

Report on
Topographic and Bathymetric Survey of Reservoirs
for Water Resources Department, Govt. of Gujarat
at Saurashtra and Northern Gujarat Region, Gujarat
Machhu-2 Reservoir

Owner



Narmada Water Resources, Water Supply & Kalpsar Department.

W.R.I. Division,
C-9 Multi-storeyed Building, Lal Darwaja,
Ahmedabad, Pin: 380001,
Gujarat, India
Email: ewriabad@gmail.com

Survey Contractor



Ocean Science & Surveying Pvt. Ltd.

C-005/006, Platform Floor, Tower No. 8
Railway Station Complex
CBD Belapur, Navi Mumbai-400 614
Maharashtra, India
Tel: +91-22-27595100 / 27575104
Fax: +91-22-27579272 / 27595110.
URL: www.oceanscience.in
E-mail: mail@oceanscience.in

OSAS Report no.

OSaS/P34320/WRD/Saurashtra/Machhu-2/178d

19th July 2021

Rev 4

DOCUMENT ISSUE FORM

Document Type		Survey Report			
Prelim/Draft/Final/Other		Draft			
Document Title		Topographic and Bathymetric Survey of Reservoirs for Water Resources Department, Govt. of Gujarat at Saurashtra and Northern Gujarat Region – Machhu-2 Reservoir			
Document No.		OSaS/P34320/WRD/Saurashtra/Machhu-2/178d Rev 4			
Prepared at		Ocean Science & Surveying Pvt. Ltd. Data Processing Centre Navi-Mumbai.			
Submitted to		Narmada Water Resources, Water Supply & Kalpsar Department			
No. of Copies		By email			
Project No.		P34320			
Revisions					
Rev	Date	Description	Prepared by		Checked by
0	26.05.2021	Draft	Sandeep Sugur		Farokh Patel
1	16.06.2021	Comments inc.	Binny Mathew		Farokh Patel
2	07.07.2021	Comments inc.	Binny Mathew		Farokh Patel
3	09.07.2021	Add old data inc	Binny Mathew		Farokh Patel
4	19.07.2021	Comments inc.	Binny Mathew		Farokh Patel
<p>This document and any drawings accompanying it are confidential and contain confidential and privileged information, which is intended solely for the recipient(s) mentioned above.</p> <p>Any unauthorised use, review, retransmission, dissemination, distribution, printing or copying of this document of any part thereof is strictly prohibited.</p>					
Revision 1			Revision 2		
No.	Section, Page	Description	1.	Contents, 4	Contents updated
1.	-,4	List of Annexures amended	2.	Executive summary,	Text updated
2.	-, 9	Text added in executive summary	3.	8.5, 30	Table 7 updated
3.	1.1,10-11	Heading changed, Impounding survey data added	4.	8.5, 32	Figure 7 updated
4.	3.2.1, 18	Table 3 updated	5.	8.6, 34-35	Table 8 updated
5.	8.3.1, 27	Impounding survey data added	6.	9, 44	Text updated
6.	8.3.2, 27	Text updated, Table removed	Revision 3		
7.	8.4, 27-28	Text updated, Table removed	1.	8.3.2, 28	Text updated
8.	8.5, 29-30	Text updated , Table 7 added for comparative statement	2.	8.5, 30-31	Table 7 updated

9.	8.5, 31	Figure 7, Curves annotated with arrows	3.	8.5, 32	Figure 7 updated
10.	8.7, 34-35	Text Updated	Revision 4		
11.	8.8, 36	Table 9 added	1.	2.1, 14	Figure 2 updated
12.	8.9.1, 37	Value updated	2.	8.5, 30-31	Table 7 updated
13.	8.10, 39	Table 10 added	3.	8.5, 33	Figure 7 updated
14.	9, 43-44	Text Updated	4.	8.8, 38	Table 9 updated
			5.	Various places	Sq.K.ft changed to M.Sq. ft Sq km changed to M.Sq.m

CONTENTS	Page No.
1 INTRODUCTION.....	11
1.1 Salient Features of Survey Area.....	11
1.2 General Location.....	13
2 SCOPE OF WORK	14
2.1 Surveyed Area.....	14
2.2 Survey Design	15
3 SURVEY CONTROL.....	16
3.1 Geodesy	16
3.2 Horizontal and vertical Control.....	16
1.1.1 Topographic survey.....	16
1.1.2 Bathymetric survey.....	19
3.3 Survey Boat	21
4 PERSONNEL	21
5 SURVEY EQUIPMENT DETAILS.....	22
5.1 General.....	22
5.2 RTK Positioning and Navigation	22
5.3 Single Beam Echo Sounder System	22
5.4 Heave Sensor	23
5.5 Auto Level Geomax	23
5.6 Real Time Kinematic (RTK) For Topographic Survey	23
5.7 Hypack Software	23
6 DATA PROCESSING AND INTERPRETATION.....	24
6.1 Navigation Data	24
6.2 Bathymetric Data	24
6.3 Charting	24
7 SURVEY RESULTS.....	25
7.1 Overview and Contour Charts	25
7.2 Bathymetry and Topography	25
7.3 Longitudinal Profile	26
7.4 Cross Section Profiles.....	26
8 CAPACITY SURVEY RESULTS	26
8.1 General.....	26
8.2 Effect of Sedimentation in Planning of Reservoirs	27
8.3 EARLIER CAPACITY SURVEYS.....	28
1.1.3 Capacity Survey of 1989.....	28
1.1.4 Capacity Survey of 2004.....	28
8.4 Elevation-Area-Capacity Survey (2021).....	28
8.5 Elevation-Area-Capacity Curves	30
8.6 Loss of Storage.....	34
8.7 Data Comparison between 1989 and 2021	36
1.1.5 Rate of siltation	36
1.1.6 Loss of gross storage capacity at F.R.L.....	37
1.1.7 Loss of dead storage capacity	37
1.1.8 Loss of live storage capacity	37
8.8 Summary of capacity surveys (1989 and 2021)	38
8.9 Data Comparison between 2004 and 2021	39

1.1.9	Rate of erosion	39
1.1.10	Increase of gross storage capacity at 57.30m (FRL)	39
1.1.11	Decrease of dead storage capacity	39
1.1.12	Increase of live storage capacity	40
8.10	Summary of Capacity Surveys (2004 and 2021)	41
8.11	Control of Sedimentation in Reservoirs	42
1.1.13	Suitable design of reservoir	42
1.1.14	Restrict the sediment inflow	42
1.1.15	Limit sediment deposition	43
1.1.16	Regular removal of deposited sediment	44
9	CONCLUSIONS	45
10	REFERENCES	47

LIST OF FIGURES

Figure 1:	Survey areas/reservoirs of Saurashtra and Northern Gujarat regions	13
Figure 2:	Surveyed areas (Topographic and Bathymetric) – Machhu-2 Reservoir	14
Figure 3:	Details of OSaS-MA-2-TBM-01	17
Figure 4:	Details of OSaS-MA-2-TBM-02	18
Figure 5:	Survey boat – SMB Ocean	21
Figure 6:	2D image of Machhu-2 reservoir surveyed area	26
Figure 7:	Elevation-area-capacity curves (2004 and 2021)	33

LIST OF TABLES

Table 1:	Surveyed areas for Machhu-2 reservoir	15
Table 2:	Geodetic Parameters	16
Table 3:	Additional TBMs	19
Table 4:	Observed water levels at Machhu-2 reservoir	20
Table 5:	Survey Personnel	21
Table 6:	Classification of gradients	24
Table 7:	Comparative statement of Machhu-2 reservoir between 2004 and 2021	32
Table 8:	Loss/ increase of storage capacity between 2004 and 2021	36
Table 9:	Rate of Sedimentation at F.R.L (57.30m)	38
Table 10:	Rate of Erosion at F.R.L (57.30m)	41

LIST OF ANNEXURES

Annexure 1:	Elevation-Area-Capacity Table	48
Annexure 2:	Mobilisation and Calibration Report	54
Annexure 3:	Previous Data	63
Annexure 4:	Daily Progress Reports	100

ACCOMPANYING CHARTS

Sr. no.	Chart name	Chart title	Chart scale
1	OSaS_P34320_WRD_Machhu-2_OV_01	Overview map (2D Bathymetry and Topography Grid Data for Machhu-2 Reservoir)	Horiz scale: 1:15000
2	OSaS_P34320_WRD_Machhu-2_CC_02	Contour Map for Machhu-2 Reservoir	Horiz scale: 1:15000
3	OSaS_P34320_WRD_Machhu-2_03	Topography and Bathymetry for Machhu-2 Reservoir (Chart 1 of 4)	Horiz scale: 1:5000 Grid: 25m x 25m
4	OSaS_P34320_WRD_Machhu-2_04	Topography and Bathymetry for Machhu-2 Reservoir (Chart 2 of 4)	Horiz scale: 1:5000 Grid: 25m x 25m
5	OSaS_P34320_WRD_Machhu-2_05	Topography and Bathymetry for Machhu-2 Reservoir (Chart 3 of 4)	Horiz scale: 1:5000 Grid: 25m x 25m
6	OSaS_P34320_WRD_Machhu-2_06	Topography and Bathymetry for Machhu-2 Reservoir (Chart 4 of 4)	Horiz scale: 1:5000 Grid: 25m x 25m
7	OSaS_P34320_WRD_Machhu-2_LP_07	Longitudinal Profile Along Lowest Elevation Line for Machhu-2 Reservoir (Sheet 01 of 01)	Horiz scale: 1:5000 Vert scale: 1:250
8	OSaS_P34320_WRD_Machhu-2_CP_08	Cross Section Profiles 01 to 10 for Machhu-2 Reservoir (Sheet 01 of 16)	Horiz scale: 1:5000 Vert scale: 1:250
9	OSaS_P34320_WRD_Machhu-2_CP_09	Cross Section Profiles 11 to 18 for Machhu-2 Reservoir (Sheet 02 of 16)	Horiz scale: 1:5000 Vert scale: 1:250
10	OSaS_P34320_WRD_Machhu-2_CP_10	Cross Section Profiles 18 to 24 for Machhu-2 Reservoir (Sheet 03 of 16)	Horiz scale: 1:5000 Vert scale: 1:250
11	OSaS_P34320_WRD_Machhu-2_CP_11	Cross Section Profiles 24 to 29 for Machhu-2 Reservoir (Sheet 04 of 16)	Horiz scale: 1:5000 Vert scale: 1:250
12	OSaS_P34320_WRD_Machhu-2_CP_12	Cross Section Profiles 30 to 35 for Machhu-2 Reservoir (Sheet 05 of 16)	Horiz scale: 1:5000 Vert scale: 1:250
13	OSaS_P34320_WRD_Machhu-2_CP_13	Cross Section Profiles 36 to 41 for Machhu-2 Reservoir (Sheet 06 of 16)	Horiz scale: 1:5000 Vert scale: 1:250
14	OSaS_P34320_WRD_Machhu-2_CP_14	Cross Section Profiles 42 to 47 for Machhu-2 Reservoir (Sheet 07 of 16)	Horiz scale: 1:5000 Vert scale: 1:250
15	OSaS_P34320_WRD_Machhu-2_CP_15	Cross Section Profiles 47 to 52 for Machhu-2 Reservoir (Sheet 08 of 16)	Horiz scale: 1:5000 Vert scale: 1:250
16	OSaS_P34320_WRD_Machhu-2_CP_16	Cross Section Profiles 52 to 58 for Machhu-2 Reservoir (Sheet 09 of 16)	Horiz scale: 1:5000 Vert scale: 1:250
17	OSaS_P34320_WRD_Machhu-2_CP_17	Cross Section Profiles 58 to 63 for Machhu-2 Reservoir (Sheet 10 of 16)	Horiz scale: 1:5000 Vert scale: 1:250
18	OSaS_P34320_WRD_Machhu-2_CP_18	Cross Section Profiles 63 to 68 for Machhu-2 Reservoir (Sheet 11 of 16)	Horiz scale: 1:5000 Vert scale: 1:250
19	OSaS_P34320_WRD_Machhu-2_CP_19	Cross Section Profiles 68 to 78 for Machhu-2 Reservoir (Sheet 12 of 16)	Horiz scale: 1:5000 Vert scale: 1:250
20	OSaS_P34320_WRD_Machhu-2_CP_20	Cross Section Profiles 78 to 88 for Machhu-2 Reservoir (Sheet 13 of 16)	Horiz scale: 1:5000 Vert scale: 1:250
21	OSaS_P34320_WRD_Machhu-2_CP_21	Cross Section Profiles 88 to 95 for Machhu-2 Reservoir (Sheet 14 of 16)	Horiz scale: 1:5000 Vert scale: 1:250
22	OSaS_P34320_WRD_Machhu-2_CP_22	Cross Section Profiles 95 to 100 for Machhu-2 Reservoir (Sheet 15 of 16)	Horiz scale: 1:5000 Vert scale: 1:250
23	OSaS_P34320_WRD_Machhu-2_CP_23	Cross Section Profiles 101 to 104 for Machhu-2 Reservoir (Sheet 16 of 16)	Horiz scale: 1:5000 Vert scale: 1:250

ABBREVIATIONS

AutoCAD	Computer aided design and drafting software application
AM	Ante meridiem
BM	Benchmark
CAD	Computer Aided Design
COG	Centre of Gravity
Cm	Centimetre
C.M.	Central Meridian
CMG	Course Made Good
Cu.m	Cubic metre
DF	Dual Frequency
DGPS	Differential Global Positioning System
dd-mm-yy	Date-Month-Year
DSL	Dead Storage Level
DTM	Digital Terrain Model
E	Easting
e.g.	Example
FRL	Full Reservoir Level
Ft.	Feet
Govt.	Government
GPS	Global Positioning System
Ha.m	Hectare metre
Horz	Horizontal
HFL	Highest Flood Level
HSE	Health, Safety & Environment
ID	Identification name/number
IHO	International Hydrographic Organization
kHz	Kilohertz
km	Kilometre
km ²	Square kilometre
KP	Kilometre Post
Lat	Latitude
LBM	Local Benchmark
Long	Longitude
Ltd.	Limited
m	Metre
MDDL	Minimum Drawdown Level
Mm ³	Million cubic metre

Mm ²	Million square metre
MRU	Motion Reference Unit
MSL	Mean Sea Level
MWL	Maximum Water Level
NA	Not Applicable
N	Northing
Nov	November
NU	North Up
NWRWS	Narmada Water Resources Water Supply
OSaS	Ocean Science & Surveying Pvt. Ltd
PM	Post meridiem
Pvt.	Private
RF	Radio Frequency
R.L.	Reduced Level
RTK	Real-time Kinematic positioning
SBES	Single Beam Echo Sounder
SMB	Survey motor boat
sq. km	Square kilometre
SVP	Sound Velocity Profile
TBM	Temporary Benchmark
TIN	Triangulated irregular network
Th.Cu.m	Thousand cubic metre
UTM	Universal Transverse Mercator projection
USB	Universal Serial Bus
VDU	Video Display Unit
Vert	Vertical
Vs	Versus
w.d.	Water depth
WGS84	World Geodetic System 1984
WRD	Water Resources Department

EXECUTIVE SUMMARY

Ocean Science & Surveying Pvt. Ltd. (OSaS) was contracted by Narmada Water Resources, Water Supply & Kalpsar Department (WRD) to initially carry out topographic and bathymetric survey of six reservoirs in the Saurashtra region; namely Shetrunji, Brahmani-1, Und 1, Machhu-1, Machhu-2 and Bhadar-1. However, as per instructions received from the client (Via document no: WRIDN/PB/Bathymetry Survey (Sau) 183/2021, dated 24th February 2021), the survey of Shetrunji reservoir was not to be carried out. The client provided a total of 8 new reservoirs where bathymetric and topographic survey were to be carried out against the cancelled Shetrunji reservoir. Hence, finally a total of thirteen reservoirs in the Saurashtra and Northern Gujarat region; namely Bhadar-1, Brahmani-1, Und-1, Machhu-1, Machhu-2, Khodiyar, Aji-1, Bhadar-2, Nara, Tappar, Rudramata, Mitti and Fatehgadh are to be surveyed as per the project specifications.

This report describes the results of the topographic and bathymetric survey services provided by OSaS to Narmada Water Resources, Water Supply & Kalpsar Department (WRD) for topographic and bathymetric mapping of the Machhu-2 reservoir, Saurashtra region, Gujarat.

To establish TBMs, two points were marked on the dam wall walkway, spaced 7.35m apart. DGPS observations were carried out at each of these points for about 2 hours on 08th March 2021. The levelling of these TBMs was carried out on the same day with respect to the known level of FRL (57.30m above MSL) as provided by the client.

The survey boat SMB Ocean, owned by OSaS, was used for conducting the survey. The survey team started mobilisation of equipment on 09th March 2021 while the survey boat was alongside the Machhu-2 dam bund road.

Initial system preparations and equipment checks were completed on 09th March. The topographic and bathymetric survey commenced on 09th March and 10th March respectively. Bathymetric survey was completed on 26th March and the survey boat was demobilised on 29th March. Topographic survey was completed on 20th April 2021.

The survey data was processed at the site on a daily basis and reporting and charting was completed in the OSaS data processing centre in Navi-Mumbai after completion of the survey.

All the co-ordinates in the report and charts are referenced to WGS 84 datum, UTM projection, CM 69° east, zone 42, northern hemisphere.

All bathymetric and topographic data has been reduced to Mean Sea Level (M.S.L) using the observed average water level of each day during the survey period. All elevations mentioned in this report and accompanying charts are in metres above MSL.

The survey was carried out in daylight hours keeping in mind the safety of personnel and survey equipment.

From the 2021 survey results, a minimum elevation of 37.9m and a maximum elevation of 55.8m above MSL was observed in the south-eastern and west-northwestern portion of the surveyed area respectively within the bathymetric section. A minimum elevation of 49.5m and a maximum elevation of 75.9m was observed in the north-western and near the central portion of the surveyed area respectively within the topographic section. The topographic survey was extended till the elevation of 59.20m (HFL) above MSL as instructed by client.

A description of the bathymetric and topographic features observed in the surveyed area has been provided in **Section 7** of this report.

Based on the document (Revised Capacity Table of Machhu-2 Irrigation Scheme Sedimentation Survey Done by GERI, Vadodara, Nov 2004), it is understood that a capacity survey was carried out in the year 2004. Hence, the survey data between 2004 and 2021 (present survey by OSaS) have been compared to

draw the conclusions on loss/ increase of reservoir capacity and rate of siltation/erosion that has occurred over the years.

The capacity (volume) results (extracted at regular intervals of 0.5m (apart from elevations 39.62m, 47.24m (DSL) and 57.30m (FRL)) obtained from the survey carried out in 2004 (provided by client) have been tabulated in **Table 7**. The detailed capacity results at 0.01m intervals as obtained from the client have been provided in **Annexure-3**.

The capacity and area results obtained from the present survey data (2021) and extracted at particular elevations (0.5m intervals) as that of 2004 for comparison have been provided in **Table 8**. The detailed area capacity results at 0.1m interval obtained from the 2021 survey data have been provided in **Annexure 1**.

The elevation area capacity curves showing a comparison of capacity survey results (2004 vs 2021) are generated using the data provided in **Table 7** and is presented in **Figure 7**.

The details of the possible erosion/ deposition phenomena and the resulting percentage increase/ loss in the gross storage capacity of the reservoir at different elevations calculated on comparing the capacity results from the surveys carried out in 2004 and 2021 have been provided in **Table 8**.

A decrease in cumulative gross storage capacity from 100.750 Mm³ (in 1989) to 92.013 Mm³ (in 2021) was observed at 57.30m (FRL) over the years from 1989 to 2021 with a calculated loss in gross storage capacity of 8.67%. The dead storage capacity at D.S.L (47.24m) decreased from 9.760 Mm³ to 3.151 Mm³ over the years from 1989 to 2021 with a calculated loss in dead storage capacity of 67.72%. The amount of sediment deposited during this period (from 1989 to 2021) at D.S.L is 6.609 Mm³. The live storage capacity at FRL (57.30m) decreased from 90.990 Mm³ to 88.862 Mm³ over the years from 1989 to 2021 with a calculated loss in live storage capacity of 2.34%.

An increase in cumulative gross storage capacity from 87.906 Mm³ (in 2004) to 92.013 Mm³ (in 2021) was observed at 57.30m (FRL) over the years from 2004 to 2021 with a calculated increase in gross storage capacity of 4.67%. The dead storage capacity at D.S.L (47.24m) decreased from 3.804 Mm³ to 3.151 Mm³ over the years from 2004 to 2021 with a calculated loss in dead storage capacity of 17.17%. The amount of sediment deposited during this period (from 2004 to 2021) at D.S.L is 0.653 Mm³. The live storage capacity at FRL (57.30m) increased from 84.102 Mm³ to 88.862 Mm³ over the years from 2004 to 2021 with a calculated increase in live storage capacity of 5.66%.

It is observed that a minimum elevation (at which a value is obtained in gross storage capacity column after volume calculations) of 39.62m and 40.0m was observed in the surveys carried out in 2004 and 2021 respectively. Hence, it can be said that the minimum elevation observed in the reservoir over the years (from 2004 to 2021) has increased from 39.62m to 40.0m, which indicates that sedimentation has occurred over the years. Thus, it can be understood that the reservoir has been filled with silt between elevations 39.62m and 40.0m from the year 2004 to 2021.

The comparison between the results obtained from the impounding survey carried out in 1989 and 2021 indicates that siltation has occurred in the reservoir over the past 32 years and the rate of siltation is calculated to be 2.29 Ha.m/100sq.km./year. Annual percentage loss of gross storage capacity and live storage capacity are 0.27% and 0.07% respectively over the past 32 years (from 1989 to 2021). The annual percentage loss of dead storage capacity is calculated to be 2.12% over the past 32 years (from 1989 to 2021). The details and calculations are provided in section **8.7**

The comparison between the results obtained from the surveys carried out in 2004 and 2021 (17 years) indicates that erosion has occurred in the reservoir over the past 17 years and the rate of erosion is calculated to be 2.02 Ha.m/100sq.km./year. Annual percentage increase of gross storage capacity and live storage capacity are 0.27% and 0.33% respectively over the past 17 years (from 2004 to 2021). The annual percentage decrease of dead storage capacity is calculated to be 1.01% from 2004 to 2021. The details and calculations are provided in section **8.9**.

1 INTRODUCTION

The Water Resources Department, Govt. of Gujarat is engaged in developing water reservoirs within the state of Gujarat, under a World Bank funding programme towards National Hydrology Projects of Govt. of India. Towards this end, the Water Resources Department requires services for conducting bathymetric survey of reservoirs of Saurashtra and Northern Gujarat regions under National Hydrology Project.

Ocean Science & Surveying Pvt. Ltd. (OSaS) was contracted by Narmada Water Resources, Water Supply & Kalpsar Department (WRD) to initially carry out topographic and bathymetric survey of six reservoirs in the Saurashtra region; namely Shetrunji, Brahmani-1, Und 1, Machhu-1, Machhu-2 and Bhadar-1. However, as per instructions received from the client (Via document no: WRIDN/PB/Bathymetry Survey (Sau) 183/2021, dated 24th February 2021), the survey of Shetrunji reservoir was not to be carried out. The client provided a total of 8 new reservoirs where bathymetric and topographic survey were to be carried out against the cancelled Shetrunji reservoir. Hence, finally a total of thirteen reservoirs in the Saurashtra and Northern Gujarat region; namely Bhadar-1, Brahmani-1, Und-1, Machhu-1, Machhu-2, Khodiyar, Aji-1, Bhadar-2, Nara, Tappar, Rudramata, Mitti and Fatehghadh are to be surveyed as per the project specifications.

This report describes the results of the topographic and bathymetric survey services provided by OSaS to Narmada Water Resources, Water Supply & Kalpsar Department (WRD) for topographic and bathymetric mapping of the Machhu-2 reservoir, Saurashtra region, Gujarat.

1.1 Salient Features of Survey Area

Machhu River rises in the hills of Jasdand-Sardar and Mandva in Rajkot district near village Khokhara in Chotila taluk of Surendranagar district in Saurashtra region of Gujarat state in India at an elevation of 220m above MSL. This is one of the northward flowing rivers of Saurashtra in Gujarat state. The Machhu basin is situated between 22°10' N to 23°10' N latitude and 70°40' E to 71°15' E longitude. The river flows in a northwesterly direction along with the district boundary of Surendranagar and Rajkot up to village Beti and then flows mainly towards north in Rajkot district and finally disappears near Malia in the little Rann of Kachchh. Machhu along with its tributaries flows 52% in the hilly area and 48% in the plains. The river irrigates Malia, Morbi, Wankaner, Jasdand and Rajkot taluks of Rajkot district and part of Chotila taluk in Surendranagar district. Machhu drains an area of 2515 km², of which more than 75% lies in Rajkot district.

The first dam on Machhu River, named Machhu-1, was built in 1959, with a catchment area of 730 km². The Machhu-2 dam was constructed downstream of Machhu-1 in 1972 near Morbi district in Gujarat, India. It was an earth-fill dam. The dam was meant to serve an irrigation scheme. Considering the long history of drought in the Saurashtra region, the primary consideration at the time of design was water storage, not flood control. It consisted of a masonry spillway of 206 metres (676 ft.) consisting of 18 sluice gates in the river section and earthen embankments on both sides.

The catchment area of the Machhu-2 dam is fan shaped, partly hilly and partly cultivated. Most of the annual rainfall in the catchment area falls in the monsoon months from June to September. The average annual rainfall in the Machhu-2 catchment is 60.2cm. The maximum temperature reaches around 43°C in the hottest month of May, whereas the lowest temperature falls to 6°C in the coldest month of January.

Machhu-2 dam failure in 1979

The Machhu-2 dam failure was a dam-related flood disaster which occurred on 11th August 1979 in Gujarat, India. The failure was caused by excessive rain and massive flooding, leading to the disintegration of the earthen walls of the four kilometre long Machhu-2 dam. The actual observed flow following the intense rainfall reached 16307 m³/s, thrice what the dam was designed for, resulting in its collapse. 762 metres (2,500 ft.) of the left embankment and 365 metres (1,198 ft.) of the right embankment collapsed. Within 20 minutes floodwaters 12 to 30 ft. (3.7m to 9.1m) in height inundated the

low-lying areas of Morbi industrial town located 5 km downstream. The Morbi dam failure was listed as the worst dam burst in the Guinness Book of Records. During reconstruction of the dam the capacity of the spillway was increased by four times and fixed at about 21,000 m³/s.

Machu dam was reconstructed in the year 1989-90 after the breach in 1979. Hence the provided data is assumed to be of the impounding survey details of Machu -2 dam in the year 1989. The following details has been extracted from the documented provide by the client.

- a. Location
 - Latitude : 22° - 46' N
 - Longitude : 70° - 52' E
- b. Catchment Area : 1193.47 km²
- c. Full Reservoir Level (F.R.L) : 57.30 m above MSL
- d. Dead Water Level (D.W.L/O.S.L) : 47.24 m above MSL
- e. Catchment Area : 1193.47 sq. km
- f. Gross Capacity at FRL : 100.75 Mm³
- g. Dead Storage : 9.76 Mm³
- h. Live Storage at FRL : 90.99 Mm³
- i. Highest Flood Level (HFL) : 59.20 m

A silt survey was conducted in the year 2004 and the results were provided by the client. The revised salient features of Machu-2 dam as per the survey in the year 2004 as follows:

- a. Catchment Area : 1193.47 sq. km
- b. Full Reservoir Level (F.R.L) : 57.30m above MSL
- c. Dead Water Level (D.W.L/O.S.L) : 47.24 m above MSL
- d. Gross Capacity at FRL : 87.906 Mm³
- e. Dead Storage : 3.804 Mm³
- f. Live Storage at FRL : 84.102 Mm³
- g. Highest Flood Level (HFL) : 59.20 m

1.2 General Location

All the thirteen reservoirs to be surveyed in the Saurashtra and Northern Gujarat region have been digitised on the Google Earth image and are shown in **Figure 1** (in red).

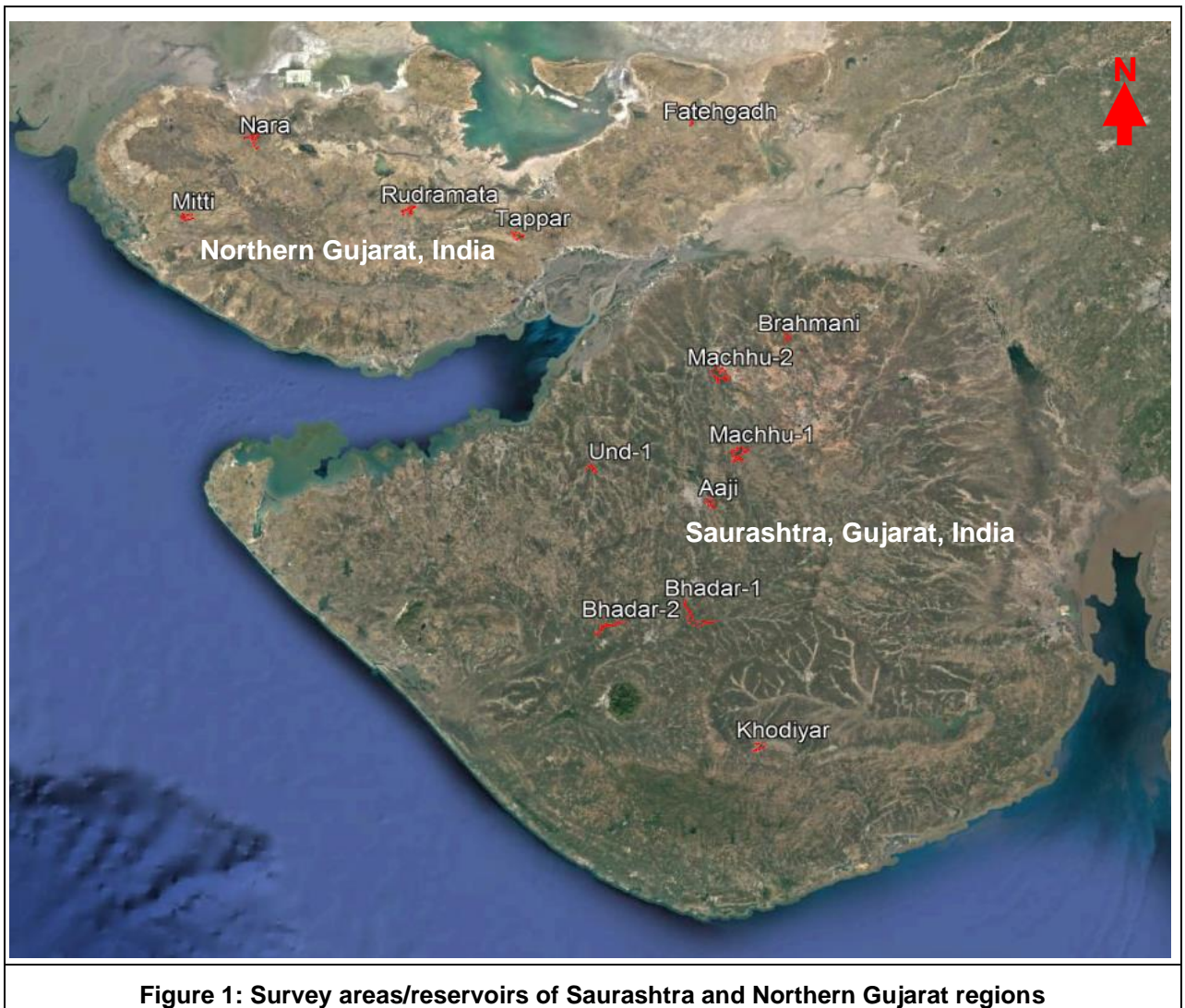


Figure 1: Survey areas/reservoirs of Saurashtra and Northern Gujarat regions

2 SCOPE OF WORK

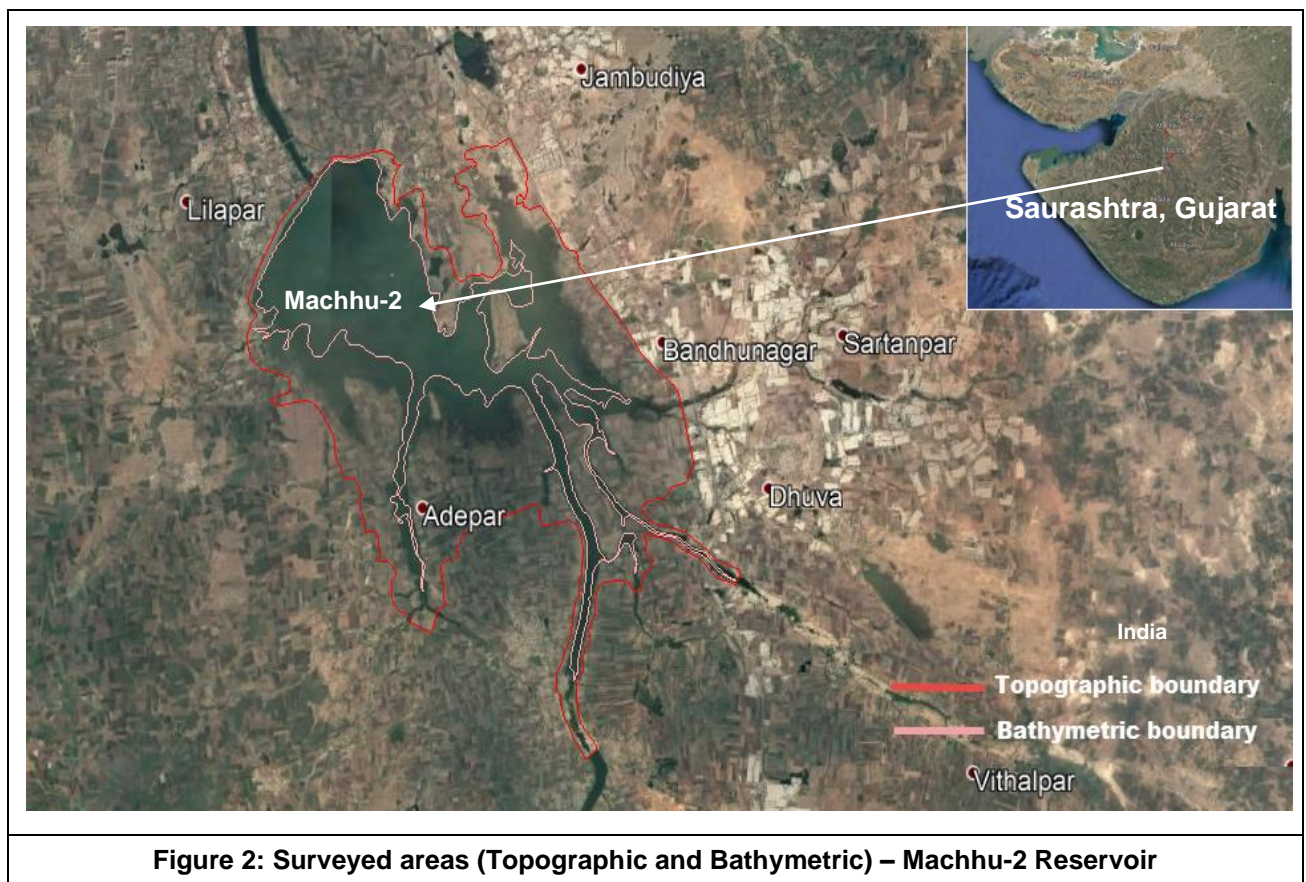
The scope of work for the survey is:

- To mobilize requisite topographic equipment and personnel at the site as specified by the client.
- To mobilize a suitable vessel along with requisite bathymetric equipment and personnel at the site specified by the client.
- To carry out topographic and single beam echo sounder bathymetric survey in the specified area.
- To estimate and study the sedimentation behaviour of reservoirs in different zones, including horizontal zones throughout the reservoirs as well as vertical zones namely (a) dead storage (b) live storage (c) flood storage, if any.
- The integrated bathymetric system will be used to collect data on depth and bottom topology of the reservoirs and rivers. Primary application is reservoir sedimentation surveying; products will be reservoir capacity figures as a function of depth, depth contours and bottom topology change over time.
- To upgrade elevation-area-capacity tables/ curves of the reservoirs.
- To prepare contour plan, longitudinal profile (L-section), cross section profiles.

2.1 Surveyed Area

The Machhu-2 dam site is located on river Machhu near Jodhpar Nadi village in Morbi taluka of Rajkot district in the Saurashtra peninsula, in the Western state of Gujarat at a distance of about 103 km from the source of the river.

The surveyed area boundaries (both topographic and bathymetric) for Machhu-2 reservoir have been overlaid on the Google earth image shown in **Figure 2**.



The topographic and bathymetric surveyed areas (in sq.km) for the Machhu-2 reservoir are provided in **Table 1** below.

Name of Reservoir	Bathymetric survey area (Sq.km.)	Topographic survey area (Sq.km.)
Machhu-2	12.92	24.75

Table 1: Surveyed areas for Machhu-2 reservoir

2.2 Survey Design

The topographic and bathymetric survey lines were planned and executed at intervals of 25m throughout the area of survey. Topographic survey was conducted using RTK base and rover system. The limit of topographic survey was up to the elevation of 59.20m (HFL) above MSL, as instructed by the client.

3 SURVEY CONTROL

3.1 Geodesy

The survey operations were conducted in WGS 84 Spheroid, Universal Transverse Mercator projection system, based on the geodetic parameters as presented below. All co-ordinates given within this document are with reference to it.

GEODETTIC PARAMETERS	
Satellite Datum	
Datum, Spheroid	WGS-84
Semi-Major Axis	6378137.000 m
Semi Minor Axis	6356752.314 m
Inverse Flattening	298.2572
Projection Parameters	
Grid Projection	Universal Transverse Mercator
Latitude of Origin of Projection	0° (Equator)
Longitude of Origin of Projection	69° E, Zone 42 North
Hemisphere	North
False Easting (metres)	500000 E
False Northing (metres)	0
Scale Factor on CM	0.9996
Units	Metres

Table 2: Geodetic Parameters

3.2 Horizontal and vertical Control

1.1.1 Topographic survey

Two reference stations were established as temporary control points/ temporary benchmarks (TBMs). The levelling of these TBMs was carried out using an auto level with respect to the known level of FRL which is 57.30m above MSL, as provided by the client. The base stations of the RTK were set up at these positions and two-hour long continuous observations were conducted using a Hemisphere Atlas Link RTK positioning system to fix the consistency of the position for horizontal control. The system provides real time correction signals, providing centimetre level accuracy. Additional TBMs were established at various parts of the survey area to keep the rover in range with respect to the base station.

The details of the reference stations OSaS-MA-2-TBM-01 and OSaS-MA-2-TBM-02 are provided in **Figure 3** and **Figure 4** respectively.

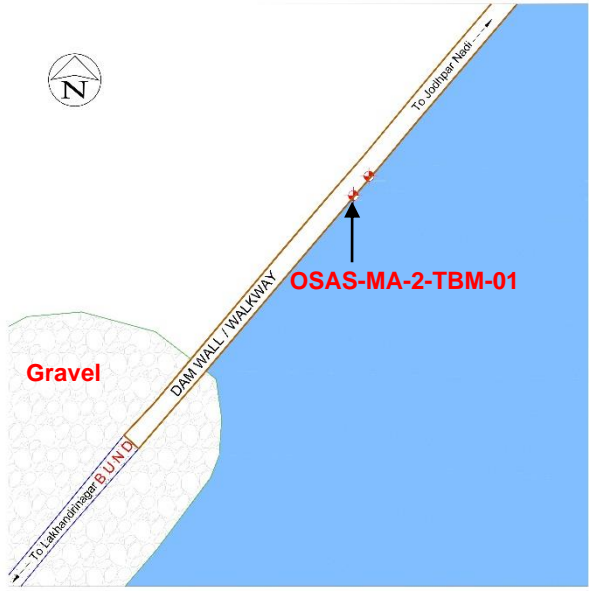
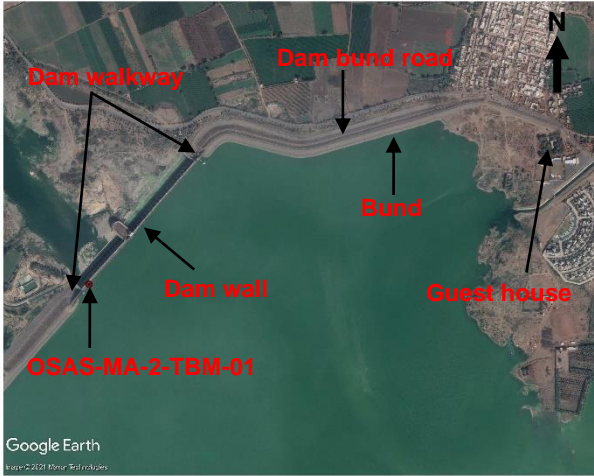

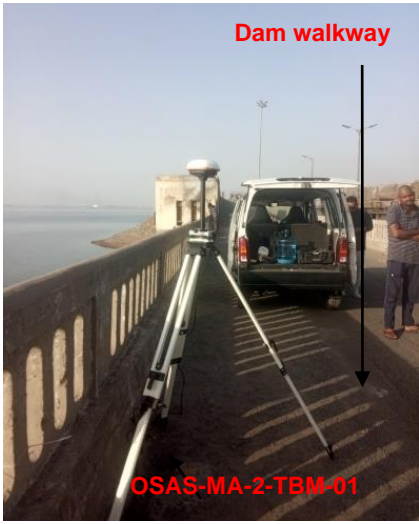
Station Number:	OSAS-MA-2-TBM-01	Latitude:	22° 45.736' N
Locality:	Machhu-2, Gujarat	Longitude:	70° 51.875' E
Geodetic Datum:	WGS84	Northing:	2518409.460 m N
Projection:	Universal Transverse Mercator	Easting:	691441.650 m E
Date:	08 th March 2021	Elevation:	59.91m above MSL
Station Description:	A rhombus with a plus sign drawn inside it is painted in yellow colour on the dam walkway.		
Access:	From the guest house at Machhu-2 dam, head north for about 20m after which turn towards northwest and continue along the dam bund road for about 1.2 km to reach the northeastern end of the dam walkway. From there, head towards southwest on the dam walkway for about 570m to reach the TBM-01 location.		
Sketch:			
Map:			
			

Figure 3: Details of OSaS-MA-2-TBM-01


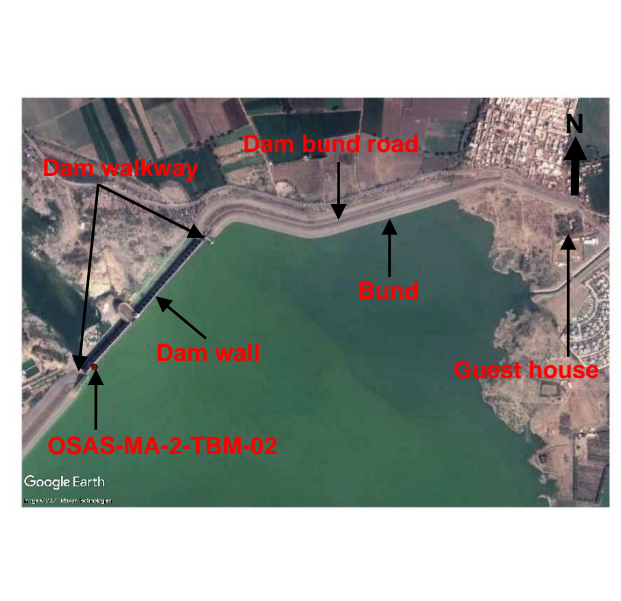


Station Number:	OSAS-MA-2-TBM-02	Latitude:	22° 45.739' N
Locality:	Machhu-2, Gujarat	Longitude:	70° 51.877' E
Geodetic Datum:	WGS84	Northing:	2518415.190 m N
Projection:	Universal Transverse Mercator	Easting:	691446.280 m E
Date:	08 th March 2021	Elevation:	59.90m above MSL
Station Description:	A circle with a dot at its centre is drawn with yellow paint on the dam walkway.		
Access:	From the guest house at Machhu-2 dam, head north for about 20m after which turn towards northwest and continue along the dam bund road for about 1.2 km to reach the northeastern end of the dam walkway. From there, head towards southwest on the dam walkway for about 563m to reach the TBM-02 location.		
Sketch:			
Map:			
			

Figure 4: Details of OSaS-MA-2-TBM-02

Additional temporary control points were established at the site to maintain the moving rover within the range of the base reference point. The following table summarises the details of all the temporary control points (TBMs) established at the site during the survey.

Sr. No.	Station Name	Latitude (N)	Longitude (E)	Easting (m)	Northing (m)	Elevations (m) w.r.t MSL
1	OSAS-MA-2-TBM-03	22° 45' 02.704"	70° 53' 48.539"	694768.833	2517175.505	80.27
2	OSAS-MA-2-TBM-04	22° 44' 05.985"	70° 53' 54.470"	694960.404	2515432.963	79.07
3	OSAS-MA-2-TBM-05	22° 44' 21.374"	70° 55' 21.880"	697448.357	2515938.496	63.34
4	OSAS-MA-2-TBM-06	22° 43' 45.275"	70° 55' 42.936"	698063.608	2514835.842	55.90
5	OSAS-MA-2-TBM-07	22° 42' 47.375"	70° 55' 25.499"	697589.145	2513048.338	62.86
6	OSAS-MA-2-TBM-08	22° 42' 08.949"	70° 56' 08.749"	698838.847	2511882.346	67.31
7	OSAS-MA-2-TBM-09	22° 41' 36.779"	70° 55' 32.199"	697808.534	2510879.203	67.58
8	OSAS-MA-2-TBM-10	22° 40' 55.671"	70° 54' 31.031"	696078.907	2509592.132	70.61
9	OSAS-MA-2-TBM-11	22° 42' 41.832"	70° 53' 56.138"	695041.146	2512844.966	61.79
10	OSAS-MA-2-TBM-12	22° 42' 54.916"	70° 53' 04.388"	693559.174	2513228.604	68.50
11	OSAS-MA-2-TBM-13	22° 43' 12.410"	70° 52' 27.481"	692499.160	2513753.384	62.01

Table 3: Additional TBMs

1.1.2 Bathymetric survey

The same two reference stations, established as temporary control points/ temporary benchmark (TBMs) for topographic survey were used as the base station for RTK positioning during bathymetric survey. The rover fixed in the survey boat can receive calculated X Y Z (Easting, Northing, and Elevation) of its position at any point within centimetre level accuracy with respect to the known base positions. The details of these reference stations OSaS-MA-2-TBM-01 and OSaS-MA-2-TBM-02 are provided in **Figure 3** and **Figure 4** respectively.

