CLASSIFICATION AND DETERMINATION OF THE RESOURCE QUALITY OBJECTIVES FOR SIGNIFICANT WATER RESOURCES IN THE INKOMATI

SUMMARY OF ECOCLASSIFICATION AND EWR RESULTS AT THE KEY BIOPHYSICAL NODES (EWR SITES) AND THE DESKTOP BIOPHYSICAL NODES

EcoClassification results for the EWR sites in X2 (Crocodile) and X3 (Sabie Sand)

EWR 1 Valeyspruit (Crocodile River)

EIS: Moderate
Highest scoring metric were diversity of sensitive habitat types present e.g. wetlands (including floodplains containing various oxbows).
PES: A/B
Minor impacts, mainly due to farming, exotic vegetation species and trout. Impacts are mostly non-flow related
REC: A/B
Maintain the PES as only moderate EIS.
AEC down: B/C
Scenario includes decreased low flows due to e.g. increased golf estates, trout farms and increased abstractions for Dullstroom. Growth of Dullstroom will also result in increased sewage. Increased grazing causing trampling and destabilisation of banks.

Driver Components	PES & REC Category	Trend	AEC↓
HYDROLOGY	A/B		B
WATER QUALITY	A		B
GEOMORPHOLOGY	B	Stable	C
Response Components	**PES & REC Category**	**Trend**	**AEC↓**
FISH	A	Stable	B/C
MACRO INVERTEBRATES	B	Stable	B/C
INSTREAM	A/B		B/C
RIPARIAN VEGETATION	A	Stable	B
ECOSTATUS	A/B		B/C

EWR 2 Goedehoop (Crocodile River)

EIS: High
Rare and endangered fish spp. which are sensitive to flow and quality changes. High species diversity.
PES: B
Impacts as for EWR 1 with increased agricultural activities and decreased flows. However, impacts mostly still non-flow related.
REC: B
Although the EIS is high, the PES is already a B and as the impacts are mostly non-flow related, it would not be realistic to improve the PES through flow related interventions.
AEC down: C
See EWR 1. Possible zero flow situations and additional impacts on moderate events.

Driver Components	PES & REC Category	Trend	AEC↓
HYDROLOGY	B		C
WATER QUALITY	B		C
GEOMORPHOLOGY	B	Stable	B/C
Response Components	**PES & REC Category**	**Trend**	**AEC↓**
FISH	B	Stable	C
MACRO INVERTEBRATES	B	Negative	C
INSTREAM	B		C
RIPARIAN VEGETATION	A/B	Negative	B
ECOSTATUS	B		C

EWR 3 Poplar Creek (Crocodile River)

EIS: High
Rare and endangered fish, vegetation and bird spp, some of which are sensitive to flow and quality changes.
PES: B/C
Major problems related to upstream Kwena Dam and its operation, e.g. migration, sedimentation, changed flow regime. The changed flow regime consists of higher than natural flows in the dry season and much lower low flows in the wet season.
REC: B
The EIS is high; therefore the REC is an improvement of the PES. This can be achieved by improving the flow regime (low flows) and removal of exotic vegetation species.
AEC down: C/D
Lower flows than natural in both the dry and wet season. Associated increase in temperature and oxygen.

Driver Components	PES Category	Trend	REC	AEC↓
HYDROLOGY	C		B	D
WATER QUALITY	C		B/C	C/D
GEOMORPHOLOGY	C	Negative	C	C
Response Components	**PES Category**	**Trend**	**REC**	**AEC↓**
FISH	B	Stable	B	C
MACRO INVERTEBRATES	C	Negative	B	C/D
INSTREAM	B/C		B	C
RIPARIAN VEGETATION	C	Negative	B	D
ECOSTATUS	B/C		B	C/D

EWR 4 KaNyamazane (Crocodile River)

EIS: High
Rare and endangered species that are sensitive to flow and quality changes are present. There is also a high species taxon richness and a diversity of habitat types
PES: C
Combination of flow and non-flow related impacts. Changes mostly related to changes in flow regime due to upstream Kwena Dam and the operation of upstream system. Abstractions return flows, landuse mismanagement, water quality issues, and sedimentation.
REC: B
The EIS is high; therefore the REC is an improvement of the PES. Improvements to flow regime will be required. Only successful if combined with removal of exotic vegetation and if there are some improvement in grazing and browsing.
AEC down: C/D
Montrose Dam with decreased floods. Pools will fill in, bars will appear, riffles will be clogged and covered with sediment, reed growth will increase, the marginal zone will expand and vegetation will encroach.

Driver Components	PES Category	Trend	REC	AEC↓
HYDROLOGY	C			
WATER QUALITY	C		B	C
GEOMORPHOLOGY	B/C	Stable	B	C
Response Components	**PES Category**	**Trend**	**REC**	**AEC↓**
FISH	B	Stable	B	C
MACRO INVERTEBRATES	C	Stable	B	D
INSTREAM	B/C		B	C
RIPARIAN VEGETATION	C	Negative	B	D
ECOSTATUS	C		B	C/D

EWR 5 Malelane (Crocodile River)

EIS: Very High
Rare and endangered spp. sensitive to flow and quality changes. High species taxon richness and diversity of habitat types, KNP on LB.
PES: C
Change in low flows, specifically in the dry season. Change in flooding regime. All impacts associated with sugarcane activities.
REC: B
The EIS is very high; therefore the REC is an improvement of the PES. Changes mostly focussing on improving the low flow regime and some land use management.
AEC down: D
Decreased low flows and periods of zero flows in some stretches of the river which will result in increased algal growth, temperature and nutrient problems, loss of deeper channel sections, increased reed and vegetation growth.

