water & sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

CLASSIFICATION OF WATER RESOURCES AND DETERMINATION OF THE COMPREHENSIVE RESERVE AND RESOURCE QUALITY OBJECTIVES IN THE MVOTI TO UMZIMKULU WATER MANAGEMENT AREA

DRAFT ESTUARY RESOURCE QUALITY OBJECTIVES

SUPPORTING DOCUMENT FOR PROJECT STEERING COMMITTEE MEETING 6

Contents

1 uMkhomazi RQOs

PES:	C	REC:	B (Remove Weir)	TEC:	B/C (Leave weir)

Components that require interventions to achieve the REC/TEC:

- *TEC/REC: Improve water quality;*
- *TEC/REC: Restore estuarine intertidal and subtidal habitat through the removal sand mining in EFZ in middle and upper reaches*
- *REC: Restore estuarine habitat through the relocation/removal of Sappi Weir*
- *REC: Restore baseflows to estuary to ensure permanently open mouth state and salinity profile.*

Ecological Specification	Threshold of Potential Concern
Hydrology	*C/D*
Maintain a flow regime to create the required habitat for birds, fish, macrophytes, microalgae and water quality	• *River inflow distribution patterns differ by more than 5% from that of Scenario B (i.e. approved flow scenario for the Mkomazi).* • *Monthly river inflow < 1.0 m3/s* • *Monthly river inflow < 2.0 m3/s persists for longer than 3 months in a row* • *Monthly river inflow < 5.0 m3/s for more than 30% of the time.*
Hydrodynamics	*A*
Maintain mouth conditions to create the required habitat for birds, fish, macrophytes, microalgae and water quality	*Flows should not exceed natural and seasonal distribution should not be compromised. Current baseflows should be upheld into estuary to maintain present mouth state and salinity regime.* • *Mouth closure occurs more than 2 - 3 weeks in a year.* • *Mouth closure occurs for more than 2 years out of ten* • *Mouth closure occurs between September and April*
Water Quality	*C*
Salinity distribution not to cause exceedence of TPCs for fish, invertebrates, macrophytes and microalgae (see above)	• *0 in the upper reaches (End of Zone C and beginning of Zone D) of the estuary.* • *Salinity values > 20 ppt in middle reaches (above the N2 bridge) during the low flow season* • *Freshwater dominated for 70% of the time*
System variables (pH, dissolved oxygen and turbidity) not to cause exceedence of TPCs for biota (see above)	*River inflow:* • *7.5 < pH > 8.5 consistently over 2 months* • *DO <6 mg/ℓ* • *Turbidity >15NTU (low flow)* • *Turbidity high flows naturally turbid* *Estuary:* • *Average turbidity >10 NTU (low flow)* • *Turbidity high flow, naturally turbid* • *7.0 < pH > 8.5 in a sampling survey* • *Average DO <6 mg/ℓ in a sampling survey*
Inorganic nutrient concentrations (NO_3-N, NH_3-N and PO_4-P) not to cause in exceedance of TPCs for macrophytes and microalgae (see above)	*River inflow (flows < 5m^3/s):* • *NOx-N >150 µg/ℓ over 2 months* • *NH3-N> 20 µg/ℓ over 2 months* • *PO4-P > 10 µg/ℓ over 2 months* *River inflow (flows > 5m^3/s):* • *Average DIN > 200 µg/ℓ* • *Average DIP > 20 µg/ℓ* *Estuary (river flows < 5m^3/s):* • *Average NOx-N > 150 µg/ℓ in a sampling survey* • *Average NH3-N > 20 µg/ℓ in a sampling survey* • *Average PO4-P > 10 µg/ℓ in a sampling survey* *Estuary (river flows > 5m^3/s):* • *Average NOx-N > 300 µg/ℓ in a sampling survey* • *Average NH3-N > 20 µg/ℓ in a sampling survey* • *Average PO4-P > 20 µg/ℓ in a sampling survey*
Presence of toxic substances not to cause exceedence of TPCs for biota (see above)	*River inflow:* • *Trace metals (to be determined)* • *Pesticides/herbicides (to be determined)* *Estuary:* • *Total metal concentrations in estuary waters exceed target values as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995* • *Total metal concentration in sediment exceeds target values as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*

Recreational use	*Microbiology: Sufficient levels (DEA, 2012)* • *Estimated risk per exposure: 8.5% GI illness risk* • *Enterococci (Count per 100 ml): < 185 (90 percentile)* • *E. coli (Count per 100 ml): < 500 (90 percentile)*
Sediment dynamics	*B*
Flood regime to maintain the sediment distribution patterns and aquatic habitat (instream physical habitat) so as not to exceed TPCs for biota (see above)	• *River inflow distribution patterns (flood components) differ by more than 20% (in terms of magnitude, timing and variability) from that of the Present State (2013)* • *Suspended sediment concentration from river inflow deviates by more than 20% of the sediment load-discharge relationship to be determined as part of baseline studies (Present State 2013)* • *Findings from the bathymetric surveys undertaken as part of a monitoring programme indicate changes in the sedimentation and erosion patterns in the estuary have occurred (± 0.5 m).* • *Intertidal and subtidal habitat in Zone C and D are not available for estuarine species (increase by > 20% from present).*
Changes in sediment grain size distribution patterns not to cause exceedance of TPCs in benthic invertebrates (see above).	• *The median bed sediment diameter deviates by more than a factor of two from levels to be determined as part of baseline studies (Present State 2013).* • *Sand/mud distribution in middle and upper reaches change by more than 20% from Present State (2013).* • *Changes in tidal amplitude at the tidal gauge of more than 20% from Present State (2013)*
Microalgae	*B*
Maintain current microalgae assemblages, specifically >5 diatom species at a frequency >3% of the total population in saline reaches (i.e. Zone A in low flow)	• *Medium phytoplankton: > 5µg l-1 for more than 50% of the stations* • *MPB: > 30mg m2 for more than 50% of the stations in the saline portion of the estuary* • *Observable bloom in the estuary*
Macrophytes	*D*
• *Maintain the distribution of macrophyte habitats.* • *Maintain the integrity of the riparian zone particulary where the sandmining no longer occurs* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *No sugarcane in the estuarine functional zone.*	• *Greater than 10 % change in the area covered by different macrophyte habitats.* • *Canalisation of lower reaches* • *Invasive plants (e.g. syringa berry, Spanish reed, black wattle, Brazilian pepper tree) largely absent from the riparian zone.* • *Die-back of reeds & sedges in the lower reaches.* • *Unvegetated, cleared areas along the banks.* • *Floating invasive aquatics observed in the upper estuary reaches.* • *Sugarcane is present in the estuarine functional zone.*
Invertebrates	*B*
• *Maintain current levels of zoobenthic abundance (including seasonal variation)* • *Retain an invertebrate community assemblage in the estuary based on species diversity and abundance that includes a variety of indigenous* • *Species diversity (between 15 species in summer - 40 species in winter).* • *Polychaetes, amphipods and tanaeids should numerically dominate during all seasons. However, abundance of all taxon groups should be higher during summer high flow periods and lower during winter low flow period.*	• *Salinities should be <15 in* • *DO's should not drop below 4 ppt in >25% of the estuary* • *Sediment distribution* • *Greater than 20% change in the intertidal and subtidal habitats* • *Occurrence of invertebrate alien species (e.g. Tarebia granifera)* • *Decrease in abundance of zooplankton by >20% in terms of numbers per m^{-2} over entire estuarine area (3 sample sites) over 3 years* • *Decrease in abundance of benthic macroinvertebrates* • *No occurrence of Paratylodiplax blephariskios in annual sample*
Fish	*D*
• *Zone C in its entirety acts as a nursery to a diversity of EDC2 species (EDC2a especially).* • *A good trophic basis exists for predatory estuarine dependant marine species (e.g. Agyrosomus japonicus,*	*As sampled by seine and gill net in open waters:* • *30 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 6 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should*

Carynx spp.). • *Estuarine residents species represented by core group (Glossogobius spp., Oligolepis spp. Ambassis spp. and Gilchistella aestuaria).* • *Oreochromis mossambicus limited to the upper reaches of Zone C in the low flow period.* • *Species assemblage comprises indigenous species only.* • *Connectivity to a healthy transitional marine-estuary waters is maintained.*	*occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni and Argyrosomus japonicas should be sampled with 80% frequency of occurrence.* • *Anguilid eels should use the system as a migratoty route between marine and riverine habitats (and catches of these eel should be reflected in river monitoring.* • *Pelagic piscivores should occur (including Caranx spp and Sphyraena spp.).* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* • *No fish kills should occur.*
Birds	*C*
The most characteristic component of the avifaunal waterbird community is the piscivores and it is this group that would be the most valuable for monitoring	• *Resident pair of African Fish Eagle disappears or fails to breed successfully* • *Pied Kingfishers, White-breasted Cormorants or Reed Cormorants fail to be recorded on more than three consecutive counts spanning a period of 18 months or more* • *Numbers of waterbird species drop below 10 for 2 consecutive counts*

2 Mvoti RQOs

PES:	D	REC:	C	TEC:	C/D

Components that require interventions to achieve the TEC:
- *Protect baseflows to estuary to improve mouth state and salinity profile.*
- *A significant improvement in water quality needed; and*
- *Partial restoration of estuarine habitat.*
- *Prevent low oxegen events that results in invertabrate/fish kills.*

Ecological specification	Threshold of potential concern
Hydrology	*C/D*
Maintain a flow regime to create the required habitat for birds, fish, macrophytes, microalgae and water quality	*Flows should not exceed natural and seasonal distribution should not be compromised.* • *River inflow distribution patterns differ by more than 5% from that of Scenario A (i.e. the recommended flow scenario for the Mvoti Estuary).* • *Monthly river inflow < 1.0 m^3/s* • *Monthly river inflow < 2.0 m^3/s persists for longer than 3 months in a row* • *Monthly river inflow < 2.0 m^3/s for more than 50% of the time.*
Hydrodynamics	*A*
Maintain a mouth conditions to create the required habitat for birds, fish, macrophytes, microalgae and water quality	• *Mouth closure occurs more than 2 - 3 weeks in a year* • *Mouth closure occurs for more than 2 years out of ten* • *Mouth closure occurs between November and June*
Water Quality	*C/D*
Salinity	• *Salinity > 20 PSU 1 km from the mouth* • *Salinity >1 PSU for >50% of the time*
System variables (pH, dissolved oxygen and turbidity) not to cause exceedence of TPCs for biota (see above)	• *<u>River inflow:</u>* *7.0 < pH > 8.5 over 2 months* *DO < 4 mg/ℓ* *Turbidity >15 NTU (low flow)* *Turbidity high flows naturally turbid* • *<u>Estuary:</u>* *Average turbidity >10 NTU (low flow)* *Turbidity high flow, naturally turbid* *Average 7.0 < pH > 8.5* *Average DO < 4 mg/ℓ*
Inorganic nutrient concentrations (NO_3-N, NH_3-N and PO_4-P) not to cause in exceedance of TPCs for macrophytes and microalgae (see above)	• *<u>River inflow:</u>* *NO_x-N >400 µg/ℓ over 2 months* *NH_3-N> 30 µg/ℓ over 2 months* *PO_4-P > 25 µg/ℓ over 2 months* • *<u>Estuary:</u>* *Average NO_x-N > 400 µg/ℓ*

	Average NH_3-N > 30 µg/ℓ *Average PO_4-P > 25 µg/ℓ*
Presence of toxic substances not to cause exceedence of TPCs for biota (see above)	• *<u>River inflow:</u>* *Trace metals (to be determined)* • *<u>Estuary</u>* *Total metal concentrations in estuary waters exceed target values as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995)* *Total metal concentration in sediment exceeds target values as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*
Recreational use	*N/A Not identified as recreational area at stakeholder meeting*
Sediment dynamics	*B/C*
Flood regime to maintain the sediment distribution patterns and aquatic habitat (instream physical habitat) so as not to exceed TPCs for biota (see above)	• *River inflow distribution patterns (flood components) differ by more than 20% (in terms of magnitude, timing and variability) from that of the Present State (2013)* • *Suspended sediment concentration from river inflow deviates by more than 20% of the sediment load-discharge relationship to be determined as part of baseline studies (Present State 2013)* • *Findings from the bathymetric surveys undertaken as part of a monitoring programme indicate changes in the sedimentation and erosion patterns in the estuary have occurred (± 0.5 m)* • *Changes in tidal amplitude at the tidal gauge of more than 20% from Present State (2013)*
Changes in sediment grain size distribution patterns not to cause exceedance of TPCs in benthic invertebrates (see above).	• *The median bed sediment diameter deviates by more than a factor of two from levels to be determined as part of baseline studies (Present State 2013)* • *Sand/mud distribution in middle and upper reaches change by more than 20% from Present State (2013)*
Microalgae	*B*
Maintain current microalgae assemblages, specifically >5 diatom species at a frequency >3% of the total population in saline reaches (i.e. Zone A in low flow)	• *Medium phytoplankton: > 3µg/l for more than 50% of the stations* • *MPB: > 20mg m2 for more than 50% of the stations in the saline portion of the estuary* • *Observable bloom in the estuary*
Macrophytes	*D*
Maintain the distribution of macrophyte habitats, particularly the freshwater mangrove, Barringtonia racemosa stand at the mouth of the estuary. *Control the spread of hygrophilous grasses into open water area.* *Prevent the spread of invasive plants, trees and shrubs as well as aquatic invasive plants.* *No sugarcane in the estuarine functional zone*	• *Greater than 10% change in macrophyte habitat* • *Increase in reeds & sedges and encroachment into main water channel due to nutrient enrichment, sedimentation and infilling of intertidal habitat* • *Decrease in open water habitat to less than 16 ha* • *Invasive plants (e.g. syringa berry, Brazilian pepper tree) and aquatic invasives (e.g. water hyacinth) cover >5% of total macrophyte area* • *Sugarcane is present in the estuarine functional zone*
Invertebrates	*E*
Fish	*D*
Maintain ecological function as • *a nursery for a limited diversity and abundance of estuarine dependant marine fishes, which use the system through to their late juvenile and adult life stages* • *habitat for a limited diversity and abundance of estuarine resident fishes which complete their life cycles in the estuary* • *habitat for a limited diversity and abundance of freshwater fishes* • *a migration corridor for facultative catadromous eels*	*As sampled by seine and gill net in open waters:* • *12 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 3 species.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Anguilid eels should use the system as a migratoty route between marine and riverine habitats (and catches of these eel should be reflected in river monitoring.* • *Pelagic piscivores should occur (including Caranx spp.).* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*
Birds	*E*
The estuary should contain a rich	• *Disappearance or lack of successful breeding by Collared Pratincoles and*

avifaunal waterbird community, occurring at high densities (relative to available shorelength) that includes representatives of all the major groups, i.e. aerial (e.g. kingfishers), swimming (e.g. cormorants) and large wading piscivores (e.g. herons), small invertebrate-feeding waders, including migratory Palaearctic sandpipers, herbivorous waterfowl (e.g. ducks and geese) and roosting terns and gulls	*the resident pair of African* • *Fish Eagles* • *Numbers of bird species drops below 30 for 3 consecutive counts* • *Number of roosting terns recorded in mid-summer fewer than 2000*

