

SanParks

In March 2008, the Nqweba Dam spilled for the first time in 22 years.

For more than 80 years, the Nqweba Dam (formerly known as Van Ryneveld's Pass Dam) has been the main water supply to Graaff-Reinet, in the Eastern Cape. Lani van Vuuren takes a look at the history of this water engineering marvel, one of the first large dams to be constructed in South Africa.

The idea of constructing a dam across the poort at the Van Ryneveld's Pass on the Sunday's River outside Graaff-Reinet was discussed among eager irrigators and thirsty townsfolk for many years. But it was not until 1918 that any attempt was made to investigate the possibilities of a storage scheme here.

In that year, a preliminary survey of the basin was made under

the supervision of CH Warren, an engineer with the Cradock branch of the Irrigation Department. The results of this survey showed that a scheme was feasible and a detailed survey followed. In 1919, an Irrigation District was proclaimed under the Irrigation and Conservation of Waters Act of 1912. Under this Act farmers could apply for easy loans and obtain engineering assistance to construct large water schemes.

Irrigation Department engineer KR Shand was promptly seconded to the site as Resident Engineer. The scheme was to comprise a concrete storage dam a little less than two kilometres north-west of Graaff-Reinet, three pick-up weirs and about 97 km of canals.

The Van Ryneveld's Pass Irrigation Board was eager to start construction, however, the Second World

War had just ended, and obtaining plant and materials proved excessively difficult (almost everything had to be imported) and expensive. The Irrigation Department, who at that time had quite a few big water schemes under construction, including the Hartbeespoort Dam, decided to tighten its belt and loans were held back for new schemes.

The lack of funds meant that from November 1920 to July 1921 the only construction that could be done at Van Ryneveld's Pass was the erection of quarters for staff and employees, installation of water supply and construction of works roads.

STAFF HOUSING

Unlike many other large dam sites at the time, the Van Ryneveld's Pass Dam site was quite close

to a town, “a 20 minute walk” as Shand put it in an Irrigation Department magazine article in 1924. As a result not nearly as many amenities were required as at other dam construction sites.

As was typical of that time, one’s position and one’s race very much dictated what lodgings one would be afforded on site. All white (skilled) quarters were constructed of brick under an iron roof. The married quarters consisted of pairs of semi-detached cottages with flat roofs while single quarters comprised single rooms with small kitchen attached. The staff (mainly engineers) lived in single cottages with pitched roofs. All the houses had water laid on to near the kitchen door and were supplied with electric light.

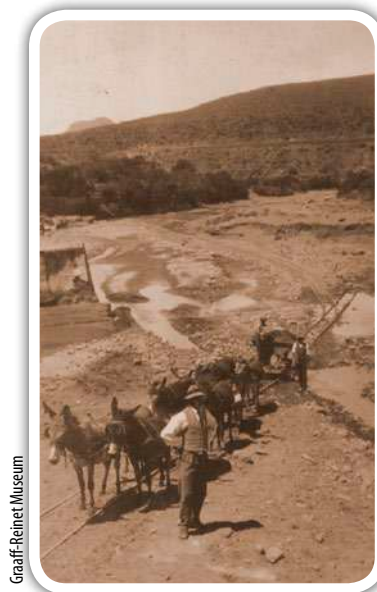
Black employees, who made up the whole of the unskilled work contingent, were housed in two brick compounds, each capable of accommodating 200 men. When the number of black staff rose to 700 between July-November 1923 the extra men had to be accommodated in huts made of cement bags.

The dam now forms part of the Camdeboo National Park, and these days it is more noted as a tourist attraction than a main water supply.

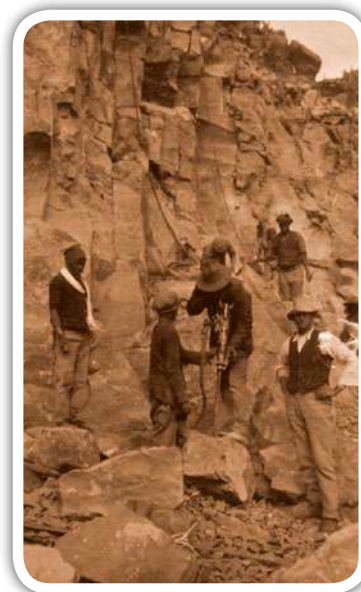
All white employees paid rent and contributed to a special medical fund. Black employees did not pay rent but did contribute to the medical fund. Water was obtained from a 136 kl service reservoir above the camp supplied by a small pumping plant on the riverbank. A sanitary service removed sanitary buckets and rubbish twice weekly.

