

# KROMME/SEEKOEI CATCHMENTS RESERVE DETERMINATION STUDY – TECHNICAL COMPONENT: COMPLETED 2006

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## 1. Background

The National Water Act (NWA, Act No. 36 of 1998, Section 3) requires that the Reserve be determined for rivers and estuaries, i.e. the quantity, quality and reliability of water needed to sustain both human use and aquatic ecosystems, to meet the requirements for economic development without seriously impacting on the long-term integrity of ecosystems. The Kromme / Seekoei River catchments were identified by the Department of Water Affairs (DWA) as requiring a Comprehensive Reserve (or Ecological Water Requirements (EWR)) assessment before licensing in the catchments could proceed, due to the apparent highly stressed nature of the catchments, over-utilisation of water resources and water quality problems in the Kromme, Seekoei and Swart rivers. Once Reserve requirements are available, a planning study can be undertaken to determine the availability of additional water for new developments. Other concerns include over-abstraction of well-fields by coastal towns in summer, and the impact of many illegal farm dams in the area.

Note that the outputs of this study represent the *Preliminary Reserve Class*, which constitute the *legally implementable Reserve* in the absence of the Water Resources Classification System (WRCS) being in place.

The Chief Directorate: Resources Directed Measures (CD: RDM) is the department within DWA tasked with the responsibility of ensuring that Reserve assessments take place before licensing can proceed, while implementation of the Reserve is undertaken by the regional office.

## 2. Approach

Although a comprehensive EWR assessment was required for the study area, the level at which a study can be undertaken is determined by the data available for use. The Kromme River study was conducted at an **intermediate** level of assessment, while the additional Diep River study (conducted in 2005) was conducted at a **rapid (III)** level. A comprehensive study could not be undertaken for the Kromme system largely due to limitations in daily hydrological data and a poor water quality record. The Kromme Estuary assessment was conducted at a **comprehensive** level of assessment.

The Seekoei studies were both conducted at a **rapid** level of assessment as no gauging weirs are found in the Seekoei system, limited hydrological data exists and no systems model has been set up for this river.

Rapid levels constitute lower confidence studies, with intermediate to comprehensive being of higher confidence. The results of **EcoClassification**, i.e. determination of the Present Ecological State (PES) as a deviation from natural conditions, are shown on Figure 1 attached to the document.

## 3. Scenario evaluation

The aim of this component of the study was to describe the ecological and water quality consequences of various operational scenarios. These operational scenarios were designed based on impacts of the EWR scenarios on yield and users, as well as considering operational constraints such as sizes of dam outlets. The EWR were tested using the yield model to determine whether there would be any impacts on users of the system and the Ecological Category. Socio-economic impacts and impacts on goods and services provided by the systems were therefore evaluated.

**Kromme River:** It was found that more water than the required EWR is presently available in the system.

**Geelhoutboom River:** Two additional flow scenarios for future developments in the Geelhoutboom system were evaluated. Results showed that there would be a drop in category below the present state should the EWR not be met.

**Kromme Estuary:** The following suite of scenarios was evaluated. All scenarios were designed so that the system has the capacity to release the required flows and no scenarios that require engineering intervention were considered. The Geelhoutboom tributary of the Kromme River flows into the estuary and needed to be included in the generation of the various scenarios.

| Scenario   | River                                                                                 |                                                                                                   |
|------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
|            | Kromme                                                                                | Geelhoutboom                                                                                      |
| Reference  | Natural Flows                                                                         | Natural Flows                                                                                     |
| Present    | $0.4 \times 10^6 \text{ m}^3$                                                         | Present inflows + $0.95 \text{ Mm}^3/\text{a}$ abstraction                                        |
| Scenario 1 | $5 \times 10^6 \text{ m}^3$ released in Nov                                           | Present inflows + $0.95 \text{ Mm}^3/\text{a}$ abstraction                                        |
| Scenario 2 | $10 \times 10^6 \text{ m}^3$ released in Oct and Jan                                  | Change in monthly flow distribution from present with $0.95 \text{ Mm}^3/\text{a}$ abstraction    |
| Scenario 3 | $0.4 \times 10^6 \text{ m}^3$ (Present inflows)                                       | Change in monthly flow distribution from present without $0.95 \text{ Mm}^3/\text{a}$ abstraction |
| Scenario 4 | $5 \times 10^6 \text{ m}^3$ released in Nov                                           | Change in monthly flow distribution from present without $0.95 \text{ Mm}^3/\text{a}$ abstraction |
| Scenario 5 | $7.5 \times 10^6 \text{ m}^3$ released in Oct and Nov                                 | Change in monthly flow distribution from present with $0.95 \text{ Mm}^3/\text{a}$ abstraction    |
| Scenario 6 | $16 \times 10^6 \text{ m}^3$ released mainly in Oct – Jan, with low winter base flows | Present inflows                                                                                   |
| Scenario 7 | $16 \times 10^6 \text{ m}^3$ released mainly in Oct – Jan                             | Present inflows                                                                                   |