3 Mhlali RQOs

PES:	**C/D**	**REC:**	**B/C**	**TEC:**	**D**

Flow:

	nMAR (MCM)	**pMAR (MCM)**
	56.26	*54.03*
C/D	*Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).* **Present base flows poses a risk to the REC.**	

Sediment processes:

C/D	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.* • *Intertidal and subtidal habitat in Zone C and D are not available for estuarine species (increase by > 20% from present).*

Mouth state:

B	*Mouth open conditions should be maintained within the current range: 48% (± 5%). Breaching levels are < 3.0 m MSL.*

Water quality: Salinity

B	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should be between 5 and 10 (to be confirmed).* *Salinity values > 20 PSU in middle reaches during the low flow season* *No 10 – 15 PSU zone detected in the estuary for 2 consecutive sampling event in a row.surveys.*

Water quality: Other

	Ecosystem health:	**Recreational use:**	*Yes*
E	*Water quality poses risk to REC/TEC, sufficiently reduced if:* **River:** *7.5 < pH > 8.5 consistently over 2 months* *DO <6 mg/l* *Turbidity >15 NTU (low flows), naturally turbid under high flows; NOx-N >200 µg/l over 2 months; NH3-N >20 µg/l over 2 months; PO4-P > 10 µg/l over 2 months* **Estuary:** *Average 7.0 < pH > 8.5 in a sampling survey* *Average DO <6 mg/l in a sampling survey* *Average turbidity >10 NTU (low flows), naturally turbid under high flows;*	*Microbiology: Sufficient levels (DEA, 2012)*	

	Average NOx-N >200 µg/l in a sampling survey; Average NH3-N >20 µg/l in a sampling surveyrvey; Average PO4-P >10 µg/l in a sampling survey *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	
Microalgae		
D	*Maintain current microalgae assemblages, specifically >5 diatom species at a frequency >3% of the total population in saline reaches (i.e. Zone A in low flow)* • *Medium phytoplankton: > 2µg/l for more than 50% of the stations* • *MPB: > 10mg m2 for more than 50% of the stations in the saline portion of the estuary* • *Observable bloom in the estuary*	
Macrophytes (plants)		
D	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries). The swamp forest habitat is of particular importance.* • *Maintain the integrity of the riparian zone. No further bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat. In particular no further sugarcane cultivation in the EFZ.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Maintain present salinity regime to maintain reed & sedge habitats (< 50 % loss of reed & sedge habitats in non-flood year).*	
Inverts		
D/E	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 40%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton are abundant.* • *Macrobenthos should be abundant and dominated by amphipods and polycheates, but should include isopods, tanaids and the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata and Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species do not dominate macrobenthos.*	
Fish		
C/D	*As sampled by seine and gill net in open waters:* • *13 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 4 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 60% frequency of occurrence.* • *Pelagic piscivores should occur.* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomlies related to water quality.* *No fish kills should occur.*	
Birds		
D/E	*The estuary should contain a relatively rich avifaunal waterbird community that includes representatives of all the major groups, i.e. aerial (e.g. kingfishers), swimming (e.g. cormorants) and large wading piscivores (e.g. herons), small invertebrate-feeding waders, including migratory Palaearctic sandpipers, herbivorous waterfowl (e.g. ducks and geese) and roosting terns and gull.* • *Disappearance or lack of successful breeding by resident pair of African Fish Eagles.* • *Numbers of bird species drops below 20 for 3 consecutive counts.* • *Number of roosting terns recorded in mid-summer fewer than 500.*	

4 Mtamvuna RQOs

PES:	B	REC:	A/B	TEC:	A/B

Components that require interventions to achieve the TEC:
- *Restoration of estuarine riparian habitat;*
- *Reduce/contol fishing high pressure;*
- *Protect baseflows to estuary to maintain mouth state and salinity profile.*

Flow:

PES	nMAR (MCM)	pMAR (MCM)
	275.19	*239.49*
B	*Flows should not exceed natural and seasonal distribution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).*	

Sediment processes:

B	• *The flood regime maintains the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow does not deviate by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*

Mouth state:

A	*Mouth open conditions should be maintained within the current range: 78% (± 10%)*

Water quality: Salinity

B	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid waters in the lower reaches should be between 10 and 15.*

Water quality: Other

	Ecosystem health	**Recreational use**	*Yes*
B	*DIN: Freshwater inflow, 50%ile <0.2 mg/l* *DIP: Freshwater inflow, 50%ile <0.015 mg/l* *DO: Entire estuary, average ≥6 mg/l* *Turbidity: Estuary, clear (<10NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Microbiology: Sufficient levels (DEA, 2012)*		

Macrophytes (plants)

B	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats (accounts for natural changes due to the dynamic nature of estuaries). See Appendix A for detail on habitats distribution on this system.* • *Improve/maintain the integrity of the riparian zone. No bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance (litter problematic) and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Lantana, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Maintain present salinity regime to maintain reed & sedge habitats (< 50 % loss of reed & sedge habitats in non-flood year).*

Invertebrates

B	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 25%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton are abundant.*

	• *Macrobenthos should be abundant and dominated by polychaetes but should include amphipods, isopods, tanaids and the crab Hymenosoma projectum. Insect taxa should occur in the far upper reaches only.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata, Varuna litterata, Macrophthalmus sp., Sesarmidae and Uca sp,* • *Molluscan assemblage should include bivalves (including tellinids, Solen cylindraceus and Eumarcia paupercula) and gastropods (including Nassarius kraussianus, Natica spp. and Polinices sp.).* • *Invasive alien species should not occur.*
Fish	
C	*As sampled by seine and gill net in open waters:* • *35 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 7 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni and Argyrsoomus japonicas should be sampled with 100% frequency of occurrence.* • *Pelagic piscivores should occur (including Caranx spp and Sphyraena spp.).* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*

5 Zolwane RQOs

PES:	**B**	**REC:**	**B**	**TEC:**	**B**

Flow:

PES	nMAR (MCM)	pMAR (MCM)
A	**2.19**	**2.31**
	Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).	

Sediment processes:

B	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*

Mouth state:

A	*Mouth open conditions should be maintained within the current range: 81% (± 5%).*

Water quality: Salinity

A	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should be between 5 and 10 (to be confirmed).*

Water quality: Other

B	*Ecosystem health:*	*Recreation use:*	*Yes*
	DIN: Freshwater inflow, 50%ile <0.2 mg/l *DIP: Freshwater inflow, 50%ile <0.015 mg/l* *DO: Entire estuary, average ≥6 mg/l* *Turbidity: Estuary, clear (<10NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as*	*Microbiology: Sufficient levels (DEA, 2012)*	

	per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)	
Macrophytes (plants)		
B	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries).* • *Maintain the integrity of the riparian zone. No bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Prevent reed encroachment that may become problematic due to nutrient enrichment from proposed future WWTW input.*	
Invertebrates		
B	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 30%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton are abundant.* • *Macrobenthos should be abundant and dominated by polychaetes but should include amphipods, isopods, tanaids and the crab Hymenosoma projectum. Insect taxa should occur in the far upper reaches only.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata, Varuna litterata, Macrophthalmus sp., Sesarmidae and Uca sp,* • *Molluscan assemblage should include bivalves (including Solen cylindraceus, Eumarcia paupercula) and gastropods (including Nassarius kraussianus, Natica spp., Polinices sp.).* • *Invasive alien species should not occur in abundance.*	
Fish		
C	*As sampled by seine and gill net in open waters:* • *30 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 6 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni and Argyrosomus japonicas should be sampled with 80% frequency of occurrence.* • *Pelagic piscivores should occur (including Caranx spp and Sphyraena spp.).* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*	

6 Sandlundlu RQOs

PES:	**C**	**REC:**	**C**	**TEC:**	**C**
Flow:					
PES	**nMAR (MCM)**		**pMAR (MCM)**		
A	*5.07*		*5.00*		
	Flows should not exceed natural and seasonal distribution should not be compromised. Current baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).				
Sediment processes:					
C	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*				
Mouth state:					

A	*Mouth open conditions should be maintained within the current range: 60% (± 10%).*		
Water quality: Salinity			
B	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should exceed 15 (to be confirmed).*		
Water quality: Other			
B	**Ecosystem health:**	**Recreation use:**	*N/A*
	DIN: Freshwater inflow, 50%ile <0.2 mg/l *DIP: Freshwater inflow, 50%ile <0.015 mg/l* *DO: Entire estuary, average ≥6 mg/l* *Turbidity: Estuary, clear (<10NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Not identified as recreational area in stakeholder meeting*	
Macrophytes (plants)			
C	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries). Submerged macrophytes have been recorded in the estuary historically.* • *Maintain the integrity of the riparian zone. No bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.*		
Inverts			
D	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 40%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton are abundant.* • *Macrobenthos should be abundant and dominated by amphipods and polycheates, but should include isopods, tanaids and the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata and Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species do not dominate macrobenthos.*		
Fish			
E	*As sampled by seine and gill net in open waters:* • *18 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 4 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni and Argyrosomus japonicas should be sampled with 60% frequency of occurrence.* • *Pelagic piscivores should occur (including Caranx spp).* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*		

7 Ku-Boboyi RQOs

PES:	**B**	**REC:**	**B**	**TEC:**	**B**
Flow:					

PES	nMAR (MCM)	pMAR (MCM)
A	*1.00*	*0.99*

	Flows should not exceed natural and seasonal distribution should not be compromised. Current baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).		
Sediment processes:			
B	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*		
Mouth state:			
B	*Mouth open conditions should be maintained within the current range: 53% (± 5%).*		
Water quality: Salinity			
A	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should exceed 10 (to be confirmed).*		
Water quality: Other			
B	**Ecosystem health:**	**Recreation use:**	*N/A*
	DIN: Freshwater inflow, 50%ile <0.2 mg/l *DIP: Freshwater inflow, 50%ile <0.015 mg/l* *DO: Entire estuary, average ≥6 mg/l* *Turbidity: Estuary, clear (<10NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Not identified as recreational area in stakeholder meeting*	
Macrophytes (plants)			
B	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries).* • *Maintain the integrity of the riparian zone. No bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Lantana, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.*		
Inverts			
B	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 40%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton are abundant.* • *Macrobenthos should be abundant and dominated by amphipods and polycheates, but should include isopods, tanaids and the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata and Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species do not dominate macrobenthos.*		
Fish			
C	*As sampled by seine and gill net in open waters:* • *13 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 4 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 60% frequency of occurrence.* • *Pelagic piscivores should occur.* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomlies related to water quality.*		

	No fish kills should occur.

8 Tongazi RQOs

PES:	B/C	REC:	B/C	TEC:	B/C

Flow:

PES	nMAR (MCM)	pMAR (MCM)
	7.00	*7.32*
A	*Flows should not exceed natural and seasonal distribution should not be compromised. Current baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).*	

Sediment processes:

B	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*

Mouth state:

B	*Mouth open conditions should be maintained within the current range: 91% (± 5%).*

Water quality: Salinity

A	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should exceed 10 (to be confirmed).*

Water quality: Other

C	*Ecostystem health:*	**Recreational use:**	*Yes*
	Water quality poses risk to REC/TEC, sufficiently reduced if: *DIN: Freshwater inflow, 50%ile <0.2 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.015 mg/l (high risk)* *DO: Entire estuary, average ≥6 mg/l (high risk)* *Turbidity: Estuary, clear (<10NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Microbiology: Sufficient levels (DEA, 2012)*	

Macrophytes (plants)

C	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries).* • *Maintain the integrity of the riparian zone. No bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Prevent macroalgal blooms and reed encroachment which are likely to become problematic due to nutrient enrichment from proposed future WWTW input.*

Inverts

C	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 30%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton are abundant.* • *Macrobenthos should be abundant and dominated by polychaetes but should include amphipods, isopods, tanaids and the crab Hymenosoma projectum. Insect taxa should occur in the far upper reaches only.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.*

	• *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata, Varuna litterata, Macrophthalmus sp., Sesarmidae and Uca sp,* • *Molluscan assemblage should include bivalves (including Solen cylindraceus, Eumarcia paupercula) and gastropods (including Nassarius kraussianus, Natica spp., Polinices sp.).* • *Invasive alien species should not occur in abundance.*
Fish	
D	*As sampled by seine and gill net in open waters:* • *30 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 6 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni and Argyrosomus japonicas should be sampled with 80% frequency of occurrence.* • *Pelagic piscivores should occur (including Caranx spp and Sphyraena spp.).* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*

9 Kandandhlovu RQOs

PES:	B	REC:	B	TEC:	B

Flow:		
PES	**nMAR (MCM)**	**pMAR (MCM)**
	1.53	*1.60*
A	*Flows should not exceed natural and seasonal distribution should not be compromised. Current baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).*	
Sediment processes:		
C	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*	
Mouth state:		
A	*Mouth open conditions should be maintained within the current range: 54% (± 5%).*	
Water quality: Salinity		
B	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should exceed 5 (to be confirmed).*	
Water quality: Other		
C	**Ecosystem health:**	**Recreational use:** *N/A*
	Water quality poses risk to REC/TEC, sufficiently reduced if: **DIN: Freshwater inflow, 50%ile <0.2 mg/l (high risk)** **DIP: Freshwater inflow, 50%ile <0.015 mg/l (high risk)** **DO: Entire estuary, average ≥6 mg/l (high risk)** *Turbidity: Estuary, clear (<10NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Not identified as recreational area in stakeholder meeting*
Macrophytes (plants)		

B	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries). In particular the swamp forest habitat is of importance.* • *Maintain the integrity of the riparian zone. No bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Improve the salinity regime to encourage the re-establishment of mangrove habitat and prevent reed encroachment.*
Inverts	
B	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 30%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton are abundant.* • *Macrobenthos should be abundant and dominated by amphipods and polycheates, but should include isopods, tanaids and the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata and Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species should not occur in abundance.*
Fish	
C	*As sampled by seine and gill net in open waters:* • *18 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 5 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 80% frequency of occurrence.* • *Pelagic piscivores should occur (including Caranx spp.).* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomlies related to water quality.* *No fish kills should occur.*

10 Mpenjati RQOs

PES:	B/C	REC:	B	TEC:	B

Components that require interventions to achieve the TEC:
- *Remove/reduce impact of sandmining;*
- *Improve water quality;*
- *Restore estuarine riparian habitat; and*
- *Protect baseflows to estuary to maintain mouth state and salinity profile.*

Flow:

PES	nMAR (MCM)	pMAR (MCM)
A	*23.61*	*23.77*
	Flows should not exceed natural and seasonal distribution should not be compromised. Current baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).	

