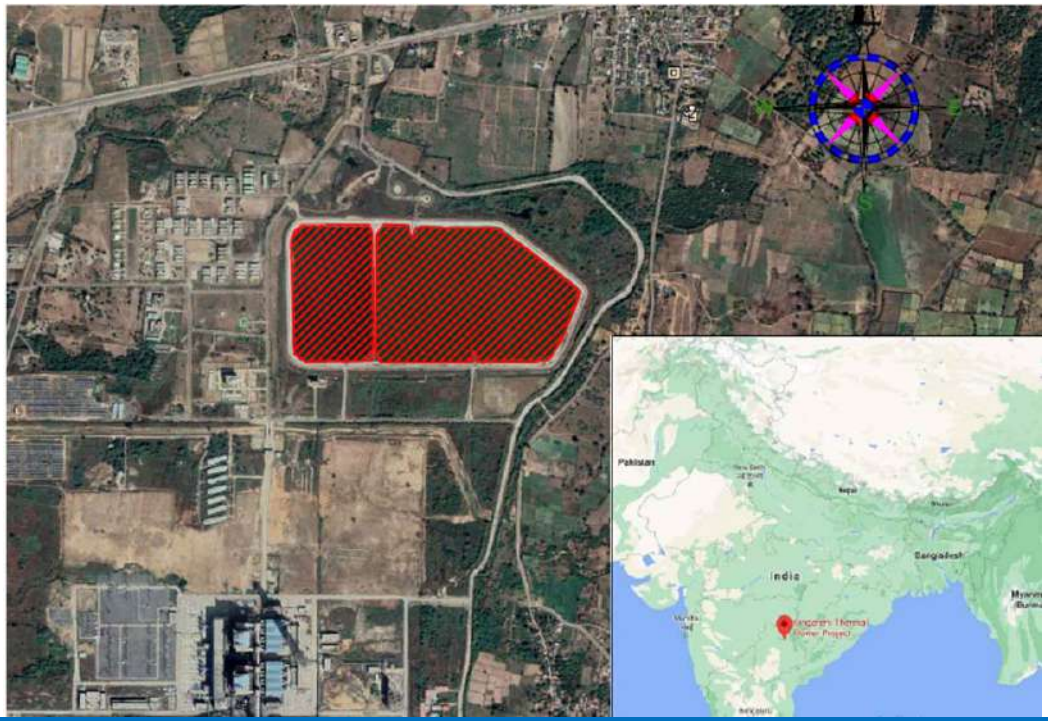
BATHYMETRIC SURVEY ASSESSMENT

STTP|RAMAGUNDEM | TELANGANA



19.5Mwp GRID CONNECTED FLOATING SOLAR POWER PLANT AT BALANCING RESERVOIR- SINGARENI THERMAL POWER PLANT, PAGADAPALLI, RAMAGUNDAM, TELANGANA

Proposed AC capacity for STPP reservoir is 10 MW(AC)

REPORT: ARS-2020-349-10-029-NG-HY-FR-00

VOLUME-1

11-11-2020

ARISYS TECHNOLOGIES, HYDERABAD

VOLUME I : BATHYMETRIC SURVEY

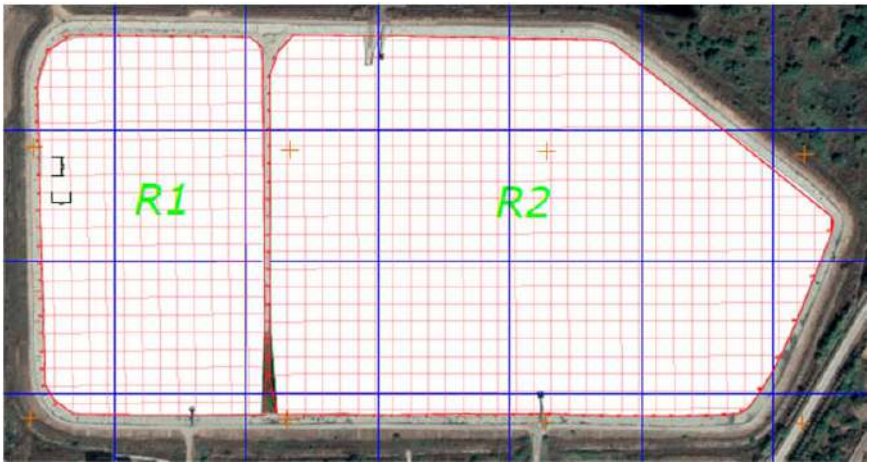
19.5Mwp GRID CONNECTED FLOATING SOLAR POWER PLANT AT BALANCING RESERVOIR-SINGARENI THERMAL POWER PLANT, PAGADAPALLI, RAMAGUNDAM, TELANGANA.

Ref.: Document No. **ARS-2020-349-10-029-NG-HY-FR-00**

Client: Novus Green Energy Systems Ltd

Project: 19.5Mwp Floating Solar PV Plant.

PROJECT LOCATION : SINGARENI THERMAL POWER PLANT, RAMAGUNDAM, TELANGANA	
Latitude	**18°50'18.08"N**
Longitude	**79°34'45.95"E**



R1-AREA	**:**	**11.40 Ha**
R2-AREA	**:**	**24.70 Ha**

FOREWORD

A Bathymetric Survey was requested by Novus Green Energy System Ltd. For Installation of 10 MW(AC) 19.5Mwp Grid Connected Floating Solar Power Plant at balancing reservoir- Singareni Thermal Power Plant (STPP), Pagadapalli, Ramagundam, Mancherial district, Telangana.

Regional Bathymetric Survey was conducted by Arisys Technologies, Hyderabad, surveying R1 & R2 Reservoir, ~~NTPC~~ Singareni Thermal Power Plant(STPP), Ramagundam, Telangana. All work was performed under the supervision of professional Surveyor.

The field surveys were completed on 3rd November 2020 and deliverables were submitted on 11th November, 2020. The Bathymetric Survey Assessment was prepared by B. Varma, Remote Sensing Specialist.

1. Water sample shall be collected from min. 3 locations in the reservoir. Test report for water quality shall be included in the report.
2. In the report write up, mention of NTPC in place of SCCL has been done at multiple locations. This may please be reverified and corrections shall be done as applicable.
3. Specific comments and corrections have been marked in the report as necessary.
4. Report shall have proper name and document no. as per the MDL. Also, revision no. for document shall be R0.

Acceptance By:

Name:
Designation

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GLOSSARY OF ABBREVIATIONS

ASCII	**American Standard Code for Information Interchange**
BM	**Benchmark**
BHEL	**Bharat Heavy Electricals**
C/A	**Coarse/Acquisition**
CM	**Central Meridian**
cm	**Centimeter**
dGPS	**Differential Global Positioning System**
DWG	**AutoCAD Drawing File**
DXF	**Drawing Exchange File**
ft.	**Foot**
GAGAN	**GPS & Geo Augmented Navigation System**
GNSS	**Global Navigation Satellite System**
GPS	**Global Positioning System**
HSE	**Health, Safety and Environment**
IHO	**International Hydrographic Organization**
KHz	**Kilo Hertz**
m	**Meter**
MHz	**Mega Hertz**
MSL	**Mean Sea Level**
MW	**Mega Watts**
NHO	**Naval Hydrographic Office**
PDOP	**Position Dilution of Precision**
PMC	**Project Management Consultant**
PRN	**Pseudo Random Noise**
PPE	**Personal Protective Equipment**
RTK	**Real Time Kinematic**
SA	**Selective Availability**
SCCL	**Singareni Collieries Company limited**
SECI	**Solar Energy Corporation of India**
STPP	**Singareni Thermal Power Plant**
TBM	**Temporary Benchmark**
PBM	**Permanent Bench mark**
USDOD	**United States Department of Defense**
UTM	**Universal Transverse Mercator**
WGS 84	**World Geodetic System 1984**

Project Background
1.0 Summary

Solar Energy Corporation of India Ltd. (SECI) is a company of the Ministry of New and Renewable Energy, Government of India, established to facilitate the implementation of the National Solar Mission (NSM). It is the only Central Public Sector Undertaking dedicated to the solar energy sector. The company's mandate has been broadened to cover the entire renewable energy domain and the company will be renamed to Renewable Energy Corporation of India (RECI).

The company is responsible for implementation of a number of government schemes, major ones being the VGF schemes for large-scale grid-connected projects under NSM, solar park scheme and grid-connected solar rooftop scheme, along with a host of other specialized schemes such as defense scheme, canal-top scheme, and floating project.

Information provided may please be reverified.

Solar Energy Corporation of India Ltd. (SECI) and Singareni Collieries Company Limited (SCCL) is planning to set up 800MW of solar power projects in Telangana, which includes 500MW of floating solar panels PV power plants on water bodies in the state of Telangana, with the support of the Telangana State Renewable Development Corporation. SCCL is planning to undertake the construction of floating solar power plants in 5 phases of 100MW each. The company added another 30MW solar power plant under Phase-I. As a part of the 300MW solar power plants taken up for construction by Singareni Collieries.

The above mentioned solar power projects will be constructed under three phases:

Phase-I: Munguru Project by Bharat Heavy Electricals (BHEL)

Phase-II: Bhoopalapalli, Mandamarri , Bellampalli and Kothagudem by Adani Power

Phase-III: Singareni Thermal Power Plant (STTP) & Dorli open cast quarry reservoir by Novus Green Energy Systems Limited.

Present Project: Project Owner - SCCL, PMC - SECI, EPC - Novus Green

The present project comes under Phase-III.
Third phase proposals include awarding the contracts for erection of floating solar plants of 10MW on the STPP- Jaipur, 5MW on the closed Bellampally Dorli OC mine quarry water along with the solar plants to be erected on land at Kothagudem and chennur.

Solar Energy Corporation of India Ltd. (SECI) has appointed —Novus Green Energy Systems Ltd. as the Engineering, procurement and construction ~~(PMC)~~ EPC for 15MW floating solar power plants i.e. 10MW at STPP and 5MW at Bellampally Dorli OC mine quarry reservoir with comprehensive operation & maintenance for a period of 10 years. Therefore —Novus Green Energy Systems Limited has awarded this contract to —Arisys Technologies as consultant.

AIM

The aim of the survey was to assess the physical characteristics of the proposed development area and provide data to inform the hydrodynamics and modeling floating solar PV. The information provided in this report will ultimately be used to assess the potential impacts to reservoir bed profile and prevailing depths for installation of floating solar panels and will be used for technical evaluation.

2.0 Project Glance

2. 1 Project Location:

Geographical Position	
Latitude : **18°50'18.08"N**	Longitutde : **79°34'45.95"E**
R1-AREA :	11.40 Ha
R2-AREA :	24.70Ha

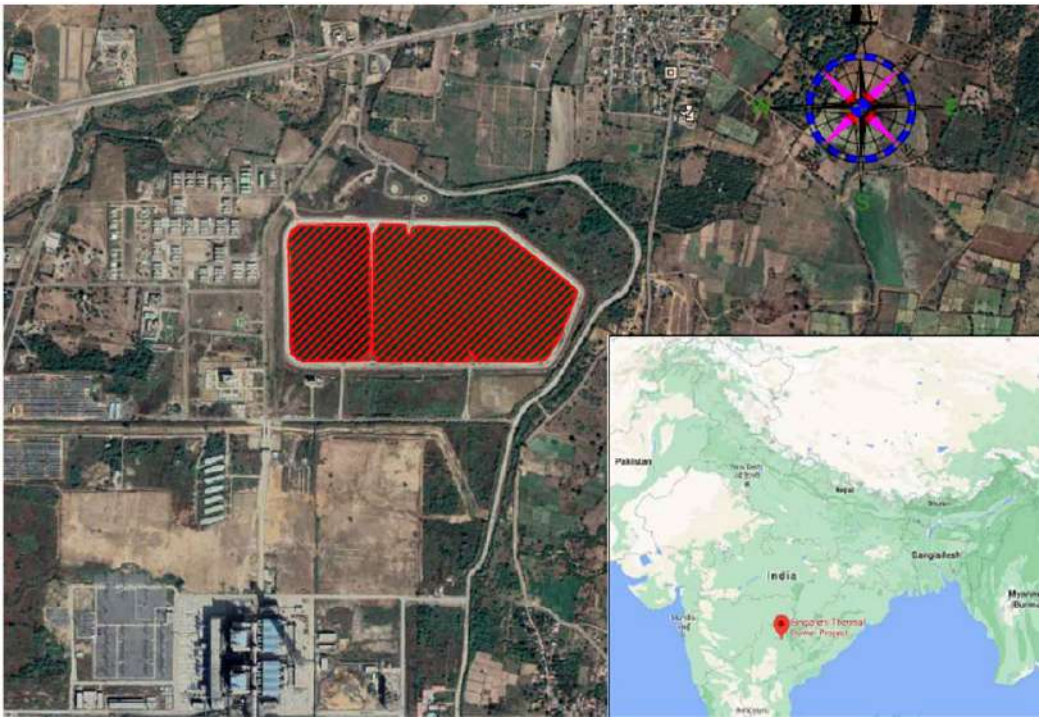


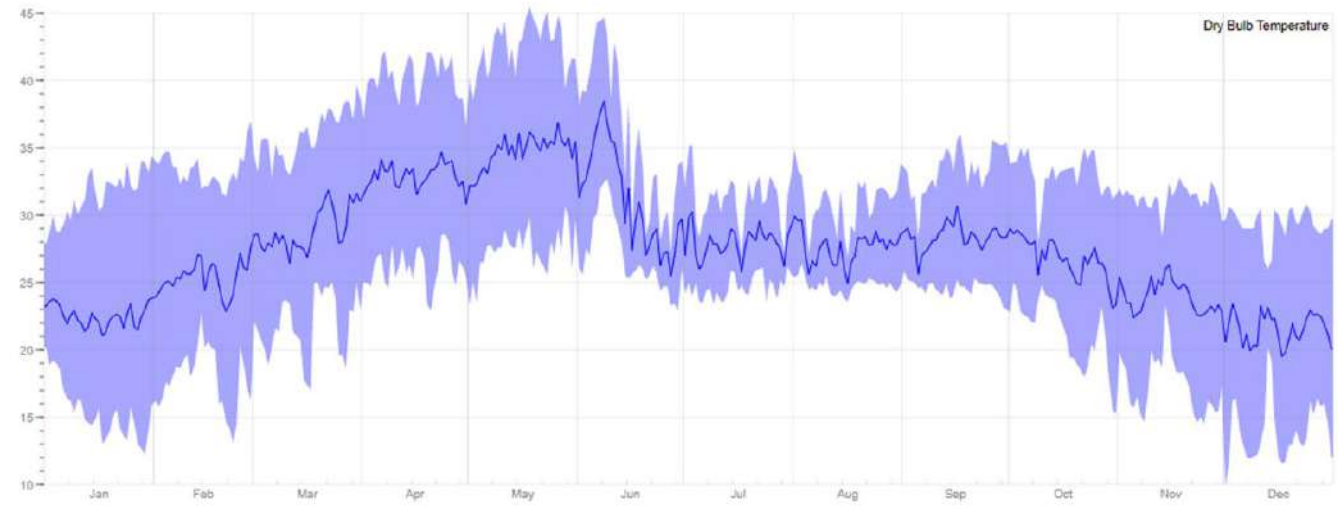
Fig 2.1 Area of Survey – Balancing Reservoir STPP

Fig : 2.2 Reservoir Layout

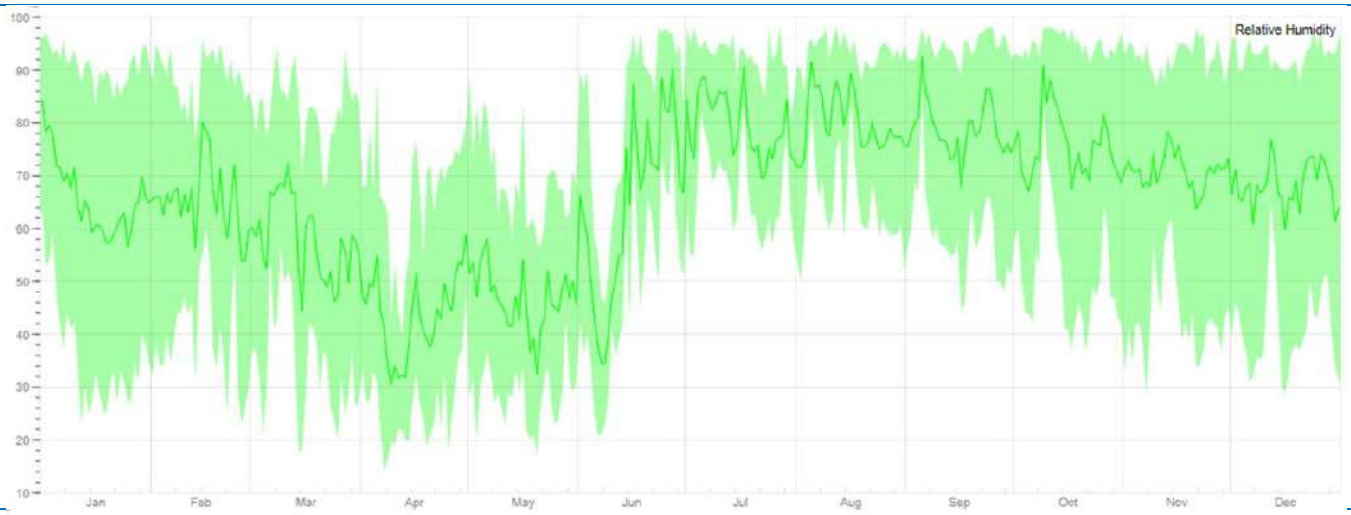
2.2 Site Description

PROJECT: 15Mw AC FLOATING SOLAR PV PLANT	
Site Name:	STTP | RAMAGUNDAM | TELANGANA
Topo Sheet No	56 N/5, 56 N/6, 56 N/9 and 56 N/10
Geographical Position	
Latitude : 18°50'18.08"N	Longitude : 79°34'45.95"E
Terrain	
Elevation:	152.50m
Slope Inclination:	1˚
Slope Azimuth:	23˚
Annual Air Temperature at 2m:	28.1˚C
Solar Radiation	
Global Horizontal Irradiance: **1934 kWh/m²**	Global Tilted Irradiance: **2065 kWh/m²**
	
PV Out : **1594 kWh/m²**	Direct Normal: **1466 kWh/m²**
	
Data	
Meteorological data source	Meteonorm 7.1
Data Format	Hourly in Typical Meteorogical Year (TMY)

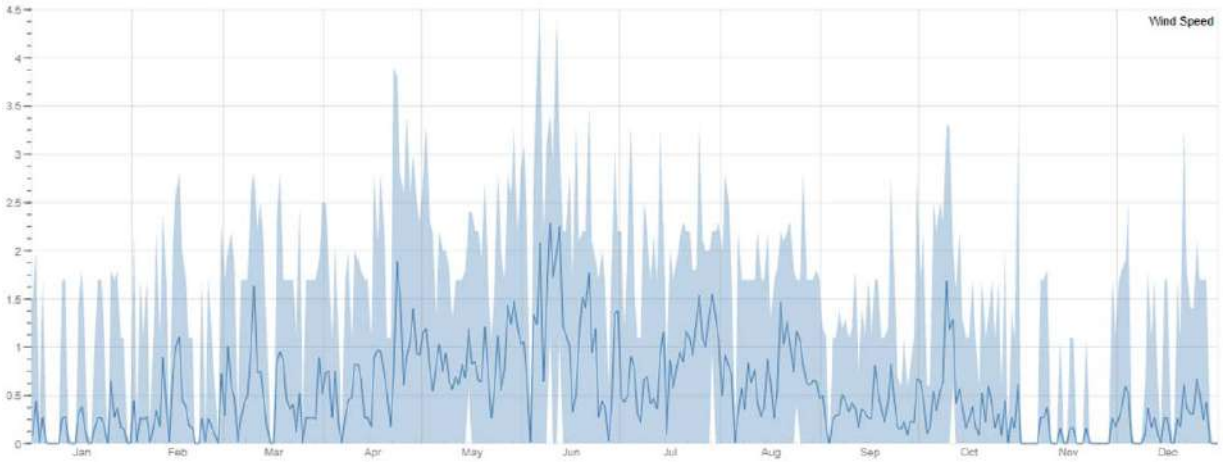
Weather : Dry Bulb Temperature



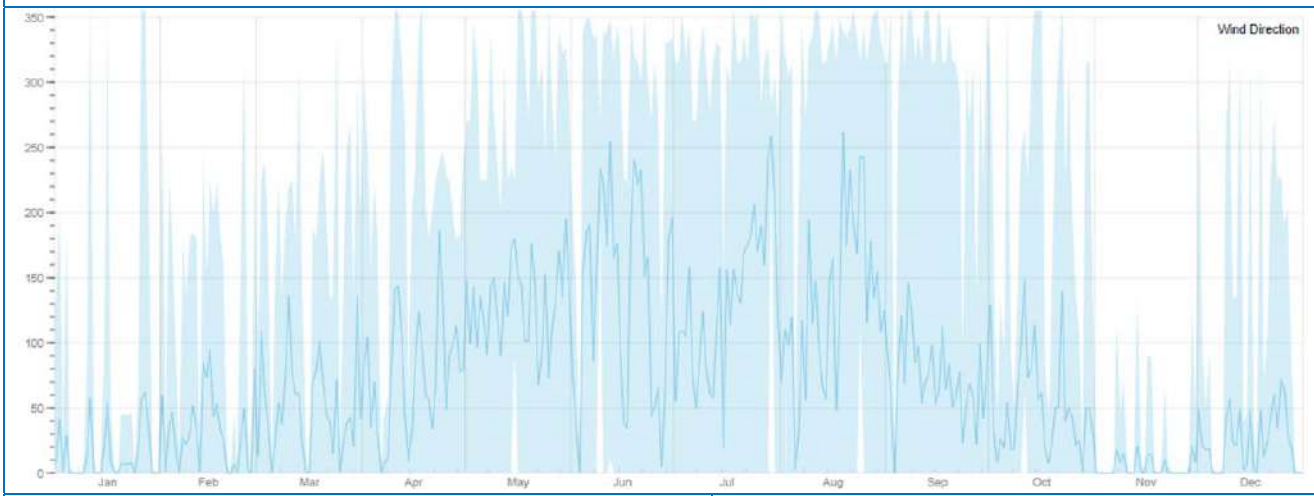
Weather : Relative Humidity



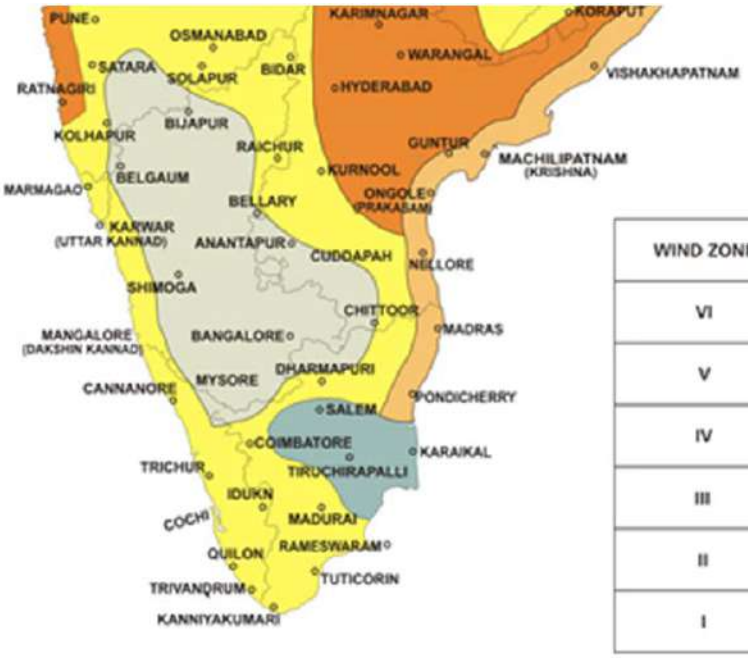
Wind Speed



Weather : Wind Direction



Predominant wind directions	NE, S, SE, SSW, SSE
Wind Zone	44m/s



WIND ZONE	BASIC WIND SPEED IN METRE/SECOND	COLOUR CODE
VI	55	
V	50	
IV	47	
III	44	
II	39	
I	33	

Seismicity	Zone-II as per IS 1893 (Part I): 2002

3.0 Bathymetry

Bathymetry is the measurement of depth of water in oceans, seas, or lakes. Recorded depths of natural bottom (i.e., reserviors, seafloor) were collected using a Odom DF 3200MK -II echo sounder.

A sound velocity cast and bar check were performed daily to calibrate for accurate vessel draft and speed of sound in the water column. Horizontal positioning was achieved by using Real Time Kinematic (RTK) GPS survey methods; this. Hemisphere R110 dGPS system was used as positioning system.) to collect all GPS data. Hydrographic survey personnel documented each data collection setup and calibration in survey field notes daily. These notes contain the date, time, station (or point) name, elevation, weather conditions, survey lines run, etc.

