# **FRESH WATER REPORT**

# FOR THE

# **EXTENSION OF THE LA MOTTE TOWNSHIP**

# FRANSCHHOEK RIVER

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### 1. Terms of Reference / Introduction

The La Motte Township in the Franschhoek Valley is to be expanded. CK Rumboll and Partners were appointed as consultants to oversee the planning process. It is foreseen that the envisaged development will have an impact on the nearby Franschhoek River and one of the legal requirements in terms of Section 21 of the National Water Act (NWA, Act 36 of 1998) is to submit a Fresh Water Report. Such a report is meant to render insight into the current ecological health of the river, to predict any deleterious impacts and to recommend remedies if required. CK Rumboll, in turn appointed VanDriel CSA to carry out the required the scientific monitoring in the river and subsequently produce the required Fresh Water Report.

The Franschhoek River (Figure 1) is a tributary in the upper watershed of the Berg River and is approximately 13 kilometres long (as determined with Google Earth) from where it arises on the peaks of the mountains to its confluence with the Berg River downstream of the Berg River Dam.



Figure 1. The Franschhoek Valley with the Franschhoek River marked in yellow. (Google Earth).

The urban area of Franschhoek is marked on the image (Figure 1), as well as the La Motte Township.

The Franschhoek River is classified as part of South African Ecoregion 12, of the Cape Fold Mountains, according to Kleynhans & Hill,1999.

The valley is surrounded by mountains of which the peaks are 1300 meters ASL high and the valley floor stretches from about 400 metres below the head waters to 180 metres at the confluence.

From the image it is evident that the valley is heavily developed with urban areas and agriculture. The La Motte plantation is clearly visible to the south and east of the township.



Figure 2. La Motte Township (CK Rumboll and Partners).

The new proposed housing areas are indicated in Figure 2 and can clearly be distinguished from the existing township.

The Berg River and specifically the Franschhoek River has been the subject of study and investigation in the past. The then Department of Water Affairs and Forestry in 2002 released a State-of-the-River report. In this report 5 indices addressed various aspects of aquatic health of which 3 were categorised as poor and 2 as fair. The desired state of the river was categorised as fair. From this it was evident that the river was significantly impacted.

The upper watershed of the Berg River, including the Franschhoek River again is the subject of investigation, this time by the Department of Environmental Affairs and Development Planning (DEADP) of the Western Cape Provincial Government. This is to include remedial action. Among others the treated sewage effluent from the Franschhoek Wastewater Treatment Works and urban runoff will be prevented from entering the river. The water quality and aquatic health would predictably benefit from these envisaged actions.

#### 2. Climate

Average rainfall (mm)



Average night-time temperature (°C)



Figure 3. Climatic data for Franschhoek

Average midday temperature (°C)



http://www.saexplorer.co.za/south-africa/climate/franschhoek\_climate.asp

Franschhoek normally receives about 863mm of rain per year and because it receives most of its rainfall during winter it has a Mediterranean climate. The chart below (lower left) shows the average rainfall values for Franschhoek per month. It receives the lowest rainfall (15mm) in February and the highest (154mm) in June. The monthly distribution of average daily maximum temperatures shows that the average midday temperatures for Franschhoek range from 14.6°C in July to 25.3°C in February. The region is the coldest during July when the mercury drops to 5.2°C on average during the night.

On the high mountain ridges it rains more than 1000 mm per year.

## 3. Flow

The climate regime results in the river flowing strongly during the rainy season and flow is much reduced during late summer.

The flow data for station G1H003 in the National Data Base reveals that in February 2013 the flow over the measuring weir at La Motte was only 0.103 million cubic metres per month. During August 2013 the flow measured 11.7 million cubic metres. This illustrates the seasonal variability of the flow down the Franschhoek River.

The watershed's surface area above the measuring weir is 47 km<sup>2</sup>.

## 4. Sampling Points

If the river classification (Wadeson, 1999) is to be taken into consideration, the Franschhoek River has upper reaches in the mountains and lower reaches in the valley floor.

The upper reaches are typical headwater mountain streams with steep slopes, fast flowing waters, with rapids and waterfalls. The upper tributaries are numerous, rivulets, with practically each crevice in the mountainside with its own stream. Most of these steams are seasonal and completely dry up in summer, while some are perennial with a reduced but always with some flow in summer. The substrate is mostly bedrock, with large cobbles and stones. The pools here contain little course sand and gravel. Vegetation is mostly clumps of moss. These streams often flow through stands of Afromontane forests with closed canopies.

The rivulets combine in the valley floor and this confluence is rather abrupt, meaning that the very steep mountain sides evens out within a short distance to a gentle

slope. The change from a headwater mountain stream to a foothill cobble occurs within a rather short distance. This slope is nevertheless steep enough to produce fast flowing water over large boulders and bedrock, with numerous rapids. Flow is slower along the banks, with some vegetation. Some large pools occur along the river, with sandy bottoms and with more riparian vegetation overhanging the water.



Figure 4. The slope changes abruptly.

The sampling points were chosen to cover the entire length of the Franschhoek River, but also because they were easily accessible with a vehicle. Four sampling points seemed to be adequate to gain a proper idea of the state of the river.

Upper Fish Farm



Figure 5. Upper Fish Farm Sampling Station

This is the uppermost sampling point high up in the watershed where anthropogenic impact is at its least. The only obvious impact is the water offtake for the fish farm. The sample was taken in a fast flowing mountain stream against a steep incline. Adjacent and above the sampling point is a waterfall of approximately 4 meters high.

Most of it is hard bedrock with some large boulders and stones. The pool there is about 2 meters wide and some 30 cm deep.

Lower Fish Farm



Figure 6. Lower Fish farm Sampling Point.

This sampling point is at the bridge downstream from the Three Streams Fish Farm. Upstream of the bridge the river is about 2 meters wide, fast flowing and with large boulders. Downstream of the bridge is a large pool, perhaps 20 meters wide and 50 cm deep, with a deeper part along the one bank. The bottom here is sandy and some vegetation hangs over the surface, mainly kikiyu grass. Just upstream of the bridge two more streams joined the river. At the time these were fast flowing, but will probably be dry during late summer.

La Motte



Figure 7. La Motte Sampling Point

This sampling point is situated upstream of the road bridge at the La Motte Township. The river here is some 20 meters wide, fast flowing, with lots of boulders and rapids, rather shallow and with a wide portion with a sandy bottom. Along the banks the water is ankle deep with exotic vegetation growing over the surface. There was lots of litter and the area seemed to be smelly. Just downstream of the bridge a fast flowing tributary joined the river. Under the bridge a measuring gauge has been constructed that sports telemetric equipment mounted on a stand next to the bridge.

Berg River Dam Road



Figure 8. Berg River Road sampling Point.

This sampling point is situated 50 meters upstream of the road bridge close to the confluence of the Franschhhoek and Berg Rivers. Since the flow was so fast that sampling in the river proved to be dangerous, sampling was carried out in the shallower regions along the bank. The bottom is mainly sandy, strewn with boulders and stones. Along the banks and in the shallows clumps of Scirpus occurred, which proved to be a good sampling location. The banks were disgraced by litter and the area was smelly.

## 5. Biomonitoring

The biomonitoring was carried our according to the methodology described by Dickens & Graham, 2002. The results are given in Table 2. The original SASS5 score sheets are available in the Appendix.

According to the Berg River State of River Report of 2004 categories are defined as natural, good, fair and poor.

The sampling point above the Three Streams Fish Farm was sampled only once. It can perhaps serve as some point of reference that indicates what the river could be like prior to any human impact. It is situated against the steep mountainside in the upper reach, the river is perennial and apart from the water offtake for the fish farm, human impact seems to be limited. Higher up the mountain slopes afforestation ceased and after the pine trees have been removed they have not been replanted. This might still have some impact on the stream, but according to the biomonitoring results the stream is from an in-stream health point of view still natural or then almost natural.

Table 1 Biomonitoring results and categorisation

Sampling Point	Coordinates
Upper Fish Farm Lower Fish Farm La Motte Berg River Dam Road	33° 55' 12" S; 19° 7' 13" E 33° 55' 12" S; 19° 7' 17" E 33° 53' 31" S; 19° 4' 49" E 33° 52' 29" S; 19° 1' 56" E

Sampling Point		2 Sep 2014	12 Oct 2014	3 Dec 2015	2 Feb 2015	Category
Upper Fish Farm	SAS5 No. of Taxa ASPT	121 14 8.6				Natural/ Good
Lower Fish Farm	SAS5 No. of Taxa ASPT	59 11 5.4	101 17 5.9	56 11 5.1	76 13 5.8	Good/ Fair
La Motte Road	SAS5 No. of Taxa ASPT	51 10 5.1	78 16 4.9	52 11 4.7	85 17 5.0	Good/ Fair
Berg River Dam Road	SAS5 No. of Taxa ASPT	52 12 4.3	48 12 4.0	50 12 4.2	84 17 4.9	Fair/ Poor

As soon as the mountains even out in valley floors, where the slope allows for development, the impact on the river is immediate. Monitoring results vary from good right through the spectrum to poor, with an average of fair. If one only considers the average score per taxon (ASPT, Table 2) it seems as if the water quality somewhat deteriorates closer to the confluence with the Berg River.

