Development, Operation and Maintenance of the Multi Modal Logistic Hub Project (IMLH) at Nangal Choudhary (District Mahendragarh) in the State of Haryana through Public Private Partnership on Design, Build, Finance, Operate and Transfer (DBFOT) basis

Project Information Memorandum 2025

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List of abbreviations

CFS – Container Freight Station

CONCOR – Container Corporation of India

DFC – Dedicated Freight Corridor

DMIC – Delhi Mumbai Industrial Corridor

GDP – Gross Domestic Product

GSDP - Gross State Domestic Product

HSIIDC – Haryana State Industrial & Infrastructure Development Corporation

ICD – Inland Container Depot

IMLH – Integrated Multi Modal Logistic Hub Project

INR – Indian New Rupee

MMLP – Multi Modal Logistics Park

NCR – National Capital Region

NICDC – National Industrial Corridor Development Corporation

PPP – Public Private Partnership

SPV – Special Purpose Vehicle

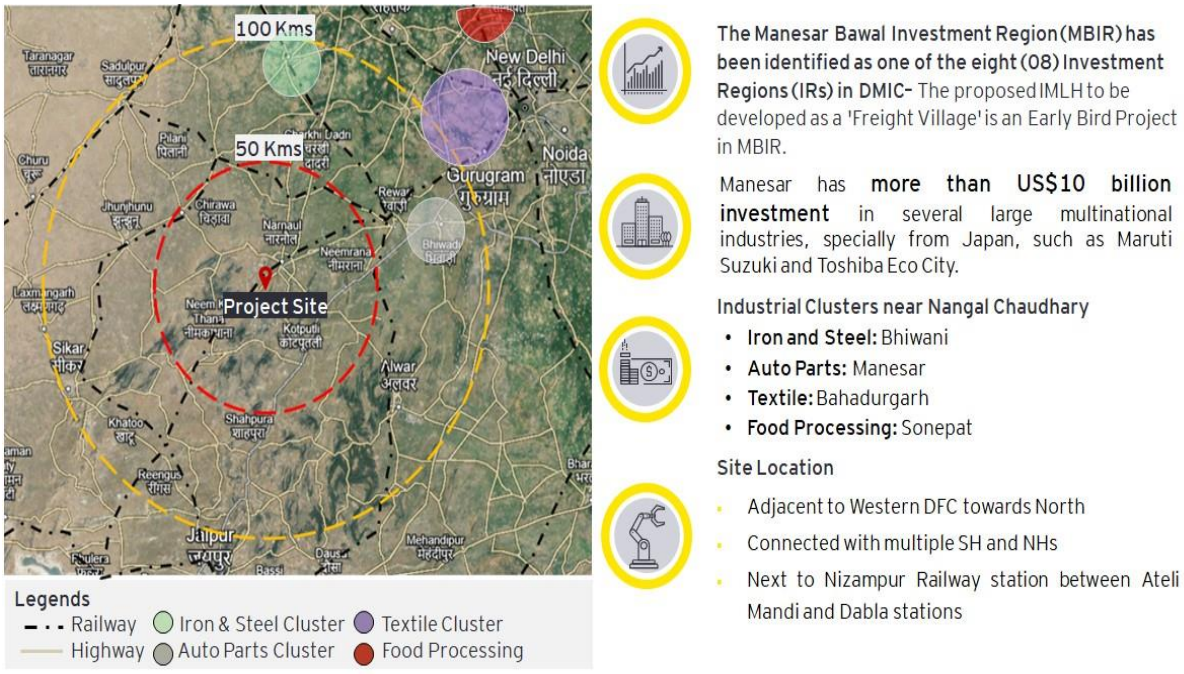
TEU – Twenty Foot Equivalent Unit

USD or US$ – United State Dollar

1 Background

The Government of India has envisaged the development of Delhi Mumbai Industrial Corridor (DMIC) along the alignment of proposed Multi-modal High Axle Load Dedicated Freight Corridor (DFC) between Delhi and Mumbai, covering an overall length of 1,503 km. Further, 'National Industrial Corridor Development and Implementation Trust (NICDIT)' (erstwhile Delhi Mumbai Industrial Corridor Development and Implementation Trust (DMICDIT)) in 50-50% joint venture partnership with Haryana State Govt. through Haryana State Industrial & Infrastructure Development Corporation Ltd. (HSIIDC) has incorporated a Special Purpose Vehicle (SPV) 'NICDC Haryana Multi Modal Logistic Hub Project Ltd.' to establish, promote, and facilitate development of IMLH Project. The location of the proposed logistics hub at Nangal is provided in the Figure 1 below.

Figure 1 Project location



Source: Google, EY Analysis

In view of the above, NICDC Haryana Multi Modal Logistic Hub Project Ltd intends to implement the project on PPP model.

2 Introduction

With a view to overcome capacity constraints and provide faster transit services on the trunk routes, Indian Railways have initiated the development of Dedicated Freight Corridors (DFCs) connecting Ludhiana in Punjab with Son Nagar in Bihar; known as the eastern corridor and Dadri in Uttar Pradesh with Jawaharlal Nehru Port in Navi Mumbai in Maharashtra called as Western Corridor. The expectation is to reduce unit cost of transportation by speeding up freight train operations and higher productivity besides meeting the demand of the growing economy.

DFCCIL has envisaged setting up of multi-commodity multimodal logistics parks through public private partnership (PPP) alongside DFC corridors at strategic locations for capturing bulk/ break bulk, unitized, liquid, reefer and Ro-Ro traffic that would establish an integrated logistics chain for more efficient and greater use of rail transport to service physical distribution of goods. In other words, these parks will function as hubs to feed the freight corridors by providing storage/warehousing, distribution and trading facilities besides offering a wide range of value addition services. In the ultimate stage, the logistics park(s) creatively can leverage cost effectiveness by conveying large quantities of material via rail to/from the hubs and then swiftly transferring the exact volumes required by customer, thereby minimizing the shipping cost and maximizing the services. These logistics terminals are expected to offer complete transport solutions to the customers. From the railway's perspective, a logistics park will facilitate integration of a cost-effective, environment-friendly transport with logistics and supply thereby enhancing the modal share of railways. The industrial corridor along the DFC will cater to the augmented demand for efficient logistics services covering transportation, handling, storage/warehousing and distribution.

