

# Mapping some archaeological features of the Opepe Bush Scenic and Historic Reserve

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# Abstract

Topographic mapping of Opepe Bush Scenic and Historic Reserve, Taupo, was carried out digitally using a combination of ground survey and small format aerial stereophotogrammetry. Permanent reference marks were established and tied into the New Zealand Cadastral Survey System using high precision GPS. Archaeological features are shown on four topographical maps: Opepe Village and stockade with 2 m contours, Opepe graveyard, the Opepe water trough and pond, and the detail of hut sites. Reserve boundaries and archaeological features are shown on a cadastral map of part of the reserve, and on the map of the village and stockade. Archaeological features are briefly described.

## 1. Introduction

Opepe Bush Scenic and Historic Reserve is about 16 km south-east of Taupo on the Napier-Taupo Highway. The reserve is managed by the Tongariro/Taupo Conservancy of the Department of Conservation (DOC). Mapping of some archaeological features of the reserve was carried out in order to identify and record those features visible within the Opepe stockade and village area, the Opepe graveyard, and the Opepe water trough. The mapping also met three additional requirements: first, to ensure that, at any time in the future, the positions of recorded archaeological features can be easily and accurately re-identified on the ground, even though no visible traces remain; second, to enable features to be accurately mapped with respect to land boundaries; and third, to produce maps that can be quickly reproduced at a variety of scales.

Plane table mapping was ruled out because it is slow and cumbersome and accurate reproduction is restricted to a little above mapping scale or smaller. Digital mapping, because of its flexibility for reproducing maps quickly at a variety of scales, was the obvious choice. Accordingly, measurements to feature positions were obtained using a theodolite and Electronic distance measurement (EDM) and entered into a computer for subsequent processing.

To enable positions of archaeological features to be easily and accurately re-identified on the ground, mapping was carried out from permanent control points buried in the ground. The control points were related by traverse, and from them it will be possible to re-establish the positions of any of the recorded archaeological features. The permanent marks provide a convenient framework for future mapping and investigation work.

The absolute positions of the control points was determined by GPS. These positions provide the information needed to accurately show the location of the archaeological features with respect to land boundaries (Fig. 1).

Mapping was carried out between December 1994 and June 1998. The site was covered in scrubby vegetation and bracken fern which was progressively cleared by the Conservancy before or during each mapping visit.

Areas mapped, shown by the attached figures, are the Opepe stockade and village (Fig. 2), the Opepe graveyard (Fig. 3), and the water trough (Fig. 4). The track linking the three areas was mapped and is shown on a cadastral plan of Part Opepe Bush Scenic and Historic Reserve (Fig. 1). Detail of five hut sites at Opepe village is shown on Fig. 5.

The survey procedures adopted in this mapping project are unusual in archaeological mapping. However, because of the benefits which should arise from being able to easily re-locate the positions of archaeological features, and having an existing control system for future recording, it is recommended that the procedures described here are adopted for future field work.

## 2. Mapping control

Survey traverses for mapping control were established in each area to the standard set out in the New Zealand Survey Regulations 1972 for rural (Class B) surveys. Each control point is a 45 cm long galvanised iron tube hammered into the ground so that the top is at a depth of 5-10 cm. Control points are marked by wooden fence posts set into the ground about a metre from the tubes. Observations were made with a Wild T1a optical theodolite with a Sokkia Red Mini EDM attached. Traverse miscloses are all less than 0.1 m (Table 1).

Each traverse was tied into the New Zealand Cadastral Survey System using GPS measurements. The measurements to the graveyard and stockade/village traverses were carried out by Sokkia New Zealand using a Trimble RTK 4000ssi GPS. The base station and origin of coordinates was Bench Mark AD12 on State Highway 5. All coordinates are in terms of Geodetic Datum 1949, and expressed as Bay of Plenty Circuit coordinates with an origin at Trig 'F' Maketu. The GPS coordinates, accurate to about  $\pm 2$  cm, should be sufficient to enable the control points to be relocated by survey or, if necessary, re-established.