Driver Components	PES Category	Trend	REC	AEC↓
HYDROLOGY	C		B	D
WATER QUALITY	C		B	D
GEOMORPHOLOGY	C/D	Negative	C	D
Response Components	**PES Category**	**Trend**	**REC**	**AEC↓**
FISH	C	Stable	B	D
MACRO INVERTEBRATES	C	Stable	B	D
INSTREAM	C		B	D
RIPARIAN VEGETATION	C	Negative	B	D
ECOSTATUS	C		B	D

EWR 6 Nkongoma (Crocodile River)

EIS: Very High
Rare and endangered spp. sensitive to flow and quality changes. High species taxon richness and diversity of habitat types, KNP on left bank.
PES: C
Change in low flows, even zero flows present, specifically in the dry season. Change in flooding regime. All impacts associated with sugarcane activities.
REC: B
The EIS is very high; therefore the REC is an improvement of the PES. Changes mostly focussing on improving the low flow regime and some land use management.
AEC down: D
Decreased low flows and periods of zero flows in some stretches of the river which will result in increased algal growth, temperature and nutrient problems, loss of deeper channel sections, increased reed and vegetation growth.

Driver Components	PES Category	Trend	REC	AEC↓
HYDROLOGY	D		B	D
WATER QUALITY	C		B	D
GEOMORPHOLOGY	C	Negative	C	C/D
Response Components	**PES Category**	**Trend**	**REC**	**AEC↓**
FISH	C	Stable	B	D
MACRO INVERTEBRATES	C	Stable	B	C/D
INSTREAM	C		B	D
RIPARIAN VEGETATION	C	Negative	B	D
ECOSTATUS	C		B	D

EWR 7 Kaap (Kaap River)

EIS: High
Rare and endangered spp. sensitive to flow and quality changes. High species taxon richness and habitat types sensitive to flow and quality changes.
PES: C
Changes are flow and non-flow related. Low to zero flows present due to upstream abstractions. Land-use activities related to agriculture and mining. Extensive exotic vegetation present.
REC B:
The EIS is high; therefore the REC is an improvement of the PES.
No zero flows, increased low flows, more moderate floods. This must happen in conjunction with exotic vegetation removal.
AEC D:
Mountain View Dam will be present which will result in much lower flows than present and decreased floods. The channel will be narrower, some riffles will be sandier and smaller in general which will result in more reeds and a narrower marginal zone.

Driver Components	PES Category	Trend	REC	AEC↓
HYDROLOGY	D		C	D
WATER QUALITY	B		B	C
GEOMORPHOLOGY	B	Negative	B	C
Response Components	**PES Category**	**Trend**	**REC**	**AEC↓**
FISH	C	Stable	B	D
MACRO INVERTEBRATES	B	Stable	B	C
INSTREAM	B/C		B	C
RIPARIAN VEGETATION	C/D	Negative	B/C	D
ECOSTATUS	C		B	D

EWR 1: Upper Sabie (Sabie River)

EIS: High
Rare and endangered fish and vegetation species. Fish species present that are intolerant to flow and flow related water quality changes. .
PES: B/C
Impacts due to forestry, exotic vegetation species, and abstraction. Impacts largely non-flow related.
REC: B
The EIS is high; therefore the REC is an improvement of the PES. Inactivity of picnic siteand removal of aliens is required. Improved fish EC dependent on improved vegetation cover.
AEC down: C/D
Decreased low flows resulting in increased sediment with increased nutrients, turbidity, temperature, additional toxics. Increased vegetation exotics and reeds on bars.

Driver Components	PES Category	Trend	REC	AEC↓
HYDROLOGY	A/B		A/B	B/C
WATER QUALITY	A/B		A/B	B/C
GEOMORPHOLOGY	B	Stable	B	C
Response Components	**PES Category**	**Trend**	**REC**	**AEC↓**
FISH	B/C	Stable	B	C/D
MACRO INVERTEBRATES	B	Stable	A/B	C
INSTREAM	B/C		B	C
RIPARIAN VEGETATION	B/C	Negative	B	C/D
ECOSTATUS	B/C		B	C/D

EWR 2: Aan de Vliet (Sabie River)

EIS: High
Rare and endangered fish and vegetation species. Species present intolerant to flow and flow related water quality changes.
PES: C
Forestry and landuse activities, mostly non-flow related.
REC: B
Changes in flow are not required to improve the state.
Remove exotic vegetation and cease mowing in the riparian zone. Reduce recreational disturbances. The nutrient status must also be improved.
AEC down: C/D
Increased abstraction could lead to increased return flows that will cause problems due to pesticides, nutrient loading etc. Mismanagement of land use in terms of forestry and agriculture

Driver Components	PES Category	Trend	REC	AEC↓
HYDROLOGY	C		B/C	D
WATER QUALITY	B		A/B	C
GEOMORPHOLOGY	B	Negative	B	C
Response Components	**PES Category**	**Trend**	**REC**	**AEC↓**
FISH	B/C	Stable	B	C/D
MACRO INVERTEBRATES	B/C	Stable	B	C
INSTREAM	B/C		B	C
RIPARIAN VEGETATION	C	Negative	B	D
ECOSTATUS	C		B	C/D

EWR 3 Kidney (Sabie River)

EIS: Very High
Rare and endangered species, taxon richness and species intolerant to flow and flow related water quality changes. Refuge area for biota and an important migration corridor for birds and fish. Within KNP.
PES: A/B
Forestry, abstraction, Inyaka Dam and landuse activities. (Flow and non-flow related)
REC: A/B
As the PES is already an A/B, the REC = the PES.
AEC Down: B/C
Increased abstractions, no Reserve implementation, less floods. Increased nutrients, changes in temperature, oxygen etc. Riffles lost due to sedimentation, channel shallower and sandier. Vegetation exotics will increase.
More reeds will be present in sandier areas.