Sediment processes:

D	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter*

	deviates by less than a factor of two from present levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.
Mouth state:	
B	*Mouth open conditions should be maintained within the current range: 70% (± 5%).*
Water quality: Salinity	
A	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid waters in the lower reaches should between 20 to 30, the middle reaches should be between 15 to 25, and the upper reaches between 10 to 15. Refer to DWS WQ data for baseline.*
Water quality: Other	

C	**Ecosystem health:**	**Recreational use:**	*N/A*
	Water quality poses risk to REC/TEC, sufficiently reduced if: *DIN: Freshwater inflow, 50%ile <0.2 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.015 mg/l (high risk)* *DO: Entire estuary, average ≥6 mg/l (high risk)* *Turbidity: Estuary, clear (<10NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Not identified as recreational area in stakeholder meeting*	

Macrophytes (plants)	
D	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries).). In particular the swamp forest habitat is of importance.* • *Maintain the integrity of the riparian zone. No bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Prevent macroalgal blooms and reed encroachment which are likely to become problematic due to nutrient enrichment from proposed future WWTW input.*
Inverts	
D	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 30%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton are abundant.* • *Macrobenthos should be abundant and dominated by polychaetes but should include amphipods, isopods, tanaids and the crab Hymenosoma projectum. Insect taxa should occur in the far upper reaches only.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Molluscan assemblage should include bivalves (including Eumarcia paupercula) and gastropods (including Nassarius kraussianus, Natica spp.).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata, Varuna litterata, Macrophthalmus sp., Sesarmidae and Uca sp,* • *Invasive alien species should not occur in abundance.*
Fish	
D	*As sampled by seine and gill net in open waters:* • *25 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 5 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni and Argyrosomus japonicas should be sampled with 80% frequency of occurrence.* • *Pelagic piscivores should occur (including Caranx spp).* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*

11 Umhlangankulu RQOs

PES:	C	REC:	C	TEC:	C

Flow:

PES	nMAR (MCM)	pMAR (MCM)
	2.87	*2.87*
A	*Flows should not exceed natural and seasonal distribution should not be compromised. Current baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).*	

Sediment processes:

D	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*

Mouth state:

A	*Mouth open conditions should be maintained within the current range: 33% (± 10%).*

Water quality: Salinity

B	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should exceed 10 (to be confirmed).*

Water quality: Other

	Ecosystem health:	**Recreational use:**	*N/A*
E	*Water quality poses risk to REC/TEC, sufficiently reduced if:* *DIN: Freshwater inflow, 50%ile <0.3 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.025 mg/l (high risk)* *DO: Entire estuary, average ≥4 mg/l (high risk)* *Turbidity: Estuary, clear (<15 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Not identified as recreational area in stakeholder meeting*	

Macrophytes (plants)

C	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries).* • *Maintain the integrity of the riparian zone. No bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Improve the salinity regime to encourage the growth of mangroves.*

Inverts

E	*As sampled by plankton net, grab and dip nets/traps (as appropriate):*

	• *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 40%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton are abundant.* • *Macrobenthos should be abundant and dominated by amphipods and polycheates, but should include isopods, tanaids and the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata and Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species do not dominate macrobenthos.*
Fish	
D	*As sampled by seine and gill net in open waters:* • *13 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 4 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 60% frequency of occurrence.* • *Pelagic piscivores should occur.* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomlies related to water quality.* *No fish kills should occur.*

12 Kaba RQOs

PES:	**C**	**REC:**	**C**	**TEC:**	**C**
Flow:					
PES	**nMAR (MCM)**		**pMAR (MCM)**		
A	*3.15*		*3.07*		
	Flows should not exceed natural and seasonal distribution should not be compromised. Current baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).				
Sediment processes:					
C	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*				
Mouth state:					
A	*Mouth open conditions should be maintained within the current range: 27% (± 10%).*				
Water quality: Salinity					
B	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should exceed 5 (to be confirmed).*				
Water quality: Other					
E	*Ecostystem health:*		**Recreational use:**	*N/A*	

	Water quality poses risk to REC/TEC, sufficiently reduced if: *DIN: Freshwater inflow, 50%ile <0.3 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.025 mg/l (high risk)* *DO: Entire estuary, average ≥4 mg/l (high risk)* *Turbidity: Estuary, clear (<15 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Not identified as recreational area in stakeholder meeting*
Macrophytes (plants)		
D	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries).* • *Maintain the integrity of the riparian zone. No further bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Maintain present salinity regime to prevent encroachment of reeds into the open water.*	
Inverts		
D	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 40%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei.* • *Macrobenthos should be abundant and dominated by amphipods, but should include isopods, tanaids, polychaetes, the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) are dominated by Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species do not dominate macrobenthos.*	
Fish		
D	*As sampled by seine and gill net in open waters:* • *10 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 3 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 60% frequency of occurrence.* • *Pelagic piscivores should occur.* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*	

13 Mbizana RQOs

PES:	**B**	**REC:**	**B**	**TEC:**	**B**
Flow:					
PES	**nMAR (MCM)**		**pMAR (MCM)**		
A	*36.30*		*35.52*		
	Flows should not exceed natural and seasonal distribution should not be compromised. Current baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).				
Sediment processes:					
C	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in*				

	the estuary do not differ significantly from present (± 0.5 m) (to be determined). • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*		
Mouth state:			
A	*Mouth open conditions should be maintained within the current range: 54% (± 5%).*		
Water quality: Salinity			
A	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid waters in the lower reaches should be between 20 to 35, the middle reaches should be between 10 to 20, and the upper reaches between 5 to10 (to be confirmed).*		
Water quality: Other			
C	**Ecosystem health:**	**Recreational use:**	*N/A*
	Water quality poses risk to REC/TEC, sufficiently reduced if: *DIN: Freshwater inflow, 50%ile <0.2 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.015 mg/l (high risk)* *DO: Entire estuary, average ≥6 mg/l (high risk)* *Turbidity: Estuary, clear (<10NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Not identified as recreational area in stakeholder meeting*	
Macrophytes (plants)			
C	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries).* • *Maintain the integrity of the riparian zone. No bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Maintain present salinity regime to prevent encroachment of reeds into the open water.*		
Inverts			
C	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 30%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton are abundant.* • *Macrobenthos should be abundant and dominated by amphipods and polycheates, but should include isopods, tanaids and the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata and Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species should not occur in abundance.*		
Fish			
C	*As sampled by seine and gill net in open waters:* • *18 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 5 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 80% frequency of occurrence.* • *Pelagic piscivores should occur (including Caranx spp.).* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomlies related to water quality.* *No fish kills should occur.*		

14 Mvutshini RQOs

PES:	B/C	REC:	B/C	TEC:	B/C

Flow:

PES	nMAR (MCM)	pMAR (MCM)
	1.66	*1.63*
A	*Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).*	

Sediment processes:

B	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*

Mouth state:

B	*Mouth open conditions should be maintained within the current range: 42% (± 5%).*

Water quality: Salinity

B	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should exceed 5 (to be confirmed).*

Water quality: Other

	Ecostystem health:	**Recreational use:**	*Yes*
D	*Water quality poses risk to REC/TEC, sufficiently reduced if:* *DIN: Freshwater inflow, 50%ile <0.2 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.015 mg/l (high risk)* *DO: Entire estuary, average ≥6 mg/l (high risk)* *Turbidity: Estuary, clear (<10NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Ramsgate (Blue Flag)* *Microbiology: Excellent levels (DEA, 2012)*	

Macrophytes (plants)

C	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries).* • *Maintain the integrity of the riparian zone. No bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Maintain present salinity regime to prevent encroachment of reeds into the open water.* • *Prevent macroalgal blooms and reed encroachment which are likely to become problematic due to nutrient enrichment from proposed future WWTW input.*

Inverts

C	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 30%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton are abundant.* • *Macrobenthos should be abundant and dominated by amphipods and polycheates, but should include isopods, tanaids and the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.*

	• *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata and Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species should not occur in abundance.*
Fish	
C	*As sampled by seine and gill net in open waters:* • *18 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 5 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 80% frequency of occurrence.* • *Pelagic piscivores should occur (including Caranx spp.).* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomlies related to water quality.* *No fish kills should occur.*

15 Bilanhlolo RQOs

PES:	**C**	**REC:**	**C**	**TEC:**	**C**
Flow:					
PES	**nMAR (MCM)**		**pMAR (MCM)**		
A	*5.02*		*4.98*		
	Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).				
Sediment processes:					
D	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*				
Mouth state:					
A	*Mouth open conditions should be maintained within the current range: 47% (± 10%).*				
Water quality: Salinity					
B	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should exceed 10 (to be confirmed).*				
Water quality: Other					
D	**Ecosystem health:**		**Recreational use:**	*Yes*	
	Water quality poses risk to REC/TEC, sufficiently reduced if: *DIN: Freshwater inflow, 50%ile <0.2 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.015 mg/l (high risk)* *DO: Entire estuary, average ≥6 mg/l (high risk)* *Turbidity: Estuary, clear (<10NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*		*Ramsgate (Blue Flag)* *Microbiology: Excellent levels (DEA, 2012)*		
Macrophytes (plants)					

E	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries).* • *Maintain the integrity of the riparian zone. No further bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.*
Inverts	
D	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 40%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton are abundant.* • *Macrobenthos should be abundant and dominated by amphipods and polycheates, but should include isopods, tanaids and the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata and Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species do not dominate macrobenthos.*
Fish	
D	*As sampled by seine and gill net in open waters:* • *13 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 4 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 60% frequency of occurrence.* • *Pelagic piscivores should occur.* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomlies related to water quality.* *No fish kills should occur.*

16 Uvuzana RQOs

PES:	**C**	**REC:**	**C**	**TEC:**	**C**
Flow:					
PES	**nMAR (MCM)**		**pMAR (MCM)**		
A	*1.05*		*1.05*		
	Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).				
Sediment processes:					
C	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*				
Mouth state:					
A	*Mouth open conditions should be maintained within the current range: 32% (± 10%).*				
Water quality: Salinity					
A	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should exceed 5 (to be confirmed).*				

Water quality: Other			
F	**Ecosystem health:**	**Recreational use:**	*N/A*
	Water quality poses risk to REC/TEC, sufficiently reduced if: *DIN: Freshwater inflow, 50%ile <0.3 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.025 mg/l (high risk)* *DO: Entire estuary, average ≥4 mg/l (high risk)* *Turbidity: Estuary, clear (<15 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Not identified as recreational area in stakeholder meeting*	
Macrophytes (plants)			
C	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries).* • *Maintain the integrity of the riparian zone. No bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Prevent further spread of reeds into water channel.*		
Inverts			
D	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 40%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei.* • *Macrobenthos should be abundant and dominated by amphipods, but should include isopods, tanaids, polychaetes, the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) are dominated by Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species do not dominate macrobenthos.*		
Fish			
D	*As sampled by seine and gill net in open waters:* • *10 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 3 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 60% frequency of occurrence.* • *Pelagic piscivores should occur.* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*		

17 Kongweni RQOs

PES:	**E**	**REC:**	**D**	**TEC:**	**EF**

Water quality: Salinity			
D	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should be between 5 and 10 (to be confirmed).*		
Water quality: Other			
F	**Ecosystem health:**	**Recreational use:**	*Yes*
	Water quality poses risk to REC/TEC, sufficiently reduced if: *DIN: Freshwater inflow, 50%ile <0.5 mg/l (high risk)*	*Major holiday destination* *Microbiology: Sufficient levels (DEA,*	

	DIP: Freshwater inflow, 50%ile <0.125 mg/l (high risk) *DO: Lower estuary, average ≥4 mg/l (high risk)* *Turbidity: Estuary, clear (<15 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*2012)*

18 Vungu RQOs

PES:	**B**	**REC:**	**B**	**TEC:**	**B**

Flow:

PES	nMAR (MCM)	pMAR (MCM)
	27.79	*28.88*
B	*Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).*	

Sediment processes:

B	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*

Mouth state:

B	*Mouth open conditions should be maintained within the current range: 95% (± 5%).*

Water quality: Salinity

B	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Bottom waters should exceed 20 (to be confirmed).*

Water quality: Other

	Ecostystem health:	**Recreational use:**	*Yes*
D	*Water quality poses risk to REC/TEC, sufficiently reduced if:* *DIN: Freshwater inflow, 50%ile <0.2 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.015 mg/l (high risk)* *DO: Entire estuary, average ≥6 mg/l (high risk)* *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Uvongo beach* *Microbiology: Sufficient levels (DEA, 2012)*	

Macrophytes (plants)

B	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the small reed area which accounts for natural changes due to the dynamic nature of estuaries).* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Prevent macroalgal blooms which are likely to become problematic due to nutrient enrichment from proposed future WWTW input.*

Iverts

C	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 30%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton are abundant.* • *Macrobenthos should be abundant and dominated by polychaetes but should include amphipods, isopods, tanaids, and polychaetes. Insect taxa should occur in the upper littoral reaches littoral only.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata and Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species should not occur in abundance.*
Fish	
C	*As sampled by seine and gill net in open waters:* • *30 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 6 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni and Argyrosomus japonicas should be sampled with 80% frequency of occurrence.* • *Pelagic piscivores should occur (including Caranx spp).* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*

19 Mhlangeni RQOs

PES:	**C**	**REC:**	**C**	**TEC:**	**C**
Flow:					
PES	**nMAR (MCM)**		**pMAR (MCM)**		
B	*9.29*		*9.82*		
	Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).				
Sediment processes:					
D	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*				
Mouth state:					
B	*Mouth open conditions should be maintained within the current range: 55% (± 10%).*				
Water quality: Salinity					
B	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should be between 10 and 15 (to be confirmed).*				
Water quality: Other					
C	**Ecosystem health:**		**Recreational use:**	*N/A*	
	Water quality poses risk to REC/TEC, sufficiently reduced if: *DIN: Freshwater inflow, 50%ile <0.3 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.025 mg/l (high risk)* *DO: Entire estuary, average ≥4 mg/l (high risk)* *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events*		*Not identified as recreational area in stakeholder meeting*		

	Toxic substances: • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	
Macrophytes (plants)		
D	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries).* • *Maintain the integrity of the riparian zone. No further bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Prevent macroalgal blooms and reed encroachment which are likely to become problematic due to nutrient enrichment from proposed future WWTW input.*	
Iverts		
D	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 40%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton are abundant.* • *Macrobenthos should be abundant and dominated by amphipods and polycheates, but should include isopods, tanaids and the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata and Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species do not dominate macrobenthos.*	
Fish		
D	*As sampled by seine and gill net in open waters:* • *13 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 4 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 60% frequency of occurrence.* • *Pelagic piscivores should occur.* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomlies related to water quality.* *No fish kills should occur.*	

20 Zotsha RQOs

PES:	**B/C**	**REC:**	**B**	**TEC:**	**B**

Components that require interventions to achieve the TEC:
- *Restoration of estuarine riparian habitat;*
- *Improve water quality.*

Flow:

PES	**nMAR (MCM)**	**pMAR (MCM)**
B	*15.74*	*16.25*
	Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).	