The water level of the reservoir with respect to the known value of FRL (57.30m above MSL) was measured twice a day during the survey. The mean value of these two readings was taken as the datum for the day's work. The depths recorded by the echo sounder were deducted from these levels to obtain the bed levels with respect to MSL. The observed water levels for each survey day are given in **Table 4**.

Survey date (dd-mm-yy)	Water level				
	Start		End		Average level in metres (above MSL)
	Time (AM)	Level (above MSL, in metres)	Time (PM)	Level (above MSL, in metres)	
10-03-21	10:00	55.88	5:00	55.86	55.87
11-03-21	10:00	55.85	5:00	55.83	55.84
12-03-21	10:00	55.84	5:00	55.84	55.84
13-03-21	10:00	55.84	5:00	55.84	55.84
14-03-21	10:00	55.83	5:00	55.82	55.82
15-03-21	10:00	55.81	5:00	55.80	55.80
16-03-21	10:00	55.79	5:00	55.78	55.78
17-03-21	10:00	55.78	5:00	55.78	55.78
18-03-21	10:00	55.77	5:00	55.76	55.76
19-03-21	10:00	55.76	5:00	55.76	55.76
20-03-21	10:00	55.75	5:00	55.75	55.75

21-03-21	10:00	55.75	5:00	55.75	55.75
22-03-21	10:00	55.75	5:00	55.75	55.75
23-03-21	10:00	55.74	5:00	55.74	55.74
24-03-21	10:00	55.74	5:00	55.73	55.73
25-03-21	10:00	55.70	5:00	55.67	55.68
26-03-21	10:00	55.64	5:00	55.62	55.63

Table 4: Observed water levels at Machhu-2 reservoir

3.3 Survey Boat

A company owned boat, SMB Ocean, was utilised for conducting the survey operations.



Figure 5: Survey boat – SMB Ocean

4 PERSONNEL

The following survey personnel were involved during the survey period.

Name	Designation	Duration
Santokh Chand	Project Manager	Project Duration (In Navi-Mumbai office)
Santosh Wakankar	Party Chief / Data Processor	07 th March – 16 th March 2021 (At site) Project duration (Data processing after returning to office from site)
Pankaj Rabary	Party Chief/ Surveyor	07 th March - 20 th April 2021
Binu Kumar	Land Surveyor	17 th March - 20 th April 2021
Nikhil Rane	Land Surveyor	07 th March - 16 th March 2021
Manoj More	Land Surveyor	07 th March – 03 rd April 2021 14 th April – 20 th April 2021
Virender Singh	Surveyor	07 th March – 03 rd April 2021 14 th April – 20 th April 2021

Table 5: Survey Personnel

5 SURVEY EQUIPMENT DETAILS

5.1 General

The equipment used for the survey is described below.

Bathymetry:

Hemisphere Atlas Link RTK Base and Rover System with accessories
Odom MK III dual frequency single beam echo sounder system with accessories
MRU-PD heave sensor
Hypack navigation system
2 x computers with associated accessories

Topography:

Hemisphere Atlas Link RTK Base and Rover System with accessories
Geomax Auto Level complete with all accessories.

Adequate spares and back-ups for critical items will be carried on board the survey vessel to ensure that failure of any hardware unit does not adversely affect progress of field work.

5.2 RTK Positioning and Navigation

A RTK system was mobilised at site to carry out the topographic and bathymetric survey. The system comprises the following:

- Atlas Antenna
- SATEL Modem
- RF Antenna
- Hemisphere Controller with stylus

The base station of the RTK was set up at the temporary benchmark. Real Time Kinematic (RTK) is a technique used to increase the accuracy of GPS signals by using a fixed base station which wirelessly sends out corrections to a moving receiver. By utilising these corrections, the GPS engine can fix the position of the antenna to within 1-2cm. GPS Real-Time Kinematic (RTK) operation provides centimetre-level accuracy by eliminating errors that are present in the GPS system. For obtaining corrected positions, a rover receiver and a source of corrections from a base station were used.

Vessel positioning was carried out by the RTK system and its heading determined using MRU-PD by the course made good method (CMG). Vessel track and offset positions were recorded digitally in the navigation software. The positioning system was interfaced to the Hypack navigation software. RTK positioning accuracy of the moving vessel was within 1-2cm.

The vessel's computed position from the RTK system receiver was interfaced to the navigation computer system. Hypack navigation and data acquisition software was used to provide track guidance information for the survey crew and also output the vessel position to assist the helmsman in maintaining the selected track guidance line. The VDU displays the selected survey line, the vessel position in relation to that line and numerical data to assist the helmsman such as the along-line and off-line distances, vessel speed and course made good, gyro heading, distance and bearing to end of line and water depth. The position of each fix, together with other information such as fix numbers, depths, and down line distances were logged to the hard drive.

Sensor offsets on the survey boat were accurately measured during mobilisation and are included in the Mobilisation report (**Annexure-1**).

5.3 Single Beam Echo Sounder System

Bathymetry data was acquired using dual frequency 33/200 kHz Echosound DF 3200 MK III single beam echo sounder. The SBES transducer assembly was side-mounted on a pole on the port side of the survey boat. A hard copy (paper) record was produced in real-time, annotated with line name, fix number, time and date. The digital output was logged by the navigation computer for post-processing.

Calibration

The echo sounder was calibrated at the survey location by conducting a bar-check. The bar-check is carried out by lowering a horizontal steel plate to known, fixed depths below the water surface directly below the echo sounder transducer. Acoustic reflections from the plate at different depths are then recorded and adjustments made to the settings for sound velocity and draft to get accurate results. A bar-check was carried out before commencing the survey and the average speed of sound obtained was entered into the unit.

5.4 Heave Sensor

An MRU-PD heave sensor was fixed on the deck of the boat about 0.5m ahead of the COG. Its output was given to the SBES unit.

5.5 Auto Level Geomax

A Geomax Auto Level was used to transfer the benchmark as provided by the client to a local benchmark. It was also used to level this local benchmark.

5.6 Real Time Kinematic (RTK) For Topographic Survey

A Hemisphere Atlas Link RTK system with base station and rover was used to conduct the survey. Base stations were established with respect to the FRL value at TBMs and rovers were used to fix the positions. This is a positioning system which can measure and calculate the XYZ (Easting, Northing and Elevation) of any given point with centimetre level accuracy with respect to the known base positions. An AutoCAD drawing can be generated with the help of the XYZ values obtained from this equipment.

5.7 Hypack Software

Navigation data was processed using the Hypack navigation software. Single beam data from the Echosound DF 3200 MK III echo sounder was also processed using the Hypack software. Hypack provides all of the tools necessary to complete the hydrographic survey requirements. It provides a tool to design a survey, collect data, apply corrections to soundings, remove outliers, plot field sheets, export data to CAD, compute volume quantities, generate contours and create/modify electronic charts.

6 DATA PROCESSING AND INTERPRETATION

This section explains the established terminology and standards for the project and how they were applied to the survey data.

6.1 Navigation Data

Raw RTK and gyro data were processed and merged to form an edited vessel track file. The final navigation data was reviewed in AutoCAD to confirm the validity of the vessel's position and to aid in the correlation between navigation data and chart location.

The survey track plots were then used for data interpretation and generation of the survey charts.

6.2 Bathymetric Data

Single beam data from the Echotrac DF 3200 MK III echo sounder was processed using the Hypack navigation package. The water level of the reservoir with respect to the known value of FRL (57.30m above MSL) was measured twice a day during the survey. The mean value of these two readings was taken as the datum for the day's work. The depths recorded by the echo sounder were deducted from these levels to obtain the bed levels with respect to MSL.

Recorded depth data was adjusted for transducer draft and changes in water mass acoustic velocity as measured during the bar-check.

Seabed Gradient Classification

The following terms were used to describe the seabed gradients.

CLASSIFICATION	GRADIENT (in terms of Degrees and Slope Interval)	
Very Gentle	<1°	< 1 in 57
Gentle	1° – 4.9°	1 in 57 to 1 in 11.7
Moderate	5° – 9.9°	1 in 11.7 to 1 in 5.7
Steep	10° – 14.9°	1 in 5.7 to 1 in 3.7
Very Steep	>15°	> 1 in 3.7

Table 6: Classification of gradients

Gradients documented in the report should be taken as an indication of general slopes for the area. The localised gradients, particularly near features such as depressions or trenches may occasionally be steeper.

Following the data processing and interpretation phase, the charts were prepared at the OSaS data processing centre, in Navi Mumbai. A team comprising a single beam data processor, CAD processor and geophysicist prepared the report and accompanying chart to WRD's specifications.

6.3 Charting

The results of this survey conducted during March and April 2021 are presented in twenty-three charts, plotted in 1:5000 scale in a 25m x 25m grid. They consist of the following:

- One overview chart displaying a 2-dimensional image of bathymetry and topography
- One contour map displaying elevation contours at 1m intervals
- One longitudinal profile along the lowest elevation line within the surveyed area
- Four charts showing topography and bathymetry of the surveyed area
- Sixteen charts showing cross section profiles along all the surveyed lines.

Their details are listed after the List of Annexures at the beginning of this report.

7 SURVEY RESULTS

7.1 Overview and Contour Charts

One chart each has been prepared for an overview of the surveyed area as well as elevation contours at 1m intervals, as described in Section 6.3 **Charting**. These charts also show the boundary between the bathymetric and topographic surveys.

7.2 Bathymetry and Topography

The bathymetry and topography of the reservoir are displayed in four charts, as described in Section 6.3 **Charting**. The elevations mentioned in this report and associated charts have been reduced to Mean Sea Level (MSL) using the observed average water level of the Machhu-2 reservoir for the corresponding survey day. Hence, all the bathymetric and topographic values mentioned in this report are with respect to MSL.

Bathymetric and topographic survey was limited at some places within the survey area due to the presence of existing private properties, factory and industrial areas, ponds, ravines, compound walls, cultivated lands, rocky areas, bushes and very shallow areas (these areas were not accessible by either the survey boat or the survey personnel). These areas have been demarcated as inaccessible areas in the charts and in **Figure 6**.

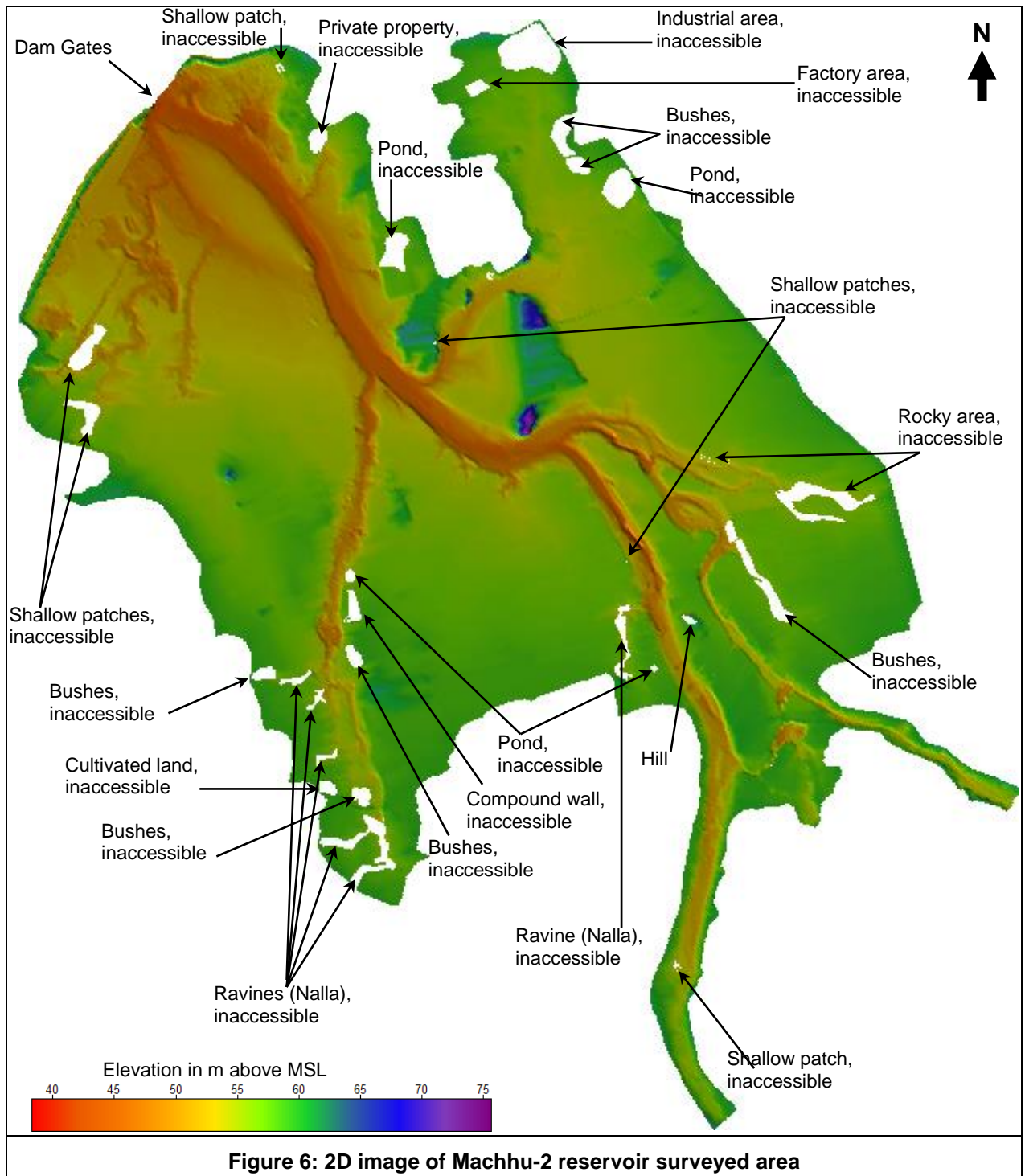
A minimum elevation of 37.9m and a maximum elevation of 55.8m was observed in the southeastern and west-northwestern portions of the surveyed area respectively within the bathymetric section.

For a major part of the reservoir a general range of elevation change between 45.0m to 55.0m is observed within the bathymetric section, where moderate to steep slopes are generally observed all along the periphery of the reservoir, with the slopes becoming gentler moving away from the periphery towards the central portion of the reservoir. Very steep gradients are observed in the vicinity of the dam gates, mainly in the adjoining areas to the northeast and southwest of the dam gates. Occasionally, very steep gradients are also observed in the bathymetric surveyed area, mainly along the periphery of the reservoir in the central, upper central, southwestern and southeastern portions of the bathymetric surveyed area.

Minimum and maximum elevations of 49.5m and of 75.9m was observed in the northwestern and near the central portion of the surveyed area respectively within the topographic section.

For a major part of the topographic surveyed area a general range of elevations between 55.0m and 60.0m is observed. The processed topographic data shows that the land is sloping with very gentle to gentle gradients from all the sides of the topographic surveyed area towards the reservoir area. Moderate to steep gradients are generally observed all along the reservoir banks where the topographic survey ends. Isolated to scattered areas, showing moderate variations in elevations compared to the surrounding topography are observed in the western, southwestern, southeastern and east-northeastern portions of the topographic surveyed area. Features like temples, houses, islands, a hill, cultivation lands, bunds, bushes, ponds, trees, ravines, roads, railway tracks, a bridge, a culvert, check dams, fences, a well, compound walls and dam wall were observed within the topographic surveyed area.

Figure 6 shows a 2-dimensional image of the Machhu-2 reservoir surveyed area generated using the gridded bathymetric and topographic data.



7.3 Longitudinal Profile

A longitudinal profile of the reservoir was generated from the lowest elevation line created by connecting the lowest bed level observed along each survey line. This longitudinal profile is provided in a single chart, as described in Section 6.3 **Charting**.

7.4 Cross Section Profiles

Cross section profiles consist of the bed levels observed along the survey lines at 100m intervals. The cross-section profiles are presented in sixteen charts, as described in Section 6.3 **Charting**.

8 CAPACITY SURVEY RESULTS

8.1 General

It is natural for lakes and reservoirs to trap a major part of the sediment brought into them by the streams in the catchment. Sedimentation of reservoirs is therefore a natural process resulting from the geologic and geomorphologic processes of water borne erosion.

Sedimentation of reservoirs leads to a gradual loss of their storage capacities available for regulation of supplies. Apart from this, it can cause operational problems created by the entry of large volumes of sediments in the canals or in the turbines, as also due to jamming of hydraulic gates. Reservoir sedimentation can also cause ecological problems due to turbidity, and due to gradual delta formation at the upstream end of the reservoirs. Therefore, sedimentation of reservoirs is a matter of vital concern in all water resources development projects.

The two dominant factors which influence the rate of silting in any storage reservoir are: (i) the relationship of capacity to inflow and (ii) the content of sediment in the inflow. The other factors that modify the long-term loss of storage capacities are (a) the trap efficiency of the reservoir, (b) the character of the sediment, and (c) the method of reservoir operation. Basically, these three factors mentioned are modifiers and do not usually have a major effect as compared to the capacity-inflow ratio and the sediment content in the inflow.

It is generally recommended to carry out capacity survey of reservoirs periodically so that the quantity of sedimentation taking place can be assessed and timely remedial measures taken. This also serves as a guide for proper sedimentation planning of future reservoirs to ensure that the reservoir sedimentation does not cause unexpected problems in the useful operation of the reservoir.

The capacity surveys in general, show that the observed rate of sedimentation is higher than the rate of sedimentation adopted in the original designs. However, it is observed that the rate of sedimentation decreases with the passage of time and the useful life of the reservoir may not get unduly reduced in most cases.

8.2 Effect of Sedimentation in Planning of Reservoirs

It is important to note that storage reservoirs built across rivers and streams lose their capacity on account of deposition of sediment. This deposition, which takes place progressively in time, reduces the active capacity of the reservoir to provide the outputs of water through the passage of time. Accumulation of sediment at or near the dam may interfere with the future functioning of water intakes and hence affects decisions regarding location and height of various outlets. It may also result in greater flow of water into canals / water conveyance systems drawing water from the reservoir. Problems of rise in flood levels in the head reaches and unsightly deposition of sediment from a recreation point of view may also crop up in the course of time.

In this regard, the Bureau of Indian Standards code IS: 12182 - 1987 "Guidelines for determination of effects of sedimentation in planning and performance of reservoir" is an important document which discusses some of the aspects of sedimentation that have to be considered while planning reservoirs. Some of the important points from the code are as follows:

While planning a reservoir, the degree of seriousness and the effect of sedimentation at the proposed location have to be judged from studies, which normally consist of a combination of:

1. Performance Assessment (Simulation) Studies with varying rate of sedimentation.
2. Likely effects of sedimentation at the dam face.

In special cases, where the effects of sedimentation on backwater levels are likely to be significant, backwater studies would be useful to understand the size of river water levels. The steps to be followed

for performance assessment studies with varying rates of sedimentation are as follows:

- a. Estimation of annual sediment yields into the reservoir or the average annual sediment yield and of trap efficiency expected.
- b. Distribution of sediment within the reservoir to obtain a sediment elevation and capacity curve at any appropriate time.

8.3 EARLIER CAPACITY SURVEYS

1.1.3 Capacity Survey of 1989

Machu dam was constructed in the year 1972. After the breach in 1979, the dam was reconstructed in the year 1989-90. Hence the provided data is assumed to be of the impounding survey details of Machu -2 dam in the year 1989. The year 1989 will be used for all further calculations regarding the comparison of impounding survey data to the current survey data. The following details has been extracted from the documented provide by the client

- a. Location

Latitude	: 22° - 46' N
Longitude	: 70° - 52' E
- b. Catchment Area : 1193.47 km²
- c. Full Reservoir Level (F.R.L) : 57.30 m above MSL
- d. Dead Water Level (D.W.L/O.S.L) : 47.24 m above MSL
- e. Catchment Area : 1193.47 Sq. Km
- f. Gross Capacity at FRL : 100.75 Mm³
- g. Dead Storage : 9.76 Mm³
- h. Live Storage at FRL : 90.99 Mm³
- i. Highest Flood Level (HFL) : 59.20 m

1.1.4 Capacity Survey of 2004

Based on the document (Revised Capacity Table of Machhu-2 Irrigation Scheme Sedimentation Survey Done by GERI, Vadodara, Nov 2004) provided by the client, it is understood that a capacity survey was carried out in 2004 prior to the current survey by OSaS in the year 2021.

The capacity results at 0.01m interval as provided by client is presented in **Annexure 3**. For the ease of further calculations and generation of elevation-area-capacity curve, the data has been extracted at particular intervals from elevations 39.62m to 57.30m (FRL) and have been provided in **Table 7**.

8.4 Elevation-Area-Capacity Survey (2021)

The water spread area and its corresponding capacity has been calculated from the acquired bathymetry and topographic data. Hypack software's TIN (Triangulated Irregular Network) MODEL package was used to calculate the Area and Capacity of the Machu-2 reservoir at intervals of 0.01m with respect to the corresponding elevation above MSL. Within the surveyed area a few places were not accessible to the survey personnel due to existing private properties, factory and industrial areas, ponds, ravines, compound walls, cultivated lands, rocky areas, bushes and very shallow areas (these areas were not accessible by either the survey boat or the topographic survey personnel). These areas have been demarcated as inaccessible areas in charts: OSaS_P34320_WRD_Machhu-2_03 to OSaS_P34320_WRD_Machhu-2_06 and in **Figure 6**.

The depths recorded by the echo sounder were reduced to obtain the bed levels (bathymetry data) with respect to MSL for the entire surveyed area. Then, the data obtained from the topographic survey was merged with the bathymetric data to output a single xyz file for the entire surveyed area. Using the Hypack software a TIN (Triangulated irregular network) model was generated from this single xyz file.

Further, using the 'TIN to level' option in Hypack software, the required range of levels (minimum and maximum water levels) and the desired interval (in this case 0.01m) at which the capacity/volume and area output is required were input in the software. Finally, a text file was generated by the software which contains all the information on the volume/capacity and area obtained at the specified elevation interval (0.01m) in the reservoir.

For comparing and generating elevation-area-capacity curves with previous surveyed data (2004), the capacity and area data from the present survey (2021) have been extracted at the same elevations as the 2004 surveyed data. The capacity and area results obtained from previous survey data (2004) and the present survey data (2021) at these particular elevations are tabulated in **Table 7** below.

The values of areas and capacities at 0.1m intervals obtained from the 2021 survey data have been provided in **Annexure 1**.

8.5 Elevation-Area-Capacity Curves

One of the most important physical characteristics of dams and their reservoirs are Elevation-area-capacity curves. These curves are important for defining the storage capacity of the reservoir and thereby can be used in reservoir operation, reservoir flood routing, determination of capacity and water spread corresponding to each elevation.

Area-capacity data at the time of impounding hasn't been made available for Machhu-2 reservoir which was constructed in 1972, whereas data is available at intervals of 0.01m from the capacity survey conducted in 2004. The current survey was conducted in 2021 and the data was provided at intervals of 0.01m. For ease of further calculations and preparation of Elevation-Area-capacity curve, the data has been selected at particular intervals. The following **Table 7** shows the comparative statement of data between 2004 and 2021 at particular intervals.

Elevation (Above MSL, m)	As per 2004 survey		As per 2021 survey		Remarks
	Gross Capacity (M.Cu.m)	Area (M.Sq.m or Sq.Km)	Gross Capacity (M.Cu.m)	Area (M.Sq.m or Sq.Km)	
39.62	0.131	0.055	0.000	0.000	
39.70	0.056	0.135	0.000	0.000	
39.80	0.058	0.141	0.000	0.000	
39.90	0.059	0.147	0.000	0.000	
40.00	0.153	0.061	0.001	0.000	
40.10	0.159	0.063	0.001	0.001	
40.20	0.166	0.064	0.001	0.001	
40.30	0.173	0.066	0.001	0.001	
40.40	0.179	0.068	0.001	0.001	
40.50	0.186	0.070	0.001	0.001	
40.60	0.193	0.072	0.001	0.001	
40.70	0.200	0.074	0.001	0.001	
40.80	0.207	0.076	0.001	0.001	
40.90	0.215	0.078	0.001	0.001	
41.00	0.223	0.080	0.001	0.001	
41.10	0.231	0.082	0.001	0.001	
41.20	0.239	0.084	0.002	0.001	
41.30	0.250	0.085	0.002	0.002	
41.40	0.259	0.090	0.002	0.002	
41.50	0.269	0.096	0.002	0.002	
41.60	0.278	0.101	0.002	0.002	

Elevation (Above MSL, m)	As per 2004 survey		As per 2021 survey		Remarks
	Gross Capacity (M.Cu.m)	Area (M.Sq.m or Sq.Km)	Gross Capacity (M.Cu.m)	Area (M.Sq.m or Sq.Km)	
41.70	0.288	0.107	0.002	0.002	
41.80	0.299	0.112	0.003	0.003	
41.90	0.310	0.117	0.003	0.003	
42.00	0.321	0.123	0.003	0.003	
42.10	0.333	0.128	0.004	0.004	
42.20	0.345	0.134	0.004	0.006	
42.31	0.359	0.139	0.005	0.008	
42.40	0.375	0.156	0.006	0.010	
42.50	0.393	0.172	0.007	0.011	
42.60	0.412	0.189	0.008	0.012	
42.70	0.432	0.205	0.009	0.016	
42.80	0.453	0.222	0.011	0.019	
42.90	0.475	0.239	0.013	0.025	
43.00	0.498	0.255	0.016	0.031	
43.10	0.522	0.272	0.019	0.042	
43.20	0.548	0.288	0.024	0.063	
43.30	0.583	0.305	0.031	0.082	
44.30	0.967	0.461	0.229	0.323	
45.30	1.581	0.783	0.771	0.842	
46.30	2.541	1.128	1.824	1.232	
47.24	3.804	1.523	3.151	1.602	D.S.L
47.30	3.898	1.550	3.248	1.626	
48.30	5.734	2.082	5.100	2.122	
49.30	8.197	2.791	7.577	2.873	
50.30	11.480	3.668	10.903	3.805	
51.30	16.013	4.530	15.294	5.065	
52.30	22.216	5.864	21.223	6.85	
53.30	30.471	7.834	28.998	8.763	
54.30	41.340	10.789	38.938	11.233	

Elevation (Above MSL, m)	As per 2004 survey		As per 2021 survey		Remarks
	Gross Capacity (M.Cu.m)	Area (M.Sq.m or Sq.Km)	Gross Capacity (M.Cu.m)	Area (M.Sq.m or Sq.Km)	
55.30	54.630	14.039	51.937	15.247	
55.38	55.778	14.221	53.172	15.646	
56.30	69.991	16.243	69.647	20.001	
57.30	87.906	19.346	92.013	25.231	F.R.L

Table 7: Comparative statement of Machhu-2 reservoir between 2004 and 2021

The above data were used for the preparation of Elevation-Area-Capacity curves. The following figure shows the Elevation-Area-Capacity curves of 2021 superimposed on the 2004 Elevation-Area-Capacity curves.

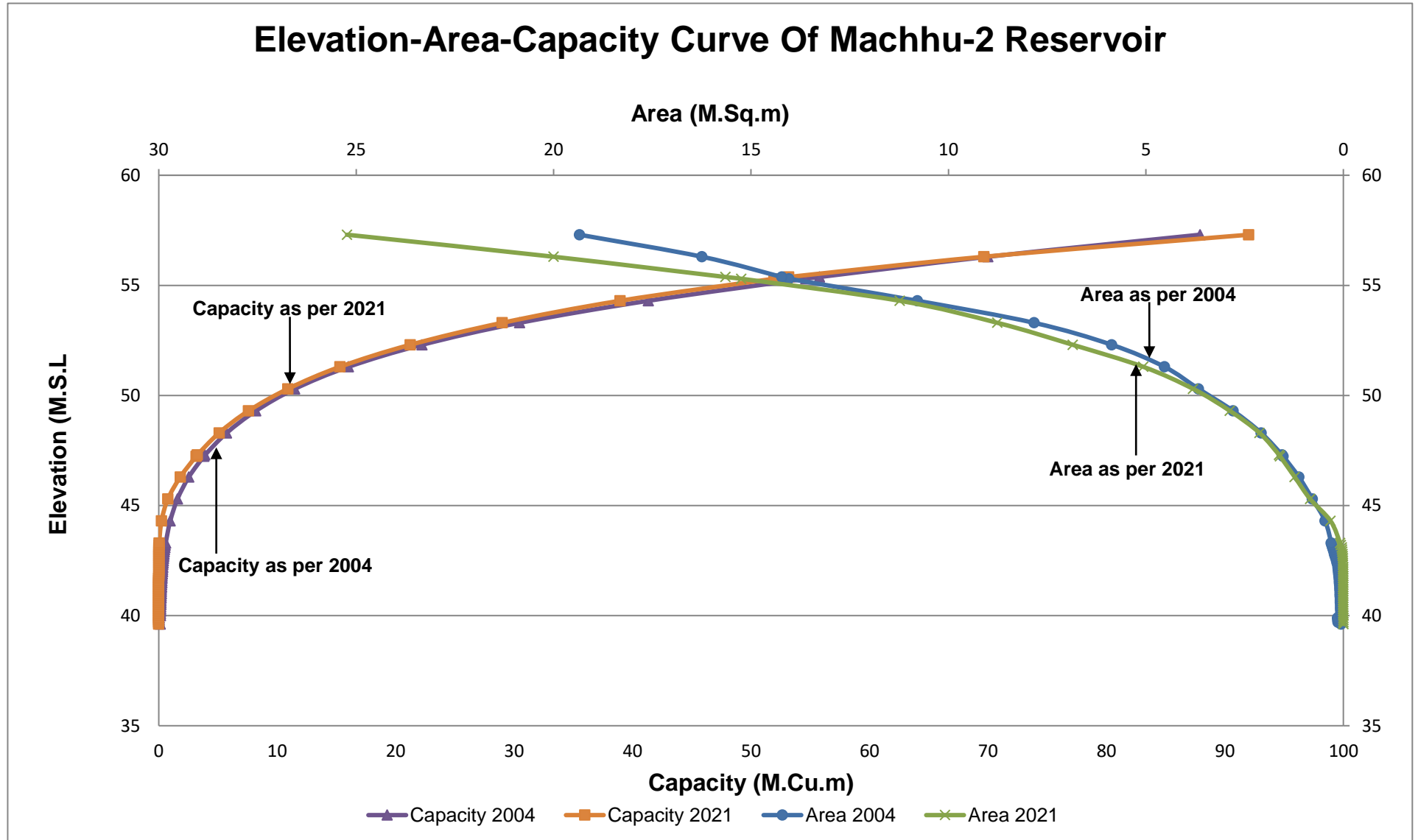


Figure 7: Elevation-area-capacity curves (2004 and 2021)

8.6 Loss of Storage

Reservoirs, created by dams on rivers, lose their storage capacity due to sedimentation. A large proportion of the transported silt eventually gets deposited at different levels of a reservoir and causes reduction not only in dead storage but also in live storage capacities. The consequence of loss in storage due to sediment accumulation may even cause operational problems. Periodic capacity survey of a reservoir is thus essential to ascertain the rate of sedimentation and reduction in storage capacity for efficient and productive management of water resources. Reservoir siltation affects the safety of an old reservoir since the sediment in the reservoirs increases the load on the wall of the dam.

The amount of silt present in any reservoir is attributed to the geological nature of the area surrounding the reservoir. If the area is rich in silt, definitely any reservoir located within the area will have a greater proportion of silt in any sediment transported into it. Since erosion sedimentation is a serious problem in different parts of the world today resulting in several reservoirs becoming completely silted over, designers should aim at the following mitigation measures of soil erosion and sediment transport processes:

- Prevention of further land degradation in any catchment to reduce siltation
- Prevention of soil erosion from catchment to reduce siltation of reservoir
- Ensuring adequate irrigation water to the demand area
- Improving land capability moisture regime in the watershed
- Improving land use to match capability
- Maintaining ecological balance in a catchment area
- Educating people in the management of a catchment

Loss of storage/capacity was assessed by comparing the capacity values between the surveys conducted in 2004 and 2021. As no data/information is available regarding the area observed at different elevations in the 2004 survey results (Revised Capacity Table of Machhu-2 Irrigation Scheme Sedimentation Survey Done by GERI, Vadodara, Nov 2004, provided by client), hence only the capacity results have been used for comparison.

It is observed that a minimum elevation (at which a value is obtained in the gross storage capacity column after volume calculations) of 39.62m and 40.0m was observed in the surveys carried out in 2004 and 2021 (present survey) respectively. Hence, it can be said that the minimum elevation observed in the reservoir over the years (from 2004 to 2021) has increased, which indicates that sedimentation has occurred over the years. Thus, it can be understood that the reservoir is filled with silt between elevations 39.62m and 40.0m from the year 2004 to 2021. Hence the cumulative capacity calculated in 2021 at elevation 39.62m is zero as indicated in **Table 8**.

On comparing the capacity data of the survey carried out in 2004 with that of 2021, it is observed that from elevations 39.62m to 56.0m there is a loss in reservoir capacity over the years from 2004 to 2021. However, an increase in reservoir capacity has been observed between elevations 56.50m and 57.30m (FRL) (**Table 8**). An increase in cumulative gross storage capacity from 87.906 M.cu.m (in 2004) to 92.013 M.cu.m (in 2021) was observed at 57.30m (FRL) over the years from 2004 to 2021 with a calculated increase in gross storage capacity of 4.67%. The dead storage capacity at D.S.L (47.24m) decreased from 3.804 M.cu.m to 3.151 M.cu.m over the years from 2004 to 2021 with a calculated loss in dead storage capacity of 17.17%. The amount of sediment deposited during this period (from 2004 to 2021) at D.S.L is 0.653 Mm³.

The details of the possible erosion/ deposition phenomena and the resulting percentage increase/ loss in the gross storage capacity of the reservoir at different elevations calculated on comparing the capacity

results from the surveys carried out in 2004 and 2021 have been provided in **Table 8**.

The elevation capacity curves comparing the results of the surveys carried out in the year 2004 and 2021 are shown in **Figure 7**.

Elevation (Above MSL, m)	Capacity 2004 (M.Cu.m)	Capacity 2021 (M.Cu.m)	Erosion / Deposition of Sediment (M.Cu.m)	% Increase / Loss of Capacity	Remarks
39.62	0.131	0.000	0.131	100.00	Loss of capacity (Deposition of sediments)
40.00	0.153	0.001	0.152	99.35	Loss of capacity (Deposition of sediments)
40.50	0.186	0.001	0.185	99.46	Loss of capacity (Deposition of sediments)
41.00	0.223	0.001	0.222	99.55	Loss of capacity (Deposition of sediments)
41.50	0.269	0.002	0.267	99.26	Loss of capacity (Deposition of sediments)
42.00	0.321	0.003	0.318	99.07	Loss of capacity (Deposition of sediments)
42.50	0.393	0.007	0.386	98.22	Loss of capacity (Deposition of sediments)
43.00	0.498	0.016	0.482	96.79	Loss of capacity (Deposition of sediments)
43.50	0.644	0.050	0.594	92.24	Loss of capacity (Deposition of sediments)
44.00	0.824	0.143	0.681	82.65	Loss of capacity (Deposition of sediments)
44.50	1.065	0.300	0.765	71.83	Loss of capacity (Deposition of sediments)
45.00	1.354	0.548	0.806	59.53	Loss of capacity (Deposition of sediments)
45.50	1.735	0.951	0.784	45.19	Loss of capacity (Deposition of sediments)
46.00	2.189	1.470	0.719	32.85	Loss of capacity (Deposition of sediments)
46.50	2.752	2.078	0.674	24.49	Loss of capacity (Deposition of sediments)
47.00	3.360	2.779	0.581	17.29	Loss of capacity (Deposition of sediments)
47.24	3.804	3.151	0.653	17.17	Loss of capacity (Deposition of sediments)
47.50	3.976	3.582	0.394	9.91	Loss of capacity (Deposition of sediments)
48.00	4.585	4.491	0.094	2.05	Loss of capacity (Deposition of sediments)
48.50	6.079	5.537	0.542	8.92	Loss of capacity (Deposition of sediments)
49.00	7.234	6.753	0.481	6.65	Loss of capacity (Deposition of sediments)
49.50	8.716	8.169	0.547	6.28	Loss of capacity (Deposition of sediments)
50.00	10.298	9.806	0.492	4.78	Loss of capacity (Deposition of sediments)
50.50	12.226	11.685	0.541	4.42	Loss of capacity (Deposition of sediments)
51.00	14.425	13.842	0.583	4.04	Loss of capacity (Deposition of sediments)
51.50	17.062	16.338	0.724	4.24	Loss of capacity (Deposition of sediments)
52.00	20.096	19.255	0.841	4.18	Loss of capacity (Deposition of sediments)
52.50	23.627	22.628	0.999	4.23	Loss of capacity (Deposition of sediments)
53.00	27.648	26.467	1.181	4.27	Loss of capacity (Deposition of sediments)
53.50	32.356	30.792	1.564	4.83	Loss of capacity (Deposition of sediments)
54.00	37.670	35.689	1.981	5.26	Loss of capacity (Deposition of sediments)
54.50	43.689	41.239	2.450	5.61	Loss of capacity (Deposition of sediments)

55.00	50.226	47.584	2.642	5.26	Loss of capacity (Deposition of sediments)
55.50	57.442	55.084	2.358	4.11	Loss of capacity (Deposition of sediments)
56.00	64.970	63.847	1.123	1.73	Loss of capacity (Deposition of sediments)
56.50	73.240	73.736	0.496*	0.68**	Increase of capacity (Erosion of sediments)
57.00	82.078	84.744	2.666*	3.25**	Increase of capacity (Erosion of sediments)
57.30	87.906	92.013	4.107*	4.67**	Increase of capacity (Erosion of sediments)

Table 8: Loss/ increase of storage capacity between 2004 and 2021

Note:

- Values highlighted with single asterisks (*) represents the volume of sediments eroded.
- Values highlighted with double asterisks (**) represents the percentage (%) increase of storage capacity.

8.7 Data Comparison between 1989 and 2021

Definitions

Full Reservoir Level: Denoted by **FRL**, this level corresponds to the storage which includes both inactive and active storages and also the flood storage, it is the highest reservoir level that can be maintained without spillway discharge.

Minimum Drawdown Level (M.D.D.L): It is the level below which the water from reservoir will not be drawn down to maintain a minimum head required in power projects.

Maximum Water Level (MWL): This water level that likely to be attained during the passage of the design flood. This level is also called as the highest reservoir level or the highest flood level.

Live storage: it is volume of water actually available at any time between the Dead Storage Level and the Full Reservoir Level.

Dead Storage Level (D.S.L): Below this level, there are no outlets to drain the water in the reservoir by gravity.

Dead storage: It is the total storage below the invert level of the lowest discharge outlet from the reservoir. It may be available to contain sedimentation, provided the sediment does not adversely affect the lowest discharge.

1.1.5 Rate of siltation

The increase of storage and rate of erosion calculations are based on the following basic data.

- The catchment area of the reservoir is 1193.47 sq.km.
- The FRL of the reservoir is given as 57.30m.
- The dead storage level of the reservoir is at 47.24m.

The results obtained after comparing the survey data of the year 1989 with that of 2021 are provided below:

Cumulative gross storage capacity at 57.30m (FRL) as per 1989 survey	= 100.750 M.Cu.m
Capacity at F.R.L as per 2021 survey	= 92.013 M.Cu.m
Silting in 32 years (1989-2021)	= 100.750 – 92.013 = 8.737 M.Cu.m
Annual Siltation	= 8.737/32= 0.273 M.Cu.m/yr
Rate of Siltation (Silt Index)	= (0.273/1193.47) x 1000 = 0.229 Th.Cu.m/sq.km/year = 2.29 Ha.m/100sq.km./year

1.1.6 Loss of gross storage capacity at F.R.L

Cumulative gross storage capacity at 57.30m (FRL) as per 1989 survey	= 100.750 M.Cu.m
Capacity at F.R.L as per 2021 survey	= 92.013 M.Cu.m
Loss of storage in 32 years (1989-2021)	= 100.750 – 92.013 = 8.737 M.Cu.m
Percentage loss of Gross storage at F.R.L in 49 years	= (8.737/100.750) x 100 = 8.67%
Annual percentage loss	= 8.67/32 = 0.27%

1.1.7 Loss of dead storage capacity

Capacity at D.S.L (47.24m) as per 1989 survey	= 9.760 M.Cu.m
Capacity at D.S.L as per 2021 survey	= 3.151 M.Cu.m
Loss of storage up to D.S.L	= 9.760 – 3.151 = 6.609 M.Cu.m
Percentage loss of dead storage capacity in 32 years	= (6.609/9.760) x 100 = 67.72%
Annual percentage loss	= 67.72/32 = 2.12%

1.1.8 Loss of live storage capacity

Live storage capacity as per 1989 survey	= 100.750 – 9.760 = 90.990 M.Cu.m
Live storage capacity as per 2021 survey	= 92.013 – 3.151 = 88.862 M.Cu.m
Loss of live storage capacity	= 90.990 – 88.862 = 2.128 M.Cu.m
Percentage loss of live storage capacity in 32 years	= (2.128/90.990) x 100 = 2.34%
Annual percentage loss	= 2.34/32 = 0.07%

8.8 Summary of capacity surveys (1989 and 2021)

Original Reservoir Data:

Year of Construction	: 1972
Year of re-construction after breach in 1979	: 1989-90
Year of impounding	: 1989
Catchment Area	: 1193.47 Sq.Km
Spread area at F.R.L (57.30m)	: N/A
Gross storage at F.R.L (57.30m)	: 100.75 M.Cu.m
Dead storage at D.S.L (47.24m)	: 9.76 M.Cu.m
Live storage at F.R.L (57.30m)	: 90.99 M.Cu.m

Rate of sedimentation (at F.R.L 57.30m) with respect to impounding year 1989													
Sr. No	Year of Survey	Capacity in M.Cu.m			Silt Deposited in M.Cu.m	Period in years	Silt Rate in M.Cu.m/Year	Loss in Capacity in M.Cu.m and percentage			Silt Index ham/100 Sq.Km/Yr	Annual % loss of capacity	Remarks
		Dead	Live	Gross				Dead	Live	Gross			
1	1972	9.760	90.990	100.750	-	-	-	-	-	-	-	-	-
3	2021	3.151	88.862	92.013	8.737	32	0.273	6.609 67.72%	2.128 2.34%	8.737 8.67%	2.29	0.27	Significant Category

Table 9: Rate of Sedimentation at F.R.L (57.30m)

According to IS-12182 (1987)

Annual % loss - Class of Reservoir

Up to 0.1	-	Insignificant
0.1 to 0.5	-	Significant
Above 0.5 years	-	Serious

Rate of Silt	-	Loss in Gross Capacity/No of Years
Silt Index	-	Silt rate/Catchment area) x 10000
Annual % Loss	-	Loss in % of Gross Capacity/No. of

8.9 Data Comparison between 2004 and 2021

For the Machhu-2 reservoir, the cumulative gross storage capacity has increased from 87.906 Mm³ (in 2004) to 92.013 Mm³ (in 2021) at FRL (57.30m). Hence a percentage increase of gross storage capacity at FRL of 4.67% over the 17 years (from 2004 to 2021) is calculated from capacity survey results of 2004 and 2021.

The details and results obtained after comparing the capacity results of 2004 with that of 2021 survey have been provided in section 1.1.9 to section 1.1.12.

1.1.9 Rate of erosion

The increase of storage and rate of erosion calculations are based on the following basic data.

- i) The catchment area of the reservoir is 1193.47 sq.km.
- ii) The FRL of the reservoir is given as 57.30m.
- iii) The dead storage level of the reservoir is at 47.24m.

The results obtained after comparing the survey data of the year 2004 with that of 2021 are provided below:

Cumulative gross storage capacity at 57.30m (FRL) as per 2004 survey	= 87.906 Mm ³
Cumulative gross storage capacity at 57.30m (FRL) as per 2021 survey	= 92.013 Mm ³
Erosion in 17 years (2004-2021)	= 92.013 – 87.906 = 4.107 Mm ³
Annual erosion	= 4.107/17 = 0.242 Mm ³ /year
Rate of erosion	= (0.242/1193.47) x 1000 = 0.202 Th.Cu.m/sq.km/year = 2.02 Ha.m/100sq.km./year

1.1.10 Increase of gross storage capacity at 57.30m (FRL)

Capacity at 57.30m as per 2004 survey	= 87.906 Mm ³
Capacity at 57.30m as per 2021 survey	= 92.013 Mm ³
Increase of gross storage in 17 years (2004-2021)	= 92.013 – 87.906 = 4.107 Mm ³
Percentage increase of gross storage at 57.30m (FRL) in 17 years	= (4.107/87.906) x 100 = 4.67%
Annual percentage increase	= 4.67/17 = 0.27%

1.1.11 Decrease of dead storage capacity

Capacity at D.S.L (47.24m) as per 2004 survey	= 3.804 Mm ³
Capacity at D.S.L (47.24m) as per 2021 survey	= 3.151 Mm ³
Decrease of storage up to D.S.L	= 3.804 – 3.151 = 0.653 Mm ³
Percentage decrease of dead storage capacity in 17 years	= (0.653/3.804) x 100 17.17%
Annual percentage decrease	= 17.17/17 = 1.01%

1.1.12 Increase of live storage capacity

Live storage capacity at 57.30m (FRL) as per 2004 survey	= 84.102 Mm ³
Live storage capacity at 57.30m (FRL) as per 2021 survey	= 88.862 Mm ³
Increase of live storage capacity in 17 years (2004-2021)	= 88.862 – 84.102
	= 4.760 Mm ³
Percentage increase of live storage capacity in 17 years	= (4.760/84.102) x 100
	= 5.66%
Annual percentage increase	= 5.66/17
	= 0.33%

8.10 Summary of Capacity Surveys (2004 and 2021)

Reservoir Data as per 2004 Silt Survey:

Year of impounding	: 1972
Year of Silt Survey	: 2004
Catchment Area	: 1193.47 Sq.Km
Spread area at F.R.L (57.30m)	: 19.346 Sq.Km
Gross storage at F.R.L (57.30m)	: 87.906 M.Cu.m
Dead storage at D.S.L (47.24m)	: 3.804 M.Cu.m
Live storage at F.R.L (57.30m)	: 84.102 M.Cu.m

Rate of siltation/erosion (at F.R.L 57.30m) with respect to the silt survey data in the year 2004													
Sr. No	Year of Survey	Capacity in M.Cu.m			Erosion in M.Cu.m	Period in years	Erosion Rate in M.Cu.m/Year	Increase/Loss in Capacity in M.Cu.m and percentage			Erosion index ham/100 Sq.Km/Yr	Annual % increase of capacity	Remarks
		Dead	Live	Gross				Dead	Live	Gross			
1	2004	3.804	84.102	87.906	-	-	-	-	-	-	-	-	-
2	2021	3.151	88.862	92.013	4.107	17	0.242	0.653* 17.17%**	4.760 5.66%	4.107 4.67%	2.02	0.27	-

Table 10: Rate of Erosion at F.R.L (57.30m)

According to IS-12182 (1987)

Annual % loss - Class of Reservoir

Up to 0.1	-	Insignificant
0.1 to 0.5	-	Significant
Above 0.5	-	Serious

Rate of Erosion	-	Increase in Gross Capacity/No of Years
Erosion Index	-	(Erosion rate/Catchment area) x 10000
Annual % Increase	-	Increase in % of Gross Capacity/No. of years

Note:

- Values highlighted with single asterisks (*) represents the volume of sediment deposited.
- Values highlighted with double asterisks (**) represents the percentage (%) loss of storage capacity.

