Popa Falls (Divundu) Hydro-power Project

Pre-feasibility Study

ARCHAEOLOGICAL ASSESSMENT

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for

Water Transfer Consultants

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QRS Job 41

EXECUTIVE SUMMARY

This report presents a review of available information on the archaeology and cultural history of the Popa Falls Hydro-power Scheme study area, located on the Kavango River near Divundu in north-eastern Namibia. The review is augmented by the results of a brief field inspection carried out in March 2003. An assessment of potential impacts affecting the archaeological and cultural historical components of the study area is presented together with recommendations for mitigation measures to be taken at the feasibility stage.

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INTRODUCTION

The Namibia Power Corporation (Pty) Ltd is investigating the feasibility of a hydro-power scheme at Popa Falls, near Divundu on the Kavango River in the northeast of the country. NamPower has awarded the tender for the pre-feasibility study to Water Transfer Consultants (WTC), a consortium of engineering firms together with Eco.plan (Pty) Ltd as environmental consultant. Eco.plan has engaged Quaternary Research Services to carry out an assessment of the archaeological and related impacts of the hydro-power scheme, according to the Terms of Reference set out below.

The Environmental Assessment Policy approved by Cabinet Resolution 16.8.94/002 requires that major developments such as the Popa Falls Hydro-power Scheme should include detailed environmental assessment and monitoring. The Draft Environmental Management Act (1998) specifically recognizes the archaeological record (Paragraph 1 (c), Definitions) as a component of the physical environment. In Namibia, archaeological remains are protected in terms of the National Monuments Act (No. 28 of 1969, as amended until 1979), remaining in force by virtue of Clause 140 of the Constitution of the Republic of Namibia. The Act requires under Section 12, Paragraph 3 (a) that developers report archaeological finds. Due to the specialized nature of the field it has become established practice to include archaeological surveys in environmental assessment programmes. NamPower has commissioned archaeological surveys for a number of major projects, including the 400kV Aries to Auas power line and the 220kV Windhoek to Walvis Bay power line.

The Kavango Region of Namibia is not well known archaeologically (Kinahan 2000; Kinahan & Deelie 1990), and most of the area has not been examined at all. However, an archaeological survey of the west bank of the Kavango River between Dikuyu Island and Mohembo revealed twenty-three sites with ceramics and other remains (Kinahan 1986). Against this background, Eco.plan requested QRS to identify, locate and describe any archaeological sites, graves and sites of special cultural or religious significance that could be affected by the development, wier impoundment and related infrastructure of the envisaged Popa Hydro-power Scheme.

In addition, QRS was required to assess the significance of the sites and the potential impact of the project according to generally accepted criteria.

ARCHAEOLOGICAL ASSESSMENT

Review of sources:

According to various migration legends, Kavango peoples, including the Mbukushu who occupy the Divundu area today, trace their origin to south-western Zambia (Brelsford 1956; Reynolds 1967). It believed that the Mbukushu arrived at the Kwando River in about 1750 and moved on to the Kavango in about 1810 as a result of pressure exerted by the southward movement of the Lozi (Gibbons 1904). These sources do not reveal whether the Mbukushu displaced other communities already settled on the Kavango River (Gibson 1981).

The earliest source of ethnographic information on the Mbukushu is the report of Henrique de Paiva Couciero (1892) who navigated the Kavango River as far as Gumare in present-day Botswana. A subsequent expedition report by João de Almeida (1912) also contained valuable ethnographic observations. It was de Almeida who established a number of forts to safeguard Portuguese interests in this area. Unfortunately, one of the forts lay within what was by then German territory and became the subject of a minor dispute before it was eventually abandoned. The fort in question, which remains partially intact (Demhardt 1999), was located at Mucusso, opposite Andara, according to a sketch by Hauptmann Streitwolf in 1913.

After several unsuccessful attempts to establish a mission amongst the Kwangari and Mbundza, in 1912 the Oblates of Mary Immaculate were given permission by the Mbukushu to build a church at Andara (Gotthardt 1946). Only in 1959 was a second mission established in the same area, at Cuangar in Angola, by the Redemptorist Fathers (Silva Rego 1964, cited in Gibson 1981). According to Fr Hermyn OMI (pers. comm.), the site at Andara was allocated to the mission by Chief Ndara because it was steep and rocky, and therefore entirely useless for purposes of cultivation. Today, the mission at Andara comprises an extensive establishment with gardens, a

hospital, a small hydro-power plant and many buildings, including workshops, offices and houses for mission staff.

