**RESOURCE QUALITY OBJECTIVES (RQOs)**

Resource Quality Objectives (RQO) are numerical and/or descriptive statements about the biological, chemical and physical attributes that characterise a resource for the level of protection defined by its Class. The NWRS therefore stipulates that “Resource Quality Objectives might describe, among other things, the quantity, pattern and timing of in stream flow; water quality; the character and condition of riparian habitat, and the characteristics and condition of the aquatic biota”.

The purpose of this document is to provide a summary of the narrative and numerical RQOs for the Letaba Catchment. The information in this document is summarised on powerpoint slides (available on the DWA website) and will also be produced as a technical report.

The section below provides the priority levels for each reach of river (called a Resource Unit) as well as the RQO for flow, biota and habitat. The water quality RQOs are attached as a separate section from page 36. The groundwater RQOs are attached as a section from page 49.

**1. RESOURCE UNIT (RU) PRIORITY LEVELS FOR RQO**

RU priority is based on the outcome of the hotspot assessment (Step 1 of the integrated steps for the NWRC and RQO determination) as well as available information and confidence in the information. There are three priority levels (see table below) each with the broad type and detail of RQOs indicated:

**Table 1 RU priority level and associated RQO description**

|  |  |  |
| --- | --- | --- |
| **RU priority level** | **RU priority level** | **Associated RQO** |
| Low (1) | 1a | Flow RQO. Habitat RQO in terms of PES & REC (EcoStatus) |
| 1b | Habitat RQO in terms of PES & REC (EcoStatus). (Total river length in declared conservation areas.) |
| Moderate (2) | 2 | Flow RQO. Habitat and biota RQO (broad) |
| High (3) | 3a | Forms part of RU represented by an EWR site. |
| 3b | EWR site. Flow RQO related to Sc 11. Detailed habitat and biota RQO (EcoSpecs) |

The allocated priority level to each SQ represented by a node name is provided below:

**Table 2 Priority level for RQO RUs**

| **Node name** | **River** | **RU Priority** |
| --- | --- | --- |
| **IUA 1** | | |
| B81A-00242 | Broederstroom | 2 |
| B81A-00256 |  | 2 |
| B81A-00263 |  | 2 |
| B81A-00270 | Broederstroom | 2 |
| B81B-00233 | Mahitse | 2 |
| B81B-00234 | Mahitse | 1a |
| B81B-00251 |  | 1a |
| B81B-00246 | Politsi | 2 |
| B81B-00269 | Morudi | 2 |
| B81B-00227 | Mahitse | 2 |
| B81B-00240 | Politsi | 2 |
| B81B-00247 | Great Letaba | 3a |
| EWR 1 | Great Letaba | 3b |
| **IUA 2** | | |
| B81D-00277 | Thabina | 2 |
| B81D-00272 | Letsitele | 2 |
| B81D-00280 | Bobs | 1a |
| B81D-00296 | Mothlaka-Semeetse | 1a |
| EWR 2 | Letsitele | 3b |
| **IUA 3** | | |
| B81C-00245 | Great Letaba | 3a |
| B81E-00244 | Great Letaba | 3a |
| B81E-00213 | Nwanedzi | 2 |
| **IUA 4** | | |
| EWR 3 | Great Letaba | 3b |
| B81F-00212 | Great Letaba | 3a |
| B81F-00215 | Great Letaba | 3a |
| B81F-00218 | Great Letaba | 3a |
| B81F-00231 | Great Letaba | 3a |
| B81J-00209 | Great Letaba | 3a |
| EWR 4 | Great Letaba | 3b |
| **IUA 5** | | |
| B81F-00228 | Reshwele | 1a |
| B81F-00232 | Makwena | 1a |
| **IUA 6** | | |
| B81F-00189 | Merekome | 1a |
| B81F-00203 | Lerwatlou | 1a |
| B81G-00164 | Molototsi | 1a |
| B81H-00162 | Metsemola | 1a |
| B81J-00187 | Mbhawula | 1a |
| B81H-00171 | Molototsi | 2 |
| **IUA 7** | | |
| B82A-00168 | Middel Letaba | 1a |
| B82D-00163 | Lebjelebore | 1a |
| B82D-00154 | Middel Letaba | 1a |
| B82B-00173 | Koedoes | 2 |
| B82D-00166 | Mosukodutsi | 2 |
| B82C-00175 | Brandboontjies | 3 |
| B82D-00146 | Middel Letaba | 3 |
| **IUA 8** | | |
| B82E-00149 | Khwali | 1 |
| B82E-00150 | Little Letaba | 1 |
| B82F-00141 | Soeketse | 1 |
| B82F-00128 | Little Letaba | 2 |
| B82F-00137 | Little Letaba | 2 |
| **IUA 9** | | |
| EWR 5 | Little Letaba | 3b |
| B82J-00165 | Little Letaba | 3a |
| B82J-00178 | Little Letaba | 3a |
| B82J-00201 | Little Letaba | 3a |
| B82J-00207 | Little Letaba | 3a |
| **IUA 10** | | |
| B82H-00127 | Nsama | 2 |

**2. IUA 1: LETABA RIVERS UPSTREAM FROM TZANEEN DAM**

**Table 3 IUA 1 flow RQO**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **RU** | **REC**  **(EWR)** | **nMAR1 (MCM)** | **pMAR2 (MCM)** | **Low flows (MCM3)** | **Low flows (%nMAR)** | **Total flows (MCM)** | **Total (%nMAR)** | **Oct** | | **Apr** | |
| **90%** | **60%** | **90%** | **60%** |
| B81A-00242 | B (C) | 23.8 | 15.2 | 3.3 | 13.9 | 5.22 | 21.9 | 0.07 | 0.07 | 0.1 | 0.25 |
| B81A-00256 | D | 16.34 | 12.18 | 2.5 | 15.3 | 3.57 | 21.9 | 0.061 | 0.064 | 0.079 | 0.156 |
| B81A-00263 | D | 5.75 | 4 | 0.87 | 15.1 | 1.26 | 21.9 | 0.012 | 0.021 | 0.03 | 0.055 |
| B81A-00270 | C | 44.47 | 30 | 8.447 | 19 | 12.043 | 27.1 | 0.112 | 0.159 | 0.213 | 0.461 |
| B81B-00233 | C | 2.69 | 2.08 | 0.5 | 18.6 | 0.738 | 27.4 | 0.004 | 0.1 | 0.009 | 0.29 |
| B81B-00234 | C | 10.13 | 8.06 | 2.15 | 21.2 | 3.013 | 29.8 | 0.023 | 0.04 | 0.023 | 0.138 |
| B81B-00246 | C | 36.3 | 20.8 | 3.6 | 10 | 6.4 | 17.7 | 0.008 | 0.015 | 0.04 | 0.32 |
| B81B-00251 | D | 1.34 | 0.98 | 0.094 | 7 | 0.206 | 15.4 | 0 | 0 | 0.001 | 0.015 |
| B81B-00269 | B | 1.95 | 1.95 | 0.47 | 23.9 | 0.68 | 34.6 | 0.002 | 0.005 | 0.005 | 0.03 |
| B81B-00227 | D | 13.6 | 10.8 | 2.01 | 14.8 | 3.01 | 22.1 | 0.03 | 0.036 | 0.05 | 0.15 |
| B81B-00240 | C | 39 | 22.8 | 4.5 | 11.4 | 7.5 | 19.1 | 0.015 | 0.03 | 0.07 | 0.34 |
| EWR RU 1 | C | 99.84 | 53.1 | 10.81 | 10.8 | 20 | 20 | 0.116 | 0.141 | 0.182 | 0.263 |

**Table 4 IUA 1 Habitat and Biota RQOs for Moderate priority RUs**

| **INDICATOR** | | **SUB-INDICATORS** | | **NARRATIVE RQO** | | | | | **NUMERICAL RQO** | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **B81A-00242** | | | | | | | | | | | |
| Riparian vegetation | | Riparian zone boundary | | Forestry (areas formally planted with plantation species) should not encroach into the riparian zone or cross the riparian zone boundary. | | | | | Not Applicable (N/A). | | |
| Aerial cover of alien plant species | | Perennial alien plant species aerial cover within the riparian zone should conform to the REC (B). | | | | | Perennial alien plant species aerial cover should be less than 20% (requirement applicable to B category). | | |
| Fish | | PES (Desktop FRAI = 16.2%, F) | | PES of fish is critically modified (possibly in F) as a result of presence of predatory alien trout. Where applicable, alien species should be removed; not allowed to spread and indigenous fish should be reintroduced if possible. | | | | | Aim to achieve a PES of at least a Category D. Control and remove alien fish species where possible and prevent further introduction of alien species and construction of dams. | | |
| Species richness | | Aim to achieve an indigenous species richness of at least 3 species (reintroduction may be required). | | | | | Introduce at least the three expected indigenous species (AURA, BLIN, and BNEE) should alien fish be controlled, reduced or restricted. | | |
| Primary indicator species (AURA) | | Flows should be adequate to ensure suitable habitats for flow dependant species (AURA). | | | | | Ensure presence of AURA in reach and maintain a Frequency of Occurrence (FROC) at >5% of sites. To attain habitat conditions for AURA to fall in an EC of C, the following flows (maintenance (60%) and drought (90%) flow duration) and habitat suitability should at least be provided:  Dry season maintenance flows: At least 0.69 m3/s to ensure 9% moderate or better habitat suitability and at least 0.061 m3/s during droughts to provide at least 7% moderate or better suitability. Ensure the presence of the secondary indicator species and do not allow reduction of their present FROC. | | |
| Macro-invertebrates | | Elmidae | | To maintain suitable conditions for this flow dependent species (moderate velocity: 0.3 - 0.6 m/s) in the Stones in Current (SIC) biotope. | | | | | | | |
| Coenagrionidae | | To maintain suitable conditions in the marginal vegetation for this key species. | | | | | | | |
| **B81A-00256** | | | | | | | | | | | |
| Riparian vegetation | | Riparian zone boundary | | | Forestry (areas formally planted with plantation species) should not encroach into the riparian zone or cross the riparian zone boundary. | | | | | N/A. | |
| Aerial cover of alien plant species | | | Perennial alien plant species aerial cover within the riparian zone should conform to the REC D). | | | | | Perennial alien plant species aerial cover should be less than 50% (requirement applicable to D Category) | |
| **B81A-00263** | | | | | | | | | | | |
| Riparian vegetation | | Longitudinal riparian zone continuity | | | Longitudinal riparian zone fragmentation should not increase | | | | | | Zero increase in riparian zone fragmentation (current % of longitudinal riparian zone axis that has woody cover should not decrease). Example of riparian zone fragmentation: González del Tánago and De Jalón. (2006). |
| Riparian zone boundary | | | Forestry (areas formally planted with plantation species) should not encroach into the riparian zone or cross the riparian zone boundary. | | | | | | Zero increase in forestry within the riparian zone. |
| Aerial cover of alien plant species | | | Perennial alien plant species aerial cover within the riparian zone should conform to the desired Ecological Category (EC). | | | | | | Perennial alien plant species aerial cover within the riparian zone should be less than 50% (requirement applicable to D Category). The relationship between % alien cover and EC is hypothesised and testable. |
| Fish | | PES  Desktop FRAI = 35.6%, E) | | | PES of fish is seriously modified (possibly in E EC) as a result of presence of predatory alien trout. Where applicable, alien species should be removed; not allowed to spread and indigenous fish should be reintroduced if possible. | | | | | Aim to achieve a PES of at least a category D. Control and remove alien fish species where possible and prevent further introduction of alien species and construction of dams. | |
| Species richness | | | Aim to achieve an indigenous species richness of at least 3 species (reintroduction may be required). | | | | | Introduce at least the three expected indigenous species (AURA, BLIN, and BNEE) should alien fish be controlled, reduced or restricted. | |
| Primary indicator species  AURA | | | Flows should be adequate to ensure suitable habitats for flow dependant species (AURA). | | | | | Ensure presence of these species in reach and maintain a FROC at >5% of sites (in relevant geozones) for AURA. | |
| Macro-invertebrates | | Simuliidae | | To maintain suitable conditions for this flow dependent species (rapid flows: > 0.6 m/s) in the SIC biotope. | | | | | | | |
| Coenagrionidae | | To maintain suitable conditions in the marginal vegetation for this key species. | | | | | | | |
| **B81A-00270** | | | | | | | | | | | |
| Riparian | | Natal Ghost frog population | | Ghost frog population viability should be maintained. | | | | | | | Possibly need to express numerical RQO for Natal Ghost Frog as density of animals. |
| Riparian zone boundary | | Forestry (areas formally planted with plantation species) should not encroach into the riparian zone or cross the riparian zone boundary. | | | | | | | Zero increase of forestry within the riparian zone. |
| Aerial cover of alien plant species within the riparian zone | | Perennial alien plant species aerial cover within the riparian zone should conform to the desired Ecological Category (EC). | | | | | | | Perennial alien plant species aerial cover within the riparian zone should be less than 30% (requirement applicable to C category).  Note: The relationship between % alien cover and EC is hypothesised and testable. |
| Fish | | PES  Desktop FRAI = 41%, D/E | PES of fish is seriously modified (possibly in D/E) as a result of presence of predatory alien trout. Where applicable, alien species should be removed; not allowed to spread and indigenous fish should be reintroduced if possible. | | | | | | | | Aim to achieve a PES of at least a Category D. Control and remove alien fish species where possible and prevent further introduction of alien species and construction of more instream dams. |
| Species richness | Aim to achieve an indigenous species richness of at least 3 species (reintroduction may be required). | | | | | | | | Introduce at least the three expected indigenous species (AURA, BLIN, and BNEE) should alien fish be controlled, reduced or restricted. |
| Primary indicator species  AURA | Flows should be adequate to ensure suitable habitats for flow dependant species (AURA). | | | | | | | | Ensure presence of these species in reach and maintain a FROC at >5% of sites (in relevant geozones) for AURA. |
| Macro-invertebrates | | Trichorythidae | To maintain suitable conditions for this flow dependent species (rapid flows: >0.6 m/s) in the SIC biotope. | | | | | | | | |
| Coenagrionidae | To maintain suitable conditions in the marginal vegetation for this key species. | | | | | | | | |
| **B81B-00233** | | | | | | | | | | | |
| Riparian | | Mountain Wagtail population | Mountain Wagtail population viability should be maintained. | | | | | | | No decrease in Mountain Wagtail density. | |
| Aerial cover of alien plant species | Perennial alien plant species aerial cover within the riparian zone should conform to the desired EC. | | | | | | | Perennial alien plant species aerial cover within the riparian zone should be less than 30% (requirement applicable to C Category).  Note: The relationship between % alien cover and EC is hypothesised and testable. | |
| Longitudinal riparian zone continuity | Longitudinal riparian zone fragmentation should not increase | | | | | | | Zero expansion of existing agriculture within the riparian zone. | |
| Riparian zone boundary | Forestry (areas formally planted with plantation species) should not encroach into the riparian zone or cross the riparian zone boundary. | | | | | | | Zero increase of forestry within the riparian zone. | |
| Fish | | PES  Desktop FRAI = 50.8%, D | | Maintain PES of at least D. | | | | | | Maintain the Fish PES in at least a D (FRAI ≥ 50%). | |
| Species richness  (BNEE, PPHI, TSPA). | | Maintain current fish species richness. | | | | | | Maintain current species diversity of at least 3 species (BNEE, PPHI and TSPA) (do not allow more than 10% deviation from species estimated for SQ reach). | |
| Primary indicator species  BNEE. | | Flows should be adequate to ensure suitable habitats for BNEE. | | | | | | Ensure presence of BNEE in reach and FROC should not decrease >10% from baseline value (to be established should monitoring be implemented). | |
| **Macro-invertebrate** | | Belostomatidae and Nepidae | | | | | | To maintain suitable conditions in the marginal vegetation (wetland seeps) for these key species. | | | |
| **B81B-00246** | | | | | | | | | | | |
| Riparian | | Natal ghost frog, Mountain wagtail and half collared kingfisher populations | | | | | | Mountain wagtail, Natal ghost frog and half collared kingfisher population(s) viability should be maintained. | | | No decrease in Mountain wagtail or half collared kingfisher density.  Possibly need to express numerical RQO for Natal ghost frog as density of animals. |
| Riparian zone boundary | | | | | | Forestry (areas formally planted with plantation species) and agriculture (orchard plantations) should not encroach into the riparian zone or cross the riparian zone boundary. | | | Zero increase of forestry or agriculture within the riparian zone. |
| Aerial cover of alien plant species | | | | | | Perennial alien plant species aerial cover within the riparian zone should conform to the desired EC. | | | Perennial alien plant species aerial cover within the riparian zone should be less than 30% (requirement applicable to C Category). |
| Longitudinal riparian zone continuity | | | | | | Longitudinal riparian zone fragmentation should not increase. | | | Zero increase in riparian zone longitudinal fragmentation. |
| Fish | | PES  Desktop FRAI = 51.4%, D | | | | | | Maintain PES of at least D | | Maintain the Fish PES in at least a D (FRAI ≥51%). | |
| Species richness  (9 Species) | | | | | | Maintain current fish species richness. | | Maintain current estimated fish species richness (do not allow more than 10% deviation from 9 species estimated for SQ reach). | |
| Primary indicator species  AURA | | | | | | Flows should be adequate to ensure suitable habitats for flow dependant species (AURA). | | Ensure presence of this species in reach and maintain a FROC at >10% of sites (in relevant geozones). | |
| Macro-invertebrates | | Perlidae and Hydropsychidae | | | | | | To maintain suitable conditions for this flow dependent species (rapid flows: >0.6 m/s) in the SIC biotope. | | | |
| Atyidae | | | | | | To maintain suitable conditions in the marginal vegetation for this key species. | | | |
| **B81B-00269** | | | | | | | | | | | |
| Riparian | | Riparian zone boundary | | | | Forestry (areas formally planted with plantation species) should not encroach into the riparian zone or cross the riparian zone boundary. | | | | N/A. | |
| Aerial cover of alien plant species | | | | Perennial alien plant species aerial cover within the riparian zone should conform to a REC (B). | | | | Perennial alien plant species aerial cover should be less than 20% (requirement applicable to B Category). | |
| Fish | | PES  Desktop FRAI = 66.8%, C | | | | Maintain PES of at least C. | | | | | Maintain the Fish PES in at least a C/D (FRAI ≥ 66%). |
| Species richness  9 species | | | | Maintain relatively high fish species richness. | | | | | Maintain relative high fish species diversity (do not allow more than 10% deviation from six species estimated for SQ reach). |
| Primary indicator species: AURA/CPRE | | | | Flows should be adequate to ensure suitable habitats for flow dependant species (AURA, CPRE). | | | | | Ensure presence of these species in reach and maintain a FROC at >10% of sites (in relevant geozones) for AURA and CPRE. |
| Macro-invertebrates | | Philopotamidae and Hydropsychidae | | | | | To maintain suitable conditions for these flow dependent species (rapid velocities: > 0.6 m/s) in the SIC biotope. | | | | |
| Coenagrionidae | | | | | To maintain suitable conditions in the marginal vegetation for this key species. | | | | |
| **B81B-00227** | | | | | | | | | | | | |
| Riparian | | | Mountain wagtail and half collared kingfisher populations | | | | | Mountain wagtail and half collared kingfisher population(s) viability should be maintained. | | | No decrease in mountain wagtail or half collared kingfisher density. | |
| Riparian zone boundary | | | | | Forestry (areas formally planted with plantation species) should not encroach into the riparian zone or cross the riparian zone boundary. | | | N/A. | |
| Aerial cover of alien plant species in the riparian zone | | | | | Perennial alien plant species aerial cover within the riparian zone should conform to a REC (B). | | | Perennial alien plant species aerial cover should be less than 20% (requirement applicable to B Category). | |
| Fish | | | PES  Desktop FRAI = 50.2%, D | | | | | Maintain PES of at least D. | | | Maintain the Fish PES in at least a D (FRAI ≥50%). | |
| Species richness  16 species | | | | | Maintain current fish species richness. | | | Maintain current species diversity of an estimated 16 species (do not allow more than 10% deviation from species estimated for SQ reach). | |
| Primary indicator species  LMOL/BMAR | | | | | Flows should be adequate to ensure suitable habitats for LMOL/BMAR. | | | Ensure presence of LMOL/BMAR in reach and FROC should not decrease >10% from baseline value (to be established should monitoring be implemented). | |
| Macro-invertebrates | | | Perlidae and Hydropsychidae | | | | | To maintain suitable conditions for these flow dependent species (rapid velocities: > 0.6 m/s) in the SIC biotope. | | | | |
| Coenagrionidae and Atyidae | | | | | To maintain suitable conditions in the marginal vegetation for these key species. | | | | |
| **B81B-00240** | | | | | | | | | | | | | |
| Riparian | | | Riparian zone boundary | | | | | | Forestry (areas formally planted with plantation species) should not encroach into the riparian zone or cross the riparian zone boundary. | | | N/A. | |
| Longitudinal riparian zone continuity | | | | | | Longitudinal riparian zone fragmentation should not increase. | | | N/A. | |
| Aerial cover of alien plant species in the riparian zone | | | | | | Perennial alien plant species aerial cover within the riparian zone should conform to a REC (B). | | | Perennial alien plant species aerial cover should be less than 30% (requirement applicable to C Category). | |
| Fish | | | PES  Desktop FRAI = 49.5%, D | | | | | | Maintain PES of at least D. | | | Maintain the Fish PES in at least a D (FRAI ≥ 49%). | |
| Species richness  18 species | | | | | | Maintain relatively high fish species richness. | | | Maintain relative high fish species richness. Do not allow more than 10% deviation from baseline (estimated at 18 species) estimated for SQ reach. | |
| Primary indicator species  AURA/CPRE | | | | | | Flows should be adequate to ensure suitable habitats for flow dependant species (AURA, CPRE). | | | Ensure presence of these species in reach and maintain a FROC at baseline levels (>10% desktop estimate) of sites for AURA and CPRE. | |
| Macro-Invertebrates | | | Perlidae and Hydropsychidae | | | | | | To maintain suitable conditions for these flow dependent species (Rapid velocities: > 0.6 m/s) in the SIC biotope. | | | | |
| Coenagrionidae and Atyidae | | | | | | To maintain suitable conditions in the marginal vegetation for these key species. | | | | |

