

STATEMENT OF QUALIFICATIONS

SURVEYING AND MAPPING



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1 Executive Summary

SECON Private Limited is an ISO 9001:2008 certified, NABL Accredited, GIS Driven Multidiscipline Engineering Company. SECON is a financially sound, stable, zero-debt Company that was established in 1981. SECON is one of the leading multidiscipline engineering consulting firms and one of the largest and oldest Surveying and Mapping firms in India. Most of SECON's clients are repeat and long-term clients.

The key differentiator for SECON is that the company is a well-established (established in 1981) financially stable (Zero Debt and Consistently Profit Making) Multidiscipline Mapping and Engineering firm that provides a total solution from a single window for the entire lifecycle of an Infrastructure development project.

The domain expertise of SECON comprises:

Design Consultancy and Engineering Services	Investigation and Services
<ol style="list-style-type: none"> 1. Irrigation, Flood Control and Water Management 2. Water, Sanitation and Storm water Engineering(Public Health Engineering) 3. Highway Engineering and Construction Supervision 4. Electrical Network Distribution Engineering 5. Oil and Gas Pipeline Transportation Routing and Feasibility 6. Web enabled GIS Driven Software Development and Database Creation for Infrastructure. 7. Software development to improve productivity for Engineering Design and Drafting (CAD) fields. 8. Civil and Structural Design 9. Town Planning and Urban Development 10. Environmental Engineering and Environmental Impact Assessments and Permitting 11. Assistance in Right of Use Acquisition and Permitting 	<ol style="list-style-type: none"> 1. Land Surveying for Topographic, Cadastral Mapping, Construction Supervision and Hydrographic Surveys 2. Geotechnical Engineering and Soil Investigations 3. Water Distribution System Leak Detection, Rehabilitation and GIS Based Asset Management Services 4. Photogrammetry, LiDar, Satellite Image Processing and Remote Sensing and generation of 3D Digital Terrain and City models. 5. GIS Data Conversion and Maintenance 6. Route Planning, 3D Corridor Mapping, Generation of GIS database 7. Ground water and Resistivity Surveys 8. Underwater Leak Detection and Turnkey Solutions 9. Exploration, Mine Survey & Planning 10. Terrain Evaluation and Geological Appraisal 11. Detection of Underground Utilities using Ground Penetrating Radar and Associated Tools.

SECON is the only firm in India to offer a Total Solution for Mapping, Infrastructure Investigation, Engineering Design and Construction Supervision. All of these services are offered wholly in-house by SECON.

SECON's over **3 decades of mapping experience** in Land Surveying, Photogrammetry, LiDAR Data Acquisition and Processing, and Remote Sensing, gives it a significant advantage for advanced mapping since it has a comprehensive combined experience in all of the above technologies.



Statement of Qualifications, Surveying and Mapping

SECON has long-term partnerships with International Engineering and Mapping Firms across Asia, North America, Africa, Middle East, Europe and Australia and has executed both Engineering and Mapping projects in these areas for its clients.

SECON is registered with Asian Development Bank (ADB) and DACON (World Bank) to provide consultancy services.

SECON has been awarded the 3rd CIDC Vishwakarma Award 2011. This is a National Award for Projects of National Excellence.

SECON has been awarded the best services Export Excellence Award-2010 by Federation of Chamber of Commerce and State Bank of India.

SECON has the following standing in India:

- The largest private Land Surveying and Mapping firm in India for Topographic and Cadastral Surveys.
- One of the Largest and most Experienced Firms for Land Acquisition Assistance for Pipeline, Highway and other Linear Corridor and Large Area projects. SECON has developed Customized Web Enabled Software for Data Management and Administration of this Complex Process which have included the compilation and data management more than 10 million parcels compiled by SECON as of date (including field data collection).
- One of the leading private Mapping and Design firm for Irrigation and Water Management projects.
- One of the largest private Highway Mapping, Design and Construction Supervision firms in India.
- One of a handful of firms in India to have the NABL certification for its Geotechnical Laboratory. NABL is the National Accreditation Board for Testing and Calibration Laboratories (NABL).

Government of India has authorized NABL as the sole accreditation body for Testing and Calibration laboratories.

