

Baseline Assessment

Tongaat Hulett Developments: Canelands East Aquatic Assessment



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EXCECUTIVE SUMMARY

GroundTruth – Water, Wetlands and Environmental Engineering (GroundTruth), were approached by Tongaat Hulett's Developments KwaZulu-Natal, to assess the baseline aquatic health of the Mdloti River at Canelands East, Verulam, KwaZulu-Natal.

This report summarizes the baseline results from the biomonitoring of the Mdloti River up- and downstream of the proposed Canelands East development.

The upstream site was in a good condition for both the diatom and index of habitat integrity assessments. Habitat was unsuitable for SASS5 monitoring.

The downstream site was also in a good condition for the diatom and index of habitat integrity assessments, the SASS5 with limited habitat showed the site to be fair.

In general the sites are in a good ecological condition. The downstream site showed some minor improvements compared to the upstream site indicating positive impacts from the area between the sites.

TABLE OF CONTENTS

1.	Introduction.....	1
2.	Methods.....	3
2.1	Physico-Chemical Monitoring.....	3
2.2	Biological Monitoring	3
3.	Results	6
3.1	Physico-Chemical Results.....	6
3.2	Biological Results.....	8
3.2.1	Site summary of the Mdloti upstream of Canelands East.....	8
3.2.2	Site summary of the Mdloti downstream of Canelands East.....	9
4.	Conclusions	10
5.	References	11
6.	Appendices.....	12
6.1	Appendix A – SASS5 Accreditation certificate	12

LIST OF FIGURES

Figure 1.1	Overview of the Canelands East study area.....	1
Figure 3.1	Summary of the biological health of the Canelands East sampling sites.....	7

LIST OF TABLES

Table 1.1	Aquatic Assessment sites for Canelands East.....	2
Table 2.1	The suite of assessments undertaken at the sampling sites on the Mdloti River ..	3
Table 2.2	SASS5 and ASPT scores used to define class boundaries for the North Eastern Coastal Belt (lower) Ecoregion level 1 (derived from Dallas, 2007), Diatom SPI/BDI scores and water quality classes (derived from Taylor <i>et al.</i> , 2006) and IHI scores (derived from Kleynhans <i>et al.</i> , 2009).....	4
Table 2.3	River health classes and their attendant ecological and management perspectives (derived from Kleynhans and Louw, 2007).....	5
Table 3.1	Summary of the water physico-chemistry results recorded up and downstream of Canelands East, December 2015	6

1. INTRODUCTION

Tongaat Hulett's Developments approached GroundTruth - Water, Wetlands and Environmental Engineering (hereafter GroundTruth) to undertake an aquatic assessment at Canelands East as part of the amendment to the Canelands: Portion 2026 of Cottonlands No. 1575 freshwater ecosystem studies. This assessment aims to address the requirement for an aquatic assessment and water quality analyses of the river system associated with the development site, based on habitat assessments and biological monitoring conducted in the field.

The Canelands East study site is located near Verulam, in KwaZulu-Natal (Figure 1.1). The site is in the quaternary catchment U30B and the North Eastern Coastal Belt Aquatic Ecoregion (Lower zone) (Kleynhans *et al.*, 2005). The Mdloti River is located to the north-west of the site.