The State of the River Report (2004) biomonitoring resulted in the Franschhoek River being categorised as poor. This is worse as the above categorisation (Table 1), probably because of the different scoring system that prevailed at the time. There is no reason to believe that the river actually improved since 2004. The flow during the first round of sampling in September 2014 was rapid, with lots of water coming down the river during the last part of the rainy season.

In February 2015 during the final round of sampling was the flow was much reduced. It was expected that during late summer when the flow is much reduced would result in deteriorating water quality much lower scores. This, however, did not materialise. Much against the expectation the river somewhat improved, possibly because the new sewage treatment works at Wemmershoek took over some of the load from the Franschhoek works, keeping partly treated sewage out of the river.

It is important to note that specimens of *Galaxias zebratus*, a small indigenous fish, were regularly found. Tadpole were regularly caught in the sampling net as well.

Another noticeable characteristic of the Franschhoek River was, at the time of sampling, that is does not display the tea-like colour of most of the rivers in the region. This colour is allegedly caused by staining from natural vegetation, as is the case with these black water rivers. The water of the Franschhoek River was clear and not stained at all.

## 6. Habitat Integrity

The habitat integrity was assessed according to the methodology of Kleynhans (1999) and Kemper (1999).

It was decided to separate the Upper Fish Farm sampling point from the rest of the river for the purposes of habitat integrity evaluation. The upper sampling point is impacted by the water offtake point. This is essentially a pipe that is stabilised in the stream with concrete. The mountain slopes were previously planted with pine trees. These plantations have since been removed and not replanted. There are still uncollected tree trunks lying about on the slopes. The Mountain Fynbos has established itself to a large extent. These are the only obvious impacts on the sampling point and the reason why it was not given a clean slate with an A category. Because of these impacts it was given a B, which is almost pristine and ecologically fully functional.

The riparian zone is hardly impacted, with a closed near pristine canopy of Afromontane forest of indigenous trees. A couple of exotic wattle trees occur in the area, as well as pioneer trees. It was categorised as B.

Further downstream the picture changes abruptly, with severe impacts. Hence it was evaluated separately. It hardly bore any resemblance with the upper sampling

		• •		Maximum	
Instream	score	weight	Product	Score	Remark
Water Abstraction	5	14	70	350	
Flow modification	5	13	65	325	
Bed modification	5	13	65	325	
Channel modification	5	13	65	325	
Water quality	5	14	70	350	
Inundation	5	10	50	250	
Exotic macrophytes	0	9	0	225	
Exotic fauna	0	8	0	200	
Solid waste disposal	0	6	0	150	
max score		100	315	2500	
% of total			12.6		
Inverse			87.4		
Class			В		Almost pristine
					Water offtake point
					· · · · · · · · · · · · · · · · · · ·
Riperian Zone					
Water abstraction	5	13	65	325	
Inundation	5	11	55	275	
Flow modification	5	12	60	300	
Water quality	5	13	65	325	
Indigenous vegetation removal	5	13	65	325	
Exotic vegetation	Ũ	10	00	020	
encroachment	5	12	60	300	
Bank erosion	0	14	0	350	
Channel modification	5	12	60	300	
		100	430	2500	
% of total			17.2		
Inverse			82.8		
Class			В		Near pristine

# Table 2 Upper Fish Farm Habitat Integrity

				Maximum	
Instream	score	weight	Product	Score	Remark
Water Abstraction	5	14	70	350	
Flow modification	5	13	65	325	
Bed modification	21	13	273	325	
Channel modification	21	13	273	325	
Water quality	16	14	224	350	
Inundation	7	10	70	250	
Exotic macrophytes	5	9	45	225	
Exotic fauna	20	8	160	200	
Solid waste disposal	7	6	42	150	
max score		100	1222	2500	
% of total			48.9		
Inverse			51.1		
			_		Largely
Class			D		modified
Riperian Zone					
Water abstraction	5	13	65	325	
Inundation	24	11	264	275	
Flow modification	24	12	288	300	
Water quality	16	13	208	325	
Indigenous vegetation removal	24	13	312	325	
Exotic vegetation					
encroachment	24	12	288	300	
Bank erosion	10	14	140	350	
Channel modification	24	12	288	300	
		100	1783	2500	
% of total			74.1		
Inverse			25.9		
Class			F		Extensively
01033			E		mouned

point. For the purpose of the evaluation the 3 sampling points were lumped together.

The channel, from downstream of the fish farm right to the confluence with the Berg River, has been heavily engineered, as has most if not all rivers in the upper watershed. The banks have been smoothed over with heavy earth moving machinery to reduce the risk of flooding and to allow for agriculture and development right next to the river. The channel has gradually been widened and straightened since the start of western civilisation in the valley to ensure a controlled and manageable flow. In fact, the La Motte Road sampling point was destroyed prior to the December 2014 round of sampling. The bank was entirely reworked probably with a large back acting machine and left unstable and prone to erosion during the next flood event. The sampling point had to be moved up further up the river.

There are numerous water offtakes along the river for irrigating the vineyards and orchard. Storm water from Franschhoek and various other settlements enter the river, including the heavily polluted runoff from informal settlements. The treated effluent from the Franschhoek sewage treatment works impacts on the Franschhoek River flow and its water quality. The smell of treated effluent is evident in the lower part of the river.

The flow modification was not obvious during the current sampling round at the end of the rainy season. The strong flow concealed the ills of the river that so prominently comes to the fore during late summer when the flow is reduced to a trickle. This evaluation resulted in a score as the river was found to be during the sampling round that hardly relates the general condition throughout the year. Hence the score should be regarded with caution.

The banks are overgrown with kikiyu grass and are for much of its length the only vegetation that offer any sort of refuge for aquatic invertebrates where it hangs over into the water. In the upper parts exotic trees such as grey poplar and oak enclose the river. There are still some stretches of rush *Juncus effusus* and palmiet *Prionium serratum* left.

The river is known to contain trout. Despite predation indigenous Cape Galaxias is still present.

One can well imagine that during historical times, prior to gross human impact, that the river overflowed its banks to create temporary wetlands with lush riverine fynbos and other vegetation typical of the area. This is no longer happening and no wetlands were observed, not even close to the confluence where such condition can be expected. The only wetlands there seemed like flooded un-rehabilitated borrow pits that have probably been dug for road building. These were not connected to the river in any way.

The category of D (largely modified) was awarded for the in-stream habitat integrity, which is a high score for such an impacted river. A category of E and even F (critically impacted) would be more realistic and would probably be awarded if more sampling rounds were to be conducted later on during the season.

Likewise, the riparian zone was awarded an E (extensively modified) category with a small margin, which actually should have been an F (critically modified), should the water quality deteriorate later on in the season and more erosion becomes evident.

# 7. Ecological Importance and Sensitivity

A river is regarded as ecologically important if it has unique species as well as unique habitats (Table 5, Kleynhans, 1999).

There are many tributaries in the Cape Fold Mountains that resemble the Franschhoek River and in this aspect it is certainly not unique. However, most of these are largely modified by development and agriculture and little natural habitat is left for scarce and endangered species. The Berg River red fin minnow *Pseudobarbus burgi* comes to mind, which is endangered by habitat destruction and introduced predatory fish such as trout and bass (Skelton, 1993). Add to this an entire community of fynbos plants, some species of which are critically endangered.

The Franschhoek River could possibly be categorised as 3 (more than one scarce or endangered taxon) and even 4 (Red Data).

## 8. Wetlands

The river has been engineered to such an extent that it has lost but all connectivity to the riparian zone. No wetlands along the river have been noted during the biomonotoring event. Near the confluence some ponds have been noted, but these seem to be borrowing pits for road building and can hardly be regarded as wetlands, or at least not natural wetlands with any link to the river.

McDonald (2014) investigated the site of the proposed expansion at La Motte and apart from sand mining pits could not find any area that could be classified as a wetland.

Hence the need for wetland preservation does not apply to the proposed expansion of the La Motte Township.

The Wemmershoek Wetland is well known among conservationists and the concern about any impacts because of development is noted. However, this wetland is to the north of the R45 trunk road and well away from the proposed La Motte development. It is most unlikely that the envisaged township can have any effect on the Wemmershoek Wetland.

# 9. Sewage

Work on the Wemmershoek Wastewater Treatment Works (WWTW) started during the first quarter of 2011 at a cost of R70 million and it was projected to take at least 20 months to complete. At this time the derelict and largely dysfunctional wastewater treatment works at Franschhoek was to be decommissioned and the sewage from Franschhoek, La Motte and Langrug was to be conveyed to the Wemmershoek WWTW with a new pipeline. This pipe was to be 500 mm in diameter and 6.5 km long (http://www.engineeringnews.co.za/article/wemmershoek-wastewater-works).