**Table 5 RU EWR 1: Fish EcoSpecs and TPCs**

| **Metric** | **Indicator** | **EcoSpecs** | **TPC (Biotic)** | **TPC (Habitat)** |
| --- | --- | --- | --- | --- |
| Ecological status | PES | PES status of fish is in a C (62.3%) (DWA, 2013a). | Decrease of PES into a lower EC than PES. | Any deterioration in habitat that results in decrease in FROC of species. |
| Species richness | All indigenous species | 20 of the expected 22 indigenous fish species estimated to be present in the reach under PES (to be verified). | 20% decrease in species richness. | Loss in diversity, abundance and condition of velocity-depth categories and cover features that lead to a loss of species. |
| Requirement for flowing water | AURA  CPRE | AURA and CPRE have a high requirement for flow during all life stages and are the most applicable indicator species for flow modification. | AURA and/or CPRE absent during any survey OR present at FROC1 of < 3 for AURA and < 3 for CPRE. (DWAF, 2006b): A minimum of 5 AURA specimens should be sampled at 80% of sites during a survey of FS and FD, electrofishing for 20 minutes. A minimum of 20 CPRE specimens should be sampled at 100% of sites during a survey of Fast Shallow (FS) and FD, electrofishing for 20 minutes). | Reduced suitability (abundance and quality) of flowing habitats (i.e. decreased flows, increased zero flows, and altered seasonality). |
| Fast Deep (FD) habitats | AURA  BEUT | AURA and BEUT have a high requirement for fast-deep habitats and are the most applicable indicator species for this velocity-depth category. | AURA and/or BEUT absent during any survey OR present at FROC of < 3 for AURA and < 3 for BEUT (DWAF, 2006b: AURA see "Requirement for flowing water", a minimum of 5 BEUT specimens should be sampled at 25% of sites during a survey of marginal vegetation (MV) and substrate, electrofishing for 20 minutes/10 sweeps with 4m pole seine net.) | Reduced suitability (abundance and quality) of FD habitats (i.e. decreased flows, increased zero flows). |
| Fast-Shallow (FS) habitats | CPRE LCYL | CPRE and LCYL have a high requirement for fast-deep habitats and are the most applicable indicator species for this velocity-depth category. | CPRE and/or LCYL absent during any survey OR present at FROC of < 3 for CPRE and < 3 for LCYL. | Reduced suitability (abundance and quality) of FS habitats (i.e. decreased flows, increased zero flows). |
| Substrate | AURA CPRE | CPRE and AURA have a high requirement for fast-deep habitats and are the most applicable indicator species for this habitat feature. | AMOS and/or AURA absent during any survey OR present at FROC of <3 for CPRE and <3 for AURA. | Increased sedimentation of riffle/rapid substrates, excessive algal growth on substrates. Increased sedimentation of riffle/rapid substrates, excessive algal growth on substrates. |
| Water quality intolerance | BEUT, AURA | BEUT and AURA have a high requirement for unmodified water quality and are the most applicable indicator species for water quality deterioration. | BEUT and/or AURA absent during any survey OR present at FROC of < 3 for BEUT and <3 for AURA. | Decreased water quality (especially flow related water quality variables such as oxygen). |
| Overhanging vegetation | PPHI, BPAU | PPHI and BPAU have a high requirement for overhanging vegetation and are the most applicable indicator species for this habitat feature. | PPHI and/or BPAU absent during any survey OR present at FROC of < 4.36 for PPHI and <3 for BPAU. | Significant change in overhanging vegetation habitats. |
| Instream vegetation | TREN  BPAU | TREN and BPAU have a high requirement for instream (aquatic) vegetation and are the most applicable indicator species for this habitat feature. | TREN and/or BPAU absent during any survey OR present at FROC of < 3 for TREN and < 3 for BPAU. | Significant change in overhanging vegetation habitats (overgrazing, flow modification, use of herbicides, agriculture) |
| Undercut banks | PCAT  BEUT | PCAT and BEUT have a high preference for undercut banks and rootwads and are the most applicable indicator species for this habitat feature. | PCAT and/or BEUT absent during any survey OR present at FROC of < 0 for PCAT and < 3 for BEUT. | Significant change in undercut bank and rootwads habitats (e.g. bank erosion, reduced flows). |
| Water column | MBRE  BMAR | MBRE and BMAR have a high requirement for water column as habitat and are the most applicable indicator species for this habitat feature. | MBRE and/or BMAR absent during any survey OR present at FROC of < 3 for MBRE and < 3 for BMAR. | Reduction in suitability of water column (i.e. increased sedimentation of pools, reduced flows). |
| Slow Deep (SD) habitats | BUNI  TREN | BUNI and TREN have a high requirement for slow-deep habitats and are the most applicable indicator species for this velocity depth category. | BUNI and/or TREN absent during any survey OR present at FROC of < 3 for BUNI and < 3 for TREN. | Significant change in SD habitat suitability (i.e. increased or decreased flows, altered seasonality, increased sedimentation of slow habitats). |
| Slow Shallow (SS) habitats | BVIV  BUNI | BVIV and BUNI have a high requirement for slow-shallow habitats and are the most applicable indicator species for this velocity depth category. | BVIV and/or BUNI absent during any survey OR present at FROC of < 3 for BVIV and < 3 for BUNI. | Significant change in SS habitat suitability (i.e. increased flows, altered seasonality, increased sedimentation of slow habitats). |
| Migratory success2 | AMOS  BMAR | It is estimated that the catadromous1 AMOS may still be present, as well as various potamodromous1 species (including BMAR). | Loss or decreased FROC2 of catadromous (such as AMOS) or potamodromous species (such as BMAR). | Alteration of longitudinal habitat through the creation of migration barriers (dams, weirs, zero flows, poor water quality causing chemical barriers). |
| Alien fish species | presence of any alien/  introduced spp. | MSAL and OMYK known or expected to be present in the SQ reach. | Presence of any additional alien/introduced species or increase in abundance and distribution of existing species. | N/A. |
| **Primary indicator species** | **AURA (CPRE and BEUT)** | **AURA estimated to be present at > 25% of sites in SQ reach (DWA, 2013b) (to be verified).** | **See "requirement for flowing water" and "Fast-Deep" above.** | **See "requirement for flowing water" and "Fast-Deep" above.** |

1 Migratory guilds:

**Catadromous** – Fishes which spend most of their lives in freshwater and migrate to the sea (or saline reaches of estuaries) to breed as adults (e.g. eels) (Catchment scale migrations).

**Potamodromous:** Truly migratory species whose entire life cycle is completed within freshwater and that undertake migrations within freshwater zones (between SQ reaches) of rivers for a variety of reasons, such as for spawning, feeding, dispersion after spawning, colonisation after droughts, for over-wintering, etc.

2 Frequency of Occurrence:

0 = Absent 1 = Present at very few sites (<10%) 2 = Present at few sites (>10 - 25%) 3 = Present at about >25 - 50 % of sites

4 = Present at most sites (>50 - 75%) 5 = Present at almost all sites (>75%)

**Table 6 RU EWR 1: Macro-invertebrate EcoSpecs and TPCs**

| **EcoSpecs** | **TPCs** |
| --- | --- |
| To ensure that the SASS5 scores and ASPT values occur in the following range: SASS5 score: > 120; Average Score Per Taxon (ASPT) value: > 6.0. | SASS5 scores less than 130 and an ASPT less than 6.0. |
| To ensure that the MIRAI score remains within the range of a C Category (62% – 78%). | A MIRAI score of 70% or less. |
| To maintain suitable flow velocity (> 0.6 m/s) and to maintain clean, un-embedded surface area (cobbles) to support the following flow-dependent taxa:   * Hydropsychidae (Abundance A). * Trichorythidae (Abundance A). | Any one of these two taxa missing in two consecutive surveys or any one of these two taxa present as a single individual in two consecutive surveys. |
| To maintain suitable flow velocity (0.3 – 0.6 m/s) and to maintain clean, un-embedded surface area (cobbles) to support the following flow-dependent taxa:   * Elmidae (Abundance A). * Heptageniidae (Abundance B). | Any one of these two taxa missing in two consecutive surveys or any one of these two taxa present as a single individual in two consecutive surveys. |
| To maintain sufficient quantity and quality of inundated vegetation to support the following vegetation-dwelling taxa:   * Coenagrionidae (Abundance A). * Dytiscidae (Abundance 1-A). | Any one of these two taxa missing in two consecutive surveys or any one of these two taxa present as a single individual in two consecutive surveys. |
| To maintain suitable conditions for the following five key taxa:   * Hydropsychidae, Trichorythidae * Heptageniidae, Elmidae * Coenagrionidae | Presence of less than four of the five key taxa listed in any survey. |
| Balanced community structure, i.e. majority of invertebrates at A abundance, certain taxa at B abundance (e.g. Simuliidae and Baetidae). To ensure that no group consistently dominates the fauna, defined as D abundance (>1000) over more than two consecutive surveys. | Any taxon occurring in an abundance of >1000 for two consecutive surveys. |

**Table 7 RU EWR 1: Riparian vegetation EcoSpecs and TPCs**

| **Metric** | **Zone assessed** | **EcoSpecs (PES)** | **EcoSpecs (Sc 11)** | **TPC (for PES)** |
| --- | --- | --- | --- | --- |
| Vegetation Cover | Marginal | Maintain marginal hydrophyte fringe along the active channel. | Maintain marginal hydrophyte fringe along the active channel. | Marginal fringe absent. |
| Lower | Maintain *B. salicina* and *Syzygium cordatum* cover. | Maintain *B. salicina* and cover | Measurable decrease in either population of 50% or more. |
| Species composition | Upper | Maintain riparian/terrestrial mix. | Maintain riparian/terrestrial mix. | When the proportion of terrestrial species reaches 50% of the total species count. |
| Upper | Maintain *B. salicina, C. imberbe* and *P. violacea* populations. | Maintain *B. salicina, C. imberbe* and *P. violacea* populations. | Visible decrease in *B. salicina, C. imberbe* or *P. violacea* cover/abundance |
| Alien invasion | Riparian | Perennial alien plant species aerial cover less than 30%. | Perennial alien plant species aerial cover less than 30%. | An increase in alien perennial species cover above 30%. |
| Indigenous riparian woody cover | Marginal | Riparian woody species cover not less than 5% and not more than 70%. | Riparian woody species cover not less than 5% and not more than 70%. | An increase in riparian woody cover above 70% OR a decrease below 5% |
| Lower | Riparian woody species cover not less than 5% and not more than 70%. | Riparian woody species cover not less than 5% and not more than 70%. | An increase in riparian woody cover above 70% OR a decrease below 5%. |
| Upper | Riparian woody species cover not less than 20% and not more than 80%. | Riparian woody species cover not less than 20% and not more than 80%. | An increase in riparian woody cover above 80% OR a decrease below 20%. |
| *Phragmites* (reed) cover | Marginal | Reed cover not less than 20%. | Reed cover not less than 20%. | A decrease in reed cover below 20%. |
| Lower | Reed cover between 10% and 90%. | Reed cover between 10% and 90%. | A decrease in reed cover below 10% OR and increase above 90%. |
| Upper | Reeds cover less than 50%. | Reeds cover less than 50%. | An increase in reed cover above 50%. |
| Riparian zone integrity | | Zero expansion of agriculture or forestry within the riparian zone. | Zero expansion of agriculture or forestry within the riparian zone. | An increase of the spatial extent of forestry or agriculture WITHIN the riparian zone. |
| Longitudinal riparian zone continuity | | Zero increase in riparian zone longitudinal fragmentation. | Zero increase in riparian zone longitudinal fragmentation. | An increase in the longitudinal fragmentation of the riparian zone. |

**IUA 2: LETSITELE AND THABINA**

**Table 8 IUA 2 flow RQO**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **RU** | **REC**  **(EWR)** | **nMAR1 (MCM)** | **pMAR2 (MCM)** | **Low flows (MCM3)** | **Low flows (%nMAR)** | **Total flows (MCM)** | **Total (%nMAR)** | **Oct** | | **Apr** | |
| **90%** | **60%** | **90%** | **60%** |
| B81D-00277 | D | 25.28 | 18.90 | 2.124 | 8.4 | 4.640 | 18.4 | 0.00 | 0.024 | 0.023 | 0.209 |
| B81D-00280 | B | 18.50 | 13.95 | 3.647 | 19.7 | 5.417 | 29.3 | 0.065 | 0.069 | 0.085 | 0.186 |
| B81D-00296 | B | 10.53 | 8.85 | 2.637 | 25.0 | 3.645 | 34.6 | 0.015 | 0.024 | 0.047 | 0.113 |
| B81D-00271 (EWR 2) |  |  |  |  |  |  |  |  |  |  |  |
| B81D-00272 | C | 91.27 | 27.51 | 13.288 | 14.6 | 20.084 | 22 | 0.066 | 0.1 | 0.245 | 0.855 |

**Table 9 IUA 2 Habitat and Biota RQOs for Moderate priority RUs**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **INDICATOR** | **SUB-INDICATORS** | | | **NARRATIVE RQO** | | **NUMERICAL RQO** | | |
| **B81D-00277** | | | | | | | | |
| Riparian | Aerial cover of alien plant species in the riparian zone | | Perennial alien plant species aerial cover within the riparian zone should conform to the desired EC. | | | | Perennial alien plant species aerial cover within the riparian zone should be less than 50% (requirement applicable to D EC). The relationship between % alien cover and EC is hypothesised & testable. | |
| Riparian zone boundary | | Agricultural activities should not encroach into the riparian zone or cross the riparian zone boundary. | | | | Zero increase of agricultural activities within the riparian zone. It is assumed that 80% cover for this particular region and particular vegetation unit is realistic (and functional). | |
| Vegetative cover along riparian zone banks | | Vegetative cover along riparian zone banks should be maintained in order to provide bank stability and prevent erosion. | | | | Vegetative cover along riparian zone banks should not be less than 80% (aerial cover). | |
| Fish | PES: D  Desktop FRAI = 50%, | | | Maintain PES of at least D. | | | Maintain the Fish PES in at least a D (FRAI ≥ 50%). | |
| Species richness  16 species | | | Maintain current fish species richness. | | | Maintain current species diversity of an estimated 16 species (do not allow more than 10% deviation from species estimated for SQ reach). | |
| Primary indicator species  LMOL/BMAR | | | Flows should be adequate to ensure suitable habitats for LMOL/BMAR. | | | Ensure presence of LMOL/BMAR in reach and FROC should not decrease > 10% from baseline value (to be established should monitoring be implemented). | |
| Macro-Invertebrates | Hydropsychidae and Trichorythidae | | | To maintain suitable conditions for these flow dependent species (Rapid velocities: > 0.6 m/s) in the SIC biotope. | | | | |
| Coenagrionidae and Belostomatidae | | | To maintain suitable conditions in the marginal vegetation for these key species. | | | | |
| **B81D-00272** | | | | | | | | |
| Riparian | | Aerial cover of alien plant species in the riparian zone | | Perennial alien plant species aerial cover within the riparian zone should conform to the desired EC. | | | | Perennial alien plant species aerial cover within the riparian zone should be less than 30% (requirement applicable to C category. |
| Riparian zone boundary | | Agricultural activities should not encroach into the riparian zone or cross the riparian zone boundary. | | | | Zero increase of agricultural activities within the riparian zone. |
| Vegetative cover along riparian zone banks | | Vegetative cover along riparian zone banks should be maintained in order to provide bank stability and prevent erosion. | | | | Vegetative cover along riparian zone banks should not be less than 80% (aerial cover). |
| Fish | | PES  Desktop FRAI = 61.9%, C/D | | Maintain PES of at least C/D. | | | | Maintain the Fish PES in at least a C/D (FRAI ≥61%). |
| Species richness | | Maintain relatively high fish species richness. | | | | Maintain relative high fish species diversity (do not allow more than 10% deviation from 25 species estimated for SQ reach). |
| Primary indicator species  AURA/CPRE | | Flows should be adequate to ensure suitable habitats for flow dependant species (AURA, CPRE). | | | | Ensure presence of these species in reach and maintain a FROC at >10% of sites (in relevant geozones) for AURA and CPRE. |
| Macro-invertebrates | | Hydropsychidae and Psephenidae | | | To maintain suitable conditions for these flow dependent species (Rapid velocities: >0.6 m/s) in the SIC biotope. | | | |
| Hydropsychidae and Heptageniidae | | | To maintain suitable conditions regarding the water quality for these key species. | | | |

**Table 10 RU EWR 2: Fish EcoSpecs and TPCs**

| **Metric** | **Indicator** | **EcoSpecs** | **TPC (Biotic)** | **TPC (Habitat)** |
| --- | --- | --- | --- | --- |
| Ecological status | All indigenous species. | Present ecological status of fish is in a C/D (61.2%). | Decrease of PES into a lower EC than PES. | Any deterioration in habitat that results in decrease in FROC1 of species. |
| Species richness | CPRE  AURA | 22 of the expected 24 indigenous fish species estimated to be present in the reach under PES (to be verified). | 20% decrease in species richness. | Loss in diversity, abundance and condition of velocity-depth categories and cover features that lead to a loss of species. |
| Requirement for flowing water | AURA  BEUT | CPRE and AURA have a high requirement for flow during all life stages and are the most applicable indicator species for flow modification. | CPRE and/or AURA absent during any survey OR present at FROC1 of < 3 for CPRE and < 2 for AURA. (DWAF, 2006b: A minimum of 3 AURA specimens should be sampled at 20% of sites during a survey of FS and FD, electrofishing for minimum 20 minutes. A minimum of 20 CPRE specimens should be sampled at 100% of sites during a survey of FS and FD, electrofishing for minimum 20 minutes). | Reduced suitability (abundance and quality) of flowing habitats (i.e. decreased flows, increased zero flows, and altered seasonality). |
| FD habitats | CPRE  LCYL | AURA and BEUT have a high requirement for fast-deep habitats and are the most applicable indicator species for this velocity-depth category. | AURA and/or BEUT absent during any survey OR present at FROC of < 2 for AURA and < 2 for BEUT. (DWAF, 2006b: AURA see "Requirement for flowing water", a minimum of 5 BEUT specimens should be sampled at 35% of sites during a survey of MV and substrate, electrofishing for minimum 20 minutes/10 sweeps with 4 m pole seine net.) | Reduced suitability (abundance and quality) of FD habitats (i.e. decreased flows, increased zero flows). |
| FS habitats | AURA  CPRE | CPRE and LCYL have a high requirement for fast-deep habitats and are the most applicable indicator species for this velocity-depth category. | CPRE and/or LCYL absent during any survey OR present at FROC of < 3 for CPRE and < 4 for LCYL. (DWAF, 2006b: CPRE see above). | Reduced suitability (abundance and quality) of FS habitats (i.e. decreased flows, increased zero flows). |
| Substrate | BEUT  AURA | AURA and CPRE have a high requirement for fast-deep habitats and are the most applicable indicator species for this habitat feature. | AURA and/or CPRE absent during any survey OR present at FROC of < 2 for AURA and < 3 for CPRE. (DWAF, 2006b: CPRE and AURA see above). | Increased sedimentation of riffle/rapid substrates, excessive algal growth on substrates, increased sedimentation of riffle/rapid substrates, excessive algal growth on substrates. |
| Water quality intolerance | PPHI  BPAU | BEUT and AURA have a high requirement for unmodified water quality and are the most applicable indicator species for water quality deterioration. | BEUT and/or AURA absent during any survey OR present at FROC of < 2 for BEUT and < 2 for AURA. (DWAF, 2006b: BEUT and AURA see above) | Decreased water quality (especially flow related water quality variables such as oxygen). |
| Overhanging vegetation | TREN  BPAU | PPHI and BPAU have a high requirement for overhanging vegetation and are the most applicable indicator species for this habitat feature. | PPHI and/or BPAU absent during any survey OR present at FROC of <5 for PPHI and <4 for BPAU. | Significant change in overhanging vegetation habitats. |
| Instream vegetation | MMAC  BEUT | TREN and BPAU have a high requirement for instream (aquatic) vegetation and are the most applicable indicator species for this habitat feature. | TREN and/or BPAU absent during any survey OR present at FROC of < 5 for TREN and < 4 for BPAU. | Significant change in overhanging vegetation habitats (overgrazing, flow modification, use of herbicides, agriculture). |
| Undercut banks | MBRE  BMAR | MMAC and BEUT have a high preference for undercut banks and rootwads and are the most applicable indicator species for this habitat feature. | MMAC and/or BEUT absent during any survey OR present at FROC of < 2 for MMAC and < 2 for BEUT. | Significant change in undercut bank and rootwads habitats (e.g. bank erosion, reduced flows). |
| Water column | BUNI  TREN | MBRE and BMAR have a high requirement for water column as habitat and are the most applicable indicator species for this habitat feature. | MBRE and/or BMAR absent during any survey OR present at FROC of < 3 for MBRE and < 4 for BMAR. | Reduction in suitability of water column (i.e. increased sedimentation of pools, reduced flows). |
| SD habitats | BVIV  BLIN | BUNI and TREN have a high requirement for SD habitats and are the most applicable indicator species for this velocity depth category. | BUNI and/or TREN absent during any survey OR present at FROC of < 5 for BUNI and < 5 for TREN. | Significant change in SD habitat suitability (i.e. increased or decreased flows, altered seasonality, increased sedimentation of slow habitats). |
| SS habitats | AMOS  BMAR | BVIV and BLIN have a high requirement for SS habitats and are the most applicable indicator species for this velocity depth category. | BVIV and/or BLIN absent during any survey OR present at FROC1 of <4.5 for BVIV and <2 for BLIN. (DWAF, 2006b: A minimum of 20 BVIV specimens should be sampled at 50% of sites during a survey of MV and substrate, electrofishing for minimum 20 minutes/10 sweeps with 4m pole seine net). | Significant change in SS habitat suitability (i.e. increased flows, altered seasonality, increased sedimentation of slow habitats). |
| Migratory success2 | Presence of any alien/  introduced spp. | It is estimated that the catadromous AMOS may still be present, as well as various potamadromous species (including BMAR). | Loss or decreased FROC1 of catadromous (such as AMOS) or potamadromous species (such as BMAR). | Alteration of longitudinal habitat through the creation of migration barriers (dams, weirs, zero flows, poor water quality causing chemical barriers). |
| Alien fish species | AURA (CPRE, BEUT, BVIV) | No known or expected to be present in the SQ reach under PES. | Presence of any alien/introduced species. | N/A. |
| **Primary indicator species** | **All indigenous species** | **AURA estimated to be present at >25% of sites in SQ reach (DWA, 2013b) (to be verified).** | **See relevant sections above for detail.** | **See relevant sections above for detail.** |

