



Freshwater Research Centre
Office 23, Imhoff Farm
Kommetjie Rd, Kommetjie
Mobile: +27786426179
Telephone: +27217830155
Email: bruce@frcsa.org.za

ECOLOGICAL RESERVE INFORMATION DOCUMENT

EVALUATION OF THE WATER AVAILABILITY IN THE RIET- HOUDENBEKS CATCHMENT – REVISED 2019

1.1 RIET RIVER HYDROLOGY (E21E – R43)

Quaternary catchment E21A-E21E includes the upstream catchment areas of the Kruis, Sand, Welgemoed, Winkelhaak, Houdenbeks and Riet Rivers. **Node R43** is the downstream limit of these rivers after the last abstraction point in the Koue Bokkeveld (**Figure 1**). The sub-catchment contributes **39% of flows to the Doring River at Node R37**. The **cumulative** estimated naturalised flow (i.e. including all the upstream catchments) at R43 is **93,7 Mm³/a** (DWS 2017) **[This figure is REVISED lower than the WR2012 estimate which placed the at MAR 151.16 and is considered a more accurate]**. An EWR of **29.13 %** of the nMAR (natural Mean Annual Runoff) is required at this node for a **C Class** river and corresponds to **27.3 Mm³ in an average year** (*Desktop Version 2, Generated on 2011/08/05*) (**Table 1**). **Table 2** shows the requirements of the Ecological Reserve adjusted according to measured monthly rainfall in each year for the years 2013-2017. Flows monitored at the Freshwater Research Centre monitoring station at **R43** measured an MAR of 15.3 Mm³ in 2013 and 12.7 Mm³ in 2015 respectively. Monthly flow volumes in excess or deficit of the Ecological Reserve are shown for these same years in **Table 2**. There was minimal flow in the river during 2015 and the river did not flow during 2016 and 2017 (**Figure 3**). **Table 3** shows that rainfall in these years exceeded the 90th percentile with a 50% less than average rainfall recorded at each rainfall station.

1.2 RIET-HOUDENBEKS HYDROLOGY (E21D)

The Riet-Houdenbeks river is a naturally seasonal system, but the duration of flows during the winter period have been curtailed by water abstraction upstream in catchments E21A-E – the river flows later in the year and for a shorter period of time. Howard (2010) estimated the irrigation demand in the Houdenbeks River at **23.761 Mm³/a** and the current day MAR at **24.68 Mm³/a** from spillage. Present Day nMAR for E21D is estimated at **50.127 Mm³/a** (*Desktop Version 2, Generated on 2011/08/05*). The 2011 Desktop Ecological Reserve assessment for quaternary catchment E21D for and Ecological category D is set at **27.72 %** of the MAR or **13.922 Mm³/a** and a Maintenance Drought Flow Lowflow at **1.392 Mm³/a**. This translates to on a **0.16 m³.s⁻¹** average release over a three month winter period to maintain a D class river during a drought (Department of Water Affairs 2014).

Table 1 Cumulative and incremental MAR for quaternary catchments in the Riet catchment. Quaternary catchments for E21D is highlighted in grey (Department of Water Affairs 2014).

	MAR (incr) (Mm ³ /a)	MARCum (cum) (Mm ³ /a)	Perc Contr.	IFR (Mm ³ /a)	%MAR	EC	River
E21A	39.425	39.425	42.1%	16.549	41.90%	D	Kruis
E21B	1.23	1.23	1.3%	0.29	23.56%	D	Welgemoed
E21C	1.284	41.939	1.4%	8.168	19.48%	C	Winkelhaak
E21D	50.217	50.217	53.6%	13.92	27.72%	D	Houdenbeks
E21E	1.616	93.722	1.7%	27.314	29.13%	C	Riet

Table 2 Annual volumes of water in excess or deficit or deficit of the Ecological Reserve using the 'Percentile Rainfall method' using from DWS (DWS 2017) 10th Percentile is 75.9 Mm³, 50th Percentil is 27.5 Mm³ and 10th Percentile is 3.75 Mm³.

Year	Rainfall Percentile	Measured (Mm ³ /a)	Measured (Mm ³ /a)	EWR (Mm ³ /a)	Deficit/Surplus (Mm ³ /a)
2013	20.0	51.6	14.0	15.7	1.7
2014	50.0	27.5	10.6	12.4	1.8
2015	99.0	3.7	1.3	0.1	-1.2
2016	90.0	8.5	2.5	0.0	-2.5
2017	99.0	3.7	1.3	0.0	-1.3

Table 3 Percentage change in the Kouebokkeveld average rainfall 1950-2015 for the years 2015, 2016 and 2017.