This upgrade would certainly do much to improve the water quality in the Franschhoek River, especially during late summer when the most of the flow of the river actually consists of partly treated sewage effluent.

The Department of Environmental Affairs (Central Government) regarded this upgrade with the utmost urgency as an official approval was issued in terms of the Environmental Management Waste Act (59 of 2008) on 12 September 2011 to the Stellenbosch Municipality to dismantle the Franschhoek WWTW as it was operating at 300% beyond its design capacity.

Judging from the strong smell of sewage at the river near La Motte during the current round of biomonitoring the new pipeline has not been connected yet.

From the DWA data base the flow in February 2013 translates to 3.7 megalitres per day. The upgrade to the Wemmershoek WWTW makes provision for 5 megalitres of raw sewage per day from the Franschhoek Valley. It seems logic to deduct that currently the volume of partly treated sewage outstrips the flow of the river, with the resulting deleterious impact on water quality and subsequent river health.

During August 2013 the mean daily flow translates to 390 megalitres a day, which was a massive volume of water if compared to the volume of sewage. If extrapolated to real time, this explains the improvement in river health, as detected with the current round of biomonitoring.

It is stands to reason that any new development of which the sewage is added to the current sewerage in Franschhoek would be seriously detrimental to the Franschhoek River. Hence is recommended that people do not move into the new housing additions to La Motte, as planned, until such time when the pipeline is connected and the new WWTW is fully operational.

## 10. Storm Water

The proposed expansion of the La Motte Township and its resulting increase in storm water is not likely to have any effect on the ecological status of the Franschhoek River. The current status of notably to critically impacted is not likely to deteriorate more because of the increase in storm water.

It would be beneficial to first contain urban runoff and storm water in a suitably designed and constructed dam prior to let it out into a stream. This would even out the river's hydrograph during storm events and in particular to hold back litter. This litter can subsequently be collected and properly disposed of. Such a system of storm water retaining could be expanded to accommodate storm water from the exiting township as well. Urban storm water management systems in South Africa are extensively described and discussed by Armitage *et al*, 2013. This is a Water Research Commission publication and is available on-line as a PDF file.

In a presentation at Yzerfontein on 4 September 2014, Mr Jason Mingo of DEADP announced that runoff from Langrug, an informal settlement, is to be retained in a system of dams prior to release into the Franschhoek River. The runoff currently is tantamount to untreated sewage and has a deleterious impact on the river. This effort is most plausible, deserves support and should be expanded to include all urban areas along the Franschhoek River.

# 11. Riperian Zone

The riparian zone has been seriously impacted to such a level that it is beyond imagination that it would ever recover to resemble anything natural. Moreover, it lost its ability to filter and restore agricultural runoff. The role and the effectiveness of a riparian zone towards the improvement of water quality in the Franschhoek River is a separate study that could possibly be formally funded and undertaken.

## 12. Water Quality

Constituent		Value
рН		6.52
Ammonia	mg/l	0.23
Nitrite + Nitrate	mg/l	0.24
Total N	mg/l	14.0
Total P	mg/l	0.03
TDS	mg/l	186
E. coli	colonies/100 ml	1.1 x 10 <sup>5</sup>

Only one water quality sample was taken because of costs restraint. The pH lever confirmed that the water at the La Motte Road sampling point differs from the typical "black water" that often is encountered in the upper watersheds in the Western Cape. The water in this area often has a much lower pH value. It would be interesting to find out why this difference has been found.

The rather low ammonia concentration indicates that the river at this point is probably not affected by a large input of partially treated sewage, as was previously the case before the new Wemmershoek Waste Water Treatment Plant was put into operation. Rivers downstream of waste water treatment plants often have much higher ammonia concentrations.

Likewise, the nitrite plus nitrate concentration seem rather low, but the total nitrogen concentration is high. This is perhaps an indication that much fertiliser is being washed away together with agricultural run-off.

Phosphorus is known to bind to the soil and does not wash away all that easily, hence the rather low concentration. It is known that farmers lose a lot of nitrogen, but tend to keep most of their phosphorus. This level in the water is however adequate for a prolific growth of algae, as has indeed been encountered at this sampling station.

Nevertheless, this altogether is a somewhat heartening situation in that the river is being impacted by agriculture, but not so much by sewage. It is not expected that the new la Motte Township would have any negative affect on the water quality in the river, as long as its waste water is not ending up in the river in any way.

A very *E. coli* count can be expected in downstream of an urbanised area and because of the many farm animals in the area. This high count is not necessarily the result of a failed waste water treatment works. Raw sewage tends to add a couple of zeros more to the count. The count is still high and the water is not fit for leisure activities such as canoeing or fishing where participants are in contact with the water. For this a maximum of 1000 counts are advised, according to the DWS Water Quality Guidelines.

#### 13. Conclusions

The scope of this report as well as the time restraint only makes provision for a single round of biomonitoring. Because of the variability of the flow this once-off round of biomonitoring does not leave the correct impression of the current river health and hence the result has to be considered with caution. Past monitoring results allow for a more realistic picture and the new DEADP program that is now being planned will add to a better understanding of Franschhoek River's health.

At this stage of the area's agricultural and urban development it seems unlikely that the riparian zone and the river's connectivity to adjacent wetlands will ever be restored as this would involve large-scale engineering. The envisaged development at La Motte does not have any bearing on wetlands or riparian zones.

New urban developments in the Western Cape are routinely fitted with storm water drainage systems that include retention dams. These dampen peak flows and retain litter. It is recommended that La Motte is provided with similar facilities.

It is strongly recommended that the planned development is not to commence unless surety can be given that the sewage generated will not be released into the Franschhoek River but will be channelled into the new Wemmershoek WWTW

#### 14. Literature

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#### 15. Appendix

In-stream Criteria	Weight	Riparian Zone Criteria	Weight
Water abstraction	14	Water abstraction	13
Flow modification	13	Inundation	11
Bed modification	13	Flow modification	12
Channel modification	13	Water quality	13
Water quality	14	Removal of indigenous vegetation	13
Inundation	10	Encroachment of exotic vegetation	12
Exotic macrophytes	9	Bank erosion	14
Exotic fauna	8	Channel modification	12
Solid waste	6		

Table 4. Habitat Criteria according to Kleynhans , 1999.

Table 3 (Continued). Habitat Integrity according to Kleynhans , 1999.

Category	Description	% of maximum score
A	Unmodified, natural	90 – 100
В	Largely natural with few modifications. A small change in natural habitats and biota, but the ecosystem function is unchanged	80 – 89
С	Moderately modified. A loss and change of the natural habitat and biota, but the ecosystem function is predominantly unchanged	60 – 79
D	Largely modified. A significant loss of natural habitat, biota and ecosystem function.	40 – 59
E	Extensive modified with loss of habitat, biota and ecosystem function	20 – 39
F	Critically modified with almost complete loss of habitat, biota and ecosystem function. In worse cases ecosystem function has been destroyed and changes are irreversible	0 - 19

Table 5. Ecological Importance and Sensitivity Categories (EISC) according to endangered organisms (Kleynhans, 1999.

Category	Description
1	One species or taxon is considered to be endangered on a local scale
2	More than one species or taxon is considered to be rare or endangered on a local scale
3	More than one species or taxon are considered to be rare or endangered on a provincial or regional scale
4	One or more species or taxa are considered to be rare or endangered on a national scale (Red Data)

Table 4 (continued). Ecological Importance and Sensitivity Categories (EISC) (Kleynhans, DWAF 1999)

EISC	Description	Score
Very High	Quaternaries/ delineations are considered to be unique on a national and international level based on an unique biodiversity (habitat and species diversity, unique species and rare or endangered species. These rivers are in terms of biota and habitat very sensitive to flow modifications and have no or little capacity for use.	>3 – 4
High	Quaternaries/ delineations are considered to be unique on a national level based on a unique biodiversity (habitat and species diversity, unique species and rare or endangered species. These rivers are in terms of biota and habitat sensitive to flow modifications and have in some cases substantial capacity for use.	>2 - <u>&lt;</u> 3
Moderate	Quaternaries/ delineations are considered to be unique on a provincial level based on a unique biodiversity (habitat and species diversity, unique species and rare or endangered species. These rivers are in terms of biota and habitat usually not very sensitive to flow modifications and often have a substantial capacity for use.	>1 - <u>&lt;</u> 2
Low / Marginal	Quaternaries/ delineations are not considered to be unique on any scale. These rivers in terms of biota and habitat are generally not very sensitive to flow modifications and usually have a substantial capacity for use.	<u>&lt;</u> 1