Sediment processes:

B	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the*

	present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined). • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*
Mouth state:	
C	*Mouth open conditions should be maintained within the current range: 76% (± 5%).*
Water quality: Salinity	
D	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should be between 5 and 10 (to be confirmed).*
Water quality: Other	
D	**Ecosystem health:** *Water quality poses risk to REC/TEC, sufficiently reduced if:* *DIN: Freshwater inflow, 50%ile <0.2 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.015 mg/l (high risk)* *DO: Entire estuary, average ≥6 mg/l (high risk)* *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*
	Recreational use: *N/A* *Not identified as recreational area in stakeholder meeting*
Macrophytes (plants)	
C	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries).* • *Maintain the integrity of the riparian zone. No bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.*
Inverts	
C	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 40%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton are abundant.* • *Macrobenthos should be abundant and dominated by polychaetes but should include amphipods, isopods, tanaids and the crab Hymenosoma projectum. Insect taxa should occur in the far upper reaches only.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Molluscan assemblage should include bivalves (including Eumarcia paupercula) and gastropods (including Natica spp.).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata, Varuna litterata, Macrophthalmus sp., Sesarmidae and Uca sp,* • *Invasive alien species do not dominate macrobenthos.*
Fish	
B	*As sampled by seine and gill net in open waters:* • *18 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 4 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni and Argyrosomus japonicas should be sampled with 60% frequency of occurrence.* • *Pelagic piscivores should occur (including Caranx spp).* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*

21 Boboyi RQO

PES:	B/C	REC:	B/C	TEC:	B/C

Flow:

PES	nMAR (MCM)	pMAR (MCM)
B	*8.25*	*8.07*

Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).

Sediment processes:

C

- *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).*
- *Changes in tidal amplitude of less than 20% from present (to be determined).*
- *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*

Mouth state:

A *Mouth open conditions should be maintained within the current range: 95% (± 5%).*

Water quality: Salinity

A *The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should exceed 5 (to be confirmed).*

Water quality: Other

	Ecosystem health:	**Recreational use:**	*N/A*
C	*Water quality poses risk to REC/TEC, sufficiently reduced if:* *DIN: Freshwater inflow, 50%ile <0.2 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.015 mg/l (high risk)* *DO: Entire estuary, average ≥6 mg/l (high risk)* *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Not identified as recreational area in stakeholder meeting*	

Macrophytes (plants)

C

- *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries).*
- *Maintain the integrity of the riparian zone. No bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat. Restrict sugarcane cultivation within the EFZ.*
- *No invasive floating aquatic species present in the estuary e.g. water hyacinth.*
- *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.*
- *Prevent macroalgal blooms and reed encroachment which are likely to become problematic due to nutrient enrichment from future WWTW input.*

Inverts

B

As sampled by plankton net, grab and dip nets/traps (as appropriate):

- *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 40%.*
- *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton are abundant.*
- *Macrobenthos should be abundant and dominated by polychaetes but should include amphipods, isopods, tanaids and the crab Hymenosoma projectum. Insect taxa should occur in the far upper reaches only.*
- *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.*
- *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.*

	• *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata, Varuna litterata, Macrophthalmus sp., Sesarmidae and Uca sp,* • *Molluscan assemblage should include bivalves (including Eumarcia paupercula) and gastropods (including Nassarius kraussianus, Natica spp.).* • *Invasive alien species do not dominate macrobenthos.*
Fish	
C	*As sampled by seine and gill net in open waters:* • *25 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 5 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni and Argyrosomus japonicas should be sampled with 60% frequency of occurrence.* • *Pelagic piscivores should occur (including Caranx spp and Sphyraena spp.).* • • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*

22 Mbango RQOs

PES:	E	REC:	D	TEC:	EF
Water quality: Salinity					
D	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should be between 5 and 10 (to be confirmed).*				
Water quality: Other					
E	**Ecostystem health:**			**Recreational use:**	*N/A*
	Water quality poses risk to REC/TEC, sufficiently reduced if: *DIN: Freshwater inflow, 50%ile <0.5 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.125 mg/l (high risk)* *DO: Lower estuary, average ≥4 mg/l (high risk)* *Turbidity: Estuary, clear (<15 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*			*Not identified as recreational area in stakeholder meeting*	

23 uMzimkulu RQOs

PES:	B	REC:	B	TEC:	B
Components that require interventions to counteract the downwards trajectory and meet the TEC: • *Eradicate invasive alien vegetation* • *Remove derelict, redundant and old quays, jetties, wharfs and revetments; and rehabilitate banks;* • *Prohibit dredge spoil dumping in inappropriate areas;* • *Manage agricultural and industrial practices in the catchment, and* • *Control/reduce and control fishing pressure..*					
Flow:					
PES	**nMAR (MCM)**		**pMAR (MCM)**		
B	*1452.49*		*1175.14*		
	Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of				

	the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).		
Sediment processes:			
C	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*		
Mouth state:			
B	*Mouth open conditions should be maintained within the current range: 97% (± 3%).*		
Water quality: Salinity			
B	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches between 20 to 30, the middle reaches should be between 15 to 25, and the upper reaches between 0 and 5.*		
Water quality: Other			
B	**Ecosystem health:**	**Recreational use:**	*Yes*
	DIN: Freshwater inflow, 50%ile <0.2 mg/l *DIP: Freshwater inflow, 50%ile <0.015 mg/l* *DO: Entire estuary, average ≥6 mg/l* *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Paddling* *Microbiology: Sufficient levels (DEA, 2012)*	
Macrophytes (plants)			
B	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries).). In particular the swamp forest habitat is of importance.* • *Maintain the integrity of the riparian zone. No bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Maintain present salinity regime to maintain reed & sedge habitats (< 50 % loss of reed & sedge habitats in non-flood year).*		
Inverts			
C	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 30%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton are abundant.* • *Macrobenthos should be abundant and dominated by polychaetes but should include amphipods, isopods, tanaids, polychaetes and the crab Hymenosoma projectum. Insect taxa should occur in the far upper reaches only.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata, Varuna litterata, Macrophthalmus sp., Sesarmidae and Uca sp,* • *Molluscan assemblage should include bivalves (including Solen cylindraceus, Eumarcia paupercula) and gastropods (including Nassarius kraussianus, Natica spp., Polinices sp.).* • *Invasive alien species should not occur in abundance.*		
Fish			
B	*As sampled by seine and gill net in open waters:* • *30 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 6 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of*		

	occurrence (every sampling trip). • *Pomadasys commersonni and Argyrosomus japonicas should be sampled with 80% frequency of occurrence.* • *Pelagic piscivores should occur (including Caranx spp and Sphyraena spp.).* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*

24 uMthente (Mtentweni) RQOs

PES:	C	REC:	C	TEC:	C

Flow:

PES	nMAR (MCM)	pMAR (MCM)
C	*12.07*	*11.14*
	Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).	

Sediment processes:

D	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*

Mouth state:

B	*Mouth open conditions should be maintained within the current range: 40% (± 10%).*

Water quality: Salinity

B	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should exceed 5 (to be confirmed).*

Water quality: Other

D	**Ecosystem health:**	**Recreational use:**	*Yes*
	Water quality poses risk to REC/TEC, sufficiently reduced if: *DIN: Freshwater inflow, 50%ile <0.3 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.025 mg/l (high risk)* *DO: Entire estuary, average ≥4 mg/l (high risk)* *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Microbiology: Sufficient levels (DEA, 2012)*	

Macrophytes (plants)

D	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries).* • *Maintain the integrity of the riparian zone. No bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Prevent further reed encroachment into the main water channel.*

Inverts

C	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 40%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton are abundant.* • *Macrobenthos should be abundant and dominated by amphipods and polycheates, but should include isopods, tanaids and the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata and Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species do not dominate macrobenthos.*
Fish	
C	*As sampled by seine and gill net in open waters:* • *13 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 4 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 60% frequency of occurrence.* • *Pelagic piscivores should occur.* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomlies related to water quality.* *No fish kills should occur.*

25 Mhlangamkulu RQOs

PES:	**C**	**REC:**	**C**	**TEC:**	**C**
Flow:					
PES	**nMAR (MCM)**		**pMAR (MCM)**		
D	*2.06*		*1.73*		
	Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).				
Sediment processes:					
C	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*				
Mouth state:					
C	*Mouth open conditions should be maintained within the current range: 19% (± 10%).*				
Water quality: Salinity					
C	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should exceed 5 (to be confirmed).*				
Water quality: Other					
D	**Ecosystem health:**		**Recreational use:**		*Yes*
	Water quality poses risk to REC/TEC, sufficiently reduced if: **DIN: Freshwater inflow, 50%ile <0.3 mg/l (high risk)** **DIP: Freshwater inflow, 50%ile <0.025 mg/l (high risk)** **DO: Entire estuary, average ≥4 mg/l (high risk)** *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:*		*San Lameer* *Microbiology: Sufficient levels (DEA, 2012)*		

	• *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	
Macrophytes (plants)		
C	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries). Mangroves have been recorded in the estuary.* • *Maintain the integrity of the riparian zone. No bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Maintain present salinity regime to maintain reed & sedge habitats (< 50 % loss of reed & sedge habitats in non-flood year).*	
Inverts		
C	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 40%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei.* • *Macrobenthos should be abundant and dominated by amphipods, but should include isopods, tanaids, polychaetes, the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) are dominated by Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species do not dominate macrobenthos.*	
Fish		
C	*As sampled by seine and gill net in open waters:* • *10 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 3 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 60% frequency of occurrence.* • *Pelagic piscivores should occur.* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*	

26 Damba RQOs

PES:	**D**	**REC:**	**C**	**TEC:**	**D**
Flow:					
PES	**nMAR (MCM)**		**pMAR (MCM)**		
D	*4.56*		*3.85*		
	Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).				
Sediment processes:					
D	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).*				

	• *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*
Mouth state:	
D	*Mouth open conditions should be maintained within the current range: 28% (± 10%).*
Water quality: Salinity	
C	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should exceed 5 (to be confirmed).*
Water quality: Other	
D	**Ecosystem health:** / **Recreational use:** *Yes* *Water quality poses risk to REC/TEC, sufficiently reduced if:* *DIN: Freshwater inflow, 50%ile <0.3 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.025 mg/l (high risk)* *DO: Entire estuary, average ≥4 mg/l (high risk)* *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)* *Microbiology: Sufficient levels (DEA, 2012)*
Macrophytes (plants)	
D	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries).* • *Of particular concern would be >20 % change in the area covered by swamp forest and Barringtonia racemosa.* • *Maintain the integrity of the riparian zone. No further bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. Ageratum conyzoides, Balloon vine (Cardiospermum grandiflorum), castor oil bush (Ricinis communis), Spanish Gold (Sesbania punicea) and Triffid weed (Chromolaena odorata) cover <5% of total macrophyte area.* • *Prevent further reed encroachment into the main water channel.*
Inverts	
C	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 40%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei.* • *Macrobenthos should be abundant and dominated by amphipods, but should include isopods, tanaids, polychaetes, the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) are dominated by Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species do not dominate macrobenthos.*
Fish	
D	*As sampled by seine and gill net in open waters:* • *10 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 3 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 60% frequency of occurrence.* • *Pelagic piscivores should occur.* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*

27 Koshwana RQOs

PES:	C/D	REC:	B	TEC:	C

Components that require interventions to achieve the TEC:
- *Maintain water quality; and*
- *Partial restoration of estuarine habitat.*
- *Prevent low oxygen events that results in fish kills.*

Flow:

PES	nMAR (MCM)	pMAR (MCM)
	2.06	*2.05*
B	**Present flows poses a risk to the REC.** *Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).*	

Sediment processes:

D	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*

Mouth state:

B	*Mouth open conditions should be maintained within the current range: 26% (± 5%).*

Water quality: Salinity

B	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should exceed 10 (to be confirmed).*

Water quality: Other

E	**Ecosystem health:**	**Recreational use:**	*Yes*
	Water quality poses risk to REC/TEC, sufficiently reduced if: *DIN: Freshwater inflow, 50%ile <0.2 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.015 mg/l (high risk)* *DO: Entire estuary, average ≥6 mg/l (high risk)* *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Microbiology: Sufficient levels (DEA, 2012)*	

Macrophytes (plants)

D	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries).* • *Maintain the integrity of the riparian zone. No further bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *Area covered by invasive waterweeds (e.g. water hyacinth, Azolla filiculoides) and nuisance filamentous algae (e.g. Enteromorpha, Ulva, Cladophora) should cover <50% of water surface area.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Prevent algal blooms and reed encroachment which are likely to become problematic due to nutrient enrichment from further WWTW input.*

Inverts

D	*As sampled by plankton net, grab and dip nets/traps (as appropriate):*

	• *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 40%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei.* • *Macrobenthos should be abundant and dominated by amphipods, but should include isopods, tanaids, polychaetes, the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) are dominated by Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species do not dominate macrobenthos.*
Fish	
D	*As sampled by seine and gill net in open waters:* • *10 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 3 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 60% frequency of occurrence.* • *Pelagic piscivores should occur.* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*

28 Intshambili RQOs

PES:	C	REC:	B	TEC:	C

Components that require interventions to achieve the TEC:
- *Improve water quality; and*
- *Partial restoration of estuarine habitat.*
- *Prevent low oxegen events that results in fish kills.*

Flow:

PES	nMAR (MCM)	pMAR (MCM)
	6.48	*4.86*
E	**Present flows poses a risk to the REC.** *Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld, and if possible improved, to the estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).*	

Sediment processes:

C	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*

Mouth state:

D	*Mouth open conditions should be maintained within the current range: 42% (± 5%).*

Water quality: Salinity

B	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should exceed 15 (to be confirmed).*

Water quality: Other

C	**Ecosystem health:**	**Recreational use:**	*Yes*
	Water quality poses risk to REC/TEC, sufficiently reduced if: *DIN: Freshwater inflow, 50%ile <0.2 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.015 mg/l (high risk)* *DO: Entire estuary, average ≥6 mg/l (high risk)*	*Microbiology: Sufficient levels (DEA, 2012)*	

	Turbidity: Estuary, clear (<10 NTU) accept during high inflow events *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	
Macrophytes (plants)		
C	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries).* • *Of particular concern would be >20 % change in the area covered by swamp forest and Barringtonia racemosa.* • *Maintain the integrity of the riparian zone. No bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.*	
Inverts		
B	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 40%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton are abundant.* • *Macrobenthos should be abundant and dominated by amphipods and polycheates, but should include isopods, tanaids and the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata and Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species do not dominate macrobenthos.*	
Fish		
C	*As sampled by seine and gill net in open waters:* • *13 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 4 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 60% frequency of occurrence.* • *Pelagic piscivores should occur.* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomlies related to water quality.* *No fish kills should occur.*	

29 Mzumbe RQOs

PES:	**C/D**	**REC:**	**C**	**TEC:**	**C**

Components that require interventions to achieve the REC/TEC:
• *Restore estuarine riparian habitat.*

Flow:

PES	**nMAR (MCM)**	**pMAR (MCM)**
B	*58.53*	*52.78*
	Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).	

