



# **GNSS Static Survey Report**

## **Nauru**



**POLITECNICO DI MILANO- DIAR**

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In collaboration with Nauru Rehabilitation Corporation

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<http://nauru.como.polimi.it>

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## Introduction

The following report outlines the [Global Navigation Satellite System](#) (GNSS) survey performed in Nauru, between 3-9 October 2011.

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This GNSS survey was performed in Nauru in order to get elevations of the top of PVC pipes used as monitoring wells. This will allow to improve the results of head data interpolation and the knowledge of the island hydrogeology. The main aim of the project (<http://nauru.como.polimi.it>) is to implement a groundwater numerical model of the island in order to suggest some proper technique to improve sustainable fresh groundwater exploitation.

The post-processing of GNSS data was assessed by :

Daniele Sampietro - Research Assistant - D.I.I.A.R.

## Survey

The GNSS survey was realized in the following points and monitoring wells(MW) :

FIX 1: a point, located in NRC camp, used as master station to perform the double differences with the other station.

S1<sup>1</sup>, S2, S3, S4, S5, S6, S7, S8, S9, S10, S11, S12, S14, S15, S16, S17, S18, S19<sup>1</sup>, S20, S21, S22, S23, S24, E2, E3<sup>1</sup>, E4, E5, E6, E7, E8, T2, T3: monitoring wells.

At 1 (Anetan 1), An 2 (Anabar 2), Ani 1 (Anibare 1), Den 1 (Denig 1), Bai 1 (Baiti 1), Ijuw 1 (Ijuw 1): private wells.

LP 1: Launch Path. It is the main pier of Buada Lagoon; from that point we can measure the height of the water surface of the lagoon.

X1: a signed point used for aerial survey, here used as control point.

H1: a mark on the pier of the main harbor measured in order to get orthometric elevation in the datum used for the survey Reduced Level (RL).

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<sup>1</sup> The measure was performed with height traversing technique from a signed point near the monitoring well; that due to high vegetation cover in the neighborhood of the well, which could decrease the antenna signal reception quality

The monitoring wells are of two kinds: external PVC pipe with steel pipe cover or PVC pipe inside a manhole.

Project specifications for elevation coordinates precision is 3 cm. After the post-processing of the GNSS observation the ellipsoidal heights of all the points have been obtained with a formal variance below 1 cm. Previous tests (Ramírez Rueda, 2010) have shown that the actual accuracy (in elevation) expected from the performed survey is of the order of 0.3 cm.

Orthometric heights have been obtained removing the undulation of the geoid obtained from the Earth Gravitational model EGM08 (Pavlis et al., 2008) from ellipsoidal heights.

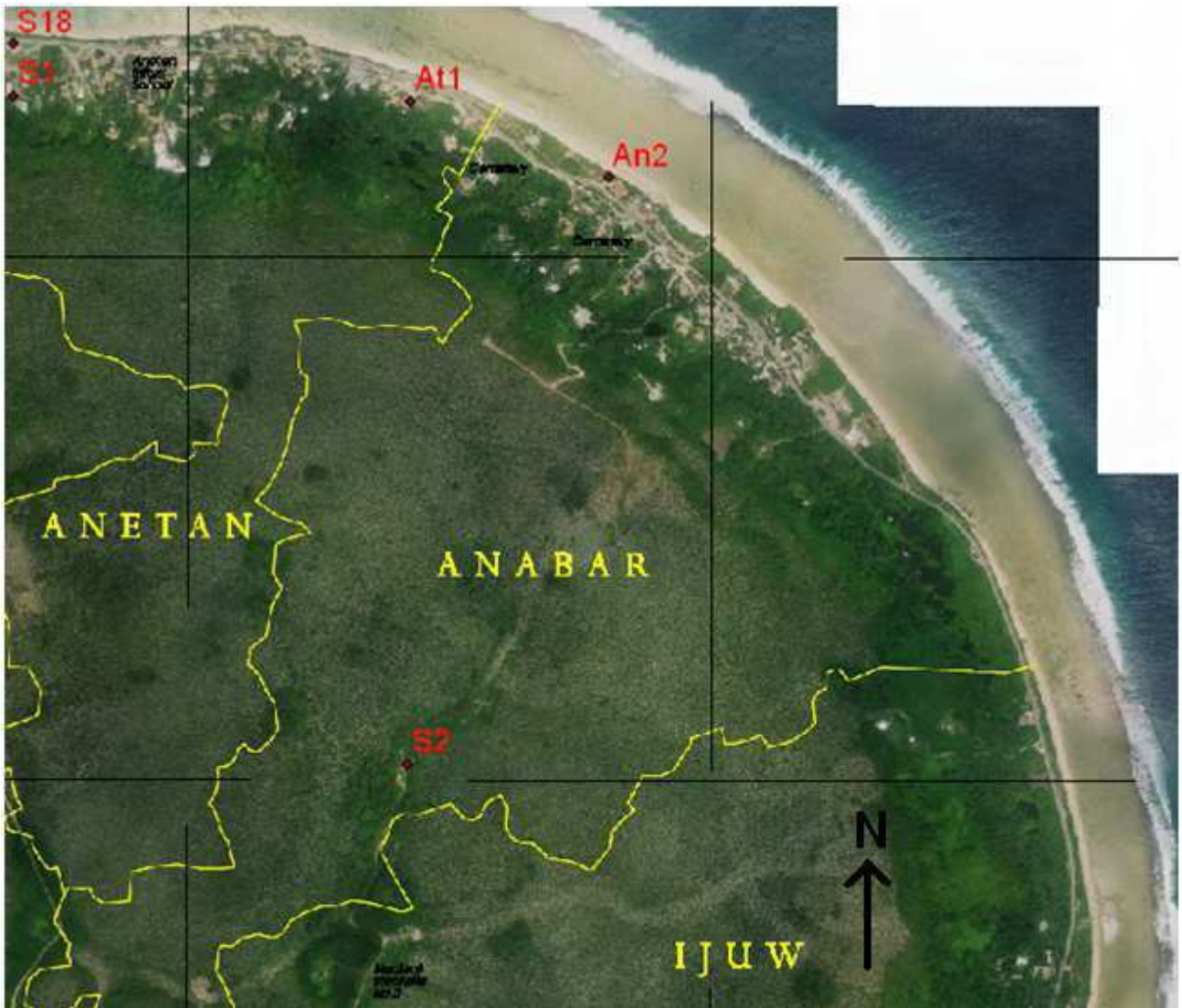


Map of South-West part of Nauru . Drawn squares are equals to 1 km<sup>2</sup>



Map of South-East part of Nauru. Drawn squares are equals to 1 km<sup>2</sup>





Map of North-East part of Nauru. Drawn squares are equals to 1 km<sup>2</sup>

## Coordinate system

GNSS positions are calculated in an Earth-centered, Earth-fixed Cartesian coordinate system, where the x and y axes are perpendicular and in the plane of the equator, and the z axis is drawn between the north and south poles. Most commonly, positions are converted to latitude, longitude, and height referred to a precisely defined ellipsoid, such as WGS-84.

These ellipsoids are mathematical models approximating the shape of the Earth, and do not reflect the equipotential surface of the Earth gravitational field (geoid). If the user is interested in orthometric elevations (elevations relative to mean sea level), a geoid model should be removed from ellipsoidal elevations (UNAVCO, 2010 ; Hofmann-Wellenhof and Moritz, 1967).

The coordinate system adopted in the survey is the following:

- a) Planimetric coordinates: Geographic WGS 84 (degrees), transformed in projected UTM 58 South coordinates afterwards for map representation.
- b) Elevation coordinates:
  - ellipsoidal elevation (WGS 84), directly obtained after the post-processing of GNSS observations;
  - orthometric elevation computed by removing from ellipsoidal height the geoid undulation (estimated using harmonic synthesis from the EGM08 global model);
  - Nauru Island Datum (NID) i.e. the tide gauge zero (Geoscience Australia, 2009);
  - elevation in the Reduced Level (RL). The Reduced Level (RL) was used first in the survey conducted by Jacobson and Hill in 1988. Its origin is defined as the point 0.166 m below the NID (Jacobson and Hill, 1988).

Jacobson and Hill for the first time in 1987 conducted a hydrogeological survey in Nauru. In reason that they adopted the Reduced Level as reference point (i.e. an elevation of 0 meters) for all their measurements, still today all the hydrogeological data are represented using RL as reference point (Figure 1 shows the relationship between NID and RL). For this reason all the measures done during the present GNSS survey need to be linked to RL.

Because the RL and the NID stay under the sea water level, to compute the shift between the orthometric elevation and the RL a small leveling survey has been performed near the tide gauge area (Figure 2). On the top of the tide gauge (figure 2, in planimetric view, and figure 3) is present a known point named NAU15 whose elevation is 6.00733 m above the NID (Geoscience Australia 2009) i.e. 6.17333 above the RL. In reason that it was impossible to place the GPS station over the tide gauge, the orthometric elevation of NAU15 was measured starting from the orthometric elevation of H1 (mark positioned on the pier of the harbor, figure 5): the difference in height between H1 and a topographic benchmark positioned near the Tide Gauge was measured through a level instrument. Then it was measured the difference in height between the topographic benchmark, just placed beside the tide gauge (figure 4), and NAU15, situated on the Tide Gauge top. So the orthometric measures was linked to the RL and the NID: the Reduced Level was found with an orthometric elevation of 2.005 m, that means that for hydrogeological measurements it is necessary to subtract 2.005 m to the orthometric measurements done during this GNSS survey. The leveling operations for the identification of the correct orthometric elevation of RL is showed in figure 6.



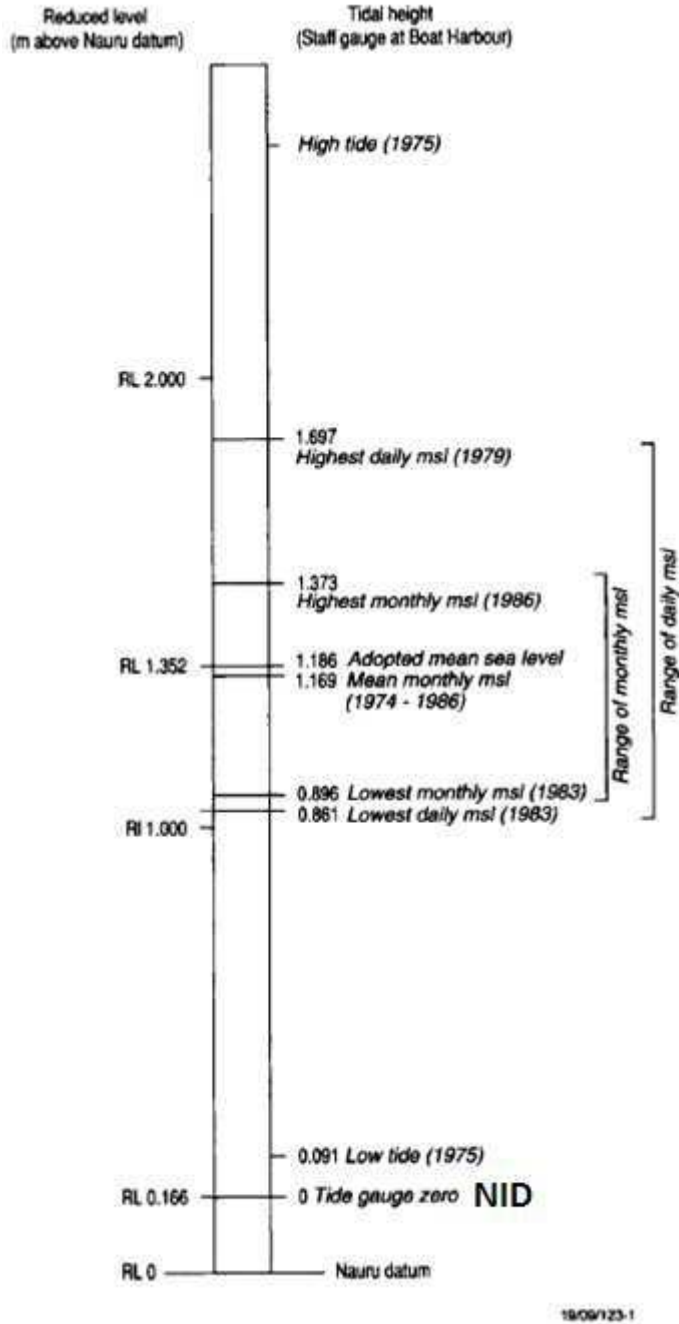


Figure 1 Mean sea level and relationship of Reduced Level to tidal height (adapted by Jacobson, Hill and Ghassemi, 1997)