Driver Components	PES & REC Category	Trend	AEC↓
HYDROLOGY	C		C/D
WATER QUALITY	B		C
GEOMORPHOLOGY	B	Negative	C
Response Components	**PES & REC Category**	**Trend**	**AEC↓**
FISH	B	Stable	C
MACRO INVERTEBRATES	B	Stable	C
INSTREAM	B		C
RIPARIAN VEGETATION	A/B	Stable	B/C
ECOSTATUS	A/B		B/C

EWR 4 Mac Mac (Mac Mac River)

EIS: High
Rare and endangered fish and vegetation species. Species present intolerant to flow and flow related water quality changes.
PES: B
Forestry, exotic vegetation and wastewater input. Impacts are flow and non-flow related.
REC: A/B
The EIS is high and the REC is therefore to improve the PES by improving the fish.Improved water quality required.
AEC down: C
Decreased low flows due to e.g. a weir or small dam in the upper catchment. This will result in embedded cobbles. Nutrients and temperature will increase. Increased exotic vegetation in the riparian zone.

Driver Components	PES Category	Trend	REC	AEC↓
HYDROLOGY	C		C	C
WATER QUALITY	A/B		A	B/C
GEOMORPHOLOGY	A	Stable	A	B
Response Components	**PES Category**	**Trend**	**REC**	**AEC↓**
FISH	B/C	Stable	B	C/D
MACRO INVERTEBRATES	A/B	Stable	A/B	B/C
INSTREAM	B		B	C
RIPARIAN VEGETATION	A/B	Negative	A/B	B/C
ECOSTATUS	B		A/B	C

EWR 5 Marite (Marite River)

EIS: High.
Rare, endangered and unique biota. Species richness high and species intolerant to flow and flow related water quality changes present.
PES: B/C
Increased low flows and landuse activities. Impacts mostly flow related
REC: B
The EIS is high; therefore the REC is an improvement of the PES. More natural distribution of flows required. Reduce grazing and trampling, remove exotic vegetation.
AEC down: C/D
No flow releases for the EWR, less dilution and less floods due to e.g. direct abstraction from the dam. More nutrients and toxics present. Sandier river, some riffles and bedrock areas in the reach will be lost, vegetation encroachment on bars and banks and embedded cobbles. Increased aliens, removal, grazing, and trampling.

Driver Components	PES Category	Trend	REC	AEC↓
HYDROLOGY	C			D
WATER QUALITY	B		B	C
GEOMORPHOLOGY	C	Negative	C	D
Response Components	**PES Category**	**Trend**	**REC**	**AEC↓**
FISH	B/C	Negative	B	C/D
MACRO INVERTEBRATES	B/C	Stable	B	C
INSTREAM	B/C		B	C/D
RIPARIAN VEGETATION	B/C	Negative	B	C/D
ECOSTATUS	B/C		B	C/D

EWR 6 Mutlumuvi (Mutlumuvi River)

EIS: High
Rare, endangered and unique biota. Taxon species richness high and species intolerant to flow and flow related water quality changes present.
PES: C
Abstraction, forestry, informal settlements and landuse activities. Impacts flow and non-flow related.
REC: B
The EIS is high and improvement requires improved system operation which improves the low flow regime.
AEC down: C/D
Decreased low flows and longer periods of zero flows. Increased algal growth. Less moderate floods will cause some impact on sedimentation. The reedbeds will become less dense and Matumi will disappear.

Driver Components	PES Category	Trend	REC	AEC↓
HYDROLOGY	C			
WATER QUALITY	B/C		B	C/D
GEOMORPHOLOGY	C	Stable	C	D
Response Components	**PES Category**	**Trend**	**AEC ↑**	**AEC↓**
FISH	C	Stable	B	D
MACRO INVERTEBRATES	B/C	Negative	B	C
INSTREAM	C		B	C/D
RIPARIAN VEGETATION	C	Negative	B	D
ECOSTATUS	C		B	C/D

EWR 7 Tlulandziteka (Tlulandziteka River)

EIS: Moderate
Rare and endangered species, high taxon richness, species intolerant to flow and flow related water quality changes.
PES: C
Forestry, abstraction, flow modification and poor landuse management. Impacts flow and non-flow related.
REC: C
Due to the moderate EIS, the REC = the PES.
AEC Up: B
Improved flows through fixing of canals, rehabilitation of forestry areas and improved management of canal system and landuse. Remove exotic vegetation, minimise agricultural disturbance and remove unused orchards.
AEC Down: D
Increased use of the dam with less spills, i.e. less floods. More abstraction and forestry. Nutrients, temperature, oxygen, and turbidity levels will change. Increase in bed height, more subsurface flows and sediment with resulting decrease in riffles and shallower pools. More reeds, alien vegetation and more removal.

Driver Components	PES & REC Category	Trend	AEC ↑	AEC↓
HYDROLOGY	A?			D
WATER QUALITY	C		B	D
GEOMORPHOLOGY	C/D	Stable	C	D
Response Components	**PES &REC Category**	**Trend**	**AEC ↑**	**AEC↓**
FISH	C	Stable	B	D
MACRO INVERTEBRATES	B/C	Negative	B	C/D
INSTREAM	C		B	D
RIPARIAN VEGETATION	C	Negative	B	D
ECOSTATUS	C		B	D

EWR 8 Lower Sand (Sand River)

EIS: High
Rare and endangered species, high taxon richness and species intolerant to flow and flow related water quality changes. Situated in KNP
PES: B
Abstraction, dams, weirs, poor landuse management. Impacts are flow and non-flow related.
REC: B
Although the EIS is high, the PES is already in a B therefore the REC = PES. Improve the macroinvertebrate EC by increasing low flows.
AEC down: C
More decreased low flows and longer periods of no flow.