All hydrographic data was collected and processed in HYPACK survey software. HYPACK used recorded RTK tides to monitor and correct for the fluctuation of the top of water throughout the survey. The single-beam bathymetry was performed with a side-mount bracket, installed on starboard side, with the GPS rover antenna on a range pole mounted directly above. This setup assured no horizontal offset or layback correction.

3.1 Scope Of Work

The scope of work for bathymetry survey at Singareni Thermal Power Plant (STPP) Pegadapalli, Ramangundam, Mancherial Dist., in the state of Telangana, India. The site location is around 16 km east from the city of Mancherial.

3.1.1 Bathymetric Survey Scope

- To establish accurate hydrography using single beam echo sounder (having nominal frequencies of 33 KHz and 200 kHz) in the area of interest.
- The survey is to be carried out in the form of 20 m line spacing to get the output data in 20mx20m grid.
- Contours of ground profile to be provided for 0.5m interval.
- Submission of final report and drawings will be in A0 size with colour coding of depth will be in the form of soft copy.

3.1.2 Activity

Arisys team was mobilized, installed, interfaced, operated all survey systems and provided all required survey personnel to undertake bathymetry survey services in the proposed area

The mobilization of the equipment from base office was done on 29th October 2020 to carry out survey activities.

Bathymetry survey started on 31st October 2020 and completed on 01st November 2020 in the area of interest as per scope of work.

3.2 Data Acquistion

Bathymetry datasets were attained utilizing floating platform. A 15-ft. platform with 40HP outboards, The resevoir conditions during data acquisition varied from calm to moderate, with varying wind direction. Daily reports were noted in the survey field notes and are included in Appendix I of this report. Bathymetric datasets were of complete coverage referenced upon the grid survey line.

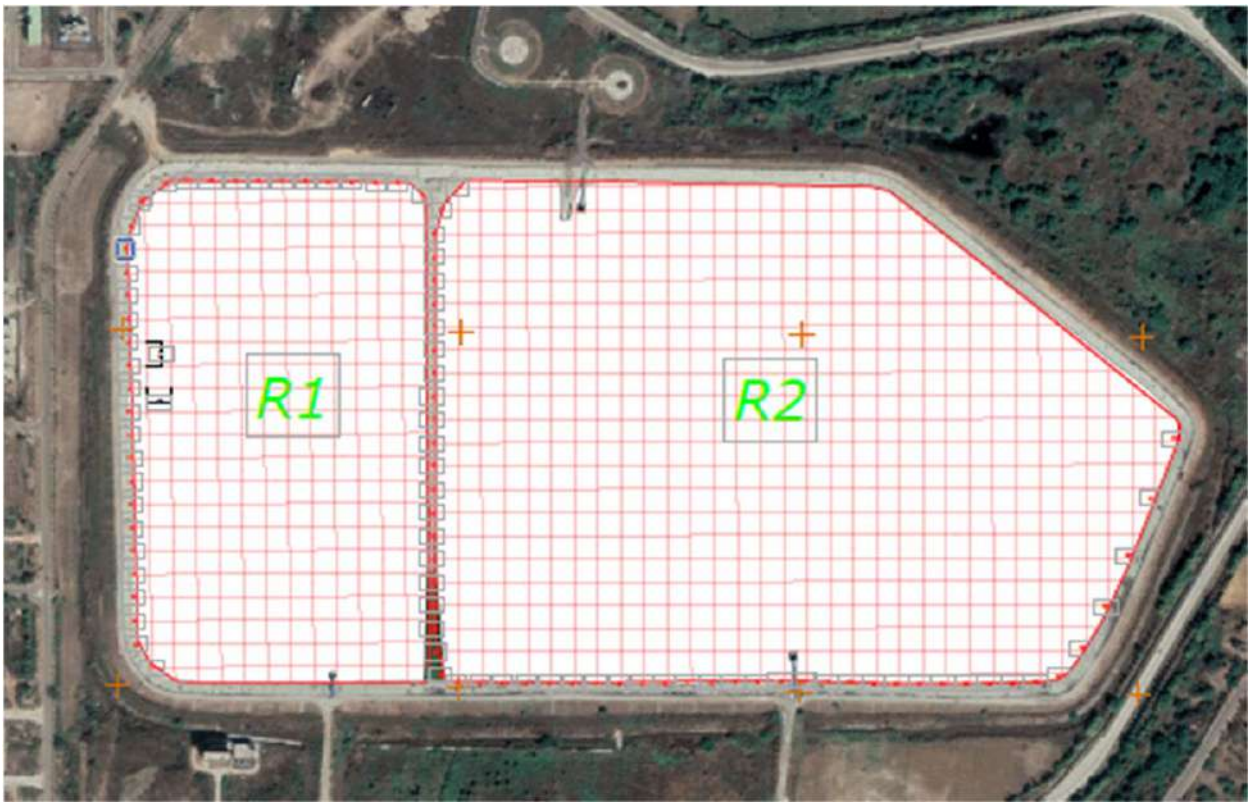


Fig: 3.0 Grid Survey Line

3.2.1 Survey Assessment Area

The area of survey is at balancing reservoir of Singareni Thermal Power Plant, Pegadapalli, Mancherial Dist., Telagana, India.

The total extent of this area is around: **3,47,150.46 sq. m.**

- **R-1 Area is around: 1,08,383.33 sq.m.**
- **R-2 area is around: 2,38,767.13 sq.m.**

The details of Survey area boundaries are given below:

Table 2: Coordinates of Survey Extents – R1 Area

COORDINATES OF SURVEY EXTENTS – R1 AREA				
WGS-84 Spheroid, UTM Projection, CM 81º East, Zone 44 North				
SL.No	Geographical Co-ordinates		UTM Co-ordinates	
	Latitude (N)	Longitude (E)	Easting (m)	Northing(m)
1	18°50'25.4832"	79°34'38.5487"	350114.3996	2083770.5427
2	18°50'10.5361"	79°34'38.7756"	350117.3561	2083310.9792
3	18°50'10.5598"	79°34'31.5245"	349905.1093	2083313.4096
4	18°50'11.5842"	79°34'29.8156"	349855.3401	2083345.3036
5	18°50'23.9454"	79°34'29.6032"	349852.1752	2083725.3688
6	18°50'25.4533"	79°34'30.8846"	349890.0553	2083771.4227
7	18°50'25.4832"	79°34'38.5487"	350114.3996	2083770.5427

Table 3: Coordinates of Survey Area – R2 Area

COORDINATES OF SURVEY AREA – R2 AREA				
WGS-84 Spheroid, UTM Projection, CM 81º East, Zone 44 North				
SL.No	Geographical Co-ordinates		UTM Co-ordinates	
	Latitude (N)	Longitude (E)	Easting (m)	Northing(m)
1	18°50'18.5281"	79°35'01.4011"	350781.6041	2083551.3718
2	18°50'25.3365"	79°34'52.3653"	350518.7870	2083762.7949
3	18°50'25.4388"	79°34'40.2254"	350163.4654	2083768.7830
4	18°50'23.9937"	79°34'38.9764"	350126.5516	2083724.6498
5	18°50'10.5775"	79°34'39.1716"	350128.9573	2083312.1588
6	18°50'10.6949"	79°34'57.6995"	350671.3285	2083311.4264
7	18°50'15.1901"	79°35'00.1890"	350745.3042	2083449.0380

4.0 Geodetic Parameters

The present survey was conducted in WGS-84 Spheroid. The parameters of the datum are as given below:

The Grid & Spheroid constants used are as follows:

Table 4: Geodetic Parameters

Local Datum Geodetic Parameters	
Spheroid	WGS-84
Datum Transformation	None
Semi-major axis (a)	6378137.0000 m
Semi-minor axis (b)	6356752.3142 m
Eccentricity	0.0818 191909 28906
Inverse flattening (1/f)	298.257223563
Projection Parameters	
Grid Projection	Universal Transverse Mercator
Central Meridian (CM)	81^{o} East (Zone 44)
Origin Latitude (False Lat)	0.0^{o}
Hemisphere	North
False Easting (FE)	500000.0 m
False Northing (FN)	0.0 m
Scale Factor on CM	0.999600
Units	International Meters

5.0 Survey Equipment Summary

For positioning of survey vessel and to aid navigation, the following system was used:

- 1x Hemisphere R110 dGPS system
- Accessories & Consumables

For recording single point water depths, the following equipment was used:

- 1x Odom Echotrac MKII with sufficient paper rolls
- 1x Dual frequency transducer 33 kHz/200 kHz + mounting pole
- 1x Bar plate
- Accessories & Consumables

For on-line route guidance, log navigation data, to provide QC of navigation data, etc., the following software were used:

- 1x Hypack data acquisition and processing software 2x Laptops
- Accessories & Consumables

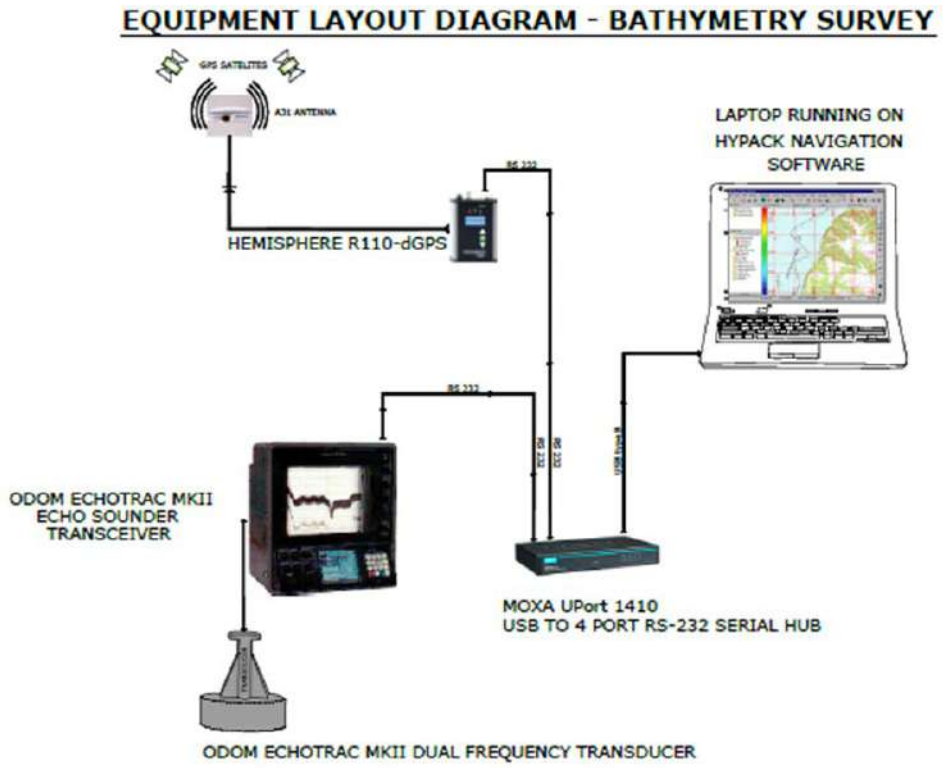
For processing of data and generated of drawings the following software were used:

- 1x Hypack 1x AutoCAD
- 1x Terra Model

Common Equipment and Accessories:

- 2x Junction box 1x Multimeter 3x Life Jackets
- 1x EP1000 generator
- 2x 230v/24v AC to DC Converter 1x Measuring Tape
- 1x Life Buoy 1x Moxa Hub

Fig: 5.0 Schematic Equipment Layout Diagram



6.0 Survey Equipment Details

6.1 Positioning Equipment

The Global Positioning System (GPS) is a burgeoning technology, which provides unrivalled accuracy and flexibility of positioning for navigation and surveying data capture. Knowing one's precise position out at sea and over water at every given instant is fundamental to the process of any surveying as all other data are correlated with respect to this position to develop the overall picture in terms of drawings, charts and maps. The more accurately one knows the position out in the survey field more accurate is the final rendition of data.

There is no need of any fixed land or marine based reference to obtain position. The GPS NAVSTAR (Navigation Satellite timing and Ranging Global Positioning System) is a satellite- based navigation, timing and positioning system. The GPS provides continuous three- dimensional positioning 24 hrs. a day throughout the world. The technology seems to be beneficiary to the GPS user community in terms of obtaining accurate data up to about few meters for navigation, meter-level for mapping, and down to millimeter level for geodetic positioning with the aid of various advanced techniques of GPS navigation called Differential GPS (dGPS) and Real Time Kinematic GPS (RTK)

The entire system comprises a bird cage constellation of satellites flying in orbits.

GPS satellites transmit two coherent beacon signals: Link 1 (L1) and Link 2 (L2). The L1 beacon is broadcast at a frequency of 1575.42 MHz and the L2 at 1227.60 MHz. The L1 signal is modulated with two pseudo random noise (PRN) codes: a protected (P) code and a clear/acquisition (C/A) code. Civilian receivers to obtain GPS system information can use the C/A code. The P code is encrypted for military use and is the only ranging broadcast on the L2 beacon. Each satellite has its own unique C/A (and P) code to provide satellite identity for acquisition and tracking. The C/A code is 1023 bits long and repeats every millisecond.

With the Selective Availability (SA) switched off in May 2000, civilian GPS users around the world will no longer experience positioning errors up to 100 meter (approximate 300 feet). However, random errors are still added to SA to keep GPS a more powerful tool for the military. Today, the common GPS units intended for civilian users are accurate to within 20 meters (approximately 60 feet); although in good conditions, units should display an error of less than 10 meters. This is an excellent standard for normal vessel navigation but not quite adequate for precise work such as Hydrographic surveying, charting and mapping for Hence there are various other options available for increasing the accuracy of the GPS positioning such as dGPS, RTK & SBAS.

Differential Corrections: These take the form of computed-observed (C-O) values for each satellite calculated at the reference station and transmitted to the survey vessel. The C-O's are applied to the pseudo ranges at the survey vessel's GPS receiver and the corrected position output to the navigation and data logging computer.

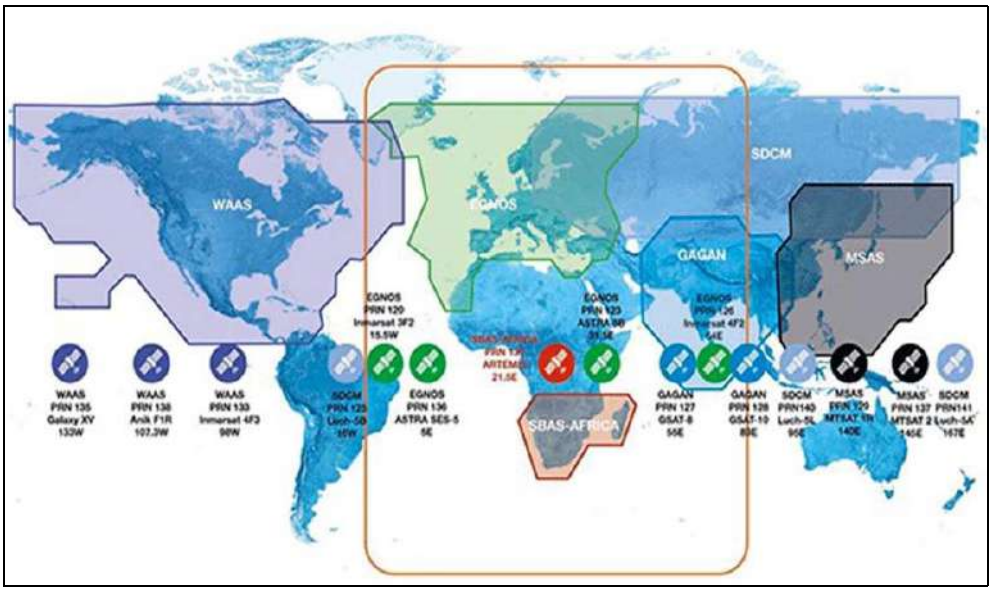
However the differential signals are limited to correction are obtained along the coastal regions of the peninsular region of certain countries only, where accurate navigation in the maritime industry take precedence over inland transportation. For this reason, reference stations transmitting the differential signal are set-up at regular distance with overlapping domains along the coastal areas.

Any GPS make/model with MSK beacon compatibility is capable of receiving differential corrections. Omni STAR Corrections: Omni STAR correction signals are proprietary, and a subscription must be bought from the Omni STAR Corporation to receive a subscription authorization.

Omni STAR uses geostationary satellites in 8 regions covering most of the landmass of each inhabited continent on Earth:

The services are generally used for high accuracy offshore maritime construction industry. Any GPS make/model with Omni STAR compatibility is capable of receiving Omni STAR corrections.

Fig: 6.0 World SBAS Coverage



SBAS Corrections: Satellite-based augmentation systems (SBAS), The SBAS concept is based on GNSS measurements by accurately-located reference stations deployed across an entire continent. The GNSS errors are then transferred to a computing center, which calculate differential corrections and integrity messages which are then broadcasted over the continent using geostationary satellites as an augmentation or overlay of the original GNSS message. SBAS messages are broadcast via geostationary satellites able to cover vast areas.

Several countries have implemented their own satellite-based augmentation system. Europe has the European Geostationary Navigation Overlay Service (EGNOS) which covers SBAS Corrections: Satellite-based augmentation systems (SBAS), The SBAS concept is based on GNSS measurements by accurately-located reference stations deployed across an entire continent. The GNSS errors are then transferred to a computing center, which calculate differential corrections and integrity messages which are then broadcasted over the continent using geostationary satellites as an augmentation or overlay of the original GNSS message. SBAS messages are broadcast via geostationary satellites able to cover vast areas.
Several countries have implemented their own satellite-based augmentation system. Europe has the European Geostationary Navigation Overlay Service (EGNOS) which covers the EU and possibly beyond. The USA has its Wide Area Augmentation System (WAAS). Japan is covered by its Multi-

functional Satellite Augmentation System (MSAS). India has launched its own SBAS programme named GPS and GEO Augmented Navigation (GAGAN) to cover the Indian subcontinent.

The services are generally during the most critical phases of aircraft flight, in particular final approaches. In addition to their use in the aviation sector, SBAS systems are essential for applications where accuracy and integrity are critical.

The SBAS corrections are most utilized during inland surveys far away from the coastlines where differential corrections (MSK beacon) signals are not reachable. Any GPS make/model with SBAS compatibility is capable of receiving SBAS corrections. These take the form of computed-observed (C-O) values for each geostationary satellite calculated at the reference station and transmitted to the survey vessel. The C-O‘s are applied to the pseudo ranges at the survey vessel‘s GPS receiver and the corrected position output goes to the navigation and data logging computer.

6.2 Positioning system Hemisphere Series R110

The positioning system Hemisphere Series R110 was used as positioning system used in this project.
his high accuracy, multipurpose receiver is based on our patented Crescent technology and is capable of receiving GPS, SBAS signals as well as radio-beacon, relying on consistent sub-meter performance with standard SBAS differential and Hemisphere GPS exclusive COAST technology that maintains accuracy during temporary loss of differential signal.

The crescent R100 offers many differential correction options for various environments and worldwide coverage.

The simpler user interface and expensive software features make Crescent R 100 the ideal solution for professional mapping, guidance and navigation applications.

This system is upgradeable to output messages up to 20Hz. The menu system provides an easy way to configure your system and the status LEDs give a quick update on the condition of the receiver.

Advantages:

- Feature-packed Sub-meter DGPS Positioning.
- Provides reception of GPS, SBAS, and Coast Guard beacon.
- Automatic dual channel SBAS and beacon tracking for more reliable signal reception..
- Delivers sub-meter positioning at rates of up to 20 Hz.
- Raw measurement data available for post-processing applications.
- COAST technology uses old differential corrections for up to 40 minutes, or more, without significant performance loss.
- Small and lightweight form factor.
- Front-panel LED indicators make it easy to monitor receiver status.

6.3 Hydrographic Equipment

6.3.1 Echo Sounder System: Odom DF 3200 MK II

Odom DF 3200 MK II was used as echo sounding to acquire bathymetric data for this project. This is generation of the ECHOTRAC dual frequency survey echo sounder employs the latest in technologies including a high-resolution thermal printer, microprocessor, DSP techniques and flat screen displays.

The sonar transceiver, echo processor, graphical operator interface and hardcopy recorder are all housed in one portable, splash-proof case. The unit is suited to table top, bulkhead, or rack mounting and is equally at home on either small survey launches or large ships. Well suited for use in the shallows of rivers and harbours, the mission variable unit is also capable of working to depths of over 2,000 metres. Either single or dual frequency configurations of the unit are available: Standard frequency is 200 and 33 kHz with Side Scan on Single Channel at 200k Hz.

6.4 Navigation Software: Hypack

HYPACK is a Windows - based software package used primarily for hydrographic surveying and data processing. HYPACK performs all of the tasks necessary to complete single beam or side scan survey from beginning to end. HYPACK "Field to Finish" process allows you to collect your data, then apply corrections, automatically remove data spikes, perform final sounding selection, and generate smooth sheets or export info to CAD.

This all-in- one module provides the surveyor with all of the tools needed to design their survey, collect data, process it, reduce it, and generate final products. Whether collecting hydrographic survey data or environmental data, or positioning a vessel in an engineering project, HYPACK® provides the tools needed to complete the job.

The standard package has everything needed to design from carrying out survey, collect single beam data, process it and generate final products, such as contours, plotting sheets output for CAD, fly-troughs, cross sections and volumes. The sides scan sonar collection and processing modules are now standard features.

This software can be interfaced simultaneously to Echo sounders, attitude sensors, Environmental sensors, Acoustic, GPS and Total Station positioning and all the data acquired can be stored in Microsoft Access database. It also enables graphical data cleaning.

6.4.1 Software Preparation Procedures

The entire computer package with peripherals was set up in the workshop and the engineer using dedicated test programs tested each unit. This also included the interfacing tests which were provided in the Software. Once all the tests were completed Hypack navigation software online system was started and tested as a whole. The overall test included data storage video display interfacing printing and plotting of results.

6.4.2 Run lines Job files and Survey Data Files

The validity of all input information to the survey online data file and run line files was of paramount importance to each survey. The first check was the comparison of the Hypack navigation software printout with the supplied co-ordinate and /or delay listing.

6.4.3 Survey Control & Offset Calculation

The offsets on the boat were measured and noted in the surveyor's field note book. Additionally, the measurements were checked from the General Arrangement Plan of the Boat. After offset data has been input to the survey online file and the fix taken from the navigation computer the offset positions were manually computed using the antenna position grid convergence and offset values. The computer printout was compared with the manually computed offset positioning and found to agree to within the computational accuracy.

6.4.4 Hardware Preparation Procedures

The hardware used for the Hypack navigation software navigation and data acquisition package was interfaced with a laptop with appropriate peripheral devices.

To perform the office test procedures the following items were interfaced:

- Laptop
- Hypack navigation software
- Hyper Terminal (Interfacing Test)
- All computers and peripheral devices were tested by means of standard system firmware.

The interfaces and devices were tested by means of Hypack navigation software. Where it is not possible to connect devices in the office the interfaces were tested using simulated data strings.

6.4.5 Hardware Mobilization Procedures

The following test procedures were carried out for installing the hardware in the floating platform:

The voltage and Frequency of the power supply were checked and proper grounding was done. The computer was setup and interfaced to the survey sensor and devices. All interactions were checked and confirmed that the interfacing is functional. Debugged any error if found in the cable connecting the systems and the data transfer was verified.

Check the validity of inputs via interfacing depths positioning data sensor data etc. Check all back up interfaces computers and peripherals and protocols.

6.4.6 Onsite Operating Procedures

The boat is having operating manual(s) on board for all Hypack navigation software modules in use. The surveyors make references to these manuals on the correct method of the system operation if found necessary.

6.4.7 Fix Numbers & Annotation

A unique fix numbering system starting and increasing from 1 without duplication was used for the project. A test was conducted to verify that the annotation of fixes is synchronized with the positional fixes. This test also confirmed that the annotation is correct and is factual.

6.4.8 Check Procedures

The surveyor ensured that the online data was of good quality and that the correct survey data was being used. The points to be checked at the start of each shift would include the following:

- Is the correct survey constants data file in use?
- Are all the pre-plots drawn?
- Are all the line data files at hand?
- Are sufficient consumables available?

When the above points are found satisfactory the field work commences. Processing was always carried out accordingly to the guidelines as described in the processing procedure. This provided the navigation computer with real time orientation and as a result the selected offset position co-ordinate was continuously computed.

6.4.9 Sensor Data Time Stamping

The data coming from all the sensors was time stamped in synchronization with the navigation system.