# 16. Biomonitoring Score Sheets

37333 30016	JIECL									-
Date	02-Sep-14	Taxon	Weight	Score	Taxon	Weight	Score	Taxon	Weight	Score
Locality	Franschhoek River	Porifera	5		Hemiptera			Diptera		
	Three Streams	Coelenterata	1		Belostomatidae	3		Athericidae	10	
	Fish Farm	Turbellaria	3	3	Corixidae	3		Blepharoceridae	15	
	Waterfall	Oligochaeta	1	1	Gerridae	5		Ceratopogonidae	5	
Coordinates	33° 55' 12" S	Huridinea	3		Hydrometridae	6		Chironomidae	2	
	19° 7' 13" E	Crustacea			Naucoridae	7		Culicidae	1	
		Amphipoda	13	13	Nepiday	3		Dixidae	10	
DO mg/l	9.3	Potamonautidaa	3		Notonectidae	3		Empididae	6	
ſemperature °C	15	Atyidae	8		Pleidae	4		Ephydridae	3	
рН		Palaemonidae	10		Veliidae	5	5	Muscidae	1	
EC mS/m		Hydracarina	8		Megaloptera			Psychodidae	1	
		Plecoptera			Corydalidae	10		Simuliidae	5	5
SASS5 Score	121	Notonemouridae	14	14	Sialidae	8		Syrphidae	1	
Number of Taxa	14	Perlidae	12		Trichoptera			Tabanidae	5	
ASPT	8.6	Ephemeroptera			Dipseudopsidae	10		Tipulidae	5	
		Baetiday 1 sp	4		Ecnomidae	8		Gastropoda		
Other Biota	Tadpole	Baetiday 2 sp	6		Hydropsychidae 1 sp	4		Ancylidae	6	
		Baetiday >3 sp	12	12	Hydropsychidae 2 sp	6		Bulinidae	3	
		Caeniday	6		Hydropsychidae <2 sp	12		Hydrobiidae	3	
		Ephemeridae	15		Phylopotamidae	10	10	Lymnaeidae	3	
		Heptageniidae	13		Polycentropodidae	12		Physidae	3	
		Leptophlebiidae	9	9	Psychomyidae	8		Planorbidae	3	
		Oligoneuriday	15		Cased Caddis			Thiaridae	3	
Comments	Pristine Upper reach	Polymitarcyidae	10		Barbarochthonidae	13	13	Viviparidae	5	
	Mountain Stream	Prosopistomatida	15		Calamoceratidae	11		Pelecipoda		
		Teloganodiadae	12	12	Glossostomatidae	11	11	Corbiculidae	5	
		Trichorythidae	9		Hydroptilidae	6		Sphariidae	3	
		Odonata			Hydrosalpingidae	15		Unionidae	6	
		Calopterygidae	10		Leptostomatidae	10				
		Clorocyphidae	10		Leptoceridae	6				
		Chorolestidae	8		Petrothrincidae	11				
		Coenagrionidae	4		Pisulidae	10				
		Lestidae	8		Sericostomatidae	13				
		Platycnemidae	10		Coleoptera					
		Protoneuridae	8		Dyticidae	5				
		Aesthnidae	8		Elmidae Dryopidae	8	8			
		Corduliidae	8		Gyrinidae	5	5			
		Gomphidae	6		Haliplidae	5				
		Libellulidae	4		Helodidae	12				
		Lepidoptera			Hydraenidae	8				
		Pyralidae	12		Hydrophilidae	5				
					Limnichidae	10				
					Psephenidae	10				-
Total				64			52			

SASS5 Score	Sheet									
Date	02-Sep-14	Taxon	Weight	Score	Taxon	Weight	Score	Taxon	Weight	Score
Locality	Franschhoek River	Porifera	5		Hemiptera			Diptera		
	Bridge below fish farm	o Coelenterata	1		Belostomatidae	3		Athericidae	10	
	Main road	Turbellaria	3		Corixidae	3	3	Blepharoceridae	15	
		Oligochaeta	1	1	Gerridae	5		Ceratopogonidae	5	
Coordinates	33° 55' 12" S	Huridinea	3		Hydrometridae	6		Chironomidae	2	2
	19° 7' 17" E	Crustacea			Naucoridae	7		Culicidae	1	1
		Amphipoda	13		Nepiday	3		Dixidae	10	
DO mg/l	9.5	Potamonautidaa	3		Notonectidae	3		Empididae	6	
Temperature °C	15.2	Atyidae	8		Pleidae	4		Ephydridae	3	
рН		Palaemonidae	10		Veliidae	5	5	Muscidae	1	
EC mS/m		Hydracarina	8		Megaloptera			Psychodidae	1	
		Plecoptera			Corydalidae	10		Simuliidae	5	5
SASS5 Score	59	Notonemouridae	14		Sialidae	8		Syrphidae	1	
Number of Taxa	11	Perlidae	12		Trichoptera			Tabanidae	5	
ASPT	5.4	Ephemeroptera			Dipseudopsidae	10		Tipulidae	5	
		Baetiday 1 sp	4		Ecnomidae	8		Gastropoda		
Other Biota	Galaxias 2	Baetiday 2 sp	6	6	Hydropsychidae 1 sp	4		Ancylidae	6	
		Baetiday >3 sp	12		Hydropsychidae 2 sp	6		Bulinidae	3	
		Caeniday	6		Hydropsychidae <2 sp	12		Hydrobiidae	3	
		Ephemeridae	15		Phylopotamidae	10		Lymnaeidae	3	
		Heptageniidae	13		Polycentropodidae	12		Physidae	3	
		Leptophlebiidae	9	9	Psychomyidae	8		Planorbidae	3	
		Oligoneuriday	15		Cased Caddis			Thiaridae	3	
Comments	Both sides of bridge	Polymitarcyidae	10		Barbarochthonidae	13		Viviparidae	5	
	Below fish farm	Prosopistomatida	15		Calamoceratidae	11		Pelecipoda		
		Teloganodiadae	12	12	Glossostomatidae	11		Corbiculidae	5	
		Trichorythidae	9		Hydroptilidae	6		Sphariidae	3	
		Odonata			Hydrosalpingidae	15		Unionidae	6	
		Calopterygidae	10		Leptostomatidae	10				
		Clorocyphidae	10		Leptoceridae	6	6			
		Chorolestidae	8		Petrothrincidae	11				
		Coenagrionidae	4		Pisulidae	10				
		Lestidae	8		Sericostomatidae	13				
		Platycnemidae	10		Coleoptera					
		Protoneuridae	8		Dyticidae	5				
		Aesthnidae	8		Elmidae Dryopidae	8				
		Corduliidae	8		Gyrinidae	5				
		Gomphidae	6		Haliplidae	5				
		Libellulidae	4	4	Helodidae	12				
		Lepidoptera			Hydraenidae	8				
		Pyralidae	12		Hydrophilidae	5	5			
					Limnichidae	10				
					Psephenidae	10				
Total				32			19			8

SASS5 Score	Sheet									
Date	02-Sep-14	Taxon	Weight	Score	Taxon	Weight	Score	Taxon	Weight	Score
Locality	Franschhoek River	Porifera	5		Hemiptera			Diptera		
	La Motte	Coelenterata	1		Belostomatidae	3		Athericidae	10	
		Turbellaria	3		Corixidae	3		Blepharoceridae	15	
		Oligochaeta	1	1	Gerridae	5		Ceratopogonidae	5	
Coordinates	33° 53' 31" S	Huridinea	3		Hydrometridae	6		Chironomidae	2	2
	19° 4' 49" E	Crustacea			Naucoridae	7		Culicidae	1	1
		Amphipoda	13		Nepiday	3		Dixidae	10	
DO mg/l	8.9	Potamonautidaa	3		Notonectidae	3		Empididae	6	
Temperature °C	17.3	Atyidae	8		Pleidae	4		Ephydridae	3	
рН		Palaemonidae	10		Veliidae	5	5	Muscidae	1	
EC mS/m		Hydracarina	8		Megaloptera			Psychodidae	1	
		Plecoptera			Corydalidae	10		Simuliidae	5	5
SASS5 Score	51	Notonemouridae	14		Sialidae	8		Syrphidae	1	
Number of Taxa	10	Perlidae	12		Trichoptera			Tabanidae	5	
ASPT	5.1	Ephemeroptera			Dipseudopsidae	10		Tipulidae	5	
		Baetidae 1 sp	4		Ecnomidae	8		Gastropoda		
Other Biota	Galaxias 2	Baetidae 2 sp	6	6	Hydropsychidae 1 sp	4		Ancylidae	6	
	small unidentified fish	Baetidae >3 sp	12		Hydropsychidae 2 sp	6		Bulinidae	3	3
		Caenidae	6		Hydropsychidae <2 sp	12		Hydrobiidae	3	
		Ephemeridae	15		Phylopotamidae	10		Lymnaeidae	3	
		Heptageniidae	13		Polycentropodidae	12		Physidae	3	
		Leptophlebiidae	9		Psychomyidae	8		Planorbidae	3	
		Oligoneuriday	15		Cased Caddis			Thiaridae	3	
Comments	Both sides of bridge	Polymitarcyidae	10		Barbarochthonidae	13		Viviparidae	5	
	Below fish farm	Prosopistomatida	15		Calamoceratidae	11		Pelecipoda		
		Teloganodidae	12	12	Glossostomatidae	11	11	Corbiculidae	5	
		Trichorythidae	9		Hydroptilidae	6		Sphariidae	3	
		Odonata			Hydrosalpingidae	15		Unionidae	6	
		Calopterygidae	10		Leptostomatidae	10				
		Clorocyphidae	10		Leptoceridae	6				
		Chorolestidae	8		Petrothrincidae	11				
		Coenagrionidae	4		Pisulidae	10				
		Lestidae	8		Sericostomatidae	13				
		Platycnemidae	10		Coleoptera					
		Protoneuridae	8		Dyticidae	5				
		Aesthnidae	8		Elmidae Dryopidae	8				
		Corduliidae	8		Gyrinidae	5	5			
		Gomphidae	6		Haliplidae	5				
		Libellulidae	4		Helodidae	12				
		Lepidoptera			Hydraenidae	8				
		Pyralidae	12		Hydrophilidae	5				
					Limnichidae	10				
					Psephenidae	10				
Total				19			21			11

