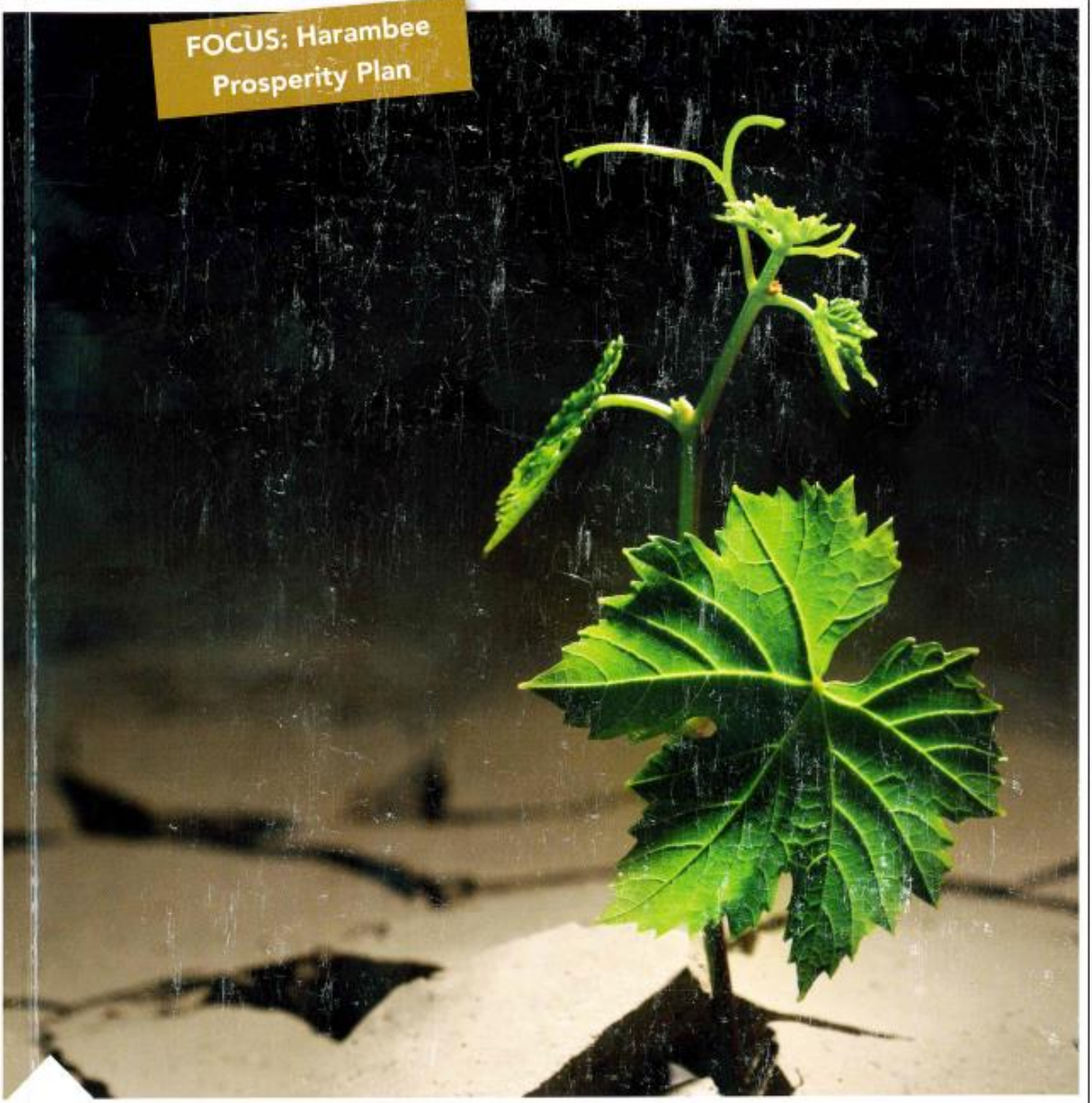
WHO'S WHO ENGINEERING NAMIBIA

ENGINEERING NAMIBIA

Volume 7 – 2016/17 edition

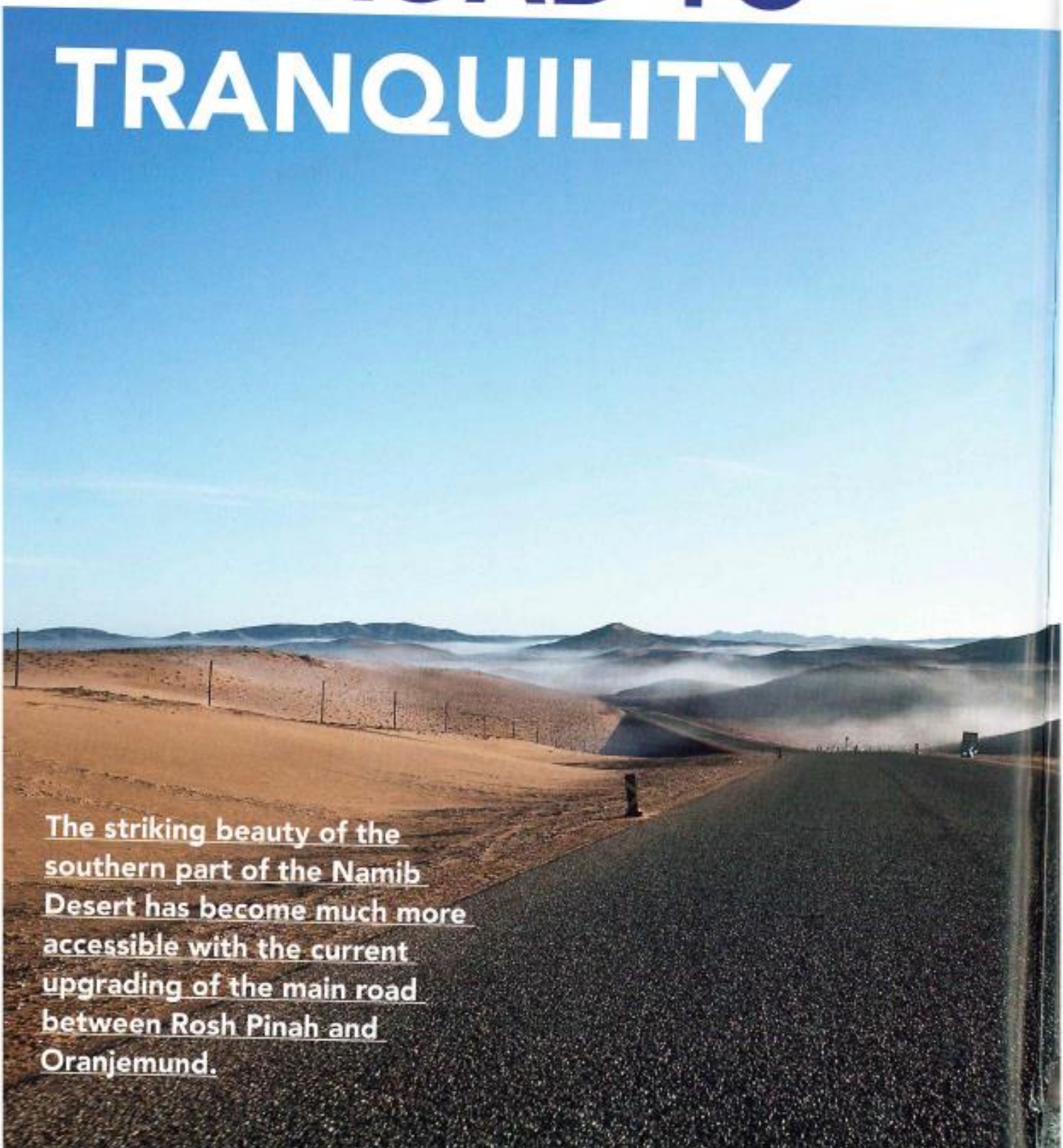
FOCUS: Harambee Prosperity Plan