7.0 Survey Process

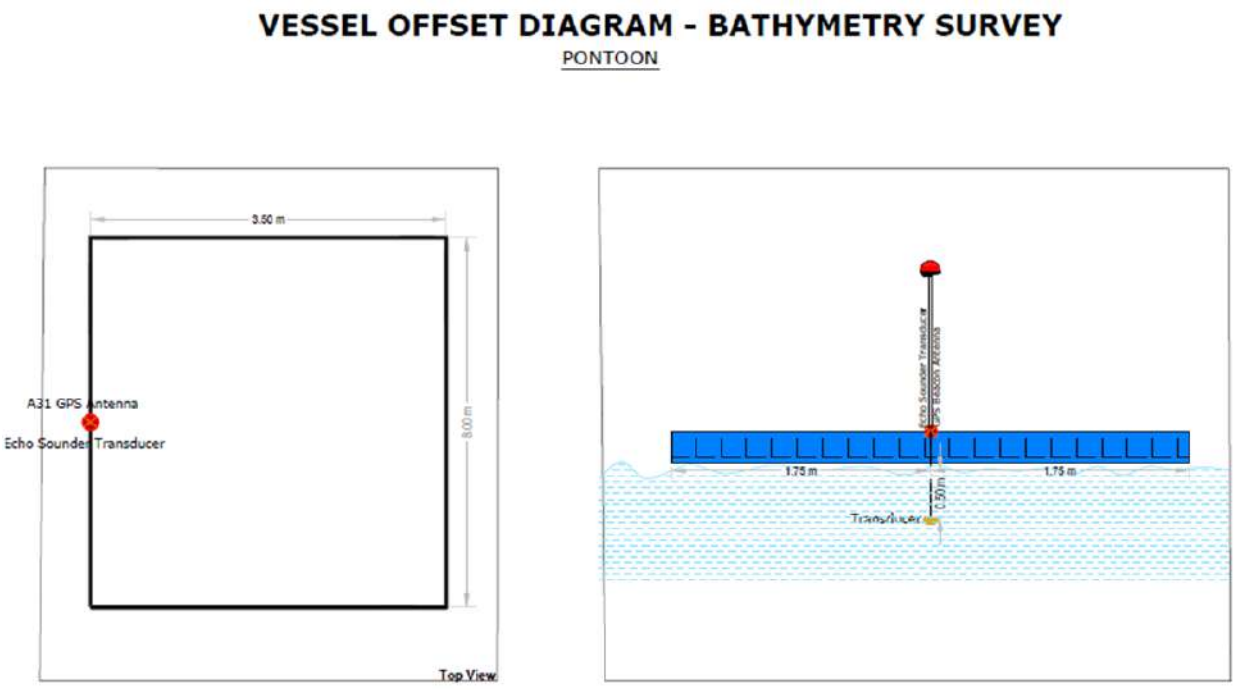
7.1 Survey Vessel

Bathymetry survey within the port area was conducted by Floating Pontoon Platform, a flattish boat that relies on float. DGPS system & echo-sounder systems were installed on this Pontoon.

Table 5: Summary of Vessel Specifications – Pontoon

SUMMARY OF VESSEL SPECIFICATIONS	
PONTOON	
Length	3.50 m
Width	3.50 m
Boat Engine	40 H p

Fig: 7.0 Vessel offsets diagram for equipment.



7.2 Notable Events In Chronological Order

Notable events of the Survey are as follows:

- Equipment and Personnel mobilized to site on : 30th October 2020
- dGPS Observation : 30th October 2020
- Bathymetry Survey Commenced on : 31st October 2020
- Bathymetry Survey Completed on : 01st November 2020
- Equipment and Personnel de-mobilized from site on : 02nd November 2020

7.3 In Harbour Tests

Hydrographic sensors were functionally wet tested by Arisys Technologies team prior to departing to the site of survey. Fix annotation and interfacing from the navigation computer to the above systems was also done.

The following tests were also conducted:

- On-line navigation computer test
- Vessel and sensor offset measurements.
- Single Beam Echo sounder transducer measured and marked for draft readings.

7.4 On site Installations & Calibrations

The following on-site calibration and functional tests were undertaken prior to the commencement of survey operations:

- Hemisphere R110 dGPS system
- Odom Echotrac DF 3200 MKII Echo Sounder

7.4.1 DGPS System

Installation:

The DGPS antenna is installed on a high point of the vessel (generally the monkey deck or the mast) where there is no or minimal obstruction between the satellites and the Antenna. The receiver unit is installed along with the other data dogging survey equipment along with the required DC / AC power supply (depending on the various makes / models). The NMEA output using a serial RS232 port is connected to the main navigation computer to enable display of the dGPS position on the Navigation computer both for data logging and real time navigation. As required from the dGPS serial ports or from the Navigation computer data strings are output and configured with other survey equipment on a need- based approach.

Calibration:

There is no GTS Benchmark nearer to site for cross checking of vertical and horizontal points at site. However NTPC clients have some reference points but there are in local coordinates. So, by keeping in view of above situation we marked some points and dGPS observations were carried out in the below mentioned locations.

Local grid co-ordinates which are given by NTPC clients are given below:
Control Points in Local Grid:

Table 6: Co-ordinates of STPP (unit-III) in Local Grid

Co-ordinates of STPP (unit-III)			
Description	**Easting (m)**	**Northing (m)**	**RL (m)**
JPP 3A	3061268.886	952623.497	852.208
JPP 4A	3061278.08	952470.76	852.736

Position of the dGPS observed points in Lat/Long and UTM is given below:

dGPS Observation Points:

Table 7: dGPS observation Points Details

dGPS Observation Points				
WGS-84 Spheroid, UTM Projection, CM 81º East, Zone 44 North				
Description	**Geographical Co-ordinates**		**UTM Co-ordinates**	
	Latitude (N)	**Longitude (E)**	**Easting(m)**	**Northing(m)**
GS-01	18°50'25.5428"	79°34'43.0599"	350246.461	2083771.315
PBM-04	18°50'25.2367"	79°34'52.3038"	350516.965	2083759.741
JPP 3A	18°49'33.1185"	79°34'48.7583"	350400.365	2082158.328
JPP 4A	18°49'28.0684"	79°34'49.0924"	350408.902	2082002.997

Using Hemisphere R110 dGPS system the position was observed and logged for about 26 min at GS-01 with an average of 260 observations, 15 min at PBM-04 with an average of 276 observations, 4 min at JPP-3A with an average of 175 observations and 3 min at JPP- 4A with an average of 110 observations was computed at the above locations.

Fig: 7.1: dGPS Observation Locations

7.4.2 Single Beam Echo Sounder System

Installation:
The echo sounder system was installed in consultation with the customer representatives and operated in accordance with the manufacturer's instructions.

The portable transducer was installed rigidly to a U-Clamp fitted on one side of the of the survey boat; the transducer shoe was kept sufficiently deep in order not to experience turbulence and aeration when the boat steamed at survey speed. The depth of the transducer below water line shall be ascertained by reference to the marks on the pole.

Calibration:
The echo sounder was interfaced to the Navigation and data Logging computer and confirmed that the digitization of depths is operational.
The bar-check method and physical measurements of the boat draft determined the draft of the boat. Checks were done at before each sounding session. On all such occasions the error observed was zero or near zero. Therefore, no corrections were necessary.
Prior to commenced survey works the Echo sounder was calibrated against a Bar Check. The procedure is carried out to confirm the following constants:

*Tx = To establish zero error (combined effect of transducer depth and delays in the recorder).

**Vp = To confirm velocity of propagation of sound in saline water.

The Vp established by temperature / salinity measurements were set on the recorder.

With the boat stopped in the water the bar was lowered to at least 2m below the transducer and the nearest mark on the chain set at the water line. The transmission line was then tuned and adjusted. After the transmission mark is set the apparent depth of the transducer was noted on the analogue record and recorded in the deck log for future reference. Care was taken not to subsequently or inadvertently move the transmission line.

The bar plate is then lowered at 2m intervals to the maximum practical depth. Time was allowed for the bar plate to settle at each depth. Initially the Tx was adjusted to match the recorded depth/digitized to the actual depth since the echoes from the first few meters from the sea surface is dominant with electrical and recorder delays. As the bar plate was lowered deeper the speed of sound was adjusted to the recorded/digitized depth with the actual depth.

On recording the maximum obtainable depth, the bar plate was similarly stepped back to the surface. The signal path delay generated by transducer and echo sounder electronics (index) is computed automatically by the system. A value of 1480 m/s (Vp) was used as the average velocity of sound in reservoir water which was applied in the prevailing environmental setup during acquisition.

Table 8: Odom Echotrac MKII Settings

ODOM ECHOTRAC MKII SETTINGS	
Frequency	200 KHz/33 KHz
Beam Width	5°/23°
Range on record	As Required
Vertical Scale	1 : 100
Positioning / Tracking	Fixed offset
Transducer Depth	0.5m below water line
Velocity of Propagation	1480 m/sec

7.5 Horizontal Control

The Pontoon used for the survey operations throughout the project was positioned by the Differential Global Positioning System (dGPS). Differential corrections were received continuously from SBAS corrections while surveying at the area of interest.

SBAS corrections broadcasted by GAGAN were utilized to obtain positional accuracy in the absence of beacon stations in this region. GPS Aided Geo Augmented Navigation or GPS and Geo Augmented Navigation system (GAGAN) is operated and maintained by the Indian government which covers most of the Indian sub-continent and the adjoining countries.

The Hemisphere R110 dGPS system were receiving SBAS corrections from GAGAN satellites though out the period of survey the NMEA string logged by it was showing corrections received from satellites which are identifiable as signals broadcast from GAGAN satellites.

7.6 Vertical Control

Bathymetric data was reduced to the mean sea level after subtracting the observed depths from the reservoir reference water levels. The change in the water levels in the reservoir with respect to MSL was recorded during the survey period.

Bed level of the reservoir w.r.t MSL is 146.5m.

Here below are the average water levels recorded during the survey period:

Table 9: Water Levels in Reservoir

WATER LEVELS (AVERAGE) IN RESERVOIR			
SL.No	**Location**	**Survey Date**	**Water Levels w.r.t MSL (m) (Day Average)**
1	R1	31st October 2020	152.8
2	R2	01st November 2020	152.9

7.7 Economy of Accuracy

International Hydrographic Organization (IHO) standardizes Hydrographical surveys in SP N44 5th edition Feb 2008 are adopted by Arisys Technologies and are used as a minimum standard.

The IHO Standards S44 45h Edition classifies surveys into four different types (four 'intended uses') as detailed below:

Special Order: Hydrographic surveys cover areas where ships may need to navigate with minimum under keel clearance and where the bottom characteristics are potentially hazardous to vessels such as boulders or rock outcroppings. This Order survey requires higher accuracies than those previously specified and for that reason has been particularly controversial. Special Order surveys are only applicable to those areas specifically designated by the Member State‘s agency responsible for the survey quality. Inherent in the requirements are closely spaced survey lines with side-scan sonar multi-transducer arrays or multi beam echo sounder arrays to obtain "100% bottom search". This term was adopted after numerous discussions on the impreciseness of the previously proposed term - 100% ensonification.

Order 1A

This order is intended for those areas where the sea is sufficiently shallow to allow natural or man-made features on the seabed to be a concern to the type of surface shipping expected to transit the area but where the under-keel clearance is less critical than for Special Order above. Because man-made or natural features may exist that are of concern to surface shipping a full sea floor search is required however the size of the feature to be detected is larger than for Special Order. Under-keel clearance becomes less critical as depth increases so the size of the feature to be detected by the full sea floor search is increased in areas where the water depth is greater than 40 meters. Order 1A surveys may be limited to water shallower than 100 meters.

Order 1B

This order is intended for areas shallower than 100 meters where a general depiction of the seabed is considered adequate for the type of surface shipping expected to transit the area. A full sea floor search is not required which means some features may be missed although the maximum permissible line spacing will limit the size of the features that are likely to remain undetected. This order of survey is only recommended where under-keel clearance is not considered to be an issue. An example would be an area where the seabed characteristics are such that the likelihood of there being a man-made or natural feature on the sea floor that will endanger the type of surface vessel expected to navigate the area is low.

Order 2

This is the least stringent order and is intended for those areas where the depth of water is such that a general depiction of the seabed is considered adequate. A full sea floor search is not required. It is recommended that Order 2 surveys are limited to areas deeper than 100 meters as once the water depth exceeds 100 meters the existence of man-made or natural features that are large enough to impact on surface navigation and yet still remain undetected by an Order 2 survey is considered to be unlikely.

The vertical and horizontal accuracy requirement of the IHO is summarized as follows: Maximum allowable THU (Total Horizontal Uncertainty) 95% Confidence level for different orders:

- 2 meters for Special Order
- meters + 5% of depth for Order 1A
- meters + 5% of depth for Order 1B
- 20 meters + 10% of depth for Order 2

Maximum allowable TVU (Total Vertical Uncertainty) 95% Confidence level for different orders:

- a= 0.25 meters b = 0.0075 meters for Special Order
- a= 0.50 meters b = 0.0013 meters for Order 1A
- a= 0.50 meters b = 0.0013 meters for Order 1B
- a= 1.00 meters b = 0.0023 meters for Order 2

a represents that portion of the uncertainty that does not vary with depth.
b is a coefficient which represents that portion of the uncertainty that varies with depth.

NHO specifically does not have any standards for reservoir and river surveys.
For this survey Order 1B is adopted as the minimum survey standard by M/s Arisys Technologies.

8.0 Survey Itinerary

The survey itinerary started keeping in view of the scope of work.
Arisys Technologies team along with the equipment mobilized from base office on 29th October 2020 and reached site & reported to clients on 30th October 2020.

On the same day visited the site along with clients and arrangement of Pontoon was also done. A trial run was conducted to check its functionality in presence of clients. DGPS observation was also done at two locations.

On 31st October 2020, all the survey equipment was installed on the Pontoon and initial checking of the equipment and bar check was done before starting of survey. Bathymetry survey was conducted in R-2 area of balancing reservoir of STPP & completed on the same day.

On 01st November 2020, bathymetry survey was conducted at R-1 area of balancing reservoir & completed on the same day. After completion of survey part we have collected boundaries points along the reservoir by using DGPS system.

On 02nd November 2020, remaining boundary points were collected within the survey area and survey team demobilized from the site on the same day after the completion of survey activities.

8.1 HSE Policy

M/s Arisys Technologies being a socially responsible organization adhered to its strict HSE policy throughout the period of survey. All survey personnel were apprised of the safety aspects and it was ensured that survey vessel was equipped with sufficient PPE gears/life jackets, torches throughout the survey period. In case of any unforeseen eventuality, a first aid kit was made readily available and all the modes of communications were through mobile phones. M/s Arisys Technologies also ensured that no non-degradable waste was thrown overboard and all the waste accumulated on-board was brought back to the shore to be disposed of properly with responsibility.

COVID-19 SOP:
M/s Arisys Technologies also ensured about the preventive measures for COVID-19 virus by maintain physical distance (a minimum of 1m) from other individuals, performed hand hygiene frequently with an alcohol based sanitizer, masks, coveralls, gloves, head covers….etc. As an additional precaution all the surveyors has been insured under Coivd-19 special insurance.

Fig: 8.1: Site Visit with Client

SCCL

Fig: 8.2: Discussion about TBM Points with NTPC Team

Fig: 8.3: DGPS Observation at Pipe Inlet

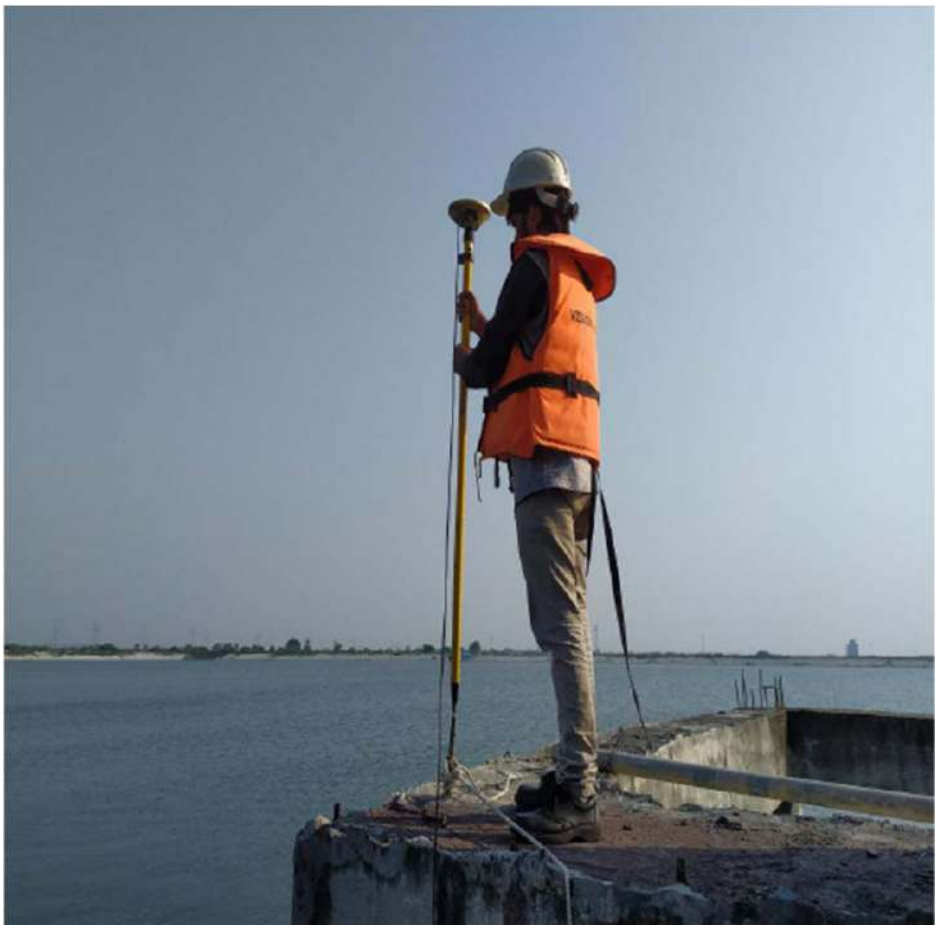


Fig: 8.4: Fixing of Pontoon at Site

Fig: 8.5: Checking the functionality of Pontoon Vessel

Fig: 8.6: Loading of Survey Equipment into the Pontoon

Fig: 8.7: Fixing of GPS at the top of Transducer

Fig: 8.8: Equipment Setup

Fig: 8.9: Conducting Echo Sounder Calibration by Bar Check Method

Fig: 8.10: Bathymetry Survey : Progress

Fig: 8.11: Barrier wall : Between R1 and R2

Fig: 8.12: North – R2 Inlet Water Pipe Line

Fig: 8.13: Water Level Variations Scale : R2 Area

Fig: 8.14: Collecting Reservoir Boundary Points By Using DGPS

Fig: 8.15: STTP Reservoir : South Orientation

9.0 Pre-Processing Procedures

9.1 Handling of Positional Data

Prior to the processing of the data files the files will be copied. The copied data files contained the positioning information will be converted to generate database points using the Hypack software. Quality Control on the data will be performed during and after the transfer of data to the database.

The following actions will be performed:

- Trace out any —0 fixes and fixes above a maximum standard deviation.
- Display the position fixes geographically and determines if any fixes are spurious and delete accordingly.
- Trace on the distance to delete fixes outside the survey lines corridor.
- The width of the corridor is such that only random fixes are deleted.
- Manually edit the position fixes to remove cluster of fixes overlaps (with caution and due diligence) and back tracking fixes. For the editing of overlaps and back tracking the processing manual should be consulted.
- Smooth the position track if this has been specified by the client. In general, no smoothing is carried out.
- Check the off-track column to ensure that the position fixtures are within specifications and that no unexpected large off tracks are present.

9.2 Handling of Single Beam Echo Sounding Data

A single beam echo sounder was used to obtain prevailing reservoir bed levels.

Prior to the processing of raw data files, the files will be copied. The bathymetric data will have been recorded using a storage cycle specified by the relevant procedure. Data interval would be set to 20 m as required for charting and generating ASCII files while the fix annotation interval would-be set-in relation to chart scale for legible plotting. The processing surveyor must ensure that the correct velocity and index have been applied to the bathymetric data.

The data was checked for the presence of unrealistic jumps or spikes in the depth values after eliminating the anomalies the profiles of the survey lines will be plotted on paper and a comparison made on the paper plot and analogue records. No smoothing of the data will be performed unless specified by the client.

10.0 Data Processing and Reporting

10.1 Navigation

All of the data required for processing were logged in HYPACK navigation software.

10.2 Positioning

The measured offsets for all equipment were entered into the navigation system and processed with Hypack max software to enable track charts to be plotted with respect to their true offsets of the sensor data. These included:

- GPS position absolute of the primary positioning system
- Common Reference Point
- Single Beam Echo sounder

The dGPS antenna was directly mounted above the echo-sounder transducer during the period of survey. Hence, there was no necessity to put offset as additional input in the navigation software.

10.3 Reference Levels

Vertical control was derived from the reservoir water level. All soundings have been reduced to Mean Sea Level (MSL).

10.4 Bathymetric Data

ODOM Echotrac Dual Frequency single beam echo sounder was used to collect the single beam bathymetric data. The logged bathymetric data was compensated —cleaned for false echoes. The data was then reduced to Mean Sea Level by applying tidal corrections from observed tides.

All of the data required for processing were logged as Hypack (RAW) files and processed using Hypack software.

The processing was done in the following manner:

On completion of bathymetry the data was post processed on an Intel based laptop using a combination of software packages i.e. Hypack & CAD. Initially the data was examined for depth and position correctness in Hypack single beam editor module. Here digitally generated profiles were examined and compared to analogue records. The digital data from the heave compensator was directly inputted to the navigation software which logged the vertical movement of the vessel digitally.

If during the survey the echo sounder digitizer briefly loses lock a zero is recorded which shows as a full height spike on the digital profile. Any zero spikes were manually removed and the track of the vessel was also examined and position spikes which result from brief loss of differential corrections were also removed.