2.1 Identification of project and project proponent

Logistics is the backbone of economic growth in the country with potential to facilitate trade, enhance farmer income, drive '**Make in India**' initiative and reduce economic disparity across states and sections of the population. An efficient, seamless and integrated logistics network is also a key driver to accelerate trade and drive overall export competitiveness of the country. Despite being a critical driver of economic development, logistics cost in India, at 14-18% of GDP[1], is high when compared to more developed economies (USA 8-10%, Europe 10%, Japan 11%) and the sector continues to be highly unorganized. India has a skewed modal mix, with 60% of freight moving on roads, which is by far the highest among large countries. Freight movement by road is typically 25 – 30% more expensive than railways for long haul routes, thereby increasing the overall freight transportation cost in India. Globally, all large countries such as the US, Germany, Italy, Japan and China among have created a network of large multi modal logistics parks to ensure a seamless transfer of goods across modes. These logistics parks provide best in class handling infrastructure, as well as a large range of logistics services including warehousing, packaging, cargo aggregation and distribution etc.

[1] LEADS Report 2021, Ministry of Commerce & Industry, https://www.deccanherald.com/business/indias-logistics-cost-will-come-down-to-9-of-gdp-in-next-two-years-gadkari-3236634

Multimodal logistic park (MMLP) is a centralized hub for all types of transportation activities and value-added services needed by exporters and local traders for shipment of their goods. It is often defined as rail/ road/ sea based inter-modal traffic handling facilitation complex comprising container terminals, bulk/break-bulk cargo terminals, warehouses, banking and office space and facilities for mechanized handling, inter-modal transfers, sorting/ grading, cold chain, aggregation/ desegregations, etc., to handle freight traffic.

It is a key policy initiative of the Government of India, led by National Industrial Corridor Development Corporation (NICDC) under Department for Promotion of Industry & Internal Trade (DPIIT), Ministry of Commerce & Industry, to develop Multi-Modal Logistics Parks as part of the 'Special Investment Regions' along the corridors demarcated across the country. The Project location is depicted in Figure 3.



Figure 2 Project Location

The development of multi modal transport logistics had its genesis in the creation of special industrial and economic development zones around sea and airports with the objective of stimulating and facilitating seamless and competitive export promotion activities. Further evolution of this trend motivated by increased economic growth has resulted in creation of Inland Distribution Networks (IDOWNs), and Inland Ports (IPs) in the hinterland as well. The efforts towards the creation of special economic zones and industrial corridors in emerging economies of countries like India attempt to capitalize on these trends, while exploring the possibility of providing logistics parks to serve these economic zones. These features recommend that the creation of required logistics infrastructure is a critical component both for export focused strategy as well as economic development of the area. In short, the logistics parks provide a base for the local business and industries to not only compete on the national level but also on the global basis.

2.2 Need for the project & its significance

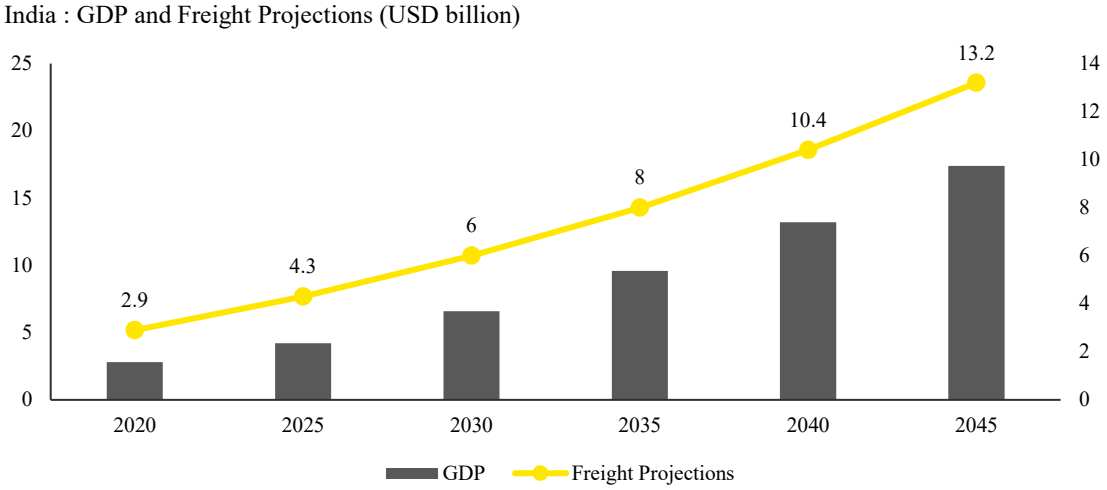
The project envisaging revised study for the development of MMLPs in the country is essential to reduce costs in the logistics sector.

With the pivotal role in driving economic progress by facilitating the efficient movement of goods and services across the supply chain, the logistics sector contributes substantially to GDP and provides livelihood for more than 22 million people. It enables timely delivery, decreases costs, and enhances competitiveness, crucial for thriving businesses. Logistics boosts productivity and trade by improving connectivity infrastructure and adopting innovative technologies, thereby stimulating economic growth. Moreover, it fosters investment and supports various sectors, contributing significantly to GDP expansion. As a key enabler of trade and commerce, the logistics sector underpins economic development, enabling nations like India to harness their full potential and achieve sustainable progress.

Current Trends

India's projected GDP growth to US$26 trillion by FY48 (US$6 trillion by 2030) and the goal to boost merchandise exports to US$1 trillion by 2030 are key drivers increasing the demand for logistics services, as displayed below in Figure 4. Between May 2023 and May 2024, the exports of India have increased by $4.62B (13.2%) from $35B to $39.6B, while imports increased by $4.72B (8.28%) from $57B to $61.8B. This robust trade growth has propelled the transportation and logistics sector, which expanded to an estimated 317.3 billion USD in 2024 and is expected to reach 545.6 billion USD by 2030, growing at a CAGR of 9.46% during the forecast period (2024-2030).

Figure 3 India GDP and Freight Projections (USD billion)



Source: Goldman Sachs/National Rail Plan

India's freight movement is heavily reliant on road transportation, which accounts for 66% of cargo movement (in ton-km), followed by rail (31%), shipping (3%), and air (1%). To support this extensive cargo movement, India has a comprehensive network of infrastructure, including over 129 inland container depots, 168 container freight stations, and approximately 300 million square feet of warehousing space.