8.11 Control of Sedimentation in Reservoirs

Sedimentation in a reservoir is a natural process which affects the capacity of the reservoir. Excess deposition of sediment directly affects the useful capacity of the reservoir based on the project requirements like irrigation, hydroelectric power, flood control etc. The rate of deposition of sediment largely depends on the annual sediment load carried by the streams and up to what extent the sediment is retained in the reservoir. This, in turn, depends upon a number of factors such as the area and nature of the catchment, level use pattern (cultivation practices, grazing, logging, construction activities and conservation practices), rainfall pattern, storage capacity, period of storage in relation to the sediment load of the stream, particle size distribution in the suspended sediment, channel hydraulics, location and size of sluices, outlet works, configuration of the reservoir, and the method and purpose of releases through the dam. An appropriate approach to these factors mentioned above is essential for efficient control of sedimentation and therefore to extend the life of the reservoir.

Numerous techniques are developed to control the sedimentation in reservoirs, broadly classified as:

- I. Suitable design of reservoir
- II. Restrict the sediment inflow
- III. Limit the sediment deposition
- IV. Regular removal of deposited sediment

1.1.13 Suitable design of reservoir

The volume of discharge directly affects the rate of sedimentation. The rate of sedimentation increases with the volume of discharge. The higher deposition of sediment within a reservoir increases the surface area of the water, thereby resulting in greater loss of water by evaporation. This will ultimately decrease of storage capacity which in turn lowers the trap efficiency of the reservoir.

The capacity of the reservoir and the size and characteristics of the reservoir and its drainage area are the most important factors governing the annual rate of accumulation of sediment. Periodic reservoir sediment surveys provide information about the rate of sediment deposited, hence can enable us to make necessary steps to limit the same. The sedimentation may take place not only in the dead storage area of a reservoir; reservoir studies have revealed significant deposition of sediment in the live storage area of a reservoir as well.

The capacity of reservoirs largely depends on various factors. Hence the following points need to be considered for their optimum design.

- Topographical, geological and geomorphological factors which directly affect the sediment yield
- Sediment delivery characteristics of the channel system
- The efficiency of the reservoir as a sediment trap
- The ratio of capacity of the reservoir to the inflow
- Configuration of the reservoir
- Method of operation of the reservoir
- Provisions for silt exclusion

1.1.14 Restrict the sediment inflow

The sediment inflow to the reservoirs can be controlled by proper watershed management and soil conservation measures to check production and transport of sediment to the catchment area. Also adopt adequate preventive measures to check the inflow of sediment into the reservoir. Soil conservation involves the prevention of loss of the topmost layer of the soil from erosion or prevention of reduced fertility caused by over usage, acidification, salinization or other chemical soil contamination. The soil conservation measures are further sub-divided as

- Engineering

- Agronomy
- Forestry

Engineering methods

Check dams

One of the methods of soil conservation is the use of check dams. A check dam is a small dam which can be either temporary or permanent, built across a minor channel, swale, or drainage ditch. They are used to slow the velocity of concentrated water flows, a practice that helps reduce erosion.

Contour trenching and bunding

In the contour trenching method, the surrounding area of the reservoir is ploughed, like contour lines. These contour lines create a water break which reduces the formation of rills and gullies during times of heavy precipitation, allowing more time for the water to settle into the soil. Also, trenches can be artificially dug along the contour lines. Water flowing down the hill is retained by the trenches, and infiltrates the soil below. Manually dug trenches are smaller, machine dug trenches can be deeper. The dimensions and the format of the trenches should correspond to the local climate and soil conditions.

A similar practice is contour bunding where stones are placed around the contours of slopes. Contour bunding or contour bundling, and contour farming involves the placement of lines of stones along the natural rises of a landscape. These techniques help to capture and hold rainfall before it can become runoff. Contour bunds also help to control soil erosion.

Gully Plugging

A gully plug is a small, temporary or permanent dam constructed across a drainage ditch, swale, or channel to lower the speed of concentrated flows. These dams can be constructed using locally available materials. These small dams reduce the speed of water flow and minimise the erosive power of runoff. They also promote the deposition of eroded materials to further stabilise the gullies.

Agronomy methods

Agronomic conservation measures function by reducing the impact of raindrops through interception and thus reducing soil erosion and increasing infiltration rates, and also reducing surface runoff and soil erosion. The major agronomic soil and water conservation practices are strip cropping, mixed cropping, intercropping, fallowing, mulching, contour ploughing, crop rotation, conservation tillage, and agroforestry.

Forestry methods

Forestry measures include forest conservancy, control on grazing, lumbering operations and forest fires along with management and protection of forest plantations.

1.1.15 Limit sediment deposition

The amount of suspended sediment is comparatively large during and just after flood flow. The settlement of sediment in the reservoir can be controlled by adequate operation of outlets in such a manner as to permit selective withdrawals of water having a higher-than-average sediment content. Thus, more water wasted at peak time of inflow will result a low level of sediment to deposit in the reservoir. There are two methods:

Density Current

Water at various levels of a reservoir often contains radically different concentrations of suspended sediment, particularly during and after flood flows and if all waste-water could be withdrawn at those levels where the concentration is highest, a significant amount of sediment might be removed from the reservoir. The density differences between the sediment-laden inflow and the clear water in the reservoir

leads to a turbidity current which plunges beneath the clear water and moves towards the dam as a submerged current. The proper allocation of gates or sluices can remove a significant amount of sediment-saturated water and therefore can reduce the amount of sedimentation.

Waste-Water Release

This method is applicable only when a reservoir is of such a size that a small part of large flood flows will fill it. A series of outlets at various elevations can eject sediment-saturated water. This method, which can remove considerable amount of sediment from the reservoir through proper gate control, will differ greatly with different locations. The drawback of this method is that waste-water release is only possible when water can be or should be wasted.

1.1.16 Regular removal of deposited sediment

Removal of accumulated sediment is considered as the last resort as the operations are very expensive unless the excavated sediment is economically usable. The removal of sediment deposits may be accomplished by a variety of mechanical and hydraulic methods, such as excavation, dredging, draining and flushing, sluicing aided by such measures as hydraulic or mechanical agitation or blasting of the sediment.

Excavation

Excavation is the removal of the sediment by hand or power operated shovel, dragline scraper or other mechanical means after draining most of the water. The excavation of silt and clay which constitute most of the material in larger reservoirs is more difficult than the excavation of sand and gravel. Fine-textured sediment cannot be excavated easily from larger reservoirs unless it is relatively fluid or relatively compact.

Dredging

In this method, the deposit is removed from the bottom of the reservoir irrespective of the level of storage using mechanical or hydraulic equipment. The various types of dredging are mechanical dredging by bucket, suction dredging with floating pipeline and a pump on a barge and siphon dredging with a floating pipe extending over the dam or connected to an opening in the dam and with a pump on a barge.

Draining and flushing

This method, also called flood sluicing, involves a relatively slow release of all stored water in a reservoir through gates or valves located near the bottom of the dam and the maintenance thereafter of open outlets for a shorter or longer period during which normal stream flow cuts into or is directed against the sediment deposits.

Sluicing with Controlled Water

In this method the controlled water supply permits choosing the time of sluicing more advantageously and the water may be directed more effectively against the sediment deposits. While the flood sluicing depends either on the occurrence of flood or on being able to release rapidly all of a full or nearly full supply of water in the main reservoir. The advantage of this method is that generally more sediment can be removed per unit of water used than in flood scouring or draining and flushing.

Sluicing with Hydraulics and Mechanical Agitation

In this method, stirring up, breaking up or moving deposits of a sediment into a stream current moving through a drained reservoir basin or into a full reservoir will tend to make the removal of sediment from the reservoir more complete. Wherever draining, flushing or sluicing appear to be warranted, the additional use of hydraulic means for stirring up the sediment deposits, or sloughing them off, into a stream flowing through the reservoir basin should be considered.

9 CONCLUSIONS

- F.R.L of the Machhu-2 reservoir is at 57.30m above M.S.L. Machhu-2 reservoir has a catchment area of 1193.47 km².
- From the document provided by the client, the gross storage at F.R.L (57.30m) and dead storage at D.S.L: (47.24m) from the impounding survey in 1989 were found to be 100.72 Mm³ and 9.76 Mm³ respectively.
- The gross storage at F.R.L (57.30m) and dead storage at D.S.L: (47.24m) during the survey carried out in 2004 were found to be 87.906 Mm³ and 3.804 Mm³ respectively (Source: Revised Capacity Table of Machhu-2 Irrigation Scheme Sedimentation Survey Done by GERI, Vadodara, Nov 2004, provided by the client).
- The gross storage at F.R.L (57.30m) and dead storage at D.S.L: (47.24m) during the survey carried out in 2021 were found to be 92.013 Mm³ and 3.151 Mm³ respectively
- Based on the document (Revised Capacity Table of Machhu-2 Irrigation Scheme Sedimentation Survey Done by GERI, Vadodara, Nov 2004), it is understood that a capacity survey was carried out in the year 2004. Hence, the survey data between the years 2004 and 2021 (present survey by OSaS) have been compared to draw the conclusions on loss/increase of reservoir capacity and rate of siltation/erosion that has occurred over the years.
- Change in storage capacity was assessed by comparing the capacity values between the surveys conducted in 2004 and 2021.
- It is observed that a minimum elevation (at which a value is obtained in gross storage capacity column after volume calculations) of 39.62m and 40.0m was observed in the surveys carried out in 2004 and 2021 respectively. Hence, it can be said that the minimum elevation observed in the reservoir over the years (from 2004 to 2021) has increased, which indicates that sedimentation has occurred over the years. Thus, it can be understood that the reservoir is filled with silt between elevations 39.62m and 40.0m from the year 2004 to 2021. Hence, the cumulative capacity calculated in 2021 at elevation 39.62m is zero as indicated in **Table 8**.
- A decrease in cumulative gross storage capacity from 100.750 Mm³ (in 1989) to 92.013 Mm³ (in 2021) was observed at 57.30m (FRL) over the years from 1989 to 2021 with a calculated loss in gross storage capacity of 8.67%. The dead storage capacity at D.S.L (47.24m) decreased from 9.760 Mm³ to 3.151 Mm³ over the years from 1989 to 2021 with a calculated loss in dead storage capacity of 67.72%. The amount of sediment deposited during this period (from 1989 to 2021) at D.S.L is 6.609 Mm³. The live storage capacity at FRL (57.30m) decreased from 90.990 Mm³ to 88.862 Mm³ over the years from 1989 to 2021 with a calculated loss in live storage capacity of 2.34%.
- An increase in cumulative gross storage capacity from 87.906 Mm³ (in 2004) to 92.013 Mm³ (in 2021) was observed at 57.30m (FRL) over the years from 2004 to 2021 with a calculated increase in gross storage capacity of 4.67%. The dead storage capacity at D.S.L (47.24m) decreased from 3.804 Mm³ to 3.151 Mm³ over the years from 2004 to 2021 with a calculated loss in dead storage capacity of 17.17%. The amount of sediment deposited during this period (from 2004 to 2021) at D.S.L is 0.653 Mm³. The live storage capacity at FRL (57.30m) increased from 84.102 Mm³ to 88.862 Mm³ over the years from 2004 to 2021 with a calculated increase in live storage capacity of 5.66%.
- The details of the possible erosion/ deposition phenomena and the resulting percentage increase/loss in the gross storage capacity of the reservoir at different elevations calculated on comparing the capacity results from the surveys carried out in 2004 and 2021 have been provided in **Table 8**.
- The elevation-area-capacity curves showing a comparison of capacity survey results (2004 vs 2021) are generated using the data provided in **Table 7** and is presented in **Figure 7**.

- The topographic survey was extended till the elevation of 59.20m (HFL) above MSL as instructed by the client.
- From the 2021 survey results, a minimum elevation of 37.9m and a maximum elevation of 55.8m above MSL was observed in the southeastern and west-northwestern portions of the surveyed area respectively within the bathymetric section. A minimum elevation of 49.5m and a maximum elevation of 75.9m was observed in the northwestern and near the central portions of the surveyed area respectively within the topographic section. A description of the bathymetric and topographic features observed in the surveyed area have been provided in section 7 of this report.
- The comparison between the results obtained from the impounding survey carried out in 1989 and 2021 indicates that siltation has occurred in the reservoir over the past 32 years and the rate of siltation is calculated to be 2.29 Ha.m/100sq.km./year. Annual percentage loss of gross storage capacity and live storage capacity are 0.27% and 0.07% respectively over the past 32 years (from 1989 to 2021). The annual percentage loss of dead storage capacity is calculated to be 2.12% over the past 32 years (from 1989 to 2021). The details and calculations are provided in section **8.7**
- The comparison between the results obtained from the surveys carried out in 2004 and 2021 (17 years) indicates that erosion has occurred in the reservoir over the past 17 years and the rate of erosion is calculated to be 2.02 Ha.m/100sq.km./year. Annual percentage increase of gross storage capacity and live storage capacity are 0.27% and 0.33% respectively over the past 17 years (from 2004 to 2021). The annual percentage decrease of dead storage capacity is calculated to be 1.01% over the past 17 years (from 2004 to 2021). The details and calculations are provided in section **8.9**.

10 REFERENCES

1. Wikipedia - https://en.wikipedia.org/wiki/1979_Machchhu_dam_failure
2. Website - <http://117.252.14.242/rbis/basin%20maps/Lunl.htm>
3. Website - <https://guj-nwrws.gujarat.gov.in/showpage.aspx?contentid=2038&lang=English>
4. Website - <https://indiawris.gov.in/wiki/doku.php?id=machhu>
5. CE IIT, Kharagpur - <https://nptel.ac.in/content/storage2/courses/105105110/pdf/m4l05.pdf>
6. *Siltation in reservoirs* by C.N. Mama and F.O. Okafor
7. *Space Technology in Assessment of Loss in Live Storage Capacity of Reservoir* by Karishma Bhatnagar Malhotra, Rishi Srivastava and Amrendra Kumar Singh.
8. *Erosion and reservoir sedimentation* by The McGraw Hill Companies.
9. *Soil erosion, sediment yield and sedimentation of reservoir* by S. Dutta
10. *Statement showing the details of dams in Gujarat (report_15-03-2021)* by N.W.R.W.S.and Kalpsar department.
11. *Hydrological model for design flood estimation for the Bhadar dam* by Jahnvi Bhatt, P.H. Pandya and Prof H.M. Gandhi

Annexure - 1
Elevation-Area-Capacity Table (2021)
Machhu-2 Reservoir

Elevation (MSL, ft)	Elevation (MSL, m)	Area (M.Sq.ft)	Area (M.Sq.m)	Live Capacity		Gross Capacity (Live + Dead)	
				Volume (M.Cu.ft)	Volume (M.Cu.m)	Volume (M.Cu.ft)	Volume (M.Cu.m)
129.99	39.62	0.000	0.000	0.000	0.000	0.000	0.000
131.23	40.00	0.000	0.000	0.000	0.000	0.035	0.001
131.56	40.10	0.011	0.001	0.000	0.000	0.035	0.001
131.89	40.20	0.011	0.001	0.000	0.000	0.035	0.001
132.22	40.30	0.011	0.001	0.000	0.000	0.035	0.001
132.55	40.40	0.011	0.001	0.000	0.000	0.035	0.001
132.87	40.50	0.011	0.001	0.000	0.000	0.035	0.001
133.20	40.60	0.011	0.001	0.000	0.000	0.035	0.001
133.53	40.70	0.011	0.001	0.000	0.000	0.035	0.001
133.86	40.80	0.011	0.001	0.000	0.000	0.035	0.001
134.19	40.90	0.011	0.001	0.000	0.000	0.035	0.001
134.51	41.00	0.011	0.001	0.000	0.000	0.035	0.001
134.84	41.10	0.011	0.001	0.000	0.000	0.035	0.001
135.17	41.20	0.011	0.001	0.000	0.000	0.071	0.002
135.50	41.30	0.022	0.002	0.000	0.000	0.071	0.002
135.83	41.40	0.022	0.002	0.000	0.000	0.071	0.002
136.15	41.50	0.022	0.002	0.000	0.000	0.071	0.002
136.48	41.60	0.022	0.002	0.000	0.000	0.071	0.002
136.81	41.70	0.022	0.002	0.000	0.000	0.071	0.002
137.14	41.80	0.032	0.003	0.000	0.000	0.106	0.003
137.47	41.90	0.032	0.003	0.000	0.000	0.106	0.003
137.80	42.00	0.032	0.003	0.000	0.000	0.106	0.003
138.12	42.10	0.043	0.004	0.000	0.000	0.141	0.004
138.45	42.20	0.065	0.006	0.000	0.000	0.141	0.004
138.78	42.30	0.086	0.008	0.000	0.000	0.177	0.005
139.11	42.40	0.108	0.010	0.000	0.000	0.212	0.006
139.44	42.50	0.118	0.011	0.000	0.000	0.247	0.007
139.76	42.60	0.129	0.012	0.000	0.000	0.283	0.008
140.09	42.70	0.172	0.016	0.000	0.000	0.318	0.009
140.42	42.80	0.205	0.019	0.000	0.000	0.388	0.011
140.75	42.90	0.269	0.025	0.000	0.000	0.459	0.013
141.08	43.00	0.334	0.031	0.000	0.000	0.565	0.016
141.40	43.10	0.452	0.042	0.000	0.000	0.671	0.019
141.73	43.20	0.678	0.063	0.000	0.000	0.848	0.024
142.06	43.30	0.883	0.082	0.000	0.000	1.095	0.031
142.39	43.40	1.055	0.098	0.000	0.000	1.413	0.040
142.72	43.50	1.249	0.116	0.000	0.000	1.766	0.050
143.04	43.60	1.485	0.138	0.000	0.000	2.190	0.062
143.37	43.70	1.894	0.176	0.000	0.000	2.719	0.077
143.70	43.80	2.250	0.209	0.000	0.000	3.390	0.096
144.03	43.90	2.551	0.237	0.000	0.000	4.167	0.118

Elevation (MSL, ft)	Elevation (MSL, m)	Area (M.Sq.ft)	Area (M.Sq.m)	Live Capacity		Gross Capacity (Live + Dead)	
				Volume (M.Cu.ft)	Volume (M.Cu.m)	Volume (M.Cu.ft)	Volume (M.Cu.m)
144.36	44.00	2.788	0.259	0.000	0.000	5.050	0.143
144.69	44.10	3.025	0.281	0.000	0.000	5.968	0.169
145.01	44.20	3.240	0.301	0.000	0.000	6.992	0.198
145.34	44.30	3.477	0.323	0.000	0.000	8.087	0.229
145.67	44.40	3.800	0.353	0.000	0.000	9.288	0.263
146.00	44.50	4.166	0.387	0.000	0.000	10.594	0.300
146.33	44.60	4.575	0.425	0.000	0.000	12.007	0.340
146.65	44.70	5.027	0.467	0.000	0.000	13.561	0.384
146.98	44.80	5.543	0.515	0.000	0.000	15.291	0.433
147.31	44.90	6.178	0.574	0.000	0.000	17.234	0.488
147.64	45.00	6.910	0.642	0.000	0.000	19.352	0.548
147.97	45.10	7.632	0.709	0.000	0.000	21.754	0.616
148.29	45.20	8.353	0.776	0.000	0.000	24.367	0.690
148.62	45.30	9.063	0.842	0.000	0.000	27.228	0.771
148.95	45.40	9.720	0.903	0.000	0.000	30.300	0.858
149.28	45.50	10.215	0.949	0.000	0.000	33.584	0.951
149.61	45.60	10.645	0.989	0.000	0.000	36.974	1.047
149.93	45.70	11.022	1.024	0.000	0.000	40.541	1.148
150.26	45.80	11.377	1.057	0.000	0.000	44.214	1.252
150.59	45.90	11.754	1.092	0.000	0.000	48.028	1.360
150.92	46.00	12.131	1.127	0.000	0.000	51.913	1.470
151.25	46.10	12.497	1.161	0.000	0.000	55.974	1.585
151.57	46.20	12.874	1.196	0.000	0.000	60.141	1.703
151.90	46.30	13.261	1.232	0.000	0.000	64.414	1.824
152.23	46.40	13.659	1.269	0.000	0.000	68.828	1.949
152.56	46.50	14.068	1.307	0.000	0.000	73.384	2.078
152.89	46.60	14.477	1.345	0.000	0.000	78.045	2.210
153.22	46.70	14.897	1.384	0.000	0.000	82.884	2.347
153.54	46.80	15.317	1.423	0.000	0.000	87.828	2.487
153.87	46.90	15.726	1.461	0.000	0.000	92.913	2.631
154.20	47.00	16.157	1.501	0.000	0.000	98.140	2.779
154.53	47.10	16.619	1.544	0.000	0.000	103.507	2.931
154.86	47.20	17.072	1.586	0.000	0.000	109.052	3.088
154.99 (DSL)	47.24 (DSL)	17.243	1.602	0.000	0.000	111.277	3.151
155.18	47.30	17.502	1.626	3.426	0.097	114.702	3.248
155.51	47.40	17.943	1.667	9.252	0.262	120.529	3.413
155.84	47.50	18.385	1.708	15.221	0.431	126.497	3.582
156.17	47.60	18.837	1.750	21.295	0.603	132.571	3.754
156.50	47.70	19.310	1.794	27.581	0.781	138.857	3.932
156.82	47.80	19.816	1.841	33.973	0.962	145.249	4.113
157.15	47.90	20.355	1.891	40.577	1.149	151.853	4.300
157.48	48.00	20.914	1.943	47.322	1.340	158.598	4.491

Elevation (MSL, ft)	Elevation (MSL, m)	Area (M.Sq.ft)	Area (M.Sq.m)	Live Capacity		Gross Capacity (Live + Dead)	
				Volume (M.Cu.ft)	Volume (M.Cu.m)	Volume (M.Cu.ft)	Volume (M.Cu.m)
157.81	48.10	21.506	1.998	54.279	1.537	165.555	4.688
158.14	48.20	22.163	2.059	61.448	1.740	172.724	4.891
158.46	48.30	22.841	2.122	68.828	1.949	180.105	5.100
158.79	48.40	23.519	2.185	76.421	2.164	187.698	5.315
159.12	48.50	24.240	2.252	84.261	2.386	195.537	5.537
159.45	48.60	24.994	2.322	92.313	2.614	203.589	5.765
159.78	48.70	25.747	2.392	100.647	2.850	211.924	6.001
160.10	48.80	26.555	2.467	109.228	3.093	220.505	6.244
160.43	48.90	27.416	2.547	118.057	3.343	229.334	6.494
160.76	49.00	28.298	2.629	127.204	3.602	238.480	6.753
161.09	49.10	29.149	2.708	136.597	3.868	247.874	7.019
161.42	49.20	30.021	2.789	146.309	4.143	257.585	7.294
161.75	49.30	30.925	2.873	156.303	4.426	267.579	7.577
162.07	49.40	31.861	2.960	166.579	4.717	277.856	7.868
162.40	49.50	32.830	3.050	177.209	5.018	288.486	8.169
162.73	49.60	33.820	3.142	188.121	5.327	299.398	8.478
163.06	49.70	34.789	3.232	199.387	5.646	310.663	8.797
163.39	49.80	35.758	3.322	210.935	5.973	322.211	9.124
163.71	49.90	36.737	3.413	222.836	6.310	334.112	9.461
164.04	50.00	37.771	3.509	235.019	6.655	346.296	9.806
164.37	50.10	38.825	3.607	247.591	7.011	358.868	10.162
164.70	50.20	39.869	3.704	260.481	7.376	371.758	10.527
165.03	50.30	40.957	3.805	273.760	7.752	385.036	10.903
165.35	50.40	42.151	3.916	287.356	8.137	398.632	11.288
165.68	50.50	43.325	4.025	301.376	8.534	412.652	11.685
166.01	50.60	44.509	4.135	315.749	8.941	427.025	12.092
166.34	50.70	45.800	4.255	330.546	9.360	441.822	12.511
166.67	50.80	47.103	4.376	345.766	9.791	457.043	12.942
166.99	50.90	48.481	4.504	361.446	10.235	472.723	13.386
167.32	51.00	49.923	4.638	377.549	10.691	488.826	13.842
167.65	51.10	51.387	4.774	394.147	11.161	505.424	14.312
167.98	51.20	52.905	4.915	411.240	11.645	522.516	14.796
168.31	51.30	54.519	5.065	428.826	12.143	540.103	15.294
168.64	51.40	56.252	5.226	446.978	12.657	558.255	15.808
168.96	51.50	58.114	5.399	465.695	13.187	576.972	16.338
169.29	51.60	59.987	5.573	485.012	13.734	596.289	16.885
169.62	51.70	61.882	5.749	504.965	14.299	616.242	17.450
169.95	51.80	63.959	5.942	525.553	14.882	636.830	18.033
170.28	51.90	65.950	6.127	546.813	15.484	658.089	18.635
170.60	52.00	67.813	6.300	568.708	16.104	679.985	19.255
170.93	52.10	69.761	6.481	591.239	16.742	702.515	19.893
171.26	52.20	71.709	6.662	614.405	17.398	725.682	20.549

Elevation (MSL, ft)	Elevation (MSL, m)	Area (M.Sq.ft)	Area (M.Sq.m)	Live Capacity		Gross Capacity (Live + Dead)	
				Volume (M.Cu.ft)	Volume (M.Cu.m)	Volume (M.Cu.ft)	Volume (M.Cu.m)
171.59	52.30	73.733	6.850	638.207	18.072	749.484	21.223
171.92	52.40	75.789	7.041	662.680	18.765	773.957	21.916
172.24	52.50	77.823	7.230	687.824	19.477	799.101	22.628
172.57	52.60	79.857	7.419	713.639	20.208	824.916	23.359
172.90	52.70	81.763	7.596	740.125	20.958	851.402	24.109
173.23	52.80	83.711	7.777	767.212	21.725	878.488	24.876
173.56	52.90	85.745	7.966	794.969	22.511	906.246	25.662
173.88	53.00	87.780	8.155	823.398	23.316	934.674	26.467
174.21	53.10	89.868	8.349	852.497	24.140	963.773	27.291
174.54	53.20	91.988	8.546	882.267	24.983	993.544	28.134
174.87	53.30	94.324	8.763	912.779	25.847	1024.056	28.998
175.20	53.40	96.724	8.986	944.068	26.733	1055.344	29.884
175.52	53.50	99.157	9.212	976.134	27.641	1087.410	30.792
175.85	53.60	101.590	9.438	1009.012	28.572	1120.288	31.723
176.18	53.70	104.076	9.669	1042.702	29.526	1153.978	32.677
176.51	53.80	106.756	9.918	1077.240	30.504	1188.516	33.655
176.84	53.90	109.695	10.191	1112.660	31.507	1223.937	34.658
177.17	54.00	112.440	10.446	1149.070	32.538	1260.346	35.689
177.49	54.10	115.292	10.711	1186.362	33.594	1297.639	36.745
177.82	54.20	118.177	10.979	1224.608	34.677	1335.884	37.828
178.15	54.30	120.911	11.233	1263.807	35.787	1375.084	38.938
178.48	54.40	123.828	11.504	1303.925	36.923	1415.201	40.074
178.81	54.50	127.057	11.804	1345.066	38.088	1456.343	41.239
179.13	54.60	130.319	12.107	1387.267	39.283	1498.544	42.434
179.46	54.70	134.043	12.453	1430.598	40.510	1541.875	43.661
179.79	54.80	138.413	12.859	1475.272	41.775	1586.548	44.926
180.12	54.90	142.815	13.268	1521.393	43.081	1632.669	46.232
180.45	55.00	148.327	13.780	1569.138	44.433	1680.415	47.584
180.77	55.10	153.536	14.264	1618.649	45.835	1729.926	48.986
181.10	55.20	158.757	14.749	1669.891	47.286	1781.168	50.437
181.43	55.30	164.117	15.247	1722.863	48.786	1834.140	51.937
181.69	55.38	168.412	15.646	1766.475	50.021	1877.751	53.172
181.76	55.40	169.435	15.741	1777.565	50.335	1888.842	53.486
182.09	55.50	174.547	16.216	1833.998	51.933	1945.275	55.084
182.41	55.60	181.275	16.841	1892.268	53.583	2003.544	56.734
182.74	55.70	186.775	17.352	1952.691	55.294	2063.968	58.445
183.07	55.80	191.457	17.787	2014.774	57.052	2126.051	60.203
183.40	55.90	196.086	18.217	2078.341	58.852	2189.617	62.003
183.73	56.00	200.919	18.666	2143.461	60.696	2254.738	63.847
184.06	56.10	205.784	19.118	2210.170	62.585	2321.447	65.736
184.38	56.20	210.488	19.555	2278.469	64.519	2389.746	67.670
184.71	56.30	215.289	20.001	2348.286	66.496	2459.563	69.647

Elevation (MSL, ft)	Elevation (MSL, m)	Area (M.Sq.ft)	Area (M.Sq.m)	Live Capacity		Gross Capacity (Live + Dead)	
				Volume (M.Cu.ft)	Volume (M.Cu.m)	Volume (M.Cu.ft)	Volume (M.Cu.m)
185.04	56.40	220.057	20.444	2419.728	68.519	2531.005	71.670
185.37	56.50	224.847	20.889	2492.688	70.585	2603.965	73.736
185.70	56.60	229.745	21.344	2567.273	72.697	2678.549	75.848
186.02	56.70	234.427	21.779	2643.411	74.853	2754.688	78.004
186.35	56.80	239.163	22.219	2721.104	77.053	2832.380	80.204
186.68	56.90	244.254	22.692	2800.385	79.298	2911.662	82.449
187.01	57.00	249.992	23.225	2881.432	81.593	2992.709	84.744
187.34	57.10	257.408	23.914	2964.634	83.949	3075.910	87.100
187.66	57.20	264.286	24.553	3050.237	86.373	3161.513	89.524
187.99 (FRL)	57.30 (FRL)	271.584	25.231	3138.135	88.862	3249.411	92.013
188.32	57.40	278.451	25.869	3228.399	91.418	3339.676	94.569
188.65	57.50	284.781	26.457	3320.818	94.035	3432.094	97.186
188.98	57.60	290.884	27.024	3415.249	96.709	3526.526	99.860
189.30	57.70	296.707	27.565	3511.623	99.438	3622.900	102.589
189.63	57.80	302.702	28.122	3609.975	102.223	3721.251	105.374
189.96	57.90	308.752	28.684	3710.268	105.063	3821.545	108.214
190.29	58.00	314.693	29.236	3812.540	107.959	3923.816	111.110
190.62	58.10	320.495	29.775	3916.753	110.910	4028.030	114.061
190.94	58.20	326.049	30.291	4022.803	113.913	4134.080	117.064
191.27	58.30	331.937	30.838	4130.725	116.969	4242.002	120.120
191.60	58.40	337.825	31.385	4240.589	120.080	4351.866	123.231
191.93	58.50	344.337	31.990	4352.466	123.248	4463.743	126.399
192.26	58.60	350.882	32.598	4466.533	126.478	4577.809	129.629
192.59	58.70	356.716	33.140	4582.612	129.765	4693.889	132.916
192.91	58.80	362.334	33.662	4700.598	133.106	4811.875	136.257
193.24	58.90	367.555	34.147	4820.351	136.497	4931.627	139.648
193.57	59.00	372.054	34.565	4941.692	139.933	5052.969	143.084
193.90	59.10	376.134	34.944	5064.410	143.408	5175.687	146.559
194.23 (HFL)	59.20 (HFL)	380.213	35.323	5188.506	146.922	5299.783	150.073

Annexure - 2
Mobilisation and Calibration Report
Machhu-2 Reservoir

1 MOBILISATION

1.1 Introduction

Ocean Science & Surveying Pvt. Ltd. (OSaS) was contracted by Narmada Water Resources, Water Supply & Kalpsar Department (WRD) to carry out topographic and bathymetric survey of six reservoirs in the Saurashtra region; namely Shetrunji, Brahmani-1, Und 1, Machhu-1, Machhu-2 and Bhadar-1. However, as per instructions received from client (Document no: WRIDN/PB/ Bathymetry Suvey (Sau) 183/2021, dated 24th February 2021), the survey of Shetrunji reservoir was not to be carried out. The client provided a total of 8 new reservoirs where bathymetry and topographic survey were to be carried out against the cancelled Shetrunji reservoir.

This report documents the mobilisation and calibrations carried out by OSaS on board SMB Ocean for bathymetric and topographic survey of Machhu-2 reservoir at Saurashtra region, Gujarat.

The survey team arrived at survey site on 07th March 2021. The survey team started mobilisation of equipment on 09th March while the survey boat SMB Ocean was alongside the Machhu-2 dam bund road. The mobilisation of equipment on board SMB Ocean was completed on 09th March.

To establish TBMs, two points were marked on the dam wall walkway which were spaced 7.35m apart. DGPS observations were carried out at each of these points for about 2 hours on 08th March 2021. The levelling of these TBMs was carried out on the same day with respect to the known level of the FRL provided by the client.

Initial system preparation and equipment checks were completed on 09th March. A bar check was carried out every day before commencing the bathymetric survey.

The topographic and bathymetric survey commenced on 09th March and 10th March respectively at Machhu-2 reservoir. Bathymetric survey was completed on 26th March and topographic survey was completed on 20th April. The survey boat was demobilised on 29th March 2021.

1.2 HSE Checks

A safety induction was given by the Party Chief prior to survey, detailing personnel responsibilities in the event of emergency, life jacket locations, safety gear locations and procedures and signals for emergencies.

Back deck procedures were explained and enforced with no single man operations and all non-essential personnel keeping clear of operations. PPE included safety boots, hard hats and cover-all's for all personnel involved in back deck operations.

1.3 Survey Equipment list on SMB Ocean

1.3.1 Navigation and Positioning

Item	Quantity
Hemisphere DGPS system with cables	1
Navigation computer with Hypack software	1
Moxa 8-port cable	4
Hemisphere Atlas Link RTK system with all accessories	3

1.3.2 Single beam Echo sounder

Item	Quantity
Odom MK III Single beam echo sounder	2
Dual frequency transducer and mounting pole	2
Bar check	1

MRU-PD	2
--------	---

1.3.3 Levelling equipment

Item	Quantity
Geomax auto level complete with all accessories	1 set

1.3.4 Power Systems

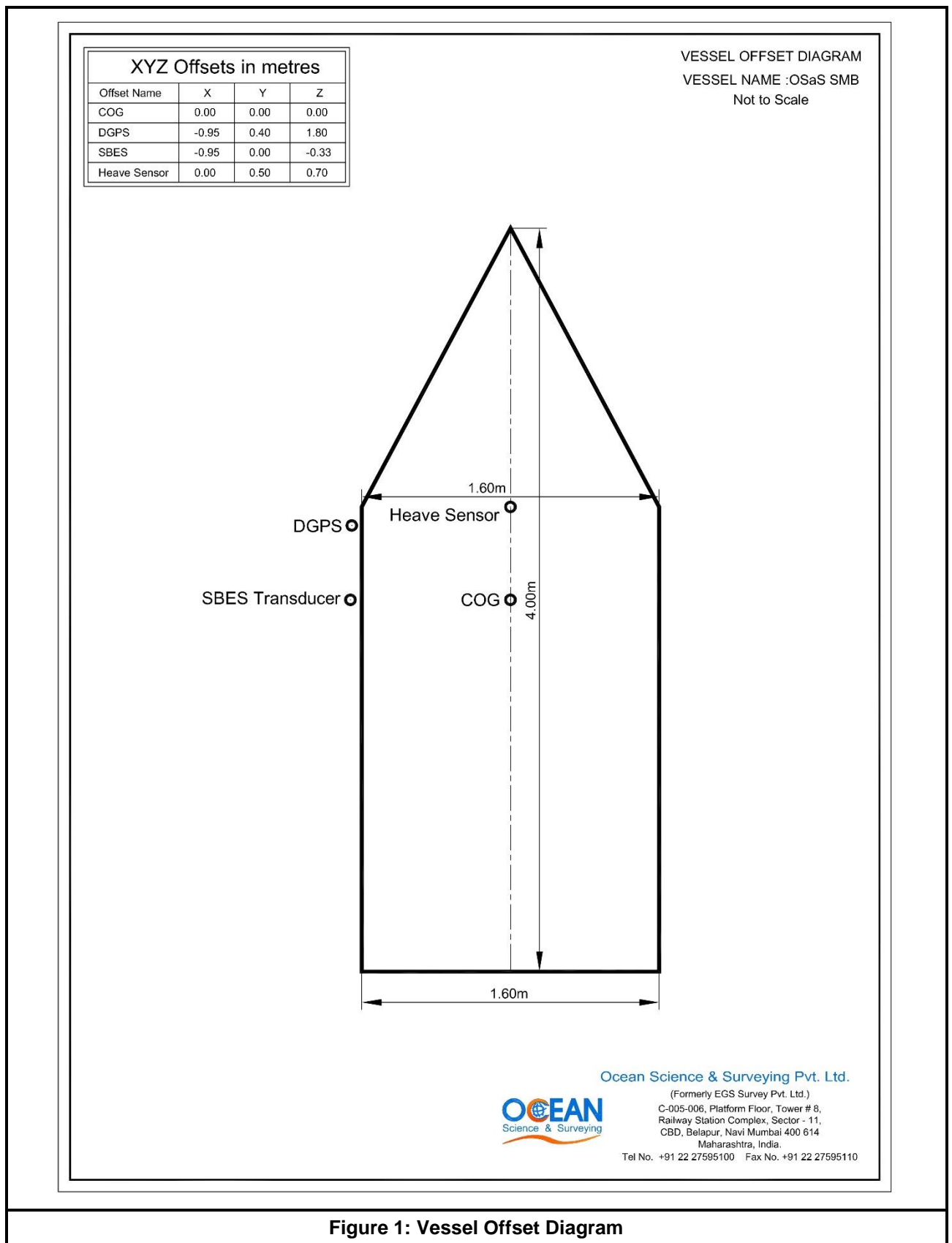
Item	Quantity
2KVA Stabilizer	2
1 KVA generator	2
24V power supply	4
Exide battery 100Ah	1
Invertor	1
12V External battery	3
12V External battery charger	3

1.3.5 Miscellaneous

Item	Quantity
LCD monitors	8
Laptop	2
Helmets / life jackets	8
Tool box	1
Tripod and Tribrach	4 & 3
Ranging Rod	3
Antenna T-Section	2 Sets
RF Antenna	3
10m RF antenna cable	3
Echo Rolls	52 nos
HP Printer	1 nos
UPS	2 Sets
Switch Board	8 Sets
Drill Machine	1 Set

1.4 Vessel Offset Diagram

The equipment offsets in the survey motor boat (SMB) Ocean are shown in **Figure 1** below:



2 EQUIPMENT CALIBRATIONS

2.1 RTK system calibrations

The details of the RTK system consistency checks are as follows:

In order to determine the integrity and reliability of the positioning system, the system was checked for its consistency during mobilisation.

Two points were manually marked on the dam wall walkway distanced 7.35m apart. About 2 hours of DGPS observations were carried out at each of the two points. After observations, the two points were established as temporary control points/ temporary benchmark (TBM). The levelling of these TBMs were completed using Geomax auto level with respect to the known level of FRL which is given as 57.30m above MSL, as provided by client. The base stations of the Hemisphere Atlas Link RTK were set up at these positions and two-hour continuous observations using Hemisphere RTK positioning system were conducted to fix the consistency of the position for horizontal control. The system provides real time correction signals, providing centimetre level accuracy. Additional TBM were established at various locations in the survey area to keep the rover in range with respect to this base station.

The details of reference stations OSaS-MA-2-TBM-01 and OSaS-MA-2-TBM-02 are provided in **Table 1** and **Table 2** respectively.

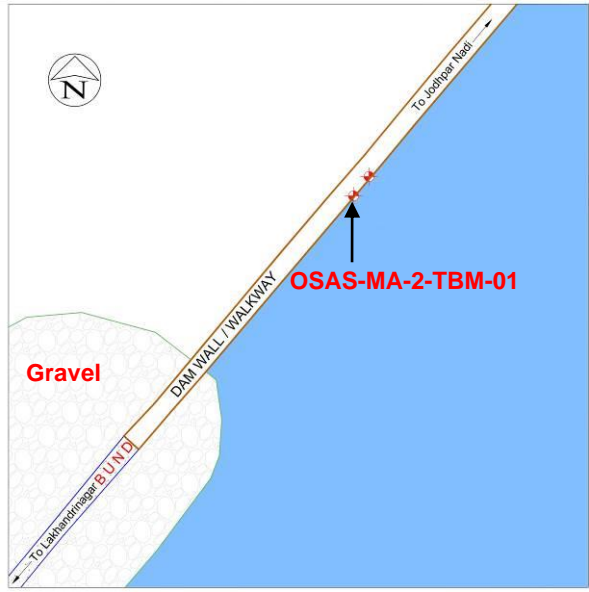


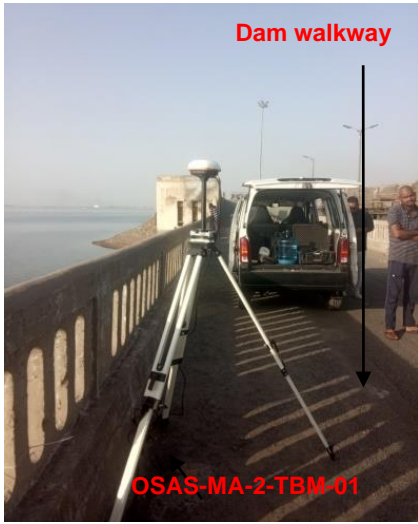
Station Number:	OSAS-MA-2-TBM-01	Latitude:	22° 45.736' N
Locality:	Machhu-2, Gujarat	Longitude:	70° 51.875' E
Geodetic Datum:	WGS84	Northing:	2518409.460 m N
Projection:	Universal Transverse Mercator	Easting:	691441.650 m E
Date:	08 th March 2021	Elevation:	59.91m above MSL
Station Description:	A rhombus with a plus sign drawn inside it is painted in yellow colour on the dam walkway.		
Access:	From the guest house at Machhu-2 dam, head north for about 20m after which turn towards northwest and continue along the dam bund road for about 1.2 km to reach the north-eastern end of the dam walkway. From there, head towards south-west on the dam walkway for about 570m to reach the TBM-01 location.		
Sketch:			
Map:			
			
			

Table 1: Details of OSaS-MA-2-TBM-01





Station Number:	OSAS-MA-2-TBM-02	Latitude:	22° 45.739' N
Locality:	Machhu-2, Gujarat	Longitude:	70° 51.877' E
Geodetic Datum:	WGS84	Northing:	2518415.190 m N
Projection:	Universal Transverse Mercator	Easting:	691446.280 m E
Date:	08 th March 2021	Elevation:	59.90m above MSL
Station Description:	A circle with a dot at its centre is drawn with yellow paint on the dam walkway.		
Access:	From the guest house at Machhu-2 dam, head north for about 20m after which turn towards northwest and continue along the dam bund road for about 1.2km to reach the north-eastern end of the dam walkway. From there, head towards south-west on the dam walkway for about 563m to reach the TBM-02 location.		
Sketch:			
Map:			
			
			

Table 2: Details of OSaS-MA-2-TBM-02

The following **Table 3** summarises the details of the additional temporary control points (TBMs) established at site during the survey to maintain the moving rover within the range of the base reference point.

Sr. No.	Easting	Northing	Elevation (m above MSL)	Station Code
1	694768.833	2517175.505	80.27	OSAS-MA-2-TBM-03
2	694960.404	2515432.963	79.07	OSAS-MA-2-TBM-04
3	697448.357	2515938.496	63.34	OSAS-MA-2-TBM-05
4	698063.608	2514835.842	55.90	OSAS-MA-2-TBM-06
5	697589.145	2513048.338	62.86	OSAS-MA-2-TBM-07
6	698838.847	2511882.346	67.31	OSAS-MA-2-TBM-08
7	697808.534	2510879.203	67.58	OSAS-MA-2-TBM-09
8	696078.907	2509592.132	70.61	OSAS-MA-2-TBM-10
9	695041.146	2512844.966	61.79	OSAS-MA-2-TBM-11
10	693559.174	2513228.604	68.50	OSAS-MA-2-TBM-12
11	692499.160	2513753.384	62.01	OSAS-MA-2-TBM-13

Table 3: Details of Additional TBMs

2.2 Single Beam Echo Sounder

The average speed of sound through the water column was input to the single beam echo sounder when a bar-check was performed before the start of survey operations. The following **Figure 2** shows the bar check extract of the Odom MK III echo sounder used in SMB Ocean.

