

1 JBS02 (EWR 3: GLADDEDRIFT (VAAL RIVER))

The information is summarised from DWA (2008a,b; 2009a; 2010a).

1.1 SITE DESCRIPTION

EWR 3 is situated in Management Resource Unit (MRU) Vaal C immediately below a bridge near Villiers. The site is a riffle over a dyke across the river. The morphology is not representative of the reach, but although the bedrock riffle with no terraces is well represented. The banks are cut, and erosion is present in the right bank (RB) upper zone. Some paths on the lower and upper zone have resulted in bank erosion and there is up to 20% cover by exotics. Fish habitat, flow-depth categories and cover is well represented at site, but macroinvertebrate habitat is poor.

Location	EWR 3	Altitude	1487 m
Longitude	28.72971	Latitude	-26.99087
EcoRegion	Highveld/Southern Central Kalahari 11.03	Quaternary catchment	C12H
Water Management Area	Upper Vaal	Geomorphological zone	Lowland



EWR 3, Gladdedrifting, April 2008

1.2 PRESENT ECOLOGICAL STATE (PES)

Geom	The site consists of bedrock and riffles. The bed is predominantly (>70%) bedrock, but cobbles/boulders are present in the main riffle and fines/mobile sediment are found in the lee and hollows of the bedrock bed. The cobbles in the main riffle have a median around 40 cm, but this is not representative of the reach which generally has a finer sediment load. There are no morphological cues and the banks are cut and steep. The upper level of the main channel bank is composed of quaternary sedimentary deposits which is highly dispersive. There is decreased transport capacity due to the altered flow regime, although the impact is less here than at EWR 2 due to the tributaries influence that ameliorate this impact. Sediment input is limited to a few tributaries, many of which are eroding and increasing the fines load causing an increase in islands at this site.
WQ	Data records (1984 - 2008 (n = 979)) from water quality station C1H017Q01 were used for the physico-chemical PES assessment. The water quality data that has been used for EWR 3 is

	<p>downstream of EWR 3 and the Waterval confluence. It is important to note that EWR 3 is upstream of the impacts of the Waterval River. The Waterval catchment is impacted by effluents from Sasol 2 and 3, Evander Goldmine, Evander and Secunda. Phosphate values are relatively low although the total phosphate (TP) values are high. Nitrogen concentrations are low and electrical conductivity and sulphates do not seem problematic.</p>
Fish	<p>All the expected fish species are still present within this RU although the FROC of some species has been reduced from reference conditions. Increased siltation and flow modification have resulted in altered habitat conditions which include deteriorated substrate condition and the loss of fast shallow (FS) and slow deep (SD) habitats causing a reduced occurrence of <i>Austroglanis sclateri</i>, <i>L. kimberleyensis</i> and <i>L. umbratus</i>. Bank erosion and sedimentation of substrates has caused a loss in cover for <i>T. sparrmanii</i> as well as the presence of the alien predator <i>M. salmoides</i>.</p>
Inverts	<p>Sep 07: SASS5 score: 103 No of Taxa: 20 ASPT: 5.2 Apr 08: SASS5 score: 120 No of Taxa: 20 ASPT: 6.0</p> <p>The macroinvertebrates present during low flow conditions in September 2007 were dominated by low-scoring taxa, such as Turbellaria and Chironomidae. The highest scoring taxon was Leptophlebiidae, and the ASPT was low (5.2). In April 2008 the flows were higher, and the ASPT increased to 6.0. The fauna was dominated by baetid mayflies (mainly <i>Baetis glaucus</i>) and the pest blackfly, <i>Simulium damnosum</i>. Taxa that were notably absent included those with a presence for SIC (Heptageniidae, Elmidae) and marginal vegetation (MV) (Atyidae, Hydracarina, Gerridae, Notonectidae and Dytiscidae).</p>
Rip veg	<p>The riparian zone occurs within Frankfort Highveld Grassland which has a conservation status of "Vulnerable" (although 65.8% of vegetation type remains). The riparian vegetation composition is close to reference, with some exotic vegetation and bank slumping occurring from the upstream bridge and cattle trampling. Vegetation is impacted by extensive livestock trampling, erosion due to the bridge and debris control. There is extensive harvesting of sedges for crafts.</p>
Diatoms	<p>Three diatom samples were taken at this site (September, December 2007 and April 2008) and 2003 diatom data was also available (Taylor, 2004), although only the September 2007 sample was viable as the flows during the other sampling effort was very high, and diatom counts were too low to provide results. The overall biological water quality EC is a C. The SPI score of the September 2007 sample was 14.4 indicating good water quality although the diatom community indicates the onset of severe water quality impacts with the presence of dominant species (<i>Nitzschia frustulum</i>, <i>Navicula reichardtiana</i> and <i>N. palea</i>) which tolerate very high to critical levels of pollution (Taylor <i>et al.</i>, 2007b). The 2002 - 2003 monthly monitoring data (Taylor, 2004) indicated that there were sharp declines in biological water quality during the months February, March, May and August (deterioration to a C/D and D EC) and the SPI scores indicate an increase in nutrient load, ionic concentrations and organic pollution. This is most likely due to increased agricultural activities and increased abstraction during this period as well as mines upstream of the site as well as Waste Water Treatment Works (WWTW) in Standerton. Salinity, nutrients and organic pollution are increasing and are variables of concern.</p>

