Implementing integrated catchment management in the Limpopo River Basin

Phase 1: Situational assessment

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BACKGROUND

The project aims to promote Integrated Catchment Management approaches in the Limpopo River Basin (**Figure 1**) in three phases:

1) Situational assessment: develop a sound spatial understanding of the key ecohydrological areas of the basin;
2) Risk assessment: develop conservation interventions in the identified areas; and
3) Develop mechanisms for implementing water stewardship schemes to mitigate the shared water risks identified in phase II.

The situational assessment should enable De Beers to understand how Venetia Mine's operations are located within a broader and dynamic socioeconomic and ecohydrological landscape as it pertains to water risks. Lessons learnt will offer useful insights for the development of specific interventions in the areas surrounding their mine operations and for other countries where De Beers operates.

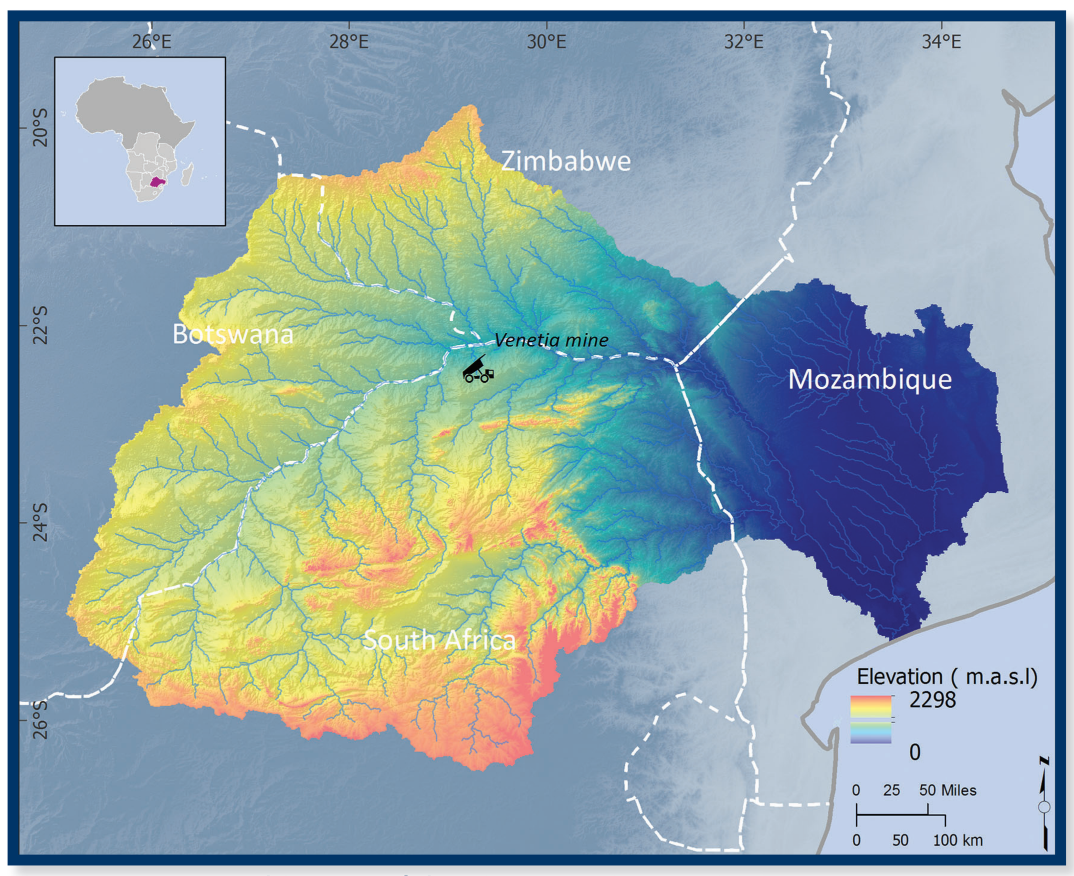

Figure 1: Topographic map of the Limpopo River Basin

THE LIMPOPO RIVER BASIN

The Limpopo River Basin (LRB) covers about 416,300 km² of the African continent and stretches over: South Africa (45%), Botswana (19%), Mozambique (21%) and Zimbabwe (15%).