Sediment processes:

D	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).*

	• *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*
Mouth state:	
C	*Mouth open conditions should be maintained within the current range: 74% (± 10%).*
Water quality: Salinity	
B	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should exceed 10 (to be confirmed).*
Water quality: Other	
C	**Ecosystem health:** / **Recreational use:** *Yes* *DIN: Freshwater inflow, 50%ile <0.3 mg/l* *DIP: Freshwater inflow, 50%ile <0.025 mg/l* *DO: Entire estuary, average ≥4 mg/l* *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)* *Microbiology: Sufficient levels (DEA, 2012)*
Macrophytes (plants)	
E	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries).* • *Maintain the integrity of the riparian zone. No bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat. Sugarcane covers a large area of the EFZ and important swamp forest habitat has been removed.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Prevent further reed encroachment into the main water channel.*
Inverts	
D	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 40%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton are abundant.* • *Macrobenthos should be abundant and dominated by polychaetes but should include amphipods, isopods, tanaids, polychaetes and the crab Hymenosoma projectum. Insect taxa should occur in the far upper reaches only.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Molluscan assemblage should include bivalves (including Eumarcia paupercula) and gastropods (including Natica spp.).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata, Varuna litterata, Macrophthalmus sp., Sesarmidae and Uca sp,* • *Invasive alien species do not dominate macrobenthos.*
Fish	
D	*As sampled by seine and gill net in open waters:* • *18 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 4 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni and Argyrosomus japonicas should be sampled with 60% frequency of occurrence.* • *Pelagic piscivores should occur (including Caranx spp).* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*

30 Mhlabatshane RQOs

PES:	B/C	REC:	A/B	TEC:	B

Components that require interventions to achieve the TEC:
- *Improve water quality; and*
- *Partial restoration of estuarine riparian habitat.*

Flow:

PES	nMAR (MCM)	pMAR (MCM)
B	*6.46*	*6.48*

Present base flows poses a risk to the REC. *Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld, where possible improved, to the estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).*

Sediment processes:

C
- *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).*
- *Changes in tidal amplitude of less than 20% from present (to be determined).*
- *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*

Mouth state:

B *Mouth open conditions should be maintained within the current range: 50% (± 5%).*

Water quality: Salinity

B *The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should exceed 20 and that of the middle reaches exceed 10 (to be confirmed).*

Water quality: Other

	Ecosystem health:	**Recreational use:**	*Yes*
D	*Water quality poses risk to REC/TEC, sufficiently reduced if:* **DIN: Freshwater inflow, 50%ile <0.2 mg/l (high risk)** **DIP: Freshwater inflow, 50%ile <0.015 mg/l (high risk)** **DO: Entire estuary, average ≥6 mg/l (high risk)** *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Blue Flag Beach* *Microbiology: Excellent levels (DEA, 2012)*		

Macrophytes (plants)

C
- *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries). In particular the freshwater mangrove, Barringtonia racemosa, swamp forest would be of importance.*
- *Maintain the integrity of the riparian zone. No bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.*
- *No invasive floating aquatic species present in the estuary e.g. water hyacinth.*
- *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.*
- *Maintain present salinity regime to maintain reed & sedge habitats (< 50 % loss of reed & sedge habitats in non-flood year).*

Inverts

C *As sampled by plankton net, grab and dip nets/traps (as appropriate):*
- *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 30%.*

	• *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton are abundant.* • *Macrobenthos should be abundant and dominated by amphipods and polycheates, but should include isopods, tanaids and the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata and Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species should not occur in abundance.*
Fish	
	As sampled by seine and gill net in open waters: • *18 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 5 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 80% frequency of occurrence.* • *Pelagic piscivores should occur (including Caranx spp.).* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomlies related to water quality.* *No fish kills should occur.*

31 Mhlungwa RQOs

PES:	**C**	**REC:**	**C**	**TEC:**	**C**
Flow:					
PES	**nMAR (MCM)**		**pMAR (MCM)**		
B	*5.78*		*5.67*		
	Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).				
Sediment processes:					
E	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*				
Mouth state:					
B	*Mouth open conditions should be maintained within the current range: 29% (± 10%).*				
Water quality: Salinity					
B	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should exceed 10 (to be confirmed).*				
Water quality: Other					
C	**Ecosystem health:**		**Recreational use:**		*Yes*
	DIN: Freshwater inflow, 50%ile <0.3 mg/l *DIP: Freshwater inflow, 50%ile <0.025 mg/l* *DO: Entire estuary, average ≥4 mg/l* *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed*		*Microbiology: Sufficient levels (DEA, 2012)*		

	targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)	

Macrophytes (plants)

D	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries). In particular the freshwater mangrove, Barringtonia racemosa, swamp forest.* • *Maintain the integrity of the riparian zone. No bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat particularly by sugarcane cultivation.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.*

Inverts

D	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 40%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei.* • *Macrobenthos should be abundant and dominated by amphipods, but should include isopods, tanaids, polychaetes, the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) are dominated by Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species do not dominate macrobenthos.*

Fish

D	*As sampled by seine and gill net in open waters:* • *10 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 3 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 60% frequency of occurrence.* • *Pelagic piscivores should occur.* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*

32 Mfazazana RQOs

PES:	**C**	**REC:**	**B**	**TEC:**	**C**

Flow:

PES	**nMAR (MCM)**	**pMAR (MCM)**
B	*2.77*	*2.57*
	Present base flows poses a risk to the REC. *Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).*	

Sediment processes:

D	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*

Mouth state:

C	*Mouth open conditions should be maintained within the current range: 24% (± 5%).*

Water quality: Salinity			
B	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should be between 5 and 10 (to be confirmed).*		
Water quality: Other			
D	**Ecosystem health:**	**Recreational use:**	*Yes*
	Water quality poses risk to REC/TEC, sufficiently reduced if: **DIN: Freshwater inflow, 50%ile <0.2 mg/l (high risk)** **DIP: Freshwater inflow, 50%ile <0.015 mg/l (high risk)** **DO: Entire estuary, average ≥6 mg/l (high risk)** *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Microbiology: Sufficient levels (DEA, 2012)*	
Macrophytes (plants)			
D	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries). In particular the freshwater mangrove, Barringtonia racemosa, swamp forest.* • *Maintain the integrity of the riparian zone. No bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat particularly by sugarcane.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.*		
Inverts			
D	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 40%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei.* • *Macrobenthos should be abundant and dominated by amphipods, but should include isopods, tanaids, polychaetes, the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) are dominated by Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species do not dominate macrobenthos.*		
Fish			
D	*As sampled by seine and gill net in open waters:* • *10 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 3 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 60% frequency of occurrence.* • *Pelagic piscivores should occur.* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*		

33 Kwa-Makosi RQOs

PES:	B/C	REC:	B	TEC:	B
Components that require interventions to achieve the REC/TEC: • *Protect baseflows to estuary to maintain mouth state and salinity profile.* • *Improve water quality; and* • *Partial restoration of estuarine habitat.*					
Flow:					

PES	nMAR (MCM)	pMAR (MCM)
B	*3.23*	*3.03*
	Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).	
Sediment processes:		
C	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*	
Mouth state:		
B	*Mouth open conditions should be maintained within the current range: 37% (± 5%).*	
Water quality: Salinity		
B	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should be between 5 and 10 (to be confirmed).*	
Water quality: Other		
C	**Ecosystem health:**	**Recreational use:** *N/A*
	Water quality poses risk to REC/TEC, sufficiently reduced if: *DIN: Freshwater inflow, 50%ile <0.2 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.015 mg/l (high risk)* *DO: Entire estuary, average ≥6 mg/l (high risk)* *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Not identified as recreational area in stakeholder meeting*
Macrophytes (plants)		
C	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries). In particular the freshwater mangrove, Barringtonia racemosa, swamp forest.* • *Maintain the integrity of the riparian zone. No bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.*	
Inverts		
C	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 30%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton are abundant.* • *Macrobenthos should be abundant and dominated by amphipods and polycheates, but should include isopods, tanaids and the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata and Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species should not occur in abundance.*	
Fish		
C	*As sampled by seine and gill net in open waters:* • *18 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.*	

	• *Estuarine resident species should comprise a minimum of 5 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 80% frequency of occurrence.* • *Pelagic piscivores should occur (including Caranx spp.).* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomlies related to water quality.* *No fish kills should occur.*

34 Mnamfu RQO

PES:	C	REC:	C	TEC:	C

Flow:

PES	nMAR (MCM)	pMAR (MCM)
B	*3.08*	*2.88*
	Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).	

Sediment processes:

C	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*

Mouth state:

B	*Mouth open conditions should be maintained within the current range: 42% (± 10%).*

Water quality: Salinity

B	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should be between 5 and 10 (to be confirmed).*

Water quality: Other

D	**Ecosystem health:**	**Recreational use:**	*N/A*
	Water quality poses risk to REC/TEC, sufficiently reduced if: **DIN: Freshwater inflow, 50%ile <0.3 mg/l (high risk)** **DIP: Freshwater inflow, 50%ile <0.025 mg/l (high risk)** **DO: Entire estuary, average ≥4 mg/l (high risk)** *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Not identified as recreational area in stakeholder meeting*	

Macrophytes (plants)

C	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries). In particular the freshwater mangrove, Barringtonia racemosa, swamp forest is important.* • *Maintain the integrity of the riparian zone. No bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.*

Inverts	
D	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 40%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton are abundant.* • *Macrobenthos should be abundant and dominated by amphipods and polycheates, but should include isopods, tanaids and the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata and Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species do not dominate macrobenthos.*
Fish	
D	*As sampled by seine and gill net in open waters:* • *13 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 4 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 60% frequency of occurrence.* • *Pelagic piscivores should occur.* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomlies related to water quality.* *No fish kills should occur.*

35 Mtwalume RQOs

PES:	C	REC:	C	TEC:	C

Flow:		
PES	**nMAR (MCM)**	**pMAR (MCM)**
B	*57.60*	*41.79*
	Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).	

Sediment processes:	
C	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*

Mouth state:	
C	*Mouth open conditions should be maintained within the current range: 71% (± 10%).*

Water quality: Salinity	
B	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should be between 15 and 20 (to be confirmed).*

Water quality: Other			
C	**Ecostystem health:**	**Recreational use:**	*Yes*
	DIN: Freshwater inflow, 50%ile <0.3 mg/l *DIP: Freshwater inflow, 50%ile <0.025 mg/l* *DO: Entire estuary, average ≥4 mg/l*	*Microbiology: Sufficient levels (DEA, 2012)*	

	Turbidity: Estuary, clear (<10 NTU) accept during high inflow events *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	
Macrophytes (plants)		
C	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries* • *Maintain the integrity of the riparian zone. No bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.*	
Inverts		
C	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 40%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton are abundant.* • *Macrobenthos should be abundant and dominated by polychaetes but should include amphipods, isopods, tanaids, polychaetes and the crab Hymenosoma projectum. Insect taxa should occur in the far upper reaches only.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Molluscan assemblage should include bivalves (including Eumarcia paupercula) and gastropods (including Natica spp.).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata, Varuna litterata, Macrophthalmus sp., Sesarmidae and Uca sp,* • *Invasive alien species do not dominate macrobenthos.*	
Fish		
C	*As sampled by seine and gill net in open waters:* • *18 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 4 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni and Argyrosomus japonicas should be sampled with 60% frequency of occurrence.* • *Pelagic piscivores should occur (including Caranx spp).* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*	

36 Mvuzi RQOs

PES:	**C**	**REC:**	**C**	**TEC:**	**C**
Flow:					
PES	**nMAR (MCM)**		**pMAR (MCM)**		
B	*1.65*		*1.55*		
	Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).				
Sediment processes:					
D	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the*				

	present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined). • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*
Mouth state:	
C	*Mouth open conditions should be maintained within the current range: 23% (± 5%).*
Water quality: Salinity	
B	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should exceed 5 (to be confirmed).*
Water quality: Other	
C	**Ecosystem health:** / **Recreational use:** *N/A* *DIN: Freshwater inflow, 50%ile <0.3 mg/l* *DIP: Freshwater inflow, 50%ile <0.025 mg/l* *DO: Entire estuary, average ≥4 mg/l* *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)* *Not identified as recreational area in stakeholder meeting*
Macrophytes (plants)	
C	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries* • *Maintain the integrity of the riparian zone. No bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Prevent further reed encroachment into the main water channel.*
Inverts	
C	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 40%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei.* • *Macrobenthos should be abundant and dominated by amphipods, but should include isopods, tanaids, polychaetes, the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) are dominated by Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species do not dominate macrobenthos.*
Fish	
C	*As sampled by seine and gill net in open waters:* • *10 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 3 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 60% frequency of occurrence.* • *Pelagic piscivores should occur.* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*

37 Fafa RQOs

PES:	C/D	REC:	C	TEC:	C

Components that require interventions to achieve the TEC:
- *Restore estuarine habitat.*

Flow:

PES	nMAR (MCM)	pMAR (MCM)
C	*46.45*	*37.64*
	Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).	

Sediment processes:

D	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*

Mouth state:

C	*Mouth open conditions should be maintained within the current range: 45% (± 10%).*

Water quality: Salinity

B	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should be between 10 and 15 (to be confirmed).*

Water quality: Other

C	**Ecosystem health:**	**Recreational use:**	*Yes*
	DIN: Freshwater inflow, 50%ile <0.3 mg/l *DIP: Freshwater inflow, 50%ile <0.025 mg/l* *DO: Entire estuary, average ≥4 mg/l* *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Microbiology: Sufficient levels (DEA, 2012)*	

Macrophytes (plants)

D	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries). In particular maintain the integrity of the swamp forest.* • *Maintain the integrity of the riparian zone. No further bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat and sand mining in the upper reaches.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Prevent further reed encroachment into the main water channel.*

Inverts

D	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 40%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei,*

	but include other groups such as mysids. Meroplankton are abundant. • *Macrobenthos should be abundant and dominated by amphipods and polycheates, but should include isopods, tanaids and the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata and Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species do not dominate macrobenthos.*
Fish	
D	*As sampled by seine and gill net in open waters:* • *13 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 4 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 60% frequency of occurrence.* • *Pelagic piscivores should occur.* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomlies related to water quality.* *No fish kills should occur.*

38 Mdesingane RQOs

PES:	**D**	**REC:**	**D**	**TEC:**	**D**
Flow:					
PES	**nMAR (MCM)**		**pMAR (MCM)**		
A	*2.02*		*2.02*		
	Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).				
Sediment processes:					
E	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*				
Mouth state:					
D	*Mouth open conditions should be maintained within the current range: 58% (± 10%).*				
Water quality: Salinity					
B	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should exceed 5 (to be confirmed).*				
Water quality: Other					
E	**Ecosystem health:**			**Recreational use:**	*N/A*
	Water quality poses risk to REC/TEC, sufficiently reduced if: *DIN: Freshwater inflow, 50%ile <0.5 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.125 mg/l (high risk)* *DO: Lower estuary, average ≥4 mg/l (high risk)* *Turbidity: Estuary, clear (<15 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed*			*Not identified as recreational area in stakeholder meeting*	

	targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)	
Macrophytes (plants)		
E	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries).* • *Maintain the integrity of the riparian zone. No further bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Prevent further reed encroachment into the main water channel.*	
Inverts		
E	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 50%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton occur.* • *Macrobenthos should be abundant and dominated by amphipods and polycheates, but should include isopods, tanaids and the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Carid prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata and Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.*	
Fish		
E	*As sampled by seine and gill net in open waters:* • *6 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 3 species.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 30% frequency of occurrence.* • *Pelagic piscivores should occur).* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomlies related to water quality.* *No fish kills should occur.*	

39 Sezela RQOs

PES:	**C**	**REC:**	**C**	**TEC:**	**C**
Flow:					
PES	**nMAR (MCM)**		**pMAR (MCM)**		
B	*3.92*		*3.89*		
	Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).				
Sediment processes:					
D	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*				
Mouth state:					
B	*Mouth open conditions should be maintained within the current range: 19% (± 5%).*				
Water quality: Salinity					

B	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should exceed 10 (to be confirmed).*
Water quality: Other	

