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***Technical and Commercial Proposal***

***For***

***AL AIN DESTINATION***

***“Roads - Wet & Dry Utilities “***

**Prepared For**

**ALSUWEIDI Engineering Consultants L.L.C**

**By**

**Infrastructure Department  
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# Document Development History

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# Introduction:

The Site Located in Al Sarouj, Al Ain has a good potential with nearby amenities like the Botanical Garden in 3 km radius. Al Ain National Museum, Al Jahili Fort & Al Ain Zoo within 6 Km radius.



*Figure 1: Project Masterplan*

# AIEcon Overview

## 2.1 Who are we

With over 35 years of experience, AIECons excels in civil engineering, specializing in flood protection, storm drainage, groundwater management, marine and coastal works, and water supply systems. With three branches worldwide, the company envisions establishing a leading, innovative organization excelling in a competitive environment, leveraging our team's expertise and skills to serve the community and enhance engineering consultancy standards.

## 2.2 AIEcon’s Vision

Our vision is establishing a progressive and well-known reputable organization in a competitive work environment where the members’ professional background, experience, skills and capabilities could be used, to serve the community in an ethical way that will help improve the consultancy field to higher respectable levels. By combining our understanding of the locals with our global expertise, we provide innovative solutions with the best quality for our communities, as we know that quality, value and adaptation to the environment are the keys of success.

## 2.3 AIEcon’s Branches

AIEcon operates through a network of regional and international branches, ensuring proximity to clients and projects. We have established offices in the USA, KSA (with a branch in Jeddah), and Cairo, Egypt. The figure (fig.2) shows the location of AIEcon offices, with our main headquarters located in Cairo, Egypt.

|  |
| --- |
|  |

*Figure 2: Location of AIEcon offices*

## 2.4 AIEcon’s Experience

AIEcon L.L.C has successfully delivered over 500 projects during 35 years of operations across the Middle East, Africa, and Asia. Backed by a team of 60 highly qualified staff holding PhDs and Master’s degrees, we bring together academic knowledge and hands-on field experience in around 20 countries. The figure (Fig. 3) illustrates the footprint of AIEcon in different countries.

|  |
| --- |
| A map of the world with different countries/regions  AI-generated content may be incorrect. |

*Figure 3: AIEcon’s Footprint*

The main fields are listed in the table below (T.1). For more details on AIEcon’s projects and expertise, please visit the company website at <https://aieconsultant.com>.

*Table 1: AIEcon’s Consultation Services*

|  |
| --- |
| Hydrological Studies and Flood Protection |
| Dam Engineering Studies |
| Marine Design and Engineering Solutions |
| Groundwater Management |
| Infrastructure Design |
| Roads, Airports and Railways Engineering |
| GIS and BIM Design |
| Surveying and Construction Supervision |

## 2.5 AIEcon’s Partners

AIEcon collaborates with a network of trusted partners, both regionally and internationally, to deliver integrated and high-quality engineering solutions. Our partnerships strengthen our ability to address complex infrastructure challenges and provide added value to our clients. The figure below (Fig. 4) shows our main partners.

|  |
| --- |
|  |

*Figure 4 AIEcon’s Partners*

# Project Scope

The scope of work includes, but is not limited to, the complete infrastructure required to serve the project. The consultant is expected to assist in the planning, engineering, and design of all infrastructure systems as outlined below:

* **Road Works / Civil Works:**
  + Excavation, backfilling, and leveling.
  + Asphalt pavement works.
  + Road signs and traffic signals.
  + Roadblocks and safety flags.
  + Traffic signage installation.
  + Hardscape works (pavers, decorative surfaces).
  + Sidewalk and curb stone installation.
  + Street furniture (benches, bollards, trash bins, etc.).
  + Wayfinding work.
* **Water Supply Systems:**
  + Potable water distribution network.
  + Water meter installation.
  + General water supply connections.
* **Drainage Systems:**
  + Sanitary sewer systems.
  + Greywater recycling systems.
  + Stormwater drainage system.
  + Rainwater collection and disposal.
* **Water Irrigation Distribution:**
  + Irrigation network and piping.
  + Control valves and irrigation boxes.
* **Structural Works:**
  + Foundations for lighting poles.
  + Electrical conduit banks.
  + Telecommunication duct banks.
  + Substation block wall enclosures.
  + Telecommunication joint boxes.
  + Thrust blocks for pipelines.
  + Equipment foundations.
  + Antenna pole and RTU (Remote Terminal Unit) panel foundations.
* **Electrical Works:**
  + Energy infrastructure (e.g., solar panels, transformers).
  + Electrical meter installation.
  + Power cables and conduits.
  + Power distribution systems.
  + Overall loop boundary lighting and power.
  + Road and street lighting systems.
  + Lighting poles and fixtures.
* **Telecommunication Works:**
  + Voice/Data/IPTV - FDT cabinet installation within the boundary.
  + Conduit access for telecom distribution network.
  + Fiber optic distribution system (Voice/Data).
  + FDT layout and configuration.
  + Telecommunication duct banks.
* **Waste and Utility Service Areas:**
  + Waste utility lines.
  + Service and maintenance areas for utilities.