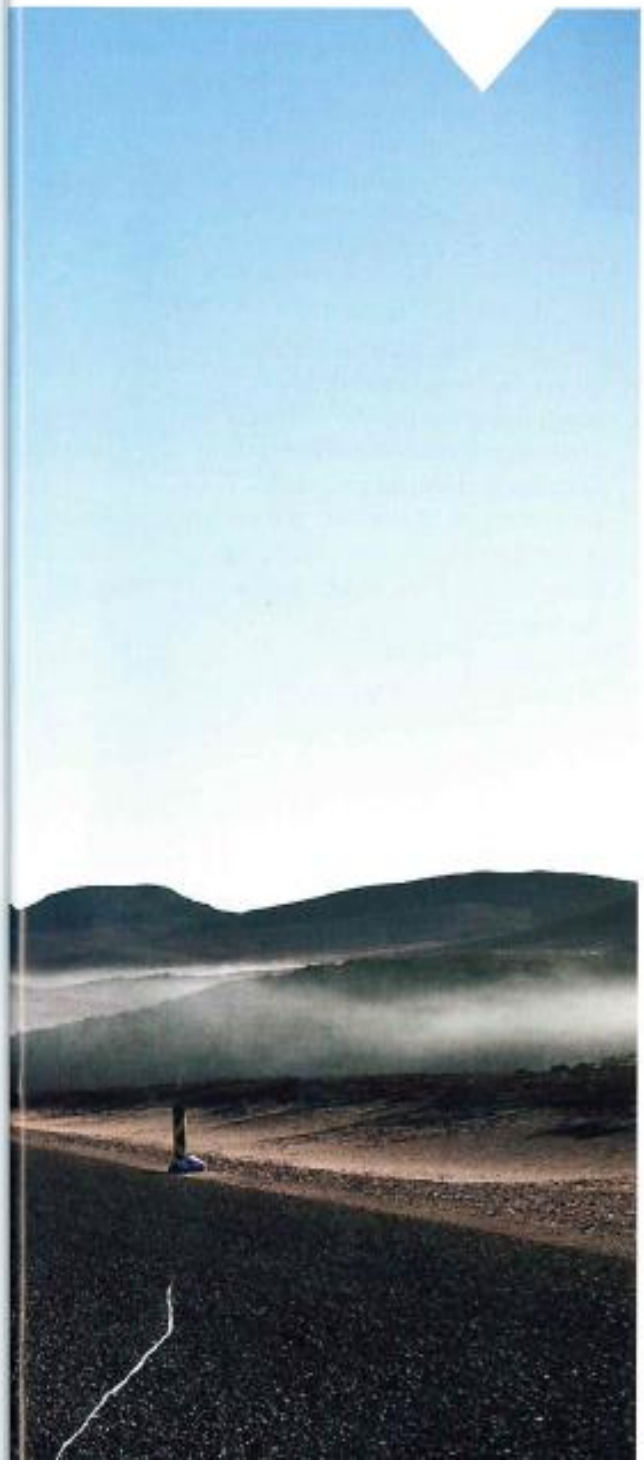
FOCUS: THE HARAMBEE PROSPERITY PLAN AND THE ENGINEERING INDUSTRY

N$45.00 VAT inclusive
ISSN 2026-7460

ORANJEMUND TO ROSH PINAH: THE ROAD TO TRANQUILITY



The striking beauty of the southern part of the Namib Desert has become much more accessible with the current upgrading of the main road between Rosh Pinah and Oranjemund.