The scenarios evaluated indicated that of the seven scenarios evaluated, five of them resulted in the system remaining in a D category (see table below). The biological responses (biotic health score) improved from an E to a D, however, the system will not easily move into a C category. Scenarios 6 and 7 are the only scenarios that would result in a C Ecological Category if implemented.

| Variable                 | Present | Kromme Estuary Scenario |    |    |    |    |    |    |
|--------------------------|---------|-------------------------|----|----|----|----|----|----|
|                          |         | 1                       | 2  | 3  | 4  | 5  | 6  | 7  |
| Habitat Health Score     | D+      | C-                      | C- | C- | C- | C- | C- | C- |
| Biotic Health Score      | E+      | D-                      | D- | D- | D- | D- | C- | D+ |
| Ecological Category (EC) | D       | D+                      | D+ | D  | D+ | D+ | C- | C- |

The suite of scenarios evaluated for the **Seekoei Estuary** is shown below:

| Name       | Seekoei Estuary                                                    | Volume ( $\text{Mm}^3/\text{a}$ ) |
|------------|--------------------------------------------------------------------|-----------------------------------|
| Reference  | Reference                                                          | 20                                |
| Present    | Present Flows                                                      | 11.5                              |
| Scenario 1 | High volume river inflow and $15 \text{ Mm}^3/\text{a}$ to estuary | 17                                |
| Scenario 2 | Moderate volume river inflow                                       | 12                                |
| Scenario 3 | Low volume river inflow                                            | 11                                |
| Scenario 4 | High volume river inflow and $13 \text{ Mm}^3/\text{a}$ to estuary | 15                                |

Scenarios 1 and 4 resulted in a significant improvement in the biotic health state of the system (see table below). Scenario 2 resulted in an overall change from a Low D to a D category, but most importantly it changed the biotic health from an E to a D category. Scenario 3 resulted in a decrease in EC to an E category (*Highly Degraded*).

| Variable                 | Present | Seekoei Estuary Scenario |    |    |    |
|--------------------------|---------|--------------------------|----|----|----|
|                          |         | 1                        | 2  | 3  | 4  |
| Habitat Health Score     | D       | B-                       | D+ | D- | B- |
| Biotic Health Score      | E+      | B-                       | D- | E+ | C+ |
| Ecological Category (EC) | D-      | B-                       | D  | E+ | B- |

#### 4. Recommendations from Reserve study

**Kromme Estuary:** It is recommended that **Scenario 4** be accepted for this system as it represents a compromise between lowest acceptable economic implications and some improvement in the ecological state of the estuary.

**Seekoei Estuary:** It is recommended that **Scenario 2** be accepted for this system. This scenario will have the least impact on the economic activity, with some improvement of the PES of the estuary.

**Kromme and Seekoei rivers:** As flow is available to maintain the Recommended Ecological Category (REC) without impacting on any users, it is recommended that the EWRs for the REC be accepted as the Ecological Reserve.

#### 5. Implementation of the Preliminary Reserve (as presented by CD: RDM)

In terms of Section 18 the Minister or the Director-General must give effect to the preliminary Reserve once it has been determined. The following strategies will be required for Reserve implementation.

- **Kromme Estuary:** The preliminary Reserve scenario proposed for the Kromme Estuary requires, in addition to the present day flows, an artificial release of  $5.0 \times 10^6 \text{ m}^3$  in November from Impofu Dam. The most effective delivery strategy would be  $5 \text{ m}^3/\text{s}$  for 6.5 days and  $1 \text{ m}^3/\text{s}$  for 25 days. An additional 12 hours of  $5 \text{ m}^3/\text{s}$  is recommended to fill up the pools (used for abstraction) below Impofu Dam to ensure that the required flows reach the estuary.
- **Seekoei Estuary:** The preliminary Reserve scenario proposed for the Seekoei Estuary requires a moderate volume river inflow of  $12 \times 10^6 \text{ m}^3/\text{a}$ . Releases from farm dams will have to be investigated.
- **Kromme River:** It was estimated that the flow requirements for EWR 3 (i.e. the Kromme River below Impofu Dam) should consist of at least two flood releases followed by at least 10 days of continuous base flow, to serve as a trigger for fish migration.
- **Estuary monitoring programmes** should be instituted to monitor the positive impact of implementation on the functioning of the estuaries.
- **Change in water use:** The estimated number of hectares that will have to be withdrawn in the Kromme River catchment to meet the Reserve requirements is estimated to be 67 hectares.

A number of **non-flow related management actions** are also presented in the Reserve template. Cognisance must be taken by both DEAT and DWA of the non-flow related issues on both the Kromme and Seekoei systems. The management of these issues in conjunction with the implementation of the Reserve will ensure the continued ecological health of both these river and estuary systems.