**Table 11 RU EWR 2: Macro-invertebrate EcoSpecs and TPCs**

| **EcoSpecs** | **TPCs** |
| --- | --- |
| To ensure that the SASS 5 scores and ASPT values occur in the following range: SASS5 score: >100; ASPT value: >5.0. | SASS5 scores less than 110 and an ASPT less than 5.2. |
| To ensure that the MIRAI score remains within the range of a C Category (62% – 78%). | A MIRAI score of 62% or less. |
| To maintain suitable flow velocity (>0.6m/s) and to maintain clean, un-embedded surface area (cobbles) to support the following flow-dependent taxa:   * Hydropsychidae (Abundance B). * Trichorythidae (Abundance 1-A). | Any one of these two taxa missing in two consecutive surveys or any one of these two taxa present as a single individual in two consecutive surveys. |
| To maintain suitable flow velocity (0.3 – 0.6 m/s) and to maintain clean, un-embedded surface area (cobbles) to support the following flow-dependent taxa:   * Libellulidae (Abundance 1-A). | This taxa missing in two consecutive surveys. |
| To maintain sufficient quantity and quality of inundated vegetation to support the following vegetation-dwelling taxa:   * Coenagrionidae (Abundance A). * Dytiscidae (Abundance A). | Any one of these two taxa missing in two consecutive surveys or any one of these two taxa present as a single individual in two consecutive surveys. |
| To maintain sufficient quantity and quality of clean course sediment to support the following bottom-dwelling taxa:   * Gomphidae (Abundance A). | This taxa missing in two consecutive surveys or present as a single individual in two consecutive surveys. |
| To maintain suitable conditions for the following five key taxa:   * Hydropsychidae, Trichorythidae * Libellulidae, Coenagrionidae * Gomphidae | Presence of less than three of the five key taxa listed in any survey. |
| Balanced community structure, i.e. majority of invertebrates at A abundance, certain taxa at B abundance (e.g. Simuliidae, Hydropsychidae and Baetidae). To ensure that no group consistently dominates the fauna, defined as D abundance (>1000) over more than two consecutive surveys. | Any taxon occurring in an abundance of >1000 for two consecutive surveys. |

**Table 12 RU EWR 2: Riparian vegetation EcoSpecs and TPCs**

| **Metric** | **Zone assessed** | **EcoSpecs (PES)** | **EcoSpecs (Sc 11)** | **TPC (for PES)** |
| --- | --- | --- | --- | --- |
| Non-woody cover | Riparian zone | Non-woody cover (excluding reeds) should not be less than 20%. | Non-woody cover (excluding reeds) should not be less than 20%. | A decrease in non-woody vegetation cover (excluding reeds) below 20%. |
| Species composition | Upper Zone | Maintain riparian/terrestrial mix. | Maintain riparian/terrestrial mix. | When the proportion of terrestrial species reaches 60% of the total species count. |
| Upper Zone | Maintain *B. salicina, C. imberbe* and *P. violacea* populations. | Maintain *B. salicina, C. imberbe* and *P. violacea* populations. | Visible decrease in *B. salicina, C. imberbe* or *P. violacea* cover/abundance. |
| Alien invasion | Riparian zone | Perennial alien plant species aerial cover less than 50%. | Perennial alien plant species aerial cover less than 50%. | An increase in alien perennial species cover above 50%. |
| Indigenous riparian woody cover | Lower Zone | Riparian woody species cover not more than 80%. | Riparian woody species cover not more than 80%. | An increase in riparian woody cover above 80%. |
| Upper Zone | Riparian woody species cover not less than 10%. | Riparian woody species cover not less than 10%. | An decrease in riparian woody cover below 10%. |
| *Phragmites* (reed) cover | Marginal Zone | Reed cover not absent. | Reed cover not absent. | An absence of reed cover. |
| Lower Zone | Reed cover not absent. | Reed cover not absent. | An absence of reed cover. |
| Upper Zone | Reeds cover more than 60%. | Reeds cover more than 60%. | An increase in reed cover above 60%. |
| Riparian zone integrity | Riparian zone | Zero expansion of agriculture activities within the riparian zone. | Zero expansion of agriculture activities within the riparian zone. | An increase of the spatial extent of forestry or agriculture WITHIN the riparian zone. |
| Longitudinal riparian zone continuity | Riparian zone | Zero increase in riparian zone longitudinal fragmentation. | Zero increase in riparian zone longitudinal fragmentation. | An increase in the longitudinal fragmentation of the riparian zone. |

**4. IUA 3: LETABA DOWNSTREAM OF TZANEEN TO PROPOSED NWAMITWA DAM**

**Table 13 IUA 3 Flow RQO**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **RU** | **REC**  **(EWR)** | **nMAR1 (MCM)** | **pMAR2 (MCM)** | **Low flows (MCM3)** | **Low flows (%nMAR)** | **Total flows (MCM)** | **Total (%nMAR)** | **Oct** | | **Apr** | |
| **90%** | **60%** | **90%** | **60%** |
| B81C-00245\* | N/a | | | | | | | | | | |
| B81E-00213 | C | 17.28 | 11.31 | 0.302 | 1.7 | 1.392 | 8.1 | 0 | 0 | 0 | 0 |
| B81E-00244\* | N/a | | | | | | | | | | |

These SQs form part of RU EWR 3, which is situated largely in IUA 4.

**Table 14 IUA 3 Habitat and Biota RQOs for Moderate priority RUs**

| **INDICATOR** | **SUB-INDICATORS** | | **NARRATIVE RQO** | | **NUMERICAL RQO** |
| --- | --- | --- | --- | --- | --- |
| **B81E-00213** | | | | | |
| Riparian | | Aerial cover of alien plant species in the riparian zone | Perennial alien plant species aerial cover within the riparian zone should conform to the desired (EC). | Perennial alien plant species aerial cover within the riparian zone should be less than 30% (requirement applicable to C EC). | |
| Riparian zone boundary | Agricultural activities should not encroach into the riparian zone or cross the riparian zone boundary. | Zero increase of agricultural activities within the riparian zone. | |
| Fish | | PES  (Desktop FRAI = 61.7%, C/D) | Maintain PES of at least C/D. | Maintain the Fish PES in at least a C/D (FRAI ≥ 61%). | |
| Species richness  (15 Species) | Maintain relatively high fish species richness. | Maintain relative high fish species richness. Do not allow more than 10% deviation from baseline (estimated at 15 species) estimated for SQ reach. | |
| Primary indicator species BMAR | Flows should be adequate to ensure suitable habitats for BMAR. | Ensure presence of BMAR in reach and FROC should not decrease > 10% from baseline value (to be established should monitoring be implemented). | |
| Macro-invertebrates | | Elmidae | To maintain suitable conditions for this flow dependent species (Moderate velocities: 0.3 - 0.6 m/s) in the SIC biotope. | | |
| Baetidae and Atyidae | To maintain suitable conditions regarding the water quality for these key species. | | |

**3. IUA 4: LETABA FROM PROPOSED NWAMITWA DAM TO KLEIN LETABA CONFLUENCE**

**Table 15 RU EWR 3: Flow RQO**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **nMAR (MCM)** | **Total flows (MCM)** | **Total (%nMAR)** | **Oct** | | **Mar** | |
| **90%** | **60%** | **90%** | **60%** |
| 394.91 | 173.42 | 43.9138 | 1.092 | 1.222 | 1.461 | 4.474 |

**Table 16 RU EWR 3: Fish EcoSpecs and TPCs**

| **Metric** |  | **PES** | | | **Recommended flow scenario (Scenario11)** |
| --- | --- | --- | --- | --- | --- |
| **Indicator** | **EcoSpecs/RQOs** | **TPC (Biotic)** | **TPC (Habitat)** | **EcoSpecs/RQOs** |
| Ecological status | PES | PES of fish is in a C (63.7%). | Decrease of PES into a lower EC than PES. | Any deterioration in habitat that results in decrease in FROC1 of species. | A slight improvement in the ecological conditions is expected but the fish will still remain in a C (67.6%). An improvement in the FROC of BEUT, BIMB, CPRE, and CSWI can be expected under this scenario. |
| Species richness | All indigenous species | 30 of the expected 33 indigenous fish species estimated to be present in the reach under PES (to be verified). | 20% decrease in species richness. | Loss in diversity, abundance and condition of velocity-depth categories and cover features that lead to a loss of species. |  |
| Requirement for flowing water. | CPRE  CSWI | CPRE and CSWI have a high requirement for flow during all life stages and are the most applicable indicator species for flow modification. | CPRE and/or CSWI absent during any survey OR present at FROC1 of < 3 for CPRE and < 1.25 for CSWI. (DWAF, 2006b: A minimum of 20 CPRE specimens should be sampled at 100% of sites during a survey of FS and FD, electrofishing for minimum 20 minutes). | Reduced suitability (abundance and quality) of flowing habitats (i.e. decreased flows, increased zero flows, and altered seasonality). | It is estimated that under the REC (Scenario (Sc) 10), improved condition may result in an increase in the FROC of CPRE (from 3 to 3.5) and CSWI (from 1.25 to 2). This species can therefore be expected to become slightly more widespread and abundant in the reach. |
| FD habitats | BEUT  CPRE | BEUT and CPRE have a high requirement for fast-deep habitats and are the most applicable indicator species for this velocity-depth category. | BEUT and/or CPRE absent during any survey OR present at FROC of < 2 for BEUT and < 3 for CPRE. | Reduced suitability (abundance and quality) of FD habitats (i.e. decreased flows, increased zero flows). | It is estimated that under the REC (Sc 10), improved condition may result in an increase in the FROC of BEUT (from 2 to 3). This species can therefore be expected to become more widespread and abundant in the reach. |
| FS habitats | CPAR  CPRE | CPAR and CPRE have a high requirement for fast-deep habitats and are the most applicable indicator species for this velocity-depth category. | CPAR and/or CPRE absent during any survey OR present at FROC of < 4 for CPAR and < 3 for CPRE. (DWAF, 2006b: A minimum of 20 CPRE and/or 10 CPAR specimens should be sampled at 100% of sites during a survey of FS and FD, electrofishing for minimum 20 minutes) | Reduced suitability (abundance and quality) of FS habitats (i.e. decreased flows, increased zero flows). | It is estimated that under the REC (scenario 10), improved condition may result in an increase in the FROC of CPRE (from 3 to 3.5). This species can therefore be expected to become slightly more widespread and abundant in the reach. |
| Substrate | LROS  CPAR | LROS and CPAR have a high requirement for fast-deep habitats and are the most applicable indicator species for this habitat feature. | LROS and/or CPAR absent during any survey OR present at FROC of < 4 for LROS and < 4 for CPAR. | Increased sedimentation of riffle/rapid substrates, excessive algal growth on substrates, Increased sedimentation of riffle/rapid substrates, excessive algal growth on substrates. |  |
| Water quality intolerance | CPRE  MMAC | CPRE and MMAC have a high requirement for unmodified water quality and are the most applicable indicator species for water quality deterioration. | CPRE and/or MMAC absent during any survey OR present at FROC of < 3 for CPRE and < 3 for MMAC. | Decreased water quality (especially flow related water quality variables such as oxygen). |  |
| Overhanging vegetation | PPHI  BPAU | PPHI and BPAU have a high requirement for overhanging vegetation and are the most applicable indicator species for this habitat feature. | PPHI and/or BPAU absent during any survey OR present at FROC of < 5 for PPHI and < 4 for BPAU. | Significant change in overhanging vegetation habitats. |  |
| Instream vegetation | TREN  BVIV | TREN and BVIV have a high requirement for instream (aquatic) vegetation and are the most applicable indicator species for this habitat feature. | TREN and/or BVIV absent during any survey OR present at FROC of < 5 for TREN and < 4 for BVIV. | Significant change in overhanging vegetation habitats (overgrazing, flow modification, use of herbicides, agriculture) |  |
| Undercut banks | MMAC  BEUT | MMAC and BEUT have a high preference for undercut banks and rootwads and are the most applicable indicator species for this habitat feature. | MMAC and/or BEUT absent during any survey OR present at FROC of < 3 for MMAC and < 2 for BEUT. | Significant change in undercut bank and rootwads habitats (e.g. bank erosion, reduced flows). |  |
| Water column | MBRE  SINT | MBRE and SINT have a high requirement for water column as habitat and are the most applicable indicator species for this habitat feature. | MBRE and/or HVIT absent during any survey OR present at FROC of < 4 for MBRE and < 5 for SINT. | Reduction in suitability of water column (i.e. increased sedimentation of pools, reduced flows). |  |
| SD habitats | BANN  BUNI | BANN and BUNI have a high requirement for slow-deep habitats and are the most applicable indicator species for this velocity depth category. | BANN and/or BUNI absent during any survey OR present at FROC of <5 for BANN and <4 for BUNI. | Significant change in SD habitat suitability (i.e. increased or decreased flows, altered seasonality, increased sedimentation of slow habitats). |  |
| SS habitats | BRAD  BVIV | BRAD and BVIV have a high requirement for slow-shallow habitats and are the most applicable indicator species for this velocity depth category. | BRAD and/or BVIV absent during any survey OR present at FROC of <4 for BRAD and <4 for BVIV. | Significant change in SS habitat suitability (i.e. increased flows, altered seasonality, increased sedimentation of slow habitats). |  |
| Migratory success2 | AMOS  BMAR | It is estimated that the catadromous AMOS may still be present, as well as various potamodromous species (including BMAR). | Loss or decreased FROC1 of catadromous (such as AMOS) or potamodromous species (such as BMAR). | Alteration of longitudinal habitat through the creation of migration barriers (dams, weirs, zero flows, poor water quality causing chemical barriers). |  |
| Alien fish species | Presence of any alien/  introduced spp. | No alien/introduced species known or expected to be present in the SQ reach. | Presence of any additional alien/introduced species or increase in abundance and distribution of existing species. | N/A. |  |
| **Primary indicator species** | **CPRE (CPAR)** | **CPRE estimated to be present at >25% of sites in SQ reach (DWA, 2013b) (to be verified).** | **See relevant sections above for detail.** | **See relevant sections above for detail.** |  |

**Table 17 RU EWR 3: Macro-invertebrate EcoSpecs and TPCs**

| **EcoSpecs** | **TPCs** |
| --- | --- |
| To ensure that the SASS 5 scores and ASPT values occur in the following range: SASS 5 score: > 120; ASPT value: > 5.5. | SASS5 scores less than 130 and an ASPT less than 5.5. |
| To ensure that the MIRAI score remains within the range of a C Category (62% – 78%). | A MIRAI score of 62% or less. |
| To maintain suitable flow velocity (>0.6 m/s) and to maintain clean, un-embedded surface area (cobbles) to support the following flow-dependent taxa:   * Hydropsychidae (Abundance B). * Trichorythidae (Abundance A). | Any one of these two taxa missing in two consecutive surveys or any one of these two taxa present as a single individual in two consecutive surveys. |
| To maintain suitable flow velocity (0.3 – 0.6 m/s) and to maintain clean, un-embedded surface area (cobbles) to support the following flow-dependent taxa:   * Heptageniidae (Abundance A). * Elmidae (Abundance A). | Any one of these two taxa missing in two consecutive surveys or any one of these two taxa present as a single individual in two consecutive surveys. |
| To maintain sufficient quantity and quality of inundated vegetation to support the following vegetation-dwelling taxa:   * Atyidae (Abundance A). * Coenagrionidae (Abundance A). | Any one of these two taxa missing in two consecutive surveys or any one of these two taxa present as a single individual in two consecutive surveys. |
| To maintain suitable conditions for the following six key taxa:   * Hydropsychidae * Trichorythidae * Heptageniidae * Elmidae * Atyidae * Coenagrionidae | Presence of less than four of the six key taxa listed in any survey. |
| Balanced community structure, i.e. majority of invertebrates at A abundance, certain taxa at B abundance (e.g. Simuliidae, Hydropsychidae and Baetidae). To ensure that no group consistently dominates the fauna, defined as D abundance (> 1000) over more than two consecutive surveys. | Any taxon occurring in an abundance of >1000 for two consecutive surveys. |

**Table 18 RU EWR 3: Riparian vegetation EcoSpecs and TPCs**

| **Metric** | **Zone assessed** | **EcoSpecs (PES)** | **EcoSpecs (Sc 11)** | **TPC (for PES)** |
| --- | --- | --- | --- | --- |
| Vegetation Cover | Marginal | Maintain marginal hydrophyte fringe and *Phragmites* along the active channel | Maintain marginal hydrophyte fringe and *Phragmites* along the active channel. | Marginal fringe absent; *Phragmites* fringe visibly (fixed photo) increasing in abundance/cover. |
| Lower | Maintain *Ficus sycomorus* and *Cyperus* patches cover. | Maintain *F. sycomorus* and *Cyperus* patches cover. | Measurable decrease in either population. |
| Species composition | Upper | Maintain riparian/terrestrial mix. | Maintain riparian/terrestrial mix. | When the proportion of terrestrial species reaches 50% of the total species count. |
| Upper | Maintain *Diospyros mespiliformis* population. | Maintain *D. mespiliformis* population. | Visible decrease in *D. mespiliformis* cover/abundance. |
| Upper | Maintain *B. salicina, C. imberbe* and *P. violacea* populations. | Maintain *B. salicina*, *C. imberbe* and *P. violacea* populations. | Visible decrease in *B. salicina*, *C. imberbe* or *P. violacea* cover/abundance. |
| Alien invasion | Riparian | Perennial alien plant species aerial cover less than 30%. | Perennial alien plant species aerial cover less than 30%. | An increase in alien perennial species cover above 30%. |
| Indigenous riparian woody cover | Marginal | Riparian woody species cover not absent and not more than 80%. | Riparian woody species cover not absent and not more than 80%. | An increase in riparian woody cover above 80% OR an absence of woody riparian species. |
| Lower | Riparian woody species cover not more than 80%. | Riparian woody species cover not less than 5% and not more than 70%. | An increase in riparian woody cover above 80%. |
| Upper | Riparian woody species cover not less than 20% and not more than 80%. | Riparian woody species cover not less than 20% and not more than 80%. | An increase in riparian woody cover above 80% OR a decrease below 20%. |
| *Phragmites* (reed) cover | Marginal | Reed cover not less than 10%. | Reed cover not less than 10%. | A decrease in reed cover below 10%. |
| Lower | Reed cover not absent. | Reed cover between 10% and 90%. | An absence of reed cover. |
| Upper | Reeds cover less than 50%. | Reeds cover less than 50%. | An increase in reed cover above 50%. |
| Riparian zone integrity | Riparian | Zero expansion of agriculture within the riparian zone. | Zero expansion of agriculture within the riparian zone. | An increase of the spatial extent of agriculture WITHIN the riparian zone. |
| Longitudinal riparian zone continuity | Riparian | Zero increase in riparian zone longitudinal fragmentation. | Zero increase in riparian zone longitudinal fragmentation. | An increase in the longitudinal fragmentation of the riparian zone. |

**Table 19 RU EWR 4: Flow RQO**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **nMAR (MCM)** | **Total flows (MCM)** | **Total (%nMAR)** | **Oct** | | **Mar** | |
| **90%** | **60%** | **90%** | **60%** |
| 441.39 | 187.73 | 42.53155 | 0.523 | 0.554 | 0.788 | 3.781 |

**Table 20 RU EWR 4: Fish EcoSpecs and TPCs**

| **Metric** |  | **PES** | | | **Recommended flow scenario (Scenario 10/11)** |
| --- | --- | --- | --- | --- | --- |
| **Indicator** | **EcoSpecs/RQOs** | **TPC (Biotic)** | **TPC (Habitat)** | **EcoSpecs/RQOs** |
| Ecological status | PES | Present ecological status of fish is in a C (64.7%). | Decrease of PES into a lower EC than PES. | Any deterioration in habitat that results in decrease in FROC1 of species. | A very slight deterioration in the ecological conditions is expected but the fish will still remain in a C (63.4%). A slight decrease is expected in the FROC of BANN, BEUT, BMAR, BPAU, BRAD, BTOP, BTRI, BUNI, BVIV, CGAR, CPRE, CPAR, LCYL, LMOL, MBRE, MMAC, PCAT and PPHI, while LROS and LRUD may increase slightly. |
| Species richness | All indigenous species | 26 of the expected 34 indigenous fish species estimated to be present in the reach under PES (to be verified). | 20% decrease in species richness. | Loss in diversity, abundance and condition of velocity-depth categories and cover features that lead to a loss of species. |
| Requirement for flowing water. | CPRE  BEUT | CPRE and BEUT have a high requirement for flow during all life stages and are the most applicable indicator species for flow modification. | CPRE and/or BEUT absent during any survey OR present at FROC# of <0.94 for CPRE and <0.5 for BEUT. (DWAF, 2006b: A minimum of 20 CPRE specimens should be sampled at 100% of sites during a survey of FS and FD, electrofishing for minimum 20 minutes). | Reduced suitability (abundance and quality) of flowing habitats (i.e. decreased flows, increased zero flows, and altered seasonality). |
| FD habitats | CPAR  BMAR | CPAR and BMAR have a high requirement for fast-deep habitats and are the most applicable indicator species for this velocity-depth category. | CPAR and/or BMAR absent during any survey OR present at FROC of < 4.5 for CPAR and < 4 for BMAR. (DWAF, 2006b: A minimum of 20 CPAR specimens should be sampled at 100% of sites during a survey of FS and FD, electrofishing for minimum 20 minutes). | Reduced suitability (abundance and quality) of FD habitats (i.e. decreased flows, increased zero flows). |
| FS habitats | CPAR  LCYL | CPAR and LCYL have a high requirement for fast-deep habitats and are the most applicable indicator species for this velocity-depth category. | CPAR and/or LCYL absent during any survey OR present at FROC of < 4.5 for CPAR and < 4 for LCYL. (DWAF, 2006b: A minimum of 20 CPAR specimens should be sampled at 100% of sites during a survey of FS and FD, electrofishing for minimum 20 minutes). | Reduced suitability (abundance and quality) of FS habitats (i.e. decreased flows, increased zero flows). |
| Substrate | LROS  CPAR | LROS and CPAR have a high requirement for fast-deep habitats and are the most applicable indicator species for this habitat feature. | LROS and/or CPAR absent during any survey OR present at FROC of < 4 for LROS and <4.5 for CPAR. (DWAF, 2006b: A minimum of 20 CPAR specimens should be sampled at 100% of sites during a survey of FS and FD, electrofishing for minimum 20 minutes) | Increased sedimentation of riffle/rapid substrates, excessive algal growth on substrates, Increased sedimentation of riffle/rapid substrates, excessive algal growth on substrates. |
| Water quality intolerance | BEUT  MMAC | BEUT and MMAC have a high requirement for unmodified water quality and are the most applicable indicator species for water quality deterioration. | BEUT and/or MMAC absent during any survey OR present at FROC of < 0.5 for BEUT and < 5 for MMAC. | Decreased water quality (especially flow related water quality variables such as oxygen). |
| Overhanging vegetation | PPHI  BPAU | PPHI and BPAU have a high requirement for overhanging vegetation and are the most applicable indicator species for this habitat feature. | PPHI and/or BPAU absent during any survey OR present at FROC of < 5 for PPHI and < 5 for BPAU. | Significant change in overhanging vegetation habitats. |
| Instream vegetation | TREN  BPAU | TREN and BPAU have a high requirement for instream (aquatic) vegetation and are the most applicable indicator species for this habitat feature. | TREN and/or BPAU absent during any survey OR present at FROC of < 5 for TREN and < 5 for BPAU. | Significant change in overhanging vegetation habitats (overgrazing, flow modification, use of herbicides, agriculture) |
| Undercut banks | MMAC  BEUT | MMAC and BEUT have a high preference for undercut banks and rootwads and are the most applicable indicator species for this habitat feature. | MMAC and/or BEUT absent during any survey OR present at FROC of < 5 for MMAC and < 0.5 for BEUT. | Significant change in undercut bank and rootwads habitats (e.g. bank erosion, reduced flows). |
| Water column | MBRE  BANN | MBRE and BANN have a high requirement for water column as habitat and are the most applicable indicator species for this habitat feature. | MBRE and/or BANN absent during any survey OR present at FROC of < 5 for MBRE and < 5 for BANN. | Reduction in suitability of water column (i.e. increased sedimentation of pools, reduced flows). |
| SD habitats | BANN  BUNI | BANN and BUNI have a high requirement for slow-deep habitats and are the most applicable indicator species for this velocity depth category. | BANN and/or BUNI absent during any survey OR present at FROC of < 5 for BANN and < 5 for BUNI. | Significant change in SD habitat suitability (i.e. increased or decreased flows, altered seasonality, increased sedimentation of slow habitats). |
| SS habitats | BRAD  BVIV | BRAD and BVIV have a high requirement for slow-shallow habitats and are the most applicable indicator species for this velocity depth category. | BRAD and/or BVIV absent during any survey OR present at FROC of < 5 for BRAD and < 5 for BVIV. | Significant change in SS habitat suitability (i.e. increased flows, altered seasonality, increased sedimentation of slow habitats). |
| Migratory success2 | BMAR  LCYL, etc. | It is estimated that the catadromous eels have been lost from this reach but various potamadromous species (including BMAR) is still present. | Loss or decreased FROC1 of catadromous (such as AMOS) or potamadromous species (such as BMAR). | Alteration of longitudinal habitat through the creation of migration barriers (dams, weirs, zero flows, poor water quality causing chemical barriers). |
| Alien fish species | Presence of any alien/  introduced spp. | No alien/introduced species known or expected to be present in the SQ reach. | Presence of any additional alien/introduced species or increase in abundance and distribution of existing species. | N/A. |
| **Primary indicator species** | **CPRE (CPAR)** | **CPRE estimated to be present at >25% of sites in SQ reach (DWA, 2013b) (to be verified).** | **See relevant sections above for detail.** | **See relevant sections above for detail.** |  |