Logistics in India

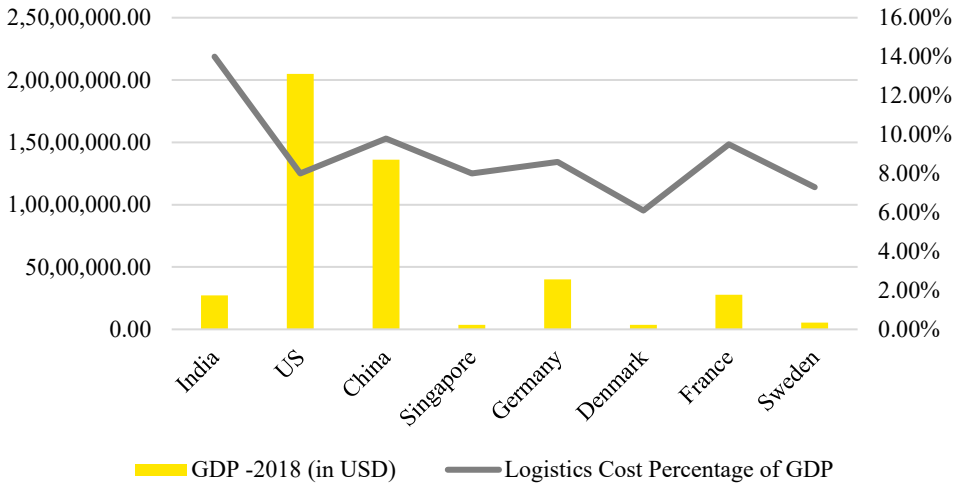
As India strives to realise its ambitious economic goals, including achieving a GDP of US$ 5.5 trillion by 2027, the transformation of the logistics sector emerges as a key driver. The Indian government has granted infrastructure status to logistics, but the industry still struggles to find the actual logistics cost, which is high for both imports and exports, making them uncompetitive in global markets. Logistics cost globally ranges between 6 - 9% (percentage of total GDP), and in India it is around 14 - 18%[2] and provides livelihood for more than 22 million people[3], as displayed below is Figure 5.

The Government of India (GOI) is addressing the high dependence on road transportation by exploring options to optimize freight movement and reduce logistics costs. Initiatives such as Gati Shakti and the National Logistics Policy aims to streamline the logistics sector, making it greener, more agile, transparent, and integrated. The goal is to reduce logistics costs 8-10% by 2030. The logistics sector is witnessing rapid infrastructure development, increased digitalization, and a heightened focus on sustainability. GOI's digital initiatives, such as 'Make in India' and the Unified Logistics Platform (ULIP), are enhancing transparency and efficiency. The Dedicated Freight Corridor (DFC) project, with an investment of approximately US$38 billion (INR 3 lakh crore), aims to develop exclusive rail tracks for goods trains. Significant private and foreign investment is needed to support the logistics sector's growth. Initiatives like the National Infrastructure Pipeline (NIP)are expected to attract investments worth approximately US$650 billion (INR 50 lakh crore).

[2] https://www.deccanherald.com/business/indias-logistics-cost-will-come-down-to-9-of-gdp-in-next-two-years-gadkari-3236634
[3] https://www.ibef.org/research/case-study/transforming-india-s-logistics-sector-challenges-and-opportunities

The logistics industry was valued at US$ 317.3 billion in 2024 and is expected to grow at a compounded annual growth rate (CAGR) of 8 – 10% to USD 484 billion by 2029[4]. However, this would first require estimating demand and organising the road and rail network. But the bulk of goods continue to move by road and the logistics industry continues to be dependent on small-time agents and truckers. A reduction will result in more competitive goods and services, resulting in more trade and commerce.

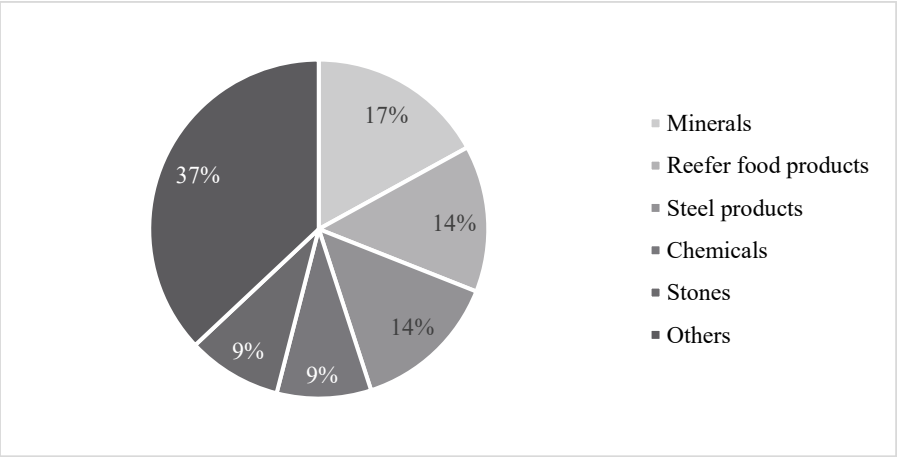
Figure 4 Logistics Cost as a percentage of GDP



Source: EY Analysis

In volume terms, various mineral products which are either containerised or containerisable are the major product group being exported from India. In 2022, this product group constituted 17% of the total containerised or containerisable exports of India. This product group's export volume has increased from 4.5 million tonnes in 2008 to 19.8 million tonnes in 2022, nearly 20 times over the decade. Reefer food products follow the minerals and constitute 14% of India's total exports. Rising demand for fish and meat has increased the commercial farming of fish and livestock in India over the years. As per the data available to us, export volume of reefer foods increased five times over decade from 4.6 million tonnes in 2008 to 15.6 million tonnes in 2022, as displayed below in Figure 6:

Figure 5 Major commodities exported from India 2022



[4] https://dpiit.gov.in/sites/default/files/leads_2024_report.pdf

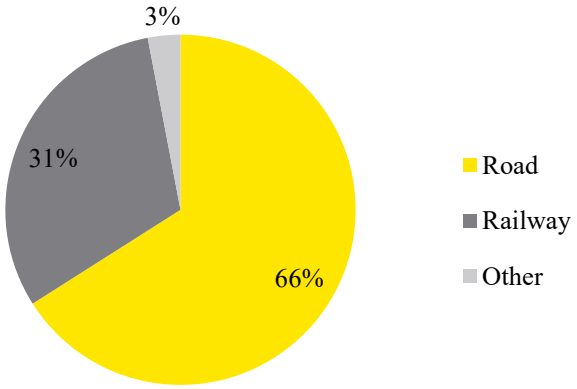
Source: Ministry of Commerce and Industry, Government of India

On the import side, chemical segment is the largest group of commodities being imported in India. In 2022, the country imported 24.7 million tonnes of chemicals compared with 6.8 million tonnes in 2008. Steel and steel products rank second in the list of imports in India. Growing industrial and infrastructural needs has kept steel product demand high in the country. Steel product imports increased from 12.4 million tonnes in 2008 to 20.5 million tonnes in 2022. Similarly, rising income levels in the country has given rise to increased demand for imported food products. Imports of food products increased by three times over the decade to reach 18.8 million tonnes in 2022.