The first systematic archaeological investigations in the Kavango region were carried out at Kapako and Vungu Vungu, near Rundu (Sandelowsky 1979). These sites yielded the earliest evidence of farming settlement in Namibia. Similar early dates have now been obtained for ceramics from the Liambezi basin in eastern Caprivi (Kinahan 2002). Popa Falls is approximately midway between these points and a detailed survey of the surrounding area indicated that farming settlement on the lower Kavango was comparatively recent (Kinahan 1986). Radiocarbon dates from these investigations are set out in the table below.

Site location	Calibrated date	Laboratory No.	Reference
Kapako	AD 840±50	Pta-234	Sandelowsky (1979)
Vungu Vungu	AD 1630±45	Pta-236	Sandelowsky (1979)
Liambezi	AD 869±60	Pta-8656	Kinahan (2002)
Liambezi	AD 1015±20	Pta-8647	Kinahan (2002)
Kamutjonga	AD 1820±45	Pta-3758	Kinahan (1986)

Radiocarbon dates from north-eastern Namibia

Archaeological remains found during the survey of the Kavango River reported by Kinahan (1986) were dominated by ceramics, with small numbers of imported glass trade beads, some stone artefacts, worked ostrich eggshell and a single iron implement, a tanged awl. With the exception of material from one site, all of the ceramics were attributable to the Mbukushu, on the basis of formal style elements and decoration characteristics that are exclusive to this group (*vide* Huffman 1980). Only one of the sites, Kamutjonga, located on the northern edge of the Mahangu Reserve, contained stratified deposit. The 19th century radiocarbon date associated with the ceramics from this site concurs with the historical dating of Mbukushu settlement in this area, as set out above.

The accompanying table indicates the distribution of the archaeological sites found during the survey. The frequency of sites found in arbitrary 5km blocks between Dikuyu and Mohembo is shown, together with average inter-site distances and average distances between the sites and the south bank of the Kavango River. Comparative data for the frequency and distribution of modern settlement (ca 1986) are also presented in the table. There is a clear correspondence between the two data sets, in terms of distribution patterns. The lower overall frequency of archaeological finds is probably attributable to the combined effects of bush clearing, ploughing and soil erosion.

The two most important characteristics of the known archaeological site distribution are:

- Strong clustering of sites within less than 0.5km of the river, with negligible occurrences at more than 1.0km. This pattern corresponds with the modern settlement distribution.
- Strong clustering of sites upstream of Bagani, with very low frequencies downstream of that point. This pattern confirms local traditions that the Mahangu Reserve was maintained as a chiefly hunting area in pre-colonial times.

No indications were found of human occupation prior to pre-colonial farming settlement in the Kavango. This, however, most probably reflects the limited scale of fieldwork, for surveys on the upper Zambezi have yielded large accumulations of early to mid-Pleistocene stone artefacts (Phillipson 1978), and adjacent parts of Botswana are rich in both Pleistocene and Holocene archaeological remains (Robbins & Murphy 1998; Thomas & Shaw 1991; Walker 1998). It is therefore predictable that the Popa Falls area would contain a more extensive archaeological sequence than has been reported so far.

Survey units	5km	10km	15km	20km	25km	30km	35km	40km	45km	50km	55km
Archaeological site frequencies	0	2	2	3	6	3	0	1	2	2	2
Average distance to nearest site (km)	-	3.6	0.8	1.0	1.0	1.0	-	6.0	1.0	1.4	1.3
Average distance to river (km)	-	0.2	0.2	0.3	0.5	0.4	-	0.9	0.4	0.7	1.1
Modern settlement frequencies	5	8	5	5	9	5	2	1	0	0	0
Average distance to nearest village (km)	0.4	0.4	1.1	0.5	0.6	0.9	3.5	3.9	-	-	-
Average distance to river (km)	0.2	0.4	0.9	0.2	0.6	0.8	1.3	0.9	-	-	-

Frequency and distribution data for archaeological and contemporary (ca 1986) settlement on the west bank of the Kavango River between Dikuyu Island and Mohembo gate, according to 5km survey units. (Kinahan 1986).