Fig: 10.0: Processing Window of Single Beam Max in Hypack Software

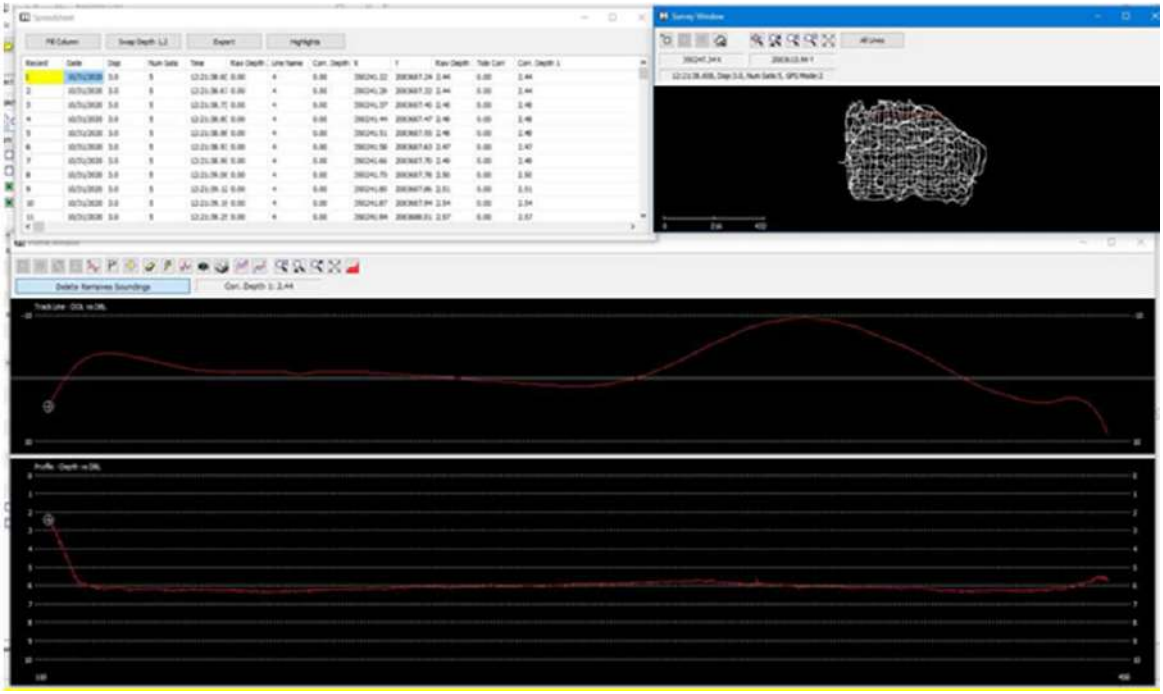
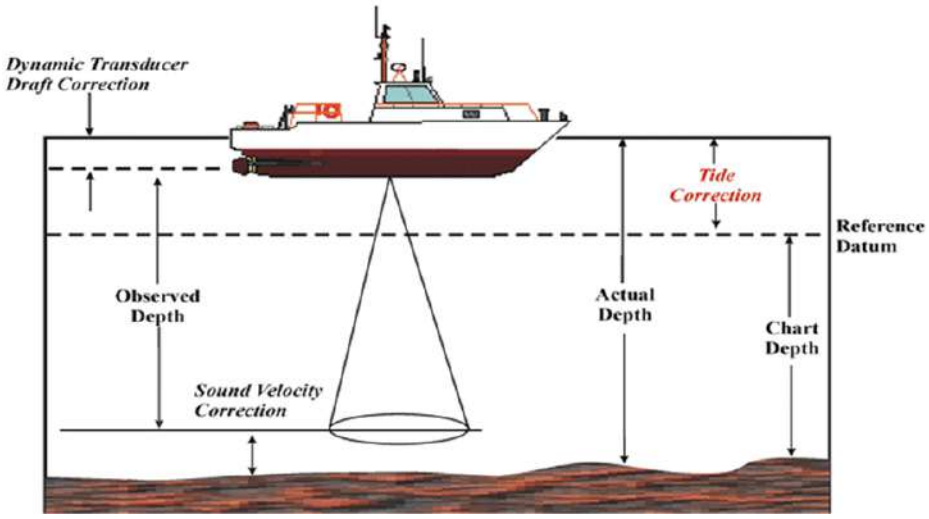


Fig: 10.1: Correction Applied to Echo Soundings

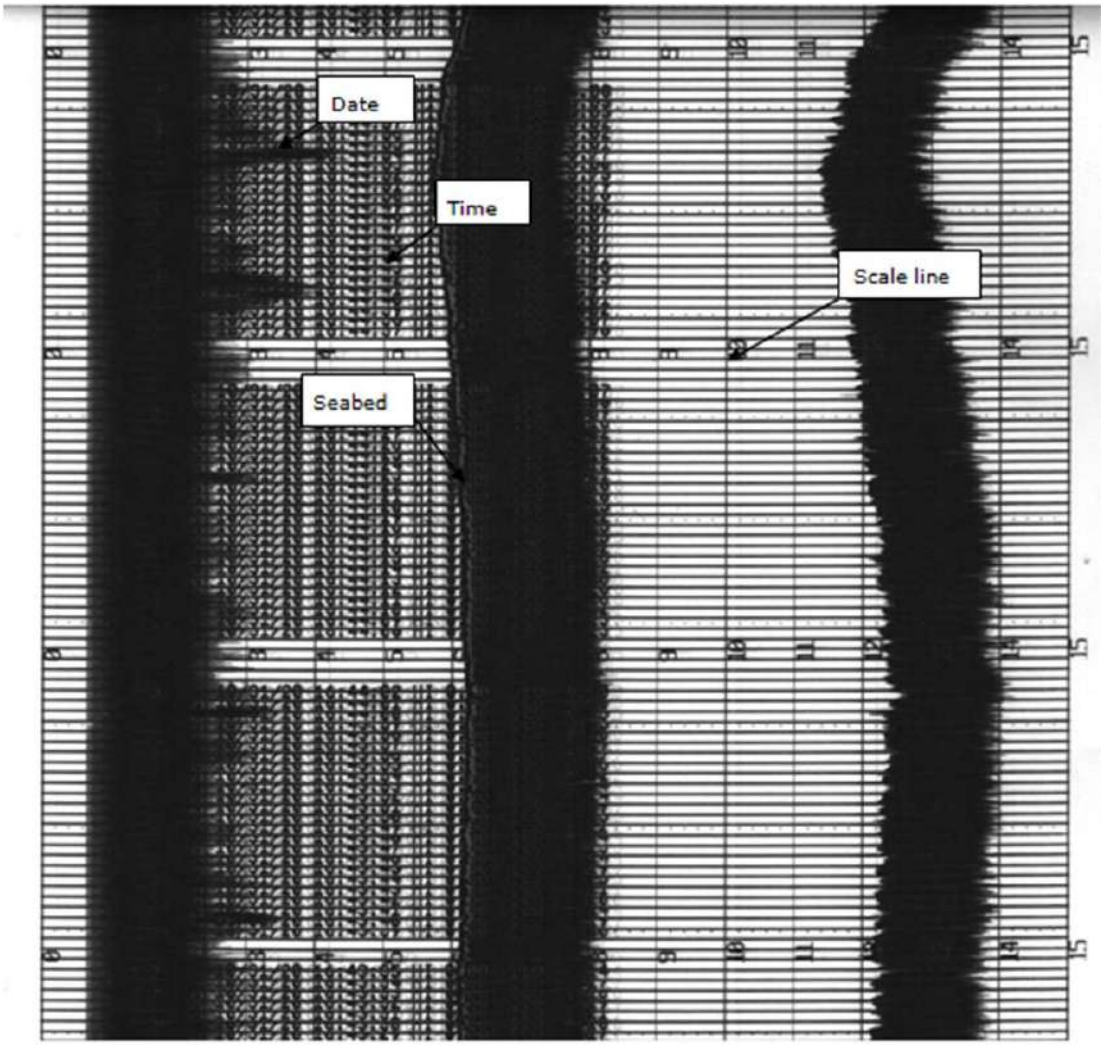


After applying the above corrections, cross checks were carried out between the bathymetry of long lines and the cross lines run. This reduced and quality controlled bathymetric data was then imported into CAD for plotting.

The bathymetry was plotted in IHO hydro-graphic format notation to the nearest 1 decimal place.

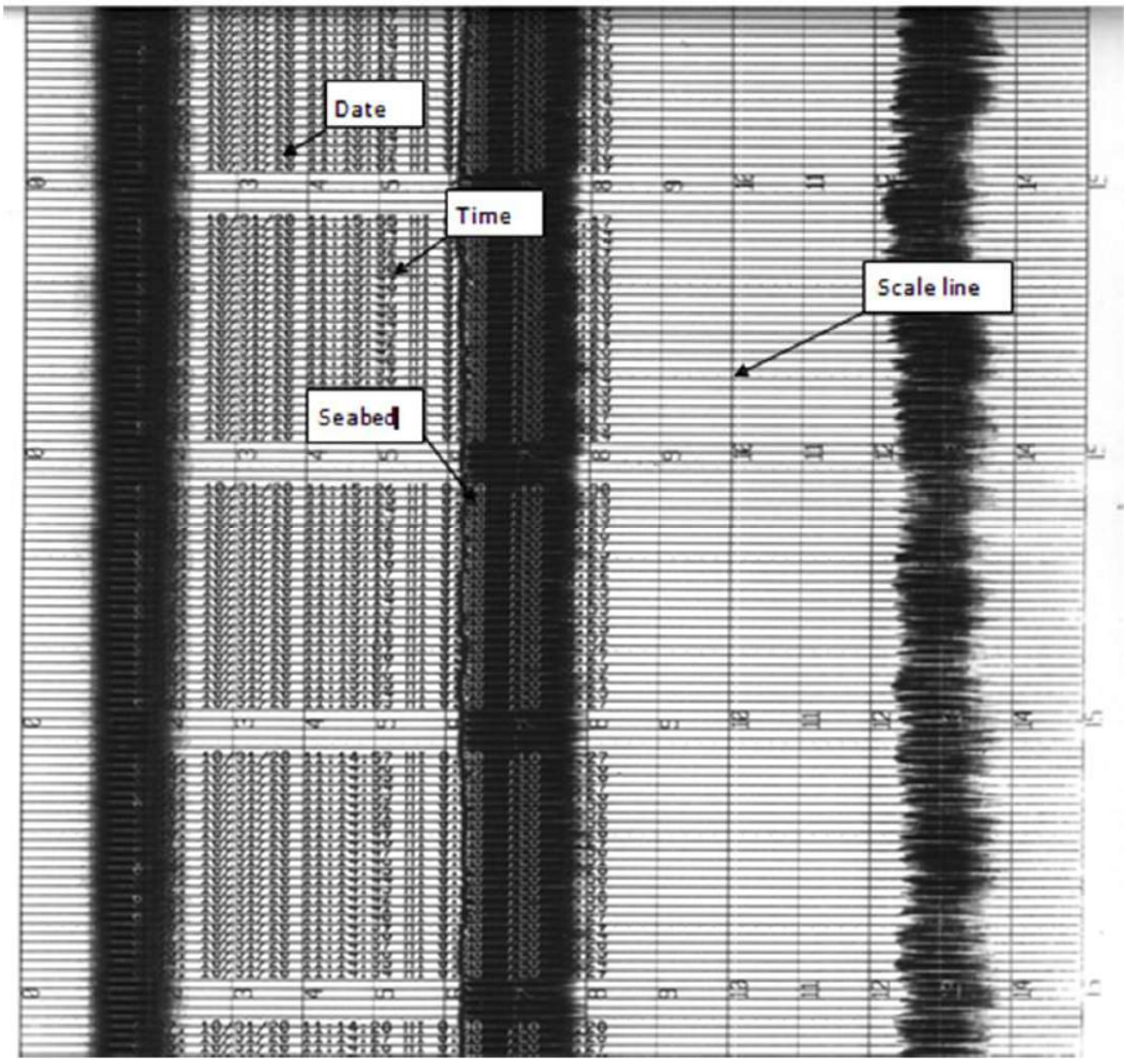
Actual Depth = Observed Depth + Draft

ES SURVEY RECORD EXAMPLE NO. 1		
IMAGE **Scanned Image**	**Location** **R2 - Balancing Reservoir STPP** **Project No.** **ARS/2020/349/10/029/NG/HY/FR/00**	**SURVEY:** **Bathymetry Survey**



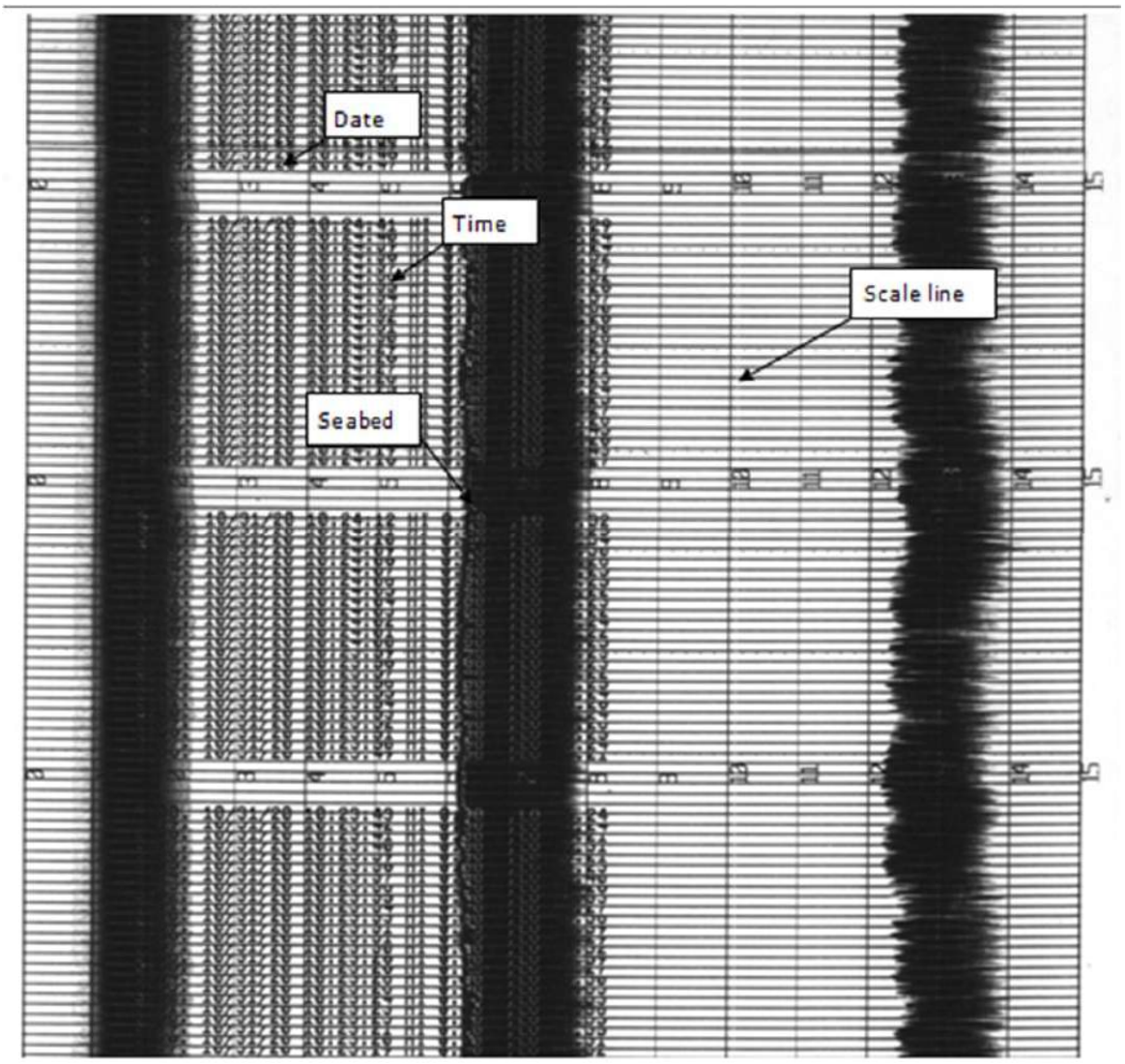
GENERAL INFORMATION	
Date of Survey:	31/10/2020
Vessel:	Floating Pontoon
Survey Equipment:	Odom Echotrac MKII
Recording Medium:	Thermal Paper
Scaling:	Image is taken by scanning, Example is not to scale
Frequency:	200/33 kHz
Velocity of Sound in Water:	1480 m/s

ES SURVEY RECORD EXAMPLE NO. 2		
IMAGE **Scanned Image**	**Location** **R2 - Balancing Reservoir STPP** **Project No.** **ARS/2020/349/10/029/NG/HY/FR/00**	**SURVEY:** **Bathymetry Survey**



GENERAL INFORMATION	
Date of Survey: Vessel:	31/10/2020
Survey Equipment:	Floating Pontoon
Recording Medium:	Odom Echotrac MKII
Scaling: Frequency:	Thermal Paper
Velocity of Sound in Water:	Image is taken by scanning, Example is not to scale
	200/33 kHz
	1480 m/s

ES SURVEY RECORD EXAMPLE NO. 3		
IMAGE **Scanned Image**	**Location** **R2 - Balancing Reservoir STPP** **Project No.** **ARS/2020/349/10/029/NG/HY/FR/00**	**SURVEY:** **Bathymetry Survey**



GENERAL INFORMATION	
Date of Survey: Vessel:	31/10/2020
Survey Equipment:	Floating Pontoon
Recording Medium:	Odom Echotrac MKII
Scaling: Frequency:	Thermal Paper
Velocity of Sound in Water:	Image is taken by scanning, Example is not to scale 200/33 kHz 1480 m/s

11.0 Detailed Results

11.1 Bathymetric Survey Summary

The mapping is done through bathymetry, the measurement of depths of water in oceans, seas and lakes. Historically, depths were measured by using a lead-line, later on single beam echo-sounders were used and presently multi-beam echo-sounders are used. Devices that use sounds in such an application fall under the family of instruments known as sonars Echo-sounders are also known as sonars - Sound Navigation Ranging.

The ability of sound to travel over such great distances allows remote sensing in a water environment. The local speed of sound can change depending on the conditions of the water such as its salinity, pressure, and temperature, but it is independent of the characteristics of the sound itself all sound waves travel at the local speed of sound. In a typical ocean environment, the speed of sound is in the neighborhood of 1500 meters per second (m/s).

The main problem in bathymetric mapping is to achieve a good resolution while maintaining the positional accuracy of the bottom, preferably obtaining the bathymetric measures in real time. In addition, it is important to keep the costs as low as possible, which means mapping a widest possible cross track. As in most signal processing applications, there is a trade between divergent needs. The trade in bathymetric sonars is between cross-track coverage, accuracy and resolution. Currently, the most important bathymetric sonars are of two types: side scan sonars and multi beam sonars.

Odom Echotrac DF 3200 MKII single frequency echo sounder was utilized to acquire the bathymetric data. The data so obtained was then processed using Hypack processing module and contouring was done using Terra model software.

11.1.1 General

Bathymetry data as obtained from the echo sounders with 20 m line spacing and was corrected and reduced to Mean Sea Level. The original soundings were sorted to 10 m x 10 m grid intervals and were downsized to 967 soundings for R1 area & 2180 soundings for R2 area. The survey area boundaries are clearly marked in the drawing. The depth contours have been drawn and are labeled. The contour interval is maintained at 0.5 m depth spacing.

The bathymetric chart has been super-imposed on the Google Earth maps shown other land references. Chart showing survey area is depicted in 1:1500 scale. Please refer to Annexure: Page – 61 for Bathymetric Data in ASCII.

11.1.2 Bathymetry Survey Results

Please refer to drawing ARS/2020/349/10/029/NG/HY/02 in Annexure in conjunction with the following paragraph:

From the bathymetry chart, the reservoir shows almost flat gradient for both r1 & R2 areas.

The maximum and minimum elevations and their location of occurrence within the survey area are given below:

Table 10: Max. & Min. Elevations Recorded – R1 Area

MAX & MIN ELEVATIONS RECORDED – R1 AREA		
Maximum area elevation within the survey	:	151.68m (towards south west side of the survey area)
Minimum area. elevation within the survey	:	146.18m (towards south west side of the survey area)

Table 11: Max. & Min. Elevations Recorded – R2 Area

MAX & MIN ELEVATIONS RECORDED – R2 AREA		
Maximum area elevation within the survey	:	151.2m (towards North West side of the survey area)
Minimum area. elevation within the survey	:	146.29m (towards south west side of the survey area)

Please refer to Annexure: Page – 62 & 63 Bathymetric Drawings.

11.2 Reservoir Bed Elevation Color Contour Map (soft copy only)

The bathymetric chart is also depicted in the form of color coded chart with the depth contours superimposed. The standard colors are taken into consideration to show the variation in depths. A contour interval of 0.5m is shown with variation in the correspondent color. A legend is plotted showing this variation as reference. This color coded chart is generated using mapping software Surfer.

The chart contains 2-D view reservoir bed profile in which X-axis represents easting‘s in meters and Y- axis represents northings in meters.

Please refer to drawing No. ARS/2020/349/10/029/N/HY/03 in Annexure: Page – 64

11.3 3-D View of Reservoir Bed Profile (soft copy only)

A 3-D map is generated using the same bathymetric data by using the same color codes by showing Z-axis as relief map. The 3-D map brings out the undulations (relief) within the survey area especially areas with considerable depth variations.

The chart contains 3-D view reservoir bed profile in which X-axis represents easting‘s in meters, Y-axis represents northings in meters and Z-axis represents elevations in meters. A vertical exaggeration of 1 in 5 is considered while plotting depths along Z-axis.

Please refer to drawing no. ARS/2020/349/10/029/NG/HY/04 & ARS/2020/349/10/029/NG/HY/05 in Annexure: Page – 65 & 66

11.4 Site Survey Description

Singareni Thermal Power Plant is situated in the southernmost part of Somagudem- Indaram Coal belt of Godavari Valley Coal Field, east of the proposed Indaram OCP coal mining project and south of NH-16. It is laying between N. Lat. 18048'40 to 18050'20 and E. Long. 79034'17 to 79035'15 falling in Survey of India Topo sheet no. 56 N/9.

The eastern part of this area is hilly and a hill ridge trending NNW to SSE is passing in the eastern part. The Vellala Gutta (411m Above MSL) located in the southeastern part is the prominent hill in this range. There are about nine unnamed hillocks are found in this hill ridge and their elevation varies from 215m above MSL to 270m above MSL. The south western part of the area is drained by Godavari River. The plain area on the northern side of River Godavari is a gently sloping plain terrain with local undulations. The local relief varies from 180m above mean sea level in the north western part to 120m above mean sea level in the South South East (SSE). The area is gently undulating and sloping towards Godavari River in South South Easterly (SSE) direction by 7m/km. The area on the southern side of River Godavari is sloping towards NNE (i.e., R. Godavari). The local relief in the southern side varies from 120m above MSL to 160m above MSL.

The area is drained by the perennial Godavari River flowing southeasterly and its ephemeral tributaries viz., Tollavagu, Pedda vagu or Tekumatla vagu and Gollavagu. Pedda vagu or Rasulpalli vagu is flowing southerly on the western side of the power plant. It originates north of Sravanpalli village, flows southerly for about 25 km to join Godavari River near Shettipalli village. It's catchment area is 177.56 sq. The eastern part of the area is drained by Gollavagu and the western part of the area is drained by Tollavagu.

The area experiences typical tropical climate of a distinct hot summer from March to June with occasional dust storms, a good monsoon between June and September and a pleasant winter from November to February.

Central Water Commission is gauging the Godavari River discharge near Mancherial. Presently in Mancherial-Ramagundam area, water is being pumped from Godavari River through intake wells to meet the requirement of ACC, NTPC, FCI and SCCL. The relative humidity is generally high in Mancherial district.

FIELD CALIBRATIONS

DGPS Observation Sheet			
Client	Novus Green Energy Systems Ltd	Date	31/10/2020
Project	Bathymetric Survey	Project	ARS/2020/349/10/029/NG/HY/FR/00
	19.5 Mwp Grid Connected Floating	Log System	Hypack Navigation
	Solar Power Plant, STPP Reservior	Surveyed by	Ramesh.Ch
	Ramagundam, Telanagana		Surya. M
Location	R2 Area STPP Inlet Pipeline	Sheets	4

DGPS Make	Hemisphere		Model	R110 Series
Time	Easting	Northing	Latitude	Longitude
15:26:18.00	350247.3000	2083771.3300	N18-50.425724	E79-34.718149
15:26:24.00	350247.3000	2083771.3300	N18-50.425724	E79-34.718131
15:26:30.00	350247.3000	2083771.3600	N18-50.425740	E79-34.718114
15:26:36.00	350247.3000	2083771.3700	N18-50.425746	E79-34.718131
15:26:42.00	350247.3000	2083771.3500	N18-50.425735	E79-34.718120
15:26:48.00	350247.2000	2083771.3500	N18-50.425735	E79-34.718109
15:26:54.00	350247.2000	2083771.3800	N18-50.425751	E79-34.718074
15:27:00.00	350247.2000	2083771.3500	N18-50.425735	E79-34.718086
15:27:06.00	350247.2000	2083771.3500	N18-50.425735	E79-34.718086
15:27:12.00	350247.2000	2083771.3600	N18-50.425740	E79-34.718080
15:27:18.00	350247.2000	2083771.3500	N18-50.425735	E79-34.718103
15:27:24.00	350247.2000	2083771.3700	N18-50.425746	E79-34.718097
15:27:30.00	350247.2000	2083771.3700	N18-50.425746	E79-34.718091
15:27:36.00	350247.2000	2083771.3800	N18-50.425751	E79-34.718069
15:27:42.00	350247.1000	2083771.3800	N18-50.425751	E79-34.718051
15:27:48.00	350247.2000	2083771.3400	N18-50.425729	E79-34.718074
15:27:54.00	350247.2000	2083771.3600	N18-50.425740	E79-34.718069
15:28:00.00	350247.2000	2083771.3800	N18-50.425751	E79-34.718057
15:28:06.00	350247.1000	2083771.4200	N18-50.425772	E79-34.718034
15:28:12.00	350247.1000	2083771.4000	N18-50.425762	E79-34.718046
15:28:18.00	350247.1000	2083771.3900	N18-50.425756	E79-34.718046
15:28:24.00	350247.2000	2083771.3500	N18-50.425735	E79-34.718080
15:28:30.00	350247.1000	2083771.3600	N18-50.425740	E79-34.718046
15:28:36.00	350247.0000	2083771.3700	N18-50.425745	E79-34.717989
15:28:42.00	350247.0000	2083771.3800	N18-50.425750	E79-34.717983
15:28:48.00	350247.1000	2083771.3400	N18-50.425729	E79-34.718018
15:28:54.00	350247.0000	2083771.3500	N18-50.425734	E79-34.717983
15:29:00.00	350247.1000	2083771.3100	N18-50.425713	E79-34.718018
15:29:06.00	350247.0000	2083771.3600	N18-50.425739	E79-34.717983
15:29:12.00	350247.1000	2083771.3400	N18-50.425729	E79-34.718000
15:29:18.00	350247.0000	2083771.3900	N18-50.425755	E79-34.717955
15:29:24.00	350247.1000	2083771.3100	N18-50.425713	E79-34.718023
15:29:30.00	350247.2000	2083771.2500	N18-50.425680	E79-34.718058
15:29:36.00	350247.1000	2083771.3100	N18-50.425713	E79-34.718012
15:29:42.00	350247.0000	2083771.3300	N18-50.425723	E79-34.717955
15:29:48.00	350246.9000	2083771.4100	N18-50.425766	E79-34.717920
15:29:54.00	350246.9000	2083771.4400	N18-50.425782	E79-34.717909
15:30:00.00	350246.9000	2083771.4000	N18-50.425761	E79-34.717920
15:30:06.00	350247.0000	2083771.3200	N18-50.425718	E79-34.717983
15:30:12.00	350246.9000	2083771.4000	N18-50.425761	E79-34.717938
15:30:18.00	350246.9000	2083771.3800	N18-50.425750	E79-34.717921
15:30:24.00	350247.0000	2083771.3800	N18-50.425750	E79-34.717943
15:30:30.00	350246.9000	2083771.3700	N18-50.425744	E79-34.717921
15:30:36.00	350247.0000	2083771.3000	N18-50.425707	E79-34.717949
15:30:42.00	350246.9000	2083771.3400	N18-50.425728	E79-34.717887
15:30:48.00	350246.8000	2083771.3400	N18-50.425728	E79-34.717881
15:30:54.00	350247.1000	2083771.2100	N18-50.425658	E79-34.718001
15:31:00.00	350247.1000	2083771.1500	N18-50.425626	E79-34.718035
15:31:06.00	350247.1000	2083771.1300	N18-50.425615	E79-34.718030
15:31:12.00	350247.1000	2083771.0800	N18-50.425588	E79-34.718030
15:31:18.00	350247.1000	2083771.0600	N18-50.425577	E79-34.718042
15:31:24.00	350247.1000	2083771.1100	N18-50.425604	E79-34.718013
15:31:30.00	350247.0000	2083771.2000	N18-50.425653	E79-34.717961
15:31:36.00	350246.9000	2083771.2400	N18-50.425674	E79-34.717887
15:31:42.00	350246.9000	2083771.1500	N18-50.425625	E79-34.717910
15:31:48.00	350246.8000	2083771.1400	N18-50.425619	E79-34.717848
15:31:54.00	350246.8000	2083771.2000	N18-50.425652	E79-34.717842
15:32:00.00	350246.8000	2083771.2200	N18-50.425662	E79-34.717830
15:32:06.00	350246.7000	2083771.2800	N18-50.425695	E79-34.717824
15:32:12.00	350246.7000	2083771.3200	N18-50.425716	E79-34.717813
15:32:18.00	350246.7000	2083771.3600	N18-50.425738	E79-34.717812
15:32:24.00	350246.6000	2083771.4300	N18-50.425776	E79-34.717744
15:32:30.00	350246.6000	2083771.4500	N18-50.425786	E79-34.717721
15:32:36.00	350246.5000	2083771.4500	N18-50.425786	E79-34.717704
15:32:42.00	350246.5000	2083771.4700	N18-50.425797	E79-34.717698
15:32:48.00	350246.5000	2083771.4900	N18-50.425808	E79-34.717692
15:32:54.00	350246.5000	2083771.5000	N18-50.425813	E79-34.717687
Time	Easting	Northing	Latitude	Longitude
15:33:00.00	350246.5000	2083771.5000	N18-50.425813	E79-34.717664
15:33:06.00	350246.4000	2083771.5600	N18-50.425845	E79-34.717652