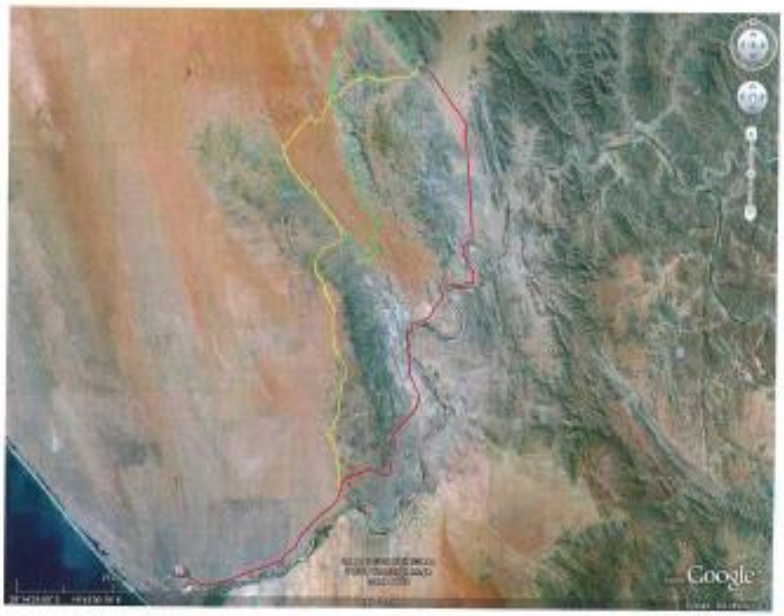


Indeed, the tourist who drives this road will discover mountain vistas such as those described by the early prospector Fred Cornel: "....range after range, peak after peak..." and all with a disorientating absence of vegetation that makes size and distance hard to judge without the reference points of trees, so that the sight seems to embrace thousands of square kilometres. The deathly barren spires of black mountains and intervening mauve dunes are defined in endless gradations against the shimmering blue sky. This is the pure essence of the Namib Desert in the Tsau//Khaeb (Sperrgebiet) National Park, where no single element takes precedent over the others, and the hazy scene stretches to the rim of the earth.

There can also be fog and there is no cellphone coverage. Both are assets: the evaporating fog leaves lakes of mist that give double and triple perspectives to the mountains that in clear skies appeared as a single block. The absence of cellphone towers gives rightful dominance to the bushman's candle plant and the dazzle of its pink buds, the overwhelming silence, and the stars at night.

This 99 km stretch of road will induce rare moments of absolute peace, where the body is relaxed and the mind asks no questions. Tourists will need nothing else to occupy them: neither music nor camera, nor any other distraction from the modern world. For those with narrower interests — the driver distracted from the view by pressing business matters or even the daily mine commuter — the route will pronounce without the need of spoken word a signal engineering achievement.

Contributed by John Williamson, assistant resident engineer, VKE Namibia Consulting Engineers



Google map of the new road between Rosh Pinah and Oranjemund, indicated on th emap with a red line.

Background to the project

The lack of a road transportation link between the //Kharas Region town of Oranjemund in the far south of Namibia and the rest of the country has been a controversial issue since the 1990s. Residents of Oranjemund have had to drive across the Orange (Gariep) River via the border post on the B1 at Noordoewer (past Port Nolloth and Steinkopf in South Africa) in order to access routes onwards to the major centres of Namibia. This increased the travel times to and from Oranjemund to anywhere else in the country by a significant amount.

Following pre-feasibility and feasibility studies undertaken prior to 2000, the Namibian Government finally decided that a bitumen road link to the national road network between Oranjemund and Lüderitz would suit neither the mining operations at Rosh Pinah nor at Skorpion, some 20 km to the north of Rosh Pinah. A road via Lüderitz would also not improve the road conditions for traffic using the national gravel road along the Orange River between Noordoewer and Rosh Pinah, which serves the Rosh Pinah/Skorpion mines and the commercial grape production unit at Aussenkehr, as well as various tourism lodges and canoeing recreational facilities along the Orange River.

A subsequent 2008 fact-finding study to investigate a direct link between Rosh Pinah and Oranjemund (see green and yellow road links on the map) so that people could avoid travelling through the diamond-mining deposits along the Orange River once again favoured the upgrading of the existing Namdeb private road along the north bank of the river, rather than the construction of a whole new route altogether.

The overall rationale for this conclusion concerned the tourism potential of the extremely beautiful scenery along the Orange River; the potential practical difficulties in crossing the very high Obib sand dunes and other parts of the pristine Namib environment; and — importantly — the fact that diamond mining in the area will one day be phased out, leaving the country with the responsibility of maintaining the existing gravel road in addition to any new direct bitumen road.

A decision was ultimately made to upgrade the 'River Route' to a bitumen surface road (see red line on the map), which would be known as Main Road 118.

In settling on that option, Government resolved to accept the challenges related to:

- constructing the bitumen highway over undulating and mountainous terrain (including the Auchas, Daberas, and Niklaas passes);
- uncertainty as to whether further mining of lower-grade diamond deposits along the historical flood plains of the river would prove to be financially viable;
- difficulties in traversing the moving sand dune terrain directly to the east of Oranjemund;
- and the challenges of constructing a safe road near Sendelingsdrif, where the alignment would be squeezed between the Orange River and the Schakalberg.

Upgrade design and construction

In January 2014, the Roads Authority contracted Raubex Namibia Construction to undertake the road works on the Main Road 118 upgrade, and VKE Namibia Consulting Engineers to carry out the design work and supervise the construction phase.