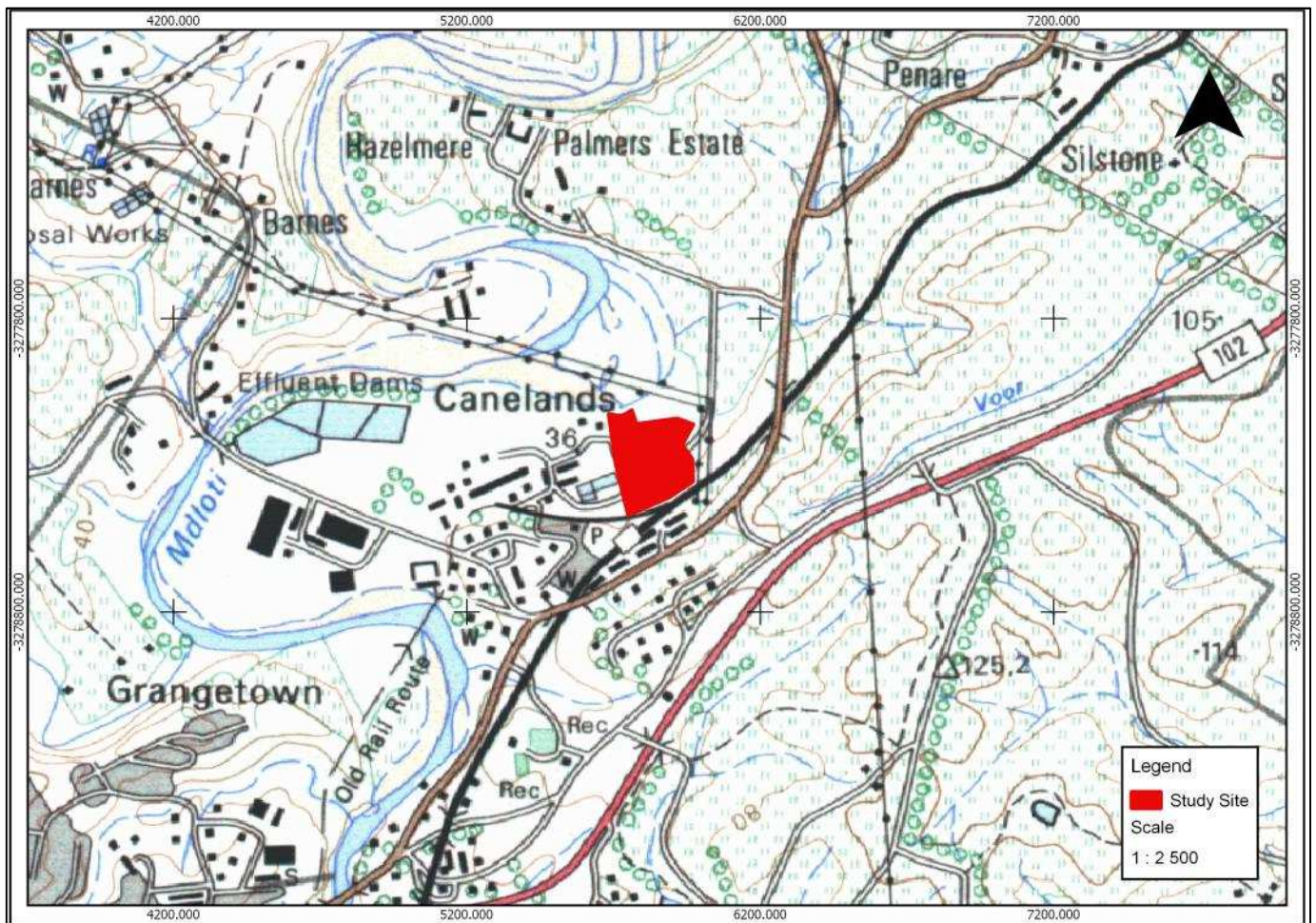


Figure 1.1 Overview of the Canelands East study area.

The aquatic assessments were conducted on the Mdloti River up and downstream of the site. Table 1.1 provides details of the co-ordinates for the monitoring sites.

Table 1.1 Aquatic Assessment sites for Canelands East

Description	Latitude	Longitude
Mdloti River upstream of Canelands East.	-29.616820	31.058068
Mdloti River downstream of Canelands East and upstream of sand mining concession.	-29.619816	31.056366

This report summarizes the findings from the baseline biological water quality assessment of the Mdloti River up and downstream of Canelands East.

2. METHODS

The methods that were applied drew on the latest available tools within South Africa for the assessment of the Present Ecological State (PES) of aquatic and riparian biota. The selection of the appropriate sampling tools (Table 2.1) was informed by the available habitat on site, the flow conditions at the time of sampling, and any other biophysical limitations.