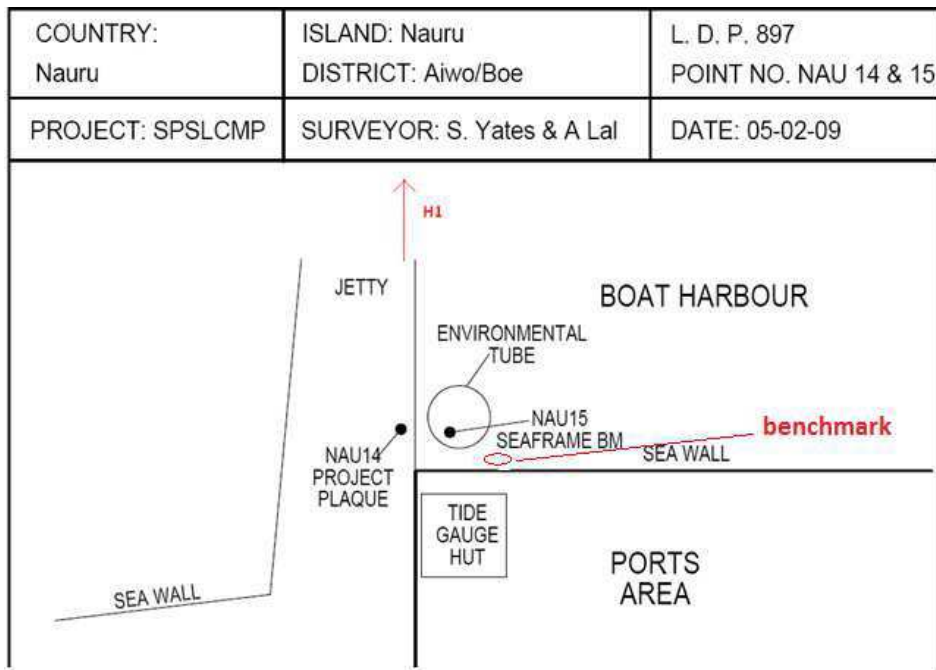


Figure 2 Topographic pattern of the marks used to positioning datum (adapted by Geoscience Australia, 2009)



Figure 3 Nauru Tide Gauge with indications of NAU15 mark



Figure 5 H1 mark



Figure 1 Benchmark near tide gauge

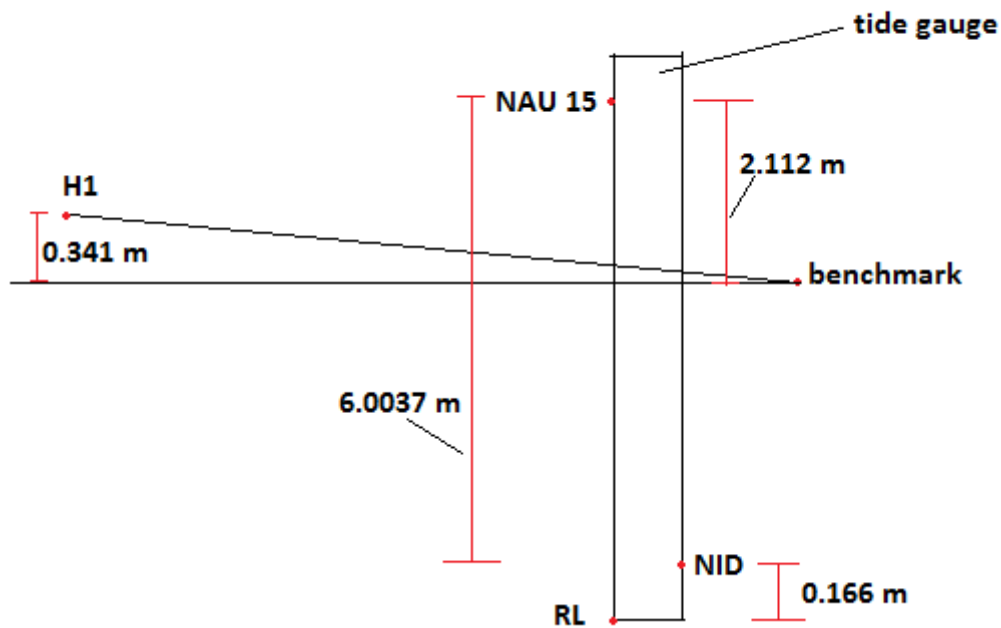


Figure 6 Pattern of the leveling operations in order to obtain the orthometric elevation of RL starting from H1

## Equipment

- n.2 Rigid Tripods Leica GST 120-9
- n.2 Double Frequency Receiver Leica GX1230GG
- n.2 Antennas Leica AX1202GG
- n.2 Antenna phase center height tape meter Leica GZS 4-1
- Leica Geoffice 5.0
- Level

## Method

The survey was performed with two double frequency Leica 1200 system GNSS receivers as shown in the following paragraph.

Since data of Nauru permanent station are freely available not every day and only with a frequency of 30 Hz, a receiver has been placed in point FIX1 and has been used as master station. The coordinates of this receiver have been estimated by double differences using the permanent station of Nauru, in the four

available days, for about 96 hours of observations (assuring a final accuracy on the coordinates of FIX1 of about 1 mm).

Obtained the coordinates of the point FIX1 the coordinates of all the other points (rover stations) were estimated by static surveying (lasting about 60 minutes) and elaborated by double differences with FIX1. Since all the points recorded with the rover GNSS station are less than 3km distant from FIX1 and since the points present in general a good sky visibility, the expected accuracy of the performed survey, considering an elevation cut-off angle of  $30^\circ$ , is less than 1 cm (Hofmann-Wellenhof et al., 2001).

In the case of monitoring wells the rover station was always positioned on the top of PVC pipe from where it is recorded water table depth. In the case of multiple PVC pipes it was always measured the position of the top of PVC pipe 1 (figure 7).

Since in points S1, S19, E3, O17 and O35 the massive presence of vegetation would affect the sky visibility (bringing inaccuracies in GNSS positioning) the ellipsoidal height was evaluated through the use of leveling survey, measuring the height difference between a marked point in their neighborhood, measured with GNSS station, and the top of PVC pipe of the monitoring well.

An important required data is the antenna phase center elevation from the designed surveyed point: it can be estimated by measuring through an instrument elevation reader with metric tape incorporated the height between the considered point and the bottom of the antenna and adding a constant given by instrument producer. The instrument height measurement could introduce an error (few millimeters) if measurement it is not taken with the necessary care. In reason that is not possible to eliminate this potential error in post-processing phase, the measurement of antenna phase center elevation was read after the installation of the receiver and repeated before the receiver removal. The post-processing phase was performed with double-difference method: it consists in the evaluation of the differences in the measurements obtained by two different GNSS receivers observing more than two different GNSS satellites in the same time. This technique allows the removal of systematic errors due to receivers and satellites; for short base length (as in Nauru case) it also allows to reduce considerably atmospheric signal propagation errors. The double-difference data post-processing was performed with the software Leica GeoOffice.



Figure 7 For monitoring wells it was always measured the position of the top of PVC pipe 1



## Survey Support

Nauru Rehabilitation Corporation supported the survey. In particular they offered a safe site to install the reference master GNSS station inside their base camp and vehicles to move around the island. Mr. Benedikt Abouke and Mr. Peter Abouke helped in the identification of the surveyed monitoring wells especially. Mr. Robin Daoe supported the work with the use of the level, evaluating the difference in height between the monitoring well top of PVC pipe and the near marked point for points with vegetation cover.

## Survey Data Recap

Table 1 Coordinates of the points directly observed through GNSS receiver. RL stays for the elevation measured above the Reduced Level.

ID	Geographic coordinates (WGS84) [degrees]		Projected coordinates (UTM 58 South) [m]		Elevation coordinates [m]		
	Latitude (S)	Longitude (E)	North (m)	East (m)	Ellipsoidal	Orthometric	RL
An2	0°30'21.20992"	166°57'1.9413"	9944051.124	717079.996	45.701	8.158	6.154
Anib1	0°31'42.10627"	166°57'6.41386"	9941565.885	717217.543	43.416	5.885	3.881
At1	0°30'16.45443"	166°56'49.62572"	9944197.330	716699.161	45.590	8.040	6.035
Bai1	0°30'30.74912"	166°55'44.70325"	9943758.791	714691.207	47.789	10.204	8.200
Den1	0°31'10.13081"	166°55'3.87024"	9942549.356	713428.096	47.143	9.538	7.534
E2	0°31'41.28449"	166°56'0.77648"	9941591.766	715187.575	72.452	34.883	32.878
E4	0°32'10.82451"	166°54'40.41275"	9940685.065	712702.033	47.952	10.339	8.334
E5	0°32'38.04413"	166°55'1.02844"	9939848.675	713339.316	45.813	8.215	6.210
E6	0°32'40.75531"	166°55'14.75731"	9939765.314	713763.868	77.465	39.876	37.872
E7	0°32'35.73763"	166°55'14.1633"	9939919.402	713745.547	77.963	40.373	38.369
E8	0°32'19.68781"	166°55'9.25267"	9940412.503	713593.845	72.713	35.118	33.113
FIX1	0°32'26.1357"	166°55'50.3579"	9940214.020	714864.997	66.342	28.772	26.767
H1	0°31'45.14407"	166°54'34.62653"	9941474.023	712523.333	44.019	6.400	4.395
Ijw1	0°31'17.72049"	166°57'26.86112"	9942314.838	717850.141	46.052	8.529	6.524
LP1	0°32'5.84037"	166°55'22.95775"	9940837.766	714017.813	42.805	5.217	3.212
S10	0°32'27.04516"	166°55'55.72073"	9940186.028	715030.831	69.022	31.455	29.451
S11	0°30'22.36840"	166°56'19.15440"	9944015.932	715756.733	76.279	38.713	36.708
S12	0°30'26.86694"	166°56'20.69055"	9943877.720	715804.198	71.195	33.630	31.625
S14	0°30'20.09586"	166°56'12.69586"	9944085.805	715557.019	74.631	37.061	35.057
S15	0°31'4.91976"	166°55'51.25903"	9942708.995	714983.641	69.528	31.950	29.945
S16	0°32'45.23902"	166°55'5.40976"	9939627.604	713474.748	45.525	7.931	5.927
S17	0°32'51.24457"	166°55'12.47321"	9939443.043	713693.124	45.390	7.801	5.797
S18	0°30'12.96168"	166°56'25.15734"	9944304.855	715942.467	45.431	7.867	5.862
S2	0°30'57.73695"	166°56'49.34856"	9942929.106	716690.204	76.397	38.851	36.846
S20	0°32'37.53354"	166°54'56.4738"	9939864.405	713198.474	45.455	7.855	5.850
S22	0°32'54.13396"	166°56'21.27783"	9939353.594	715820.945	73.840	36.292	34.288
S23	0°30'29.95214"	166°55'59.44608"	9943783.138	715147.162	74.768	37.191	35.187
S3	0°30'38.63239"	166°56'19.02853"	9943516.295	715752.608	53.203	15.638	13.634
S4	0°31'24.53559"	166°56'21.36181"	9942106.102	715824.422	70.310	32.751	30.747
S5	0°31'29.91931"	166°55'41.02453"	9941941.097	714576.916	67.364	29.783	27.778
S6	0°32'4.32076"	166°56'5.10543"	9940884.040	715321.288	71.057	33.493	31.488
S7	0°32'42.81182"	166°56'47.33099"	9939701.156	716626.785	57.969	20.435	18.430
S8	0°32'23.77374"	166°55'53.68651"	9940286.548	714967.959	66.647	29.079	27.074
S9	0°32'45.65564"	166°55'22.13206"	9939614.640	713991.897	74.402	36.818	34.814
T2	0°32'43.71972"	166°55'6.82156"	9939674.263	713518.417	45.679	8.085	6.080
T3	0°30'23.57008"	166°56'4.81139"	9943979.148	715313.142	71.672	34.098	32.093
X1	0°30'23.46334"	166°56'20.69634"	9943982.280	715804.407	75.636	38.071	36.066



In table 2 are listed the points whose elevations are measured with height traversing technique from a signed point near the monitoring well; that due to high vegetation cover in the neighborhood of the well, which could decrease the antenna signal reception quality. The planimetric coordinates (geographic and projected both) are taken from previous leveling operations made by NRC.

**Table 2** Coordinates of the points measured indirectly with height traversing technique. RL stays for the elevation measured above the Reduced Level.