Field observations:

During a four-day visit to the proposed Popa Falls Hydro-power Scheme study area (7^{th} to 10^{th} March, 2003) the ground covered by the 1986 survey was re-assessed. Many new developments have occurred during the interim, including roads, shops, schools and sundry government buildings. Furthermore, the nodes of development that existed at the time of the 1986 survey, such as the Andara Mission and the Frans Dimbare Centre have expanded considerably. As a result of these developments and the concomitant increase in homesteads and garden plots, little ground remains undisturbed on the west bank of the Kavango River upstream of Popa Falls. Given the scale of disturbance and the fact that the archaeological sites found during the

1986 survey were rather superficial in nature, this particular area is considered to have no further archaeological potential.

At the time of the 1986 survey, the east bank of the Kavango River was a military area and not accessible. Although this restriction is no longer in place, recent guerrilla incursions have left many unexploded anti-personnel mines in the area and it is not considered safe for foot surveys, according to Inspector Shilelo of the Namibian Police in Rundu. There is no immediate prospect of clearing the mines and for this reason it is necessary to extrapolate from the detailed survey coverage of the west bank to predict what is likely to occur on the east bank. From these data it is reasonable to expect a relatively high density of recent archaeological sites within less than 1.0km of the riverbank. Whether any of these sites would have potential for further investigation is impossible to say, although it is clear that there has been rather little modern disturbance in the area and the archaeological sites should be reasonably well preserved.

The Portuguese fort at Mucusso lies almost immediately opposite Andara and, unfortunately, within the area that is presently unsafe to survey. According to Demhardt (1999), the fort is largely intact and therefore constitutes an interesting and valuable historic site. The elevation of the fort above the maximum flood level of the Kavango River is not known.

Another part of the study area that was not visited during the 1986 survey was the group of islands in the Kavango River upstream of Andara, and used until recently as burial places for members of chiefly lineages. Although there is no mention of this practice in the ethnographic work of Gibson, Larson and McGurk (1981) the importance of the islands is readily acknowledged in the area today. In the company of Thomas Mvoko, pastoral worker at Andara mission, I visited the general area of the islands and arranged with Timotheus Kudomo, catechist, to visit the most important islands in order to resolve some contradictions in the information provided, and to inspect the burial sites at first hand.

According to Mr Mvoko, three islands were used as chiefly burial places, namely Dikuyu, Thipanana and Gororo. It appears that the islands were used sequentially,

from the first arrival of the Mbukushu on the Kavango, until the last decade, when a burial plot was established on the west bank. Thus, Dikuyu is the burial place of the first chiefs, Thipanana of the subsequent chiefs, including Ndara, and Gororo of the most recent, including Max Mukushe and Frans Dimbare. The most recent site is located on the west bank of the river opposite Gororo Island.

The burial plot opposite Gororo[1] has been in use for approximately eight years, according to Mr Mvoko. It is fenced with single-strand barbed wire and may not be entered except for purposes of further interments. The plot is effectively an island. The south-western corner-post of the fenced enclosure lies 130m from the bank of the river and 2.18m above the present high water level. Since the gradient drops by 1.4m within 30m of the bank it is clear that very extensive overbank flooding, affecting the whole burial plot, would result from a rise of 2m in the water level.

The information provided by Mr Kudomo confirmed the basic facts supplied by Mr Mvoko, but he added that several other islands were also used and that burial on the islands was not exclusive to members of the current chiefly lineage. A small island named Dingengera[2], adjacent to Thipanana, was described by Mr Kudomo as "full" of graves. When pressed he estimated that at least forty people were buried there and that there was no room for further burials. On Thipanana, Mr Kudomo indicated the burial places[3] of four persons belonging to his own family, namely:

Naitha Kudomo †1993
Kathiku Anastasie †1999
Kapinga Majambo †1998
Maumbo Kupembona †2001

The graves on Thipanana were unmarked, and lay in dense bush, with tall specimens of *Garcinia ?livingstonia, Peltophorum africanum, Terminalia sericea* and *Acacia hebeclada* among others, with undergrowth of *Rhus undulata* and *Grewia flavescens* shrubs. The graves lay no more than 2m above the present high water level of the

[1] Site QRS 41/3 located at 18°01.870'S 21°26.232'E
[2] Site QRS 41/5 located at 18°01.907'S 21°25.368'E
[3] Site QRS 41/4 located at 18°02.008'S 21°25.492'E

river, and while ponds of water with stands of *Phragmites australis* lay close at hand there was no direct indication that the island was subject to regular inundation. The species composition of the island vegetation is predominantly that of dry woodland and although it represents a riparian luxurience, it is probably a relic of the woodland that existed on the riverbanks and adjacent ground until it was cleared for settlement and cultivation.