15:33:12.00	350246.4000	2083771.5600	N18-50.425845	E79-34.717652
15:33:18.00	350246.4000	2083771.5300	N18-50.425829	E79-34.717635
15:33:24.00	350246.4000	2083771.5500	N18-50.425840	E79-34.717635
15:33:30.00	350246.4000	2083771.5100	N18-50.425818	E79-34.717624
15:33:36.00	350246.4000	2083771.5400	N18-50.425834	E79-34.717641
15:33:42.00	350246.4000	2083771.5000	N18-50.425813	E79-34.717630
15:33:48.00	350246.4000	2083771.5100	N18-50.425818	E79-34.717635
15:33:54.00	350246.4000	2083771.4900	N18-50.425807	E79-34.717641
15:34:00.00	350246.5000	2083771.5000	N18-50.425813	E79-34.717664
15:34:06.00	350246.5000	2083771.5000	N18-50.425813	E79-34.717669
15:34:12.00	350246.4000	2083771.4800	N18-50.425802	E79-34.717652
15:34:18.00	350246.5000	2083771.4800	N18-50.425802	E79-34.717658
15:34:24.00	350246.5000	2083771.5000	N18-50.425813	E79-34.717658
15:34:30.00	350246.5000	2083771.5300	N18-50.425829	E79-34.717658
15:34:36.00	350246.5000	2083771.5300	N18-50.425829	E79-34.717664
15:34:42.00	350246.5000	2083771.5200	N18-50.425824	E79-34.717664
15:34:48.00	350246.5000	2083771.5100	N18-50.425818	E79-34.717675
15:34:54.00	350246.5000	2083771.5100	N18-50.425819	E79-34.717698
15:35:00.00	350246.5000	2083771.4800	N18-50.425802	E79-34.717687
15:35:06.00	350246.5000	2083771.4600	N18-50.425791	E79-34.717681
15:35:12.00	350246.5000	2083771.4600	N18-50.425791	E79-34.717675
15:35:18.00	350246.5000	2083771.4200	N18-50.425769	E79-34.717658
15:35:24.00	350246.5000	2083771.4200	N18-50.425770	E79-34.717670
15:35:30.00	350246.5000	2083771.4300	N18-50.425775	E79-34.717664
15:35:36.00	350246.5000	2083771.4000	N18-50.425759	E79-34.717676
15:35:42.00	350246.5000	2083771.3900	N18-50.425754	E79-34.717710
15:35:48.00	350246.5000	2083771.4000	N18-50.425759	E79-34.717698
15:35:54.00	350246.5000	2083771.4300	N18-50.425775	E79-34.717681
15:36:00.00	350246.5000	2083771.3600	N18-50.425737	E79-34.717670
15:36:06.00	350246.5000	2083771.3900	N18-50.425753	E79-34.717670
15:36:12.00	350246.5000	2083771.4200	N18-50.425770	E79-34.717676
15:36:18.00	350246.5000	2083771.4300	N18-50.425775	E79-34.717698
15:36:24.00	350246.5000	2083771.4500	N18-50.425786	E79-34.717670
15:36:30.00	350246.5000	2083771.4500	N18-50.425786	E79-34.717670
15:36:36.00	350246.5000	2083771.4600	N18-50.425791	E79-34.717670
15:36:42.00	350246.5000	2083771.4700	N18-50.425797	E79-34.717675
15:36:48.00	350246.4000	2083771.5100	N18-50.425818	E79-34.717652
15:36:54.00	350246.4000	2083771.4900	N18-50.425807	E79-34.717652
15:37:00.00	350246.5000	2083771.5000	N18-50.425813	E79-34.717692
15:37:06.00	350246.5000	2083771.4800	N18-50.425802	E79-34.717687
15:37:12.00	350246.6000	2083771.4400	N18-50.425781	E79-34.717744
15:37:18.00	350246.7000	2083771.3800	N18-50.425749	E79-34.717801
15:37:24.00	350246.7000	2083771.3700	N18-50.425744	E79-34.717818
15:37:30.00	350246.6000	2083771.3800	N18-50.425749	E79-34.717761
15:37:36.00	350246.5000	2083771.4500	N18-50.425786	E79-34.717710
15:37:42.00	350246.6000	2083771.3200	N18-50.425716	E79-34.717767
15:37:48.00	350246.6000	2083771.3700	N18-50.425743	E79-34.717721
15:37:54.00	350246.5000	2083771.3600	N18-50.425737	E79-34.717687
15:38:00.00	350246.5000	2083771.3900	N18-50.425754	E79-34.717710
15:38:06.00	350246.6000	2083771.3900	N18-50.425754	E79-34.717716
15:38:12.00	350246.5000	2083771.3900	N18-50.425753	E79-34.717664
15:38:18.00	350246.5000	2083771.3200	N18-50.425715	E79-34.717659
15:38:24.00	350246.4000	2083771.3500	N18-50.425731	E79-34.717636
15:38:30.00	350246.3000	2083771.3500	N18-50.425731	E79-34.717596
15:38:36.00	350246.4000	2083771.3100	N18-50.425710	E79-34.717619
15:38:42.00	350246.4000	2083771.3400	N18-50.425726	E79-34.717619
15:38:48.00	350246.4000	2083771.3400	N18-50.425726	E79-34.717608
15:38:54.00	350246.3000	2083771.3900	N18-50.425753	E79-34.717590
15:39:00.00	350246.3000	2083771.3700	N18-50.425742	E79-34.717596
15:39:06.00	350246.3000	2083771.3800	N18-50.425747	E79-34.717579
15:39:12.00	350246.3000	2083771.3700	N18-50.425742	E79-34.717573
15:39:18.00	350246.3000	2083771.3400	N18-50.425725	E79-34.717573
15:39:24.00	350246.2000	2083771.4000	N18-50.425758	E79-34.717533
15:39:30.00	350246.3000	2083771.3800	N18-50.425747	E79-34.717573
15:39:36.00	350246.3000	2083771.3300	N18-50.425720	E79-34.717579
15:39:42.00	350246.4000	2083771.3300	N18-50.425720	E79-34.717602
15:39:48.00	350246.4000	2083771.3600	N18-50.425737	E79-34.717607
15:39:54.00	350246.4000	2083771.3200	N18-50.425715	E79-34.717608
15:40:00.00	350246.4000	2083771.3000	N18-50.425704	E79-34.717648
15:40:06.00	350246.4000	2083771.2300	N18-50.425666	E79-34.717631
15:40:12.00	350246.4000	2083771.2300	N18-50.425666	E79-34.717619
15:40:18.00	350246.4000	2083771.2200	N18-50.425661	E79-34.717602
15:40:24.00	350246.4000	2083771.1800	N18-50.425639	E79-34.717603
15:40:30.00	350246.3000	2083771.2000	N18-50.425650	E79-34.717580
15:40:36.00	350246.4000	2083771.1900	N18-50.425644	E79-34.717614
15:40:42.00	350246.3000	2083771.3400	N18-50.425725	E79-34.717545
15:40:48.00	350246.3000	2083771.3800	N18-50.425747	E79-34.717545
15:40:54.00	350246.2000	2083771.4000	N18-50.425758	E79-34.717516
15:41:00.00	350246.2000	2083771.3600	N18-50.425736	E79-34.717522
15:41:06.00	350246.3000	2083771.3100	N18-50.425709	E79-34.717562
15:41:12.00	350246.3000	2083771.3100	N18-50.425709	E79-34.717574
15:41:18.00	350246.4000	2083771.2800	N18-50.425693	E79-34.717602
15:41:24.00	350246.4000	2083771.2300	N18-50.425666	E79-34.717614
15:41:30.00	350246.3000	2083771.2800	N18-50.425693	E79-34.717551

Time	Easting	Northing	Latitude	Longitude
15:50:12.00	350246.1000	2083771.1600	N18-50.425627	E79-34.717472
15:50:18.00	350246.1000	2083771.1200	N18-50.425605	E79-34.717478
15:50:24.00	350246.1000	2083771.1100	N18-50.425600	E79-34.717483
15:50:30.00	350246.1000	2083771.1100	N18-50.425600	E79-34.717478
15:50:36.00	350246.2000	2083771.0900	N18-50.425589	E79-34.717489
15:50:42.00	350246.1000	2083771.1100	N18-50.425600	E79-34.717478
15:50:48.00	350246.1000	2083771.1000	N18-50.425595	E79-34.717472
15:50:54.00	350246.1000	2083771.1100	N18-50.425600	E79-34.717461
15:51:00.00	350246.1000	2083771.0600	N18-50.425573	E79-34.717444
15:51:06.00	350246.1000	2083771.0900	N18-50.425589	E79-34.717444
15:51:12.00	350246.1000	2083771.1000	N18-50.425594	E79-34.717438
15:51:18.00	350246.1000	2083771.0500	N18-50.425567	E79-34.717467
15:51:24.00	350246.1000	2083771.0600	N18-50.425573	E79-34.717467
15:51:30.00	350246.1000	2083771.0800	N18-50.425584	E79-34.717455
15:51:36.00	350246.1000	2083771.0500	N18-50.425567	E79-34.717444
15:51:42.00	350246.1000	2083771.0400	N18-50.425562	E79-34.717450
15:51:48.00	350246.1000	2083771.0100	N18-50.425546	E79-34.717450
15:51:54.00	350246.1000	2083770.9700	N18-50.425524	E79-34.717450
15:52:00.00	350246.1000	2083770.9400	N18-50.425508	E79-34.717456
15:52:06.00	350246.1000	2083770.9200	N18-50.425497	E79-34.717456
15:52:12.00	350246.1000	2083770.9000	N18-50.425486	E79-34.717473
Average	**350246.461**	**2083771.315**		

Brief Description of Station: DGPS was observed at GS-01 NNW Corner of R2 Bund area at STPP balancing reservoir.

GENERAL INFORMATION:

Diff. Correction Source: Satellite Based Augmented System (SBAS)

Projection: UTM

Datum: WGS-84, CM-81, Zone-44

Prepared by: Ramesh CH **Checked by:** Sanjana Reddy B

DGPS Observation Sheet			
Client	Novus Green Energy Systems Ltd	Date	31/11/2020
Project	Bathymetric Survey	Project	ARS/2020/349/10/029/NG/HY/FR/00
	19.5 Mwp Grid Connected Floating	Log System	Hypack Navigation
	Solar Power Plant, STPP Reservior	Surveyed by	Ramesh.Ch
	Ramagundam, Telanagana		Surya. M
Location	R2 Area STPP Inlet Pipeline	Sheets	3

DGPS Make	Hemisphe		Model	R110 Series
Time	Easting	Northing	Latitude	Longitude
16:51:13.99	350517.3200	2083759.2200	N18-50.420331	E79-34.871935
16:51:16.99	350517.3200	2083759.3400	N18-50.420396	E79-34.871935
16:51:19.99	350517.3200	2083759.4300	N18-50.420445	E79-34.871934
16:51:22.99	350517.3200	2083759.5200	N18-50.420494	E79-34.871934
16:51:25.99	350517.3200	2083759.5500	N18-50.420510	E79-34.871934
16:51:28.99	350517.3200	2083759.5900	N18-50.420532	E79-34.871934
16:51:31.99	350517.3000	2083759.6500	N18-50.420564	E79-34.871922
16:51:34.99	350517.2900	2083759.6600	N18-50.420570	E79-34.871916
16:51:37.99	350517.2600	2083759.6500	N18-50.420564	E79-34.871899
16:51:40.99	350517.2500	2083759.6300	N18-50.420553	E79-34.871894
16:51:43.99	350517.2400	2083759.6600	N18-50.420570	E79-34.871888
16:51:46.99	350517.2300	2083759.6500	N18-50.420564	E79-34.871882
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17:02:04.97	350516.5600	2083760.3300	N18-50.420930	E79-34.871498
17:02:07.97	350516.5600	2083760.3100	N18-50.420919	E79-34.871498
17:02:10.97	350516.5600	2083760.3200	N18-50.420924	E79-34.871498
17:02:13.97	350516.5600	2083760.3200	N18-50.420924	E79-34.871498
17:02:16.97	350516.5800	2083760.3200	N18-50.420924	E79-34.871509
17:02:19.97	350516.5900	2083760.3200	N18-50.420925	E79-34.871515
17:02:22.97	350516.5800	2083760.3300	N18-50.420930	E79-34.871509
17:02:25.97	350516.6000	2083760.3200	N18-50.420925	E79-34.871520
17:02:28.97	350516.6000	2083760.3000	N18-50.420914	E79-34.871520
17:02:31.97	350516.6000	2083760.2900	N18-50.420908	E79-34.871520
17:02:34.97	350516.6000	2083760.2800	N18-50.420903	E79-34.871521
17:02:37.97	350516.6200	2083760.2500	N18-50.420887	E79-34.871532
17:02:40.97	350516.6400	2083760.2200	N18-50.420871	E79-34.871544
17:02:43.97	350516.6400	2083760.1900	N18-50.420854	E79-34.871544
17:02:46.97	350516.6400	2083760.1700	N18-50.420843	E79-34.871544
17:02:49.97	350516.6400	2083760.1400	N18-50.420827	E79-34.871544
17:02:52.97	350516.6400	2083760.1200	N18-50.420816	E79-34.871544
17:02:55.97	350516.6400	2083760.1100	N18-50.420811	E79-34.871544
17:02:58.97	350516.6400	2083760.1100	N18-50.420811	E79-34.871544
17:03:01.97	350516.6600	2083760.1100	N18-50.420811	E79-34.871555
17:03:04.97	350516.6700	2083760.1000	N18-50.420806	E79-34.871561
17:03:07.97	350516.6700	2083760.0900	N18-50.420800	E79-34.871561

17:03:10.97	350516.6800	2083760.0800	N18-50.420795	E79-34.871567
17:03:13.97	350516.6900	2083760.0800	N18-50.420795	E79-34.871573
Time	Easting	Northing	Latitude	Longitude
17:03:16.97	350516.7000	2083760.0700	N18-50.420789	E79-34.871578
17:03:19.97	350516.7200	2083760.0400	N18-50.420773	E79-34.871590
17:03:22.97	350516.7200	2083760.0400	N18-50.420773	E79-34.871590
17:03:25.97	350516.7300	2083760.0200	N18-50.420763	E79-34.871596
17:03:28.97	350516.7300	2083760.0100	N18-50.420757	E79-34.871596
17:03:31.97	350516.7500	2083759.9800	N18-50.420741	E79-34.871607
17:03:34.97	350516.7600	2083759.9600	N18-50.420730	E79-34.871613
17:03:37.97	350516.7600	2083759.9600	N18-50.420730	E79-34.871613
17:03:40.97	350516.7600	2083759.9500	N18-50.420725	E79-34.871613
17:03:43.97	350516.7600	2083759.9400	N18-50.420719	E79-34.871613
17:03:46.97	350516.7600	2083759.9500	N18-50.420725	E79-34.871613
17:03:49.97	350516.7500	2083759.9600	N18-50.420730	E79-34.871607
17:03:52.97	350516.7500	2083759.9800	N18-50.420741	E79-34.871607
17:03:55.97	350516.7500	2083759.9800	N18-50.420741	E79-34.871607
17:03:58.97	350516.7500	2083759.9800	N18-50.420741	E79-34.871607
17:04:01.97	350516.7500	2083760.0000	N18-50.420752	E79-34.871607
17:04:04.97	350516.7500	2083759.9900	N18-50.420746	E79-34.871607
17:04:07.97	350516.7400	2083759.9600	N18-50.420730	E79-34.871602
17:04:10.97	350516.7400	2083759.9600	N18-50.420730	E79-34.871602
17:04:13.97	350516.7500	2083759.9400	N18-50.420719	E79-34.871607
17:04:16.97	350516.7600	2083759.9300	N18-50.420714	E79-34.871613
17:04:19.97	350516.7600	2083759.9200	N18-50.420708	E79-34.871613
17:04:22.97	350516.7600	2083759.9100	N18-50.420703	E79-34.871613
17:04:25.96	350516.7700	2083759.8900	N18-50.420692	E79-34.871619
17:04:28.96	350516.7700	2083759.8800	N18-50.420687	E79-34.871619
17:04:31.96	350516.7700	2083759.8800	N18-50.420687	E79-34.871619
17:04:34.97	350516.7700	2083759.8700	N18-50.420681	E79-34.871619
17:04:37.97	350516.7600	2083759.8600	N18-50.420676	E79-34.871614
17:04:40.97	350516.7500	2083759.8500	N18-50.420670	E79-34.871608
17:04:43.96	350516.7400	2083759.8500	N18-50.420670	E79-34.871602
17:04:46.96	350516.7300	2083759.8500	N18-50.420670	E79-34.871597
17:04:49.96	350516.7200	2083759.8600	N18-50.420676	E79-34.871591
17:04:52.96	350516.7100	2083759.8300	N18-50.420659	E79-34.871585
17:04:55.97	350516.7200	2083759.8400	N18-50.420665	E79-34.871591
17:04:58.96	350516.7200	2083759.8500	N18-50.420670	E79-34.871591
Average	350516.965	2083759.741		

Brief Description of Station: dGPS was observed at NNE Corner R2 Bund at STPP balancing reservoir

GENERAL INFORMATION:

Diff. Correction Source: Satellite Based Augmented System (SBAS)

Projection: UTM

Datum: WGS-84, CM-81, Zone-44

Prepared by: Ramesh CH **Checked by:** Sanjana Reddy B

DGPS Observation Sheet			
Client	Novus Green Energy Systems Ltd	Date	01/11/2020
Project	Bathymetric Survey	Project	ARS/2020/349/10/029/NG/HY/FR/00
	19.5 Mwp Grid Connected Floating	Log System	Hypack Navigation
	Solar Power Plant, STPP Reservior	Surveyed by	Ramesh.Ch
	Ramagundam, Telanagana		Surya. M
Location	R1 Area STPP	Sheets	3

DGPS Make	Hemisphe		Model	R110 Series
Time	Easting	Northing	Latitude	Longitude
12:56:52.24	350399.5600	2082158.5200	N18-49.552076	E79-34.812180
12:56:53.24	350399.6200	2082158.5100	N18-49.552070	E79-34.812214
12:56:54.25	350399.6800	2082158.5000	N18-49.552065	E79-34.812248
12:56:55.24	350399.7200	2082158.5000	N18-49.552065	E79-34.812271
12:56:56.24	350399.7600	2082158.5000	N18-49.552066	E79-34.812294
12:56:57.24	350399.8000	2082158.4900	N18-49.552060	E79-34.812317
12:56:58.24	350399.8600	2082158.4900	N18-49.552061	E79-34.812351
12:56:59.24	350399.8800	2082158.4900	N18-49.552061	E79-34.812362
12:57:00.24	350399.9200	2082158.4700	N18-49.552050	E79-34.812385
12:57:01.24	350399.9400	2082158.4800	N18-49.552055	E79-34.812396
12:57:02.25	350399.9600	2082158.4600	N18-49.552045	E79-34.812408
12:57:03.24	350399.9700	2082158.4600	N18-49.552045	E79-34.812414
12:57:04.24	350399.9700	2082158.4600	N18-49.552045	E79-34.812414
12:57:05.24	350399.9800	2082158.4700	N18-49.552050	E79-34.812419
12:57:06.25	350399.9500	2082158.5000	N18-49.552066	E79-34.812402
12:57:07.24	350399.9400	2082158.5300	N18-49.552083	E79-34.812396
12:57:08.24	350399.9300	2082158.5700	N18-49.552104	E79-34.812390
12:57:09.24	350399.9300	2082158.5900	N18-49.552115	E79-34.812390
12:57:10.24	350399.9300	2082158.6000	N18-49.552120	E79-34.812390
12:57:11.25	350399.9300	2082158.6200	N18-49.552131	E79-34.812390
12:57:12.24	350399.9300	2082158.6300	N18-49.552137	E79-34.812390
12:57:13.24	350399.9500	2082158.6400	N18-49.552142	E79-34.812401
12:57:14.24	350399.9500	2082158.6500	N18-49.552148	E79-34.812401
12:57:15.24	350399.9300	2082158.6700	N18-49.552158	E79-34.812390
12:57:16.25	350399.9100	2082158.6600	N18-49.552153	E79-34.812378
12:57:17.24	350399.9000	2082158.6700	N18-49.552158	E79-34.812373
12:57:18.24	350399.8900	2082158.6700	N18-49.552158	E79-34.812367
12:57:19.25	350399.8900	2082158.6800	N18-49.552164	E79-34.812367
12:57:20.24	350399.8900	2082158.6800	N18-49.552164	E79-34.812367
12:57:21.24	350399.8800	2082158.6700	N18-49.552158	E79-34.812361
12:57:22.24	350399.8900	2082158.6500	N18-49.552147	E79-34.812367
12:57:23.24	350399.8900	2082158.6400	N18-49.552142	E79-34.812367
12:57:24.24	350399.8800	2082158.6300	N18-49.552137	E79-34.812362
12:57:25.24	350399.8900	2082158.6200	N18-49.552131	E79-34.812367
12:57:26.24	350399.9200	2082158.5900	N18-49.552115	E79-34.812385
12:57:27.25	350399.8800	2082158.6200	N18-49.552131	E79-34.812362
12:57:28.25	350399.8800	2082158.6700	N18-49.552158	E79-34.812361
12:57:29.25	350399.8900	2082158.6800	N18-49.552164	E79-34.812367
12:57:30.25	350399.8800	2082158.6900	N18-49.552169	E79-34.812361
12:57:31.25	350399.8700	2082158.6900	N18-49.552169	E79-34.812356
12:57:32.24	350399.8500	2082158.6900	N18-49.552169	E79-34.812344
12:57:33.24	350399.8700	2082158.6900	N18-49.552169	E79-34.812356
12:57:34.25	350399.8900	2082158.7200	N18-49.552185	E79-34.812367
12:57:35.24	350399.9100	2082158.7000	N18-49.552175	E79-34.812378
12:57:36.24	350399.9100	2082158.7000	N18-49.552175	E79-34.812378
12:57:37.24	350399.9300	2082158.6800	N18-49.552164	E79-34.812390
12:57:38.24	350399.9700	2082158.6700	N18-49.552159	E79-34.812413
12:57:39.24	350400.0100	2082158.6400	N18-49.552143	E79-34.812436
12:57:40.24	350400.0100	2082158.6100	N18-49.552126	E79-34.812436
12:57:41.24	350400.0100	2082158.5800	N18-49.552110	E79-34.812436
12:57:42.24	350400.0600	2082158.5700	N18-49.552105	E79-34.812464
12:57:43.24	350400.0900	2082158.5300	N18-49.552083	E79-34.812482
12:57:44.24	350400.1200	2082158.5200	N18-49.552078	E79-34.812499
12:57:45.24	350400.1100	2082158.5200	N18-49.552078	E79-34.812493
12:57:46.24	350400.1400	2082158.5100	N18-49.552073	E79-34.812510
12:57:47.24	350400.1700	2082158.5200	N18-49.552078	E79-34.812527
12:57:48.24	350400.1500	2082158.5200	N18-49.552078	E79-34.812516
12:57:49.24	350400.1800	2082158.5300	N18-49.552084	E79-34.812533
12:57:50.24	350400.1600	2082158.5100	N18-49.552073	E79-34.812522
12:57:51.24	350400.1800	2082158.4900	N18-49.552062	E79-34.812533
12:57:52.24	350400.1900	2082158.4800	N18-49.552057	E79-34.812539
12:57:53.24	350400.2100	2082158.4800	N18-49.552057	E79-34.812550
12:57:54.24	350400.2700	2082158.4800	N18-49.552057	E79-34.812584
12:57:55.24	350400.3200	2082158.4700	N18-49.552052	E79-34.812613
12:57:56.24	350400.3700	2082158.4500	N18-49.552041	E79-34.812641
12:57:57.24	350400.3900	2082158.4200	N18-49.552025	E79-34.812653
12:57:58.25	350400.4200	2082158.3900	N18-49.552009	E79-34.812670
12:57:59.24	350400.4200	2082158.3400	N18-49.551982	E79-34.812670
12:58:00.25	350400.4500	2082158.3100	N18-49.551966	E79-34.812688

