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### **Master planning**

- Site Reconnaissance and Inventory
- Site SWOT analysis
- Land use studies, development plans for urban renewal & “Greenfield/brownfield” sites
- Study of development opportunities for specific sites
- Overall Master plan including sub-division layouts architectural layouts, landscape plans, infrastructure plans and cost estimates
- Transport Planning including general circulation strategy and traffic modelling
- Phasing Plans

### **Civil and Structural Engineering**

- Preparation of schematic details
- Detailed structural analysis and design
- Drawing up specifications and detailing

### **Building Services**

- MEP detailing
- Plumbing and Sanitation
- HVAC & R
- Fire Protection System
- Security System & Access control
- Intelligent Building Systems

### **Contract Documentation**

- Preparation of tender documents including bill of quantities and tender drawings
- Appraisal of tender responses, assistance in appointment of contracting agencies

## **SERVICES IN HIGHWAYS & BRIDGES**

### **Highways**

- Traffic & Transportation

#### **Preliminary and Detailed design**

- Route location
- Geometric design
- Embankments, pavements and drainage
- Signage and Lighting
- Electronic Traffic Control
- Landscaping

#### **Contract Preparation and Supervision**

- Contract Documentation
- Tender evaluation
- Contract Administration
- Supervision of Construction
- Materials control and laboratory testing
- Measurements
- Independent Audits and Quality Assurance
- Adjudication and dispute resolution

## **SERVICES IN TRAFFIC & TRANSPORTATION**

Consultant to provide specialist services in the following activities

### **Township and Building Level Transportation Infrastructure**

- City and Infrastructure Development Plans as per Local Governments rules.
- Internal Road Hierarchy and Traffic Infrastructure Requirements.
- Traffic Management, Circulation & Access Planning for Townships
- Traffic Impact Assessment for new developments
- Parking Demand Assessment for new developments
- Parking Layout Planning and Design
- Pedestrian Facilities & Circulation Planning

### **Urban Infrastructure**

- Urban Traffic Control
- Bus Priority Schemes
- Intelligent Transportation Systems
- Station Area Improvement Schemes
- Bus/Truck Terminus Planning

### **Services**

- Feasibility Studies
- Planning & Concept Design
- Detailed Design
- Four Stage Transportation Planning
- Micro Simulation Modelling
- Economic Assessment using HDM and Financial Assessment
- Design & Contract Preparation
- Execution Advisory

## **SERVICES IN WATER & WASTEWATER**

Civil/Structural Engineering

- Treatment works
- Pumping stations
- Sewerage modelling
- Drainage Area Studies
- Pipelines
- Dams and reservoirs
- Geotechnical

Mechanical/Electrical Engineering

- Treatment works
- Pumping stations
- Hydro-power
- HV substations & distribution systems
- Building services
- SCADA

### **3.1 Masterplan Evaluation**

#### **3.1.1 Site Analysis - Existing utilities and resource identification**

- Infrastructure assessment - This involves assessment of existing onsite infrastructure, review of secondary data provided by client like soil reports, topo survey, traffic data if any etc.
- Slope analysis to determine accessibility/constructability of roads at higher elevations. In addition to this identify the ridge and valley for storm water management, sewage conveyance and gravity feeders to the entire development.
- SWOT Analysis of the site.

The concept plan provided by the master planner to be reviewed for roads and infrastructure with the intent of identifying any deficiencies or alternative engineering proposals to development. Broadly the master plan is to be studied for following aspects

- The density of development.
- Proposed mix use.
- Proposed Net FSI.

The above aspects would enable to assess, evaluate and locate physical infrastructure requirements such as water treatment works, Sewage treatment plant, solid waste management site, Intermediate pumping station for water & sewage systems, HVAC plant rooms, electrical sub stations, , etc.

Based on the conceptual land use plan, projected workforce, FSI distribution, resident and floating population for the project area the infrastructure zones for storm, sewer, power etc. are defined in addition to the capacity requirements for each of this utility. This further translate into plot sizes needed to be reserved in the overall plan to proceed with the Concept infrastructure design.