Driver Components	PES Category	Trend	REC	AEC↓
HYDROLOGY	C?		C	D?
WATER QUALITY	B		B	C
GEOMORPHOLOGY	C	Negative	C	Lower C
Response Components	**PES Category**	**Trend**	**REC**	**AEC↓**
FISH	B	Stable	B	C
MACRO INVERTEBRATES	C	Negative	B	C/D
INSTREAM	B/C		B	C
RIPARIAN VEGETATION	B	Stable	B	B/C
ECOSTATUS	B	Negative	B	C

EcoClassification results for the EWR sites in Elands Tributary of the Crocodile (X2)[1]

EWR ER1 (Elands River)

EIS: Moderate
The EIS (present) was rated as Moderate, and there were no endangered species are associated with the river.
PES: B
Related to afforestation and some abstractions for irrigation. Impacts are flow and non-flow related.
REC: B
Due to the moderate EIS, the REC = the PES.

Component	PES and REC
Hydrology	B
Physico chemical	A
Geomorphology	B/C (B)
Fish	A/B
Invertebrates	B
Riparian vegetation	B
EcoStatus	B

EWR ER 2 (Elands River)

EIS: High
Endangered species, viz C. bifurcus occurs in the reach. Other flow and water quality sensitive species of particular importance include A. uranoscopus, B. argenteus, C. pretoriae and B. polylepis. The B. polylepis population in the Elands River is of particular importance due to it being isolated from L. marequensis in the Crocodile River. As a consequence, B. polylepis has developed particular variations in mouth morphology, which do not occur when L. marequensis is present.
PES: B
Reduced flows, afforestation of the floodplain areas and some possible engineering (straightening) of the active channel. Impacts are flow and non-flow related.
REC: B
Although the EIS is High, the PES is already in a B therefore the REC = PES.

Component	PES and REC
Hydrology	B
Physico chemical	A
Geomorphology	C
Fish	A/B (B)
Invertebrates	B
Riparian vegetation	D
EcoStatus	B

EcoClassification results for the EWR sites in the Komati (X1)

EWR K1 Gevonden (Upper Komati River)

EIS: High
Presence of the endangered fish, mammal, reptile and bird species. Presence of endemic fish and frog species.The high importance of the area for conservation (Songimvelo Reserve, Nkomazi Wilderness Area and Transboundary Park).
PES: B/C
Major flow related impacts due to Nooitgedacht Dam – reduced low flows and floods. Forestry also impacts low flows and water quality deterioration due to trout dams and tourist developments.
REC: B/C
The EIS ishigh, indicating that an improvement is required. However, due to the strategic importance and scarcity of water it was considered unrealistic to recommend a higher category. Maintaining the river as a Category B/C would be adequate from an ecological point of view.

Component	PES and REC
Hydrology	C
Physico chemical	B
Geomorphology	C
Fish	C
Invertebrates	B/C
Riparian vegetation	C
EcoStatus	B/C

EWR K2 Kromdraai (Upper Komati River)

EIS: High
Presence of the endangered fish, mammal, reptile and bird species. Presence of endemic fish and frog species.The high importance of the area for conservation (Songimvelo Reserve, Nkomazi Wilderness Area and Transboundary Park).
PES: C
Major impacts are flow related – low flows and floods are impacted by Vygeboom Dam. Deteriorated water quality also impacts the site.
REC: B
The EIS is high; therefore the REC is an improvement of the PES. Improvement can be achieved by non-flow related measures.

Component	PES	REC
Hydrology	C/D	B
Physico chemical	B/C	B
Geomorphology	C/D	C
Fish	C	B
Invertebrates	C	B
Riparian vegetation	C	B
EcoStatus	C	B

[1] *Results are in the process of being refined. The EIS as well as the fish and macro-invertebrate results have been updated, but results for other components are still pending and 2006 data have been used.*

EWR K3 Tonga (Lower Komati River)

EIS: Moderate
Diversity of habitats, the presence of rare, vulnerable and endangered fish, mammal, reptile and bird species. Presence of endemic macro-invertebrate taxa and fish species intolerant to flow. Species richness and the importance as a migration corridor for eels, Macrobracium and local breeding migrations of fish and birds.
PES: E?
Major problems during 2006 were related to frequent and extended periods of flow cessation, caused primarily by diversion of water at Tonga Weir; vegetation clearing and sand mining as well as deteriorated water quality. Conditions may have improved in recent years however, which may be attributed to more constant baseflow releases from Maguga Dam to meet irrigation demand in the lower Komati River and international (Mozambique) obligations. The latest information therefore indicates an improvement in the period 2006 to 2013. Revision of results is still in progress and the PES needs validation.
REC: D
Due to the moderate EIS, the REC = the PES.

Component	PES	REC
Hydrology	E	D
Physico chemical	D	C
Geomorphology	D/E	D
Fish	C/D	C/D
Invertebrates	D	D
Riparian vegetation	D/E	D
EcoStatus	E?	D

EWR G1Vaalkop (Gladdespruit)

EIS: Low
Presence of two flow-dependent fish species, the sensitivity to flow changes and flow related water quality changes.
PES: D
Combination of flow and non-flow related impacts. The main impacts are related to reduced low flows due to forestry, water quality problems due to acid mine drainage from old gold mines, sulphates and raw sewerage, erosion and sedimentation, alien invasives and trout dams.
REC: D
Due to the low EIS, the REC = the PES.