- The first private company to execute LiDAR flying and processing services in India. SECON now one of the largest LiDAR Data processing company in India.

SECON has executed over:

- 65,000 km of large-scale Pipeline Corridor Mapping – this includes Route Engineering, Topographical and Cadastral Mapping and Rights-of-Way Acquisition assistance and management. This is the largest amount of Pipeline Corridor mapping done by any corporation in India.
- 15000 km of mapping, design, and construction supervision of highways
- 11950 sq km of large-scale mapping (topographical and cadastral) for Irrigation projects. This includes the Topographic and Cadastral Mapping of 6000 Sq Km for the World Bank Aided Uttar Pradesh Water System Restructuring Project.
- 7950 Sq Km of Irrigation and Water Management design projects. SECON is currently executing and Irrigation Mapping and Design Project for an area of 14000 sq km for the Narmada River Basin in Madhya Pradesh. This project was done by mapping with a combination of High Resolution (0.5 m) Stereo Satellite Imagery and Land Survey Method. This technology is being used for the first time in India for an Irrigation and Water Management project.

Statement of Qualifications, Surveying and Mapping

- 600 infrastructure development projects (includes subdivision/township mapping, design and planning) which includes construction supervision and quality control for the International Tech Park (ITPL) in Bangalore.
- 600,000 meters of geotechnical investigation and drilling in various soil strata including investigations for the Bangalore International Airport.
- SECON has completed a major multimillion dollar mapping and consulting project for the planning and design of the Water and Sanitation system for 13 municipalities (100 settlements) in Libya. The capital expenditure of the project is around 2.5 billion US\$.
- SECON has successfully completed the Multi Million Dollar Contract for Project Management Consultancy Services for Up Gradation of important Road Corridors in Bangalore Urban and Rural Districts for a length of 1004 Km. Estimated capital expenditure of the project is 9.96 Billion Rupees(US \$ 220 million).
- SECON has successfully completed more than 500,000 Sq Km of LiDar, Photogrammetry and Remote Sensing Projects as of August 2010.

SECON has a state of the art 105,000 sq ft ISO 9001:2008 certified operations center set on a 2.5 acre campus in Bangalore, India that is fully owned by the company. Bangalore is the technology capital of India and is globally recognized for its technical excellence.



2 SURVEYING AND MAPPING

2.1 Introduction

SECON is one of the largest Surveying Firms in India having almost 3 decades (Established 1981) of experience having executed projects to Government, Public and Private Sector Organisations.

SECON offers comprehensive Surveying Services in-house, which includes Precision Ground Control, Map Compilation by Photogrammetry, LiDAR and Processing of Satellite imagery supplemented by Ground Truthing. SECON has executed one of the largest World Bank aided Land Survey Project in India covering 600,000 Ha in the World Bank Aided Project in Uttar Pradesh. SECON has also completed the Survey of 22 Cities in Gujarat. City and Survey of 100 Towns in Libya

Land is the one of the most disputed assets among people. This is because of lack of proper ownership details and digital land records.

To avoid disputes the land records has to be regularized and authenticated ownership details should be scrutinized and digitized records in the name of the owner of the property should be issued. To carry out this plan Surveying plays an important role.

SECON also as Service Provider operates and maintains the Citizen Service Centers and Back Office. Maintaining and preserving spatial and non-spatial data relating to ownership of properties. Creation of property ownership records, by Survey Mapping and Enquiry, Generation of Maps and Sketches of each property along with Ownership and other land related details and maintenance of the same.

2.2 Human Resources

The Team Composition is a very good mix of Senior and Experienced Engineers having held responsible positions in their respective fields in both public and private sectors and has successfully implemented various infrastructural schemes. The staff composition chart is as follows.



3 Facilities

3.1 Equipment

Type of Instrument	Accuracy Level
DGPS	3mm+ 0.5ppm
Electronic Total Station	1mm + 1ppm, 2mm + 2ppm, 5mm + 2ppm
Hand Held GPS	15m (49ft), <3m, 95%typical, 1 - 5 m (3-15ft), 3m (WAAS), 15m,-95% typical, 2m-to-5m positioning acc
Electronic Distance Meter	+0.1% (100*100mm), +0.2% (100*100mm)
Digital Level	0.9mm with invar staff & 1.5mm
Automatic Level	+/-0.08mm to 2.5mm per Km in double run, 1/16" @ 200 ft, 0.9mm with invar staff & 1.5mm

3.2 Software

Land acquisition using proprietary software - ROU Master

SECON has developed proprietary software called ROU Master which helps in the automation of the land acquisition process. The laborious task of generating Notifications and Notices is now simplified by this application.