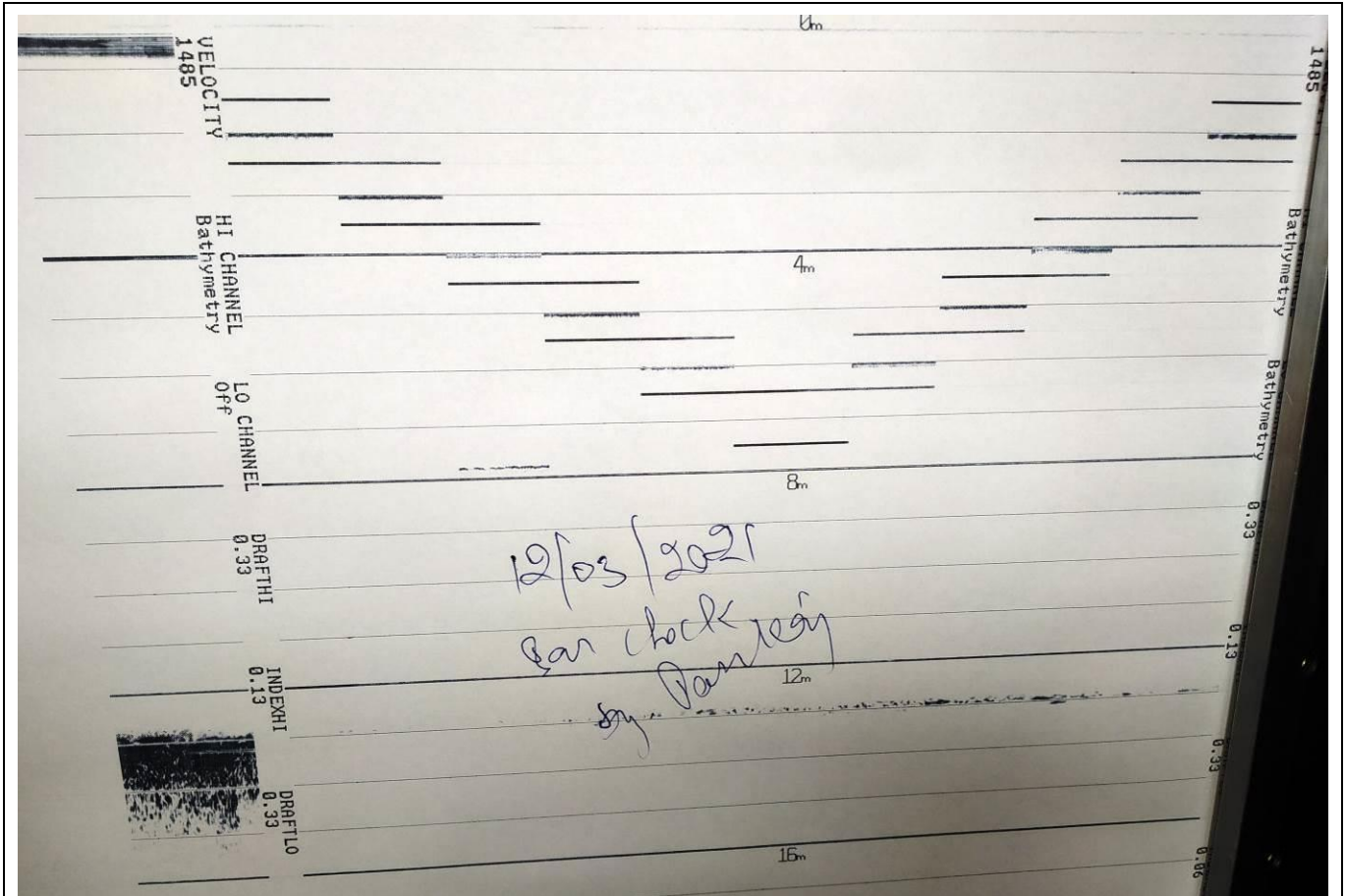


Figure 2: Bar check calibration on board OSAS SMB

3 CONCLUSIONS

Mobilisation for this project, including calibration and verification were carried out on board SMB Ocean in a safe and acceptable manner. All systems performed to specifications throughout the length of the survey.

Annexure - 3
Previous data – Capacity results–2004
Machhu-2 Reservoir

Table 1 to Table 36 provides the previous survey data (Capacity results–2004), extracted from client-provided document (Revised Capacity Table of Machhu-2, done by GERI, Vadodara in Nov–2004).

MACHHU-II IRRIGATION SCHEME									
REVISED CAPACITY TABLE OF MACHHU-II IRRIGATION SCHEME SEDIMENTATION SURVEY DONE BY GERI, VADODARA IN NOV.-2004									
LEVEL		DEPTH		DEAD STORAGE		LIVE STORAGE		GROSS STORAGE	
Mt.	Feet.	Mt.	Feet.	Mcum.	Mcft.	Mcum.	Mcft.	Mcum.	Mcft.
1	2	3	4	5	6	7	8	9	10
39.62	129.99	0.00	0.00	0.131	4.63	0.000	0.00	0.131	4.63
39.63	130.02	0.01	0.03	0.132	4.65	0.000	0.00	0.132	4.65
39.64	130.05	0.02	0.07	0.132	4.66	0.000	0.00	0.132	4.66
39.65	130.09	0.03	0.10	0.133	4.68	0.000	0.00	0.133	4.68
39.66	130.12	0.04	0.13	0.133	4.70	0.000	0.00	0.133	4.70
39.67	130.15	0.05	0.16	0.134	4.72	0.000	0.00	0.134	4.72
39.68	130.18	0.06	0.20	0.134	4.74	0.000	0.00	0.134	4.74
39.69	130.22	0.07	0.23	0.135	4.76	0.000	0.00	0.135	4.76
39.70	130.25	0.08	0.26	0.135	4.78	0.000	0.00	0.135	4.78
39.71	130.28	0.09	0.30	0.136	4.80	0.000	0.00	0.136	4.80
39.72	130.31	0.10	0.33	0.136	4.82	0.000	0.00	0.136	4.82
39.73	130.35	0.11	0.36	0.137	4.84	0.000	0.00	0.137	4.84
39.74	130.38	0.12	0.39	0.138	4.86	0.000	0.00	0.138	4.86
39.75	130.41	0.13	0.43	0.138	4.88	0.000	0.00	0.138	4.88
39.76	130.45	0.14	0.46	0.139	4.90	0.000	0.00	0.139	4.90
39.77	130.48	0.15	0.49	0.139	4.92	0.000	0.00	0.139	4.92
39.78	130.51	0.16	0.52	0.140	4.94	0.000	0.00	0.140	4.94
39.79	130.54	0.17	0.56	0.140	4.96	0.000	0.00	0.140	4.96
39.80	130.58	0.18	0.59	0.141	4.98	0.000	0.00	0.141	4.98
39.81	130.61	0.19	0.62	0.141	5.00	0.000	0.00	0.141	5.00
39.82	130.64	0.20	0.66	0.142	5.02	0.000	0.00	0.142	5.02
39.83	130.68	0.21	0.69	0.143	5.04	0.000	0.00	0.143	5.04
39.84	130.71	0.22	0.72	0.143	5.06	0.000	0.00	0.143	5.06
39.85	130.74	0.23	0.75	0.144	5.08	0.000	0.00	0.144	5.08
39.86	130.77	0.24	0.79	0.144	5.10	0.000	0.00	0.144	5.10
39.87	130.81	0.25	0.82	0.145	5.12	0.000	0.00	0.145	5.12
39.88	130.84	0.26	0.85	0.146	5.14	0.000	0.00	0.146	5.14
39.89	130.87	0.27	0.89	0.146	5.16	0.000	0.00	0.146	5.16
39.90	130.91	0.28	0.92	0.147	5.18	0.000	0.00	0.147	5.18
39.91	130.94	0.29	0.95	0.147	5.20	0.000	0.00	0.147	5.20
39.92	130.97	0.30	0.98	0.148	5.22	0.000	0.00	0.148	5.22
39.93	131.00	0.31	1.02	0.149	5.25	0.000	0.00	0.149	5.25
39.94	131.04	0.32	1.05	0.149	5.27	0.000	0.00	0.149	5.27
39.95	131.07	0.33	1.08	0.150	5.29	0.000	0.00	0.150	5.29
39.96	131.10	0.34	1.12	0.150	5.31	0.000	0.00	0.150	5.31
39.97	131.14	0.35	1.15	0.151	5.33	0.000	0.00	0.151	5.33
39.98	131.17	0.36	1.18	0.152	5.35	0.000	0.00	0.152	5.35
39.99	131.20	0.37	1.21	0.152	5.38	0.000	0.00	0.152	5.38
40.00	131.23	0.38	1.25	0.153	5.40	0.000	0.00	0.153	5.40

Submerg Area, in 89. km

0.055

0.056

0.0575

0.0592

0.0608

Table 1: Previous data (2004) Page 1 of 36

1	2	3	4	5	6	7	8	9	10
40.01	131.27	0.39	1.28	0.153	5.42	0.000	0.00	0.153	5.42
40.02	131.30	0.40	1.31	0.154	5.44	0.000	0.00	0.154	5.44
40.03	131.33	0.41	1.35	0.155	5.46	0.000	0.00	0.155	5.46
40.04	131.36	0.42	1.38	0.155	5.49	0.000	0.00	0.155	5.49
40.05	131.40	0.43	1.41	0.156	5.51	0.000	0.00	0.156	5.51
40.06	131.43	0.44	1.44	0.157	5.53	0.000	0.00	0.157	5.53
40.07	131.46	0.45	1.48	0.157	5.55	0.000	0.00	0.157	5.55
40.08	131.50	0.46	1.51	0.158	5.57	0.000	0.00	0.158	5.57
40.09	131.53	0.47	1.54	0.159	5.60	0.000	0.00	0.159	5.60
40.10	131.56	0.48	1.57	0.159	5.62	0.000	0.00	0.159	5.62
40.11	131.59	0.49	1.61	0.160	5.64	0.000	0.00	0.160	5.64
40.12	131.63	0.50	1.64	0.160	5.67	0.000	0.00	0.160	5.67
40.13	131.66	0.51	1.67	0.161	5.69	0.000	0.00	0.161	5.69
40.14	131.69	0.52	1.71	0.162	5.71	0.000	0.00	0.162	5.71
40.15	131.73	0.53	1.74	0.162	5.74	0.000	0.00	0.162	5.74
40.16	131.76	0.54	1.77	0.163	5.76	0.000	0.00	0.163	5.76
40.17	131.79	0.55	1.80	0.164	5.78	0.000	0.00	0.164	5.78
40.18	131.82	0.56	1.84	0.164	5.81	0.000	0.00	0.164	5.81
40.19	131.86	0.57	1.87	0.165	5.83	0.000	0.00	0.165	5.83
40.20	131.89	0.58	1.90	0.166	5.85	0.000	0.00	0.166	5.85
40.21	131.92	0.59	1.94	0.166	5.88	0.000	0.00	0.166	5.88
40.22	131.96	0.60	1.97	0.167	5.90	0.000	0.00	0.167	5.90
40.23	131.99	0.61	2.00	0.168	5.92	0.000	0.00	0.168	5.92
40.24	132.02	0.62	2.03	0.168	5.95	0.000	0.00	0.168	5.95
40.25	132.05	0.63	2.07	0.169	5.97	0.000	0.00	0.169	5.97
40.26	132.09	0.64	2.10	0.170	6.00	0.000	0.00	0.170	6.00
40.27	132.12	0.65	2.13	0.171	6.02	0.000	0.00	0.171	6.02
40.28	132.15	0.66	2.17	0.171	6.05	0.000	0.00	0.171	6.05
40.29	132.19	0.67	2.20	0.172	6.07	0.000	0.00	0.172	6.07
40.30	132.22	0.68	2.23	0.173	6.11	0.000	0.00	0.173	6.11
40.31	132.25	0.69	2.26	0.174	6.13	0.000	0.00	0.174	6.13
40.32	132.28	0.70	2.30	0.174	6.15	0.000	0.00	0.174	6.15
40.33	132.32	0.71	2.33	0.175	6.18	0.000	0.00	0.175	6.18
40.34	132.35	0.72	2.36	0.176	6.20	0.000	0.00	0.176	6.20
40.35	132.38	0.73	2.40	0.176	6.22	0.000	0.00	0.176	6.22
40.36	132.41	0.74	2.43	0.177	6.24	0.000	0.00	0.177	6.24
40.37	132.45	0.75	2.46	0.177	6.27	0.000	0.00	0.177	6.27
40.38	132.48	0.76	2.49	0.178	6.29	0.000	0.00	0.178	6.29
40.39	132.51	0.77	2.53	0.179	6.31	0.000	0.00	0.179	6.31
40.40	132.55	0.78	2.56	0.179	6.34	0.000	0.00	0.179	6.34
40.41	132.58	0.79	2.59	0.180	6.36	0.000	0.00	0.180	6.36
40.42	132.61	0.80	2.62	0.181	6.38	0.000	0.00	0.181	6.38
40.43	132.64	0.81	2.66	0.181	6.41	0.000	0.00	0.181	6.41
40.44	132.68	0.82	2.69	0.182	6.43	0.000	0.00	0.182	6.43
40.45	132.71	0.83	2.72	0.183	6.45	0.000	0.00	0.183	6.45
40.46	132.74	0.84	2.76	0.183	6.48	0.000	0.00	0.183	6.48
40.47	132.78	0.85	2.79	0.184	6.50	0.000	0.00	0.184	6.50
40.48	132.81	0.86	2.82	0.185	6.52	0.000	0.00	0.185	6.52
40.49	132.84	0.87	2.85	0.185	6.55	0.000	0.00	0.185	6.55
40.50	132.87	0.88	2.89	0.186	6.57	0.000	0.00	0.186	6.57

0.0625

0.0614

0.066

0.068

0.070

Table 2: Previous data (2004) Page 2 of 36

1	2	3	4	5	6	7	8	9	10
40.51	132.91	0.89	2.92	0.187	6.59	0.000	0.00	0.187	6.59
40.52	132.94	0.90	2.95	0.187	6.62	0.000	0.00	0.187	6.62
40.53	132.97	0.91	2.99	0.188	6.64	0.000	0.00	0.188	6.64
40.54	133.01	0.92	3.02	0.189	6.67	0.000	0.00	0.189	6.67
40.55	133.04	0.93	3.05	0.189	6.69	0.000	0.00	0.189	6.69
40.56	133.07	0.94	3.08	0.190	6.71	0.000	0.00	0.190	6.71
40.57	133.10	0.95	3.12	0.191	6.74	0.000	0.00	0.191	6.74
40.58	133.14	0.96	3.15	0.192	6.76	0.000	0.00	0.192	6.76
40.59	133.17	0.97	3.18	0.192	6.79	0.000	0.00	0.192	6.79
40.60	133.20	0.98	3.22	0.193	6.81	0.000	0.00	0.193	6.81
40.61	133.23	0.99	3.25	0.194	6.84	0.000	0.00	0.194	6.84
40.62	133.27	1.00	3.28	0.194	6.86	0.000	0.00	0.194	6.86
40.63	133.30	1.01	3.31	0.195	6.89	0.000	0.00	0.195	6.89
40.64	133.33	1.02	3.35	0.196	6.91	0.000	0.00	0.196	6.91
40.65	133.37	1.03	3.38	0.196	6.94	0.000	0.00	0.196	6.94
40.66	133.40	1.04	3.41	0.197	6.96	0.000	0.00	0.197	6.96
40.67	133.43	1.05	3.44	0.198	6.99	0.000	0.00	0.198	6.99
40.68	133.46	1.06	3.48	0.199	7.01	0.000	0.00	0.199	7.01
40.69	133.50	1.07	3.51	0.199	7.04	0.000	0.00	0.199	7.04
40.70	133.53	1.08	3.54	0.200	7.07	0.000	0.00	0.200	7.07
40.71	133.56	1.09	3.58	0.201	7.09	0.000	0.00	0.201	7.09
40.72	133.60	1.10	3.61	0.202	7.12	0.000	0.00	0.202	7.12
40.73	133.63	1.11	3.64	0.202	7.14	0.000	0.00	0.202	7.14
40.74	133.66	1.12	3.67	0.203	7.17	0.000	0.00	0.203	7.17
40.75	133.69	1.13	3.71	0.204	7.19	0.000	0.00	0.204	7.19
40.76	133.73	1.14	3.74	0.204	7.22	0.000	0.00	0.204	7.22
40.77	133.76	1.15	3.77	0.205	7.25	0.000	0.00	0.205	7.25
40.78	133.79	1.16	3.81	0.206	7.27	0.000	0.00	0.206	7.27
40.79	133.83	1.17	3.84	0.207	7.30	0.000	0.00	0.207	7.30
40.80	133.86	1.18	3.87	0.207	7.33	0.000	0.00	0.207	7.33
40.81	133.89	1.19	3.90	0.208	7.35	0.000	0.00	0.208	7.35
40.82	133.92	1.20	3.94	0.209	7.38	0.000	0.00	0.209	7.38
40.83	133.96	1.21	3.97	0.210	7.41	0.000	0.00	0.210	7.41
40.84	133.99	1.22	4.00	0.211	7.43	0.000	0.00	0.211	7.43
40.85	134.02	1.23	4.04	0.211	7.46	0.000	0.00	0.211	7.46
40.86	134.06	1.24	4.07	0.212	7.49	0.000	0.00	0.212	7.49
40.87	134.09	1.25	4.10	0.213	7.52	0.000	0.00	0.213	7.52
40.88	134.12	1.26	4.13	0.214	7.54	0.000	0.00	0.214	7.54
40.89	134.15	1.27	4.17	0.214	7.57	0.000	0.00	0.214	7.57
40.90	134.19	1.28	4.20	0.215	7.60	0.000	0.00	0.215	7.60
40.91	134.22	1.29	4.23	0.216	7.63	0.000	0.00	0.216	7.63
40.92	134.25	1.30	4.27	0.217	7.65	0.000	0.00	0.217	7.65
40.93	134.28	1.31	4.30	0.218	7.68	0.000	0.00	0.218	7.68
40.94	134.32	1.32	4.33	0.218	7.71	0.000	0.00	0.218	7.71
40.95	134.35	1.33	4.36	0.219	7.74	0.000	0.00	0.219	7.74
40.96	134.38	1.34	4.40	0.220	7.77	0.000	0.00	0.220	7.77
40.97	134.42	1.35	4.43	0.221	7.79	0.000	0.00	0.221	7.79
40.98	134.45	1.36	4.46	0.221	7.82	0.000	0.00	0.221	7.82
40.99	134.48	1.37	4.49	0.222	7.85	0.000	0.00	0.222	7.85
41.00	134.51	1.38	4.53	0.223	7.88	0.000	0.00	0.223	7.88

0.072

0.074

0.076

0.078

0.080

Page 3

Rh

Table 3: Previous data (2004) Page 3 of 36

1	2	3	4	5	6	7	8	9	10
41.01	134.55	1.39	4.56	0.224	7.91	0.000	0.00	0.224	7.91
41.02	134.58	1.40	4.59	0.225	7.94	0.000	0.00	0.225	7.94
41.03	134.61	1.41	4.63	0.226	7.97	0.000	0.00	0.226	7.97
41.04	134.65	1.42	4.66	0.226	7.99	0.000	0.00	0.226	7.99
41.05	134.68	1.43	4.69	0.227	8.02	0.000	0.00	0.227	8.02
41.06	134.71	1.44	4.72	0.228	8.05	0.000	0.00	0.228	8.05
41.07	134.74	1.45	4.76	0.229	8.08	0.000	0.00	0.229	8.08
41.08	134.78	1.46	4.79	0.230	8.11	0.000	0.00	0.230	8.11
41.09	134.81	1.47	4.82	0.231	8.14	0.000	0.00	0.231	8.14
41.10	134.84	1.48	4.86	0.231	8.17	0.000	0.00	0.231	8.17
41.11	134.88	1.49	4.89	0.232	8.20	0.000	0.00	0.232	8.20
41.12	134.91	1.50	4.92	0.233	8.23	0.000	0.00	0.233	8.23
41.13	134.94	1.51	4.95	0.234	8.26	0.000	0.00	0.234	8.26
41.14	134.97	1.52	4.99	0.235	8.29	0.000	0.00	0.235	8.29
41.15	135.01	1.53	5.02	0.236	8.32	0.000	0.00	0.236	8.32
41.16	135.04	1.54	5.05	0.236	8.35	0.000	0.00	0.236	8.35
41.17	135.07	1.55	5.09	0.237	8.38	0.000	0.00	0.237	8.38
41.18	135.10	1.56	5.12	0.238	8.41	0.000	0.00	0.238	8.41
41.19	135.14	1.57	5.15	0.239	8.44	0.000	0.00	0.239	8.44
41.20	135.17	1.58	5.18	0.240	8.47	0.000	0.00	0.240	8.47
41.21	135.20	1.59	5.22	0.241	8.50	0.000	0.00	0.241	8.50
41.22	135.24	1.60	5.25	0.242	8.54	0.000	0.00	0.242	8.54
41.23	135.27	1.61	5.28	0.243	8.57	0.000	0.00	0.243	8.57
41.24	135.30	1.62	5.31	0.243	8.60	0.000	0.00	0.243	8.60
41.25	135.33	1.63	5.35	0.244	8.63	0.000	0.00	0.244	8.63
41.26	135.37	1.64	5.38	0.245	8.66	0.000	0.00	0.245	8.66
41.27	135.40	1.65	5.41	0.246	8.69	0.000	0.00	0.246	8.69
41.28	135.43	1.66	5.45	0.247	8.72	0.000	0.00	0.247	8.72
41.29	135.47	1.67	5.48	0.248	8.75	0.000	0.00	0.248	8.75
41.30	135.50	1.68	5.51	0.250	8.83	0.000	0.00	0.250	8.83
41.31	135.53	1.69	5.54	0.251	8.86	0.000	0.00	0.251	8.86
41.32	135.56	1.70	5.58	0.252	8.89	0.000	0.00	0.252	8.89
41.33	135.60	1.71	5.61	0.253	8.92	0.000	0.00	0.253	8.92
41.34	135.63	1.72	5.64	0.254	8.96	0.000	0.00	0.254	8.96
41.35	135.66	1.73	5.68	0.255	8.99	0.000	0.00	0.255	8.99
41.36	135.70	1.74	5.71	0.255	9.02	0.000	0.00	0.255	9.02
41.37	135.73	1.75	5.74	0.256	9.05	0.000	0.00	0.256	9.05
41.38	135.76	1.76	5.77	0.257	9.08	0.000	0.00	0.257	9.08
41.39	135.79	1.77	5.81	0.258	9.12	0.000	0.00	0.258	9.12
41.40	135.83	1.78	5.84	0.259	9.15	0.000	0.00	0.259	9.15
41.41	135.86	1.79	5.87	0.260	9.18	0.000	0.00	0.260	9.18
41.42	135.89	1.80	5.91	0.261	9.22	0.000	0.00	0.261	9.22
41.43	135.93	1.81	5.94	0.262	9.25	0.000	0.00	0.262	9.25
41.44	135.96	1.82	5.97	0.263	9.28	0.000	0.00	0.263	9.28
41.45	135.99	1.83	6.00	0.264	9.31	0.000	0.00	0.264	9.31
41.46	136.02	1.84	6.04	0.265	9.35	0.000	0.00	0.265	9.35
41.47	136.06	1.85	6.07	0.266	9.38	0.000	0.00	0.266	9.38
41.48	136.09	1.86	6.10	0.267	9.42	0.000	0.00	0.267	9.42
41.49	136.12	1.87	6.14	0.268	9.45	0.000	0.00	0.268	9.45
41.50	136.15	1.88	6.17	0.269	9.48	0.000	0.00	0.269	9.48

Table 4: Previous data (2004) Page 4 of 36

1	2	3	4	5	6	7	8	9	10
41.51	136.19	1.89	6.20	0.269	9.52	0.000	0.00	0.269	9.52
41.52	136.22	1.90	6.23	0.270	9.55	0.000	0.00	0.270	9.55
41.53	136.25	1.91	6.27	0.271	9.59	0.000	0.00	0.271	9.59
41.54	136.29	1.92	6.30	0.272	9.62	0.000	0.00	0.272	9.62
41.55	136.32	1.93	6.33	0.273	9.65	0.000	0.00	0.273	9.65
41.56	136.35	1.94	6.36	0.274	9.69	0.000	0.00	0.274	9.69
41.57	136.38	1.95	6.40	0.275	9.72	0.000	0.00	0.275	9.72
41.58	136.42	1.96	6.43	0.276	9.76	0.000	0.00	0.276	9.76
41.59	136.45	1.97	6.46	0.277	9.79	0.000	0.00	0.277	9.79
41.60	136.48	1.98	6.50	0.278	9.83	0.000	0.00	0.278	9.83
41.61	136.52	1.99	6.53	0.279	9.86	0.000	0.00	0.279	9.86
41.62	136.55	2.00	6.56	0.280	9.90	0.000	0.00	0.280	9.90
41.63	136.58	2.01	6.59	0.281	9.93	0.000	0.00	0.281	9.93
41.64	136.61	2.02	6.63	0.282	9.97	0.000	0.00	0.282	9.97
41.65	136.65	2.03	6.66	0.283	10.00	0.000	0.00	0.283	10.00
41.66	136.68	2.04	6.69	0.284	10.04	0.000	0.00	0.284	10.04
41.67	136.71	2.05	6.73	0.285	10.08	0.000	0.00	0.285	10.08
41.68	136.75	2.06	6.76	0.286	10.11	0.000	0.00	0.286	10.11
41.69	136.78	2.07	6.79	0.287	10.15	0.000	0.00	0.287	10.15
41.70	136.81	2.08	6.82	0.288	10.19	0.000	0.00	0.288	10.19
41.71	136.84	2.09	6.86	0.289	10.22	0.000	0.00	0.289	10.22
41.72	136.88	2.10	6.89	0.290	10.26	0.000	0.00	0.290	10.26
41.73	136.91	2.11	6.92	0.292	10.30	0.000	0.00	0.292	10.30
41.74	136.94	2.12	6.96	0.293	10.33	0.000	0.00	0.293	10.33
41.75	136.98	2.13	6.99	0.294	10.37	0.000	0.00	0.294	10.37
41.76	137.01	2.14	7.02	0.295	10.41	0.000	0.00	0.295	10.41
41.77	137.04	2.15	7.05	0.296	10.44	0.000	0.00	0.296	10.44
41.78	137.07	2.16	7.09	0.297	10.48	0.000	0.00	0.297	10.48
41.79	137.11	2.17	7.12	0.298	10.52	0.000	0.00	0.298	10.52
41.80	137.14	2.18	7.15	0.299	10.56	0.000	0.00	0.299	10.56
41.81	137.17	2.19	7.19	0.300	10.59	0.000	0.00	0.300	10.59
41.82	137.20	2.20	7.22	0.301	10.63	0.000	0.00	0.301	10.63
41.83	137.24	2.21	7.25	0.302	10.67	0.000	0.00	0.302	10.67
41.84	137.27	2.22	7.28	0.303	10.71	0.000	0.00	0.303	10.71
41.85	137.30	2.23	7.32	0.304	10.75	0.000	0.00	0.304	10.75
41.86	137.34	2.24	7.35	0.305	10.78	0.000	0.00	0.305	10.78
41.87	137.37	2.25	7.38	0.306	10.82	0.000	0.00	0.306	10.82
41.88	137.40	2.26	7.41	0.308	10.86	0.000	0.00	0.308	10.86
41.89	137.43	2.27	7.45	0.309	10.90	0.000	0.00	0.309	10.90
41.90	137.47	2.28	7.48	0.310	10.94	0.000	0.00	0.310	10.94
41.91	137.50	2.29	7.51	0.311	10.98	0.000	0.00	0.311	10.98
41.92	137.53	2.30	7.55	0.312	11.02	0.000	0.00	0.312	11.02
41.93	137.57	2.31	7.58	0.313	11.06	0.000	0.00	0.313	11.06
41.94	137.60	2.32	7.61	0.314	11.10	0.000	0.00	0.314	11.10
41.95	137.63	2.33	7.64	0.315	11.14	0.000	0.00	0.315	11.14
41.96	137.66	2.34	7.68	0.316	11.18	0.000	0.00	0.316	11.18
41.97	137.70	2.35	7.71	0.318	11.22	0.000	0.00	0.318	11.22
41.98	137.73	2.36	7.74	0.319	11.26	0.000	0.00	0.319	11.26
41.99	137.76	2.37	7.78	0.320	11.30	0.000	0.00	0.320	11.30
42.00	137.80	2.38	7.81	0.321	11.34	0.000	0.00	0.321	11.34

Page 5

Table 5: Previous data (2004) Page 5 of 36

1	2	3	4	5	6	7	8	9	10
42.01	137.83	2.39	7.84	0.322	11.38	0.000	0.00	0.322	11.38
42.02	137.86	2.40	7.87	0.323	11.42	0.000	0.00	0.323	11.42
42.03	137.89	2.41	7.91	0.325	11.46	0.000	0.00	0.325	11.46
42.04	137.93	2.42	7.94	0.326	11.50	0.000	0.00	0.326	11.50
42.05	137.96	2.43	7.97	0.327	11.54	0.000	0.00	0.327	11.54
42.06	137.99	2.44	8.01	0.328	11.58	0.000	0.00	0.328	11.58
42.07	138.02	2.45	8.04	0.329	11.63	0.000	0.00	0.329	11.63
42.08	138.06	2.46	8.07	0.330	11.67	0.000	0.00	0.330	11.67
42.09	138.09	2.47	8.10	0.332	11.71	0.000	0.00	0.332	11.71
42.10	138.12	2.48	8.14	0.333	11.75	0.000	0.00	0.333	11.75 0.1282
42.11	138.16	2.49	8.17	0.334	11.79	0.000	0.00	0.334	11.79
42.12	138.19	2.50	8.20	0.335	11.83	0.000	0.00	0.335	11.83
42.13	138.22	2.51	8.23	0.336	11.88	0.000	0.00	0.336	11.88
42.14	138.25	2.52	8.27	0.338	11.92	0.000	0.00	0.338	11.92
42.15	138.29	2.53	8.30	0.339	11.96	0.000	0.00	0.339	11.96
42.16	138.32	2.54	8.33	0.340	12.00	0.000	0.00	0.340	12.00
42.17	138.35	2.55	8.37	0.341	12.05	0.000	0.00	0.341	12.05
42.18	138.39	2.56	8.40	0.342	12.09	0.000	0.00	0.342	12.09
42.19	138.42	2.57	8.43	0.344	12.13	0.000	0.00	0.344	12.13
42.20	138.45	2.58	8.46	0.345	12.18	0.000	0.00	0.345	12.18 0.1336
42.21	138.48	2.59	8.50	0.346	12.22	0.000	0.00	0.346	12.22
42.22	138.52	2.60	8.53	0.347	12.27	0.000	0.00	0.347	12.27
42.23	138.55	2.61	8.56	0.349	12.31	0.000	0.00	0.349	12.31
42.24	138.58	2.62	8.60	0.350	12.35	0.000	0.00	0.350	12.35
42.25	138.62	2.63	8.63	0.351	12.40	0.000	0.00	0.351	12.40
42.26	138.65	2.64	8.66	0.352	12.44	0.000	0.00	0.352	12.44
42.27	138.68	2.65	8.69	0.354	12.49	0.000	0.00	0.354	12.49
42.28	138.71	2.66	8.73	0.355	12.53	0.000	0.00	0.355	12.53
42.29	138.75	2.67	8.76	0.356	12.58	0.000	0.00	0.356	12.58
42.30	138.78	2.68	8.79	0.357	12.62	0.000	0.00	0.357	12.62
42.31	138.81	2.69	8.83	0.359	12.68	0.000	0.00	0.359	12.68 0.139
42.32	138.85	2.70	8.86	0.361	12.74	0.000	0.00	0.361	12.74
42.33	138.88	2.71	8.89	0.362	12.80	0.000	0.00	0.362	12.80
42.34	138.91	2.72	8.92	0.364	12.86	0.000	0.00	0.364	12.86
42.35	138.94	2.73	8.96	0.366	12.92	0.000	0.00	0.366	12.92
42.36	138.98	2.74	8.99	0.368	12.98	0.000	0.00	0.368	12.98
42.37	139.01	2.75	9.02	0.369	13.04	0.000	0.00	0.369	13.04
42.38	139.04	2.76	9.06	0.371	13.11	0.000	0.00	0.371	13.11
42.39	139.07	2.77	9.09	0.373	13.17	0.000	0.00	0.373	13.17
42.40	139.11	2.78	9.12	0.375	13.23	0.000	0.00	0.375	13.23 0.1556
42.41	139.14	2.79	9.15	0.376	13.29	0.000	0.00	0.376	13.29
42.42	139.17	2.80	9.19	0.378	13.36	0.000	0.00	0.378	13.36
42.43	139.21	2.81	9.22	0.380	13.42	0.000	0.00	0.380	13.42
42.44	139.24	2.82	9.25	0.382	13.48	0.000	0.00	0.382	13.48
42.45	139.27	2.83	9.28	0.384	13.55	0.000	0.00	0.384	13.55
42.46	139.30	2.84	9.32	0.385	13.61	0.000	0.00	0.385	13.61
42.47	139.34	2.85	9.35	0.387	13.68	0.000	0.00	0.387	13.68
42.48	139.37	2.86	9.38	0.389	13.74	0.000	0.00	0.389	13.74
42.49	139.40	2.87	9.42	0.391	13.81	0.000	0.00	0.391	13.81
42.50	139.44	2.88	9.45	0.393	13.87	0.000	0.00	0.393	13.87 0.1722

Page 6

Table 6: Previous data (2004) Page 6 of 36

1	2	3	4	5	6	7	8	9	10
42.51	139.47	2.89	9.48	0.395	13.94	0.000	0.00	0.395	13.94
42.52	139.50	2.90	9.51	0.397	14.01	0.000	0.00	0.397	14.01
42.53	139.53	2.91	9.55	0.398	14.07	0.000	0.00	0.398	14.07
42.54	139.57	2.92	9.58	0.400	14.14	0.000	0.00	0.400	14.14
42.55	139.60	2.93	9.61	0.402	14.21	0.000	0.00	0.402	14.21
42.56	139.63	2.94	9.65	0.404	14.27	0.000	0.00	0.404	14.27
42.57	139.67	2.95	9.68	0.406	14.34	0.000	0.00	0.406	14.34
42.58	139.70	2.96	9.71	0.408	14.41	0.000	0.00	0.408	14.41
42.59	139.73	2.97	9.74	0.410	14.48	0.000	0.00	0.410	14.48
42.60	139.76	2.98	9.78	0.412	14.55	0.000	0.00	0.412	14.55
42.61	139.80	2.99	9.81	0.414	14.62	0.000	0.00	0.414	14.62
42.62	139.83	3.00	9.84	0.416	14.69	0.000	0.00	0.416	14.69
42.63	139.86	3.01	9.88	0.418	14.76	0.000	0.00	0.418	14.76
42.64	139.90	3.02	9.91	0.420	14.83	0.000	0.00	0.420	14.83
42.65	139.93	3.03	9.94	0.422	14.90	0.000	0.00	0.422	14.90
42.66	139.96	3.04	9.97	0.424	14.97	0.000	0.00	0.424	14.97
42.67	139.99	3.05	10.01	0.426	15.04	0.000	0.00	0.426	15.04
42.68	140.03	3.06	10.04	0.428	15.11	0.000	0.00	0.428	15.11
42.69	140.06	3.07	10.07	0.430	15.18	0.000	0.00	0.430	15.18
42.70	140.09	3.08	10.10	0.432	15.26	0.000	0.00	0.432	15.26
42.71	140.12	3.09	10.14	0.434	15.33	0.000	0.00	0.434	15.33
42.72	140.16	3.10	10.17	0.436	15.40	0.000	0.00	0.436	15.40
42.73	140.19	3.11	10.20	0.438	15.47	0.000	0.00	0.438	15.47
42.74	140.22	3.12	10.24	0.440	15.55	0.000	0.00	0.440	15.55
42.75	140.26	3.13	10.27	0.442	15.62	0.000	0.00	0.442	15.62
42.76	140.29	3.14	10.30	0.444	15.70	0.000	0.00	0.444	15.70
42.77	140.32	3.15	10.33	0.447	15.77	0.000	0.00	0.447	15.77
42.78	140.35	3.16	10.37	0.449	15.85	0.000	0.00	0.449	15.85
42.79	140.39	3.17	10.40	0.451	15.92	0.000	0.00	0.451	15.92
42.80	140.42	3.18	10.43	0.453	16.00	0.000	0.00	0.453	16.00
42.81	140.45	3.19	10.47	0.455	16.07	0.000	0.00	0.455	16.07
42.82	140.49	3.20	10.50	0.457	16.15	0.000	0.00	0.457	16.15
42.83	140.52	3.21	10.53	0.459	16.23	0.000	0.00	0.459	16.23
42.84	140.55	3.22	10.56	0.462	16.30	0.000	0.00	0.462	16.30
42.85	140.58	3.23	10.60	0.464	16.38	0.000	0.00	0.464	16.38
42.86	140.62	3.24	10.63	0.466	16.46	0.000	0.00	0.466	16.46
42.87	140.65	3.25	10.66	0.468	16.54	0.000	0.00	0.468	16.54
42.88	140.68	3.26	10.70	0.470	16.62	0.000	0.00	0.470	16.62
42.89	140.72	3.27	10.73	0.473	16.69	0.000	0.00	0.473	16.69
42.90	140.75	3.28	10.76	0.475	16.77	0.000	0.00	0.475	16.77
42.91	140.78	3.29	10.79	0.477	16.85	0.000	0.00	0.477	16.85
42.92	140.81	3.30	10.83	0.480	16.93	0.000	0.00	0.480	16.93
42.93	140.85	3.31	10.86	0.482	17.01	0.000	0.00	0.482	17.01
42.94	140.88	3.32	10.89	0.484	17.10	0.000	0.00	0.484	17.10
42.95	140.91	3.33	10.93	0.486	17.18	0.000	0.00	0.486	17.18
42.96	140.94	3.34	10.96	0.489	17.26	0.000	0.00	0.489	17.26
42.97	140.98	3.35	10.99	0.491	17.34	0.000	0.00	0.491	17.34
42.98	141.01	3.36	11.02	0.493	17.42	0.000	0.00	0.493	17.42
42.99	141.04	3.37	11.06	0.496	17.51	0.000	0.00	0.496	17.51
43.00	141.08	3.38	11.09	0.498	17.59	0.000	0.00	0.498	17.59

Page 7

Table 7: Previous data (2004) Page 7 of 36

1	2	3	4	5	6	7	8	9	10
43.01	141.11	3.39	11.12	0.500	17.67	0.000	0.00	0.500	17.67
43.02	141.14	3.40	11.15	0.503	17.76	0.000	0.00	0.503	17.76
43.03	141.17	3.41	11.19	0.505	17.84	0.000	0.00	0.505	17.84
43.04	141.21	3.42	11.22	0.508	17.93	0.000	0.00	0.508	17.93
43.05	141.24	3.43	11.25	0.510	18.01	0.000	0.00	0.510	18.01
43.06	141.27	3.44	11.29	0.512	18.10	0.000	0.00	0.512	18.10
43.07	141.31	3.45	11.32	0.515	18.18	0.000	0.00	0.515	18.18
43.08	141.34	3.46	11.35	0.517	18.27	0.000	0.00	0.517	18.27
43.09	141.37	3.47	11.38	0.520	18.36	0.000	0.00	0.520	18.36
43.10	141.40	3.48	11.42	0.522	18.44	0.000	0.00	0.522	18.44
43.11	141.44	3.49	11.45	0.525	18.53	0.000	0.00	0.525	18.53
43.12	141.47	3.50	11.48	0.527	18.62	0.000	0.00	0.527	18.62
43.13	141.50	3.51	11.52	0.530	18.71	0.000	0.00	0.530	18.71
43.14	141.54	3.52	11.55	0.532	18.80	0.000	0.00	0.532	18.80
43.15	141.57	3.53	11.58	0.535	18.89	0.000	0.00	0.535	18.89
43.16	141.60	3.54	11.61	0.537	18.98	0.000	0.00	0.537	18.98
43.17	141.63	3.55	11.65	0.540	19.07	0.000	0.00	0.540	19.07
43.18	141.67	3.56	11.68	0.542	19.16	0.000	0.00	0.542	19.16
43.19	141.70	3.57	11.71	0.545	19.25	0.000	0.00	0.545	19.25
43.20	141.73	3.58	11.75	0.548	19.34	0.000	0.00	0.548	19.34
43.21	141.77	3.59	11.78	0.550	19.43	0.000	0.00	0.550	19.43
43.22	141.80	3.60	11.81	0.553	19.52	0.000	0.00	0.553	19.52
43.23	141.83	3.61	11.84	0.555	19.62	0.000	0.00	0.555	19.62
43.24	141.86	3.62	11.88	0.558	19.71	0.000	0.00	0.558	19.71
43.25	141.90	3.63	11.91	0.561	19.80	0.000	0.00	0.561	19.80
43.26	141.93	3.64	11.94	0.563	19.90	0.000	0.00	0.563	19.90
43.27	141.96	3.65	11.98	0.566	19.99	0.000	0.00	0.566	19.99
43.28	141.99	3.66	12.01	0.569	20.09	0.000	0.00	0.569	20.09
43.29	142.03	3.67	12.04	0.572	20.18	0.000	0.00	0.572	20.18
43.30	142.06	3.68	12.07	0.583	20.59	0.000	0.00	0.583	20.59
43.31	142.09	3.69	12.11	0.586	20.69	0.000	0.00	0.586	20.69
43.32	142.13	3.70	12.14	0.589	20.79	0.000	0.00	0.589	20.79
43.33	142.16	3.71	12.17	0.592	20.90	0.000	0.00	0.592	20.90
43.34	142.19	3.72	12.20	0.595	21.00	0.000	0.00	0.595	21.00
43.35	142.22	3.73	12.24	0.598	21.10	0.000	0.00	0.598	21.10
43.36	142.26	3.74	12.27	0.601	21.21	0.000	0.00	0.601	21.21
43.37	142.29	3.75	12.30	0.604	21.31	0.000	0.00	0.604	21.31
43.38	142.32	3.76	12.34	0.607	21.42	0.000	0.00	0.607	21.42
43.39	142.36	3.77	12.37	0.610	21.53	0.000	0.00	0.610	21.53
43.40	142.39	3.78	12.40	0.613	21.63	0.000	0.00	0.613	21.63
43.41	142.42	3.79	12.43	0.616	21.74	0.000	0.00	0.616	21.74
43.42	142.45	3.80	12.47	0.619	21.85	0.000	0.00	0.619	21.85
43.43	142.49	3.81	12.50	0.622	21.95	0.000	0.00	0.622	21.95
43.44	142.52	3.82	12.53	0.625	22.06	0.000	0.00	0.625	22.06
43.45	142.55	3.83	12.57	0.628	22.17	0.000	0.00	0.628	22.17
43.46	142.59	3.84	12.60	0.631	22.28	0.000	0.00	0.631	22.28
43.47	142.62	3.85	12.63	0.634	22.39	0.000	0.00	0.634	22.39
43.48	142.65	3.86	12.66	0.637	22.50	0.000	0.00	0.637	22.50
43.49	142.68	3.87	12.70	0.640	22.62	0.000	0.00	0.640	22.62
43.50	142.72	3.88	12.73	0.644	22.73	0.000	0.00	0.644	22.73

0.2718

0.2284

0.305

Table 8: Previous data (2004) Page 8 of 36

1	2	3	4	5	6	7	8	9	10
43.51	142.75	3.89	12.76	0.647	22.84	0.000	0.00	0.647	22.84
43.52	142.78	3.90	12.80	0.650	22.95	0.000	0.00	0.650	22.95
43.53	142.81	3.91	12.83	0.653	23.07	0.000	0.00	0.653	23.07
43.54	142.85	3.92	12.86	0.656	23.18	0.000	0.00	0.656	23.18
43.55	142.88	3.93	12.89	0.660	23.30	0.000	0.00	0.660	23.30
43.56	142.91	3.94	12.93	0.663	23.41	0.000	0.00	0.663	23.41
43.57	142.95	3.95	12.96	0.666	23.53	0.000	0.00	0.666	23.53
43.58	142.98	3.96	12.99	0.670	23.64	0.000	0.00	0.670	23.64
43.59	143.01	3.97	13.02	0.673	23.76	0.000	0.00	0.673	23.76
43.60	143.04	3.98	13.06	0.676	23.88	0.000	0.00	0.676	23.88
43.61	143.08	3.99	13.09	0.680	24.00	0.000	0.00	0.680	24.00
43.62	143.11	4.00	13.12	0.683	24.12	0.000	0.00	0.683	24.12
43.63	143.14	4.01	13.16	0.686	24.24	0.000	0.00	0.686	24.24
43.64	143.18	4.02	13.19	0.690	24.36	0.000	0.00	0.690	24.36
43.65	143.21	4.03	13.22	0.693	24.48	0.000	0.00	0.693	24.48
43.66	143.24	4.04	13.25	0.697	24.60	0.000	0.00	0.697	24.60
43.67	143.27	4.05	13.29	0.700	24.72	0.000	0.00	0.700	24.72
43.68	143.31	4.06	13.32	0.703	24.84	0.000	0.00	0.703	24.84
43.69	143.34	4.07	13.35	0.707	24.97	0.000	0.00	0.707	24.97
43.70	143.37	4.08	13.39	0.710	25.09	0.000	0.00	0.710	25.09
43.71	143.41	4.09	13.42	0.714	25.21	0.000	0.00	0.714	25.21
43.72	143.44	4.10	13.45	0.718	25.34	0.000	0.00	0.718	25.34
43.73	143.47	4.11	13.48	0.721	25.46	0.000	0.00	0.721	25.46
43.74	143.50	4.12	13.52	0.725	25.59	0.000	0.00	0.725	25.59
43.75	143.54	4.13	13.55	0.728	25.72	0.000	0.00	0.728	25.72
43.76	143.57	4.14	13.58	0.732	25.84	0.000	0.00	0.732	25.84
43.77	143.60	4.15	13.62	0.735	25.97	0.000	0.00	0.735	25.97
43.78	143.64	4.16	13.65	0.739	26.10	0.000	0.00	0.739	26.10
43.79	143.67	4.17	13.68	0.743	26.23	0.000	0.00	0.743	26.23
43.80	143.70	4.18	13.71	0.746	26.36	0.000	0.00	0.746	26.36
43.81	143.73	4.19	13.75	0.750	26.49	0.000	0.00	0.750	26.49
43.82	143.77	4.20	13.78	0.754	26.62	0.000	0.00	0.754	26.62
43.83	143.80	4.21	13.81	0.758	26.75	0.000	0.00	0.758	26.75
43.84	143.83	4.22	13.85	0.761	26.89	0.000	0.00	0.761	26.89
43.85	143.86	4.23	13.88	0.765	27.02	0.000	0.00	0.765	27.02
43.86	143.90	4.24	13.91	0.769	27.15	0.000	0.00	0.769	27.15
43.87	143.93	4.25	13.94	0.773	27.29	0.000	0.00	0.773	27.29
43.88	143.96	4.26	13.98	0.777	27.42	0.000	0.00	0.777	27.42
43.89	144.00	4.27	14.01	0.780	27.56	0.000	0.00	0.780	27.56
43.90	144.03	4.28	14.04	0.784	27.70	0.000	0.00	0.784	27.70
43.91	144.06	4.29	14.07	0.788	27.83	0.000	0.00	0.788	27.83
43.92	144.09	4.30	14.11	0.792	27.97	0.000	0.00	0.792	27.97
43.93	144.13	4.31	14.14	0.796	28.11	0.000	0.00	0.796	28.11
43.94	144.16	4.32	14.17	0.800	28.25	0.000	0.00	0.800	28.25
43.95	144.19	4.33	14.21	0.804	28.39	0.000	0.00	0.804	28.39
43.96	144.23	4.34	14.24	0.808	28.53	0.000	0.00	0.808	28.53
43.97	144.26	4.35	14.27	0.812	28.67	0.000	0.00	0.812	28.67
43.98	144.29	4.36	14.30	0.816	28.81	0.000	0.00	0.816	28.81
43.99	144.32	4.37	14.34	0.820	28.96	0.000	0.00	0.820	28.96
44.00	144.36	4.38	14.37	0.824	29.10	0.000	0.00	0.824	29.10

