RIVER HEALTH PROGRAMME

A BIOMONITORING SURVEY OF THE MOGOL (or MOKOLO) RIVER CATCHMENT (LIMPOPO), UNDERTAKEN DURING 2002.

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Executive Summary.

Background.

The Mogol River Catchment was prioritized for study during 2002. The river was prioritized because of growing concerns, which were being raised about the ecological impacts arising from the spraying of reed beds in the river with herbicides. Reedbeds in the lower river below Mokolo Dam are being sprayed in order to promote the flow of water along the river for the farming industry. Water is released from Mokolo Dam in irregular pulses.

A team of scientists, technicians and students worked together to plan and undertake a systematic biomonitoring survey of the river catchment. 31 biomonitoring sites were selected. The sites were assessed using standard River Health Programme (RHP) biomonitoring protocols between May and September 2002

- Fish — Fish Assemblage Integrity Index (FAII)
- Invertebrates — South African Scoring System Version 5 (SASS5)
- Riparian Vegetation — Riparian Vegetation Index. (RVI)
- Geomorphology — Geomorphology Index (GI)

In Situ Water Quality was also assessed.

This technical report brings together all of the results of the above surveys, but should be read in conjunction with the Mogol Catchment Site Inventory Report. This technical report is written in "technical or scientific language" but provides the foundation for the production of a State of River Report (SORR), which will be written in more user friendly language. Reults in this report are thus detailed, but can with some loss of accuracy be summarized in terms of the SORR product.

The CD version of this report includes the detailed calculations of each monitoring protocol, together with graphics and a detailed photographic library of each site. A poster depicting the summarized results of this survey was produced for SASAqS 2003 (Capetown) and is also included on the CD.

The survey was used for capacity building purposes and separate detailed reports have been written, which provide progress in this regard. Following the completion of this survey, the department still lacks specialists to address vegetation issues.

Results.

Results depict the present ecological state of each river reach of the catchment as based on level 2 eco-region boundaries (See Figure 1 page 12). Results are non judgemental and merely describe the state of the catchment as it was, during the study period. Very limited historical information was available for interpretive purposes and as such results should only be viewed with moderately high confidence. Further future surveys are required to assess trends and to build confidence in results.

Summarized results based on 4 Present Ecological State Classes as utilized in RHP State of River Reports (SORR).

NATURAL	A
GOOD	B/C
FAIR	C/D
POOR	E/F

River Reach	Ecoregion	FISH	INVERTS	RIP VEG	GEO
		FAII	SASS5	RVI	IMPACT
Mogol	2.04	C	C	D	D
Mogol	2.03	D	C	D	N/A
Mogol	1.05	B	A/B	C	B/C
Mogol	2.03 B	D	C/D	C	B/C
Mogol	1.05 B	D	C/D	C	C
Mogol	1.03	N/A	N/A	N/A	N/A
Sand	2.05	C	A/C	C-E	B/C
Klein Sand	2.05	D	C	C	N/A
Klein Sand	2.04	D	N/A	N/A	D
Frikkiesloop	2.03	C	C	C	B
Sterkstroom	2.03	C	B/C	C	B
Taaibosspruit	2.03	D	B/C	B	B
Dwars & Jim se Loop	1.05	D	B/C	C	N/A
Frikkiesloop	1.05	C	B	B	C
Rietspruit	2.03B	C	C	B/C	B/C

Perhaps the greatest result associated with this study is the increased awareness of aquatic issues within the catchment. Throughout the survey, the study team went to great lengths to discuss aquatic ecology with water resource managers, stakeholders and landowners. The response illicited from these stakeholders indicated that there has been a clear lack of departmental presence in the catchment to address such issues, but now there is a realization that something good is happening.

The capacity building exercise associated with this study was also considered a success, although some internal problems remain with the application of the Riparian Vegetation Index.

Conclusions.

As can be seen from the above table, the present ecological state of the Mogol River Catchment lies predominantly in a fair to good Ecological Class. The fish populations of the catchment appear to be slightly more impacted than aquatic invertebrates. This is almost certainly as a result of reduced river flows and fragmentation of the system through the placement of dams and weirs. Very few flow dependent or migratory fish species were encountered throughout the survey. Invasive alien fish were recorded in the river at two locations. The lower flow requirements of invertebrates, together with their mobility, has probably buffered impacts of reduced flows and fragmentation on their populations.

Vegetation results reflect the high occurrence of alien vegetation, encroachment of terrestrial vegetation and destruction of the riparian zone through poor land use practices.

The geomorphological state of the system reflects changes in flow regime and localized site impacts. As the template for all other indices, the geomorphological state also reflects reduced habitat availability and disturbance, which is often accompanied by invasive alien vegetation encrachment.

Water quality throughout the study area was considered to be good. However, pulsed releases from Mokolo Dam are thought to be harmful in that they interfere with temperatures within the lower river, along with the obvious impacts associated with unseasonal flow patterns.

While the Mogol Catchment is currently in a Fair to Good state, increasing water demands within the catchment are likely to cause a downward trend in the overall status of the system.

No indication could be found to suggest that the spraying of reed beds was having an adverse effect on the lower river. However, flow regulation is considered to be causing significant impact throughout the system.

No one site within the Catchment could be considered to reflect a natural state or reference condition. Given the number of nature reserves on tributaries to the Mogol, this fact is quite surprising. It is however once again a reflection of catchment fragmentation and irregular flow patterns.

Recommendations.

Given the high water demands in the catchment, lack of water storage and the Present Ecological Status of the Catchment, is is difficult to make recommendations which are likely to significantly improve the current status of the River.

Nevertheless, the following should be considered.

- In terms of water supply for the environment, there have been no studies undertaken for the Mogol to date. The establishment of an ecological reserve would go some way towards protecting the existing fauna and flora, while providing some indication of water availability for future licences.
- Pulsed releases from Mokolo Dam are coordinated for agricultural purposes with little recognition of environmental requirements. From an environmental perspective, releases should mimic the natural hydrological regime of the system. Pulses of flow are considered detrimental to the ecology. Departmental management should liaise with water resource managers in an effort to improve the management of flows for the environment.
- A concerted effort to eradicate alien vegetation in the catchment can be motivated.
- The lack of historical data for the catchment reflects a lack of work within the catchment by aquatic specialists. A higher profile and presence of aquatic

scientific staff in the catchment would greatly improve liaison with all landowners along the river. The production and distribution of a State of River Report will further the awareness of aquatic issues but will not suffice. Scientists need to be appointed to undertake regular monitoring of the river and to provide specialist support to the community on issues such as alien fish introductions.

- Large areas of the lower sections of the river near Ellisras (Lephalale) are being mined for sand and this has a serious effect on the system. The channels are modified and the riverine vegetation is destroyed at the access points for vehicles as well as the disruption of any stabilizing growth in the riverbed. This in turn accentuates erosion in times of high flows. Sand mining appears to be bypassing the necessary EIA procedures. The situation needs review and stricter control.

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1. Introduction.

The Mogol River rises in the bushveld basin, approximately 25km to the west of Nylstroom and flows northwards for approximately 200 km before joining the Limpopo River. The lower catchment is dominated by game farming, while the upper catchment is dominated by irrigated agriculture.

Important, perennial tributaries to the Mogol include the Sterkstroom, Taaibosspruit, Frikkies se loop, Loubadspruit, Sand, Klein Sand, Rietspruit and Dwars Rivers.

Only one large dam, the Mokolo Dam, occurs in the Catchment. Flow below the Mokolo Dam is regulated and here the system experiences periodic pulses of flow throughout the year. Upstream of Mokolo Dam, the system is considered to be perennial, although in recent times the main river is becoming more seasonal in nature.

The Mogol River below the Mokolo Dam is heavily infested with the common reed, *Phragmites mauritianus*. The reed is thought to be affecting releases of water from the Mokolo Dam and as a result, there have been numerous attempts to eradicate the reeds through the aerial spraying of herbicides. This activity gave rise to concerns in the Department of Environmental Affairs and as a result, the river was prioritized for an ecological assessment during the 2002 period.

A systematic biomonitoring survey of perennial rivers of the Mogol Catchment was undertaken between May and September 2002. A total of 30 sites were surveyed during this period. All sites were assessed for fish, invertebrates, riparian vegetation and geomorphology. In situ water quality was also recorded. In each case, River Health Programme (RHP) monitoring protocols were followed closely and results are presented in this report.

At the time of the survey, the river was not flowing in its lower reaches near the Limpopo confluence. A monitoring site (no 31) was identified in this region but could not be surveyed.

A second report, the "Mogol River Site Inventory Report" provides up to date information pertaining to the monitoring sites used during the 2002 survey. This report is standardized against a template which has been published through the River Health Programme series. The report is intended to be carried into the field during future surveys, so that repeat surveys can be undertaken at exactly the same localities, with similar monitoring effort. Additional important information is supplied, for reference in future surveys.

It should be noted that monitoring records for all disciplines are sparse within this catchment. Although some fish survey records do exist, none of these records can be attributed to those specific sites chosen for this survey. Accordingly, those historical records which do exist, have value for interpretation of results, but have little value for the future of this "site based" monitoring programme.

The 2002 survey, together with the compilation of the technical report and site inventory report has been undertaken as a capacity building exercise. In addition,

there has been little information against which interpretation of results can be made. While every effort has been made to standardize methodologies in the compilation of these reports, it should be noted that some components of this study are highly subjective. Results of the survey should therefore be regarded with ***Moderate Confidence***.

Note. This report has been edited and compiled by M. K. Angliss (DFED) but with contributions from the following authors. Contributing reports have all been edited to provide a logical progression through the main report.

Fish	S. Rodgers (DFED)
Riparian vegetation	P. Fouche (Riparian monitoring CC)
Geomorphology	L. du Preeze (Rhodes University)
Graphics	P.J. Fouche (DFED)
All other sections	M.K. Angliss

NOTE: It is recognized that the Mogol River has recently been renamed as the Mokolo River (e.g. recent 1:50,000 maps). However historical data sets all refer to the old name of the "Mogol" and as such the original name has been used throughout this report. Mogol may therefore be replaced by Mokolo wherever the old name occurs.

2. The study area.

The study area lies within the Mogol Tertiary Catchment A42. The catchment has a gross area of 8395km^2 and a mean annual runoff (net) of 312.3 (10^6m^3) (Midgely et al. 1994)

Rainfall. (from Midgely et al. 1994)
Rainfall (Mean annual precipiotation (MAP)) varies between 700mm in the Waterberg to 400mm in the Limpopo Plain. The mean annual precipitation is 558mm.

Temperatures. (from Midgely et al. 1994)
Mean annual temperatures range between 14degrees in the South and 22 degrees in the North.

Vegetation. (from Acocks)
The catchment is dominated by Mixed Bushveld and Sour Bushveld. In the Limpopo Plain, Arid Sweet Bushveld occurs while pockets of North-Eastern Mountain Sourveld occur in higher lying areas to the south of the catchment.

Geology.
Most of the upper and middle catchment is comprised of conglomerates of the Waterberg Group and Glentig Formation (porous unconsolidated and consolidated sedimentary strata). In the Limpopo Plain, the river also traverses sandstones of the Undifferentiated Karoo Sequence (intercalated arenaceous and argillaceous strata) and Migmatites of the Limpopo Mobile Belt (undifferentiated assemblage of compact sedimentary extrusive and intrusive rocks).

Land use.

The catchment is dominated by agriculture and game farming. The only towns of significance are Ellisras, Alma, Marken and Vaalwater.

Economy.

3. Ecoregions.

The Institute for Water Quality Studies (IWQS), a section of the Department of Water Affairs and Forestry, published a Preliminary Level 1 River Ecoregion Classification System for South Africa (Kleynhans, CJ, et al., 2002). Level 1 ecoregions were delineated in this document. The ecoregions are determined through an assessment of dominant physical and biological characteristics. Level 2 ecoregion classification was done using the same parameters but using more detail.

Ecoregion 2.05, 2.04 and 2.03: Central Highlands:

The Sand River forms the upper part of the Mogol River and is located in a large flattish valley surrounded by hills. A number of streams flow through steep rocky areas in the mountainous sections. The Mogol flows out of this region into a section of the Limpopo Plain through a relatively steep sided gorge. It leaves this area at the inflow of the Mokolo Dam. The area from this point again falls within the Central Highlands. The Mogol River flows through the central highlands until the confluence with the Rietspruit. The area is characterized by Waterberg Moist Mountain Bushveld (Low and Rebelo, 1996). Altitude varies between 1200 meters and 1600 meters and rainfall varies between 400 and 600 mm. per annum. Mean annual temperatures vary from 16° C to 20° C.

Ecoregion 1.05 and 1.03: Limpopo Plain:

The Mogol River flows through a section of the Limpopo Plain between the gorge south of Vaalwater and the inflow of the Mogol Dam. It again enters the Limpopo Plain at the junction between the Mogol River and the Rietspruit and continues down the Limpopo valley. The area is characterized mainly by flat plains with a low gradient. This area falls mainly in the Sweet Bushveld (Low and Rebelo, 1996). Altitude varies between 780 m and 1100 m. Rainfall varies between 300 and 400 mm per annum. Mean annual temperatures vary from 20° C to 22° C.

Figure 1. **Ecoregions (level 1 and 2) and monitoring sites of the Mogol River Catchment. Ecoregion shape files as supplied by DWAF 2002. Map design by P. Fouche.**

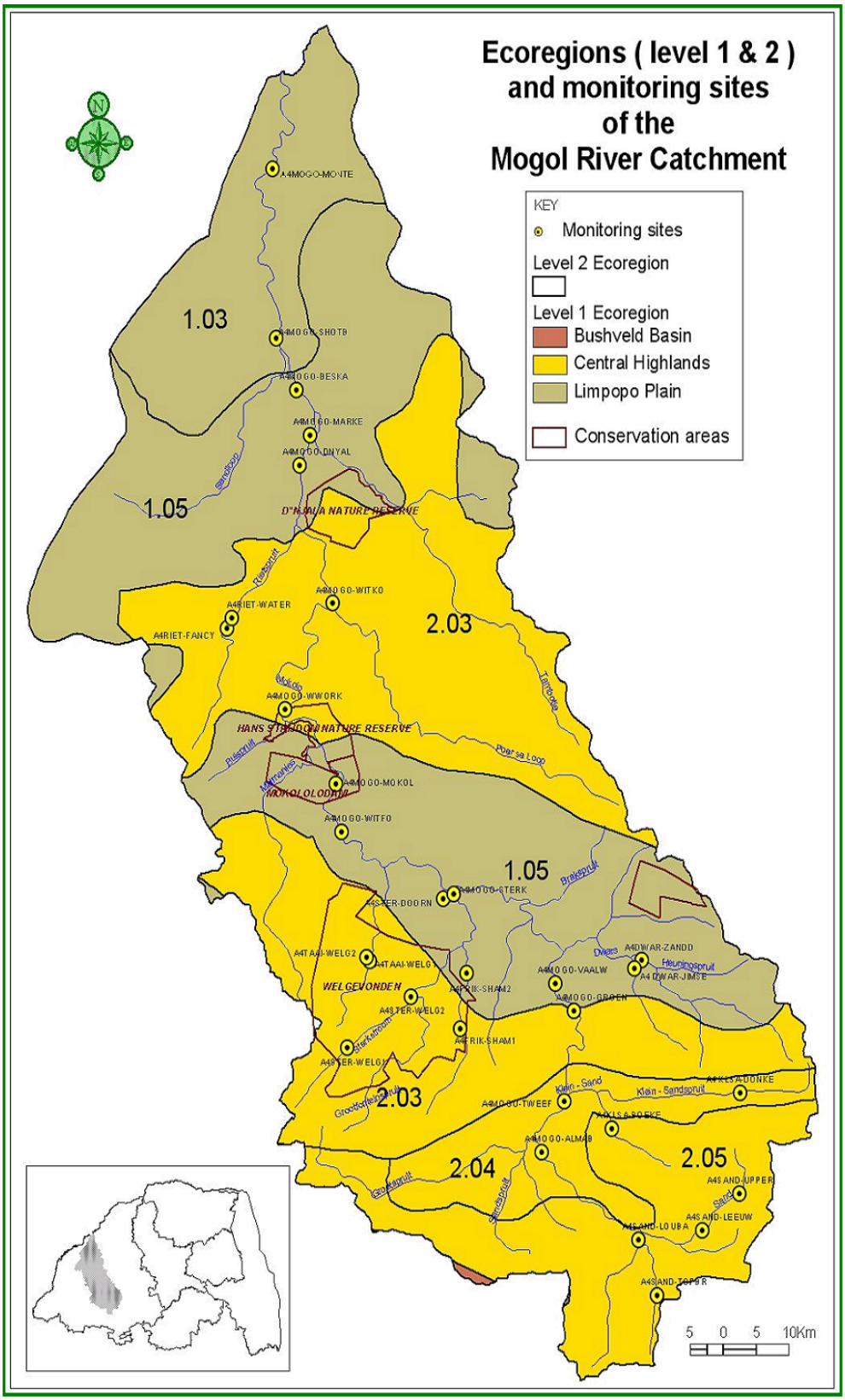


Table 1. Names, locations and eco-regions of all monitoring sites occurring within the study area.

Report No	RHP site Reference	ALT (m)	Ecoregion	River	Stream	Site Name	Date surveyed	Lat Degrees (S)	Long Degrees (E)
1	A4SAND-UPPER	1440	2.05	Mogol		Sand upper site	28.08.2002	-24.5345	28.34305
2	A4SAND-LEEUW	1350	2.05	Mogol	Sand Trib.	Leeuwenhof Lodge Bridge	28.08.2002	-24.57706667	28.29251667
3	A4SAND-TOPBR	1350	2.05	Mogol	Sand (trb. Of Loubad)	Top Bridge	29.08.2002	-24.65283333	28.2307
4	A4SAND-LOUBA	1280	2.05	Mogol	Loubad	Road/Rail Bridge	27.08.2002	-24.58778333	28.20521667
5	A4KLSA-BOEKE	1180	2.05	Mogol	Sand	Turn off to Melkrivier	28.08.2002	-24.45888333	28.16963333
6	A4MOGO-ALMAB	1160	2.04	Mogol	Sand	Alma Bridge	28.08.2002	-24.48591667	28.0737
7	A4MOGO-TWEEF	1200	2.04	Mogol	Mogol	Tweefontein Bridge	05.09.2002	-24.42723333	28.1047
8	A4 KLSA-DONKE	1255	2.04	Mogol	Klein Sand	Klein Sand	29.08.2002	-24.41713333	28.34366667
9	A4STER-WELG1	1305	2.03	Mogol	Sterkstroom	Broken bridge	25.06.2002	-24.36445	27.80961667
10	A4STER-WELG2	1200	2.03	Mogol	Sterkstroom	Grootfontein Junction	25.06.2002	-24.30571667	27.8971
11	A4TAAI-WELG1	1200	2.03	Mogol	Taaibosspruit	Monitor Bridge	27.06.2002	-24.26356	27.84038333
12	A4TAAI-WELG2	1190	2.03	Mogol	Taaibosspruit	Second Bridge	27.06.2002	-24.25918333	27.83663333
13	A4FRIK-SHAM1	1280	2.03	Mogol	Frikkie's loop	Frikkies top bridge	26.06.2002	-24.3425	27.96355
14	A4MOGO-GROEN	1150	2.03	Mogol	Mogol	Bridge upstream of Vaalwater	29.08.2002	-24.32148333	28.11745
15	A4MOGO-WWORK	860	2.03	Mogol	Mogol	Mokolo Dam Waterworks	28.05.2002	-23.97066667	27.72595
16	A4MOGO-WITKO	840	2.03	Mogol	Mogol	Witkop Causeway	29.05.2002	-23.84773333	27.79033333
17	A4RIET-FANCY	900	2.03	Mogol	Rietspruit	Rietspruit (3) Fancy	28.05.2002	-23.87706667	27.6463
18	A4RIET-WATER	890	2.03	Mogol	Rietspruit	Rietspruit (4) Waterfall	29.05.2002	-23.86486667	27.65303333
19	A4DWAR-ZANDD	1195	1.05	Mogol	Dwars	Dwars1	27.08.2002	-24.26293333	28.2103
20	A4 DWAR-JIMSE	1200	1.05	Mogol	Dwars	Jim se Loop	06.09.2002	-24.27183333	28.1997
21	A4MOGO-VAALW	1135	1.05	Mogol	Mogol	Vaalwater Sewage	30.08.2002	-24.28936667	28.0924
22	A4FRIK-SHAM2	1150	1.05	Mogol	Frikkie's loop	Welgefonden camp/fence	26..06.2002	-24.2779	27.97196667
23	A4STER-DOORN	1015	1.05	Mogol	Sterkstroom	Low Mogol Bridge	26.08.2002	-24.1915	27.9404
24	A4MOGO-STERK	1010	1.05	Mogol	Mogol	Sterkstroom Junction	27.08.2002	-24.1861	27.9547

Report No	RHP site Reference	ALT (m)	Ecoregion	River	Stream	Site Name	Date surveyed	Lat Degrees (S)	Long Degrees (E)
25	A4MOGO-WITFO	950	1.05	Mogol	Mogol	Witfontein Bridge	05.09.2002	-24.1137	27.80235
26	A4MOGO-MOKOL	915	1.05	Mogol	Mogol	Mokolo Reserve	04.09.2002	-24.05798333	27.79485
27	A4MOGO-DNYAL	818	1.05	Mogol	Mogol	D'Nyala Bridge	27.05.2002	-23.68746667	27.74556667
28	A4MOGO-MARKE	818	1.05	Mogol	Mogol	Marken Bridge	31.05 2002	-23.65215	27.75973333
29	A4MOGO-BESKA	815	1.05	Mogol	Mogol	Beska Bridge	30.05.2002	-23.5999	27.74105
30	A4MOGO-SHOTB	810	1.05	Mogol	Mogol	Shotbelt (below angling club)	30.05 2002	-23.53935	27.714
31	A4MOGO-MONTE	795	1.03	Mogol	Mogol	Monte Christo Bridge	Not surveyed	-23.36833333	27.69583333

4. Geomorphological zonation of the Mogol River Catchment.

Geomorphology is one of several components used to assess the overall condition of a site. Commonly applied components include invertebrates, fish, riparian vegetation, habitat integrity, water quality, hydrology and geomorphology. Invertebrates, fish and vegetation together give a good picture of the ecological integrity of a site and reflect the condition of the bio-physical habitat, which are described by the remaining components, habitat integrity, water quality, hydrology and geomorphology. Changes to the stream biota must therefore be assessed against a background of possible changes to channel morphology and channel condition. (Rowntree and Ziervogel; 1999)

Rowntree and Wadeson (1999) developed a template which allows one to describe the longitudinal zone through the evaluation of valley form, gradient and characteristic channel features (Table 2).

This classification system may provide a more detailed evaluation of the river than can be obtained from examining eco-region level 2 maps. There should however be considerable correlation between the two.

The 2002 study was coordinated with Rhodes University to provide an opportunity to test geomorphological categorizations which are in development. A student, Miss Leanne du Preeze was in attendance during some of the site investigations and has subsequently submitted a report which is attached below.

Table 2. Geomorphological zonation of river channels (after Rowntree and Wadeson, 1999).

Longitudinal Zone	Macro-reach characteristics			Characteristic channel features
	Valley form	Gradient class	Zone class	
A. Zonation associated with a "normal" profile.				
Source zone	V10	not specified	S	Low gradient, upland plateau or upland basin able to store water. Spongy or peaty hydromorphic soils.
Mountain headwater stream	V1, V3	>0.1	A	A very steep gradient stream dominated by vertical flow over bedrock with waterfalls and plunge pools. Normally first or second order. Reach types include bedrock fall and cascades.
Mountain stream	V1, V3	0.04 - 0.99	B	Steep gradient stream dominated by bedrock and boulders, locally cobble or coarse gravel in pools. Reach types include cascades, bedrock fall, step-pool. Approximate equal distribution of "vertical" and "horizontal" flow components.

Longitudinal Zone	Macro-reach characteristics			Characteristic channel features
	Valley form	Gradient class	Zone class	
Transitional	V2, V3, V4, V6	0.02 - 0.039	C	Moderately steep stream dominated by bedrock or boulder. Reach types include plain-bed, pool-rapid or pool-riffle. Confined or semi-confined valley floor with limited flood plain development.
Upper foothills	V4, V6	0.005 - 0.019	D	Moderately steep, cobble-bed or mixed bedrock-cobble bed channel, with plain-bed, pool-riffle or pool-rapid reach types. Length of pools and riffles/rapids similar. Narrow flood plain of sand, gravel or cobble often present.
Lower foothills	V8, V10	0.001 - 0.005	E	Lower gradient mixed bed alluvial channel with sand and gravel dominating the bed, locally may be bedrock controlled. Reach types typically include pool-riffle or pool-rapid, sand bars common in pools. Pools of significantly greater extent than rapids or riffles. Flood plain often present.
Lowland river	V4, V8, V10	0.0001 - 0.001	F	Low gradient alluvial fine bed channel, typically regime reach type. May be confined, but fully developed meandering pattern within a distinct flood plain develops in unconfined reaches where there is an increased silt content in bed or banks.
B. Additional zones associated with a rejuvenated profile.				
Rejuvenated bedrock fall/ cascades	V1, V4	>0.02	A/B/ Cr	Moderate to steep gradient, confined channel (gorge) resulting from uplift in the middle to lower reaches of the long profile, limited lateral development of alluvial features, reach types include bedrock fall, cascades and pool rapid.
Rejuvenated foothills	V2, V3, V4, V6	0.001 - 0.02	D/Er	Steepened section within middle reaches of the river caused by uplift, often within or downstream of a gorge. Characteristics similar to foothills (gravel/cobble-bed rivers with pool-riffle / pool-rapid morphology) but of a higher order. A compound channel is often present with an active channel contained within a macro-channel activated only during infrequent flood events. A limited flood plain may be present between the active and macro-channel
Upland flood plain	V8, V10	<0.005	Fr	An upland low gradient channel, often associated with uplift plateau areas as occur beneath the eastern escarpment.

A Geomorphological Overview of the River Health Program Survey Undertaken for the Mogol River System, Limpopo Province, South Africa

Leanne du Preez
Rhodes University

A. Geomorphological Zonation of the Main Stream.

A long profile of the main river channel has been constructed (see Figure 2). According to gradients calculated along this profile, the river has been zoned according to the classification system proposed by Rowntree *et al.* (2000). This zonation process has revealed that approximately the upper two-thirds of the main stream, except for two very short sections, may be placed into zone class 'E' which represents lower foothill river reaches (see Table 3). Two of the RHP sites selected for this main channel (sites 1 and 2 described in section C) are located within the 'E' zone class. Channels which fall into this category have been summarized in Rowntree *et al.* (2000) as having the following characteristics :-

- Lower gradient mixed bed alluvial channels with sand and gravel dominating the bed, though local bedrock control may be present
- Reach types typically include pool-riffle or pool-rapid
- Sand bars common in pools
- Pools of significantly greater extent than rapids or riffles
- Flood plain often present

Figure 2. Long Profile of the Mogol River.

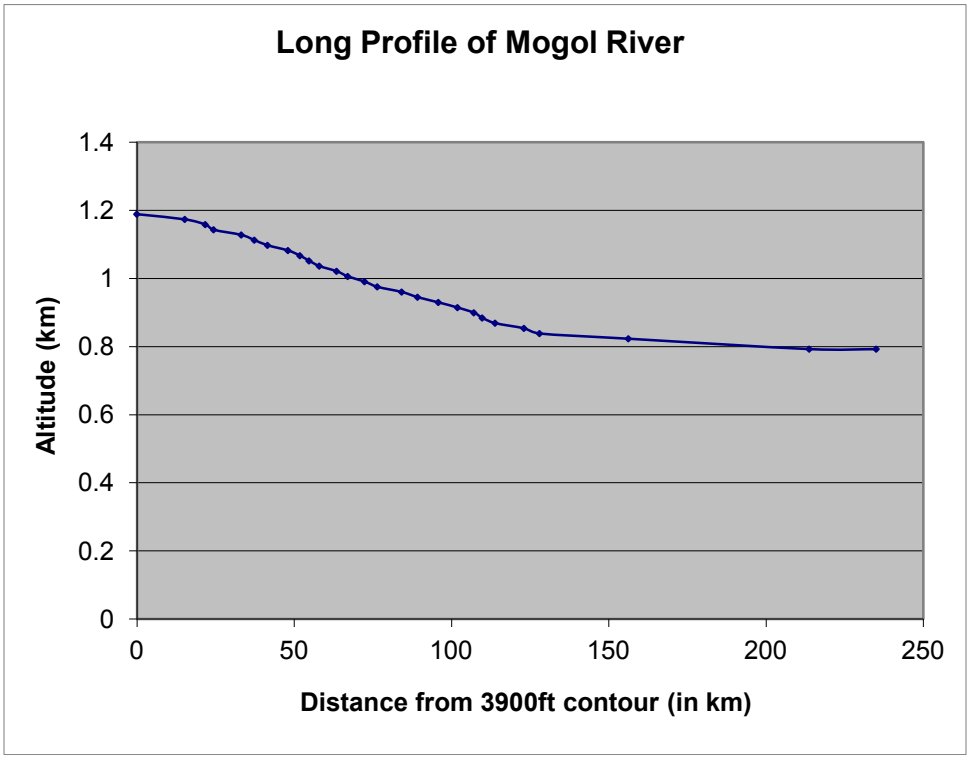


Table 3. Gradient and zone class of the Mogol River, derived from the long profile.

Cumulative distance from start of Mokolo profile	Length of section (km)	Gradient	Zone Class
15.25	15.25	0.0010	E
21.75	6.5	0.0023	E
24.4	2.65	0.0058	D
33.2	8.8	0.0017	E
37.35	4.15	0.0037	E
41.55	4.2	0.0036	E
48.05	6.5	0.0023	E
51.85	3.8	0.0040	E
54.75	2.9	0.0053	E
58	3.25	0.0047	E
63.5	5.5	0.0028	E
67.05	3.55	0.0043	E
72.4	5.35	0.0028	E
76.45	4.05	0.0038	E
84.2	7.75	0.0020	E
89.25	5.05	0.0030	E
95.85	6.6	0.0023	E
101.95	6.1	0.0025	E
107.15	5.2	0.0029	E
109.8	2.65	0.0058	D

Cumulative distance from start of Mokolo profile	Length of section (km)	Gradient	Zone Class
113.9	4.1	0.0037	E
123.075	9.175	0.0017	E
128.025	4.95	0.0031	E
156.275	28.25	0.0005	F
213.775	57.5	0.0005	F
235.075	21.3	0.0000	F

The remaining lower one-third of the channel may be classified as falling into the 'F' zone class which represents lowland river channels. Five RHP sites (sites 3 to 7 described in section C) are located within this geomorphological zone The expected characteristics of this class according to Rowntree et al. are as follows :-

- Low gradient alluvial fine bed channels
- Typically regime reach type
- May be confined
- In unconfined reaches where there is an increased silt content in bed or banks, a fully developed meandering pattern within a distinct flood plain develops

B. Geomorphological Zonation of Sites on Tributaries.

Complete long profiles have not been constructed for the seven tributaries and sub-tributaries on which monitoring sites are situated. However, gradient classes have been calculated for each of the sites in order that they may be classified into zones according to the classification system of Rowntree *et al.* (2000). This zonation is presented in Table 4.

Table 4. Zonation of sites surveyed on tributaries.

Site	Gradient	Zone Class
Site 1 : Tributary to the Sand – A4SAND-LEEUW	0.0092	D (upper foothills)
Site 2 : Tributary to the Sand – A4KLSA-DONKE	0.0762	B (mountain stream)
Site 3 : Mogol (Sand) A4MOGO-ALMAB	0.0020	E (lower foothills)
Site 4 : Sterkstroom at Broken Bridge – A4 STER-WELG1	0.0109	D (upper foothills)
Site 5 : Sterkstroom at Groot Junction – A4 STER-WELG2	0.0091	D (upper foothills)
Site 6 : Frikkiesloop at Top Bridge – A4 FRIK-SHAM1	0.0145	D (upper foothills)
Site 7 : Frikkiesloop at WelgevondenCamp – A4 FRIK-SHAM2	0.0131	D (upper foothills)
Site 8 : Taaibosspruit – A4 TAAI-WELG1	0.0160	D (upper foothills)
Site 9 : Taaibosspruit – A4 TAAI-WELG2	0.0160	D (upper foothills)
Site 10 : Rietspruit – A4 RIET-FANCY	0.0095	D (upper foothills)
Site 11 : Rietspruit (4) Bridge – A4 RIET-WATER	0.0095	D (upper foothills)

Expected channel characteristics for channels in these classes according to Rowntree *et al.* (2000) are as follows :-

'B' (mountain stream zones)

- Steep gradient streams dominated by bedrock and boulders

- Local dominance of cobble or coarse gravel in pools
- Reach types include cascades, bedrock fall and step pool
- Approximate equal distribution of "vertical" and "horizontal" flow components

'D' (upper foothill zones)

- Moderately steep, cobble-bed or mixed bedrock-cobble bed channel
- Plane bed, pool-riffle or pool-rapid reach types
- Length of pools and riffles/rapids similar
- Narrow flood plain of sand, gravel or cobble often present

'E' (lower foothill zones)

- see section A

C. Geomorphological Status of selected RHP Sites on the Main Channel (moving in a downstream direction)

According to the extent of the geomorphological effects of human impacts on a river system, a site assessed may be placed within an impact class ranging from 'A' to 'F' as the perceived geomorphological "health" of the river decreases (Rowntree, *pers. comm*.). The definitions of these impact classes are presented in Table 5. In this section of the report, for each site assessed, a brief summary is given along with site details and the site's impact class.

Table 5. Geomorphological Impact Classes.

CLASS	**Geomorphological change**	**Anthropogenic Indicators**
A: unmodified natural	no changes, erosion and deposition within reach are in balance	No human impacts identified in the catchment
B: largely natural	short term changes that can be reset within the frequency of the 'bankfull' flood.	Human impacts identified, but no clear evidence of channel response
C: moderately modified	slow trajectory of change, can be reset within five to ten 'bank full' events by restoring natural flow/ sediment regime and bank stability	Significant human impacts, changes to bed structure evident, localized bank erosion and channel widening, or deposition and narrowing. Changes reversible in the short term.

CLASS	Geomorphological change	Anthropogenic Indicators
D: largely modified	well into the trajectory of change, may be difficult to restore natural conditions; river adjusting its form to the current sediment load and flow regime.	Major human impacts resulting in significant long term changes to channel geometry, pattern or reach type that may be irreversible.
E: seriously modified	engineering intervention required for rehabilitation	Channel structure largely engineered, but bed perimeter includes some natural materials that can be worked by fluvial processes (includes gabions, engineered bank stabilization, channel straightening or re-alignment, bulldozing.
F: critically modified	major engineering intervention required for rehabilitation	Totally engineered channel, no natural material in the channel perimeter

SITE 1 : A4MOGO-STERK

Latitude : 24.19ºS (approx.)
Longitude : 27.94167ºE (approx.)
Map : 2427BB
Quaternary Catchment : A42F
Lithology (WR90) : Porous unconsolidated and consolidated sedimentary strata
Site summary : This is a mixed channel section with bed material consisting predominantly of large, tightly packed and moderately embedded cobbles. The reach is classified as pool-riffle and numerous sand/gravel bars are present in the reach. These are expected attributes of a zone 'E' river. Bank stability on the left and right is considered to be moderate with slight fluvial bank erosion having been noted on both banks. The site is located in close proximity to the confluence of the Mogol and Sterkstroom rivers which has resulted in complex geomorphological processes in the reach, e.g. overbank deposition in the riparian area between the two rivers. Impacts noted in the reach include a few causeways and a moderate amount of alien vegetation present in the riparian zone. It is suspected that nutrient enrichment may have resulted in dense reed sections found at the site, which have necessitated the formation of micro channels within them. These reed sections seem to alter the natural flow and sediment transportation regimes within the reach.

Impact Class : B/C

Site 2 : A4 MOGO-WWORK

Latitude : 23.970667ºS

Longitude : 27.72595ºE
Map : 2327 DC
Quaternary Catchment : A42G
Lithology (WR90) : Porous unconsolidated and consolidated sedimentary strata
Site summary : This site is located on a mixed channel section which has been classified as having a pool-rapid morphology. The dominant bed material is cobble. Impacts noted along this reach include a causeway, a bridge, a weir, a pump, invasive vegetation, vegetation clearance, footpaths and impacts due to domestic animals. Bank stability is identified as being low, though there is bedrock present on the left hand bank. There is more fluvial bank erosion on the right hand bank than on the left. Habitat diversity is reasonably high.

Impact Class : C

Site 3 : A4 MOGO-WITKO

Latitude : 23.8477333ºS
Longitude : 27.790333ºE
Map : 2327 DD
Quaternary Catchment : A42G
Lithology (WR90) : Porous unconsolidated and consolidated sedimentary strata
Site summary : This site has been classified as alluvial and as having a pool-riffle morphology. The dominant bed material is sand. Identified impacts include a causeway, a water abstraction pump, domestic animals and footpaths. Bank stability has been classified as low on both banks and slight fluvial erosion as well as limited sub-aerial erosion has been noted. Habitat diversity is moderate.

Impact Class : B/C

Site 4 : A4 MOGO-DNYAL

Latitude : 23.687467ºS
Longitude : 27.745567ºE
Map : 2327 DA
Quaternary Catchment : A42H
Lithology (WR90) : Porous unconsolidated and consolidated sedimentary strata
Site summary : The site is located on an alluvial, pool-riffle section with sand as the dominant bed material. Impacts noted on this reach include a bridge, a pump and mining as well as animals, footpaths, vegetation clearance and invasive vegetation. All of these have the potential to alter natural sediment and flow regimes. Bank stability is low and moderate fluvial bank erosion has been noted on both banks. Habitat diversity is higher than at site 3 above.

Impact Class : B/C

Site 5 : A4 MOGO-MARKE

Latitude : 23.65215ºS
Longitude : 27.7597333ºE
Map : 2327 DB
Quaternary Catchment : A42H
Lithology (WR90) : Intercalcated arenaceous and argillaceous strata
Site summary : This site is located on an alluvial pool-riffle section with sand as the dominant bed material. Impacts noted include a bridge, a pump, mining activity, animals, footpaths and vegetation clearance. Bank stability is low with slight fluvial erosion having been noted on the left and right hand banks. Limited rilling and livestock tracks are also present on both banks. Habitat diversity is high whilst habitat cover is low.