**Table 21 RU EWR 4: Macro-invertebrate EcoSpecs and TPCs**

| **EcoSpecs** | **TPCs** | **Recommended scenario: C/D EC** |
| --- | --- | --- |
| To ensure that the SASS5 scores and ASPT values occur in the following range: SASS5 score: > 120; ASPT value: > 5.0. | SASS5 scores less than 120 and an ASPT less than 5.2. | The lower flows during winter will have an impact on the macro-invertebrate habitat and water quality. This will impact on the species preferring flow velocity (>0.6 m/s) and species requiring high water quality parameters. |
| To ensure that the MIRAI score remains within the range of a C Category (62% – 78%). | A MIRAI score of 62% or less. | The EcoSpecs will be downgraded to accommodate the lower MIRAI score of 57 - 62% (C/D). |
| To maintain suitable flow velocity (>0.6m/s) and to maintain clean, un-embedded surface area (cobbles) to support the following flow-dependent taxa:   * Hydropsychidae (Abundance B). * Trichorythidae (Abundance A). | Any one of these two taxa missing in two consecutive surveys or any one of these two taxa present as a single individual in two consecutive surveys. | Since SIC habitat is restricted in the reach, Hydropsychidae and Trichorythidae might disappear from the system and the EcoSpec for the 0.3 – 0.6 m/s flow velocity will take its place. |
| To maintain suitable flow velocity (0.3 – 0.6 m/s) and to maintain clean, un-embedded surface area (cobbles) to support the following flow-dependent taxa:   * Heptageniidae (Abundance A). * Elmidae (Abundance A). | Any one of these two taxa missing in two consecutive surveys or any one of these two taxa present as a single individual in two consecutive surveys. | Although these taxa will be stressed even more, it is not expected that they will disappear and this EcoSpec can still be used. |
| To maintain sufficient quantity and quality of inundated vegetation to support the following vegetation-dwelling taxa:   * Atyidae (Abundance A). * Coenagrionidae (Abundance A). | Any one of these two taxa missing in two consecutive surveys or any one of these two taxa present as a single individual in two consecutive surveys. | Although this habitat will be stressed even more, it is not expected that the indicator species will disappear and this EcoSpec can still be used. |
| To maintain suitable conditions for the following six key taxa:   * Hydropsychidae * Trichorythidae * Heptageniidae * Elmidae * Atyidae * Coenagrionidae | Presence of less than four of the six key taxa listed in any survey. | Since Hydropsychidae and Trichorythidae might disappear during this scenario, the EcoSpecs might change as follows:  To maintain suitable conditions for the following four key taxa:   * Heptageniidae * Elmidae * Atyidae * Coenagrionidae |
| Balanced community structure, i.e. majority of invertebrates at A abundance, certain taxa at B abundance (e.g. Gomphidae, Corixidae and Baetidae). To ensure that no group consistently dominates the fauna, defined as D abundance (>1000) over more than two consecutive surveys. | Any taxon occurring in an abundance of >1000 for two consecutive surveys. | The EcoSpecs should not change:  Any taxon occurring in an abundance of >1000 for two consecutive surveys. |

**Table 22 RU EWR 4: Riparian vegetation EcoSpecs and TPCs**

| **Metric** | **Zone assessed** | **EcoSpecs (PES)** | **EcoSpecs (Sc 11)** | **TPC (for PES)** | **Note** |
| --- | --- | --- | --- | --- | --- |
| Vegetation Cover | Marginal | Maintain marginal hydrophyte fringe and *Phragmites* along the active channel. | Maintain marginal hydrophyte fringe and *Phragmites* along the active channel. | Marginal fringe absent; *Phragmites* fringe visibly (fixed photo) increasing in abundance/cover. | Adapted from DWAF (2006b), fringe cover (either reeds or woody overhang) is important habitat for instream and riparian fauna. |
| Lower | Maintain *Nuxia floribunda* and *Combretum erythrophyllum* cover. | Maintain *N. floribunda* and *C. erythrophyllum* cover. | Measurable decrease in either population; failure to recover following large floods. | Adapted from DWAF (2006b), active channel woody component is important habitat for instream and riparian fauna. |
| Species composition | Lower | Maintain at least 10 indigenous riparian tree species. | Maintain at least 10 indigenous riparian tree species. | Absence of any of the following: *N. floribunda, C. erythrophyllum, Phoenix reclinata, P. violace* or *B. salicina.* | Adapted from DWAF (2006b). |
| Alien invasion | Riparian | Perennial alien plant species aerial cover less than 30%. | Perennial alien plant species aerial cover less than 30%. | An increase in alien perennial species cover above 30%. | See hypothesis for Lowveld rivers (alien invasion) (electronic information). |
| Indigenous riparian woody cover | Marginal | Riparian woody species cover not less than 5% and not more than 70%. | Riparian woody species cover not absent or not more than 80%. | An increase in riparian woody cover above 70% OR a decrease below 5%. | See hypothesis for Lowveld rivers (woody vegetation)  (electronic information). |
| Lower | Riparian woody species cover not less than 5% and not more than 70%. | Riparian woody species cover not less than 5% and not more than 70%. | An increase in riparian woody cover above 70% OR a decrease below 5%. | See hypothesis for Lowveld rivers (woody vegetation)  (electronic information). |
| Upper | Riparian woody species cover not less than 30% and not more than 60%. | Riparian woody species cover not less than 30% and not more than 70%. | An increase in riparian woody cover above 60% OR a decrease below 30%. | See hypothesis for Lowveld rivers (woody vegetation)  (electronic information). |
| *Phragmites* (reed) cover | Marginal | Reed cover not less than 20%. | Reed cover not less than 10%. | A decrease in reed cover below 20%. | See hypothesis for Lowveld rivers (reeds) (electronic information). |
| Lower | Reed cover between 10% and 90%. | Reed cover between 10% and 90%. | A decrease in reed cover below 10% OR and increase above 90%. | See hypothesis for Lowveld rivers (reeds) (electronic information). |
| Upper | Reeds cover less than 40%. | Reeds cover less than 40%. | An increase in reed cover above 40%. | See hypothesis for Lowveld rivers (reeds) (electronic information). |

**6. IUA 5: SOUTHERN TRIBUTARIES TO LETABA**

**Table 23 IUA 5 Flow RQO**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **RU** | **REC**  **(EWR)** | **nMAR1 (MCM)** | **pMAR2 (MCM)** | **Low flows (MCM3)** | **Low flows (%nMAR)** | **Total flows (MCM)** | **Total (%nMAR)** | **Oct** | | **Apr** | |
| **90%** | **60%** | **90%** | **60%** |
| B81F-00228 | B | 3.53 | 2.87 | 0.03 | 0.8 | 0.322 | 9.1 | 0 | 0 | 0 | 0.004 |
| B81F-00232 | B | 2.75 | 2.54 | 0.094 | 3.4 | 0.346 | 12.6 | 0 | 0 | 0 | 0 |

**7. IUA 6 NORTHERN TRIBUTARIES TO LETABA**

**Table 24 IUA 6 Flow RQO**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **RU** | **REC**  **(EWR)** | **nMAR1 (MCM)** | **pMAR2 (MCM)** | **Low flows (MCM3)** | **Low flows (%nMAR)** | **Total flows (MCM)** | **Total (%nMAR)** | **Oct** | | **Apr** | |
| **90%** | **60%** | **90%** | **60%** |
| B81F-00189 | C | 4.75 | 4.08 | 0.062 | 1.3 | 0.337 | 7.1 | 0 | 0 | 0 | 0.008 |
| B81F-00203 | C | 3.74 | 3.08 | 0.071 | 1.9 | 0.328 | 8.8 | 0 | 0 | 0 | 0 |
| B81G-00164 | D | 16.72 | 14.30 | 0.072 | 0.4 | 1.11 | 6.6 | 0 | 0 | 0 | 0.016 |
| B81H-00162 | C | 0.64 | 0.59 | 0.012 | 1.8 | 0.063 | 9.8 | 0 | 0 | 0 | 0.016 |
| B81H-00171 | D | 25.84 | 22.6 | 0.254 | 1.0 | 1.671 | 6.5 | 0 | 0 | 0 | 0.006 |

**Table 25 IUA 6 Habitat and Biota RQOs for Moderate priority RUs**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **INDICATOR** | **SUB-INDICATORS** | | **NARRATIVE RQO** | **NUMERICAL RQO** |
| **B81H-00171** | | | | |
| Riparian | Vegetative cover along riparian zone banks | Vegetative cover along riparian zone banks should be maintained in order to provide bank stability and prevent erosion. | | Vegetative cover along riparian zone banks should not be less than 60% (aerial cover). |

**8. IUA 7: UPPER MIDDLE LETABA AND TRIBUTARIES US OF MIDDLE LETABA DAM**

**Table 26 IUA 7 Flow RQO**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **RU** | **REC**  **(EWR)** | **nMAR1 (MCM)** | **pMAR2 (MCM)** | **Low flows (MCM3)** | **Low flows (%nMAR)** | **Total flows (MCM)** | **Total (%nMAR)** | **Oct** | | **Apr** | |
| **90%** | **60%** | **90%** | **60%** |
| B82A-00168 | C | 31.12 | 25.07 | 4.339 | 13.9 | 7.564 | 24.3 | 0.007 | 0.068 | 0.031 | 0.362 |
| B82B-00173 | D | 23.13 | 15.76 | 1.377 | 6.0 | 2.848 | 12.3 | 0.007 | 0.012 | 0.013 | 0.081 |
| B82C-00175 | E | Water quality RQOs only | | | | | | | | | |
| B82D-00163 | C | 4.9 | 4.29 | 0.818 | 16.7 | 1.261 | 25.8 | 0.004 | 0.012 | 0.008 | 0.047 |
| B82D-00154 | D | 40.53 | 32.96 | 3.527 | 8.7 | 7.025 | 17.3 | 0.015 | 0.071 | 0.021 | 0..432 |
| B82D-00166 | D | 42.25 | 27.77 | 1.776 | 4.2 | 4.296 | 10.2 | 0 | 0.034 | 0 | 0.214 |
| B82D-00146 | E | Water quality RQOs only | | | | | | | | | |

**Table 27 IUA 7 Habitat and Biota RQOs for Moderate priority RUs**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **INDICATOR** | **SUB-INDICATORS** | | **NARRATIVE RQO** | | | **NUMERICAL RQO** |
| **B82D-00166** | | | | | | |
| Riparian | | Riparian zone boundary and integrity | Agricultural activities should not encroach into the riparian zone or cross the riparian zone boundary.  Riparian zone fragmentation should not increase. | | Zero increase of agricultural activities within the riparian zone.  RQOs only applicable to riparian zone not associated with dam or backup areas related to dam. | |
| Vegetative cover along riparian zone banks | Vegetative cover along riparian zone banks should be maintained in order to provide bank stability and prevent erosion. | | Vegetative cover along riparian zone banks should not be less than 60% (aerial cover). It is assumed that 60% cover for this particular region and particular vegetation unit is realistic (and functional) but the hypothesis is testable. | |
| Fish | | PES  Desktop FRAI = 44.7%, D | Maintain PES of at least D. | | Maintain the Fish PES in at least a D (FRAI ≥ 44%). | |
| Species richness  7 Species | Maintain fish species richness. | | Maintain fish species richness. Do not allow more than 10% deviation from baseline (estimated at 7 species) for SQ reach. | |
| Primary indicator species  BVIV/BTOP | Flows should be adequate to ensure suitable habitats for BVIV/BTOP. | | Ensure presence of BVIV and BTOP in reach and FROC should not decrease >10% from baseline value (to be established should monitoring be implemented). | |
| **B82B-00173** | | | | | | |
| Riparian | | Riparian zone boundary and integrity | Agricultural activities should not encroach into the riparian zone or cross the riparian zone boundary.  Riparian zone fragmentation should not increase. | | Zero increase of agricultural activities within the riparian zone. | |
| Fish | | PES  Desktop FRAI = 52.4%, D | Maintain PES of at least D. | | Maintain the Fish PES in at least a D (FRAI ≥ 52%). | |
| Species richness  7 Species | Maintain fish species richness. | | Maintain fish species richness. Do not allow more than 10% deviation from baseline (estimated at 7 species) for SQ reach. | |
| Primary indicator species  BVIV/BTOP | Flows should be adequate to ensure suitable habitats for BVIV/BTOP. | | Ensure presence of BVIV and BTOP in reach and FROC should not decrease >10% from baseline value (to be established should monitoring be implemented). | |
| Secondary indicator species  Water quality (BTOP/BVIV)  Vegetation (BVIV/TREN). | Maintain adequate water quality, substrate of good quality and vegetation as cover for fish. | | Ensure the presence of the secondary indicator species and do not allow reduction of their present FROC. | |
| Macro-invertebrates | | Hydropsychidae and Elmidae | | To maintain suitable conditions for these flow dependent species (Moderate to rapid velocities: 0.3 - > 0.6 m/s) in the SIC biotope. | | |

**9. IUA 8 KLEIN LETABA US FROM THE MIDDLE LETABA DAM**

**Table 28 IUA 8 Flow RQO**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **RU** | **REC**  **(EWR)** | **nMAR1 (MCM)** | **pMAR2 (MCM)** | **Low flows (MCM3)** | **Low flows (%nMAR)** | **Total flows (MCM)** | **Total (%nMAR)** | **Oct** | | **Apr** | |
| **90%** | **60%** | **90%** | **60%** |
| B82E-00149 | B | 4.51 | 4.02 | 0.126 | 2.8 | 0.624 | 13.9 | 0 | 0.02 | 0 | 0 |
| B82E-00150 | C | 3.48 | 3.08 | 0.037 | 1.1 | 0.558 | 16.1 | 0 | 0.038 | 0 | 0 |
| B82F-00141 | C | 7.32 | 7.19 | 0.115 | 1.6 | 0.935 | 12.8 | 0 | 0 | 0.003 | 0.051 |
| B82F-00128 | C | 32.13 | 30.26 | 1.595 | 5.0 | 4.962 | 15.4 | 0.004 | 0.016 | 0.017 | 0.428 |
| B82F-00137 | D | 13.64 | 12.42 | 0.063 | 0.5 | 1.319 | 9.7 | 0 | 0 | 0.004 | 0.164 |

**Table 29 IUA 8 Habitat and Biota RQOs for Moderate priority RUs**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **INDICATOR** | **SUB-INDICATORS** | | **NARRATIVE RQO** | **NUMERICAL RQO** | |
| **B82F-00128** | | | | | |
| Riparian | | Riparian boundary | Agricultural activities should not encroach into the riparian zone or cross the riparian zone boundary. | Zero increase of agricultural activities within the riparian zone. It is assumed that 60% cover for this particular region and particular vegetation unit is realistic (and functional) but the hypothesis is testable. | |
| Riparianlongitudinal continuity | Riparian zone fragmentation should not increase. | Zero increase in riparian zone fragmentation. The relationship between % alien cover and EC is hypothesised and testable. | |
| Vegetative cover along riparian zone banks | Vegetative cover along riparian zone banks should be maintained to provide bank stability & prevent erosion. | Vegetative cover along riparian zone banks should not be less than 60% (aerial cover). | |
| Aerial cover of alien plant species within the riparian zone | Perennial alien plant species aerial cover within the riparian zone should conform to the desired EC. | Perennial alien plant species aerial cover within the riparian zone should be less than 30% (requirement applicable to C Category). | |
| Fish | | PES D, Desktop FRAI = 51.22% | Maintain PES of at least D. | Maintain the Fish PES in at least a D (FRAI ≥ 51%). | |
| Species richness  10 species | Maintain fish species richness. | Maintain fish species richness. Do not allow more than 10% deviation from baseline (estimated at 10 species) estimated for SQ reach. | |
| Primary indicator species  BMAR | Flows should be adequate to ensure suitable habitats for BMAR. | Ensure presence of BMAR in reach & FROC should not decrease >10% from baseline value (to be established during monitoring). | |
| Macro-invertebrates | | Hydropsychidae and Elmidae | To maintain suitable conditions for flow dependent species (moderate to rapid velocities: 0.3 - > 0.6 m/s) in the SIC biotope. | | |
| Coenagrionidae, Belostomatidae | To maintain suitable conditions in the marginal vegetation for these key species. | | |
| **B82F-00137** | | | | | |
| Riparian | | Riparian zone boundary | Agricultural activities should not encroach into the riparian zone or cross the riparian zone boundary. | | Zero increase of agricultural activities within the riparian zone.  It is assumed that 60% cover for this particular region and particular vegetation unit is realistic (and functional) but the hypothesis is testable. |
| Riparian zone longitudinal continuity | Riparian zone fragmentation should not increase. | | Zero increase in riparian zone fragmentation. |
| Vegetative cover along riparian zone banks | Vegetative cover along riparian zone banks should be maintained in order to provide bank stability and prevent erosion. | | Vegetative cover along riparian zone banks should not be less than 60% (aerial cover). |

**10. IUA 9: KLEIN LETABA DS FROM THE MIDDLE LETABA DAM**

**Table 30 IUA 9 Flow RQO**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **nMAR (MCM)** | **Total flows (MCM)** | **Total (%nMAR)** | **Oct** | | **Mar** | |
| **90%** | **60%** | **90%** | **60%** |
| 99.84 | 55.85 | 55.94 | 0.015 | 0.030 | 0.034 | 0.069 |

**Table 31 RU EWR 5: Fish EcoSpecs and TPCs**

| **Metric** |  | **PES** | | | **Recommended flow scenario (Scenario 10/11)** |
| --- | --- | --- | --- | --- | --- |
| **Indicator** | **EcoSpecs/RQOs** | **TPC (Biotic)** | **TPC (Habitat)** | **EcoSpecs/RQOs** |
| Ecological status | PES | Present ecological status of fish is in a C (68.7%). | Decrease of PES into a lower EC than PES. | Any deterioration in habitat that results in decrease in FROC1 of species. | A slight deterioration in the ecological conditions is expected but the fish will still remain in a C (63.3%). Although flow and thus habitat abundance will be better during dry and most of wet season when compared to the PES, the lack of floods result in deterioration of substrate quality and loss of pools (due to sedimentation related to reduction in floods), leading to a slight decrease in the FROC of many species. |
| Species richness | All indigenous species | 23 of the expected 23 indigenous fish species estimated to be present in the reach under PES (to be verified). | 20% decrease in species richness. | Loss in diversity, abundance and condition of velocity-depth categories and cover features that lead to a loss of species. |
| Requirement for flowing water. | CPAR  BMAR | CPAR and BMAR have a high requirement for flow during all life stages and are the most applicable indicator species for flow modification. | CPAR and/or BMAR absent during any survey OR present at FROC1 of < 3 for CPAR and <2 for BMAR. (DWAF, 2006b: A minimum of 5 CPAR specimens should be sampled at 20% of sites during a survey of FS and FD, electrofishing for minimum 20 minutes). | Reduced suitability (abundance and quality) of flowing habitats (i.e. decreased flows, increased zero flows, and altered seasonality). |
| FD habitats | CPAR  BMAR | CPAR and BMAR have a high requirement for fast-deep habitats and are the most applicable indicator species for this velocity-depth category. | CPAR and/or BMAR absent during any survey OR present at FROC of < 3 for CPAR and < 2 for BMAR. | Reduced suitability (abundance & quality) of FD habitats (i.e. decreased flows, increased zero flows). |
| FS habitats | CPAR  LCYL | CPAR and LCYL have a high requirement for fast-deep habitats and are the most applicable indicator species for this velocity-depth category. | CPAR and/or LCYL absent during any survey OR present at FROC of < 3 for CPAR and < 3 for LCYL. | Reduced suitability (abundance and quality) of FS habitats (i.e. decreased flows, increased zero flows). |
| Substrate | LROS  CPAR | LROS and CPAR have a high requirement for fast-deep habitats and are the most applicable indicator species for this habitat feature. | LROS and/or CPAR absent during any survey OR present at FROC of < 3 for LROS and < 3 for CPAR. | Increased sedimentation of riffle/rapid substrates, excessive algal growth on substrates, Increased sedimentation of riffle/rapid substrates, excessive algal growth on substrates. |
| Water quality intolerance | LMOL  CPAR | LMOL and CPAR have a high requirement for unmodified water quality and are the most applicable indicator species for water quality deterioration. | LMOL and/or CPAR absent during any survey OR present at FROC of < 3 for LMOL and < 3 for CPAR. | Decreased water quality (especially flow related water quality variables such as oxygen). |
| Overhanging vegetation | BVIV  BRAD | BVIV and BRAD have a high requirement for overhanging vegetation and are the most applicable indicator species for this habitat feature. | BVIV and/or BRAD absent during any survey OR present at FROC of < 3.5 for BVIV and < 3.5 for BRAD. (DWAF, 2006b: A minimum of 20 BVIV specimens should be sampled at 85% of sites during a survey, electrofishing for minimum 20 minutes/10 sweeps with 4m pole seine net.). | Significant change in overhanging vegetation habitats. |
| Instream vegetation | TREN  BPAU | TREN and BPAU have a high requirement for instream (aquatic) vegetation and are the most applicable indicator species for this habitat feature. | TREN and/or BPAU absent during any survey OR present at FROC of < 3.5 for TREN and < 3.5 for BPAU. | Significant change in overhanging vegetation habitats (overgrazing, flow modification, use of herbicides, agriculture). |
| Undercut banks | SZAM  PPHI | SZAM and PPHI have a high preference for undercut banks and rootwads and are the most applicable indicator species for this habitat feature. | SZAM and/or PPHI absent during any survey OR present at FROC of < 2 for SZAM and < 3.5 for PPHI. | Significant change in undercut bank and rootwads habitats (e.g. bank erosion, reduced flows). |
| Water column | MBRE  BANN | MBRE and BANN have a high requirement for water column as habitat and are the most applicable indicator species for this habitat feature. | MBRE and/or BANN absent during any survey OR present at FROC of < 3.5 for MBRE and < 3.5 for BANN. | Reduction in suitability of water column (i.e. increased sedimentation of pools, reduced flows). |
| SD habitats | BANN  BUNI | BANN and BUNI have a high requirement for slow-deep habitats and are the most applicable indicator species for this velocity depth category. | BANN and/or BUNI absent during any survey OR present at FROC of < 3.5 for BANN and < 3.5 for BUNI. (DWAF, 2006b: A minimum of 10 BUNI specimens should be sampled at 60% of sites during a survey, electrofishing for minimum 20 minutes/10 sweeps with 4m pole seine net. | Significant change in SD habitat suitability (i.e. increased or decreased flows, altered seasonality, increased sedimentation of slow habitats). |
| SS habitats | BRAD  BVIV | BRAD and BVIV have a high requirement for slow-shallow habitats and are the most applicable indicator species for this velocity depth category. | BRAD and/or BVIV absent during any survey OR present at FROC of < 3.5 for BRAD and < 3.5 for BVIV. | Significant change in SS habitat suitability (i.e. increased flows, altered seasonality, increased sedimentation of slow habitats). |
| Migratory success2 | BMAR  LMOL, etc. | It is estimated that the catadromous eels have been lost from this reach but various potamodromous species (including BMAR) is still present. | Loss or decreased FROC potamodromous species (such as BMAR). | Alteration of longitudinal habitat through the creation of migration barriers (dams, weirs, zero flows, poor water quality causing chemical barriers). |
| Alien fish species | presence of any alien/introduced spp. | No alien/introduced species known or expected to be present in the SQ reach. | Presence of any additional alien/introduced species or increase in abundance and distribution of existing species. | N/A |
| **Primary indicator species** | **CPAR (BMAR)** | **CPAR estimated to be present at >25% of sites in SQ reach (DWA, 2013b) (to be verified).** | **See relevant sections above for detail.** | **See relevant sections above for detail.** |  |