Other software's developed by SECON in-house for Survey and Mapping

- Based on the response and waiting time at the Service Center, SECON will procure a Electronic Queue Management System (EQMS)
- E Token Dispensing System
- Software to integrate E Token Dispensing System with UPR system
- Software to track downtime of Internet connectivity

4 SERVICES OFFERED

- Topographical Survey
- Cadastral Survey
- Engineering and Hydrographic Survey
- Mapping

4.1 Topographical Survey

Scope of work generally includes control survey, monumenting, frame work for planimetric and height control, using DGPS, Total Stations, EDMs, Precision Theodolites and Automatic levels. Property line survey, validation, topographical and precision engineering survey and setting out for land development works.

Field data and sections are plotted, digitized and DTM output is supplied to the client together with a survey report.

Hydrographic survey work include control survey, sub-bottom profiling, related investigations by using DGPS, Eco Sounders and Lead Lining, depending on site condition.

Other services include tidal observations, harmonic analysis, study of current and wave analysis and related Ocean Engineering services up to limited water depth.

The Survey shall include the following:

- Desk top Study
- Planning of control network
- Ground Reccee
- Monumentation and Embedding of Control Pillars
- DGPS Survey
 - Observation
 - Post Processing
 - Levelling
- Electronic Total Station
 - Traversing
 - Observation
 - Computations
 - Capturing the detail
 - Boundary Survey
- Accuracy
 - Levelling
 - Traverse

Demarcation of the project area boundary to be carried out in the presence of client, by fixing flag points at the bends.

Collection of underground and above surface utility drawings of the adjoining property areas is essential for infrastructure projects.

Spot heights to be collected at all the definable points, in addition to the detail survey at specified intervals in order to bring out the true shape of the terrain.

Handheld GPS instruments may be used in averaging mode for 30 minutes observation period during good satellite strength for obtaining positional co ordinates in WGS 84 Ellipsoid, UTM grid projection, if the positional accuracy requirement is in the range 1 to 5 m.

4.2 Cadastral Survey

Cadastral Survey is most complex and complicated activity. Hence, considerable effort is required to source and update cadastral data. Superimposition of Cadastral Map on Topographical Map is an important issue because of scale error. Hence, during topographical survey stage itself, salient cadastral survey details such as village tri-junctions, important field bunds, nala and track junctions that appear in village maps will be co-ordinated and heighted to facilitate easy rubber sheeting.

Project area falling under different districts will be superimposed on the respective District and Tehsil Revenue Maps to identify the names of villages. The maps of these identified villages will be collected from the Revenue Department. Information about land records will also be collected from the Revenue

Department to store the data in different layers (GIS). All the established control points will be transferred on the village maps.

The following activities will be carried out

- Collection of Village Maps, marking and verification of existing / proposed road network.
- Scanning, vectorisation and mosaicing of village maps
- Identification of the affected survey numbers
- Collection of ownership details of the affected survey numbers
- Preparation of Land Acquisition Plan and Schedules
- Format for cadastral and text data
- Digitization of cadastral data
- GIS layers

4.3 Engineering and Hydrographic Survey

Hydrological survey include study of upstream and down stream bank and bed conditions, data collection regarding high flood / high tide levels for calculation of scouring depth. Catchment area and hydraulic model study, discharge to design waterways.