DONKEY AND LEG POWER

A start was made on the foundations of the dam in July 1921. Excavation work was carried out in four sections: left flank, base excavation, river section and right flank. About 27 432 m of soil were taken



Graaff-Reinet Museum



Left: Workers drilling rock during excavations for the foundations.

Far left: Donkeys haul sand during the excavation of the dam. About 27 432 m of soil were taken out by means of donkeys and scrapers.

out by means of donkeys and scrapers. “This method proved very economical as long as the scrapers could be worked at right angles to the wall of the dam, which meant that a load was taken out going and coming, dumping both up and downstream,” wrote Shand.

After going down 3 m the pull up became too steep; a cut was then

method was confined to that portion of the excavation close to the riverbank. At the far end, inclines and light track were put down and cocopans hauled up the inclines by means of donkeys and then pushed out through the cut in the riverbank.

The riverbed did offer some resistance in the form of large boulders, up to about a cubic metre, which had to be removed with pick and shovel as the purchase of a steam shovel proved too inhibitive. The donkeys were later replaced with large mechanical plant. Practically all the machinery on the works was electrically driven, the power being generated at a central power station located alongside the railway siding for easy handling of coal. Excavation

made in the riverbank, scrapers taken through this and dumped in the riverbed. This meant a long haul and an empty trip back, so this



Graaff-Reinet Museum

The three main irrigation outlet valves are placed on the downstream side of the wall.

was completed at the end of September 1923.

Concrete work started in November 1922 and by November 1923, 52 754 m³ of concrete had been placed. The great part of this concrete was placed by means of tip trucks; when work was below

ground surface level, the trucks were run out on the side of the excavation, and concrete tipped down chutes into trucks at a lower level.

These trucks ran on rails resting on gum poles which, in turn, were carried by the shuttering: a day's work was shuttered off in pockets 4,2 m by 5,5 m wide by 1,4 m high. Once the wall reached ground surface level, the trucks were run out directly on the shuttering.

The steel shuttering was built into panels 6 m by 3 m and 4,6 m by 3 m for the upstream and downstream faces respectively and was used only on these faces. The upstream panels weighed about 227 kg and were handled by cranes. When a crane was unavailable these panels had to be lifted by 'sheer legs and chain blocks.'

The dam was completed towards the end of 1924. In total, nearly a quarter of a million bags of cement were used in the construction of the wall and over 80 km of steel rods were cut, bent and assembled and placed in the superstructure.

Work on the canal structure was kicked off early in 1924 and supervised from the dam. The scheme was constructed for around £400 000, the costs of the canals being a fifth of the total cost of the scheme.

A HERO'S BURIAL

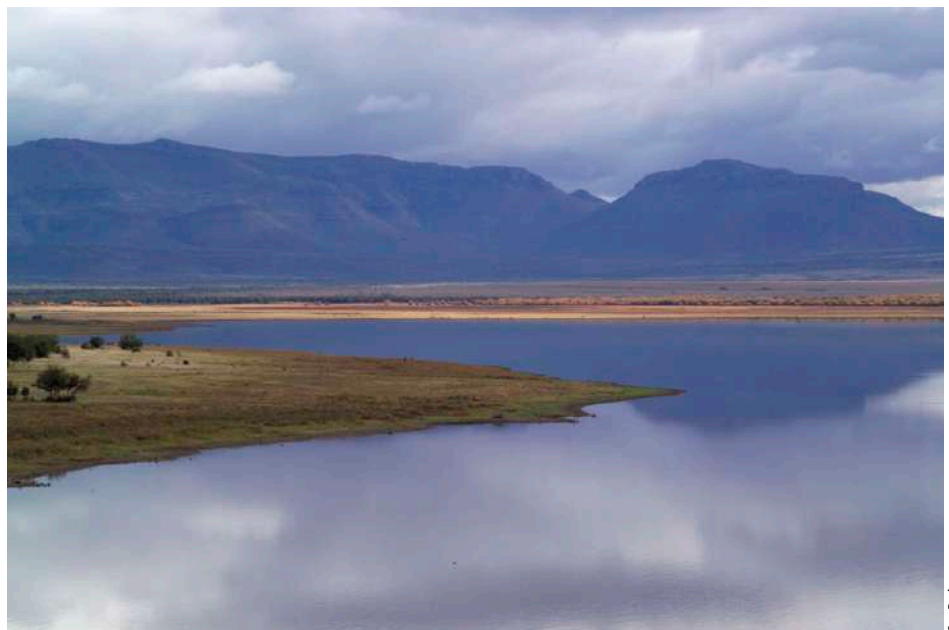
One famous name connected with the Nqweba Dam is that of Gideon Scheepers. Among others, the Boer Commandant participated in the battle of Magersfontein and escaped when General Piet Cronje surrendered at Paardeberg. He further led a commando of 150 men to take on British forces in the Cape Colony during the South African War (1899-1902). Becoming seriously ill he was captured on a farm in Prince Albert in October 1901 and sentenced to death by firing squad in Graaff-Reinet. Scheepers was executed on 18 January, 1902, and buried in an undisclosed location. Legend has it that his remains now lie under the waters of the Nqweba Dam.