Component	PES and REC
Hydrology	B
Physico chemical	C
Geomorphology	D
Fish	D
Invertebrates	D
Riparian vegetation	D
EcoStatus	D

EWR T1Teespruit (Teespruit)

EIS: Moderate
Presence of endangered fish species and the presence of two flow-dependent fish species.
PES: C
Small-scale abstractions impact low flows. Deteriorated water quality in the lower reaches of the river and encroachment of alien vegetation are the main non-flow related impacts.
REC: C
Due to the moderate EIS, the REC = the PES.

Component	PES and REC
Hydrology	B
Physico chemical	C
Geomorphology	C
Fish	C
Invertebrates	C
Riparian vegetation	C
EcoStatus	C

EWR L1 Kleindoringkop (Lomati River)

EIS: High
Diversity of habitats, the presence of the endangered fish, mammal, reptile and bird species. Presence of flow-dependent fish species, the high number of fish speciesand the importance of the area for conservation at a national scale.
PES: C
Change in low flows, due to Schoemans Dam. The dam has impacted on the geomorphology of the river. Altered fish community and vegetation has occurred. Recent data indicates that impacts on flow are ongoing, and vegetation removal, cultivation of the riparian zone and agricultural return flows impact the site.
REC: C
The EIS ishigh, indicating that an improvement is required. However a REC cannot be achieved by improving flows because it is probably neither feasible nor possible to improve present conditionssignificantly.

Component	PES and REC
Hydrology	D
Physico chemical	B/C
Geomorphology	D
Fish	C
Invertebrates	C
Riparian vegetation	B/C
EcoStatus	C

EWR results for the EWR sites in the X2 (Crocodile) and X3 (Sabie Sand)

EWR site	nMAR	PMAR	%PMAR of nMAR	EC	Maintenance low flows		Drought low flows		High flows		Long term mean	
	MCM	MCM	MCM		MCM	(%nMAR)	MCM	(%nMAR)	MCM	(%nMAR)	MCM	(% nMAR)
Crocodile												
EWR 1	15.19	14.90	98%	A/B PES, REC	3.8	24.8	1.54	10.13	0.93	6.14	4.69	30.9
				B/C AEC	2.56	16.84	1.54	10.13	0.93	6.14	3.71	24.4
EWR 2	47.11	44.80	95%	B PES, REC	23.53	49.95	9.23	19.58	3.50	7.43	26.85	57
				C AEC	11.39	24.18	9.23	19.58	3.03	6.44	17.43	37
EWR 3	169.9	1515.2	892%	B/C PES	74.76	44	30.75	18.1	16.7	9.8	93.78	55.2
				B REC		A time series of requirements could not be generated as improvement of the PES required flows higher than the reference time series (present day), during the wet season.						
EWR 4	754.1	528.3	70%	B PES, REC	216.4	28.7	74.66	9.9	46.8	6.2	260.16	34.5
				C/D AEC	99.54	13.2	74.66	9.9	38.7	5.1	160.62	21.3
EWR 5	1006.2	637.9	63%	C PES	214.3	21.3	121.8	12.1	53.3	5.3	301.87	30
				B REC	349.2	34.7	121.8	12.1	74.5	7.4	404.50	40.2
				D AEC	121.8	12.1	121.8	12.1	29.2	2.9	214.33	21.3

EWR site	nMAR	PMAR	%PMAR of nMAR	EC	Maintenance low flows		Drought low flows		High flows		Long term mean	
	MCM	MCM	MCM		MCM	(%nMAR)	MCM	(%nMAR)	MCM	(%nMAR)	MCM	(% nMAR)
EWR 6	1063.1	525.2	49%	C PES	147.8	13.9	112.7	10.6	78.7	7.4	264.72	24.9
				B REC	323.2	30.4	112.7	10.6	140.3	13.2	466.71	43.9
				D AEC	123	11.6	47.84	4.5	48.9	4.6	152.03	14.3
EWR 7	169	86.6	51%	C PES	25.2	14.9	11.16	6.6	10.82	6.4	38.87	23
				B REC	50	29.6	11.16	6.6	12.51	7.4	62.20	36.8
				D AEC	10.14	6	11.16	6.6	8.96	5.3	27.72	16.4
Sabie Sand												
EWR 1	140.18	109	78%	B/C PES	46.54	33.2	17	12.1	7.43	5.3	52.99	37.8
				B REC	61.82	44.1	17	12.1	8.55	6.1	64.90	46.3
				C/D AEC	29.02	20.7	17	12.1	6.31	4.5	43.46	31
EWR 2	262.1	199.5	76%	B/C PES	51.90	19.8	29.1	11.1	11.5	4.4	73.39	28
				B REC	81.52	31.1	29.1	11.1	13.1	5	93.57	35.7
				C/D AEC	32.76	12.5	29.1	11.1	9.44	3.6	57.93	22.1
EWR 3	495.86	322.1	65%	A/B PES/REC	155.2	31.3	48.1	9.7	31.7	6.4	183.5	37
				B/C AEC	101.2	20.4	48.1	9.7	26.8	5.4	134.4	27.1
EWR 4	65.78	51.8	79%	A/B PES/REC	20.59	31.3	6.38	9.7	4.21	6.4	24.34	37
				B/C AEC	13.42	20.4	6.38	9.7	3.55	5.4	17.83	27.1
EWR 5	157.09	89.7	57%	B/C PES	32.67	20.8	12.6	8	10.2	6.5	44.30	28.2
				B REC	47.44	30.2	12.6	8	11.2	7.1	57.02	36.3
				C/D AEC	15.39	9.8	12.6	8	8.48	5.4	31.10	19.8
EWR 6	44.99	29.9	66%	C PES	9.99	22.2	4.63	10.3	2.83	6.3	14.58	32.4
				B AEC	14.49	32.2	6.03	13.4	2.83	6.3	17.37	38.6
				C/D AEC	6.21	13.8	4.63	10.3	2.56	5.7	11.56	25.7
EWR 7	28.88	17.3	60%	C PES	5.11	17.7	2.05	7.1	3.18	11	9.15	31.7
				B REC	7.65	26.5	3.23	11.2	3.81	13.2	11.38	39.4
				D AEC	2.71	9.4	2.05	7.1	2.95	10.2	7.77	26.9
EWR 8	133.61	88.5	66%	B PES/REC	22.85	17.1	4.54	3.4	9.75	7.3	33.80	25.3
				C AEC	12.69	9.5	4.54	3.4	8.82	6.6	24.58	18.4