Stations	Years	AVGRnfl	% 2015		% 2016		% 2017		% 5%	
			2015	Change	2016	Change	2017	Change	Min	Quart
Algeria	109	699	375	-46%	524	-25%	235	-66%	235	446
Bokkeveldskloof	80	682	346	-49%	682	0%	447	-34%	323	379
Citrusdal	106	706	353	-50%					353	449
De Keur	81	647	365	-44%	675	4%	298	-54%	216	344
Die Erf	24	325	171	-47%	267	-18%	230	-29%	139	163
Exelsior	25	376	201	-47%	361	-4%	180	-52%	180	206
Kromrivier	62	369	195	-47%	278	-25%	152	-59%	152	204
Kunje	54	857	386	-55%	702	-18%	370	-57%	353	380
Odessa	25	306	144	-53%	248	-19%	176	-43%	139	147
All Stations		552	282	-49%	467	-15%	261	-53%	232	302

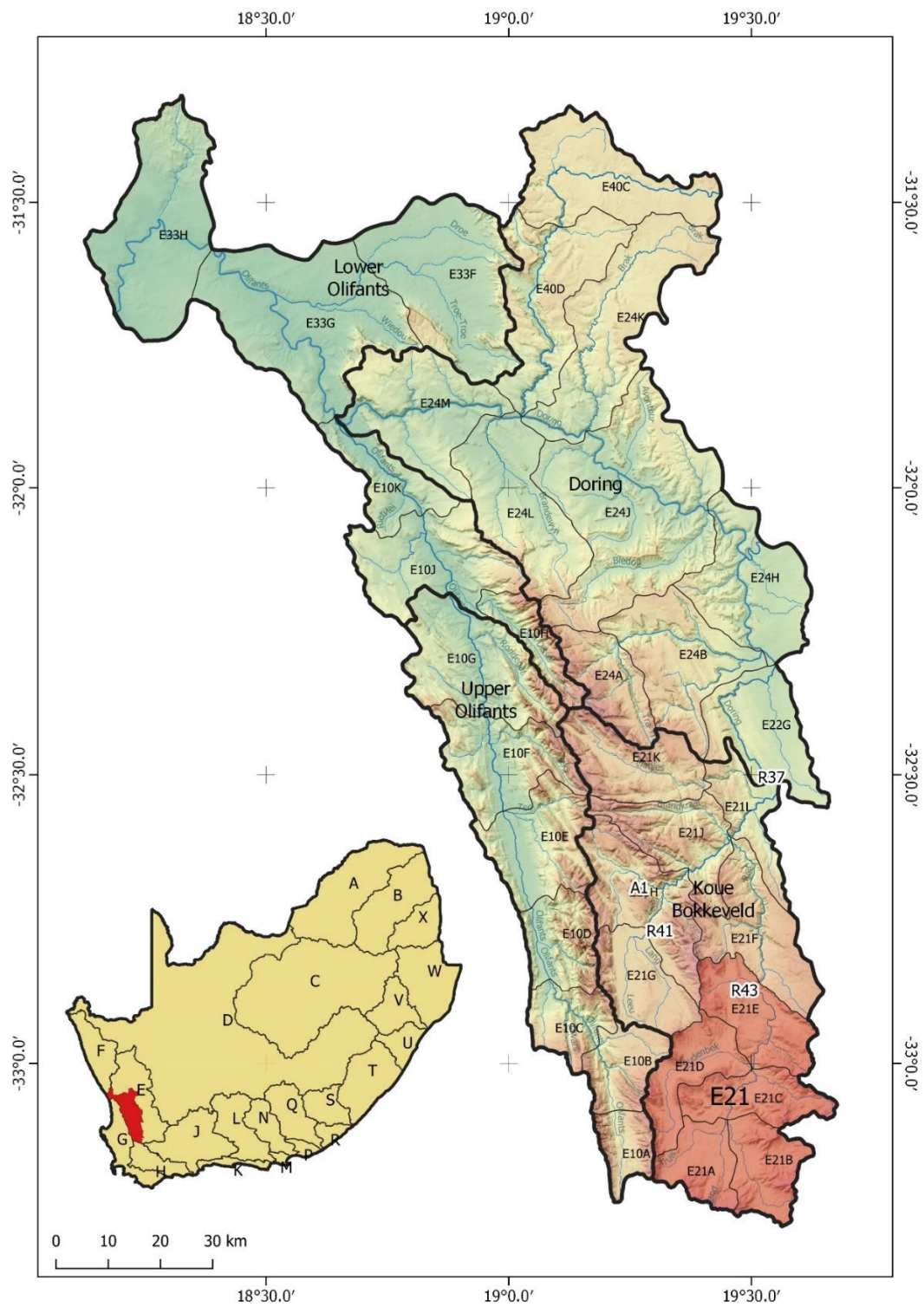


Figure 1 Kouebokkeveld quaternary catchments. Riet-Houdensbeks catchment (E21) highlighted in red.