Graaff-Reinet Museum

Left top and bottom: The dam under construction in July 1923. More than 700 men worked to construct the dam in less than four years – a record for that time.

Below: Nqweba Dam (formerly Van Rynevelds Pass Dam) was one of the first large dams to be constructed in South Africa in the 1920s.



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THE WATER WOES OF GRAAFF-REINET

The fourth-oldest western settlement in South Africa, Graaff-Reinet was established by the Dutch occupiers of the Cape in 1786. As was common with many colonial settlements at that time, the site, on a loan farm belonging to Dirk Coetsee, was selected mainly for its defensive potential, being surrounded by the Sunday's River on three sides. The town was named after Governor Cornelis Jacob van de Graaff and his wife Cornelia Reynet.

Despite its proximity to the river, the problem of water supply remained a dominating theme in the life of Graaff-Reinet for centuries. In 1797, John Barrow found the appearance of the town "as miserable as that of the poorest village in England."

In the decades after Barrow's visit circumstances got a little better. As Graaff-Reinet grew into a bustling trading centre a temporary dam of driftsand and brushwood was constructed in the Sunday's River. From this dam a furrow was led to the outskirts of town, where it was channelled into a number of canals for distribution to the gardens of the town's inhabitants, called erfholders. These erfholders used the water to grow produce, particularly vines.

In 1820, another dam and furrow, which became known as the upper dam and furrow, were constructed. The original works then became the lower dam and furrow. The making of a dam higher up in the river would reduce the flow of water into the lower dam so to compensate lower furrow users, a proportion of the water of the upper furrow was turned over the district mill located at the top end of town and into the lower furrow. However, the volume of water from the upper furrow that should be turned over the mill was a contentious issue and conflict over water between upper and lower sections of the town continued for decades.

The very system by which Graaff-Reinet was supplied with water also became an increasing source of dissatisfaction to the people in town. The two temporary dams in the Sunday's River were washed away every time the river came down in flood, and both furrows became choked with mud. This meant that there was no water going into town until the dams were reconstructed and the furrows cleaned. This could take between a few days to a few weeks.

For those inhabitants who did not have wells or rainwater tanks on their properties, this was quite a concern. They had to rely on so-called 'brand-dams' or fire-dams for their drinking water. These dams were formed simply by a widening of the furrows into squares of 3 m to 4 m and served, to a certain extent, as drains. According to *the Herald* newspaper when these dams were cleaned "the accumulated filth which is exposed and thrown out was sufficient to turn the stomach of even a municipal commissioner."

Decades of financial difficulty prevented the municipality from improving the situation until 1873 when the municipal board decided to test the water from a groundwater source known as Mackie's Pitt. Unfortunately tests revealed that the underground water was connected with the Sunday's River. This meant that the municipal board could not use this water without consent of the erfholders, who were entitled to all the water in the river above the two dams.

During November and December 1874, heavy rains not only washed away the dams, but almost completely destroyed the lower furrow. The damage was considered to be permanent. Graaff-Reinet applied to Parliament for a loan of £12 000 to improve its water supply and in December 1875 Government Hydraulic Engineer John Gamble met with the

municipal board to investigate possible schemes.