2.1 Physico-Chemical Monitoring

To inform the interpretation of the biological assessments the sampling was supplemented by the *in-situ* collection of a suite of physico-chemical determinants related to water quality (Table 2.1).

Table 2.1 The suite of assessments undertaken at the sampling sites on the Mdloti River

<i>Assessment</i>	Upstream	Downstream
<i>Aquatic invertebrates (SASS5)</i>		✓
<i>Benthic diatoms</i>	✓	✓
<i>Instream and riparian habitat (IHI)</i>	✓	✓
<i>Physico-chemical water quality</i>	✓	✓

2.2 Biological Monitoring

Different biological indices (Table 2.1) informed the determination of the Present Ecological State (PES) of the water courses at the various sites. Quantification of the status of the aquatic invertebrate biota at monitoring sites was performed using the SASS5 method (Dickens & Graham, 2002), accredited to ISO 17025, with ancillary measures of habitat availability for aquatic biota generated by the Integrated Habitat Assessment System (IHAS) version 2 of McMillan (1998). The sites were also tested for biological integrity and health using the diatom based indices (e.g. SPI - Specific Pollution sensitivity Index (SPI)) (Taylor, 2006). A Department of Water and Sanitation accredited SASS5 practitioner (Appendix A) undertook the sampling and analysis.

Depending on the presence of different aquatic taxa which have different pollution tolerance ratings, each biological indicator assessment provides an indication of the state of health of the river. Generally, the higher the index (e.g. SASS score, ASPT, or SPI) the better the

health, or condition, of a river (Table 2.2). Reference sites for respective Ecoregions as well as those data available from the University of the North West and the South African Diatom Collection, were used to establish the benchmark against which to measure the current “state” or “river health” of monitored sites. The SASS5 sites fell within the North Eastern Coastal Belt lower (17.01) aquatic ecoregion (Kleynhans *et al.*, 2005) and were interpreted according to the SASS interpretation guidelines (Dallas, 2007).

Table 2.2 SASS5 and ASPT scores used to define class boundaries for the North Eastern Coastal Belt (lower) Ecoregion level 1 (derived from Dallas, 2007), Diatom SPI/BDI scores and water quality classes (derived from Taylor *et al.*, 2006) and IHI scores (derived from Kleynhans *et al.*, 2009)

River Health Class		Indices			
		SASS5	ASPT	SPI	IHI
Natural	>	142	7.2	17	90
Good	>	109	6.5	13	80
Fair	>	86	5.8	9	60
Poor	>	56	5.0	5	40
Seriously Modified	<	56	5.0	5	40

Due to their lower dependence on diverse aquatic habitats, benthic diatoms (algae) (De La Rey, 2004) can provide additional information with respect to the specific impacts associated with modified water quality. In addition to the SASS5 indices, benthic diatom samples were collected and analysed to provide an indication of the impact of the present state of water quality on aquatic biota. Data from the diatom samples are interpreted according to the Specific Pollution sensitivity Index (SPI) to assess the “health status” of the river at each of the sites (Table 2.3). The Percentage Pollution Tolerant Values (% PTV) were also determined. % PTV is the proportion of diatoms within a sample that tolerate pollution therefore giving a further indication of water quality within a river system.

Table 2.3 River health classes and their attendant ecological and management perspectives (derived from Kleynhans and Louw, 2007)

River health classes	Ecological perspective	Management perspective
Natural	No or negligible modification of in-stream and riparian habitats and biota.	Protected rivers; relatively untouched by human hands; no discharges or impoundments allowed.
Good	Ecosystems essentially in a good state; biodiversity largely intact.	Some human-related disturbance, but mostly of low impact potential.
Fair	A few sensitive species may be lost; lower abundances of biological populations may occur.	Zones of competing uses; developmental pressures are dominant feature.
Poor	Habitat diversity and availability have declined; mostly only tolerant species present; species present are often diseased; population dynamics have been disrupted (e.g. biota can no longer breed or alien species have invaded the ecosystem).	Often characterised by high human densities or extensive resource exploitation. Management intervention is needed to improve river health – e.g. to restore flow patterns, river habitats or water quality.
Seriously Modified	Loss of habitat availability and high levels of pollution result in few families being present due to the loss on most intolerant forms.	Often characterised by high human densities, pollution or extensive resource exploitation and modification. Management intervention is needed for improvement to occur.