Key Issues in the Logistics Sector in India

In India, the logistics sector is now close to $282 billion and is projected to develop quickly to $557.4 billion by 2032 growing at a CAGR of 7.85%[5]. Even though the industry has changed significantly over the years, it still faces numerous interrelated problems and bottlenecks, including a poor mix of modes of transportation, high indirect costs, Tax Structure and Warehousing Problems, inadequate infrastructure, Driver Shortage & Retention, clumsy procedures, a lack of integrated planning, a lack of standardization, and a slow uptake of technology. Notably, in 2023 road transport dominates the logistics value chain's most important element, transportation, with a freight modal share of 66% in India followed by 31% through railways and other modes (like coastal shipping/waterways and air) constitute 3%[6], as displayed below in Figure 7.

Figure 6 Freight modal share of major modes in India



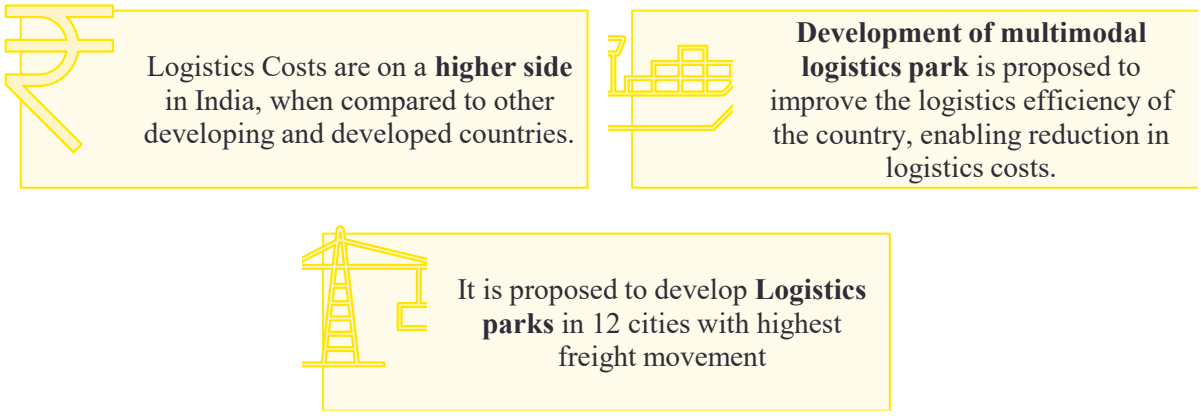
When compared to other countries, India's high logistics costs can have an adverse effect on economic efficiency and growth since they limit the expansion of the primary and secondary industries and the ability of Indian goods to compete on the international market.

The Government of India has been implementing numerous efforts to bring about structural reforms and give the sector a boost since it is aware of the importance of the logistics sector for high economic growth and the fulfilment of the country's aspiration to be a global manufacturing powerhouse. The institutional framework, policy and planning, process improvement, infrastructure development, skill development, and technology innovation are just a few of the many elements of the industry that these projects cover.

[5] https://www.itln.in/logistics/from-bytes-to-billions-how-data-is-driving-indias-logistics-1353274#:~:text=India's%20logistics%20sector%20is%20one,per%20cent%20during%202024%2D2032.
[6] https://www.statista.com/statistics/1248877/india-share-of-freight-logistics-by-modes/#:~:text=In%202023%2C%20around%2066%20percent,2008%20to%20around%2031%20percent.

There is a strong need for MMLPs in India, as displayed below in Figure 8.

Figure 7 Need for MMLPs in India



The improvement in the nation's position on the Logistics Performance Index (LPI), a benchmarking instrument created by the World Bank to relatively assess the logistics performance of other nations, also reflects the influence of the government's increased attention on the logistics industry in recent years.

Notably, India's standing on the LPI rose from position 54 in 2014 to position 35 in 2016 but fell to position 44 in 2018. Currently it has consolidated its position to 38th as per the 2023 report.

Key Importance of MMLPs

Typically, MMLPs serve as nodes for the consolidation of freight and its transportation using the most efficient method, which lowers costs and strengthens the logistics system from an economic and environmental standpoint. By facilitating the transit of freight in big trucks rather than smaller ones, freight aggregation has shown to reduce the carbon impact. Additionally, the provision of road and rail links in a logistics park enables multimodal transportation, further assisting in the movement of long- and short-haul commodities in an area. Modern mechanized space is provided by MMLPs, increasing the efficiency of the storage and warehousing sector in each city. Additionally, MMLPs offer value-added services including packing, labelling, inventory management, quality control, customs clearance, and additional tracking and tracing services.

However, in the presence of an MMLP, typically the movement would be based on a hub and spoke model, wherein aggregation of freight would take place at a single facility, i.e., MMLP, thereby reducing the cost as well as the number of vehicles moving on the road. For the subject MMLP, the components/ features of the facility will be based on cargo composition. Creating a multimodal logistic hub consists of having an ICD (Inland Container depot), which stores the freight and has customs clearance facilities. This along with a CFS (container freight services) integrated the freights in a one place. The logistic park is expected to have rail and road as the primary mode of transport. The feeder line would be trodden mostly by road, while the main to and fro movement of freight would be done by Rail. The advantage of this sort of a logistic hub is multi-fold:

Economic Benefits

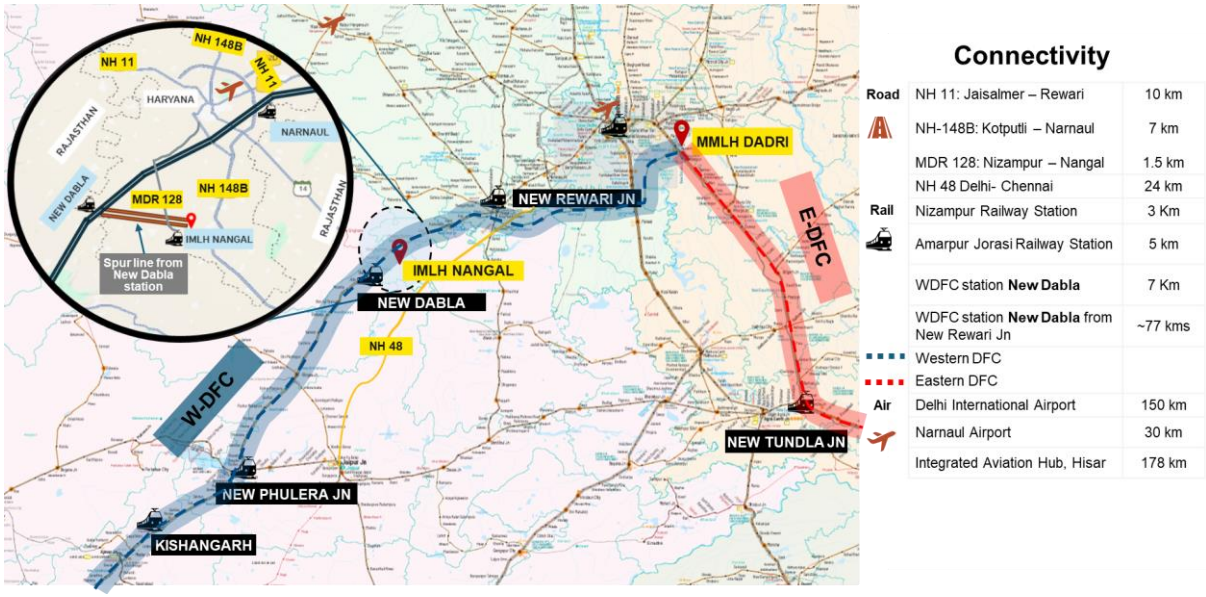
- Consolidation, leading to improved operational efficiency – Availability of Ro-Ro trains.
- Reduction in the overall carbon footprint
- Reduction in the overall transport cost
- Excellent transport links compared to “stand alone” distribution centres with easy access to long haul rail network as well as to delivery points in the catchment area by trucking.
- Customs clearance facilities.
- Round the clock service, being generally located away from urban settlement areas.

- Costs saving as all the facilities are provided at one location.
- Enhanced security systems.
- Availability of more options for selection of competitive and reliable logistics providers.
- Maintenance and repair of container units

2.3 Hinterland Overview

The site proposed for the development of the IMLH is spread over 408 acres. The project site is located across 3 villages namely Bashirpur, Ghataser and Talot and the site is near the Haryana- Rajasthan Border region, as depicted in Figure 10. The site is located along the Western Dedicated Freight Corridor (WDFC) Rewari Phulera Chord. In addition to WDFC, the site is well connected with the National Highways, State highways and Airports.

Figure 8 Project Site



The key characteristics are:

- **Large and Contiguous Land Parcel**: The site offers a substantial and uninterrupted land area, which is advantageous for efficient master planning and development.
- **No Aravali Plantation or Village Abadi**: The absence of Aravali plantation and village settlements simplifies the approval process, making it easier to proceed with the project.
- **Proximity to Amarpur Jorasi Railway Station**: The existing rail connectivity to Amarpur Jorasi station facilitates passenger traffic movement, enhancing accessibility.
- **2 km Frontage on Upcoming Western Dedicated Freight Corridor (WDFC)**: The site enjoys a 2 km frontage along the WDFC, which will significantly ease the transportation of goods across the country.
- **Access to Canal and Groundwater**: Multiple water sources, including canal water and groundwater, provide essential resources for the logistics hub.

Overall, the proposed IMLH aligns with the objective of creating a strong economic base with state-of-the-art infrastructure facilities within the Manesar Bawal Investment Region (MBIR) as part of the Delhi-Mumbai Industrial Corridor (DMIC) initiative. The proposed site is equidistant from IGI Airport and Jaipur International Airport, being approximately 145 km from the IGI Airport in Delhi and 167 km from Jaipur International Airport, giving the site convenient access to air travel. The site also has direct access to NH 148 B1 (formerly State Highway 17) providing a crucial link. It connects the site to Gurgaon via Dharuhera and Rewari, where an Inland

Container Depot (ICD) is located. Additionally, it opens access to northern regions such as Rajasthan, Punjab, and Himachal Pradesh. The site connects to the National Highway 8 through Narnaul, facilitating transportation to Gurgaon, Delhi, and Uttar Pradesh. This axis also serves major industrial nodes like Bawal, Neemrana, Ghilot and Behror.

2.4 Economic and demographic profiling

Demography

As per the census of 2011, the working population for the district of Mahendragarh stands at 1,90,229 (Working people within the age of 19-59 have been taken into consideration for the study). Of this, men constitute approximately 83% and the rest is women. If we take a glance at the urban to rural split, it stands at 84% and 16% respectively for urban and rural. About 32% of the working-class people fall in the age group of 30-39, followed by 28.5% in the range of 20-29. Almost a quarter of the working class lies in the age group of 40-49 and the remaining is contributed by the 50-59 age group, as depicted below.

Table 1 Working age Population for Mahendragarh District

Mahendragarh District	Urban		Rural	
Male	1,31,962	83.37%	28,155	88.15%
Female	26,326	16.63%	7863	11.85%

Source: Department of Economic and Statistical Affairs, Haryana and NSO, New Delhi

Further, Mahatma Gandhi National Rural Employment Guarantee Act 2005 (MNREGA) data gives an insight to sort of workforce present in the hinterland. These characteristics are tabulated below:

Table 2 Working age population Characteristics

District	Mahendragarh	Count
No. of Registered	Household	64,813
No. of Registered	Persons	91,231
Cumulative No. of HH issued job cards	SCs	15,168
Cumulative No. of HH issued job cards	STs	0
Cumulative No. of HH issued job cards	Others	49,212
Cumulative No. of HH issued job cards	Total	64,380
Employment demanded	Household	3,031
Employment demanded	Persons	3,729
Employment offered	Household	3,031
Employment offered	Persons	3,729
Employment Availed	Household	2,164
Employment Availed	Persons	2,617
Employment Availed	Total Person-days	43,225

Source: Department of Economic and Statistical Affairs, Haryana and NSO, New Delhi

Economy of Haryana

The Department of Economic and Statistical Affairs, Haryana regularly compiles the SDP estimates for the State, following the technical guidance provided by the NSO, New Delhi.