E	**Ecosystem health:**	**Recreational use:**	*N/A*
	Water quality poses risk to REC/TEC, sufficiently reduced if: *DIN: Freshwater inflow, 50%ile <0.3 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.25 mg/l (high risk)* *DO: Entire estuary, average ≥4 mg/l (high risk)* *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Not identified as recreational area in stakeholder meeting*	

Macrophytes (plants)	
D	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries).* • *Maintain the integrity of the riparian zone. No further bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Prevent algal blooms and reed encroachment that may become problematic due to nutrient enrichment from further proposed WWTW input.*
Inverts	
D	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 40%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei.* • *Macrobenthos should be abundant and dominated by amphipods, but should include isopods, tanaids, polychaetes, the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) are dominated by Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species do not dominate macrobenthos.*
Fish	
D	*As sampled by seine and gill net in open waters:* • *10 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 3 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 60% frequency of occurrence.* • *Pelagic piscivores should occur.* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*

40 Mkumbane RQOs

PES:	**C**	**REC:**	**C**	**TEC:**	**C**

Flow:		
PES	**nMAR (MCM)**	**pMAR (MCM)**
B	*3.79*	*3.54*
	Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the	

	Present (2015).		
Sediment processes:			
D	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*		
Mouth state:			
B	*Mouth open conditions should be maintained within the current range: 8% (± 5%).*		
Water quality: Salinity			
B	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should exceed 5 (to be confirmed).*		
Water quality: Other			
D	**Ecosystem health:**	**Recreational use:**	*N/A*
	Water quality poses risk to REC/TEC, sufficiently reduced if: *DIN: Freshwater inflow, 50%ile <0.3 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.025 mg/l (high risk)* *DO: Entire estuary, average ≥4 mg/l (high risk)* *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Not identified as recreational area in stakeholder meeting*	
Macrophytes (plants)			
D	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries).* • *Maintain the integrity of the riparian zone. No further bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Prevent further reed encroachment into the main water channel.*		
Inverts			
D	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 40%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei.* • *Macrobenthos should be abundant and dominated by amphipods, but should include isopods, tanaids, polychaetes, the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) are dominated by Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species do not dominate macrobenthos.*		
Fish			
D	*As sampled by seine and gill net in open waters:* • *10 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 3 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 60% frequency of occurrence.* • *Pelagic piscivores should occur.* • *No alien fish species should occur.*		

	• *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*

41 uMuziwezinto (Mzinto) RQOs

PES:	C/D	REC:	C/D	TEC:	C/D

Flow:

PES	nMAR (MCM)	pMAR (MCM)
	23.17	*20.09*
C	*Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).*	

Sediment processes:

D	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of 2 from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a 5 year average.*

Mouth state:

C	*Mouth open conditions should be maintained within the current range: 15% (± 5%).*

Water quality: Salinity

C	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should exceed 5 (to be confirmed).*

Water quality: Other

	Ecosystem health:	**Recreational use:**	*N/A*
D	*Water quality poses risk to REC/TEC, sufficiently reduced if:* *DIN: Freshwater inflow, 50%ile <0.3 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.025 mg/l (high risk)* *DO: Entire estuary, average ≥4 mg/l (high risk)* *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Not identified as recreational area in stakeholder meeting*	

Macrophytes (plants)

D	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries). In particular the freshwater mangrove, Barringtonia racemosa, swamp forest is important.* • *Maintain the integrity of the riparian zone. No further bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.*

Inverts

D	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 40%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei.* • *Macrobenthos should be abundant and dominated by amphipods, but should include isopods, tanaids, polychaetes, the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.*

	• *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) are dominated by Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species do not dominate macrobenthos.*
Fish	
D	*As sampled by seine and gill net in open waters:* • *10 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 3 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 60% frequency of occurrence.* • *Pelagic piscivores should occur.* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*

42 Nkomba RQOs

PES:	B/C	REC:	B/C	TEC:	B/C
Flow:					

PES	nMAR (MCM)	pMAR (MCM)
	0.69	*0.69*
A	*Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).*	

Sediment processes:	
C	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*
Mouth state:	
A	*Mouth open conditions should be maintained within the current range: 10% (± 5%).*
Water quality: Salinity	
A	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should exceed 5 (to be confirmed).*
Water quality: Other	

D	**Ecostystem health:**	**Recreational use:**	*N/A*
	Water quality poses risk to REC/TEC, sufficiently reduced if: *DIN: Freshwater inflow, 50%ile <0.3 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.025 mg/l (high risk)* *DO: Entire estuary, average ≥4 mg/l (high risk)* *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Not identified as recreational area in stakeholder meeting*	

Macrophytes (plants)

D	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries).* • *Maintain the integrity of the riparian zone. No further bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.*
Inverts	
D	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 30%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei.* • *Macrobenthos should be abundant and dominated by amphipods, but should include isopods, tanaids, polychaetes, the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) are dominated by Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods (including Melanoides tuberculata).* • *Invasive alien species should not occur in abundance.*
Fish	
C	*As sampled by seine and gill net in open waters:* • *15 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 4 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 70% frequency of occurrence.* • *Pelagic piscivores should occur.* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*

43 Mzimayi RQOs

PES:	**C/D**	**REC:**	**C/D**	**TEC:**	**C/D**
Flow:					
PES	**nMAR (MCM)**		**pMAR (MCM)**		
D	*6.15*		*4.55*		
	Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).				
Sediment processes:					
C	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*				
Mouth state:					
D	*Mouth open conditions should be maintained within the current range: 20% (± 5%).*				
Water quality: Salinity					
C	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should be between 0 and 5 (to be confirmed).*				

Water quality: Other			
D	**Ecosystem health:**	**Recreational use:**	*Yes*
	Water quality poses risk to REC/TEC, sufficiently reduced if: *DIN: Freshwater inflow, 50%ile <0.3 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.025 mg/l (high risk)* *DO: Entire estuary, average ≥4 mg/l (high risk)* *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Microbiology: Sufficient levels (DEA, 2012)*	
Macrophytes (plants)			
C	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries).* • *Maintain the integrity of the riparian zone. No bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Prevent further reed encroachment into the main water channel.*		
Inverts			
D	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 40%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei.* • *Macrobenthos should be abundant and dominated by amphipods, but should include isopods, tanaids, polychaetes, the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) are dominated by Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species do not dominate macrobenthos.*		
Fish			
C	*As sampled by seine and gill net in open waters:* • *10 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 3 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 60% frequency of occurrence.* • *Pelagic piscivores should occur.* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*		

44 Mpambanyoni RQOs

PES:	**C**	**REC:**	**C**	**TEC:**	**C**
Flow:					
PES	**nMAR (MCM)**		**pMAR (MCM)**		
B	*60.06*		*55.53*		
	Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).				
Sediment processes:					

D	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*

Mouth state:

B	*Mouth open conditions should be maintained within the current range: 78% (± 10%).*

Water quality: Salinity

A	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should be between 10 and 15 (to be confirmed).*

Water quality: Other

D	**Ecosystem health:**	**Recreational use:**	*Yes*
	Water quality poses risk to REC/TEC, sufficiently reduced if: *DIN: Freshwater inflow, 50%ile <0.3 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.025 mg/l (high risk)* *DO: Entire estuary, average ≥4 mg/l (high risk)* *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Scottborough* *Microbiology: Sufficient levels (DEA, 2012)*	

Macrophytes (plants)

D	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries).* • *Maintain the integrity of the riparian zone. No further bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat particularly by sugarcane cultivation.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.*

Inverts

D	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 40%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton are abundant.* • *Macrobenthos should be abundant and dominated by polychaetes but should include amphipods, isopods, tanaids, polychaetes and the crab Hymenosoma projectum. Insect taxa should occur in the far upper reaches only.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Molluscan assemblage should include bivalves (including Eumarcia paupercula) and gastropods (including Natica spp.).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata, Varuna litterata, Macrophthalmus sp., Sesarmidae and Uca sp.* • *Invasive alien species do not dominate macrobenthos.*

Fish

C	*As sampled by seine and gill net in open waters:* • *18 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 4 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni and Argyrosomus japonicas should be sampled with 60% frequency of occurrence.*

	• *Pelagic piscivores should occur (including Caranx spp).* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*

45 Mahlongwa RQOs

PES:	C	REC:	B	TEC:	B

Components that require interventions to achieve the REC/TEC:
- *Protect baseflows to estuary to maintain mouth state and salinity profile.*
- *Improve water quality; and*
- *Partial restoration estuarine riparian habitat; and*
- *Control and reduce fishing pressure..*

Flow:

PES	nMAR (MCM)	pMAR (MCM)
B	*13.76*	*13.18*
	Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).	

Sediment processes:

D	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*

Mouth state:

A	*Mouth open conditions should be maintained within the current range: 22% (± 5%).*

Water quality: Salinity

B	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should exceed 10 (to be confirmed).*

Water quality: Other

D	**Ecosystem health:**	**Recreational use:**	*Yes*
	Water quality poses risk to REC/TEC, sufficiently reduced if: *DIN: Freshwater inflow, 50%ile <0.2 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.015 mg/l (high risk)* *DO: Entire estuary, average ≥6 mg/l (high risk)* *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Microbiology: Sufficient levels (DEA, 2012)*	

Macrophytes (plants)

C	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries).* • *Maintain the integrity of the riparian zone. No bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Maintain present salinity regime to maintain reed & sedge habitats (< 50 % loss of reed & sedge habitats in non-flood year).* • *Improve salinity regime to encourage the reestablishment of mangrove habitat.*

Inverts	
C	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 30%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei.* • *Macrobenthos should be abundant and dominated by amphipods, but should include isopods, tanaids, polychaetes, the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) are dominated by Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods (including Melanoides tuberculata).* • *Invasive alien species should not occur in abundance.*
Fish	
C	*As sampled by seine and gill net in open waters:* • *15 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 4 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 70% frequency of occurrence.* • *Pelagic piscivores should occur.* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*

46 Mahlongwane RQOs

PES:	**C**	**REC:**	**B**	**TEC:**	**B**

Components that require interventions to achieve the REC/TEC:
- *Protect baseflows to estuary to maintain mouth state and salinity profile.*
- *Improve water quality; and*
- *Partial restoration of estuarine riparian habitat.*

Flow:

PES	**nMAR (MCM)**	**pMAR (MCM)**
B	**2.69**	**2.93**
	Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).	

Sediment processes:	
D	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*
Mouth state:	
B	*Mouth open conditions should be maintained within the current range: 13% (± 5%).*
Water quality: Salinity	
B	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should exceed 10 (to be confirmed).*
Water quality: Other	

D	**Ecosystem health:**	**Recreational use:**	*Yes*

	Water quality poses risk to REC/TEC, sufficiently reduced if: *DIN: Freshwater inflow, 50%ile <0.2 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.015 mg/l (high risk)* *DO: Entire estuary, average ≥6 mg/l (high risk)* *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Microbiology: Sufficient levels (DEA, 2012)*
Macrophytes (plants)		
D	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries). In particular the Barringtonia racemosa and Hibiscus tiliaceus swamp forest is important.* • *Maintain the integrity of the riparian zone. No further bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Prevent further reed encroachment into the main water channel.*	
Inverts		
C	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 30%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei.* • *Macrobenthos should be abundant and dominated by amphipods, but should include isopods, tanaids, polychaetes, the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) are dominated by Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods (including Melanoides tuberculata).* • *Invasive alien species should not occur in abundance.*	
Fish		
C	*As sampled by seine and gill net in open waters:* • *15 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 4 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 70% frequency of occurrence.* • *Pelagic piscivores should occur.* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*	

47 Ngane RQOs

PES:	**C**	**REC:**	**C**	**TEC:**	**C**
Flow:					
PES	**nMAR (MCM)**		**pMAR (MCM)**		
B	*3.83*		*4.30*		
	Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).				
Sediment processes:					
D	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical*				

	habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined). • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*
Mouth state:	
C	*Mouth open conditions should be maintained within the current range: 54% (± 5%).*
Water quality: Salinity	
C	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should be between 5 and 10 (to be confirmed).*
Water quality: Other	

C	**Ecosystem health:**	**Recreational use:**	*Yes*
	DIN: Freshwater inflow, 50%ile <0.3 mg/l *DIP: Freshwater inflow, 50%ile <0.025 mg/l* *DO: Entire estuary, average ≥4 mg/l* *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Microbiology: Sufficient levels (DEA, 2012)*	

Macrophytes (plants)	
D	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries).* • *Maintain the integrity of the riparian zone. No further bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Maintain some saline input to encourage the growth of mangroves (e.g. Bruguiera gymnorrhiza).* • *Prevent disturbance and further reed encroachment into the main water channel.*
Inverts	
D	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 40%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton are abundant.* • *Macrobenthos should be abundant and dominated by amphipods and polycheates, but should include isopods, tanaids and the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata and Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species do not dominate macrobenthos.*
Fish	
D	*As sampled by seine and gill net in open waters:* • *13 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 4 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 60% frequency of occurrence.* • *Pelagic piscivores should occur.* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomlies related to water quality.* *No fish kills should occur.*

48 Umgababa RQOs

PES:	C	REC:	B	TEC:	B/C

Components that require interventions to achieve the REC/TEC:
- *Improve water quality; and*
- *Partial restoration of estuarine habitat.*

Flow:

PES	nMAR (MCM)	pMAR (MCM)
C	*10.56*	*9.58*
	Present base flows poses a risk to the REC. *Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).*	

Sediment processes:

C	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*

Mouth state:

C	*Mouth open conditions should be maintained within the current range: 46% (± 5%).*

Water quality: Salinity

B	*The system needs variability in salinity regime, with a measurable increase in salinity in the system during the low flow season. Mid-waters in the lower reaches should exceed 15, while the middle and upper reaches should exceed 10 and 5 respectivly (to be confirmed).*

Water quality: Other

C	**Ecosystem health:**	**Recreational use:**	*Yes*
	Water quality poses risk to REC/TEC, sufficiently reduced if: *DIN: Freshwater inflow, 50%ile <0.2 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.015 mg/l (high risk)* *DO: Entire estuary, average ≥6 mg/l (high risk)* *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Microbiology: Sufficient levels (DEA, 2012)*	

Macrophytes (plants)

D	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries). Submerged macrophytes (Ruppia and Zostera) used to occur in this estuary. The large Juncus kraussii stands are important.* • *Maintain the integrity of the riparian zone. No further bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the important floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Maintain present salinity regime to maintain reed & sedge habitats (< 50 % loss of reed & sedge habitats in non-flood year).* • *Improve salinity regime to encourage the reestablishment of mangrove habitat.*

Inverts

C	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 30%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton are abundant.* • *Macrobenthos should be abundant and dominated by amphipods and polycheates, but should include isopods, tanaids and the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata and Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species should not occur in abundance.*
Fish	
C	*As sampled by seine and gill net in open waters:* • *18 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 5 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 80% frequency of occurrence.* • *Pelagic piscivores should occur (including Caranx spp.).* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomlies related to water quality.* *No fish kills should occur.*

49 Msimbazi RQOs

PES:	**B**	**REC:**	**A**	**TEC:**	**B**

Flow:

PES	**nMAR (MCM)**	**pMAR (MCM)**
	10.04	*10.34*
A	*Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).*	