3. RESULTS

A summary of the various health conditions for each site is provided graphically in Figure 3.1. The physico-chemical results are summarized below in Table 3.1, while site specific assessments and biomonitoring results are presented in section 3.2.

3.1 Physico-Chemical Results

The physico-chemical water quality was compared to the Department of Water and Sanitation (DWS) water quality guidelines for aquatic ecosystems – target water quality ranges (TWQR) (DWAF, 1996).

Table 3.1 Summary of the water physico-chemistry results recorded up and downstream of Canelands East, December 2015

Determinant	Units	Upstream	Downstream
Conductivity	mS/m	42.1	40.8
Dissolved Oxygen	mg O ₂ /L (% saturation)	6.51 (81%)	3.90 (46%)
pH	pH units	7.06	6.98
Temperature	°C	26.3	23.8
Clarity	cm	72	88

The comparisons of the downstream results with the upstream results indicate very little variation due to changes associated with the Canelands East site. Furthermore the determinands analyzed were within acceptable levels according to the DWS TWQR, with the exception of dissolved oxygen at the downstream site. Dissolved oxygen however, naturally fluctuates throughout the day and longer term monitoring would therefore be required to determine a baseline level for dissolved oxygen at the site.

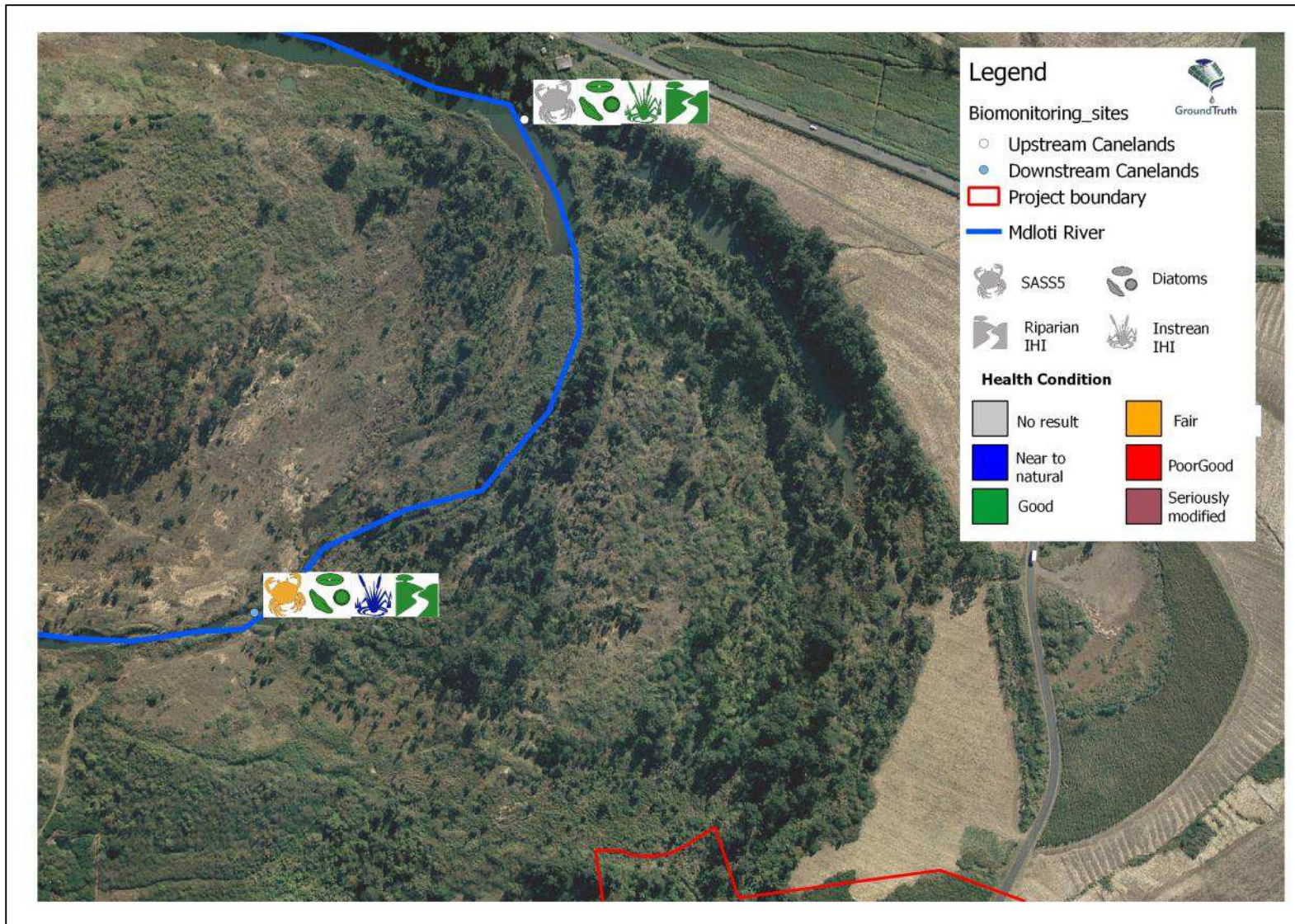



Figure 3.1 Summary of the biological health of the Canelands East sampling sites.

3.2 Biological Results

Biological results are tabulated per site below and colour coded to represent the ecological category of each assessment.

3.2.1 Site summary of the Mdloti upstream of Canelands East

View of the sample site			View downstream of the sample site		
					
Date	Index of Habitat Integrity		Diatoms		Status
	Instream	Riparian	SPI	%PTV	
9/12/2015	89	88	13.6	61	Good



Present Health Status

The Mdloti upstream of Canelands East was assessed below the impacts from the Hazelmere water treatment plant. Due to habitat limitations SASS5 macroinvertebrate assessments were not included at this site. The biological health was determined using diatoms.

The diatom results indicate that the biological water quality was in a good condition at the time of the assessment. The percentage Pollution Tolerant Values (%PTV) indicated that there is organic pollution impacting the system.