Venetia Mine

Commissioned in 1992, Venetia is an open pit mine (**Figure 2**) located in the semi-arid A63E catchment (**Figure 3**). To sustain its current mining operations, the mine abstracts water from two alluvial aquifers (Greefswald and Schroda), that lies at the confluence of the Limpopo and Shashe River, located within the Mapungubwe National Park. Schroda Dam, located in the A71L catchment (**Figure 3**) is a 4.08 Mm³ off-channel storage dam that stores excess floodwater and water abstracted from the Greefswald alluvial aquifer. Water abstracted from the Schroda well field merely augments the supply from Greefswald (Brown and Erasmus, 2004).

Figure 2: Venetia Mine, open pit

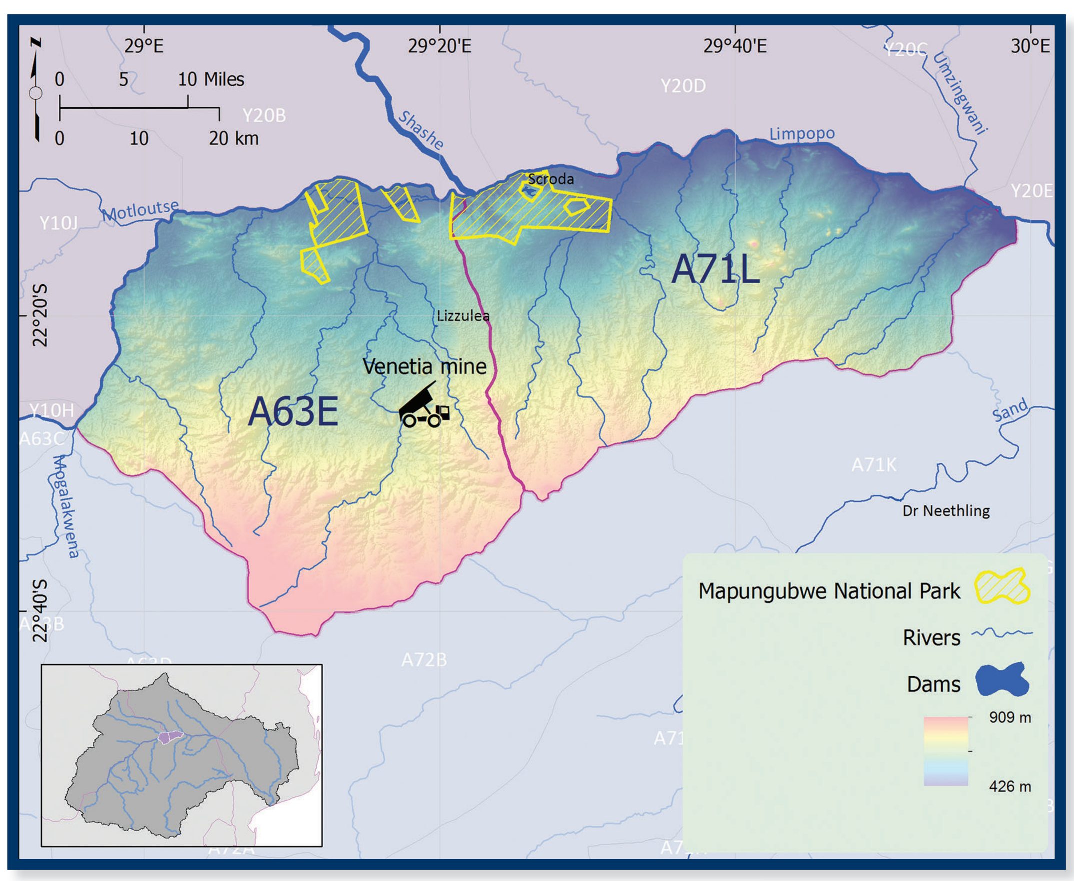

Figure 3: Location of De Beers Venetia Mine in the A63E catchment

Mapungubwe National Park

Sited at the confluence of the Limpopo and Shashe Rivers in far northern South Africa, the park is a 198 km² state property supporting low densities of wildlife. The park contains the Greefswald forest (0.45 km²) – a near-unique riverine indigenous gallery forest – the Maloutswa pan and pools that provide habitat for various fish and other aquatic species when there is no surface flow.

SOCIAL–ECOLOGICAL SYSTEM OF THE LRB

It is important to keep sight of the fact that we are dealing with a single and interlined system – a so-called social-ecological system – that includes the following.