SASS5 Score	Sheet									
Date	02-Sep-14	Taxon	Weight	Score	Taxon	Weight	Score	Taxon	Weight	Score
Locality	Franschhoek River	Porifera	5		Hemiptera			Diptera		
	Berg River Dam road	Coelenterata	1		Belostomatidae	3		Athericidae	10	
		Turbellaria	3	3	Corixidae	3		Blepharoceridae	15	
		Oligochaeta	1	1	Gerridae	5		Ceratopogonidae	5	
Coordinates	33° 52' 29" S	Huridinea	3	3	Hydrometridae	6		Chironomidae	2	2
	19° 1' 56" E	Crustacea			Naucoridae	7		Culicidae	1	
		Amphipoda	13		Nepiday	3		Dixidae	10	
DO mg/l	8.3	Potamonautidae	3	3	Notonectidae	3		Empididae	6	
Temperature °C	16.9	Atyidae	8		Pleidae	4		Ephydridae	3	
рН		Palaemonidae	10		Veliidae	5		Muscidae	1	
EC mS/m		Hydracarina	8		Megaloptera			Psychodidae	1	
		Plecoptera			Corydalidae	10		Simuliidae	5	5
SASS5 Score	52	Notonemouridae	14		Sialidae	8		Syrphidae	1	
Number of Taxa	12	Perlidae	12		Trichoptera			Tabanidae	5	
ASPT	4.3	Ephemeroptera			Dipseudopsidae	10		Tipulidae	5	
		Baetidae 1 sp	4		Ecnomidae	8		Gastropoda		
Other Biota		Baetidae 2 sp	6	6	Hydropsychidae 1 sp	4		Ancylidae	6	
		Baetidae >3 sp	12		Hydropsychidae 2 sp	6		Bulinidae	3	
		Caenidae	6		Hydropsychidae <2 sp	12		Hydrobiidae	3	
		Ephemeridae	15		Phylopotamidae	10		Lymnaeidae	3	
		Heptageniidae	13		Polycentropodidae	12		Physidae	3	
		Leptophlebiidae	9		Psychomyidae	8		Planorbidae	3	
		Oligoneuriday	15		Cased Caddis			Thiaridae	3	
Comments	upstream	Polymitarcyidae	10		Barbarochthonidae	13		Viviparidae	5	
	road bridge	Prosopistomatida	15		Calamoceratidae	11		Pelecipoda		
	smelly	Teloganodidae	12		Glossostomatidae	11	11	Corbiculidae	5	
		Trichorythidae	9		Hydroptilidae	6		Sphariidae	3	
		Odonata			Hydrosalpingidae	15		Unionidae	6	
		Calopterygidae	10		Leptostomatidae	10				
		Clorocyphidae	10		Leptoceridae	6				
		Chorolestidae	8		Petrothrincidae	11				
		Coenagrionidae	4	4	Pisulidae	10				
		Lestidae	8		Sericostomatidae	13				
		Platycnemidae	10		Coleoptera					
		Protoneuridae	8		Dyticidae	5	5			
		Aesthnidae	8		Elmidae Dryopidae	8				
		Corduliidae	8		Gyrinidae	5	5			
		Gomphidae	6		Haliplidae	5				
		Libellulidae	4	4	Helodidae	12				
		Lepidoptera			Hydraenidae	8				
		Pyralidae	12		Hydrophilidae	5				
					Limnichidae	10				
					Psephenidae	10				
Total				24			21			7

SASS5 Score	Sheet									
Date	12 October 2014	Taxon	Weight	Score	Taxon	Weight	Score	Taxon	Weight	Score
Locality	Lower Fish farm	Porifera	5		Hemiptera			Diptera		
	Franschhoek River	Coelenterata	1		Belostomatidae	3		Athericidae	10	
		Turbellaria	3	3	Corixidae	3	3	Blepharoceridae	15	
		Oligochaeta	1	1	Gerridae	5		Ceratopogonidae	5	
Coordinates		Huridinea	3		Hydrometridae	6		Chironomidae	2	2
		Crustacea			Naucoridae	7		Culicidae	1	
		Amphipoda	13		Nepidae	3	3	Dixidae	10	10
DO mg/l		Potamonautidaa	3		Notonectidae	3		Empididae	6	
Temperature °C	17	Atyidae	8		Pleidae	4		Ephydridae	3	
рН		Palaemonidae	10		Veliidae	5	5	Muscidae	1	
EC mS/m		Hydracarina	8	8	Megaloptera			Psychodidae	1	
		Plecoptera			Corydalidae	10		Simuliidae	5	5
SASS5 Score	101	Notonemouridae	14		Sialidae	8		Syrphidae	1	
Number of Taxa	17	Perlidae	12		Trichoptera			Tabanidae	5	
ASPT	5.9	Ephemeroptera			Dipseudopsidae	10		Tipulidae	5	
		Baetidae 1 sp	4		Ecnomidae	8		Gastropoda		
Other Biota	Galaxias	Baetidae 2 sp	6		Hydropsychidae 1 sp	4		Ancylidae	6	
		Baetidae >3 sp	12	12	Hydropsychidae 2 sp	6		Bulinidae	3	
		Caenidae	6	6	Hydropsychidae <2 sp	12		Hydrobiidae	3	
		Ephemeridae	15		Phylopotamidae	10		Lymnaeidae	3	
		Heptageniidae	13		Polycentropodidae	12		Physidae	3	
		Leptophlebiidae	9		Psychomyidae	8		Planorbidae	3	
		Oligoneuriday	15		Cased Caddis			Thiaridae	3	
Comments		Polymitarcyidae	10		Barbarochthonidae	13		Viviparidae	5	
		Prosopistomatida	15		Calamoceratidae	11		Pelecipoda		
		Teloganodiadae	12	12	Glossostomatidae	11	11	Corbiculidae	5	
		Trichorythidae	9		Hydroptilidae	6		Sphariidae	3	
		Odonata			Hydrosalpingidae	15		Unionidae	6	
		Calopterygidae	10		Leptostomatidae	10				
		Clorocyphidae	10		Leptoceridae	6	6			
		Chorolestidae	8		Petrothrincidae	11				
		Coenagrionidae	4		Pisulidae	10				
		Lestidae	8		Sericostomatidae	13				
		Platycnemidae	10		Coleoptera					
		Protoneuridae	8		Dyticidae	5	5			
		Aesthnidae	8		Elmidae Dryopidae	8				
		Corduliidae	8		Gyrinidae	5				
		Gomphidae	6		Haliplidae	5				
		Libellulidae	4	4	Helodidae	12				
		Lepidoptera			Hydraenidae	8				
		Pyralidae	12		Hydrophilidae	5	5			
					Limnichidae	10				
					Psephenidae	10				
Score				46			38			17