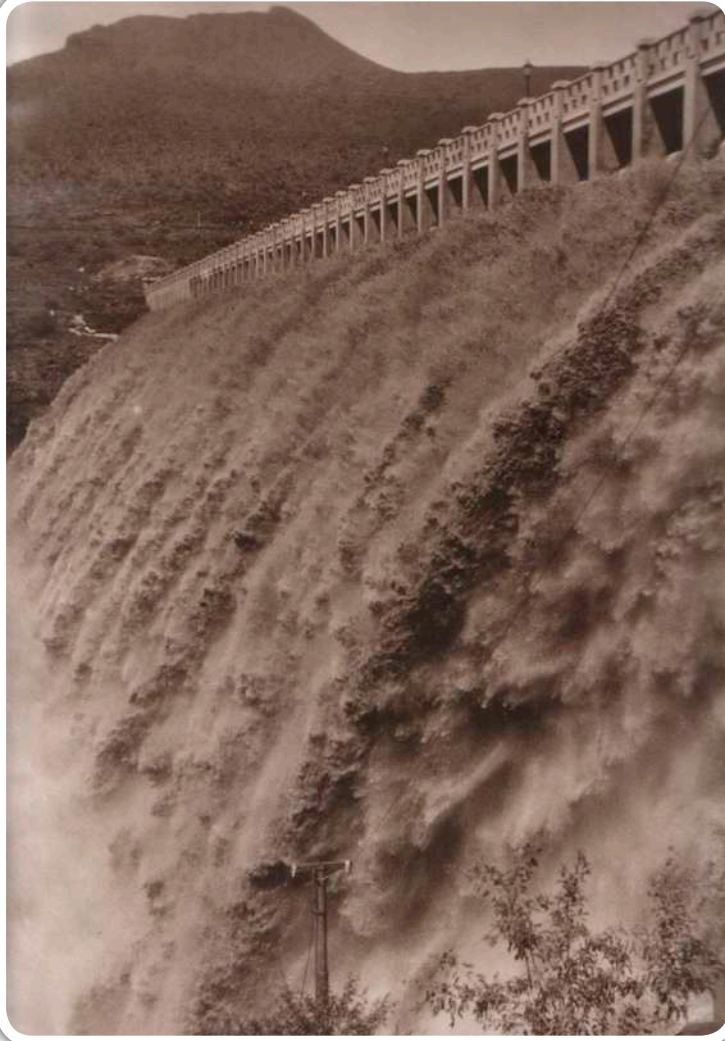
After many investigations and much discussion a plan was construed to sink two wells at Mackie's Pit and construct a concrete culvert to carry the water by gravitation to the mill; here the water would be divided between the upper and lower furrows. The fall from the upper to the lower furrow would be used to drive a turbine to pump 227 kℓ of water a day to a service reservoir. Water from this reservoir would be used for household purposes as well as in the case of fires.

At a town council meeting in 1881, it was decided to carry out only part of Gamble's scheme – that wells be sunk at Mackie's Pit and a furrow constructed to the upper furrow. The works were completed in November 1882. A decision was then made to continue the works a little further so that they would be secure against a flooding of the river (however, the in-fighting became so bad that these plans were never completed).

By 1908, people were thinking in terms of a weir across the Sunday's River and it was in this direction that further attempts were made to improve the water supply of Graaff-Reinet, which culminated in the construction of the Nqweba Dam in 1921. The wells of Mackie's Pit were covered by the dam.

The Graaff-Reinet Municipal Board at the new town water scheme in 1884.





The dam spilling for the first time. The downstream face is made up of staggered steps, which break up the mass of floodwater spilling over the crest.