### **3.1.2 Traffic and Transportation Assessment**

Consultant to prepare a plan identifying the relationship of physical connectors between various land uses, basic services, amenities and common facilities.

- 1) Public realm: Consultant to prepare typology plans and schematics which identify the approach to sidewalks, streets and integration with development clusters, projected workforce & dependent/resident population and facility requirements. These will be identified based on the conceptual land use categories and associated community infrastructure requirements by applying appropriate standards.
- 2) Consultant to prepare a series of movement framework plans for the relevant modes including motor vehicles, walking, cycling and bus which identify the approach to transportation at each node and network layout. Taking into consideration the relationship to adjacent land uses the new network is appropriately integrated with the surrounding network so as to mitigate the impact and minimize future problems.
- 3) Trip generation and traffic demand estimate to be prepared and analysed in the project area and corresponding infrastructure requirements are proposed into the master plan along with appropriate parking strategies.

- 4) Model split analysis to be conducted for all possible scenarios considering the current and future traffic within and around the proposed development. This enables to adjudge the ROW's needed to be reserved within the proposed development which caters for the future traffic, thereby leading to congestion free vehicular movement.
- 5) The above analysis enables the master planner to
  - a) Design of ingress and outgress points i.e. connectors from the existing road network to the proposed development.
  - b) Design critical junctions within townships.
  - c) parking strategy
  - d) Rearrange the proposed density of development, if needed in discussion with the client and master planner etc.

### **3.1.3 Road Geometrics**

Feasibility of road construction based on contour analysis is vital as these would govern the low-density developments at higher elevations. The master plan will be evaluated for the alignment of the road & ROW requirements for its construction. The road design team shall work in close co-ordination with the client to understand the ROW requirements, positions of signages, requirement of lay bays, conflicting points in the network to produce junction design strategy and the most important is the reassessment of plots affected due to revision of horizontal and vertical design of roads.

### **3.1.4 Storm Water Management**

The natural drainage pattern of the site shall be studied in conjunction to the proposed master plan. The study shall take into consideration the High flood levels, aquifer levels, soil property and the proposed grading of the site. The design team shall work in close co-ordination with the road team to identify the high and low points i.e. vertical profile of the roads at the cross drain locations. An overall high level incremental runoff shall be estimated to check the adequacy of the natural drains.

### **3.1.5 Firefighting arrangement**

It is essential to analyse the firefighting arrangement by assessing the availability of nearby Fire station and make provision accordingly. The master plan assessment shall take into consideration necessary codes, standards and propose appropriate firefighting scheme which shall include plots needed to be reserved for fire stations if any & fire tanks water tanks, fire water outlet for fire fighters in proposed development.

### **3.1.6 Solid Waste Management**

The principle of 3 'R'S Reduce, Recycle and Reuse to be proposed. Waste segregation and full recycling systems in every residential and commercial unit is promoted. Landscape waste composted on or near site, Residential composting

systems and education, green building strategy, including recycled materials and hazardous material disposal sites are identified, sized and earmarked in the master plan.

Broadly the Analysis and recommendations for changes required to be made to the subdivision plan to accommodate roads and infrastructure findings shall form part of the master plan evaluation report.

### **3.1.7 Deliverables**

- Traffic and Transportation Report
- Existing utilities and resource identification report.
- Master Plan evaluation report.

### **3.2 Concept Stage**

At this stage Consultant to take up the finalized concept master plan and provide conceptual infrastructure planning for all infrastructure works. Consultant to:-

- Give inputs which will help quantify approximate earthworks involved for road construction and comment on the brief of Earthworks and retaining structure requirements to manage the contours.
- Provide options for planning of
  - Storm water drainage system.
  - Technology & process for potable water treatment with cost benefit analysis.
  - Water Supply transmission and distribution scheme.
  - Recycled water distribution scheme.
  - Fire fighting system.
  - Sewage management system.
  - STP technology with cost benefit analysis.
  - Sludge Disposal Management Plan.
  - Solid Waste quantities and Management Plan
  - Energy Management Plan.
  - Integration of smart city concepts in consultation with ICT consultants appointed by client.
  - Irrigation strategy, options and overall scheme.
  - Power distribution system.
  - Security & Control System ( CCTV & BMS)
  - Layout of power distribution system/lighting system
  - Feasibility study on renewable energy system in the premises
  - Feasibility on HVAC system