The IHI assessments showed the integrity of both the instream and riparian habitats to be good. The main impacts at the site were related to construction/sand mining activities immediately upstream of the site and alien vegetation.

3.2.2 Site summary of the Mdloti downstream of Canelands East

View upstream of sample site			View downstream of sample site				
							
Date	Index of Habitat Integrity		Macro-invertebrates		Diatoms		Status
	Instream	Riparian	SASS Score	ASPT	SPI	%PTV	
9/12/2015	93	89	106	5	16.2	52	Good

Present Health Status

The site was located downstream of Canelands East but upstream of the sand mining concession. The SASS5 assessment indicated the biological water quality was in a fair condition; however, habitat was limited at the site which in turn negatively impacted the SASS score. Diatoms which are not habitat dependent possibly provide a better indication of the condition of the site. The diatoms showed the site to be in a good condition with the score improving compared to the upstream site: this would suggest a lack of additional impacts emanating from the Canelands East property.

The instream habitat integrity was near to natural with only minor impacts at the site. The riparian habitat was in a good condition, with alien plants being the main impact.

4. CONCLUSIONS

The assessments undertaken to determine the baseline conditions of the Mdloti River, revealed that there were various impacts affecting the systems. Most of these impacts were only minor and had not affected the integrity of the site to a large degree.

The site upstream of Canelands East was in a good condition in terms of both the biological water quality and habitat integrity. The construction and other activities upstream near the water treatment works do, however, pose a threat to the overall condition of the site.

The site downstream of Canelands East was also in a good condition and showed signs that water quality and habitat integrity had improved compared to the upstream site.

The baseline assessment identified that the affects from Canelands East were leading to an improved water quality of the Mdloti River. It is recommended that future activities on site should not allow the water quality of the downstream site to decline below that of the upstream site.

5. REFERENCES

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6. APPENDICES

6.1 Appendix A – SASS5 Accreditation certificate