SASS5 Score	Sheet									
Date	12 October 2014	Taxon	Weight	Score	Taxon	Weight	Score	Taxon	Weight	Score
Locality	La Motte Bridge	Porifera	5		Hemiptera			Diptera		
	Franschhoek River	Coelenterata	1		Belostomatidae	3		Athericidae	10	
		Turbellaria	3	3	Corixidae	3	3	Blepharoceridae	15	
		Oligochaeta	1	1	Gerridae	5	5	Ceratopogonidae	5	
Coordinates		Huridinea	3	3	Hydrometridae	6		Chironomidae	2	2
		Crustacea			Naucoridae	7		Culicidae	1	1
		Amphipoda	13		Nepidae	3		Dixidae	10	
DO mg/l		Potamonautidaa	3		Notonectidae	3		Empididae	6	
Temperature °C	17	Atyidae	8		Pleidae	4		Ephydridae	3	
рН		Palaemonidae	10		Veliidae	5		Muscidae	1	
EC mS/m		Hydracarina	8		Megaloptera			Psychodidae	1	
		Plecoptera			Corydalidae	10		Simuliidae	5	5
SASS5 Score	78	Notonemouridae	14		Sialidae	8		Syrphidae	1	
Number of Taxa	16	Perlidae	12		Trichoptera			Tabanidae	5	
ASPT	4.9	Ephemeroptera			Dipseudopsidae	10		Tipulidae	5	
		Baetidae 1 sp	4		Ecnomidae	8		Gastropoda		
Other Biota	Galaxias	Baetidae 2 sp	6		Hydropsychidae 1 sp	4		Ancylidae	6	
	Clicking stream frogs	Baetidae >3 sp	12	12	Hydropsychidae 2 sp	6		Bulinidae	3	3
	tadpoles	Caenidae	6	6	Hydropsychidae <2 sp	12		Hydrobiidae	3	
		Ephemeridae	15		Phylopotamidae	10		Lymnaeidae	3	
		Heptageniidae	13		Polycentropodidae	12		Physidae	3	
		Leptophlebiidae	9		Psychomyidae	8		Planorbidae	3	
		Oligoneuriday	15		Cased Caddis			Thiaridae	3	
Comments		Polymitarcyidae	10		Barbarochthonidae	13		Viviparidae	5	
		Prosopistomatida	15		Calamoceratidae	11		Pelecipoda		
		Teloganodiadae	12		Glossostomatidae	11	11	Corbiculidae	5	
		Trichorythidae	9		Hydroptilidae	6		Sphariidae	3	
		Odonata			Hydrosalpingidae	15		Unionidae	6	
		Calopterygidae	10		Leptostomatidae	10				
		Clorocyphidae	10		Leptoceridae	6				
		Chorolestidae	8		Petrothrincidae	11				
		Coenagrionidae	4	4	Pisulidae	10				
		Lestidae	8		Sericostomatidae	13				
		Platycnemidae	10		Coleoptera					
		Protoneuridae	8		Dyticidae	5	5			
		Aesthnidae	8		Elmidae Dryopidae	8				
		Corduliidae	8		Gyrinidae	5	5			
		Gomphidae	6		Haliplidae	5				
		Libellulidae	4	4	Helodidae	12				
		Lepidoptera			Hydraenidae	8				
		Pyralidae	12		Hydrophilidae	5	5			
					Limnichidae	10				
					Psephenidae	10				
Score				33			34			11

SASS5 Score	Sheet									
Date	12 October 2014	Taxon	Weight	Score	Taxon	Weight	Score	Taxon	Weight	Score
Locality	Berg River Dam Bridge	Porifera	5		Hemiptera			Diptera		
	Franschhoek River	Coelenterata	1		Belostomatidae	3		Athericidae	10	
		Turbellaria	3	3	Corixidae	3		Blepharoceridae	15	
		Oligochaeta	1	1	Gerridae	5		Ceratopogonidae	5	
Coordinates		Huridinea	3	3	Hydrometridae	6		Chironomidae	2	2
		Crustacea			Naucoridae	7	7	Culicidae	1	1
		Amphipoda	13		Nepidae	3		Dixidae	10	
DO mg/l		Potamonautidae	3		Notonectidae	3		Empididae	6	
Temperature °C	15	Atyidae	8		Pleidae	4		Ephydridae	3	
pН		Palaemonidae	10		Veliidae	5		Muscidae	1	1
EC mS/m		Hydracarina	8		Megaloptera			Psychodidae	1	
		Plecoptera			Corydalidae	10		Simuliidae	5	5
SASS5 Score	48	Notonemouridae	14		Sialidae	8		Syrphidae	1	
Number of Taxa	12	Perlidae	12		Trichoptera			Tabanidae	5	
ASPT	4.0	Ephemeroptera			Dipseudopsidae	10		Tipulidae	5	
		Baetidae 1 sp	4		Ecnomidae	8		Gastropoda		
Other Biota	Galaxias	Baetidae 2 sp	6	6	Hydropsychidae 1 sp	4		Ancylidae	6	
		Baetidae >3 sp	12		Hydropsychidae 2 sp	6		Bulinidae	3	3
		Caenidae	6		Hydropsychidae <2 sp	12		Hydrobiidae	3	
		Ephemeridae	15		Phylopotamidae	10		Lymnaeidae	3	
		Heptageniidae	13		Polycentropodidae	12		Physidae	3	
		Leptophlebiidae	9		Psychomyidae	8		Planorbidae	3	
		Oligoneuriday	15		Cased Caddis			Thiaridae	3	
Comments		Polymitarcyidae	10		Barbarochthonidae	13		Viviparidae	5	
		Prosopistomatida	15		Calamoceratidae	11		Pelecipoda		
		Teloganodiadae	12		Glossostomatidae	11	11	Corbiculidae	5	
		Trichorythidae	9		Hydroptilidae	6		Sphariidae	3	
		Odonata			Hydrosalpingidae	15		Unionidae	6	
		Calopterygidae	10		Leptostomatidae	10				
		Clorocyphidae	10		Leptoceridae	6				
		Chorolestidae	8		Petrothrincidae	11				
		Coenagrionidae	4		Pisulidae	10				
		Lestidae	8		Sericostomatidae	13				
		Platycnemidae	10		Coleoptera					
		Protoneuridae	8		Dyticidae	5				
		Aesthnidae	8		Elmidae Dryopidae	8				
		Corduliidae	8		Gyrinidae	5	5			
		Gomphidae	6		Haliplidae	5				
		Libellulidae	4		Helodidae	12				
		Lepidoptera			Hydraenidae	8				
		Pyralidae	12		Hydrophilidae	5				
					Limnichidae	10				
					Psephenidae	10				
Score				13			23			12

SASS5 Score	Sheet									
Date	03-Dec-14	Taxon	Weight	Score	Taxon	Weight	Score	Taxon	Weight	Score
Locality	Franschhoek River	Porifera	5		Hemiptera			Diptera		
	Berg River Dam Road	Coelenterata	1		Belostomatidae	3		Athericidae	10	
		Turbellaria	3	3	Corixidae	3	3	Blepharoceridae	15	
		Oligochaeta	1	1	Gerridae	5		Ceratopogonidae	5	
Coordinates	33° 52' 29" S	Huridinea	3	3	Hydrometridae	6		Chironomidae	2	2
	19° 1' 56" E	Crustacea			Naucoridae	7		Culicidae	1	
		Amphipoda	13		Nepidae	3		Dixidae	10	
DO mg/l		Potamonautidae	3		Notonectidae	3		Empididae	6	
Temperature °C	19	Atyidae	8		Pleidae	4		Ephydridae	3	
рН		Palaemonidae	10		Veliidae	5		Muscidae	1	
EC mS/m		Hydracarina	8		Megaloptera			Psychodidae	1	
		Plecoptera			Corydalidae	10		Simuliidae	5	5
SASS5 Score	50	Notonemouridae	14		Sialidae	8		Syrphidae	1	
Number of Taxa	12	Perlidae	12		Trichoptera			Tabanidae	5	
ASPT	4.2	Ephemeroptera			Dipseudopsidae	10		Tipulidae	5	
		Baetidae 1 sp	4		Ecnomidae	8		Gastropoda		
Other Biota	Tadpoles	Baetidae 2 sp	6	6	Hydropsychidae 1 sp	4	4	Ancylidae	6	
	Galaxias	Baetidae >3 sp	12		Hydropsychidae 2 sp	6		Bulinidae	3	3
		Caenidae	6		Hydropsychidae <2 sp	12		Hydrobiidae	3	
		Ephemeridae	15		Phylopotamidae	10		Lymnaeidae	3	
		Heptageniidae	13		Polycentropodidae	12		Physidae	3	
		Leptophlebiidae	9		Psychomyidae	8		Planorbidae	3	
		Oligoneuridae	15		Cased Caddis			Thiaridae	3	
Comments	upstream	Polymitarcyidae	10		Barbarochthonidae	13		Viviparidae	5	
	road bridge	Prosopistomatida	15		Calamoceratidae	11		Pelecipoda		
		Teloganodidae	12		Glossostomatidae	11	11	Corbiculidae	5	
		Trichorythidae	9		Hydroptilidae	6		Sphariidae	3	
		Odonata			Hydrosalpingidae	15		Unionidae	6	
		Calopterygidae	10		Leptostomatidae	10				
		Clorocyphidae	10		Leptoceridae	6				
		Chorolestidae	8		Petrothrincidae	11				
		Coenagrionidae	4	4	Pisulidae	10				
		Lestidae	8		Sericostomatidae	13				
		Platycnemidae	10		Coleoptera					
		Protoneuridae	8		Dyticidae	5				
		Aesthnidae	8		Elmidae Dryopidae	8				
		Corduliidae	8		Gyrinidae	5	5			
		Gomphidae	6		Haliplidae	5				
		Libellulidae	4		Helodidae	12				
		Lepidoptera			Hydraenidae	8				
		Pyralidae	12		Hydrophilidae	5				
					Limnichidae	10				
					Psephenidae	10				
Total				17			23			10