**Table 32 RU EWR 5: Macro-invertebrate EcoSpecs and TPCs**

| **EcoSpecs** | **TPCs** |
| --- | --- |
| To ensure that the SASS 5 scores and ASPT values occur in the following range: SASS 5 score: >100; ASPT value: > 5.0. | SASS 5 scores less than 110 and an ASPT less than 5.0. |
| To ensure that the MIRAI score remains within the range of a C/D category (57% – 62%). | A MIRAI score of 58% or less. |
| To maintain suitable flow velocity (>0.6 m/s) and to maintain clean, un-embedded surface area (cobbles) to support the following flow-dependent taxa:   * Hydropsychidae (Abundance B), Trichorythidae (Abundance A). | Any one of these two taxa missing in two consecutive surveys or any one of these two taxa present as a single individual in two consecutive surveys. |
| To maintain suitable flow velocity (0.3 – 0.6 m/s) and to maintain clean, un-embedded surface area (cobbles) to support the following flow-dependent taxa:   * Heptageniidae (Abundance A), Elmidae (Abundance A). | Any one of these two taxa missing in two consecutive surveys or any one of these two taxa present as a single individual in two consecutive surveys. |
| To maintain sufficient quantity and quality of inundated vegetation to support the following vegetation-dwelling taxa:   * Atyidae (Abundance A), Coenagrionidae (Abundance A). | Any one of these two taxa missing in two consecutive surveys or any one of these two taxa present as a single individual in two consecutive surveys. |
| To maintain suitable conditions for the following six key taxa:   * Hydropsychidae, Trichorythidae, Heptageniidae, Elmidae, Atyidae, Coenagrionidae | Presence of less than four of the six key taxa listed in any survey. |
| Balanced community structure, i.e. majority of invertebrates at A abundance, certain taxa at B abundance (e.g. Gomphidae, Simulidae and Baetidae). To ensure that no group consistently dominates the fauna, defined as D abundance (> 1000) over more than two consecutive surveys. | Any taxon occurring in an abundance of > 1000 for two consecutive surveys. |

**Table 33 RU EWR 5: Riparian vegetation EcoSpecs and TPCs**

| **Metric** | **Zone assessed** | **EcoSpecs (PES)** | **EcoSpecs (Sc 11)** | **TPC (for PES)** |
| --- | --- | --- | --- | --- |
| Vegetation Cover | Marginal Zone | Maintain marginal hydrophyte fringe and *Phragmites* along the active channel and *Cyperus marginatus* patches in places | Maintain marginal hydrophyte fringe and *Phragmites* along the active channel and *C. marginatus* patches in places. | Marginal fringe absent; *Phragmites* fringe visibly (fixed photo) increasing in abundance/cover; *C. marginatus* absent. |
| Secondary channels | Maintain between 25 and 50% marginal hydrophyte cover in secondary channels during summer | Maintain between 25% and 50% marginal hydrophyte cover in secondary channels during summer. | Marginal hydrophyte cover in secondary channels less than 25% OR more than 50% in summer. |
| Lower Zone | Maintain *Ficus sycomorus* and *Combretum erythrophyllum* cover. | Maintain *F. sycomorus* and *C. erythrophyllum* cover. | Measurable decrease in either population; failure to recover following large floods. |
| Species composition | Lower Zone | Maintain at least 14 indigenous riparian tree species. | Maintain at least 14 indigenous riparian tree species. | Absence of any of the following: *Co. erythrophyllum* or *F. sycomorus* |
| Upper zone | Maintain *Diospyros mespiliformis, B. salicina, C. imberbe, P. violace and Trichelia emetica* populations. | Maintain *D. mespiliformis, B. salicina, C. imberbe, P. violace* and *T. emetica* populations. | Visible decrease in *D. mespiliformis*, *B. salicina*, *C. imberbe*, *P. violace* and *T. emetica* cover/abundance. |
| Alien invasion | Riparian zone | Perennial alien plant species aerial cover less than 30%. | Perennial alien plant species aerial cover less than 30%. | An increase in alien perennial species cover above 30%. |
| Indigenous riparian woody cover | Marginal Zone | Riparian woody species cover not absent and not more than 80%. | Riparian woody species cover not absent and not more than 80%. | An increase in riparian woody cover above 80% OR an absence of woody riparian species. |
| Lower Zone | Riparian woody species cover not less than 5% and not more than 70%. | Riparian woody species cover not less than 5% and not more than 80%. | An increase in riparian woody cover above 70% OR a decrease below 5%. |
| Upper Zone | Riparian woody species cover not less than 20% and not more than 80%. | Riparian woody species cover not less than 20% and not more than 80%. | An increase in riparian woody cover above 80% OR a decrease below 20%. |
| *Phragmites* (reed) cover | Marginal Zone | Reed cover not less than 10%. | Reed cover not less than 10%. | A decrease in reed cover below 10%. |
| Lower Zone | Reed cover between 10% and 90%. | Reed cover not absent. | A decrease in reed cover below 10% OR and increase above 90%. |
| Upper Zone | Reeds cover less than 50%. | Reeds cover less than 50%. | An increase in reed cover above 50%. |
| Riparian zone integrity | Riparian zone | Zero expansion of agriculture within the riparian zone. | Zero expansion of agriculture within the riparian zone. | An increase of the spatial extent of agriculture WITHIN the riparian zone. |
| Longitudinal riparian zone continuity | Riparian zone | Zero increase in riparian zone longitudinal fragmentation. | Zero increase in riparian zone longitudinal fragmentation. | An increase in the longitudinal fragmentation of the riparian zone. |

**11. IUA 10 LOWER KLEIN LETABA TRIBUTARIES**

**Table 34 IUA 10 Flow RQO**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **RU** | **REC**  **(EWR)** | **nMAR1 (MCM)** | **pMAR2 (MCM)** | **Low flows (MCM3)** | **Low flows (%nMAR)** | **Total flows (MCM)** | **Total (%nMAR)** | **Oct** | | **Apr** | |
| **90%** | **60%** | **90%** | **60%** |
| B82H-00127 | C | 6.91 | 4.42 | 0.07 | 1 | 0.73 | 10.6 | River ephemeral - only flood requirements | | | |
| B82H-00139 | B | 3.1 | 3.1 | 0.021 | 0.7 | 0.463 | 14.9 | River ephemeral - only flood requirements | | | |
| B82H-00157 | B | 11.72 | 9.21 | 0.202 | 1.7 | 1.683 | 14.4 | 0 | 0 | 0 | 0.004 |
| B82J-00197 | B | 0.66 | 0.64 | 0.024 | 3.6 | 0.091 | 13.7 | River ephemeral - only flood requirements | | | |

**Table 35 IUA 10 Habitat and Biota RQOs for Moderate priority RUs**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **INDICATOR** | **SUB-INDICATORS** | | | **NARRATIVE RQO** | | **NUMERICAL RQO** |
| **B82H-00127** | | | | | | |
| Riparian | | Riparian zone boundary | | Agricultural activities should not encroach into the riparian zone or cross the riparian zone boundary. | Zero increase of agricultural activities within the riparian zone. It is assumed that 60% cover for this particular region and particular vegetation unit is realistic (and functional) but the hypothesis is testable. | | |
| Riparian zone longitudinal continuity | | Riparian zone fragmentation should not increase. | Zero increase in riparian zone fragmentation. | | |
| Vegetative cover along riparian zone banks | | Vegetative cover along riparian zone banks should be maintained in order to provide bank stability and prevent erosion. | Vegetative cover along riparian zone banks should not be less than 60% (aerial cover). The relationship between % alien cover and EC is hypothesised and testable. | | |
| Aerial cover of alien plant species in the riparian zone | | Perennial alien plant species aerial cover within the riparian zone should conform to the desired Ecological Category (EC). | Perennial alien plant species aerial cover within the riparian zone should be less than 30% (requirement applicable to C Category). | | |
| **B82H-00157** | | | | | | | |
| Riparian | | Riparian zone boundary | Agricultural activities should not encroach into the riparian zone or cross the riparian zone boundary. | | Zero increase of agricultural activities within the riparian zone. It is assumed that 80% cover for this particular region and particular vegetation unit is realistic (and functional) but the hypothesis is testable. | | |
| Riparian zone longitudinal continuity | Riparian zone fragmentation should not increase. | | Zero increase in riparian zone fragmentation. | | |
| Vegetative cover along riparian zone banks | Vegetative cover along riparian zone banks should be maintained in order to provide bank stability and prevent erosion. | | Vegetative cover along riparian zone banks should not be less than 60% (aerial cover)  Note: It is assumed that 80% cover for this particular region and particular vegetation unit is realistic (and functional) but the hypothesis is testable. | | |

**12. IUA 11: LETABA MAIN STEM IN THE KNP**

**Table 36 IUA 11 Flow RQO**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **nMAR (MCM)** | **Total flows (MCM)** | **Total (%nMAR)** | **Oct** | | **Mar** | |
| **90%** | **60%** | **90%** | **60%** |
| 646 | 318.74 | 49.34 | 0.523 | 0.554 | 0.87 | 3.9 |

**Table 37 RU EWR 7: Fish EcoSpecs and TPCs**

| **Metric** |  | **PES** | | | **Recommended flow scenario (Scenario 11)** |
| --- | --- | --- | --- | --- | --- |
| **Indicator** | **EcoSpecs/RQOs** | **TPC (Biotic)** | **TPC (Habitat)** | **EcoSpecs/RQOs** |
| Ecological status | PES | Present ecological status of fish is in a C (64.4%). | Decrease of PES into a lower EC than PES. | Any deterioration in habitat that results in decrease in FROC1 of species. | An notable deterioration in the ecological conditions are expected under this scenario with the fish decreasing from a C to a C/D. Although base flows will be suitable during wet and dry season, decrease in floods will result in loss of pools (sedimentation) and although riffle/rapid habitats are limited, the quality of these will also be reduced due to lack of flushing. A reduced FROC is expected for most of the fish species and especially those with a preference for flowing conditions. |
| Species richness | All indigenous species | 29 of the expected 32 indigenous fish species estimated to be present in the reach under PES (to be verified). | 20% decrease in species richness. | Loss in diversity, abundance and condition of velocity-depth categories and cover features that lead to a loss of species. |
| Requirement for flowing water. | LCON  LMOL | LCON and LMOL have a high requirement for flow during all life stages and are the most applicable indicator species for flow modification. | LCON and/or LMOL absent during any survey OR present at FROC1 of < 3 for LCON and < 4.5 for LMOL. | Reduced suitability (abundance and quality) of flowing habitats (i.e. decreased flows, increased zero flows, and altered seasonality). |
| FD habitats | LCON  CPAR | LCON and CPAR have a high requirement for fast-deep habitats and are the most applicable indicator species for this velocity-depth category. | LCON and/or CPAR absent during any survey OR present at FROC of < 3 for LCON and < 3.5 for CPAR. (DWAF 2006b: A minimum of 10 CPAR specimens should be sampled at 70% of sites during a survey of FS and FD, electrofishing for minimum 20 minutes) | Reduced suitability (abundance and quality) of FD habitats (i.e. decreased flows, increased zero flows). |
| FS habitats | CPAR  LCYL | CPAR and LCYL have a high requirement for fast-deep habitats and are the most applicable indicator species for this velocity-depth category. | CPAR and/or LCYL absent during any survey OR present at FROC of < 3.5 for CPAR and < 4.5 for LCYL. | Reduced suitability (abundance and quality) of FS habitats (i.e. decreased flows, increased zero flows). |
| Substrate | LCON  LROS | LCON and LROS have a high requirement for fast-deep habitats and are the most applicable indicator species for this habitat feature. | LCON and/or LROS absent during any survey OR present at FROC of < 3 for LCON and < 3 for LROS. | Increased sedimentation of riffle/rapid substrates, excessive algal growth on substrates, Increased sedimentation of riffle/rapid substrates, excessive algal growth on substrates. |
| Water quality intolerance | MMAC  LMOL | MMAC and LMOL have a high requirement for unmodified water quality and are the most applicable indicator species for water quality deterioration. | MMAC and/or LMOL absent during any survey OR present at FROC of < 3 for MMAC and < 4.5 for LMOL. | Decreased water quality (especially flow related water quality variables such as oxygen). |
| Overhanging vegetation | PPHI  TREN | PPHI and TREN have a high requirement for overhanging vegetation and are the most applicable indicator species for this habitat feature. | PPHI and/or TREN absent during any survey OR present at FROC of < 3 for PPHI and < 5 for TREN. | Significant change in overhanging vegetation habitats. |
| Instream vegetation | TREN | TREN and have a high requirement for instream (aquatic) vegetation and are the most applicable indicator species for this habitat feature. | TREN and/or absent during any survey OR present at FROC of < 5 for TREN. | Significant change in overhanging vegetation habitats (overgrazing, flow modification, use of herbicides, agriculture). |
| Undercut banks | MMAC  PCAT | MMAC and PCAT have a high preference for undercut banks and rootwads and are the most applicable indicator species for this habitat feature. | MMAC and/or PCAT absent during any survey OR present at FROC of < 3 for MMAC and < 3 for PCAT. | Significant change in undercut bank and rootwads habitats (e.g. bank erosion, reduced flows). |
| Water column | MBRE  HVIT | MBRE and HVIT have a high requirement for water column as habitat and are the most applicable indicator species for this habitat feature. | MBRE and/or HVIT absent during any survey OR present at FROC of <4 for MBRE and < 3.5 for HVIT. (DWAF 2006b: A minimum of 3 HVIT specimens should be sampled at 50% of sites during a survey using appropriate methods). | Reduction in suitability of water column (i.e. increased sedimentation of pools, reduced flows). |
| SD habitats | BANN  BUNI | BANN and BUNI have a high requirement for slow-deep habitats and are the most applicable indicator species for this velocity depth category. | BANN and/or BUNI absent during any survey OR present at FROC of < 3.5 for BANN and < 3.5 for BUNI. | Significant change in SD habitat suitability (i.e. increased or decreased flows, altered seasonality, increased sedimentation of slow habitats). |
| SS habitats | BRAD  BVIV | BRAD and BVIV have a high requirement for slow-shallow habitats and are the most applicable indicator species for this velocity depth category. | BRAD and/or BVIV absent during any survey OR present at FROC of < 3.5 for BRAD and < 3.5 for BVIV. | Significant change in SS habitat suitability (i.e. increased flows, altered seasonality, increased sedimentation of slow habitats). |
| Migratory success2 | BMAR  LMOL, etc. | It is estimated that the catadromous eels have been lost from this reach but various potamodromous species (including BMAR) is still present. | Loss or decreased FROC potamodromous species (such as BMAR). (DWAF, 2006b: A minimum of 20 BMAR specimens should be sampled at 100% of sites during a survey, using appropriate methods). | Alteration of longitudinal habitat through the creation of migration barriers (dams, weirs, zero flows, poor water quality causing chemical barriers). |
| Alien fish species | Presence of any alien/introduced spp. | No alien/introduced species known or expected to be present in the SQ reach. | Presence of any additional alien/introduced species or increase in abundance and distribution of existing species. | N/A. |
| **Primary indicator species** | **CPAR**  **(BMAR)** | **CPAR estimated to be present at > 25% of sites in SQ reach (2013) (to be verified).** | **See relevant sections above for detail.** | **See relevant sections above for detail.** |  |

**Table 38 RU EWR 7: Macro-invertebrate EcoSpecs and TPCs**

| **EcoSpecs** | **TPCs** | **Recommended scenario: C/D EC** |
| --- | --- | --- |
| To ensure that the SASS 5 scores and ASPT values occur in the following range: SASS 5 score: >70; ASPT value: >4.0. | SASS5 scores less than 75 and an ASPT less than 4.5. | The lower flows during winter will have an impact on the macro-invertebrate habitat and water quality. This will impact on the species preferring flow velocity (>0.6 m/s) and species requiring high water quality parameters. |
| To ensure that the MIRAI score remains within the range of a C Category (62% – 78%). | A MIRAI score of 65% or less. | The EcoSpecs will reduce to accommodate the lower MIRAI score of 60% or less. |
| To maintain suitable flow velocity (>0.6 m/s) and to maintain clean, un-embedded surface area (cobbles) to support the following flow-dependent taxa:   * Hydropsychidae (Abundance A). | Hydropsychidae missing in two consecutive surveys or present as a single individual in two consecutive surveys where the SIC habitat is available. | Since stones-in-current habitat is restricted in the reach, Hydropsychidae might disappear from the system and the EcoSpec for the 0.3 – 0.6 m/s flow velocity will take its place. |
| To maintain suitable flow velocity (0.3 – 0.6 m/s) and to maintain clean, un-embedded surface area (cobbles) to support the following flow-dependent taxa:   * Libellulidae (Abundance A). * Coenagrionidae (Abundance A). | Any one of these two taxa missing in two consecutive surveys or any one of these two taxa present as a single individual in two consecutive surveys. | Although these taxa will be stressed even more, it is not expected that they will disappear and this EcoSpec can still be used. |
| To maintain sufficient quantity and quality of inundated vegetation to support the following vegetation-dwelling taxa:   * Atyidae (Abundance A). * Coenagrionidae (Abundance A). | Any one of these two taxa missing in two consecutive surveys or any one of these two taxa present as a single individual in two consecutive surveys. | Although this habitat will be stressed even more, it is not expected that the indicator species will disappear and this EcoSpec can still be used. |
| To maintain suitable conditions for the following five key taxa:   * Hydropsychidae, Libellulidae * Coenagrionidae, Atyidae * Gomphidae | Presence of less than three of the five key taxa listed in any survey. | Since Hydropsychidae might disappear during this scenario, the EcoSpecs might change as follows:  To maintain suitable conditions for the following four key taxa:   * Libellulidae, Coenagrionidae, Atyidae, Gomphidae |
| Balanced community structure, i.e. majority of invetebrates at A abundance, certain taxa at B abundance (e.g. Baetidae, Caenidae and Thiaridae). To ensure that no group consistently dominates the fauna, defined as D abundance (>1000) over than two consecutive surveys. | Any taxon occurring in an abundance of > 1000 for two consecutive surveys. | The EcoSpecs should not change:  Any taxon occurring in an abundance of > 1000 for two consecutive surveys. |

**Table 39 EWR 7 Riparian vegetation EcoSpecs and TPC**

| **Metric** | **Zone assessed** | **EcoSpecs (PES)** | **EcoSpecs (Sc 11)** | **TPC (for PES)** |
| --- | --- | --- | --- | --- |
| Vegetation Cover | Marginal Zone | Maintain marginal hydrophyte fringe and *Phragmites* along the active channel and *C. marginatus, Cynodon dactylon* and *Leersia hexandra* patches in places. | Maintain marginal hydrophyte fringe and *Phragmites* along the active channel and *C. marginatus, C. dactylon* and *L. hexandra* patches in places. | Marginal fringe largely absent; *Phragmites* fringe visibly (fixed photo) decreasing/increasing in abundance/cover; *C. marginatus, L. hexandra or C. dactylon* absent. |
| Lower Zone | Presence of some obligate riparian tree species | Presence of some obligate riparian tree species | Absence of obligate riparian trees OR failure to recover after large floods |
| Upper Zone | Maintain *B. maughamii* subsp*. maughamii, B. salicina, C. imberbe, P. violace*, and C*ombretum microphyllum* populations. | Maintain *B. maughamii* subsp. *maughamii, B. salicina, C. imberbe, P. violace*, and C*. microphyllum* populations. | Visible decrease or absence of *B. maughamii* subsp. *maughamii, B. salicina, C. imberbe, P. violace, and C. microphyllum* cover /abundance; mortality of *C. imberbe* adults. |
| Alien Invasion | Riparian zone | Perennial alien plant species aerial cover less than 10%. | Perennial alien plant species aerial cover less than 10%. | An increase in alien perennial species cover above 10%. |
| Indigenous Riparian Woody Cover | Marginal Zone | Riparian woody species cover not absent and not more than 80% (goal for marginal zone in Category C). | Riparian woody species cover not less than 5% and not more than 70% (goal for marginal zone in Category B/C). | An increase in riparian woody cover above 80% OR an absence of woody riparian species. |
| Lower Zone | Riparian woody species cover not less than 5% and not more than 70%. | Riparian woody species cover not less than 5% and not more than 70%. | An increase in riparian woody cover above 70% OR a decrease below 5%. |
| Upper Zone | Riparian woody species cover not less than 30% and not more than 60%. | Riparian woody species cover not less than 20% and not more than 80%. | An increase in riparian woody cover above 60% OR a decrease below 30%. |
| *Phragmites* (reed) cover | Marginal Zone | Reed cover not less than 10%. | Reed cover not less than 20%. | A decrease in reed cover below 10%. |
| Lower Zone | Reed cover between 10% and 90%. | Reed cover between 10% and 90%. | A decrease in reed cover below 10% OR and increase above 90%. |
| Upper Zone | Reeds cover less than 40%. | Reeds cover less than 50%. | An increase in reed cover above 40%. |
| Riparian zone integrity | Riparian zone | Zero expansion of agriculture or forestry within the riparian zone. | Zero expansion of agriculture or forestry within the riparian zone. | An increase of the spatial extent of forestry or agriculture WITHIN the riparian zone. |
| Longitudinal riparian zone continuity | Riparian zone | Zero increase in riparian zone longitudinal fragmentation. | Zero increase in riparian zone longitudinal fragmentation. | An increase in the longitudinal fragmentation of the riparian zone. |