ENGINEERING FEATURES

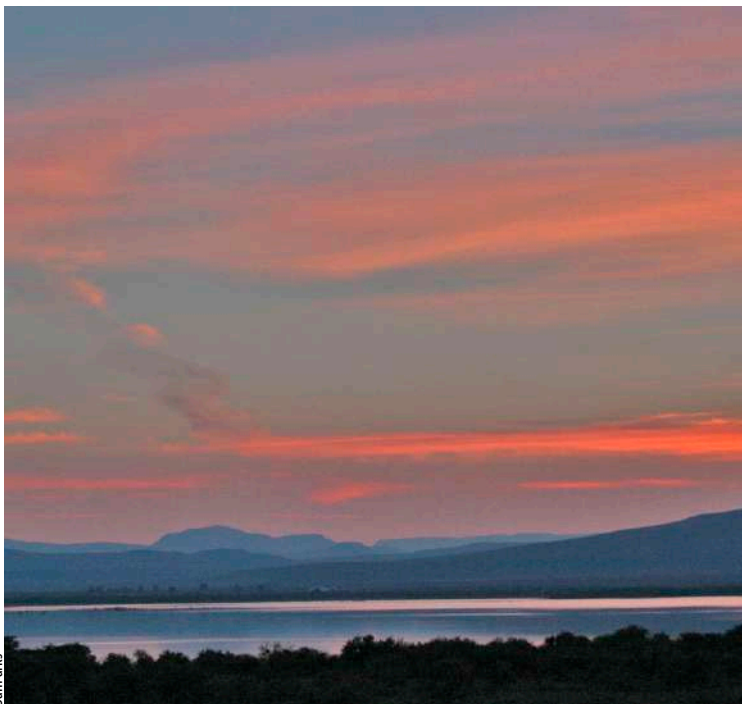
The dam consists of a mass concrete wall of gravity section, straight in plan of the overspill type. The upstream face is vertical and the downstream face stepped (a novel feature at the time). These steps are staggered to break up water coming over the crest in case of high floods and so reduce the pounding action on the toe of the dam and foundation.

No special provision was made to form a water cushion as it was anticipated that a natural water cushion would be formed with a certain amount of surface material being scoured away, leaving a standing pool at the toe.

The spillway over the main wall is 169 m long and an auxiliary spillway on the left flank 69 m long. A removable reinforced concrete

SOURCES

- *Notes on some of the more important irrigation and multi-purpose schemes built and/or controlled by the Department of Water Affairs, September 1969, Compiled by the Department of Water Affairs*
- *Van Ryneveld's Pass Irrigation Scheme. Souvenir of the official opening of the works, 14th July, 1925* by the Van Ryneveld's Pass Irrigation Board
- *Van Rynevelds Pass Irrigation Scheme in South African Irrigation Department Magazine, Vol. 3 No 1, March 1924*
- *From frontier to midlands: A history of the Graaff-Reinet District, 1786-1910* by KW Smith
- www.graaffreinettourism.co.za/index.php?page_name=more&menu_id=1
- www.sahistory.org.za/pages/places/villages/eastern-Cape/graaffreinet.htm
- Thanks to Graaff-Reinet Museum, Camdeboo Municipality and SanParks for photographs.



Water from Nqweba Dam is no longer used for irrigation. The dam falls within Camdeboo National Park and is a major tourist attraction in the area.

superstructure, 381 m long with a pedestrian walkway around 2 m wide, extends over the entire length of the top of the wall.

The main irrigation outlet valves are placed on the downstream side of the wall, and discharge into the riverbed. As the dam also serves as a storage reservoir for Graaff-Reinet, a valve tower on the upstream side of the wall draws off the water for the town. Initially three pipelines served the town's requirements.

AN UNEASY FUTURE

Like other dams in the area, Nqweba Dam has lost much of its capacity due to excessive siltation. This, in addition to an increase in soil salinity, has made irrigated agriculture a high-risk activity in the catchment, and over the years many farmers have gone out of business.

However, the dam still provides much needed water to the town of Graaff-Reinet, and when the Van Ryneveld's Pass Irrigation Board was dissolved in 2001/02 the ownership of Nqweba Dam passed on to Camdeboo Municipality. The dam now forms part of the Camdeboo National Park, and these days it is more noted as a tourist attraction than a main water supply.

The future of the dam is uncertain, however. A safety inspection of the dam in 1998 classified it as 'one of the most unsafe dams of its size in South Africa' as it is reportedly unstable under flood conditions. Investigations into various options are still being weighed to improve this situation – in the extreme case the cost to decommission the dam and replace it with another source to supply water to Graaff-Reinet may have to be considered if the structural measures are found to be too expensive. □

MAIN FEATURES OF NQWEBA DAM

Dam type: Mass concrete gravity section overspill type

Maximum height of concrete wall above riverbed: 33 m

Length of dam at crest: 356,6 m

Crest width (overall): 3 m

Footway: 2 m

Maximum excavation depth: 14,4 m

(Original) gross capacity at full supply level: 78 843 Mℓ

Quantity of concrete in main wall: 99 392 m³



Call for Registration: WDM Specialists

The Water Demand Management (WDM) Programme is hosted by the Development Bank of Southern Africa (DBSA) and supported by the Swedish International Development Cooperation Agency (Sida).

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