Impact Class : C

Site 6 : A4 MOGO-BESKA

Latitude : 23.5999ºS
Longitude : 27.74105ºE
Map : 2327 DA
Quaternary Catchmen t : A42J
Lithology (WR90) : Intercalcated arenaceous and argillaceous strata
Site summary : The site is located in an alluvial pool-riffle reach with sand as the dominant bed material. Channel modifications include a bridge, a pump and channelization along with animals and footpaths. Bank stability is low with slight fluvial erosion having been noted on the left and right hand banks. Limited rilling and livestock tracks are also present on both banks. Habitat diversity is moderate, as is habitat cover.

Impact Class : C

Site 7 : A4 MOGO-SHOTB

Latitude : 23.53935ºS
Longitude : 27.714ºE
Map : 2327 DA
Quaternary Catchment : A42J
Lithology (WR90) : Intercalcated arenaceous and argillaceous strata
Site summary : This site falls within an alluvial regime reach. Sand is the dominant bed material. Bank stability on the left and right hand banks is classified as high with only slight fluvial erosion having been noted on both banks. Habitat diversity is high while habitat cover is low. The processes operating at the site are very complex largely due to the modification of the natural flow regime as a result of timed releases from the upstream Mokolo Dam. These releases have resulted in a naturally "unstable" channel becoming artificially stabilized. Other impacts noted in the reach include a small amount of sediment extraction and causeways, although these are few.

Impact Class : D

D. Geomorphological Status of RHP Sites on Selected Tributaries to the Main Channel

SITE 1 : A4SAND-LEEUW

Latitude : 24.57783ºS
Longitude : 28.29183ºE
Map : 2428 CB
Quaternary Catchment : A42A
Lithology (WR90) : Porous unconsolidated and consolidated sedimentary strata
Site summary : This site is a steep, bedrock dominated mountain stream which has been classified as a cascade system on grounds of the step and pool units found within it. The stability of both banks is high due to bedrock dominance. Both habitat diversity and habitat cover are high. The stream may be considered as being confined. All in all this is a reach which, geomorphologically, is relatively resistant to change, although certain impacts and their effects are evident in the reach. These include the presence of many alien trees in the riparian zone which has resulted in snags in the system. There is also slight channel encroachment by reeds evident in pool sections. However, it is expected that these will be removed during flood events. Other impacts which may have an impact on this reach are an upstream dam, a few storage weirs and causeways, recent removal of alien vegetation from the riparian zone and some sediment sources as a result of paths and tracks.

Impact Class : C

Site 2 : A4SAND-DONKE

Latitude : 24.534ºS
Longitude : 28.3433ºE
Map : 2428 CB
Quaternary Catchment : A42A
Lithology (WR90) : Acid and intermediate lavas
Site summary : This site is located in an alluvial reach section with gravel as the dominant bed material. The reach type has been classified as "pool-riffle". Stability of both banks is low with extensive fluvial erosion and limited sub-aerial erosion having been noted. Habitat diversity is low and habitat cover is moderate. This section represents an incising meandering channel. Localized bank protection structures in the form of gabions have been introduced to the system. Downstream of the site, there is a poplar plantation, and it is interesting to note that beyond this, the reach type changes to a mixed bedrock rapid system. Other impacts in this reach include a few storage weirs and causeways, alien vegetation in the riparian zone and some sediment sources related to human activity.

Impact Class : D

SITE 3 : A4MOGO-ALMAB

Latitude : 24.487778ºS
Longitude : 28.07833ºE
Map : 2428 AC
Quaternary Catchment : A42A
Lithology (WR90) : Porous unconsolidated and consolidated sedimentary strata
Site summary : This site is located within a mixed pool-rapid reach. The dominant bed material is sand. Stability of both banks is classified as moderate, and moderate fluvial bank erosion is evident. Habitat diversity is moderate, as is habitat cover. Within the reach, there has been extensive destabilization by willow trees. Alien vegetation has also resulted in the presence of large woody debris (LWD) in the channel. There is evidence of channel shifting in the reach and there is a high level of local erosion at the hydraulic control. Other impacts include many storage weirs, frequent causeways and recent removal of alien vegetation from the riparian zone.

Impact Class : D

Site 4 : A4 STER-WELG1

Latitude : 24.36445ºS
Longitude : 27.8096166ºE
Map : 2427 BD
Quaternary Catchment : A42D
Lithology (WR90) : Porous unconsolidated and consolidated sedimentary strata
Site summary : This site is in a mixed pool-rapid channel section. The dominant bed materials are bedrock and boulder. Stability of the left and right hand banks is low and slight fluvial bank erosion is evident. Habitat diversity is moderate to high, and habitat cover is moderate. Channel modifications include a bridge and associated local erosion.

Impact Class : B

Site 5 : A4 STER-WELG2

Latitude : 24.3057166ºS
Longitude : 27.8971ºE
Map : 2427 BD
Quaternary Catchment : A42D
Lithology (WR90) : Porous unconsolidated and consolidated sedimentary strata
Site summary : This site is located in a mixed, pool-rapid channel section. The dominant bed materials are bedrock and boulder. Stability of the left and right hand banks is low and slight fluvial bank erosion is evident. Habitat diversity is moderate to high, and habitat cover is moderate. Channel modifications include a causeway and a weir, as well as footpaths and invasive vegetation.

Impact Class : B

Site 6 : A4 FRIK-SHAM1

Latitude : 24.3425ºS
Longitude : 27.96355ºE
Map : 2427 BD
Quaternary Catchment : A42D
Lithology (WR90) : Porous unconsolidated and consolidated sedimentary strata
Site summary : This site is located in a mixed, pool-rapid channel section. The dominant bed materials are bedrock and boulder. Stability of the left and right hand banks is low and slight fluvial as well as sub-aerial bank erosion is evident. Habitat diversity and habitat cover are moderate. Impacts noted in the reach include a bridge and a weir.

Impact Class : B

Site 7 : A4 FRIK-SHAM2

Latitude : 24.2779ºS
Longitude : 27.971967ºE
Map : 2427 BD
Quaternary Catchment : A42D
Lithology (WR90) : Porous unconsolidated and consolidated sedimentary strata
Site summary : The site is located in a mixed pool-rapid system. The dominant bed materials are bedrock, boulder and sand. Stability of both banks is low, though there is more evidence of both fluvial and sub-aerial erosion on the right hand bank than on the left. Habitat diversity is moderate to high, whilst habitat cover is high. Channel and bank modifications include a causeway, a bridge, a weir, a pump, footpaths and vegetation clearance.

Impact Class : C

Site 8 : A4 TAAI-WELG1

Latitude : 24.26355ºS
Longitude : 27.8403833ºE
Map : 2427 BD
Quaternary Catchment : A42F
Lithology (WR90) : Porous unconsolidated and consolidated sedimentary strata
Site summary : The site is located in a mixed pool-rapid system. The dominant bed materials are bedrock and moderately packed and embedded cobble. Stability of both banks is low, with slight fluvial bank erosion having been noted. Habitat diversity and habitat cover are high. Impacts noted in the reach include a causeway, a bridge and footpaths.

Impact Class : B

Site 9 : A4 TAAI-WELG2

Latitude : 24.2591833ºS
Longitude : 27.8366333ºE
Map : 2427 BD
Quaternary Catchment : A42F
Lithology (WR90) : Porous unconsolidated and consolidated sedimentary strata
Site summary : This site falls within a mixed pool-rapid reach with bedrock and sand as dominant bed materials. Stability of both banks is considered to be low. Slight fluvial erosion is noted on both banks. There is evidence of limited sub-aerial erosion on the left hand bank. Habitat diversity is moderate to high and habitat cover is high. Channel modifications include a bridge and footpaths.

Impact Class : B

SITE 10 : A4 RIET-FANCY

Latitude : 23.877067º S
Longitude : 27.6463ºE
Map : 2327 DC Afguns
Quaternary Catchment : A42G
Lithology (WR90) : Porous unconsolidated and consolidated sedimentary strata
Site summary : The site is located in a mixed pool-rapid reach. Dominant bed material is tightly packed, moderately embedded cobble. Bank stability is classed as low, with slight fluvial erosion and limited sub-aerial erosion having been noted on both banks. Habitat diversity and habitat cover are both considered to be high. Channel modifications noted in the reach include a bridge, a weir, footpaths and vegetation clearance.

Impact class : B/C

SITE 11 : A4 RIET-WATER

Latitude : 23.864867º S
Longitude : 27.6530333ºE
Map : 2327 DC Afguns
Quaternary Catchment : A42G
Lithology (WR90) : Porous unconsolidated and consolidated sedimentary strata
Site summary : This site falls within a "mountain stream" zone. The channel type has been defined as "mixed", with bed material consisting predominantly of boulders and sand. The reach has been classified as a pool-rapid system. Bank stability is high and no erosion was evident on either of the banks. Habitat diversity is moderate and there is an abundance of habitat cover. The only impacts evident are a bridge with in-channel supports, though it is not considered to be a significant reach impact (ie. its effects are localized), and some invasive vegetation on the banks, though this is not seen as being geomorphologically significant at this stage.

Impact class : B

E. Summary

The Mogol River and its tributaries originate in a region of porous consolidated and unconsolidated sedimentary strata and then flow through a region of intercalated arenaceous and argillaceous strata before reaching the Limpopo River. All of the sites with the latter underlying lithology fall into the "lowland river" zone, whilst sites within the first geological region vary in their zonation between the "upper foothill" stream and the "lowland river". In terms of geomorphological "health, of the sites selected for this study, 33.3% are classified as "B" class rivers, 22.2% are on the boundary between the "B" and "C" classes, 27.8% are "C" class sites and the remaining 16.7% are "D" class sites. It should be noted that in terms of overall geomorphological impact, local disturbances such as causeways and weirs may have largely local impacts on geomorphological process. Thus, assessments carried out for sites disturbed by such impacts may not be representative of the entire reach within which the site is located.

5. In situ water quality.

Temperature, pH and conductivity were measured at each of the monitoring sites, using hand held instruments. Measurement of pH was erratic due to a faulty instrument.

Table 6. Temperatue, pH and conductivity recorded at each of the monitoring sites. Date and weather are also shown.

SITE NO	RHP CODE	DATE	PH	CONDUCTIVITY	TEMPERATURE	WEATHER
1	A4SAND-UPPER	28.08.2002		50	20	mild
2	A4SAND-LEEUW	28.08.2002		80	20	mild
3	A4SAND-TOPBR	29.08.2002		20	15	overcast rain
4	A4SAND-LOUBA	27.08.2002		50	20	overcast warm
5	A4KLSA-BOEKE	28.08.2002		70	21	mild
6	A4MOGO-ALMAB	28.08.2002		70	19	mild clear
7	A4MOGO-TWEEF	05.09.2002		60	20	hot clear
8	A4 KLSA-DONKE	29.08.2002		0	0	cool overcast
9	A4STER-WELG1	25.06.2002	8	10	16	mild clear
10	A4STER-WELG2	25.06.2002	8.7	10	11	mild clear
11	A4TAAI-WELG1	27.06.2002		10	10	hot clear
12	A4TAAI-WELG2	27.06.2002		10	11	hot clear
13	A4FRIK-SHAM1	26.06.2002	8.3	10	13	clear warm
14	A4MOGO-GROEN	29.08.2002		70	20	cool overcast
15	A4MOGO-WWORK	28.05.2002	8.1	50	19.5	overcast mild
16	A4MOGO-WITKO	29.05.2002	8	50	21	clear hot
17	A4RIET-FANCY	28.05.2002	8.1	40	21	Mild clear
18	A4RIET-WATER	29.05.2002	8	40	21	hot clear

SITE NO	RHP CODE	DATE	PH	CONDUCTIVITY	TEMPERATURE	WEATHER
19	A4DWAR-ZANDD	27.06.2002		100	28	hot clear
20	A4 DWAR-JIMSE	06.09.2002		50	16	cool overcast
21	A4MOGO-VAALW	30.08.2002		70	18	cool overcast
22	A4FRIK-SHAM2	26..06.2002	8.3	20	20	hot clear
23	A4STER-DOORN	26.08.2002		40	21	hot clear windy
24	A4MOGO-STERK	27.08.2002		80	22	cool overcast
25	A4MOGO-WITFO	05.09.2002		90	20	cool overcast
26	A4MOGO-MOKOL	04.09.2002		80	24	cool overcast
27	A4MOGO-DNYAL	27.05.2002	8.1	60	21	warm windy
28	A4MOGO-MARKE	31.05 2002	8.3	60	18	cool overcast
29	A4MOGO-BESKA	30.05.2002	7.8	70	18	clear hot
30	A4MOGO-SHOTB	30.05 2002	7.5	60	20	clear hot
31	A4MOGO-MONTE	Not surveyed				

6. Fish.

6.1 Fish monitoring methods.

Fish were gathered using the following techniques.

- Electro - shocking apparatus: a two to three man operation, whereby fish are stunned using AC electric current. The stunned fish are collected in hand held scoop nets positioned down stream. The method is suited to shallow (< 1m depth) swift flowing water over assorted substrates. Also useful around snags, undercut banks and in heavily vegetated but shallow pools.

- Seine net: a net measuring 15m length by 3.5m deep, with 12mm knotless nylon netting. The net is pulled through the water by 2 - 4 people, and fish are collected in a central bag. Suitable for deep pools that are clear of snags.

- Small seine net: a small piece of seine netting attached to two wooden poles. This two man net measures 2m by 1.5m deep, and again has 10 mm mesh. The net is useful for sampling in small pools, but is particularly designed for use under and amongst overhanging and marginal vegetation.

- Cast or throw net: a circular nylon net, 1.6m radius, with 12mm mesh size. Cast nets can be used by an individual in any habitat that is clear of snags and obstructions.

Most fish caught were identified at site and returned to the river alive. (A small number of fish from a few sites were kept for our reference collection of fish from the Mogol River Catchment.

When possible, individual fish were examined for parasite loads.

The habitat at the site was categorized, and where possible individual habitats sampled. The effort used to catch fish in each habitat at each site was recorded. However, in the upper catchment, the narrow channel of the river often resulted in efforts being combined for multiple habitats.

Fish habitat is categorized into four velocity depth classes, and allocated a subjective score based upon their abundance using a five-point scale. (Kleynhans 1997)

Fast Deep (F/D); Fast Shallow (F/S); Slow Deep (S/D); Slow Shallow (S/S)
(0=Absent; 1=Rare; 2=Sparse; 3=Moderate; 4=Extensive)

The same scale is utilized to assess the availability of cover types for each velocity depth class. Four cover types are assessed.
(Overhanging vegetation; Undercut bank and root wads; Substrate; Aquatic macrophytes).

Slow Deep Water = > 0.5 meters. Fast water = > 0.3 m/sec.
Fast Deep Water = > 0.3 meters.

Each site was subjected to exhaustive searches using the most appropriate collecting techniques, given the prevailing flow conditions. At all sites, multiple habitats were sampled. At all sites, habitats of similar velocity depth classes and cover types were sampled at different localities.

Table 7. Scientific, English, Afrikaans and abbreviated names for fish expected to occur within the Northern Province study area of the Mogol River Catchment. (Names from Skelton, 1993, 2001 and 2002)

Species	English Common Name	Afrikaans	ABB
Anguilla bengalensis labiata	African mottled eel	Afrika-bontpaling	Aben
Aplocheilichthys johnstoni	Johnston's topminnow	Johnston se lampogie	Ajoh
Anguilla mossambica	Longfin eel	Geelbek-paling	Amos
Amphilius uranoscopus	Common mountain catfish	Gewone bergbaber	Aura
Barbus annectens	Broadstriped barb	Breestreep-ghieliemientjie	Bann
Barbus bifrenatus	Hyphen barb	Skakel-ghieliemientjie	Bbif
Barbus brevipinnis	Shortfin barb	Kortvin-ghieliemientjie	Bbre
Barbus marequensis	Largescale yellowfish	Grootskub-geelvis	Bmar
Barbus paludinosus	Straightfin barb	Lynvin of Moeras-ghieliemientjie	Bpau
Barbus radiatus	Beira barb	Beira-ghieliemientjie	Brad
Barbus trimaculatus	Threespot barb	Driekol-ghieliemientjie	Btri
Barbus unitaeniatus	Longbeard barb	Longbaard-ghieliemientjie	Buni
Barbus viviparus	Bowstripe barb	Boogstreep-ghieliemientjie	Bviv
Chetia flaviventris	Canary Kurper	Kanariekurper	Cfla
Chiloglanis paratus	Sawfin rock catlet	Saagvin-suierbekkie	Cpar
Chiloglanis pretoriae	Shortspine suckermouth	Kortstekel-suierbekkie	Cpre
Clarias gariepinus	Sharptooth catfish	Sterkpandbaber	Cgar
Labeo cylindricus	Redeye labeo	Rooioog-moddervis	Lcyl
Labeo molybdinus	Leaden labeo	Loodvis	Lmol
Labeo rosae	Rednose labeo	Rooineus-moddervis	Lros
Labeo ruddi	Silver labeo	Silwer-moddervis	Lrud
Marcusenius macrolepidotus	Bulldog	Snawelvis	Mmac
Mesobola brevianalis	River sardine	Riviersardyn	Mbre
Micralestes acutidens	Silver robber	Silwer-rower	Macu
Oreochromis mossambicus	Mozambique tilapia	Bloukurper	Omos
Petrocephalus (catostoma) wesselsi (Skelton 2002)	Churchill	Stompkoppie	Pcat
Pseudocrenilabrus philander	Southern mouthbrooder	Suidelike mondbroeier	Pphi
Schilbe intermedius	Silver catfish	Silwerbaber	Sint
Synodontis zambezensis	Brown squeaker	Bruin skreeubaber	Szam
Tilapia rendalli	Redbreast tilapia	Rooiborskurper	Tren
Tilapia sparrmanii	Banded tilapia	Vleikurper	Tspa

6.2 Application of the Fish Assemblage Integrity Index (FAII) to determine the present ecological state of the fish communities of the Mogol River Catchment in the Northern Province study area. (Kleynhans; 1997) (RHP series)

Through professional judgment, a review of Table 7 and Appendix A (Catch data), allows one to reconstruct the hypothesised fish community for each of the ecoregions under natural conditions. (provided in Tables 10 and 11) Such a reconstruction takes into account the distribution of the species in other catchments, their habitat preferences, availability of habitats, and an assessment of the temperature and water quality tolerances of the species.

6.3 Calculation of the FAII.

The FAII is a function that compares the expected FAII scores to the observed. The observed FAII score is expressed as a percentage of the expected, to arrive at a relative FAII rating.

FAII(Relative) = FAII(obs)/FAII(exp) x 100

Where FAII(Exp) = T (A(exp)+F(exp)+H(exp))/3

And where FAII(obs) = T (A(obs)+F(obs)+H(obs))/3

T = Intolerance rating
A = Abundance
F= Frequency of occurrence
H= Health rating.

Dr. Kleynhans has developed a dedicated spreadsheet programme that calculates the FAII per segment, providing the following information is provided.

Manipulation of data, to provide the following information is attached as APPENDICES.

Intolerance: Contained within APPENDIX B and C.

The intolerance ratings are a combined assessment of the trophic specialisation of the species, its habitat specialisation, its sensitivity to water quality, and its dependence upon flowing water. Intolerance is rated on a 5-point scale, where 1 is a tolerant species, while 5 is an intolerant species.

Angliss, Kleynhans et al (1999) reviewed the intolerance (or sensitivity ratings) and cover preferences of each species of fish occurring within the country including the Mogol River. From this report, the sensitivity or intolerance scores for all of those fish expected from the Mogol Catchment may be extracted.

Abundance: Contained within APPENDIX A.

Observed abundance of each species is calculated by assessing the catch data for each site, to generate a standardized catch per unit effort for each species. Where more than one method was employed at the site, results are based upon the method yielding the highest result. Where more than one site exists in a segment, the CPUE is calculated by averaging that of the sites.

Expected abundance of species is estimated, based upon available information and professional judgment. In this regard, extensive catch data is available which allows the abundance factor to be used with confidence.

A standard Electro shocking effort = 20 minutes per site
A standard small seine net effort = 2 efforts per site
A standard large seine net effort = 3 efforts per site
A standard cast net effort = 20 throws per site

1 - 5 individuals per standard monitoring effort = 1 (Rare)
6 - 15 individuals per standard effort = 3 (Moderate Abundance)
>15 individuals per standard effort = 5 (Abundant)

Frequency of occurrence: Contained within APPENDIX A.

Frequency of occurrence refers to the regularity at which a species can occur in the given zone.

Expected frequency is again based on historical data and professional judgment.

Occurrence at <34 % sites in segment = 1 (Infrequent Occurrence.)
Occurrence at 34 - 66 % of sites in segment = 3 (Frequent Occurrence).
Occurrence at >67% of sites in segment = 5 (Widespread Occurrence.)

Health rating: Contained within APPENDIX A.

The occurrence of sick, deformed or parasite-laden fish at each site is noted. The percentage of fish of each species affected determines the score. Where more than one site occurs in a segment, the score is calculated as a percentage of the total number of fish encountered.

1 = Frequency of affected fish > 5%
3 = Frequency of affected fish 2 – 5 %
5 = Frequency of affected fish <2%

Thus based on the equation "**FAII (Relative) = FAII (obs)/FAII (exp) x 100", Kleynhans** (1997) developed a descriptive template which places the index scores into FAII classes. (Table 8) FAII classes in turn can be compared against the more generic

template which describes the present ecological state and the ecological management class of a river system., and which fits all monitoring indices. (Table 9)

Table 8. FAII assessment classes. (From Kleynhans; 1997)

Class	Description of Generally Expected Conditions	FAII Score (Percent of total)
A	Unmodified, or approximates natural conditions closely.	90 - 100
B	Largely natural with few modifications. A change in community characteristics may have taken place but species richness and presence of intolerant species indicate little modification.	80 - 89
C	Moderately modified. A lower than expected species richness and presence of most intolerant species. Some impairment of health may be evident at the lower end of this scale.	60 - 79
D	Largely modified. A clearly lower than expected species richness and absence or much lowered presence of intolerant and moderately intolerant species. Impairment of health may become more evident at the lower end of this class.	40 - 59
E	Seriously modified. A strikingly lower than expected species richness and general absence of intolerant and moderately intolerant species. Impairment of health may become very evident.	20 - 39
F	Critically modified. An extremely lowered species richness and an absence of intolerant and moderately intolerant species. Only tolerant species may be present with a complete loss of species at the lower end of the class. Impairment of health generally very evident.	0 - 19

Table 9. A descriptive template for the Ecological Management Classes (EMC) of river systems. (From Kleynhans; 1997)

CLASS: MANAGEMENT CLASSES:	MANAGEMENT CLASSES: DESCRIPTION OF PERCEIVED CONDITIONS
WITHIN DESIRED RANGE	
A: UNMODIFIED OR LARGELY NATURAL.	The natural abiotic template should not be modified. The characteristics of the resource should be determined by unmodified natural disturbance regimes. There should be no human induced risks to the abiotic and biotic maintenance of the resource. The supply capacity of the resource will not be used.
B: LARGELY NATURAL WITH FEW MODIFICATIONS	Only a small risk of modifying the natural abiotic template and exceeding the resource base should be allowed. Although the risk to the well being and survival of especially intolerant biota (depending on the nature of the disturbance) at a very limited number of localities may be slightly higher than expected under natural conditions, the resilience and adaptability of the biota must not be compromised. The impact of acute disturbances must be totally mitigated by the presence of sufficient refuge areas.
C: MODERATELY MODIFIED	A moderate risk of modifying the abiotic template and exceeding the resource base may be allowed. Risks to the well-being and survival of intolerant biota (depending on the nature of the disturbance) may generally be increased with some reduction of resilience and adaptability at a small number of localities. However, the impact of local and acute disturbances must at least partly be mitigated by the presence of sufficient refuge areas.
D: LARGELY MODIFIED	A large risk of modifying the abiotic template and exceeding the resource base may be allowed. Risks to the well-being and survival of intolerant biota (depending on the nature of the disturbance) may be allowed to generally increase substantially with resulting low abundances and frequency of occurrence, and a reduction of resilience and adaptability at a large number of localities. However, the associated increase in abundance of tolerant species must not be allowed to assume pest proportions. The impact of local and acute disturbances must at least to some extent be mitigated by refuge areas.
OUTSIDE DESIRED RANGE	
E: SERIOUSLY MODIFIED	The losses of natural habitats and basic ecosystem functions are extensive.
F: CRITICALLY MODIFIED	Modifications have reached a critical level and the system has been modified completely, with an almost complete loss of natural habitats

6.4 Results of the fish surveys.

Table 10. The developed species list for each of the ecoregions of the Mogol with species recorded during the 2002 survey

Sand 2.05		Mogol 2.04		Mogol 2.03		Mogol 1.05		Mogol 2.03 B		Mogol 1.05 B		Mogol 1.03	
Expected	**Present**	**Expected**	**Present**	**Expected**	**Present**	**Expected**	**Present**	**Expected**	**Present**	**Expected**	**Present**	**Expected**	**Present**
ABEN	P	ABEN		ABEN		ABEN		ABEN		ABEN		ABEN	
AURA	P	AJOH	P	AJOH	P	AJOH	P	AJOH	P	AJOH	P	AJOH	P
BBIF	P	AMOS		AMOS		AMOS		AMOS		AMOS		AMOS	
BBRE	P	AURA		AURA	P	AURA	P	BANN	P	BANN		BANN	
BMAR	P	BBIF		BBIF	P	BBIF	P	BBIF	P	BBIF	P	BBIF	P
BPAU	P	BBRE	P	BBRE		BBRE	P	BMAR		BMAR	P	BMAR	
BTRI	P	BMAR	P	BMAR	P	BMAR	P	BPAU		BPAU		BPAU	
CGAR	P	BPAU	P	BPAU		BPAU	P	BTRI	P	BRAD	P	BRAD	
CPRE	P	BTRI	P	BTRI		BTRI	P	CFLA	P	BTRI	P	BTRI	P
LMOL	P	BUNI	P	BUNI	P	CFLA	P	CGAR		BUNI		BUNI	
PPHI	P	CGAR		BVIV		CGAR	P	CPAR		BVIV		BVIV	
TSPA	P	CPRE	P	CFLA	P	CPRE	P	CPRE		CFLA	P	CFLA	P
		LMOL	P	CGAR	P	LCYL	P	LCYL	P	CGAR		CGAR	
		MMAC	P	CPRE	P	LMOL	P	LMOL	P	CPAR	P	CPAR	
		PPHI	P	LMOL		MACU	P	LRUD	P	LCYL	P	LMOL	
		TSPA	P	MMAC		MMAC	P	MACU	P	LMOL	P	LROS	
				PPHI	P	OMOS	P	MBRE		LROS		LRUD	
				TSPA	P	PCAT	P	MMAC	P	LRUD		MACU	
						PPHI	P	OMOS	P	MACU	P	MBRE	
						TREN	P	PCAT	P	MBRE		MMAC	
						TSPA	P	PPHI	P	MMAC		OMOS	
								SINT	P	OMOS	P	PPHI	P
								TREN		PCAT	P	SINT	
								TSPA	P	PPHI	P	SZAM	
										SINT		TREN	
										SZAM	P	TSPA	P
										TREN	P		
										TSPA	P		

Table 11. The developed species list for each of the ecoregions of the Mogol tributaries with species recorded during the 2002 survey

Klein Sand 2.05		Klein Sand 2.04		Frikkiesloop 2.03		Sterkstroom 2.03		Taaibos spruit 2.03		Dwars 1.05		Frikkiesloop 1.05		Rietspruit 2.03	
Exp.	**Pres.**	**Exp.**	**Pres.**	**Exp.**	**Pres.**	**Exp.**	**Pres.**	**Exp.**	**Pres.**	**Exp.**	**Pres.**	**Exp.**	**Pres.**	**Exp.**	**Pres.**
AJOH		AJOH	P	AMOS		ABEN		AJOH		ABEN		ABEN		ABEN	
AMOS		BPAU		AURA	P	AMOS		AMOS		AMOS		AMOS		AMOS	
BBIF		PPHI	P	BBIF	P	AURA	P	BBIF	P	AURA	P	AURA	P	BANN	P
BBRE	P	TSPA		BBRE	P	BBIF	P	BBRE	P	BBIF	P	BBIF	P	BBIF	P
BPAU	P			BEUT	P	BBRE	P	BMAR		BMAR	P	BBRE	P	BPAU	P
PPHI	P			BMAR	P	BEUT	P	BPAU	P	BPAU	P	BEUT	P	BRAD	P
TSPA	P			BTRI	P	BMAR	P	BTRI		BTRI	P	BMAR	P	BTRI	P
				LCYL		BPAU	P	CFLA		BUNI	P	BPAU	P	BUNI	
				LMOL		BTRI	P	LMOL		CFLA		BUNI		CFLA	
				MMAC	P	BUNI		TREN	P	CGAR	P	CFLA		CGAR	P
				PCAT		CFLA	P	TSPA	P	LMOL		CGAR		LCYL	
						CGAR				PPHI	P	CPRE	P	LMOL	P
						CPRE	P			TSPA	P	LCYL		LRUD	P
						LCYL						LMOL		MMAC	P
						LMOL	P					MACU	P	OMOS	
						MMAC	P					OMOS	P	PCAT	P
						PCAT						PPHI	P	PPHI	P
						PPHI	P					TSPA	P	SINT	P
						TSPA	P							TREN	P
														TSPA	P

FAII Result Summary for all monitoring segments are presented in APPENDIX B and C

Table 12. Summarized FAII results for all segments of main stem Mogol.

SEGMENT	FAII (REL SCORE)	FAII CLASS	SPECIES EXPECTED	SPECIES RECORDED
2.04	72	C	16	11
2.03	51	D	18	10
1.05	82	B	21	19
2.03 B	59	D	24	15
1.05 B	47	D	28	16
1.03	20	F	26	6

Table 13. Summarized FAII results for all segments of Mogol tributaries.

SEGMENT	FAII (REL SCORE)	FAII CLASS	SPECIES EXPECTED	SPECIES RECORDED
2.05 Sand	79	C	12	12
2.05 Klein Sand	60	D	7	4
2.04 Klein Sand	56	D	4	2
2.03 Frikkiesloop	63	C	11	7
2.03 Sterkstroom	66	C	19	13
2.03 Taaibosspruit	54	D	11	5
1.05 Dwars	54	D	13	9
1.05 Frikkiesloop	62	C	18	11
2.03 B Rietspruit	63	C	20	14

6.5 Discussion of fish results for main stem Mogol:

This critical part of the process needs to be motivated carefully, as erroneous data here can cause severe disruption to the final FAII score.

This river is complex for the following reasons. It runs through a section of the Central Highlands eco region that consists of plains and deep valleys with steep sides. It then enters a section of the Limpopo Plain which is relatively flat. The river then enters a steep sided gorge which again falls within the Central Highlands. The Mogol dam is in the area where the river enters this ecoregion. The river runs through this steep sided valley and leaves the ecoregion at the Rietspruit junction with the Mogol. It then enters the Limpopo Plain, which consists of low flat plains. The ecoregion 1.05 (Limpopo plain) that intrudes into the Central Highlands (2.03) should probably be classified as some separate region from the Limpopo Plain.

For the purposes of this report the river was divided up into the sites along the main stem of the Mogol River in their respective eco regions and the tributaries in their respective

eco regions. The tributaries all originate in a different ecoregion to where they join the Mogol and were thus listed separately.

Sand 2.05 FAII Class C

Fish populations in this section of the catchment of the Mogol are difficult to assess.

- There are only two historical records of fish distribution at two different sites close to the Loubad site in this region.
- Four sites were assessed in this section of river.
- No species of fish have been recorded at all four sites on all occasions. Single records for *Anguilla bengalensis, Amphilius uranoscopus, Barbus bifrenatus, Labeobarbus maraquensis, Barbus paludinosus, Barbus trimaculatus, Chiloglanis pretoriae, Clarias gariepinus, Labeo molybdinus* have been made. A record was made of the large mouth bass, *Micropterus salmoides*.
- *Barbus brevipinnis* has recently been classified as a red data species and was found at three of the four sites. This classification appears to be wrong for this species in the Waterberg catchment.
- *Amphilius uranoscopus, Labeobarbus marequensis,Chiloglanis pretoriae* and *Labeo molybdinus* are flow dependant. In such a small community, the absence of one species can seriously impact upon the FAII score. It is a cause for concern that these species were found at one site each in this area.

The confirmed record of the migratory eel, *Anguilla bengalensis* in this reach is not unexpected. However, degradation of the middle and lower catchment, together with the placement of large dams in the system, are likely to limit the ongoing presence of this fish.

Silt deposition and poor habitat availability seem to be the main cause of the lower FAII classification.

Mogol 2.04 FAII Class C

There are only two sites in this ecoregion along the Mogol main stem.

- With the exception of *Pseudocrenilabrus philander* no species of fish has been recorded at both sites on all occasions.
- *Barbus brevipinnis* has recently been classified as a red data species and was found at one of the two sites. This classification appears to be wrong for this species in the Waterberg catchment.
- *Labeobarbus marequensis,Chiloglanis pretoriae* and *Labeo molybdinus* are flow dependant. In such a small community, as in the previous ecoregion, the absence of one species can seriously impact upon the FAII score.

Silt deposition and poor habitat availability seem to be the main cause of the lower FAII classification.

Mogol 2.03 FAII Class D

The section of river in this ecoregion is very short and only has one monitoring site on it. The river is in a poor condition, being impacted on by farming activities, etc. Deposition also has a major effect on available fish habitat.

Mogol 1.05 FAII Class B

The presence of 19 of a potential 21 fish species recorded in Mogol 1.05 account for the observed FAII class.

The river is seriously impacted on in the upper portion of this segment by irrigation farming though the lower portions are still relatively good, the area being used mainly for game farming and tourism.

Given the pressures on this section of river it seems to be in a fairly good condition.

Mogol 2.03B FAII Class D

15 of a potential 24 species were recorded in this reach, but abundances were generally low. The absence of flow dependent species such as *C. paratus* and *C. pretoriae* is of concern. It appears that most of the habitat for these species has been destroyed by sand deposits in the river from flood events. The top site is just below a gauging weir below the Mogol dam wall and seems to be impacted by flooding and low flows alternatively.

This segment of the river is also heavily impacted on by irrigation farming. Controlled releases from the dam have also resulted in a lot of sand deposition with little scouring taking place. This has resulted in increased reed beds with a resultant loss of habitat for the flow dependent species.

The current class D river is not acceptable. Management should strive to improve the management class of this segment to at least a class C river.

Mogol 1.05B FAII Class D and Mogol 1.03 Class F

The two eco-regions, 1.05 and 1.03 are discussed together as there are very small differences between the two.16 of a potential 28 species were recorded in the reach 1.05 and 6 of a potential 26 species in reach 1.03.

The low classes achieved in this section of river are due to low flows, which result in larger siltation and a reduction of available water lower down in the river. Habitats were also largely confined to sand and gravel with some mud and large amounts of reed growing in the substrates.

6.6 Discussion of fish results for Mogol tributaries:

The tributaries do not form continuous links with the main river or each other in the various ecoregions and have thus been described separately.

Klein sand 2.05 Class D (Boekenhout)

This stream is small and probably ephemeral. Habitat is also limited and impacted on by farming practices.

Klein sand 2.04 Class D (Donkerhoek)

This stream is seasonal and dries up in the dry periods of the year. The habitat just has a sandy and muddy bottom thus limiting the species of fish that might occur there.

Frikkies Loop 2.03 Class C

This site is just above the large dam on Shambala. The area was previously used for cattle grazing but has now been converted to game ranching and tourism. The river has been affected by flooding with some undercutting of banks and mild erosion. The absence of *Labeo spp* in this section is strange as this species is common in these habitats.

Sterkstroom 2.03 Class C

This stream runs through the Welgevonden Nature Reserve and is currently in a fairly good condition. There is a fair amount of impact from bridges and an occasional weir on this section.

Taaibos 2.03 Class D

This stream runs through the Welgevonden Nature Reserve and is currently in a fairly good condition. There is a fair amount of impact from bridges and an occasional weir on this section.

Dwars 1.05 Class D

This stream is an area where mixed farming takes place and the rivers dry up each year with the exception of a few pools and farm dams. The stream gets impacted on by bridges, dams and cattle.

Frikkies Loop 1.05 Class C

This site is in Shambala. The area was previously used for cattle grazing but has now been converted to game ranching and tourism. The river has been affected by flooding with some undercutting of banks and mild erosion. The absence of *Labeo* spp in this section is strange as this species is common in these habitats.

Rietspruit 2.03 B Class C

This stream runs through farming areas. This stream probably slows down to a trickle or a series of pools during the dry season. Impacts are mainly from cattle, bridges and crossings.

6.7 Conclusions and recommendations for the fish survey.

The river is in a fair condition. The river and tributaries in the catchment above the Mokolo Dam still seem to be in a fairly good condition. The main stem Mogol below the Mokolo Dam is showing signs of stress. This is a result of flow manipulation through controlled releases from the dam. The water is released at times required by the farmers for irrigation. This results in slower flows, which limits floods and these cannot scour the river clear of sand and reeds. The slower flows also result in a quicker deposition of silt and sand, which in turn covers most of the prime fish habitat areas.

Large areas of the lower sections of the river near Ellisras (Lephalale) are being mined for sand and this has a serious effect on the system. The channels are modified and the riverine vegetation is destroyed at the access points for vehicles as well as the disruption of any stabilizing growth in the riverbed. This in turn accentuates erosion in times of high flows.

Extensive spraying of reeds is taking place and a study should be conducted to determine what changes result from these impacts on the aquatic biota.

Normally tributaries act as refuges for fish during times of flow extremes but it seems that in certain areas of this catchment the main stem of the river is a refuge for fish during some of these events.

Judging from the fish caught in the section where the Limpopo Plain (1.05) intrudes into the Central Highlands (2.03) as well as the general topography, it would seem to indicate that the section of Limpopo Plain mentioned should have a different classification, possibly a sub region of the Central Highlands.

All sites should be managed for a higher FAII score. The upper catchments in protected areas (private nature reserves) are already being managed to improve habitat quality and farmers outside these areas should be encouraged to follow suite.

Management of these areas to reach these target classes should be done in such a way as to limit sand mining to certain areas and reduce other impacts such as vegetation destruction and inflow of pesticides and unnatural nutrients.