- Control Survey, monumentation for planimetric and height control
- Rapid updation and large scale surveys using satellite imagery and aerial photographs
- 3D contouring, terrain modeling and deformation study
- Property line survey, validation for large infrastructure projects
- Alignment surveys for utilities
- High precision engineering survey and setting out
- Sub bottom profiling and related investigations
- Route optimization of navigation channels.
- Ocean engineering, harmonic analysis for tides, current and wave studies

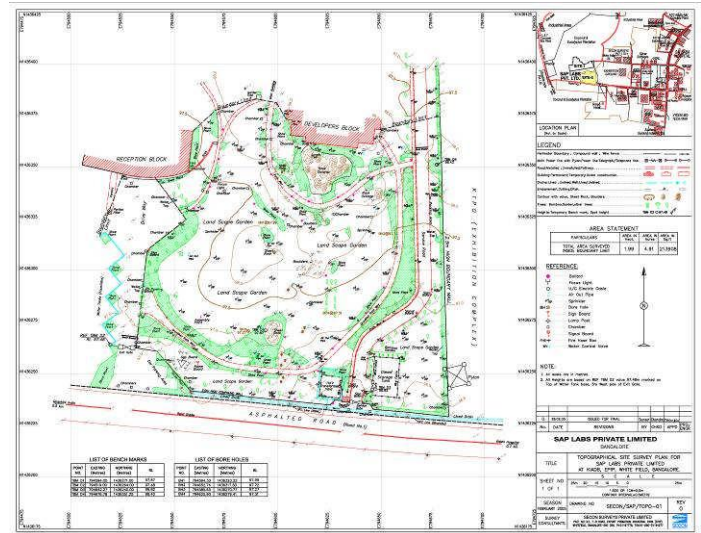
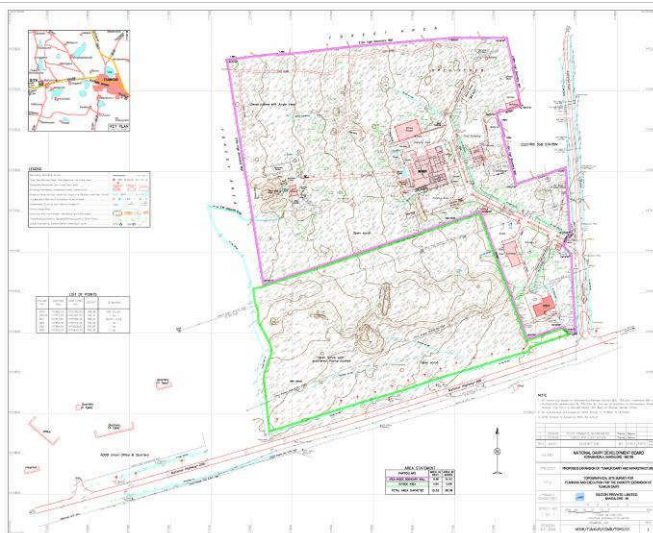
4.4 Mapping

4.4.1 Preparation of Maps

Other than CAD software's, MS office, etc. following SECON's in-house developed software's will be used for speedy & efficient data processing and for generation of required outputs.

- Automap software for downloading Total station Data and Mapping
- LS/CS Generator software for Automatic Generation of LS/CS Drawing
- SECON Cad software for control point plotting & general mapping

The following typical maps are generated using the above mentioned software:



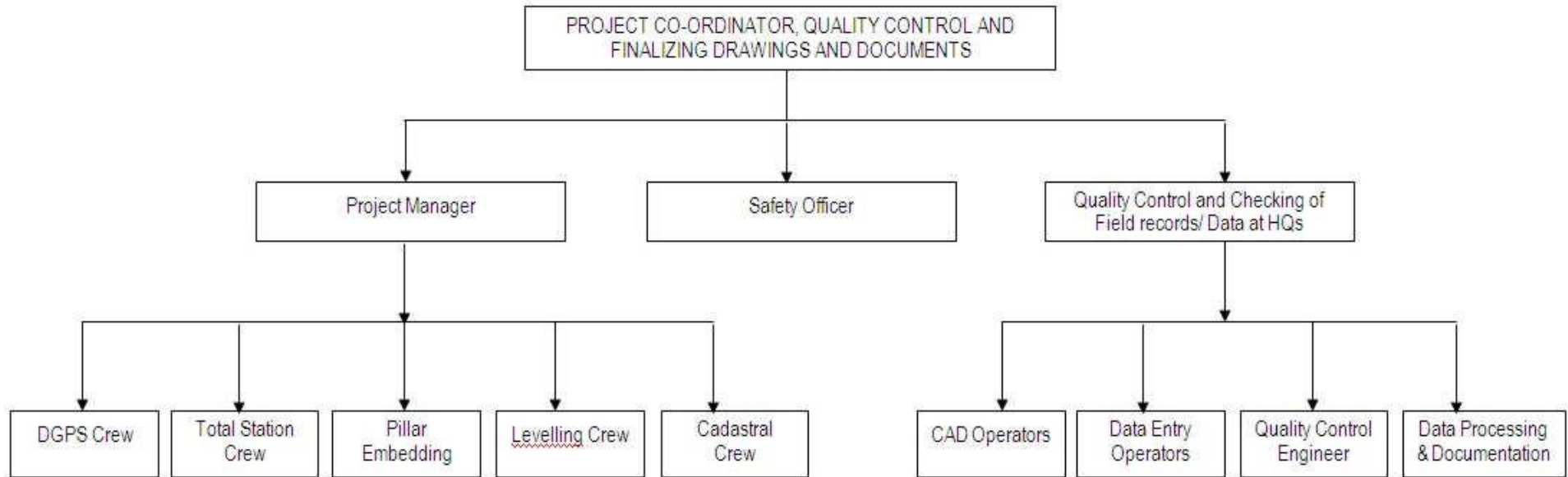
Preparation of **Digital Land Parcel Map** using the following latest survey methods:

- Using Aerial Photos
- Using High-Resolution Satellite Images
- Using Ground/Field Methods

Other Major Activities included are listed below:

- Establishment of Survey Control Network.
- Geo-referenced Village Maps
- Serving Notices.
- Identification and Marking of property Boundary Corner Points.
- Measurement of co-ordinates of property Boundary Corner Points.
- Collection, compilation and comparison of Ownership related data
- Non-Spatial Data Collection
- Creation of Property Ownership Records
- Mapping of Properties
- Creation of a comprehensive Cadastre
- Continuous management and maintenance of property records
- Enquiry into Ownership
- Finalization of Property Records.
- Establishment and Maintenance of CFC.
- Data Capture, Data Processing, Digitization and compilation of maps

5 Organization Chart for Survey



6 Relevant Project Experience

Relevant experience gained in executing major Projects are listed below

- Detailed Engineering Survey, Preparation of Map using 0.6m resolution Quick Bird Images, Investigation for Planning and Design of Water Supply, Sewerage and Storm Water Drainage System, Electrical Power Network, Road Lighting System, Telecommunication Distribution Network System and Road Network for 100 Towns in Tripoli Region, Libya.
- World Bank Aided Topographic and Cadastral Survey & Preparation of Land Records in Sub - Basin areas of Uttar Pradesh for an area of 6068 Sq. Km.
- Topographical and Cadastral Survey Work of road corridors for Satellite Town Ring Road, Intermediate Ring Road, Radial Roads and Individual Town Ring Roads for all the Taluks of Bangalore District under NHDP Phase VII Programme for 1100 Kms
- Preparation of Base Map of 12 Cities covering an area of 2500 Sq Km in Gujarat for Planning Gas Grid and Development of Web based GIS Application with Utility Network details, Roads etc
- Provision of detailed Topographical Survey for 6500 acres
- Joint Measurement Survey by using Electronic Total Station including Demarcation and Taking Longitudinal Section of Canal and Preparation of Pucca Proposal for Land Acquisition of Distributaries / Minor Canals covering an area of 5,388 Ha
- Establishment of Precision DGPS Control Points & Carrying out Traverse in between DGPS Points, Leveling using Digital Level including Detail Survey of 30 m corridor along East - West and North - South Corridors for a length of 44.10 Km
- Aerial Survey for Flood Assessment for Northern Area Development Project in Block RJ-ON-90/1, Rajasthan for an area of 250 Sq Km
- Topographical Survey, Generation of sectional drawings including Geotechnical Investigation for the proposed expansion at Bangalore International Airport, Devanahalli for 5500 acres
- Consultancy Services for setting up Brackishwater Shrimp Farms, under World Bank Aid, at Bideipur and Narendrapur in the states of Orissa and P.T. Palem in Andhra Pradesh for 4300 Ha
- Survey Work and Preparation of Land Plan of National Highways in the state of Karnataka (Length 629 Km)
- Implementation of Urban Property Ownership Records for 2,00,000 Properties for Mysore city, Karnataka