Mr Kudomo mentioned the existence of a small island on the northern side of Thipanana, which he referred to as the "island of the chiefs". He also recalled that his father had told him once of further graves on Tanhwe Island on the northern side of Durumutji Island, opposite Andara. Apart from his contradiction of the notion of chiefly exclusivity, Mr Kudomo also stated that the islands were used because the graves were safe from hyena, and from accidental disturbance during ploughing. He did, however add that islands with graves were generally avoided, and that they were not used for grazing or timber collection. He appeared rather apprehensive of the possible inundation of such sites, which seemed to confirm that natural flooding was rare or even unknown.

The south bank of the Kavango River at Popa Falls has been heavily disturbed by the construction of the Popa Falls Resort and although some stone artefacts are found in the road cuttings there is apparently no intact deposit. On the opposite bank of the river less disturbance has taken place and this area was inspected in detail. At the northern end of the quartzite outcrop forming the Popa Falls (a member of the Pre-Cambrian Nosib complex), the rock is overlain by approximately 3m of coarse alluvium. At this point[4] the bank drops at an angle of 15° towards a small sandy beach. Slight erosion of the bank has exposed an undisturbed deposit of stone artefacts, over an area of approximately 20x25m, with a surface density of 5 objects/m^2.

A sample of 22 artefacts collected from the surface of the site was dominated by early Middle Stone Age pieces in reddish quartzite, with three informal core fragments on cryptocrytalline silicate which may belong to a Later Stone Age assemblage. The

[4] Site QRS 41/6 located at 18°06.882'S 21°34.999'E

quartzite artefacts included four polyhedral cores ranging in size from 46mm to 73mm in their maximum dimensions. The assemblage also contained one small pebble chopper with alternate trimming flake scars, a range of denticulate pieces made on snapped non-Levallois blade flakes, and a range of informal chunks with some retouch or utilization damage. This combination of polyhedrals, pebble artefacts, and flake tools with minimal formal retouch corresponds with the assemblage profile of MSA1, as described by Volman (1984) on the basis of South African material.

MSA1 assemblages in South Africa are thought to date to approximately 128 000 years BP on the basis of their correspondence with proxy evidence of Oxygen Isotope Stage 6 (Shackleton & Opdyke 1973, 1976; Mankinen & Dalrymple 1979). The apparent association of the artefacts with the Popa Falls outcrop may not be coincidental. Tectonic movements on the south-western limb of the African Rift system created two sub-parallel faults in north-western Botswana, the Gomare and the Thamalakane, aligned north-east: south-west. The graben which formed between the faults greatly increased the gradient of the Kavango River in the fault-controlled panhandle of the Okavango Delta. This re-incision of the Kavango River would have encountered the resistant sub-surface quartzite body at Popa Falls sometime during the late Pleistocene, following the evidence of Mallick *et al.* (1981) and Cooke (1975, 1980).

The occurrence of MSA1 material in association with the falls conforms to the geological evidence and suggests that the Popa Falls themselves may be as young as 100 000 years. It is significant that Pleistocene archaeological sites on the upper Zambezi in Zambia are also strongly associated with waterfalls and rapids (Phillipson 1978; Clark 1950) and that these, too, are geologically young features (Thomas & Shaw 1991). Such locations may have presented a number of attractions for prehistoric communities, including safe crossing points and suitable fishing spots, so that the occurrence of these sites indicates a real or strategic association rather than the chance preservation of archaeological materials.

Outline sequence:

The archaeological and historical sequence of the Popa Falls Hydro-power Scheme study area may be summarized as follows:

Late Pleistocene (approximately 100 000 years BP) arrival of Middle Stone Age hunting communities at newly-exposed Popa Falls. This presence may be continuous to the Holocene

Holocene (last 10 000 years BP) scattered Later Stone Age hunting communities throughout the area and evidently at very low densities. This presence would have been continuous to historical times.

Recent (within the last 1 000 years BP) first appearance of Iron Age farming communities in the Kavango Region. Evidence from the Popa Falls area is scanty and ambiguous.

Recent (within the last 200 years BP, and calendric) arrival of Mbukushu communities from the Kwando-Linyanti area. Settled mainly in the area upstream of Popa Falls, with very limited presence downstream.