**The Class and Preliminary Reserve for the Kromme/Seekoei River System and Kromme and Seekoei estuaries as described above was approved in terms of Sections 14 (1) (b) and 17 (1) (a) of the National Water Act, Act 36 of 1998 on 27/12/2006 by the DWA DG. The signing off of the Reserve allows licence applications to be considered.**

#### 6. Recommendations (as presented by CD: RDM)

- Immediate attention is given to the development of operating rules for dams and weirs in the catchment to ensure that effective releases be made for the ecological requirement.
- Urgent development of policy surrounding the future existence and/or operation of the large and numerous dams, particularly in the Seekoei/Swart system.
- Urgent development of policy to ensure that all regulatory structures contain outlet facilities capable of providing the downstream ecological requirements, particularly during low-flow periods.
- The non-flow related management interventions described in Section 1 of this document is given serious consideration, particularly in terms of the development of effective estuary management plans and the removal of the causeway on the Seekoei Estuary.
- Investigate water use efficiency by the NMMM and institute effective water conservation and water demand management.
- Improve water use efficiency and irrigation management practices in the Kromme River catchment, given the fact that irrigation of lucerne is not very efficient.

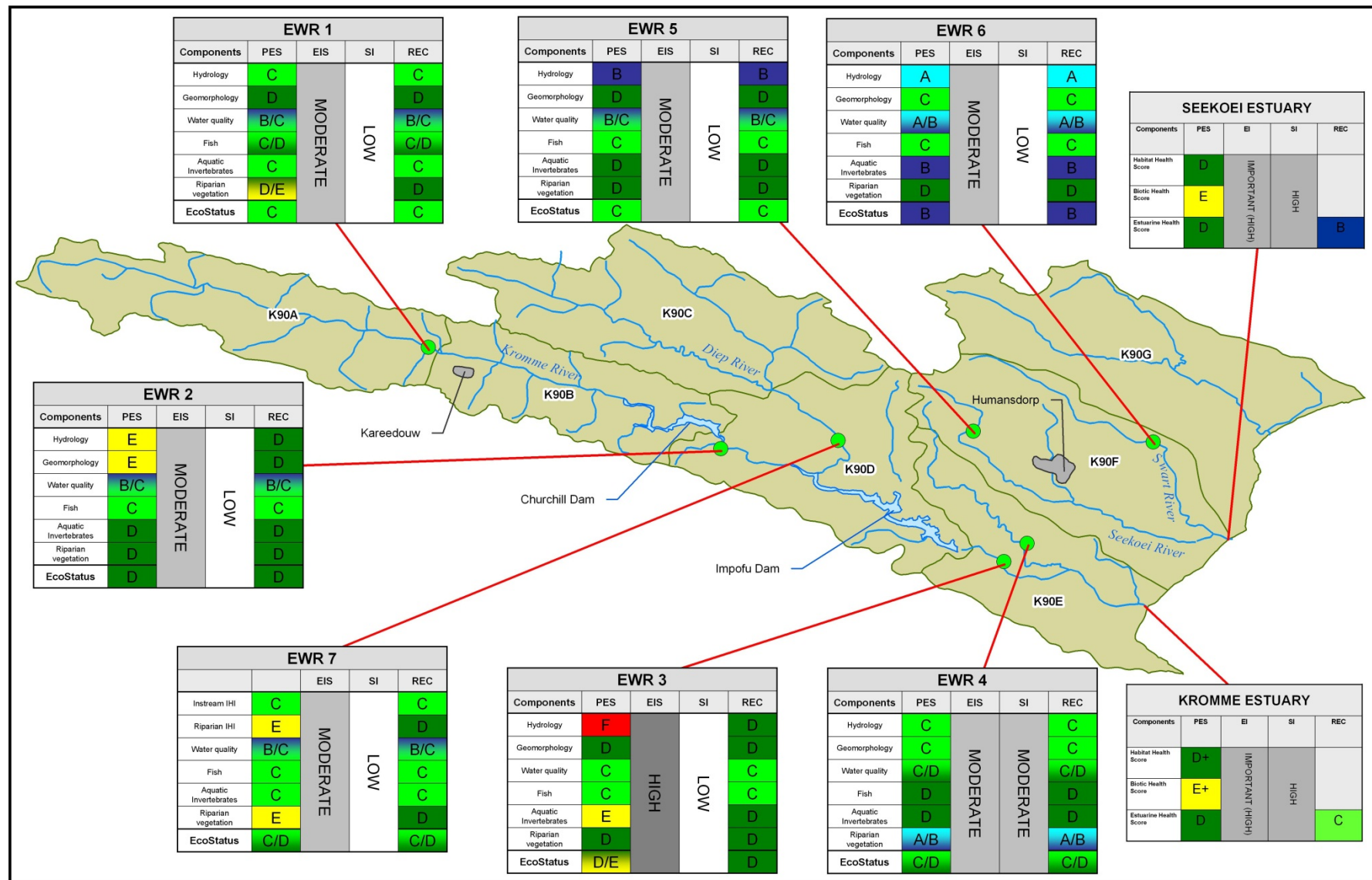


Figure 1: Map of the Kromme/Seekoei study area showing the PES, Ecological Importance and Sensitivity (EIS) and REC per EWR site and estuary