# Project stages:

The project stages will be summarized as follows:

# Project Methodology:

Our project methodology is structured to ensure high-quality, integrated design and documentation for each major scope component:

* **Roads**: The methodology includes master alignment planning, geometric design to AASHTO standards, pavement structure design, and full CAD/Civil 3D modeling with phased review submissions.
* **Wet Utilities**: We apply hydraulic modeling, clash analysis, and sustainable design principles to develop robust water, sewer, storm drainage, and firefighting networks.
* **Dry Utilities**: Our process involves coordinated layout of MV networks, low voltage systems, street lighting, telecom, and CCTV, with detailed shop drawings and compliance to local and international standards.

## 4.1 Road Networks Design Methodology

The road network is designed to function as a unified circulation system using a "one-step" hierarchy,

A structured methodology has been developed for the roadway design works to ensure the project objectives are met and the scope requirements are fulfilled. The approach follows a logical sequence and ensures full integration between the various stages of work. The process has been divided into Four main stages, each comprising a set of specific tasks and technical deliverables, as outlined below:

### 4.1.1 **Step 01**: Basis of Design Report (BODR)

During this phase, the basis of design report will be introduced as it contains a comprehensive set of design criteria that govern all elements of the roadway design, including geometric elements, pavement structure, signage, and safety features. These criteria are established in accordance with relevant local and international engineering standards and tailored to the specific requirements and context of the project. Coordination with other disciplines (such as drainage, utilities, structural, traffic, and electrical systems, etc) will also take place during this phase to ensure that the design criteria are harmonized across all project components. This interdisciplinary alignment is essential to maintain consistency, avoid conflicts, and achieve a fully integrated and functional design solution.

### 4.1.2 **Step 02**: Schematic Design

Following the submission and approval of the BODR along with addressing the client’s comments, the schematic design phase will commence. This phase includes the following key deliverables:

* **Road Network Hierarchy**: A structured classification of roads based on their function and level of service.
* **Horizontal Layout Plans**: Detailed horizontal plans of the road network, indicating dimensions, coordinates, and designing vehicle swept paths at horizontal curves and intersections.
* **Longitudinal Profiles**: Road profiles showing existing and proposed ground levels, slopes, and vertical alignment details.
* **Typical Cross-Sections**: Standard cross-sectional views illustrating the configuration of various road types, including carriageways, shoulders, medians, and sidewalks.
* **Pavement Construction Sections**: Detailed structural cross-sections showing pavement layer composition, thicknesses, and materials as per design standards.

### 4.1.3 **Step 03**: Design Development

At this stage, the road design reaches an advanced level of development, incorporating all prior feedback and technical refinements. The objective is to present a complete set of design documents suitable for final review before tendering stage. Following the submission of the schematic road design, the approval of longitudinal profiles, and the incorporation of the client’s comments, the detailed design phase will commence. This stage includes the preparation of final design documentation and the following key deliverables:

* **Final Horizontal Layout Plans**: Comprehensive drawings including dimensioning plans, coordinate grids, finished level elevations, pavement markings, and signage layouts.
* **Detailed Longitudinal Profiles**: Finalized vertical alignment drawings with design levels, slopes, and other geometric features.
* **Typical Cross Sections**: Refined cross-sectional views representing various road categories with all design elements.
* **Pavement Construction Sections**: Detailed drawings showing the structural layers of the pavement with material specifications and layer thicknesses.
* **Bill of Quantities (BOQ)**: A complete and itemized list of quantities covering all roadwork components for pricing and procurement.
* **Technical Specifications**: Comprehensive technical guidelines and requirements for the execution of road construction works, including materials, workmanship, and quality standards.

### 4.1.4 **Step 04**: Tendering Stage

This phase represents the culmination of the design process, with all components finalized, reviewed, and approved. The core objective is to present the complete, coordinated, and construction-ready design package. All previous comments and coordination items are fully resolved, and the documents are prepared for execution on site. Key final deliveries include:

* **Updated BODR**: At the tender stage, the Basis of Design Report (BODR) is updated to reflect the most current design decisions, refinements, and coordination outcomes. This updated version incorporates any changes resulting from detailed studies, stakeholder feedback, or coordination with other disciplines. The report ensures that all design criteria are clearly defined and aligned with the project’s scope, regulatory requirements, and site-specific constraints. It serves as a critical reference for tender documents, enabling contractors to fully understand the design with intent and prepare accurate, competitive bids.
* **Final Construction Drawings**: Fully detailed and coordinated drawings for all road elements, including alignments, profiles, cross-sections, pavement structures, signage, and markings.
* **Final Bill of Quantities (BOQ)**: Accurate and itemized quantity take-offs for all work items, ready for tendering and procurement.
* **Final Technical Specifications**: Approved specifications covering all materials, workmanship, and execution standards required for construction.
* **IFC Submission Package**: A complete, organized set of documents compiled and formatted for contractor use during the construction phase.