Page 9

Table 9: Previous data (2004) Page 9 of 36

1	2	3	4	5	6	7	8	9	10
44.01	144.39	4.39	14.40	0.828	29.24	0.000	0.00	0.828	29.24
44.02	144.42	4.40	14.44	0.832	29.39	0.000	0.00	0.832	29.39
44.03	144.46	4.41	14.47	0.836	29.53	0.000	0.00	0.836	29.53
44.04	144.49	4.42	14.50	0.840	29.68	0.000	0.00	0.840	29.68
44.05	144.52	4.43	14.53	0.845	29.83	0.000	0.00	0.845	29.83
44.06	144.55	4.44	14.57	0.849	29.98	0.000	0.00	0.849	29.98
44.07	144.59	4.45	14.60	0.853	30.12	0.000	0.00	0.853	30.12
44.08	144.62	4.46	14.63	0.857	30.27	0.000	0.00	0.857	30.27
44.09	144.65	4.47	14.67	0.861	30.42	0.000	0.00	0.861	30.42
44.10	144.69	4.48	14.70	0.866	30.57	0.000	0.00	0.866	30.57
44.11	144.72	4.49	14.73	0.870	30.73	0.000	0.00	0.870	30.73
44.12	144.75	4.50	14.76	0.874	30.88	0.000	0.00	0.874	30.88
44.13	144.78	4.51	14.80	0.879	31.03	0.000	0.00	0.879	31.03
44.14	144.82	4.52	14.83	0.883	31.18	0.000	0.00	0.883	31.18
44.15	144.85	4.53	14.86	0.887	31.34	0.000	0.00	0.887	31.34
44.16	144.88	4.54	14.90	0.892	31.49	0.000	0.00	0.892	31.49
44.17	144.91	4.55	14.93	0.896	31.65	0.000	0.00	0.896	31.65
44.18	144.95	4.56	14.96	0.901	31.81	0.000	0.00	0.901	31.81
44.19	144.98	4.57	14.99	0.905	31.96	0.000	0.00	0.905	31.96
44.20	145.01	4.58	15.03	0.910	32.12	0.000	0.00	0.910	32.12
44.21	145.05	4.59	15.06	0.914	32.28	0.000	0.00	0.914	32.28
44.22	145.08	4.60	15.09	0.919	32.44	0.000	0.00	0.919	32.44
44.23	145.11	4.61	15.12	0.923	32.60	0.000	0.00	0.923	32.60
44.24	145.14	4.62	15.16	0.928	32.76	0.000	0.00	0.928	32.76
44.25	145.18	4.63	15.19	0.932	32.93	0.000	0.00	0.932	32.93
44.26	145.21	4.64	15.22	0.937	33.09	0.000	0.00	0.937	33.09
44.27	145.24	4.65	15.26	0.942	33.25	0.000	0.00	0.942	33.25
44.28	145.28	4.66	15.29	0.946	33.42	0.000	0.00	0.946	33.42
44.29	145.31	4.67	15.32	0.951	33.58	0.000	0.00	0.951	33.58
44.30	145.34	4.68	15.35	0.967	34.15	0.000	0.00	0.967	34.15
44.31	145.37	4.69	15.39	0.972	34.31	0.000	0.00	0.972	34.31
44.32	145.41	4.70	15.42	0.976	34.48	0.000	0.00	0.976	34.48
44.33	145.44	4.71	15.45	0.981	34.65	0.000	0.00	0.981	34.65
44.34	145.47	4.72	15.49	0.986	34.81	0.000	0.00	0.986	34.81
44.35	145.51	4.73	15.52	0.991	34.98	0.000	0.00	0.991	34.98
44.36	145.54	4.74	15.55	0.995	35.15	0.000	0.00	0.995	35.15
44.37	145.57	4.75	15.58	1.000	35.32	0.000	0.00	1.000	35.32
44.38	145.60	4.76	15.62	1.005	35.49	0.000	0.00	1.005	35.49
44.39	145.64	4.77	15.65	1.010	35.66	0.000	0.00	1.010	35.66
44.40	145.67	4.78	15.68	1.015	35.83	0.000	0.00	1.015	35.83
44.41	145.70	4.79	15.72	1.020	36.00	0.000	0.00	1.020	36.00
44.42	145.73	4.80	15.75	1.024	36.18	0.000	0.00	1.024	36.18
44.43	145.77	4.81	15.78	1.029	36.35	0.000	0.00	1.029	36.35
44.44	145.80	4.82	15.81	1.034	36.53	0.000	0.00	1.034	36.53
44.45	145.83	4.83	15.85	1.039	36.70	0.000	0.00	1.039	36.70
44.46	145.87	4.84	15.88	1.044	36.88	0.000	0.00	1.044	36.88
44.47	145.90	4.85	15.91	1.049	37.06	0.000	0.00	1.049	37.06
44.48	145.93	4.86	15.94	1.054	37.24	0.000	0.00	1.054	37.24
44.49	145.96	4.87	15.98	1.060	37.42	0.000	0.00	1.060	37.42
44.50	146.00	4.88	16.01	1.065	37.60	0.000	0.00	1.065	37.60

0.461

Page 10

Table 10: Previous data (2004) Page 10 of 36

1	2	3	4	5	6	7	8	9	10
44.51	146.03	4.89	16.04	1.070	37.78	0.000	0.00	1.070	37.78
44.52	146.06	4.90	16.08	1.075	37.96	0.000	0.00	1.075	37.96
44.53	146.10	4.91	16.11	1.080	38.14	0.000	0.00	1.080	38.14
44.54	146.13	4.92	16.14	1.085	38.33	0.000	0.00	1.085	38.33
44.55	146.16	4.93	16.17	1.091	38.51	0.000	0.00	1.091	38.51
44.56	146.19	4.94	16.21	1.096	38.70	0.000	0.00	1.096	38.70
44.57	146.23	4.95	16.24	1.101	38.88	0.000	0.00	1.101	38.88
44.58	146.26	4.96	16.27	1.106	39.07	0.000	0.00	1.106	39.07
44.59	146.29	4.97	16.31	1.112	39.26	0.000	0.00	1.112	39.26
44.60	146.33	4.98	16.34	1.117	39.45	0.000	0.00	1.117	39.45
44.61	146.36	4.99	16.37	1.122	39.64	0.000	0.00	1.122	39.64
44.62	146.39	5.00	16.40	1.128	39.83	0.000	0.00	1.128	39.83
44.63	146.42	5.01	16.44	1.133	40.02	0.000	0.00	1.133	40.02
44.64	146.46	5.02	16.47	1.139	40.21	0.000	0.00	1.139	40.21
44.65	146.49	5.03	16.50	1.144	40.41	0.000	0.00	1.144	40.41
44.66	146.52	5.04	16.54	1.150	40.60	0.000	0.00	1.150	40.60
44.67	146.56	5.05	16.57	1.155	40.80	0.000	0.00	1.155	40.80
44.68	146.59	5.06	16.60	1.161	41.00	0.000	0.00	1.161	41.00
44.69	146.62	5.07	16.63	1.166	41.19	0.000	0.00	1.166	41.19
44.70	146.65	5.08	16.67	1.172	41.39	0.000	0.00	1.172	41.39
44.71	146.69	5.09	16.70	1.178	41.59	0.000	0.00	1.178	41.59
44.72	146.72	5.10	16.73	1.183	41.79	0.000	0.00	1.183	41.79
44.73	146.75	5.11	16.77	1.189	41.99	0.000	0.00	1.189	41.99
44.74	146.78	5.12	16.80	1.195	42.20	0.000	0.00	1.195	42.20
44.75	146.82	5.13	16.83	1.201	42.40	0.000	0.00	1.201	42.40
44.76	146.85	5.14	16.86	1.206	42.60	0.000	0.00	1.206	42.60
44.77	146.88	5.15	16.90	1.212	42.81	0.000	0.00	1.212	42.81
44.78	146.92	5.16	16.93	1.218	43.02	0.000	0.00	1.218	43.02
44.79	146.95	5.17	16.96	1.224	43.22	0.000	0.00	1.224	43.22
44.80	146.98	5.18	16.99	1.230	43.43	0.000	0.00	1.230	43.43
44.81	147.01	5.19	17.03	1.236	43.64	0.000	0.00	1.236	43.64
44.82	147.05	5.20	17.06	1.242	43.85	0.000	0.00	1.242	43.85
44.83	147.08	5.21	17.09	1.248	44.06	0.000	0.00	1.248	44.06
44.84	147.11	5.22	17.13	1.254	44.27	0.000	0.00	1.254	44.27
44.85	147.15	5.23	17.16	1.260	44.49	0.000	0.00	1.260	44.49
44.86	147.18	5.24	17.19	1.266	44.70	0.000	0.00	1.266	44.70
44.87	147.21	5.25	17.22	1.272	44.92	0.000	0.00	1.272	44.92
44.88	147.24	5.26	17.26	1.278	45.13	0.000	0.00	1.278	45.13
44.89	147.28	5.27	17.29	1.284	45.35	0.000	0.00	1.284	45.35
44.90	147.31	5.28	17.32	1.290	45.57	0.000	0.00	1.290	45.57
44.91	147.34	5.29	17.36	1.297	45.79	0.000	0.00	1.297	45.79
44.92	147.38	5.30	17.39	1.303	46.01	0.000	0.00	1.303	46.01
44.93	147.41	5.31	17.42	1.309	46.23	0.000	0.00	1.309	46.23
44.94	147.44	5.32	17.45	1.315	46.46	0.000	0.00	1.315	46.46
44.95	147.47	5.33	17.49	1.322	46.68	0.000	0.00	1.322	46.68
44.96	147.51	5.34	17.52	1.328	46.90	0.000	0.00	1.328	46.90
44.97	147.54	5.35	17.55	1.335	47.13	0.000	0.00	1.335	47.13
44.98	147.57	5.36	17.59	1.341	47.36	0.000	0.00	1.341	47.36
44.99	147.60	5.37	17.62	1.347	47.59	0.000	0.00	1.347	47.59
45.00	147.64	5.38	17.65	1.354	47.82	0.000	0.00	1.354	47.82

Page 11

Table 11: Previous data (2004) Page 11 of 36

1	2	3	4	5	6	7	8	9	10
45.01	147.67	5.39	17.68	1.360	48.05	0.000	0.00	1.360	48.05
45.02	147.70	5.40	17.72	1.367	48.28	0.000	0.00	1.367	48.28
45.03	147.74	5.41	17.75	1.374	48.51	0.000	0.00	1.374	48.51
45.04	147.77	5.42	17.78	1.380	48.74	0.000	0.00	1.380	48.74
45.05	147.80	5.43	17.81	1.387	48.98	0.000	0.00	1.387	48.98
45.06	147.83	5.44	17.85	1.394	49.21	0.000	0.00	1.394	49.21
45.07	147.87	5.45	17.88	1.400	49.45	0.000	0.00	1.400	49.45
45.08	147.90	5.46	17.91	1.407	49.69	0.000	0.00	1.407	49.69
45.09	147.93	5.47	17.95	1.414	49.93	0.000	0.00	1.414	49.93
45.10	147.97	5.48	17.98	1.421	50.17	0.000	0.00	1.421	50.17
45.11	148.00	5.49	18.01	1.428	50.41	0.000	0.00	1.428	50.41
45.12	148.03	5.50	18.04	1.434	50.66	0.000	0.00	1.434	50.66
45.13	148.06	5.51	18.08	1.441	50.90	0.000	0.00	1.441	50.90
45.14	148.10	5.52	18.11	1.448	51.14	0.000	0.00	1.448	51.14
45.15	148.13	5.53	18.14	1.455	51.39	0.000	0.00	1.455	51.39
45.16	148.16	5.54	18.18	1.462	51.64	0.000	0.00	1.462	51.64
45.17	148.20	5.55	18.21	1.469	51.89	0.000	0.00	1.469	51.89
45.18	148.23	5.56	18.24	1.476	52.14	0.000	0.00	1.476	52.14
45.19	148.26	5.57	18.27	1.483	52.39	0.000	0.00	1.483	52.39
45.20	148.29	5.58	18.31	1.491	52.64	0.000	0.00	1.491	52.64
45.21	148.33	5.59	18.34	1.498	52.90	0.000	0.00	1.498	52.90
45.22	148.36	5.60	18.37	1.505	53.15	0.000	0.00	1.505	53.15
45.23	148.39	5.61	18.41	1.512	53.41	0.000	0.00	1.512	53.41
45.24	148.43	5.62	18.44	1.520	53.66	0.000	0.00	1.520	53.66
45.25	148.46	5.63	18.47	1.527	53.92	0.000	0.00	1.527	53.92
45.26	148.49	5.64	18.50	1.534	54.18	0.000	0.00	1.534	54.18
45.27	148.52	5.65	18.54	1.542	54.44	0.000	0.00	1.542	54.44
45.28	148.56	5.66	18.57	1.549	54.71	0.000	0.00	1.549	54.71
45.29	148.59	5.67	18.60	1.557	54.97	0.000	0.00	1.557	54.97
45.30	148.62	5.68	18.64	1.581	55.83	0.000	0.00	1.581	55.83
45.31	148.65	5.69	18.67	1.588	56.09	0.000	0.00	1.588	56.09
45.32	148.69	5.70	18.70	1.596	56.35	0.000	0.00	1.596	56.35
45.33	148.72	5.71	18.73	1.603	56.62	0.000	0.00	1.603	56.62
45.34	148.75	5.72	18.77	1.611	56.88	0.000	0.00	1.611	56.88
45.35	148.79	5.73	18.80	1.618	57.15	0.000	0.00	1.618	57.15
45.36	148.82	5.74	18.83	1.626	57.41	0.000	0.00	1.626	57.41
45.37	148.85	5.75	18.86	1.633	57.68	0.000	0.00	1.633	57.68
45.38	148.88	5.76	18.90	1.641	57.95	0.000	0.00	1.641	57.95
45.39	148.92	5.77	18.93	1.649	58.22	0.000	0.00	1.649	58.22
45.40	148.95	5.78	18.96	1.656	58.49	0.000	0.00	1.656	58.49
45.41	148.98	5.79	19.00	1.664	58.76	0.000	0.00	1.664	58.76
45.42	149.02	5.80	19.03	1.672	59.04	0.000	0.00	1.672	59.04
45.43	149.05	5.81	19.06	1.680	59.31	0.000	0.00	1.680	59.31
45.44	149.08	5.82	19.09	1.687	59.59	0.000	0.00	1.687	59.59
45.45	149.11	5.83	19.13	1.695	59.87	0.000	0.00	1.695	59.87
45.46	149.15	5.84	19.16	1.703	60.14	0.000	0.00	1.703	60.14
45.47	149.18	5.85	19.19	1.711	60.42	0.000	0.00	1.711	60.42
45.48	149.21	5.86	19.23	1.719	60.71	0.000	0.00	1.719	60.71
45.49	149.25	5.87	19.26	1.727	60.99	0.000	0.00	1.727	60.99
45.50	149.28	5.88	19.29	1.735	61.27	0.000	0.00	1.735	61.27

Q-783

Table 12: Previous data (2004) Page 12 of 36

1	2	3	4	5	6	7	8	9	10
45.51	149.31	5.89	19.32	1.743	61.56	0.000	0.00	1.743	61.56
45.52	149.34	5.90	19.36	1.751	61.85	0.000	0.00	1.751	61.85
45.53	149.38	5.91	19.39	1.759	62.13	0.000	0.00	1.759	62.13
45.54	149.41	5.92	19.42	1.768	62.42	0.000	0.00	1.768	62.42
45.55	149.44	5.93	19.46	1.776	62.71	0.000	0.00	1.776	62.71
45.56	149.48	5.94	19.49	1.784	63.01	0.000	0.00	1.784	63.01
45.57	149.51	5.95	19.52	1.792	63.30	0.000	0.00	1.792	63.30
45.58	149.54	5.96	19.55	1.801	63.60	0.000	0.00	1.801	63.60
45.59	149.57	5.97	19.59	1.809	63.89	0.000	0.00	1.809	63.89
45.60	149.61	5.98	19.62	1.818	64.19	0.000	0.00	1.818	64.19
45.61	149.64	5.99	19.65	1.826	64.49	0.000	0.00	1.826	64.49
45.62	149.67	6.00	19.69	1.835	64.79	0.000	0.00	1.835	64.79
45.63	149.70	6.01	19.72	1.843	65.09	0.000	0.00	1.843	65.09
45.64	149.74	6.02	19.75	1.852	65.39	0.000	0.00	1.852	65.39
45.65	149.77	6.03	19.78	1.860	65.70	0.000	0.00	1.860	65.70
45.66	149.80	6.04	19.82	1.869	66.01	0.000	0.00	1.869	66.01
45.67	149.84	6.05	19.85	1.878	66.31	0.000	0.00	1.878	66.31
45.68	149.87	6.06	19.88	1.887	66.62	0.000	0.00	1.887	66.62
45.69	149.90	6.07	19.91	1.895	66.93	0.000	0.00	1.895	66.93
45.70	149.93	6.08	19.95	1.904	67.24	0.000	0.00	1.904	67.24
45.71	149.97	6.09	19.98	1.913	67.56	0.000	0.00	1.913	67.56
45.72	150.00	6.10	20.01	1.922	67.87	0.000	0.00	1.922	67.87
45.73	150.03	6.11	20.05	1.931	68.19	0.000	0.00	1.931	68.19
45.74	150.07	6.12	20.08	1.940	68.51	0.000	0.00	1.940	68.51
45.75	150.10	6.13	20.11	1.949	68.83	0.000	0.00	1.949	68.83
45.76	150.13	6.14	20.14	1.958	69.15	0.000	0.00	1.958	69.15
45.77	150.16	6.15	20.18	1.967	69.47	0.000	0.00	1.967	69.47
45.78	150.20	6.16	20.21	1.976	69.79	0.000	0.00	1.976	69.79
45.79	150.23	6.17	20.24	1.985	70.12	0.000	0.00	1.985	70.12
45.80	150.26	6.18	20.28	1.995	70.44	0.000	0.00	1.995	70.44
45.81	150.30	6.19	20.31	2.004	70.77	0.000	0.00	2.004	70.77
45.82	150.33	6.20	20.34	2.013	71.10	0.000	0.00	2.013	71.10
45.83	150.36	6.21	20.37	2.023	71.43	0.000	0.00	2.023	71.43
45.84	150.39	6.22	20.41	2.032	71.77	0.000	0.00	2.032	71.77
45.85	150.43	6.23	20.44	2.042	72.10	0.000	0.00	2.042	72.10
45.86	150.46	6.24	20.47	2.051	72.44	0.000	0.00	2.051	72.44
45.87	150.49	6.25	20.51	2.061	72.77	0.000	0.00	2.061	72.77
45.88	150.52	6.26	20.54	2.070	73.11	0.000	0.00	2.070	73.11
45.89	150.56	6.27	20.57	2.080	73.45	0.000	0.00	2.080	73.45
45.90	150.59	6.28	20.60	2.090	73.80	0.000	0.00	2.090	73.80
45.91	150.62	6.29	20.64	2.099	74.14	0.000	0.00	2.099	74.14
45.92	150.66	6.30	20.67	2.109	74.49	0.000	0.00	2.109	74.49
45.93	150.69	6.31	20.70	2.119	74.83	0.000	0.00	2.119	74.83
45.94	150.72	6.32	20.73	2.129	75.18	0.000	0.00	2.129	75.18
45.95	150.75	6.33	20.77	2.139	75.53	0.000	0.00	2.139	75.53
45.96	150.79	6.34	20.80	2.149	75.88	0.000	0.00	2.149	75.88
45.97	150.82	6.35	20.83	2.159	76.24	0.000	0.00	2.159	76.24
45.98	150.85	6.36	20.87	2.169	76.59	0.000	0.00	2.169	76.59
45.99	150.89	6.37	20.90	2.179	76.95	0.000	0.00	2.179	76.95
46.00	150.92	6.38	20.93	2.189	77.31	0.000	0.00	2.189	77.31

Page 13

Table 13: Previous data (2004) Page 13 of 36

1	2	3	4	5	6	7	8	9	10
46.01	150.95	6.39	20.96	2.199	77.67	0.000	0.00	2.199	77.67
46.02	150.98	6.40	21.00	2.210	78.03	0.000	0.00	2.210	78.03
46.03	151.02	6.41	21.03	2.220	78.39	0.000	0.00	2.220	78.39
46.04	151.05	6.42	21.06	2.230	78.76	0.000	0.00	2.230	78.76
46.05	151.08	6.43	21.10	2.241	79.13	0.000	0.00	2.241	79.13
46.06	151.12	6.44	21.13	2.251	79.50	0.000	0.00	2.251	79.50
46.07	151.15	6.45	21.16	2.262	79.87	0.000	0.00	2.262	79.87
46.08	151.18	6.46	21.19	2.272	80.24	0.000	0.00	2.272	80.24
46.09	151.21	6.47	21.23	2.283	80.61	0.000	0.00	2.283	80.61
46.10	151.25	6.48	21.26	2.293	80.99	0.000	0.00	2.293	80.99
46.11	151.28	6.49	21.29	2.304	81.37	0.000	0.00	2.304	81.37
46.12	151.31	6.50	21.33	2.315	81.74	0.000	0.00	2.315	81.74
46.13	151.35	6.51	21.36	2.326	82.13	0.000	0.00	2.326	82.13
46.14	151.38	6.52	21.39	2.336	82.51	0.000	0.00	2.336	82.51
46.15	151.41	6.53	21.42	2.347	82.89	0.000	0.00	2.347	82.89
46.16	151.44	6.54	21.46	2.358	83.28	0.000	0.00	2.358	83.28
46.17	151.48	6.55	21.49	2.369	83.67	0.000	0.00	2.369	83.67
46.18	151.51	6.56	21.52	2.380	84.06	0.000	0.00	2.380	84.06
46.19	151.54	6.57	21.56	2.391	84.45	0.000	0.00	2.391	84.45
46.20	151.57	6.58	21.59	2.402	84.84	0.000	0.00	2.402	84.84
46.21	151.61	6.59	21.62	2.414	85.24	0.000	0.00	2.414	85.24
46.22	151.64	6.60	21.65	2.425	85.63	0.000	0.00	2.425	85.63
46.23	151.67	6.61	21.69	2.436	86.03	0.000	0.00	2.436	86.03
46.24	151.71	6.62	21.72	2.448	86.43	0.000	0.00	2.448	86.43
46.25	151.74	6.63	21.75	2.459	86.84	0.000	0.00	2.459	86.84
46.26	151.77	6.64	21.78	2.470	87.24	0.000	0.00	2.470	87.24
46.27	151.80	6.65	21.82	2.482	87.65	0.000	0.00	2.482	87.65
46.28	151.84	6.66	21.85	2.493	88.06	0.000	0.00	2.493	88.06
46.29	151.87	6.67	21.88	2.505	88.47	0.000	0.00	2.505	88.47
46.30	151.90	6.68	21.92	2.517	88.89	0.000	0.00	2.517	88.89
46.31	151.94	6.69	21.95	2.529	89.31	0.000	0.00	2.529	89.31
46.32	151.97	6.70	21.98	2.541	89.74	0.000	0.00	2.541	89.74
46.33	152.00	6.71	22.01	2.553	90.17	0.000	0.00	2.553	90.17
46.34	152.03	6.72	22.05	2.565	90.60	0.000	0.00	2.565	90.60
46.35	152.07	6.73	22.08	2.577	91.03	0.000	0.00	2.577	91.03
46.36	152.10	6.74	22.11	2.589	91.46	0.000	0.00	2.589	91.46
46.37	152.13	6.75	22.15	2.601	91.89	0.000	0.00	2.601	91.89
46.38	152.17	6.76	22.18	2.613	92.32	0.000	0.00	2.613	92.32
46.39	152.20	6.77	22.21	2.625	92.75	0.000	0.00	2.625	92.75
46.40	152.23	6.78	22.24	2.637	93.18	0.000	0.00	2.637	93.18
46.41	152.26	6.79	22.28	2.649	93.61	0.000	0.00	2.649	93.61
46.42	152.30	6.80	22.31	2.661	94.04	0.000	0.00	2.661	94.04
46.43	152.33	6.81	22.34	2.673	94.47	0.000	0.00	2.673	94.47
46.44	152.36	6.82	22.38	2.685	94.90	0.000	0.00	2.685	94.90
46.45	152.40	6.83	22.41	2.697	95.33	0.000	0.00	2.697	95.33
46.46	152.43	6.84	22.44	2.709	95.76	0.000	0.00	2.709	95.76
46.47	152.46	6.85	22.47	2.721	96.19	0.000	0.00	2.721	96.19
46.48	152.49	6.86	22.51	2.733	96.62	0.000	0.00	2.733	96.62
46.49	152.53	6.87	22.54	2.745	97.05	0.000	0.00	2.745	97.05
46.50	152.56	6.88	22.57	2.757	97.48	0.000	0.00	2.757	97.48

1-128

Table 14: Previous data (2004) Page 14 of 36

1	2	3	4	5	6	7	8	9	10
46 51	152.59	6.89	22.60	2.763	97.58	0.000	0.00	2.763	97.58
46 52	152.62	6.90	22.64	2.774	97.97	0.000	0.00	2.774	97.97
46 53	152.66	6.91	22.67	2.785	98.36	0.000	0.00	2.785	98.36
46 54	152.69	6.92	22.70	2.796	98.76	0.000	0.00	2.796	98.76
46 55	152.72	6.93	22.74	2.808	99.15	0.000	0.00	2.808	99.15
46 56	152.76	6.94	22.77	2.819	99.55	0.000	0.00	2.819	99.55
46 57	152.79	6.95	22.80	2.830	99.95	0.000	0.00	2.830	99.95
46 58	152.82	6.96	22.83	2.842	100.35	0.000	0.00	2.842	100.35
46 59	152.85	6.97	22.87	2.853	100.75	0.000	0.00	2.853	100.75
46 60	152.89	6.98	22.90	2.864	101.15	0.000	0.00	2.864	101.15
46 61	152.92	6.99	22.93	2.876	101.56	0.000	0.00	2.876	101.56
46 62	152.95	7.00	22.97	2.887	101.96	0.000	0.00	2.887	101.96
46 63	152.99	7.01	23.00	2.899	102.37	0.000	0.00	2.899	102.37
46 64	153.02	7.02	23.03	2.910	102.78	0.000	0.00	2.910	102.78
46 65	153.05	7.03	23.06	2.922	103.19	0.000	0.00	2.922	103.19
46 66	153.08	7.04	23.10	2.934	103.60	0.000	0.00	2.934	103.60
46 67	153.12	7.05	23.13	2.945	104.02	0.000	0.00	2.945	104.02
46 68	153.15	7.06	23.16	2.957	104.43	0.000	0.00	2.957	104.43
46 69	153.18	7.07	23.20	2.969	104.85	0.000	0.00	2.969	104.85
46 70	153.22	7.08	23.23	2.981	105.27	0.000	0.00	2.981	105.27
46 71	153.25	7.09	23.26	2.993	105.69	0.000	0.00	2.993	105.69
46 72	153.28	7.10	23.29	3.005	106.12	0.000	0.00	3.005	106.12
46 73	153.31	7.11	23.33	3.017	106.54	0.000	0.00	3.017	106.54
46 74	153.35	7.12	23.36	3.029	106.97	0.000	0.00	3.029	106.97
46 75	153.38	7.13	23.39	3.041	107.39	0.000	0.00	3.041	107.39
46 76	153.41	7.14	23.43	3.053	107.82	0.000	0.00	3.053	107.82
46 77	153.44	7.15	23.46	3.065	108.26	0.000	0.00	3.065	108.26
46 78	153.48	7.16	23.49	3.078	108.69	0.000	0.00	3.078	108.69
46 79	153.51	7.17	23.52	3.090	109.12	0.000	0.00	3.090	109.12
46 80	153.54	7.18	23.56	3.102	109.56	0.000	0.00	3.102	109.56
46 81	153.58	7.19	23.59	3.115	110.00	0.000	0.00	3.115	110.00
46 82	153.61	7.20	23.62	3.127	110.44	0.000	0.00	3.127	110.44
46 83	153.64	7.21	23.65	3.140	110.88	0.000	0.00	3.140	110.88
46 84	153.67	7.22	23.69	3.152	111.32	0.000	0.00	3.152	111.32
46 85	153.71	7.23	23.72	3.165	111.77	0.000	0.00	3.165	111.77
46 86	153.74	7.24	23.75	3.178	112.22	0.000	0.00	3.178	112.22
46 87	153.77	7.25	23.79	3.190	112.66	0.000	0.00	3.190	112.66
46 88	153.81	7.26	23.82	3.203	113.11	0.000	0.00	3.203	113.11
46 89	153.84	7.27	23.85	3.216	113.57	0.000	0.00	3.216	113.57
46 90	153.87	7.28	23.88	3.229	114.02	0.000	0.00	3.229	114.02
46 91	153.90	7.29	23.92	3.242	114.48	0.000	0.00	3.242	114.48
46 92	153.94	7.30	23.95	3.255	114.94	0.000	0.00	3.255	114.94
46 93	153.97	7.31	23.98	3.268	115.40	0.000	0.00	3.268	115.40
46 94	154.00	7.32	24.02	3.281	115.86	0.000	0.00	3.281	115.86
46 95	154.04	7.33	24.05	3.294	116.32	0.000	0.00	3.294	116.32
46 96	154.07	7.34	24.08	3.307	116.79	0.000	0.00	3.307	116.79
46 97	154.10	7.35	24.11	3.320	117.25	0.000	0.00	3.320	117.25
46 98	154.13	7.36	24.15	3.333	117.72	0.000	0.00	3.333	117.72
46 99	154.17	7.37	24.18	3.347	118.19	0.000	0.00	3.347	118.19
47 00	154.20	7.38	24.21	3.360	118.67	0.000	0.00	3.360	118.67

Page 15

Table 15: Previous data (2004) Page 15 of 36

1	2	3	4	5	6	7	8	9	10
47.01	154.23	7.39	24.25	3.374	119.14	0.000	0.00	3.374	119.14
47.02	154.27	7.40	24.28	3.387	119.62	0.000	0.00	3.387	119.62
47.03	154.30	7.41	24.31	3.401	120.09	0.000	0.00	3.401	120.09
47.04	154.33	7.42	24.34	3.414	120.58	0.000	0.00	3.414	120.58
47.05	154.36	7.43	24.38	3.428	121.06	0.000	0.00	3.428	121.06
47.06	154.40	7.44	24.41	3.442	121.54	0.000	0.00	3.442	121.54
47.07	154.43	7.45	24.44	3.455	122.03	0.000	0.00	3.455	122.03
47.08	154.46	7.46	24.48	3.469	122.52	0.000	0.00	3.469	122.52
47.09	154.49	7.47	24.51	3.483	123.01	0.000	0.00	3.483	123.01
47.10	154.53	7.48	24.54	3.497	123.50	0.000	0.00	3.497	123.50
47.11	154.56	7.49	24.57	3.511	123.99	0.000	0.00	3.511	123.99
47.12	154.59	7.50	24.61	3.525	124.49	0.000	0.00	3.525	124.49
47.13	154.63	7.51	24.64	3.539	124.99	0.000	0.00	3.539	124.99
47.14	154.66	7.52	24.67	3.553	125.49	0.000	0.00	3.553	125.49
47.15	154.69	7.53	24.70	3.568	125.99	0.000	0.00	3.568	125.99
47.16	154.72	7.54	24.74	3.582	126.49	0.000	0.00	3.582	126.49
47.17	154.76	7.55	24.77	3.596	127.00	0.000	0.00	3.596	127.00
47.18	154.79	7.56	24.80	3.611	127.51	0.000	0.00	3.611	127.51
47.19	154.82	7.57	24.84	3.625	128.02	0.000	0.00	3.625	128.02
47.20	154.86	7.58	24.87	3.639	128.53	0.000	0.00	3.639	128.53
47.21	154.89	7.59	24.90	3.654	129.04	0.000	0.00	3.654	129.04
47.22	154.92	7.60	24.93	3.669	129.56	0.000	0.00	3.669	129.56
47.23	154.95	7.61	24.97	3.683	130.08	0.000	0.00	3.683	130.08
47.24	154.99	7.62	25.00	3.804	134.34	0.000	0.00	3.804	134.34
47.25	155.02	0.01	0.03	3.804	134.34	0.015	0.53	3.819	134.87
47.26	155.05	0.02	0.07	3.804	134.34	0.031	1.09	3.835	135.43
47.27	155.09	0.03	0.10	3.804	134.34	0.046	1.62	3.850	135.96
47.28	155.12	0.04	0.13	3.804	134.34	0.061	2.15	3.865	136.49
47.29	155.15	0.05	0.16	3.804	134.34	0.077	2.72	3.881	137.06
47.30	155.18	0.06	0.20	3.804	134.34	0.094	3.32	3.898	137.66
47.31	155.22	0.07	0.23	3.804	134.34	0.097	3.42	3.901	137.76
47.32	155.25	0.08	0.26	3.804	134.34	0.100	3.53	3.904	137.86
47.33	155.28	0.09	0.30	3.804	134.34	0.103	3.63	3.907	137.97
47.34	155.31	0.10	0.33	3.804	134.34	0.106	3.75	3.910	138.08
47.35	155.35	0.11	0.36	3.804	134.34	0.109	3.86	3.913	138.20
47.36	155.38	0.12	0.39	3.804	134.34	0.113	3.98	3.917	138.32
47.37	155.41	0.13	0.43	3.804	134.34	0.116	4.10	3.920	138.44
47.38	155.45	0.14	0.46	3.804	134.34	0.120	4.23	3.924	138.57
47.39	155.48	0.15	0.49	3.804	134.34	0.123	4.36	3.927	138.70
47.40	155.51	0.16	0.52	3.804	134.34	0.127	4.49	3.931	138.83
47.41	155.54	0.17	0.56	3.804	134.34	0.131	4.63	3.935	138.97
47.42	155.58	0.18	0.59	3.804	134.34	0.135	4.77	3.939	139.11
47.43	155.61	0.19	0.62	3.804	134.34	0.139	4.92	3.943	139.26
47.44	155.64	0.20	0.66	3.804	134.34	0.144	5.07	3.948	139.41
47.45	155.68	0.21	0.69	3.804	134.34	0.148	5.22	3.952	139.56
47.46	155.71	0.22	0.72	3.804	134.34	0.152	5.39	3.956	139.72
47.47	155.74	0.23	0.75	3.804	134.34	0.157	5.55	3.961	139.89
47.48	155.77	0.24	0.79	3.804	134.34	0.162	5.72	3.966	140.06
47.49	155.81	0.25	0.82	3.804	134.34	0.167	5.90	3.971	140.23
47.50	155.84	0.26	0.85	3.804	134.34	0.172	6.08	3.976	140.42

Dead
Live
1-523

1-550

Table 16: Previous data (2004) Page 16 of 36

1	2	3	4	5	6	7	8	9	10
47 51	155.87	0.27	0.89	3.804	134.34	0.177	6.26	3.981	140.60
47 52	155.91	0.28	0.92	3.804	134.34	0.183	6.46	3.987	140.79
47 53	155.94	0.29	0.95	3.804	134.34	0.188	6.65	3.992	140.99
47 54	155.97	0.30	0.98	3.804	134.34	0.194	6.86	3.998	141.20
47 55	156.00	0.31	1.02	3.804	134.34	0.200	7.07	4.004	141.41
47 56	156.04	0.32	1.05	3.804	134.34	0.206	7.29	4.010	141.62
47 57	156.07	0.33	1.08	3.804	134.34	0.213	7.51	4.017	141.85
47 58	156.10	0.34	1.12	3.804	134.34	0.219	7.74	4.023	142.08
47 59	156.14	0.35	1.15	3.804	134.34	0.226	7.98	4.030	142.32
47 60	156.17	0.36	1.18	3.804	134.34	0.233	8.22	4.037	142.56
47 61	156.20	0.37	1.21	3.804	134.34	0.240	8.48	4.044	142.81
47 62	156.23	0.38	1.25	3.804	134.34	0.247	8.74	4.051	143.07
47 63	156.27	0.39	1.28	3.804	134.34	0.255	9.00	4.059	143.34
47 64	156.30	0.40	1.31	3.804	134.34	0.263	9.28	4.067	143.62
47 65	156.33	0.41	1.35	3.804	134.34	0.271	9.57	4.075	143.90
47 66	156.36	0.42	1.38	3.804	134.34	0.279	9.86	4.083	144.20
47 67	156.40	0.43	1.41	3.804	134.34	0.288	10.16	4.092	144.50
47 68	156.43	0.44	1.44	3.804	134.34	0.297	10.47	4.101	144.81
47 69	156.46	0.45	1.48	3.804	134.34	0.306	10.80	4.110	145.13
47 70	156.50	0.46	1.51	3.804	134.34	0.315	11.13	4.119	145.47
47 71	156.53	0.47	1.54	3.804	134.34	0.325	11.47	4.129	145.81
47 72	156.56	0.48	1.57	3.804	134.34	0.335	11.82	4.139	146.16
47 73	156.59	0.49	1.61	3.804	134.34	0.345	12.18	4.149	146.52
47 74	156.63	0.50	1.64	3.804	134.34	0.356	12.56	4.160	146.90
47 75	156.66	0.51	1.67	3.804	134.34	0.367	12.94	4.171	147.28
47 76	156.69	0.52	1.71	3.804	134.34	0.378	13.34	4.182	147.68
47 77	156.73	0.53	1.74	3.804	134.34	0.389	13.75	4.193	148.09
47 78	156.76	0.54	1.77	3.804	134.34	0.401	14.17	4.205	148.51
47 79	156.79	0.55	1.80	3.804	134.34	0.414	14.61	4.218	148.95
47 80	156.82	0.56	1.84	3.804	134.34	0.426	15.06	4.230	149.39
47 81	156.86	0.57	1.87	3.804	134.34	0.439	15.52	4.243	149.86
47 82	156.89	0.58	1.90	3.804	134.34	0.453	15.99	4.257	150.33
47 83	156.92	0.59	1.94	3.804	134.34	0.467	16.49	4.271	150.82
47 84	156.96	0.60	1.97	3.804	134.34	0.481	16.99	4.285	151.33
47 85	156.99	0.61	2.00	3.804	134.34	0.496	17.51	4.300	151.85
47 86	157.02	0.62	2.03	3.804	134.34	0.511	18.05	4.315	152.39
47 87	157.05	0.63	2.07	3.804	134.34	0.527	18.60	4.331	152.94
47 88	157.09	0.64	2.10	3.804	134.34	0.543	19.18	4.347	153.51
47 89	157.12	0.65	2.13	3.804	134.34	0.560	19.76	4.364	154.10
47 90	157.15	0.66	2.17	3.804	134.34	0.577	20.37	4.381	154.71
47 91	157.19	0.67	2.20	3.804	134.34	0.595	21.00	4.399	155.34
47 92	157.22	0.68	2.23	3.804	134.34	0.613	21.64	4.417	155.98
47 93	157.25	0.69	2.26	3.804	134.34	0.632	22.31	4.436	156.64
47 94	157.28	0.70	2.30	3.804	134.34	0.651	22.99	4.455	157.33
47 95	157.32	0.71	2.33	3.804	134.34	0.671	23.70	4.475	158.03
47 96	157.35	0.72	2.36	3.804	134.34	0.692	24.42	4.496	158.76
47 97	157.38	0.73	2.40	3.804	134.34	0.713	25.17	4.517	159.51
47 98	157.41	0.74	2.43	3.804	134.34	0.735	25.95	4.539	160.28
47 99	157.45	0.75	2.46	3.804	134.34	0.757	26.74	4.561	161.08
48 00	157.48	0.76	2.49	3.804	134.34	0.781	27.56	4.585	161.90

Page 17

Table 17: Previous data (2004) Page 17 of 36

1	2	3	4	5	6	7	8	9	10
48.01	157.51	0.77	2.53	3.804	134.34	0.804	28.41	4.608	162.75
48.02	157.55	0.78	2.56	3.804	134.34	0.829	29.28	4.633	163.62
48.03	157.58	0.79	2.59	3.804	134.34	0.855	30.18	4.659	164.52
48.04	157.61	0.80	2.62	3.804	134.34	0.881	31.11	4.685	165.45
48.05	157.64	0.81	2.66	3.804	134.34	0.908	32.06	4.712	166.40
48.06	157.68	0.82	2.69	3.804	134.34	0.936	33.05	4.740	167.39
48.07	157.71	0.83	2.72	3.804	134.34	0.965	34.06	4.769	168.40
48.08	157.74	0.84	2.76	3.804	134.34	0.994	35.11	4.798	169.45
48.09	157.78	0.85	2.79	3.804	134.34	1.025	36.19	4.829	170.52
48.10	157.81	0.86	2.82	3.804	134.34	1.056	37.30	4.860	171.63
48.11	157.84	0.87	2.85	3.804	134.34	1.089	38.44	4.893	172.78
48.12	157.87	0.88	2.89	3.804	134.34	1.122	39.62	4.926	173.96
48.13	157.91	0.89	2.92	3.804	134.34	1.156	40.84	4.960	175.18
48.14	157.94	0.90	2.95	3.804	134.34	1.192	42.09	4.996	176.43
48.15	157.97	0.91	2.99	3.804	134.34	1.228	43.38	5.032	177.72
48.16	158.01	0.92	3.02	3.804	134.34	1.266	44.72	5.070	179.05
48.17	158.04	0.93	3.05	3.804	134.34	1.305	46.09	5.109	180.43
48.18	158.07	0.94	3.08	3.804	134.34	1.345	47.50	5.149	181.84
48.19	158.10	0.95	3.12	3.804	134.34	1.386	48.96	5.190	183.30
48.20	158.14	0.96	3.15	3.804	134.34	1.429	50.47	5.233	184.80
48.21	158.17	0.97	3.18	3.804	134.34	1.473	52.01	5.277	186.35
48.22	158.20	0.98	3.22	3.804	134.34	1.518	53.61	5.322	187.95
48.23	158.23	0.99	3.25	3.804	134.34	1.565	55.26	5.369	189.60
48.24	158.27	1.00	3.28	3.804	134.34	1.613	56.95	5.417	191.29
48.25	158.30	1.01	3.31	3.804	134.34	1.662	58.70	5.466	193.04
48.26	158.33	1.02	3.35	3.804	134.34	1.713	60.50	5.517	194.84
48.27	158.37	1.03	3.38	3.804	134.34	1.766	62.36	5.570	196.70
48.28	158.40	1.04	3.41	3.804	134.34	1.820	64.28	5.624	198.61
48.29	158.43	1.05	3.44	3.804	134.34	1.876	66.25	5.680	200.59
48.30	158.46	1.06	3.48	3.804	134.34	1.930	68.16	5.734	202.50
48.31	158.50	1.07	3.51	3.804	134.34	1.946	68.72	5.750	203.06
48.32	158.53	1.08	3.54	3.804	134.34	1.962	69.29	5.766	203.63
48.33	158.56	1.09	3.58	3.804	134.34	1.978	69.86	5.782	204.20
48.34	158.60	1.10	3.61	3.804	134.34	1.994	70.44	5.798	204.77
48.35	158.63	1.11	3.64	3.804	134.34	2.011	71.02	5.815	205.35
48.36	158.66	1.12	3.67	3.804	134.34	2.028	71.60	5.832	205.94
48.37	158.69	1.13	3.71	3.804	134.34	2.044	72.19	5.848	206.53
48.38	158.73	1.14	3.74	3.804	134.34	2.061	72.79	5.865	207.13
48.39	158.76	1.15	3.77	3.804	134.34	2.078	73.39	5.882	207.73
48.40	158.79	1.16	3.81	3.804	134.34	2.095	73.99	5.899	208.33
48.41	158.83	1.17	3.84	3.804	134.34	2.113	74.60	5.917	208.94
48.42	158.86	1.18	3.87	3.804	134.34	2.130	75.22	5.934	209.56
48.43	158.89	1.19	3.90	3.804	134.34	2.148	75.84	5.952	210.18
48.44	158.92	1.20	3.94	3.804	134.34	2.165	76.47	5.969	210.80
48.45	158.96	1.21	3.97	3.804	134.34	2.183	77.10	5.987	211.44
48.46	158.99	1.22	4.00	3.804	134.34	2.201	77.73	6.005	212.07
48.47	159.02	1.23	4.04	3.804	134.34	2.219	78.37	6.023	212.71
48.48	159.06	1.24	4.07	3.804	134.34	2.238	79.02	6.042	213.36
48.49	159.09	1.25	4.10	3.804	134.34	2.256	79.67	6.060	214.01
48.50	159.12	1.26	4.13	3.804	134.34	2.275	80.33	6.079	214.67