- Develop standards for street/parking area/landscape lighting to be used throughout development in consultation with architect and landscape planner

### **3.2.1 Design Basis Report**

Based on site analysis, existing infrastructure assessment and master plan evaluation the infrastructure design team then prepare design basis report and a high level services plan. This plan is also supported by utility cross sections which shall define the corridors for planned utilities. The design basis report broadly covers following:-

- Design Criteria
- Assumptions for Design
- Codes and Standards adopted
- System Requirement
- Area Requirement
- Outline Description of the System

The design basis report is submitted as a draft submission to understand the concept of the infrastructure planning. Our team closely co-ordinate with the client's team to brief about the concept and estimated block cost. After carrying out series of discussions and presentations, the final DBR is submitted.

### **3.2.2 Deliverables**

- Concept-level design documents including line diagrams, SLD's, to explain the design intent.
- Design basis report.
- Drawings volume in A3 size at appropriate scale.
- Block Cost

### **3.3 Schematic Stage.**

Based on the approved DBR and the parameters set out there in, the assignment moves into next stage of preliminary/schematic design. During this stage, following tasks are conducted:-

- Broad sizing for the entire infrastructure works.
- L section and Cut Fill analysis for the proposed road network.
- L section of natural storm water drains
- Typical coordinated utility cross sections
- SLD's for power distribution system
- The design and drawings at such level of detailing that block costs prepared in the concept stage is verified for its correctness.



### 3.3.1 Deliverables

- Plan showing final location of
  - Septic Tank or STP as applicable.
  - Electrical Substation and Feeder Pillars.
  - Underground water tanks, its capacities and building served by it.
  - Solid waste management treatment sites.
  - Intermediate pumping stations.
  - Location of Fire Hydrant & fire Station
  - Location of HVAC Plant & Network (If Required)
  - CCTV location
- Schematic Layout and SLD of
  - Road network with horizontal and vertical profile.
  - Storm Water Layout showing outfall locations and drain alignment.
  - Water Supply distribution and its pumping arrangement.
  - WTP plot layout and GAD of WTP.
  - Sewer Line Layout showing route plan upto the Septic Tank or STP as applicable.
  - Plot layout and GAD of STP.
  - UG tank and Pump room layouts.
  - Fire fighting system .
  - Landscape Irrigation system layout.
  - Electrical Layout covering following aspects
    - HT Layout, if applicable.
    - LT Layout
    - Sub Station layout with transformer capacity.
    - Optic Fibre Cable layout
    - Location of Feeder Pillars.
    - Single Line Diagram.
    - D.G Capacity and its area requirement, if applicable.
    - Schematic piping and distribution systems etc.
    - Substation layouts.
- Schematic layout of CCTV & BMS system
- Utility cross sections for all roads.
- Block cost
- Concept Deviation report

### **3.4 Detail Engineering Design Stage**

Upon approval of schematic design document, design shall move into detail aspects of each utility service taking into consideration the phases of construction. Accordingly, the design shall be detailed out to exact line and levels to understand the

- Limit of work for each of the utility service in each of the phase.
- Overlap of utility network between different phases.
- Impact on the overall cost estimate submitted in the earlier stage.

The design will be fully coordinated for site level MEP components, drainage works and other structural requirements. The necessary modifications to the design shall be done to ensure smooth transition between different phases.