## 4.2 Road Network Design Elements

Design parameters represent the fundamental principles and standards upon which the engineering design of the road network is based. These parameters encompass a range of technical, functional, and environmental factors that directly influence the selection of design elements—such as design speeds, design vehicle dimensions, longitudinal and cross slopes, terrain characteristics, and safety requirements. The design criteria are derived from recognized local and international codes and standards to ensure operational efficiency, user safety, and long-term infrastructure sustainability. The key design parameters are outlined in the following section

### 4.2.1 Road Hierarchy

The design of the road network is based on the hierarchical classification principle, which categorizes roads according to their function and level of service into arterial roads, collector roads, and local roads. This classification ensures smooth traffic flow, operational efficiency, and the organized distribution of traffic loads. The hierarchy is defined in alignment with the urban master plan of the area and through effective integration with the existing and regional road networks to ensure easy accessibility and seamless connectivity between internal and external areas. The design also considers the provision of safe entry and exits points, and an appropriate distribution of intersections to minimize conflict points and enhance traffic safety. Furthermore, this classification plays a vital role in determining design speeds. The (table 3) presents the engineering characteristics of each road classification in the project according to the international Code:

*Table 2: Engineering Characteristics of Road Classification*

|  |  |  |  |
| --- | --- | --- | --- |
| **Desigen Item** | **Local Roads** | **Collector Roads** | **Arterial Roads** |
| Design Speed | **30 – 40 km/h** | **40 – 60 km/h** | **60 – 80 km/h** |
| Number of Lanes per Direction | **1 lane** | **1 – 2 lanes** | **2 – 3 lanes** |
| Minimum Lane Width | **2.7 m** | **3.3 m** | **3.6 m** |
| Cross Slope (for drainage) | **1.5% – 2%** | **1.5% – 2%** | **1.5% – 2%** |
| Max Preferred Cross Slope (in curves) | **4%** | **4%** | **4%** |

### 4.2.2 Design Vehicle

The design vehicle chosen is a single-unit truck, which matches the SU-12 vehicle type according to the American AASHTO code. This is in line with the nature of the project’s operations. The length of the SU-12 vehicle is approximately 12 meters, and it is used as a reference to determine the design dimensions of road network components such as lane widths, curve radii, turning areas, and particularly at intersections, entrances, exits, and loading/unloading zones. The design considers providing appropriate pathways for these vehicles, ensuring smooth traffic flow and road safety in an efficient industrial operational environment. The following figure illustrates the engineering characteristics of the design vehicle, and its dimensions as follows:

|  |  |
| --- | --- |
| Height= 3.35 – 4.11 m  Length= 12.04 m  Width= 2.44 m  Inner Radius= 11.09 m  Design Radius= 15.60m | A blueprint of a truck  AI-generated content may be incorrect. |

*Figure 5: Engineering Characteristics of the Design Vehicle*

### 4.2.3 Stopping Sight Distance:

Stopping Sight Distance (SSD) is crucial for road design as it directly impacts road safety, especially in situations with sudden changes in speed or direction or unexpected obstacles. SSD helps determine design requirements for curves, intersections, and traffic signs. Given the project’s road types, SSD is used as the primary reference to ensure drivers can safely stop in case of an obstacle. It is based on the design speed, driver reaction time, road gradient, and tire-road friction. SSD is key to ensuring traffic safety, reducing accidents, and improving road efficiency. The following table (Table 4) shows the values of the required SSD for different design speeds according to the international code.

*Table 3: Stopping Sight Distance for design speeds*

|  |  |
| --- | --- |
| **Desigen Speed (km/h)** | **Stopping Sight Distance (m)** |
| **30** | **35** |
| **40** | **50** |
| **50** | **65** |
| **60** | **85** |
| **70** | **105** |
| **80** | **130** |
| **90** | **160** |

### 4.2.4 Horizontal Curves

Determining the horizontal curve radius is a key element in road design, as it directly affects vehicle safety and stability during turning. It is selected based on the design speed and superelevation, to ensure proper balance of centrifugal and lateral forces, especially on industrial roads used by heavy trucks. A specific formula is used to calculate the required radius based on speed and superelevation, with reference to standard tables provided in the AASHTO codes.

**e+fs = v2/127R**

R = Minimum radius of circular curve (m)

V = Design speed (km/h)

e = Maximum super elevation rate %

fs = side friction factor

### 4.2.5 Vertical Curves

Vertical curves are designed to provide adequate sight distance for drivers and ensure safe and smooth transitions between different road grades. The length of vertical curves is calculated using a standard formula, and the rate of curvature (K) is determined based on the design speed and stopping sight distance (SSD), using tables provided in the AASHTO code.