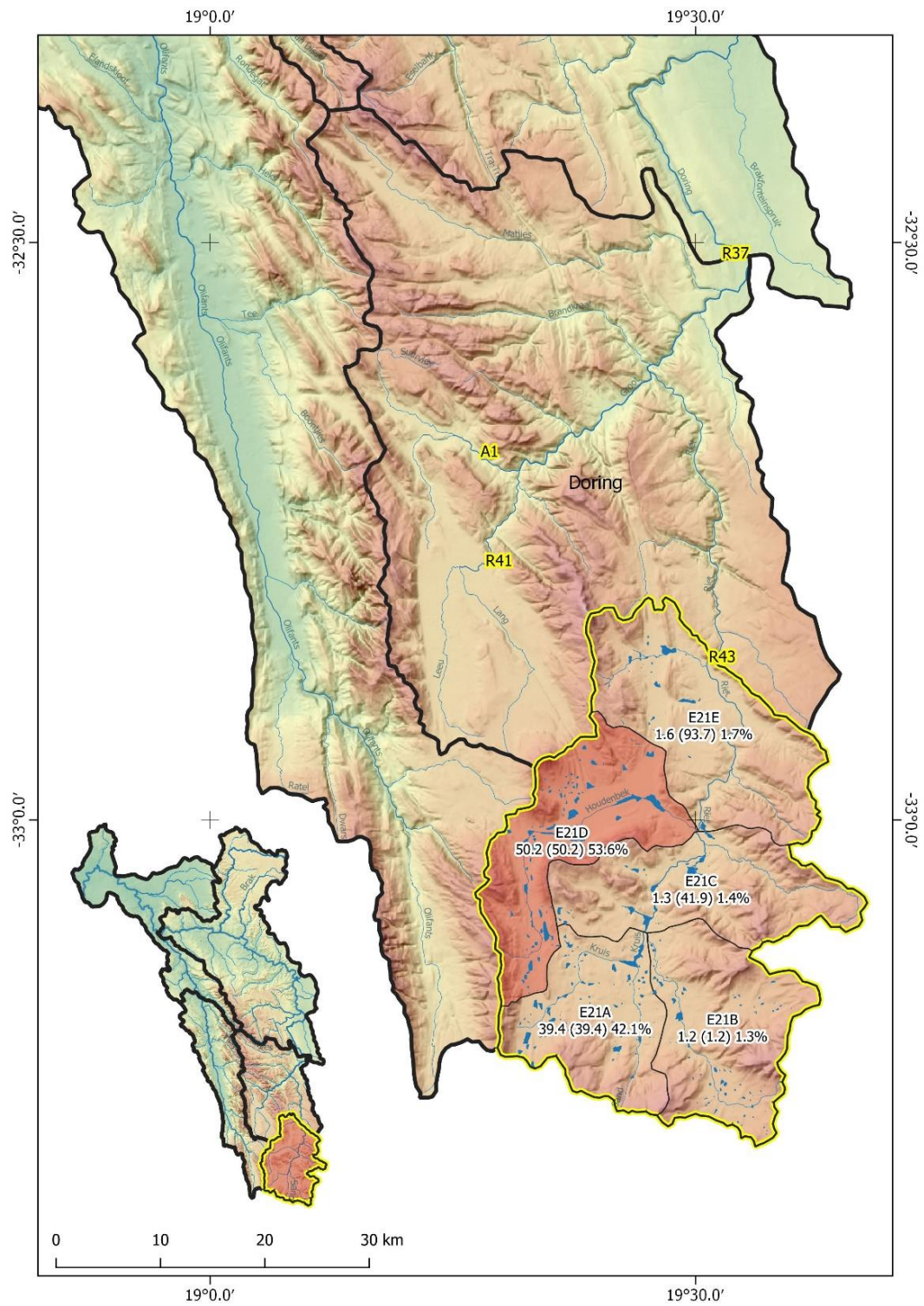


Figure 2 Sub-catchment E21 showing: Mean Annual Incremental Runoff: (Cumulative Runoff): percentage contribution to the runoff at R43. The Houdenbeks catchment (E21D) highlighted in red.