Sediment processes:	
C	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*
Mouth state:	
A	*Mouth open conditions should be maintained within the current range: 36% (± 5%).*
Water quality: Salinity	
B	*The system needs variability in salinity regime, with a measurable increase in salinity in the system during the low flow season. Mid-waters in the lower reaches should exceed 15, while the middle and upper reaches should exceed 10 and 5 respectivly (to be confirmed).*
Water quality: Other	

C	**Ecostystem health:**	**Recreational use:**	*Yes*
	Water quality poses risk to REC/TEC, sufficiently reduced if: *DIN: Freshwater inflow, 50%ile <0.2 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.015 mg/l (high risk)* *DO: Entire estuary, average ≥6 mg/l (high risk)* *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events*	*Microbiology: Sufficient levels (DEA, 2012)*	

	Toxic substances: • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	
Macrophytes (plants)		
D	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries).* • *Maintain the integrity of the riparian zone. No further bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Maintain present salinity regime to maintain reed & sedge habitats (< 50 % loss of reed & sedge habitats in non-flood year).* • *Improve the salinity regime to encourage the re-establishment of mangrove habitat.*	
Inverts		
B	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 30%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton are abundant.* • *Macrobenthos should be abundant and dominated by amphipods and polycheates, but should include isopods, tanaids and the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata and Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species should not occur in abundance.*	
Fish		
C	*As sampled by seine and gill net in open waters:* • *18 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 5 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 80% frequency of occurrence.* • *Pelagic piscivores should occur (including Caranx spp.).* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomlies related to water quality.* *No fish kills should occur.*	

50 Lovu RQOs

PES:	C/D	REC:	B	TEC:	B/C
Components that require interventions to achieve the TEC: • *Improve water quality; and* • *Partial restoration of estuarine habitat.*					
Flow:					
PES	**nMAR (MCM)**		**pMAR (MCM)**		
D	*119.10*		*82.47*		
	Flows should not exceed natural and seasonal distribution should not be compromised. Current baseflows should be upheld into estuary to maintain present mouth state and salinity regime. Distribution patterns of the flood components differ by no more than 10% (magnitude, timing and variability) from that of the Present (2015). **The Present baseflows/ low flows poses a risk to the REC and should be elevated.**				
Sediment processes:					
D	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the*				

	present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined). • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*
Mouth state:	
C	*Mouth open conditions should be maintained within the current range: 77% (± 5%).*
Water quality: Salinity	
C	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season.* *PES: Mid-waters in the lower reaches should exceed 25, the middle reaches it should exceed 20, while the upper reaches should vary between 10 to 15* *REC: Mid-waters in the lower reaches should vary between 20 to 35, the middle reaches it should exceed 15, while the upper reaches should vary between 5 to 10.*
Water quality: Other	
C	**Ecosystem health:** / **Recreational use:** *Yes* *Water quality poses risk to REC/TEC, sufficiently reduced if:* *DIN: Freshwater inflow, 50%ile <0.2 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.015 mg/l (high risk)* *DO: Entire estuary, average ≥6 mg/l (high risk)* *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)* *Microbiology: Sufficient levels (DEA, 2012)*
Macrophytes (plants)	
D	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries). In particular the swamp forest habitat is important.* • *Maintain the integrity of the riparian zone. No further bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Improve the salinity regime to encourage the re-establishment of mangrove habitat.*
Inverts	
C	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton & benthic assemblages (baselines to be set) not deviate by > 30%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton are abundant.* • *Macrobenthos should be abundant and dominated by amphipods and polycheates, but should include isopods, tanaids and the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata and Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species should not occur in abundance.*
Fish	
C	*As sampled by seine and gill net in open waters:* • *25 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 5 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni and Argyrosomus japonicas should be sampled with 80% frequency of occurrence.* • *Pelagic piscivores should occur (including Caranx spp).* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.*

	No fish kills should occur.

51 Little aManzimtoti RQOs

PES:	E	REC:	D	TEC:	EF

Components that require interventions to achieve the REC:
- *Reduce some of the baseflows to estuary to improve mouth state and salinity profile.*
- *Significant improvement in water quality; and*
- *Partial restoration of estuarine habitat.*
- *Prevent low oxegen events that results in fish kills.*

Water quality: Other

E	**Ecosystem health:**	**Recreational use:**	*Yes*
	Water quality poses risk to REC/TEC, sufficiently reduced if: *DIN: Freshwater inflow, 50%ile <0.5 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.125 mg/l (high risk)* *DO: Lower estuary, average ≥4 mg/l (high risk)* *Turbidity: Estuary, clear (<15 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Microbiology: Sufficient levels (DEA, 2012)*	

52 aManzimtoti RQOs

PES:	D/E	REC:	D	TEC:	D

Components that require interventions to achieve the REC:
- *Protect baseflows to estuary to maintain mouth state and salinity profile.*
- **Improve catchment water quality***; and*
- *Maintain estuarine habitat.*
- *Prevent low oxygen events that results in fish kills.*

Flow:

PES	nMAR (MCM)	pMAR (MCM)
C	*5.30*	*6.75*
	Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).	

Sediment processes:

D	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*

Mouth state:

C	*Mouth open conditions should be maintained within the current range: 44% (± 5%).*

Water quality: Salinity

C	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should exceed 15, the middle reaches should exceed 10, while the upper reaches exceed 5.*

Water quality: Other			
F	**Ecosystem health:**	**Recreational use:**	*Yes*
	Water quality poses risk to REC/TEC, sufficiently reduced if: *DIN: Freshwater inflow, 50%ile <0.5 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.125 mg/l (high risk)* *DO: Lower estuary, average ≥4 mg/l (high risk)* *Turbidity: Estuary, clear (<15 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Microbiology: Sufficient levels (DEA, 2012)*	
Macrophytes (plants)			
E	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries). Maintain the integrity of the riparian zone.* • *No further bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Area covered by invasive waterweeds (e.g. water hyacinth, Azolla filiculoides) and nuisance filamentous algae (e.g. Enteromorpha, Ulva, Cladophora) should cover <50% of water surface area.*		
Inverts			
F	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 50%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton occur.* • *Macrobenthos should be abundant and dominated by amphipods and polycheates, but should include isopods, tanaids and the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Carid prawns should occur.* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata and Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.*		
Fish			
F	*As sampled by seine and gill net in open waters:* • *6 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 3 species.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 30% frequency of occurrence.* • *Pelagic piscivores (e.g. Caranx spp.) should occur.* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomlies related to water quality.* *No fish kills should occur.*		

53 Mbokodweni RQOs

PES:	E	REC:	D	TEC:	EF
Water quality: Other					
F	**Ecosystem health:**		**Recreational use:**	*Yes*	
	Water quality poses risk to REC/TEC, sufficiently reduced if: **DIN: Freshwater inflow, 50%ile <0.5 mg/l (high risk)** **DIP: Freshwater inflow, 50%ile <0.125 mg/l (high risk)** **DO: Lower estuary, average ≥4 mg/l (high risk)** *Turbidity: Estuary, clear (<15 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);*		*Microbiology: Sufficient levels (DEA, 2012)*		

	• *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	

54 Sipingo RQOs

PES:	F	REC:	E	TEC:	EF

Water quality: Salinity

F	*The system needs variability in salinity regime, with a measurable increase in salinity during the low flow season. Mid-waters in the lower reaches should exceed 30, the middle reaches should exceed 20, while the upper reaches is 5 (to be confirmed).*

Water quality: Other

F	**Ecosystem health:**	**Recreational use:**	*Yes*
	Water quality poses risk to REC/TEC, sufficiently reduced if: **DIN: Freshwater inflow, 50%ile <0.5 mg/l (high risk)** **DIP: Freshwater inflow, 50%ile <0.125 mg/l (high risk)** **DO: Lower estuary, average ≥4 mg/l (high risk)** *Turbidity: Estuary, clear (<15 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Microbiology: Sufficient levels (DEA, 2012)*	

55 Durban Bay RQOs for shallow water and intertidal areas

PES:	E	REC:	D*	TEC:	D*

Components that require interventions to restore functionality (not back to refrence) to Durban Bay (achive the REC/TEC):
- *Protect baseflows to estuary to maintain mouth state and salinity profile.*
- *Improve water quality;*
- *Reduce fishing effort, and*
- *Partial restoration of estuarine habitat in upper reaches.*
- *Prevent low oxegen events that results in fish kills.*

Flow:

PES	nMAR (MCM)	pMAR (MCM)
	36.33	*63.44*
D	*Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).*	

Sediment processes:

F	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*

Hydrodynamics:

E	*Mouth open conditions should be maintained within the current range: 100%*

Water quality: Salinity

E	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should be between 30 and 35, while the*

	upper reaches should vary between 25 to 30.		
Water quality: Other			
C	**Ecosystem health:**	**Recreational use:**	*Yes*
	Water quality poses risk to REC/TEC, sufficiently reduced if: *DIN: Freshwater inflow, 50%ile <0.3 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.025 mg/l (high risk)* *DO: Entire estuary, average ≥4 mg/l (high risk)* *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Microbiology: Sufficient levels (DEA, 2012)*	
Macrophytes (plants)			
F	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries). In particular the remnant intertidal mangrove areas are important.* • *Prevent further disturbance and development of the riparian and floodplain habitat.*		
Inverts			
F	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 50%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton occur frequently.* • *Macrobenthos should be abundant and dominated by polychaetes but should include amphipods, isopods, tanaids, polychaetes.* • *Chironomid larvae, oligochaetes and the polychaete Capitella capitata should not occur in abundance and should not dominate the benthos.* • *Penaeid prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas throughout and should be abundant on the system's sandbanks in the lower reaches.* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata, Macrophthalmus sp., Portunus sanguinolentus, Sesarmidae and Uca sp.* • *Molluscan assemblage should include bivalves (including tellinids, Solen cylindraceus, Eumarcia paupercula, Dosinia hepatica) and gastropods (including Nassarius kraussianus, Natica spp. and Polinices sp.).* • *Invasive alien species do not occur in the soft sedminent macrobenthos.*		
Fish			
F	*As sampled by seine and gill net in open waters:* • *30 species should occur to include estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 3 species.* • *Liza dumerilli, Acathopagurs vagus, Rhabdosargus holubi, Sillago sihama, Gerres filamentosus, Ambassis spp., Leiognathus equula and Pomadasys commersonni should be sampled with 100% frequency of occurrence (ie, every sampling trip).* • *Pelagic piscivores should occur (including Caranx and Sphyraena spp.).* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*		

56 uMngeni (Mgeni) RQOs

PES:	D/E	REC:	D	TEC:	D

Components that require interventions to achieve the REC/TEC:

- *Restore baseflows to estuary to improve mouth state and salinity profile and Implement flow allocation in an estuary friendly manneri*
- *A significant improvement in water quality needed; and*
- *Restoration of macrophytes: removal of alien plant species, replanting/ reintroduction with indigenous species (some of which is already occurring)*
- *Wetland engineering (creation of new wetland habitats in close proximity to the uMngeni River banks,.*
- *Review the current breaching policy that only requires breaching after 2 to 3 weeks, this poses a risk to plant communities and birds.*
- *Develop an Estuary Management Plan*

• *Prevent low oxegen events that results in fish kills.*		
Flow:		
PES	**nMAR (MCM)**	**pMAR (MCM)**
D	*671.30*	*208.46*
	Present flows poses a risk to the REC/TEC. *Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).*	
Sediment processes:		
E	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*	
Mouth state:		
F	*Mouth open conditions should be maintained within the current range: 95% (+5%).*	
Water quality: Salinity		
F	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should be between 5 and 10 (to be confirmed).*	
Water quality: Other		
D	**Ecosystem health:**	**Recreational use:** *Yes*
	DIN: Freshwater inflow, 50%ile <0.5 mg/l *DIP: Freshwater inflow, 50%ile <0.125 mg/l* *DO: Lower estuary, average ≥4 mg/l* *Turbidity: Estuary, clear (<15 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Microbiology: Sufficient levels (DEA, 2012)*
Macrophytes (plants)		
F	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries). In particular the mangrove habitat is important.* • *Maintain the integrity of the riparian zone. No additional bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Area covered by invasive waterweeds (e.g. water hyacinth, Azolla filiculoides) and nuisance filamentous algae (e.g. Enteromorpha, Ulva, Cladophora) should cover <50% of water surface area.*	
F	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 50%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton occur frequently.* • *Macrobenthos should be abundant and dominated by polychaetes but should include amphipods, isopods, tanaids, and the crab Hymenosoma projectum. Insect taxa should occur in the far upper reaches only.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid prawns should occur.* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata, Varuna litterata, Macrophthalmus sp., Sesarmidae and Uca sp,* • *Molluscan assemblage should include bivalves and gastropods (including Nassarius kraussianus, Natica spp.).*	

	• *Invasive alien species do not dominate macrobenthos in lower reaches.*
Fish	
F	*As sampled by seine and gill net in open waters:* • *12 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 3 species.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni and Argyrosomus japonicas should be sampled with 30% frequency of occurrence.* • *Pelagic piscivores should occur (including Caranx spp.).* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*

57 Mhlanga RQOs

PES:	D	REC:	B	TEC:	B

Components that require interventions to achieve the TEC:
Ensure that the existing pumping scheme comes into operation so that:
- *Restore baseflows to estuary to improve mouth state and salinity profile.*
- *A significant improvement in water quality needed; and*
- *Partial restoration of estuarine habitat.*
- *Prevent low oxegen events that results in fish kills.*

Flow:

PES	nMAR (MCM)	pMAR (MCM)
	13.34	*22.33*
D	**Present flows poses a risk to the REC.** *Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).*	

Sediment processes:

D	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*

Mouth state:

D	*Mouth open conditions should be maintained within the current range: 48% (± 10%).*

Water quality: Salinity

E	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should be between 5 and 10 (to be confirmed).*

Water quality: Other

D	**Ecosystem health:**	**Recreational use:**	*Yes*
	Water quality poses risk to REC/TEC, sufficiently reduced if: **DIN: Freshwater inflow, 50%ile <0.2 mg/l (high risk)** **DIP: Freshwater inflow, 50%ile <0.015 mg/l (high risk)** **DO: Entire estuary, average ≥6 mg/l (high risk)** *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention*	*Microbiology: Sufficient levels (DEA, 2012)*	

	Secretariat and CSIR, 2009)	
Macrophytes (plants)		
C	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries). In particular the swamp forest habitat is important.* • *Maintain the integrity of the riparian zone. No bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Improve salinity regime to encourage reestablishment of mangrove habitat.*	
Inverts		
E	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 30%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton are abundant.* • *Macrobenthos should be abundant and dominated by amphipods and polycheates, but should include isopods, tanaids and the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata and Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species should not occur in abundance.*	
Fish		
E	*As sampled by seine and gill net in open waters:* • *18 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 5 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 80% frequency of occurrence.* • *Pelagic piscivores should occur (including Caranx spp.).* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomlies related to water quality.* *No fish kills should occur.*	

58 uMdloti (Mdloti) RQOs

PES:	**D**	**REC:**	**C**	**TEC:**	**D**

Components that require interventions to achieve the TEC:
- *Restore baseflows to estuary to improve mouth state and salinity profile.*
- *A significant improvement in water quality needed; and*
- *Partial restoration of estuarine habitat.*
- *Prevent low oxegen events that results in fish kills.*

Flow:

PES	**nMAR (MCM)**	**pMAR (MCM)**
D	*100.19*	*85.03*
	Present flows poses a risk to the REC. *Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).*	

Sediment processes:

C	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter*

	deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.
Mouth state:	
D	*Mouth open conditions should be maintained within the current range: 40% (± 5%).*
Water quality: Salinity	
B	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should be between 5 and 10 (to be confirmed).*
Water quality: Other	

F	**Ecosystem health:**	**Recreational use:**	*Yes*
	Water quality poses risk to REC/TEC, sufficiently reduced if: *DIN: Freshwater inflow, 50%ile <0.3 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.025 mg/l (high risk)* *DO: Entire estuary, average ≥4 mg/l (high risk)* *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Windsurfing* *Microbiology: Sufficient levels (DEA, 2012)*	

Macrophytes (plants)	
D	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries). In particular the swamp forest habitat is important.* • *Maintain the integrity of the riparian zone. No further bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Maintain present salinity regime to maintain reed & sedge habitats (< 50 % loss of reed & sedge habitats in non-flood year).*
Inverts	
D	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 50%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton occur.* • *Macrobenthos should be abundant and dominated by amphipods and polycheates, but should include isopods, tanaids and the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Carid prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata and Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.*
Fish	
D	*As sampled by seine and gill net in open waters:* • *6 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 3 species.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 30% frequency of occurrence.* • *Pelagic piscivores should occur.* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomlies related to water quality.* *No fish kills should occur.*

59 uThongathi (Tongati) RQOs

PES:	D	REC:	C	TEC:	D

Components that require interventions to achieve the REC/TEC:
- *Restore baseflows to estuary to improve mouth state and salinity profile.*
- *A significant improvement in water quality needed; and*
- *Partial restoration of estuarine habitat.*
- *Prevent low oxegen events that results in fish kills.*

Flow:

PES	nMAR (MCM)	pMAR (MCM)
C	*70.79*	*79.21*

Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).