**Lc = K A**

Lc =Vertical curve length (m)

K = Rate of change of curvature

A = Algebraic difference of grades

Longitudinal slopes are also a key factor in vertical alignment planning. They vary significantly based on the road classification and design speed. The table (Table5) below shows the permissible longitudinal slope values according to the MOT:

*Table 4: Permissible Longitudinal Slope Values*

|  |  |  |
| --- | --- | --- |
| **Road Type** | **Minimum Longitudinal Slope (%)** | **Maximum Longitudinal Slope (%)** |
| Arterial Road | **0.25** | **6** |
| Collector Road | **0.25** | **8** |
| Local Road | **0.25** | **9** |

However, it is recommended that the slope does not exceed 4% to ensure smooth, safe, and efficient vehicle movement—especially considering the nature of the project roads.

### 4.2.6 Pavement Design

Pavement structural design depends on available data such as traffic volumes, soil properties at the site, materials used in the pavement layers, and environmental factors specific to the project location. In the absence of such data, the standard pavement sections provided in the intrnational Code are used as a reference.

### 4.2.7 Road Markings & Traffic Signs

Pavement markings and road signs are essential complementary elements in road design and safety, as they directly contribute to traffic regulation, safety enhancement, and guidance for road users. Pavement markings include lane lines, stop lines, pedestrian crossings, and directional arrows, while signage includes warning, regulatory, and directional/informational signs. These elements are designed according to the standards outlined in the Highway Standards and/or the MUTCD (Manual on Uniform Traffic Control Devices) to ensure clear visibility and easy understanding for all driver categories—particularly in industrial areas that require precise management of heavy and service vehicle movements. The placement of signs and markings also considers factors such as sight distance, appropriate location, retroreflectivity, and suitable size to ensure effectiveness during both day and night.

### 4.2.8 Required Data

To prepare the required road design work, the following data must be provided:

* General layout plan (after approval of the master plan).
* Topographic survey (to be provided by the client).
* Soil report (to be provided by the client).
* Traffic study, if available (to be provided by the client).

## 4.3 Wet Utilities Design Methodology

This scope includes all wet utility systems required for industrial operations. The design and shop drawings cover only the distribution networks located within the site boundaries. ***Centralized facilities such as water treatment plants, sewage treatment plants, and water storage reservoirs are not included in this proposal*** and may be considered under additional services upon specific request from SID. The process has been divided into Four main stages, each comprising a set of specific tasks and technical deliverables, as outlined below:

### 4.3.1 **Step 01**: Data Collection and Analysis

Following receipt of the approved masterplan, AIEcon will review and assess all relevant design inputs, including project survey data, geotechnical studies, hydrogeological conditions, existing utilities, meteorological data, and local design standards. This ensures that the wet utilities design is based on accurate, site-specific information and integrates with off-site infrastructure. Relevant data from the Master Planner.

* Survey of the Project area in digital format.
* Previous geotechnical and geological studies.
* Hydro-geological and groundwater aquifers data (if it exists).
* Inventory of existing structures, features, and utilities.
* Existing and future off-site utilities schemes (if available).
* Site-specific constraints.
* Design Standards and local regulations for all works related to wet utilities.
* Meteorological Data.
* The characteristics of each plot, e.g., (total area, the Built-up Area, land use…..etc).
* The Built-up Area (BUA) of each category of building for multi-use plots (if any).
* Location(s) of primary high-voltage/medium-voltage Substations (if present) that will serve the project.
* Number of floors & units per floor of each plot in each building.
* Client specific requirements for telecom networks and security systems
* All Mechanical electrical loads and its location.

### 4.3.2 **Step 02**: Conceptual Design

This stage involves the development of a comprehensive Concept Design Report with in-depth preliminary designs for **potable water, wastewater, storm drainage, Sewage network, systems**. The scope includes route alignment studies, conceptual hydraulic modeling, sizing of mains and branches, initial equipment selection (e.g., pump capacities, valve locations), and integration mapping with other infrastructure. AIEcon will analyze development constraints, propose phased implementation plans, and perform preliminary cost assessments with cost-benefit and impact analyses. The deliverables will also include draft investment plans, authority approval strategies, stakeholder consultation records, and graphical presentations highlighting functional, spatial, and aesthetic design considerations through workshops and visual simulations.

* Concept Design Report.
* Development Constraints & Recommendation.
* Development Implementation & Phasing Strategy / Plan.
* Cost plan & Cost-benefit analysis.
* Investment Plans & Impact Analysis.
* Stakeholder Consultation summary.
* Presentation Workshops of the deliverables to the Client featuring and illustrating all aesthetic and functional elements within the development.
* Planning and Authority approvals, as required.
* Architectural Guidelines for any future development by private Properties owners.

### 4.3.3 **Step 03**: Detailed Design

This stage focuses on delivering a complete set of construction-ready documentation. It includes advanced hydraulic modeling (e.g., SEWERCAD outputs), detailed plans, longitudinal profiles, cross-sections, equipment schedules, and precise construction drawings covering all wet utility systems. The design incorporates all prior feedback and ensures alignment with other disciplines, minimizing conflicts. Deliverables consist of finalized technical specifications, comprehensive BOQs, detailed calculation notes, material specifications, and authority submission packages. The design covers detailed layouts for gravity and pressurized networks, force mains, pump station design, manhole and chamber detailing, storm catch basin layouts and coordinated mechanical components for all systems. The package is prepared for tendering, ensuring accuracy for cost estimation and construction execution.