2-082

Table 18: Previous data (2004) Page 18 of 36

1	2	3	4	5	6	7	8	9	10
48.51	159.15	1.27	4.17	3.804	134.34	2.293	80.99	6.097	215.33
48.52	159.19	1.28	4.20	3.804	134.34	2.312	81.66	6.116	216.00
48.53	159.22	1.29	4.23	3.804	134.34	2.331	82.34	6.135	216.67
48.54	159.25	1.30	4.27	3.804	134.34	2.351	83.01	6.155	217.35
48.55	159.28	1.31	4.30	3.804	134.34	2.370	83.70	6.174	218.04
48.56	159.32	1.32	4.33	3.804	134.34	2.390	84.39	6.194	218.73
48.57	159.35	1.33	4.36	3.804	134.34	2.409	85.09	6.213	219.42
48.58	159.38	1.34	4.40	3.804	134.34	2.429	85.79	6.233	220.13
48.59	159.42	1.35	4.43	3.804	134.34	2.449	86.50	6.253	220.83
48.60	159.45	1.36	4.46	3.804	134.34	2.469	87.21	6.273	221.55
48.61	159.48	1.37	4.49	3.804	134.34	2.490	87.93	6.294	222.27
48.62	159.51	1.38	4.53	3.804	134.34	2.510	88.65	6.314	222.99
48.63	159.55	1.39	4.56	3.804	134.34	2.531	89.39	6.335	223.72
48.64	159.58	1.40	4.59	3.804	134.34	2.552	90.12	6.356	224.46
48.65	159.61	1.41	4.63	3.804	134.34	2.573	90.87	6.377	225.20
48.66	159.65	1.42	4.66	3.804	134.34	2.594	91.62	6.398	225.95
48.67	159.68	1.43	4.69	3.804	134.34	2.616	92.37	6.420	226.71
48.68	159.71	1.44	4.72	3.804	134.34	2.637	93.13	6.441	227.47
48.69	159.74	1.45	4.76	3.804	134.34	2.659	93.90	6.463	228.24
48.70	159.78	1.46	4.79	3.804	134.34	2.681	94.68	6.485	229.02
48.71	159.81	1.47	4.82	3.804	134.34	2.703	95.46	6.507	229.80
48.72	159.84	1.48	4.86	3.804	134.34	2.725	96.25	6.529	230.58
48.73	159.88	1.49	4.89	3.804	134.34	2.748	97.04	6.552	231.38
48.74	159.91	1.50	4.92	3.804	134.34	2.771	97.84	6.575	232.18
48.75	159.94	1.51	4.95	3.804	134.34	2.793	98.65	6.597	232.99
48.76	159.97	1.52	4.99	3.804	134.34	2.816	99.46	6.620	233.80
48.77	160.01	1.53	5.02	3.804	134.34	2.840	100.28	6.644	234.62
48.78	160.04	1.54	5.05	3.804	134.34	2.863	101.11	6.667	235.45
48.79	160.07	1.55	5.09	3.804	134.34	2.887	101.94	6.691	236.28
48.80	160.10	1.56	5.12	3.804	134.34	2.911	102.78	6.715	237.12
48.81	160.14	1.57	5.15	3.804	134.34	2.935	103.63	6.739	237.97
48.82	160.17	1.58	5.18	3.804	134.34	2.959	104.49	6.763	238.83
48.83	160.20	1.59	5.22	3.804	134.34	2.983	105.35	6.787	239.69
48.84	160.24	1.60	5.25	3.804	134.34	3.008	106.22	6.812	240.56
48.85	160.27	1.61	5.28	3.804	134.34	3.033	107.10	6.837	241.43
48.86	160.30	1.62	5.31	3.804	134.34	3.058	107.98	6.862	242.32
48.87	160.33	1.63	5.35	3.804	134.34	3.083	108.87	6.887	243.21
48.88	160.37	1.64	5.38	3.804	134.34	3.108	109.77	6.912	244.11
48.89	160.40	1.65	5.41	3.804	134.34	3.134	110.67	6.938	245.01
48.90	160.43	1.66	5.45	3.804	134.34	3.160	111.59	6.964	245.92
48.91	160.47	1.67	5.48	3.804	134.34	3.186	112.51	6.990	246.85
48.92	160.50	1.68	5.51	3.804	134.34	3.212	113.43	7.016	247.77
48.93	160.53	1.69	5.54	3.804	134.34	3.239	114.37	7.043	248.71
48.94	160.56	1.70	5.58	3.804	134.34	3.265	115.31	7.069	249.65
48.95	160.60	1.71	5.61	3.804	134.34	3.292	116.27	7.096	250.60
48.96	160.63	1.72	5.64	3.804	134.34	3.319	117.22	7.123	251.56
48.97	160.66	1.73	5.68	3.804	134.34	3.347	118.19	7.151	252.53
48.98	160.70	1.74	5.71	3.804	134.34	3.374	119.17	7.178	253.51
48.99	160.73	1.75	5.74	3.804	134.34	3.402	120.15	7.206	254.49
49.00	160.76	1.76	5.77	3.804	134.34	3.430	121.14	7.234	255.48

Page 19

Table 19: Previous data (2004) Page 19 of 36

1	2	3	4	5	6	7	8	9	10
49.01	160.79	1.77	5.81	3.804	134.34	3.459	122.14	7.263	256.48
49.02	160.83	1.78	5.84	3.804	134.34	3.487	123.15	7.291	257.49
49.03	160.86	1.79	5.87	3.804	134.34	3.516	124.16	7.320	258.50
49.04	160.89	1.80	5.91	3.804	134.34	3.545	125.19	7.349	259.53
49.05	160.93	1.81	5.94	3.804	134.34	3.574	126.22	7.378	260.56
49.06	160.96	1.82	5.97	3.804	134.34	3.604	127.26	7.408	261.60
49.07	160.99	1.83	6.00	3.804	134.34	3.633	128.31	7.437	262.65
49.08	161.02	1.84	6.04	3.804	134.34	3.663	129.37	7.467	263.71
49.09	161.06	1.85	6.07	3.804	134.34	3.694	130.44	7.498	264.78
49.10	161.09	1.86	6.10	3.804	134.34	3.724	131.51	7.528	265.85
49.11	161.12	1.87	6.14	3.804	134.34	3.755	132.60	7.559	266.94
49.12	161.15	1.88	6.17	3.804	134.34	3.786	133.69	7.590	268.03
49.13	161.19	1.89	6.20	3.804	134.34	3.817	134.80	7.621	269.14
49.14	161.22	1.90	6.23	3.804	134.34	3.848	135.91	7.652	270.25
49.15	161.25	1.91	6.27	3.804	134.34	3.880	137.03	7.684	271.37
49.16	161.29	1.92	6.30	3.804	134.34	3.912	138.16	7.716	272.50
49.17	161.32	1.93	6.33	3.804	134.34	3.945	139.30	7.749	273.64
49.18	161.35	1.94	6.36	3.804	134.34	3.977	140.45	7.781	274.79
49.19	161.38	1.95	6.40	3.804	134.34	4.010	141.61	7.814	275.95
49.20	161.42	1.96	6.43	3.804	134.34	4.043	142.78	7.847	277.11
49.21	161.45	1.97	6.46	3.804	134.34	4.076	143.95	7.880	278.29
49.22	161.48	1.98	6.50	3.804	134.34	4.110	145.14	7.914	279.48
49.23	161.52	1.99	6.53	3.804	134.34	4.144	146.34	7.948	280.68
49.24	161.55	2.00	6.56	3.804	134.34	4.178	147.55	7.982	281.89
49.25	161.58	2.01	6.59	3.804	134.34	4.212	148.76	8.016	283.10
49.26	161.61	2.02	6.63	3.804	134.34	4.247	149.99	8.051	284.33
49.27	161.65	2.03	6.66	3.804	134.34	4.282	151.23	8.086	285.57
49.28	161.68	2.04	6.69	3.804	134.34	4.318	152.48	8.122	286.81
49.29	161.71	2.05	6.73	3.804	134.34	4.353	153.73	8.157	288.07
49.30	161.75	2.06	6.76	3.804	134.34	4.393	155.14	8.197	289.48
49.31	161.78	2.07	6.79	3.804	134.34	4.418	156.01	8.222	290.35
49.32	161.81	2.08	6.82	3.804	134.34	4.442	156.88	8.246	291.22
49.33	161.84	2.09	6.86	3.804	134.34	4.467	157.76	8.271	292.10
49.34	161.88	2.10	6.89	3.804	134.34	4.492	158.64	8.296	292.98
49.35	161.91	2.11	6.92	3.804	134.34	4.517	159.53	8.321	293.87
49.36	161.94	2.12	6.96	3.804	134.34	4.543	160.42	8.347	294.76
49.37	161.98	2.13	6.99	3.804	134.34	4.568	161.32	8.372	295.66
49.38	162.01	2.14	7.02	3.804	134.34	4.594	162.23	8.398	296.57
49.39	162.04	2.15	7.05	3.804	134.34	4.619	163.14	8.423	297.47
49.40	162.07	2.16	7.09	3.804	134.34	4.645	164.05	8.449	298.39
49.41	162.11	2.17	7.12	3.804	134.34	4.671	164.97	8.475	299.31
49.42	162.14	2.18	7.15	3.804	134.34	4.697	165.89	8.501	300.23
49.43	162.17	2.19	7.19	3.804	134.34	4.724	166.82	8.528	301.16
49.44	162.20	2.20	7.22	3.804	134.34	4.750	167.75	8.554	302.09
49.45	162.24	2.21	7.25	3.804	134.34	4.777	168.69	8.581	303.03
49.46	162.27	2.22	7.28	3.804	134.34	4.804	169.64	8.608	303.98
49.47	162.30	2.23	7.32	3.804	134.34	4.830	170.59	8.634	304.93
49.48	162.34	2.24	7.35	3.804	134.34	4.858	171.54	8.662	305.88
49.49	162.37	2.25	7.38	3.804	134.34	4.885	172.50	8.689	306.84
49.50	162.40	2.26	7.41	3.804	134.34	4.912	173.47	8.716	307.81

2-791

Table 20: Previous data (2004) Page 20 of 36

1	2	3	4	5	6	7	8	9	10
49.51	162.43	2.27	7.45	3.804	134.34	4.940	174.44	8.744	308.78
49.52	162.47	2.28	7.48	3.804	134.34	4.967	175.42	8.771	309.76
49.53	162.50	2.29	7.51	3.804	134.34	4.995	176.40	8.799	310.74
49.54	162.53	2.30	7.55	3.804	134.34	5.023	177.39	8.827	311.73
49.55	162.57	2.31	7.58	3.804	134.34	5.051	178.38	8.855	312.72
49.56	162.60	2.32	7.61	3.804	134.34	5.079	179.38	8.883	313.72
49.57	162.63	2.33	7.64	3.804	134.34	5.108	180.39	8.912	314.72
49.58	162.66	2.34	7.68	3.804	134.34	5.137	181.40	8.941	315.73
49.59	162.70	2.35	7.71	3.804	134.34	5.165	182.41	8.969	316.75
49.60	162.73	2.36	7.74	3.804	134.34	5.194	183.43	8.998	317.77
49.61	162.76	2.37	7.78	3.804	134.34	5.223	184.46	9.027	318.80
49.62	162.80	2.38	7.81	3.804	134.34	5.253	185.49	9.057	319.83
49.63	162.83	2.39	7.84	3.804	134.34	5.282	186.53	9.086	320.87
49.64	162.86	2.40	7.87	3.804	134.34	5.312	187.58	9.116	321.92
49.65	162.89	2.41	7.91	3.804	134.34	5.341	188.63	9.145	322.97
49.66	162.93	2.42	7.94	3.804	134.34	5.371	189.68	9.175	324.02
49.67	162.96	2.43	7.97	3.804	134.34	5.401	190.75	9.205	325.08
49.68	162.99	2.44	8.01	3.804	134.34	5.432	191.81	9.236	326.15
49.69	163.02	2.45	8.04	3.804	134.34	5.462	192.89	9.266	327.23
49.70	163.06	2.46	8.07	3.804	134.34	5.493	193.97	9.297	328.31
49.71	163.09	2.47	8.10	3.804	134.34	5.523	195.05	9.327	329.39
49.72	163.12	2.48	8.14	3.804	134.34	5.554	196.15	9.358	330.49
49.73	163.16	2.49	8.17	3.804	134.34	5.585	197.25	9.389	331.58
49.74	163.19	2.50	8.20	3.804	134.34	5.617	198.35	9.421	332.69
49.75	163.22	2.51	8.23	3.804	134.34	5.648	199.46	9.452	333.80
49.76	163.25	2.52	8.27	3.804	134.34	5.680	200.58	9.484	334.92
49.77	163.29	2.53	8.30	3.804	134.34	5.711	201.70	9.515	336.04
49.78	163.32	2.54	8.33	3.804	134.34	5.743	202.83	9.547	337.17
49.79	163.35	2.55	8.37	3.804	134.34	5.776	203.97	9.580	338.30
49.80	163.39	2.56	8.40	3.804	134.34	5.808	205.11	9.612	339.45
49.81	163.42	2.57	8.43	3.804	134.34	5.840	206.26	9.644	340.60
49.82	163.45	2.58	8.46	3.804	134.34	5.873	207.41	9.677	341.75
49.83	163.48	2.59	8.50	3.804	134.34	5.906	208.57	9.710	342.91
49.84	163.52	2.60	8.53	3.804	134.34	5.939	209.74	9.743	344.08
49.85	163.55	2.61	8.56	3.804	134.34	5.972	210.92	9.776	345.25
49.86	163.58	2.62	8.60	3.804	134.34	6.006	212.10	9.810	346.44
49.87	163.62	2.63	8.63	3.804	134.34	6.040	213.29	9.844	347.62
49.88	163.65	2.64	8.66	3.804	134.34	6.073	214.48	9.877	348.82
49.89	163.68	2.65	8.69	3.804	134.34	6.107	215.68	9.911	350.02
49.90	163.71	2.66	8.73	3.804	134.34	6.142	216.89	9.946	351.23
49.91	163.75	2.67	8.76	3.804	134.34	6.176	218.10	9.980	352.44
49.92	163.78	2.68	8.79	3.804	134.34	6.211	219.32	10.015	353.66
49.93	163.81	2.69	8.83	3.804	134.34	6.245	220.55	10.049	354.89
49.94	163.85	2.70	8.86	3.804	134.34	6.280	221.79	10.084	356.13
49.95	163.88	2.71	8.89	3.804	134.34	6.315	223.03	10.119	357.37
49.96	163.91	2.72	8.92	3.804	134.34	6.351	224.28	10.155	358.62
49.97	163.94	2.73	8.96	3.804	134.34	6.386	225.53	10.190	359.87
49.98	163.98	2.74	8.99	3.804	134.34	6.422	226.80	10.226	361.14
49.99	164.01	2.75	9.02	3.804	134.34	6.458	228.07	10.262	362.41
50.00	164.04	2.76	9.06	3.804	134.34	6.494	229.34	10.298	363.68

Page 21

Table 21: Previous data (2004) Page 21 of 36

1	2	3	4	5	6	7	8	9	10
50.01	164.07	2.77	9.09	3.804	134.34	6.531	230.63	10.335	364.97
50.02	164.11	2.78	9.12	3.804	134.34	6.567	231.92	10.371	366.26
50.03	164.14	2.79	9.15	3.804	134.34	6.604	233.22	10.408	367.56
50.04	164.17	2.80	9.19	3.804	134.34	6.641	234.53	10.445	368.86
50.05	164.21	2.81	9.22	3.804	134.34	6.678	235.84	10.482	370.18
50.06	164.24	2.82	9.25	3.804	134.34	6.716	237.16	10.520	371.50
50.07	164.27	2.83	9.28	3.804	134.34	6.753	238.49	10.557	372.83
50.08	164.30	2.84	9.32	3.804	134.34	6.791	239.82	10.595	374.16
50.09	164.34	2.85	9.35	3.804	134.34	6.829	241.17	10.633	375.50
50.10	164.37	2.86	9.38	3.804	134.34	6.867	242.52	10.671	376.85
50.11	164.40	2.87	9.42	3.804	134.34	6.906	243.87	10.710	378.21
50.12	164.44	2.88	9.45	3.804	134.34	6.944	245.24	10.748	379.58
50.13	164.47	2.89	9.48	3.804	134.34	6.983	246.61	10.787	380.95
50.14	164.50	2.90	9.51	3.804	134.34	7.022	247.99	10.826	382.33
50.15	164.53	2.91	9.55	3.804	134.34	7.062	249.38	10.866	383.72
50.16	164.57	2.92	9.58	3.804	134.34	7.101	250.78	10.905	385.12
50.17	164.60	2.93	9.61	3.804	134.34	7.141	252.18	10.945	386.52
50.18	164.63	2.94	9.65	3.804	134.34	7.181	253.60	10.985	387.94
50.19	164.67	2.95	9.68	3.804	134.34	7.221	255.02	11.025	389.36
50.20	164.70	2.96	9.71	3.804	134.34	7.262	256.44	11.066	390.78
50.21	164.73	2.97	9.74	3.804	134.34	7.302	257.88	11.106	392.22
50.22	164.76	2.98	9.78	3.804	134.34	7.343	259.33	11.147	393.66
50.23	164.80	2.99	9.81	3.804	134.34	7.384	260.78	11.188	395.12
50.24	164.83	3.00	9.84	3.804	134.34	7.426	262.24	11.230	396.58
50.25	164.86	3.01	9.88	3.804	134.34	7.467	263.71	11.271	398.04
50.26	164.90	3.02	9.91	3.804	134.34	7.509	265.18	11.313	399.52
50.27	164.93	3.03	9.94	3.804	134.34	7.551	266.67	11.355	401.01
50.28	164.96	3.04	9.97	3.804	134.34	7.593	268.16	11.397	402.50
50.29	164.99	3.05	10.01	3.804	134.34	7.636	269.66	11.440	404.00
50.30	165.03	3.06	10.04	3.804	134.34	7.676	271.08	11.480	405.42
50.31	165.06	3.07	10.07	3.804	134.34	7.712	272.34	11.516	406.68
50.32	165.09	3.08	10.10	3.804	134.34	7.748	273.60	11.552	407.94
50.33	165.12	3.09	10.14	3.804	134.34	7.784	274.88	11.588	409.22
50.34	165.16	3.10	10.17	3.804	134.34	7.820	276.16	11.624	410.49
50.35	165.19	3.11	10.20	3.804	134.34	7.856	277.44	11.660	411.78
50.36	165.22	3.12	10.24	3.804	134.34	7.893	278.73	11.697	413.07
50.37	165.26	3.13	10.27	3.804	134.34	7.929	280.03	11.733	414.36
50.38	165.29	3.14	10.30	3.804	134.34	7.966	281.33	11.770	415.67
50.39	165.32	3.15	10.33	3.804	134.34	8.003	282.64	11.807	416.97
50.40	165.35	3.16	10.37	3.804	134.34	8.040	283.95	11.844	418.29
50.41	165.39	3.17	10.40	3.804	134.34	8.078	285.27	11.882	419.61
50.42	165.42	3.18	10.43	3.804	134.34	8.115	286.60	11.919	420.94
50.43	165.45	3.19	10.47	3.804	134.34	8.153	287.93	11.957	422.27
50.44	165.49	3.20	10.50	3.804	134.34	8.191	289.27	11.995	423.61
50.45	165.52	3.21	10.53	3.804	134.34	8.229	290.61	12.033	424.95
50.46	165.55	3.22	10.56	3.804	134.34	8.267	291.97	12.071	426.30
50.47	165.58	3.23	10.60	3.804	134.34	8.306	293.32	12.110	427.66
50.48	165.62	3.24	10.63	3.804	134.34	8.345	294.69	12.149	429.02
50.49	165.65	3.25	10.66	3.804	134.34	8.383	296.06	12.187	430.40
50.50	165.68	3.26	10.70	3.804	134.34	8.422	297.43	12.226	431.77

3-668

Table 22: Previous data (2004) Page 22 of 36

1	2	3	4	5	6	7	8	9	10
50.51	165.72	3.27	10.73	3.804	134.34	8.461	298.82	12.265	433.15
50.52	165.75	3.28	10.76	3.804	134.34	8.501	300.21	12.305	434.54
50.53	165.78	3.29	10.79	3.804	134.34	8.540	301.60	12.344	435.94
50.54	165.81	3.30	10.83	3.804	134.34	8.580	303.00	12.384	437.34
50.55	165.85	3.31	10.86	3.804	134.34	8.620	304.41	12.424	438.75
50.56	165.88	3.32	10.89	3.804	134.34	8.660	305.83	12.464	440.17
50.57	165.91	3.33	10.93	3.804	134.34	8.700	307.25	12.504	441.59
50.58	165.94	3.34	10.96	3.804	134.34	8.741	308.68	12.545	443.02
50.59	165.98	3.35	10.99	3.804	134.34	8.781	310.12	12.585	444.45
50.60	166.01	3.36	11.02	3.804	134.34	8.822	311.56	12.626	445.90
50.61	166.04	3.37	11.06	3.804	134.34	8.863	313.01	12.667	447.34
50.62	166.08	3.38	11.09	3.804	134.34	8.904	314.46	12.708	448.80
50.63	166.11	3.39	11.12	3.804	134.34	8.946	315.92	12.750	450.26
50.64	166.14	3.40	11.15	3.804	134.34	8.987	317.39	12.791	451.73
50.65	166.17	3.41	11.19	3.804	134.34	9.029	318.87	12.833	453.21
50.66	166.21	3.42	11.22	3.804	134.34	9.071	320.35	12.875	454.69
50.67	166.24	3.43	11.25	3.804	134.34	9.113	321.84	12.917	456.18
50.68	166.27	3.44	11.29	3.804	134.34	9.156	323.34	12.960	457.68
50.69	166.31	3.45	11.32	3.804	134.34	9.198	324.84	13.002	459.18
50.70	166.34	3.46	11.35	3.804	134.34	9.241	326.35	13.045	460.69
50.71	166.37	3.47	11.38	3.804	134.34	9.284	327.87	13.088	462.21
50.72	166.40	3.48	11.42	3.804	134.34	9.327	329.39	13.131	463.73
50.73	166.44	3.49	11.45	3.804	134.34	9.371	330.93	13.175	465.26
50.74	166.47	3.50	11.48	3.804	134.34	9.414	332.46	13.218	466.80
50.75	166.50	3.51	11.52	3.804	134.34	9.458	334.01	13.262	468.35
50.76	166.54	3.52	11.55	3.804	134.34	9.502	335.56	13.306	469.90
50.77	166.57	3.53	11.58	3.804	134.34	9.546	337.12	13.350	471.46
50.78	166.60	3.54	11.61	3.804	134.34	9.591	338.69	13.395	473.03
50.79	166.63	3.55	11.65	3.804	134.34	9.635	340.27	13.439	474.60
50.80	166.67	3.56	11.68	3.804	134.34	9.680	341.85	13.484	476.19
50.81	166.70	3.57	11.71	3.804	134.34	9.725	343.44	13.529	477.78
50.82	166.73	3.58	11.75	3.804	134.34	9.770	345.04	13.574	479.37
50.83	166.77	3.59	11.78	3.804	134.34	9.816	346.64	13.620	480.98
50.84	166.80	3.60	11.81	3.804	134.34	9.861	348.25	13.665	482.59
50.85	166.83	3.61	11.84	3.804	134.34	9.907	349.87	13.711	484.21
50.86	166.86	3.62	11.88	3.804	134.34	9.953	351.50	13.757	485.84
50.87	166.90	3.63	11.91	3.804	134.34	9.999	353.13	13.803	487.47
50.88	166.93	3.64	11.94	3.804	134.34	10.046	354.77	13.850	489.11
50.89	166.96	3.65	11.98	3.804	134.34	10.093	356.42	13.897	490.76
50.90	166.99	3.66	12.01	3.804	134.34	10.140	358.08	13.944	492.42
50.91	167.03	3.67	12.04	3.804	134.34	10.187	359.75	13.991	494.08
50.92	167.06	3.68	12.07	3.804	134.34	10.234	361.42	14.038	495.76
50.93	167.09	3.69	12.11	3.804	134.34	10.282	363.10	14.086	497.44
50.94	167.13	3.70	12.14	3.804	134.34	10.330	364.79	14.134	499.13
50.95	167.16	3.71	12.17	3.804	134.34	10.378	366.48	14.182	500.82
50.96	167.19	3.72	12.20	3.804	134.34	10.426	368.19	14.230	502.53
50.97	167.22	3.73	12.24	3.804	134.34	10.474	369.90	14.278	504.24
50.98	167.26	3.74	12.27	3.804	134.34	10.523	371.62	14.327	505.96
50.99	167.29	3.75	12.30	3.804	134.34	10.572	373.35	14.376	507.69
51.00	167.32	3.76	12.34	3.804	134.34	10.621	375.08	14.425	509.42

Page 23

Table 23: Previous data (2004) Page 23 of 36

1	2	3	4	5	6	7	8	9	10
51.01	167.36	3.77	12.37	3.804	134.34	10.671	376.83	14.475	511.17
51.02	167.39	3.78	12.40	3.804	134.34	10.720	378.58	14.524	512.92
51.03	167.42	3.79	12.43	3.804	134.34	10.770	380.34	14.574	514.68
51.04	167.45	3.80	12.47	3.804	134.34	10.820	382.11	14.624	516.45
51.05	167.49	3.81	12.50	3.804	134.34	10.870	383.89	14.674	518.23
51.06	167.52	3.82	12.53	3.804	134.34	10.921	385.67	14.725	520.01
51.07	167.55	3.83	12.57	3.804	134.34	10.972	387.47	14.776	521.80
51.08	167.59	3.84	12.60	3.804	134.34	11.023	389.27	14.827	523.61
51.09	167.62	3.85	12.63	3.804	134.34	11.074	391.08	14.878	525.42
51.10	167.65	3.86	12.66	3.804	134.34	11.125	392.90	14.929	527.23
51.11	167.68	3.87	12.70	3.804	134.34	11.177	394.72	14.981	529.06
51.12	167.72	3.88	12.73	3.804	134.34	11.229	396.56	15.033	530.90
51.13	167.75	3.89	12.76	3.804	134.34	11.281	398.40	15.085	532.74
51.14	167.78	3.90	12.80	3.804	134.34	11.334	400.25	15.138	534.59
51.15	167.81	3.91	12.83	3.804	134.34	11.387	402.12	15.191	536.45
51.16	167.85	3.92	12.86	3.804	134.34	11.439	403.99	15.243	538.32
51.17	167.88	3.93	12.89	3.804	134.34	11.493	405.86	15.297	540.20
51.18	167.91	3.94	12.93	3.804	134.34	11.546	407.75	15.350	542.09
51.19	167.95	3.95	12.96	3.804	134.34	11.600	409.65	15.404	543.99
51.20	167.98	3.96	12.99	3.804	134.34	11.654	411.55	15.458	545.89
51.21	168.01	3.97	13.02	3.804	134.34	11.708	413.47	15.512	547.80
51.22	168.04	3.98	13.06	3.804	134.34	11.762	415.39	15.566	549.73
51.23	168.08	3.99	13.09	3.804	134.34	11.817	417.32	15.621	551.66
51.24	168.11	4.00	13.12	3.804	134.34	11.872	419.26	15.676	553.60
51.25	168.14	4.01	13.16	3.804	134.34	11.927	421.21	15.731	555.55
51.26	168.18	4.02	13.19	3.804	134.34	11.983	423.17	15.787	557.51
51.27	168.21	4.03	13.22	3.804	134.34	12.038	425.14	15.842	559.48
51.28	168.24	4.04	13.25	3.804	134.34	12.094	427.11	15.898	561.45
51.29	168.27	4.05	13.29	3.804	134.34	12.151	429.10	15.955	563.44
51.30	168.31	4.06	13.32	3.804	134.34	12.209	431.16	16.013	565.50
51.31	168.34	4.07	13.35	3.804	134.34	12.259	432.94	16.063	567.28
51.32	168.37	4.08	13.39	3.804	134.34	12.310	434.73	16.114	569.07
51.33	168.41	4.09	13.42	3.804	134.34	12.361	436.53	16.165	570.86
51.34	168.44	4.10	13.45	3.804	134.34	12.412	438.33	16.216	572.67
51.35	168.47	4.11	13.48	3.804	134.34	12.463	440.14	16.267	574.48
51.36	168.50	4.12	13.52	3.804	134.34	12.515	441.96	16.319	576.29
51.37	168.54	4.13	13.55	3.804	134.34	12.566	443.78	16.370	578.12
51.38	168.57	4.14	13.58	3.804	134.34	12.618	445.61	16.422	579.95
51.39	168.60	4.15	13.62	3.804	134.34	12.670	447.45	16.474	581.79
51.40	168.64	4.16	13.65	3.804	134.34	12.723	449.30	16.527	583.64
51.41	168.67	4.17	13.68	3.804	134.34	12.775	451.16	16.579	585.50
51.42	168.70	4.18	13.71	3.804	134.34	12.828	453.02	16.632	587.36
51.43	168.73	4.19	13.75	3.804	134.34	12.881	454.89	16.685	589.23
51.44	168.77	4.20	13.78	3.804	134.34	12.934	456.77	16.738	591.11
51.45	168.80	4.21	13.81	3.804	134.34	12.988	458.66	16.792	593.00
51.46	168.83	4.22	13.85	3.804	134.34	13.041	460.55	16.845	594.89
51.47	168.86	4.23	13.88	3.804	134.34	13.095	462.45	16.899	596.79
51.48	168.90	4.24	13.91	3.804	134.34	13.149	464.36	16.953	598.70
51.49	168.93	4.25	13.94	3.804	134.34	13.203	466.28	17.007	600.62
51.50	168.96	4.26	13.98	3.804	134.34	13.258	468.21	17.062	602.55

4.530

Table 24: Previous data (2004) Page 24 of 36

1	2	3	4	5	6	7	8	9	10
51.51	169.00	4.27	14.01	3.804	134.34	13.313	470.14	17.117	604.48
51.52	169.03	4.28	14.04	3.804	134.34	13.368	472.08	17.172	606.42
51.53	169.06	4.29	14.07	3.804	134.34	13.423	474.03	17.227	608.37
51.54	169.09	4.30	14.11	3.804	134.34	13.478	475.99	17.282	610.33
51.55	169.13	4.31	14.14	3.804	134.34	13.534	477.96	17.338	612.29
51.56	169.16	4.32	14.17	3.804	134.34	13.590	479.93	17.394	614.27
51.57	169.19	4.33	14.21	3.804	134.34	13.646	481.91	17.450	616.25
51.58	169.23	4.34	14.24	3.804	134.34	13.702	483.90	17.506	618.24
51.59	169.26	4.35	14.27	3.804	134.34	13.759	485.90	17.563	620.24
51.60	169.29	4.36	14.30	3.804	134.34	13.816	487.91	17.620	622.25
51.61	169.32	4.37	14.34	3.804	134.34	13.873	489.92	17.677	624.26
51.62	169.36	4.38	14.37	3.804	134.34	13.930	491.95	17.734	626.28
51.63	169.39	4.39	14.40	3.804	134.34	13.988	493.98	17.792	628.32
51.64	169.42	4.40	14.44	3.804	134.34	14.046	496.02	17.850	630.36
51.65	169.46	4.41	14.47	3.804	134.34	14.104	498.07	17.908	632.40
51.66	169.49	4.42	14.50	3.804	134.34	14.162	500.12	17.966	634.46
51.67	169.52	4.43	14.53	3.804	134.34	14.220	502.19	18.024	636.53
51.68	169.55	4.44	14.57	3.804	134.34	14.279	504.26	18.083	638.60
51.69	169.59	4.45	14.60	3.804	134.34	14.338	506.35	18.142	640.68
51.70	169.62	4.46	14.63	3.804	134.34	14.397	508.44	18.201	642.78
51.71	169.65	4.47	14.67	3.804	134.34	14.457	510.54	18.261	644.87
51.72	169.69	4.48	14.70	3.804	134.34	14.516	512.65	18.320	646.98
51.73	169.72	4.49	14.73	3.804	134.34	14.576	514.76	18.380	649.10
51.74	169.75	4.50	14.76	3.804	134.34	14.637	516.89	18.441	651.23
51.75	169.78	4.51	14.80	3.804	134.34	14.697	519.02	18.501	653.36
51.76	169.82	4.52	14.83	3.804	134.34	14.758	521.17	18.562	655.50
51.77	169.85	4.53	14.86	3.804	134.34	14.819	523.32	18.623	657.66
51.78	169.88	4.54	14.90	3.804	134.34	14.880	525.48	18.684	659.82
51.79	169.91	4.55	14.93	3.804	134.34	14.941	527.65	18.745	661.99
51.80	169.95	4.56	14.96	3.804	134.34	15.003	529.83	18.807	664.17
51.81	169.98	4.57	14.99	3.804	134.34	15.065	532.02	18.869	666.36
51.82	170.01	4.58	15.03	3.804	134.34	15.127	534.22	18.931	668.55
51.83	170.05	4.59	15.06	3.804	134.34	15.190	536.42	18.994	670.76
51.84	170.08	4.60	15.09	3.804	134.34	15.252	538.64	19.056	672.98
51.85	170.11	4.61	15.12	3.804	134.34	15.315	540.86	19.119	675.20
51.86	170.14	4.62	15.16	3.804	134.34	15.379	543.10	19.183	677.43
51.87	170.18	4.63	15.19	3.804	134.34	15.442	545.34	19.246	679.68
51.88	170.21	4.64	15.22	3.804	134.34	15.506	547.59	19.310	681.93
51.89	170.24	4.65	15.26	3.804	134.34	15.570	549.85	19.374	684.19
51.90	170.28	4.66	15.29	3.804	134.34	15.634	552.12	19.438	686.46
51.91	170.31	4.67	15.32	3.804	134.34	15.699	554.40	19.503	688.74
51.92	170.34	4.68	15.35	3.804	134.34	15.764	556.69	19.568	691.03
51.93	170.37	4.69	15.39	3.804	134.34	15.829	558.99	19.633	693.33
51.94	170.41	4.70	15.42	3.804	134.34	15.894	561.30	19.698	695.64
51.95	170.44	4.71	15.45	3.804	134.34	15.960	563.62	19.764	697.96
51.96	170.47	4.72	15.49	3.804	134.34	16.026	565.95	19.830	700.28
51.97	170.51	4.73	15.52	3.804	134.34	16.092	568.28	19.896	702.62
51.98	170.54	4.74	15.55	3.804	134.34	16.158	570.63	19.962	704.97
51.99	170.57	4.75	15.58	3.804	134.34	16.225	572.99	20.029	707.33
52.00	170.60	4.76	15.62	3.804	134.34	16.292	575.35	20.096	709.69

Page 25

Table 25: Previous data (2004) Page 25 of 36

1	2	3	4	5	6	7	8	9	10
52.01	170.64	4.77	15.65	3.804	134.34	16.359	577.73	20.163	712.07
52.02	170.67	4.78	15.68	3.804	134.34	16.427	580.12	20.231	714.45
52.03	170.70	4.79	15.72	3.804	134.34	16.495	582.51	20.299	716.85
52.04	170.73	4.80	15.75	3.804	134.34	16.563	584.92	20.367	719.26
52.05	170.77	4.81	15.78	3.804	134.34	16.631	587.33	20.435	721.67
52.06	170.80	4.82	15.81	3.804	134.34	16.700	589.76	20.504	724.10
52.07	170.83	4.83	15.85	3.804	134.34	16.769	592.20	20.573	726.53
52.08	170.87	4.84	15.88	3.804	134.34	16.838	594.64	20.642	728.98
52.09	170.90	4.85	15.91	3.804	134.34	16.908	597.10	20.712	731.44
52.10	170.93	4.86	15.94	3.804	134.34	16.978	599.56	20.782	733.90
52.11	170.96	4.87	15.98	3.804	134.34	17.048	602.04	20.852	736.38
52.12	171.00	4.88	16.01	3.804	134.34	17.118	604.53	20.922	738.86
52.13	171.03	4.89	16.04	3.804	134.34	17.189	607.02	20.993	741.36
52.14	171.06	4.90	16.08	3.804	134.34	17.260	609.53	21.064	743.87
52.15	171.10	4.91	16.11	3.804	134.34	17.331	612.05	21.135	746.38
52.16	171.13	4.92	16.14	3.804	134.34	17.403	614.57	21.207	748.91
52.17	171.16	4.93	16.17	3.804	134.34	17.475	617.11	21.279	751.45
52.18	171.19	4.94	16.21	3.804	134.34	17.547	619.66	21.351	754.00
52.19	171.23	4.95	16.24	3.804	134.34	17.619	622.22	21.423	756.56
52.20	171.26	4.96	16.27	3.804	134.34	17.692	624.79	21.496	759.13
52.21	171.29	4.97	16.31	3.804	134.34	17.765	627.37	21.569	761.71
52.22	171.33	4.98	16.34	3.804	134.34	17.838	629.96	21.642	764.30
52.23	171.36	4.99	16.37	3.804	134.34	17.912	632.56	21.716	766.90
52.24	171.39	5.00	16.40	3.804	134.34	17.986	635.18	21.790	769.51
52.25	171.42	5.01	16.44	3.804	134.34	18.060	637.80	21.864	772.14
52.26	171.46	5.02	16.47	3.804	134.34	18.135	640.43	21.939	774.77
52.27	171.49	5.03	16.50	3.804	134.34	18.210	643.08	22.014	777.42
52.28	171.52	5.04	16.54	3.804	134.34	18.285	645.73	22.089	780.07
52.29	171.56	5.05	16.57	3.804	134.34	18.360	648.40	22.164	782.74
52.30	171.59	5.06	16.60	3.804	134.34	18.412	650.22	22.216	784.56
52.31	171.62	5.07	16.63	3.804	134.34	18.480	652.63	22.284	786.96
52.32	171.65	5.08	16.67	3.804	134.34	18.549	655.04	22.353	789.38
52.33	171.69	5.09	16.70	3.804	134.34	18.617	657.46	22.421	791.80
52.34	171.72	5.10	16.73	3.804	134.34	18.686	659.90	22.490	794.23
52.35	171.75	5.11	16.77	3.804	134.34	18.755	662.34	22.559	796.68
52.36	171.78	5.12	16.80	3.804	134.34	18.825	664.79	22.629	799.13
52.37	171.82	5.13	16.83	3.804	134.34	18.894	667.25	22.698	801.59
52.38	171.85	5.14	16.86	3.804	134.34	18.964	669.72	22.768	804.06
52.39	171.88	5.15	16.90	3.804	134.34	19.034	672.20	22.838	806.53
52.40	171.92	5.16	16.93	3.804	134.34	19.105	674.68	22.909	809.02
52.41	171.95	5.17	16.96	3.804	134.34	19.175	677.18	22.979	811.52
52.42	171.98	5.18	16.99	3.804	134.34	19.246	679.68	23.050	814.02
52.43	172.01	5.19	17.03	3.804	134.34	19.318	682.20	23.122	816.54
52.44	172.05	5.20	17.06	3.804	134.34	19.389	684.72	23.193	819.06
52.45	172.08	5.21	17.09	3.804	134.34	19.461	687.26	23.265	821.60
52.46	172.11	5.22	17.13	3.804	134.34	19.533	689.80	23.337	824.14
52.47	172.15	5.23	17.16	3.804	134.34	19.605	692.35	23.409	826.69
52.48	172.18	5.24	17.19	3.804	134.34	19.678	694.91	23.482	829.25
52.49	172.21	5.25	17.22	3.804	134.34	19.750	697.48	23.554	831.82
52.50	172.24	5.26	17.26	3.804	134.34	19.823	700.07	23.627	834.40

Page 26

Table 26: Previous data (2004) Page 26 of 36

1	2	3	4	5	6	7	8	9	10
52.51	172.28	5.27	17.29	3.804	134.34	19.897	702.66	23.701	836.99
52.52	172.31	5.28	17.32	3.804	134.34	19.970	705.26	23.774	839.59
52.53	172.34	5.29	17.36	3.804	134.34	20.044	707.86	23.848	842.20
52.54	172.38	5.30	17.39	3.804	134.34	20.118	710.48	23.922	844.82
52.55	172.41	5.31	17.42	3.804	134.34	20.193	713.11	23.997	847.45
52.56	172.44	5.32	17.45	3.804	134.34	20.268	715.75	24.072	850.09
52.57	172.47	5.33	17.49	3.804	134.34	20.343	718.40	24.147	852.74
52.58	172.51	5.34	17.52	3.804	134.34	20.418	721.06	24.222	855.40
52.59	172.54	5.35	17.55	3.804	134.34	20.493	723.73	24.297	858.06
52.60	172.57	5.36	17.59	3.804	134.34	20.569	726.40	24.373	860.74
52.61	172.60	5.37	17.62	3.804	134.34	20.645	729.09	24.449	863.43
52.62	172.64	5.38	17.65	3.804	134.34	20.722	731.79	24.526	866.13
52.63	172.67	5.39	17.68	3.804	134.34	20.798	734.50	24.602	868.83
52.64	172.70	5.40	17.72	3.804	134.34	20.875	737.21	24.679	871.55
52.65	172.74	5.41	17.75	3.804	134.34	20.953	739.94	24.757	874.28
52.66	172.77	5.42	17.78	3.804	134.34	21.030	742.68	24.834	877.02
52.67	172.80	5.43	17.81	3.804	134.34	21.108	745.43	24.912	879.77
52.68	172.83	5.44	17.85	3.804	134.34	21.186	748.19	24.990	882.52
52.69	172.87	5.45	17.88	3.804	134.34	21.264	750.95	25.068	885.29
52.70	172.90	5.46	17.91	3.804	134.34	21.343	753.73	25.147	888.07
52.71	172.93	5.47	17.95	3.804	134.34	21.422	756.52	25.226	890.86
52.72	172.97	5.48	17.98	3.804	134.34	21.501	759.32	25.305	893.66
52.73	173.00	5.49	18.01	3.804	134.34	21.581	762.13	25.385	896.47
52.74	173.03	5.50	18.04	3.804	134.34	21.661	764.95	25.465	899.29
52.75	173.06	5.51	18.08	3.804	134.34	21.741	767.78	25.545	902.12
52.76	173.10	5.52	18.11	3.804	134.34	21.821	770.62	25.625	904.96
52.77	173.13	5.53	18.14	3.804	134.34	21.902	773.47	25.706	907.81
52.78	173.16	5.54	18.18	3.804	134.34	21.983	776.33	25.787	910.67
52.79	173.20	5.55	18.21	3.804	134.34	22.064	779.21	25.868	913.54
52.80	173.23	5.56	18.24	3.804	134.34	22.146	782.09	25.950	916.43
52.81	173.26	5.57	18.27	3.804	134.34	22.228	784.98	26.032	919.32
52.82	173.29	5.58	18.31	3.804	134.34	22.310	787.89	26.114	922.23
52.83	173.33	5.59	18.34	3.804	134.34	22.393	790.80	26.197	925.14
52.84	173.36	5.60	18.37	3.804	134.34	22.476	793.73	26.280	928.07
52.85	173.39	5.61	18.41	3.804	134.34	22.559	796.67	26.363	931.00
52.86	173.43	5.62	18.44	3.804	134.34	22.642	799.61	26.446	933.95
52.87	173.46	5.63	18.47	3.804	134.34	22.726	802.57	26.530	936.91
52.88	173.49	5.64	18.50	3.804	134.34	22.810	805.54	26.614	939.88
52.89	173.52	5.65	18.54	3.804	134.34	22.895	808.52	26.699	942.86
52.90	173.56	5.66	18.57	3.804	134.34	22.979	811.51	26.783	945.85
52.91	173.59	5.67	18.60	3.804	134.34	23.064	814.52	26.868	948.85
52.92	173.62	5.68	18.64	3.804	134.34	23.150	817.53	26.954	951.87
52.93	173.65	5.69	18.67	3.804	134.34	23.235	820.55	27.039	954.89
52.94	173.69	5.70	18.70	3.804	134.34	23.321	823.59	27.125	957.93
52.95	173.72	5.71	18.73	3.804	134.34	23.408	826.64	27.212	960.98
52.96	173.75	5.72	18.77	3.804	134.34	23.494	829.70	27.298	964.03
52.97	173.79	5.73	18.80	3.804	134.34	23.581	832.77	27.385	967.10
52.98	173.82	5.74	18.83	3.804	134.34	23.668	835.85	27.472	970.19
52.99	173.85	5.75	18.86	3.804	134.34	23.756	838.94	27.560	973.28
53.00	173.88	5.76	18.90	3.804	134.34	23.844	842.04	27.648	976.38