Hydrology

Increasing trends of exploitation of the basin's surface water resources, especially in the upper reaches of tributaries rising in South Africa (**Figure 4**), has led to sustained reductions in river flows in downstream reaches of the main stem of the Limpopo River. Much of the surface water exploitation in the basin states relies on storage reservoirs built on tributary rivers. Surface water use is directed primarily to irrigated agriculture, afforestation and the supply of domestic water to towns and communities, with smaller quantities for industry, power generation and mining activities. Flows in the Upper LRB originate mainly from the Crocodile and Shashe tributaries (**Figure 4**). The basin contains a number of alluvial aquifers and deep river pools storages that have to be filled before channel flow generated in upstream wetter regions can progress downstream – therefore the Limpopo River is dry for most of the year.

Ecosystem

The ULRB is dominated by the Southern Africa Bushveld (Olson, 2001). Kalahari Acacia *Baikiaea* woodlands are found in the Botswana portion of the basin and highveld grasslands in the headwaters of the Crocodile subbasin. Apart from the Motloutse and Lotsane subbasins in northwest Botswana, the ULRB is highly impacted. Dominant land- or water-use drivers of river condition in the ULRB include infestation by invasive alien plants; surface and groundwater abstraction; damming of rivers (especially in South Africa and Zimbabwe); damming of wetlands; and pollution from mining activities and commercial agriculture.

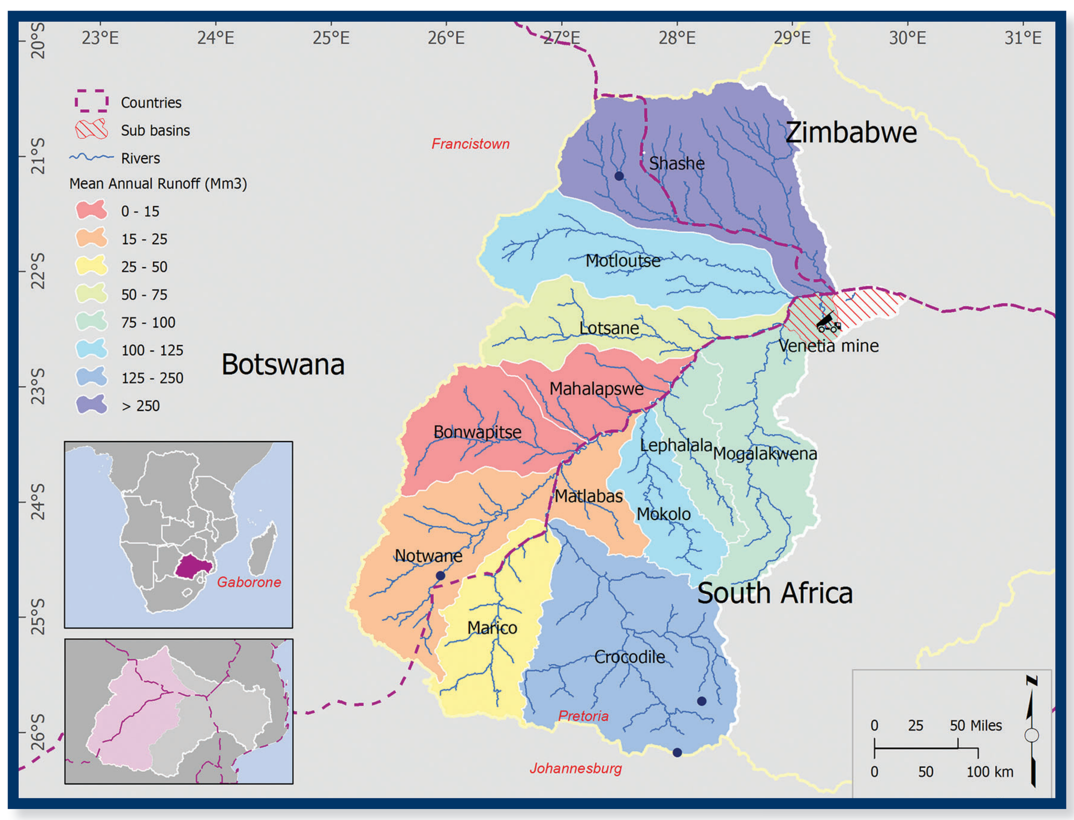

Figure 4: Denaturalised mean annual runoff of the tributaries of the upper Limpopo

Socio-economic

The most important economic activities in the LRB are dryland and irrigated agriculture; cattle, game and dairy farming; conservation; tourism; and an array of small to large mining and industrial enterprises. The majority of the populace relies on subsistence agriculture and is considered to exist in a state of poverty. Whilst most urban communities receive adequate water from formal reticulation systems, rural communities are at greatest risk of failing water supplies. This situation is worse during dry seasons each year and may reach critical levels during periods of extended drought.