* **Final Horizontal Layout Plans**: Comprehensive drawings including dimensioning Key map, plans, coordinate grids, finished level elevations, pavement markings, and signage layouts.
* **Detailed Longitudinal Profiles**: Finalized vertical alignment drawings with design levels, slopes, and other geometric features.
* **Cross-Sections**: Refined cross-sectional views representing various road categories with all design elements.
* **Pavement Construction Sections**: Detailed drawings showing the structural layers of the pavement with material specifications and layer thicknesses.
* **Bill of Quantities (BOQ)**: A complete and itemized list of quantities covering all roadwork components for pricing and procurement.
* **Technical Specifications**: Comprehensive technical guidelines and requirements for the execution of road construction works, including materials, workmanship, and quality standards.
* **Design Development Report**: A detailed report accompanying the detailed design submission, summarizing the complete scope of design works carried out to date. It includes finalized design criteria, methodologies, key design outputs (plans, profiles, sections), and responses to previous review comments. The report also presents coordination outcomes with other disciplines, identifies any remaining design issues, and outlines the next steps toward final submission and approval.
* **Collection System (sewage and storm)**: The complete and detailed master plan with appropriate drawing scale, showing:
  + Buildings, sites of public utilities (such as pumping stations and local or regional wastewater treatment plants if needed).
  + Sewage collection networks,
  + Mechanical component related to above networks, Force mains and pump stations (if any).
  + The existing main storm water collection system plans and layouts.
  + Catch basins locations as well as the layouts of storm drainage network proposed for the project area.
* **Longitudinal sections**: for main pipelines showing road levels, locations of manholes, and all the necessary details.
* **Ancillary Items**: Piping accessories, manholes and details, and types of connections.
* **Calculation Note**: to be produced by SEWERCAD software.

### 4.3.4 **Step 04**: BIM Integration Design (optional)

Implementation of Building Information Modeling (BIM) involves creating an integrated digital model of all wet utility systems that facilitates precise design coordination, construction planning, and future facility management. The BIM stage ensures comprehensive integration of all disciplines, enhances technical accuracy, and provides a data-rich asset for the client. The main activities of this stage include:

* Development of a federated 3D model encompassing all wet utility networks, structures, and equipment.
* Clash detection analysis to identify and resolve spatial conflicts between wet utilities, dry utilities, roads, and structures.
* Coordination meetings and reviews using BIM tools to align all design disciplines.
* Generation of accurate construction documentation directly from the BIM environment.
* Preparation of digital deliverables that support construction sequencing, maintenance planning, and asset management systems.
* Ensuring full compliance of the BIM model with local and international design standards and authority requirements.

## 4.4 Wet Utilities Design Elements

There are five main elements for wet utilities

* **Potable Water Supply System**
  + Example: Looped PVC network (DN200–400) with plot connections and isolation valves
* **Wastewater Collection System**
  + Example: Gravity-fed PVC pipelines (DN250–600), manholes, interceptors
* **Storm Drainage System**
  + Example: Trench drains, catch basins, underground network to a retention basin

### 4.4.1 Potable Water Supply System:

* Industrial-grade PVC piping (DN200-400) provides corrosion resistance and long-term durability.
* A pressure-regulated looped main distribution network connects directly to each industrial plot, ensuring redundancy and fire demand coverage.
* Isolation valves are placed at logical segments to support phased development and maintenance without full system shutdown.

#### 4.4.1.1 Potable Water Network Design Consideration:

* Potable water for the new buildings shall be supplied from the existing network.
* Sprinkler system of the buildings, if any, shall be fed from the dedicated storage tank within the building facilities. This tank will be served by a potable water network.
* Distribution main and sub mains shall be designed for the estimated average flow rate based on building population and water bunkering/wash down requirement to ensure minimum pressure at the farthest point of the network.
* The peak requirements for the building's domestic use and sprinkler system shall be achieved through network sizing from the building’s water storage tank to building appliances.
* Figure 6 illustrates the various design drawings for the potable water network

|  |
| --- |
|  |
| *Figure 6: Potable Water Network Design* |

**Designing a Water Network is crucial for several reasons:**

1. **Water Quality and Pressure**: A well-designed water network ensures that water is delivered to consumers at an acceptable pressure and maintains good water quality.
2. **Meeting Demand**: It helps in meeting the required water demands efficiently, ensuring that all users have access to sufficient water.
3. **Reliability**: Proper design minimizes the risk of outages and ensures that the system can handle fluctuations and uncertainties in water demand.
4. **Cost-Effectiveness**: Efficient design can reduce both initial construction costs and long-term operational and maintenance expenses.
5. **Environmental Protection**: It supports the conservation of natural resources and minimizes environmental impact.