Flows out of the dam should be regulated to simulate natural events at the right times of the year to assist fish with their breeding cycles. Weirs and other obstructions should be modified to allow the natural migration of fish in the system.

6.8 Acknowledgements

This survey was a first time effort on my part to conduct a complete survey and produce a technical report. Mr. Mick Angliss and Mr. Paul Fouche are thanked for their help in teaching me the differences between the various fish species and the habitats where one would expect to find them as well as the use of the various indices to reach some sort of a conclusion. Mr. Pierre Fouche did the mapping for this survey and also assisted with ground verification of some sites that were not done during the surveys.

7. Invertebrates.

7.1 Invertebrate Monitoring Methods.

The survey for invertebrates was based upon methods developed for Biomonitoring, utilizing the SASS5 protocols (Dickens et al. 2001). (South African Scoring System version 5)

During this survey, the biomonitoring protocols were followed correctly, to obtain valid SASS5 scores. All available habitats were sampled. (Taking cognizance of available habitat both up and down stream a distance of 100 metres)

The SASS5 protocol requires that invertebrate abundances be recorded for each habitat type to family level only. Each family recorded has a predetermined sensitivity rating (score). All scores for the sites are totaled to yield the SASS5 score. The average score of all of the families recorded (ASPT) provides an indication on the number of sensitive, high scoring species represented in the total score.

SASS5 scores must thus be rated in terms of the Average Score Per Taxon (ASPT) and available habitat. In this regard, the Habitat Quality Index (HQI) was applied. The Integrated Habitat Assessment (IHAS) score sheet was also utilized and total scores obtained. However IHAS scores were not manipulated to provide refined SASS5 scores. The IHAS methodology is still under considerable review and there has been little attempt to fine tune the methodology in the lowveld. Scores are thus reflected for future reference only.

Abundances were also recorded and are presented in the tables attached in Appendix D. Invertebrates were recorded to family level only and returned to the river alive.

The method of collecting macro invertebrates utilizes a fine mesh net (1mm nylon) measuring 30 cm x 30 cm. Bottom substrates are disturbed through kicking (kick

sampling) and invertebrates collected downstream. Vegetation is sampled by sweeping the net to and fro. Sampling times are indicated on the score sheet.

SASS4 protocols were documented in detail by Thirion et al. (1995). In addition, Chutter (1998) provided a broad framework for river classification for both acidic and alkaline streams based on SASS4 data.

Thirion (1998) produced a template (Table 14) which allows for the interpretation of SASS4 scores with the ASPT, in terms of the Present Ecological State (PES) following the same classification hierarchy as indicated in Table 9. This interpretive framework provides for ranges of scores and ASPT's for each eco-region.

During 2001 a workshop took place to upgrade SASS4 to SASS 5. The results were documented by Dickens et. al. (2001). SASS5 provides for a more detailed and standardized approach to the protocol, leading to improved acceptability of the protocol across the country. However interpretive frameworks have yet to be updated to provide a method for assessing results, based on SASS5 scores.

At this time it is still necessary to convert SASS5 scores back to SASS4 scores for the purposes of assessing the ecological state. In the case of the Limpopo Province, differences in scores between SASS4 and SASS5 are minimal. Significant differences are expected in areas where there are diverse *Trichoptera* (caddis flies). This commonly occurs in streams of the Western and Eastern Cape.

No habitat scores are currently being interpreted for inclusion into this framework.

Given the availability of the above interpretive frameworks, none have been refined for the Limpopo Plain eco-region. There are two reasons for this.

- There has been very limited work in the Limpopo Plain eco–region. As such data is sparse for statistical analysis.
- River flows within the Limpopo Plain are predominantly seasonal. SASS methodologies must be interpreted with great caution if applied in seasonal rivers.

This survey of the lower Mogol River includes a significant number of sites in the Limpopo Plain eco-region. In the past 2 – 3 years, limited data has also been gathered from other rivers of this eco-region. A low confidence assessment of these scores can therefore be attempted for the first time.

Table 14. Description of SASS4 condition classes. (From Thirion 2001)

CLASS	BIOTIC MODIFICATION RELATIVE TO CURRENT BEST ATTAINABLE CONDITION	DESCRIPTION	SASS5 SCORE (%OF REFERENCE CONDITION)	ASPT VALUE (% OF REFERENCE CONDITION
A	Unimpaired	Community structures and functions comparable to the best situation to be expected. Optimum community structure (composition and dominance) for stream size and habitat quality.	90 – 100 80 - 89	Variable >90
B	Minimally impaired	Largely natural with few modifications. A small change in community structure may have taken place but ecosystem functions are essentially unchanged	80 – 89 70 – 79 70 - 89	<75 >90 75 – 90
C	Moderately impaired	Community structure and function less than the reference condition. Community composition lower than expected due to loss of some sensitive forms. Basic ecosystem functions are still predominantly unchanged.	60 – 79 50 – 69 50 – 79	>75 60 - 75
D	Largely impaired	Fewer families present than expected, due to loss of most intolerant forms. Basic ecosystem functions have changed.	50 – 59 40 – 49	<60 Variable
E	Seriously impaired	Few aquatic families present, due to loss of most intolerant forms. An extensive loss of basic ecosystem functions has occurred.	20 – 39	Variable
F	Critically impaired	Few aquatic families present, with high densities of organisms, then dominated by a few taxa. Only tolerant organisms present.	0 - 19	Variable

Table15. SASS4 and ASPT values per Ecoregion as an indication of biotic condition. (Adapted from Thirion 2000) (Limpopo eco-regions)

REGION	SASS4	ASPT	CONDITION
HIGHVELD	>120	>6	EXCELLENT
	91-120	5-6	VERY GOOD
	71-90	4.5-5.5	GOOD
	56-70	4.5-5.5	FAIR
	30-35	VARIABLE	POOR
	<30	VARIABLE	VERY POOR
CENTRAL HIGHLANDS	161-170;>170	>7;>6	EXCELLENT
	121-160;141-170	>7; >6	VERY GOOD
	91-120; 121-140	<7.5;<7	GOOD

	61-90	<6	FAIR
	30-60	VARIABLE	POOR
	<30	VARIABLE	VERY POOR
BUSHVELD BASIN	>180	>6	EXCELLENT
	141-180	6-7	VERY GOOD
	91-140	5-6.5	GOOD
	61-90	<6	FAIR
	30-60	VARIABLE	POOR
	<30	VARIABLE	VERY POOR
GREAT ESCARPMENT MOUNTAINS	161-180;>180	>7;>6	EXCELLENT
	141-160; 161-180	>6; 6-7	VERY GOOD
	91-140	>5.5	GOOD
	61-90	<6	FAIR
	30-60	VARIABLE	POOR
	<30	VARIABLE	VERY POOR
LOWVELD AND LEBOMBO MOUNTAINS	141-160; >160	>7; >6	EXCELLENT
	106-140; 106-160; 131-160	>7; 6-7; 5-6	VERY GOOD
	76-105; 106-130	>5; 5-6	GOOD
	61-75	4-6	FAIR
	30-60	VARIABLE	POOR
	<30	VARIABLE	VERY POOR

7.2 Interpretation of Limpopo Plain data.

This interpretation is based upon data from both the Mogol and Nzhelele Rivers. (Table 18). The method, developed by Thirion involves graphical presentation of SASS scores against ASPT. (Figure 3) Placement of the scores into ecological classes is based upon those original guidelines from Thirion et al. (1995), guidelines from Chutter (1998) and intuitive expert judgment. (Gut scores)

It should be noted that both Thirion (1995) and Chutter (1998) recommended 5 ecological classes as opposed to the current 6 classes. (Tables 16 and 17)

Following this graphical analysis, the gut score classes are refined accordingly.

The interpretation at this time is based upon level 1 eco-regions only.

Table 16. **Categories used to classify habitat, SASS4 and ASPT values. From Thirion et al. (1995).**

HABITAT	SASS4	ASPT	CONDITION
>100	>140	>7	Excellent
80 - 100	100 - 140	5 - 7	Good

HABITAT	SASS4	ASPT	CONDITION
60 - 80	60 - 100	3 - 5	Fair
40 - 60	30 - 60	2 - 3	Poor
<40	<30	<2	Very poor.

Table 17 Guidelines for the interpretation of SASS4 scores for southern African waters which are not naturally acidic (pH>6) from Chutter (1998)

SASS4 Score	ASPT	Condition
>100	>6	Water quality natural, habitat diversity high.
<100	>6	Water quality natural, habitat diversity reduced.
>100	<6	Borderline case between water quality natural and some deterioration in water quality. Interpretation should be based on the extent by which SASS4 exceeds 100 and ASPT is <6.
50 – 100	<6	Some deterioration in water quality.
<50	Variable	Major deterioration in water quality.

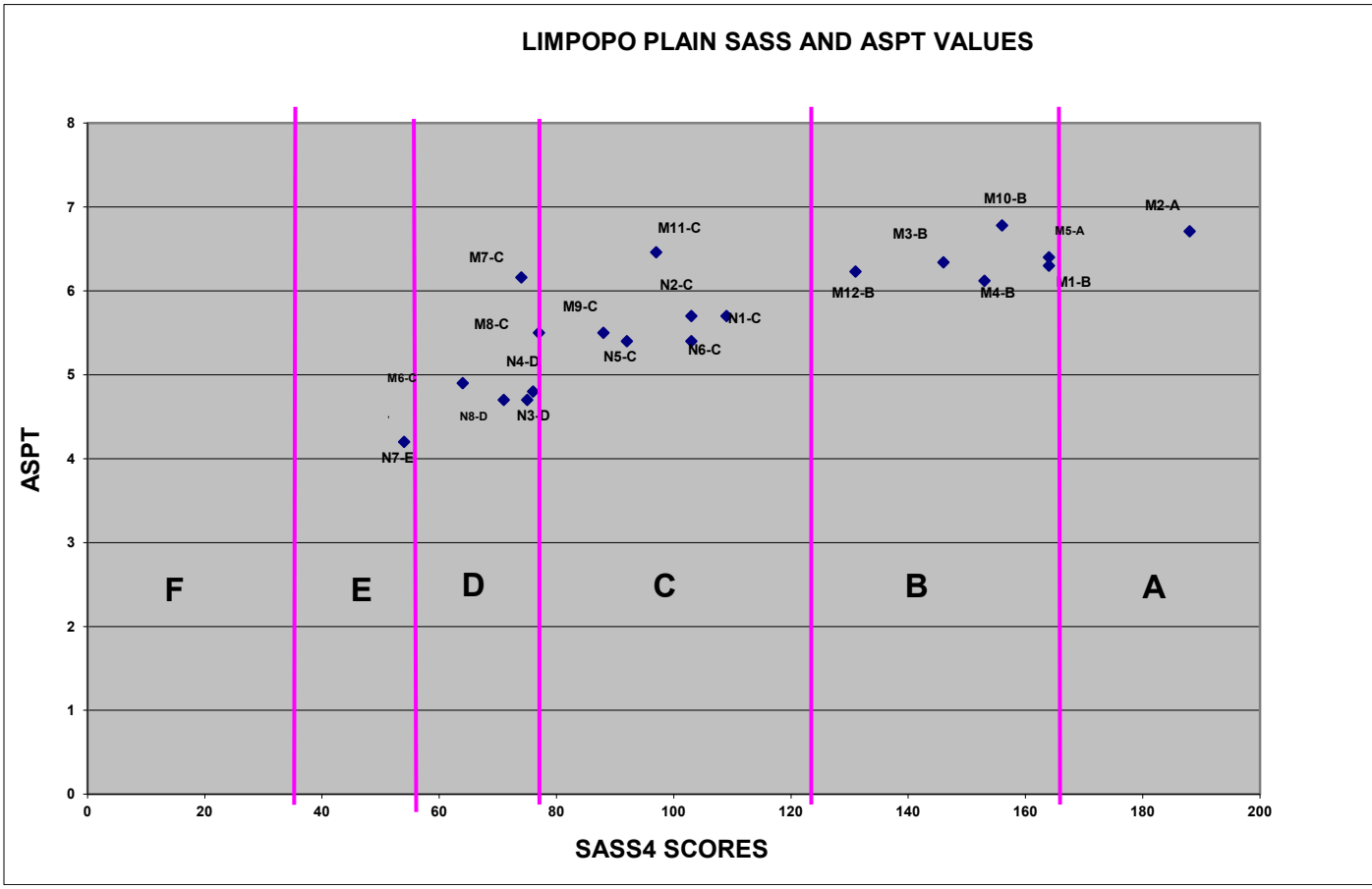
Table 18. Data used for the Limpopo Plain analysis.

	Identifier	Eco-region	SASS4	ASPT	Gut EC
A4STER-DOORN	M1-B	1.05	164	6.3	B
A4MOGO-VAALW	M2-A	1.05	188	6.71	A
A4MOGO-STERK	M3-B	1.05	146	6.34	B
A4MOGO-WITFO	M4-B	1.05	153	6.12	B
A4MOGO-MOKOL	M5-A	1.05	164	6.4	A
A4MOGO-DNYAL	M6-C	1.05	64	4.9	C
A4MOGO-MARKE	M7-C	1.05	74	6.16	C
A4MOGO-BESKA	M8-C	1.05	77	5.5	C
A4MOGO-SHOTB	M9-C	1.03	88	5.5	C
A4FRIK-SHAM2	M10-B	1.05	156	6.78	B
A4DWAR-ZANDD	M11-C	1.05	97	6.46	C
A4 DWAR-JIMSE	M12-B	1.05	131	6.23	B
Nzh 1 July 02	N1-C	1.01	109	5.7	C
Nzh 2 July 02	N2-C	1.01	103	5.7	C
Nzh 3 July 02	N3-D	1.01	75	4.7	D
Nzh 4 July 02	N4-D	1.01	76	4.8	D
Nzh 1 Sept 02	N5-C	1.01	92	5.4	C
Nzh 2 Sept 02	N6-C	1.01	103	5.4	C
Nzh 3 Sept 02	N7-E	1.01	54	4.2	E
Nzh 4 Sept 02	N8-D	1.01	71	4.7	D

Table 19. SASS4 and ASPT values for the Limpopo Plain ecoregion as an indication of biotic condition.

SASS4	ASPT	CONDITION	CLASS
>165	Variable	EXCELLENT	A
125 - 164	Variable	VERY GOOD	B
80 - 124	Variable	GOOD	C
60 - 79	Variable	FAIR	D
40 - 59	Variable	POOR	E
<40	Variable	VERY POOR	F

Figure 3. Limpopo Plain SASS4 scores and ASPT values.



7.3 Results.

For the purposes of this study, results are presented for individual sites within the eco regions of each river tributary. Both SASS5 and SASS4 scores are indicated. Detailed results are attached as Appendix D.

7.3.1 Tributaries.

Sand River Ecoregion 2.05

Site	A4SAND-TOPBR	
Ecoregion	**2.05**	
	SASS5	**SASS4**
Score	131	135
No. of families	20	20
Score/taxon (ASPT)	6.55	6.75
IHAS	87	87
HQI	109	109
Class	**C**	

Site	A4SAND-LOUBA	
Ecoregion	**2.05**	
	SASS5	**SASS4**
Score	177	180
No. of families	27	27
Score/taxon (ASPT)	6.6	6.66666667
IHAS	95	95
HQI	122	122
Class	**A**	

Site	A4SAND-UPPER	
Ecoregion	**2.05**	
	SASS5	**SASS4**
Score	101	102
No. of families	17	16
Score/taxon (ASPT)	5.9	6.375
IHAS	71	71
HQI	96	96
Class	**C**	

Site	A4SAND-LEEUW	
Ecoregion	**2.05**	
	SASS5	**SASS4**
Score	132	138
No. of families	22	22
Score/taxon (ASPT)	6	6.27272727
IHAS	76	76
HQI	111	111
Class	**C**	

Site	A4KLSA-BOEKE	
Ecoregion	**2.05**	
	SASS5	**SASS4**
Score	127	133
No. of families	19	18
Score/taxon (ASPT)	6.68	7.38888889
IHAS	90	90
HQI	112	112
Class	**C**	

The rivers in this eco-region are predominantly in a good condition. (Class C) However, the Loubadspruit tributary had a noticeably better invertebrate community, which was reflected by an excellent score (Class A). The Loubadspruit is steeper in gradient, and appears to have stronger, perennial flow than the other streams in this region. These factors contribute towards better quality instream habitat. The Loubadspruit should be regarded as a valuable refuge and provides an important indication of reference conditions.

Klein Sand Ecoregion 2.04

Site	A4KLSA-DONKE
Ecoregion	**2.04**
	Not surveyed
Score	N/A
No. of families	N/A
Score/taxon (ASPT)	N/A
IHAS	N/A
HQI	N/A
Class	**N/A**

Not surveyed due to lack of flow.

Frikkies Se Loop Eco-region 2.03

Site	A4FRIK-SHAM1	
Ecoregion	2.03	
	SASS5	SASS4
Score	112	118
No. of families	19	19
Score/taxon (ASPT)	5.9	6.210526
IHAS	68	68
HQI	90	90
Class	C	

Frikkies Se Loop Eco-region 1.05

	A4FRIK-SHAM2	
Ecoregion	1.05	
	SASS5	SASS4
Score	153	156
No. of families	23	23
Score/taxon (ASPT)	6.7	6.782609
IHAS	82	82
HQI	95	95
Class	B	

The Frikkies Se Loop flows steeply from the Central Highland eco-region of the Waterberg to the Limpopo Plain. Only one sight was surveyed in each eco-region of this river. The Frikkies Se Loop lies almost entirely within the Shambala Reserve and as such, the river should be expected to reflect good SASS scores. However, the upstream site does not truly reflect its expected class. In this region, the invertebrate communities reflect a good class. (Class C) However, the habitat is somewhat degraded due to sediment deposition, largely as a result of construction activities and from erosion caused during the 2000 floods. In the lower catchment, there is a noticeable improvement in benthic habitats with a substantial increase in invertebrate fauna. (Class B)

Sterkstroom Eco-region 2.03

Site	A4STER-WELG1	
Ecoregion	2.03	
	SASS5	SASS4
Score	116	122
No. of families	18	18
Score/taxon (ASPT)	6.4	6.77777778
IHAS	77	77
HQI	103	103
Class	C	

Site	A4STER-WELG2	
Ecoregion	2.03	
	SASS5	SASS4
Score	147	156
No. of families	21	21
Score/taxon (ASPT)	7	7.42857143
IHAS	81	81
HQI	104	104
Class	B	

Sterkstroom Eco-region 1.05

Site	A4STER-DOORN	
Ecoregion	1.05	
	SASS5	SASS4
Score	156	164
No. of families	26	26
Score/taxon (ASPT)	6	6.30769231
IHAS	76	76
HQI	113	113
Class	B	

The Sterkstroom flows through similar terrain as the Frikkies Se Loop. It rises in the Central Highlands area of the Waterberg and flows steeply into the Limpopo Plain. Most of the river lies within the Welgevonden Nature Reserve. The upper catchment is in a good (Class C) condition, but the river condition improves further downstream (Class B). The upper river was again affected by the floods of 2000, with numerous small weirs being damaged. The alien fish species *Micropterus salmoides* is known to be present in the upper reaches and could be having a negative influence on the invertebrate biota.

Taaibosspruit Eco-region 2.03

Site	A4TAAI-WELG1	
Ecoregion	2.03	
	SASS5	SASS4
Score	125	134
No. of families	20	20
Score/taxon (ASPT)	6.25	6.7
IHAS	87	87
HQI	121	121
Class	C	C

Site	A4TAAI-WELG2	
Ecoregion	**2.03**	
	SASS5	**SASS4**
Score	143	149
No. of families	21	20
Score/taxon (ASPT)	6.8	7.45
IHAS	74	74
HQI	99	99
Class	**B**	**B**

The Taaibosspruit again flows from Welgevonden Nature Reserve. Only two sites in the Central Highland eco-region were surveyed and these were in very close proximity to each other. The two sites however had significantly different habitat. SASS results indicate that these sites are borderline between Class B and C.

Dwars River Eco-region 1.05

Site	A4DWAR-ZANDD	
Ecoregion	**1.05**	
	SASS5	**SASS4**
Score	104	97
No. of families	16	15
Score/taxon (ASPT)	6.5	6.46666667
IHAS	55	55
HQI	77	77
Class	**C**	

Site	A4 DWAR-JIMSE	
Ecoregion	**1.05**	
	SASS5	**SASS4**
Score	130	131
No. of families	21	21
Score/taxon (ASPT)	6.2	6.23809524
IHAS	83	83
HQI	109	109
Class	**B**	

At the time of the survey, the Dwars River had almost stopped flowing, while its tributary the Jim Se Loop was flowing more strongly. The Dwars River is regarded as a historically perennial river, but in recent times has a more seasonal flow regime. The better habitat availability of the Jim Se Loop, associated with flowing water, is thought to account for the very good condition (Class B). It is however likely, that given similar flow condition, the Dwars River would reflect an improved score.

Rietspruit Eco-region 2.03.

Site	A4RIET-FANCY	
Ecoregion	2.03	
	SASS5	SASS4
Score	147	147
No. of families	25	24
Score/taxon (ASPT)	5.9	6.125
IHAS	87	87
HQI	121	121
Class	C	

Site	A4RIET-WATER	
Ecoregion	2.03	
	SASS5	SASS4
Score	138	141
No. of families	22	21
Score/taxon (ASPT)	6.27	6.71
IHAS	86	86
HQI	117	117
Class	C	

The two sites on the Rietspruit are in close proximity. Habitat is almost identical. The sites occur in private lands and lie just downstream from a new dam. The scores obtained are borderline between Class C, good and Class B, very good.

7.3.2 Mogol main stem.

Mogol Eco-region 2.04

Site	A4MOGO-ALMAB	
Ecoregion	2.04	
	SASS5	SASS4
Score	94	98
No. of families	16	16
Score/taxon (ASPT)	5.9	6.125
IHAS	73	73
HQI	97	97
Class	C	

Site	A4MOGO-TWEEF	
Ecoregion	2.04	
	SASS5	SASS4
Score	97	99
No. of families	17	17
Score/taxon (ASPT)	5.7	5.82352941
IHAS	79	79
HQI	88	88
Class	C	

This eco-region is dominated by slow deep water, with many weirs and the habitat availability is poor. In addition, the extensive irrigation farms are expected to have a negative influence on invertebrate populations because of the widespread use of pesticides. Given this scenario, the good results (ClassC) are something of a surprise.

Mogol Eco-region 2.03

Site	A4MOGO-GROEN	
Ecoregion	2.03	
	SASS5	SASS4
Score	137	141
No. of families	22	22
Score/taxon (ASPT)	6.2	6.40909091
IHAS	70	70
HQI	106	106
Class	C	

As can be seen from the attached eco region map, the Mogol main stem passes through both eco-regions 2.03 and 1.05 twice. This single result is for the upper catchment portion of eco-region 2.03. At this site, there are numerous imacts, including construction activity around the site. In addition, the alien fish species *Micropterus salmoides* was recorded and could be having a negative effect on invertebrates. Nevertheless, habitat is diverse and the good result obtained (Class C) is a reflection of this habitat diversity.

Mogol Eco-region 1.05

Site	A4MOGO-VAALW	
Ecoregion	1.05	
	SASS5	SASS4
Score	185	188
No. of families	28	28
Score/taxon (ASPT)	6.6	6.71428571
IHAS	89	89
HQI	122	122
Class	A	

Site	A4MOGO-STERK	
Ecoregion	1.05	
	SASS5	SASS4
Score	149	146
No. of families	23	23
Score/taxon (ASPT)	6.5	6.34782609
IHAS	76	76
HQI	120	
Class	B	

Site	A4MOGO-WITFO	
Ecoregion	1.05	
	SASS5	SASS4
Score	152	153
No. of families	25	25
Score/taxon (ASPT)	6.1	6.12
IHAS	86	86
HQI	116	116
Class	B	

Site	A4MOGO-MOKOL	
Ecoregion	1.05	
	SASS5	SASS4
Score	172	164
No. of families	28	26
Score/taxon (ASPT)	6.1	6.30769231
IHAS	90	90
HQI	119	119
Class	B	

Throughout this section of eco-region 1.05, the terrain is dominated by private nature reserves. The protection afforded to the river by the private land owners is without doubt protecting the riparian and consequently the instream habitat. In addition, the river in this region continues to be perennial through most years and the habitat diversity is very high. The river is heavily braided, and in places has multiple channels. The very good condition (Class B) is encouraging. The excellent condition (Class A) record, collected from the Vaalwater site suggests that reference conditions can be predicted with relatively high confidence.

Mogol Eco-region 2.03

Site	A4MOGO-WWORK	
Ecoregion	2.03	
	SASS5	SASS4
Score	132	135
No. of families	22	22
Score/taxon (ASPT)	6	6.13636364
IHAS	90	90
HQI	114	114
Class	C	

Site	A4MOGO-WITKO	
Ecoregion	2.03	
	SASS5	SASS4
Score	84	**86**
No. of families	16	**16**
Score/taxon (ASPT)	5.25	**5.375**
IHAS	65	**65**
HQI	94	**94**
Class	D	

Both sites fall below Mokolo Dam and are subjected to periodic pulses of flow, which are released for downstream farming. The record for the Mokolo Dam site reflects the good quality of the habitat available here. However, the lower site near Witkop produced a fair result (Class D). Although the Witkop site is still categorized as falling within eco-region 2.03, the characteristics of the site more closely resemble those of the Limpopo Plain 1.05. The river is dominated by sandy runs and deep pools, while rocky habitats are almost non existent. If this result was interpreted against the predicted Limpopo eco-region scores, the site would be ranked as good (Class C). Refinement of eco-region boundaries is pending.

Mogol Eco-region 1.05

Site	A4MOGO-DNYAL	
Ecoregion	1.05	
	SASS5	SASS4
Score	66	64
No. of families	13	13
Score/taxon (ASPT)	5.1	4.92307692
IHAS	77	77
HQI	99	99
Class	C	

Site	A4MOGO-MARKE	
Ecoregion	1.05	
	SASS5	SASS4
Score	70	74
No. of families	12	12
Score/taxon (ASPT)	5.8	6.16666667
IHAS	61	61
HQI	89	89
Class	D	

Site	A4MOGO-BESKA	
Ecoregion	1.05	
	SASS5	SASS4
Score	72	77
No. of families	14	14
Score/taxon (ASPT)	5.1	5.5
IHAS	52	52
HQI	71	71
Class	D	

Site	A4MOGO-SHOTB	
Ecoregion	1.03	
	SASS5	SASS4
Score	86	88
No. of families	16	16
Score/taxon (ASPT)	5.4	5.5
IHAS	72	72
HQI	78	78
Class	C	

The Limpopo Plain eco-region is seriously impacted by reduced flows. In addition, habitat quality is poor and is dominated by dense reed growth, deep sandy pools and shallow sandy runs. Nevertheless, given habitat limitations, the region is falling between fair (Class D) and good (Class C).

7.4 Invertebrate Fauna.

Detailed records of invertebrate families recorded per site can be seen in Appendix D. Although SASS scores recorded throughout the survey area reflect a good condition, there are a number of sensitive invertebrate Taxa which were surprisingly absent or present in low numbers.

- Cased caddis (*Trichoptera*) were in low abundance throughout the survey.

- Stoneflies (*Plecoptera*) were seldom encountered in their expected habitat.
- The diversity of mayflies was low. (*Ephemoptera*)

The vast majority of the invertebrates recorded were non sensitive and this fact is noticeable in the observed ASPT of each site. No new Taxa for the province were recorded.

7.5 Conclusions for the invertebrate survey.

This study was the first time that invertebrates have been systematically surveyed in the Mogol Catchment. The SASS protocol is well developed and the author has considerable experience of applying this protocol in other catchments. The results obtained should therefore be viewed with fairly high confidence. However a number of issues can be highlighted for further evaluation, in order to improve future assessments.

- Eco-region boundaries are under review. The process of defining eco-region boundaries is being driven by the Department of Water Affairs and Forestry, Institute for Water Quality Studies. In recent months, this Department was afforded the opportunity to comment and suggest refinement for level 1 boundaries. In the case of the Mogol Catchment, no refinements were suggested. However, Level 2 boundaries have yet to be clearly defined. For the purposes of this study, the Level 2 boundaries show a close correlation to the geomorphological zonation of the catchment. Nevertheless, some refinements to Level 2 boundaries can be suggested, after the analysis of this survey.
- The interpretation of SASS results for the Limpopo Plain eco-region need further refinement. This study has included a first level interpretation of scores which are considered to approximate to six ecological classes. More data from other river catchments in this eco-region is required for further refinement.
- SASS results in seasonal rivers should be interpreted with great care. The lower Mogol River is, to all intense and purposes, now seasonal. Some upper catchment tributaries are also tending towards seasonality. However, during the period of this study, the river did not stop flowing at those sites surveyed and results are therefore acceptable. Interpretation of Limpopo Plain Data must reflect such seasonality in the long term. More data is needed.
- This survey was conducted during the May to September period of 2002, when most of the "perennial" rivers had been flowing following strong rains in previous years. (NB: 2000 flood). Water resources in the catchment are known to be stressed and the whole catchment has subsequently entered a severe drought with many rivers having cessation of flow. It is therefore possible that the results of the 2002 survey, reflect a "best case scenario" for the catchment. Further surveys are needed to provide a clearer picture of the condition of the catchment. Seasonal variations should be taken into consideration in this regard.

Noting the above, the results of the invertebrate survey indicate that the aquatic habitat of the Mogol Catchment is still in a good condition which supports a high diversity of invertebrate fauna.

The Mogol River below the Mokolo Dam is without doubt the most stressed portion of the catchment. However, even here the river is considered to reflect a fair to good condition based on the invertebrate populations present. The infestation of *Phragmites mauritianus* (common reed), and the resultant attempts to manage this growth through aerial spraying, appears to have had an indeterminate impact upon aquatic invertebrate communities.

This study was used as a training exercise for members of the project team. While members of the team have concentrated upon their own specific disciplines during this study, exposure to the SASS protocol has contributed to the further development of team members.

As a first time study of the Mogol Catchment, the team encountered many helpful land owners and other parties, whose assistance enabled the river survey to succeed. One of the big successes that this study can claim is the heightened level of public awareness in riverine issues, which came about through many hours of discussion at the river's edge.

8. RIPARIAN VEGETATION ASSESSMENT OF THE MOGOL RIVER CATCHMENT . *Compiled by PSO Fouche.*

8.1 MATERIALS AND METHODS

Time of the survey.

The survey was conducted during May, June, August and September 2002 as part of the general River Health Programme (RHP) monitoring survey of the Mogol River Catchment.

Site selection.

Since the riparian vegetation monitoring formed part of the larger RHP monitoring programme the sites were usually close to the sites selected for aquatic invertebrate (SASS) and fish (FAII) monitoring. Care was however taken to find suitable vegetation either up- or downstream from the general site that was as representative of the river, and the specific reach of the river, as possible. The area in which the vegetation was monitored did however still include the sites of the two other indices.

At each site the extent of riparian zone was identified and within this zone approximately 200 meters on both banks were monitored. The riparian vegetation assessment guidelines, provided by Kemper (2001), were followed to ensure that all the sites were monitored similarly during this survey.

Biomonitoring Site Assessment Forms.

During this survey version 05/02/00 of the RVI biomonitoring site assessment form was used as prescribed by Kemper (2001).

Plant identification.

Plants were identified using the keys provided in Germishuizen (1997), Grant and Thomas (2000), Coates Palgraves (1981), van Wyk and Malan (1988) and van Wyk and van Wyk (1997). However if a plant could not be identified, plant material was collected, as prescribed in the field guide of Kemper and Linstrom (2000), and later identified by

the Herbarium at the University of the North and by department of Biological Sciences at the University of Venda.

In order to decide whether the trees and shrubs could be regarded as riparian or terrestrial the descriptions provided by Grant and Thomas (2000), Coates Palgraves (1981) and van Wyk and van Wyk (1997) were used. These descriptions and class applied in this report are illustrated in table 1.

Ecozones and ecoregions.
Since both of the abovementioned terms are used in this report the terms and their application is hereby clarified.

Although characteristics such as climate are usually considered, the definition in this report for the term ecozone is mainly based on the detailed vegetation map of Rebelo and Low (Grant and Thomas, 2000). The typical plants found in it therefore characterize each ecozone and in this report the term was mainly used in decisions involving plants.

The term ecoregion on the other hand, refers to regions of broad ecological similarity (State of the Rivers Report, 2001). Variation in physiography, climate, soils and vegetation is used to delineate ecoregions. South Africa has eighteen first level, or main, ecoregions. A river in a particular ecoregion will then be more comparable to a river in the same ecoregion elsewhere than to a river in a different ecoregion. Because of this similarity these ecoregions provide convenient boundaries within which to do biological assessments and set quality objectives. When an ecoregion is numbered the decimal value refers to subdivision into level two.

During the survey both ecoregions and ecozones were considered, but the ecozones were specifically important when decisions concerning the riparian or terrestrial status of plants were made (table 1)

Table 20. Classification of trees and shrubs in the four Bushveld ecozones (Grant and Thomas, 2000) of the Mogol River Catchment for implementation of the RVI.

Scientific name	Common names	Classification according to Grant and Thomas (2000)	Classification according to van Wyk & van Wyk (1997)	Classification accor-ding to Palgraves (1981)	Applied Class t = tree T= terrestrial R=riparian
Acacia caffra	Gewone haakdoring/ common hook thorn	**Riparian in all ecozones.**			**tR**
Acacia erioloba	Kameeldoring/Camel thorn	**Riparian in Mixed Bushveld and Central Mountain ecozones**			**tR**
Acacia erubescens	Blou haak / blue acacia	**Riparian in Northern mountain and Mixed Bushveld ecozones**			**tR**
Acacia karroo	Soet doring/ sweet thorn	**Riparian in all ecozones**			**tR**
Acacia mellifera	Swarthaak/black thorn		**Terrestrial**		**tT**
Acacia rehmanniana	Sydoring/silky acacia		**Riparian**	**Riparian**	**tR**
Acacia welwitschii	Delagoa-doring/Delagoa thorn		**Terrestrial**	**Terrestrial**	**tT**
Bersama tysoniana	Gewone witessenhout/common white ash		**Terrestrial**	**Terrestrial**	**tT**
Brachylaena rotundata	Bergvaalbos/mountain silver oak	**Riparian in Central Mountain ecozones**.		**Riverine fringes**	**tR**
Bridelia mollis	Fluweel soetbessie/velvet leaved sweet berry	**Terrestrial**			**tT**
Buddleja salviifolia	Salie hout/quilted buddleja or sagewood	**Riparian in all ecozones except in Thorny Bushveld.**			**tR**
Burkea africana	Sandsering/red or wild seringa	**Riparian in Mixed Bushveld ecozone**			**tR**
Cadaba aphylla	Swartstorm/Leafless cadaba		**Terrestrial**	**Terrestrial**	**sT**
Celtis africana	Witstinkhout/white stink wood	**Riparian in all ecozones.**			**tR**
Clerodendron glabrum	Tontelhout/Tinderwood	**Riverine**			**tR**
Combretum apiculatum	Rooi boswilg	**Terrestrial**			**tT**

Scientific name	Common names	Classification according to Grant and Thomas (2000)	Classification according to van Wyk & van Wyk (1997)	Classification accor-ding to Palgraves (1981)	Applied Class t = tree T= terrestrial R=riparian
Combretum erythrophylum	Riviervaderlandswilg/river bushwillow	**Riparian in all ecozones.**			**tR**
Combretum imberbe	Hardekool/leadwood	**Riparian in Northern Mountains, Central Mountains, Sour Bushveld ecozones**			**tR**
Combretum moggi	Rots boswilg/rock bushwillow/			**Terrestrial**	**sT**
Combretum molle	Fluweelboswilg/velvet bushwillow	**Terrestrial**			**tT**
Combretum zeyheri	Raasblaar large fruited bushwillow	**Terrestrial**		**River banks**	**tT**
Croton gratisimus	Laventel koorsbessie/lavender fever berry	**Terrestrial**			**tT**
Commiphora edulis	Skurwe blaar kanniedood/rough leaved corkwood/		**Terrestrial**		**tT**
Dichrostachys cinerea	Sekelbos/sickle bush	**Terrestrial**			**tT**
Diospyrus lycioides	Bloubos/bluebush			**Terrestrial**	**sT**
Diplorhynchus condylocarpus	Horing peultjie/hornpod tree	**Terrestrial**			**tT**
Dombeya rotundifolia	Drolpeer/wild pear	**Riparian in all ecozones**			**tR**
Elephantorrhiza burkei	Basboontjie/sumach bean	**Terrestrial**			**tT**
Engelerophytum magalismontanum	Stamvrug/milkplum	**Terrestrial**		**Riverine fringes**	**tR**
Euclea divinorum	Towerghwarrie/magic guarri			**Riparian**	**tR**
Euclea natalensis	Natal ghwarrie largeleaf guarri			**Riparian**	**tR**
Euclea crispa	Blou ghwarrie/ blue guarri		**Terrestrial**	**Terrestrial**	**tT**
Faurea saligna	Boekenhout/beechwood	**Terrestrial**		**River banks**	**tR**
Ficus ingens	Rooiblaar vy/red leafed fig	**Riverine**			**tR**
Ficus sur	Besemtros vy/broom cluster fig	**Riparian in all ecozones**			**tR**
Fluggae virosa	Witbessiebos/White-berry bush		**Terrestrial**		**tT**

Scientific name	Common names	Classification according to Grant and Thomas (2000)	Classification according to van Wyk & van Wyk (1997)	Classification accor-ding to Palgraves (1981)	Applied Class t = tree T= terrestrial R=riparian
Gardenia volkensii	Bosveld katjiepiering/ Savannah gardenia		**Terrestrial**		**tR**
Grewia flava	Wilderosyntjie/brandybush			**Terrestrial**	**tT**
Grewia flavescens	Skurweblaar rosyntjie rough leaved raisin			**Riparian**	**tR**
Grewia monticola	Vaal rosyntjie/silver raisin	**Riparian in Mixed Bushveld ecozones.**			**tR**
Grewia occidentalis	Kruis bessie/cross berry			**Terrestrial**	**tT**
Gymnosporia buxifolia (M. heterophylla)	Gewone pendoring/common spike thorn	**Riparian in Central and Northern Mountain and Thorny Bushveld ecozones**			**tR**
Heteromorpha trifoliata	Wildepietersielie/ parsley tree		**Terrestrial**	**Terrestrial**	**tT**
Heteropyxis natalensis	Laventelboom/lavender tree	**Riparian in Central and Northern Mountain ecozones**			**tR**
Hexalobus monopetalus	Shakama pruim/shakama plum		**Riparian**		**tR**
Maerua angolensis	Knoppies boontjie boom/ bead bean tree		**Terrestrial**		**tT**
Mimusops zeyheri	Moepel/Transvaal milkwood			**Riparian**	**tR**
Nuxia oppositifolia	Watervlier/Water elder	**Riparian**			**tR**
Ochna arborea	Kaapse rooihout/Cape plane		**Terrestrial**	**Terrestrial**	**tT**
Ochna pulcra	Lekkerbreek /peeling plane		**Terrestrial**	**Terrestrial**	**tT**
Olax dissitiflora	Klein suurpruim/small sourplum		**Riparian**		**tR**
Olea eurpaea	Olienhout/wild olive	**Riparian in all ecozones**			**tR**
Osyrus quadripartita	Bergbas/transvaal sumach		**Terrestrial**	**Terrestrial**	**tT**
Papea capensis	Doppruim/jacket-plum	**Riparian in Central Mountain ecozones**	**Riverine fringes**		**tR**
Peltophorum africanum	Huilboom/weeping wattle	**Terrestrial**			**tT**

Scientific name	Common names	Classification according to Grant and Thomas (2000)	Classification according to van Wyk & van Wyk (1997)	Classification accor-ding to Palgraves (1981)	Applied Class t = tree T= terrestrial R=riparian
Pterocelastrus echinatus	Wit kershout/white candle wood		**Riverine fringes**		**tR**
Pterocarpus rotundifolius	Dopperkiaat/roundleaved bloodwood		**Terrestrial**		**tT**
Rhus chirindensis	Bostaaibos/red currant rhus	**Riparian in all ecozones**			**tR**
Rhus lancea	Karree/karroo tree	**Riparian in all ecozones**			**tR**
Rhus pyroides	Gewone taaibos common currant rhus	**Riparian in Central. Mountains and Sour and Thorny Bushveld ecozones**			**tR**
Schotia brachypetala	Huilboerboon/weeping boerboon	**Riparian in Central, Northern Mountain & Sour Bushveld ecozones**			**tR**
Sclerocarya birrea	Maroela/marula	**Terrestrial**			**tT**
Spirostachus africana	Tambotie/tamboti	**Riparian in all ecozones**			**tR**
Sterculia rogersii	Gewone sterkastaaing/common star chesnut		**Terrestrial**		**tR**
Strychnos madagascariensis	Swart klapper/black monkey	**Riparian in all ecozones**			**tR**
Syzygium cordatum	Waterbessie/waterberry	**Riparian in all ecozones**			**tR**
Syzygium guineense	Waterpeer/water pear/		**Riparian**		**tR**
Terminalia sericea	Vaalboom/transvaal silver leaf	**Terrestrial**			**tT**
Vitex rehmannii	Pypsteel boom/pipe-stem tree	**Terrestrial**			**tT**
Vangueria infausta	Wilde mispel/ wild medlar		**Terrestrial**	**Terrestrial**	**tT**
Ziziphus mucronata	Blinkblaar-wag-n-bietjie/ buffalo thorn	**Riparian in all ecozones**			**tR**

Substrate particle size.