Governance

Each basin state has its own water management systems and segments their respective territories into Water Management Units or Water Management Areas. These divisions are normally in the form of sub-catchments, though some of the larger sub-catchments may be further sub-divided. The formal constitution of catchment councils or catchment management agencies has only taken place in Zimbabwe. In South Africa, the process of setting up formal Catchment Management Agencies for the 19 Water Management Areas still lags behind. In Botswana and Mozambique, water management is either undertaken by central Government or delegated to Provincial Departments.

Projected climatic changes

Model projections indicate that warming over the Limpopo River Basin will continue to occur at an accelerated rate during the 21st century. The period 2011 - 2040 is projected to be about 1°C to 2°C warmer than the period 1961 - 1990 (**Figure 5a**). Slight rainfall decreases are projected to occur over the Limpopo River Basin for the period 2011-2040 vs 1961-1990 (**Figure 5b**).

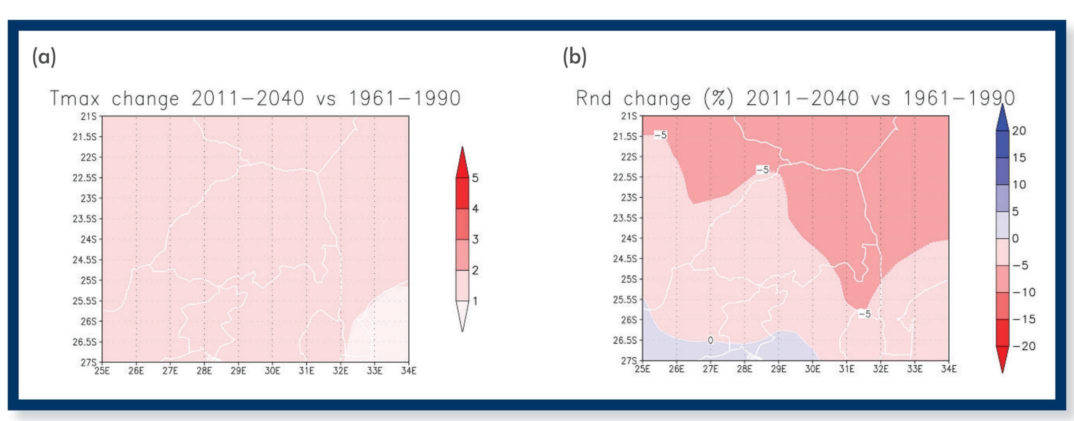

Figure 5: Projected (a) rise in annual average maximum temperature (b) change in annual rainfall totals (percentage change) over the Limpopo River Basin (combined average of six projections)

A situational assessment of De Beers' mining operations within a water-stressed area, and close to an ecologically sensitive area, offers useful insights for the development of specific interventions in the areas surrounding their mining operations. This also holds implications for the specific mine's sustainability.

EMERGING ISSUES

Projected climatic changes and water infrastructure developments in the upper LRB will most likely reduce the high flows of the Limpopo River and affect the recharge of the alluvial aquifers and the pool storages located in the A63E and A71L catchments.

The riverine gallery forest (**Figure 6**) is an aquifer-dependent ecosystem situated on the same aquifer used by the Venetia Mine and recharged by the Limpopo River main stem. The isolated contribution of De Beers' water abstraction schemes on the transformation of the forest to open woodland is yet to be established. The current impact of De Beers' water scheme on the water pools (especially the poacher's pool) is unknown.

To help maintain the fragile ecosystem of the Mapungubwe National Park, we need to develop a better understanding of the impact of water abstraction on this critical ecosystem. This is because water use in the basin is going to increase, as other large water users are being licenced and the planned dams in Botswana will further exacerbate the situation.

Figure 6: 2010 aerial photograph of the Greefswald forest along the banks of the Limpopo River

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