Overall, a well-designed water network is essential for providing reliable, high-quality water service to consumers while being cost-effective and environmentally sustainable.

### 4.4.2 Wastewater Collection System:

* Designed to handle combined sanitary and process wastewater from manufacturing zones.
* Gravity PVC pipelines (DN250-600) with slope-optimized alignment ensure self-cleansing velocity.
* Precast manholes are provided every 40 m, with additional industrial interceptors at each plot discharge point.
* The sewer network design is presented in Figure 7 through multiple drawing types.

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| *Figure 7: Wastewater Network Design* |

#### 4.3.2.1 Wastewater Network Design Consideration:

* The sewage generated from the new buildings under the PROJECT shall be routed through a new gravity network and connected to the existing network.
* The new gravity network shall be connected to an existing pumping station.
* The suitability of existing pumping station based on the Invert level of new gravity system shall be verified by the Consultant during the detailed design stage.
* The new buildings will have their own sewage collection network, which will be designed during detailed engineering by the Consultant. Each building will connect to the new proposed gravity network through a manhole or interconnecting chamber.

**Designing a Wastewater Network is crucial for several reasons:**

1. It prevents **public health** hazards by ensuring proper waste conveyance.
2. It minimizes risk of system failures or **overflows**.
3. It ensures compliance with **environmental regulations**.
4. It reduces long-term maintenance needs.
5. It supports efficient connection of future facilities.
6. It protects local ecosystems from pollution.

### 4.4.3 Storm Drainage System:

* A full underground drainage system using roadside catch basins and industrial trench drains to accommodate large impervious surface runoff.
* Water is directed to a central retention basin engineered for peak storm events with overflow protection.
* Industrial-grade PVC piping provides chemical resistance against potential surface pollutants.
* The storm drainage network design is presented in Figure 8 through multiple drawing types.

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| *Figure 8: Storm Drainage Design Network* |

#### 4.3.3.1 Storm Drainage Network Design Consideration:

* Drainage from building’s roof: The surface run off collected from roof of buildings will be transported through vertical pipeline and discharging into a splash block. Thereafter, the storm drainage will be collected by gullies and grated catch pits.
* Drainage from paved areas/ roads: Paved areas and roads will be graded so that the surface run off will be directed away from buildings and towards gully points and grated catch pits.
* Underground network: The storm drainage collected from gully points and grated catch pit will be routed through underground gravity pipe network with manholes at a slope.
* Check valve at outfall: Outfall shall be provided with check valve

**Designing a Storm Drainage Network is crucial for several reasons:**

1. It mitigates flooding risks and safeguards property and operations.
2. It ensures rapid and controlled removal of stormwater.
3. It contributes to environmental protection by preventing uncontrolled runoff and erosion.
4. It reduces maintenance burdens from sediment build-up.
5. It protects public safety.

## 4.5 Dry Utilities Design Methodology

This scope includes all dry utility systems essential for industrial operations, covering electrical distribution, telecommunications, street lighting, and CCTV surveillance networks. The design and shop drawings are limited to distribution networks within the site boundaries. *External infrastructure (e.g., primary substations, telecom exchanges) is excluded unless explicitly requested by the client*. The execution follows **four key stages**:

### 4.5.1 **Step 01**: Data Collection and Analysis

AIEcon will review all provided masterplans, existing utility maps, and technical specifications to ensure alignment with project requirements. Key activities include:

* **Data Review**:
  + Survey data (topographic, geotechnical).
  + Existing electrical/telecom infrastructure and capacity.
  + Local authority Load demand calculations per plot (industrial, lighting, CCTV).
* **Deliverables**:
  + Inventory of existing dry utilities.
  + Gap analysis and conflict identification with wet utilities/roads.
  + Preliminary routing studies for cables/ducts.

### 4.5.2 **Step 02**: Conceptual Design

Development of a **Concept Design Report** covering:

* **Electrical**: MV/LV network architecture, substation siting, load balancing.
* **Telecom/CCTV**: Duct bank routing, redundancy planning.
* **Street Lighting**: Pole spacing, luminaire selection, energy efficiency analysis.
* **Deliverables**:
  + Conceptual single-line diagrams (SLDs) for electrical networks.
  + Duct bank and manhole layout plans.
  + Cost estimates and phasing strategy.

### 4.5.3 **Step 03**: Detailed Design

Construction-ready deliverables, including:

* **Electrical**:
  + Detailed SLDs, cable sizing calculations, protection coordination studies.
  + Substation layouts, RMU schedules, earthing/lightning protection.
* **Telecom/CCTV**:
  + Fiber optic cabling plans, manhole/chamber details.
  + Camera positioning and control room integration.
* **Street Lighting**:
  + Pole foundation designs, photometric analysis, control panel schematics.
* **Deliverables**:
  + **BIM-compliant drawings**: Horizontal plans, profiles, cross-sections.
  + **BOQs**: Itemized quantities for cables, poles, transformers, etc.
  + **Technical Specifications**: Compliance with IEC, IEEE, and local & international codes.