In order to standardize, the classification of the riparian substrate as supplied by Rowntree and Wadeson was used: Boulders: particles > 256mm (larger than an adult head), Cobble: particles from 64 – 256mm (larger than a fist), Gravel: particles from 2 – 64 mm (small pea to size of fist) and sand: particles < 2mm (but individual grains still visible). The description in brackets refers to how the size was practically determined in the field.

8.2 DATA PRESENTATION AND CALCULATION OF THE RVI

a) Site description tables

In order to provide a synopsis of each site the data is presented as a RVI Description Table as prescribed by Kemper (2001). This also allows for easy calculation of the RVI with all the index scores directly at hand. These Description Tables are presented in appendix I of this report.

b) RVI calculation and presentation.

The scoring of the results to determine EVC (extent of vegetation cover), SI (structural intactness), PCIRS (percentage cover of indigenous riparian species) and RIRS (recruitment of indigenous species) were done according to the scoring system or tables provided by Kemper (2001).

Each of these sub-indices were then calculated using the formula provided by Kemper (op cit). To calculate the RVI score the formula supplied below was used:

$$RVI = [(EVC) + ((SI \times PCIRS) + (RIRS))]$$

The calculations and RVI scores obtained are also presented as part of the site Description Tables in appendix I.

c) Graphical presentations

As indicated by Kemper (2001) graphical results facilitate easy comparison of rivers or river segments. This could also be used to indicate and illustrate trends of change in the river. It was therefore decided to present the RVI findings of the sites in each of the rivers in graphical form.

8.3 RESULTS

The sites and rivers.

The following twenty eight sites in the rivers listed below where monitored:

i) The Sand River (5 sites),

ii) The Loubad River (1 site),

iii) The Dwars River (2 sites),

iv) Frikkie se Loop (2 sites),

v) Sterkstroom (3 sites),

vi) Taaibosspruit (2 sites),

vii) Rietspruit (2 sites) and

viii) The mainstem of the Mogol River (11 sites)

The exact location and summarized details of each site are listed in the Site Description Tables (appendix 1). Each site was named, numbered and given a reference number. These details are reflected both in the Site Description Tables (appendix 1) and in table 2.

In these tables the following information is also listed: the channel type, the substrate types (in order of dominance), the level of disturbances and causes of disturbance in order of importance, the two main vegetation types, the three most dominant woody species and the species richness at the site. Each set of the abovementioned information also has a reference number added (eg. D4 or D7 etc) which refer directly to the site assessment forms.

In the tables the following abbreviations apply: VL= very low, L = low, M = medium, H = high and VH = very high.

A rough sketch map of each site was site was also drawn. These maps form part of the original field forms sets and are available as reference.

All the tributaries, except for the Dwars River, that flow into the Mogol River originate in and flow mostly through the Central Mountain ecozone. The only exception where the another ecozone is involved is in the case of the total Dwars River and where the Mogol main stem flows through a Mixed Bushveld ecozone in the vicinity of the Mokolo Dam and downstream of the town of Lephalale / Ellisras.

Rivers that originate and flow through the same ecoregion for their whole length are the Dwars River (ecoregion 1.05) and the Taaibosspruit and Rietspruit (ecoregion 2.03). The Sterk River and Frikkie se Loop both originate in ecoregion 2.03 and flow into ecoregion 1.05. The Sand River originates in ecoregion 2.05 and its final site was in ecoregion 2.04. The main stem of the Mogol River flows, except for the first two sites, which are in ecoregions 2.04 and 2.03 respectively, through ecoregion 1.05. The only site in the Loubad River was in ecoregion 2.05.

The RVI scores

The scores calculated for the 28 sites are indicated in the Site Description Tables (appendix 1) and in the third column of table 2. As a matter of convenience the descriptions of the 6 Ecological Reserve Classes appear in table 3. These scores were also used to prepare graphs of the status of the riparian vegetation and trends in the rivers and these are presented as Figures 1, 2, 3 and. 4. The four smaller tributaries (Dwars River, Rietspruit, Taaibosspruit and Frikkie se Loop) are placed in one graph, while the Sand River, Sterkstroom and main stem of the Mogol River are presented separately. In each of the figures the Ecological Reserve Class boundaries are indicated as horizontal lines to facilitate the explanation of trends.

The extent of disturbance and of vegetation invasion in the catchment.

The extent of invasion by reeds and terrestrial and alien plants are reflected in table 2 where the RVI scoring of invasion per site is again illustrated. In the case of the alien and terrestrial plants all the species recorded at each site are also listed in his table.

TABLE 21. Extent of alien, terrestrial and reed invasion of the riparian zone at the sites in Mogol River Catchment surveyed in 2002. The sites are arranged in each tributary starting from headwater to confluence with Mokolo River. The same approach applies to the main stem of the Mogol River. ERC: Ecological Reserve Assessment Class, VL: very low, L: low, M: medium, H: high, VH: very high)

Location		RVI	Exotics		Terrestrials		Reeds
River	**Site Name, reference and number**	**Score & ERC**	**Score in RVI**	**Specie**	**Score in RVI**	**Specie**	**Score in RVI**
Sandrivier	Sand upper site A4SAND-UPPER (1)	12 E	L	*Persicum* sp *S. babylonica*	VL	*L. javonica*	VL
Sandrivier	Leeuwenhof A4SAND-LEEUW (2)	13 C	L-M	*Populus* sp *L. camara* *M. azedarach*	L	*D. lycioides*	VL
Sandrivier	Top bridge A4SAND-TOPBR (3)	13 C	VH	*Populus* sp *Honey locus*	M	*D. lycioides*	VL
Sandrivier	Turn-off to Melkrivier A4KLSA-BOEKE (5)	16 C	L	*M. azedarach* *M. alba*	L	*L. javonica* *G. occidentalis* *D. cinerea*	VL
Sandrivier	Alma Bridge A4SMOGO-ALMAB (6)	12 D	VH	*Populus* *M. alba* *S. babylonica* Privet sp	L	*D. lycioides*	L
Louwbad River	Rail/road Bridge A4SAND-LOUBA (4)	11 D	M	*S. punicea* *Populus* sp *Eucalyptus* sp *Persicum* sp	L	*T. sericea* *Protea* sp *V. rehmania* *O. arborea*	VL
Dwarsrivier	Dwars 1 A4DWAR-ZANDD (19)	12 D	M-H	*S. punicea* *Populus* sp *Eucalyptus* sp	VL	*D. lycioides* *A. rehmania*	L

Location		RVI	Exotics		Terrestrials		Reeds
River	**Site Name, reference and number**	**Score & ERC**	**Score in RVI**	**Specie**	**Score in RVI**	**Specie**	**Score in RVI**
Dwarsrivier	Jim se loop A4DWAR-JIMSE (20)	13 C	VL	*S. punicea* *M. azedarach* *Opuntia*	L	*D. lycioides* *D. cinereae*	0
Frikkie se loop	Frikkies top bridge A4FRIK-SHAM1 (13)	15 C	0	*none*	L	*T. sericea* **O. pulcra** *Protea* sp	VL
Frikkie se loop	Welgevonden Camp A4FRIK-SHAM2 (22)	17 B	0	*none*	VL	*D. lycioides* *T. sericea* *C. moggi* *C. apiculatum*	VL
Sterkstroom	Broken bridge A4STER-WELG1 (9)	15 C	0	*none*	VL	*T. sericea* *L. javonica*	L
Sterkstroom	Sterkstroom/grootfontein Junction A4STER-WELG2 (10)	16 C	VL	*S. punicea* *M. azedarach*	L	*O.pulcra* *T. sericea* *L. javonica*	L
Sterkstroom	Low Mogol bridge A4STER-DOORN (23)	11 D	M-H	*M. alba* *M. azedarach*	L	*D. lycioides*	L
Taaibosspruit	Monitor bridge A4TAAI-WELG1 (11)	18 B	0	*none*	VL –L	*D. lycioides* *T. sericea* *O. pulcra*	VL

Location		RVI	Exotics		Terrestrials		Reeds
River	**Site Name, reference and number**	**Score & ERC**	**Score in RVI**	**Specie**	**Score in RVI**	**Specie**	**Score in RVI**
Taaibosspruit	Second bridge A4TAAI-WELG2 (12)	18 B	0	*none*	VL	*T. sericea* *D. cinerea*	VL
Rietspruit	Rietspruit (3) Fancy A4RIET-FANCY (17)	17 B	VL	**S. sesban**	L	*D. cinerea* *T. sericea*	VL
Rietspruit	Rietspruit (4) Waterfall A4RIET-WATER (18)	16 C	VL	**R. communis**	M	*D. cinerea* *C. gratissimus* *B. mollis* *A. welwitschia*	VL
Mogol	Tweefontein bridge A4MOGO-TWEEF (7)	12 D	H	*Populus* sp *M. azedarach*	VL	*D. lycioides*	VH
Mogol	Bridge upsteam of Vaalwater A4MOGO-GROEN (14)	12 D	L	*S. punicea* *M. azedarach* *M. alba*	M	*T. sericea* *P. rotundifolia* *D. lycioides*	M
Mogol	Vaalwater sewage A4MOGO-VAALW (21)	13 C	H	*Eucalyptus* sp *M. azedarach* *S. punicea*	0	*None*	VL
Mogol	Sterkstroom Confluence A4MOGO-STERK (24)	15 C	VL-L	*S. punicea* *M. azedarach* *M. alba*	L	*T. sericea* *O. pulcra* *P. rotundifolius*	L

Location		RVI	Exotics		Terrestrials		Reeds
River	**Site Name, reference and number**	**Score & ERC**	**Score in RVI**	**Specie**	**Score in RVI**	**Specie**	**Score in RVI**
Mogol	Witfontein bridge A4MOGO-WITFO (25)	14 C	L	*M. azedarach*	L	*P. africanum* *T. sericea*	M
Mogol	Mokolo reserve A4MOGO-MOKOL (26)	16 C	0	*None*	VL	*T. sericea* *O. arborea* *C. gratissimus*	L
Mogol	Mokolo Dam Waterworks A4MOGO-WWORK (15)	14 C	VL	*S. punicea*	M	*T. sericea* *D. cinerea* *O. arborea*	M
Mogol	Witkop causeway A4MOGO-WITKO (16)	13 C	0	*None*	M-H	*D. cinerea* *T. sericea* *D. lyciooides* *S. birrea*	M
Mogol	D' Nyala Bridge A4MOGO-DNYAL (27)	13 C	L	*M. azedarach*	M	*T. sericea* *D. cinerea* *D. lycioides* *G. flavescens*	M
Mogol	Marken Bridge A4MOGO-MARKE (28)	12 D	VL	*M. azedarach*	M	*T. sericea* *D. lycioides* *D. cinereae*	M
Mogol	Beska bridge A4MOGO-BESKA (29)	14 C	0	*None*	M	*T. sericea* *D. lyciodes* *A. Mellifera* *D. cinerea*	H

In order to illustrate the extent of disturbance within the riparian zone at the sites the disturbance scores and cause of disturbance was extracted from the Site Description Tables (appendix 1) and presented in tabular form (table 4).

Site inventory of shrubs and trees.

The trees and shrubs recorded and identified at each site are presented in tables 5, 6 and 7. Some tributaries are presented together in the same table in order to save space. The same list of species was used as a template for each table to serve as an indication of which species were not present or were not recorded.

8.4 Discussion.

RVI scores and trends in the rivers (APPENDIX E)

a) The Sand River

As is indicated in figure 1 this river changes from largely modified (ERC class D) at its upper site to a class C at sites 2, 3 and 5 and back to a class D at the last site. This last site is at Alma Bridge. Although three sites in the river fall within a class C, the scores of 13 can be regarded as low and it is felt that this river could be classified as low C/ high D (C/D).

b) The four small tributaries

Of the four the Taaibosspruit was rated the best, with both its sites rated as class B. This could be attributed to the fact that both sites were in a nature reserve. In Frikkie se Loop, also with both sites in a nature reserve, the uppermost site was rated as Class C but this improved to a class B at the second site. In the Rietspruit there was a downward trend in the second site, but this could be attributed to flood damage. Al three rivers could be regarded as class B rivers. The Dwars River however was in a worse state than the three others and although there was an upward trend from class D to class C, this river could be classified as class D.

Table 22. RVI scores and description of the corresponding Ecological Reserve Classes adapted from Kemper (2001) .

RVI Scores	Assessment classes	Description
19 – 20	**A**	***UNMODIFIED, NATURAL***
17 – 18	**B**	**Largely natural with few modifications.** (A small change in natural habitats and biota may have taken place but the ecosystem functions are predominantly unchanged)
13 – 16	**C**	**Moderately modified.** (A loss and change of natural habitats and biota have occurred but the basic ecosystem functions are still predominantly unchanged)
9 - 12	**D**	**Largely modified.** (A large loss of natural habitat, biota and basic ecosystem functions have occurred)
5 - 8	**E**	**Seriously modified** (The loss of natural habitat, biota and basic ecosystem functions are extensive.)
0 - 4	**F**	**Critically modified** (Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In worst cases the changes are irreversible).

c) <u>The Sterkstroom</u>

The downward trend observed in this river, from a class C at the two upper sites to a class D at the site near the confluence with the Mogol is indicative of the fact that the two upper sites are situated in a reserve.

d) <u>The main stem of the Mogol.</u>

The RVI scores at the sites indicate that the river improves from a class D to a class C after the first two sites and it remains in this class for the next 5 sites. The higher scores of 14, 15 and 16 scored in this class are at sites above the Mokolo Dam with 16 having been scored in the Mokolo Ranch. At the second last site the scores drops to 12 but is again 14 at the last site. This river could on the basis of this findings be regarded as a class C river.

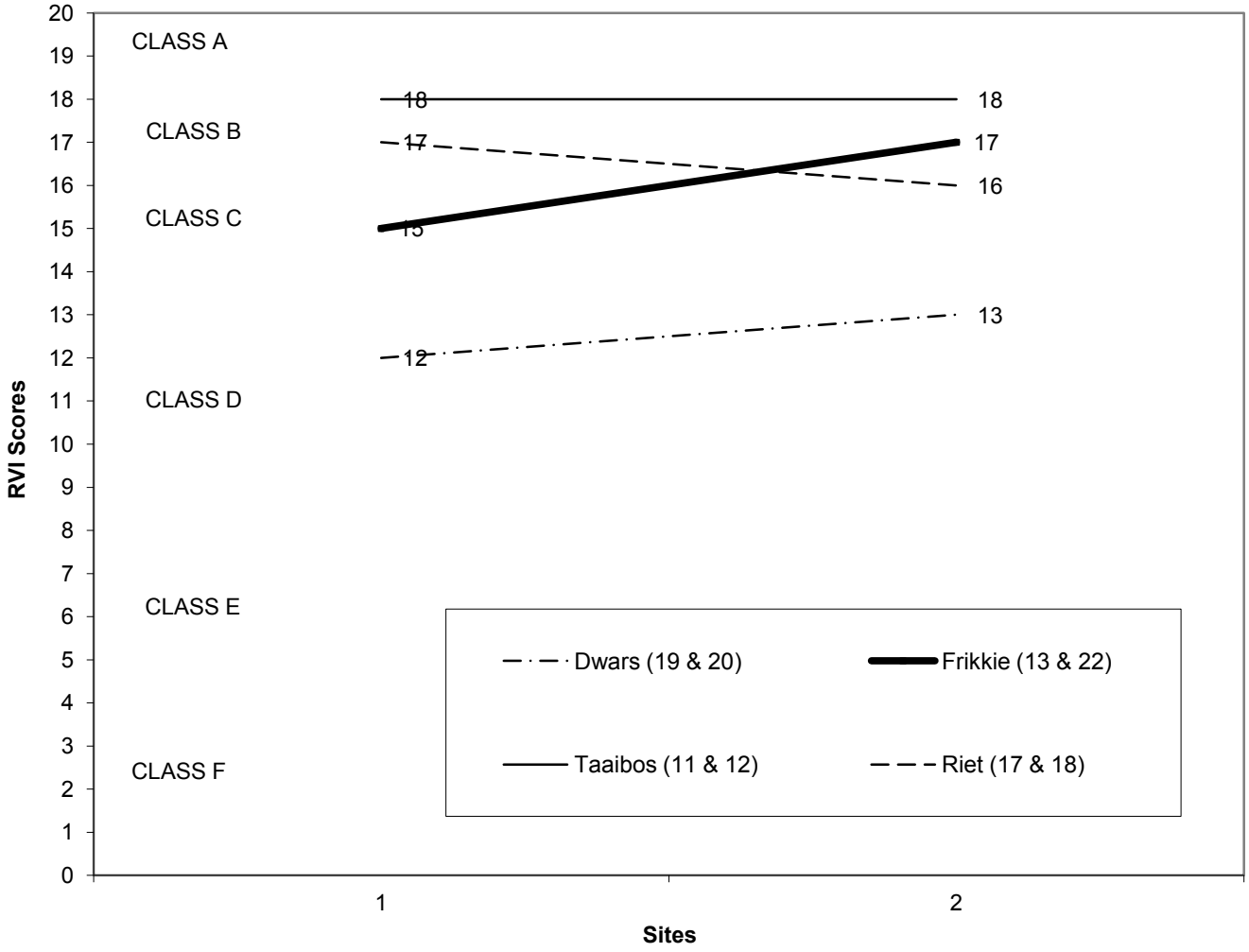


Figure 5: RVI scores obtained in the Dwars River, Frikkie se loop, Taaibosspruit and Rietspruit during the 2002 RHP survey of the Mogol River Catchment. The site numbers are supplied in brackets in the legend and the RVI scores are indicated on the graph

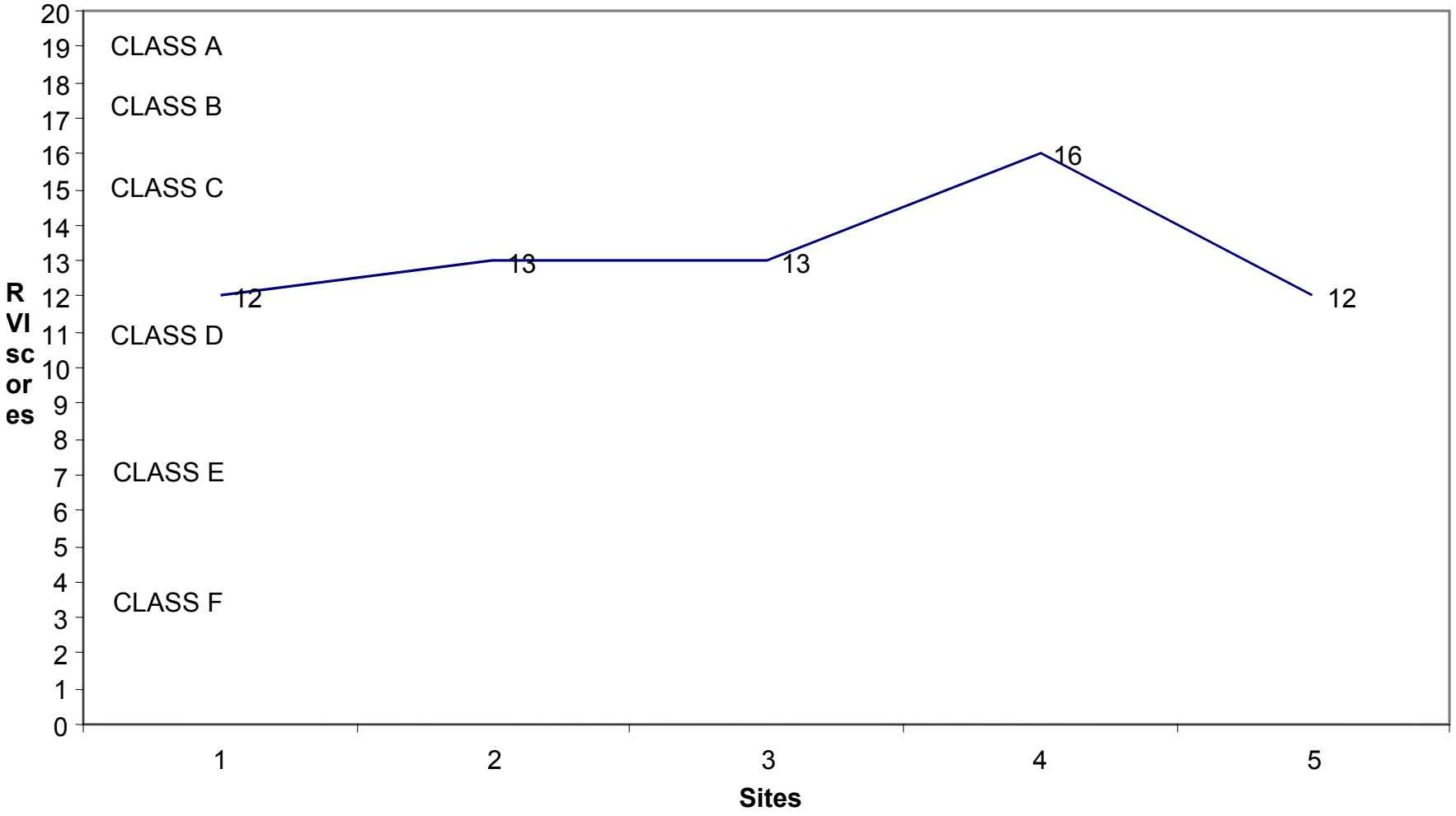


Figure 4: RVI scores obtained at sites 1,2,3,5 and 6 in the Sand River during the 2002 survey of the Mogol River catchment. The score obtained at each site is indicated on the graph.

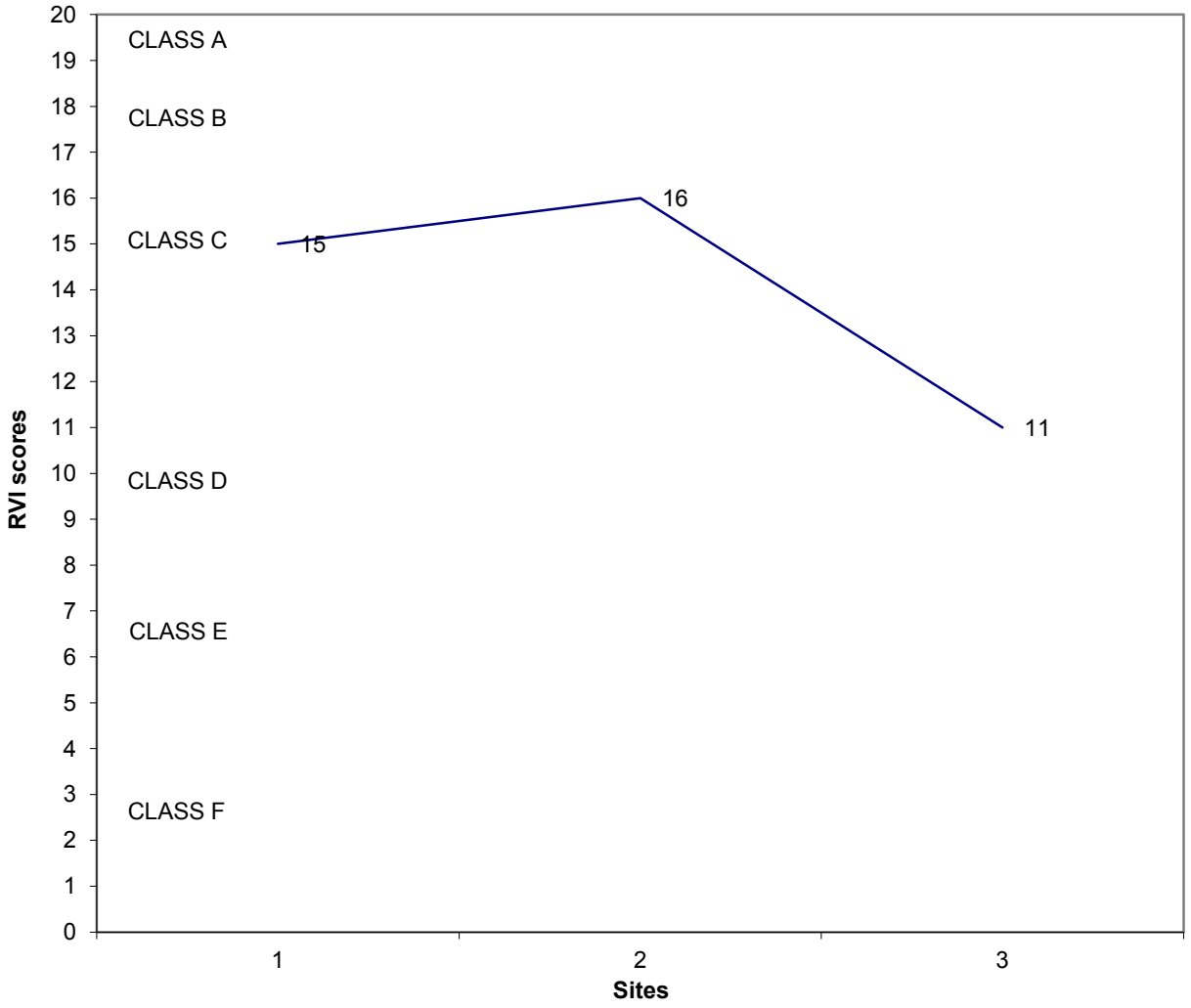


Figure 6: RVI scores obtained at sites 9, 10 and 23 in the Sterkstroom during the 2002 RHP survey in the Mogol River Catchment. The scores obtained at the three sites are indicated on the graph.

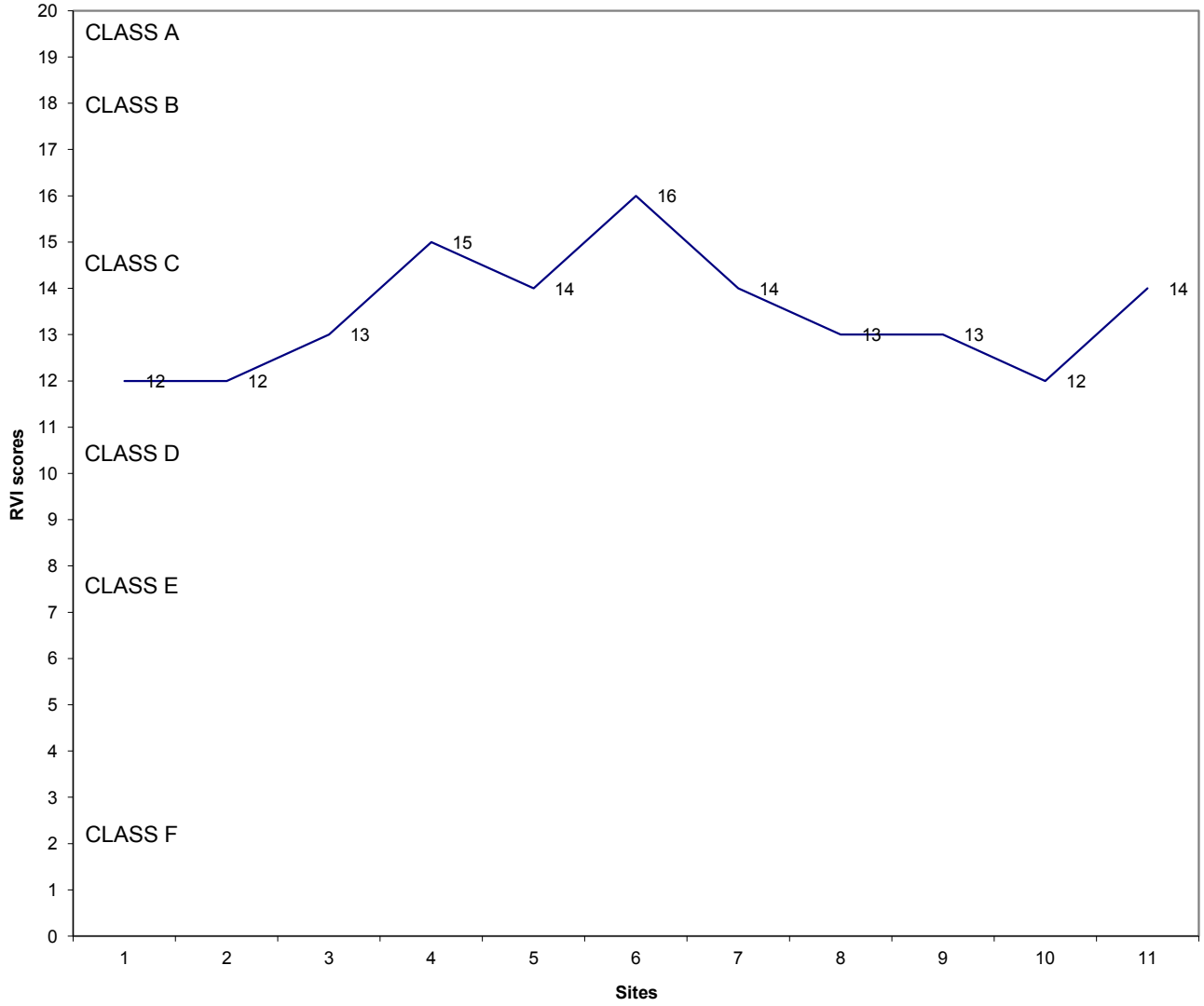


Figure 7: RVI scores at sites 7, 14, 21, 24, 25,26, 15, 16, 27, 28 and 29 in the main stem of the Mogol River obtaned during the 2002 RHP survey. The scores obtaned at each site is indicated on the graph.

8.5 Vegetation invasion (Table 21).

a) Sand River

In this river the extent of vegetation invasion ranged from very low to very high. Two notable sites are sites 3 and 6 where the density of Populus plants was extremely high. Calculations of the Populus at the sites showed densities of 1- 2 juveniles per square meter and 4 adults per every 5 square meters at site 3. At this site more than 0,5 hectares of the riparian zone was occupied by this species. A similar situation existed at site 6 where a calculated 0,1 hectare was occupied by poplars at a density comparable to site 3. At site three the situation was exacerbated by the presence of large numbers of terrestrial specie, *D. lycioides.* Invasion by reeds at all sites varied from very low to low and reeds therefore had very little influence on the RVI scores.

b) The four small tributaries

It should be noted that all the sites of both the Taaibosspruit and Frikkie se Loop no exotic vegetation could be found. While in the Rietspruit and the second site exotics were rated as very low, exotic invasion rated as medium to high at the upper site in the Dwars River. Invasion by terrestrials and by reeds was either very low or low at all the sites of these rivers.

c) The Sterkstroom

All the sites have little reed invasion but some extent of invasion by terrestrial plants. Where the two upper sites have very little invasion by exotics the high degree of invasion at site 23 is of great concern.

d) The main stem of the Mogol.

While at three sites (see table 1) no exotic vegetation was observed, the other sites did have exotic plants growing in the riparian zone. Except for site 21 the invasion at these sites rated either as low or very low.

At the upper sites terrestrial invasion, except for site 14, were rated as low or very low. This picture however changed downstream of the Mokolo dam where all the sites were rated as having medium or even high scores of terrestrial invasion. A similar pattern is observed when invasion by reeds is concerned. Both reed and terrestrial

invasion in the reach of the river below the dam are clear indication of the flood control created by the Mokolo Dam.

8.6 Disturbance (Table 23).

a) Sand River

At five of the six sites in this river the major cause of disturbance was vegetation invasion and infrastructure.

b) The four small tributaries

Except for the Dwars River where disturbance ranged from very low to very high, the disturbance scores at the rest of the sites in the other three rivers were either very low or low. The causes of these disturbances was varied, as is shown in table 4.

c) The Sterkstroom

Although the disturbance scores varied at the three sites the maximum scores of either medium to very high, contributed to the low RVI scores in this river. While floods and infrastructure were responsible for the disturbance at sites 9 and 10, vegetation invasion and crop farming caused the disturbance at site 23.

d) The main stem of the Mokolo

The extent of disturbance as illustrated in table 4 is quite varied ranging from very low to very high. The same variation applies to the causes of disturbance at all the sites.

TABLE 23: Disturbance scores and major causes of disturbances in the sites monitored in the Mogol River Catchment during the RHP survey of 2002. The sites are arranged in each tributary starting from headwater to confluence with Mogol River. The same approach applies to the main stem of the Mogol River. ERC: Ecological Reserve Assessment Class, VL: very low, L: low, M: medium, H: high, VH: very high.

Location			RVI	Disturbance	
River	Site Name and number		Score & ERC	Range of scores	Causes
Sandrivier	Sand upper site	1	12/E	L-H	Flood Infrastructure
Sandrivier	Leeuwenhof	2	13/C	M	Vegetation invasion Flow regulation
Sandrivier	Top bridge	3	13/C	VL - H	Vegetation invasion Roads & bridges
Sandrivier	Turn-off to Melkrivier	5	16/C	VL –L	Roads and bridges Vegetation invasion
Sandrivier	Alma Bridge	6	12/D	L - VH	Vegetation invasion Weir
Louwbad River	Rail/road Bridge	4	11/D	VL – M	Bridges Local inundation
Dwarsrivier	Dwars (1)	19	12/D	VL - VH	Vegetation invasion Local inundation
Dwarsrivier	Jim se loop	20	13/C	L - M	Vegetation invasion Infrastructure
Frikkie se loop	Frikkies top bridge	13	15/C	VL -L	Roads and bridges Erosion and sediments
Frikkie se loop	Welgevonden Camp	22	17/B	VL - L	Grazing and browsing Roads and bridges
Sterkstroom	Broken bridge	9	15/C	VL - M	Floods Bridges
Sterkstroom	Sterkstroom/grootfontein	10	16/C	VL - M	Floods Roads and bridges
Sterkstroom	Low Mogol bridge	23	11/D	VL - VH	Vegetation invasion Crop farming/erosion
Taaibosspruit	Monitor bridge	11	18/B	VL - L	Roads and bridges Grazing
Taaibosspruit	Second bridge	12	18/B	VL	Floods Grazing
Rietspruit	Rietspruit (3) Fancy	17	17/B	L	***Flow regulation*** Bush clearing
Rietspruit	Rietspruit (4) Waterfall	18	16/C	VL	***Floods*** Grazing and browsing
Mokolo	Tweefontein bridge	7	12/D	L	Roads and bridges
Mokolo	Upsteam of Vaalwater	14	12/D	L - M	Roads and bridges Crop farming/grazing

Location		RVI	Disturbance	
River	Site Name and number	Score & ERC	Range of scores	Causes
Mokolo	Vaalwater sewage 21	13/C	VL - VH	Vegetation invasion Vegetation removal
Mokolo	Sterkstroom Confluence 24	15/C	L - H	Roads and bridges Vegetation invasion
Mokolo	Witfontein bridge 25	14/C	VL - M	Roads and bridges Grazing
Mokolo	Mokolo reserve 26	16/C	VL - L	Grazing and browsing Roads and bridges
Mokolo	Mokolo Dam Waterworks 15	14/C	VL - M	Flow regulation Local inundation
Mokolo	Witkop causeway 16	13/C	L - M	Roads and bridges Flow regulation
Mokolo	D' Nyala Bridge 27	13/C	VL - M	Vegetation invasion Roads and bridges
Mokolo	Marken Bridge 28	12/D	L - M	Crop farming Vegetation invasion
Mokolo	Beska bridge 29	14/C	VL - H	Reed invasion Roads and bridges

8.7 CONCLUSIONS.

The influence of flow regulation and the absence of the normal flooding regime, caused by the Mokolo Dam, are clearly illustrated by the invasion of the riparian zone by reeds and terrestrial woody species.