The project is scheduled for completion by June 2017 at a final construction cost of close to N$700 million for the 99 km of road between Oranjemund and Rosh Pinah.

The Roads Authority had been compelled to accelerate the planning and construction of the road, which led to the initiation of a 'design-under-construction' approach.

Under this strategy, VKE found it became quite a challenge to provide timely design information to the contractor, who was placed under pressure to comply with a programme that could not be planned for accurately in the absence of a completed design.

» The design-under-construction approach prescribed by the client to accelerate the planning and construction of the road led to quite a challenge for the engineers to provide timely design information to the contractor. «

In addition, not all quantities could be verified at tender stage, which negatively affected the accuracy of the project's cost-estimation during the initial stages.

Technically, however, the project has gone surprisingly smoothly to date, with relatively few adjustments to the adopted design parameters found to be necessary.

Challenges relating to road construction in sandy environments

During sandstorms, public traffic has become stuck in thick sand deposits on the temporary route diversion, with visibility limited to only tens of metres at times. The strong winds occurring in the area also added thick layers of sand over half-completed work, which at times delayed progress, since corrective measures were needed to address the damage caused by the sand.

A temporary water storage dam ended up being partially filled with wind-blown sand and had to be reconstructed. Buried PVC pipelines were exposed by wind and damaged, causing disruption in the supply of pumped construction water to the work site.

(Below) Sandstorms — a frequent occurance — added to the challenges faced by the construction team: a temporary water storage dam ended up being partially filled with wind-blown sand; construction vehicles got stuck; visibility is reduced to tens of metres only and sand covered half-completed work which has to be removed before construction could recommence.

1. Orange River in flood in 2006, which also flooded the road.
2. The road before construction commenced.
3. & 4. Construction of the road alongside the Orange River.
5. The final level of the road will be raised above the highest water level recorded in 1974 when both the Orange and Fish Rivers came down in full flood.

In the dune field area, the road was designed to be elevated and provided with gravel side-slope protection to reduce the effect of windblown sand deposits on the road. Sand is still regularly blown onto the road, although this will not affect road users that much in the future, since thin sand deposits are driven off by vehicles.

During construction, however, it required nearly daily cleaning of each pavement layer and bitumen application prior to the contractor continuing with the next layer or bitumen application, before the wind speed picked up

again in the afternoon. The contractor, not unnaturally, reported endless frustration with sand removal over sections of the road.

Additional challenges to the upgrade

Quartzitic boulders that had been screened out during diamond-mining operations in the area were put to good use as a source of crushed stone products, but brought about challenges to reduce excessive clayey fines between the rock stockpiles.

Most deep-cutting operations through hard material presented specific challenges, requiring extensive drilling and blasting. Many shallow cuts also required drilling and blasting too, however.

The section of road between the Schakalberg and the Orange River represented a particular engineering challenge, originating back to the time when the predecessor of Namdeb Diamond Corporation, Consolidated Diamond Mines (CDM), instructed an operator with a bulldozer to form a narrow road using infill material, starting from the Oranjemund end and heading towards Sendelingsdrif in the east, all along the mountain rock just above low water level.

The road height here had since been raised several times when the entire road was upgraded by the mine for internal use, in order to elevate the road above the higher water levels that regularly overtopped the road and thus avoid the regular closure of the road in times of high floods.

The road will now need to be raised above the highest water level recorded in 1974 when both the Orange and Fish Rivers came down in full flood. The photographs above indicate the progress made to date with this problematic 2 km-long section along the Orange River towards Sendelingsdrif.

A further complication turned out to be the presence of overhanging and loose large rocks higher up in the mountains, as well as further areas of unstable rock that developed during the removal of support rock in places where the rock strata dip towards the river and where rock anchors cannot be used to stabilise the rock. This occurred where fracturing of the rock became excessive as a result of too many fractured faces dipping in different directions.

High-risk rock had to be removed using extensive drilling and blasting and on occasion by applying high-pressure water jetting to soften up inter-layers to reduce internal friction, followed by econdary blasting.

The road, when completed, will be of a very high geometric standard with an excellent riding quality, which will complement the beautiful natural scenery of southern Namibia. The road is envisaged to significantly reduce accidents, time and travel costs for the residents of Oranjemund.

Above: BEFORE *Below: AFTER*