13. IUA 12: LETABA TRIBUTARIES IN THE KNP

**Table 40 Habitat RQOs provided as the REC**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **RU (SQ)** | **River** | **Level of Impacts** | **PES** | **REC** |
| B83A-00193 | Shipikani | **SMALL:** Crossings low water, inundation, roads, small dams (farm), vegetation removal. | **A** | **A** |
| B83A-00238 | Nharhweni | **SMALL:** Inundation, roads, small dams (farm), vegetation removal.  **MODERATE:** Recreation. | **A** | **A** |
| B83A-00254 | Ngwenyeni | **SMALL:** Crossings low water, roads, vegetation removal. | **A** | **A** |
| B83B-00161 | Tsende | **SMALL:** Inundation, large dams, roads, grazing/trampling, vegetation removal. | **B** | **B** |
| B83D-00204 | Manyeleti | **SMALL:** Inundation, Small dams (farm), vegetation removal. | **A** | **A** |
| B83D-00208 | Makhadzi | **SMALL:** Crossings low water, roads, grazing/trampling, vegetation removal. | **A** | **A** |
| B83D-00261 | Nwanedzi | **SMALL:** Crossings low water, erosion, roads, grazing/trampling, vegetation removal. | **A** | **A** |
| B83D-00236 | Makhadzi | **SMALL:** Crossings low water, inundation, roads, vegetation removal. | **A** | **A** |

**SUMMARY OF WATER QUALITY RESOURCE QUALITY OBJECTIVES**

The water quality information is presented as follows:

* Per IUA and identified river reach or node:
  + Key user
  + Water quality issue
  + Water quality narrative RQO for main drivers; i.e. UserSpecs and/or EcoSpecs
  + Water quality numerical RQO for main drivers; i.e. UserSpecs and/or EcoSpecs
* Per EWR site:
  + EcoSpecs, i.e. detailed water quality objectives for the aquatic ecosystem from the Reserve study
  + Thresholds or Potential Concern (TPCs), i.e. for the aquatic ecosystem from the Reserve study

**IUA 1: LETABA UPSTREAM OF TZANEEN DAM**

* **EWR 1, Letaba (B81B-00264)**

**Key user:** Forestry and some irrigation

**Water quality issue:** Slight nutrient elevations are the main water quality issue.

|  |  |
| --- | --- |
| **Water quality narrative RQO** | **Water quality numerical RQO** |
| Ensure that nutrient levels are within Acceptable limits. | 50th percentile of the data must be less than 0.015 mg/L PO4-P (aquatic ecosystems: driver) |
| Ensure water quality state maintains biotic requirements as specified by RQOs for biota. | See specified biota requirements |

**EWR 1 (Appel) reach, Letaba River: EcoSpecs (water quality)**

|  |  |
| --- | --- |
| River: Letaba | |
| Monitoring site: B8H014Q01 | |
| EWR Site: 1 | |
| Water quality metrics | | **Ecospecs** |
| Inorganic salts(a) | MgSO4 | The 95th percentile of the data must be ≤ 16 mg/L |
| Na2SO4 | The 95th percentile of the data must be ≤ 20 mg/L |
| MgCl2 | The 95th percentile of the data must be ≤ 15 mg/L |
| CaCl2 | The 95th percentile of the data must be ≤ 21 mg/L |
| NaCl | The 95th percentile of the data must be ≤ 45 mg/L |
| CaSO4 | The 95th percentile of the data must be ≤ 351 mg/L |
| Physical variables | EC | The 95th percentile of the data must be ≤ 30 mS/m |
| pH | The 5th and 95th percentile of the data must be between 6.5 to 8.0 |
| Temperature | Small deviation from the natural temperature range |
| Dissolved oxygen(b) | The 5th percentile of the data must be ≥ 8 mg/L |
| Turbidity(b) | Vary by a small amount from the natural turbidity range; minor silting of instream habitats acceptable |
| Nutrients | TIN | The 50th percentile of the data must be ≤ 0.25 mg/L |
| PO4-P | The 50th percentile of the data must be ≤ 0.015 mg/L |
| Response variables | Chl-*a* phytoplankton (b) | The 50th percentile of the data must be ≤ 15 mg/m2 |
| Chl-*a* periphyton | The 50th percentile of the data must be ≤ 21 mg/m2 |
| Toxics | Toxics listed in DWA (2008) | The 95th percentile of the data must be within the A category boundaries |
| Other | The 95th percentile of the data must be within the Target Water Quality Range (TWQR) as stated in DWAF (1996) |

(a) To be generated using TEACHA when the TPC for EC is exceeded or salt pollution expected.

(b) No data were available for this assessment. All EcoSpecs and TPCs need verification as based on expert judgement.

**EWR 1 (Appel) reach, Letaba River: Thresholds of Potential Concern (water quality)**

|  |  |
| --- | --- |
| River: Letaba | |
| Monitoring site: B8H014Q01 | |
| EWR Site: 1 | |
| Water quality metrics | | **TPC** |
| Inorganic salts(a) | MgSO4 | The 95th percentile of the data must be between 13 - 16 mg/L |
| Na2SO4 | The 95th percentile of the data must be between 16 – 20 mg/L |
| MgCl2 | The 95th percentile of the data must be between 12 – 15 mg/L |
| CaCl2 | The 95th percentile of the data must be between 17 – 21 mg/L |
| NaCl | The 95th percentile of the data must be between 36 – 45 mg/L |
| CaSO4 | The 95th percentile of the data must be between 281 – 351 mg/L |
| Physical variables | EC | The 95th percentile of the data must be between 24 – 30 mS/m |
| pH | 5th percentile of the data must not be less than 6.7  95th percentile of the data must not be greater than 7.6 |
| Temperature | Small deviation from the natural temperature range. Initiate baseline monitoring. |
| Dissolved oxygen | 5th percentile of the data must be 6.4 – 8.0 mg/L. Initiate baseline monitoring for this variable. |
| Turbidity | Small deviation from the natural conditions. Initiate baseline monitoring. |
| Nutrients | TIN | The 50th percentile of the data must be between 0.2 –0.25 mg/L |
| PO4-P | The 50th percentile of the data must be between 0.012 – 0.015 mg/L |
| Response variables | Chl-*a* phytoplankton | The 50th percentile of the data must be between 12 – 15 μg/L |
| Chl-*a* periphyton | The 50th percentile of the data must be between 17 – 21 mg/m2 |
| Toxics | Toxics listed in DWA (2008) | The 95th percentile of the data must be within the A category boundaries |
| Other | An impact is expected if the 95th percentile of the data exceeds the Chronic Effects Value (CEV) as stated in DWAF (1996) |

(a) To be generated using TEACHA when the TPC for EC is exceeded or salt pollution expected

**IUA 2: LETSITELE AND THABINA**

* **Thabina (B81D-00277)**

**Key user:** Agriculture

**Water quality issue:** Elevated nutrient levels, primarily due to Lenyenye WWTW.

|  |  |
| --- | --- |
| **Water quality narrative RQOs** | **Water quality numerical RQOs** |
| Ensure that nutrient levels are within Acceptable limits. | 50th percentile of the data must be less than or equal to 0.025 mg/L PO4-P (Agriculture - irrigation: driver) |
| Meet faecal coliform targets for recreational (full contact) use | Meet the TWQR of 0-130 counts per 100 ml (DWAF, 1996a) |
| Ensure water quality state maintains biotic requirements as specified by RQOs for biota. | See specified biota requirements |

* **EWR 2, Letsitele (B81D-00271)**

**Key user:** Citrus plantations and irrigation

**Water quality issue:** Main water quality issues are elevated nutrients, salts and potential toxics.

| **Water quality narrative RQOs** | **Water quality numerical RQOs** |
| --- | --- |
| Ensure that nutrient levels are within Tolerable limits. | 50th percentile of the data must be less than or equal to 0.025 mg/L PO4-P (Agriculture - irrigation: driver) |
| Ensure that electrical conductivity (salt) levels are within Ideal limits. | 75th percentile of the data must be less than or equal to 30 mS/m (Aquatic ecosystems: driver) |
| Meet faecal coliform targets for recreational (full contact) use | Meet the TWQR of 0-130 counts per 100 ml (DWAF, 1996a) |
| Ensure that toxics are within Ideal limits or A categories. | 75th percentile of the data must be within the TWQR for toxics. Numerical limits can be found in DWAF (1996b) and DWAF (2008). |
| Ensure water quality state maintains biotic requirements as specified by RQOs for biota. | See specified biota requirements |

* **Letsitele (B81D-00272)**

**Key user:** Citrus plantations and irrigation

**Water quality issue:** Main water quality issues are elevated nutrients, salts and potential toxics.

|  |  |
| --- | --- |
| **Water quality narrative RQOs** | **Water quality numerical RQOs** |
| Ensure that nutrient levels are within Tolerable limits. | 50th percentile of the data must be less than or equal to 0.025 mg/L PO4-P (Agriculture - irrigation: driver) |
| Ensure that electrical conductivity (salt) levels are within Ideal limits. | 75th percentile of the data must be less than or equal to 30 mS/m (Aquatic ecosystems: driver) |
| Ensure that toxics are within Ideal limits or A categories. | 75th percentile of the data must be within the TWQR for toxics. Numerical limits can be found in DWAF (1996) and DWAF (2008). |
| Ensure water quality state maintains biotic requirements as specified by RQOs for biota. | See specified biota requirements |

As land-use and impacts change along the Letsitele RU, it was divided into two Water Quality Sub-Units (WQSUs). However, only one suitable DWA water quality monitoring point exists, i.e. B8H010Q01near Letsitele Tank at EWR 2. **WQSUs 8 and 9 were therefore combined for the PES evaluation. EcoSpec and TPC tables are therefore valid for B81D-00271 (containing EWR2) and B81D-00272, i.e the length of the Letsitele River.**

**Letsitele River: EcoSpecs (water quality)**

|  |  |
| --- | --- |
| River: Letsitele | |
| Monitoring site: B8H010Q01 | |
| EWR Site: 2 | |
| Water quality metrics | | **Ecospecs** |
| Inorganic salts(a) | MgSO4 | The 95th percentile of the data must be ≤ 16 mg/L |
| Na2SO4 | The 95th percentile of the data must be ≤ 20 mg/L |
| MgCl2 | The 95th percentile of the data must be ≤ 15 mg/L |
| CaCl2 | The 95th percentile of the data must be ≤ 21 mg/L |
| NaCl | The 95th percentile of the data must be ≤ 45 mg/L |
| CaSO4 | The 95th percentile of the data must be ≤ 351 mg/L |
| Physical variables | EC | The 95th percentile of the data must be ≤ 30 mS/m |
| pH | The 5th and 95th percentiles of the data must be between 6.5 to 8.0 |
| Temperature | Moderate and infrequent deviation from the natural temperature range. Vary by no more than 2°C. |
| Dissolved oxygen(b) | The 5th percentile of the data must be ≥ 7 mg/L |
| Turbidity(b) | Moderate changes with temporary high sediment loads and turbidity during runoff events. |
| Nutrients | TIN | The 50th percentile of the data must be ≤ 0.7 mg/L |
| PO4-P | The 50th percentile of the data must be ≤ 0.025 mg/L |
| Response variables | Chl-*a* phytoplankton (b) | The 50th percentile of the data must be ≤ 20 mg/m2 |
| Chl-*a* periphyton | The 50th percentile of the data must be ≤ 21 mg/m2 |
| Toxics | Toxics listed in DWA (2008) | The 95th percentile of the data must be within the A category boundaries |
| Other | The 95th percentile of the data must be within the Target Water Quality Range (TWQR) as stated in DWAF (1996) |

(a) To be generated using TEACHA when the TPC for EC is exceeded or salt pollution expected.

(b) No data were available for this assessment. All EcoSpecs and TPCs need verification as based on expert judgement.

**Letsitele River: Thresholds of Potential Concern (water quality)**

|  |  |
| --- | --- |
| River: Letsitele | |
| Monitoring site: B8H010Q01 | |
| EWR Site: 2 | |
| Water quality metrics | | **TPC** |
| Inorganic salts(a) | MgSO4 | The 95th percentile of the data must be between 13 - 16 mg/L |
| Na2SO4 | The 95th percentile of the data must be between 16 – 20 mg/L |
| MgCl2 | The 95th percentile of the data must be between 12 – 15 mg/L |
| CaCl2 | The 95th percentile of the data must be between 17 – 21 mg/L |
| NaCl | The 95th percentile of the data must be between 36 – 45 mg/L |
| CaSO4 | The 95th percentile of the data must be between 281 – 351 mg/L |
| Physical variables | EC | The 95th percentile of the data must be between 24 – 30 mS/m |
| pH | 5th percentile of the data must not be less than 6.7  95th percentile of the data must not be greater than 7.6 |
| Temperature | Unnatural deviation from the natural temperature range. Initiate baseline monitoring. |
| Dissolved oxygen | 5th percentile of the data must be 7.2 – 7.0 mg/L. Initiate baseline monitoring for this variable. |
| Turbidity | Small deviation from the natural conditions. Initiate baseline monitoring. |
| Nutrients | TIN | The 50th percentile of the data must be between 0.55 – 0.7 mg/L |
| PO4-P | The 50th percentile of the data must be between 0.02 – 0.025 mg/L |
| Response variables | Chl-*a* phytoplankton | The 50th percentile of the data must be between 16 – 20 μg/L |
| Chl-*a* periphyton | The 50th percentile of the data must be between 17 – 21 mg/m2 |
| Toxics | Toxics listed in DWA (2008) | The 95th percentile of the data must be within the A category boundaries |
| Other | An impact is expected if the 95th percentile of the data exceeds the Chronic Effects Value (CEV) as stated in DWAF (1996) |

(a) To be generated using TEACHA when the TPC for EC is exceeded or salt pollution expected

**IUA 3: LETABA DOWNSTREAM OF TZANEEN TO PROPOSED NWAMITWA DAM**

* **Nwanedzi (B81E-00213)**

**Key user:** Agriculture

**Water quality issue:** Elevated nutrient levels.

|  |  |
| --- | --- |
| **Water quality narrative RQOs** | **Water quality numerical RQOs** |
| Ensure that nutrient levels are within Tolerable limits. | 50th percentile of the data must be less than or equal to 0.025 mg/L PO4-P (Agriculture - irrigation: driver) |
| Ensure that electrical conductivity (salt) levels are within Ideal limits. | 75th percentile of the data must be less than or equal to 30 mS/m (Aquatic ecosystems: driver) |
| Ensure that toxics are within Ideal limits or A categories. | 75th percentile of the data must be within the TWQR for toxics. Numerical limits can be found in DWAF (1996) and DWAF (2008). |
| Ensure water quality state maintains biotic requirements as specified by RQOs for biota. | See specified biota requirements |

**IUA 4: LETABA FROM PROPOSED NWAMITWA DAM TO KLEIN LETABA CONFLUENCE**

* **EWR 3, Letaba (B81F-00200)**

**Key user:** Irrigation agriculture, particularly for citrus plantations (e.g. Nagude Farm Estate).

**Water quality issue:** The use of pesticides and herbicides, and expected elevated levels of periphyton, nitrogen and phosphates.

|  |  |
| --- | --- |
| **Water quality narrative RQOs** | **Water quality numerical RQOs** |
| Ensure that nutrient levels are within Acceptable limits. | 50th percentile of the data must be less than or equal to 0.015 mg/L PO4-P (Aquatic ecosystems: driver) |
| Ensure that electrical conductivity (salt) levels are within Ideal limits. | 75th percentile of the data must be less than or equal to 30 mS/m (Industry Cat 3: driver) |
| Ensure that pH stays within Ideal limits. | 5th and 95th percentiles of pH data must be between 6.5 and 8.0 (Aquatic ecosystems: driver) |
| Ensure that toxics are within Ideal limits or A categories. | 75th percentile of the data must be within the TWQR for toxics. Numerical limits can be found in DWAF (1996b) and DWAF (2008). |
| Ensure water quality state maintains biotic requirements as specified by RQOs for biota. | See specified biota requirements |

**EWR 3 (Prieska Weir) reach, Letaba River: EcoSpecs (water quality)**

|  |  |
| --- | --- |
| River: Groot Letaba | |
| Monitoring site: B8H009Q01 | |
| EWR Site: 3 | |
| Water quality metrics | | **Ecospecs** |
| Inorganic salts(a) | MgSO4 | The 95th percentile of the data must be ≤ 23 mg/L |
| Na2SO4 | The 95th percentile of the data must be ≤ 20 mg/L |
| MgCl2 | The 95th percentile of the data must be ≤ 15 mg/L |
| CaCl2 | The 95th percentile of the data must be ≤ 21 mg/L |
| NaCl | The 95th percentile of the data must be ≤ 191 mg/L |
| CaSO4 | The 95th percentile of the data must be ≤ 351 mg/L |
| Physical variables | EC | The 95th percentile of the data must be ≤ 55 mS/m |
| pH | The 5th and 95th percentiles of the data must be between 6.5 to 8.0 |
| Temperature | Moderate and infrequent deviation from the natural temperature range. Vary by no more than 2°C. |
| Dissolved oxygen(b) | The 5th percentile of the data must be ≥ 7 mg/L |
| Turbidity(b) | Moderate changes with temporary high sediment loads and turbidity during runoff events. |
| Nutrients | TIN | The 50th percentile of the data must be ≤ 0.7 mg/L |
| PO4-P | The 50th percentile of the data must be ≤ 0.015 mg/L |
| Response variables | Chl-*a* phytoplankton (b) | The 50th percentile of the data must be ≤ 20 mg/m2 |
| Chl-*a* periphyton | The 50th percentile of the data must be ≤ 21 mg/m2 |
| Toxics | Toxics listed in DWA (2008) | The 95th percentile of the data must be within the A category boundaries |
| Other | The 95th percentile of the data must be within the Target Water Quality Range (TWQR) as stated in DWAF (1996) |

(a) To be generated using TEACHA when the TPC for EC is exceeded or salt pollution expected.

(b) No data were available for this assessment. All EcoSpecs and TPCs need verification as based on expert judgement.

**EWR 3 (Prieska Weir) reach, Letaba River: Thresholds of Potential Concern (water quality)**

|  |  |
| --- | --- |
| River: Groot Letaba | |
| Monitoring site: B8H009Q01 | |
| EWR Site: 3 | |
| Water quality metrics | | **TPC** |
| Inorganic salts(a) | MgSO4 | The 95th percentile of the data must be between 18 - 23 mg/L |
| Na2SO4 | The 95th percentile of the data must be between 16 – 20 mg/L |
| MgCl2 | The 95th percentile of the data must be between 12 – 15 mg/L |
| CaCl2 | The 95th percentile of the data must be between 17 – 21 mg/L |
| NaCl | The 95th percentile of the data must be between 153 – 191 mg/L |
| CaSO4 | The 95th percentile of the data must be between 281 – 351 mg/L |
| Physical variables | EC | The 95th percentile of the data must be between 44 – 55 mS/m |
| pH | 5th percentile of the data must not be less than 6.7  95th percentile of the data must not be greater than 7.6 |
| Temperature | Unnatural deviation from the natural temperature range. Initiate baseline monitoring. |
| Dissolved oxygen | 5th percentile of the data must be 7.2 – 7.0 mg/L. Initiate baseline monitoring for this variable. |
| Turbidity | Small deviation from the natural conditions. Initiate baseline monitoring. |
| Nutrients | TIN | The 50th percentile of the data must be between 0.55 – 0.7 mg/L |
| PO4-P | The 50th percentile of the data must be between 0.012 – 0.015 mg/L |
| Response variables | Chl-*a* phytoplankton | The 50th percentile of the data must be between 16 – 20 μg/L |
| Chl-*a* periphyton | The 50th percentile of the data must be between 17 – 21 mg/m2 |
| Toxics | Toxics listed in DWA (2008) | The 95th percentile of the data must be within the A category boundaries |
| Other | An impact is expected if the 95th percentile of the data exceeds the Chronic Effects Value (CEV) as stated in DWAF (1996) |

(a) To be generated using TEACHA when the TPC for EC is exceeded or salt pollution expected

* **EWR 4, Letaba (B81J-00219)**

**Key user:** Limited cultivated lands and subsistence agriculture and livestock.

**Water quality issue:** Issues are linked primarily to nutrient elevations and increased turbidities related to subsistence land use and settlements in the area.

|  |  |
| --- | --- |
| **Water quality narrative RQOs** | **Water quality numerical RQOs** |
| Ensure that nutrient levels are within Acceptable limits. | 50th percentile of the data must be less than or equal to 0.025 mg/L PO4-P (Aquatic ecosystems: driver) |
| Ensure that electrical conductivity (salt) levels are within Ideal limits. | 75th percentile of the data must be less than or equal to 30 mS/m (Industry Cat 3: driver) |
| Ensure that pH stays within Acceptable limits. | 5th and 95th percentiles of pH data must be between 6.5 and 8.4 (Industry Cat 3: driver) |
| Ensure that turbidity or clarity levels stay within Acceptable limits. | A moderate change from present with temporary high sediment loads and turbidity during runoff events. (Aquatic ecosystems: driver) |
| Ensure that toxics are within Ideal limits or A categories. | 75th percentile of the data must be within the TWQR for toxics. Numerical limits can be found in DWAF (1996b) and DWAF (2008). |
| Ensure water quality state maintains biotic requirements as specified by RQOs for biota. | See specified biota requirements |

**EWR 4 (Letaba Ranch) reach, Letaba River: EcoSpecs (water quality)**

|  |  |
| --- | --- |
| River: Groot Letaba | |
| Monitoring site: B8H008Q01 | |
| EWR Site: 4 | |
| Water quality metrics | | **Ecospecs** |
| Inorganic salts(a) | MgSO4 | The 95th percentile of the data must be ≤ 16 mg/L |
| Na2SO4 | The 95th percentile of the data must be ≤ 20 mg/L |
| MgCl2 | The 95th percentile of the data must be ≤ 15 mg/L |
| CaCl2 | The 95th percentile of the data must be ≤ 21 mg/L |
| NaCl | The 95th percentile of the data must be ≤ 191 mg/L |
| CaSO4 | The 95th percentile of the data must be ≤ 351 mg/L |
| Physical variables | EC | The 95th percentile of the data must be ≤ 55 mS/m |
| pH | The 5th percentile of the data must be between 5.9 to 6.5, and the 95th percentile between 8.0 to 8.8 |
| Temperature | Moderate and infrequent deviation from the natural temperature range. Vary by no more than 2°C. |
| Dissolved oxygen(b) | The 5th percentile of the data must be ≥ 7 mg/L |
| Turbidity(b) | Moderate changes with temporary high sediment loads and turbidity during runoff events. |
| Nutrients | TIN | The 50th percentile of the data must be ≤ 0.25 mg/L |
| PO4-P | The 50th percentile of the data must be ≤ 0.025 mg/L |
| Response variables | Chl-*a* phytoplankton (b) | The 50th percentile of the data must be ≤ 15 mg/m2 |
| Chl-*a* periphyton | The 50th percentile of the data must be ≤ 12 mg/m2 |
| Toxics | Toxics listed in DWA (2008) | The 95th percentile of the data must be within the A category boundaries |
| Other | The 95th percentile of the data must be within the Target Water Quality Range (TWQR) as stated in DWAF (1996) |

(a) To be generated using TEACHA when the TPC for EC is exceeded or salt pollution expected.