The design sheets, BOQ's, quantity sheet for the services are prepared and submitted to client. Consultant to also submit report highlighting the deviations from the concept design stage (if any) and review the cost parameters alongside with the client so that budget can be finalized. The detail design consists of following activities: -

#### **3.4.1 Roadworks**

- Finalization of road levels in discussion with the master planner, client and landscape designer.
- Finalization of Vertical and horizontal profile of the road.
- Detail design of critical junctions and entry exits of the site.
- Finalization of site grading plan and cut-fill quantities.
- Detail Material specifications.
- Update Cost Estimates

#### **3.4.2 Water Supply and Waste Water Drainage system**

- Finalization of total water demand, WTP and STP capacities.
- Designing of water transmission network including pipe size/diameter, pipe material, and residual pressure head.
- Designing of potable/recycled water distribution network using water GEMS V8i. Hydraulic design of trunk main, local distribution piping, storage reservoirs in the distribution network.
- Process and Hydraulic calculation for selected scheme of WTP along with hydraulic diagram and list of Mechanical and Electrical equipment with broad cost estimates.
- Process and Hydraulic calculation for selected scheme of STP along with

hydraulic diagram and list of Mechanical and Electrical equipment with broad cost estimates.

- Detail calculations for the pumping system for all services.
- Detailed layout of STP & WTP plots.
- MEP layout for infrastructure service buildings like Pump rooms, Plant rooms, WTP, STP.
- Structural Design and Drawings for infrastructure service buildings like Pump rooms, Plant rooms, WTP, STP.
- Detail Material specifications.
- Detailed layout of Solid Waste treatment plots.
- Detailed layout of Water supply, Sewer & Irrigation system.
- Update Cost Estimates.

### **3.4.3 Storm Water System**

### **3.4.4 Fire Fighting System**

- Detailed fire fighting layout providing location of Fire hydrants and its route.

### **3.4.5 Power Distribution Network**

- Finalization of total demand load.
- Detailed distribution layout of HV/LV system.
- Finalization of SLD's.
- Voltage drop calculations.
- Typical trench details.
- Detailed Substation layouts.
- Detailed street light layout.
- MEP layout for infrastructure service buildings like, Receiving Sub-station, Distribution sub-station.
- Structural Design and Drawings for infrastructure service buildings like, Receiving Sub-station, Distribution sub-station.
- Area lighting in co-ordination with landscape consultant.
- CCTV System layout
- BMS system architect & details
- Coordination with ICT Vendor for central control system
- ROW provision for communication system.
- Detail Material specifications.
- Update Cost Estimates.

### **3.4.6 Co-ordinated Services Plan (CSP).**

The detailed design drawings shall be superimposed and verified for clash analysis. This analysis would be unable to revisit the design and make necessary changes to finalize the preparation of GFC.

Appropriate sections at junctions, crossings shall be detailed out to understand the quantum of work involved at a location.

### **3.4.7 Deliverables**

- Concept design deviation report
- Detail design report for all services as below: -
  - Roadwork's: - Horizontal and vertical alignment report.
  - Water, Waste Water and Storm water drainage: - Hydraulic output report/hydraulic statement along with L - Sections.
  - Fire Fighting: - Hydraulic calculation specifying the pressure at each of the hydrant location.
  - Power Distribution System: - Cable sizing and DIALUX output sheet/report.
- Note explaining the integration of smart city concepts in the design.
- Co-ordinated services plan.
- Detailed cost estimate.

This detailed engineering then gets transformed into Good for Construction (GFC) and Tender drawings for various services as elaborated below.

### **3.5 Tender Documentation**

During this stage of the design the approved preliminary drawings and utility arrangements are taken as a base and following are prepared and submitted

- Tender Drawings
- Bill of Quantity with measurement sheet, Rate analysis and Quotations.
- Special Conditions of contract.
- Detailed Technical Specifications.
- Finalization of PQC.

In addition to the above, consultant shall

- With the Client, mutually approve the final list of invited bidders. Prepare documentation for the pre-qualification of contractors for the Project. The Client shall issue the documents and after their return will forward them to the Consultant who shall prepare a report with recommendations for the selection of contractors for invitation to tender. The short-listing of tenderers shall fully comply with the requirements of the Client.
- Assist Client with interviews and the selection of the Contractor(s) to bid the Works.

