

# WAGENDRIFT – A symbol of local engineering innovation



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*Constructed during South Africa's golden era of dam-building in the 1960s, Wagendrift Dam, in KwaZulu-Natal, is a showcase for local engineering ingenuity.*

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Sites for possible water storage in the Upper Thukela River and its tributaries were first investigated by the Irrigation Department after the Second World War. The resultant report, published in 1948, sited the Bushmans

River above Estcourt as a particularly good spot to build a dam to stabilise water supply to the town and irrigation farmers in the area. Estcourt, which began its life as a modest trading store established by its first inhabitant Clem Heeley in 1847, had by then flourished into the largest industrial and commercial centre in the Midlands region. It was thought that by providing additional water resources, these enterprises could be expanded.

The potential of the Upper Thukela as a potential stimulator

of the economy was noticed even then. "It [is] apparent that the rivers of Northern Natal, properly regulated, represent extremely important water resources in the national economy which, in point in fact, exceed the requirements of all possible agricultural development in their valleys and reasonable industrial use," wrote Department Director LA Mackenzie in his 1948 report. Of course, the Thukela River would later become one of South Africa's strategically most important river systems with the construction

**Top right:** Wagendrift Dam from the air. It was the first structure of significance to be constructed in the Upper Thukela River system.

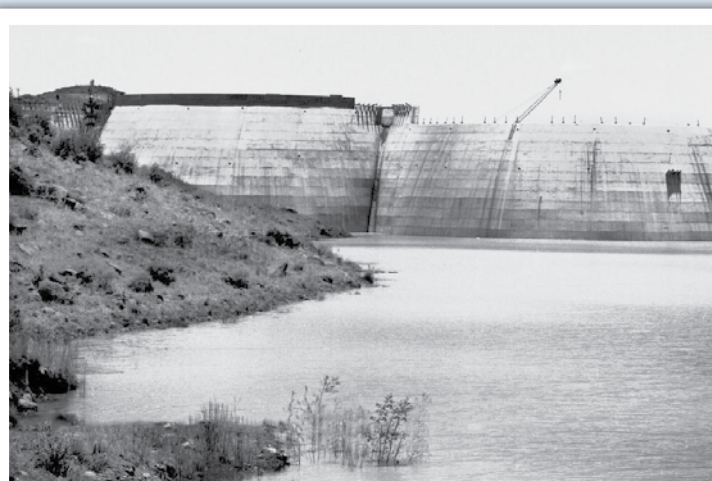
**Middle right:** Wagendrift Dam rises in the Bushman River. The dam had an original maximum capacity of 58,4-million m<sup>3</sup>.

**Bottom right:** Wagendrift's unusual design was selected to retain the economics of an arch structure while fitting a wide-bottomed site. The dam wall is 281 m long from flank to flank.

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of the Thukela-Vaal Transfer Scheme to supply water to Gauteng.

The 1948 report recommended that initial operations be focused on establishing a dam on the Bushmans River above Estcourt and so work was undertaken in this regard by DWA. Various possibilities were investigated, including establishing the dam on the farm *Groot Mieli-etuin*, but the department eventually settled for a dam site on the farm *Wagendrift* – some 6 km upstream and south west of Estcourt. The farm takes its name from the drift through the Bushmans River used by transport wagons on their way from Port Natal to the goldfields of the Witwatersrand. This site was thought to have good storage

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characteristics and be well placed in respect of the water resources available. In addition, it would inundate relatively undeveloped areas. The primary objective of the dam would be to ‘stabilise the flow of the Bushmans River to overcome the seasonal shortages experienced by irrigators lower down the valley at Weenen and to provide an assured supply for municipal and industrial use in Estcourt’.

The proposed scheme was approved by Parliament in 1959, and work on the construction camp began that same year. The department had managed to obtain 20 railway construction houses in Estcourt for housing a large



proportion of its employees, and so only 19 additional houses had to be erected at the dam site. By the end of March, 1960, the camp and works buildings had been completed and a start was made on excavation – 6 116 m<sup>3</sup> of excavation was done that first year.

In total, some 96 000 m<sup>3</sup> of soil was excavated and 73 00 m<sup>3</sup> of rock, while some 54 000 m<sup>3</sup> of concrete went into the dam wall. By the end of July, 1960, it was possible to cast the first concrete in the central buttress and a year later the river was brought under control of the structure – the concrete work having been completed for the full bed width of the river section. The dam was eventually completed in 1963 and officially opened on 14 March, 1964 amidst great fanfare. The final dam is a 40 m-high multiple double-curvature arch dam – believed to be the first of its kind in the world. The design retained the economics of an arch structure while fitting a wide-bottomed site at the same time. Wagendrift had an initial storage capacity of some 58,4 million m<sup>3</sup>. Like many other South African dams, this dam was also designed in such a way to allow for future raising.

During the final design stage the initial arches were modified to domes – the latter being more economical than arches and also offering the added possibility of simplification of the outlet and scouring arrangements. The final structure had four domes supported by five buttresses spanning the major section of the river. The flanks have been closed off by means of half-domes with the crown thrust from the half-domes carried to the foundation and flanks by means of prestressed cantilever thrust blocks. One of the greatest challenges of the project was the shuttering – while the type of shuttering used at Kariba Dam was applied it took a considerable time before proficiency in application of a flat plane to a warped or curved surface was achieved.

DWA designers had to design a dam that would be able to withstand extremely variable flow, from as little as about 0,1 m<sup>3</sup>/s to in excess of 28 m<sup>3</sup>/s. High flood discharge is carried over the two central domes which provide a spillway length of 107 m, but low floods and service requirements are accommodated by the outlet works contained in the central buttress. The whole structure is symmetrical about the central buttress which has been split on its centre line to provide for the outlet works. The buttress is virtually a mass gravity structure but has

been reinforced near the upstream face by means of post-tensioned stressing cables. A 2,7 m by 3 m radial gate was installed for desilting purposes. This was originally operated by means of an electrically drive rack-and-pinion winch. The normal service openings were provided in the form of three sets of 0,9 m-diameter pipes so connected that they are able to discharge water through one set of outlets. Designed and constructed by the Department of Water Affairs the dam is a prime example of local engineering innovation. □

**Below:** The Dam nearing completion. Some of the shuttering can still be seen. The dam used the same type of shuttering as that applied on the construction of Kariba Dam.

**Bottom:** Wagendrift Dam spilling. Today, the dam makes a magnificent site for motorists passing on the N3 highway.



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