As a check on the accuracy of the GPS positions a reading was taken on Motukino trig station. The GPS position of the trig station differed from LINZ Geodetic Database coordinates by 0.1 m north, 0.01 m east and 0.2 m height. The GPS position of an old boundary peg (O.P. Ren S.O. 43211) found near the Opepe Stockade differed from the plan position by 10.2 m. The old peg is assumed to be out of position, or it is not the peg shown on the plan.

Orientation of the Opepe stockade and village traverse is determined from GPS coordinates for IT4 and IT5. The bearing of the line between IT4 and IT5 is  $105^{\circ}22'$ . The origin of coordinates for the traverse is IT4 and was determined by GPS as 278146.22 m east and 588016.06 m north. Comparison of the distance between IT4 and IT5 measured by EDM and by GPS agreed within 0.01 m. A check on the bearing is provided by the GPS coordinates for IT9, which differ from the traverse coordinates by 0.08 m east and 0.01 m north.

Orientation and position of the graveyard map is based on GPS coordinates for IT1 and the south corner fence post. A check is provided by GPS and traverse coordinates for the fence-angle post nearly midway along the north side, which differed by 0.19 m east and 0.06 m north.

TABLE 1. CONTROL SURVEY DATA FOR ARCHAEOLOGICAL MAPPING, OPEPE BUSH SCENIC AND HISTORIC RESERVE.

POINT	DEGREES	MINUTES	HORIZONTAL DISTANCE	EAST	NORTH	TOTAL EAST	TOTAL NORTH	REMARKS
Graveyard								
IT1						278576.55	588095.24	Coordinates by GPS
IT2	85	1	33.33	33.20	2.90	278609.75	588098.14	
IT3	6	4	9.59	1.01	9.54	278610.77	588107.67	
Village and stockade								
IT4	by	GPS				278146.22	588016.06	Coordinates by GPS
IT8	105	22	78.45	75.65	-20.79	278221.87	587995.26	Origin of bearings by GPS IT4-IT5
IT5	105	22	69.45	66.97	-18.40	278288.84	587976.84	
IT6	13	12	23.95	5.47	23.32	278294.31	588000.15	
IT9	315	14	51.55	-36.30	36.60	278258.02	588036.74	
IT10	270	1	34.80	-34.80	0.01	278223.22	588036.73	
IT11	309	23	37.75	-29.18	23.95	278194.05	588060.67	
IT4	227	0	65.40	-47.83	-44.60	278146.22	588016.06	
			361.35	-0.03	0.08			Traverse distance and misclose
IT9						278258.02	588036.74	
IT14	86	38	39.43	39.36	2.32	278297.37	588039.05	
IT16	90	51	74.36	74.35	-1.10	278371.71	588037.94	
IT15	261	18	62.76	-62.04	-9.49	278309.67	588028.44	
IT6	208	29	32.18	-15.35	-28.28	278294.31	588000.15	
			208.73	-0.03	-0.02			Traverse distance and misclose
IT14						278297.37	588039.05	
IT15	130	49	16.26	12.31	-10.63	278309.67	588028.44	
			16.26	0.01	-0.02			Traverse distance and misclose
IT9						278258.02	588036.74	
IT12	356	1	31.70	-2.20	31.62	278255.81	588068.36	
IT5						278288.84	587976.84	
IT7	67	26	92.25	85.19	35.40	278374.03	588012.24	
Trough								
IT10								
IT11	212	42	23.72	-12.81	-19.96			Bearing approximate only
IT12	192	19	9.01	-1.92	-8.80			Bearing approximate only

No radio link could be obtained between the base station and the water trough, and the positions of the traverse marks at the water trough were therefore established using a Trimble ProXL GPS and measurements differentially-corrected from the LINZ Rotorua base station. The ProXL coordinates are not in the same terms as the 4000 ssi coordinates and are accurate only to about  $\pm 1$  m. The position and orientation of the map of the water trough is therefore only approximate. The map, however, is correct for scale.