SASS5 Score	Sheet									
Date	03-Dec-14	Taxon	Weight	Score	Taxon	Weight	Score	Taxon	Weight	Score
Locality	Franschhoek River	Porifera	5		Hemiptera			Diptera		
	La Motte Road	Coelenterata	1		Belostomatidae	3		Athericidae	10	
		Turbellaria	3		Corixidae	3	3	Blepharoceridae	15	
		Oligochaeta	1	1	Gerridae	5		Ceratopogonidae	5	
Coordinates		Huridinea	3	3	Hydrometridae	6		Chironomidae	2	2
		Crustacea			Naucoridae	7		Culicidae	1	
		Amphipoda	13		Nepidae	3		Dixidae	10	
DO mg/l		Potamonautidae	3		Notonectidae	3		Empididae	6	
Temperature °C	19	Atyidae	8		Pleidae	4		Ephydridae	3	
рН		Palaemonidae	10		Veliidae	5		Muscidae	1	
EC mS/m		Hydracarina	8		Megaloptera			Psychodidae	1	
		Plecoptera			Corydalidae	10		Simuliidae	5	5
SASS5 Score	52	Notonemouridae	14		Sialidae	8		Syrphidae	1	
Number of Taxa	11	Perlidae	12		Trichoptera			Tabanidae	5	
ASPT	4.7	Ephemeroptera			Dipseudopsidae	10		Tipulidae	5	
		Baetidae 1 sp	4		Ecnomidae	8		Gastropoda		
Other Biota	Tadpoles	Baetidae 2 sp	6		Hydropsychidae 1 sp	4		Ancylidae	6	
		Baetidae >3 sp	12	12	Hydropsychidae 2 sp	6		Bulinidae	3	3
		Caenidae	6		Hydropsychidae <2 sp	12		Hydrobiidae	3	
		Ephemeridae	15		Phylopotamidae	10		Lymnaeidae	3	3
		Heptageniidae	13		Polycentropodidae	12		Physidae	3	
		Leptophlebiidae	9		Psychomyidae	8		Planorbidae	3	
		Oligoneuridae	15		Cased Caddis			Thiaridae	3	
Comments	Water turbulent	Polymitarcyidae	10		Barbarochthonidae	13		Viviparidae	5	
	like grey water	Prosopistomatida	15		Calamoceratidae	11		Pelecipoda		
		Teloganodidae	12		Glossostomatidae	11	11	Corbiculidae	5	
	Bank disturbed	Trichorythidae	9		Hydroptilidae	6		Sphariidae	3	
	with backacter	Odonata			Hydrosalpingidae	15		Unionidae	6	
		Calopterygidae	10		Leptostomatidae	10				
		Clorocyphidae	10		Leptoceridae	6				
		Chorolestidae	8		Petrothrincidae	11				
		Coenagrionidae	4	4	Pisulidae	10				
		Lestidae	8		Sericostomatidae	13				
		Platycnemidae	10		Coleoptera					
		Protoneuridae	8		Dyticidae	5				
		Aesthnidae	8		Elmidae Dryopidae	8				
		Corduliidae	8		Gyrinidae	5	5			
		Gomphidae	6		Haliplidae	5				
		Libellulidae	4		Helodidae	12				
		Lepidoptera			Hydraenidae	8				
		Pyralidae	12		Hydrophilidae	5				
					Limnichidae	10				
					Psephenidae	10				
Total				20			19			13

SASS5 Score	Sheet									
Date	03-Dec-14	Taxon	Weight	Score	Taxon	Weight	Score	Taxon	Weight	Score
Locality	Franschhoek River	Porifera	5		Hemiptera			Diptera		
	Lower Fish farm	Coelenterata	1		Belostomatidae	3		Athericidae	10	
		Turbellaria	3		Corixidae	3	3	Blepharoceridae	15	
		Oligochaeta	1	1	Gerridae	5		Ceratopogonidae	5	
Coordinates		Huridinea	3	3	Hydrometridae	6		Chironomidae	2	2
		Crustacea			Naucoridae	7		Culicidae	1	
		Amphipoda	13		Nepidae	3		Dixidae	10	
DO mg/l		Potamonautidae	3	3	Notonectidae	3		Empididae	6	
Temperature °C	19	Atyidae	8		Pleidae	4		Ephydridae	3	
рН		Palaemonidae	10		Veliidae	5	5	Muscidae	1	
EC mS/m		Hydracarina	8	8	Megaloptera			Psychodidae	1	
		Plecoptera			Corydalidae	10		Simuliidae	5	5
SASS5 Score	56	Notonemouridae	14		Sialidae	8		Syrphidae	1	
Number of Taxa	11	Perlidae	12		Trichoptera			Tabanidae	5	
ASPT	5.1	Ephemeroptera			Dipseudopsidae	10		Tipulidae	5	
		Baetidae 1 sp	4		Ecnomidae	8		Gastropoda		
Other Biota	Trout	Baetidae 2 sp	6		Hydropsychidae 1 sp	4		Ancylidae	6	
	Galaxias	Baetidae >3 sp	12	12	Hydropsychidae 2 sp	6		Bulinidae	3	
		Caenidae	6		Hydropsychidae <2 sp	12		Hydrobiidae	3	
		Ephemeridae	15		Phylopotamidae	10		Lymnaeidae	3	
		Heptageniidae	13		Polycentropodidae	12		Physidae	3	
		Leptophlebiidae	9		Psychomyidae	8		Planorbidae	3	
		Oligoneuridae	15		Cased Caddis			Thiaridae	3	
Comments	Clear water	Polymitarcyidae	10		Barbarochthonidae	13		Viviparidae	5	
		Prosopistomatida	15		Calamoceratidae	11		Pelecipoda		
		Teloganodidae	12		Glossostomatidae	11		Corbiculidae	5	
		Trichorythidae	9		Hydroptilidae	6		Sphariidae	3	
		Odonata			Hydrosalpingidae	15		Unionidae	6	
		Calopterygidae	10		Leptostomatidae	10				
		Clorocyphidae	10		Leptoceridae	6	6			
		Chorolestidae	8		Petrothrincidae	11				
		Coenagrionidae	4		Pisulidae	10				
		Lestidae	8		Sericostomatidae	13				
		Platycnemidae	10		Coleoptera					
		Protoneuridae	8		Dyticidae	5				
		Aesthnidae	8		Elmidae Dryopidae	8				
		Corduliidae	8		Gyrinidae	5				
		Gomphidae	6		Haliplidae	5				
		Libellulidae	4		Helodidae	12				
		Lepidoptera			Hydraenidae	8	8			
		Pyralidae	12		Hydrophilidae	5				
					Limnichidae	10				
					Psephenidae	10				
Total				27			22			7

SASS5 Score	Sheet									
Date	03-Feb-15	Taxon	Weight	Score	Taxon	Weight	Score	Taxon	Weight	Score
Locality	Franschhoek River	Porifera	5		Hemiptera			Diptera		
	Berg River Dam Road	Coelenterata	1		Belostomatidae	3		Athericidae	10	
		Turbellaria	3	3	Corixidae	3	3	Blepharoceridae	15	
		Oligochaeta	1	1	Gerridae	5	5	Ceratopogonidae	5	
Coordinates		Huridinea	3	3	Hydrometridae	6		Chironomidae	2	2
		Crustacea			Naucoridae	7	7	Culicidae	1	
		Amphipoda	13		Nepidae	3		Dixidae	10	
DO mg/l		Potamonautidae	3	3	Notonectidae	3		Empididae	6	
Temperature °C	25	Atyidae	8		Pleidae	4		Ephydridae	3	
рН		Palaemonidae	10		Veliidae	5		Muscidae	1	
EC mS/m		Hydracarina	8		Megaloptera			Psychodidae	1	
		Plecoptera			Corydalidae	10		Simuliidae	5	5
SASS5 Score	85	Notonemouridae	14		Sialidae	8		Syrphidae	1	
Number of Taxa	17	Perlidae	12		Trichoptera			Tabanidae	5	
ASPT	5	Ephemeroptera			Dipseudopsidae	10		Tipulidae	5	
		Baetidae 1 sp	4		Ecnomidae	8		Gastropoda		
Other Biota	Tadpoles	Baetidae 2 sp	6		Hydropsychidae 1 sp	4		Ancylidae	6	
		Baetidae >3 sp	12	12	Hydropsychidae 2 sp	6		Bulinidae	3	3
		Caenidae	6		Hydropsychidae <2 sp	12		Hydrobiidae	3	
		Ephemeridae	15		Phylopotamidae	10		Lymnaeidae	3	
		Heptageniidae	13		Polycentropodidae	12		Physidae	3	
		Leptophlebiidae	9		Psychomyidae	8		Planorbidae	3	
		Oligoneuridae	15		Cased Caddis			Thiaridae	3	
Comments		Polymitarcyidae	10		Barbarochthonidae	13		Viviparidae	5	
		Prosopistomatida	15		Calamoceratidae	11		Pelecipoda		
		Teloganodiadae	12		Glossostomatidae	11	11	Corbiculidae	5	
		Trichorythidae	9		Hydroptilidae	6		Sphariidae	3	
		Odonata			Hydrosalpingidae	15		Unionidae	6	
		Calopterygidae	10		Leptostomatidae	10				
		Clorocyphidae	10		Leptoceridae	6				
		Chorolestidae	8		Petrothrincidae	11				
		Coenagrionidae	4	4	Pisulidae	10				
		Lestidae	8		Sericostomatidae	13				
		Platycnemidae	10		Coleoptera					
		Protoneuridae	8		Dyticidae	5				
		Aesthnidae	8	8	Elmidae Dryopidae	8				
		Corduliidae	8		Gyrinidae	5	5			
		Gomphidae	6	6	Haliplidae	5				
		Libellulidae	4	4	Helodidae	12				
		Lepidoptera			Hydraenidae	8				
		Pyralidae	12		Hydrophilidae	5				
					Limnichidae	10				
					Psephenidae	10				
Score				44			31			10