ID	Geographic coordinates (WGS84) [degrees]		Projected coordinates (UTM 58 South) [m]		Elevation coordinates [m]		
	Latitude (S)	Longitude (E)	North (m)	East (m)	Ellipsoidal	<u>Orthometric</u>	RL
E3	0°31'55.55"	166°55'24.61"	9941154.000	714069.000	43.961	6.373	4.368
S1	0°30'16.18"	166°56'25.046"	9944206.000	715939.000	46.391	8.448	6.824
S19	0°31'39.988"	166°55'17.167"	9941632.000	713839.000	57.654	20.058	18.054
S21	0°30'23.607"	166°56'4.936"	9943978.000	715317.000	71.532	33.958	31.953
S24	0°30'21.82"	166°56'18.1"	9944033.000	715724.000	76.309	38.743	36.738

## Monographs

Here following are showed the monographs of monitoring wells and other mark points, which can be used for hydraulic head measurement, observed in the survey.

For each point are indicated :

- 1) The GNSS Survey date
- 2) Identification code
- 3) District where it belongs
- 4) Planimetric coordinates:
  - a. Geographic (WGS 84 reference system) in degrees
  - b. Projected (UTM 58 South reference system) in meters
- 5) Elevation coordinates:
  - a. Ellipsoidal (WGS 84 reference system) in meters
  - b. Orthometric (mean sea level reference system) in meters
  - c. Above datum (Reduced Level reference system) in meters
- 6) Pictures of the measured point
- 7) Mapping of the point
- 8) Water table depth records (where available) from the measured point
- 9) Possible observations and notes

Points FIX1, H1 and X1 are not present in the list of monographs, in reason that they can't be used to measure hydraulic head.



# S1

DISTRICT	Anetan
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 56'25,046"
	Lat:	-0° 30'16,18"
PROJECTED		
UTM(58S)	N [m]:	9944206.000
	E [m]:	715939.000

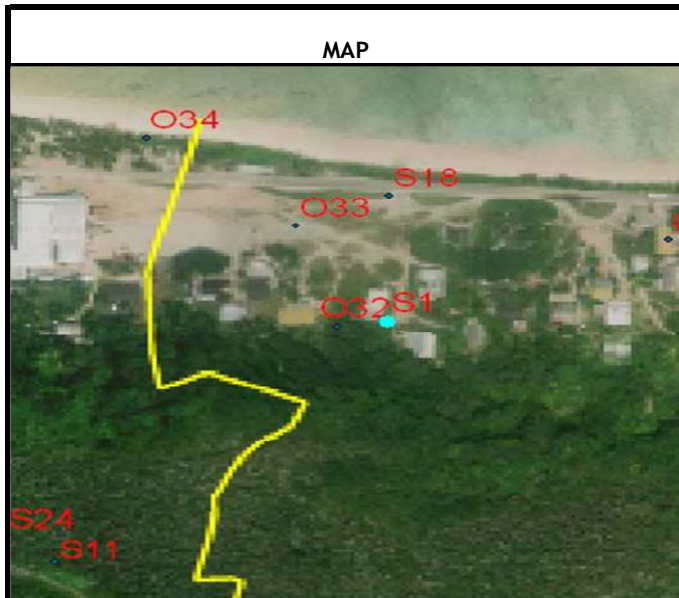
ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>46.3914</b>	<b>8.8284</b>
ELEVATION ABOVE DATUM*	
<b>6.8237</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)

## PICTURE AND TOPOGRAPHIC PATTERN



4 cm = elevation difference between external steel pipe top and PVC pipe top



## WATER TABLE DEPTH RECORDS

Date	Time	Meters
29/04/2009	13:56	5.165
16/11/2009	09:23	5.012
26/04/2010	19:22	4.780
12/12/2010	12:59	4.940

## OBSERVATIONS



# S2

DISTRICT	Anabar
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 56'49,34856"
	Lat:	-0° 30'57,73695"
PROJECTED		
UTM(58S)	N [m]:	9942929.106
	E [m]:	716690.204

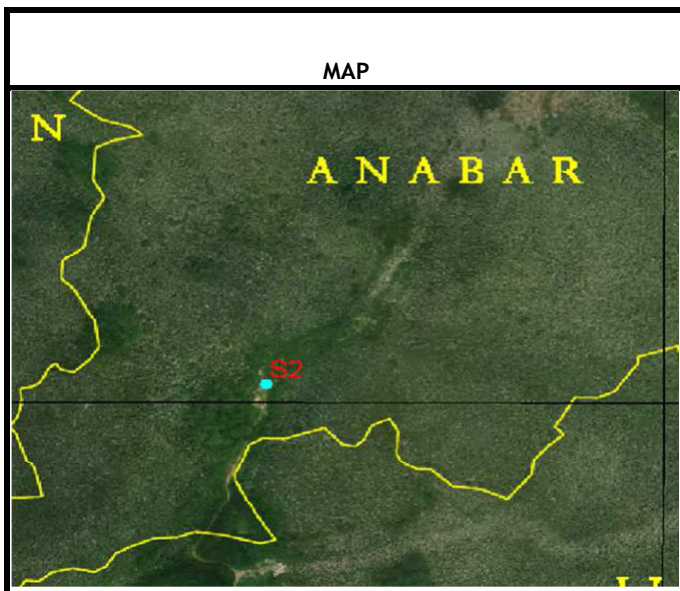
ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>76.3967</b>	<b>38.8507</b>
ELEVATION ABOVE DATUM*	
<b>36.8460</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)

## PICTURE AND TOPOGRAPHIC PATTERN



14,8 cm = elevation difference between ground level and PVC pipe top



## WATER TABLE DEPTH RECORDS

Date	Time	Meters
29/04/2009	14:53	35.373
16/11/2009	15:16	34.655
26/04/2010	14:54	34.570
12/12/2010	09:34	34.750

## OBSERVATIONS

**S3**

DISTRICT	Ewa
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 56'19,02853"
	Lat:	-0° 30'38,63239"
PROJECTED		
UTM(58S)	N [m]:	9943516.295
	E [m]:	715752.608

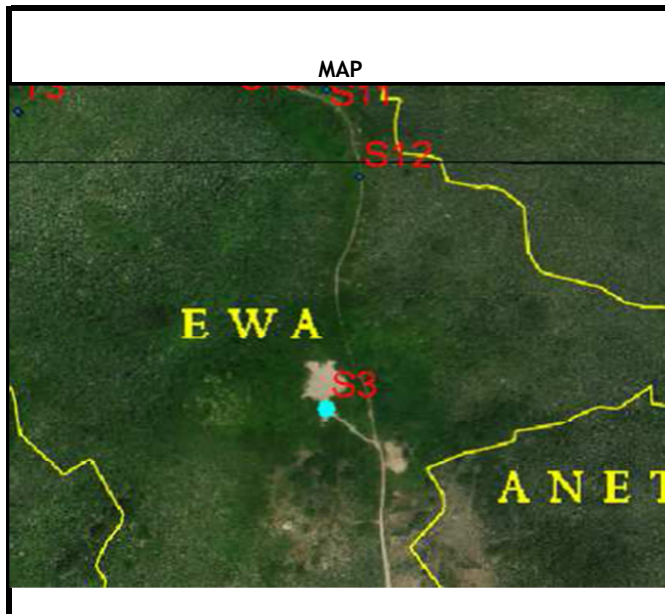
ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>53.1493</b>	<b>15.6383</b>
ELEVATION ABOVE DATUM*	
<b>13.6336</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)

**PICTURE AND TOPOGRAPHIC PATTERN**



5,4 cm = elevation difference between external steel pipe top and PVC pipe top



**WATER TABLE DEPTH RECORDS**

Date	Time	Meters
29/04/2009	16:23	12.129
16/11/2009	15:30	11.605
26/04/2010	14:37	11.545
12/12/2010	09:46	11.620

OBSERVATIONS



**S4**

DISTRICT	Anibare
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 56'21,36181"
	Lat:	-0° 31'24,53559"
PROJECTED		
UTM(58S)	N [m]:	9942106.102
	E [m]:	715824.422

ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>70.3104</b>	<b>32.7514</b>
ELEVATION ABOVE DATUM*	
<b>30.7467</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)

**PICTURE AND TOPOGRAPHIC PATTERN**



4,1 cm = elevation difference between external steel pipe top and PVC pipe top

**MAP**



**WATER TABLE DEPTH RECORDS**

Date	Time	Meters
29/04/2009	15:06	29.094
16/11/2009	15:10	28.570
26/04/2010	14:37	28.470

**OBSERVATIONS**

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**S5**

DISTRICT	Nibok
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 55' 41,02453"
	Lat:	-0° 31' 29,91931"
PROJECTED		
UTM(58S)	N [m]:	9941941.097
	E [m]:	714576.916

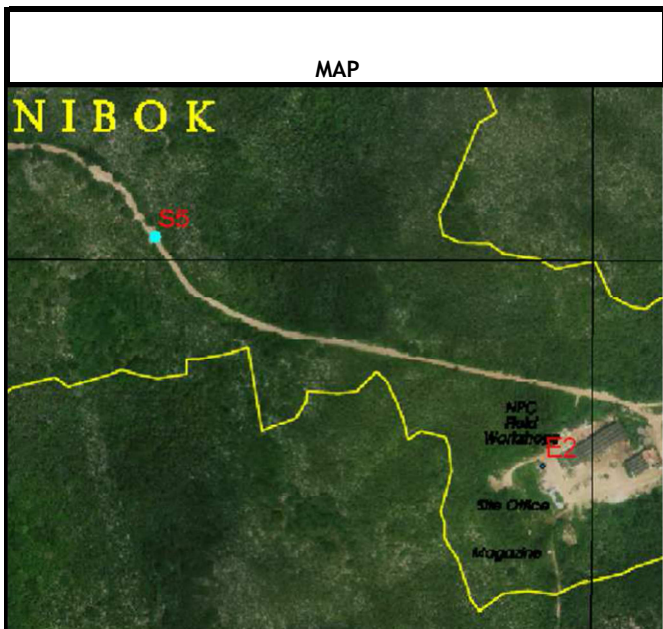
ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>67.3639</b>	<b>29.7829</b>
ELEVATION ABOVE DATUM*	
<b>27.7782</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)

**PICTURE AND TOPOGRAPHIC PATTERN**



3,8 cm = elevation difference between external steel pipe top and PVC pipe top



**WATER TABLE DEPTH RECORDS**

Date	Time	Meters
29/04/2009	15:06	25.855
16/11/2009	14:30	25.720
26/04/2010	16:41	25.350
12/12/2010	09:13	25.690

**OBSERVATIONS**



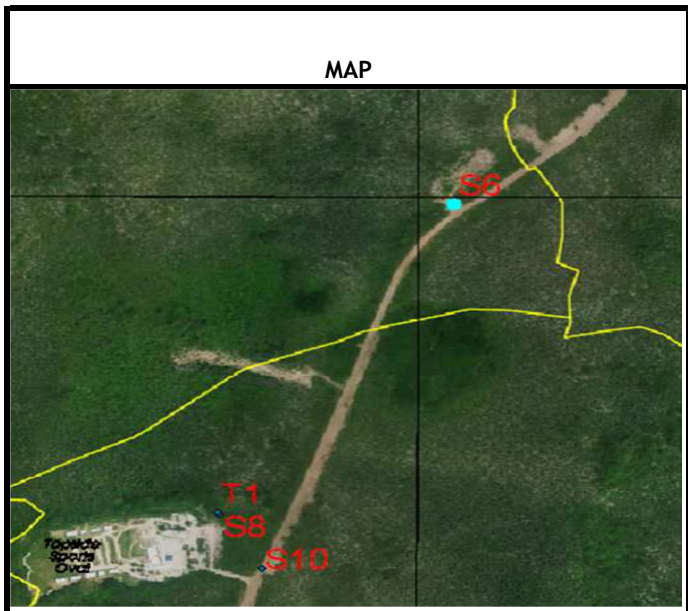
# S6

DISTRICT	Buada
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 56'5,10543"
	Lat:	-0° 32'4,32076"
PROJECTED		
UTM(58S)	N [m]:	9940884.040
	E [m]:	715321.288

ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>71.0569</b>	<b>33.4929</b>
ELEVATION ABOVE DATUM*	
<b>31.4882</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)



**PICTURE AND TOPOGRAPHIC PATTERN**



1,7 cm = elevation difference between external steel pipe top and PVC pipe top

**WATER TABLE DEPTH RECORDS**

Date	Time	Meters
29/04/2009	10:28	29.270
16/11/2009	08:33	29.470
26/04/2010	15:10	29.130
12/12/2010	11:05	29.370

**OBSERVATIONS**





**S7**

DISTRICT	Menen
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 56'47,33099"
	Lat:	-0° 32'42,81182"
PROJECTED		
UTM(58S)	N [m]:	9939701.156
	E [m]:	716626.785

ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>57.9689</b>	<b>20.4349</b>
ELEVATION ABOVE DATUM*	
<b>18.4302</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)

**PICTURE AND TOPOGRAPHIC PATTERN**



13,5 cm = elevation difference between ground level and PVC pipe top

**MAP**



**WATER TABLE DEPTH RECORDS**

Date	Time	Meters
29/04/2009	12:15	16.640
16/11/2009	12:18	16.620
26/04/2010	19:00	16.240
12/12/2010	13:55	16.540

**OBSERVATIONS**

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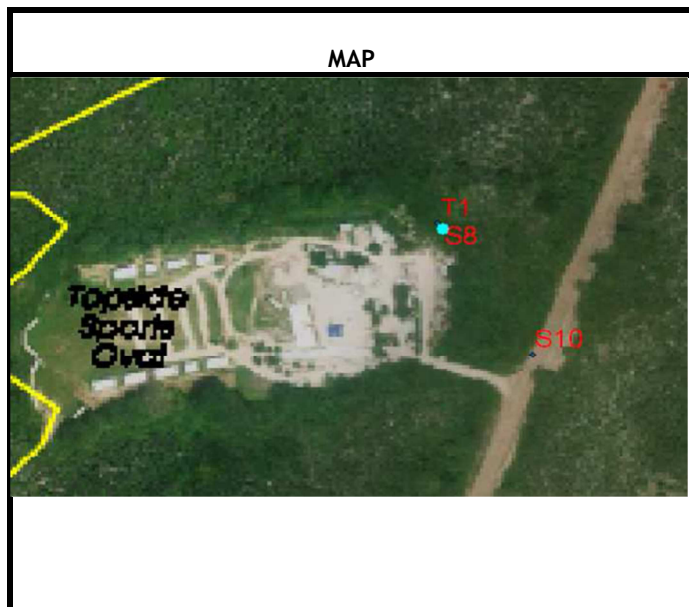
**S8**

DISTRICT	Menen	
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 55'53,68651"
	Lat:	-0° 32'23,77374"
PROJECTED		
UTM(58S)	N [m]:	9940286.548
	E [m]:	714967.959

ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>66.6465</b>	<b>29.0785</b>
ELEVATION ABOVE DATUM*	
<b>27.0738</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)



**PICTURE AND TOPOGRAPHIC PATTERN**



1,8 cm = elevation difference between external steel pipe top and PVC pipe top

WATER TABLE DEPTH RECORDS		
Date	Time	Meters
29/04/2009	10:12	24.950
16/11/2009	13:53	25.110
26/04/2010	14:00	24.860
12/12/2010	11:32	24.980

**OBSERVATIONS**



**S9**

DISTRICT	Yaren
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PLANIMETRIC COORDINATES	
GEOGRAPHIC	
WGS84	Long: 166° 55'22,13206"
	Lat: -0° 32' 45,65564"
PROJECTED	
UTM(58S)	N [m]: 9939614.640
	E [m]: 713991.897

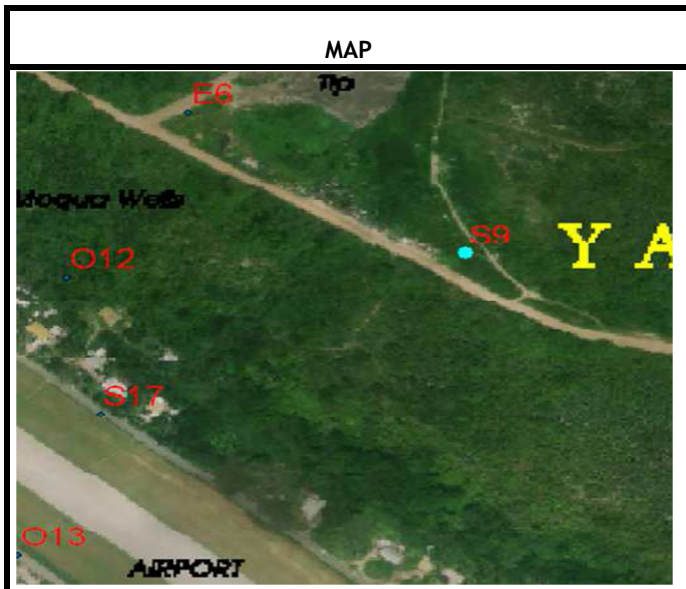
ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>74.4022</b>	<b>36.8182</b>
ELEVATION ABOVE DATUM*	
<b>34.8135</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)

**PICTURE AND TOPOGRAPHIC PATTERN**



1,6 cm = elevation difference between external steel pipe top and PVC pipe top



WATER TABLE DEPTH RECORDS		
Date	Time	Meters
29/04/2009	09:42	32.551
16/11/2009	13:48	32.810
26/04/2010	15:48	32.370

OBSERVATIONS



**S10**

DISTRICT	Buada
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 55'55,72073"
	Lat:	-0° 32'27,04516"
PROJECTED		
UTM(58S)	N [m]:	9940186.028
	E [m]:	715030.831

ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>69.0224</b>	<b>31.4554</b>
ELEVATION ABOVE DATUM*	
<b>29.4507</b>	

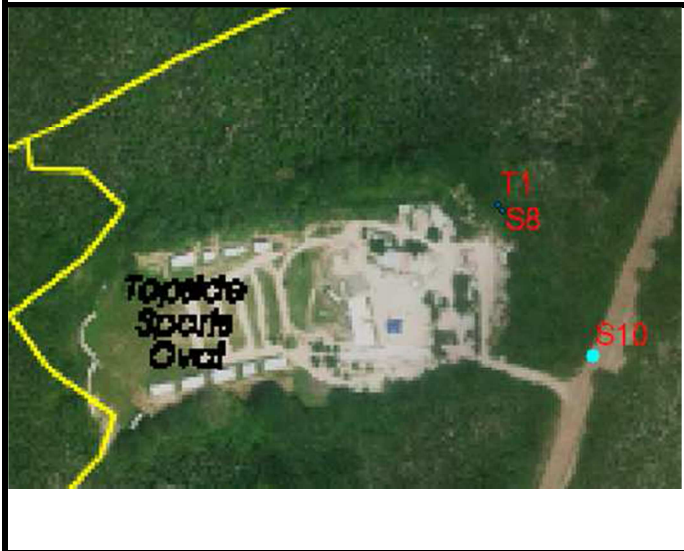
\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)

**PICTURE AND TOPOGRAPHIC PATTERN**



3 cm = elevation difference between external steel pipe top and PVC pipe top

**MAP**



**WATER TABLE DEPTH RECORDS**

Date	Time	Meters
29/04/2009	10:19	27.300
16/11/2009	14:06	27.480
26/04/2010	12:25	27.532
12/12/2010	11:24	27.370

**OBSERVATIONS**

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# S11

DISTRICT	Ewa
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 56' 19,15440"
	Lat:	-0° 30' 22,36840"
PROJECTED		
UTM(58S)	N [m]:	9944015.932
	E [m]:	715756.733

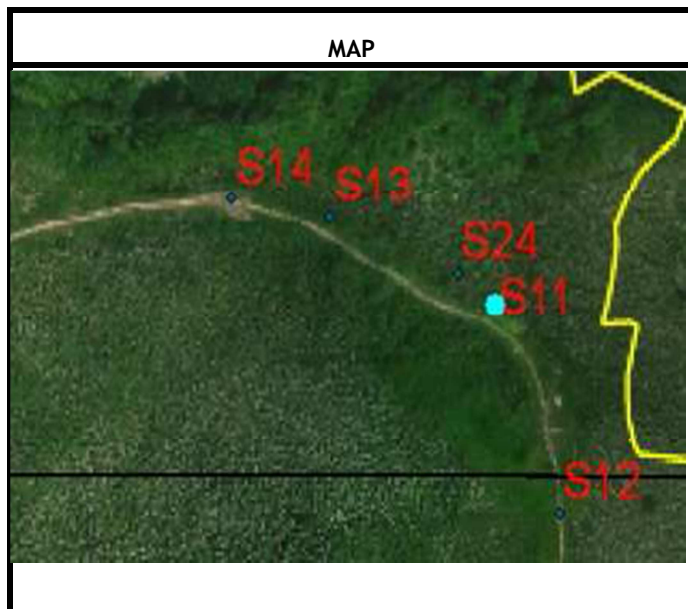
ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>76.2789</b>	<b>38.7129</b>
ELEVATION ABOVE DATUM*	
<b>36.7082</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)

### PICTURE AND TOPOGRAPHIC PATTERN



10 cm = elevation difference between ground level and PVC pipe top



### WATER TABLE DEPTH RECORDS

Date	Time	Meters
29/04/2009	16:47	35.119
16/11/2009	15:44	34.445
26/04/2010	11:48	34.940
12/12/2010	10:07	34.705

OBSERVATIONS



# S12

DISTRICT	Ewa
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 56'20,69055"
	Lat:	-0° 30'26,86694"
PROJECTED		
UTM(58S)	N [m]:	9943877.720
	E [m]:	715804.198

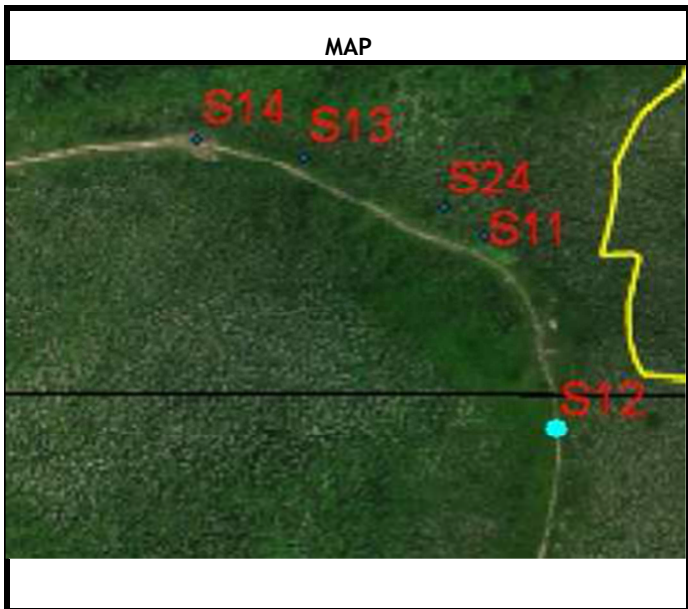
ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>71.1946</b>	<b>33.6296</b>
ELEVATION ABOVE DATUM*	
<b>31.6249</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)

## PICTURE AND TOPOGRAPHIC PATTERN



4 cm = elevation difference between external steel pipe top and PVC pipe top



## WATER TABLE DEPTH RECORDS

Date	Time	Meters
29/04/2009	16:28	30.144
16/11/2009	15:37	29.545
26/04/2010	12:03	29.920
12/12/2010	09:52	29.660

OBSERVATIONS



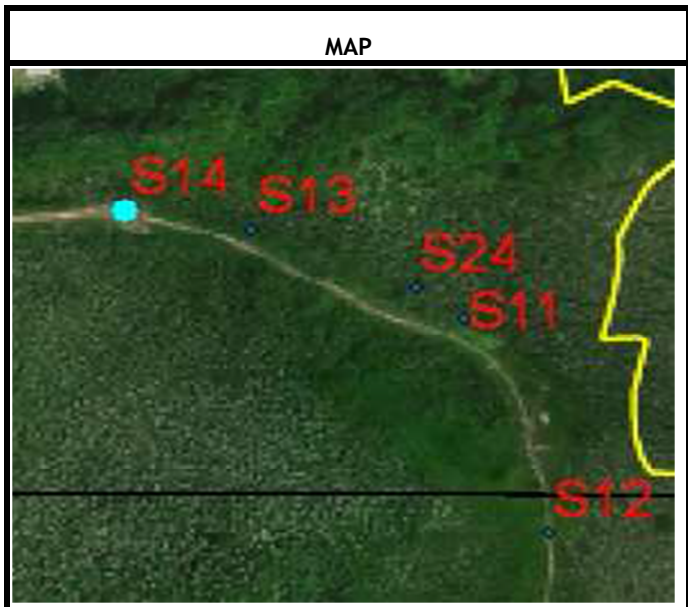
**S14**

DISTRICT	Ewa
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 56' 12,69586"
	Lat:	-0° 30' 20,09586"
PROJECTED		
UTM(58S)	N [m]:	9944085.805
	E [m]:	715557.019

ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>74.6314</b>	<b>37.0614</b>
DATUM ELEVATION	
<b>35.0567</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)