(b) No data were available for this assessment. All EcoSpecs and TPCs need verification as based on expert judgement.

**EWR 4 (Letaba Ranch) reach, Letaba River: Thresholds of Potential Concern (water quality)**

|  |  |
| --- | --- |
| River: Groot Letaba | |
| Monitoring site: B8H008Q01 | |
| EWR Site: 4 | |
| Water quality metrics | | **TPC** |
| Inorganic salts(a) | MgSO4 | The 95th percentile of the data must be between 13 - 16 mg/L |
| Na2SO4 | The 95th percentile of the data must be between 16 – 20 mg/L |
| MgCl2 | The 95th percentile of the data must be between 12 – 15 mg/L |
| CaCl2 | The 95th percentile of the data must be between 17 – 21 mg/L |
| NaCl | The 95th percentile of the data must be between 153 – 191 mg/L |
| CaSO4 | The 95th percentile of the data must be between 281 – 351 mg/L |
| Physical variables | EC | The 95th percentile of the data must be between 44 – 55 mS/m |
| pH | 5th percentile of the data must not be less than 6.1.  95th percentile of the data must not be greater than 8.6. |
| Temperature | Unnatural deviation from the natural temperature range. Initiate baseline monitoring. |
| Dissolved oxygen | 5th percentile of the data must be 7.2 – 7.0 mg/L. Initiate baseline monitoring for this variable. |
| Turbidity | Small deviation from the natural conditions. Initiate baseline monitoring. |
| Nutrients | TIN | The 50th percentile of the data must be between 0.2 – 0.25 mg/L |
| PO4-P | The 50th percentile of the data must be between 0.02 – 0.025 mg/L |
| Response variables | Chl-*a* phytoplankton | The 50th percentile of the data must be between 12 – 15 μg/L |
| Chl-*a* periphyton | The 50th percentile of the data must be between 10 – 12 mg/m2 |
| Toxics | Toxics listed in DWA (2008) | The 95th percentile of the data must be within the A category boundaries |
| Other | An impact is expected if the 95th percentile of the data exceeds the Chronic Effects Value (CEV) as stated in DWAF (1996) |

(a) To be generated using TEACHA when the TPC for EC is exceeded or salt pollution expected

**IUA 6: NORTHERN TRIBUTARIES TO LETABA**

* **Molototsi (B81G-00164)**

**Key user:** Settlements

**Water quality issue:** Elevated nutrient levels primarily due to Ga-Kgapene WWTW.

|  |  |
| --- | --- |
| **Water quality narrative RQOs** | **Water quality numerical RQOs** |
| Ensure that nutrient levels are within Tolerable limits. | 50th percentile of the data must be less than or equal to 0.025 mg/L PO4-P (Aquatic ecosystem: driver) |
| Meet faecal coliform targets for recreational (full contact) use | Meet the TWQR of 0-130 counts per 100 ml (DWAF, 1996a) |
| Ensure that toxics are within Ideal limits or A categories. | 75th percentile of the data must be within the TWQR for toxics. Numerical limits can be found in DWAF (1996b) and DWAF (2008). |
| Ensure water quality state maintains biotic requirements as specified by RQOs for biota. | See specified biota requirements |

**IUA 7: UPPER MIDDLE LETABA AND TRIBUTARIES UPSTREAM OF MIDDLE LETABA DAM**

* **Koedoes (B82B-00173)**

**Key user:** Agricultural activities, including commercial tomato producers ZZ2 at Mooketsi.

**Water quality issue:** Elevated nutrient levels and potential toxics from fertilizer use.

|  |  |
| --- | --- |
| **Water quality narrative RQO** | **Water quality numerical RQO** |
| Ensure that nutrient levels are within Acceptable limits. | 50th percentile of the data must be less than or equal to 0.015 mg/L PO4-P (Aquatic ecosystems / Agriculture - Irrigation: drivers) |
| Ensure that toxics are within Ideal limits or A categories. | 75th percentile of the data must be within the TWQR for toxics. Numerical limits can be found in DWAF (1996b) and DWAF (2008). |
| Ensure water quality state maintains biotic requirements as specified by RQOs for biota. | See specified biota requirements |

* **Mosukodutsi (B82D-00166)**

**Key user:** Agricultural activities

**Water quality issue:** Elevated nutrient levels

|  |  |
| --- | --- |
| **Water quality narrative RQO** | **Water quality numerical RQO** |
| Ensure that nutrient levels are within Acceptable limits. | 50th percentile of the data must be less than or equal to 0.015 mg/L PO4-P (Aquatic ecosystems / Agriculture - Irrigation: drivers) |
| Ensure that toxics are within Ideal limits or A categories. | 75th percentile of the data must be within the TWQR for toxics. Numerical limits can be found in DWAF (1996b) and DWAF (2008). |
| Ensure water quality state maintains biotic requirements as specified by RQOs for biota. | See specified biota requirements |

* **Brandboontjies (B82C-00175)**

**Key user:** Agricultural activities

**Water quality issue:** Elevated nutrient levels are primarily due to the Modjadjiskoof-Duiwelskloof WWTW.

| **Water quality narrative RQO** | **Water quality numerical RQO** |
| --- | --- |
| Ensure that nutrient levels are within Tolerable limits. | 50th percentile of the data must be less than or equal to 0.125 mg/L PO4-P (Aquatic ecosystems / Agriculture - Irrigation: drivers).  50th percentile of the data must be less than or equal to 1.0 mg/L TIN-N (Aquatic ecosystems: driver). |
| Ensure that electrical conductivity (salt) levels are within Acceptable limits. | 75th percentile of the data must be less than or equal to 55 mS/m (Aquatic ecosystems: driver) |
| Meet faecal coliform targets for recreational (full contact) use | Meet the TWQR of 0-130 counts per 100 ml (DWAF, 1996a) |
| Ensure that toxics are within Ideal limits or A categories. |  |
| Ensure water quality state maintains biotic requirements as specified by RQOs for biota. | See specified biota requirements |

* **Middel Letaba (B82D-00146)**

**Key user:** Agricultural activities

**Water quality issue:** Elevated nutrient levels due to agricultural activities.

|  |  |
| --- | --- |
| **Water quality narrative RQO** | **Water quality numerical RQO** |
| Ensure that nutrient levels are within Acceptable limits. | 50th percentile of the data must be less than or equal to 0.015 mg/L PO4-P (Aquatic ecosystems / Agriculture - Irrigation: drivers) |
| Ensure that toxics are within Ideal limits or A categories. | 75th percentile of the data must be within the TWQR for toxics. Numerical limits can be found in DWAF (1996b) and DWAF (2008). |
| Ensure water quality state maintains biotic requirements as specified by RQOs for biota. | See specified biota requirements |

**IUA 8 AND PART OF IUA 9: KLEIN LETABA**

No water quality data are available for this area. Historical flow data are only available from B8H015, i.e. Klein Letaba at Rossbach (1970 – 1972). Due to similarities in land-use, this WQSU (WQSU 12, i.e. SQs B82F-00128 and B82F-00137) will be combined with WQSU 13 (i.e. part of B82G-00135), i.e. **up to Giyani**. **As** **WQSUs 12 and 13 were combined for the PES evaluation, EcoSpec and TPC tables are therefore valid for B82F-00128, B82F-00137 and B82G-00135 up to Giyani.**

**Key user:** Informal settlements and subsistence irrigation

**Water quality issue:** Elevated nutrients and turbidities

|  |  |
| --- | --- |
| **Water quality narrative RQOs** | **Water quality numerical RQOs** |
| Ensure that nutrient levels are within Acceptable limits. | 50th percentile of the data must be less than or equal to 0.015 mg/L PO4-P (Aquatic ecosystems: driver) |
| Meet faecal coliform targets for recreational (full contact) use | Meet the TWQR of 0-130 counts per 100 ml (DWAF, 1996a) |
| Ensure that turbidity or clarity levels stay within Acceptable limits. | A moderate change from present with temporary high sediment loads and turbidity during runoff events. (Aquatic ecosystems: driver) |
| Ensure that toxics are within Ideal limits or A categories. | 75th percentile of the data must be within the TWQR for toxics. Numerical limits can be found in DWAF (1996) and DWAF (2008). |
| Ensure water quality state maintains biotic requirements as specified by RQOs for biota. | See specified biota requirements |

**B82F-00128, B82F-00137 and EWR up to Giyani, Klein Letaba River: EcoSpecs (water quality)**

|  |  |
| --- | --- |
| River: Klein Letaba | |
| Monitoring site: B8H033Q01 | |
| EWR Site: 5 | |
| Water quality metrics | | **Ecospecs** |
| Inorganic salts(a) | MgSO4 | The 95th percentile of the data must be ≤ 23 mg/L |
| Na2SO4 | The 95th percentile of the data must be ≤ 20 mg/L |
| MgCl2 | The 95th percentile of the data must be ≤ 15 mg/L |
| CaCl2 | The 95th percentile of the data must be ≤ 21 mg/L |
| NaCl | The 95th percentile of the data must be ≤ 191 mg/L |
| CaSO4 | The 95th percentile of the data must be ≤ 351 mg/L |
| Physical variables | EC | The 95th percentile of the data must be ≤ 55 mS/m |
| pH | The 5th percentile of the data must be between 5.9 to 6.5, and the 95th percentile between 8.0 to 8.8 |
| Temperature | Moderate and infrequent deviation from the natural temperature range. Vary by no more than 2°C. |
| Dissolved oxygen(b) | The 5th percentile of the data must be ≥ 7 mg/L |
| Turbidity(b) | Moderate changes with temporary high sediment loads and turbidity during runoff events. |
| Nutrients | TIN | The 50th percentile of the data must be ≤ 0.25 mg/L |
| PO4-P | The 50th percentile of the data must be ≤ 0.075 mg/L |
| Response variables | Chl-*a* phytoplankton (b) | The 50th percentile of the data must be ≤ 20 mg/m2 |
| Chl-*a* periphyton | The 50th percentile of the data must be ≤ 52.5 mg/m2 |
| Toxics | Toxics listed in DWA (2008) | The 95th percentile of the data must be within the A category boundaries |
| Other | The 95th percentile of the data must be within the Target Water Quality Range (TWQR) as stated in DWAF (1996) |

(a) To be generated using TEACHA when the TPC for EC is exceeded or salt pollution expected.

(b) No data were available for this assessment. All EcoSpecs and TPCs need verification as based on expert judgement.

**B82F-00128, B82F-00137 and EWR 5 up to Giyani, Klein Letaba River: Thresholds of Potential Concern (water quality)**

|  |  |
| --- | --- |
| River: Klein Letaba | |
| Monitoring site: B8H033Q01 | |
| EWR Site: 5 | |
| Water quality metrics | | **TPC** |
| Inorganic salts(a) | MgSO4 | The 95th percentile of the data must be between 18.5 - 23 mg/L |
| Na2SO4 | The 95th percentile of the data must be between 16 – 20 mg/L |
| MgCl2 | The 95th percentile of the data must be between 12 – 15 mg/L |
| CaCl2 | The 95th percentile of the data must be between 17 – 21 mg/L |
| NaCl | The 95th percentile of the data must be between 153 – 191 mg/L |
| CaSO4 | The 95th percentile of the data must be between 281 – 351 mg/L |
| Physical variables | EC | The 95th percentile of the data must be between 44 – 55 mS/m |
| pH | 5th percentile of the data must not be less than 6.1.  95th percentile of the data must not be greater than 8.6. |
| Temperature | Unnatural deviation from the natural temperature range. Initiate baseline monitoring. |
| Dissolved oxygen | 5th percentile of the data must be 7.2 – 7.0 mg/L. Initiate baseline monitoring for this variable. |
| Turbidity | Small deviation from the natural conditions. Initiate baseline monitoring. |
| Nutrients | TIN | The 50th percentile of the data must be between 0.2 – 0.25 mg/L |
| PO4-P | The 50th percentile of the data must be between 0.06 – 0.075 mg/L |
| Response variables | Chl-*a* phytoplankton | The 50th percentile of the data must be between 16 – 20 μg/L |
| Chl-*a* periphyton | The 50th percentile of the data must be between 42 – 52.5 mg/m2 |
| Toxics | Toxics listed in DWA (2008) | The 95th percentile of the data must be within the A category boundaries |
| Other | An impact is expected if the 95th percentile of the data exceeds the Chronic Effects Value (CEV) as stated in DWAF (1996) |

(a) To be generated using TEACHA when the TPC for EC is exceeded or salt pollution expected

**PART OF IUA 9: KLEIN LETABA DOWNSTREAM FROM GIYANI TO CONFLUENCE**

**Key user:** The main land-use is dense urban settlements (e.g. Giyani) and informal settlements (i.e. limited subsistence and cultivated agriculture, with livestock).

**Water quality issue:** Elevated nutrients; urban effluents; increased turbidities

|  |  |
| --- | --- |
| **Water quality narrative RQO** | **Water quality numerical RQO** |
| Ensure that nutrient levels are within Acceptable limits. | 50th percentile of the data must be less than or equal to 0.025 mg/L PO4-P (Aquatic ecosystems: driver). |
| Ensure that electrical conductivity (salt) levels are within Acceptable limits. | 75th percentile of the data must be less than or equal to 55 mS/m (Aquatic ecosystems: driver) |
| Ensure that turbidity or clarity levels stay within Acceptable limits. | A moderate change from present with temporary high sediment loads and turbidity during runoff events. (Aquatic ecosystems: driver) |
| Meet faecal coliform targets for recreational (full contact) use | Meet the TWQR of 0-130 counts per 100 ml (DWAF, 1996a) |
| Ensure that toxics are within Ideal limits or A categories. | 75th percentile of the data must be within the TWQR for toxics. Numerical limits can be found in DWAF (1996) and DWAF (2008). |
| Ensure water quality state maintains biotic requirements as specified by RQOs for biota. | See specified biota requirements |

**Klein Letaba River downstream Giyani to confluence: EcoSpecs (water quality)**

|  |  |
| --- | --- |
| River: Klein Letaba d/s Giyani | |
| Monitoring site: B8H033Q01 | |
| EWR Site: - | |
| Water quality metrics | | **Ecospecs** |
| Inorganic salts(a) | MgSO4 | The 95th percentile of the data must be ≤ 23 mg/L |
| Na2SO4 | The 95th percentile of the data must be ≤ 20 mg/L |
| MgCl2 | The 95th percentile of the data must be ≤ 15 mg/L |
| CaCl2 | The 95th percentile of the data must be ≤ 21 mg/L |
| NaCl | The 95th percentile of the data must be ≤ 191 mg/L |
| CaSO4 | The 95th percentile of the data must be ≤ 351 mg/L |
| Physical variables | EC | The 95th percentile of the data must be ≤ 55 mS/m |
| pH | The 5th percentile of the data must be between 5.9 to 6.5, and the 95th percentile between 8.8 to 9.2 |
| Temperature | Moderate and infrequent deviation from the natural temperature range. Vary by no more than 2°C. |
| Dissolved oxygen(b) | The 5th percentile of the data must be ≥ 7 mg/L |
| Turbidity(b) | Moderate changes with temporary high sediment loads and turbidity during runoff events. |
| Nutrients | TIN | The 50th percentile of the data must be ≤ 0.7 mg/L |
| PO4-P(c) | The 50th percentile of the data must be ≤ 0.125 mg/L |
| Response variables | Chl-*a* phytoplankton (b) | The 50th percentile of the data must be ≤ 20 mg/m2 |
| Chl-*a* periphyton | The 50th percentile of the data must be ≤ 84 mg/m2 |
| Toxics | Toxics listed in DWA (2008) | The 95th percentile of the data must be within the A category boundaries |
| Other | The 95th percentile of the data must be within the Target Water Quality Range (TWQR) as stated in DWAF (1996) |

(a) To be generated using TEACHA when the TPC for EC is exceeded or salt pollution expected.

(b) No data were available for this assessment. All EcoSpecs and TPCs need verification as based on expert judgement.

**Klein Letaba River downstream Giyani to confluence: Thresholds of Potential Concern (water quality)**

|  |  |
| --- | --- |
| River: Klein Letaba d/s Giyani | |
| Monitoring site: B8H033Q01 | |
| EWR Site: - | |
| Water quality metrics | | **TPC** |
| Inorganic salts(a) | MgSO4 | The 95th percentile of the data must be between 18.5 - 23 mg/L |
| Na2SO4 | The 95th percentile of the data must be between 16 – 20 mg/L |
| MgCl2 | The 95th percentile of the data must be between 12 – 15 mg/L |
| CaCl2 | The 95th percentile of the data must be between 17 – 21 mg/L |
| NaCl | The 95th percentile of the data must be between 153 – 191 mg/L |
| CaSO4 | The 95th percentile of the data must be between 281 – 351 mg/L |
| Physical variables | EC | The 95th percentile of the data must be between 44 – 55 mS/m |
| pH | 5th percentile of the data must not be less than 6.1.  95th percentile of the data must not be greater than 9.0. |
| Temperature | Unnatural deviation from the natural temperature range. Initiate baseline monitoring. |
| Dissolved oxygen | 5th percentile of the data must be 7.2 – 7.0 mg/L. Initiate baseline monitoring for this variable. |
| Turbidity | Small deviation from the natural conditions. Initiate baseline monitoring. |
| Nutrients | TIN(b) | The 50th percentile of the data must be between 0.55 – 0.7 mg/L |
| PO4-P(b) | The 50th percentile of the data must be between 0.1 – 0.125 mg/L |
| Response variables | Chl-*a* phytoplankton | The 50th percentile of the data must be between 16 – 20 μg/L |
| Chl-*a* periphyton | The 50th percentile of the data must be between 67 – 84 mg/m2 |
| Toxics | Toxics listed in DWA (2008) | The 95th percentile of the data must be within the A category boundaries |
| Other | An impact is expected if the 95th percentile of the data exceeds the Chronic Effects Value (CEV) as stated in DWAF (1996) |

(a) To be generated using TEACHA when the TPC for EC is exceeded or salt pollution expected

(b) TPC is exceeded in parts of the catchment.

**IUA 11: LETABA MAIN STEM IN THE KNP**

* **EWR 7, Letaba River (B83D-00255)**

**Key user:** Land-use is protected land or conservation area, i.e. the Kruger National Park.

**Water quality issue:** Nutrient and salt elevations and parameters such as increased turbidity linked to land use (i.e. irrigation and settlements) outside of the KNP.

|  |  |
| --- | --- |
| **Water quality narrative RQO** | **Water quality numerical RQO** |
| Ensure that nutrient levels are within Acceptable limits. | 50th percentile of the data must be less than or equal to 0.025 mg/L PO4-P (Aquatic ecosystems: driver). |
| Ensure that electrical conductivity (salt) levels are within Acceptable limits. | 75th percentile of the data must be less than or equal to 55 mS/m (Aquatic ecosystems: driver) |
| Ensure that turbidity or clarity levels stay within Ideal limits. | A small change from natural state (Aquatic ecosystems: driver) |
| Ensure that toxics are within Ideal limits or A categories. | 75th percentile of the data must be within the TWQR for toxics. Numerical limits can be found in DWAF (1996) and DWAF (2008). |
| Ensure water quality state maintains biotic requirements as specified by RQOs for biota. | See specified biota requirements |

**EWR 7 reach, Letaba River: EcoSpecs (water quality)**

|  |  |
| --- | --- |
| River: Letaba | |
| Monitoring site: B8H028Q01 | |
| EWR Site: 7 | |
| Water quality metrics | | **Ecospecs** |
| Inorganic salts(a) | MgSO4 | The 95th percentile of the data must be ≤ 23 mg/L |
| Na2SO4 | The 95th percentile of the data must be ≤ 20 mg/L |
| MgCl2 | The 95th percentile of the data must be ≤ 30 mg/L |
| CaCl2 | The 95th percentile of the data must be ≤ 57 mg/L |
| NaCl | The 95th percentile of the data must be ≤ 191 mg/L |
| CaSO4 | The 95th percentile of the data must be ≤ 351 mg/L |
| Physical variables | EC | The 95th percentile of the data must be ≤ 55 mS/m |
| pH | The 5th percentile of the data must be between 6.5 to 8.0, and the 95th percentile between 8.0 to 8.8 |
| Temperature | Moderate and infrequent deviation from the natural temperature range. Vary by no more than 2°C. |
| Dissolved oxygen(b) | The 5th percentile of the data must be ≥ 7 mg/L |
| Turbidity(b) | Small deviation from natural conditions. |
| Nutrients | TIN | The 50th percentile of the data must be ≤ 0.25 mg/L |
| PO4-P | The 50th percentile of the data must be ≤ 0.025 mg/L |
| Response variables | Chl-*a* phytoplankton (b) | The 50th percentile of the data must be ≤ 15 mg/m2 |
| Chl-*a* periphyton | The 50th percentile of the data must be ≤ 21 mg/m2 |
| Toxics | Toxics listed in DWA (2008) | The 95th percentile of the data must be within the A category boundaries |
| Other | The 95th percentile of the data must be within the Target Water Quality Range (TWQR) as stated in DWAF (1996) |

(a) To be generated using TEACHA when the TPC for EC is exceeded or salt pollution expected.

(b) No data were available for this assessment. All EcoSpecs and TPCs need verification as based on expert judgement.