It is observed that the Gross State Domestic Product (GSDP) of the State, at current prices, has increased from Rs. 2,97,538.52 crore in 2011-12 to Rs 9,94,154.08 crore in 2022-23 marking a growth of 234.13 percent making it the 13th largest economy in India. At constant (2011-12) prices, the GSDP has grown from Rs 2,97,538.52 crore in 2011-12 to Rs. 6,08,420.26 crore in 2022-23, reflecting a growth rate of 104.48%. The average annual growth

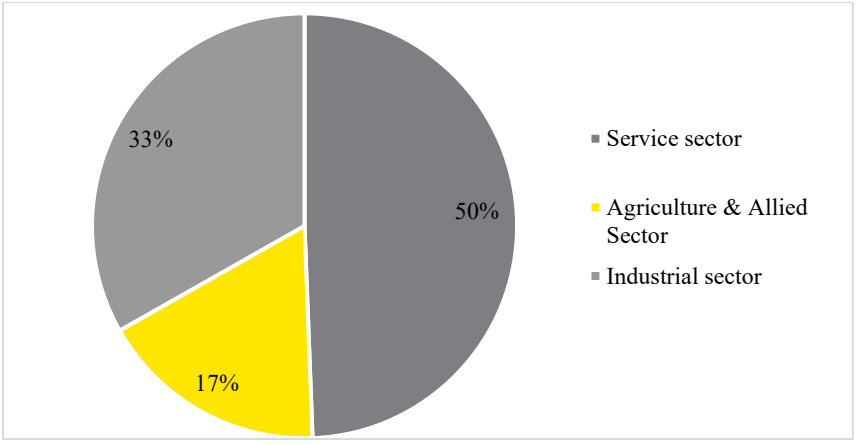
rate of the GSDP during the period 2012-13 to 2022-23 is estimated at 11.7% at current prices and 6.8% at constant prices.

Analysis reveals that the Primary Sector of State's economy has witnessed an average annual growth rate of 3.5%, while the Secondary and Tertiary sectors have grown at average annual growth rates of 6.8% and 7.4% respectively, in real terms from 2012-13 to 2022-23. This indicates that the secondary and tertiary sectors have experienced faster growth as compared to the primary sector. In terms of per capita income, the State has seen an increase from Rs. 1,06,085 in 2011-12 to Rs. 2,96,685 in 2022-23 at current prices, indicating a growth of 179.7 percent. At constant prices, per capita income has risen from Rs. 1,06,085 in 2011-12 to Rs. 1,81,961 in 2022-23 reflecting a growth of 71.5 percent. Comparatively, the per capita income of the Indian Union has increased by 171.46% and 55.01% at current and constant prices, respectively during the period 2011-12 to 2022-23. This indicates that the State's economic development has outpaced that of India.

The share of Primary sector in the Gross State Value Added (GSVA) has declined from 23.6% in 2011-12 to 17.9% in 2021-22 at constant prices. The share of Secondary sector has slightly increased from 31.6 percent in 2011-12 to 33.2% in 2021-22, while the contribution of the Tertiary sector has risen from 44.9% in 2011-12 to 48.9% in 2021-22. These changes in the sectoral composition of GSVA over the years reflect the overall progress of the developing economy. It signifies that the State economy is advancing towards a stable and mature State.

In 2022-23, the share of the Primary sector decreased to 17.6% as compared to previous year, while the share of the Secondary sector reduced to 33% from its share of 33.2% recorded in the previous year. On the other hand, the share of the Tertiary Sector slightly increased to 49.4% in 2022-23 from 48.9%percent recorded in 2021-22, as depicted in figure below.

Figure 9 Sector-wise Composition of State's Economy at Constant (2011-12) Prices in 2022-23



Source: National Census 2011-12/EY Analysis

As a sectoral shift from agriculture to manufacturing and services mostly is followed by an increase in the per capita income, it can be said that the IMLH Haryana would further augment the process of upliftment of the economic status of the working population.

The growth of Gross State Value Added (GSVA) of the State at constant (2011-12) prices has been estimated as 10.1% in 2021-22. In 2022-23 growth of GSVA has been estimated as 7.1%. The growth of 6.3% in Industry Sector and 8.4% in Service Sector led to the overall growth of 7.1% in 2022-23.

The year over year (YoY) growth in GSVA in real terms is shown in the Table below.

Table 3 Sector wise working age population split

Sector	Haryana								All India
	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22 (Q)	2022-23 (A)	2022-23 (A)
Agriculture & Allied	3.8	7.9	7	8.8	5.3	-0.7	1.6	5.3	3.5
Industry	11.4	12.9	3.6	13	-2.4	-2	11.8	6.3	4.1
Services	10.8	8.6	5.6	8.5	4.6	-9	12.4	8.4	9.1
GSVA	**9.7**	**9.9**	**5.2**	**10**	**2.4**	**-5.2**	**10.1**	**7.1**	**6.7**

Legend: Q: Quick Estimates A: Advance Estimates

Source: Statistical Handbook (2022-23), Department of Economic and Statistical Affairs, Haryana and NSO, New Delhi

The State's economy was predominantly an agrarian economy. During 1969-70, as per the 4th Five Year Plan, the contribution of Agriculture and Allied Sectors (crops, livestock, forestry, and fishing) to the GSDP at constant prices was the largest (60.7%). followed by Services (21.7%) and Industry (17.6%) Sectors.

During the period of 37 years (1969-70 to 2006-07) intervening 4th and 10th Five Year Plans, Industry and Services Sectors registered higher average annual growth than the Agriculture and Allied Sectors which resulted in the increased share of Industry and Services Sectors and decreased share of Agriculture and Allied Sectors in the GSDP. The share of Agriculture and Allied Sectors in GSDP declined from 60.7% in 1969-70 to 21.3% in 2006-07 while the share of Industry Sector increased from 17.6% in 1969-70 to 32.1% in 2006-07. The share of Services Sector increased from 21.7% to 46.6% during this period. Since the 11th Five Year Plan, the pace of structural transformation of the State's economy remained continued consequent upon the higher growth recorded in Services sector as compared to other two Sectors during this period and onwards, the share of Services sector in GSVA strengthened to 49.4% in 2022-23 resulting in the decrease share of Agriculture and Allied Sectors (17.4%). The contribution of Industry Sector has been recorded as 33.2% of the GSVA in 2022-23

The Per Capita Net State Domestic Product also known as Per Capita income is the average income earned per person. At the time of formation of Haryana State in 1966, the per capita income of the State at current prices was only Rs. 608[7]. The per capita income of the State and the growth rates are presented in the Table below:

Table 4 per capita income Haryana

Year	Per Capita Income of Haryana (Rs)		Per Capita Income of All India (Rs)	
	At current price	At constant (2011-12) Prices	At current price	At constant (2011-12) Prices
2011-12	106,085	106,085	63,462	63,462
2012-13	121,269	111,780	70,983	65,538
2013-14	137,770	119,791	79,118	68,572
2014-15	147,382	125,032	86,647	72,805
2015-16	164,963	137,833	94,797	77,659
2016-17	184,982	150,259	104,880	83,003
2017-18	208,437	156,200	115,224	87,586
2018-19	223,022	169,604	125,946	92,133
2019-20	230,563	170,616	132,115	94,270
2020-21[8]	229,065	155,756	126,855	85,110