**PICTURE AND TOPOGRAPHIC PATTERN**



4,5 cm = elevation difference between external steel pipe top and PVC pipe top

WATER TABLE DEPTH RECORDS		
Date	Time	Meters
29/04/2009	17:00	33.462
16/11/2009	16:06	32.790
26/04/2010	11:30	33.410
12/12/2010	10:12	33.070

OBSERVATIONS

# S15

DISTRICT	Uaboe
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 55'51,25903"
	Lat:	-0° 31' 4,91976"
PROJECTED		
UTM(58S)	N [m]:	9942708.995
	E [m]:	714983.641

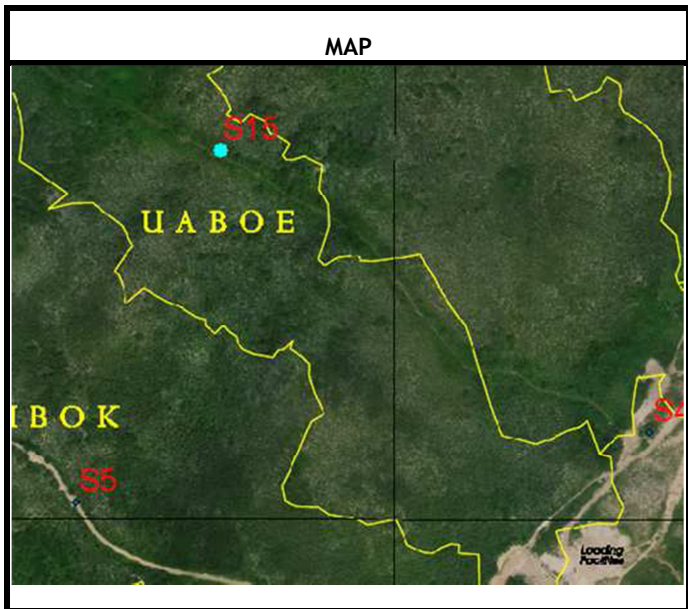
ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>69.5276</b>	<b>31.9496</b>
ELEVATION ABOVE DATUM*	
<b>29.9449</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)

## PICTURE AND TOPOGRAPHIC PATTERN



4,6 cm = elevation difference between external steel pipe top and PVC pipe top



## WATER TABLE DEPTH RECORDS

Date	Time	Meters
29/04/2009	15:24	28.440
16/11/2009	14:59	27.900
26/04/2010	14:20	27.780
12/12/2010	09:22	27.875

## OBSERVATIONS





# S16

DISTRICT	Yaren
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 55'5,40976"
	Lat:	-0° 32'45,23902"
PROJECTED		
UTM(58S)	N [m]:	9939627.604
	E [m]:	713474.748

ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>45.5253</b>	<b>7.9313</b>
ELEVATION ABOVE DATUM*	
<b>5.9266</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)

## PICTURE AND TOPOGRAPHIC PATTERN



6,2 cm = elevation difference between ground level and PVC pipe top

## MAP



## WATER TABLE DEPTH RECORDS

Date	Time	Meters
29/04/2009	11:29	3.901
16/11/2009	19:13	3.600
26/04/2010	18:03	3.575
12/12/2010	14:14	4.000

## OBSERVATIONS

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# S17

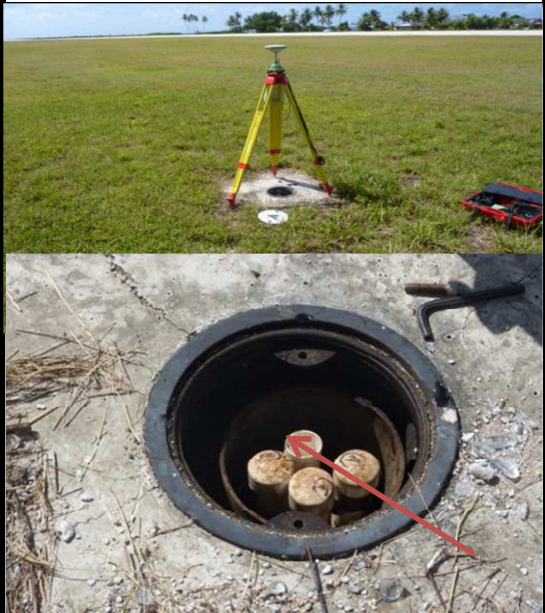
DISTRICT	Yaren
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 55' 12,47321"
	Lat:	-0° 32' 51,24457"
PROJECTED		
UTM(58S)	N [m]:	9939443.043
	E [m]:	713693.124

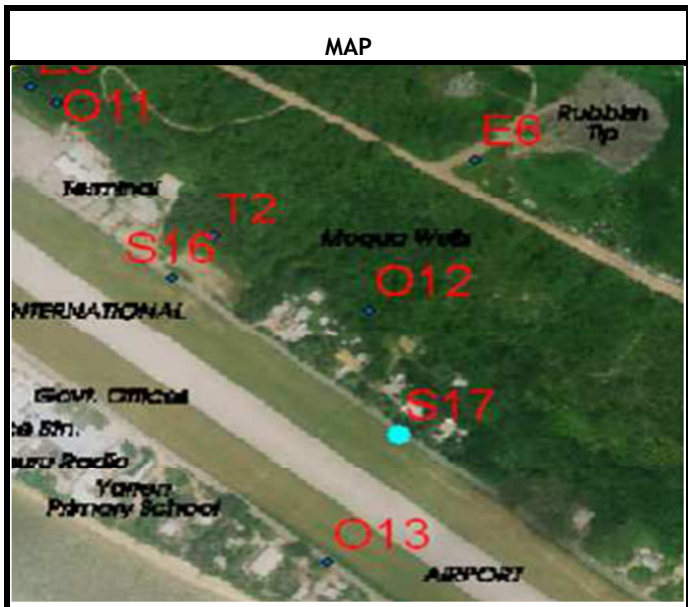
ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>45.3903</b>	<b>7.8013</b>
ELEVATION ABOVE DATUM*	
<b>5.7966</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)

## PICTURE AND TOPOGRAPHIC PATTERN



9,8 cm = elevation difference between ground level and PVC pipe top



## WATER TABLE DEPTH RECORDS

Date	Time	Meters
29/04/2009	11:19	3.860
16/11/2009	18:59	3.380
26/04/2010	18:14	3.490
12/12/2010	14:24	3.920

## OBSERVATIONS



**S18**

DISTRICT	Anetan
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 56'25,15734"
	Lat:	-0° 30'12,96168"
PROJECTED		
UTM(58S)	N [m]:	9944304.855
	E [m]:	715942.467

ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>45.4305</b>	<b>7.8665</b>
ELEVATION ABOVE DATUM*	
<b>5.8618</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)

**PICTURE AND TOPOGRAPHIC PATTERN**



20 cm = elevation difference between ground level and PVC pipe top

**MAP**



**WATER TABLE DEPTH RECORDS**

Date	Time	Meters
29/04/2009	13:38	3.950
16/11/2009	09:12	3.780
26/04/2010	19:38	3.690
12/12/2010	12:45	3.930

**OBSERVATIONS**

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**S19**

DISTRICT	Buada
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 55'17,167"
	Lat:	0° 31'39,988"
PROJECTED		
UTM(58S)	N [m]:	9941632.000
	E [m]:	713839.000

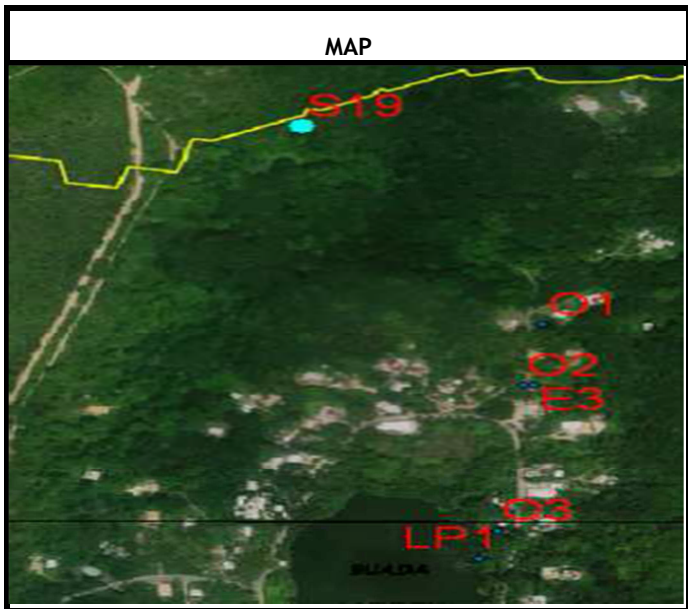
ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>57.6535</b>	<b>20.0585</b>
ELEVATION ABOVE DATUM*	
<b>18.0538</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)

**PICTURE AND TOPOGRAPHIC PATTERN**



12,8 cm = elevation difference between external steel pipe top and PVC pipe top



**WATER TABLE DEPTH RECORDS**

Date	Time	Meters
29/04/2009	08:55	15.432
16/11/2009	13:07	15.870
26/04/2010	16:51	15.230
12/12/2010	08:56	15.640

OBSERVATIONS



# S20

DISTRICT	Yaren
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 54'56,4738"
	Lat:	-0° 32'37,53354"
PROJECTED		
UTM(58S)	N [m]:	9939864.405
	E [m]:	713198.474

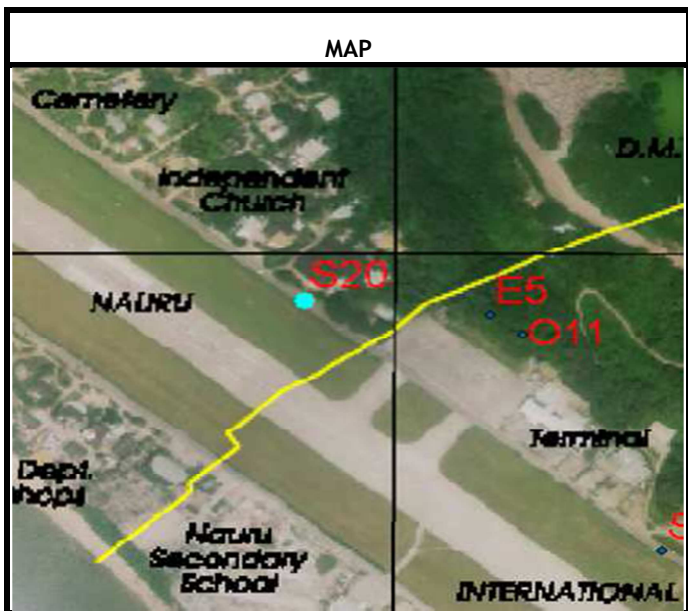
ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>45.4547</b>	<b>7.8547</b>
ELEVATION ABOVE DATUM*	
<b>5.8500</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)

## PICTURE AND TOPOGRAPHIC PATTERN



13,4 cm = elevation difference between ground level and PVC pipe top



## WATER TABLE DEPTH RECORDS

Date	Time	Meters
29/04/2009	10:57	3.925
16/11/2009	19:23	3.610
26/04/2010	17:43	3.585
12/12/2010	14:32	4.020

## OBSERVATIONS



**S21**

DISTRICT	Ewa
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 56'4,936"
	Lat:	-0° 30'23,607"
PROJECTED		
UTM(58S)	N [m]:	9943978.000
	E [m]:	715317.000

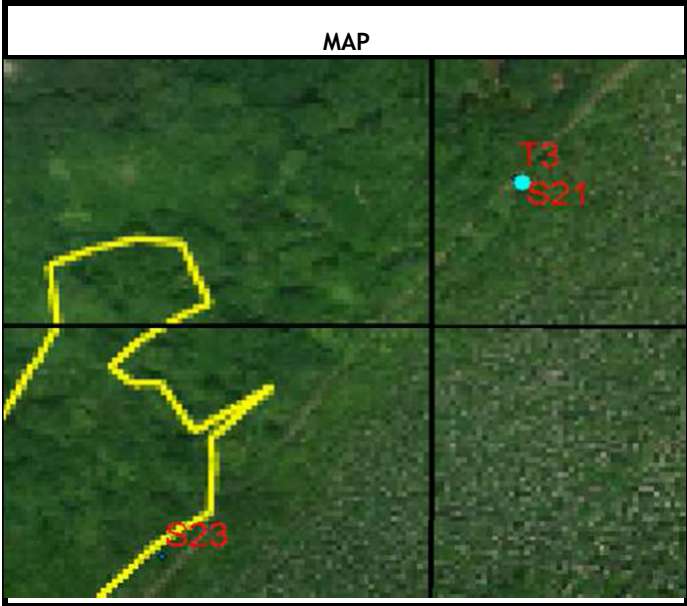
ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>71.5318</b>	<b>33.9578</b>
ELEVATION ABOVE DATUM*	
<b>31.9531</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)