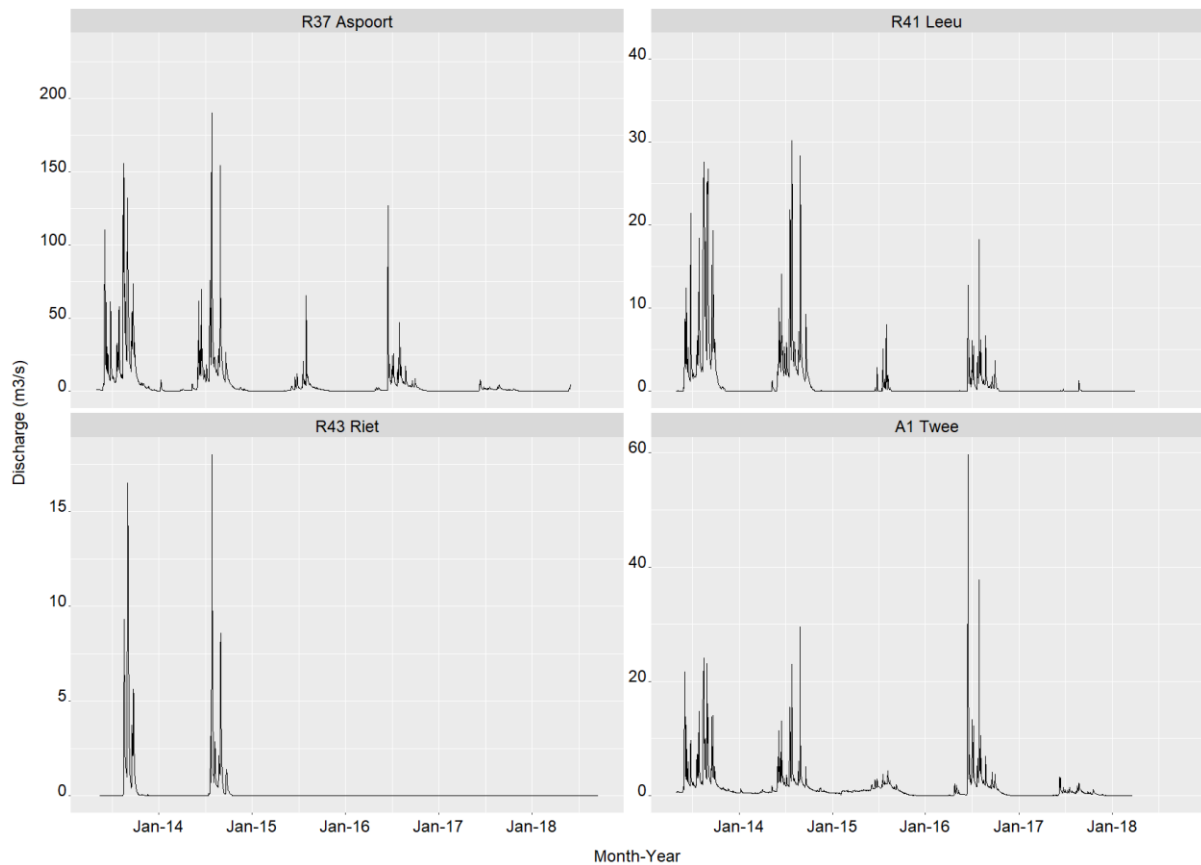


Figure 3 Hydrographs of gauged flows at Aspoort (R37), Leeu (R41), Riet-Houdenbeks (R43) and Twee (A1).

1.3 SUMMARY FOR THE HOUDENBEKS

Water resources in the wider Koue Bokkeveld and the Riet-Houdenbeks in particular are currently being impacted by a drought which rainfall records suggest is more severe and longer in duration than any previous drought on record. Current non-compliance with Ecological Reserve allocations are therefore primarily due to these unprecedented environmental conditions. Using the revised hydrological data, under historical conditions and in an average year, both the Freshwater Research Centre flow records and estimates of water availability produced by Howard (Howard 2010) suggest that there is in the region of 1.8 Mm³ available in catchment E21D, but that this will not be available each year. Flows in the Houdenbeks River are 'flashy', meaning that runoff is rapid and large volumes of water are available in some years for brief periods of time. Some of this water could be allocated for agriculture provided effective monitoring and management systems are in place which include the release environmental flows downstream.

- Department of Water Affairs. 2014. Determination of Resource Quality Objectives for the Olifants Doorn Water Management Area – Report No. 3 - RQO Determination Report. Prepared by Umvoto Africa (Pty) Ltd in association with Southern Water Ecological Research and Consulting cc (Authors: K Riemann, A Joubert, C. Brown) on behalf of the Directorate : RDM Compliance. *DWA Report No. XXX*. Department of Water Affairs, Pretoria. 200 pp.
- DWS 2017. Proposed Reserve Determination of water resources for the Olifants-Doorn catchments. Government Gazette, 13 April 2017. Notice 356 of 2017. No. 40785.
- Howard, G. 2010. Evaluation of the hydrology of the Leeu River in the Kouebokkeveld. *Project No. 2008-154*. Department of Water Affairs and Forestry, Olifants/Doring Catchment Management: Western Cape. 26 pp.