Sl. No	Assignment Name	Assignment Highlights
1	Detailed Engineering Survey, Preparation of Map using 0.6m resolution Quick Bird Images, Investigation for Planning and Design of Water Supply, Sewerage and Storm Water Drainage System, Electrical Power Network, Road Lighting System, Telecommunication Distribution Network System and Road Network for 100 Towns in Tripoli Region, Libya.	<p>Base Map was prepared using 0.6m high resolution Satellite Imagery. DGPS and Total Stations were used for control with respect to pre-established control locations having x,y,z co-ordinates. The city maps were scanned, mosaiced and digitized to generate GIS database for subsequent planning and Design of Water, Sewerage, Storm Water, Road, Power and Telecom Network.</p> <ul style="list-style-type: none"> • 15 Electronic Total Stations were deployed for 16 months • Spatial Data processed for an area covering 250 Sq Km. • For Survey Part : 18,198 No. of Maps prepared on 1:1000 / 1:2000 / 1:5000 scale • For Design Part : 32,493 No. drawings prepared on 1:1000 scale • Rectification of 0.6m High Resolution Satellite Image and GIS database creation using ERDAS & ESRI Products.
2	World Bank Aided Topographic and Cadastral Survey & Preparation of Land Records in Sub - Basin areas covering an area of 6068 Sq Km	<ul style="list-style-type: none"> • Establishment of high precision Ground control points based on Survey of India GTS framework, Topographical Survey using modern Digital Instruments, Total Stations, Differential GPS and Computerisation of information. • Cadastral survey, collection of maps, data, scanning, geo- referencing, superimposition, rubber sheeting of revenue survey maps. • Land information data shape file includes area of each village, parcel, cultivated land with / without irrigation facilities, waste land, forest land, ownership detail, 7/12 extract, type of land, documentation of revenue records, digitisation of survey numbers, extent of land and compilation of combined topographical and village maps. • Integrated multi component Cadastral Survey in a Geo-referenced UTM grid system. • Creation of GIS database, Development of Irrigation Resource Information System (IRIS) and installation. • Collecting information of all water abstraction structures, Geographic data acquisition, Digital Photographs Storing, Processing and Generation of GIS Database for easy updation, compatible and accessed by GIS / CAD Programmes for Engineering Application and Land Information System. • Prioritisation, Project Planning, Watershed management for optimization of natural and manmade resources, • Generation of customized Drawings, seamless Maps by automated software tools for Engineering Design and Rehabilitation • Transfer of Technology and Training of Departmental personnel in automated tools, GIS

Sl. No	Assignment Name	Assignment Highlights
		functions etc.
3	Topographical and Cadastral Survey including Property Inventory and Preparation of Base Map using high resolution 0.6 m Quick Bird Satellite Imagery for planning Integrated Road Network connecting Satellite Town Ring Road, Intermediate Ring Road, Radial Roads and Individual Town Ring Roads for all the Taluks of Bangalore District under NHDP Phase VII Programme for 1100 Km	<ul style="list-style-type: none"> • Preparation of Base Map using Satellite Images and superimposing proposed Development Plans. • Desktop Study and Reconnaissance Survey to finalise Bypass (to avoid major Settlements), Detours (to have proper Geometrics) and locations for Control Points. • Establishing precision Ground control points. • Data Capture on finalized alignment and Preparation of Planimetry Drawings. • Collection of District, Taluk, Village Maps and Land Parcel Maps. • Cadastral Survey and Joint measurement • Superimposing Planimetry Drawings on Village Maps and Field Verification. • Collection of Ownership details for affected Survey Numbers. • Preparation of Village wise Land parcels Maps
4	Preparation of Base Map of 12 Cities in Gujarat for Planning Gas Grid and Development of Web based GIS Application with Utility Network details, Roads etc for an area of 2500 Sq Km	<ul style="list-style-type: none"> • Procurement of 0.6m High Resolution Quick Bird Satellite Images from NRSC • Establishment of GPS Control Points • Preparation of Base map at 1:3000 scale and Superimposing Details of Pipeline Network such as Steel Pipeline, Feeder Pipeline, Polyethylene Network etc. • As-built integration and Consumer Database Geo Coding. • Site validation and Attribute Data Collection as per the data dictionary for utilities like Telephone poles, Electric poles, Transformers and Sewer Manholes. • Generation of final Base Map and GIS Geodatabase Creation of the area under study. • Development and Customisation of Web based City Gas GIS application with user friendly tools. • Installation of the client server architecture system in client LAN/WAN • Training Manual Preparation and conducting full time training to client staff.
5	Joint Measurement Survey by using Electronic Total Station (ETS) including Demarcation, Preparation of Pucca Proposal for Land Acquisition of Tributaries / Minor	<ul style="list-style-type: none"> • Establishment of high precision Ground Control Points, Topographical Survey using modern Digital Instruments, Total Stations, Differential GPS and Computerisation of information. • Cadastral survey, Joint measurement, Area calculation for land parcels and collection of ownership details (7/12). • Generation of customized Drawings, seamless Maps by automated software tools, for