In most of the tributaries and the main stream of the Mogol River above the dam the extent of invasion, for both reeds and terrestrials, range from very low to low. Below the dam this situation however changes and the extent of invasion, by both components, is higher at all the sites ranging from medium to high.

Although chemical spraying of the reeds had reportedly been undertaken, no marked effect of the exercise was visible at the sites that were monitored.

Exotics

Although only ten exotic plant species were identified in the catchment the extent of invasion by some of these species is a cause for concern. Three species involved are poplars (*Populus* sp), mulberry (*Morus alba*) and seringa (*Melia azedarach)*. At two

sites (Alma Bridge and the upper site in the Sand River) the extent of invasion by poplars were rated as *very high.* At these sites the plant density ranged from 1 - 4 plants per square meter and in both cases more than 30 % of the area selected, contained poplars. The invasion by exotics could not be related to flooding, as is the case with reeds and terrestrials and seemed to be localized in certain sites.

Table 24: Trees and shrubs recorded in the riparian zone of four of the tributaries of the Mogol River in 2002. The sites are arranged in order, starting from the upper catchment. The last site is closest to the confluence of the river with the Mogol River.

	Site numbers							
	Dwars River		Frikkie se loop		Taaibos-spruit		Rietspruit	
Scientific name	19	20	13	22	11	12	17	18
Acacia caffra				ŏ				
Acacia erioloba								
Acacia erubescens								ŏ
Acacia karroo	ŏ	ŏ						
Acacia mellifera								
Acacia rehmanniana	ŏ							
Acacia welwitschii								ŏ
Bersama tysoniana								ŏ
Brachylaena rotundata								
Bridelia mollis				ŏ	ŏ			ŏ
Buddleja salviifolia								
Burkea africana			ŏ	ŏ	ŏ	ŏ		
Cadaba aphylla								
Celtis africana								
Clerodendron glabrum				ŏ				
Combretum apiculatum			ŏ	ŏ			ŏ	ŏ
Combretum erythrophylum								
Combretum imberbe								
Combretum moggi			ŏ	ŏ				ŏ
Combretum molle					ŏ	ŏ		
Combretum zeyheri								
Croton gratisimus								ŏ
Commiphora edulis								
Dichrostachys cinerea		ŏ				ŏ	ŏ	ŏ
Diospyrus lycioides	ŏ	ŏ	ŏ	ŏ	ŏ			
Diplorhynchus condylocarpus								
Dombeya rotundifolia				ŏ	ŏ	ŏ		
Elephantorrhiza burkei				ŏ				
Engelerophytum magalismontanum			ŏ	ŏ		ŏ		
Euclea divinorum		ŏ						
Euclea natalensis			ŏ	ŏ				ŏ
Euclea crispa								
Faurea saligna			ŏ	ŏ	ŏ	ŏ		
Ficus ingens								
Ficus sur				ŏ				
Fluggae virosa								ŏ
Gardenia volkensii							ŏ	
Grewia flava		ŏ						
Grewia flavescens	ŏ							ŏ

	Site numbers							
	Dwars River		Frikkie se loop		Taaibos-spruit		Rietspruit	
Grewia monticola								ŏ
Grewia occidentalis				ŏ				
Gymnosporia buxifolia	ŏ	ŏ	ŏ					
Heteromorpha trifoliata								
Heteropyxis natalensis			ŏ	ŏ	ŏ			ŏ
Hexalobus monopetalus							ŏ	ŏ
Lippea javonica						ŏ		
Maerua angolensis								
Mimusops zeyheri								ŏ
Nuxia oppositifolia								ŏ
Ochna arborea				ŏ				
Ochna pulcra			ŏ	ŏ	ŏ	ŏ		ŏ
Olax dissitiflora								
Olea eurpaea								
Osyrus quadripartita								
Papea capensis								
Peltophorum africanum		ŏ		ŏ				
Pterocelastrus echinatus								ŏ
Pterocarpus rotundifolius				ŏ				
Rhus chirindensis				ŏ				
Rhus lancea		ŏ		ŏ		ŏ		
Rhus pyroides	ŏ	ŏ						
Schotia brachypetala								
Sclerocarya birrea								ŏ
Spirostachus africana								ŏ
Sterculia rogersii								
Strychnos madagascariensis								ŏ
Syzygium cordatum				ŏ	ŏ	ŏ	ŏ	
Syzygium guineense			ŏ				ŏ	ŏ
Terminalia sericea	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ
Vitex rehmannii				ŏ				
Vangueria infausta							ŏ	
Ziziphus mucronata	ŏ	ŏ						ŏ

Table 25. Inventory of the indigenous trees and shrubs recorded in the riparian zone of the Sand and Sterk rivers in 2002. The sites are arranged in the correct following order starting from the upper catchment. The last site in each tributary is closest to the confluence of the specific river with the Mogol River.

	SITE NUMBERS							
	Sand River					Sterk River		
Scientific names	1	2	3	5	6	9	10	23
Acacia caffra								
Acacia erioloba								
Acacia erubescens								
Acacia karroo	ŏ			ŏ				ŏ
Acacia mellifera								
Acacia rehmanniana				ŏ				
Acacia welwitschii								
Bersama tysoniana								
Brachylaena rotundata								
Bridelia mollis							ŏ	
Buddleja salviifolia	ŏ	ŏ		ŏ	ŏ			
Burkea africana						ŏ		
Cadaba aphylla								
Celtis africana		ŏ	ŏ	ŏ				
Clerodendron glabrum								
Combretum apiculatum								
Combretum erythrophylum								ŏ
Combretum imberbe								
Combretum moggi								
Combretum molle		ŏ						
Combretum zeyheri				ŏ			ŏ	
Croton gratisimus								
Commiphora edulis								
Dichrostachys cinerea				ŏ				
Diospyrus lycioides	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ
Diplorhynchus condylocarpus							ŏ	
Dombeya rotundifolia				ŏ				
Elephantorrhiza burkei								
Engelerophytum magalismontanum							ŏ	
Euclea divinorum		ŏ		ŏ				
Euclea natalensis								ŏ
Euclea crispa							ŏ	
Faurea saligna		ŏ				ŏ		
Ficus ingens								
Ficus sur								
Fluggae virosa								
Gardenia volkensii								
Grewia flava								
Grewia flavescens								
Grewia monticola								
Grewia occidentalis				ŏ				
Gymnosporia buxifolia			ŏ		ŏ			ŏ
Heteromorpha trifoliata			ŏ					
Heteropyxis natalensis				ŏ			ŏ	
Hexalobus monopetalus								
Lippea javonica	ŏ	ŏ		ŏ		ŏ	ŏ	
Maerua angolensis								

	SITE NUMBERS							
	Sand River					Sterk River		
Mimusops zeyheri								
Nuxia oppositifolia								
Ochna arborea								
Ochna pulcra						♂	♂	
Olax dissitiflora								
Olea eurpaea								♂
Osyrus quadripartita		♂						
Papea capensis		♂						
Peltophorum africanum								
Protea sp.								
Pterocelastrus echinatus								
Pterocarpus rotundifolius								
Rhus chirindensis								
Rhus lancea	♂	♂	♂		♂			
Rhus pyroides	♂	♂	♂	♂	♂			♂
Schotia brachypetala								
Sclerocarya birrea								
Spirostachus africana								
Sterculia rogersii								
Strychnos madagascariensis								
Syzygium cordatum						♂	♂	
Syzygium guineense							♂	
Terminalia sericea				♂		♂	♂	
Vitex rehmannii							♂	
Vangueria infausta						♂		
Ziziphus mucronata		♂	♂	♂	♂		♂	

Table 26. Trees and shrubs recorded in the riparian zone of the Mogol River in 2002. The sites are arranged in the correct following starting from the upper catchment. The last site is closest to the confluence of the river with the Limpopo River

	Site numbers										
Scientific name	7	14	21	24	25	26	15	16	27	28	29
Acacia caffra					ŏ						
Acacia erioloba										ŏ	ŏ
Acacia erubescens				ŏ	ŏ			ŏ			ŏ
Acacia karroo				ŏ	ŏ	ŏ			ŏ	ŏ	ŏ
Acacia mellifera											ŏ
Acacia rehmanniana											
Acacia welwitschii											
Bersama tysoniana											
Brachylaena rotundata											
Bridelia mollis											ŏ
Buddleja salviifolia											
Burkea africana				ŏ							
Cadaba aphylla								ŏ			
Celtis africana											
Clerodendron glabrum											
Combretum apiculatum						ŏ					
Combretum erythrophylum		ŏ	ŏ	ŏ	ŏ	ŏ					
Combretum imberbe					ŏ						ŏ
Combretum moggi											
Combretum molle						ŏ					
Combretum zeyheri								ŏ			
Croton gratisimus						ŏ					
Commiphora edulis											
Dichrostachys cinerea							ŏ	ŏ	ŏ	ŏ	ŏ
Diospyrus lycioides	ŏ	ŏ		ŏ				ŏ	ŏ	ŏ	ŏ
Diplorhynchus condylocarpus											
Dombeya rotundifolia											
Elephantorrhiza burkei											
Engelerophytum magalismontanum											
Euclea divinorum		ŏ			ŏ						
Euclea natalensis						ŏ					
Euclea crispa											
Faurea saligna		ŏ									
Ficus ingens						ŏ					
Ficus sur											
Fluggae virosa				ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ
Gardenia volkensii						ŏ					
Grewia flava								ŏ		ŏ	ŏ
Grewia flavescens		ŏ						ŏ	ŏ	ŏ	ŏ
Grewia monticola								ŏ			
Grewia occidentalis		ŏ							ŏ		
Gymnosporia buxifolia	ŏ	ŏ	ŏ	ŏ							
Heteromorpha trifoliata											
Heteropyxis natalensis					ŏ						
Hexalobus monopetalus						ŏ					
Lippea javonica		ŏ									
Maerua angolensis								ŏ			
Mimusops zeyheri											
Nuxia oppositifolia					ŏ	ŏ	ŏ				

	Site numbers										
Ochna arborea				♂		♂	♂				
Ochna pulcra		♂		♂							
Olax dissitiflora											
Olea eurpaea											
Osyrus quadripartita											
Papea capensis											
Peltophorum africanum					♂		♂	♂			♂
Pterocelastrus echinatus											
Pterocarpus rotundifolius		♂		♂				♂			
Rhus chirindensis											
Rhus lancea											
Rhus pyroides	♂	♂	♂		♂			♂	♂	♂	♂
Schotia brachypetala				♂							
Sclerocarya birrea								♂		♂	
Spirostachus africana											
Sterculia rogersii								♂			
Strychnos madagascariensis											
Syzygium cordatum				♂							
Syzygium guineense						♂	♂			♂	
Terminalia sericea		♂		♂	♂	♂	♂	♂	♂	♂	♂
Vitex rehmannii							♂				
Vangueria infausta								♂			
Ziziphus mucronata	♂	♂	♂	♂	♂			♂	♂	♂	♂

9. Summarized Results.

Table 27. Summarized results per site, based upon 6 classes (A –F) of each of the monitored protocols.

Report No	RHP site Reference	Ecoregion	Geo	FISH	INVERTS	VEG
			Impact Class	FAII	SASS5	RVI
1	A4SAND-UPPER	2.05		C	C	E
2	A4SAND-LEEUW	2.05	B/C	C	C	C
3	A4SAND-TOPBR	2.05		C	C	C
4	A4SAND-LOUBA	2.05		C	A	D
5	A4KLSA-BOEKE	2.05		D	C	C
6	A4MOGO-ALMAB	2.04	D	C	C	D
7	A4MOGO-TWEEF	2.04		C	C	D
8	A4 KLSA-DONKE	2.04	D	D	N/A	N/A
9	A4STER-WELG1	2.03	B	C	C	C
10	A4STER-WELG2	2.03	B	C	B	C
11	A4TAAI-WELG1	2.03	B	D	C	B
12	A4TAAI-WELG2	2.03	B	D	B	B
13	A4FRIK-SHAM1	2.03	B	C	C	C
14	A4MOGO-GROEN	2.03		D	C	D
15	A4MOGO-WWORK	2.03B	C	D	C	C
16	A4MOGO-WITKO	2.03B	B/C	D	D	C
17	A4RIET-FANCY	2.03	B/C	C	C	B
18	A4RIET-WATER	2.03	B/C	C	C	C
19	A4DWAR-ZANDD	1.05		D	C	D
20	A4 DWAR-JIMSE	1.05		D	B	C
21	A4MOGO-VAALW	1.05		B	A	C
22	A4FRIK-SHAM2	1.05	C	B	B	B
23	A4STER-DOORN	1.05		B	B	D
24	A4MOGO-STERK	1.05	B/C	B	B	C
25	A4MOGO-WITFO	1.05		B	B	C
26	A4MOGO-MOKOL	1.05		B	B	C
27	A4MOGO-DNYAL	1.05B	B/C	D	C	C
28	A4MOGO-MARKE	1.05B	C	D	D	C
29	A4MOGO-BESKA	1.05B	C	D	D	C
30	A4MOGO-SHOTB	1.05B	D	D	C	N/A
31	A4MOGO-MONTE	1.03		N/A	N/A	N/A

Table 28. Summarized results based on 4 classes as utilized in RHP State of River Reports.

NATURAL	A
GOOD	B/C
FAIR	C/D
POOR	E/F

River Reach	Ecoregion	FISH	INVERTS	RIP VEG	GEO
		FAII	SASS5	RVI	IMPACT
Mogol	2.04	C	C	D	D
Mogol	2.03	D	C	D	N/A
Mogol	1.05	B	A/B	C	B/C
Mogol	2.03 B	D	C/D	C	B/C
Mogol	1.05 B	D	C/D	C	C
Mogol	1.03	N/A	N/A	N/A	N/A
Sand	2.05	C	A/C	C-E	B/C
Klein Sand	2.05	D	C	C	N/A
Klein Sand	2.04	D	N/A	N/A	D
Frikkiesloop	2.03	C	C	C	B
Sterkstroom	2.03	C	B/C	C	B
Taaibosspruit	2.03	D	B/C	B	B
Dwars & Jim se Loop	1.05	D	B/C	C	N/A
Frikkiesloop	1.05	C	B	B	C
Rietspruit	2.03B	C	C	B/C	B/C

10. Management recommendations.

Given the high water demands in the catchment, lack of water storage and the Present Ecological Status of the Catchment, is is difficult to make recommendations which are likely to significantly improve the current status of the River.

Nevertheless, the following should be considered.

- In terms of water supply for the environment, there have been no studies undertaken for the Mogol to date. The establishment of an ecological reserve would go some way towards protecting the existing fauna and flora, while providing some indication of water availability for future licences.
- Pulsed releases from Mokolo Dam are coordinated for agricultural purposes with little recognition of environmental requirements. From an environmental perspective, releases should mimic the natural hydrological regime of the system. Pulses of flow are considered detrimental to the ecology. Departmental management should liaise with water resource managers in an effort to improve the management of flows for the environment.
- A concerted effort to eradicate alien vegetation in the catchment can be motivated.
- The lack of historical data for the catchment reflects a lack of work within the catchment by aquatic specialists. A higher profile and presence of aquatic

scientific staff in the catchment would greatly improve liaison with all landowners along the river. The production and distribution of a State of River Report will further the awareness of aquatic issues but will not suffice. Scientists need to be appointed to undertake regular monitoring of the river.

- Large areas of the lower sections of the river near Ellisras (Lephalale) are being mined for sand and this has a serious effect on the system. The channels are modified and the riverine vegetation is destroyed at the access points for vehicles as well as the disruption of any stabilizing growth in the riverbed. This in turn accentuates erosion in times of high flows. Sand mining appears to be bypassing the necessary EIA procedures. The situation needs review and stricter control.

11. Acknowledgements.

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RIVER HEALTH PROGRAMME

A BIOMONITORING SURVEY OF THE MOGOL (MOKOLO) RIVER CATCHMENT (LIMPOPO), UNDERTAKEN DURING 2002.

APPENDIX 1

SITE INVENTORY

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Introduction.

The Mogol River rises in the bushveld basin, approximately 25km to the west of Nylstroom and flows northwards for approximately 200 km before joining the Limpopo River. The lower catchment is dominated by game farming, while the upper catchment is dominated by irrigated agriculture.

Important, perennial tributaries to the Mogol include the Sterkstroom, Taaibosspruit, Frikkies se loop, Loubadspruit, Sand, Klein Sand, Rietspruit and Dwars Rivers.

Only one large dam, the Mokolo Dam occurs in the Catchment. Flow below the Mokolo Dam is regulated and here the system experiences periodic pulses of flow throughout the year. Upstream of Mokolo Dam, the system is considered to be perennial, although in recent times the main river is becoming more seasonal in nature.

The Mogol River below the Mokolo Dam is heavily infested with the common reed, *Phragmites mauritianus.* The reed is thought to be impacting on releases of water from the Mokolo Dam and as a result, there have been numerous attempts to eradicate the reeds through the aerial spraying of herbicides. This activity gave rise to concerns in the Department of Environmental Affairs and as a result, the river was prioritized for an ecological assessment during the 2002 period.

A systematic biomonitoring survey of perennial rivers of the Mogol Catchment was undertaken between May and September 2002. A total of 30 sites were surveyed during this period. All sites were assessed for fish, invertebrates, riparian vegetation and geomorphology. In situ water quality was also recorded.

At the time of the survey, the river was not flowing in its lower reaches near the Limpopo confluence. A monitoring site (no 31) was identified in this region but could not be surveyed.

This "Site Inventory Report" provides up to date information pertaining to the monitoring sites used during the 2002 survey. This report is standardized against a template which has been published through the River Health Programme series. However, some modifications to the vegetation component have been made and are thus re-described below. The report is intended to be carried into the field during future surveys, so that repeat surveys can be undertaken at exactly the same localities, with similar monitoring effort. Additional important information is supplied, for reference in future surveys.

It should be noted that monitoring records for all disciplines are sparse within this catchment. Although some fish survey records do exist, none of these records can be attributed to those specific sites chosen for this survey. Accordingly, those historical records which do exist, have value for interpretation of results, but have little value for the future of this "site based" monitoring programme.

The 2002 survey, together with the compilation of the technical report and site inventory report has been undertaken as a capacity building exercise. In addition, there has been little information against which interpretation of results can be made. While every effort has been made to standardize methodologies in the compilation of these reports, it should be noted that some components of this study are highly subjective. Results of the survey should therefore be regarded with ***Moderate Confidence***

Explanation of Vegetation Tables. (P.S.O. Fouche)

i) **Dominant vegetation:** The type of plant or plant forms which are most common at the site and which clearly characterize the site in terms of riparian vegetation. This information is derived from the actual counts made during a "walkabout" survey of the RVI site. This includes riparian, terrestrial and exotic species.

a) **Dominance by biomass:** An estimate based on the number of woody specimens taller than 2m. The three most dominant species are ranked in order of dominance

b) **Dominance by recruitment:** An estimate based on the number of woody specimens shorter than 2m. The three most dominant species are ranked in order of dominance.

NB – only the top three species are listed in the inventory.

ii) **Substrate:** The type of substrate found at the site due to the extent of the transportation or deposition of river bed material by the river. The substrate was classified according to the data in the table below.

Substrate classification (adapted from Rowntree and Wadeson)

Substrate class	**Size (mm)**	**Practical description**
Bedrock	N/a	
Boulder	> 256	Larger than adult head
Cobble	64 – 256	Larger than fist
Gravel	2 – 64	Small pea → smaller than fist
Sand	0,06 – 2	Individual grains are visible
Silt and clay	< 0,06	Powdery or soapy, grains not visible

In the inventory, boulders and cobbles are listed together as rock/cobble and sand and gravel are listed together. An additional category namely soil is also added. This was done in order to conform to the RVI site assessment form used during the survey.
The substrate types are listed in order of priority.

iii) Channel type: The dominant channel-form that characterises the site, particularly in terms of the number of channels present. The type of channel is determined by the inherent stability of the bed material present and by the number of channels present. Based on the number, channels are categorized either as single or multiple. Multiple channels can also be categorized on the channel substrate e.g. An *anabranched channel* flows between stable bedrock while a *braided channel* is observed in unstable river beds such as is seen in classical sand rivers.
The term mixed is used to describe situation where anabranching and braiding occurs.

iv) Surrounding land use: The type of use for which the surrounding land is exploited.
v) Ecological rating: A qualitative rating, which considers the type of vegetation present, its abundance, species diversity and structural integrity. The sites are rated as high, medium or low.

vi) Site suitability: This refers to the suitability of the specific site as a future site for biomonitoring and is listed suitable or not suitable. These decisions are based on species diversity and the position of the site.

vii) Width of riparian zone: The width of the area adjacent to the river that could be defined as the riparian zone based on the description proved by Kemper 2001. The widths in the inventory are the following: right hand bank and islands and are recorded in this order.

viii) Invasion of the riparian zone. This information is derived from the actual counts made during a "walkabout" survey of the RVI site.

a) **Invasion by alien species:** The species are listed and the extent of invasion is categorized as Very high (VL), High (H), medium, (M), Low (L) or Very Low (VL).
b) **Invasion by terrestrial species.** The species are listed and the extent of invasion is categorized as Very high (VL), High (H), medium, (M), Low (L) or Very Low (VL).

NB – only the top three species of a) and b) are listed in the inventory.

SITE INFORMATION

Report reference: 1 **Riverbase code:** **A4SAND-UPPER**

Sampling date: August 2002

River Name: Sand
Locality:
Latitude (S) 24°-32.07'
Longitude (E) 28 ° -20.583'
Altitude (m.a.m.s.l.) 1440

Ecoregion: 2.05

Hydrological type: Perennial

Stream Classification:
B (Mountain stream) Pool riffle, gravel bed.

Access:

Travelling west from Nylstroom on the R33, turn right onto the Doornfontein Road. (Dooringpoort). The road follows a tributary of the Sand River. The road becomes gravel and eventually bears left to cross over the river. The site lies approx. 200m downstream from the bridge and is accessed through a gate and a dirt track leading down to the rivers edge.

Site History:

Fish:	2002	Geomorph:	2002
Invertebrates:	2002	Photographs:	2002
Riparian Vegetation:	2002		

Invertebrates

SASS5 Biotopes sampled: SIC, SOOC, MVEG, G, S, M.
IHAS: (Un-adjusted) 71
HQI: 96

Ecological importance:
Biomonitoring value: 2
Habitat diversity: 2

Fish

Fish habitat and sampling effort:

Habitat	Electro shocker	Small seine	Large Seine	Cast Net	Gill net
	Minutes	no of hauls	no of hauls	throws	Hrs
SD		6			
SS					
FD					
FS					

Fish habitat and cover rating:

Habitat	Abundance	Overhanging	Undercut Banks	Substrate	Aquatic
		Vegetation	& Root Wads		Macrophytes
SD	2	2	3	2	0
SS	4	3	3	2	0
FD	0	0	0	0	0
FS	4	2	3	3	0

Ecological importance:

Biomonitoring value: 2
Habitat diversity: 3
Species richness (recorded): 4

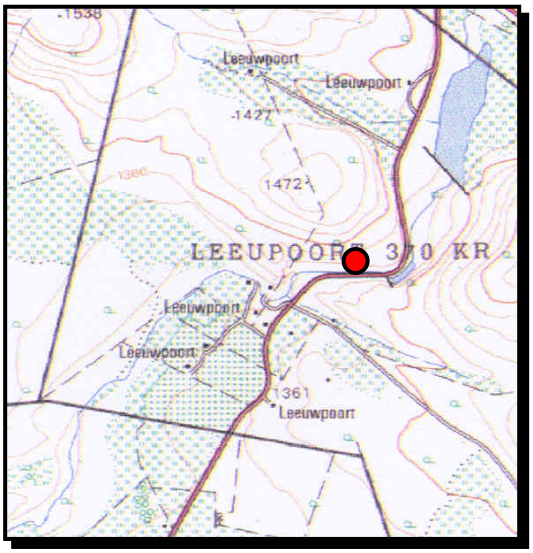
Riparian Vegetation

Inventory	
Site suitability	Not suitable, low species diversity and highly impacted
i) Channel type	Single
ii) Active channel width	10m
iii) Surrounding land use	Stock and irrigation farming
iv) Ecological rating	Medium
v) Width of riparian zone a) RHB	5m
b) LHB	10m
c) Islands	0
vi) Substrate in riparian zone	Cobble/ gravel & sand/sediment
vii) Dominant vegetation:	Grasses
viii) Dominant species a) by biomass	*B. salvifolia, R. pyroides, D. lyciodes.*
b) by recruitment	*B. salvifolia, D. lycioides R. pyroides,*
ix) Invasion of the riparian zone a) alien species	*Persicum* (L) *S. babylonica* (L)
b) terrestrial species	*L.* javonica (VL)

SITE INFORMATION

Report reference: 2 **Riverbase code:** **A4SAND-LEEUW**

Sampling date: August 2002



River Name: Sand

Locality:

Latitude (S)	24 ^{o} -34.62’
Longitude (E)	28 ^{o} -17.551’
Altitude (m.a.m.s.l.)	1350

Ecoregion: 2.05

Hydrological type: Perennial

Stream Classification:
D (Upper foothills) Step and pool/cascade, bedrock dominated.

Access:

Travelling west from Nylstroom, cross over the Sand River and immediately turn left. The gravel road passes a large dam and eventually crosses the river again at the upper end of Leeuwenhoof Lodge. The site is extends downstream 200m from the bridge into the grounds of Leeuwenhoff Lodge. Permission should be sought from Lodge Management to gain access to the site. Be careful of breeding ostriches.

Site History:				
	Fish:	2002	Geomorph:	2002
	Invertebrates:	2002	Photographs:	2002
	Riparian Vegetation:	2002		

Invertebrates

SASS5 Biotopes sampled: SIC, SOOC, MVEG, S, GR.
IHAS: (Un-adjusted) 76
HQI: 111

Ecological importance:

Biomonitoring value:	2
Habitat diversity:	2

Fish

Fish habitat and sampling effort:

Habitat	Electro shocker	Small seine	Large Seine	Cast Net	Gill net
	Minutes	no of hauls	no of hauls	throws	Hrs
SD					
SS					
FD					
FS	24				

Fish habitat and cover rating:

Habitat	Abundance	Overhanging	Undercut Banks	Substrate	Aquatic
		Vegetation	& Root Wads		Macrophytes
SD	2	4	4	0	3
SS	4	2	0	2	0
FD	1	1	0	3	0
FS	2	4	2	4	0

Ecological importance:

Biomonitoring value: 2
Habitat diversity: 2
Species richness (recorded): 3

Riparian Vegetation

Inventory	
Site suitability	Suitable
i) Channel type	Single
ii) Active channel width	5m
iii) Surrounding land use	Stock farming
iv) Ecological rating	Medium
v) Width of riparian zone a) RHB	5 – 10m
b) LHB	20m
c) Islands	0
vi) Substrate in riparian zone	Soil/bedrock/gravel & sand/gravel
vii) Dominant vegetation:	Trees
viii) Dominant species a) by biomass	*E. divinorum, D. lycioides*, *Populus* sp.
b) by recruitment	*E. divinorum, Populus* sp , *D. lycioides*
ix) Invasion of the riparian zone a) alien species	*Populus* sp (H) *L. camara* (M) *Melia azedarach* (M)
b) terrestrial species	*D. lyciodes* (L)

SITE INFORMATION

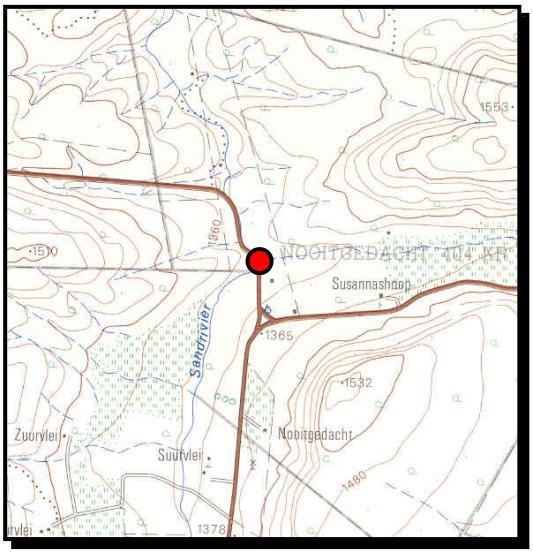
Report reference: 3 **Riverbase code:** **A4SAND-TOPBR**

Sampling date: August 2002

River Name: Sand

Locality:

Latitude (S)	24° -39.17’
Longitude (E)	28° -13.842’
Altitude (m.a.m.s.l.)	1350



Ecoregion: 2.05

Hydrological type: Perennial

Stream Classification:

B (Mountain stream) Pool riffle, gravel bed.

Access:

Travel from site 2 towards site 4. The Sand River can be seen on the RHS. Approx. 1km before site 4, turn left onto another gravel road. Travel approx. 10km, bearing left twice. The road eventually crosses the stream on a sharp bend. There is a small dam approx. 200m upstream from the bridge. The site extends from the dam, to approx. 100m below the road bridge.

Site History:

Fish:	2002	Geomorph:	2002
Invertebrates:	2002	Photographs:	2002
Riparian Vegetation:	2002		

Invertebrates

SASS5 Biotopes sampled: SIC, SOOC, MV, VIC, G.
IHAS: (Un-adjusted) 87
HQI: 109

Ecological importance:

Biomonitoring value: 2
Habitat diversity: 3

Fish

Fish habitat and sampling effort:

Habitat	Electro shocker	Small seine	Large Seine	Cast Net	Gill net
	Minutes	no of hauls	no of hauls	throws	Hrs
SD		7			
SS					
FD					
FS	20				

Fish habitat and cover rating:

Habitat	Abundance	Overhanging	Undercut Banks	Substrate	Aquatic
		Vegetation	& Root Wads		Macrophytes
SD	3	3	3	3	2
SS	3	3	3	3	2
FD	3	3	3	3	2
FS	3	3	3	3	2

Ecological importance:

Biomonitoring value: 3
Habitat diversity: 3
Species richness: 6
Alien species recorded. Msal.

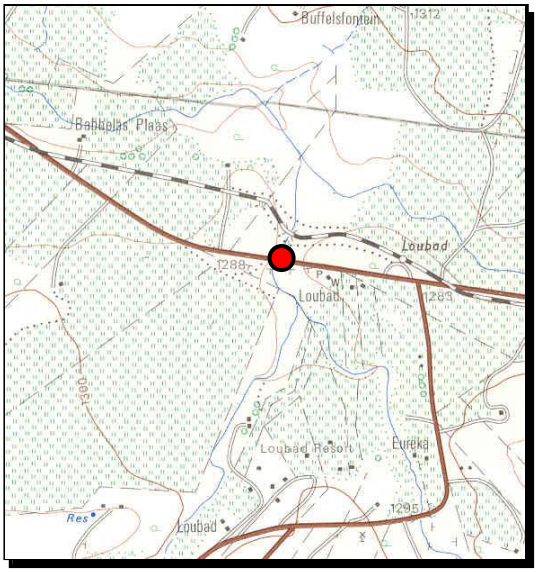
Riparian Vegetation

Inventory	
Site suitability	Not suitable, area to confined.
i) Channel type	Single
ii) Active channel width	4m
iii) Surrounding land use	Stock farming
iv) Ecological rating	Medium
v) Width of riparian zone a) RHB	15m
b) LHB	20m
c) Islands	0
vi) Substrate in riparian zone	Soil, gravel, sand, cobble
vii) Dominant vegetation:	Trees
viii) Dominant species a) by biomass	*Populus sp, D. lycioides, R. pyroides*
b) by recruitment	*Populus sp, D. lycioides, R. pyroides*
ix) Invasion of the riparian zone a) alien species	*Populus* (VH)
b) terrestrial species	*D. lycioides* (M)

SITE INFORMATION

Report reference: 4 **Riverbase code:** **A4SAND-LOUBA**

Sampling date: August 2002



River Name: Loubadspruit

Locality:

Latitude (S)	24^{o} -35.26’
Longitude (E)	28^{o} -12.313’
Altitude (m.a.m.s.l.)	1280

Ecoregion: 2.05

Hydrological type: Perennial

Stream Classification:

E (Lower foothill) Pool rapid, bedrock outcrops with gravel bed dominating.

Access:

From site 2, continue on the dirt road towards Alma. The road eventually crosses the Loubadspruit. A rail bridge can be seen approx. 200metres down stream. The site lies between the road and rail bridge and is accessed by climbing through the broken fence.

Site History:

Fish:	2002	Geomorph:	2002
Invertebrates:	2002	Photographs:	2002
Riparian Vegetation:	2002		

Invertebrates

SASS5 Biotopes sampled: SIC, SOOC, BR, MV, G.
IHAS: (Un-adjusted) 95
HQI: 122

Ecological importance:

Biomonitoring value: 4
Habitat diversity: 4

Fish

Fish habitat and sampling effort:

Habitat	Electro shocker	Small seine	Large Seine	Cast Net	Gill net
	Minutes	no of hauls	no of hauls	throws	Hrs
SD		5			
SS					
FD	20				
FS					

Fish habitat and cover rating:

Habitat	Abundance	Overhanging	Undercut Banks	Substrate	Aquatic
		Vegetation	& Root Wads		Macrophytes
SD	4	3	3	4	0
SS	3	1	1	3	0
FD	3	1	3	4	0
FS	4	2	3	4	0

Ecological importance:

Biomonitoring value: 4
Habitat diversity: 4
Species richness (recorded): 5

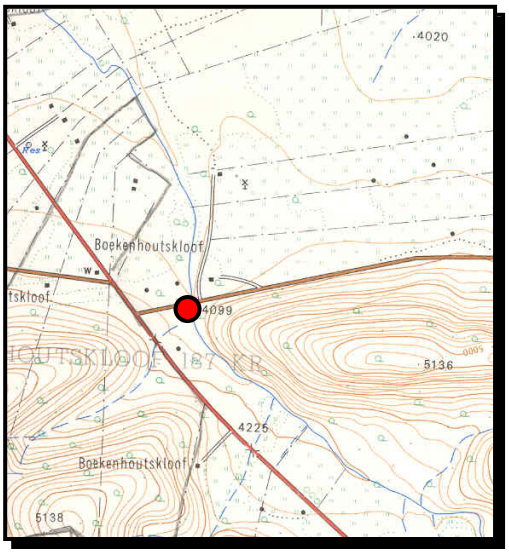
Riparian Vegetation

Inventory	
Site suitability	Suitable
i) Channel type	Single
ii) Active channel width	15m
iii) Surrounding land use	Stock farming
iv) Ecological rating	Medium
v) Width of riparian zone a) RHB	20m
b) LHB	20m
c) Islands	0
vi) Substrate in riparian zone	Bedrock, Sediment, gravel, sand
vii) Dominant vegetation:	Trees and shrubs
viii) Dominant species a) by biomass	*S. punicea, Populus, R. pyroides*
b) by recruitment	*S. punicea, R. pyroides, A. karroo*
ix) Invasion of the riparian zone a) alien species	*S. punicea (M), Populus (M), Eucalyptus (L), Persicum (L)*
b) terrestrial species	*T.sericea (L), Protea (L), V. rehmani (L)*

SITE INFORMATION

Report reference: 5 **Riverbase code:** **A4KLSA-BOEKE**

Sampling date: August 2002



River Name: Sand

Locality:

Latitude (S)	24° –27.533’
Longitude (E)	28° –10.178’
Altitude (m.a.m.s.l.)	1180

Ecoregion: 2.05

Hydrological type: Perennial

Stream Classification:

E (Lower foothill) Pool rapid, bedrock outcrops with gravel bed dominating.

Access:

Travelling west from Nylstroom along the R33, turn right onto the Rietfontein Road approx. 18km before Vaalwater. Within 500m, the road crosses the river. The site lies 100m up and downstream of the bridge. The site lies on private ground but is readily accessed through a farm compound.

Site History:

Fish:	2002	Geomorph:	2002
Invertebrates:	2002	Photographs:	2002
Riparian Vegetation:	2002		

Invertebrates

SASS5 Biotopes sampled: SIC, SOOC, MV
IHAS: (Un-adjusted) 90
HQI: 112

Ecological importance:

Biomonitoring value: 2
Habitat diversity: 3

Fish

Fish habitat and sampling effort:

Habitat	Electro shocker	Small seine	Large Seine	Cast Net	Gill net
	Minutes	no of hauls	no of hauls	throws	Hrs
SD		4			
SS					
FD					
FS	14				

Fish habitat and cover rating:

Habitat	Abundance	Overhanging	Undercut Banks	Substrate	Aquatic
		Vegetation	& Root Wads		Macrophytes
SD	4	1	2	2	2
SS	3	3	1	2	0
FD	1	2	2	3	0
FS	3	4	1	3	0

Ecological importance:

Biomonitoring value: 3
Habitat diversity: 3
Species richness (recorded): 4

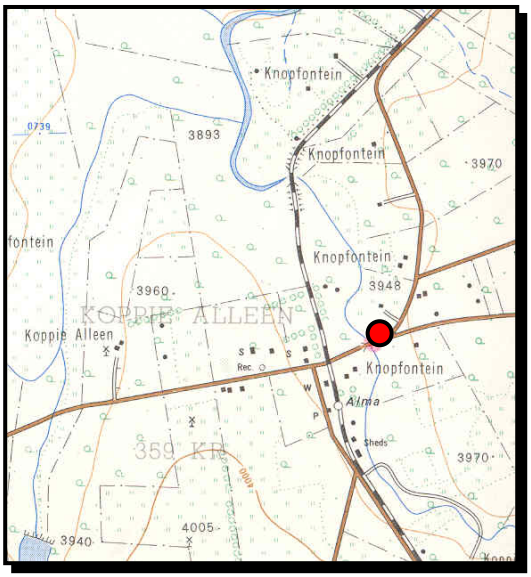
Riparian Vegetation

Inventory	
Site suitability	Suitable
i) Channel type	10m
ii) Active channel width	Single
iii) Surrounding land use	Stock farming, residential
iv) Ecological rating	Medium – high
v) Width of riparian zone a) RHB	30m
b) LHB	10m
c) Islands	0
vi) Substrate in riparian zone	Soil, bedrock, cobble, gravel
vii) Dominant vegetation:	Trees and shrubs
viii) Dominant species a) by biomass	*B. salvifolia, D lycioides, M. azedarach*
b) by recruitment	*B. salvifolia, C. africana, M. azedarach*
ix) Invasion of the riparian zone a) alien species	*M. azedarach (M), M. alba (VL)*
b) terrestrial species	*L. javonica (L), G. occidentalis (VL), D. cinerea (VL)*

SITE INFORMATION

Report reference: 6 **Riverbase code:** **A4MOGO-ALMAB**

Sampling date: August 2002



River Name: Sand
Locality:
Latitude (S) 24° –29.155'
Longitude (E) 28° –04.422'
Altitude (m.a.m.s.l.) 1160

Ecoregion: 2.04

Hydrological type: Perennial

Stream Classification:
E (Lower foothill) Pool rapid, sand.