Time	Easting	Northing	Latitude	Longitude
12:58:01.24	350400.4800	2082158.2700	N18-49.551944	E79-34.812705
12:58:02.25	350400.5300	2082158.2300	N18-49.551923	E79-34.812733
12:58:03.24	350400.5600	2082158.2000	N18-49.551906	E79-34.812751
12:58:04.24	350400.6000	2082158.1500	N18-49.551879	E79-34.812774
12:58:05.24	350400.6200	2082158.1500	N18-49.551880	E79-34.812785
12:58:06.24	350400.6500	2082158.1300	N18-49.551869	E79-34.812802
12:58:07.24	350400.6300	2082158.1500	N18-49.551880	E79-34.812791
12:58:08.24	350400.6000	2082158.1800	N18-49.551896	E79-34.812774
12:58:09.24	350400.5800	2082158.1400	N18-49.551874	E79-34.812762
12:58:10.24	350400.5600	2082158.1400	N18-49.551874	E79-34.812751
12:58:11.24	350400.5700	2082158.1400	N18-49.551874	E79-34.812757
12:58:12.24	350400.5500	2082158.1400	N18-49.551874	E79-34.812745
12:58:13.24	350400.5400	2082158.1400	N18-49.551874	E79-34.812740
12:58:14.24	350400.5600	2082158.1300	N18-49.551868	E79-34.812751
12:58:15.24	350400.5400	2082158.1300	N18-49.551868	E79-34.812740
12:58:16.24	350400.5300	2082158.1300	N18-49.551868	E79-34.812734
12:58:17.25	350400.5200	2082158.1400	N18-49.551874	E79-34.812728
12:58:18.24	350400.4800	2082158.1900	N18-49.551901	E79-34.812705
12:58:19.24	350400.4700	2082158.2400	N18-49.551928	E79-34.812699
12:58:20.24	350400.4500	2082158.2600	N18-49.551938	E79-34.812688
12:58:21.24	350400.4500	2082158.2600	N18-49.551938	E79-34.812688
12:58:22.24	350400.4300	2082158.2600	N18-49.551938	E79-34.812676
12:58:23.24	350400.4400	2082158.2600	N18-49.551938	E79-34.812682
12:58:24.24	350400.4500	2082158.2400	N18-49.551928	E79-34.812688
12:58:25.24	350400.4400	2082158.2200	N18-49.551917	E79-34.812682
12:58:26.24	350400.4600	2082158.2100	N18-49.551911	E79-34.812694
12:58:27.24	350400.4800	2082158.2000	N18-49.551906	E79-34.812705
12:58:28.24	350400.5100	2082158.1800	N18-49.551895	E79-34.812722
12:58:29.24	350400.5300	2082158.1500	N18-49.551879	E79-34.812734
12:58:30.24	350400.5700	2082158.1400	N18-49.551874	E79-34.812757
12:58:31.24	350400.6300	2082158.0900	N18-49.551847	E79-34.812791
12:58:32.24	350400.6300	2082158.0900	N18-49.551847	E79-34.812791
12:58:33.24	350400.6400	2082158.0700	N18-49.551836	E79-34.812797
12:58:34.24	350400.6700	2082158.0500	N18-49.551826	E79-34.812814
12:58:35.24	350400.6900	2082158.0200	N18-49.551809	E79-34.812825
12:58:36.24	350400.7000	2082157.9700	N18-49.551782	E79-34.812831
12:58:37.24	350400.7100	2082157.9400	N18-49.551766	E79-34.812837
12:58:38.24	350400.7500	2082157.9000	N18-49.551745	E79-34.812860
12:58:39.24	350400.7600	2082157.8900	N18-49.551739	E79-34.812866
12:58:40.24	350400.7500	2082157.9000	N18-49.551745	E79-34.812860
12:58:41.24	350400.7300	2082157.9400	N18-49.551766	E79-34.812849
12:58:42.24	350400.7200	2082157.9500	N18-49.551772	E79-34.812843
12:58:43.24	350400.7500	2082157.9000	N18-49.551745	E79-34.812860
12:58:44.24	350400.8000	2082157.8500	N18-49.551718	E79-34.812889
12:58:45.24	350400.8300	2082157.8400	N18-49.551712	E79-34.812906
12:58:46.24	350400.8400	2082157.8000	N18-49.551691	E79-34.812912
12:58:47.24	350400.8800	2082157.7700	N18-49.551675	E79-34.812935
12:58:48.24	350400.9200	2082157.7600	N18-49.551669	E79-34.812958
12:58:49.24	350400.8800	2082157.8000	N18-49.551691	E79-34.812935
12:58:50.24	350400.8400	2082157.8400	N18-49.551712	E79-34.812912
12:58:51.24	350400.7800	2082157.8700	N18-49.551728	E79-34.812877
12:58:52.24	350400.7900	2082157.8600	N18-49.551723	E79-34.812883
12:58:53.24	350400.7700	2082157.9000	N18-49.551745	E79-34.812872
12:58:54.24	350400.7500	2082157.9100	N18-49.551750	E79-34.812860
12:58:55.24	350400.7700	2082157.9400	N18-49.551766	E79-34.812871
12:58:56.24	350400.7600	2082157.9600	N18-49.551777	E79-34.812866
12:58:57.24	350400.7600	2082157.9600	N18-49.551777	E79-34.812866
12:58:58.24	350400.8000	2082157.9600	N18-49.551777	E79-34.812888
12:58:59.24	350400.8300	2082157.9300	N18-49.551761	E79-34.812906
12:59:00.24	350400.8800	2082157.9100	N18-49.551751	E79-34.812934
12:59:01.24	350400.9300	2082157.8800	N18-49.551735	E79-34.812963
12:59:02.24	350400.9600	2082157.8600	N18-49.551724	E79-34.812980
12:59:03.24	350400.9900	2082157.8200	N18-49.551702	E79-34.812997
12:59:04.24	350400.9800	2082157.7900	N18-49.551686	E79-34.812992
12:59:05.24	350400.9600	2082157.7800	N18-49.551680	E79-34.812980
12:59:06.24	350400.9400	2082157.7900	N18-49.551686	E79-34.812969
12:59:07.24	350400.9300	2082157.7900	N18-49.551686	E79-34.812963
12:59:08.24	350400.9100	2082157.8000	N18-49.551691	E79-34.812952
12:59:09.24	350400.8300	2082157.9700	N18-49.551783	E79-34.812905
12:59:10.24	350400.7400	2082158.0700	N18-49.551837	E79-34.812854
12:59:11.24	350400.6700	2082158.1500	N18-49.551880	E79-34.812813
12:59:12.24	350400.6200	2082158.2100	N18-49.551912	E79-34.812785
12:59:13.24	350400.5700	2082158.2700	N18-49.551944	E79-34.812756
12:59:14.24	350400.5400	2082158.3000	N18-49.551961	E79-34.812739
12:59:15.24	350400.5200	2082158.3500	N18-49.551988	E79-34.812727
12:59:16.24	350400.5100	2082158.3900	N18-49.552009	E79-34.812721
12:59:17.24	350400.4900	2082158.4100	N18-49.552020	E79-34.812710
12:59:18.24	350400.4600	2082158.4300	N18-49.552031	E79-34.812693
12:59:19.24	350400.4400	2082158.4400	N18-49.552036	E79-34.812681
12:59:20.24	350400.4500	2082158.4600	N18-49.552047	E79-34.812687
12:59:21.24	350400.4600	2082158.5100	N18-49.552074	E79-34.812692
12:59:22.24	350400.4700	2082158.5000	N18-49.552069	E79-34.812698
12:59:23.24	350400.4500	2082158.5100	N18-49.552074	E79-34.812687
12:59:24.24	350400.4400	2082158.5000	N18-49.552068	E79-34.812681
12:59:25.24	350400.4400	2082158.5100	N18-49.552074	E79-34.812681

12:59:26.24	350400.4500	2082158.5100	N18-49.552074	E79-34.812687
Time	Easting	Northing	Latitude	Longitude
12:59:27.24	350400.4600	2082158.5300	N18-49.552085	E79-34.812692
12:59:28.24	350400.4700	2082158.5200	N18-49.552079	E79-34.812698
12:59:29.24	350400.4700	2082158.5200	N18-49.552079	E79-34.812698
12:59:30.24	350400.4800	2082158.5100	N18-49.552074	E79-34.812704
12:59:31.24	350400.4800	2082158.5000	N18-49.552069	E79-34.812704
12:59:32.24	350400.4900	2082158.4900	N18-49.552063	E79-34.812709
12:59:33.24	350400.4900	2082158.4900	N18-49.552063	E79-34.812709
12:59:34.24	350400.5000	2082158.5000	N18-49.552069	E79-34.812715
12:59:35.24	350400.5300	2082158.5100	N18-49.552074	E79-34.812732
12:59:36.24	350400.5100	2082158.5300	N18-49.552085	E79-34.812721
12:59:37.24	350400.5000	2082158.5200	N18-49.552080	E79-34.812715
12:59:38.24	350400.5000	2082158.5200	N18-49.552080	E79-34.812715
12:59:39.24	350400.5000	2082158.5100	N18-49.552074	E79-34.812715
12:59:40.24	350400.4600	2082158.5200	N18-49.552079	E79-34.812692
12:59:41.24	350400.3800	2082158.5300	N18-49.552085	E79-34.812647
12:59:42.24	350400.3200	2082158.5200	N18-49.552079	E79-34.812613
12:59:43.24	350400.3000	2082158.5200	N18-49.552079	E79-34.812601
12:59:44.24	350400.2900	2082158.5300	N18-49.552084	E79-34.812595
12:59:45.24	350400.3400	2082158.5400	N18-49.552090	E79-34.812624
12:59:46.24	350400.4800	2082158.5100	N18-49.552074	E79-34.812704
Average	350400.365	2082158.328		

Brief Description of Station: dGPS was observed at R1 Bund at STPP balancing reservoir

GENERAL INFORMATION:

Diff. Correction Source: Satellite Based Augmented System (SBAS)

Projection: UTM

Datum: WGS-84, CM-81, Zone-44

Prepared by: Ramesh CH **Checked by:** Sanjana Reddy B

DGPS Observation Sheet			
Client	Novus Green Energy Systems Ltd	Date	02/11/2020
Project	Bathymetric Survey	Project	ARS/2020/349/10/029/NG/HY/FR/00
	19.5 Mwp Grid Connected Floating	Log System	Hypack Navigation
	Solar Power Plant, STPP Reservior	Surveyed by	Ramesh.Ch
	Ramagundam, Telanagana		Surya. M
Location	R1 Area STPP	Sheets	3

DGPS Make	Hemisphere		Model	R110 Series
Time	Easting	Northing	Latitude	Longitude
13:11:16.00	350408.5800	2082003.7000	N18-49.468186	E79-34.818020
13:11:17.00	350408.6200	2082003.6300	N18-49.468148	E79-34.818043
13:11:18.00	350408.6600	2082003.5600	N18-49.468111	E79-34.818066
13:11:19.00	350408.6900	2082003.4800	N18-49.468067	E79-34.818084
13:11:20.00	350408.7300	2082003.4100	N18-49.468030	E79-34.818107
13:11:21.00	350408.7700	2082003.3400	N18-49.467992	E79-34.818130
13:11:22.00	350408.8000	2082003.2600	N18-49.467949	E79-34.818147
13:11:23.00	350408.8400	2082003.1900	N18-49.467911	E79-34.818170
13:11:24.00	350408.8800	2082003.1200	N18-49.467873	E79-34.818193
13:11:25.00	350408.9100	2082003.0400	N18-49.467830	E79-34.818211
13:11:26.00	350408.9500	2082002.9700	N18-49.467792	E79-34.818234
13:11:27.00	350408.9800	2082002.8900	N18-49.467749	E79-34.818251
13:11:28.00	350409.0200	2082002.8200	N18-49.467711	E79-34.818274
13:11:29.00	350409.0600	2082002.7500	N18-49.467673	E79-34.818297
13:11:30.00	350409.0900	2082002.6700	N18-49.467630	E79-34.818315
13:11:31.00	350409.1300	2082002.6000	N18-49.467592	E79-34.818338
13:11:32.00	350409.1200	2082002.5100	N18-49.467543	E79-34.818333
13:11:33.00	350409.0900	2082002.4700	N18-49.467522	E79-34.818316
13:11:34.00	350409.0500	2082002.4700	N18-49.467521	E79-34.818293
13:11:35.00	350409.0400	2082002.5100	N18-49.467543	E79-34.818287
13:11:36.00	350409.0200	2082002.5700	N18-49.467575	E79-34.818276
13:11:37.00	350409.0000	2082002.6000	N18-49.467592	E79-34.818264
13:11:38.00	350408.9500	2082002.6400	N18-49.467613	E79-34.818235
13:11:39.00	350408.9200	2082002.7100	N18-49.467651	E79-34.818218
13:11:40.00	350408.8800	2082002.8100	N18-49.467705	E79-34.818195
13:11:41.00	350408.8700	2082002.8200	N18-49.467710	E79-34.818189
13:11:42.00	350408.8700	2082002.8200	N18-49.467710	E79-34.818189
13:11:43.00	350408.8700	2082002.8200	N18-49.467710	E79-34.818189
13:11:44.00	350408.8700	2082002.8200	N18-49.467710	E79-34.818189
13:11:45.00	350408.8700	2082002.8200	N18-49.467710	E79-34.818189
13:11:46.00	350409.0600	2082002.3000	N18-49.467429	E79-34.818300
13:11:47.00	350409.2500	2082001.7700	N18-49.467143	E79-34.818410
13:11:48.00	350409.0400	2082002.4200	N18-49.467494	E79-34.818288
13:11:49.00	350408.8900	2082002.8800	N18-49.467743	E79-34.818200
13:11:50.00	350408.8000	2082003.1800	N18-49.467905	E79-34.818148
13:11:51.00	350408.7200	2082003.3900	N18-49.468019	E79-34.818101
13:11:52.00	350408.6700	2082003.5400	N18-49.468100	E79-34.818072
13:11:53.00	350408.6300	2082003.6200	N18-49.468143	E79-34.818049
13:11:54.00	350408.6300	2082003.6300	N18-49.468148	E79-34.818049
13:11:55.00	350408.6400	2082003.5700	N18-49.468116	E79-34.818055
13:11:56.00	350408.6700	2082003.4800	N18-49.468067	E79-34.818072
13:11:57.00	350408.6900	2082003.3900	N18-49.468019	E79-34.818084
13:11:58.00	350408.7200	2082003.2800	N18-49.467959	E79-34.818102
13:11:59.00	350408.7500	2082003.1600	N18-49.467894	E79-34.818119
13:12:00.00	350408.8100	2082003.0300	N18-49.467824	E79-34.818154
13:12:01.00	350408.8700	2082002.8700	N18-49.467737	E79-34.818189
13:12:02.00	350408.9300	2082002.7200	N18-49.467656	E79-34.818224
13:12:03.00	350409.0000	2082002.6000	N18-49.467592	E79-34.818264
13:12:04.00	350409.0800	2082002.4400	N18-49.467505	E79-34.818310
13:12:05.00	350409.1700	2082002.2700	N18-49.467413	E79-34.818362
13:12:06.00	350409.2600	2082002.1100	N18-49.467327	E79-34.818414
13:12:07.00	350409.3300	2082001.9500	N18-49.467241	E79-34.818455
13:12:08.00	350409.3900	2082001.8100	N18-49.467165	E79-34.818490
13:12:09.00	350409.4000	2082001.8200	N18-49.467170	E79-34.818495
13:12:10.00	350409.4000	2082001.8300	N18-49.467176	E79-34.818495
13:12:11.00	350409.4100	2082001.8400	N18-49.467181	E79-34.818501
13:12:12.00	350409.4200	2082001.8400	N18-49.467181	E79-34.818507
13:12:13.00	350409.4300	2082001.8500	N18-49.467187	E79-34.818512
13:12:14.00	350409.4300	2082001.8600	N18-49.467192	E79-34.818512
13:12:15.00	350409.4400	2082001.8700	N18-49.467198	E79-34.818518
13:12:16.00	350409.2400	2082002.3500	N18-49.467457	E79-34.818402
13:12:17.00	350409.0400	2082002.8300	N18-49.467716	E79-34.818286
13:12:18.00	350408.8400	2082003.3200	N18-49.467981	E79-34.818170
13:12:19.00	350408.8400	2082003.3500	N18-49.467997	E79-34.818170
13:12:20.00	350408.8300	2082003.3700	N18-49.468008	E79-34.818164
13:12:21.00	350408.8300	2082003.4000	N18-49.468025	E79-34.818164
13:12:22.00	350408.8300	2082003.4300	N18-49.468041	E79-34.818163
13:12:23.00	350408.8300	2082003.4600	N18-49.468057	E79-34.818163
13:12:24.00	350408.8200	2082003.4800	N18-49.468068	E79-34.818158

Time	Easting	Northing	Latitude	Longitude
13:12:25.00	350408.8200	2082003.5100	N18-49.468084	E79-34.818157
13:12:26.00	350408.9500	2082003.1400	N18-49.467884	E79-34.818233
13:12:27.00	350409.0500	2082002.8000	N18-49.467700	E79-34.818292
13:12:28.00	350409.1600	2082002.4800	N18-49.467527	E79-34.818356
13:12:29.00	350409.2800	2082002.1500	N18-49.467349	E79-34.818425
13:12:30.00	350409.3800	2082001.8500	N18-49.467187	E79-34.818484
13:12:31.00	350409.3800	2082001.8600	N18-49.467192	E79-34.818484
13:12:32.00	350409.3800	2082001.8700	N18-49.467198	E79-34.818484
13:12:33.00	350409.3700	2082001.8800	N18-49.467203	E79-34.818478
13:12:34.00	350409.3700	2082001.8900	N18-49.467208	E79-34.818478
13:12:35.00	350408.3800	2082003.6300	N18-49.468147	E79-34.817906
13:12:36.00	350408.4000	2082003.6300	N18-49.468147	E79-34.817918
13:12:37.00	350408.4200	2082003.6400	N18-49.468153	E79-34.817929
13:12:38.00	350408.4300	2082003.6400	N18-49.468153	E79-34.817935
13:12:39.00	350408.4500	2082003.6500	N18-49.468158	E79-34.817946
13:12:40.00	350408.4700	2082003.6500	N18-49.468159	E79-34.817957
13:12:41.00	350408.4900	2082003.6600	N18-49.468164	E79-34.817969
13:12:42.00	350408.5000	2082003.6600	N18-49.468164	E79-34.817975
13:12:43.00	350408.5200	2082003.6700	N18-49.468170	E79-34.817986
13:12:44.00	350408.5400	2082003.6700	N18-49.468170	E79-34.817997
13:12:45.00	350408.5600	2082003.6800	N18-49.468175	E79-34.818009
13:12:46.00	350408.5800	2082003.6800	N18-49.468175	E79-34.818020
13:12:47.00	350408.5900	2082003.6900	N18-49.468181	E79-34.818026
13:12:48.00	350408.6100	2082003.6900	N18-49.468181	E79-34.818037
13:12:49.00	350408.6300	2082003.7000	N18-49.468186	E79-34.818048
13:12:50.00	350408.6500	2082003.7000	N18-49.468186	E79-34.818060
13:12:51.00	350408.6600	2082003.7100	N18-49.468192	E79-34.818065
13:12:52.00	350408.6800	2082003.7100	N18-49.468192	E79-34.818077
13:12:53.00	350408.7000	2082003.7200	N18-49.468197	E79-34.818088
13:12:54.00	350408.7200	2082003.7200	N18-49.468198	E79-34.818100
13:12:55.00	350408.7400	2082003.7300	N18-49.468203	E79-34.818111
13:12:56.00	350408.7500	2082003.7300	N18-49.468203	E79-34.818117
13:12:57.00	350408.7700	2082003.7400	N18-49.468209	E79-34.818128
13:12:58.00	350408.7900	2082003.7400	N18-49.468209	E79-34.818139
13:12:59.00	350408.8100	2082003.7500	N18-49.468214	E79-34.818151
13:13:00.00	350408.8200	2082003.7500	N18-49.468214	E79-34.818156
13:13:01.00	350408.8400	2082003.7600	N18-49.468220	E79-34.818168
13:13:02.00	350408.8600	2082003.7600	N18-49.468220	E79-34.818179
13:13:03.00	350409.0200	2082003.1000	N18-49.467863	E79-34.818273
13:13:04.00	350409.1800	2082002.5600	N18-49.467571	E79-34.818367
13:13:05.00	350409.3500	2082001.9900	N18-49.467262	E79-34.818466
Average	**350408.902**	**2082002.997**		

Brief Description of Station: dGPS was observed at R1 Bund at STPP balancing reservoir

GENERAL INFORMATION:

Diff. Correction Source: Satellite Based Augmented System (SBAS)

Projection: UTM

Datum: WGS-84, CM-81, Zone-44

Prepared by: Ramesh CH **Checked by:** Sanjana Reddy B

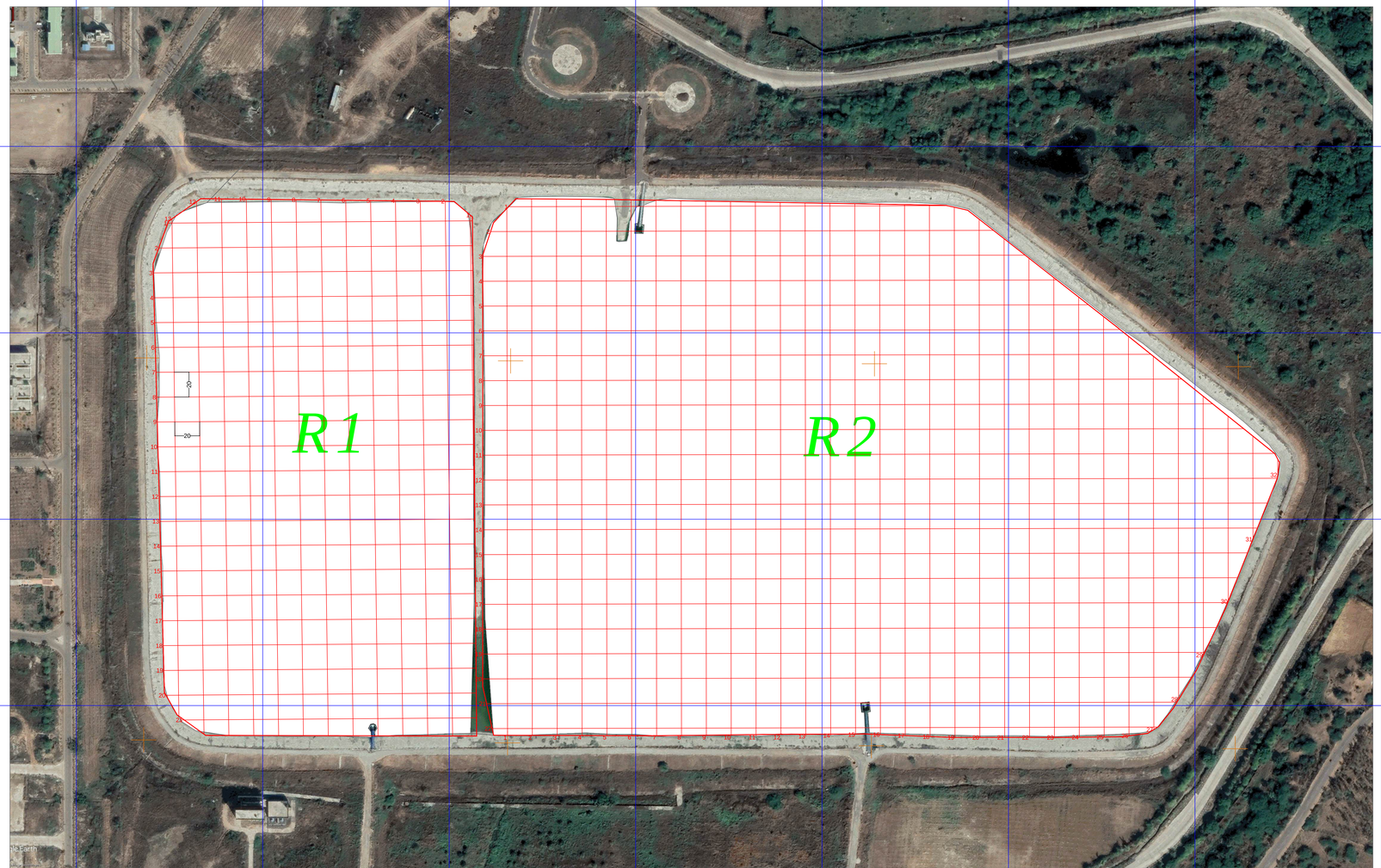
ANNEXURES

E349650 E349800 E349950 E350100 E350250 E350400 E350550 E350700 E350850

N2084100 N2083950 N2083800 N2083650 N2083500 N2083350 N2083200 N2083050

18°50'30" 18°50'20" 18°50'10"

79°34'30" 79°34'40" 79°34'50" 79°35'00"

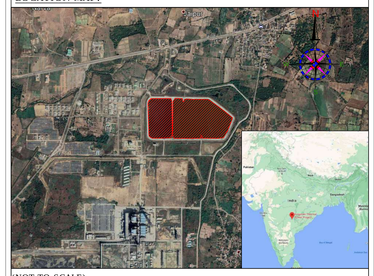


N

W E

S

LOCATION MAP:



(NOT TO SCALE)

NOTE:

(1) All dimensions are in metres.