**PICTURE AND TOPOGRAPHIC PATTERN**



10 cm = elevation difference between ground level and PVC pipe top



**WATER TABLE DEPTH RECORDS**

Date	Time	Meters
29/04/2009	17:07	30.426
16/11/2009	16:20	29.920
26/04/2010	11:04	30.410
12/12/2010	10:18	30.140

**OBSERVATIONS**

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**S22**

DISTRICT	Menen
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 56'21,27783"
	Lat:	-0° 32'54,13396"
PROJECTED		
UTM(58S)	N [m]:	9939353.594
	E [m]:	715820.945

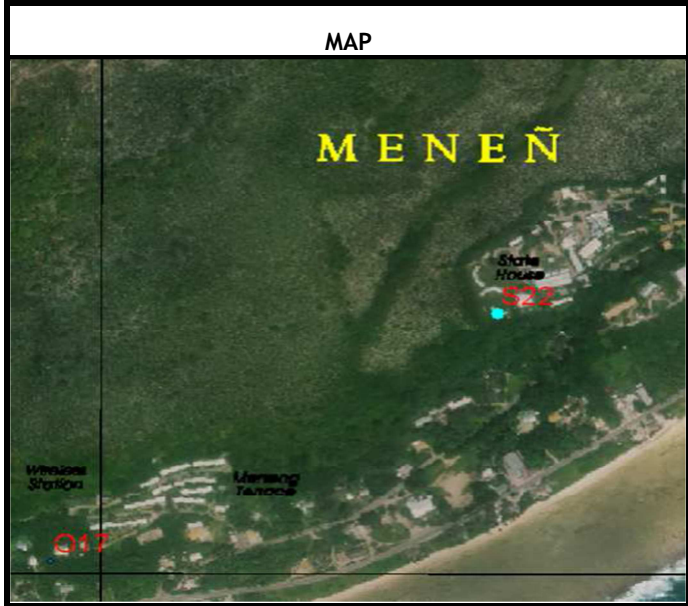
ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>73.8402</b>	<b>36.2922</b>
ELEVATION ABOVE DATUM*	
<b>34.2875</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)

**PICTURE AND TOPOGRAPHIC PATTERN**



18,7 cm = elevation difference between ground level and PVC pipe top



**WATER TABLE DEPTH RECORDS**

Date	Time	Meters
29/04/2009	11:56	32.450
16/11/2009	11:45	32.580
26/04/2010	18:35	32.060
12/12/2010	13:26	32.420

OBSERVATIONS

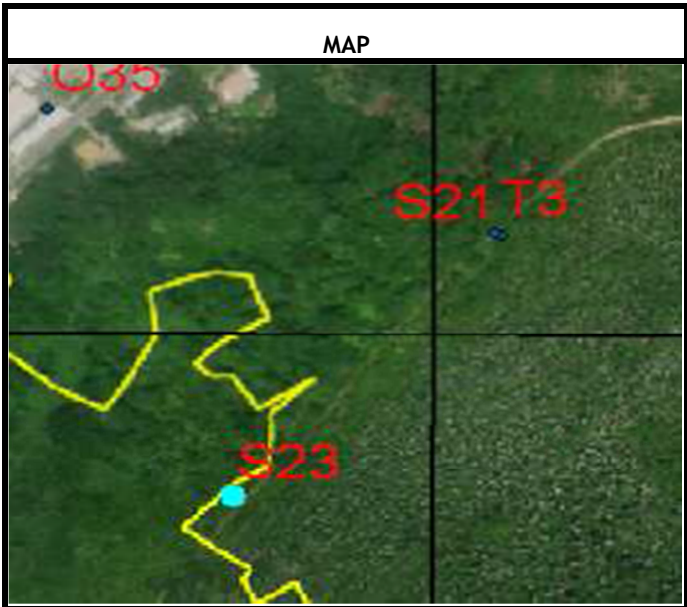
**S23**

DISTRICT	Ewa
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 55'59,44608"
	Lat:	-0° 30'29,95214"
PROJECTED		
UTM(58S)	N [m]:	9943783.138
	E [m]:	715147.162

ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>74.7682</b>	<b>37.1912</b>
ELEVATION ABOVE DATUM*	
<b>35.1865</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)



**PICTURE AND TOPOGRAPHIC PATTERN**



21,4 cm = elevation difference between ground level and PVC pipe top

WATER TABLE DEPTH RECORDS		
Date	Time	Meters
29/04/2009	15:35	33.640
16/11/2009	16:46	32.730
26/04/2010	10:44	33.440
12/12/2010	10:41	33.100

OBSERVATIONS





**S24**

DISTRICT	Ewa
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 56' 18,1"
	Lat:	-0° 30' 21,82"
PROJECTED		
UTM(58S)	N [m]:	9944033.000
	E [m]:	715724.000

ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>76.3089</b>	<b>38.7429</b>
ELEVATION ABOVE DATUM*	
<b>36.7382</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)

**PICTURE AND TOPOGRAPHIC PATTERN**



6,8 cm = elevation difference between external steel pipe top and PVC pipe top

**MAP**



**WATER TABLE DEPTH RECORDS**

Date	Time	Meters
29/04/2009	16:35	35.135
16/11/2009	15:49	34.430
26/04/2010	11:40	34.982
12/12/2010	09:57	34.690

**OBSERVATIONS**

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# T2

DISTRICT	Yaren
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 55'6,82156"
	Lat:	-0° 32'43,71972"
PROJECTED		
UTM(58S)	N [m]:	9939674.263
	E [m]:	713518.417

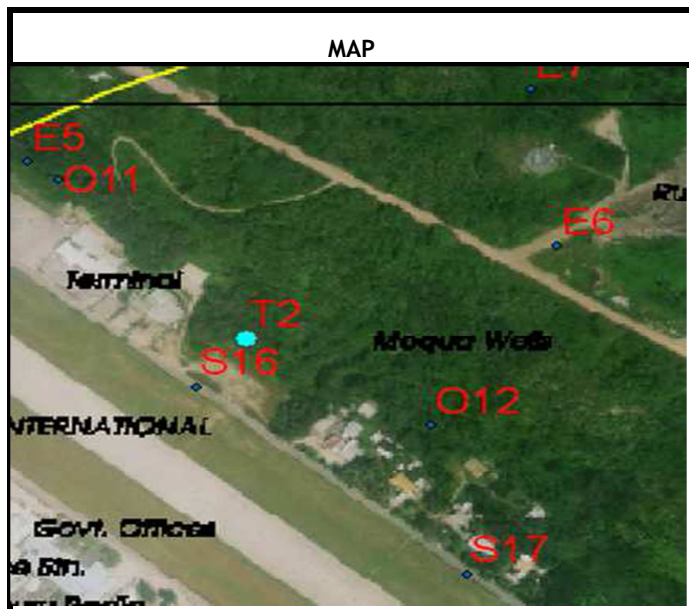
ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>45.6790</b>	<b>8.085</b>
ELEVATION ABOVE DATUM*	
<b>6.0803</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)

## PICTURE AND TOPOGRAPHIC PATTERN



12 cm = elevation difference between ground level and PVC pipe top



## WATER TABLE DEPTH RECORDS

Date	Time	Meters
29/04/2009	11:39	4.050
16/11/2009	11:21	4.370
26/04/2010	20:04	4.000
12/12/2010	14:09	4.170

OBSERVATIONS



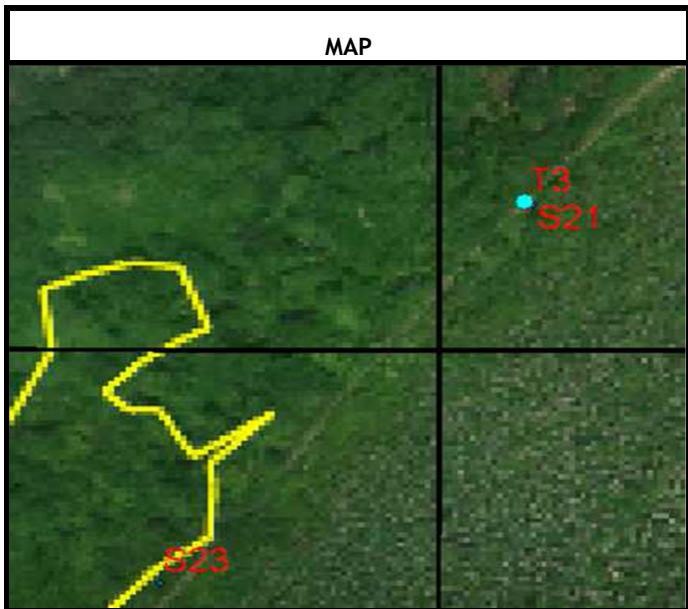
# T3

DISTRICT	Ewa
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 56'4,81139"
	Lat:	-0° 30'23,57008"
PROJECTED		
UTM(58S)	N [m]:	9943979.148
	E [m]:	715313.142

ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>71.6718</b>	<b>34.0978</b>
ELEVATION ABOVE DATUM*	
<b>32.0931</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)



## PICTURE AND TOPOGRAPHIC PATTERN



17 cm = elevation difference between ground level and PVC pipe top

WATER TABLE DEPTH RECORDS		
Date	Time	Meters
29/04/2009	17:25	30.291
16/11/2009	16:37	29.995
26/04/2010	11:40	30.150
12/12/2010	10:32	29.890

OBSERVATIONS



**E2**

DISTRICT	Nibok
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 56'0,77648"
	Lat:	-0° 31'41,28449"
PROJECTED		
UTM(58S)	N [m]:	9941591.766
	E [m]:	715187.575

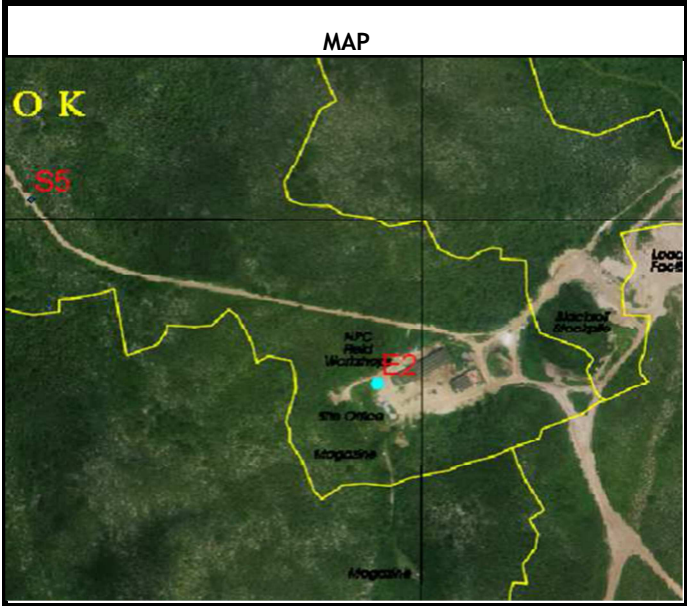
ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>72.4516</b>	<b>34.8826</b>
ELEVATION ABOVE DATUM*	
<b>32.8779</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)

**PICTURE AND TOPOGRAPHIC PATTERN**



3 cm = elevation difference between external steel pipe top and PVC pipe top



**WATER TABLE DEPTH RECORDS**

Date	Time	Meters
30/04/2009	07:25	30.749
16/11/2009	20:01	30.112
26/04/2010	20:28	30.775
12/12/2010	14:51	31.020

**OBSERVATIONS**

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**E3**

DISTRICT	Buada
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 55' 24,61"
	Lat:	-0° 31' 55,55"
PROJECTED		
UTM(58S)	N [m]:	9941154.000
	E [m]:	714069.000

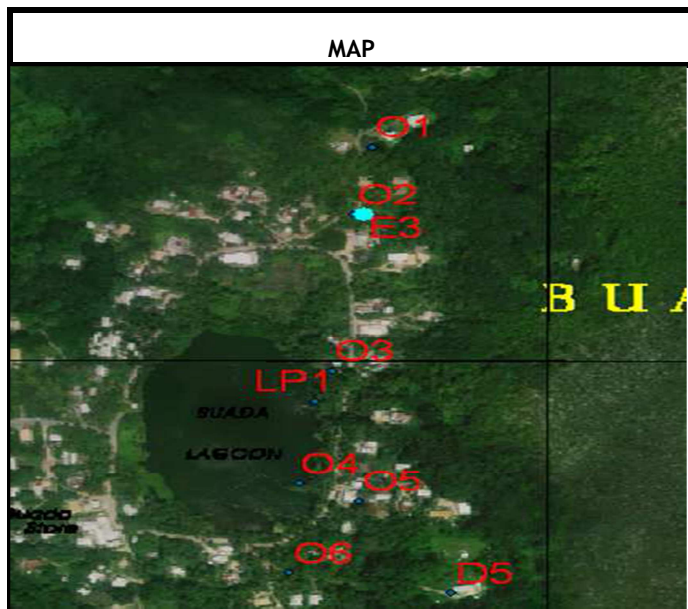
ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>43.9609</b>	<b>6.3729</b>
ELEVATION ABOVE DATUM*	
<b>4.3682</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)