Access:

Approach Alma from Loubad (site 4). On reaching Alma, bear right. The road crosses the river on the outskirts of town. A small weir is situated just upstream of the bridge. The site extends 100m downstream from the weir and bridge. The site is accessed through the broken fence.

Site History:

Fish:	2002	Geomorph:	2002
Invertebrates:	2002	Photographs:	2002
Riparian Vegetation:	2002		

Invertebrates

SASS5 Biotopes sampled: SIC, SOOC, MV,G.
IHAS: (Un-adjusted) 73
HQI: 97

Ecological importance:
Biomonitoring value: 1
Habitat diversity: 2

Fish

Fish habitat and sampling effort:

Habitat	Electro shocker	Small seine	Large Seine	Cast Net	Gill net
	Minutes	no of hauls	no of hauls	throws	Hrs
SD			3		
SS					
FD					
FS	21				

Fish habitat and cover rating:

Habitat	Abundance	Overhanging	Undercut Banks	Substrate	Aquatic
		Vegetation	& Root Wads		Macrophytes
SD	4	4	3	2	0
SS	2	2	2	2	0
FD	4	3	3	3	0
FS	3	3	2	3	0

Ecological importance:

Biomonitoring value: 2
Habitat diversity: 3
Species richness (recorded): 9

Riparian Vegetation

Inventory	
Site suitability	Not suitable, highly impacted
i) Channel type	Braided
ii) Active channel width	20m
iii) Surrounding land use	Stock farming
iv) Ecological rating	Low
v) Width of riparian zone a) RHB	20m
b) LHB	20m
c) Islands	2m
vi) Substrate in riparian zone	Soil, gravel/sand, sediment
vii) Dominant vegetation:	Trees
viii) Dominant species a) by biomass	*Populus sp , M.azedarach, D. lycioides*
b) by recruitment	*Populus sp , M.azedarach, G. buxifolia*
ix) Invasion of the riparian zone a) alien species	*Populus sp (VH) , M.azedarach (VH),S. babylonica (VH)*
b) terrestrial species	*D. lycioides* (L)

SITE INFORMATION

Report reference: 7 **Riverbase code:** **A4MOGO-TWEEF**
Sampling date: August 2002

River Name: Mogol

Locality:
Latitude (S) 24^{o} –29.155’
Longitude (E) 28^{o} –04.422’
Altitude (m.a.m.s.l.) 1200

Ecoregion: 2.04

Hydrological type: Perennial

Stream Classification:
E (Lower foothill) Pool riffle, bedrock controlled, gravel bed.

Access:

Travel along the dirt road from Alma (site 6) towards Vaalwater. At Tweestroom Railway Station, turn left. Approx. 400m further on the road crosses the river. The site includes pools upstream and downstream from the bridge.

Site History:

Fish:	2002	Geomorph:	2002
Invertebrates:	2002	Photographs:	2002
Riparian Vegetation:	2002		

Invertebrates

SASS5 Biotopes sampled: SIC, MV,M.
IHAS: (Un-adjusted) 77
HQI: 99

Ecological importance:
Biomonitoring value: 1
Habitat diversity: 2

Fish

Fish habitat and sampling effort:

Habitat	Electro shocker	Small seine	Large Seine	Cast Net	Gill net
	Minutes	no of hauls	no of hauls	throws	Hrs
SD		3	1		
SS					
FD					
FS					

Fish habitat and cover rating:

Habitat	Abundance	Overhanging	Undercut Banks	Substrate	Aquatic
		Vegetation	& Root Wads		Macrophytes
SD	2	4	4	2	4
SS	2	4	4	2	4
FD	3	4	4	3	4
FS	4	4	4	3	4

Ecological importance:

Biomonitoring value: 2
Habitat diversity: 3
Species richness (recorded): 5

Riparian Vegetation

Inventory	
Site suitability	Not suitable, low species diversity.
i) Channel type	Single
ii) Active channel width	45m
iii) Surrounding land use	Stock and irrigation farming
iv) Ecological rating	Medium
v) Width of riparian zone a) RHB	10m
b) LHB	5m
c) Islands	0
vi) Substrate in riparian zone	Soil, gravel/sand, rock/cobble
vii) Dominant vegetation:	Trees and shrubs
viii) Dominant species a) by biomass	*Populus, G. buxifolia, R. pyroides*
b) by recruitment	*G. buxifolia, D. lycioides, Populus sp*
ix) Invasion of the riparian zone a) alien species	*Populus sp (H), M.azedarach (L)*
b) terrestrial species	*D. lycioides (VL)*

SITE INFORMATION

Report reference: 8 **Riverbase code:** **A4 KLSA-DONKE**

Sampling date: August 2002

River Name: Klein Sand

Locality:

Latitude (S)	24^{o} –25.028’
Longitude (E)	28^{o} –20.62’
Altitude (m.a.m.s.l.)	1255

Ecoregion: 2.04

Hydrological type: Seasonal

Stream Classification:
E (Lower foothill) Pool riffle, sand bed.

Access:

Take the Rietfontein Road from the R33 and travel past site 5. At the T junction (Heuningfontein) turn left. Shortly after, bear left again. Travel a further 5km towards the mountain. The road crosses the stream just downstream from a small dam. The site extends into a cattle ranch downstream. At the time of the 2002 survey the river was barely flowing. Fish were sampled in a pool immediately below the bridge.

Site History:

Fish:	2002	Geomorph:	2002
Invertebrates:	2002	Photographs:	2002
Riparian Vegetation:	2002		

Invertebrates

SASS5 Biotopes sampled: Not surveyed (inadequate flow)
IHAS: (Un-adjusted)
HQI:

Ecological importance:

Biomonitoring value: 2
Habitat diversity: 2

Fish

Fish habitat and sampling effort:

Habitat	Electro shocker	Small seine	Large Seine	Cast Net	Gill net
	Minutes	no of hauls	no of hauls	throws	Hrs
SD		3			
SS					
FD					
FS					

Fish habitat and cover rating:

Habitat	Abundance	Overhanging	Undercut Banks	Substrate	Aquatic
		Vegetation	& Root Wads		Macrophytes
SD	2	1	1	2	2
SS	3	1	0	2	2
FD	0	0	0	0	0
FS	0	0	0	0	0

Ecological importance:

Biomonitoring value: 2
Habitat diversity: 2
Species richness (recorded): 2

Riparian Vegetation

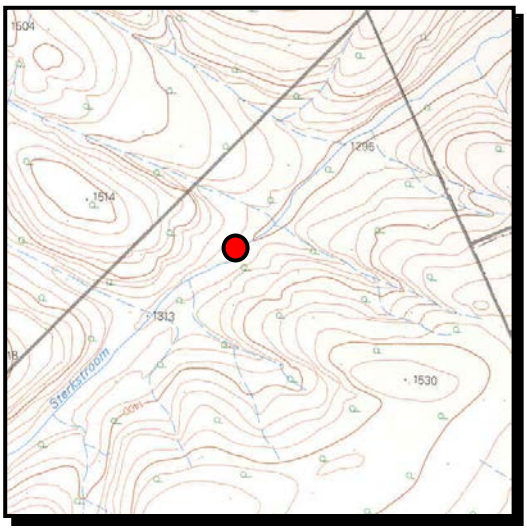
Not surveyed.

SITE INFORMATION

Report reference: 9 **Riverbase code:** **A4STER-WELG1**

Sampling date: June 2002

River Name: Sterkstroom



Locality:

Latitude (S)	24° –21.867’
Longitude (E)	27° –48.577’
Altitude (m.a.m.s.l.)	1305

Ecoregion: 2.03

Hydrological type: Perennial

Stream Classification:
D (upper foothill) mixed pool rapid, bedrock and boulder.

Access:

Travel approx. 8km past Vaalwater on the R33. Enter Welgevonden at the main gate. The manager of Welgevonden is Erwin Leibnitz. He will arrange for an escort to all 4 sites falling on Welgevonden. Make arrangements in advance. (welgevonden@xsinet.co.za) This site lies just downstream from the Grootfontein junction.

Site History:

Fish:	2002	Geomorph:	2002
Invertebrates:	2002	Photographs:	2002
Riparian Vegetation:	2002		

Invertebrates

SASS5 Biotopes sampled: SIC, SOOC, MV, BR, G, S.
IHAS: (Un-adjusted) 77
HQI: 103

Ecological importance:
Biomonitoring value: 3
Habitat diversity: 3

Fish

Fish habitat and sampling effort:

Habitat	Electro shocker	Small seine	Large Seine	Cast Net	Gill net
	Minutes	no of hauls	no of hauls	throws	Hrs
SD		4	1		
SS					
FD					
FS	20				

Fish habitat and cover rating:

Habitat	Abundance	Overhanging	Undercut Banks	Substrate	Aquatic
		Vegetation	& Root Wads		Macrophytes
SD	2	2	2	2	2
SS	3	2	2	3	2
FD	2	2	2	4	1
FS	3	1	1	3	1

Ecological importance:

Biomonitoring value: 3
Habitat diversity: 3
Species richness (recorded): 8

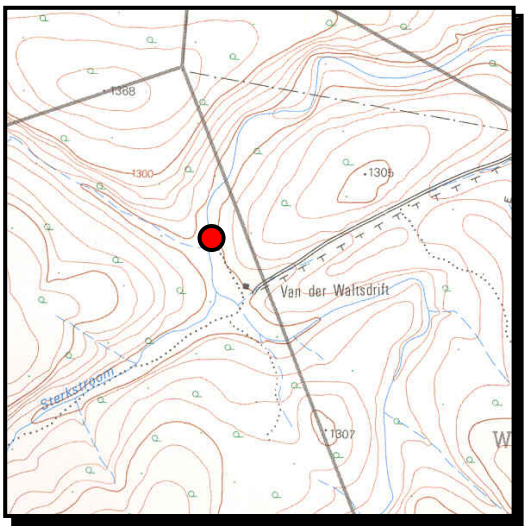
Riparian Vegetation

Inventory	
Site suitability	Suitable
i) Channel type	Single
ii) Active channel width	5 – 8m
iii) Surrounding land use	Nature reserve
iv) Ecological rating	High
v) Width of riparian zone a) RHB	20m
b) LHB	10m
c) Islands	0
vi) Substrate in riparian zone	Soil, rock/cobble
vii) Dominant vegetation:	Grass
viii) Dominant species a) by biomass	*F. saligna, T.sericea, B. africana*
b) by recruitment	*F. saligna, S. cordatum, T.sericea,*
ix) Invasion of the riparian zone a) alien species	None
b) terrestrial species	*T. sericea (VL), L. javonica (VL)*

SITE INFORMATION

Report reference: 10 **Riverbase code:** **A4STER-WELG2**

Sampling date: June 2002



River Name: Sterkstroom
Locality:
Latitude (S) 24° –18.343'
Longitude (E) 27° –53.826'
Altitude (m.a.m.s.l.) 1200

Ecoregion: 2.03

Hydrological type: Perennial

Stream Classification:
D (upper foothill) mixed pool rapid, bedrock

Access:
As per site 9.

Travel approx. 8km past Vaalwater on the R33. Enter Welgevonden at the main gate. The manager of Welgevonden is Erwin Leibnitz. He will arrange for an escort to all 4 sites falling on Welgevonden. Make arrangements in advance. (welgevonden@xsinet.co.za) This site lies below a broken bridge in the headwaters of the Sterkstroom.

Site History:

Fish:	2002	Geomorph:	2002
Invertebrates:	2002	Photographs:	2002
Riparian Vegetation:	2002		

Invertebrates

SASS5 Biotopes sampled: SIC, SOOC, MV, BR, G, S.
IHAS: (Un-adjusted) 81
HQI: 104

Ecological importance:
Biomonitoring value: 4
Habitat diversity: 4

Fish

Fish habitat and sampling effort:

Habitat	Electro shocker	Small seine	Large Seine	Cast Net	Gill net
	Minutes	no of hauls	no of hauls	throws	Hrs
SD	35	8	2		
SS					
FD	20				
FS					

Fish habitat and cover rating:

Habitat	Abundance	Overhanging	Undercut Banks	Substrate	Aquatic
		Vegetation	& Root Wads		Macrophytes
SD	4	3	3	4	3
SS	4	3	3	4	3
FD	3	3	2	4	3
FS	4	3	2	4	3

Ecological importance:

Biomonitoring value: 4
Habitat diversity: 4
Species richness (recorded): 13

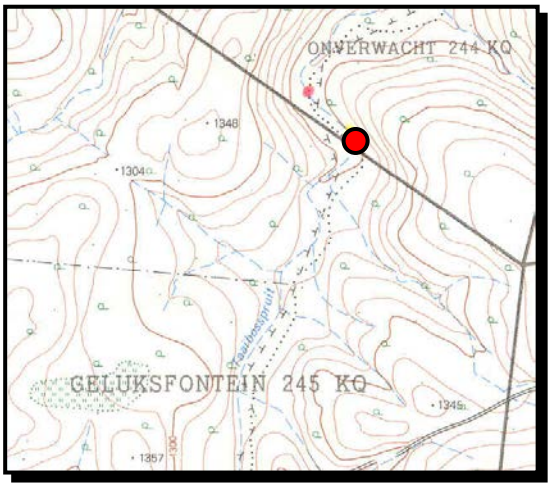
Riparian Vegetation

Inventory	
Site suitability	Suitable
i) Channel type	Multiple/Anabranched
ii) Active channel width	30m
iii) Surrounding land use	Nature reserve
iv) Ecological rating	High
v) Width of riparian zone a) RHB	25m
b) LHB	4m
c) Islands	5-6m
vi) Substrate in riparian zone	Rock/cobble, soil, gravel/sand/ bedrock
vii) Dominant vegetation:	Trees
viii) Dominant species a) by biomass	*S. guineense, S. cordatum*
b) by recruitment	*S. guineense, S. cordatum*
ix) Invasion of the riparian zone a) alien species	*S. punicea (VL), M. azedarach (VL)*
b) terrestrial species	*O. pulcra (L), T. sericea (L) l. javonica (VL)*

SITE INFORMATION

Report reference: 11 **Riverbase code:** **A4TAAI-WELG1**

Sampling date: June 2002



River Name: Taaibosspruit

Locality:

Latitude (S)	24^{o} –15.81’
Longitude (E)	27^{o} –50.423’
Altitude (m.a.m.s.l.)	1200

Ecoregion: 2.03

Hydrological type: Perennial

Stream Classification:
D (upper foothill) mixed pool rapid, bedrock and cobble.

Access:
As per site 9 and 10.

Travel approx. 8km past Vaalwater on the R33. Enter Welgevonden at the main gate. The manager of Welgevonden is Erwin Leibnitz. He will arrange for an escort to all 4 sites falling on Welgevonden. Make arrangements in advance. (welgevonden@xsinet.co.za) This site lies downstream of a low level bridge. (the bridge overtops in low flows)

Site History:

Fish:	2002	Geomorph:	2002
Invertebrates:	2002	Photographs:	2002
Riparian Vegetation:	2002		

Invertebrates

SASS5 Biotopes sampled: SIC, SOOC, MV, VIC, G, S.
IHAS: (Un-adjusted) 87
HQI: 121

Ecological importance:
Biomonitoring value: 4
Habitat diversity: 4

Fish

Fish habitat and sampling effort:

Habitat	Electro shocker	Small seine	Large Seine	Cast Net	Gill net
	Minutes	no of hauls	no of hauls	throws	Hrs
SD			4		
SS					
FD	20				
FS					

Fish habitat and cover rating:

Habitat	Abundance	Overhanging	Undercut Banks	Substrate	Aquatic
		Vegetation	& Root Wads		Macrophytes
SD	3	3	3	2	0
SS	3	3	3	1	0
FD	3	4	3	3	0
FS	3	4	3	3	0

Ecological importance:

Biomonitoring value: 3
Habitat diversity: 3
Species richness (recorded): 5

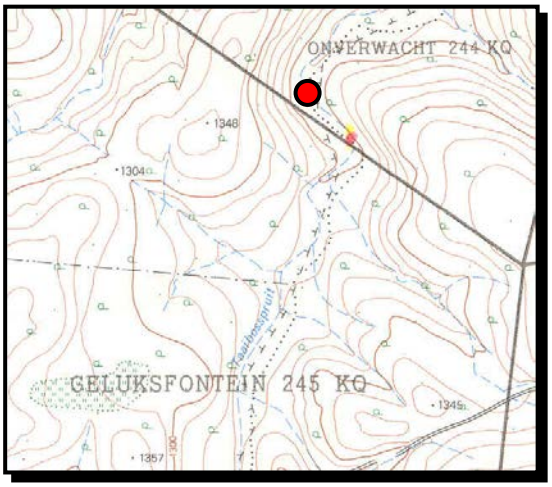
Riparian Vegetation

Inventory	
Site suitability	Suitable
i) Channel type	Braided
ii) Active channel width	15m
iii) Surrounding land use	Nature reserve
iv) Ecological rating	High
v) Width of riparian zone a) RHB	35m
b) LHB	25m
c) Islands	0
vi) Substrate in riparian zone	Soil, gravel/sand, rock/cobble
vii) Dominant vegetation:	Trees and grass
viii) Dominant species a) by biomass	*B. africana, D. lycioides, S. cordatum*
b) by recruitment	*S. cordatum, D. lycioides, H. natalensis.*
ix) Invasion of the riparian zone a) alien species	None
b) terrestrial species	*D. lycioides (L), T. sericea (VL), O.pulcra (VL)*

SITE INFORMATION

Report reference: 12 **Riverbase code:** **A4TAAI-WELG2**

Sampling date: June 2002



River Name: Taaibosspruit

Locality:

Latitude (S)	24° –15.551’
Longitude (E)	27° –50.198’
Altitude (m.a.m.s.l.)	1190

Ecoregion: 2.03

Hydrological type: Perennial

Stream Classification:
D (upper foothill) mixed pool rapid, bedrock and sand.

Access:
As per sites 9, 10 and 11.

Travel approx. 8km past Vaalwater on the R33. Enter Welgevonden at the main gate. The manager of Welgevonden is Erwin Leibnitz. He will arrange for an escort to all 4 sites falling on Welgevonden. Make arrangements in advance. (welgevonden@xsinet.co.za) This site lies either side of a bridge, approx 1km down from site 11.

Site History:

Fish:	2002	Geomorph:	2002
Invertebrates:	2002	Photographs:	2002
Riparian Vegetation:	2002		

Invertebrates

SASS5 Biotopes sampled: MV, VIC, G, S, M.
IHAS: (Un-adjusted) 74
HQI: 99

Ecological importance:
Biomonitoring value: 2
Habitat diversity: 2

Fish

Fish habitat and sampling effort:

Habitat	Electro shocker	Small seine	Large Seine	Cast Net	Gill net
	Minutes	no of hauls	no of hauls	throws	Hrs
SD		24			
SS					
FD					
FS					

Fish habitat and cover rating:

Habitat	Abundance	Overhanging	Undercut Banks	Substrate	Aquatic
		Vegetation	& Root Wads		Macrophytes
SD	3	4	3	2	0
SS	3	4	3	2	0
FD	2	4	3	2	0
FS	2	4	3	2	0

Ecological importance:

Biomonitoring value: 2
Habitat diversity: 2
Species richness (recorded): 5

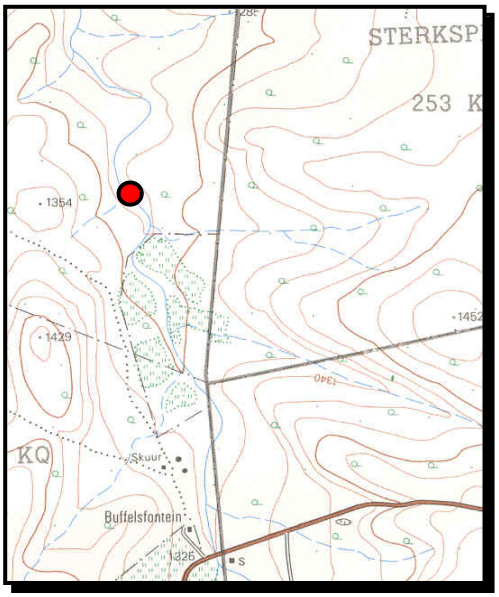
Riparian Vegetation

Inventory	
Site suitability	Suitable but is a repeat of site 11.
i) Channel type	Single
ii) Active channel width	8m
iii) Surrounding land use	Nature reserve
iv) Ecological rating	High
v) Width of riparian zone a) RHB	15m
b) LHB	15m
c) Islands	0
vi) Substrate in riparian zone	Gravel/sand, soil, rock/cobble
vii) Dominant vegetation:	Trees
viii) Dominant species a) by biomass	*S. cordatum, F.saligna, T. sericea*
b) by recruitment	*S. cordatum, F. saligna, B. africana*
ix) Invasion of the riparian zone a) alien species	None
b) terrestrial species	*T.sericea (VL), D. cinerea (VL)*

SITE INFORMATION

Report reference: 13 **Riverbase code:** **A4FRIK-SHAM1**

Sampling date: June 2002



River Name: Frikkies se loop

Locality:

Latitude (S)	24^{o} –20.55’
Longitude (E)	27^{o} –57.813’
Altitude (m.a.m.s.l.)	1280

Ecoregion: 2.03

Hydrological type: Perennial

Stream Classification:
D (upper foothill) mixed pool rapid, bedrock and boulder.

Access:

Travel 4km west of Vaalwater on the R33 and turn left. Travel about 10km along the dirt road. Enter Shambala Nature Reserve at the office gate on the RHS. Prior arrangement is necessary. Speak to Mr. Riem Venter. This site lies below a bridge on the far side of Sable Camp. (just upstream from the Douw Steyn Dam)

Site History:

Fish:	2002	Geomorph:	2002
Invertebrates:	2002	Photographs:	2002
Riparian Vegetation:	2002		

Invertebrates

SASS5 Biotopes sampled: SIC, SOOC, MV, BR, G, S.
IHAS: (Un-adjusted) 68
HQI: 90

Ecological importance:
Biomonitoring value: 3
Habitat diversity: 2

Fish

Fish habitat and sampling effort:

Habitat	Electro shocker	Small seine	Large Seine	Cast Net	Gill net
	Minutes	no of hauls	no of hauls	throws	Hrs
SD		4			
SS					
FD					
FS	18				

Fish habitat and cover rating:

Habitat	Abundance	Overhanging	Undercut Banks	Substrate	Aquatic
		Vegetation	& Root Wads		Macrophytes
SD	3	3	2	1	0
SS	1	1	1	1	0
FD	1	1	2	3	0
FS	3	1	1	3	0

Ecological importance:

Biomonitoring value: 3
Habitat diversity: 2
Species richness (recorded): 7

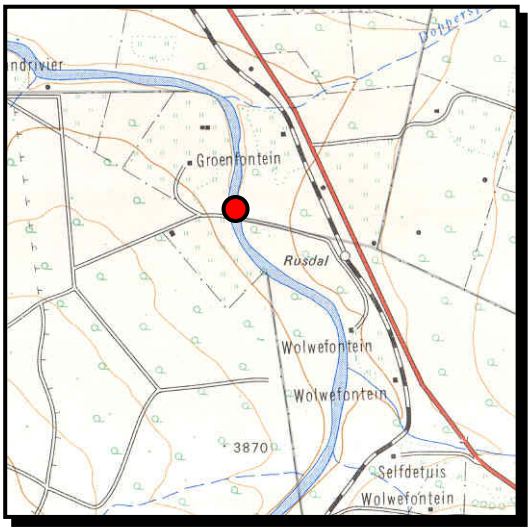
Riparian Vegetation

Inventory	
Site suitability	Suitable
i) Channel type	Single
ii) Active channel width	3m
iii) Surrounding land use	Nature reserve
iv) Ecological rating	High
v) Width of riparian zone a) RHB	5
b) LHB	25
c) Islands	2
vi) Substrate in riparian zone	Bedrock, soil, gravel/sand
vii) Dominant vegetation:	Trees and grass
viii) Dominant species a) by biomass	*S. guineense, B. africana, T. sericea*
b) by recruitment	*S. guineense, O. pulcra, F. saligna*
ix) Invasion of the riparian zone a) alien species	None
b) terrestrial species	*Protea sp (M) ., O. pulcra (L) T. sericea (VL)*

SITE INFORMATION

Report reference: 14 **Riverbase code:** **A4MOGO-GROEN**

Sampling date: August 2002



River Name: Mogol

Locality:

Latitude (S)	24° –19.289’
Longitude (E)	28° –07.047’
Altitude (m.a.m.s.l.)	1150

Ecoregion: 2.03

Hydrological type: Perennial

Stream Classification:

E (Lower foothill) Mixed pool rapid, bedrock Sand and gravel.

Access:

Travel towards Vaalwater on the R33. 3km before Vaalwater, turn left onto the Groenfontein Road. Cross over the railway line and travel approx 1km. The road crosses the Mogol River. This multiple channeled site lies up and down from the bridge.

Site History:

Fish:	2002	Geomorph:	2002
Invertebrates:	2002	Photographs:	2002
Riparian Vegetation:	2002		

Invertebrates

SASS5 Biotopes sampled: SIC, SOOC, MV, VIC, BR, G, S.
IHAS: (Un-adjusted) 70
HQI: 106

Ecological importance:

Biomonitoring value: 3
Habitat diversity: 4

Fish

Fish habitat and sampling effort:

Habitat	Electro shocker	Small seine	Large Seine	Cast Net	Gill net
	Minutes	no of hauls	no of hauls	throws	Hrs
SD		2	3		
SS					
FD	15				
FS	15				

Fish habitat and cover rating:

Habitat	Abundance	Overhanging	Undercut Banks	Substrate	Aquatic
		Vegetation	& Root Wads		Macrophytes
SD	4	4	4	2	1
SS	4	4	2	2	0
FD	4	4	4	4	0
FS	3	2	1	4	0

Ecological importance:

Biomonitoring value: 3
Habitat diversity: 4
Species richness (recorded): 11
Alien species. Msal

Riparian Vegetation

Inventory	
Site suitability	Not suitable
i) Channel type	Single
ii) Active channel width	70m
iii) Surrounding land use	Irrigation farming
iv) Ecological rating	Low
v) Width of riparian zone a) RHB	15m
b) LHB	5m
c) Islands	30
vi) Substrate in riparian zone	Soil, gravel/sand, rock/cobble, bedrock
vii) Dominant vegetation:	Trees and shrubs
viii) Dominant species a) by biomass	*T. sericea, R. pyroides, S. punicea*
b) by recruitment	*D. lycioides, T. sericea, E. divinorum*
ix) Invasion of the riparian zone a) alien species	*S. punicea (L), M. azedarach (L), M. alba (L)*
b) terrestrial species	*T. sericea (M), P. rotundifolia (M), D. lycioides (M)*

SITE INFORMATION

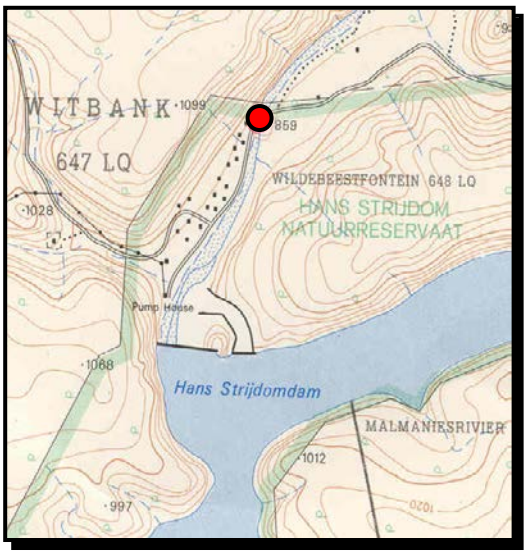
Report reference: 15 **Riverbase code:** **A4MOGO-WWORK**

Sampling date: May 2002

River Name: Mogol

Locality:

Latitude (S)	23° –58.24’
Longitude (E)	27° –43.557’
Altitude (m.a.m.s.l.)	860



Ecoregion: 2.03

Hydrological type: Perennial

Stream Classification:

E (Lower foothill), Pool rapid, cobble and boulder.

Access:

From Ellisras, travel to the Mokolo Dam. Take the turning to the DWAF office situated below the dam wall. On reaching the river, turn left and travel along the river approx. 1km until the road crosses the river at a broken bridge, just downstream from the gauging weir. The site extends from the weir to 100m below the bridge. **Beware of crocodiles.**

Site History:

Fish:	2002	Geomorph:	2002
Invertebrates:	2002	Photographs:	2002
Riparian Vegetation:	2002		

Invertebrates

SASS5 Biotopes sampled: SIC, SOOC, MV, VIC, BR, G, S.
IHAS: (Un-adjusted) 90
HQI: 114

Ecological importance:

Biomonitoring value: 4
Habitat diversity: 4

Fish

Fish habitat and sampling effort:

Habitat	Electro shocker	Small seine	Large Seine	Cast Net	Gill net
	Minutes	no of hauls	no of hauls	throws	Hrs
SD		3			
SS					
FD	12				
FS	12				

Fish habitat and cover rating:

Habitat	Abundance	Overhanging	Undercut Banks	Substrate	Aquatic
		Vegetation	& Root Wads		Macrophytes
SD	4	2	2	2	2
SS	3	2	1	2	1
FD	4	4	3	3	0
FS	2	3	2	2	0

Ecological importance:

Biomonitoring value: 3
Habitat diversity: 4
Species richness (recorded): 12

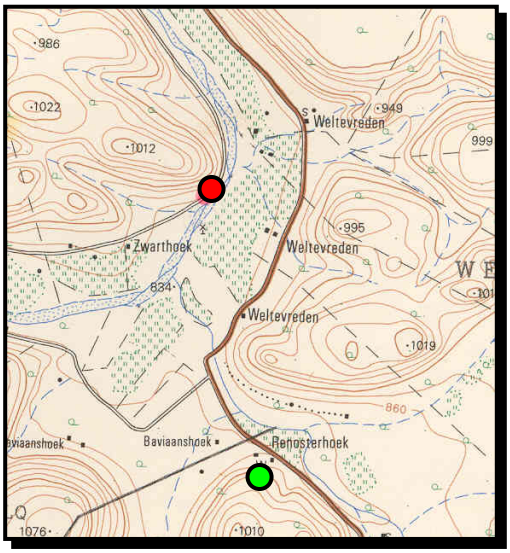
Riparian Vegetation

Inventory	
Site suitability	Suitable
i) Channel type	Single
ii) Active channel width	10m
iii) Surrounding land use	Nature reserve
iv) Ecological rating	Medium
v) Width of riparian zone a) RHB	25m
b) LHB	15m
c) Islands	0
vi) Substrate in riparian zone	Gravel/sand, bedrock, rock/cobble
vii) Dominant vegetation:	Trees and shrubs
viii) Dominant species a) by biomass	*S. guineense, N. oppositifolia, S. punicea*
b) by recruitment	*S. guineense, T. sericea, S. punicea*
ix) Invasion of the riparian zone a) alien species	*S. punicea (VL)*
b) terrestrial species	*T.sericea (M), D. cinerea ((M), O. arborea (L)*

SITE INFORMATION

Report reference: 16 **Riverbase code:** **A4MOGO-WITKO**

Sampling date: May 2002



River Name: Mogol

Locality:

Latitude (S)	24^{o} –50.864’
Longitude (E)	27^{o} –47.42’
Altitude (m.a.m.s.l.)	840

Ecoregion: 2.03

Hydrological type: Perennial

Stream Classification:
F (Lowland river) alluvial, pool riffle.

Access:

Travel south from Ellisras and turn left towards Vaalwater. The road crosses the river almost immediately. 200m further on, turn right onto the Witkop Road. The site is situated on a farm approx. 1km downstream from the Poer se loop. The farm entrance is next to a small school. This multiple channeled site lies on a cobble crossing. Locate by GPS if necessary. The chairman of the Mogol WUA, Mr. Hansie Kruger lives in a house as the road bends across the Poer se loop. (see green dot) He can assist with introductions to farmers in this area. Tel: 014 763 4367.

Site History:

Fish:	2002	Geomorph:	2002
Invertebrates:	2002	Photographs:	2002
Riparian Vegetation:	2002		

Invertebrates

SASS5 Biotopes sampled: MV, VIC, S.
IHAS: (Un-adjusted) 65
HQI: 94

Ecological importance:
Biomonitoring value: 2
Habitat diversity: 2

Fish

Fish habitat and sampling effort:

Habitat	Electro shocker	Small seine	Large Seine	Cast Net	Gill net
	Minutes	no of hauls	no of hauls	throws	Hrs
SD		2			
SS					
FD	15				
FS					

Fish habitat and cover rating:

Habitat	Abundance	Overhanging	Undercut Banks	Substrate	Aquatic
		Vegetation	& Root Wads		Macrophytes
SD	4	4	0	2	2
SS	4	3	3	2	3
FD	1	1	0	2	3
FS	2	1	3	3	0

Ecological importance:

Biomonitoring value: 2
Habitat diversity: 2
Species richness (recorded): 12

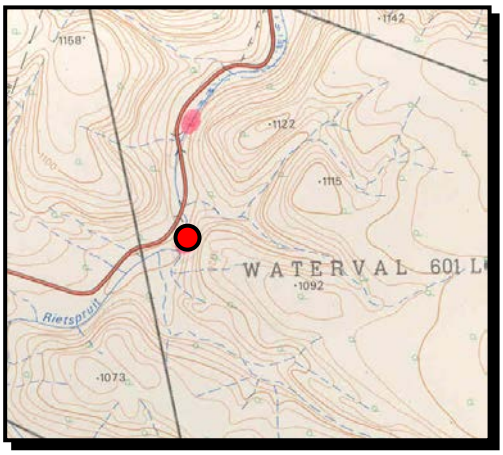
Riparian Vegetation

Inventory	
Site suitability	Not suitable since a large parts of the left hand bank is not accessible.
i) Channel type	Braided
ii) Active channel width	60m
iii) Surrounding land use	Stock and irrigation farming
iv) Ecological rating	Medium
v) Width of riparian zone a) RHB	20m
b) LHB	15m
c) Islands	10m
vi) Substrate in riparian zone	Soil, rock/cobble, gavel/sand
vii) Dominant vegetation:	Reeds and trees
viii) Dominant species a) by biomass	*D. cinerea, G. flavescens, R. pyroides*
b) by recruitment	*D. cinerea, G. flavescens, G. monticola*
ix) Invasion of the riparian zone a) alien species	*None*
b) terrestrial species	*D. cinerea (H), T. sericea (M), D. lycioides (L)*

SITE INFORMATION

Report reference: 17 **Riverbase code:** **A4RIET-FANCY**

Sampling date: May 2002



River Name: Rietspruit

Locality:

Latitude (S)	24^{o} –52.624’
Longitude (E)	27^{o} –38.778’
Altitude (m.a.m.s.l.)	900

Ecoregion: 2.03

Hydrological type: Perennial

Stream Classification:

D (Upper foothill), mixed pool rapid with embedded cobble.

Access:

Travel approx. 25km from Ellisras towards Thabazimbi on the R510. The road crosses two numbered bridges of the Rietspruit River. This site is situated on the farm “Fancy” adjacent to the bridge “Ruitspruit 3”. The farm owner should be approached. The site lies approximately 500m into the farm, just below a newly constructed dam and angling camp.

Site History:

Fish:	2002	Geomorph:	2002
Invertebrates:	2002	Photographs:	2002
Riparian Vegetation:	2002		

Invertebrates

SASS5 Biotopes sampled: SIC, SOOC, MV, VIC, BR, G, S.
IHAS: (Un-adjusted) 87
HQI: 121

Ecological importance:

Biomonitoring value: 3
Habitat diversity: 3

Fish

Fish habitat and sampling effort:

Habitat	Electro shocker	Small seine	Large Seine	Cast Net	Gill net
	Minutes	no of hauls	no of hauls	throws	Hrs
SD		3			
SS					
FD	40				
FS					

Fish habitat and cover rating:

Habitat	Abundance	Overhanging	Undercut Banks	Substrate	Aquatic
		Vegetation	& Root Wads		Macrophytes
SD	3	3	3	3	1
SS	2	2	3	2	0
FD	3	2	3	3	0
FS	3	2	2	2	0

Ecological importance:

Biomonitoring value: 3
Habitat diversity: 3
Species richness (recorded): 11

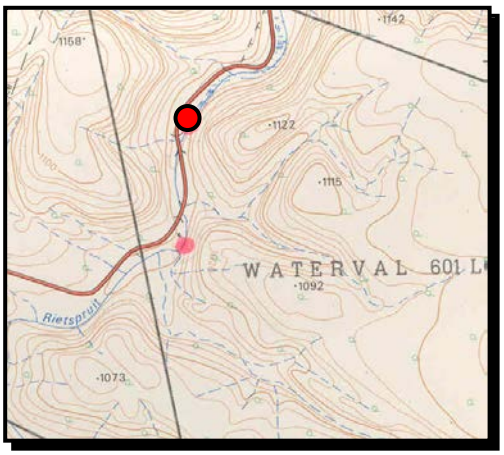
Riparian Vegetation

Inventory	
Site suitability	Suitable
i) Channel type	Single
ii) Active channel width	4m
iii) Surrounding land use	Stock and irrigation farming
iv) Ecological rating	High
v) Width of riparian zone a) RHB	5m
b) LHB	10m
c) Islands	0
vi) Substrate in riparian zone	Rock/cobble, soil, gravel/sand
vii) Dominant vegetation:	Trees
viii) Dominant species a) by biomass	*S. guineense, T. sericea, D. cinerea*
b) by recruitment	*S. guineense, F. virosa, D. cinerea*
ix) Invasion of the riparian zone a) alien species	*S. sesban (VL)*

SITE INFORMATION

Report reference: 18 **Riverbase code:** **A4RIET-WATER**

Sampling date: May 2002



River Name: Rietspruit

Locality:

Latitude (S)	23^{o} –51.892’
Longitude (E)	27^{o} –39.182’
Altitude (m.a.m.s.l.)	890

Ecoregion: 2.03

Hydrological type: Perennial

Stream Classification:

D (Upper foothill), mixed pool rapid, boulders and sand.