(2) Please Refer to ARS/2020/349/10/029/NG/HY/FR/00.

GEODETIC PARAMETERS:

Spheroid	: WGS 1984 (Zone 44 N)
Datum Transformation	: None
Projection	: Universal Transverse Mercator (UTM)
False Easting	: 500000.0000m
False Northing	: 0.0000m
Central Meridian (CM)	: 081°00'00.00" East
Latitude of Origin	: 00°00'00.00" North
Longitude of Origin	: 081°00'00.00" East
Semi-Major axis (a)	: 6378137.000 m
Semi-Minor axis (b)	: 6356752.3142 m
Inverse flattening (1/f)	: 298.257223563
Scale factor at CM	: 0.999600
Units	: International Metres

LEGEND:

UTM GRID

GEOGRAPHICAL GRATICULE

PLAN LINES WITH 20m SPACING IN BOTH DIRECTIONS.

CLIENT:

Novus Green

Address: Plot NO100, "Siddhi"
1st and 2nd Floor, P & T Colony,Trimulgerry,
Secundrabad -50015,Telangana,India.
Email : info@novusgreen.in
Web : www.novusgreen.in

SURVEYED BY:

ARISYS TECHNOLOGIES

Address: 7-1-32/5/2
Leelanagar,Begumpet
Hyderabad-500016
Email : mail@arisys.in
Web : www.arisys.in

PROJECT TITLE:

BATHYMETRY SURVEY FOR INSTALLATION OF 10MWGRID CONNECTED FLOATING SOLAR POWER PLANT AT BALANCING RESERVOIR- SINGHARENI THERMAL POWER PLANT, PAGADAPALLI, MANCHERIAL DISTRICT, TELANGANA

DRAWING TITLE:

Bathymetry Survey - Pre Plan

SCALE:

1:1500

15 0 15 30 45 60 75 90 105 120 135 150 Metres

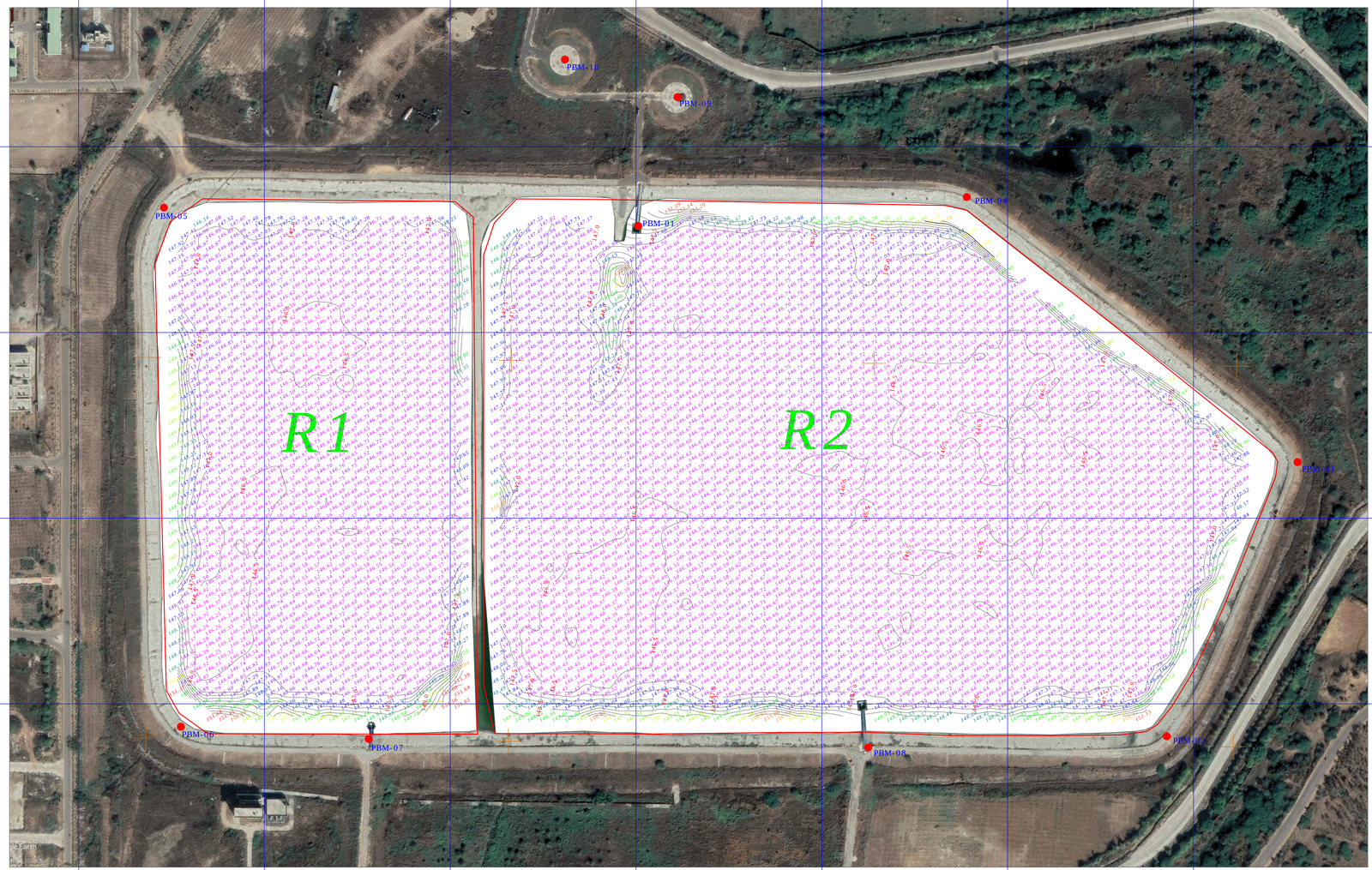
Drawing No	ARS/2020/349/10/029/NG/HY/01		
Survey Dates			
Surveyed by			
Prepared by	M Surya	REV-##	DATE
Checked by	VV Apparao	REV00	11-11-2020
Sheet No	01 of 01		

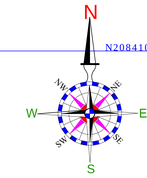
E349650 E349800 E349950 E350100 E350250 E350400 E350550 E350700 E350850

N2084100 N2083950 N2083800 N2083650 N2083500 N2083350 N2083200 N2083050

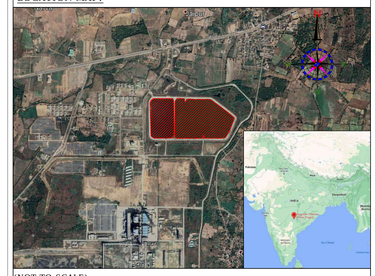
18°50'30" 18°50'20" 18°50'10"

79°34'30" 79°34'40" 79°34'50" 79°35'00"





LOCATION MAP:



(NOT TO SCALE)

NOTE:

(1) Soundings are reduced to water level scale at STPP Reservoir which is w.r.t MSL on 31-10-2020 & 01-11-2020.

(2) Differential GPS corrections from SBASS have been used for Horizontal Positioning.

(3) Odom Echotrac MKII dual frequency (200 kHz/33 kHz) Echosounder has been used for collecting soundings.

(4) All Levels are in metres.

(5) All dimensions are in metres.

(6) Please Refer to ARS/2020/349/10/029/NG/HY/FR/00.

GEODETIC PARAMETERS:

Spheroid	: WGS 1984 (Zone 44 N)
Datum Transformation	: None
Projection	: Universal Transverse Mercator (UTM)
False Easting	: 500000.0000m
False Northing	: 0.0000m
Central Meridian (CM)	: 081°00'00.00" East
Latitude of Origin	: 00°00'00.00" North
Longitude of Origin	: 081°00'00.00" East
Semi-Major axis (a)	: 6378137.000 m
Semi-Minor axis (b)	: 6356752.3142 m
Inverse flattening (1/f)	: 298.257223563
Scale factor at CM	: 0.999600
Units	: International Metres

LEGEND:

UTM GRID

GEOGRAPHICAL GRATICULE

RESERVOIR BED ELEVATIONS IN METRES

0.5mtrs CONTOUR

DGPS OBSERVATION POINTS

COLOR SCALE :

< 146.50
146.50 - 146.69
146.70 - 146.89
146.90 - 147.09
147.10 - 147.29
147.30 - 147.49
147.50 - 147.69
147.70 - 147.89
147.90 - 148.09
148.10 - 148.29
148.30 - 148.49
148.50 - 148.69
148.70 - 148.89
148.90 - 149.09
149.10 - 149.29
149.30 - 149.49
149.50 - 149.69
149.70 - 149.89
149.90 - 150.09
150.10 - 150.29
150.30 - 150.49
150.50 - 150.69
150.70 - 150.89
150.90 - 151.09
151.10 - 151.29
>= 151.30

CLIENT:

Novus Green

Address: Plot NO100, "Siddhi"
1st and 2nd Floor, P & T Colony,Trimulgerry,
Secundrabad -50015,Telangana,India.
Email : info@novusgreen.in
Web : www.novusgreen.in

SURVEYED BY:

ARISYS TECHNOLOGIES

Address: 7-1-32/5/2
Leelanagar,Begumpet
Hyderabad-500016
Email : mail@arisys.in
Web : www.arisys.in

PROJECT TITLE:

BATHYMETRY SURVEY FOR INSTALLATION OF 10MWGRID CONNECTED FLOATING SOLAR POWER PLANT AT BALANCING RESERVOIR- SINGHARENI THERMAL POWER PLANT, PAGADAPALLI, MANCHERIAL DISTRICT, TELANGANA

DRAWING TITLE:

REDUCED LEVEL CHART

SCALE: 1:1500

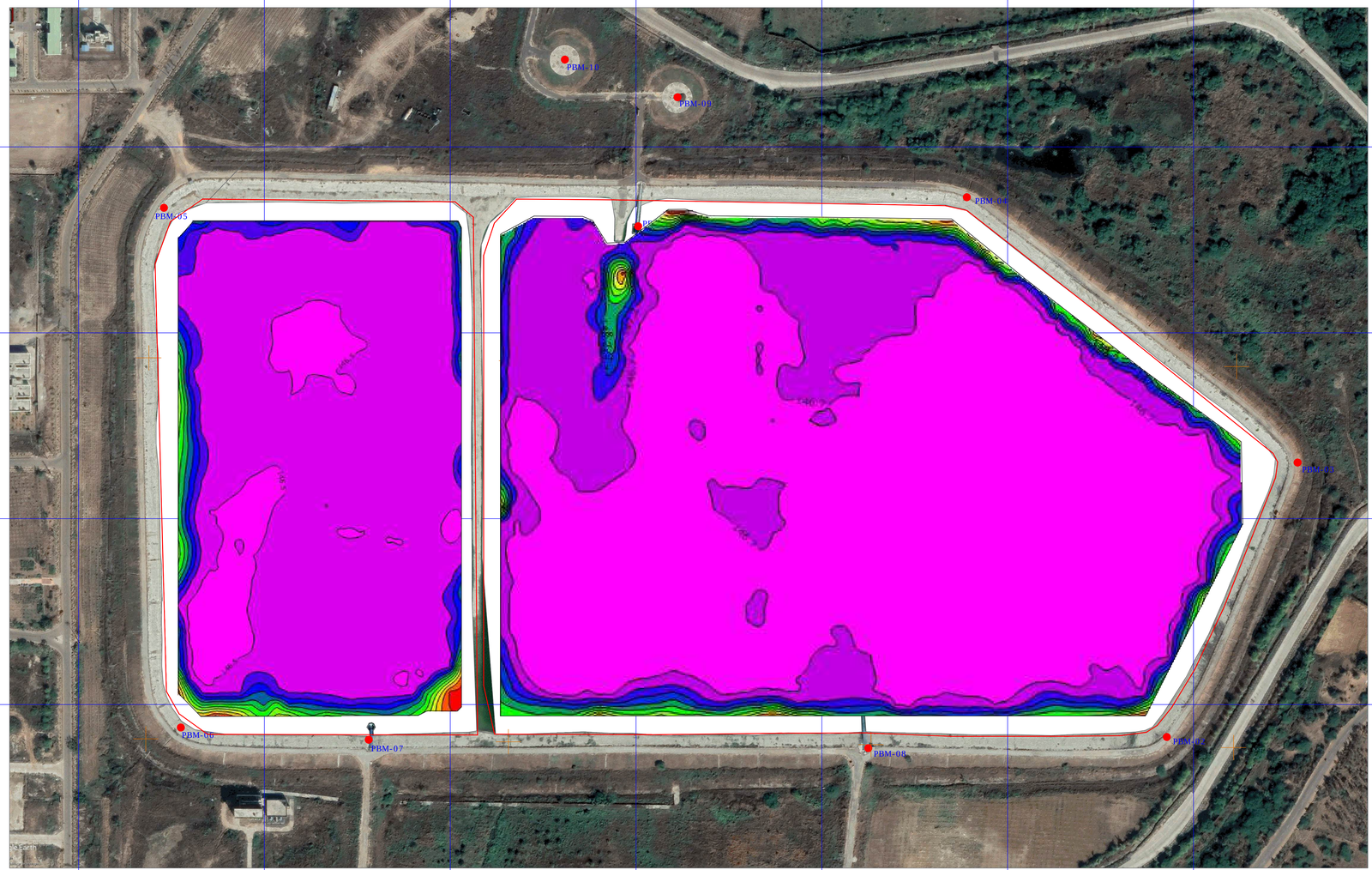
15 0 15 30 45 60 75 90 105 120 135 150 metres

Drawing No	ARS/2020/349/10/029/NG/HY/02		
Survey Dates	31/10/2020 to 02/11/2020		
Surveyed by	CH Ramesh & M Surya		
Prepared by	M Surya	REV-##	DATE
Checked by	VV Apparao	REV00	11-11-2020
Sheet No	01 of 01		

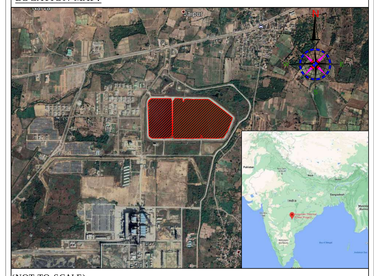
E349650 E349800 E349950 E350100 E350250 E350400 E350550 E350700 E350850

N2084100 N2083950 N2083800 N2083650 N2083500 N2083350 N2083200 N2083050

18°50'30" 18°50'20" 18°50'10"



LOCATION MAP:



(NOT TO SCALE)

NOTE:

(1) Soundings are reduced to water level scale at STPP Reservoir which is w.r.t MSL on 31-10-2020 & 01-11-2020.
(2) Differential GPS corrections from SBASS have been used for Horizontal Positioning.
(3) Odom Echotrac MKII dual frequency (200 kHz/33 kHz) Echosounder has been used for collecting soundings.
(4) All Levels are in metres.
(5) All dimensions are in metres.
(6) Please Refer to ARS/2020/349/10/029/NG/HY/FR/00.

GEODETIC PARAMETERS:

Spheroid	: WGS 1984 (Zone 44 N)
Datum Transformation	: None
Projection	: Universal Transverse Mercator (UTM)
False Easting	: 500000.0000m
False Northing	: 0.0000m
Central Meridian (CM)	: 081°00'00.00" East
Latitude of Origin	: 00°00'00.00" North
Longitude of Origin	: 081°00'00.00" East
Semi-Major axis (a)	: 6378137.000 m
Semi-Minor axis (b)	: 6356752.3142 m
Inverse flattening (1/f)	: 298.257223563
Scale factor at CM	: 0.999600
Units	: International Metres

LEGEND:

UTM GRID

GEOGRAPHICAL GRATICULE

0.5mtrs CONTOUR

DGPS OBSERVATION POINTS

R-1 COLOR SCALE :

151.5
151
150.5
150
149.5
149
148.5
148
147.5
147
146.5
146

R-2 COLOR SCALE :

151.2
150.7
150.2
149.7
149.2
148.7
148.2
147.7
147.2
146.7
146.2

CLIENT:

Novus Green
Address: Plot NO100, "Siddhi"
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PROJECT TITLE:

BATHYMETRY SURVEY FOR INSTALLATION OF 10MWGRID CONNECTED FLOATING SOLAR POWER PLANT AT BALANCING RESERVOIR- SINGHARENI THERMAL POWER PLANT, PAGADAPALLI, MANCHERIAL DISTRICT, TELANGANA

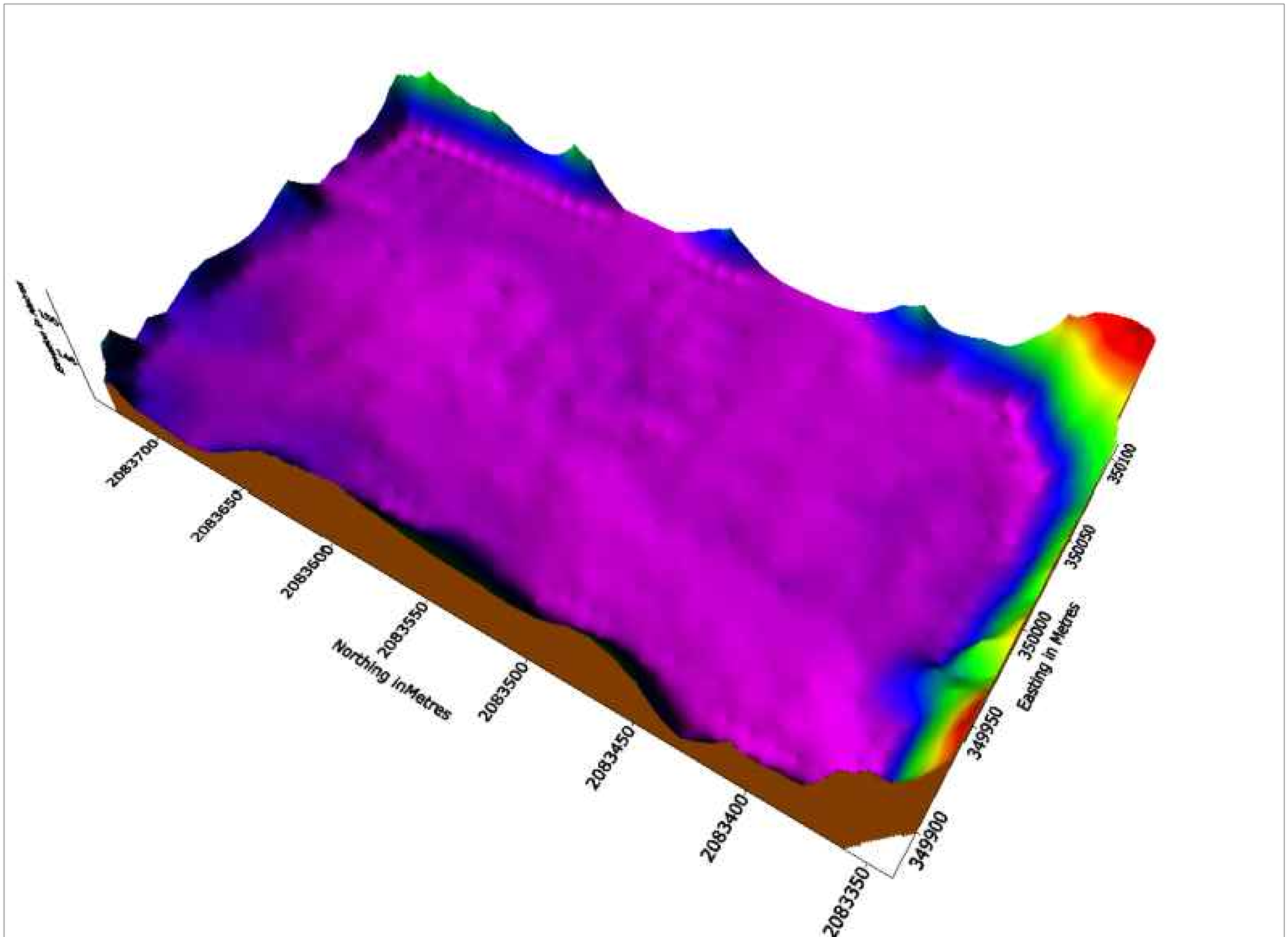
DRAWING TITLE:

RESERVOIR BED ELEVATION COLOUR CONTOUR MAP

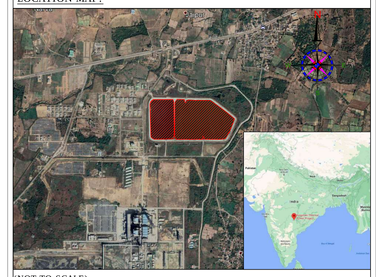
SCALE: 1:1500

15 0 15 30 45 60 75 90 105 120 135 150 metres

Drawing No	ARS/2020/349/10/029/NG/HY/03		
Survey Dates	31/10/2020 to 02/11/2020		
Surveyed by	CH Ramesh & M Surya		
Prepared by	M Surya	REV-##	DATE
Checked by	VV Apparao	REV00	11-11-2020
Sheet No	01 of 01		



LOCATION MAP:



(NOT TO SCALE)

NOTE:

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(6) Please Refer to ARS/2020/349/10/029/NG/HY/FR/00.