**PICTURE AND TOPOGRAPHIC PATTERN**



5 cm = elevation difference between external steel pipe top and PVC pipe top



**WATER TABLE DEPTH RECORDS**

Date	Time	Meters
29/04/2009	09:03	1.750
16/11/2009	13:15	2.260
26/04/2010	17:00	1.660
12/12/2010	08:49	2.020

**OBSERVATIONS**



**E4**

DISTRICT	Aiwo	
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 54'40,41275"
	Lat:	-0° 32'10,82451"
PROJECTED		
UTM(58S)	N [m]:	9940685.065
	E [m]:	712702.033

ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>47.9517</b>	<b>10.3387</b>
ELEVATION ABOVE DATUM*	
<b>8.3340</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)

**PICTURE AND TOPOGRAPHIC PATTERN**



4,4 cm = elevation difference between external steel pipe top and PVC pipe top

**MAP**



**WATER TABLE DEPTH RECORDS**

Date	Time	Meters
29/04/2009	14:21	6.853
16/11/2009	19:40	6.220
26/04/2010	20:16	6.685
12/12/2010	14:43	6.650

**OBSERVATIONS**

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**E5**

DISTRICT	Yaren
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 55'1,02844"
	Lat:	-0° 32'38,04413"
PROJECTED		
UTM(58S)	N [m]:	9939848.675
	E [m]:	713339.316

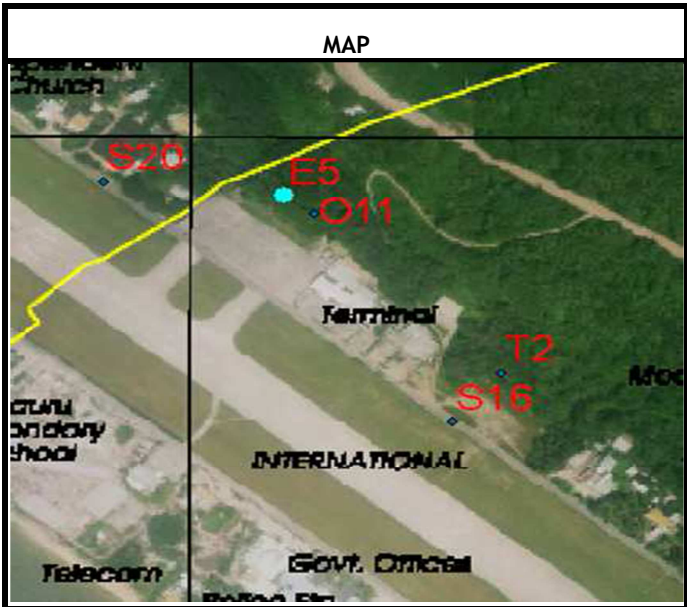
ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>45.8126</b>	<b>8.2146</b>
ELEVATION ABOVE DATUM*	
<b>6.2099</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)

**PICTURE AND TOPOGRAPHIC PATTERN**



1 cm = elevation difference between external steel pipe top and PVC pipe top



**WATER TABLE DEPTH RECORDS**

Date	Time	Meters
29/04/2009	11:11	4.220
16/11/2009	19:33	3.890
26/04/2010	17:57	3.810
12/12/2010	14:40	4.340

**OBSERVATIONS**



# E6

DISTRICT	Yaren
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PLANIMETRIC COORDINATES			
GEOGRAPHIC			
WGS84	Long:	166° 55' 14,75731"	
	Lat:	-0° 32' 40,75531"	
PROJECTED			
UTM(58S)	N [m]:	9939765.314	
	E [m]:	713763.868	

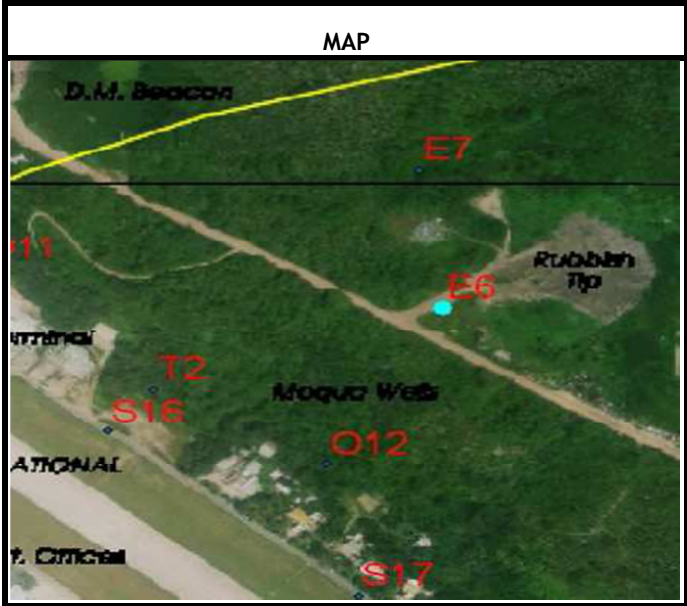
ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>77.4652</b>	<b>39.8762</b>
ELEVATION ABOVE DATUM*	
<b>37.8715</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)

## PICTURE AND TOPOGRAPHIC PATTERN



6 cm = elevation difference between external steel pipe top and PVC pipe top



## WATER TABLE DEPTH RECORDS

Date	Time	Meters
29/04/2009	09:36	35.770
16/11/2009	13:42	36.045
26/04/2010	16:08	35.530
12/12/2010	11:53	35.980

## OBSERVATIONS



**E7**

DISTRICT	Yaren
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 55'14,1633"
	Lat:	-0° 32'35,73763"
PROJECTED		
UTM(58S)	N [m]:	9939919.402
	E [m]:	713745.547

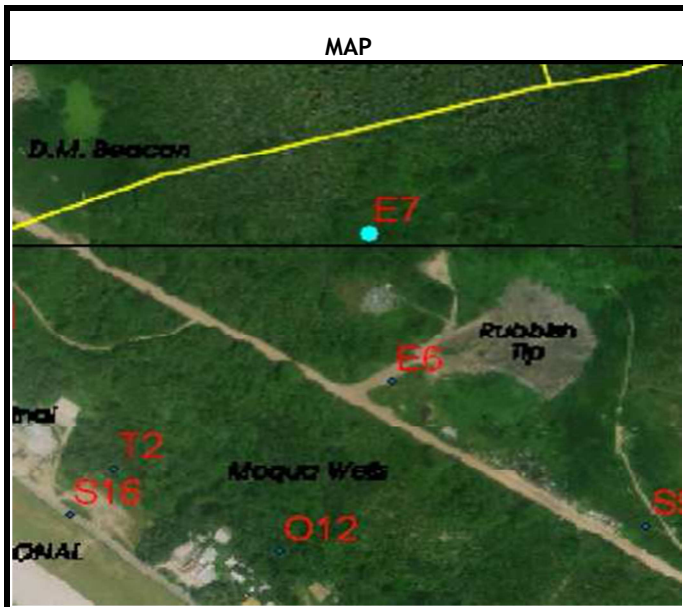
ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>77.9634</b>	<b>40.3734</b>
ELEVATION ABOVE DATUM*	
<b>38.3687</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)

**PICTURE AND TOPOGRAPHIC PATTERN**



6 cm = elevation difference between ground level and PVC pipe top



**WATER TABLE DEPTH RECORDS**

Date	Time	Meters
29/04/2009	09:28	36.1
16/11/2009	13:35	36.42
26/04/2010	15:58	35.89
12/12/2010	11:47	36.32

**OBSERVATIONS**



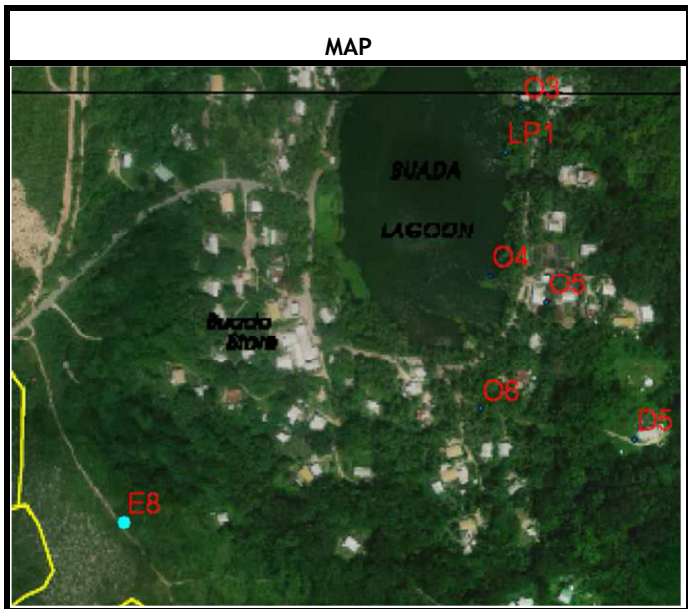
**E8**

DISTRICT	Buada
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 55'9,25267"
	Lat:	-0° 32'19,68781"
PROJECTED		
UTM(58S)	N [m]:	9940412.503
	E [m]:	713593.845

ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>72.7125</b>	<b>35.1175</b>
ELEVATION ABOVE DATUM*	
<b>33.1128</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)



**PICTURE AND TOPOGRAPHIC PATTERN**



8,1 cm = elevation difference between external steel pipe top and PVC pipe top

WATER TABLE DEPTH RECORDS		
Date	Time	Meters
29/04/2009	09:18	30.830
16/11/2009	13:25	31.237
26/04/2010	16:18	30.690
12/12/2010	08:25	31.060

OBSERVATIONS



## At 1 (Anetan 1)


DISTRICT	Anetan
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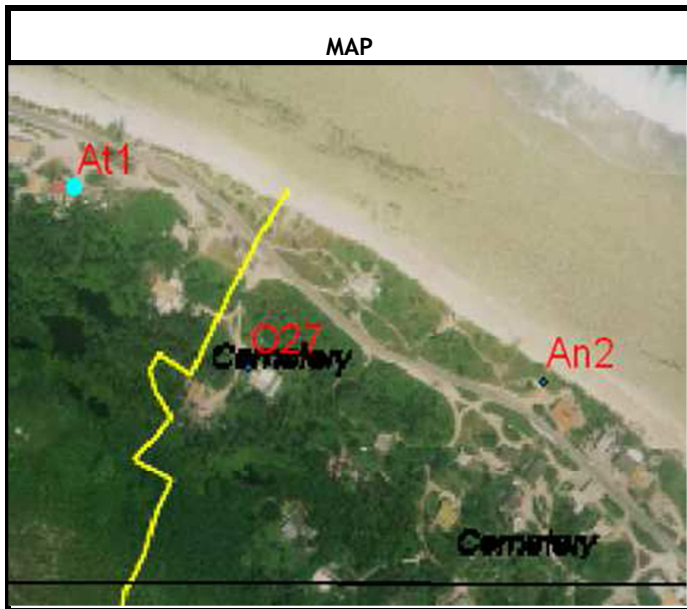
PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 56' 49,62572"
	Lat:	-0° 30' 16,45443"
PROJECTED		
UTM(58S)	N [m]:	9944197.330
	E [m]:	716699.161

ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>45.5896</b>	<b>8.0396</b>
ELEVATION ABOVE DATUM*	
<b>6.0349</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)

**PICTURE AND TOPOGRAPHIC PATTERN**





WATER TABLE DEPTH RECORDS		
Date	Time	Meters
04/10/2011	15:35	4.370

<b>OBSERVATIONS</b>



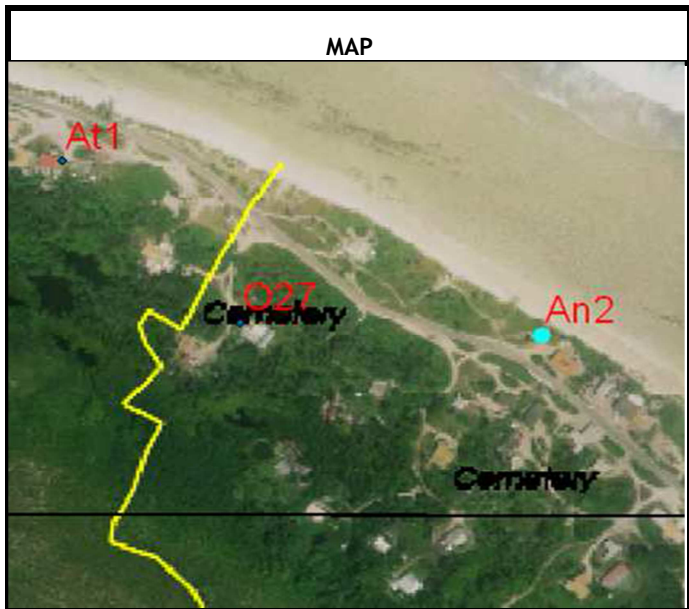
## An 2 (Anabar 2)