SASS5 Score	Sheet									
Date	03-Feb-15	Taxon	Weight	Score	Taxon	Weight	Score	Taxon	Weight	Score
Locality	Franschhoek River	Porifera	5		Hemiptera			Diptera		
	Berg River Dam Road	Coelenterata	1		Belostomatidae	3		Athericidae	10	
		Turbellaria	3		Corixidae	3	3	Blepharoceridae	15	
		Oligochaeta	1	1	Gerridae	5		Ceratopogonidae	5	
Coordinates		Huridinea	3	3	Hydrometridae	6		Chironomidae	2	2
		Crustacea			Naucoridae	7	7	Culicidae	1	
		Amphipoda	13		Nepidae	3	3	Dixidae	10	
DO mg/l		Potamonautidae	3	3	Notonectidae	3		Empididae	6	
Temperature °C	24	Atyidae	8		Pleidae	4		Ephydridae	3	
рН		Palaemonidae	10		Veliidae	5		Muscidae	1	
EC mS/m		Hydracarina	8		Megaloptera			Psychodidae	1	
		Plecoptera			Corydalidae	10		Simuliidae	5	
SASS5 Score	84	Notonemouridae	14		Sialidae	8		Syrphidae	1	
Number of Taxa	17	Perlidae	12		Trichoptera			Tabanidae	5	
ASPT	4.9	Ephemeroptera			Dipseudopsidae	10		Tipulidae	5	
		Baetidae 1 sp	4		Ecnomidae	8		Gastropoda		
Other Biota	Tadpoles	Baetidae 2 sp	6		Hydropsychidae 1 sp	4	4	Ancylidae	6	
		Baetidae >3 sp	12	12	Hydropsychidae 2 sp	6		Bulinidae	3	3
		Caenidae	6		Hydropsychidae <2 sp	12		Hydrobiidae	3	
		Ephemeridae	15		Phylopotamidae	10		Lymnaeidae	3	
		Heptageniidae	13		Polycentropodidae	12		Physidae	3	
		Leptophlebiidae	9		Psychomyidae	8		Planorbidae	3	
		Oligoneuridae	15		Cased Caddis			Thiaridae	3	
Comments		Polymitarcyidae	10		Barbarochthonidae	13		Viviparidae	5	
		Prosopistomatida	15		Calamoceratidae	11		Pelecipoda		
		Teloganodiadae	12		Glossostomatidae	11	11	Corbiculidae	5	
		Trichorythidae	9		Hydroptilidae	6		Sphariidae	3	
		Odonata			Hydrosalpingidae	15		Unionidae	6	
		Calopterygidae	10		Leptostomatidae	10				
		Clorocyphidae	10		Leptoceridae	6				
		Chorolestidae	8		Petrothrincidae	11				
		Coenagrionidae	4	4	Pisulidae	10				
		Lestidae	8		Sericostomatidae	13				
		Platycnemidae	10		Coleoptera					
		Protoneuridae	8		Dyticidae	5	5			
		Aesthnidae	8	8	Elmidae Dryopidae	8				
		Corduliidae	8		Gyrinidae	5	5			
		Gomphidae	6	6	Haliplidae	5				
		Libellulidae	4	4	Helodidae	12				
		Lepidoptera			Hydraenidae	8				
		Pyralidae	12		Hydrophilidae	5				
					Limnichidae	10				
					Psephenidae	10				
Score				41			38			5

SASS5 Score Sheet										
Date	03-Feb-15	Taxon	Weight	Score	Taxon	Weight	Score	Taxon	Weight	Score
Locality	Franschhoek River	Porifera	5		Hemiptera			Diptera		
	Lower Fish Farm	Coelenterata	1		Belostomatidae	3		Athericidae	10	
		Turbellaria	3		Corixidae	3	3	Blepharoceridae	15	
		Oligochaeta	1	1	Gerridae	5		Ceratopogonidae	5	
Coordinates		Huridinea	3		Hydrometridae	6		Chironomidae	2	2
		Crustacea			Naucoridae	7		Culicidae	1	
		Amphipoda	13		Nepidae	3		Dixidae	10	10
DO mg/l		Potamonautidae	3	3	Notonectidae	3		Empididae	6	
Temperature °C	24	Atyidae	8		Pleidae	4		Ephydridae	3	
рН		Palaemonidae	10		Veliidae	5	5	Muscidae	1	
EC mS/m		Hydracarina	8	8	Megaloptera			Psychodidae	1	
		Plecoptera			Corydalidae	10		Simuliidae	5	
SASS5 Score	76	Notonemouridae	14		Sialidae	8		Syrphidae	1	
Number of Taxa	13	Perlidae	12		Trichoptera			Tabanidae	5	
ASPT	5.8	Ephemeroptera			Dipseudopsidae	10		Tipulidae	5	
		Baetidae 1 sp	4		Ecnomidae	8		Gastropoda		
Other Biota	Tadpoles	Baetidae 2 sp	6	6	Hydropsychidae 1 sp	4		Ancylidae	6	
	Galaxias	Baetidae >3 sp	12		Hydropsychidae 2 sp	6		Bulinidae	3	
		Caenidae	6		Hydropsychidae <2 sp	12		Hydrobiidae	3	
		Ephemeridae	15		Phylopotamidae	10		Lymnaeidae	3	
		Heptageniidae	13		Polycentropodidae	12		Physidae	3	
		Leptophlebiidae	9		Psychomyidae	8	8	Planorbidae	3	
		Oligoneuridae	15		Cased Caddis			Thiaridae	3	
Comments		Polymitarcyidae	10		Barbarochthonidae	13		Viviparidae	5	
		Prosopistomatida	15		Calamoceratidae	11		Pelecipoda		
		Teloganodiadae	12		Glossostomatidae	11	11	Corbiculidae	5	
		Trichorythidae	9		Hydroptilidae	6		Sphariidae	3	
		Odonata			Hydrosalpingidae	15		Unionidae	6	
		Calopterygidae	10		Leptostomatidae	10				
		Clorocyphidae	10		Leptoceridae	6	6			
		Chorolestidae	8		Petrothrincidae	11				
		Coenagrionidae	4		Pisulidae	10				
		Lestidae	8		Sericostomatidae	13				
		Platycnemidae	10		Coleoptera					
		Protoneuridae	8		Dyticidae	5				
		Aesthnidae	8		Elmidae Dryopidae	8				
		Corduliidae	8		Gyrinidae	5	5			
		Gomphidae	6		Haliplidae	5				
		Libellulidae	4		Helodidae	12				
		Lepidoptera			Hydraenidae	8	8			
		Pyralidae	12		Hydrophilidae	5				
					Limnichidae	10				
					Psephenidae	10				
Score				18			46			12

#### 17. Declaration of Independence

I, Dirk van Driel, as the appointed independent specialist hereby declare that I:

- Act/ed as the independent specialist in this application
- Regard the information contained in this report as it relates to my specialist input/study to be true and correct and;
- Do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management act;
- Have and will not have vested interest in the proposed activity;
- Have disclosed to the applicant, EAP and competent authority any material information have or may have to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the environmental Impact Assessment Regulations, 2010 and any specific environmental management act.
- Am fully aware and meet the responsibilities in terms of the NEMA, the Environmental Impacts Assessment Regulations, 2010 (specifically in terms of regulation 17 of GN No. R543) and any specific environmental management act and that failure to comply with these requirements may constitute and result in disqualification;
- Have ensured that information containing all relevant facts on respect of the specialist input / study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties facilitated in such a manner that all interested and affected parties were provided with reasonable opportunity to participate and to provide comments on the specialist input / study;
- Have ensured that all the comments of all the interested and affected parties on the specialist input were considered, recorded and submitted to the competent authority in respect of the application;
- Have ensured that the names of all the interested and affected parties that participated in terms of the specialist input / study were recorded in the register of interested and affected parties who participated in the public participation process;
- Have provided the competent authority with access to all information at my disposal regarding the application, weather such information is favourable or not and;
- Am aware that a false declaration is an offence in terms of regulation 71 of GN No. R543.

D VAN DRIEL

Signature of the specialist:

Name of the company:

VanDrielCSA Date: 9 Se

Date: 9 September 2014