Sl. No	Assignment Name	Assignment Highlights
	Canals covering an area of 5388 Ha	<p>Engineering Design and Rehabilitation</p> <ul style="list-style-type: none"> • Transfer of Technology and Training of Departmental personnel in automated tools, GIS functions etc. • Taking of L-Section of Canal and preparation of Pucca Proposal for Land Acquisition of Distributaries and Canals. • Computerized Joint Measurement Sheet duly superimposing the field survey bunds and Tippan /FMB. • Land Acquisition Schedule as per land acquisition act 4(i). • Land Acquisition Statement • Kami Jasti Patrak • Land Acquisition Statement for acquisition of land for construction of canal showing details of survey nos. and signed Tukda Patrak
6	Aerial Survey for Flood Assessment for Northern Area Development Project in Block RJ-ON-90/1, Rajasthan for an area of 250 Sq Km	<ul style="list-style-type: none"> • Obtaining Flying Permission from Ministry of Defence / Govt. of India. • Flight Planning and Scheduling • Aerial Photography and processing • Establishment and Processing of Ground Control Points by DGPS observations • Carrying out Cadastral Survey, Collection of ownership details and documentation.
7	Topographical Survey, Generation of sectional drawings including Geotechnical Investigation for the proposed expansion at Bangalore International Airport, Devanahalli for 5500 acres	<ul style="list-style-type: none"> • Carrying out topographical survey on 1:7500 scale showing all topographical and cultural features including sheet rocks and their extent, levels at every 25 meters and contour interval at 0.5 metre. • Monumentation of demarcated facilities by stone of size 150mm x 150 mm x 450 mm embedded up to a depth of about 200 mm below ground level. Exposed surface will be painted and numbered serially • Setting out corner points at the connecting edges of Taxiway, apron between Phase 1 & 2 • Generation of Topographical drawings
8	Survey Work & Preparation of Land Plan in State of Karnataka for 629 Km length	<p>Carrying out authentication of surveyed tracing sheets by concerned Land Records Authorities (DDLRL / ADLR / Thashildars) with the help of NH Division assistance and required letters.</p> <ul style="list-style-type: none"> • Establishing Dual frequency DGPS control points. • Carrying out Total Station Survey of survey/ numbers/Gut No. corners and plotting of surveyed area.

Sl. No	Assignment Name	Assignment Highlights
		<ul style="list-style-type: none"> • Collection of data i.e, Village Maps, City Survey Maps, gut book tippan etc., & getting verification and authentication from concerned authorities. • Carrying out detailed Survey with the help of Total station along the road upto 30 m on either side from the road Centre or upto private property whichever is less.
9	Implementation of Urban Property Ownership Records of 2,75,000 properties Project for Mysore city, Karnataka	<ul style="list-style-type: none"> • Establishment of Ground Control Network, Creation of Index Map, Non-Spatial Data Collection, Measurement & Mapping of Properties, Creation of Property Ownership Records, Measurement of Coordinates of Plot Boundary Points, Mapping of Properties, Creation of a comprehensive Cadastre, Continuous management and maintenance of property records and Operation and maintenance at the Service Center and Back office.
10	Surveying and Mapping of 14000 sq Km of Narmada Valley River Basin	<ul style="list-style-type: none"> • Establishment of GPS Control • DTM compilation using High Resolution (0.5 m) Stereo Satellite Imagery • Verification by Leveling