DISTRICT	Anabar
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 57'1,9413"
	Lat:	-0° 30'21,20992"
PROJECTED		
UTM(58S)	N [m]:	9944051.124
	E [m]:	717079.996

ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>45.7012</b>	<b>8.1582</b>
ELEVATION ABOVE DATUM*	
<b>6.1535</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)



WATER TABLE DEPTH RECORDS		
Date	Time	Meters
04/10/2011	15:15	4.390

OBSERVATIONS



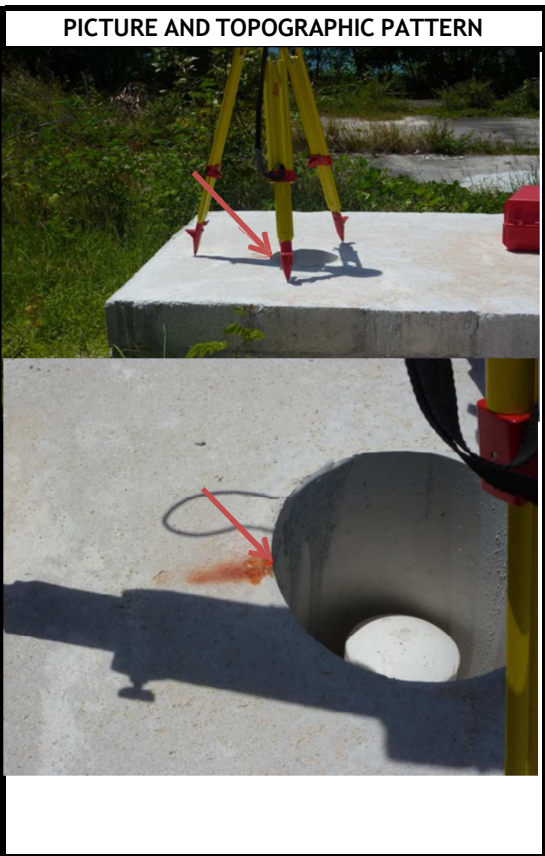
## Bai 1 (Baiti 1)

DISTRICT	Baiti
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 55'44,70325"
	Lat:	-0° 30'30,74912"
PROJECTED		
UTM(58S)	N [m]:	9943758.791
	E [m]:	714691.207

ELEVATION COORDINATES	
ELLIPSODAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>47.7893</b>	<b>10.2043</b>
ELEVATION ABOVE DATUM*	
<b>8.1996</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)



WATER TABLE DEPTH RECORDS		
Date	Time	Meters

OBSERVATIONS



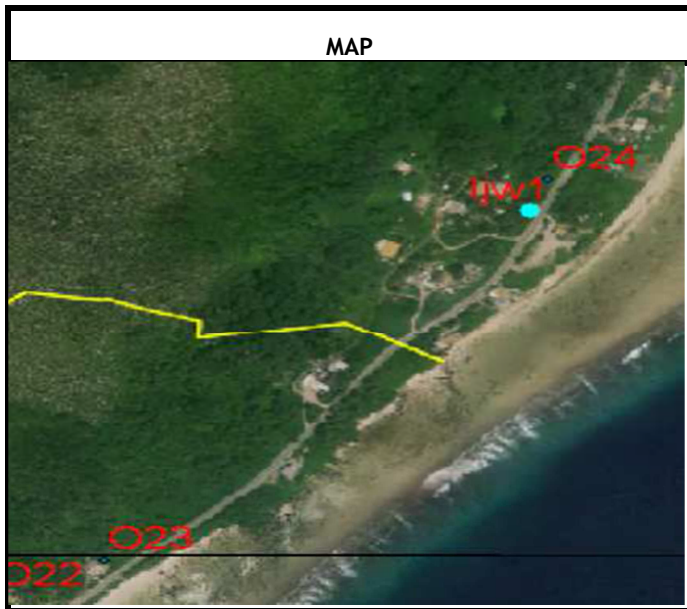
## Ijw 1 (Ijuw 1)

DISTRICT	Ijuw
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 57' 26,86112"
	Lat:	0° 31' 17,72049"
PROJECTED		
UTM(58S)	N [m]:	9942314.838
	E [m]:	717850.141

ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>46.0519</b>	<b>8.5289</b>
ELEVATION ABOVE DATUM*	
<b>6.5242</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)



WATER TABLE DEPTH RECORDS		
Date	Time	Meters
04/10/2011	14:45	4.750

OBSERVATIONS



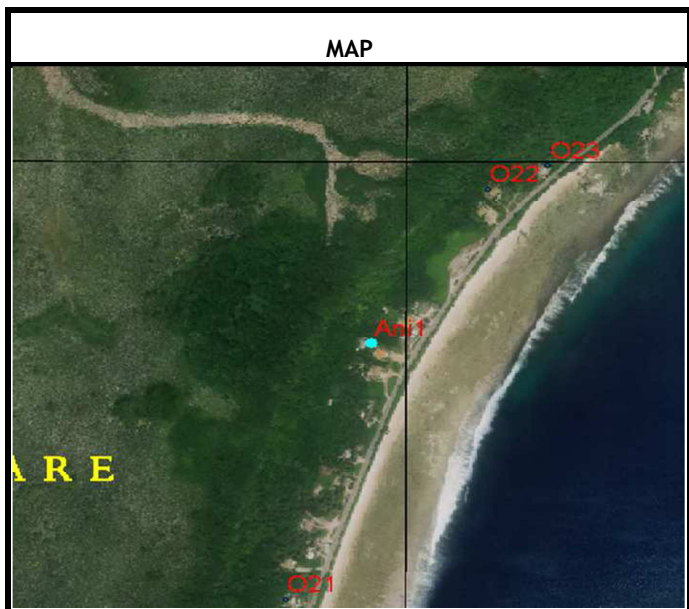
## Ani 1 (Anibare 1)

DISTRICT	Anibare
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 57'6,41386"
	Lat:	-0° 31'42,10627"
PROJECTED		
UTM(58S)	N [m]:	9941565.885
	E [m]:	717217.543

ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>43.4162</b>	<b>5.8852</b>
ELEVATION ABOVE DATUM*	
<b>3.8805</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)



WATER TABLE DEPTH RECORDS		
Date	Time	Meters
05/10/2011	16:40	1.940

OBSERVATIONS



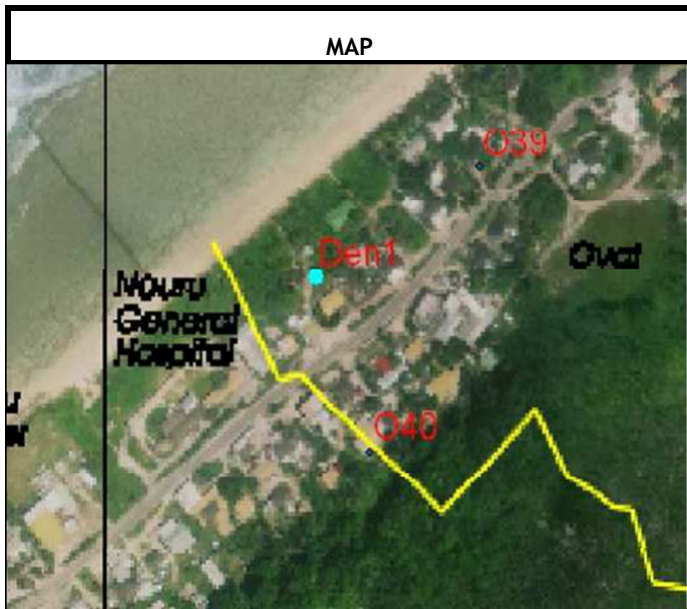
## Den 1 (Denig 1)

DISTRICT	Nibok
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 55'3,87024"
	Lat:	-0° 31'10,13081"
PROJECTED		
UTM(58S)	N [m]:	9942549.356
	E [m]:	713428.096

ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>47.1434</b>	<b>9.5384</b>
ELEVATION ABOVE DATUM*	
<b>7.5337</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)



WATER TABLE DEPTH RECORDS		
Date	Time	Meters
04/10/2011	16:30	5.270

OBSERVATIONS





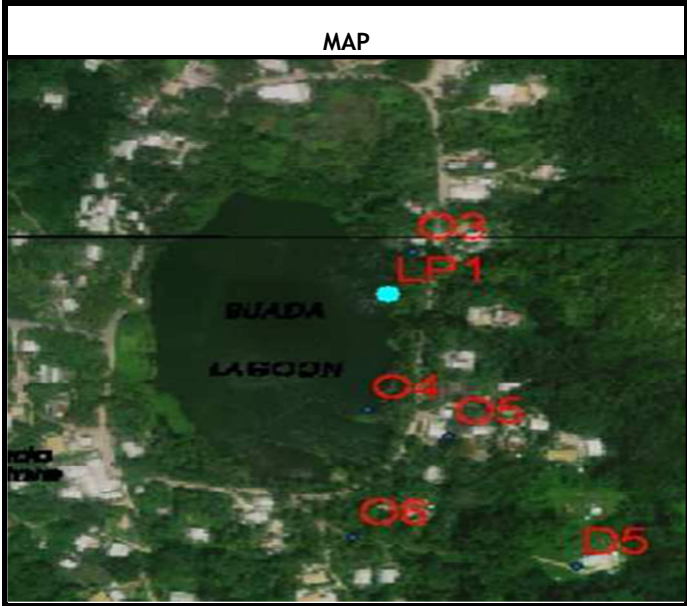
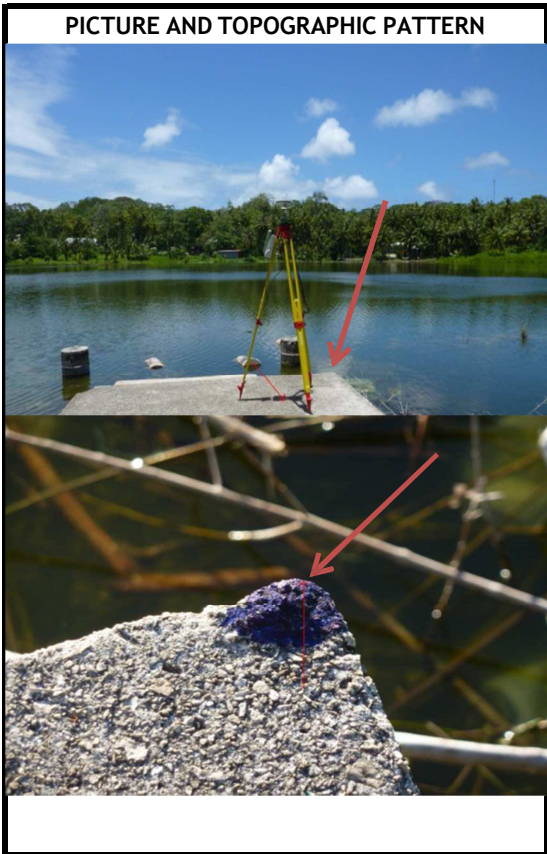
## LP1 (Launch Path)

DISTRICT	Buada
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PLANIMETRIC COORDINATES		
GEOGRAPHIC		
WGS84	Long:	166° 55'22,95775"
	Lat:	-0° 32'5,84037"
PROJECTED		
UTM(58S)	N [m]:	9940837.766
	E [m]:	714017.813

ELEVATION COORDINATES	
ELLIPSOIDAL ELEVATION (h)	ORTHOMETRIC ELEVATION (m.s.l.)
<b>42.8050</b>	<b>5.217</b>
ELEVATION ABOVE DATUM*	
<b>3.2123</b>	

\* Datum corresponds to the Reduced Level described by Jacobson and Hill (1993) that stays 0,166 m below the Nauru Island Datum (i.e. the zero Tide gauge)



WATER TABLE DEPTH RECORDS		
Date	Time	Meters
05/10/2011	11:31	0.870

<b>OBSERVATIONS</b>

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