Table 27: Previous data (2004) Page 27 of 36

1	2	3	4	5	6	7	8	9	10
53.01	173.92	5.77	18.93	3.804	134.34	23.932	845.16	27.736	979.50
53.02	173.95	5.78	18.96	3.804	134.34	24.021	848.29	27.825	982.63
53.03	173.98	5.79	19.00	3.804	134.34	24.109	851.43	27.913	985.76
53.04	174.02	5.80	19.03	3.804	134.34	24.199	854.58	28.003	988.91
53.05	174.05	5.81	19.06	3.804	134.34	24.288	857.74	28.092	992.08
53.06	174.08	5.82	19.09	3.804	134.34	24.378	860.91	28.182	995.25
53.07	174.11	5.83	19.13	3.804	134.34	24.468	864.10	28.272	998.43
53.08	174.15	5.84	19.16	3.804	134.34	24.559	867.29	28.363	1001.63
53.09	174.18	5.85	19.19	3.804	134.34	24.650	870.50	28.454	1004.84
53.10	174.21	5.86	19.23	3.804	134.34	24.741	873.72	28.545	1008.06
53.11	174.25	5.87	19.26	3.804	134.34	24.832	876.96	28.636	1011.29
53.12	174.28	5.88	19.29	3.804	134.34	24.924	880.20	28.728	1014.54
53.13	174.31	5.89	19.32	3.804	134.34	25.017	883.46	28.821	1017.80
53.14	174.34	5.90	19.36	3.804	134.34	25.109	886.73	28.913	1021.07
53.15	174.38	5.91	19.39	3.804	134.34	25.202	890.01	29.006	1024.35
53.16	174.41	5.92	19.42	3.804	134.34	25.295	893.30	29.099	1027.64
53.17	174.44	5.93	19.46	3.804	134.34	25.389	896.61	29.193	1030.94
53.18	174.48	5.94	19.49	3.804	134.34	25.483	899.92	29.287	1034.26
53.19	174.51	5.95	19.52	3.804	134.34	25.577	903.25	29.381	1037.59
53.20	174.54	5.96	19.55	3.804	134.34	25.672	906.60	29.476	1040.93
53.21	174.57	5.97	19.59	3.804	134.34	25.767	909.95	29.571	1044.29
53.22	174.61	5.98	19.62	3.804	134.34	25.862	913.32	29.666	1047.65
53.23	174.64	5.99	19.65	3.804	134.34	25.958	916.70	29.762	1051.03
53.24	174.67	6.00	19.69	3.804	134.34	26.054	920.09	29.858	1054.43
53.25	174.70	6.01	19.72	3.804	134.34	26.150	923.49	29.954	1057.83
53.26	174.74	6.02	19.75	3.804	134.34	26.247	926.91	30.051	1061.25
53.27	174.77	6.03	19.78	3.804	134.34	26.344	930.34	30.148	1064.68
53.28	174.80	6.04	19.82	3.804	134.34	26.441	933.78	30.245	1068.12
53.29	174.84	6.05	19.85	3.804	134.34	26.539	937.24	30.343	1071.57
53.30	174.87	6.06	19.88	3.804	134.34	26.637	941.75	30.441	1076.08
53.31	174.90	6.07	19.91	3.804	134.34	26.735	946.27	30.540	1080.60
53.32	174.93	6.08	19.95	3.804	134.34	26.834	950.81	30.640	1085.13
53.33	174.97	6.09	19.98	3.804	134.34	26.934	955.37	30.741	1089.67
53.34	175.00	6.10	20.01	3.804	134.34	27.034	959.95	30.843	1094.23
53.35	175.03	6.11	20.05	3.804	134.34	27.135	964.55	30.946	1098.80
53.36	175.07	6.12	20.08	3.804	134.34	27.236	969.17	31.050	1103.39
53.37	175.10	6.13	20.11	3.804	134.34	27.338	973.81	31.155	1108.00
53.38	175.13	6.14	20.14	3.804	134.34	27.441	978.47	31.261	1112.63
53.39	175.16	6.15	20.18	3.804	134.34	27.545	983.15	31.368	1117.28
53.40	175.20	6.16	20.21	3.804	134.34	27.650	987.85	31.476	1121.95
53.41	175.23	6.17	20.24	3.804	134.34	27.756	992.57	31.585	1126.64
53.42	175.26	6.18	20.28	3.804	134.34	27.862	997.31	31.695	1131.35
53.43	175.30	6.19	20.31	3.804	134.34	27.969	1002.07	31.806	1136.08
53.44	175.33	6.20	20.34	3.804	134.34	28.077	1006.85	31.918	1140.83
53.45	175.36	6.21	20.37	3.804	134.34	28.186	1011.65	32.031	1145.60
53.46	175.39	6.22	20.41	3.804	134.34	28.296	1016.47	32.145	1150.39
53.47	175.43	6.23	20.44	3.804	134.34	28.407	1021.31	32.260	1155.20
53.48	175.46	6.24	20.47	3.804	134.34	28.519	1026.17	32.376	1160.03
53.49	175.49	6.25	20.51	3.804	134.34	28.632	1031.05	32.493	1164.88
53.50	175.52	6.26	20.54	3.804	134.34	28.746	1035.95	32.611	1169.75

7-834

Table 28: Previous data (2004) Page 28 of 36

1	2	3	4	5	6	7	8	9	10
53.51	175.56	6.27	20.57	3.804	134.34	28.649	1011.75	32.453	1146.08
53.52	175.59	6.28	20.60	3.804	134.34	28.747	1015.21	32.551	1149.54
53.53	175.62	6.29	20.64	3.804	134.34	28.845	1018.68	32.649	1153.02
53.54	175.66	6.30	20.67	3.804	134.34	28.944	1022.16	32.748	1156.50
53.55	175.69	6.31	20.70	3.804	134.34	29.043	1025.66	32.847	1160.00
53.56	175.72	6.32	20.73	3.804	134.34	29.142	1029.16	32.946	1163.50
53.57	175.75	6.33	20.77	3.804	134.34	29.242	1032.68	33.046	1167.02
53.58	175.79	6.34	20.80	3.804	134.34	29.342	1036.22	33.146	1170.55
53.59	175.82	6.35	20.83	3.804	134.34	29.442	1039.76	33.246	1174.10
53.60	175.85	6.36	20.87	3.804	134.34	29.543	1043.32	33.347	1177.65
53.61	175.89	6.37	20.90	3.804	134.34	29.644	1046.88	33.448	1181.22
53.62	175.92	6.38	20.93	3.804	134.34	29.746	1050.46	33.550	1184.80
53.63	175.95	6.39	20.96	3.804	134.34	29.847	1054.06	33.651	1188.40
53.64	175.98	6.40	21.00	3.804	134.34	29.949	1057.66	33.753	1192.00
53.65	176.02	6.41	21.03	3.804	134.34	30.052	1061.28	33.856	1195.62
53.66	176.05	6.42	21.06	3.804	134.34	30.155	1064.91	33.959	1199.25
53.67	176.08	6.43	21.10	3.804	134.34	30.258	1068.55	34.062	1202.89
53.68	176.12	6.44	21.13	3.804	134.34	30.361	1072.21	34.165	1206.54
53.69	176.15	6.45	21.16	3.804	134.34	30.465	1075.87	34.269	1210.21
53.70	176.18	6.46	21.19	3.804	134.34	30.569	1079.55	34.373	1213.89
53.71	176.21	6.47	21.23	3.804	134.34	30.674	1083.24	34.478	1217.58
53.72	176.25	6.48	21.26	3.804	134.34	30.779	1086.95	34.583	1221.29
53.73	176.28	6.49	21.29	3.804	134.34	30.884	1090.67	34.688	1225.00
53.74	176.31	6.50	21.33	3.804	134.34	30.990	1094.40	34.794	1228.73
53.75	176.35	6.51	21.36	3.804	134.34	31.096	1098.14	34.900	1232.48
53.76	176.38	6.52	21.39	3.804	134.34	31.202	1101.89	35.006	1236.23
53.77	176.41	6.53	21.42	3.804	134.34	31.309	1105.66	35.113	1240.00
53.78	176.44	6.54	21.46	3.804	134.34	31.416	1109.44	35.220	1243.78
53.79	176.48	6.55	21.49	3.804	134.34	31.523	1113.24	35.327	1247.58
53.80	176.51	6.56	21.52	3.804	134.34	31.631	1117.05	35.435	1251.38
53.81	176.54	6.57	21.56	3.804	134.34	31.739	1120.87	35.543	1255.20
53.82	176.57	6.58	21.59	3.804	134.34	31.848	1124.70	35.652	1259.04
53.83	176.61	6.59	21.62	3.804	134.34	31.957	1128.55	35.761	1262.88
53.84	176.64	6.60	21.65	3.804	134.34	32.066	1132.41	35.870	1266.74
53.85	176.67	6.61	21.69	3.804	134.34	32.176	1136.28	35.980	1270.62
53.86	176.71	6.62	21.72	3.804	134.34	32.286	1140.16	36.090	1274.50
53.87	176.74	6.63	21.75	3.804	134.34	32.396	1144.06	36.200	1278.40
53.88	176.77	6.64	21.78	3.804	134.34	32.507	1147.98	36.311	1282.31
53.89	176.80	6.65	21.82	3.804	134.34	32.618	1151.90	36.422	1286.24
53.90	176.84	6.66	21.85	3.804	134.34	32.729	1155.84	36.533	1290.18
53.91	176.87	6.67	21.88	3.804	134.34	32.841	1159.80	36.645	1294.13
53.92	176.90	6.68	21.92	3.804	134.34	32.954	1163.76	36.758	1298.10
53.93	176.94	6.69	21.95	3.804	134.34	33.066	1167.74	36.870	1302.08
53.94	176.97	6.70	21.98	3.804	134.34	33.180	1171.74	36.984	1306.07
53.95	177.00	6.71	22.01	3.804	134.34	33.293	1175.74	37.097	1310.08
53.96	177.03	6.72	22.05	3.804	134.34	33.407	1179.76	37.211	1314.10
53.97	177.07	6.73	22.08	3.804	134.34	33.521	1183.80	37.325	1318.14
53.98	177.10	6.74	22.11	3.804	134.34	33.636	1187.85	37.440	1322.19
53.99	177.13	6.75	22.15	3.804	134.34	33.751	1191.91	37.555	1326.25
54.00	177.17	6.76	22.18	3.804	134.34	33.866	1195.99	37.670	1330.32

Page 29

Table 29: Previous data (2004) Page 29 of 36

1	2	3	4	5	6	7	8	9	10
54.01	177.20	6.77	22.21	3.804	134.34	33.982	1200.08	37.786	1334.41
54.02	177.23	6.78	22.24	3.804	134.34	34.098	1204.18	37.902	1338.52
54.03	177.26	6.79	22.28	3.804	134.34	34.215	1208.30	38.019	1342.64
54.04	177.30	6.80	22.31	3.804	134.34	34.332	1212.43	38.136	1346.77
54.05	177.33	6.81	22.34	3.804	134.34	34.449	1216.58	38.253	1350.92
54.06	177.36	6.82	22.38	3.804	134.34	34.567	1220.74	38.371	1355.08
54.07	177.40	6.83	22.41	3.804	134.34	34.685	1224.91	38.489	1359.25
54.08	177.43	6.84	22.44	3.804	134.34	34.804	1229.10	38.608	1363.44
54.09	177.46	6.85	22.47	3.804	134.34	34.923	1233.31	38.727	1367.64
54.10	177.49	6.86	22.51	3.804	134.34	35.042	1237.52	38.846	1371.86
54.11	177.53	6.87	22.54	3.804	134.34	35.162	1241.76	38.966	1376.09
54.12	177.56	6.88	22.57	3.804	134.34	35.283	1246.00	39.087	1380.34
54.13	177.59	6.89	22.60	3.804	134.34	35.403	1250.26	39.207	1384.60
54.14	177.62	6.90	22.64	3.804	134.34	35.524	1254.54	39.328	1388.88
54.15	177.66	6.91	22.67	3.804	134.34	35.646	1258.83	39.450	1393.17
54.16	177.69	6.92	22.70	3.804	134.34	35.768	1263.14	39.572	1397.47
54.17	177.72	6.93	22.74	3.804	134.34	35.890	1267.46	39.694	1401.79
54.18	177.76	6.94	22.77	3.804	134.34	36.013	1271.79	39.817	1406.13
54.19	177.79	6.95	22.80	3.804	134.34	36.136	1276.14	39.940	1410.48
54.20	177.82	6.96	22.83	3.804	134.34	36.260	1280.50	40.064	1414.84
54.21	177.85	6.97	22.87	3.804	134.34	36.384	1284.88	40.188	1419.22
54.22	177.89	6.98	22.90	3.804	134.34	36.508	1289.28	40.312	1423.62
54.23	177.92	6.99	22.93	3.804	134.34	36.633	1293.69	40.437	1428.03
54.24	177.95	7.00	22.97	3.804	134.34	36.758	1298.11	40.562	1432.45
54.25	177.99	7.01	23.00	3.804	134.34	36.884	1302.55	40.688	1436.89
54.26	178.02	7.02	23.03	3.804	134.34	37.010	1307.01	40.814	1441.34
54.27	178.05	7.03	23.06	3.804	134.34	37.137	1311.48	40.941	1445.81
54.28	178.08	7.04	23.10	3.804	134.34	37.264	1315.96	41.068	1450.30
54.29	178.12	7.05	23.13	3.804	134.34	37.391	1320.46	41.195	1454.80
54.30	178.15	7.06	23.16	3.804	134.34	37.536	1325.58	41.340	1459.92
54.31	178.18	7.07	23.20	3.804	134.34	37.650	1329.61	41.454	1463.95
54.32	178.22	7.08	23.23	3.804	134.34	37.765	1333.66	41.569	1467.99
54.33	178.25	7.09	23.26	3.804	134.34	37.879	1337.71	41.683	1472.05
54.34	178.28	7.10	23.29	3.804	134.34	37.995	1341.78	41.799	1476.11
54.35	178.31	7.11	23.33	3.804	134.34	38.110	1345.86	41.914	1480.19
54.36	178.35	7.12	23.36	3.804	134.34	38.226	1349.95	42.030	1484.29
54.37	178.38	7.13	23.39	3.804	134.34	38.342	1354.05	42.146	1488.39
54.38	178.41	7.14	23.43	3.804	134.34	38.459	1358.17	42.263	1492.51
54.39	178.44	7.15	23.46	3.804	134.34	38.576	1362.30	42.380	1496.63
54.40	178.48	7.16	23.49	3.804	134.34	38.693	1366.44	42.497	1500.78
54.41	178.51	7.17	23.52	3.804	134.34	38.810	1370.59	42.614	1504.93
54.42	178.54	7.18	23.56	3.804	134.34	38.928	1374.76	42.732	1509.10
54.43	178.58	7.19	23.59	3.804	134.34	39.047	1378.94	42.851	1513.28
54.44	178.61	7.20	23.62	3.804	134.34	39.165	1383.13	42.969	1517.47
54.45	178.64	7.21	23.65	3.804	134.34	39.285	1387.33	43.089	1521.67
54.46	178.67	7.22	23.69	3.804	134.34	39.404	1391.55	43.208	1525.89
54.47	178.71	7.23	23.72	3.804	134.34	39.524	1395.78	43.328	1530.12
54.48	178.74	7.24	23.75	3.804	134.34	39.644	1400.02	43.448	1534.36
54.49	178.77	7.25	23.79	3.804	134.34	39.764	1404.28	43.568	1538.62
54.50	178.81	7.26	23.82	3.804	134.34	39.885	1408.55	43.689	1542.89

10-789

Table 30: Previous data (2004) Page 30 of 36

1	2	3	4	5	6	7	8	9	10
54.51	178.84	7.27	23.85	3.804	134.34	40.007	1412.83	43.811	1547.17
54.52	178.87	7.28	23.88	3.804	134.34	40.128	1417.13	43.932	1551.47
54.53	178.90	7.29	23.92	3.804	134.34	40.250	1421.44	44.054	1555.77
54.54	178.94	7.30	23.95	3.804	134.34	40.373	1425.76	44.177	1560.09
54.55	178.97	7.31	23.98	3.804	134.34	40.495	1430.09	44.299	1564.43
54.56	179.00	7.32	24.02	3.804	134.34	40.618	1434.44	44.422	1568.78
54.57	179.04	7.33	24.05	3.804	134.34	40.742	1438.80	44.546	1573.14
54.58	179.07	7.34	24.08	3.804	134.34	40.866	1443.17	44.670	1577.51
54.59	179.10	7.35	24.11	3.804	134.34	40.990	1447.56	44.794	1581.90
54.60	179.13	7.36	24.15	3.804	134.34	41.115	1451.96	44.919	1586.30
54.61	179.17	7.37	24.18	3.804	134.34	41.240	1456.37	45.044	1590.71
54.62	179.20	7.38	24.21	3.804	134.34	41.365	1460.80	45.169	1595.14
54.63	179.23	7.39	24.25	3.804	134.34	41.491	1465.24	45.295	1599.58
54.64	179.27	7.40	24.28	3.804	134.34	41.617	1469.70	45.421	1604.04
54.65	179.30	7.41	24.31	3.804	134.34	41.743	1474.16	45.547	1608.50
54.66	179.33	7.42	24.34	3.804	134.34	41.870	1478.65	45.674	1612.98
54.67	179.36	7.43	24.38	3.804	134.34	41.997	1483.14	45.801	1617.48
54.68	179.40	7.44	24.41	3.804	134.34	42.125	1487.65	45.929	1621.99
54.69	179.43	7.45	24.44	3.804	134.34	42.253	1492.17	46.057	1626.51
54.70	179.46	7.46	24.48	3.804	134.34	42.382	1496.71	46.186	1631.05
54.71	179.49	7.47	24.51	3.804	134.34	42.511	1501.26	46.315	1635.60
54.72	179.53	7.48	24.54	3.804	134.34	42.640	1505.82	46.444	1640.16
54.73	179.56	7.49	24.57	3.804	134.34	42.769	1510.40	46.573	1644.74
54.74	179.59	7.50	24.61	3.804	134.34	42.899	1514.99	46.703	1649.33
54.75	179.63	7.51	24.64	3.804	134.34	43.030	1519.60	46.834	1653.94
54.76	179.66	7.52	24.67	3.804	134.34	43.161	1524.22	46.965	1658.56
54.77	179.69	7.53	24.70	3.804	134.34	43.292	1528.85	47.096	1663.19
54.78	179.72	7.54	24.74	3.804	134.34	43.423	1533.50	47.227	1667.84
54.79	179.76	7.55	24.77	3.804	134.34	43.555	1538.16	47.359	1672.50
54.80	179.79	7.56	24.80	3.804	134.34	43.688	1542.84	47.492	1677.17
54.81	179.82	7.57	24.84	3.804	134.34	43.821	1547.53	47.625	1681.86
54.82	179.86	7.58	24.87	3.804	134.34	43.954	1552.23	47.758	1686.57
54.83	179.89	7.59	24.90	3.804	134.34	44.087	1556.95	47.891	1691.29
54.84	179.92	7.60	24.93	3.804	134.34	44.222	1561.68	48.026	1696.02
54.85	179.95	7.61	24.97	3.804	134.34	44.356	1566.43	48.160	1700.77
54.86	179.99	7.62	25.00	3.804	134.34	44.491	1571.19	48.295	1705.53
54.87	180.02	7.63	25.03	3.804	134.34	44.626	1575.97	48.430	1710.31
54.88	180.05	7.64	25.07	3.804	134.34	44.762	1580.76	48.566	1715.10
54.89	180.09	7.65	25.10	3.804	134.34	44.898	1585.57	48.702	1719.90
54.90	180.12	7.66	25.13	3.804	134.34	45.034	1590.39	48.838	1724.72
54.91	180.15	7.67	25.16	3.804	134.34	45.171	1595.22	48.975	1729.56
54.92	180.18	7.68	25.20	3.804	134.34	45.308	1600.07	49.112	1734.41
54.93	180.22	7.69	25.23	3.804	134.34	45.446	1604.93	49.250	1739.27
54.94	180.25	7.70	25.26	3.804	134.34	45.584	1609.81	49.388	1744.15
54.95	180.28	7.71	25.30	3.804	134.34	45.723	1614.71	49.527	1749.04
54.96	180.31	7.72	25.33	3.804	134.34	45.862	1619.62	49.666	1753.95
54.97	180.35	7.73	25.36	3.804	134.34	46.001	1624.54	49.805	1758.88
54.98	180.38	7.74	25.39	3.804	134.34	46.141	1629.48	49.945	1763.82
54.99	180.41	7.75	25.43	3.804	134.34	46.281	1634.43	50.085	1768.77
55.00	180.45	7.76	25.46	3.804	134.34	46.422	1639.40	50.226	1773.74

Page 31

Table 31: Previous data (2004) Page 31 of 36

1	2	3	4	5	6	7	8	9	10
55.01	180.48	7.77	25.49	3.804	134.34	48.563	1644.38	50.367	1778.72
55.02	180.51	7.78	25.52	3.804	134.34	48.705	1649.38	50.509	1783.72
55.03	180.54	7.79	25.56	3.804	134.34	48.847	1654.40	50.651	1788.73
55.04	180.58	7.80	25.59	3.804	134.34	48.989	1659.43	50.793	1793.76
55.05	180.61	7.81	25.62	3.804	134.34	47.132	1664.47	50.936	1798.81
55.06	180.64	7.82	25.66	3.804	134.34	47.275	1669.53	51.079	1803.87
55.07	180.68	7.83	25.69	3.804	134.34	47.419	1674.61	51.223	1808.94
55.08	180.71	7.84	25.72	3.804	134.34	47.563	1679.70	51.367	1814.04
55.09	180.74	7.85	25.75	3.804	134.34	47.708	1684.80	51.512	1819.14
55.10	180.77	7.86	25.79	3.804	134.34	47.853	1689.92	51.657	1824.26
55.11	180.81	7.87	25.82	3.804	134.34	47.998	1695.06	51.802	1829.40
55.12	180.84	7.88	25.85	3.804	134.34	48.144	1700.22	51.948	1834.55
55.13	180.87	7.89	25.89	3.804	134.34	48.291	1705.38	52.095	1839.72
55.14	180.91	7.90	25.92	3.804	134.34	48.437	1710.57	52.241	1844.91
55.15	180.94	7.91	25.95	3.804	134.34	48.585	1715.77	52.389	1850.11
55.16	180.97	7.92	25.98	3.804	134.34	48.732	1720.98	52.536	1855.32
55.17	181.00	7.93	26.02	3.804	134.34	48.881	1726.22	52.685	1860.55
55.18	181.04	7.94	26.05	3.804	134.34	49.029	1731.46	52.833	1865.80
55.19	181.07	7.95	26.08	3.804	134.34	49.178	1736.73	52.982	1871.07
55.20	181.10	7.96	26.12	3.804	134.34	49.328	1742.01	53.132	1876.35
55.21	181.14	7.97	26.15	3.804	134.34	49.478	1747.30	53.282	1881.64
55.22	181.17	7.98	26.18	3.804	134.34	49.628	1752.61	53.432	1886.95
55.23	181.20	7.99	26.21	3.804	134.34	49.779	1757.94	53.583	1892.28
55.24	181.23	8.00	26.25	3.804	134.34	49.930	1763.29	53.734	1897.62
55.25	181.27	8.01	26.28	3.804	134.34	50.082	1768.65	53.886	1902.99
55.26	181.30	8.02	26.31	3.804	134.34	50.234	1774.02	54.038	1908.36
55.27	181.33	8.03	26.35	3.804	134.34	50.387	1779.42	54.191	1913.76
55.28	181.36	8.04	26.38	3.804	134.34	50.540	1784.83	54.344	1919.16
55.29	181.40	8.05	26.41	3.804	134.34	50.694	1790.25	54.498	1924.59
55.30	181.43	8.06	26.44	3.804	134.34	50.826	1794.92	54.630	1929.26
55.31	181.46	8.07	26.48	3.804	134.34	50.968	1799.95	54.772	1934.28
55.32	181.50	8.08	26.51	3.804	134.34	51.111	1804.99	54.915	1939.32
55.33	181.53	8.09	26.54	3.804	134.34	51.254	1810.04	55.058	1944.38
55.34	181.56	8.10	26.57	3.804	134.34	51.398	1815.11	55.202	1949.45
55.35	181.59	8.11	26.61	3.804	134.34	51.542	1820.19	55.346	1954.53
55.36	181.63	8.12	26.64	3.804	134.34	51.686	1825.29	55.490	1959.62
55.37	181.66	8.13	26.67	3.804	134.34	51.831	1830.40	55.635	1964.74
55.38	181.69	8.14	26.71	3.804	134.34	51.974	1835.46	55.778	1969.80
55.39	181.73	8.15	26.74	3.804	134.34	52.111	1840.29	55.915	1974.63
55.40	181.76	8.16	26.77	3.804	134.34	52.248	1845.13	56.052	1979.47
55.41	181.79	8.17	26.80	3.804	134.34	52.385	1849.98	56.189	1984.32
55.42	181.82	8.18	26.84	3.804	134.34	52.523	1854.85	56.327	1989.19
55.43	181.86	8.19	26.87	3.804	134.34	52.661	1859.73	56.465	1994.06
55.44	181.89	8.20	26.90	3.804	134.34	52.800	1864.62	56.604	1998.95
55.45	181.92	8.21	26.94	3.804	134.34	52.938	1869.52	56.742	2003.86
55.46	181.96	8.22	26.97	3.804	134.34	53.078	1874.44	56.882	2008.78
55.47	181.99	8.23	27.00	3.804	134.34	53.217	1879.37	57.021	2013.71
55.48	182.02	8.24	27.03	3.804	134.34	53.357	1884.31	57.161	2018.65
55.49	182.05	8.25	27.07	3.804	134.34	53.498	1889.27	57.302	2023.60
55.50	182.09	8.26	27.10	3.804	134.34	53.638	1894.23	57.442	2028.57

14.039

14.221

Table 32: Previous data (2004) Page 32 of 36

1	2	3	4	5	6	7	8	9	10
55.51	182.12	8.27	27.13	3.804	134.34	53.779	1899.22	57.583	2033.55
55.52	182.15	8.28	27.17	3.804	134.34	53.921	1904.21	57.725	2038.55
55.53	182.19	8.29	27.20	3.804	134.34	54.063	1909.22	57.867	2043.56
55.54	182.22	8.30	27.23	3.804	134.34	54.205	1914.24	58.009	2048.58
55.55	182.25	8.31	27.26	3.804	134.34	54.347	1919.27	58.151	2053.61
55.56	182.28	8.32	27.30	3.804	134.34	54.490	1924.32	58.294	2058.66
55.57	182.32	8.33	27.33	3.804	134.34	54.634	1929.38	58.438	2063.72
55.58	182.35	8.34	27.36	3.804	134.34	54.777	1934.46	58.581	2068.80
55.59	182.38	8.35	27.40	3.804	134.34	54.921	1939.55	58.725	2073.88
55.60	182.41	8.36	27.43	3.804	134.34	55.066	1944.65	58.870	2078.98
55.61	182.45	8.37	27.46	3.804	134.34	55.211	1949.76	59.015	2084.10
55.62	182.48	8.38	27.49	3.804	134.34	55.356	1954.89	59.160	2089.23
55.63	182.51	8.39	27.53	3.804	134.34	55.501	1960.03	59.305	2094.37
55.64	182.55	8.40	27.56	3.804	134.34	55.647	1965.18	59.451	2099.52
55.65	182.58	8.41	27.59	3.804	134.34	55.794	1970.35	59.598	2104.69
55.66	182.61	8.42	27.62	3.804	134.34	55.940	1975.54	59.744	2109.87
55.67	182.64	8.43	27.66	3.804	134.34	56.088	1980.73	59.892	2115.07
55.68	182.68	8.44	27.69	3.804	134.34	56.235	1985.94	60.039	2120.28
55.69	182.71	8.45	27.72	3.804	134.34	56.383	1991.16	60.187	2125.50
55.70	182.74	8.46	27.76	3.804	134.34	56.531	1996.40	60.335	2130.74
55.71	182.78	8.47	27.79	3.804	134.34	56.680	2001.65	60.484	2135.99
55.72	182.81	8.48	27.82	3.804	134.34	56.829	2006.92	60.633	2141.25
55.73	182.84	8.49	27.85	3.804	134.34	56.978	2012.19	60.782	2146.53
55.74	182.87	8.50	27.89	3.804	134.34	57.128	2017.49	60.932	2151.82
55.75	182.91	8.51	27.92	3.804	134.34	57.279	2022.79	61.083	2157.13
55.76	182.94	8.52	27.95	3.804	134.34	57.429	2028.11	61.233	2162.45
55.77	182.97	8.53	27.99	3.804	134.34	57.580	2033.45	61.384	2167.78
55.78	183.01	8.54	28.02	3.804	134.34	57.732	2038.79	61.536	2173.13
55.79	183.04	8.55	28.05	3.804	134.34	57.883	2044.16	61.687	2178.49
55.80	183.07	8.56	28.08	3.804	134.34	58.036	2049.53	61.840	2183.87
55.81	183.10	8.57	28.12	3.804	134.34	58.188	2054.92	61.992	2189.26
55.82	183.14	8.58	28.15	3.804	134.34	58.341	2060.33	62.145	2194.66
55.83	183.17	8.59	28.18	3.804	134.34	58.495	2065.74	62.299	2200.08
55.84	183.20	8.60	28.22	3.804	134.34	58.649	2071.18	62.453	2205.52
55.85	183.23	8.61	28.25	3.804	134.34	58.803	2076.62	62.607	2210.96
55.86	183.27	8.62	28.28	3.804	134.34	58.958	2082.09	62.762	2216.42
55.87	183.30	8.63	28.31	3.804	134.34	59.113	2087.56	62.917	2221.90
55.88	183.33	8.64	28.35	3.804	134.34	59.268	2093.05	63.072	2227.39
55.89	183.37	8.65	28.38	3.804	134.34	59.424	2098.56	63.228	2232.90
55.90	183.40	8.66	28.41	3.804	134.34	59.580	2104.08	63.384	2238.41
55.91	183.43	8.67	28.44	3.804	134.34	59.737	2109.61	63.541	2243.95
55.92	183.46	8.68	28.48	3.804	134.34	59.894	2115.16	63.698	2249.50
55.93	183.50	8.69	28.51	3.804	134.34	60.052	2120.72	63.856	2255.06
55.94	183.53	8.70	28.54	3.804	134.34	60.210	2126.30	64.014	2260.64
55.95	183.56	8.71	28.58	3.804	134.34	60.368	2131.89	64.172	2266.23
55.96	183.60	8.72	28.61	3.804	134.34	60.527	2137.50	64.331	2271.84
55.97	183.63	8.73	28.64	3.804	134.34	60.686	2143.12	64.490	2277.46
55.98	183.66	8.74	28.67	3.804	134.34	60.845	2148.76	64.649	2283.09
55.99	183.69	8.75	28.71	3.804	134.34	61.005	2154.41	64.809	2288.75
56.00	183.73	8.76	28.74	3.804	134.34	61.166	2160.07	64.970	2294.41

Page 33

Table 33: Previous data (2004) Page 33 of 36

1	2	3	4	5	6	7	8	9	10
56.01	183.76	8.77	28.77	3.804	134.34	61.327	2165.75	65.131	2300.09
56.02	183.79	8.78	28.81	3.804	134.34	61.488	2171.45	65.292	2305.79
56.03	183.83	8.79	28.84	3.804	134.34	61.650	2177.16	65.454	2311.50
56.04	183.86	8.80	28.87	3.804	134.34	61.812	2182.89	65.616	2317.23
56.05	183.89	8.81	28.90	3.804	134.34	61.974	2188.63	65.778	2322.97
56.06	183.92	8.82	28.94	3.804	134.34	62.137	2194.38	65.941	2328.72
56.07	183.96	8.83	28.97	3.804	134.34	62.301	2200.16	66.105	2334.49
56.08	183.99	8.84	29.00	3.804	134.34	62.465	2205.94	66.269	2340.28
56.09	184.02	8.85	29.04	3.804	134.34	62.629	2211.74	66.433	2346.08
56.10	184.06	8.86	29.07	3.804	134.34	62.794	2217.56	66.598	2351.90
56.11	184.09	8.87	29.10	3.804	134.34	62.959	2223.39	66.763	2357.73
56.12	184.12	8.88	29.13	3.804	134.34	63.124	2229.24	66.928	2363.58
56.13	184.15	8.89	29.17	3.804	134.34	63.290	2235.10	67.094	2369.44
56.14	184.19	8.90	29.20	3.804	134.34	63.457	2240.98	67.261	2375.32
56.15	184.22	8.91	29.23	3.804	134.34	63.624	2246.87	67.428	2381.21
56.16	184.25	8.92	29.27	3.804	134.34	63.791	2252.78	67.595	2387.12
56.17	184.28	8.93	29.30	3.804	134.34	63.959	2258.71	67.763	2393.05
56.18	184.32	8.94	29.33	3.804	134.34	64.127	2264.65	67.931	2398.99
56.19	184.35	8.95	29.36	3.804	134.34	64.296	2270.61	68.100	2404.94
56.20	184.38	8.96	29.40	3.804	134.34	64.465	2276.58	68.269	2410.92
56.21	184.42	8.97	29.43	3.804	134.34	64.634	2282.56	68.438	2416.90
56.22	184.45	8.98	29.46	3.804	134.34	64.804	2288.57	68.608	2422.91
56.23	184.48	8.99	29.49	3.804	134.34	64.975	2294.59	68.779	2428.92
56.24	184.51	9.00	29.53	3.804	134.34	65.146	2300.62	68.950	2434.96
56.25	184.55	9.01	29.56	3.804	134.34	65.317	2306.67	69.121	2441.01
56.26	184.58	9.02	29.59	3.804	134.34	65.489	2312.74	69.293	2447.08
56.27	184.61	9.03	29.63	3.804	134.34	65.661	2318.82	69.465	2453.16
56.28	184.65	9.04	29.66	3.804	134.34	65.834	2324.92	69.638	2459.26
56.29	184.68	9.05	29.69	3.804	134.34	66.007	2331.03	69.811	2465.37
56.30	184.71	9.06	29.72	3.804	134.34	66.187	2337.39	69.991	2471.73
56.31	184.74	9.07	29.76	3.804	134.34	66.346	2343.00	70.150	2477.34
56.32	184.78	9.08	29.79	3.804	134.34	66.505	2348.62	70.309	2482.96
56.33	184.81	9.09	29.82	3.804	134.34	66.664	2354.26	70.468	2488.59
56.34	184.84	9.10	29.86	3.804	134.34	66.824	2359.90	70.628	2494.24
56.35	184.88	9.11	29.89	3.804	134.34	66.985	2365.57	70.789	2499.90
56.36	184.91	9.12	29.92	3.804	134.34	67.145	2371.24	70.949	2505.58
56.37	184.94	9.13	29.95	3.804	134.34	67.307	2376.93	71.111	2511.27
56.38	184.97	9.14	29.99	3.804	134.34	67.468	2382.63	71.272	2516.97
56.39	185.01	9.15	30.02	3.804	134.34	67.630	2388.35	71.434	2522.69
56.40	185.04	9.16	30.05	3.804	134.34	67.792	2394.08	71.596	2528.42
56.41	185.07	9.17	30.09	3.804	134.34	67.955	2399.82	71.759	2534.16
56.42	185.10	9.18	30.12	3.804	134.34	68.118	2405.58	71.922	2539.92
56.43	185.14	9.19	30.15	3.804	134.34	68.281	2411.35	72.085	2545.69
56.44	185.17	9.20	30.18	3.804	134.34	68.445	2417.13	72.249	2551.47
56.45	185.20	9.21	30.22	3.804	134.34	68.609	2422.93	72.413	2557.27
56.46	185.24	9.22	30.25	3.804	134.34	68.774	2428.74	72.578	2563.08
56.47	185.27	9.23	30.28	3.804	134.34	68.939	2434.57	72.743	2568.91
56.48	185.30	9.24	30.31	3.804	134.34	69.104	2440.41	72.908	2574.75
56.49	185.33	9.25	30.35	3.804	134.34	69.270	2446.27	73.074	2580.60
56.50	185.37	9.26	30.38	3.804	134.34	69.436	2452.14	73.240	2586.47

16-243

Table 34: Previous data (2004) Page 34 of 36

1	2	3	4	5	6	7	8	9	10
56.51	185.40	9.27	30.41	3.804	134.34	69.603	2458.02	73.407	2592.36
56.52	185.43	9.28	30.45	3.804	134.34	69.770	2463.91	73.574	2598.25
56.53	185.47	9.29	30.48	3.804	134.34	69.937	2469.83	73.741	2604.16
56.54	185.50	9.30	30.51	3.804	134.34	70.105	2475.75	73.909	2610.09
56.55	185.53	9.31	30.54	3.804	134.34	70.273	2481.69	74.077	2616.03
56.56	185.56	9.32	30.58	3.804	134.34	70.442	2487.64	74.246	2621.98
56.57	185.60	9.33	30.61	3.804	134.34	70.611	2493.61	74.415	2627.95
56.58	185.63	9.34	30.64	3.804	134.34	70.780	2499.59	74.584	2633.93
56.59	185.66	9.35	30.68	3.804	134.34	70.950	2505.59	74.754	2639.93
56.60	185.70	9.36	30.71	3.804	134.34	71.120	2511.60	74.924	2645.94
56.61	185.73	9.37	30.74	3.804	134.34	71.291	2517.63	75.095	2651.96
56.62	185.76	9.38	30.77	3.804	134.34	71.462	2523.67	75.266	2658.00
56.63	185.79	9.39	30.81	3.804	134.34	71.633	2529.72	75.437	2664.06
56.64	185.83	9.40	30.84	3.804	134.34	71.805	2535.79	75.609	2670.13
56.65	185.86	9.41	30.87	3.804	134.34	71.977	2541.87	75.781	2676.21
56.66	185.89	9.42	30.91	3.804	134.34	72.150	2547.97	75.954	2682.31
56.67	185.93	9.43	30.94	3.804	134.34	72.323	2554.08	76.127	2688.42
56.68	185.96	9.44	30.97	3.804	134.34	72.496	2560.21	76.300	2694.55
56.69	185.99	9.45	31.00	3.804	134.34	72.670	2566.35	76.474	2700.69
56.70	186.02	9.46	31.04	3.804	134.34	72.845	2572.51	76.649	2706.85
56.71	186.06	9.47	31.07	3.804	134.34	73.019	2578.68	76.823	2713.02
56.72	186.09	9.48	31.10	3.804	134.34	73.195	2584.87	76.999	2719.20
56.73	186.12	9.49	31.14	3.804	134.34	73.370	2591.07	77.174	2725.41
56.74	186.15	9.50	31.17	3.804	134.34	73.546	2597.28	77.350	2731.62
56.75	186.19	9.51	31.20	3.804	134.34	73.723	2603.51	77.527	2737.85
56.76	186.22	9.52	31.23	3.804	134.34	73.899	2609.76	77.703	2744.10
56.77	186.25	9.53	31.27	3.804	134.34	74.077	2616.02	77.881	2750.36
56.78	186.29	9.54	31.30	3.804	134.34	74.254	2622.30	78.058	2756.64
56.79	186.32	9.55	31.33	3.804	134.34	74.433	2628.59	78.237	2762.93
56.80	186.35	9.56	31.36	3.804	134.34	74.611	2634.89	78.415	2769.23
56.81	186.38	9.57	31.40	3.804	134.34	74.790	2641.22	78.594	2775.55
56.82	186.42	9.58	31.43	3.804	134.34	74.970	2647.55	78.774	2781.89
56.83	186.45	9.59	31.46	3.804	134.34	75.149	2653.90	78.953	2788.24
56.84	186.48	9.60	31.50	3.804	134.34	75.330	2660.27	79.134	2794.61
56.85	186.52	9.61	31.53	3.804	134.34	75.510	2666.65	79.314	2800.99
56.86	186.55	9.62	31.56	3.804	134.34	75.692	2673.05	79.496	2807.39
56.87	186.58	9.63	31.59	3.804	134.34	75.873	2679.46	79.677	2813.80
56.88	186.61	9.64	31.63	3.804	134.34	76.055	2685.89	79.859	2820.23
56.89	186.65	9.65	31.66	3.804	134.34	76.238	2692.33	80.042	2826.67
56.90	186.68	9.66	31.69	3.804	134.34	76.421	2698.79	80.225	2833.13
56.91	186.71	9.67	31.73	3.804	134.34	76.604	2705.27	80.408	2839.60
56.92	186.75	9.68	31.76	3.804	134.34	76.788	2711.76	80.592	2846.09
56.93	186.78	9.69	31.79	3.804	134.34	76.972	2718.26	80.776	2852.60
56.94	186.81	9.70	31.82	3.804	134.34	77.157	2724.78	80.961	2859.12
56.95	186.84	9.71	31.86	3.804	134.34	77.342	2731.32	81.146	2865.66
56.96	186.88	9.72	31.89	3.804	134.34	77.527	2737.87	81.331	2872.21
56.97	186.91	9.73	31.92	3.804	134.34	77.713	2744.44	81.517	2878.78
56.98	186.94	9.74	31.96	3.804	134.34	77.900	2751.02	81.704	2885.36
56.99	186.98	9.75	31.99	3.804	134.34	78.086	2757.62	81.890	2891.96
57.00	187.01	9.76	32.02	3.804	134.34	78.274	2764.24	82.078	2898.58

Table 35: Previous data (2004) Page 35 of 36

1	2	3	4	5	6	7	8	9	10
57.01	187.04	9.77	32.05	3.804	134.34	78.462	2770.87	82.266	2905.21
57.02	187.07	9.78	32.09	3.804	134.34	78.650	2777.52	82.454	2911.86
57.03	187.11	9.79	32.12	3.804	134.34	78.838	2784.18	82.642	2918.52
57.04	187.14	9.80	32.15	3.804	134.34	79.028	2790.86	82.832	2925.20
57.05	187.17	9.81	32.19	3.804	134.34	79.217	2797.56	83.021	2931.89
57.06	187.20	9.82	32.22	3.804	134.34	79.407	2804.27	83.211	2938.61
57.07	187.24	9.83	32.25	3.804	134.34	79.598	2810.99	83.402	2945.33
57.08	187.27	9.84	32.28	3.804	134.34	79.789	2817.74	83.593	2952.08
57.09	187.30	9.85	32.32	3.804	134.34	79.980	2824.50	83.784	2958.84
57.10	187.34	9.86	32.35	3.804	134.34	80.172	2831.27	83.976	2965.61
57.11	187.37	9.87	32.38	3.804	134.34	80.364	2838.07	84.168	2972.40
57.12	187.40	9.88	32.41	3.804	134.34	80.557	2844.87	84.361	2979.21
57.13	187.43	9.89	32.45	3.804	134.34	80.750	2851.70	84.554	2986.04
57.14	187.47	9.90	32.48	3.804	134.34	80.944	2858.54	84.748	2992.88
57.15	187.50	9.91	32.51	3.804	134.34	81.138	2865.40	84.942	2999.74
57.16	187.53	9.92	32.55	3.804	134.34	81.333	2872.27	85.137	3006.61
57.17	187.57	9.93	32.58	3.804	134.34	81.528	2879.16	85.332	3013.50
57.18	187.60	9.94	32.61	3.804	134.34	81.724	2886.07	85.528	3020.41
57.19	187.63	9.95	32.64	3.804	134.34	81.920	2892.99	85.724	3027.33
57.20	187.66	9.96	32.68	3.804	134.34	82.116	2899.93	85.920	3034.27
57.21	187.70	9.97	32.71	3.804	134.34	82.313	2906.89	86.117	3041.23
57.22	187.73	9.98	32.74	3.804	134.34	82.511	2913.86	86.315	3048.20
57.23	187.76	9.99	32.78	3.804	134.34	82.709	2920.86	86.513	3055.19
57.24	187.80	10.00	32.81	3.804	134.34	82.907	2927.86	86.711	3062.20
57.25	187.83	10.01	32.84	3.804	134.34	83.106	2934.89	86.910	3069.22
57.26	187.86	10.02	32.87	3.804	134.34	83.305	2941.93	87.109	3076.27
57.27	187.89	10.03	32.91	3.804	134.34	83.505	2948.98	87.309	3083.32
57.28	187.93	10.04	32.94	3.804	134.34	83.705	2956.06	87.509	3090.40
57.29	187.96	10.05	32.97	3.804	134.34	83.906	2963.15	87.710	3097.49
57.30	187.99	10.06	33.01	3.804	134.34	84.102	2970.06	87.906	3104.40

Submerged
Area
in sqk

19.346
km²

Submerged Area:-

57.30 FRL → 19.346 km²

→ 1934.6 ha

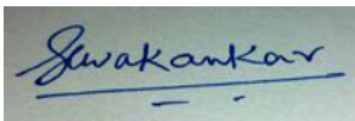
Table 36: Previous data (2004) Page 36 of 36

Annexure - 4
Daily Progress Reports
Machhu-2 Reservoir

 DAILY PROGRESS REPORT	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2


DPR No. 001

Client:	Narmada Water Resources, Water Supply & Kalpsar Department			Project No:	P34320
Vessel:	OSaS SMB			Date:	08-03-2021
Location:	Machhu 2 Dam			Sheet No:	1 of 1
Party Chief: Santosh Wakankar				Client Rep.	
Survey Personnel:					
1. Pankaj Rabary		2. Nikhil Rane		3. Manoj More	
4. Virender Singh		5.		6.	
7.		8.		9.	
10.					
Equipment	RTKsystem	SBES system	Auto level	Heave sensor	
	Hypacknav system	Bar check	Generator		
	Computer				
Time (hrs)		Activities			
1330	2030	Level transferred from FRL to Dam wall, Benchmark baseline established			
		Today's coverage		Cumulative coverage	
		Bathymetry: __ sq.km	Line km: __	Bathymetry: __ sq.km	Line km: __
		Topo: __ sq.km	Line km: __	Topo: __ sq.km	Line km: __
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Bathy survey mobilisation, start of topo survey					
Remarks: Surveyor Virender Singh joined the team at 1300					
			Client Representative		
Party Chief					

 <p>DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2


DPR No.002

Client:	Narmada Water Resources, Water Supply & Kalpsar Department			Project No:	P34320	
Vessel:	OSaS SMB			Date:	09-03-2021	
Location:	Machhu 2 Dam			Sheet No:	1 of 1	
Party Chief: Santosh Wakankar				Client Rep.		
Survey Personnel:						
1. Pankaj Rabary		2. Nikhil Rane		3. Manoj More		
4. Virender Singh		5.		6.		
7.		8.		9.		
10.						
Equipment	RTKsystem		SBES system		Auto level	
	Hypack nav system		Bar check		Generator	
	Computer					
Time (hrs)		Activities				
0900	1000	Team reached site and set up RTK reference station				
1000	1700	Topo survey carried out				
1000	1600	Survey boat mobilisation completed				
1600	1700	Wet test and trial run carried out				
1700	1730	Secured base and team return to guest house				
		Today's coverage		Cumulative coverage		
		Bathymetry: __sq.km		Line km: __		Bathymetry: __ sq.km
		Topo: 0.12sq.km		Line km: 4.6		Line km: 4.6
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours		
Plan for next 24 hours: Start Bathy survey, continue topo survey						
Remarks: Client Rep. Visited the site today morning and was briefed by the survey team regarding the survey plan						
				Client Representative		
Party Chief						

 <p align="center">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2


DPR No. 003

Client:	Narmada Water Resources, Water Supply & Kalpsar Department			Project No:	P34320
Vessel:	OSaS SMB			Date:	10-03-2021
Location:	Machhu 2 Dam			Sheet No:	1 of 1
Party Chief: Santosh Wakankar				Client Rep.	
Survey Personnel:					
1. Pankaj Rabary		2. Nikhil Rane		3. Manoj More	
4. Virender Singh		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system		SBES system		Auto level
	Hypack nav system		Bar check		Generator
	Computer				
Time (hrs)		Activities			
0900	1000	Team reached site and set up RTK reference station, Bar check carried out			
1000	1800	Topo & Bathy survey carried out			
1800	1830	Secured base and team return to guest house			
		Today's coverage		Cumulative coverage	
		Bathymetry: 0.8 sq.km Line km: 32.0		Bathymetry: 0.8 sq.km Line km: 32.0	
		Topo: 0.17sq.km Line km: 6.8		Topo: 0.29sq.km Line km: 11.4	
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Bathy & Topo survey					
Remarks:					
 <p align="center"><u>Santosh Wakankar</u></p>					
Party Chief			Client Representative		

 <p style="text-align: center;">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2