1.3 MAIN IMPACTS AT THE SITE

	PES	Causes	Sources	F/NF
WQ	C	Increased TP, some salinity and nutrients.	Agricultural runoff and as a result increased nutrients from point and diffuse sources (e.g. agriculture, Standerton WWTW, industrial and residential runoff).	NF

	PES	Causes	Sources	F/NF
Geom	C	Decreased transport capacity as there is almost no floods.	Grootdraai Dam.	F
		Decreased sediment supply.		
		Morphological change: increased islands.	Due to increased fines load and decreased floods.	NF
Rip veg	C	Removal of vegetation.	Extensive trampling by livestock and erosion; small scale from cattle and large scale from bridge and debris control. Also extensive harvesting of sedges for crafts.	NF
Fish	C	Altered habitat diversity (fluctuation from natural composition) as a result of flow modification.	Grootdraai Dam, water transfer scheme upstream of Grootraai Dam, other sources of abstraction.	F
		Decreased overhanging vegetation as cover for fish due to bank erosion.	Agricultural and livestock farming activities.	NF
		Increased sedimentation result in deterioration of substrate as habitat (clogging interstitial spaces, loss of important spawning habitats, etc.)	Bank erosion and vegetation removal and dryland crops and grazing.	
		Decreased substrate quality related to increased benthic growth.	Increased nutrients from point and diffuse sources (e.g. agriculture, Standerton WWTW, industrial and residential runoff).	
		Decreased water quality affect species with requirement for high water quality.		
		Decreased species diversity and abundance (especially small species) as result of presence of aggressive alien predator (<i>M. salmoides</i>) and <i>Gambusia affinis</i> ..	Presence of aggressive alien predatory species (<i>M. salmoides</i>) naturally spreading for recreation/angling.	
		Increased turbidity.	Erosion and presence of bottom feeding alien <i>C. carpio</i> .	
		Loss of aquatic vegetation (AV) and MV as cover for fish.	Potential presence of herbivorous alien <i>Ctenopharyngodon idella</i> (grass carp).	
Presence of migration barriers reduces migration success (breeding, feeding and dispersal) of some species.	Grootdraai Dam upstream and Vaal Dam downstream, as well as other major dams and various weirs. Farm dams in tributaries reduce refuge areas.			
Inverts	C	Reduced baseflows.	Grootdraai Dam.	F
		Water quality (nutrients).	Agricultural runoff.	NF

1.4 RESULTS: PRESENT ECOLOGICAL STATE

Driver Components	PES	Trend
GEOMORPHOLOGY	C	Stable
WATER QUALITY	C	Stable
DIATOMS	C	
Response Components	PES	Trend
FISH	C	Stable
MACRO INVERTEBRATES	C	Stable
INSTREAM	C	
RIPARIAN VEGETATION	C	Stable
ECOSTATUS	C	

The PES is a C mainly due to impacts relating to changes in flow regime due to Grootdraai Dam, illegal irrigation, livestock farming and vegetation removal.

1.5 SUITABILITY AS FUTURE BIOMONITORING SITE

OSAEH 11.2 and EWR 3 are close together and is in the lower reach of the MRU and therefore will be a valuable site to detect upstream impacts. However the site is upstream of the Waterval River confluence and therefore the deteriorated water quality entering the Vaal River from the Waterval catchment will not be detected.