[7] Indiastat – year wise per capita income of Haryana (1966-2022)
[8] https://www.pib.gov.in/PressReleasePage.aspx?PRID=1942055

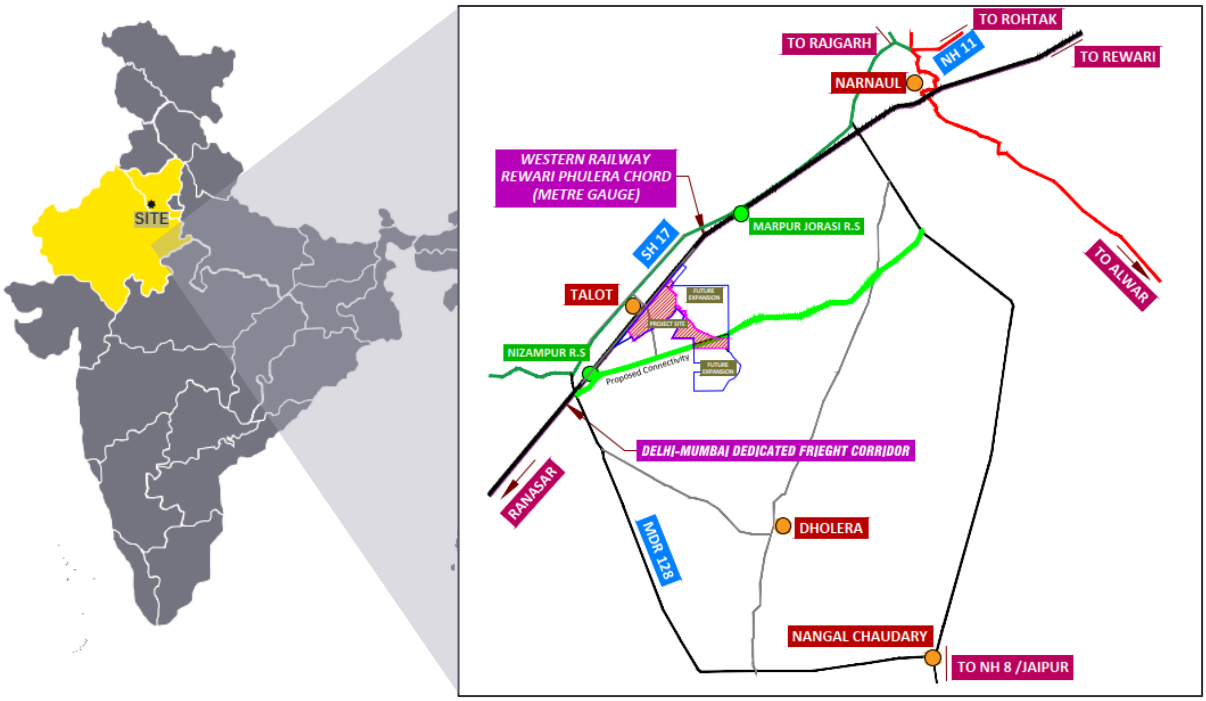
Year	Per Capita Income of Haryana (Rs)		Per Capita Income of All India (Rs)	
	At current price	At constant (2011-12) Prices	At current price	At constant (2011-12) Prices
2021-22[11]	264,835	172,657	150,007	91,481
2022-23[11]	296,685	181,961	170,620*	96,522

Source: Statistical Handbook (2022-23), Department of Economic and Statistical Affairs, Haryana and NSO, New Delhi

2.5 Road & rail connectivity in the region

This is intended to assess the connectivity of rail link to transport the incremental traffic due to setting up of IMLH, container terminal and additional facilities. Timely creation of adequate infrastructure is the prime requirement for generating additional capacity to deal with the projected level of traffic for which availability of land is the basic requirement.

Figure 10 Connectivity to Project Site



Based on the traffic and the land use plan, site of the IMLH have been identified and already finalised.

Existing Road Network

The project is well integrated with the national highways network with NH148B being connected to the project site through the Nizampur-Nangal Shaloo providing North South axis and NH11 through SH17 for the East West axis. Both axes pass through Narnaul located 15 Km from the project site. To ease access to the site, the SPV has constructed a 2/4 lane road linking SH 17 (Narnaul to Nizampur Road) and NH148B (Narnaul to Nangal Chaudhary Stretch), as depicted in figure 10 above.

Rail Connectivity from DFC Rail Network

For fixing up the take-off stations from both the ends, a branch line from the New Dabla station on the Western Dedicated Freight Corridor has been established. In addition, the facility can access the goods shed of Nizampur Railway Station for transporting freight via main railway line of the East Central Railway.