- Obtain confirmation from the pre-qualified contractors to participate in the tender.
- Answer pre- bid queries and prepare and issue any necessary addenda to the tender documents.
- Hold meetings with any Tenderers as authorized by the Client to obtain technical and commercial clarification of bids and minuting discussions for records and future reference;
- Assist with the review of bid proposals and make recommendations to the Client as to the award of the construction contracts
- Assist the Client in the review and preparation of the Construction Contract.

### **3.5.1 Bidding and Evaluation Phase Deliverables**

- Report on Contractor pre-qualification interviews
- Initial Tender Summary Report
- Tender Analysis Report
- Bid Review Report and Recommendations

Once the tenders are floated, the team also assists in :-

- Attending pre bid meeting
- Clearing all the queries
- Technical Evaluation

### **3.6 Good for Construction Stage**

Following drawings shall form part of the submission

#### **3.6.1 Roadwork's:-**

- Road Hierarchy Plan.
- Setting out details for roads and Junctions.
- Detailed Horizontal alignment.
- Detailed vertical alignment
- Signage Plan for roadwork's.
- Typical details of road markings.
- Junction Geometric details.
- Pavement crust details.
- Road construction details.
- Details of Kerbs.
- Details of Kerb ramp.
- Typical Details of earthwork.

### **3.6.2 Storm Water System**

- Detailed storm water layout.
- Location and details of Cross drains i.e. RCC Pipe/culverts at crossings and outfall with its level as per design.
- Details of chambers for maintenance with its size and inlet points from the road and its interval.
- Schedule of Storm water drains specifying the Ground levels, invert levels, Slope to be adopted, invert depths from U/S to D/S upto Outfall.
- Typical Section of Storm water drain with details of RCC Covers specifying Heavy duty and Light duty.
- RCC details of road side drains & cross drainage works.

### **3.6.3 Water Supply( Potable & recycled) Layout with following details**

- Final transmission and distribution plan with size of the pipes, pressure at end points and details of PRV's, air valves, gate valves, as required.
- Valve Types and its Chamber locations.
- Underground Water Tank section specifying inlet and outlet levels.
- Detailed Plot layout for WTP.
- MEP drawings for WTP & Pump rooms.
- Structural details for Pipe bedding, crossings, encasing (wherever needed), WTP, Pump rooms and thrust blocks at junctions.

#### **3.6.4 Sewerage System with following details**

- Final Route plan with size of the pipes.
- Material Specification of pipes.
- Schedule of Sewer specifying the Ground levels, invert levels, Slope to be adopted, invert depths from start till Outfall i.e. Septic Tank or STP as applicable.
- Location of Manhole and its distance.
- Typical detail of Manhole.
- STP Layouts with finished ground levels and process diagram.
- Detailed Plot layout for STP.
- MEP drawings for STP, Pump rooms.
- Structural drawings for STP.

#### **3.6.5 Electrical Distribution System with following details**

- Final SLD (Single Line Diagram).
- Layout of HT and LT with final location of Feeder pillar.
- Typical section of Feeder Pillar as per type of feeder pillar i.e. 3 way, Four way etc.
- Typical Section of Cable Trench for HT and LT as applicable.
- ELV Layout (OFC Layout).
- Electrical Sub-station layout with details of transformer, cable route within the Substation Plot and earthing details.
- Street Light Layout with distance between poles.
- Renewable Energy system layout & schematic (If adopted)
- CCTV Layout & schematic layout
- BMS System layout & System Architect
- MEP layout for receiving and distribution substation.
- Structural layout for receiving and distribution substation.
- Detailed Plot layout for receiving and distribution substation.

#### **3.7 During Execution**

During this stage Consultant shall visit the site periodically to assess whether the execution is being done on the design drawings submitted by us. Once the visit is conducted, a brief of the discussion of the visits shall be sent out to client in form of site visit report or Minutes of meeting or via email.

The issues pertaining to the execution would be sorted out in consultation with the engineer in-charge of the site and if required, the outcome of the same would be briefed to client.

### **3.8 Testing and Commissioning**

During this stage, Consultant to be physically present to check the output of the constructed services. post, visit a report shall be submitted which would be signed off by the client as well as our project head.