GEODETIC PARAMETERS:

Spheroid	: WGS 1984 (Zone 44 N)
Datum Transformation	: None
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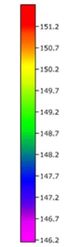
Semi-Minor axis (b)	: 6356752.3142 m
Inverse flattening (1/f)	: 298.257223563
Scale factor at CM	: 0.999600
Units	: International Metres

R-1 COLOR SCALE :



CLIENT:

Novus Green

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PROJECT TITLE:

BATHYMETRY SURVEY FOR INSTALLATION OF 10MWGRID CONNECTED FLOATING SOLAR POWER PLANT AT BALANCING RESERVOIR- SINGHARENI THERMAL POWER PLANT, PAGADAPALLI, MANCHERIAL DISTRICT, TELANGANA

DRAWING TITLE:

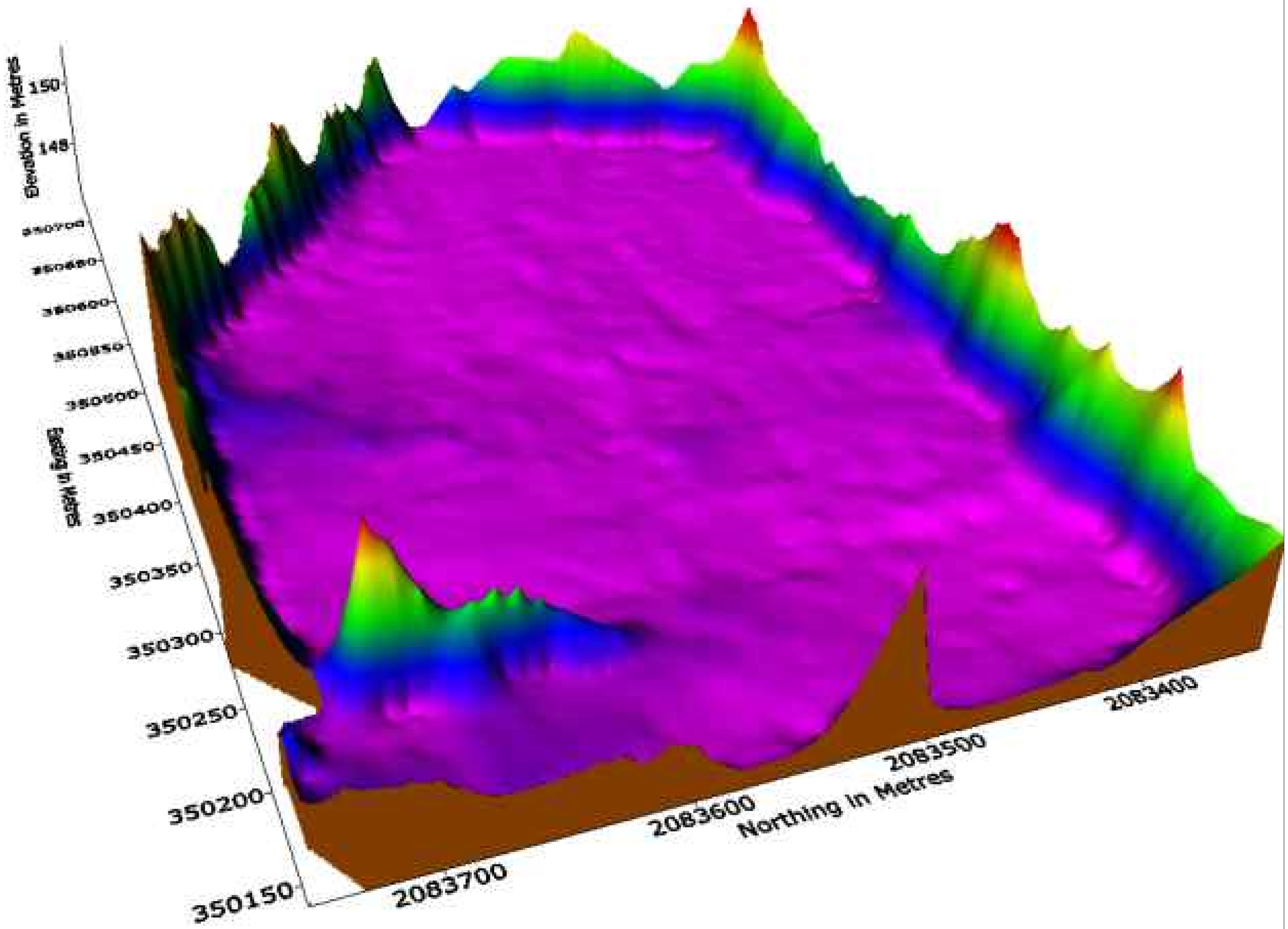
3-D VIEW OF RESERVOIR BED PROFILE - R1 AREA

SCALE:

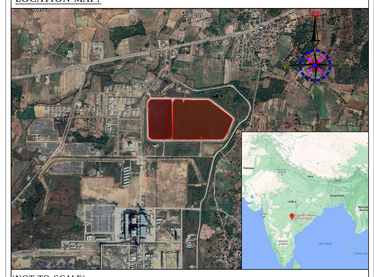
1:1500

15 0 15 30 45 60 75 90 105 120 135 150 Metres

Drawing No	ARS/2020/349/10/029/NG/HY/04		
Survey Dates	31/10/2020 to 02/11/2020		
Surveyed by	CH Ramesh & M Surya		
Prepared by	M Surya	REV-##	DATE
Checked by	VV Apparao	REV00	11-11-2020
Sheet No	01 of 01		



LOCATION MAP:



(NOT TO SCALE)

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Longitude of Origin	: 081°00'00.00" East
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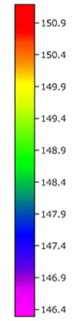
Semi-Minor axis (b)	: 6356752.3142 m
Inverse flattening (1/f)	: 298.257223563
Scale factor at CM	: 0.999600
Units	: International Metres

R-2 COLOR SCALE :



CLIENT:

Novus Green

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Secundrabad -50015,Telangana,India.
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SURVEYED BY:

ARISYS TECHNOLOGIES

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PROJECT TITLE:

BATHYMETRY SURVEY FOR INSTALLATION OF 10MWGRID CONNECTED FLOATING SOLAR POWER PLANT AT BALANCING RESERVOIR- SINGHARENI THERMAL POWER PLANT, PAGADAPALLI, MANCHERIAL DISTRICT, TELANGANA

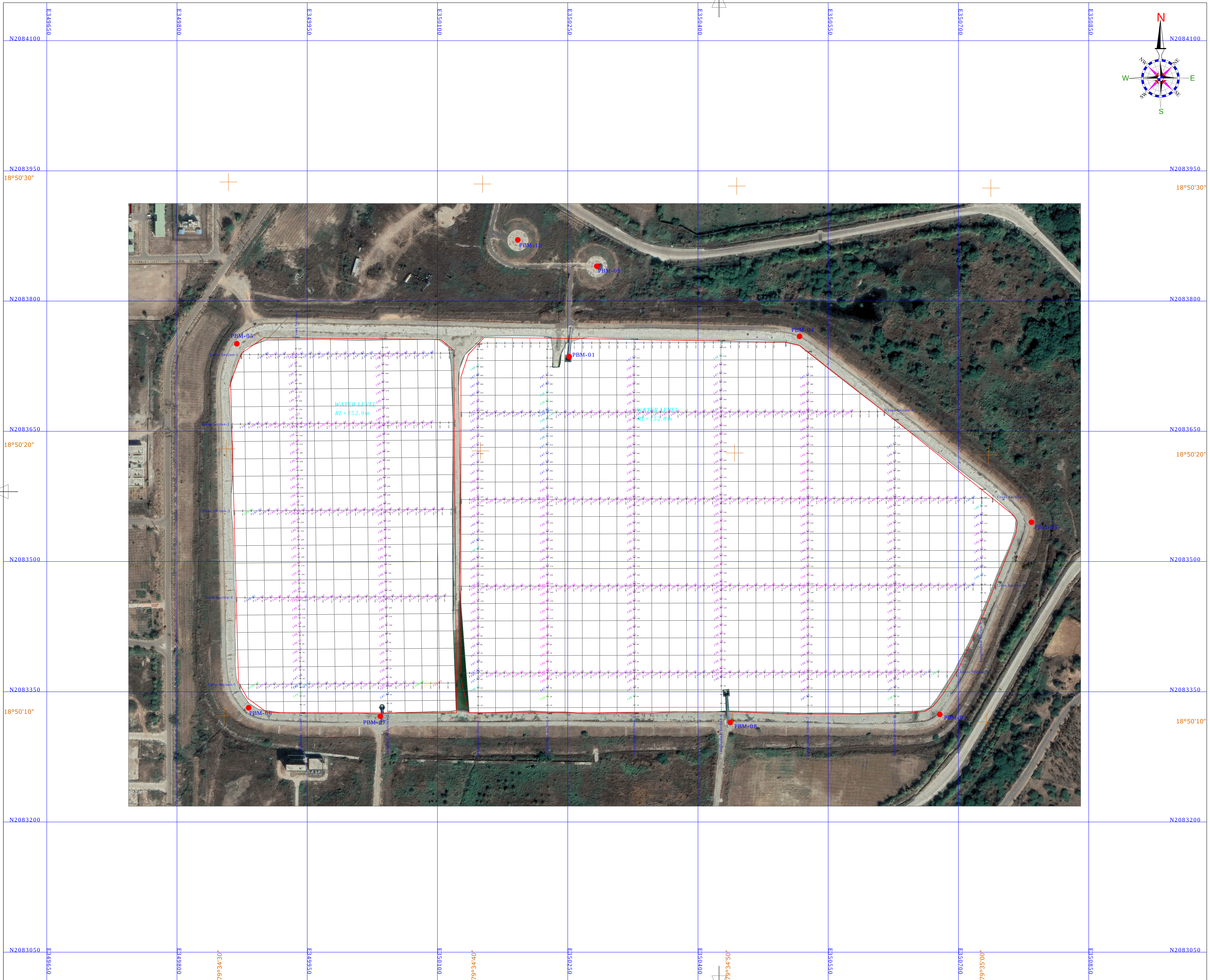
DRAWING TITLE:

3-D VIEW OF RESERVOIR BED PROFILE - R2 AREA

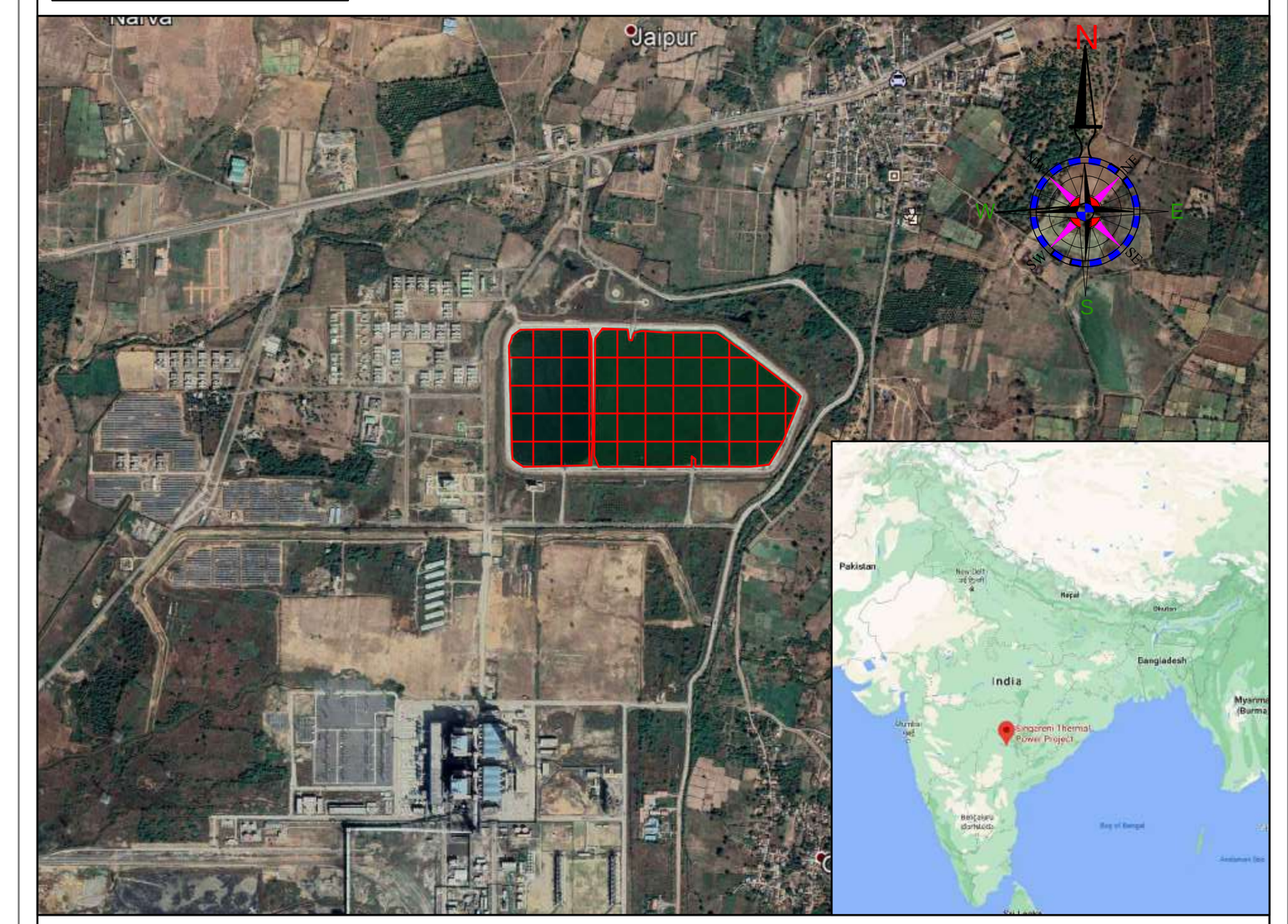
SCALE: 1:1500

15 0 15 30 45 60 75 90 105 120 135 150 metres

Drawing No	ARS/2020/349/10/029/NG/HY/05		
Survey Dates	31/10/2020 to 02/11/2020		
Surveyed by	CH Ramesh & M Surya		
Prepared by	M Surya	REV-##	DATE
Checked by	VV Apparao	REV00	11-11-2020
Sheet No	01 of 01		



LOCATION MAP:



(NOT TO SCALE)

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GEODETIC PARAMETERS:

Spheroid	: WGS 1984 (Zone 44 N)
Datum Transformation	: None
Projection	: Universal Transverse Mercator (UTM)
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False Northing	: 0.0000m
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Longitude of Origin	: 081°00'00.00" East
Semi-Major axis (a)	: 6378137.000 m
Semi-Minor axis (b)	: 6356752.3142 m
Inverse flattening (1/f)	: 298.257223563
Scale factor at CM	: 0.999600
Units	: International Metres

LEGEND:

- UTM GRID
- GEOGRAPHICAL GRATICULE
- RESERVOIR BED ELEVATIONS IN METRES
- DGPS OBSERVATION POINTS (PBM-06)

COLOR SCALE :

- < 146.50
- 146.50 - 146.69
- 146.70 - 146.89
- 146.90 - 147.09
- 147.10 - 147.29
- 147.30 - 147.49
- 147.50 - 147.69
- 147.70 - 147.89
- 147.90 - 148.09
- 148.10 - 148.29
- 148.30 - 148.49
- 148.50 - 148.69
- 148.70 - 148.89
- 148.90 - 149.09
- 149.10 - 149.29
- 149.30 - 149.49
- 149.50 - 149.69
- 149.70 - 149.89
- 149.90 - 150.09
- 150.10 - 150.29
- 150.30 - 150.49
- 150.50 - 150.69
- 150.70 - 150.89
- 150.90 - 151.09
- 151.10 - 151.29
- >= 151.30

CLIENT:

Novus Green

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PROJECT TITLE:

BATHYMETRY SURVEY FOR INSTALLATION OF 19.5MW GRID CONNECTED FLOATING SOLAR POWER PLANT AT BALANCING RESERVOIR- SINGARENI THERMAL POWER PLANT, PAGADAPALLI, MANCHERIAL DISTRICT, TELANGANA

DRAWING TITLE:

PROFILE PLAN MAP

SCALE:

1:1500

15 0 15 30 45 60 75 90 105 120 135 150 metres

Drawing No	ARS/2020/349/10/029/NG/HY/04A		
Survey Dates	31/10/2020 to 02/11/2020		
Surveyed by	CH Ramesh & M Surya		
Prepared by	M Surya	REV-##	DATE
Checked by	VV Apparao	REV00	19-11-2020
Sheet No	01 of 03		

W E

Water Level at Dam

Chainage	24.834	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000	190.000	200.000	210.000	220.000	226.355
Reservoir Bed Level	148.200	147.676	147.153	147.272	147.151	147.451	147.698	147.605	147.368	147.220	147.201	147.438	147.827	147.734	147.049	146.797	146.916	146.982	147.263	147.350	147.804	148.251

Cross Section-1

W E

Water Level at Dam

Chainage	16.970	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000	190.000	200.000	210.000	220.000	230.000	240.000	246.377
Reservoir Bed Level	147.654	147.433	146.935	146.843	146.830	146.752	146.705	146.658	146.545	146.447	146.400	146.345	146.339	146.429	146.510	146.586	146.651	146.702	146.720	146.696	146.665	146.628	146.685	147.189	148.409

Cross Section-2

W E

Water Level at Dam

Chainage	14.350	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000	190.000	200.000	210.000	220.000	230.000	240.000	244.355
Reservoir Bed Level	149.470	148.810	147.717	146.960	146.754	146.715	146.602	146.555	146.581	146.584	146.636	146.704	146.696	146.683	146.674	146.689	146.716	146.691	146.645	146.660	146.637	146.611	146.598	146.855	147.000

Cross Section-3

W E

Water Level at Dam

Chainage	11.720	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000	190.000	200.000	210.000	220.000	230.000	240.000	241.727
Reservoir Bed Level	149.334	148.064	146.721	146.520	146.484	146.432	146.467	146.548	146.611	146.668	146.590	146.569	146.605	146.590	146.537	146.569	146.553	146.558	146.568	146.553	146.510	146.559	146.628	147.102	147.198

Cross Section-4

S N

Water Level at Dam

Chainage	14.861	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000	190.000	200.000	210.000	220.000	230.000	240.000	250.000	260.000	270.000	280.000	290.000	300.000	310.000	320.000	330.000	340.000	350.000	360.000	370.000	380.000	390.000	400.000	410.000	414.901
Reservoir Bed Level	149.696	149.453	148.278	147.586	147.051	146.709	146.531	146.510	146.525	146.536	146.528	146.513	146.493	146.488	146.483	146.460	146.460	146.439	146.430	146.446	146.513	146.561	146.546	146.580	146.630	146.658	146.664	146.654	146.644	146.642	146.681	146.710	146.699	146.725	146.762	146.810	146.885	146.952	146.952	146.996	147.146	147.301

Longitudinal Section-1

W E

Water Level at Dam

Chainage	11.047	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000	190.000	200.000	210.000	220.000	230.000	240.000	247.758
Reservoir Bed Level	150.961	148.787	147.161	147.107	147.171	147.386	147.969	147.906	147.231	147.060	147.024	146.967	146.948	146.885	146.739	146.708	146.766	146.767	146.709	147.179	148.972	150.312	151.608	151.601	151.461

Cross Section-5

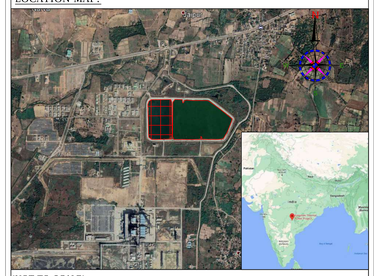
S N

Water Level at Dam

Chainage	13.311	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	170.000	180.000	190.000	200.000	210.000	220.000	230.000	240.000	250.000	260.000	270.000	280.000	290.000	300.000	310.000	320.000	330.000	340.000	350.000	360.000	370.000	380.000	390.000	400.000	410.000	413.350
Reservoir Bed Level	148.799	147.924	146.998	146.675	146.668	146.673	146.694	146.642	146.598	146.571	146.564	146.532	146.541	146.551	146.523	146.516	146.546	146.588	146.574	146.554	146.598	146.675	146.714	146.679	146.686	146.701	146.694	146.651	146.612	146.602	146.572	146.585	146.654	146.695	146.706	146.679	146.660	146.652	146.677	146.701	146.744	146.881

Longitudinal Section-2

LOCATION MAP:



(NOT TO SCALE)

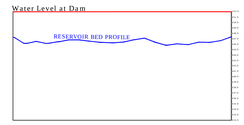
NOTE:

(1) All Levels are in metres.

(2) All dimensions are in metres.

(3) Please Refer to GS/2020/349/10/029/AR/HY/FR/00.

LEGEND:



CROSS SECTION - ---

LONGITUDINAL SECTION - ---

Horizontal Scale - 1:2000

Vertical Scale - 1:400

MDDL - MINIMUM DRAW DOWN LEVEL

CLIENT:

Novus Green

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PROJECT TITLE:

BATHYMETRY SURVEY FOR INSTALLATION OF 19.5 MWp GRID CONNECTED FLOATING SOLAR POWER PLANT AT BALANCING RESERVOIR- SINGARENI THERMAL POWER PLANT, PAGADAPALLI, MANCHERIAL DISTRICT, TELANGANA

DRAWING TITLE:

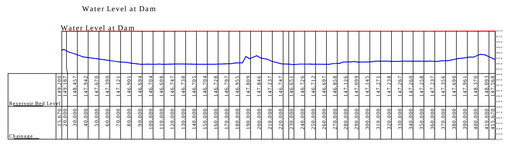
CROSS & LONGITUDINAL SECTIONS OF RESERVOIR BED PROFILE LS-1 TO LS-2 & CS-1 TO CS-5

SCALE: Horizontal Scale-1:1000,Vertical Scale-1:200

10 0 10 20 30 40 50 60 70 80 90 100 metres

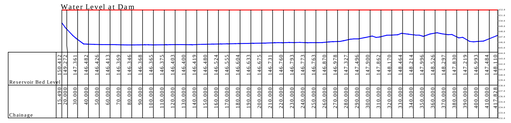
Drawing No	ARS/2020/349/10/029/NG/HY/04B		
Survey Dates	31/10/2020 to 02/11/2020		
Surveyed by	CH Ramesh & M Surya		
Prepared by	M Surya	REV-##	DATE
Checked by	VV Apparao	REV00	19-11-2020
Sheet No	02 of 03		

S N



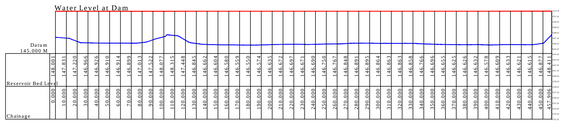
Longitudinal Section-3

S N



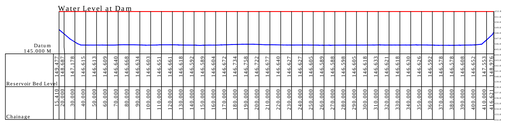
Longitudinal Section-4

W E



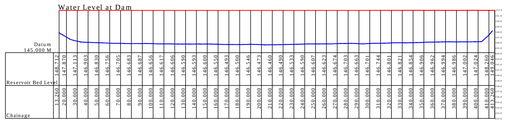
Cross Section-6

S N



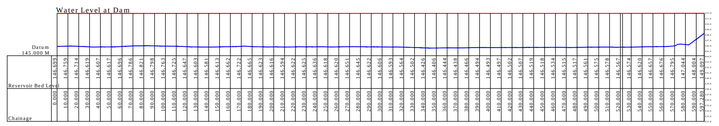
Longitudinal Section-5

S N



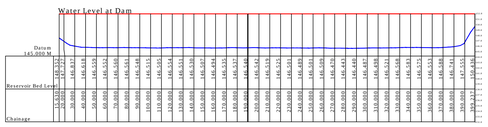
Longitudinal Section-6

W E



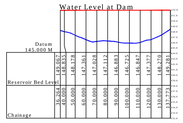
Cross Section-7

S N



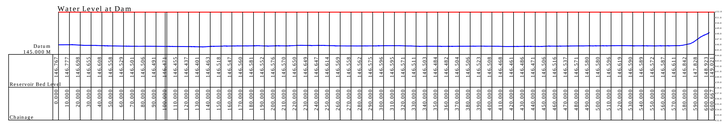
Longitudinal Section-7

S N



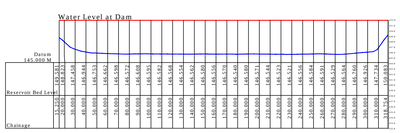
Longitudinal Section-9

W E



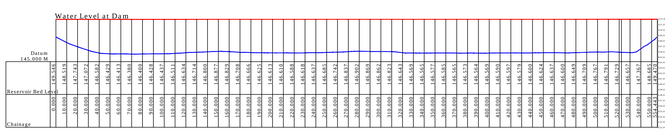
Cross Section-8

S N



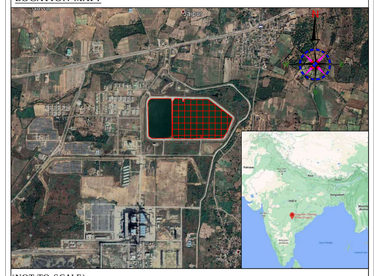
Longitudinal Section-8

W E



Cross Section-9

LOCATION MAP:



(NOT TO SCALE)

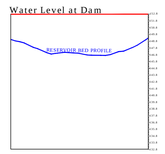
NOTE:

(1) All Levels are in metres.

(2) All dimensions are in metres.

(3) Please Refer to GS/2020/349/10/029/AR/HY/FR/00.

LEGEND:



LONGITUDINAL SECTION - -.--
Horizontal Scale- 1:2000
Vertical Scale- 1:400
MSSL - MINIMUM DRAW DOWN LEVEL

CLIENT:

Novus Green

Novus Green
Address: Plot NO100, "Siddhi"
1st and 2nd Floor, P & T Colony,Trimulgerry,
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SURVEYED BY:

ARISYS TECHNOLOGIES
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Leelanagar,Begumpet
Hyderabad-500016
Email : mail@arisys.in
Web : www.arisys.in

PROJECT TITLE:

BATHYMETRY SURVEY FOR INSTALLATION OF, 19.5Mwp GRID CONNECTED FLOATING SOLAR POWER PLANT AT BALANCING RESERVOIR-SINGARENI THERMAL POWER PLANT, PAGADAPALLI, MANCHERIAL DISTRICT, TELANGANA

DRAWING TITLE:

CROSS & LONGITUDINAL SECTIONS OF RESERVOIR BED PROFILE LS-3 TO LS-9 & CS-6 TO CS-9

SCALE: Horizontal Scale-1:2000,Vertical Scale-1:400

20 0 20 40 60 80 100 120 140 160 180 200 metres

Drawing No	ARS/2020/349/10/029/NG/HY/04C		
Survey	31/10/2020 to 02/11/2020		
~~Date~~			
Surveyed by	CH Ramesh & M Surya		
Prepared by	M Surya	REV-##	DATE
Checked by	VV Apparao	REV00	19-11-2020
Sheet No	03 of 03		