### 4.5.4 **Step 05**: BIM Integration (optional)

* Federated 3D model integrating all dry utilities with clash detection.
* Digital twins for electrical/telecom networks to support asset management.
* As-built documentation for handover.

## 4.6 Dry Utilities Design Elements

### 4.6.1 Electrical Distribution Network

A medium voltage (11kV) ring network designed to ensure continuous power supply to heavy industrial equipment and plant operations. Power is distributed via Ring Main Units (RMUs) and electrical kiosks located strategically across load centers. Plot-level metering and control panels will be incorporated to meet facility-specific energy demands.

Figure 9 provides a visual representation of the different electrical network design elements

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| A collage of electrical network design  AI-generated content may be incorrect. |
| *Figure 9: Electrical Network Design* |

* **MV Network (11kV)**:

Design of the complete medium voltage (11kV) primary distribution system covering the industrial park. Includes ring main configuration, substations, RMUs, load centers, and plot-level metering.

* + Ring-main configuration with RMUs and underground XLPE cables.
  + Substations (e.g., 11kV/0.4kV) at load centres.
* **LV Network (400V)**:

Design of low voltage distribution system integrated with electrical kiosks and main panels. Provision for internal lighting, small power distribution, and connections to buildings.

* + Distribution panels, meter kiosks, and plot connections.
* **Design Considerations**:
  + Fault current analysis, voltage drop limits, and N+1 redundancy.

### 4.6.2 Telecommunications Network

Redundant telecom duct banks designed alongside the electrical corridors to provide reliable digital and data connectivity. Manholes are positioned at 150-meter intervals for future maintenance, access, and network expansions. This system supports smart manufacturing capabilities and secure data infrastructure.

* **Fiber Optic Ducts**: HDPE ducts (Ø110mm) with pull boxes every 150m.
* **Manholes**: Precast concrete with cable trays and labeling.
* **Redundancy**: Dual-path routing for critical data links.

Shown in Figure 10 are the different drawings comprising the telecommunication network design

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| A collage of blueprints  AI-generated content may be incorrect. |
| *Figure 10: Telecommunications Network Design* |

### 4.6.3 Street Lighting Network

Design of street lighting system including pole locations, luminaire specifications, and cabling routes. Coordination with power supply sources and compliance with local lighting standards.

* **Poles**: Galvanized steel, 8–12m height, 30–50m spacing.
* **Luminaires**: LED fixtures (5000K, 100W+) with smart controls.
* **Power Supply**: Dedicated LV feeders from electrical kiosks.

The Street lighting network design, including its various components, is shown in the drawings presented in Figure 11.

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| A collage of a diagram  AI-generated content may be incorrect. |
| *Figure 11: Street lighting Network Design* |

### 4.6.4 CCTV Surveillance Network

Layout of CCTV camera positions, cabling routes, and connection to control rooms. Coordination of power and data requirements for surveillance infrastructure.

* **Cameras**: IP-based, weatherproof, with night vision.
* **Cabling**: Fiber backbone + copper for power.
* **Control Room**: Video wall integration and storage servers.

Shown in Figure 12 are the different drawings comprising the CCTV Surveillance network design

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| A diagram of a building  AI-generated content may be incorrect. |
| *Figure 12: CCTV Surveillance Network Design* |

### 4.6.5 Applied Codes

* **Electrical**: IEC 60364,
* **Telecom**: ITU-T standards, NTRA regulations.
* **Street Lighting**: EN 13201, CIE guidelines.
* **CCTV**: ISO 27001 (cybersecurity), local surveillance laws.

# [Computer Models and Software Packages](#_Toc199154235)

The following software tools will be used throughout the design, modeling, analysis, and documentation stages of the project:

* **Autodesk Civil 3D**: For road design, grading, and corridor modeling.
* **Autodesk Revit / Navisworks**: For BIM modeling, clash detection, and coordination.
* **AutoCAD**: For drafting and detailed 2D documentation.
* **SEWERCAD**: For hydraulic modeling and analysis of sewer and stormwater networks.
* **WaterCAD / WaterGEMS**: For potable water network hydraulic calculations.
* **HEC-HMS**: For hydrologic analysis and stormwater runoff modeling.
* **GIS (ArcGIS / QGIS**): For spatial analysis, utility mapping, and data management.
* **InfraWizard**: For Crossing Points Check will automatically and instantly analyze every crossing point between two pipes and calculate the vertical clearance between them.
* **Microsoft Office Suite**: For reports, calculations, and presentations.

***Note: SID is responsible for providing all necessary baseline data and project inputs required for design (e.g., geotechnical, topographic, and as-built surveys, utility records, and authority guidelines).***

# Deliverables List

## 7.1 Road Design

**Design Deliverables:**

1. Road Alignment & Geometric Design Report.
2. Pavement Design Report with layer specifications and thickness calculations.
3. Civil 3D Base Layout.
4. Plan & Profile Drawings.
5. Typical Cross-Sections.
6. Intersection Layouts with Signage and Marking Details.
7. Cut/Fill Earthwork Analysis.