Recent (within the last 100 years calendric) arrival of Portuguese expeditions from Angola, German military and civil presence, and establishment of the OMI mission at Andara.

ASSESSMENT OF IMPACTS

As far as sites of archaeological and cultural importance are concerned, the major impacts of the envisaged Popa Falls Hydro-power Scheme would result from *earthmoving works* during construction, *inundation* within the reservoir, and accelerated *soil erosion*, primarily at maximum draw-down. In the case of archaeological and cultural sites such impacts are immediate, or occasionally progressive. The *impacts are never reversible*, but it is possible to mitigate at least some by influencing the design process, or by carrying out rescue excavations.

To be more specific, the construction stage of any version of the scheme will entail large-scale earthmoving operations. According to the available data such operations will directly impact upon and probably destroy a number of archaeological sites *at any point upstream* of Popa Falls. The likely extent of damage on the west bank would be small due to the disturbance of this area in the last decade. However, extrapolating from the same data to the east bank of the Kavango River suggests that significant damage would be caused. It is anticipated that the use of mechanical bush-clearing would have the same effects on archaeological sites as would earthmoving activities.

Dam construction at the Popa Falls site would result in the destruction of at least one late Pleistocene Stone Age site. It must be stressed that the site of the actual dam or weir is only one likely focus of disturbance or destruction. In this case, the positioning of a tail-race, or other components of the scheme, such as an access road, turbines or a power plant, would also entail considerable disturbance.

The impact of inundation would be entirely destructive in the case of the archaeological sites known from the study area. At present, the significance of the known sites on the west bank of the river and upstream of Popa Falls is considered to be *low*, on the grounds that the sites have already been investigated; that they are known to be very small, and that the area has been extensively disturbed. It is expected that similar archaeological sites would exist on the east bank of the river. At this stage, the east bank upstream of Popa Falls is considered to have a *medium* level of significance, on the grounds that the area has not been investigated, and the sites are expected to be undisturbed, thus raising their potential information value.

Inundation of the area around Andara would be highly destructive. The mission buildings are relatively low-lying and could be flooded by a 2m rise in the maximum water level of the river. The mission is partly independent in it's own hydro-power generating capacity, and this, as well as the water supply to the mission would be affected by a change in the water level of the river. Bearing in mind that the mission is a community service centre for the surrounding area, any disruption of farming on the riverbanks would adversely affect the mission at Andara.

Also at risk to inundation are the island burial grounds upstream of Andara. In the case of these sites it must be emphasized that limiting the extent of back-flooding would not necessarily ensure that the islands remained unaffected. Any fundamental change in the flow regime of the river will affect the complex dynamics that maintain the size and shape of the islands. A large, slack-water impoundment downstream of the islands could exacerbate their natural erosion while reducing the energy level and replacement sediment load of the incoming water. The result might be that the islands would simply dissolve. A lower energy regime might also result in rapid sedimentation at the head of the reservoir, promoting lateral expansion of the islands and the creation of a large wetland area in which people displaced by downstream flooding might attempt to settle and farm. Settlement of the islands would thus lead to disturbance of the burial grounds.

A further potential impact is that of accelerated erosion, especially during draw-down when little vegetation remains between the maximum water level and the the bed level of the dam. This is most likely to occur at the end of the dry season when the soil is most exposed, and the first heavy rains of the season would cause significant sheet erosion. Where erosion gullies exist, these would exhibit very rapid headward erosion during the early rains. Such erosion, accompanied by the collapse of gully sides no longer held intact by tree roots would entirely destroy the integrity of archaeological deposits. Standing structures such as the Andara mission and the Mucusso fort would be greatly damaged by this type of erosion.

The various expected impacts on the archaeological and cultural components of the Popa Falls Hydro-power Scheme study area are summarized below:

Nature	Construction	Inundation	Erosion
Extent	localized	extensive	localized
Duration	permanent	permanent	permanent
Intensity	medium	medium	medium
Probability	definite	definite	highly probable
Significance	medium	medium	low/medium

RECOMMENDATIONS

Mitigation measures recommended for the feasibility stage of the Popa Falls Hydro-power Scheme are as follows:

- Full documentation of all known graves on the Kavango River islands as far upstream as Dikuyu
- On-site measurement of elevation differences between infrastructure and maximum flood levels at Andara Mission.
- Test excavation of Site QRS 41/6, to *precede* any drilling or other investigations of footing conditions for a wier at this site.

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