EWR results for the EWR sites in Elands Tributary of the Crocodile (X2)

EWR site	nMAR	EC	Maintenance low flows		Drought low flows		High flows		Long term mean	
	MCM		MCM	(%nMAR)	MCM	(%nMAR)	MCM	(%nMAR)	MCM	(% nMAR)
ER 1	50.1	B PES, REC	18.45	36.82	4.9	9.79	6.01	12	24.46	48.82
ER 2	50.1	B PES, REC	68.46	33.98	21.77	10.8	22.23	11.03	90.7	45.02

EWR results for the EWR sites in the Komati (X1)

EWR site	nMAR	PMAR	%PMAR of nMAR	EC	Maintenance low flows		High flows		Long term mean	
	MCM	MCM	MCM		MCM	(%nMAR)	MCM	(%nMAR)	MCM	(% nMAR)
K1	158.62	108.46	68.38	B/C PES, REC	27.38	17.30	16.30	10.20	43.68	27.50
K2	545.56	318.64	58.41	C PES	50.87	9.30	49.00	9.00	99.87	18.30
K3	1021.67	489.84	47.95	D REC	101.10	9.90	74.46	7.30	175.55	17.20
G1	29.52	21.18	71.75	D PES, REC	5.89	19.90	2.05	7.00	7.94	26.90
T1	56.36	45.13	80.07	C PES, REC	12.75	22.60	7.15	12.70	19.89	35.30
L1	294.31	229.53	77.99	C PES, REC	34.46	11.70	16.50	5.60	50.96	17.30

Summary of Desktop EWRs for the biophysical nodes in the Inkomati Catchment (Komati, Crocodile and Sabie Rivers)

IUA	SQ node	River name	MAR (10^6 m^3)		REC	Long-term requirements			
			Natural	PD		Low flows		Total flows	
						10^6 m^3	MAR	10^6 m^3	MAR
Inkomati River Catchment									
X1-1	X11A-01248	Vaalwaterspruit	26.3	22.4	C	3.73	14.2%	6.19	23.5%
X1-1	X11A-01295	Vaalwaterspruit	15.4	12.9	C	2.81	18.2%	4.20	27.2%
X1-1	X11A-01300		1.7	1.4	B	0.31	18.1%	0.48	28.1%
X1-1	X11A-01354		3.9	3.1	C	0.59	15.1%	0.96	24.5%
X1-1	X11A-01358	Vaalwaterspruit	6.6	5.7	C	1.13	17.3%	1.76	26.8%
X1-1	X11B-01272	Boesmanspruit	51.2	41.9	C	7.76	15.1%	12.38	24.2%
X1-1	X11B-01361		4.2	3.6	B/C	0.68	16.0%	1.14	27.0%
X1-1	X11B-01370	Boesmanspruit	4.8	3.5	B	0.91	19.0%	1.39	28.8%
X1-1	X11C-01147	Witkloofspruit	11.4	9.9	C	1.54	13.5%	2.51	22.1%
X1-2	X11D-01129	Klein-Komati	21.0	17.8	C	4.04	19.2%	5.76	27.4%
X1-2	X11D-01137	Waarkraalloop	11.7	10.9	C	2.18	18.6%	3.19	27.3%
X1-2	X11E-01237	Swartspruit	14.8	13.8	C	2.85	19.3%	4.13	27.9%
X1-2	X11F-01133	Bankspruit	6.5	5.8	B	1.32	20.3%	2.00	30.8%
X1-2	X11G-01143	Gemakstroom	10.4	7.9	C	1.82	17.5%	2.72	26.1%
X1-2	X11G-01188	Ndubazi	17.4	14.2	B	4.33	24.9%	6.07	34.9%
X1-3	X11D-01196	Komati	95.4	51.1	C	13.39	14.0%	19.17	20.1%
X1-3	X11D-01219	Komati	73.6	33.0	C/D	6.78	9.2%	9.04	12.3%
X1-3	X11E-01157	Komati	118.3	72.4	B/C	20.99	17.7%	30.31	25.6%
X1-4	X11K-01165	Poponyane	13.7	10.8	C	2.01	14.7%	3.12	22.7%
X1-4	X11K-01179	Gladdespruit	64.4	30.8	C	8.68	13.5%	13.04	20.2%
X1-4	X11K-01194	Gladdespruit	71.2	36.8	C	7.86	11.0%	13.59	19.1%
X1-4	X11K-01199		2.4	1.5	D	0.36	15.1%	0.53	22.3%
X1-5	X12K-01316	Komati	577.0	348.9	D	79.99	13.9%	122.33	21.2%
X1-6	X12A-01305	Buffelspruit	32.0	24.2	C	7.26	22.7%	9.69	30.3%
X1-6	X12B-01246	Hlatjiwe	22.1	17.1	C	5.04	22.8%	6.75	30.5%
X1-6	X12C-01242	Phophenyane	6.3	5.9	B	1.80	28.7%	2.35	37.5%
X1-6	X12C-01271	Buffelspruit	71.1	56.4	B	22.53	31.7%	28.76	40.5%
X1-6	X12D-01235	Seekoeispruit	97.0	80.0	C	22.54	23.2%	29.58	30.5%
X1-6	X12H-01318	Sandspruit	13.9	13.3	C	3.36	24.1%	4.43	31.7%
X1-6	X12H-01338	Sandspruit	4.4	4.3	B	1.24	27.9%	1.64	36.7%
X1-6	X12H-01340		4.8	4.3	B	1.48	30.6%	1.92	39.5%
X1-6	X12J-01202	Mtsoli	66.5	58.6	B	15.92	23.9%	22.26	33.5%
X1-6	X12K-01332	Mhlangampepa	3.4	3.4	B	1.06	30.7%	1.38	40.0%
X1-6	X12K-01333	Mlondozi	22.4	22.3	C	4.56	20.3%	6.34	28.2%
X1-7	X14A-01173	Lomati	84.4	72.0	B	23.24	27.5%	30.65	36.3%
X1-7	X14B-01166	Ugutugulo	20.9	14.3	B/C	4.88	23.4%	6.61	31.7%
X1-9	X13J-01141	Mzinti	6.3	4.2	D	0.66	10.5%	1.21	19.1%
X1-9	X13J-01205	Mbiteni	5.9	5.1	D	0.50	8.6%	1.04	17.6%
X1-9	X13J-01221	Komati	1000.3	535.0	D	137.12	13.7%	197.35	19.7%
X1-10	X13K-01068	Nkwakwa	5.4	5.4	C/D	0.61	11.2%	1.23	22.7%
X1-10	X13K-01114	Komati	1341.4	645.6	D	172.51	12.9%	242.23	18.1%
X1-10	X13K-01136	Mambane	1.8	1.8	D	0.24	13.1%	0.41	22.4%
X1-10	X13L-00995	Komati	1356.6	504.8	D	97.40	7.2%	150.08	11.1%
X1-10	X13L-01000	Ngweti	4.6	2.5	D	0.35	7.5%	0.67	14.5%
Crocodile River Catchment									
X2-1	X21A-01008		na	na	C/D	na	na	na	na