**EWR 7 reach, Letaba River: Thresholds of Potential Concern (water quality)**

|  |  |
| --- | --- |
| River: Letaba | |
| Monitoring site: B8H028Q01 | |
| EWR Site: 7 | |
| Water quality metrics | | **TPC** |
| Inorganic salts(a) | MgSO4 | The 95th percentile of the data must be between 18.5 - 23 mg/L |
| Na2SO4 | The 95th percentile of the data must be between 16 – 20 mg/L |
| MgCl2 | The 95th percentile of the data must be between 24 – 30 mg/L |
| CaCl2 | The 95th percentile of the data must be between 46 – 57 mg/L |
| NaCl | The 95th percentile of the data must be between 153 – 191 mg/L |
| CaSO4 | The 95th percentile of the data must be between 281 – 351 mg/L |
| Physical variables | EC | The 95th percentile of the data must be between 44 – 55 mS/m |
| pH | 5th percentile of the data must not be less than 6.7.  95th percentile of the data must not be greater than 8.6. |
| Temperature | Unnatural deviation from the natural temperature range. Initiate baseline monitoring. |
| Dissolved oxygen | 5th percentile of the data must be 7.2 – 7.0 mg/L. Initiate baseline monitoring for this variable. |
| Turbidity | Small deviation from the natural conditions. Initiate baseline monitoring. |
| Nutrients | TIN | The 50th percentile of the data must be between 0.2 – 0.25 mg/L |
| PO4-P | The 50th percentile of the data must be between 0.02 – 0.025 mg/L |
| Response variables | Chl-*a* phytoplankton | The 50th percentile of the data must be between 12 – 15 μg/L |
| Chl-*a* periphyton | The 50th percentile of the data must be between 17 – 21 mg/m2 |
| Toxics | Toxics listed in DWA (2008) | The 95th percentile of the data must be within the A category boundaries |
| Other | An impact is expected if the 95th percentile of the data exceeds the Chronic Effects Value (CEV) as stated in DWAF (1996) |

(a) To be generated using TEACHA when the TPC for EC is exceeded or salt pollution expected

**SUMMARY OF GROUNDWATER RESOURCE QUALITY OBJECTIVES**

The groundwater information is presented as follows:

* Per Quaternary catchment in each IUA:
  + Existing groundwater use and stress index (total use/aquifer recharge)
  + The Harvest and economic Exploitation Potentials
  + Recharge and aquifer recharge (which excludes the component of recharge lost as interflow and not available to groundwater users)
  + Groundwater contribution to baseflow, interflow and total baseflow
  + The Natural MAR, and the present MAR resulting only from present day groundwater abstraction
  + The reduced baseflow that would occur if groundwater abstraction would be increased to the harvest potential
  + Significance of baseflow to the catchment
  + Groundwater numerical RQO for the protection of baseflow

**IUA 1: LETABA UPSTREAM OF TZANEEN DAM**

* **B81A, B81B**

**Key user:** Forestry and some irrigation

**Key issue:** Groundwater abstraction and afforestation impacts significantly on baseflow in this IUA. This IUA provides nearly 45% of baseflow in the Letaba. Only 15% of baseflow is from the regional aquifer, consequently afforestation can have a greater impact than abstraction by diminishing interflow from high lying areas

|  |  |
| --- | --- |
| **Groundwater narrative RQO** | **Groundwater numerical RQO** |
| Groundwater is underutilised. Abstraction impacts significantly on baseflow and this region is one of the most significant sources of baseflow in the Letaba system. Hence further investigations as to the impact of abstraction and SFR activities are required before any significant increase takes place. | Groundwater abstraction can be increased from 2.79 Mm3/a to 10.44 Mm3/a, with a 4.76 Mm3 reduction in baseflow. |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| QUAT | Natural  MAR | Irrigation | Water Supply | Total  Use | Stress index | Harvest  Potential | Exploitation  Potential | Recharge | Aquifer  recharge | Interflow | Baseflow | G’water  baseflow | Present  baseflow | Present  MAR  reduction | Reduced  baseflow  due to  increased abstraction |
|  | Mm3/a | Mm3/a | Mm3/a | Mm3/a |  | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a |  |
| B81A | 75.71 | 0.15 | 0.00 | 0.15 | 0.01 | 2.72 | 1.36 | 50.84 | 10.34 | 40.50 | 48.07 | 7.57 | 47.92 | 0.15 | 45.35 |
| B81B | 134.26 | 2.64 | 0.00 | 2.64 | 0.13 | 7.72 | 5.40 | 94.15 | 20.32 | 73.83 | 74.95 | 1.12 | 73.81 | 1.13 | 71.63 |
| Total | 209.97 | 2.79 | 0.00 | 2.79 |  | 10.44 | 6.76 | 144.99 | 30.66 | 114.33 | 123.02 | 8.69 | 121.73 | 1.28 | 116.98 |
| Percent contribution to total baseflow of the Letaba | | | | | | | | 44.95% | | | | | | | |

**IUA 2: LETSITELE AND THABINA**

* **B 81D**

**Key user:** Agriculture

**Key issue:** Groundwater abstraction and afforestation impacts significantly on baseflow in this IUA. This IUA provides nearly 29% of baseflow in the Letaba, of which only 2% is from the regional aquifer.

|  |  |
| --- | --- |
| **Groundwater narrative RQO** | **Groundwater numerical RQO** |
| Groundwater is moderately utilised. Abstraction impacts significantly on baseflow and this region is a significant source of baseflow in the Letaba system. Further investigations as to the impact of abstraction and SFR activities are required before any additional abstraction takes place. | Groundwater abstraction can be increased from 4.13 Mm3/a to 7.77 Mm3/a, with a 1.60 Mm3 reduction in baseflow. |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| QUAT | Natural  MAR | Irrigation | Water Supply | Total  Use | Stress index | Harvest  Potential | Exploitation  Potential | Recharge | Aquifer  recharge | Interflow | Baseflow | G’water  baseflow | Present  baseflow | Present  MAR  reduction | Reduced  baseflow  due to  increased abstraction |
|  | Mm3/a | Mm3/a | Mm3/a | Mm3/a |  | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a |  |
| B81D | 107.85 | 1.13 | 3.00 | 4.13 | 0.32 | 7.77 | 5.44 | 90.25 | 12.84 | 77.41 | 79.00 | 1.59 | 77.18 | 1.83 | 75.58 |
| Percent contribution to total baseflow of the Letaba | | | | | | | | 28.86 | | | | | | | |

**IUA 3: LETABA DOWNSTREAM OF TZANEEN TO PROPOSED NWAMITWA DAM**

* **B81C, B81E**

**Key user:** Agriculture

**Key issue:** Groundwater abstraction impacts significantly on baseflow in this IUA. This IUA provides 9% of baseflow in the Letaba, hence impacts on downstream users.

|  |  |  |
| --- | --- | --- |
| **Catchment** | **Groundwater narrative RQO** | **Groundwater numerical RQO** |
| B81C | Groundwater is heavily utilised. Abstraction impacts significantly on baseflow and this region is a significant source of baseflow in the Letaba system. Further investigations as to the impact of abstraction and SFR activities are required before any additional abstraction takes | Groundwater abstraction exceeds the Harvest Potential but not the simulated aquifer recharge. No further abstraction should take place without a review of the harvest potential. |
| B81E | Groundwater is over exploited and has resulted in significant baseflow depletion from the catchment. No further groundwater abstraction should be permitted. | Groundwater abstraction exceeds the Harvest Potential but not the simulated aquifer recharge. No further abstraction should take place without a review of the harvest potential. |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| QUAT | Natural  MAR | Irrigation | Water Supply | Total  Use | Stress index | Harvest  Potential | Exploitation  Potential | Recharge | Aquifer  recharge | Interflow | Baseflow | G’water  baseflow | Present  baseflow | Present  MAR  reduction | Reduced  baseflow  due to  increased abstraction |
|  | Mm3/a | Mm3/a | Mm3/a | Mm3/a |  | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a |  |
| B81C | 28.70 | 5.47 | 0.00 | 5.47 | 0.34 | 3.33 | 2.00 | 27.82 | 16.27 | 11.55 | 22.09 | 10.54 | 18.21 | 3.86 |  |
| B81E | 30.96 | 15.16 | 0.59 | 15.75 | 0.87 | 8.95 | 5.37 | 20.93 | 18.20 | 2.73 | 2.77 | 0.04 | 1.98 | 0.77 |  |
| total | 59.66 | 20.63 | 0.59 | 21.22 |  | 12.28 | 7.37 | 48.75 | 34.47 | 14.28 | 24.86 | 10.58 | 20.19 | 4.63 |  |
| Percent contribution to total baseflow of the Letaba | | | | | | | | 9.08 | | | | | | | |

**IUA 4 and 5 and part of 6: LETABA FROM PROPOSED NWAMITWA DAM TO KLEIN LETABA CONFLUENCE**

* **B81F, B81J**

**Key user:** Irrigation agriculture, particularly for citrus plantations (e.g. Nagude Farm Estate).

**Key issue:** Groundwater abstraction has little impact on baseflow in this IUA

|  |  |  |
| --- | --- | --- |
| **Catchment** | **Groundwater narrative RQO** | **Groundwater numerical RQO** |
| B81F | Groundwater is significantly utilised. Abstraction can be marginally increased up to the Harvest Potential with little to no impact on baseflow | Groundwater abstraction can be increased from 7.94 Mm3/a to 14.40 Mm3/a, with no further reduction in baseflow. |
| B81J | Groundwater is underutilised and can be utilised up to the Harvest Potential with little to no impact on baseflow | Groundwater abstraction can be increased to 6.46 Mm3/a, with a 0.06 Mm3 reduction in baseflow. |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| QUAT | Natural  MAR | Irrigation | Water Supply | Total  Use | Stress index | Harvest  Potential | Exploitation  Potential | Recharge | Aquifer  recharge | Interflow | Baseflow | G’water  baseflow | Present  baseflow | Present  MAR  reduction | Reduced  baseflow  due to  increased abstraction |
|  | Mm3/a | Mm3/a | Mm3/a | Mm3/a |  | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a |  |
| B81F | 23.67 | 7.94 | 0.00 | 7.94 | 0.43 | 14.40 | 10.08 | 18.47 | 18.47 | 0.00 | 0.06 | 0.06 | 0.00 | 0.19 | 0.00 |
| B81J | 9.06 | 0.00 | 0.00 | 0.00 | 0.00 | 6.46 | 4.52 | 6.40 | 6.34 | 0.06 | 0.06 | 0.00 | 0.06 | 0.00 | 0.00 |
| Total | 32.73 | 7.94 | 0.00 | 7.94 |  | 20.86 | 14.60 | 24.87 | 24.81 | 0.06 | 0.12 | 0.06 | 0.06 | 0.19 | 0.00 |
| Percent contribution to total baseflow of the Letaba | | | | | | | | 0.04 | | | | | | | |

**IUA 6: NORTHERN TRIBUTARIES TO LETABA**

* **B81G, B81H parts of B81F and J**

**Key user:** Irrigation

**Key issue:** Groundwater abstraction has little impact on baseflow in this IUA. This IUA is only a minor source of baseflow in the Letaba

|  |  |  |
| --- | --- | --- |
| **Catchment** | **Groundwater narrative RQO** | **Groundwater numerical RQO** |
| B81G | Groundwater is moderately utilised. Abstraction can be increased up to the Harvest Potential with little or no impact on baseflow. | Groundwater abstraction can be increased from 5.06 Mm3/a to 6.78 Mm3/a, with a 0.05 Mm3/a reduction in baseflow. |
| B81H | Groundwater use is low and can be utilised up to the Harvest Potential with little to no impact on baseflow | Groundwater abstraction can be increased from 2.62 Mm3/a to 7.97 Mm3/a, with no reduction in baseflow. |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| QUAT | Natural  MAR | Irrigation | Water Supply | Total  Use | Stress index | Harvest  Potential | Exploitation  Potential | Recharge | Aquifer  recharge | Interflow | Baseflow | G’water  baseflow | Present  baseflow | Present  MAR  reduction | Reduced  baseflow  due to  increased abstraction |
|  | Mm3/a | Mm3/a | Mm3/a | Mm3/a |  | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a |  |
| B81G | 25.49 | 5.06 | 0.00 | 5.06 | 0.40 | 6.78 | 4.75 | 18.32 | 12.58 | 5.74 | 5.87 | 0.13 | 5.72 | 0.16 | 5.67 |
| B81H | 9.69 | 2.62 | 0.00 | 2.62 | 0.30 | 7.97 | 5.58 | 8.80 | 8.80 | 0.00 | 0.01 | 0.01 | 0.00 | 0.05 | 0.00 |
| Total | 35.18 | 7.68 | 0.00 | 7.68 |  | 14.75 | 10.33 | 27.12 | 21.38 | 5.74 | 5.88 | 0.14 | 5.72 | 0.21 | 5.67 |
| Percent contribution to total baseflow of the Letaba | | | | | | | | 2.15 | | | | | | | |

**IUA 7: UPPER MIDDLE LETABA AND TRIBUTARIES UPSTREAM OF MIDDLE LETABA DAM**

* **B82A, B82B, B82C, B82D**

**Key user:** Agricultural activities, including commercial tomato producers ZZ2 at Mooketsi, water supply.

**Key issue:** Groundwater abstraction has significant impact on baseflow in this IUA. This IUA was a significant source of baseflow in the Letaba, contributing 14% of baseflow, however, its contribution has been diminished by more than 50% due to groundwater abstraction

|  |  |  |
| --- | --- | --- |
| **Catchment** | **Groundwater narrative RQO** | **Groundwater numerical RQO** |
| B82A, B82D | Groundwater is moderately utilised. Abstraction impacts signifcantly on baseflow locally and on inflows into the middle Letaba dam. Increases in abstraction should consider the impacts on the yield of the middle letaba dam. | Groundwater abstraction can be increased from 7.45 Mm3/a to 17.47 Mm3/a, with a 5.27 Mm3/a reduction in baseflow. An investigation of the baseflow reduction on the yield of the middle Letaba dam is required |
| B82B, B82C | Groundwater is over exploited and has resulted in significant reduction in inflows into the Middle letaba dam. No further groundwater abstraction should be permitted. | Groundwater abstraction exceeds the Harvest Potential and the simulated aquifer recharge. No further abstraction should take place. |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| QUAT | Natural  MAR | Irrigation | Water Supply | Total  Use | Stress index | Harvest  Potential | Exploitation  Potential | Recharge | Aquifer  recharge | Interflow | Baseflow | G’water  baseflow | Present  baseflow | Present  MAR  reduction | Reduced  baseflow  due to  increased abstraction |
|  | Mm3/a | Mm3/a | Mm3/a | Mm3/a |  | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a |  |
| B82A | 28.20 | 1.48 | 1.45 | 2.93 | 0.26 | 7.37 | 4.42 | 17.48 | 11.36 | 6.12 | 12.57 | 6.45 | 11.05 | 1.53 | 8.74 |
| B82D | 20.85 | 0.52 | 4.00 | 4.52 | 0.44 | 10.11 | 7.08 | 13.46 | 10.35 | 3.11 | 7.87 | 4.76 | 5.47 | 2.39 | 2.51 |
| B82B | 23.13 | 14.50 | 0.00 | 14.50 | 1.53 | 6.50 | 3.90 | 14.71 | 9.50 | 5.21 | 10.68 | 5.47 | 1.55 | 9.18 | 1.55 |
| B82C | 17.23 | 13.00 | 0.00 | 13.00 | 1.82 | 4.76 | 3.33 | 11.41 | 7.14 | 4.27 | 7.54 | 3.27 | 0.26 | 7.34 | 0.26 |
| Total | 89.41 | 29.50 | 5.45 | 34.95 |  | 28.73 | 18.72 | 57.06 | 38.35 | 18.71 | 38.66 | 19.95 | 18.33 | 20.44 | 13.06 |
| Percent contribution to total baseflow of the Letaba | | | | | | | | 14.13 | | | | | | | |

**IUA 8: KLEIN LETABA**

* **B82E, B82F**

**Key user:** Informal settlements and subsistence irrigation

**Key issue:** Groundwater abstraction has a minor impact on baseflow in this IUA. This IUA is a minor source of baseflow to the Letaba.

|  |  |
| --- | --- |
| **Groundwater narrative RQO** | **Groundwater numerical RQO** |
| Groundwater is underutilised. Abstraction impacts signifcantly on baseflow, however the impact is local as the region is not a significant source of baseflow to the Letaba system. Abstraction can be increased depending on low flow requirements in the Klein Letaba | Groundwater abstraction can be increased from 2.88 Mm3/a to 18.46 Mm3/a, with a 1.1 Mm3/a reduction in baseflow. |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| QUAT | Natural  MAR | Irrigation | Water Supply | Total  Use | Stress index | Harvest  Potential | Exploitation  Potential | Recharge | Aquifer  recharge | Interflow | Baseflow | G’water  baseflow | Present  baseflow | Present  MAR  reduction | Reduced  baseflow  due to  increased abstraction |
|  | Mm3/a | Mm3/a | Mm3/a | Mm3/a |  | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a |  |
| B82E | 11.29 | 1.45 | 0.00 | 1.45 | 0.18 | 6.41 | 4.49 | 8.32 | 8.05 | 0.27 | 0.48 | 0.21 | 0.36 | 0.12 | 0.00 |
| B82F | 22.59 | 1.43 | 0.00 | 1.43 | 0.10 | 12.05 | 8.44 | 14.84 | 14.30 | 0.54 | 1.54 | 1.00 | 1.44 | 0.10 | 0.70 |
| Total | 33.88 | 2.88 | 0.00 | 2.88 |  | 18.46 | 12.92 | 23.16 | 22.35 | 0.81 | 2.02 | 1.21 | 1.80 | 0.22 | 0.70 |
| Percent contribution to total baseflow of the Letaba | | | | | | | | 0.74 | | | | | | | |

**Part of IUA 9: KLEIN LETABA DOWNSTREAM TO CONFLUENCE WITH NSAMA**

* **B82G**

**Key user:** The main land-use is dense urban settlements (e.g. Giyani) and informal settlements (i.e. limited subsistence and cultivated agriculture, with livestock).

**Key issue:** Groundwater abstraction has a minor impact on baseflow in this IUA. This IUA is a very minor source of baseflow to the Letaba.

|  |  |
| --- | --- |
| **Groundwater narrative RQO** | **Groundwater numerical RQO** |
| Groundwater use is low and can be utilised up to the Harvest Potential with little to no impact on baseflow | Groundwater abstraction can be increased from 0.6 Mm3/a to 11.02 Mm3/a, with a 0.05 Mm3/a reduction in baseflow. |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| QUAT | Natural  MAR | Irrigation | Water Supply | Total  Use | Stress index | Harvest  Potential | Exploitation  Potential | Recharge | Aquifer  recharge | Interflow | Baseflow | G’water  baseflow | Present  baseflow | Present  MAR  reduction | Reduced  baseflow  due to  increased abstraction |
|  | Mm3/a | Mm3/a | Mm3/a | Mm3/a |  | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a |  |
| B82G | 15.21 | 0.60 | 0.00 | 0.60 | 0.06 | 11.02 | 7.72 | 10.80 | 10.75 | 0.05 | 0.06 | 0.01 | 0.05 | 0.01 | 0.00 |
| Percent contribution to total baseflow of the Letaba | | | | | | | | 0.02 | | | | | | | |

**Part of IUA 9 AND IUA 10: NSAMA AND KLEIN LETABA DOWNSTREAM TO CONFLUENCE WITH LETABA**

* **B82H, B82J**

**Key user:** Minor irrigation use

**Key issue:** Groundwater abstraction has a minor impact on baseflow in this IUA. This IUA is a very minor source of baseflow to the Letaba.

|  |  |
| --- | --- |
| **Groundwater narrative RQO** | **Groundwater numerical RQO** |
| Groundwater is underutilised and can be utilised up to the Harvest Potential with little to no impact on baseflow | Groundwater abstraction can be increased from 0.16 Mm3/a to 14.89 Mm3/a, with a 0.05 Mm3/a reduction in baseflow. |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| QUAT | Natural  MAR | Irrigation | Water Supply | Total  Use | Stress index | Harvest  Potential | Exploitation  Potential | Recharge | Aquifer  recharge | Interflow | Baseflow | G’water  baseflow | Present  baseflow | Present  MAR  reduction | Reduced  baseflow  due to  increased abstraction |
|  | Mm3/a | Mm3/a | Mm3/a | Mm3/a |  | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a |  |
| B82H | 11.71 | 0.16 | 0.00 | 0.16 | 0.02 | 8.47 | 5.93 | 8.55 | 8.52 | 0.03 | 0.04 | 0.01 | 0.04 | 0.00 | 0.00 |
| B82J | 14.36 | 0.00 | 0.00 | 0.00 | 0.00 | 6.42 | 4.49 | 9.27 | 9.27 | 0.00 | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 |
| Total | 26.07 | 0.16 | 0.00 | 0.16 | 0.02 | 14.89 | 10.42 | 17.82 | 17.79 | 0.03 | 0.05 | 0.02 | 0.05 | 0.00 | 0.00 |
| Percent contribution to total baseflow of the Letaba | | | | | | | | 0.02 | | | | | | | |

**IUA 12: LETABA IN THE KNP**

* **B83A, B83B, B83C, B83D, B83E**

**Key user:** Land-use is protected land or conservation area, i.e. the Kruger National Park.

**Key issue:** Groundwater abstraction has a minor impact on baseflow in this IUA. This IUA is a very minor source of baseflow to the Letaba.

|  |  |
| --- | --- |
| **Groundwater narrative RQO** | **Groundwater numerical RQO** |
| Groundwater is underutilised and can be utilised up to the Harvest Potential with little to no impact on baseflow | Groundwater abstraction can be increased to 29.44 Mm3/a, with a 0.02 Mm3/a reduction in baseflow. |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| QUAT | Natural  MAR | Irrigation | Water Supply | Total  Use | Stress index | Harvest  Potential | Exploitation  Potential | Recharge | Aquifer  recharge | Interflow | Baseflow | G’water  baseflow | Present  baseflow | Present  MAR  reduction | Reduced  baseflow  due to  increased abstraction |
|  | Mm3/a | Mm3/a | Mm3/a | Mm3/a |  | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a | Mm3/a |  |
| B83A | 19.63 | 0.00 | 0.00 | 0.00 | 0.00 | 12.08 | 8.46 | 11.77 | 11.77 | 0.00 | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 |
| B83B | 7.42 | 0.00 | 0.00 | 0.00 | 0.00 | 3.51 | 2.46 | 5.71 | 5.71 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| B83C | 10.00 | 0.00 | 0.00 | 0.00 | 0.00 | 4.74 | 3.32 | 7.70 | 7.70 | 0.00 | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 |
| B83D | 10.31 | 0.00 | 0.00 | 0.00 | 0.00 | 6.64 | 4.65 | 7.88 | 7.88 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| B83E | 4.73 | 0.00 | 0.00 | 0.00 | 0.00 | 2.48 | 1.49 | 3.11 | 3.11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 52.09 | 0.00 | 0.00 | 0.00 | 0.00 | 29.44 | 20.36 | 36.15 | 36.15 | 0.00 | 0.02 | 0.02 | 0.02 | 0.00 | 0.00 |
| Percent contribution to total baseflow of the Letaba | | | | | | | | 0.01 | | | | | | | |