Present flows poses a risk to the REC.

Sediment processes:

D

- *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).*
- *Changes in tidal amplitude of less than 20% from present (to be determined).*
- *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*

Mouth state:

B *Mouth open conditions should be maintained within the current range: 84% (± 10%).*

Water quality: Salinity

C *The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should be between 5 and 10 (to be confirmed).*

Water quality: Other

F

Ecosystem health:	**Recreational use:**	*N/A*
Water quality poses risk to REC/TEC, sufficiently reduced if: *DIN: Freshwater inflow, 50%ile <0.5 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.125 mg/l (high risk)* *DO: Lower estuary, average ≥4 mg/l (high risk)* *Turbidity: Estuary, clear (<15 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Not identified as recreational area in stakeholder meeting*	

Macrophytes (plants)

D

- *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries).*
- *Maintain the integrity of the riparian zone. No further bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat. In particular by sugarcane cultivation in the EFZ.*
- *No invasive floating aquatic species present in the estuary e.g. water hyacinth.*
- *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.*
- *Maintain present salinity regime to maintain reed & sedge habitats (< 50 % loss of reed & sedge habitats in non-flood year).*

Inverts	
E	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 50%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton occur frequently.* • *Macrobenthos should be abundant and dominated by polychaetes but should include amphipods, isopods, tanaids, polychaetes and the crab Hymenosoma projectum. Insect taxa should occur in the far upper reaches only.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Molluscan assemblage should include bivalves and gastropods.* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata, Varuna litterata, Macrophthalmus sp., Sesarmidae and Uca sp,* • *Invasive alien species do not dominate macrobenthos in lower reaches.*
Fish	
E	*As sampled by seine and gill net in open waters:* • *10 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 3 species.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 30% frequency of occurrence.* • *Pelagic piscivores should occur (including Caranx spp.).* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomlies related to water quality.* *No fish kills should occur.*

60 Bob's Stream RQOs

PES:	**B/C**	**REC:**	**B/C**	**TEC:**	**B/C**

Flow:

PES	**nMAR (MCM)**	**pMAR (MCM)**
	0.53	*0.53*
A	*Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).*	

Sediment processes:	
D	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*
Mouth state:	
A	*Mouth open conditions should be maintained within the current range: 20% (± 5%).*
Water quality: Salinity	
A	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should exceed 5 (to be confirmed).*
Water quality: Other	

D	**Ecostystem health:**	**Recreational use:**	*N/A*
	Water quality poses risk to REC/TEC, sufficiently reduced if: *DIN: Freshwater inflow, 50%ile <0.2 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.015 mg/l (high risk)* *DO: Entire estuary, average ≥6 mg/l (high risk)*	*No identified as recreational area at stakeholder meeting*	

	Turbidity: Estuary, clear (<10 NTU) accept during high inflow events *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	
Macrophytes (plants)		
C	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries).* • *Maintain the integrity of the riparian zone. No bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.*	
Inverts		
B	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 30%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei.* • *Macrobenthos should be abundant and dominated by amphipods, but should include isopods, tanaids, polychaetes, the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) are dominated by Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods (including Melanoides tuberculata).* • *Invasive alien species should not occur in abundance.*	
Fish		
B	*As sampled by seine and gill net in open waters:* • *15 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 4 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 30% frequency of occurrence.* • *Pelagic piscivores should occur.* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*	

61 Seteni RQOs

PES:	**B/C**	**REC:**	**B/C**	**TEC:**	**B/C**
Flow:					
PES	**nMAR (MCM)**		**pMAR (MCM)**		
A	*1.42*		*1.42*		
	Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).				
Sediment processes:					
D	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter*				

	deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.		
Mouth state:			
A	*Mouth open conditions should be maintained within the current range: 35% (± 5%).*		
Water quality: Salinity			
A	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should exceed 5 (to be confirmed).*		
Water quality: Other			
D	**Ecosystem health:**	**Recreational use:**	*N/A*
	Water quality poses risk to REC/TEC, sufficiently reduced if: **DIN: Freshwater inflow, 50%ile <0.2 mg/l (high risk)** **DIP: Freshwater inflow, 50%ile <0.015 mg/l (high risk)** **DO: Entire estuary, average ≥6 mg/l (high risk)** *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*No identified as recreational area at stakeholder meeting*	
Macrophytes (plants)			
D	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries). In particular the swamp forest habitat would be of importance.* • *Maintain the integrity of the riparian zone. No further bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat. In particular no further sugarcane cultivation should take place in the EFZ.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.*		
Inverts			
B	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 30%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton are abundant.* • *Macrobenthos should be abundant and dominated by amphipods and polycheates, but should include isopods, tanaids and the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata and Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species should not occur in abundance.*		
Fish			
B	*As sampled by seine and gill net in open waters:* • *18 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 5 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 80% frequency of occurrence.* • *Pelagic piscivores should occur (including Caranx spp.).* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomlies related to water quality.* *No fish kills should occur.*		

62 Mdlotane RQOs

PES:	B	REC:	A/B	TEC:	A/B

Flow:

PES	nMAR (MCM)	pMAR (MCM)
	6.04	*5.85*
A	*Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).*	

Sediment processes:

B	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*

Mouth state:

B	*Mouth open conditions should be maintained within the current range: 14% (± 5%).*

Water quality: Salinity

B	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should exceed 10 (to be confirmed).*

Water quality: Other

D	**Ecosystem health:**	**Recreational use:**	*Yes*
	Water quality poses risk to REC/TEC, sufficiently reduced if: *DIN: Freshwater inflow, 50%ile <0.2 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.015 mg/l (high risk)* *DO: Entire estuary, average ≥6 mg/l (high risk)* *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Microbiology: Sufficient levels (DEA, 2012)*	

Macrophytes (plants)

B	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries). In particular the swamp forest habitat is of importance.* • *Maintain the integrity of the riparian zone. No bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Maintain present salinity regime to maintain reed & sedge habitats (< 50 % loss of reed & sedge habitats in non-flood year).*

Inverts

C	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 25%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei.* • *Macrobenthos should be abundant and dominated by amphipods, but should include isopods, tanaids, polychaetes, the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.*

	• *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) are dominated by Varuna litterata.* • *Molluscan assemblage should include bivalves (including Hiatula lunulata) and gastropods (including Melanoides tuberculata).* • *Invasive alien species should not occur.*
Fish	
C	*As sampled by seine and gill net in open waters:* • *18 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 4 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 70% frequency of occurrence.* • *Pelagic piscivores should occur (including Caranx spp.).* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*

63 Nonoti RQOs

PES:	C	REC:	C	TEC:	C
Flow:					
PES	**nMAR (MCM)**		**pMAR (MCM)**		
B	*34.74*		*34.74*		
	Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).				
Sediment processes:					
C	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*				
Mouth state:					
B	*Mouth open conditions should be maintained within the current range: 18% (± 5%).*				
Water quality: Salinity					
B	*The system needs variability in salinity regime, with a measurable increase in salinity in the lower and middle reaches during the low flow season. Mid-waters in the lower reaches should exceed 10 (to be confirmed).*				
Water quality: Other					
D	**Ecosystem health:**		**Recreational use:**	*Yes*	
	Water quality poses risk to REC/TEC, sufficiently reduced if: *DIN: Freshwater inflow, 50%ile <0.3 mg/l (high risk)* *DIP: Freshwater inflow, 50%ile <0.025 mg/l (high risk)* *DO: Entire estuary, average ≥4 mg/l (high risk)* *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*		*Microbiology: Sufficient levels (DEA, 2012)*		
Macrophytes (plants)					

D	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries).* • *Maintain the integrity of the riparian zone. No further bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat. In particular no further sugarcane cultivation should take place within the EFZ.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Prevent macroalgal blooms and reed encroachment which are likely to become problematic due to nutrient enrichment from proposed further WWTW input.*
Inverts	
C	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 40%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei.* • *Macrobenthos should be abundant and dominated by amphipods, but should include isopods, tanaids, polychaetes, the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) are dominated by Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species do not dominate macrobenthos.*
Fish	
E	*As sampled by seine and gill net in open waters:* • *10 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 3 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 60% frequency of occurrence.* • *Pelagic piscivores should occur.* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomalies related to water quality.* *No fish kills should occur.*

64 Zinkwasi RQOs

PES:	B/C	REC:	A/B	TEC:	B

Components that require interventions to achieve the REC/TEC:
- *Protect baseflows to estuary to ensure mouth state and salinity regime.*
- *Improve water quality; and*
- *Partial restoration of estuarine habitat.*

Flow:

PES	nMAR (MCM)	pMAR (MCM)
A	*14.49*	*14.04*
	Flows should not exceed natural and seasonal distrubution should not be compromised. Currrent baseflows should be upheld into estuary to maintain present mouth state and salinity regime. The distribution patterns of the flood components differ by no more than 10% (in terms of magnitude, timing and variability) from that of the Present (2015).	

Sediment processes:	
C	• *The flood regime maintain the sediment distribution patterns and aquatic habitat (instream physical habitat).The suspended sediment concentration from river inflow do not deviates by more than 20% of the present sediment load-discharge relationship (to be determined). The sedimentation and erosion patterns in the estuary do not differ significantly from present (± 0.5 m) (to be determined).* • *Changes in tidal amplitude of less than 20% from present (to be determined).* • *Changes in sediment grain size distribution patterns similar to present. The median bed sediment diameter deviates by less than a factor of two from present levels levels (to be determined). The sand/mud distributions in middle and upper reaches do not change by more than 20% from Present State over a five year average.*
Mouth state:	

A	*Mouth open conditions should be maintained within the current range: 28% (± 5%).*		
Water quality: Salinity			
B	*The system needs variability in salinity regime. Mid-waters in the lower reaches should be between 20 to 15, while the middle reaches should vary between 10 to 15 and the upper reaches between 5 to 10.*		
Water quality: Other			
C	**Ecosystem health:**	**Recreational use:**	*Yes*
	Water quality poses risk to REC/TEC, sufficiently reduced if: **DIN: Freshwater inflow, 50%ile <0.2 mg/l (high risk)** **DIP: Freshwater inflow, 50%ile <0.015 mg/l (high risk)** **DO: Entire estuary, average ≥6 mg/l (high risk)** *Turbidity: Estuary, clear (<10 NTU) accept during high inflow events* *Toxic substances:* • *Substance concentrations in estuarine waters not to exceed targets as per SA Water Quality Guidelines for coastal marine waters (DWAF, 1995);* • *Substance concentrations in estuarine sediment not to exceed targets as per WIO Region guidelines (UNEP/Nairobi Convention Secretariat and CSIR, 2009)*	*Microbiology: Sufficient levels (DEA, 2012)*	
Macrophytes (plants)			
C	• *Maintain the distribution of current macrophyte habitats (< 20 % change in the area covered by different macrophyte habitats which accounts for natural changes due to the dynamic nature of estuaries). In particular the swamp forest habitat is of importance.* • *Maintain the integrity of the riparian zone. No further bare patches or unvegetated, cleared areas along the banks. Prevent further disturbance and development of the floodplain habitat. No further sugarcane culitivation in the EFZ.* • *No invasive floating aquatic species present in the estuary e.g. water hyacinth.* • *Control the spread of invasive plants in the riparian zone. Invasive plants (e.g. syringa berry, Casuarina, Spanish reed, black wattle, Brazilian pepper tree) cover <5% of total macrophyte area.* • *Maintain present salinity regime to maintain reed & sedge habitats (< 50 % loss of reed & sedge habitats in non-flood year).*		
Inverts			
C	*As sampled by plankton net, grab and dip nets/traps (as appropriate):* • *Population abundances of plankton and benthic assemblages (baselines to be set) should not deviate by more than 30%.* • *Zooplankton should be dominated by estuarine copepods Acartia natalensis and Pseudodiaptomus hessei, but include other groups such as mysids. Meroplankton are abundant.* • *Macrobenthos should be abundant and dominated by amphipods and polycheates, but should include isopods, tanaids and the crab Hymenosoma projectum and insect taxa.* • *Chironomid larvae and oligochaetes should not occur in abundance and should not dominate the benthos.* • *Penaeid and carid (Caridina and Macrobrachium) prawns should occur.* • *Sandprawn Callichirus kraussi should occur in sandy areas in the systems lower reaches (to be confirmed).* • *Large brachyuran crabs (macrocrustacea) should include Scylla serrata and Varuna litterata.* • *Molluscan assemblage should include bivalves and gastropods.* • *Invasive alien species should not occur in abundance.*		
Fish			
C	*As sampled by seine and gill net in open waters:* • *18 species should occur to include freshwater, estuarine resident and estuarine dependant marine fishes.* • *Estuarine resident species should comprise a minimum of 5 species.* • *Estuarine resident and estuarine dependant marine fishes should dominate cathes by abundance.* • *Oligolepis keiensis, Oligolepis acutipennis, Gilchristella aestuaria, Glossogobius callidus, Myxus capensis and Rhabdosargus holubi should occur with 100% frequency of occurrence (every sampling trip).* • *Pomadasys commersonni should be sampled with 80% frequency of occurrence.* • *Pelagic piscivores should occur (including Caranx and Sphyraena spp.).* • *No alien fish species should occur.* • *Fish should be free of lesions and other anomlies related to water quality.* *No fish kills should occur.*		