IUA	SQ node	River name	MAR (10^6 m^3)		REC	Long-term requirements			
			Natural	PD		Low flows		Total flows	
						10^6 m^3	MAR	10^6 m^3	MAR
X2-1	X21B-00898	Lunsklip	9.6	8.4	C/D	1.78	18.4%	2.49	25.8%
X2-1	X21B-00925	Lunsklip	25.8	22.2	C	6.01	23.3%	8.07	31.3%
X2-1	X21B-00929	Gemsbokspruit	3.8	3.3	C/D	0.71	18.9%	0.99	26.3%
X2-1	X21C-00859	Alexanderspruit	28.8	26.2	C	6.81	23.6%	9.09	31.5%
X2-2	X21D-00938	Crocodile	124.8	104.5	C	24.51	19.6%	29.99	24.0%
X2-2	X21D-00957	Buffelskloofspruit	16.9	12.9	C	4.22	25.0%	5.50	32.6%
X2-2	X21E-00897	Buffelskloofspruit	8.4	6.6	B	2.15	25.6%	2.96	35.3%
X2-2	X21E-00947	Crocodile	125.1	104.7	B	30.35	24.3%	36.11	28.9%
X2-3	X21F-01046	Elands	35.1	31.6	C	9.49	27.1%	12.35	35.2%
X2-3	X21F-01081	Elands	50.8	46.8	C	13.90	27.4%	18.02	35.5%
X2-3	X21F-01091	Rietvleispruit	3.3	3.1	C	0.90	27.1%	1.17	35.4%
X2-3	X21F-01092	Leeuspruit	11.9	11.2	C/D	2.81	23.6%	3.70	31.2%
X2-3	X21F-01096	Dawsonsspruit	na	na	A	na	na	na	na
X2-3	X21F-01100	Leeuspruit	11.9	11.2	C	3.21	27.0%	4.17	35.1%
X2-4	X21G-01016	Swartkoppiespruit	11.4	9.7	C	2.77	24.4%	3.70	32.5%
X2-4	X21G-01090	Weltevredespruit	5.5	4.7	C	1.31	23.6%	1.77	32.0%
X2-4	X21H-01060	Ngodwana	59.6	36.2	B	7.61	12.8%	13.20	22.1%
X2-4	X21J-01013	Elands	151.5	124.1	C	33.97	22.4%	46.15	30.5%
X2-4	X21K-01007	Lupelule	29.4	22.9	B	6.59	22.4%	9.43	32.1%
X2-7	X22A-00824	Blystaanspruit	21.0	15.0	B/C	5.76	27.4%	7.42	35.3%
X2-7	X22A-00875	Houtbosloop	6.9	5.0	B/C	1.82	26.2%	2.36	34.2%
X2-7	X22A-00887	Beestekraalspruit	3.7	2.7	B/C	0.96	25.9%	1.26	33.9%
X2-7	X22A-00913	Houtbosloop	75.3	53.9	B	24.84	33.0%	31.11	41.3%
X2-7	X22A-00917	Houtbosloop	14.8	10.6	C	3.31	22.3%	4.40	29.7%
X2-7	X22A-00919	Houtbosloop	10.6	7.6	B/C	2.85	26.8%	3.69	34.7%
X2-7	X22A-00920		1.7	1.2	B	0.52	30.8%	0.67	39.4%
X2-7	X22C-00990	Visspruit	3.4	3.0	B/C	0.67	20.0%	1.05	31.1%
X2-8	X22C-01004	Gladdespruit	16.3	10.7	C	1.80	11.1%	3.39	20.9%
X2-8	X22D-00843	Nels	20.6	14.9	C	4.51	21.9%	6.09	29.6%
X2-8	X22D-00846		13.8	10.0	C	3.32	24.1%	4.39	31.9%
X2-8	X22E-00833	Kruisfonteinspruit	11.1	8.2	C	2.08	18.7%	2.96	26.6%
X2-8	X22E-00849	Sand	8.7	6.4	C	1.71	19.8%	2.40	27.7%
X2-8	X22F-00842	Nels	74.9	45.1	C	8.37	11.2%	14.21	19.0%
X2-8	X22F-00886	Sand	48.9	37.3	C	9.48	19.4%	13.41	27.4%
X2-8	X22F-00977	Nels	125.4	84.9	C/D	21.08	16.8%	30.24	24.1%
X2-8	X22H-00836	Wit	43.0	20.0	D	3.41	7.9%	6.39	14.9%
X2-9	X22K-01029	Blinkwater	7.6	6.8	C	1.44	19.0%	2.05	27.2%
X2-9	X22K-01042	Mbuzulwane	1.2	1.1	B	0.34	28.7%	0.46	38.5%
X2-9	X22K-01043	Blinkwater	5.9	5.4	B	1.43	24.2%	2.07	34.9%
X2-10	X23B-01052	Noordkaap	50.9	33.5	D	8.66	17.0%	11.96	23.5%
X2-10	X23C-01098	Suidkaap	61.8	37.8	C	20.12	32.6%	24.40	39.5%
X2-10	X23E-01154	Queens	39.5	25.0	C	7.26	18.4%	10.71	27.1%
X2-10	X23F-01120	Suidkaap	109.8	57.1	C	26.51	24.1%	34.04	31.0%
X2-12	X24A-00826	Nsikazi	2.0	1.9	C	0.48	24.2%	0.67	34.0%
X2-12	X24A-00881	Nsikazi	11.7	11.3	B	3.44	29.5%	4.75	40.6%
X2-12	X24B-00903	Gutshwa	25.4	24.8	D	4.11	16.2%	6.21	24.4%
X2-12	X24B-00928	Nsikazi	42.4	41.4	A/B	13.46	31.8%	18.65	44.0%
X2-12	X24C-00978	Nsikazi	52.3	42.0	B	16.06	30.7%	21.15	40.5%
Sabie River Catchment									
X3-1	X31A-00741	Klein Sabie	14.6	11.8	C	2.15	14.7%	3.37	23.0%