## 7.2 Wet Utilities Design

**Design Deliverables:**

1. Concept Design.
2. Hydraulic Calculations (Water, Sewer, Stormwater).
3. Utility Coordination and Clash Detection Report.
4. Design Basis Report (pipe material, sizing, standards compliance).
5. Utility Corridor Layouts.
6. Longitudinal Profiles.
7. Manhole and Chamber Details.
8. Stormwater Drainage Plans.
9. Firefighting Loop Plans.

## 7.3 Dry Utilities Design

**Design Deliverables:**

1. Electrical Load Distribution Scheme and SLDs.
2. Telecom Routing and System Layout.
3. Electrical and Telecom Duct Bank Plans.
4. Manhole and Equipment Installation Details.

## 7.4 Notes

* **Formats: All CAD files in .DWG (AutoCAD) + PDF for review.**
* **Standards: AASHTO, international standard (water), and local authority requirements.**
* **Review Cycles: 30% / 60% / 90% submission stages.**
* **Coordination & Compliance will be reported and solved through Navisworks**
* **3D Model (for visualization and stakeholder review) will be available upon request.**

# Time Schedule

|  |  |
| --- | --- |
| Project Stage | Duration (Days) |
| Stage 1: Concept Design | 30 Days |
| Stage 2: Detailed Design | 60 Days |
| Stage 3: Tender Stage | 45 Days |

# Financial Proposal

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Description automatically generated **AIEConLLC**

## Appendix II – Abbreviations & Terms Table

| **Abbreviation / Term** | **Full Term / Description** |
| --- | --- |
| **AASHTO** | American Association of State Highway and Transportation Officials (code reference) |
| **Acres** | A unit of area commonly used in land measurement (1 acre = 4,046.86 m²) |
| **Basis of Design Report (BODR)** | Foundational report defining design criteria |
| **BIM** | Building Information Modeling for integrated 3D design and data management |
| **CCTV / CCTV Network** | Closed-Circuit Television system for site security monitoring |
| **CCVT** | *(Not defined in the source — placeholder)* |
| **Catch pits** | Chambers collecting surface runoff before entering the drainage system |
| **Civil 3D** | Autodesk Civil 3D – civil engineering design and documentation software |
| **Control valves** | Valves regulating flow and pressure in utility networks |
| **DN200 / DN400** | Nominal Diameter 200 mm / 400 mm (Diameter Nominal – standard sizing for pipes) |
| **Drip lines** | Irrigation pipes delivering water directly to plant roots |
| **Electrical Load Distribution Scheme and SLDs** | Schematic drawings representing power distribution and simplified electrical diagrams |
| **GIS** | Geographic Information Systems for spatial data analysis and mapping |
| **High-pressure mains** | Pipelines designed for high-pressure fluid delivery, typically in firefighting |
| **Hydrants** | Fixed outlets on firefighting mains for hose connections |
| **Isolation valves** | Valves enabling sections of a network to be shut off for maintenance |
| **Looped mains** | Ring-shaped main water pipelines ensure redundancy |
| **LV / LV Distribution Network** | Low-voltage electrical network for lighting and small power |
| **MV / MV Distribution Network** | Medium Voltage electrical network providing power distribution |
| **MUTCD** | Manual on Uniform Traffic Control Devices |
| **NFPA** | National Fire Protection Association, a fire safety standards body |
| **Potable Water Supply System** | Network supplying drinking-quality water to buildings and facilities |
| **Primary Irrigation Distribution Network** | Non-potable water system for landscape irrigation with zoning and control valves |
| **PVC** | Polyvinyl Chloride, a material for pipelines and fittings |
| **Ring Main Units (RMUs) / RMU** | Electrical distribution equipment used in medium-voltage networks |
| **SDM** | SDM for Development & Management |
| **SDM Elsewedy Industrial Development** | Full reference to the client entity as SDM in partnership with Elsewedy Industrial Development |
| **SID** | Elsewedy Industrial Development |
| **SLD / SLDs / single-line diagrams** | Single Line Diagram(s) – simplified notation for electrical systems |
| **SOW** | Scope of Work |
| **Storm Drainage System** | System managing runoff from roofs and paved areas to prevent flooding |
| **Street Lighting Network** | An electrical system providing illumination along roads |
| **Sub-mains** | Branch water pipelines distribute flow to sub-areas |
| **Sustainable Drainage System (SUDS)** | System designed to manage surface water sustainably |
| **Telecommunication Network** | Ducts and cables for voice, data, and digital communication |
| **Trench drains** | Surface channels capture and convey runoff water |
| **Wastewater Collection System** | Gravity system collecting and conveying sewage and industrial effluent |
| **WTP** | Water Treatment Plant |
| **WWTP** | Wastewater Treatment Plant |
| **Zone manifolds** | Headers distribute irrigation water to various zones |