DPR No. 004

Client:	Narmada Water Resources, Water Supply & Kalpsar Department			Project No:	P34320
Vessel:	OSaS SMB			Date:	11-03-2021
Location:	Machhu 2 Dam			Sheet No:	1 of 1
Party Chief: Santosh Wakankar				Client Rep.	
Survey Personnel:					
1. Pankaj Rabary		2. Nikhil Rane		3. Manoj More	
4. Virender Singh		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system		SBES system	Auto level	
	Hypack nav system		Bar check	Generator	
	Computer				
Time (hrs)		Activities			
0830	0930	Team reached site and set up RTK reference station, bar check carried out			
0930	1815	Topo & bathy survey carried out			
1815	1845	Secured base and team return to guest house			
		Today's coverage		Cumulative coverage	
		Bathymetry: 1.1sq.km	Line km: 43.69	Bathymetry: 1.9sq.km	Line km: 75.69
		Topo: 0.23sq.km	Line km: 9.2	Topo: 0.52sq.km	Line km: 20.6
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Bathy & Topo survey					
Remarks:					
					
Party Chief			Client Representative		

 <p style="text-align: center;">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2


DPR No. 005

Client:	Narmada Water Resources, Water Supply & Kalpsar Department			Project No:	P34320
Vessel:	OSaS SMB			Date:	12-03-2021
Location:	Machhu 2 Dam			Sheet No:	1 of 1
Party Chief: Santosh Wakankar				Client Rep.	
Survey Personnel:					
1. Pankaj Rabary		2. Nikhil Rane		3. Manoj More	
4. Virender Singh		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system		SBES system	Auto level	
	Hypack nav system		Bar check	Generator	
	Computer				
Time (hrs)		Activities			
0830	0930	Team reached site and set up RTK reference station, Bar check carried out			
0930	1815	Topo & Bathy survey carried out			
1815	1845	Secured base and team return to guest house			
		Today's coverage		Cumulative coverage	
		Bathymetry: 1.0sq.km	Line km: 40.30	Bathymetry: 2.9sq.km	Line km: 115.99
		Topo: 0.37sq.km	Line km: 14.8	Topo: 0.89sq.km	Line km: 35.4
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Bathy & Topo survey					
Remarks:					
					
Party Chief			Client Representative		

 <p style="text-align: center;">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2


DPR No. 007

Client:	Narmada Water Resources, Water Supply & Kalpsar Department			Project No.:	P34320	
Vessel:	OSaS SMB			Date:	14-03-2021	
Location:	Machhu 2 Dam			Sheet No.:	1 of 1	
Party Chief: Santosh Wakankar				Client Rep.:		
Survey Personnel:						
1. Pankaj Rabary		2. Nikhil Rane		3. Manoj More		
4. Virender Singh		5.		6.		
7.		8.		9.		
10.						
Equipment	RTK system		SBES system		Auto level	
	Hypack nav system		Bar check		Generator	
	Computer					
Time (hrs)		Activities				
0830	0930	Team reached site and set up RTK reference station, Bar check carried out				
0930	1815	Topo & Bathy survey carried out				
1815	1845	Secured base and team return to guest house				
		Today's coverage			Cumulative coverage	
		Bathymetry: 1.12 sq.km		Line km:45.10		
		Bathymetry: 5.12 sq.km		Line km: 205.39		
		Topo: 0.21 sq.km		Line km:8.4		
		Topo:1.45 sq.km		Line km:57.8		
		Weather downtime today: 0 hour			Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Bathy & Topo survey						
Remarks:						
						
Party Chief				Client Representative		

 DAILY PROGRESS REPORT	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu2


DPR No. 008

Client:	Narmada Water Resources, Water Supply & Kalpsar Department	Project No:	P34320	
Vessel:	OSaS SMB	Date:	15-03-2021	
Location:	Machhu2 Dam	Sheet No:	1 of 1	
Party Chief: Santosh Wakankar		Client Rep.		
Survey Personnel:				
1. Pankaj Rabary	2. Nikhil Rane		3. Manoj More	
4. Virender Singh	5.		6.	
7.	8.		9.	
10.				
Equipment	RTK system	SBES system	Auto level	
	Hypack nav system	Bar check	Generator	
	Computer			
Time (hrs)		Activities		
0800	0900	Team reached site and set up RTK reference station, Bar check carried out		
0900	1815	Topo & Bathy survey carried out		
1815	1845	Secured base and team returned to guest house		
		Today's coverage	Cumulative coverage	
		Bathymetry: 1.10sq.km	Line km: 43.00	Bathymetry: 6.20sq.km
		Topo: 0.45sq.km	Line km: 18.0	Topo: 1.90 sq.km
		Weather downtime today: 0 hour	Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Bathy & Topo survey				
Remarks:				
 Party Chief		Client Representative		

 <p style="text-align: center;">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2

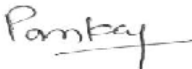
DPR No. 009

Client:	Narmada Water Resources, Water Supply & Kalpsar Department		Project No:	P34320	
Vessel:	OSaS SMB		Date:	16-03-2021	
Location:	Machhu 2 Dam		Sheet No:	1 of 1	
Party Chief: Santosh Wakankar			Client Rep.		
Survey Personnel:					
1. Pankaj Rabary		2. Nikhil Rane		3. Manoj More	
4. Virender Singh		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system		SBES system		Auto level
	Hypack nav system		Bar check		Generator
	Computer				
Time (hrs)		Activities			
0800	0900	Team reached site and set up RTK reference station, Bar check carried out			
0900	1815	Topo & Bathy survey carried out			
1815	1845	Secured base and team returned to guest house			
		Today's coverage		Cumulative coverage	
		Bathymetry: 0.99sq.km	Line km: 39.50	Bathymetry: 7.18sq.km	Line km: 287.89
		Topo: 0.33sq.km	Line km: 13.2	Topo: 2.23 sq.km	Line km: 89.0
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Bathy & Topo survey					
Remarks: Binukumar joined the team					
 Santosh Wakankar			 Client Representative		
Party Chief					

 <p style="text-align: center;">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2


DPR No. 010

Client:	Narmada Water Resources, Water Supply & Kalpsar Department		Project No:	P34320	
Vessel:	OSaS SMB		Date:	17-03-2021	
Location:	Machhu 2 Dam		Sheet No:	1 of 1	
Party Chief: Pankaj Rabary			Client Rep.		
Survey Personnel:					
1. Virender Singh		2. Binu Kumar		3. Manoj More	
4.		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system	SBES system	Auto level	Heave sensor	
	Hypack nav system	Bar check	Generator		
	Computer				
Time (hrs)	Activities				
0800	0900	Team reached site and set up RTK reference station, bar check carried out			
0900	1730	Topo & bathy survey carried out.			
1730	1830	Secured base and team returned to guest house			
		Today's coverage		Cumulative coverage	
		Bathymetry: 0.87sq.km	Line km: 34.65	Bathymetry: 8.05sq.km	Line km: 322.54
		Topo: 0.32sq.km	Line km: 12.8	Topo: 2.55 sq.km	Line km: 101.8
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue bathy & topo survey					
Remarks: Santosh Wakankar and Nikhil Rane left site this morning.					
 Party Chief			 Client Representative		

 <p>DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2


DPR No. 011

Client:	Narmada Water Resources, Water Supply & Kalpsar Department		Project No:	P34320	
Vessel:	OSaS SMB		Date:	18-03-2021	
Location:	Machhu 2 Dam		Sheet No:	1 of 1	
Party Chief: Pankaj Rabary			Client Rep.		
Survey Personnel:					
1. Virender Singh		2. Binu Kumar		3. Manoj More	
4.		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system	SBES system	Auto level		Heave sensor
	Hypack nav system	Bar check	Generator		
	Computer				
Time (hrs)		Activities			
0830		0930 Team reached site and set up RTK reference station, bar check carried out			
0930		1830 Topo & bathy survey carried out.			
1830		1930 Secured base and team returned to guest house			
		Today's coverage		Cumulative coverage	
		Bathymetry: 0.47sq.km	Line km: 18.8	Bathymetry: 8.52sq.km	Line km: 341.34
		Topo: 0.36sq.km	Line km: 14.4	Topo: 2.91 sq.km	Line km: 116.2
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Bathy & Topo survey					
Remarks:					
					
Party Chief			Client Representative		

 <p style="text-align: center;">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2


DPR No. 012

Client:	Narmada Water Resources, Water Supply & Kalpsar Department			Project No:	P34320
Vessel:	OSaS SMB			Date:	19-03-2021
Location:	Machhu 2 Dam			Sheet No:	1 of 1
Party Chief: Pankaj Rabary				Client Rep.	
Survey Personnel:					
1. Virender Singh		2. Binu Kumar		3. Manoj More	
4.		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system		SBES system	Auto level	
	Hypack nav system		Bar check	Generator	
	Computer				
Time (hrs)		Activities			
0830	0930	Team reached site and set up RTK reference station, bar check carried out			
0930	1230	Temporary benchmark point established on a hill near to survey area and base station transferred on that point.			
1230	1830	Topo & bathy survey carried out.			
1830	1900	Secured base and team returned to guest house			
		Today's coverage		Cumulative coverage	
		Bathymetry: 0.82sq.km	Line km: 32.8	Bathymetry: 9.34sq.km	Line km: 374.14
		Topo: 0.15sq.km	Line km: 6	Topo: 3.06 sq.km	Line km: 122.2
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Bathy & Topo survey					
Remarks:					
					
Party Chief			Client Representative		

 <p style="text-align: center;">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2

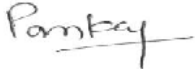
DPR No. 013

Client:	Narmada Water Resources, Water Supply & Kalpsar Department		Project No:	P34320	
Vessel:	OSaS SMB		Date:	20-03-2021	
Location:	Machhu 2 Dam		Sheet No:	1 of 1	
Party Chief: Pankaj Rabary			Client Rep.		
Survey Personnel:					
1. Virender Singh		2. Binu Kumar		3. Manoj More	
4.		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system	SBES system	Auto level		Heave sensor
	Hypack nav system	Bar check	Generator		
	Computer				
Time (hrs)		Activities			
0800	0900	Team reached site and set up RTK reference station, bar check carried out			
0900	1800	Topo & bathy survey carried out. Marked a temporary TBM on an island			
1800	1900	Secured base and team returned to guest house			
		Today's coverage		Cumulative coverage	
		Bathymetry: 0.83sq.km	Line km: 33.3	Bathymetry: 10.17sq.km	Line km: 407.44
		Topo: 0.57sq.km	Line km: 22.8	Topo: 3.63 sq.km	Line km: 145
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Bathy & Topo survey					
Remarks:					
					
Party Chief			Client Representative		

 <p style="text-align: center;">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2

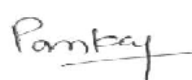
DPR No. 014

Client:	Narmada Water Resources, Water Supply & Kalpsar Department		Project No:	P34320	
Vessel:	OSaS SMB		Date:	21-03-2021	
Location:	Machhu 2 Dam		Sheet No:	1 of 1	
Party Chief: Pankaj Rabary			Client Rep.		
Survey Personnel:					
1. Virender Singh		2. Binu Kumar		3. Manoj More	
4.		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system	SBES system	Auto level		Heave sensor
	Hypack nav system	Bar check	Generator		
	Computer				
Time (hrs)		Activities			
0800	0900	Team reached site. Transit to the survey area			
0900	1000	Set up RTK reference station, bar check carried out			
1000	1800	Topo & bathy survey carried out.			
1800	1900	Secured base and team returned to guest house			
		Today's coverage		Cumulative coverage	
		Bathymetry: 0.65sq.km	Line km: 26	Bathymetry: 10.82sq.km	Line km: 433.44
		Topo: 0.49sq.km	Line km: 19.6	Topo: 4.12 sq.km	Line km: 164.6
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Bathy & Topo survey					
Remarks:					
 Party Chief			 Client Representative		

 <p style="text-align: center;">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2

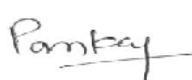
DPR No. 015

Client:	Narmada Water Resources, Water Supply & Kalpsar Department		Project No:	P34320	
Vessel:	OSaS SMB		Date:	22-03-2021	
Location:	Machhu 2 Dam		Sheet No:	1 of 1	
Party Chief: Pankaj Rabary			Client Rep.		
Survey Personnel:					
1. Virender Singh		2. Binu Kumar		3. Manoj More	
4.		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system	SBES system	Auto level		Heave sensor
	Hypack nav system	Bar check	Generator		
	Computer				
Time (hrs)		Activities			
0830	0930	Transit to the survey area			
0930	1030	Set up RTK reference station, bar check carried out			
1030	1800	Topo & bathy survey carried out.			
1800	1900	Secured base and team returned to guest house			
Note	:-	Today less bathy line kms achieved due to shallow area and short lines			
		Today's coverage		Cumulative coverage	
		Bathymetry: 0.41sq.km	Line km: 16.40	Bathymetry: 11.23 sq.km	Line km: 449.84
		Topo: 0.33sq.km	Line km: 13.20	Topo: 4.45 sq.km	Line km: 177.8
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Bathy & Topo survey					
Remarks:					
					
Party Chief			Client Representative		

 <p align="center">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2

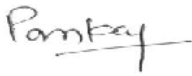
DPR No. 016

Client:	Narmada Water Resources, Water Supply & Kalpsar Department	Project No:	P34320	
Vessel:	OSaS SMB	Date:	23-03-2021	
Location:	Machhu 2 Dam	Sheet No:	1 of 1	
Party Chief: Pankaj Rabary		Client Rep.		
Survey Personnel:				
1. Virender Singh	2. Binu Kumar	3. Manoj More		
4.	5.	6.		
7.	8.	9.		
10.				
Equipment	RTK system	SBES system	Auto level	Heave sensor
	Hypack nav system	Bar check	Generator	
	Computer			
Time (hrs)		Activities		
0830	0930	Transit to the survey area		
0930	1030	Set up RTK reference station, bar check carried out		
1030	1800	Topo & bathy survey carried out.		
1800	1900	Secured base and team returned to guest house		
		Today's coverage		
		Cumulative coverage		
		Bathymetry: 0.64 sq.km	Line km: 25.43	
		Bathymetry: 11.87sq.km	Line km: 475.27	
		Topo: 0.42sq.km	Line km: 16.80	
		Topo: 4.87 sq.km	Line km: 194.6	
		Weather downtime today: 0 hour		
		Cumulative weather downtime: 0 hours		
Plan for next 24 hours: Continue Bathy & Topo survey				
Remarks:				
				
Party Chief		Client Representative		

 <p style="text-align: center;">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2

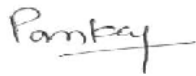
DPR No. 017

Client:	Narmada Water Resources, Water Supply & Kalpsar Department		Project No:	P34320	
Vessel:	OSaS SMB		Date:	24-03-2021	
Location:	Machhu 2 Dam		Sheet No:	1 of 1	
Party Chief: Pankaj Rabary			Client Rep.		
Survey Personnel:					
1.	Virender Singh	2.	Binu Kumar	3.	Manoj More
4.		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system	SBES system	Auto level	Heave sensor	
	Hypack nav system	Bar check	Generator		
	Computer				
Time (hrs)	Activities				
0830	0930	Transit to the survey area			
0930	1000	Set up RTK reference station, bar check carried out			
1000	1730	Topo & bathy survey carried out.			
1730	1830	Secured base and team returned to guest house			
Note	-	As of now bathy survey has been completed as per area boundary received from office. Tomorrow we will discuss with the client representative about survey area boundary in rivers and channels, will see if area is left as per client requirement.			
		Today's coverage		Cumulative coverage	
		Bathymetry: 0.23 sq.km	Line km: 9.20	Bathymetry: 12.10 sq.km Line km: 484.47	
		Topo: 0.24sq.km	Line km: 9.60	Topo: 5.11 sq.km Line km: 204.2	
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Bathy & Topo survey					
Remarks:					
					
Party Chief		Client Representative			

 <p style="text-align: center;">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2


DPR No. 018

Client:	Narmada Water Resources, Water Supply & Kalpsar Department		Project No:	P34320	
Vessel:	OSaS SMB		Date:	25-03-2021	
Location:	Machhu 2 Dam		Sheet No:	1 of 1	
Party Chief: Pankaj Rabary			Client Rep.		
Survey Personnel:					
1. Virender Singh		2. Binu Kumar		3. Manoj More	
4.		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system		SBES system		Auto level
	Hypack nav system		Bar check		Generator
	Computer				
Time (hrs)		Activities			
0830	0930	Transit to the survey area			
0930	1000	Set up RTK reference station, bar check carried out			
1000	1730	Topo & bathy survey carried out.			
1730	1830	Secured base and team returned to guest house			
Note	:-	Today met with client representative. Some patchwork in river and a small channel done.			
		Expect to complete tomorrow.			
		Today's coverage		Cumulative coverage	
		Bathymetry: 0.54sq.km	Line km: 21.60	Bathymetry: 12.64sq.km	Line km: 506.07
		Topo: 0.89sq.km	Line km: 35.60	Topo: 6.00 sq.km	Line km: 239.8
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Bathy & Topo survey					
Remarks:					
					
Party Chief			Client Representative		

 <p style="text-align: center;">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2

DPR No. 019

Client:	Narmada Water Resources, Water Supply & Kalpsar Department		Project No:	P34320	
Vessel:	OSaS SMB		Date:	26-03-2021	
Location:	Machhu 2 Dam		Sheet No:	1 of 1	
Party Chief: Pankaj Rabary			Client Rep.		
Survey Personnel:					
1. Virender Singh		2. Binu Kumar		3. Manoj More	
4.		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system		SBES system		Auto level
	Hypack nav system		Bar check		Generator
	Computer				
Time (hrs)		Activities			
0815	0900	Transit to the survey area			
0900	1000	Set up RTK reference station, Bar check carried out			
1000	1730	Topo & bathy survey carried out.			
1730	1830	Secured base and team returned to guest house			
	Note	Bathy survey completed. Requesting for boat demobilisation.			
		Today's coverage		Cumulative coverage	
		Bathymetry: 0.28sq.km	Line km: 11.20	Bathymetry: 12.92sq.km	Line km: 517.27
		Topo: 0.73sq.km	Line km: 29.20	Topo: 6.73sq.km	Line km: 269
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Topo survey					
Remarks:					
 Party Chief			 Client Representative		

 DAILY PROGRESS REPORT	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2

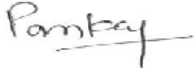
DPR No. 020

Client:	Narmada Water Resources, Water Supply & Kalpsar Department			Project No:	P34320
Vessel:	OSaS SMB			Date:	27-03-2021
Location:	Machhu 2 Dam			Sheet No:	1 of 1
Party Chief: Pankaj Rabary				Client Rep.	
Survey Personnel:					
1. Virender Singh		2. Binu Kumar		3. Manoj More	
4.		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system	SBES system	Auto level		Heave sensor
	Hypack nav system	Bar check	Generator		
	Computer				
Time (hrs)	Activities				
0830	0900	Transit to the survey area			
0900	1000	Set up RTK reference station			
1000	1730	Topo survey carried out			
1730	1830	Secured base and team returned to guest house			
		Today's coverage		Cumulative coverage	
		Bathymetry: -	Line km: -	Bathymetry: 12.92sq.km	Line km: 517.27
		Topo: 0.92sq.km	Line km: 36.8	Topo: 7.65sq.km	Line km: 305.8
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Topo survey					
Remarks:					
Party Chief			Client Representative		

 <p style="text-align: center;">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2

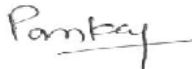
DPR No. 021

Client:	Narmada Water Resources, Water Supply & Kalpsar Department		Project No:	P34320	
Vessel:	OSaS SMB		Date:	28-03-2021	
Location:	Machhu 2 Dam		Sheet No:	1 of 1	
Party Chief: Pankaj Rabary			Client Rep.		
Survey Personnel:					
1. Virender Singh		2. Binu Kumar		3. Manoj More	
4.		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system	SBES system	Auto level		Heave sensor
	Hypack nav system	Bar check	Generator		
	Computer				
Time (hrs)		Activities			
0830	0900	Transit to the survey area			
0900	1000	Set up RTK reference station, bar check carried out			
1000	1730	Topo survey carried out.			
1730	1830	Secured base and team returned to guest house			
		Today's coverage		Cumulative coverage	
		Bathymetry: -	Line km: -	Bathymetry: 12.92sq.km	Line km: 517.27
		Topo: 1.65sq.km	Line km: 66	Topo: 9.30sq.km	Line km: 371.8
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue topo survey					
Remarks:					
 Party Chief			 Client Representative		

 <p style="text-align: center;">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2

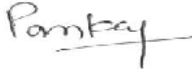
DPR No. 022

Client:	Narmada Water Resources, Water Supply & Kalpsar Department		Project No:	P34320	
Vessel:	OSaS SMB		Date:	29-03-2021	
Location:	Machhu 2 Dam		Sheet No:	1 of 1	
Party Chief: Pankaj Rabary			Client Rep.		
Survey Personnel:					
1. Virender Singh		2. Binu Kumar		3. Manoj More	
4.		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system		SBES system		Auto level
	Hypack nav system		Bar check		Generator
	Computer				
Time (hrs)		Activities			
0830	0900	Transit to the survey area			
0900	1000	Set up RTK reference station, bar check carried out			
1000	1600	Topo survey carried out.			
1600	1700	Secured base and team returned to guest house			
1700	1830	Bathy survey boat demobilised			
		Today's coverage		Cumulative coverage	
		Bathymetry: -	Line km: -	Bathymetry: 12.92sq.km	Line km: 517.27
		Topo: 0.5sq.km	Line km: 20	Topo: 9.80sq.km	Line km: 391.8
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue topo survey					
Remarks:					
					
Party Chief			Client Representative		

 <p style="text-align: center;">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2

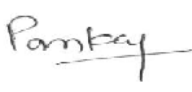
DPR No. 023

Client:	Narmada Water Resources, Water Supply & Kalpsar Department		Project No:	P34320	
Vessel:	OSaS SMB		Date:	30-03-2021	
Location:	Machhu 2 Dam		Sheet No:	1 of 1	
Party Chief: Pankaj Rabary			Client Rep.		
Survey Personnel:					
1. Virender Singh		2. Binu Kumar		3. Manoj More	
4.		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system	SBES system	Auto level	Heave sensor	
	Hypack nav system	Bar check	Generator		
	Computer				
Time (hrs)		Activities			
0830	0900	Transit to the survey area			
0900	1000	Set up RTK reference station.			
1000	1730	Topo survey carried out.			
1730	1830	Secured base and team returned to guest house			
		Today's coverage		Cumulative coverage	
		Bathymetry: -	Line km: -	Bathymetry: 12.92sq.km	Line km: 517.27
		Topo: 0.68sq.km	Line km: 27.2	Topo: 10.48sq.km	Line km: 419
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Topo survey					
Remarks:					
					
Party Chief			Client Representative		

 <p style="text-align: center;">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2


DPR No. 024

Client:	Narmada Water Resources, Water Supply & Kalpsar Department		Project No:	P34320	
Vessel:	OSaS SMB		Date:	31-03-2021	
Location:	Machhu 2 Dam		Sheet No:	1 of 1	
Party Chief: Pankaj Rabary			Client Rep.		
Survey Personnel:					
1. Virender Singh		2. Binu Kumar		3. Manoj More	
4.		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system	SBES system	Auto level		Heave sensor
	Hypack nav system	Bar check	Generator		
	Computer				
Time (hrs)		Activities			
0800	0900	Transit to the survey area			
0900	0930	Set up RTK reference station.			
0930	1630	Topo survey carried out.			
1630	1700	A temporary benchmark point marked on new location			
1700	1800	Secured base and team returned to guest house			
		Today's coverage		Cumulative coverage	
		Bathymetry: -	Line km: -	Bathymetry: 12.92sq.km	Line km: 517.27
		Topo: 0.58sq.km	Line km: 23.2	Topo: 11.06sq.km	Line km: 442.2
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Topo survey					
Remarks:					
					
Party Chief			Client Representative		

 <p style="text-align: center;">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2


DPR No. 025

Client:	Narmada Water Resources, Water Supply & Kalpsar Department		Project No:	P34320	
Vessel:	OSaS SMB		Date:	01-04-2021	
Location:	Machhu 2 Dam		Sheet No:	1 of 1	
Party Chief: Pankaj Rabary			Client Rep.		
Survey Personnel:					
1. Virender Singh		2. Binu Kumar		3. Manoj More	
4.		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system		SBES system		Auto level
	Hypack nav system		Bar check		Generator
	Computer				
Time (hrs)		Activities			
0830	0900	Transit to the survey area			
0900	0930	Set up RTK reference station.			
0930	1700	Topo survey carried out.			
1700	1730	A temporary benchmark point marked on new location			
1730	1830	Secured base and team returned to guest house			
		Today's coverage		Cumulative coverage	
		Bathymetry: -	Line km: -	Bathymetry: 12.92sq.km	Line km: 517.27
		Topo: 0.44sq.km	Line km: 17.6	Topo: 11.50sq.km	Line km: 459.80
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Topo survey					
Remarks:					
					
Party Chief			Client Representative		

 <p style="text-align: center;">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2


DPR No. 026

Client:	Narmada Water Resources, Water Supply & Kalpsar Department			Project No:	P34320
Vessel:	OSaS SMB			Date:	02-04-2021
Location:	Machhu 2 Dam			Sheet No:	1 of 1
Party Chief: Pankaj Rabary				Client Rep.	
Survey Personnel:					
1. Virender Singh		2. Binu Kumar		3. Manoj More	
4.		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system		SBES system		Auto level
	Hypack nav system		Bar check		Generator
	Computer				
Time (hrs)		Activities			
0830	0900	Transit to the survey area			
0900	0930	Set up RTK reference station.			
0930	1730	Topo survey carried out.			
1730	1830	Secured base and team returned to guest house			
		Today's coverage		Cumulative coverage	
		Bathymetry: -	Line km: -	Bathymetry: 12.92sq.km	Line km: 517.27
		Topo: 0.72sq.km	Line km: 28.8	Topo: 12.22sq.km	Line km: 488.6
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Topo survey					
Remarks:					
					
Party Chief			Client Representative		

 <p style="text-align: center;">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2


DPR No. 027

Client:	Narmada Water Resources, Water Supply & Kalpsar Department		Project No:	P34320	
Vessel:	OSaS SMB		Date:	03-04-2021	
Location:	Machhu 2 Dam		Sheet No:	1 of 1	
Party Chief: Pankaj Rabary			Client Rep.		
Survey Personnel:					
1. Virender Singh		2. Binu Kumar		3. Manoj More	
4.		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system		SBES system		Auto level
	Hypack nav system		Bar check		Generator
	Computer				
Time (hrs)		Activities			
0830	0900	Transit to the survey area			
0900	0930	Set up RTK reference station.			
0930	1500	Topo survey carried out.			
1500	1600	Secured base and team returned to guest house			
		Today's coverage		Cumulative coverage	
		Bathymetry: -	Line km: -	Bathymetry: 12.92sq.km	Line km: 517.27
		Topo: 0.40sq.km	Line km: 16	Topo: 12.62sq.km	Line km: 504.6
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Topo survey					
Remarks: Virender Singh and Manoj More left site at 17:00 hrs.					
					
Party Chief			Client Representative		

	DAILY PROGRESS REPORT	Form No.:	Sy01R
		Revision:	01
		Date:	11/07/2014
		Approved By	PKT

Location Machhu 2


DPR No. 028

Client:	Narmada Water Resources, Water Supply & Kalpsar Department			Project No:	P34320
Vessel:	OSaS SMB			Date:	04-04-2021
Location:	Machhu 2 Dam			Sheet No:	1 of 1
Party Chief: Pankaj Rabary				Client Rep.	
Survey Personnel:					
1. Binu Kumar		2.		3.	
4.		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system		SBES system		Auto level
	Hypack nav system		Bar check		Generator
	Computer				
Time (hrs)		Activities			
0800	0900	Transit to the survey area			
0900	0930	Set up RTK reference station.			
0930	1700	Topo survey carried out.			
1700	1800	Secured base and team returned to guest house			
		Today's coverage		Cumulative coverage	
		Bathymetry: -	Line km: -	Bathymetry: 12.92sq.km	Line km: 517.27
		Topo: 0.46sq.km	Line km: 18.4	Topo: 13.08sq.km	Line km: 523
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Topo survey					
Remarks:					
					
Party Chief			Client Representative		

	DAILY PROGRESS REPORT	Form No.:	Sy01R
		Revision:	01
		Date:	11/07/2014
		Approved By	PKT

Location Machhu 2


DPR No. 029

Client:	Narmada Water Resources, Water Supply & Kalpsar Department		Project No:	P34320	
Vessel:	OSaS SMB		Date:	05-04-2021	
Location:	Machhu 2 Dam		Sheet No:	1 of 1	
Party Chief: Pankaj Rabary			Client Rep.		
Survey Personnel:					
1. Binu Kumar		2.		3.	
4.		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system	SBES system	Auto level		Heave sensor
	Hypack nav system	Bar check	Generator		
	Computer				
Time (hrs)		Activities			
0800	0900	Transit to the survey area			
0900	0930	Set up RTK reference station.			
0930	1130	Temporary benchmark point marked on a new location near to survey area and base station transferred to that point.			
1130	1730	Topo survey carried out			
1730	1830	Secured base and team returned to guest house			
		Today's coverage		Cumulative coverage	
		Bathymetry: -	Line km: -	Bathymetry: 12.92sq.km	Line km: 517.27
		Topo: 0.22sq.km	Line km: 8.8	Topo: 13.30sq.km	Line km: 531.8
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Topo survey					
Remarks:					
					
Party Chief			Client Representative		

 <p style="text-align: center;">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2


DPR No. 030


Client:	Narmada Water Resources, Water Supply & Kalpsar Department			Project No:	P34320
Vessel:	OSaS SMB			Date:	06-04-2021
Location:	Machhu 2 Dam			Sheet No:	1 of 1
Party Chief: Pankaj Rabary				Client Rep.	
Survey Personnel:					
1. Binu Kumar	2.		3.		
4.	5.		6.		
7.	8.		9.		
10.					
Equipment	RTK system	SBES system	Auto level	Heave sensor	
	Hypack nav system	Bar check	Generator		
	Computer				
Time (hrs)		Activities			
0800	0900	Transit to the survey area			
0900	0930	Set up RTK reference station.			
0930	1730	Topo survey carried out			
1730	1830	Secured base and team returned to guest house			
		Today's coverage		Cumulative coverage	
		Bathymetry: -	Line km: -	Bathymetry: 12.92sq.km	Line km: 517.27
		Topo: 0.33sq.km	Line km: 13.2	Topo: 13.63sq.km	Line km: 545
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Topo survey					
Remarks:					
 Party Chief			 Client Representative		

 <p style="text-align: center;">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2


DPR No. 031

Client:	Narmada Water Resources, Water Supply & Kalpsar Department		Project No:	P34320	
Vessel:	OSaS SMB		Date:	07-04-2021	
Location:	Machhu 2 Dam		Sheet No:	1 of 1	
Party Chief: Pankaj Rabary			Client Rep.		
Survey Personnel:					
1. Binu Kumar		2.		3.	
4.		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system	SBES system	Auto level		Heave sensor
	Hypack nav system	Bar check	Generator		
	Computer				
Time (hrs)		Activities			
0800	0900	Transit to the survey area			
0900	0930	Set up RTK reference station.			
0930	1730	Topo survey carried out			
1730	1830	Secured base and team returned to guest house			
		Today's coverage		Cumulative coverage	
		Bathymetry: -	Line km: -	Bathymetry: 12.92sq.km	Line km: 517.27
		Topo: 0.22sq.km	Line km: 8.8	Topo: 13.85sq.km	Line km: 553.8
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Topo survey					
Remarks:					
					
Party Chief			Client Representative		

 <p style="text-align: center;">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2


DPR No. 032


Client:	Narmada Water Resources, Water Supply & Kalpsar Department		Project No:	P34320	
Vessel:	OSaS SMB		Date:	08-04-2021	
Location:	Machhu 2 Dam		Sheet No:	1 of 1	
Party Chief: Pankaj Rabary			Client Rep.		
Survey Personnel:					
1. Binu Kumar		2.		3.	
4.		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system	SBES system	Auto level		Heave sensor
	Hypack nav system	Bar check	Generator		
	Computer				
Time (hrs)		Activities			
0800	0900	Transit to the survey area			
0900	0930	Set up RTK reference station.			
0930	1730	Topo survey carried out			
1730	1830	Secured base and team returned to guest house			
		Today's coverage		Cumulative coverage	
		Bathymetry: -	Line km: -	Bathymetry: 12.92sq.km	Line km: 517.27
		Topo: 0.31sq.km	Line km: 12.4	Topo: 14.16sq.km	Line km: 566.2
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Topo survey					
Remarks:					
					
Party Chief			Client Representative		

 DAILY PROGRESS REPORT	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2


DPR No. 033

Client:	Narmada Water Resources, Water Supply & Kalpsar Department			Project No:	P34320
Vessel:	OSaS SMB			Date:	09-04-2021
Location:	Machhu 2 Dam			Sheet No:	1 of 1
Party Chief: Pankaj Rabary				Client Rep.	
Survey Personnel:					
1. Binu Kumar	2.		3.		
4.	5.		6.		
7.	8.		9.		
10.					
Equipment	RTK system	SBES system	Auto level		Heave sensor
	Hypack nav system	Bar check	Generator		
	Computer				
Time (hrs)		Activities			
0800	0900	Transit to the survey area			
0900	0930	Set up RTK reference station.			
0930	1730	Topo survey carried out			
1730	1830	Secured base and team returned to guest house			
		Today's coverage		Cumulative coverage	
		Bathymetry: -	Line km: -	Bathymetry: 12.92sq.km	Line km: 517.27
		Topo: 0.42sq.km	Line km: 16.8	Topo: 14.58sq.km	Line km: 583
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Topo survey					
Remarks:					
					
Party Chief			Client Representative		

 <p style="text-align: center;">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2


DPR No. 034

Client:	Narmada Water Resources, Water Supply & Kalpsar Department		Project No:	P34320	
Vessel:	OSaS SMB		Date:	10-04-2021	
Location:	Machhu 2 Dam		Sheet No:	1 of 1	
Party Chief: Pankaj Rabary			Client Rep.		
Survey Personnel:					
1. Binu Kumar		2.		3.	
4.		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system	SBES system	Auto level		Heave sensor
	Hypack nav system	Bar check	Generator		
	Computer				
Time (hrs)		Activities			
0800	0830	Transit to the survey area			
0830	0900	Set up RTK reference station.			
0900	1730	Topo survey carried out			
1730	1830	Secured base and team returned to guest house			
		Today's coverage		Cumulative coverage	
		Bathymetry: -	Line km: -	Bathymetry: 12.92sq.km	Line km: 517.27
		Topo: 0.75sq.km	Line km: 30	Topo: 15.33sq.km	Line km: 613
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Topo survey					
Remarks:					
					
Party Chief			Client Representative		

 <p align="center">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2


DPR No. 035

Client:	Narmada Water Resources, Water Supply & Kalpsar Department		Project No:	P34320	
Vessel:	OSaS SMB		Date:	11-04-2021	
Location:	Machhu 2 Dam		Sheet No:	1 of 1	
Party Chief: Pankaj Rabary			Client Rep.		
Survey Personnel:					
1. Binu Kumar		2.		3.	
4.		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system	SBES system	Auto level	Heave sensor	
	Hypack nav system	Bar check	Generator		
	Computer				
Time (hrs)	Activities				
0800	0830	Transit to the survey area			
0830	0900	Set up RTK reference station.			
0900	1730	Topo survey carried out			
1730	1830	Secured base and team returned to guest house			
		Today's coverage		Cumulative coverage	
		Bathymetry: -	Line km: -	Bathymetry: 12.92sq.km	Line km: 517.27
		Topo: 0.74sq.km	Line km: 29.6	Topo: 16.07sq.km	Line km: 642.6
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Topo survey					
Remarks:					
					
Party Chief			Client Representative		

 <p style="text-align: center;">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2


DPR No. 036

Client:	Narmada Water Resources, Water Supply & Kalpsar Department			Project No:	P34320
Vessel:	OSaS SMB			Date:	12-04-2021
Location:	Machhu 2 Dam			Sheet No:	1 of 1
Party Chief: Pankaj Rabary				Client Rep.	
Survey Personnel:					
1. Binu Kumar		2.		3.	
4.		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system	SBES system	Auto level		Heave sensor
	Hypack nav system	Bar check	Generator		
	Computer				
Time (hrs)		Activities			
0800	0830	Transit to the survey area			
0830	0900	Set up RTK reference station.			
0900	1730	Topo survey carried out			
1730	1830	Secured base and team returned to guest house			
		Today's coverage		Cumulative coverage	
		Bathymetry: -	Line km: -	Bathymetry: 12.92sq.km	Line km: 517.27
		Topo: 0.59sq.km	Line km: 23.6	Topo: 16.66sq.km	Line km: 666.2
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Topo survey					
Remarks: Virender Singh and Manoj More reached site today at 13:00 hrs.					
					
Party Chief			Client Representative		

 <p>DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2


DPR No. 037

Client:	Narmada Water Resources, Water Supply & Kalpsar Department			Project No:	P34320
Vessel:	OSaS SMB			Date:	13-04-2021
Location:	Machhu 2 Dam			Sheet No:	1 of 1
Party Chief: Pankaj Rabary				Client Rep.	
Survey Personnel:					
1. Binu Kumar		2.		3.	
4.		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system	SBES system	Auto level		Heave sensor
	Hypack nav system	Bar check	Generator		
	Computer				
Time (hrs)		Activities			
0800	0830	Transit to the survey area			
0830	0900	Set up RTK reference station.			
0900	1730	Topo survey carried out			
1730	1830	Secured base and team returned to guest house			
		Today's coverage		Cumulative coverage	
		Bathymetry: -	Line km: -	Bathymetry: 12.92sq.km	Line km: 517.27
		Topo: 1.19.sq.km	Line km: 47.6	Topo: 17.85sq.km	Line km: 713.8
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Topo survey					
Remarks: Virender Singh and Manoj More reached site today at 13:00 hrs.					
 Party Chief			 Client Representative		

 <p style="text-align: center;">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2


DPR No. 038


Client:	Narmada Water Resources, Water Supply & Kalpsar Department			Project No:	P34320
Vessel:	OSaS SMB			Date:	14-04-2021
Location:	Machhu 2 Dam			Sheet No:	1 of 1
Party Chief: Pankaj Rabary				Client Rep.	
Survey Personnel:					
1. Binu Kumar		2. Virender Singh		3. Manoj More	
4.		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system	SBES system	Auto level		Heave sensor
	Hypack nav system	Bar check	Generator		
	Computer				
Time (hrs)		Activities			
0800	0830	Transit to the survey area			
0830	0900	Set up RTK reference station.			
0900	1730	Topo survey carried out			
1730	1830	Secured base and team returned to guest house			
		Today's coverage		Cumulative coverage	
		Bathymetry: -	Line km: -	Bathymetry: 12.92sq.km	Line km: 517.27
		Topo: 1.04.sq.km	Line km: 41.60	Topo: 18.89sq.km	Line km: 755.40
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Topo survey					
Remarks:					
					
Party Chief			Client Representative		

 <p style="text-align: center;">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2


DPR No. 039

Client:	Narmada Water Resources, Water Supply & Kalpsar Department		Project No:	P34320	
Vessel:	OSaS SMB		Date:	15-04-2021	
Location:	Machhu 2 Dam		Sheet No:	1 of 1	
Party Chief: Pankaj Rabary			Client Rep.		
Survey Personnel:					
1. Binu Kumar		2. Virender Singh		3. Manoj More	
4.		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system		SBES system		Auto level
	Hypack nav system		Bar check		Generator
	Computer				
Time (hrs)		Activities			
0800	0830	Transit to the survey area			
0830	0900	Set up RTK reference station.			
0900	1730	Topo survey carried out			
1730	1830	Secured base and team returned to guest house			
		Today's coverage		Cumulative coverage	
		Bathymetry: -	Line km: -	Bathymetry: 12.92sq.km	Line km: 517.27
		Topo: 1.17.sq.km	Line km: 46.8	Topo: 20.06sq.km	Line km: 802.2
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Topo survey					
Remarks:					
					
Party Chief			Client Representative		

 <p style="text-align: center;">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2


DPR No. 040

Client:	Narmada Water Resources, Water Supply & Kalpsar Department	Project No:	P34320		
Vessel:	OSaS SMB	Date:	16-04-2021		
Location:	Machhu 2 Dam	Sheet No:	1 of 1		
Party Chief: Pankaj Rabary		Client Rep.			
Survey Personnel:					
1. Binu Kumar		2. Virender Singh		3. Manoj More	
4.		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system	SBES system	Auto level		Heave sensor
	Hypack nav system	Bar check	Generator		
	Computer				
Time (hrs)		Activities			
0800	0830	Transit to the survey area			
0830	0900	Set up RTK reference station.			
0900	1730	Topo survey carried out			
1730	1830	Secured base and team returned to guest house			
		Today's coverage		Cumulative coverage	
		Bathymetry: -	Line km: -	Bathymetry: 12.92sq.km	Line km: 517.27
		Topo: 0.86.sq.km	Line km: 34.4	Topo: 20.92sq.km	Line km: 836.6
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Topo survey					
Remarks:					
			<p style="text-align: center;">Client Representative</p>		
<p style="text-align: center;">Party Chief</p>					

 DAILY PROGRESS REPORT	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2


DPR No. 041

Client:	Narmada Water Resources, Water Supply & Kalpsar Department		Project No:	P34320	
Vessel:	OSaS SMB		Date:	17-04-2021	
Location:	Machhu 2 Dam		Sheet No:	1 of 1	
Party Chief: Pankaj Rabary			Client Rep.		
Survey Personnel:					
1. Binu Kumar		2. Virender Singh		3. Manoj More	
4.		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system	SBES system	Auto level	Heave sensor	
	Hypack nav system	Bar check	Generator		
	Computer				
Time (hrs)		Activities			
0800	0830	Transit to the survey area			
0830	0900	Set up RTK reference station.			
0900	1730	Topo survey carried out			
1730	1830	Secured base and team returned to guest house			
		Today's coverage		Cumulative coverage	
		Bathymetry: -	Line km: -	Bathymetry: 12.92sq.km	Line km: 517.27
		Topo: 0.92.sq.km	Line km: 36.8	Topo: 21.84sq.km	Line km: 873.4
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Topo survey					
Remarks:					
					
Party Chief			Client Representative		

 <p style="text-align: center;">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2

DPR No. 042

Client:	Narmada Water Resources, Water Supply & Kalpsar Department		Project No:	P34320	
Vessel:	OSaS SMB		Date:	18-04-2021	
Location:	Machhu 2 Dam		Sheet No:	1 of 1	
Party Chief: Pankaj Rabary			Client Rep.		
Survey Personnel:					
1. Binu Kumar		2. Virender Singh		3. Manoj More	
4.		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system	SBES system	Auto level		Heave sensor
	Hypack nav system	Bar check	Generator		
	Computer				
Time (hrs)		Activities			
0800	0830	Transit to the survey area			
0830	0900	Set up RTK reference station.			
0900	1730	Topo survey carried out			
1730	1830	Secured base and team returned to guest house			
		Today's coverage		Cumulative coverage	
		Bathymetry: -	Line km: -	Bathymetry: 12.92sq.km	Line km: 517.27
		Topo: 0.93sq.km	Line km: 37.2	Topo: 22.77sq.km	Line km: 910.6
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	
Plan for next 24 hours: Continue Topo survey					
Remarks:					
					
Party Chief			Client Representative		

 <p align="center">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT


Location Machhu 2


DPR No. 043

Client:	Narmada Water Resources, Water Supply & Kalpsar Department			Project No:	P34320
Vessel:	OSaS SMB			Date:	19-04-2021
Location:	Machhu 2 Dam			Sheet No:	1 of 1
Party Chief: Pankaj Rabary				Client Rep.	
Survey Personnel:					
1. Binu Kumar	2. Virender Singh		3. Manoj More		
4.	5.		6.		
7.	8.		9.		
10.					
Equipment	RTK system	SBES system	Auto level		Heave sensor
	Hypack nav system	Bar check	Generator		
	Computer				
Time (hrs)		Activities			
0815	0845	Transit to the survey area			
0845	0915	Set up RTK reference station.			
0915	1720	Topo survey carried out			
1720	1830	Secured base and team returned to guest house			
		Today's coverage		Cumulative coverage	
		Bathymetry: -	Line km: -	Bathymetry: 12.92sq.km	Line km: 517.27
		Topo: 1.07sq.km	Line km: 42.8	Topo: 23.84sq.km	Line km: 953.40
		Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours	

Plan for next 24 hours: Continue Topo survey


Remarks:

	<p align="center">Client Representative</p>
Party Chief	

 <p style="text-align: center;">DAILY PROGRESS REPORT</p>	Form No.:	Sy01R
	Revision:	01
	Date:	11/07/2014
	Approved By	PKT

Location Machhu 2

DPR No. 044

Client:	Narmada Water Resources, Water Supply & Kalpsar Department		Project No:	P34320	
Vessel:	OSaS SMB		Date:	20-04-2021	
Location:	Machhu 2 Dam		Sheet No:	1 of 1	
Party Chief: Pankaj Rabary			Client Rep.		
Survey Personnel:					
1. Binu Kumar		2. Virender Singh		3. Manoj More	
4.		5.		6.	
7.		8.		9.	
10.					
Equipment	RTK system		SBES system		Auto level
	Hypack nav system		Bar check		Generator
	Computer				
Time (hrs)		Activities			
0800	0830	Transit to the survey area			
0830	0900	Set up RTK reference station.			
0900	1730	Topo survey carried out			
1730	1830	Secured base and team returned to guest house			
0930	1730	Party chief visited Brahmani 1 dam site. Also met client representative Mr. K G Limbadiya at office of sectional officer (Brahmani-1) irrigation scheme, Halvad.			
Note	:-	Machhu 2 site survey completed today.			
Today's coverage			Cumulative coverage		
Bathymetry: -		Line km: -		Bathymetry: 12.92sq.km	
Topo: 0.91sq.km		Line km: 36.4		Line km: 517.27	
Weather downtime today: 0 hour		Cumulative weather downtime: 0 hours			
Plan for next 24 hours: Boat and equipment shifting from Machhu 2 dam to Brahmani 1 dam site.					
Remarks:					
					
Party Chief			Client Representative		