IUA	SQ node	River name	MAR (10^6 m^3)		REC	Long-term requirements			
			Natural	PD		Low flows		Total flows	
						10^6 m^3	MAR	10^6 m^3	MAR
X3-1	X31A-00783		12.1	9.5	C	3.17	26.1%	4.09	33.8%
X3-1	X31A-00786		4.7	3.6	B	1.82	39.1%	2.22	47.8%
X3-1	X31A-00794		na	na	B	na	na	na	na
X3-1	X31A-00796		na	na	B	na	na	na	na
X3-1	X31A-00803		na	na	B/C	na	na	na	na
X3-2	X31B-00792	Goudstroom	12.2	9.8	B/C	3.79	31.0%	4.75	38.9%
X3-2	X31E-00647a	Marite	79.9	62.8	B/C	20.58	25.8%	27.74	34.7%
X3-2	X31F-00695	Motitsi	43.9	35.8	C	7.82	17.8%	11.62	26.5%
X3-4	X31D-00773	Sabani	19.2	7.6	C/D	3.13	16.3%	3.75	19.5%
X3-4	X31H-00819	White Waters	28.9	16.2	C	7.51	25.9%	9.09	31.4%
X3-4	X31J-00774	Noord-Sand	45.1	20.2	D	4.21	9.3%	7.22	16.0%
X3-4	X31J-00835	Noord-Sand	12.0	11.0	D	2.91	24.2%	3.76	31.3%
X3-4	X31K-00713	Bejani	2.4	2.4	D	0.40	16.9%	0.61	25.7%
X3-4	X31L-00657	Matsavana	3.8	2.6	C	0.17	4.3%	0.65	16.8%
X3-4	X31L-00664	Saringwa	10.9	9.5	C	1.47	13.5%	2.67	24.5%
X3-4	X31L-00678	Saringwa	3.2	3.2	B/C	0.59	18.2%	1.00	30.8%
X3-4	X31M-00673	Musutlu	1.8	1.8	B/C	0.19	10.6%	0.34	19.0%
X3-6	X31K-00771	Phabeni	2.5	2.5	B	0.70	27.8%	0.97	39.0%
X3-7	X32E-00629	Nwarhele	10.6	9.9	C/D	1.93	18.2%	2.76	26.1%
X3-7	X32F-00628	Nwarhele	14.8	14.0	C/D	3.44	23.3%	4.63	31.3%
X3-8	X32B-00551	Motlamogatsana	15.4	10.4	C	2.75	17.9%	3.95	25.7%
X3-8	X32C-00558	Nwandlamuhari	49.7	25.0	C	7.64	15.4%	10.02	20.2%
X3-8	X32C-00564	Mphyanyana	3.1	2.0	C	0.05	1.6%	0.33	10.5%
X3-8	X32C-00606	Nwandlamuhari	53.2	33.7	C	8.77	16.5%	12.54	23.6%
X3-8	X32G-00549	Khokhovela	3.9	3.8	C	0.41	10.4%	0.67	17.0%
X3-9	X32H-00560	Phungwe	7.6	7.3	A	1.19	15.7%	1.98	26.1%

na: Small SQ catchment areas (less than 3km^2) and hence no hydrology modelled (small flows and inaccurate at this resolution).