Access:

Travel approx. 25km from Ellisras towards Thabazimbi on the R510. The road crosses two numbered bridges of the Rietspruit River. This site is situated just below the bridge “Rietspruit 4”. The site is accessed through a “tricky”fence and should be located by GPS and the sound of the waterfall. (100m from the road) The site extends 100m back above the top of the waterfall.

Site History:

Fish:	2002	Geomorph:	2002
Invertebrates:	2002	Photographs:	2002
Riparian Vegetation:	2002		

Invertebrates

SASS5 Biotopes sampled: SIC, SOOC, MV, BR, G, S.
IHAS: (Un-adjusted) 86
HQI: 117

Ecological importance:

Biomonitoring value: 3
Habitat diversity: 3

Fish

Fish habitat and sampling effort:

Habitat	Electro shocker	Small seine	Large Seine	Cast Net	Gill net
	Minutes	no of hauls	no of hauls	throws	Hrs
SD		1			
SS					
FD	40				
FS					

Fish habitat and cover rating:

Habitat	Abundance	Overhanging	Undercut Banks	Substrate	Aquatic
		Vegetation	& Root Wads		Macrophytes
SD	3	1	2	2	1
SS	3	2	2	2	0
FD	3	1	1	3	0
FS	2	3	2	3	0

Ecological importance:

Biomonitoring value: 3
Habitat diversity: 3
Species richness (recorded): 10

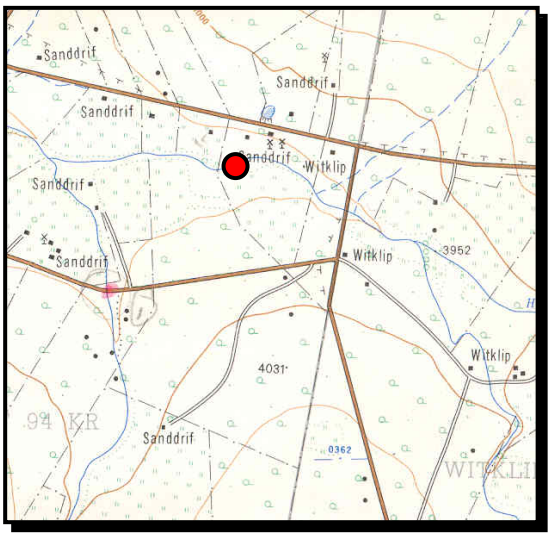
Riparian Vegetation

Inventory	
Site suitability	Suitable
i) Channel type	Mixed
ii) Active channel width	4m
iii) Surrounding land use	Game and stock farming
iv) Ecological rating	High
v) Width of riparian zone a) RHB	20m
b) LHB	50m
c) Islands	0
vi) Substrate in riparian zone	Rock/cobble, gravel/sand, soil
vii) Dominant vegetation:	Trees and shrubs
viii) Dominant species a) by biomass	*F. virosa, D. cinerea, C. gratisimus*
b) by recruitment	*S. guineense, F. virosa, O,. arborea*
ix) Invasion of the riparian zone a) alien species	*R. communis (VL)*
b) terrestrial species	*D. cinerea (H), C. gratisimus (L), B. mollis (VL)*

SITE INFORMATION

Report reference: 19 **Riverbase code:** **A4DWAR-ZANDD**

Sampling date: August 2002



River Name: Dwars

Locality:

Latitude (S)	24° –15.776’
Longitude (E)	28° –12.618’
Altitude (m.a.m.s.l.)	1195

Ecoregion: 1.05

Hydrological type: Perennial

Stream Classification:

D (lower foothill) pool riffle, sand and gravel.

Access:

Travel approx. 10km from Vaalwater towards Melkrivier on the main tar road. Immediately after crossing the Dwars River turn right onto the Witklip gravel road. The site is situated on a farm on the left. The farmer caries side arms and has many dogs. He is nonetheless very helpful. Permission to access the river must be sought. Follow the owners directions and locate the site by GPS.

Site History:

Fish:	2002	Geomorph:	2002
Invertebrates:	2002	Photographs:	2002
Riparian Vegetation:	2002		

Invertebrates

SASS5 Biotopes sampled: SIC, SOOC, MV, S, M.
IHAS: (Un-adjusted) 55
HQI: 77

Ecological importance:

Biomonitoring value: 2
Habitat diversity: 2

Fish

Fish habitat and sampling effort:

Habitat	Electro shocker	Small seine	Large Seine	Cast Net	Gill net
	Minutes	no of hauls	no of hauls	throws	Hrs
SD		2			
SS	20				
FD					
FS					

Fish habitat and cover rating:

Habitat	Abundance	Overhanging	Undercut Banks	Substrate	Aquatic
		Vegetation	& Root Wads		Macrophytes
SD	4	3	3	1	0
SS	3	1	1	1	0
FD	0				
FS	0				

Ecological importance:

Biomonitoring value: 2
Habitat diversity: 2
Species richness (recorded): 4

Riparian Vegetation

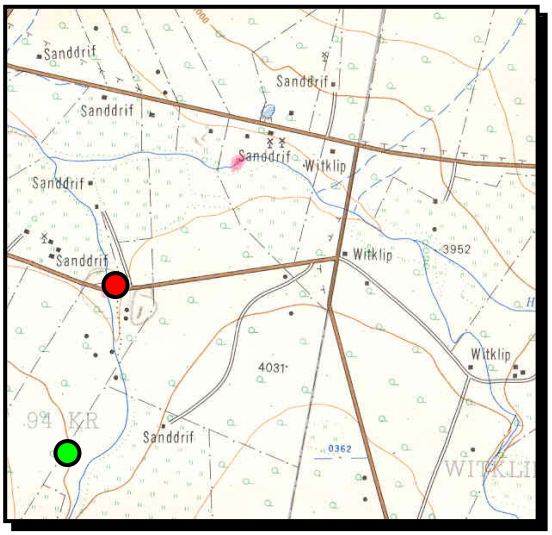
Inventory	
Site suitability	Not suitable, too impacted and low species diversity
i) Channel type	Single
ii) Active channel width	14m
iii) Surrounding land use	Stock farming
iv) Ecological rating	Low
v) Width of riparian zone a) RHB	10m
b) LHB	10m
c) Islands	0
vi) Substrate in riparian zone	Soil, Gravel/sand
vii) Dominant vegetation:	Trees and grass
viii) Dominant species a) by biomass	*S. punicea, Populus sp, R. pyroides*
b) by recruitment	*S. punicea, Z mucronata, Populus sp.*
ix) Invasion of the riparian zone a) alien species	*S. punicea (H), Populus sp (M), Eucalyptus sp (M)*
b) terrestrial species	*D. lycioides (VL), A. rehmaniana (VL)*

SITE INFORMATION

Report reference: 20 **Riverbase code:** **A4 DWAR-JIMSE**

Sampling date: September 2002

River Name: Jim se loop.



Locality:

Latitude (S)	24° –16.31’
Longitude (E)	28° –11.982’
Altitude (m.a.m.s.l.)	1200

Ecoregion: 1.05

Hydrological type: Perennial

Stream Classification:
D (lower foothill) pool riffle, cobble gravel and sand.

Access:

Travel approx. 10km from Vaalwater towards Melkriver on the main tar road. Immediately after crossing the Dwars River turn right onto the Witklip gravel road and pass site 19. Turn right and then right again. The road heads back towards the Marken Road and in doing so crosses the Jim se loop. The site lies downstream from the bridge. The landowner lives upstream from the bridge. (green dot) Access to his house is easy. He is very helpful and is developing an angling camp.

Site History:

Fish:	2002	Geomorph:	2002
Invertebrates:	2002	Photographs:	2002
Riparian Vegetation:	2002		

Invertebrates

SASS5 Biotopes sampled: SIC, SOOC, MV, BR, G, S.
IHAS: (Un-adjusted) 83
HQI: 109

Ecological importance:
Biomonitoring value: 3
Habitat diversity: 3

Fish

Fish habitat and sampling effort:

Habitat	Electro shocker	Small seine	Large Seine	Cast Net	Gill net
	Minutes	no of hauls	no of hauls	throws	Hrs
SD		6			
SS	12				
FD					
FS					

Fish habitat and cover rating:

Habitat	Abundance	Overhanging	Undercut Banks	Substrate	Aquatic
		Vegetation	& Root Wads		Macrophytes
SD	4	3	3	4	2
SS	4	3	3	4	2
FD	3	0	0	0	0
FS	4	3	3	4	2

Ecological importance:

Biomonitoring value: 3
Habitat diversity: 3
Species richness (recorded): 9

Riparian Vegetation

Inventory	
Site suitability	Suitable
i) Channel type	Single
ii) Active channel width	10m
iii) Surrounding land use	Game farming
iv) Ecological rating	Medium
v) Width of riparian zone a) RHB	15m
b) LHB	10m
c) Islands	0
vi) Substrate in riparian zone	Soil, rock/cobble, bedrock
vii) Dominant vegetation:	Trees
viii) Dominant species a) by biomass	*T. sericea, R. pyroides, A. karroo*
b) by recruitment	*G. buxifolia, G. flava, A. karroo*
ix) Invasion of the riparian zone a) alien species	*S. punicea (L), M. azedarach (VL), Opuntia sp*
b) terrestrial species	*T. sericea, (L) D. lycioides (L)*

SITE INFORMATION

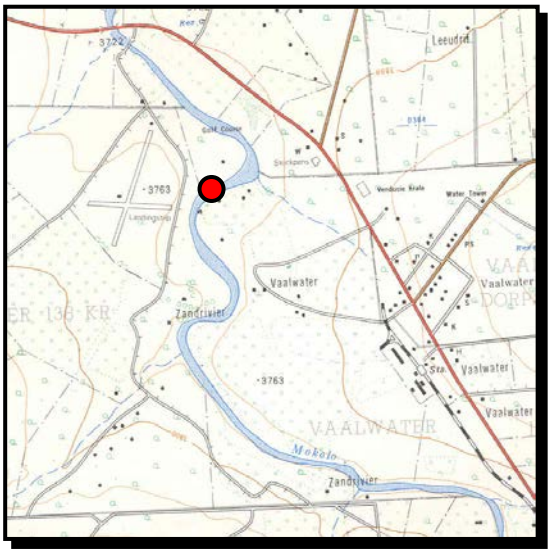
Report reference: 21 **Riverbase code:** **A4MOGO-VAALW**

Sampling date: August 2002

River Name: Mogol

Locality:

Latitude (S)	24° –17.362’
Longitude (E)	28° –05.544’
Altitude (m.a.m.s.l.)	1135



Ecoregion: 1.05

Hydrological type: Perennial

Stream Classification:

E (lower foothill) Pool riffle, bedrock outcrops, boulders and cobble at site.

Access:

In Vaalwater town, take the road sign posted to the veterinary clinic. The site lies 400m down this gravel road and is just upstream of the sewage plant return flow. The owner of the curio shop situated in the garage on the Vaalwater Road junction should be approached regarding access. Access at the time of this survey was open. (ie. no fence)

Site History:

Fish:	2002	Geomorph:	2002
Invertebrates:	2002	Photographs:	2002
Riparian Vegetation:	2002		

Invertebrates

SASS5 Biotopes sampled: SIC, SOOC, MV, BR, G, S.
IHAS: (Un-adjusted) 89
HQI: 122

Ecological importance:

Biomonitoring value: 4
Habitat diversity: 3

Fish

Fish habitat and sampling effort:

Habitat	Electro shocker	Small seine	Large Seine	Cast Net	Gill net
	Minutes	no of hauls	no of hauls	throws	Hrs
SD					
SS					
FD	20				
FS	20				

Fish habitat and cover rating:

Habitat	Abundance	Overhanging	Undercut Banks	Substrate	Aquatic
		Vegetation	& Root Wads		Macrophytes
SD	3	2	1	2	2
SS	4	2	3	2	2
FD	3	0	0	3	0
FS	4	1	0	3	1

Ecological importance:

Biomonitoring value: 3
Habitat diversity: 3
Species richness (recorded): 8

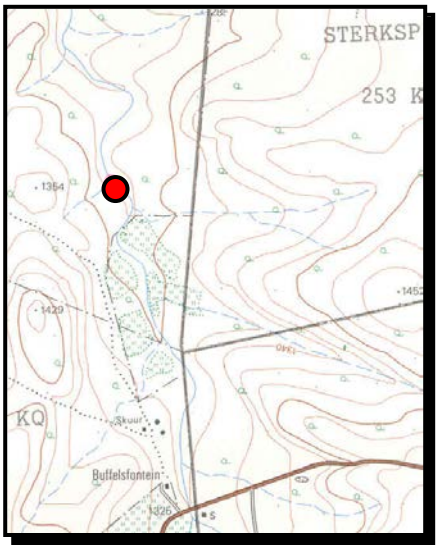
Riparian Vegetation

Inventory	
Site suitability	Not suitable, the multiple channels causes the site to be too complex
i) Channel type	Braided
ii) Active channel width	50m
iii) Surrounding land use	General farming
iv) Ecological rating	Low
v) Width of riparian zone a) RHB	30
b) LHB	15
c) Islands	60
vi) Substrate in riparian zone	Soil. Gravel/sand, rock/cobble
vii) Dominant vegetation:	Trees
viii) Dominant species a) by biomass	*Eucalyptus sp, M. azedarach, C.. erythrophylum*
b) by recruitment	*G. buxifolia, C. erythrophylum, Z. mucronata*
ix) Invasion of the riparian zone a) alien species	*Eucalyptus sp (H), M. azedarach (M), S. punicea (M)*
b) terrestrial species	None

SITE INFORMATION

Report reference: 22 **Riverbase code:** **A4FRIK-SHAM2**

Sampling date: June 2002



River Name: Frikkies se loop
Locality:
Latitude (S) 24^{o} –16.674’
Longitude (E) 27^{o} –58.318’
Altitude (m.a.m.s.l.) 1150

Ecoregion: 1.05

Hydrological type: Perennial

Stream Classification:
D (Upper foothills) mixed pool rapid, bedrock, boulders and sand.

Access:
As per site 13.

Travel 4km west of Vaalwater on the R33 and turn left. Travel about 10km along the dirt road. Enter Shambala Nature Reserve at the office gate on the RHS. Prior arrangement is necessary. Speak to Mr. Riem Venter. Travel to this site via the welgevonden fence line. The site lies below a cobble crossing at an old farm house. Locate by GPS.

Site History:

Fish:	2002	Geomorph:	2002
Invertebrates:	2002	Photographs:	2002
Riparian Vegetation:	2002		

Invertebrates

SASS5 Biotopes sampled: SIC, SOOC, MV, BR, G, S.
IHAS: (Un-adjusted) 82
HQI: 95

Ecological importance:
Biomonitoring value: 4
Habitat diversity: 4

Fish

Fish habitat and sampling effort:

Habitat	Electro shocker	Small seine	Large Seine	Cast Net	Gill net
	Minutes	no of hauls	no of hauls	throws	Hrs
SD			2		
SS	17	5			
FD					
FS					

Fish habitat and cover rating:

Habitat	Abundance	Overhanging	Undercut Banks	Substrate	Aquatic
		Vegetation	& Root Wads		Macrophytes
SD	4	1	2	1	3
SS	4	1	1	1	1
FD	1	2	2	3	0
FS	4	2	1	3	0

Ecological importance:

Biomonitoring value: 4
Habitat diversity: 4
Species richness (recorded): 11

Riparian Vegetation

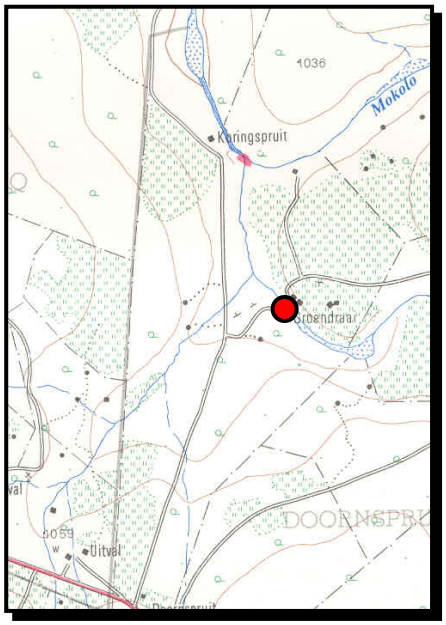
Inventory	
Site suitability	Suitable
i) Channel type	Anabranched
ii) Active channel width	30m
iii) Surrounding land use	Nature reserve
iv) Ecological rating	High
v) Width of riparian zone a) RHB	30m
b) LHB	10m
c) Islands	0
vi) Substrate in riparian zone	Rock/cobble,soil, gravel/sand
vii) Dominant vegetation:	Trees and shrubs
viii) Dominant species a) by biomass	D. lycioides, S. cordatum, B. africana
b) by recruitment	S. cordatum, D. lycioides, H. natalensis
ix) Invasion of the riparian zone a) alien species	None
b) terrestrial species	D. lycioides (L), T. sericea (VL), C. apiculatum (VL)

SITE INFORMATION

Report reference: 23 **Riverbase code:** **A4STER-DOORN**

Sampling date: August 2002

River Name: Sterkstroom
Locality:
Latitude (S) 24^{o} –11.490’
Longitude (E) 27^{o} –56.424’
Altitude (m.a.m.s.l.) 1015



Ecoregion: 1.05

Hydrological type: Perennial

Stream Classification:
E (Lower foothills) Pool riffle, bedrock outcrops with cobble bed.

Access:

Travel from Vaalwater towards Ellisras on the R33. Just before crossing the Sterkstroom, turn right (at tobacco sheds) and follow the dirt road. The road follows the river for about 10km and eventually crosses the river below a small informal compound. The site lies up and downstream of this bridge. The site is open.

Site History:

Fish:	2002	Geomorph:	2002
Invertebrates:	2002	Photographs:	2002
Riparian Vegetation:	2002		

Invertebrates

SASS5 Biotopes sampled: SIC, SOOC, MV, VIC, BR, G, S.
IHAS: (Un-adjusted) 76
HQI: 113

Ecological importance:
Biomonitoring value: 3
Habitat diversity: 3

Fish

Fish habitat and sampling effort:

Habitat	Electro shocker	Small seine	Large Seine	Cast Net	Gill net
	Minutes	no of hauls	no of hauls	throws	Hrs
SD		5			
SS					
FD					
FS	20				

Fish habitat and cover rating:

Habitat	Abundance	Overhanging	Undercut Banks	Substrate	Aquatic
		Vegetation	& Root Wads		Macrophytes
SD	4	4	3	3	2
SS	2	3	3	2	0
FD	2	3	3	3	0
FS	2	2	1	3	0

Ecological importance:

Biomonitoring value: 3
Habitat diversity: 3
Species richness (recorded): 16

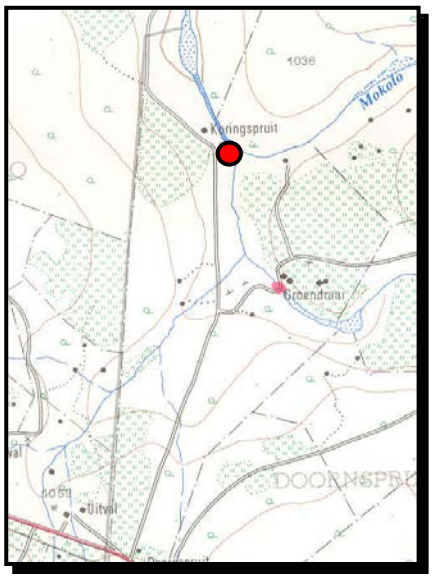
Riparian Vegetation

Inventory	
Site suitability	Suitable but highly impacted left hand bank. Can be left out because of similar sites in same ecoregion.
i) Channel type	Single
ii) Active channel width	30m
iii) Surrounding land use	General farming and residential
iv) Ecological rating	Low
v) Width of riparian zone a) RHB	15m
b) LHB	5m
c) Islands	0
vi) Substrate in riparian zone	Soil, bedrock, rock/cobble, gravel
vii) Dominant vegetation:	Trees
viii) Dominant species a) by biomass	*M. azedarach, M. alba, G. buxifolia*
b) by recruitment	*D. lycioides, G. buxifolia, M. azedarach*
ix) Invasion of the riparian zone a) alien species	*M. alba (H), M. azedarach (M)*
b) terrestrial species	*D. lycioides (M)*

SITE INFORMATION

Report reference: 24 **Riverbase code:** **A4MOGO-STERK**

Sampling date: August 2002



River Name: Mogol
Locality:
Latitude (S) 24° –11.166'
Longitude (E) 27° –57.282'
Altitude (m.a.m.s.l.) 1010

Ecoregion: 1.05

Hydrological type: Perennial

Stream Classification:
E (Lower foothills) mixed pool riffle, cobble bed.

Access:

Travel to site 23 and continue onward for about 1km, bearing right. As you approach a large irrigation farm, the road forks to the right and heads down to the river. The river crossing is at a site with multiple channels. The site extends up and downstream of the crossing.

Site History:

Fish:	2002	Geomorph:	2002
Invertebrates:	2002	Photographs:	2002
Riparian Vegetation:	2002		

Invertebrates

SASS5 Biotopes sampled: SIC, SOOC, MV, VIC.
IHAS: (Un-adjusted) 76
HQI: 120

Ecological importance:
Biomonitoring value: 3
Habitat diversity: 3

Fish

Fish habitat and sampling effort:

Habitat	Electro shocker	Small seine	Large Seine	Cast Net	Gill net
	Minutes	no of hauls	no of hauls	throws	Hrs
SD					
SS		3			
FD					
FS	21				

Fish habitat and cover rating:

Habitat	Abundance	Overhanging	Undercut Banks	Substrate	Aquatic
		Vegetation	& Root Wads		Macrophytes
SD	2	4	3	3	1
SS	2	3	2	3	0
FD	3	3	3	4	0
FS	4	3	2	4	0

Ecological importance:

Biomonitoring value: 3
Habitat diversity: 3
Species richness (recorded): 10

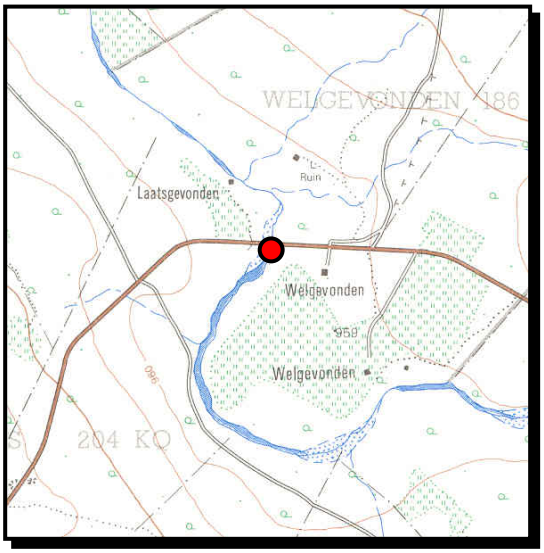
Riparian Vegetation

Inventory	
Site suitability	Suitable but is complex because of confluence.
i) Channel type	Braided
ii) Active channel width	150m
iii) Surrounding land use	General farming
iv) Ecological rating	Medium
v) Width of riparian zone a) RHB	10m
b) LHB	20m
c) Islands	0
vi) Substrate in riparian zone	Soil, rock/cobble, gravel/sand, bedrock
vii) Dominant vegetation:	Trees
viii) Dominant species a) by biomass	*C. erythrophylum, T. sericea, O. pulcra*
b) by recruitment	*C. erythrophylum, S. cordatum, S. punicea*
ix) Invasion of the riparian zone a) alien species	*S. punicea (L), M. azedarach (VL), M. alba*
b) terrestrial species	*T. sericea (L), O. pulcra (L), P. rotundifolia*

SITE INFORMATION

Report reference: 25 **Riverbase code:** **A4MOGO-WITFO**

Sampling date: September 2002



River Name: Mogol

Locality:

Latitude (S)	24° –06.822’
Longitude (E)	27° –48.141’
Altitude (m.a.m.s.l.)	950

Ecoregion: 1.05

Hydrological type: Perennial

Stream Classification:

E (Lower foothill) Pool riffle, bedrock outcrops, cobble and gravel dominate.

Access:

Take the R33 from Vaalwater towards Ellisras. Just before Bulge River, take the gravel - Witfontein turning. Approx. 8km further on, the road passes over the river on a low level bridge. On the LHS is Mokolo Ranch. The site includes riffles upstream and rapids approx. 100m downstream from the bridge, into Mokolo Ranch. It is recommended that site 26 on Mokolo Ranch be surveyed first, to gain permission to cross through the fence line at this site.

Site History:

Fish:	2002	Geomorph:	2002
Invertebrates:	2002	Photographs:	2002
Riparian Vegetation:	2002		

Invertebrates

SASS5 Biotopes sampled: SIC, SOOC, MV, VIC, BR, G, S.
IHAS: (Un-adjusted) 86
HQI: 116

Ecological importance:

Biomonitoring value: 3
Habitat diversity: 4

Fish

Fish habitat and sampling effort:

Habitat	Electro shocker	Small seine	Large Seine	Cast Net	Gill net
	Minutes	no of hauls	no of hauls	throws	Hrs
SD		6		5	
SS					
FD					
FS	20				

Fish habitat and cover rating:

Habitat	Abundance	Overhanging	Undercut Banks	Substrate	Aquatic
		Vegetation	& Root Wads		Macrophytes
SD	3	4	4	3	4
SS	3	4	4	3	4
FD	3	3	3	4	3
FS	3	3	3	4	3

Ecological importance:

Biomonitoring value: 3
Habitat diversity: 4
Species richness (recorded): 10

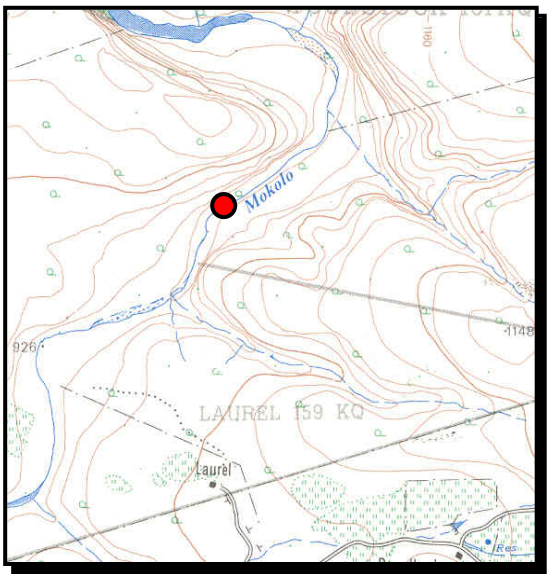
Riparian Vegetation

Inventory	
Site suitability	Suitable
i) Channel type	Braided
ii) Active channel width	190m
iii) Surrounding land use	Nature reserve, game farming
iv) Ecological rating	Medium
v) Width of riparian zone a) RHB	35m
b) LHB	30m
c) Islands	0
vi) Substrate in riparian zone	Bedrock, soil, rock/cobble, gravel
vii) Dominant vegetation:	Trees and reeds
viii) Dominant species a) by biomass	*C. erythrophylum, C. imberbi, R. pyroides*
b) by recruitment	*A. erubesces, C. erythrophylum, F. virosa.*
ix) Invasion of the riparian zone a) alien species	*M. azedarach (VL)*
b) terrestrial species	*P. africanum (VL), T. sericea (VL)*

SITE INFORMATION

Report reference: 26 **Riverbase code:** **A4MOGO-MOKOL**

Sampling date: September 2002



River Name: Mogol

Locality:

Latitude (S)	24° –03.479’
Longitude (E)	27° –47.691’
Altitude (m.a.m.s.l.)	915

Ecoregion: 1.05

Hydrological type: Perennial?

Stream Classification:

A steepened section within a Lower foothill zone (E). Pool rapid and riffle. Bedrock dominates within a localized gorge. Cobble and gravel substrates present.

Access:

Travel to site 25 along the Witfontein Road. Just before the bridge of site 25, turn left into Mokolo Ranch. Arrangements must be made beforehand because the gates are locked. The site lies at the northern extremity of the Ranch in a gorge, which leads into Mokolo Dam. The site lies up and downstream, of a low level bridge.

Site History:

Fish:	2002	Geomorph:	2002
Invertebrates:	2002	Photographs:	2002
Riparian Vegetation:	2002		

Invertebrates

SASS5 Biotopes sampled: SIC, SOOC, MV, VIC, G, S.
IHAS: (Un-adjusted) 90
HQI: 119

Ecological importance:

Biomonitoring value: 4
Habitat diversity: 4

Fish

Fish habitat and sampling effort:

Habitat	Electro shocker	Small seine	Large Seine	Cast Net	Gill net
	Minutes	no of hauls	no of hauls	throws	Hrs
SD				8	
SS	22				
FD					
FS	17				

Fish habitat and cover rating:

Habitat	Abundance	Overhanging	Undercut Banks	Substrate	Aquatic
		Vegetation	& Root Wads		Macrophytes
SD	3	3	2	3	3
SS	4	3	3	3	3
FD	3	2	1	4	3
FS	4	2	2	4	3

Ecological importance:

Biomonitoring value: 4
Habitat diversity: 4
Species richness (recorded): 11

Riparian Vegetation

Inventory	
Site suitability	Suitable
i) Channel type	Braided
ii) Active channel width	40m
iii) Surrounding land use	Nature reserve
iv) Ecological rating	High
v) Width of riparian zone a) RHB	100
b) LHB	20
c) Islands	0
vi) Substrate in riparian zone	Gravel/sand, rock/cobble, soil
vii) Dominant vegetation:	Trees
viii) Dominant species a) by biomass	*S. guineense, N. opositifolia, T. sericea*
b) by recruitment	*S. guineense, N. opositifolia, T. sericea*
ix) Invasion of the riparian zone a) alien species	None
b) terrestrial species	*T. sericea (VL), O. arborea (VL), C. gratisimus (VL)*

SITE INFORMATION

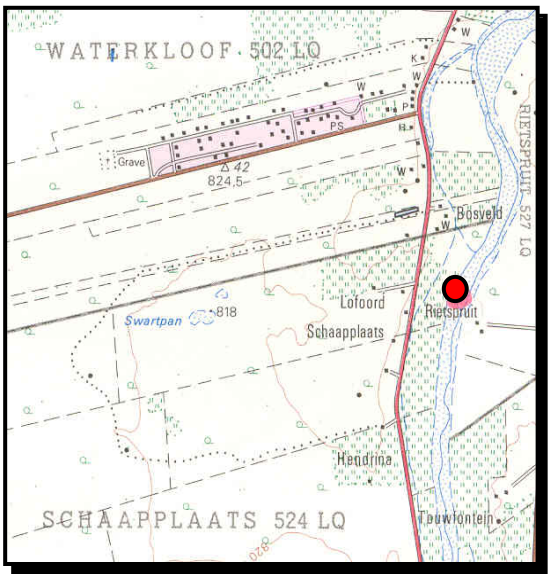
Report reference: 27 **Riverbase code:** **A4MOGO-DNYAL**

Sampling date: May 2002

River Name: Mogol

Locality:

Latitude (S)	23° –41.248’
Longitude (E)	27° –44.734’
Altitude (m.a.m.s.l.)	818



Ecoregion: 1.05

Hydrological type: Seasonal in all but the wettest of years?

Stream Classification:

F (Lowland river) alluvial, pool riffle. Sand.

Access:

The site lies either side of the Mogol bridge on the Ellisras – Vaalwater Road, approx. 5km from Ellisras.

Site History:

Fish:	2002	Geomorph:	2002
Invertebrates:	2002	Photographs:	2002
Riparian Vegetation:	2002		

Invertebrates

SASS5 Biotopes sampled: SIC, SOOC, MV, VIC, G, S.
IHAS: (Un-adjusted) 77
HQI: 99

Ecological importance:

Biomonitoring value: 3
Habitat diversity: 3

Fish

Fish habitat and sampling effort:

Habitat	Electro shocker	Small seine	Large Seine	Cast Net	Gill net
	Minutes	no of hauls	no of hauls	throws	Hrs
SD			2		
SS					
FD	8				
FS	11				

Fish habitat and cover rating:

Habitat	Abundance	Overhanging	Undercut Banks	Substrate	Aquatic
		Vegetation	& Root Wads		Macrophytes
SD	3	3	3	1	0
SS	3	1	1	1	0
FD	3	1	3	2	0
FS	4	1	1	2	0

Ecological importance:

Biomonitoring value: 3
Habitat diversity: 3
Species richness (recorded): 20

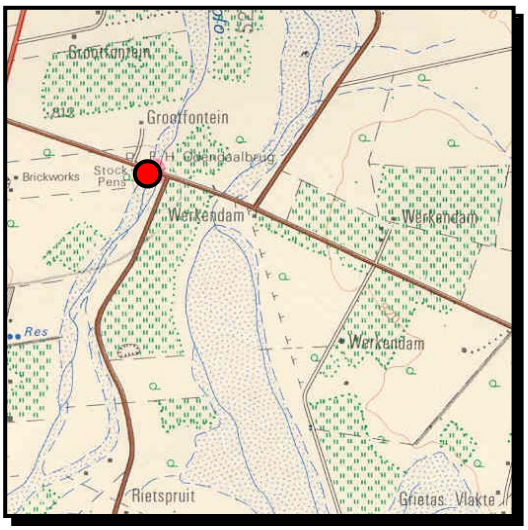
Riparian Vegetation

Inventory	
Site suitability	Suitable – but complex and impacted. Restricted access to right hand bank
i) Channel type	Braided
ii) Active channel width	30m
iii) Surrounding land use	Nature reserve and stock farming
iv) Ecological rating	Low
v) Width of riparian zone a) RHB	30
b) LHB	30
c) Islands	40
vi) Substrate in riparian zone	Gravel/sand, soil, rock/cobble
vii) Dominant vegetation:	Trees and reeds
viii) Dominant species a) by biomass	*A. karroo, T. sericea, G. flavescens.*
b) by recruitment	*D. cinerea, D. lycioides, R. pyroides.*
ix) Invasion of the riparian zone a) alien species	*M. azedarach (L)*
b) terrestrial species	*T. sericea (M), D. cinerea (M), D. lycioides (M)*

SITE INFORMATION

Report reference: 28 **Riverbase code:** **A4MOGO-MARKE**

Sampling date: May 2002



River Name: Mogol

Locality:

Latitude (S)	23^{o} –39.129’
Longitude (E)	27^{o} –45.584’
Altitude (m.a.m.s.l.)	818

Ecoregion: 1.05

Hydrological type: Seasonal in all but the wettest of years?

Stream Classification:

F (Lowland river) alluvial, pool riffle. Sand.

Access:

The site lies either side of the Ellisras – Marken Road bridge approx 5km from Ellisras.

Site History:

Fish:	2002	Geomorph:	2002
Invertebrates:	2002	Photographs:	2002
Riparian Vegetation:	2002		

Invertebrates

SASS5 Biotopes sampled: SIC, SOOC, MV, VIC, S.
IHAS: (Un-adjusted) 61
HQI: 89

Ecological importance:

Biomonitoring value: 2
Habitat diversity: 3

Fish

Fish habitat and sampling effort:

Habitat	Electro shocker	Small seine	Large Seine	Cast Net	Gill net
	Minutes	no of hauls	no of hauls	throws	Hrs
SD			5		
SS					
FD	15				
FS					

Fish habitat and cover rating:

Habitat	Abundance	Overhanging	Undercut Banks	Substrate	Aquatic
		Vegetation	& Root Wads		Macrophytes
SD	4	3	2	1	1
SS	3	3	2	1	2
FD	3	0	0	1	0
FS	0	0	0	0	0

Ecological importance:

Biomonitoring value: 3
Habitat diversity: 3
Species richness (recorded): 9

Riparian Vegetation

Inventory	
Site suitability	Suitable
i) Channel type	Braided
ii) Active channel width	100m
iii) Surrounding land use	General farming
iv) Ecological rating	Low
v) Width of riparian zone a) RHB	20
b) LHB	30
c) Islands	15
vi) Substrate in riparian zone	Gravel/sand, soil
vii) Dominant vegetation:	Trees
viii) Dominant species a) by biomass	*A. karroo, R. pyroides, T. sericea*
b) by recruitment	*D. lycioides, D. cinerea, G. flava*
ix) Invasion of the riparian zone a) alien species	*M. azedarach (VL)*
b) terrestrial species	*T. sericea (M), D. lycioides (L), D. cinerea (L)*

SITE INFORMATION

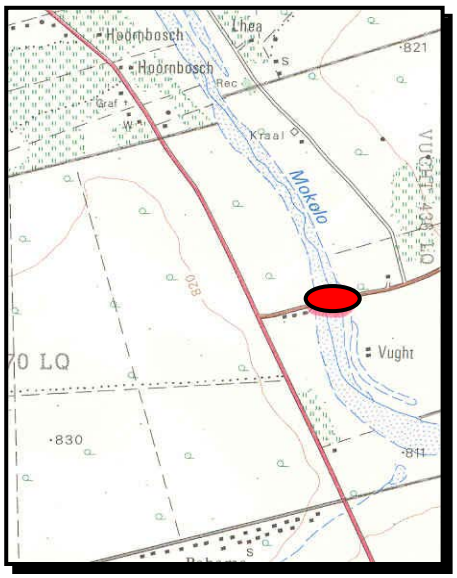
Report reference: 29 **Riverbase code:** **A4MOGO-BESKA**

Sampling date: May 2002

River Name: Mogol

Locality:

Latitude (S)	23° –35.994’
Longitude (E)	27° –44.463’
Altitude (m.a.m.s.l.)	815



Ecoregion: 1.05

Hydrological type: Seasonal in all but the wettest of years?

Stream Classification:

F (Lowland river) alluvial, pool riffle. Sand.

Access:

Travel North on the R510 from Ellisras. After approx. 10km, turn right towards Beska. The site lies upstream of the Beska Road bridge. NB. This is a wide multiple channeled site with many isolated pools in the flood plain area. All available habitats were sampled in the 2002 survey.

