construction phase of this project. One post construction audit should be conducted once construction is complete.

The EMPr details the post construction, rehabilitation, and closure objectives which will be monitored by the ECO and compliance authorities.

6.8 Financial Provisions as Per Section 3(s)

The contractor is responsible for and must ensure that the site has been rehabilitated in full before leaving the site. No upfront financial provision is required for this project.

6.9 EAP Opinion on Whether Or Not to Authorize Activity and Recommendations and Conditions for Authorisation as Per Section 3(n) and (p)

With respect to the site and technology alternatives, it is recommended that preferred site and technology alternatives be authorised. The significance of the impacts associated with the construction of the siphon and abstraction point is considered 'low'.

6.10 Summary of Recommendations for the construction of the Block 1 siphon and Block 6 abstraction point:

Stakeholders, Properties & Services

- As standard construction practices the engineer and contractor should identify all existing services that may be affected prior to construction.
- The contractor should liaise with local community members regarding restriction of access during construction.

Traffic & Construction Pedestrians

- The contractor must take into consideration the potential movements of surrounding stakeholders.
- Appropriate signage and barriers must be used to cordon off construction areas.
- All construction vehicles should be fitted with the appropriate silencers and exhausts.
- Speed limits must be obeyed.

Housekeeping, waste management, storage, and materials handling

- Littering must not be permitted on site.
- All hazardous materials and substances should be stored within a secured area in the construction camp. The storage area should be a hard surfaced, bunded, and covered area.
- Cement mixing must be done on a hard surface that is protected from storm water runoff.
- Contractors should be required to dispose of construction rubble at an appropriate landfill site. Delivery notes and safe disposal certificates to prove appropriate disposal should be available.
- Appropriate and sufficient toilet facilities must be provided by the contractor.
- Toilet facilities must be provided by a registered company and all sewage must be disposed of at an appropriate facility. Safe disposal certificates must be kept on record.
- Toilet facilities must not be located within 32m of any watercourse.

Dust and erosion control

- A water cart should be used to dampen dusty surfaces and suppress dust.
- Exposed areas should be rehabilitated and re-vegetated as soon as possible during construction.
- Areas exposed to erosion must be protected through the use of sand bags, berms and efficient construction processes i.e.: limiting the extent (footprint) and duration period that areas are exposed. The contractor must ensure that any blockages created during construction are resolved.

Stormwater management and protection of the watercourse

- The engineer/contractor must ensure that only clean storm water runoff enters the environment. Any contaminated run off must be collected and disposed of.
- All watercourse must be identified and demarcated at the start of construction.
- No excavated material or fill material may be stored within the drainage line or within 32m of any watercourse.
- Only the area directly in the path of construction may be cleared and excavated. The remainder of the watercourse must be demarcated as a 'no-go' area.
- Heavy vehicles should avoid working near the watercourse as much as possible.
- Stormwater may not be channelled directly into any water body without the flow velocity being slowed. Channelled flows must be diffused.

Protection of Heritage Resources

- Attention is drawn to the South African Heritage Resources Act, 1999 (Act No. 25 of 1999) and the KwaZulu-Natal Heritage Act (Act no 4 of 2008) which, requires that operations that expose archaeological or historical remains should cease immediately, pending evaluation by the provincial heritage agency.

Specific conditions

- The construction footprint of both sites must be demarcated;
- Ensure that the construction activities do not interrupt flow even during low flow periods;
- Vehicles must only use the designated crossing points;
- Heavy vehicles must remain at least 32m away from the Tugela River and its tributary unless required for construction purposes;
- No storage may occur within 32m of the Tugela River and its tributary; and
- Stormwater outlets must be fitted with erosion protection features to diffuse flow.

Appendix A: Drawings and Maps

Appendix B: Specialist Reports

Appendix C: Noticeboard

Appendix D: Notification

Appendix E: Adverts

Appendix F: Registered I &Aps

Appendix G: Comments and Responses

Appendix H: Impacts Scoring Matrix

Appendix I: EAP Declaration

Appendix J: Environmental Management Programme