## 3. Heights and contours

Ground contours were obtained for the village and stockade area. Height information from which the contours were produced was obtained by aerial stereophotogrammetry using a Hasselblad camera. The origin for heights is Bench Mark AD12 (722.42 m a.m.s.l.). Heights of the traverse marks were obtained by GPS and transferred to photocontrol points. Ground heights were measured from the photographs using the Adam MPS2 digital stereoplotter at the Otago University Department of Surveying. Contours were interpolated from the heights using SDR Map. Checks on the heights of known points showed errors of up to 0.7 m at the edges of the photography and the data was therefore used to draw contours only at 2 m intervals.

## 4. Mapping

Archaeological features were mapped from the control points using the T1a Wild optical theodolite with the Sokkia Red Mini EDM attached. A small number of features were mapped using a Sokkia PowerSet Total Station. Positions of archaeological features were recorded to the nearest 5 cm. The track linking the three areas (Fig. 1) was mapped using a Trimble ProXL GPS with differential corrections. Final plans were prepared in DesignCad.

Archaeological features are shown on four maps: Topographical Map of Opepe Village and Stockade (Fig. 2), Map of Opepe Graves (Fig. 3), Sketch Map of Opepe Water Trough and Pond (Fig. 4) and Detail of hut sites (Fig. 5). Notes on the features mapped are listed below and should be read in conjunction with the Conservation Plan and condition report prepared by Lynda Bowers.

### 4.1 TOPOGRAPHICAL MAP OF OPEPE VILLAGE AND STOCKADE

(See Fig. 2). The Opepe Village and Stockade are located on the top and flanks of a steep-sided flat-topped ridge formed of relatively soft pumice and tephra running east-west. The stockade is positioned just to the east of the ridge centre, and the ground falls away to the north, south and west and rises slightly to the east.

Old photographs taken c. 1870 and c. 1880 show houses and huts on the top and flanks of the ridge, and in the valley along the south side of the ridge. The positions of houses and huts on the south flank are indicated on the ground by terraces cut into the side of the ridge. Similar terraces are present on the north flank of the ridge and out of view of the photographs on the south flank. Where identification of the terraces as hut or house sites is clear from photographs, the terraces are labelled H. Where there is no photographic confirmation and the terraces are inferred to be hut sites, they are labelled h.

Archaeological features on the top of the ridge include more or less rectangular raised mounds, hummocky ground, a raised platform, slightly depressed areas, concrete steps, remains of a pumice fireplace, drains, and the remains of an old wood-burning copper. Although some, if not all, of these features date from the occupation of the Opepe village, none of the features has been unambiguously associated with any of the houses or huts shown in the old photographs.

The Roadman's Hut, still standing but in very poor condition, is located on a platform raised about 30 cm on the south side which has the same orientation as the hut. A drain, up to c. 40 cm wide and 20–30 cm deep, runs from the southeastern corner of the hut to the south flank of the ridge. A second drain, up to c. 90 cm wide and 30 cm deep, runs from the east side of the platform to the ridge flank.

Two shallow depressed areas, possibly pathways, are located on the top of the ridge. Both are depressed c. 25 cm below the surrounding ground level. The first runs from the top of a track on the north flank of the ridge, across the north side of the Roadman's Hut, towards the stockade. The second runs from the south flank of the ridge above the roadman's garage towards the concrete steps.

A well, about 0.9 m square on the north side of the ridge and west of the main access track, contained water and was lined with wooden slabs. Its position was determined using the ProXL GPS. Three other more or less rectangular holes in the ground, each less than 2 m deep, unlined and dry, were mapped. Their purpose is uncertain and they are labelled as either cellars or wells.

The valley running east-west along the south side of the ridge is the site of the old hotel and the old main highway between Taupo and Napier. Four mounds of earth all less than 1 m high are recorded. One is parallel with a large drain alongside the road and is probably spoil from the digging of the drain. The origin and purpose of the other three is unknown.

#### 4.2 PART OPEPE BUSH SCENIC AND HISTORIC RESERVE

(See Fig. 1). This map is based on GPS measurements for the tracks, and on survey data for land boundaries and other cadastral features taken from relevant survey plans. Survey Plans consulted were: S.O.47093, S.O.43211, S.O.16198.

## 5. Acknowledgements

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