Site History:

Fish:	2002	Geomorph:	2002
Invertebrates:	2002	Photographs:	2002
Riparian Vegetation:	2002		

Invertebrates

SASS5 Biotopes sampled: SIC, SOOC, MV, VIC, S.
IHAS: (Un-adjusted) 52
HQI: 71

Ecological importance:

Biomonitoring value: 2
Habitat diversity: 3

Fish

Fish habitat and sampling effort:

Habitat	Electro shocker	Small seine	Large Seine	Cast Net	Gill net
	Minutes	no of hauls	no of hauls	throws	Hrs
SD	23	1	2		
SS					
FD					
FS					

Fish habitat and cover rating:

Habitat	Abundance	Overhanging Vegetation	Undercut Banks & Root Wads	Substrate	Aquatic Macrophytes
SD	4	4	3	2	2
SS	1	4	3	2	0
FD	2	0	3	2	0
FS	0	0	0	0	0

Ecological importance:

Biomonitoring value: 2
Habitat diversity: 2
Species richness (recorded): 10

Riparian Vegetation

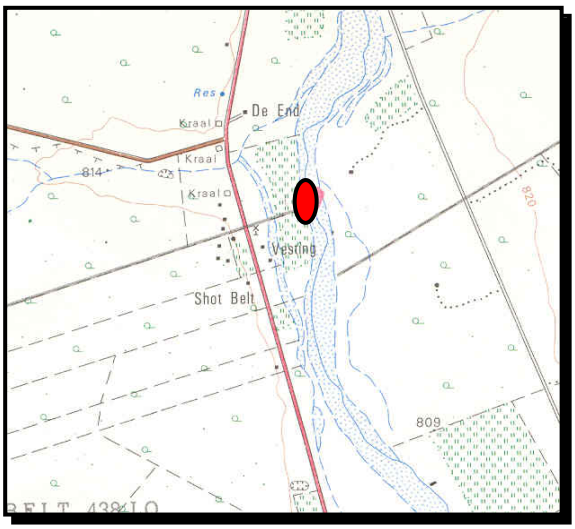
Inventory	
Site suitability	Suitable
i) Channel type	Single
ii) Active channel width	60m
iii) Surrounding land use	Stock farming
iv) Ecological rating	Low
v) Width of riparian zone a) RHB	70
b) LHB	20
c) Islands	0
vi) Substrate in riparian zone	Soil, gravel/sand
vii) Dominant vegetation:	Trees and reeds
viii) Dominant species a) by biomass	*Z. mucronata, T. sericea, A. karroo*
b) by recruitment	*D. lycioides, Z. mucronata, D. cinerea*
ix) Invasion of the riparian zone a) alien species	*None*
b) terrestrial species	*T. cinerea (H), D. lycioides (M), A. mellifera (M)*

SITE INFORMATION

Report reference: 30 **Riverbase code:** **A4MOGO-SHOTB**

Sampling date: May 2002

River Name: Mogol



Locality:

Latitude (S)	23° –32.361’
Longitude (E)	27° –42.840’
Altitude (m.a.m.s.l.)	810

Ecoregion: 1.05

Hydrological type: Seasonal in all but the wettest of years?

Stream Classification:
F (Lowland river) alluvial, pool riffle. Sand.

Access:

Travel North from Elliras on the R510. After approx. 20km, an ox bow can be seen on the RHS with the entrance for an angling club. Just past the angling club, the entrance to the farm Shotbelt will be seen. Entrance to the site is through the farm. Permission to enter must be sought from the owner. Access to the site is by wading through narrow channels which meander through dense stands of reeds. Locate by GPS. The site consists of a large pool and gravel riffles. **Beware of hippo’s.**

Site History:

Fish:	2002	Geomorph:	2002
Invertebrates:	2002	Photographs:	2002
Riparian Vegetation:	2002		

Invertebrates

SASS5 Biotopes sampled: MV, G, S.
IHAS: (Un-adjusted) 72
HQI: 78

Ecological importance:
Biomonitoring value: 2
Habitat diversity: 2

Fish

Fish habitat and sampling effort:

Habitat	Electro shocker	Small seine	Large Seine	Cast Net	Gill net
	Minutes	no of hauls	no of hauls	throws	Hrs
SD			3		
SS					
FD					
FS					

Fish habitat and cover rating:

Habitat	Abundance	Overhanging	Undercut Banks	Substrate	Aquatic
		Vegetation	& Root Wads		Macrophytes
SD	2	2	2	1	2
SS	3	3	2	1	2
FD	2	0	0	1	1
FS	2	0	0	3	1

Ecological importance:

Biomonitoring value: 2
Habitat diversity: 2
Species richness (recorded): 6

Riparian Vegetation

Not surveyed. Site dominated by extensive reedbeds.

SITE INFORMATION

Report reference: 31 **Riverbase code:** **A4MOGO-MONTE**

Sampling date: May 2002

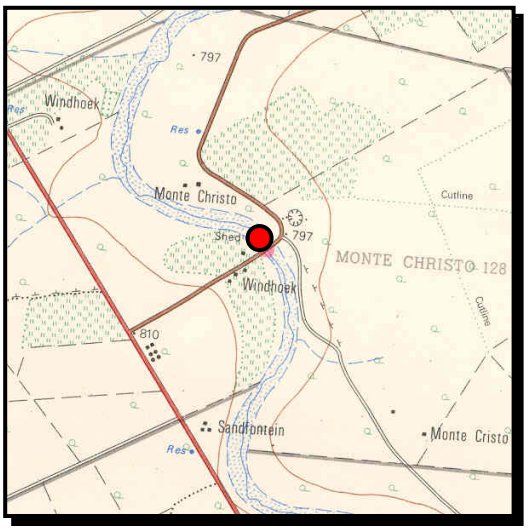
River Name: Mogol

Locality:

Latitude (S)	23° –22.10’
Longitude (E)	27° –41.75’
Altitude (m.a.m.s.l.)	795

Ecoregion: 1.03

Hydrological type: Seasonal in all but the wettest of years?



Stream Classification:

F (Lowland river) alluvial, pool riffle. Sand.

Access:

Travel North from Ellisras on the R510. After approx. 40km, turn right onto the R572. A site can be found in the vicinity of the bridge. Due to lack of flow, no site was used during the 2002 survey.

Site History:

Fish:		Geomorph:	2002
Invertebrates:		Photographs:	2002
Riparian Vegetation:			

Invertebrates

Not surveyed - No flow

Fish

Riparian Vegetation

SITE INFORMATION

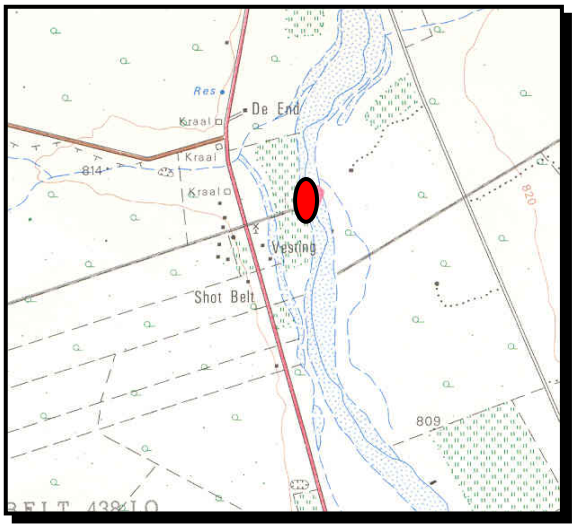
Report reference: 30 **Riverbase code:** **A4MOGO-SHOTB**

Sampling date: May 2002

River Name: Mogol

Locality:

Latitude (S)	23° –32.361’
Longitude (E)	27° –42.840’
Altitude (m.a.m.s.l.)	810



Ecoregion: 1.05

Hydrological type: Seasonal in all but the wettest of years?

Stream Classification:

F (Lowland river) alluvial, pool riffle. Sand.

Access:

Travel North from Elliras on the R510. After approx. 20km, an ox bow can be seen on the RHS with the entrance for an angling club. Just past the angling club, the entrance to the farm Shotbelt will be seen. Entrance to the site is through the farm. Permission to enter must be sought from the owner. Access to the site is by wading through narrow channels which meander through dense stands of reeds. Locate by GPS. The site consists of a large pool and gravel riffles. **Beware of hippo’s.**

Site History:

Fish:	2002	Geomorph:	2002
Invertebrates:	2002	Photographs:	2002
Riparian Vegetation:	2002		

Invertebrates

SASS5 Biotopes sampled: MV, G, S.
IHAS: (Un-adjusted) 72
HQI: 78

Ecological importance:

Biomonitoring value: 2
Habitat diversity: 2

Fish

Fish habitat and sampling effort:

Habitat	Electro shocker	Small seine	Large Seine	Cast Net	Gill net
	Minutes	no of hauls	no of hauls	throws	Hrs
SD			3		
SS					
FD					
FS					

Fish habitat and cover rating:

Habitat	Abundance	Overhanging	Undercut Banks	Substrate	Aquatic
		Vegetation	& Root Wads		Macrophytes
SD	2	2	2	1	2
SS	3	3	2	1	2
FD	2	0	0	1	1
FS	2	0	0	3	1

Ecological importance:

Biomonitoring value: 2
Habitat diversity: 2
Species richness (recorded): 6

Riparian Vegetation

Not surveyed. Site dominated by extensive reedbeds.

1. The inventory layout

1.1 Introduction

With respect to the riparian vegetation, a layout based on the one used by Hill *et al* (2001) was applied in this inventory report on the Mogol River. Terminology for the Mogol RVI inventory, (explained in List A), follows that applied by Hill *et al* (op cit) for the Crocodile, Sabie and Olifants Rivers. Minor adjustments were made to some descriptions and these changed items and some new items are listed in list B. The latter were added because of their deemed importance. This inventory is intended to extend upon the information listed in the summary of Riparian Vegetation Index (RVI) of each site, that formed part of the report by Fouche (2003) and care was taken not to repeat all the aspects already listed in that summary.

List A

i) **Dominant vegetation:** The type of plant or plant forms which are most common at the site and which clearly characterize the site in terms of riparian vegetation. This information is derived from the actual counts made during a "walkabout" survey of the RVI site. This includes riparian, terrestrial and exotic species.

a) **Dominance by biomass:** An estimate based on the number of woody specimens taller than 2m. The three most dominant species are ranked in order of dominance

b) **Dominance by recruitment:** An estimate based on the number of woody specimens shorter than 2m. The three most dominant species are ranked in order of dominance.

NB – only the top three species are listed in the inventory.

ii) **Substrate:** The type of substrate found at the site due to the extent of the transportation or deposition of river bed material by the river. The substrate was classified according to the data in the table below.

Table 1: Substrate classification (adapted from Rowntree and Wadeson)

Substrate class	**Size (mm)**	**Practical description**
Bedrock	N/a	
Boulder	> 256	Larger than adult head
Cobble	64 – 256	Larger than fist
Gravel	2 – 64	Small pea → smaller than fist
Sand	0,06 – 2	Individual grains are visible
Silt and clay	< 0,06	Powdery or soapy, grains not visible

In the inventory, boulders and cobbles are listed together as rock/cobble and sand and gravel are listed together. An additional category namely soil is also added. This was done in order to conform to the RVI site assessment form used during the survey.
The substrate types are listed in order of priority.

iii) Channel type: The dominant channel-form that characterises the site, particularly in terms of the number of channels present. The type of channel is determined by the inherent stability of the bed material present and by the number of channels present. Based on the number, channels are categorized either as single or multiple. Multiple channels can also be categorized on the channel substrate eg: An *anabranched channel* flows between stable bedrock while a *braided channel* is observed in unstable river beds such as is seen in classical sand rivers.
The term mixed is used to describe situation where anabranching and braiding occurs.
iv) Surrounding land use: The type of use for which the surrounding land is exploited.
v) Ecological rating: A qualitative rating, which considers the type of vegetation present, its abundance, species diversity and structural integrity. The sites are rated as high, medium or low.
vi) Site suitability: This refers to the suitability of the specific site as a future site for biomonitoring and is listed suitable or not suitable. These decisions are based on specie diversity and the position of the site.

List B
vii) Width of riparian zone: The width of the area adjacent to the river that could be defined as the riparian zone based on the description proved by Kemper 2001. The widths in the inventory are the following: right hand bank and islands and are recorded in this order.

viii) Invasion of the riparian zone. This information is derived from the actual counts made during a "walkabout" survey of the RVI site.

a) **Invasion by alien species:** The species are listed and the extent of invasion is categorized as Very high (VL), High (H), medium, (M), Low (L) or Very Low (VL).
b) **Invasion by terrestrial species.** The species are listed and the extent of invasion is categorized as Very high (VL), High (H), medium, (M), Low (L) or Very Low (VL).

NB – only the top three species of a) and b) are listed in the inventory.

Reference list:
Fouche, P.S.O. 2003. Assessment of the Riparian Vegetation in the Mogol River Catchment. Report prepared for the Directorate Environmental Affairs, Limpopo Province.
Hill, L., Vos, P., Moolman, J. and Silberbauer. 2001. *Inventory of river health programme monitoring sites on the Olifants, Sabie and Crocodile rivers.* WRC report 850/2/01
Kemper, N.L. 2001. *Riparian vegetation index.* WRC report 850/3/01
Rowntree, K. and Wadeson, R *Field manual for channel classification and condition assessment.*

2. Inventory of the sites:

Site details					
River	Mogol		**Stream**	Sand River	
Site ref	A4SAND-UPPER	**Site no**	1	**Site name**	Sand upper site
Inventory					
Site suitability	Not suitable, low species diversity and highly impacted				
i) Channel type				Single	
ii) Active channel width				10m	
iii) Surrounding land use				Stock and irrigation farming	
iv) Ecological rating				Medium	
v) Width of riparian zone a) RHB				5m	
b) LHB				10m	
c) Islands				0	
vi) Substrate in riparian zone				Cobble/ gravel & sand/sediment	
vii) Dominant vegetation:				Grasses	
viii) Dominant species a) by biomass				*B. salvifolia, R. pyroides, D. lyciodes.*	
b) by recruitment				*B. salvifolia, D. lycioides R. pyroides,*	
ix) Invasion of the riparian zone a) alien species				*Persicum* (L) *S. babylonica* (L)	
b) terrestrial species				*L.* javonica (VL)	

Site details					
River	Mogol		**Stream**	Sand River tributary	
Site ref	A4SAND-LEEU	**Site no**	2	**Site name**	Leeuwenhof Lodge bridge
Inventory					
Site suitability	Suitable				
i) Channel type				Single	
ii) Active channel width				5m	
iii) Surrounding land use				Stock farming	
iv) Ecological rating				Medium	
v) Width of riparian zone a) RHB				5 – 10m	
b) LHB				20m	
c) Islands				0	
vi) Substrate in riparian zone				Soil/bedrock/gravel & sand/gravel	
vii) Dominant vegetation:				Trees	
viii) Dominant species a) by biomass				*E. divinorum, D. lycioides, Populus* sp.	
b) by recruitment				*E. divinorum, Populus* sp , *D. lycioides*	
ix) Invasion of the riparian zone a) alien species				*Populus* sp (H) *L. camara* (M) *Melia azedarach* (M)	
b) terrestrial species				*D. lyciodes* (L)	

Site details					
River	Mogol		**Stream**	Sand River tributary	
Site ref	A4SAND-TOBR	**Site no**	3	**Site name**	Top bridge
Inventory					
Site suitability	Not suitable, area to confined.				
i) Channel type				Single	
ii) Active channel width				4m	
iii) Surrounding land use				Stock farming	
iv) Ecological rating				Medium	
v) Width of riparian zone a) RHB				15m	
b) LHB				20m	
c) Islands				0	
vi) Substrate in riparian zone				Soil, gravel, sand, cobble	
vii) Dominant vegetation:				Trees	
viii) Dominant species a) by biomass				*Populus sp, D. lycioides, R. pyroides*	
b) by recruitment				*Populus sp, D. lycioides, R. pyroides*	
ix) Invasion of the riparian zone a) alien species				*Populus* (VH)	
b) terrestrial species				*D. lycioides* (M)	

Site details					
River	Mogol		**Stream**	Loubad River	
Site ref	A4SAND-LOUBA	**Site no**	4	**Site name**	Road/rail bridge
Inventory					
Site suitability	Suitable				
i) Channel type				Single	
ii) Active channel width				15m	
iii) Surrounding land use				Stock farming	
iv) Ecological rating				Medium	
v) Width of riparian zone a) RHB				20m	
b) LHB				20m	
c) Islands				0	
vi) Substrate in riparian zone				Bedrock, Sediment, gravel, sand	
vii) Dominant vegetation:				Trees and shrubs	
viii) Dominant species a) by biomass				*S. punicea, Populus, R. pyroides*	
b) by recruitment				*S. punicea, R. pyroides, A. karroo*	
ix) Invasion of the riparian zone a) alien species				*S. punicea (M), Populus (M), Eucalyptus (L), Persicum (L)*	
b) terrestrial species				*T.sericea (L), Protea (L), V. rehmani (L)*	

Site details					
River	Mogol			**Stream**	Sand
Site ref	A4KLSA-BOEKE	**Site no**	5	**Site name**	Turn-off to melkrivier
Inventory					
Site suitability	Suitable				
i) Channel type					10m
ii) Active channel width					Single
iii) Surrounding land use					Stock farming, residential
iv) Ecological rating					Medium – high
v) Width of riparian zone a) RHB					30m
b) LHB					10m
c) Islands					0
vi) Substrate in riparian zone					Soil, bedrock, cobble, gravel
vii) Dominant vegetation:					Trees and shrubs
viii) Dominant species a) by biomass					*B. salvifolia, D lycioides, M. azedarach*
b) by recruitment					*B. salvifolia, C. africana, M. azedarach*
ix) Invasion of the riparian zone a) alien species					*M. azedarach (M), M. alba (VL)*
b) terrestrial species					*L. javonica (L), G. occidentalis (VL), D. cinerea (VL)*

Site details					
River	Mogol			**Stream**	
Site ref	A4MOGO-ALMAB	**Site no**	6	**Site name**	Alma Bridge
Inventory					
Site suitability	Not suitable, highly impacted				
i) Channel type					Braided
ii) Active channel width					20m
iii) Surrounding land use					Stock farming
iv) Ecological rating					Low
v) Width of riparian zone a) RHB					20m
b) LHB					20m
c) Islands					2m
vi) Substrate in riparian zone					Soil, gravel/sand, sediment
vii) Dominant vegetation:					Trees
viii) Dominant species a) by biomass					*Populus sp , M.azedarach, D. lycioides*
b) by recruitment					*Populus sp , M.azedarach, G. buxifolia*
ix) Invasion of the riparian zone a) alien species					*Populus sp (VH) , M.azedarach (VH),S. babylonica (VH)*
b) terrestrial species					*D. lycioides* (L)

Site details					
River	Mogol		**Stream**	Mokolo	
Site ref	A4MOGO-TWEEF	**Site no**	7	**Site name**	Tweefontein bridge
Inventory					
Site suitability	Not suitable, low species diversity.				
i) Channel type				Single	
ii) Active channel width				45m	
iii) Surrounding land use				Stock and irrigation farming	
iv) Ecological rating				Medium	
v) Width of riparian zone a) RHB				10m	
b) LHB				5m	
c) Islands				0	
vi) Substrate in riparian zone				Soil, gravel/sand, rock/cobble	
vii) Dominant vegetation:				Trees and shrubs	
viii) Dominant species a) by biomass				*Populus, G. buxifolia, R. pyroides*	
b) by recruitment				*G. buxifolia, D. lycioides, Populus sp*	
ix) Invasion of the riparian zone a) alien species				*Populus sp (H), M.azedarach (L)*	
b) terrestrial species				*D. lycioides (VL)*	

Site details					
River	Mogol		**Stream**	Sterkstroom	
Site ref	A4STER-WELG1	**Site no**	9	**Site name**	Broken bridge
Inventory					
Site suitability	Suitable				
i) Channel type				Single	
ii) Active channel width				5 – 8m	
iii) Surrounding land use				Nature reserve	
iv) Ecological rating				High	
v) Width of riparian zone a) RHB				20m	
b) LHB				10m	
c) Islands				0	
vi) Substrate in riparian zone				Soil, rock/cobble	
vii) Dominant vegetation:				Grass	
viii) Dominant species a) by biomass				*F. saligna, T.sericea, B. africana*	
b) by recruitment				*F. saligna, S. cordatum, T.sericea,*	
ix) Invasion of the riparian zone a) alien species				None	
b) terrestrial species				*T. sericea (VL), L. javonica (VL)*	

Site details					
River	Mogol		**Stream**	Sterkstroom	
Site ref	A4STER-WELG2	**Site no**	10	**Site name**	Grootfontein junction
Inventory					
Site suitability	Suitable				
i) Channel type				Multiple/Anabranched	
ii) Active channel width				30m	
iii) Surrounding land use				Nature reserve	
iv) Ecological rating				High	
v) Width of riparian zone a) RHB				25m	
b) LHB				4m	
c) Islands				5-6m	
vi) Substrate in riparian zone				Rock/cobble, soil, gravel/sand/ bedrock	
vii) Dominant vegetation:				Trees	
viii) Dominant species a) by biomass				*S. guineense, S. cordatum*	
b) by recruitment				*S. guineense, S. cordatum*	
ix) Invasion of the riparian zone a) alien species				*S. punicea (VL), M. azedarach (VL)*	
b) terrestrial species				*O. pulcra (L), T. sericea (L) l. javonica (VL)*	

Site details					
River	Mogol		**Stream**	Taaibosspruit	
Site ref	A4TAAI-WELG1	**Site no**	11	**Site name**	Monitor Bridge
Inventory					
Site suitability	Suitable				
i) Channel type				Braided	
ii) Active channel width				15m	
iii) Surrounding land use				Nature reserve	
iv) Ecological rating				High	
v) Width of riparian zone a) RHB				35m	
b) LHB				25m	
c) Islands				0	
vi) Substrate in riparian zone				Soil, gravel/sand, rock/cobble	
vii) Dominant vegetation:				Trees and grass	
viii) Dominant species a) by biomass				*B. africana, D. lycioides, S. cordatum*	
b) by recruitment				*S. cordatum, D. lycioides, H. natalensis.*	
ix) Invasion of the riparian zone a) alien species				None	
b) terrestrial species				*D. lycioides (L), T. sericea (VL), O.pulcra (VL)*	

Site details					
River	Mogol			**Stream**	Taaibosspruit
Site ref	A4TAAI-WELG1	**Site no**	12	**Site name**	Second bridge
Inventory					
Site suitability	Suitable but is a repeat of site 11.				
i) Channel type					Single
ii) Active channel width					8m
iii) Surrounding land use					Nature reserve
iv) Ecological rating					High
v) Width of riparian zone a) RHB					15m
b) LHB					15m
c) Islands					0
vi) Substrate in riparian zone					Gravel/sand, soil, rock/cobble
vii) Dominant vegetation:					Trees
viii) Dominant species a) by biomass					*S. cordatum, F.saligna, T. sericea*
b) by recruitment					*S. cordatum, F. saligna, B. africana*
ix) Invasion of the riparian zone a) alien species					None
b) terrestrial species					*T.sericea (VL), D. cinerea (VL)*

Site details					
River	Mogol			**Stream**	Frikkie se loop
Site ref	A4FRIK-SHAM1	**Site no**	13	**Site name**	Frikkies top bridge
Inventory					
Site suitability	Suitable				
i) Channel type					Single
ii) Active channel width					3m
iii) Surrounding land use					Nature reserve
iv) Ecological rating					High
v) Width of riparian zone a) RHB					5
b) LHB					25
c) Islands					2
vi) Substrate in riparian zone					Bedrock, soil, gravel/sand
vii) Dominant vegetation:					Trees and grass
viii) Dominant species a) by biomass					*S. guineense, B. africana, T. sericea*
b) by recruitment					*S. guineense, O. pulcra, F. saligna*
ix) Invasion of the riparian zone a) alien species					None
b) terrestrial species					*Protea sp (M) ., O. pulcra (L) T. sericea (VL)*

Site details					
River	Mogol		**Stream**	Mokolo	
Site ref	A4MOGO-GROEN	**Site no**	14	**Site name**	Bridge upstream of Vaalwater
Inventory					
Site suitability	Not suitable				
i) Channel type				Single	
ii) Active channel width				70m	
iii) Surrounding land use				Irrigation farming	
iv) Ecological rating				Low	
v) Width of riparian zone a) RHB				15m	
b) LHB				5m	
c) Islands				30	
vi) Substrate in riparian zone				Soil, gravel/sand, rock/cobble, bedrock	
vii) Dominant vegetation:				Trees and shrubs	
viii) Dominant species a) by biomass				*T. sericea, R. pyroides, S. punicea*	
b) by recruitment				*D. lycioides, T. sericea, E. divinorum*	
ix) Invasion of the riparian zone a) alien species				*S. punicea (L), M. azedarach (L), M. alba (L)*	
b) terrestrial species				*T. sericea (M), P. rotundifolia (M), D. lycioides (M)*	

Site details					
River	Mogol		**Stream**	Mokolo	
Site ref	A4MOGO-WWORK	**Site no**	15	**Site name**	Mokolo dam waterworks
Inventory					
Site suitability	Suitable				
i) Channel type				Single	
ii) Active channel width				10m	
iii) Surrounding land use				Nature reserve	
iv) Ecological rating				Medium	
v) Width of riparian zone a) RHB				25m	
b) LHB				15m	
c) Islands				0	
vi) Substrate in riparian zone				Gravel/sand, bedrock, rock/cobble	
vii) Dominant vegetation:				Trees and shrubs	
viii) Dominant species a) by biomass				*S. guineense, N. oppositifolia, S. punicea*	
b) by recruitment				*S. guineense, T. sericea, S. punicea*	
ix) Invasion of the riparian zone a) alien species				*S. punicea (VL)*	
b) terrestrial species				*T.sericea (M), D. cinerea ((M), O. arborea (L)*	

Site details					
River	Mogol		**Stream**	Mokolo	
Site ref	A4MOGO-WITKO	**Site no**	16	**Site name**	Witkop causeway
Inventory					
Site suitability	Not suitable since a large parts of the left hand bank is not accessible.				

i) Channel type	Braided
ii) Active channel width	60m
iii) Surrounding land use	Stock and irrigation farming
iv) Ecological rating	Medium
v) Width of riparian zone a) RHB	20m
b) LHB	15m
c) Islands	10m
vi) Substrate in riparian zone	Soil, rock/cobble, gavel/sand
vii) Dominant vegetation:	Reeds and trees
viii) Dominant species a) by biomass	*D. cinerea, G. flavescens, R. pyroides*
b) by recruitment	*D. cinerea, G. flavescens, G. monticola*
ix) Invasion of the riparian zone a) alien species	*None*
b) terrestrial species	*D. cinerea (H), T. sericea (M), D. lycioides (L)*

Site details					
River	Mogol		**Stream**	Rietspruit	
Site ref	A4RIET-FANCY	**Site no**	17	**Site name**	Rietspruit (3) Fancy
Inventory					
Site suitability	Suitable				

i) Channel type	Single
ii) Active channel width	4m
iii) Surrounding land use	Stock and irrigation farming
iv) Ecological rating	High
v) Width of riparian zone a) RHB	5m
b) LHB	10m
c) Islands	0
vi) Substrate in riparian zone	Rock/cobble, soil, gravel/sand
vii) Dominant vegetation:	Trees
viii) Dominant species a) by biomass	*S. guineense, T. sericea, D. cinerea*
b) by recruitment	*S. guineense, F. virosa, D. cinerea*
ix) Invasion of the riparian zone a) alien species	*S. sesban (VL)*

b) terrestrial species					*T. sericea (L), D. cinerea (L)*
Site details					
River	Mogol			**Stream**	Rietspruit
Site ref	A4RIET-WATER	**Site no**	18	**Site name**	Rietspruit (4) waterfall
Inventory					
Site suitability	Suitable				
i) Channel type					Mixed
ii) Active channel width					4m
iii) Surrounding land use					Game and stock farming
iv) Ecological rating					High
v) Width of riparian zone a) RHB					20m
b) LHB					50m
c) Islands					0
vi) Substrate in riparian zone					Rock/cobble, gravel/sand, soil
vii) Dominant vegetation:					Trees and shrubs
viii) Dominant species a) by biomass					*F. virosa, D. cinerea, C. gratisimus*
b) by recruitment					*S. guineense, F. virosa, O,. arborea*
ix) Invasion of the riparian zone a) alien species					*R. communis (VL)*
b) terrestrial species					*D. cinerea (H), C. gratisimus (L), B. mollis (VL)*

Site details					
River	Mogol			**Stream**	Dwarsrivier
Site ref	A4DWAR-ZAND	**Site no**	19	**Site name**	Dwars 1
Inventory					
Site suitability	Not suitable, too impacted and low specie diversity				
i) Channel type					Single
ii) Active channel width					14m
iii) Surrounding land use					Stock farming
iv) Ecological rating					Low
v) Width of riparian zone a) RHB					10m
b) LHB					10m
c) Islands					0
vi) Substrate in riparian zone					Soil, Gravel/sand
vii) Dominant vegetation:					Trees and grass
viii) Dominant species a) by biomass					*S. punicea, Populus sp, R. pyroides*
b) by recruitment					*S. punicea, Z mucronata, Populus sp.*
ix) Invasion of the riparian zone a) alien species					*S. punicea (H), Populus sp (M), Eucalyptus sp (M)*
b) terrestrial species					*D. lycioides (VL), A. rehmaniana (VL)*

Site details					
River	Mogol	**Stream**	Jim se loop		
Site ref	A4DWAR-JIMSE	**Site no**	20	**Site name**	Jim se loop
Inventory					
Site suitability	Suitable				
i) Channel type					Single
ii) Active channel width					10m
iii) Surrounding land use					Game farming
iv) Ecological rating					Medium
v) Width of riparian zone a) RHB					15m
b) LHB					10m
c) Islands					0
vi) Substrate in riparian zone					Soil, rock/cobble, bedrock
vii) Dominant vegetation:					Trees
viii) Dominant species a) by biomass					*T. sericea, R. pyroides, A. karroo*
b) by recruitment					*G. buxifolia, G. flava, A. karroo*
ix) Invasion of the riparian zone a) alien species					*S. punicea (L), M. azedarach (VL), Opuntia sp*
b) terrestrial species					*T. sericea, (L) D. lycioides (L)*

Site details					
River	Mogol	**Stream**	Mokolo		
Site ref	A4MOGO-VAALW	**Site no**	21	**Site name**	Vaalwater Sewage
Inventory					
Site suitability	Not suitable, the multiple channels causes the site to be too complex				
i) Channel type					Braided
ii) Active channel width					50m
iii) Surrounding land use					General farming
iv) Ecological rating					Low
v) Width of riparian zone a) RHB					30
b) LHB					15
c) Islands					60
vi) Substrate in riparian zone					Soil. Gravel/sand, rock/cobble
vii) Dominant vegetation:					Trees
viii) Dominant species a) by biomass					*Eucalyptus sp, M. azedarach, C.. erythrophylum*
b) by recruitment					*G. buxifolia, C. erythrophylum, Z. mucronata*
ix) Invasion of the riparian zone a) alien species					*Eucalyptus sp (H), M. azedarach (M), S. punicea (M)*
b) terrestrial species					None

Site details					
River	Mogol		**Stream**	Frikkie se loop	
Site ref	A4FRIK-SHAM2	**Site no**	22	**Site name**	Welgevonden camp/fence
Inventory					
Site suitability	Suitable				
i) Channel type					Anabranched
ii) Active channel width					30m
iii) Surrounding land use					Nature reserve
iv) Ecological rating					High
v) Width of riparian zone a) RHB					30m
b) LHB					10m
c) Islands					0
vi) Substrate in riparian zone					Rock/cobble,soil, gravel/sand
vii) Dominant vegetation:					Trees and shrubs
viii) Dominant species a) by biomass					D. lycioides, S. cordatum, B. africana
b) by recruitment					S. cordatum, D. lycioides, H. natalensis
ix) Invasion of the riparian zone a) alien species					None
b) terrestrial species					D. lycioides (L), T. sericea (VL), C. apiculatum (VL)

Site details					
River	Mogol		**Stream**	Sterkstroom	
Site ref	A4STER-DOORN	**Site no**	23	**Site name**	Low Mogol Bridge
Inventory					
Site suitability	Suitable but highly impacted left hand bank. Can be left out because of similar sites in same ecoregion.				
i) Channel type					Single
ii) Active channel width					30m
iii) Surrounding land use					General farming and residential
iv) Ecological rating					Low
v) Width of riparian zone a) RHB					15m
b) LHB					5m
c) Islands					0
vi) Substrate in riparian zone					Soil, bedrock, rock/cobble, gravel
vii) Dominant vegetation:					Trees
viii) Dominant species a) by biomass					*M. azedarach, M. alba, G. buxifolia*
b) by recruitment					*D. lycioides, G. buxifolia, M. azedarach*
ix) Invasion of the riparian zone a) alien species					*M. alba (H), M. azedarach (M)*
b) terrestrial species					*D. lycioides (M)*

Site details					
River	Mogol		**Stream**	Mokolo	
Site ref	A4MOGO-STERK	**Site no**	24	**Site name**	Sterkstroom junction
Inventory					
Site suitability	Suitable but is complex because of confluence.				
i) Channel type				Braided	
ii) Active channel width				150m	
iii) Surrounding land use				General farming	
iv) Ecological rating				Medium	
v) Width of riparian zone a) RHB				10m	
b) LHB				20m	
c) Islands				0	
vi) Substrate in riparian zone				Soil, rock/cobble, gravel/sand, bedrock	
vii) Dominant vegetation:				Trees	
viii) Dominant species a) by biomass				*C. erythrophylum, T. sericea, O. pulcra*	
b) by recruitment				*C. erythrophylum, S. cordatum, S. punicea*	
ix) Invasion of the riparian zone a) alien species				*S. punicea (L), M. azedarach (VL), M. alba*	
b) terrestrial species				*T. sericea (L), O. pulcra (L), P. rotundifolia*	

Site details					
River	Mogol		**Stream**	Mokolo	
Site ref	A4MOGO-WITFO	**Site no**	25	**Site name**	Witfontein bridge
Inventory					
Site suitability	Suitable				
i) Channel type				Braided	
ii) Active channel width				190m	
iii) Surrounding land use				Nature reserve, game farming	
iv) Ecological rating				Medium	
v) Width of riparian zone a) RHB				35m	
b) LHB				30m	
c) Islands				0	
vi) Substrate in riparian zone				Bedrock, soil, rock/cobble, gravel	
vii) Dominant vegetation:				Trees and reeds	
viii) Dominant species a) by biomass				*C. erythrophylum, C. imberbi, R. pyroides*	
b) by recruitment				*A. erubesces, C. erythrophylum, F. virosa.*	
ix) Invasion of the riparian zone a) alien species				*M. azedarach (VL)*	

b) terrestrial species	*P. africanum (VL), T. sericea (VL)*

Site details					
River	Mogol		**Stream**	Mokolo	
Site ref	A4MOGO-MOKOL	**Site no**	26	**Site name**	Mokolo reserve
Inventory					
Site suitability	Suitable				
i) Channel type				Braided	
ii) Active channel width				40m	
iii) Surrounding land use				Nature reserve	
iv) Ecological rating				High	
v) Width of riparian zone a) RHB				100	
b) LHB				20	
c) Islands				0	
vi) Substrate in riparian zone				Gravel/sand, rock/cobble, soil	
vii) Dominant vegetation:				Trees	
viii) Dominant species a) by biomass				*S. guineense, N. opositifolia, T. sericea*	
b) by recruitment				*S. guineense, N. opositifolia, T. sericea*	
ix) Invasion of the riparian zone a) alien species				None	
b) terrestrial species				*T. sericea (VL), O. arborea (VL), C. gratisimus (VL)*	

Site details					
River	Mogol		**Stream**	Mokolo	
Site ref	A4MOGO-DNYAL	**Site no**	27	**Site name**	D'Nyala bridge
Inventory					
Site suitability	Suitable – but complex and impacted. Restricted access to right hand bank				
i) Channel type				Braided	
ii) Active channel width				30m	
iii) Surrounding land use				Nature reserve and stock farming	
iv) Ecological rating				Low	
v) Width of riparian zone a) RHB				30	
b) LHB				30	
c) Islands				40	
vi) Substrate in riparian zone				Gravel/sand, soil, rock/cobble	
vii) Dominant vegetation:				Trees and reeds	
viii) Dominant species a) by biomass				*A. karroo, T. sericea, G. flavescens.*	
b) by recruitment				*D. cinerea, D. lycioides, R. pyroides.*	
ix) Invasion of the riparian zone a) alien species				*M. azedarach (L)*	

b) terrestrial species	*T. sericea (M), D. cinerea (M), D. lycioides (M)*

Site details					
River	Mogol		**Stream**	Mokolo	
Site ref	A4MOGO-MARKE	**Site no**	28	**Site name**	Marken bridge
Inventory					
Site suitability	Suitable				
i) Channel type				Braided	
ii) Active channel width				100m	
iii) Surrounding land use				General farming	
iv) Ecological rating				Low	
v) Width of riparian zone a) RHB				20	
b) LHB				30	
c) Islands				15	
vi) Substrate in riparian zone				Gravel/sand, soil	
vii) Dominant vegetation:				Trees	
viii) Dominant species a) by biomass				*A. karroo, R. pyroides, T. sericea*	
b) by recruitment				*D. lycioides, D. cinerea, G. flava*	
ix) Invasion of the riparian zone a) alien species				*M. azedarach (VL)*	
b) terrestrial species				*T. sericea (M), D. lycioides (L), D. cinerea (L)*	

Site details					
River	Mogol		**Stream**	Mokolo	
Site ref	A4MOGO-BESKA	**Site no**	29	**Site name**	Beska bridge
Inventory					
Site suitability	Suitable				
i) Channel type				Single	
ii) Active channel width				60m	
iii) Surrounding land use				Stock farming	
iv) Ecological rating				Low	
v) Width of riparian zone a) RHB				70	
b) LHB				20	
c) Islands				0	
vi) Substrate in riparian zone				Soil, gravel/sand	
vii) Dominant vegetation:				Trees and reeds	
viii) Dominant species a) by biomass				*Z. mucronata, T. sericea, A. karroo*	
b) by recruitment				*D. lycioides, Z. mucronata, D. cinerea*	
ix) Invasion of the riparian zone a) alien species				*None*	
b) terrestrial species				*T. cinerea (H), D. lycioides (M), A. mellifera (M)*	