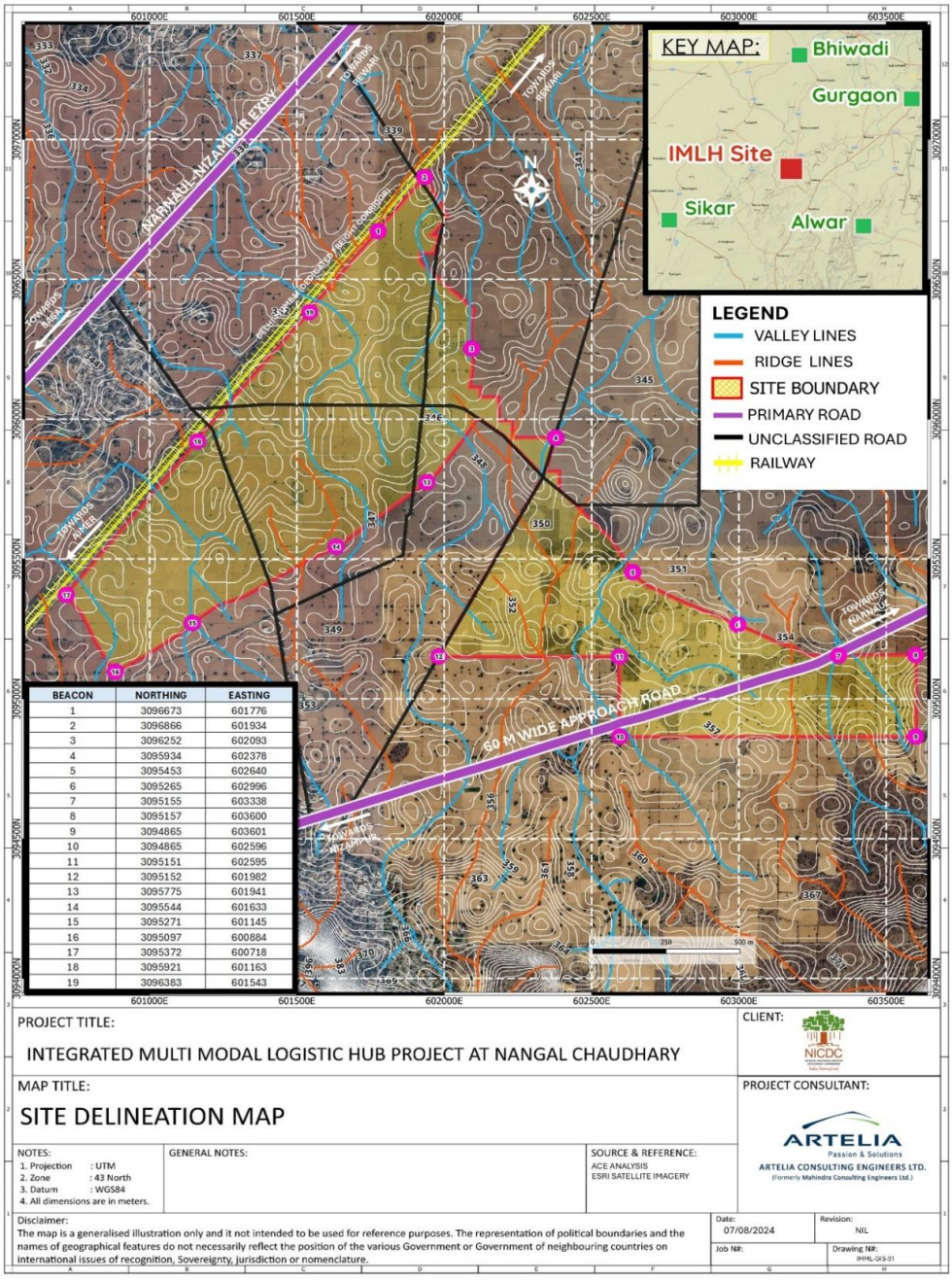
2.6 Site Description

Site assessment and appreciation of IMLH Haryana site location

A. Site features assessment		
i.	Location and site area	• The site is in Mahendragarh District, Haryana and covers across three villages namely Bashirpur, Ghataser and Talot. It is located at proximity to Haryana – Rajasthan border region. • The site is located along the Western Dedicated Freight Corridor (WDFC) Rewari Phulera Chord. • In addition to WDFC, the site is well connected with State highways and Airports. • It is situated 7km away from Nizampur town and 14 km from Narnaul which has the most social and commercial amenities. • The respective coordinates of the site have been plotted as per UTM/43N/WGS84[9] projection system. • The overall site is spread 408 acres. There is an adjacent piece of land admeasuring ~478 acres which is not part of the current project.
ii.	Nature of land profile	• The profile of the site is flat with few/minor undulations. A few minor ridgelines run from South to North direction but does not have major impact on the contours of the site. • The southern boundary of the site abuts a hillock, and some part of the hill falls within the project site. • The profile of the site has sloping topography with the Eastern edge of the site having the highest elevation of 357m at the foothills of the hill. The site has few minor streamlines passing across the site from South to North direction. These are minor and are formed during monsoon season. • The topography of the site is ~357m at the Eastern edge of the site and further drops to 342m towards the Northwestern side of the site which has the envisaged railway siding facility. • The site has an excellent drainage pattern which limits water stagnation within the site. The natural drainage pattern is to be maintained while planning to avoid environmental impact on the surrounding areas.
iii.	Rainfall of the Region	Average annual rainfall is about 450mm, and the rainiest month of the year is from June to September.
iv.	Climate	The Region has sub-tropical arid/ humid climatic condition
v.	Land shape/ configuration	The site is irregular in shape and is split into two land parcels. A small strip of about 15m connects both the parcel A & parcel B in the Phase IA of 408 acres.
vi.	Adjacencies	• East – Hill. • West – SH 17 & Railway Siding Facility • North – Talot village & barren land • South – Ghatasher village
vii.	Site delineation	• The site is located between the Northing of 3095152m to 3096673m and Easting of 601543m to 603600m.

[9] Source: The Authority.

Figure 11 Site delineation map of IMLH Haryana

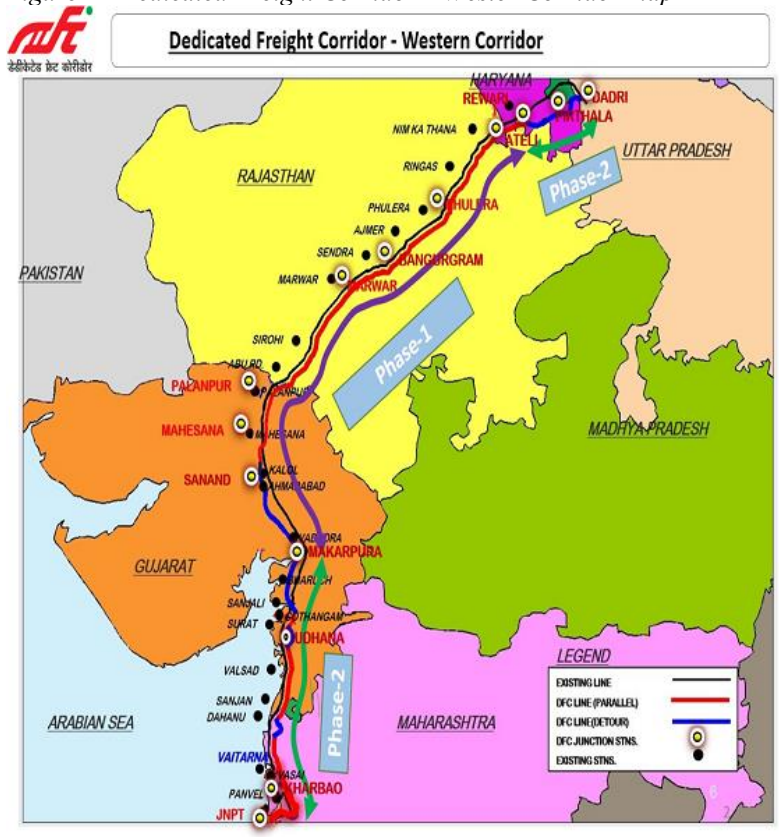


BEACON	NORTHING	EASTING
1	3096673	601776
2	3096866	601934
3	3096252	602093
4	3095934	602378
5	3095453	602640
6	3095265	602996
7	3095155	603338
8	3095157	603600
9	3094865	603601
10	3094865	602596
11	3095151	602595
12	3095152	601982
13	3095775	601941
14	3095544	601633
15	3095271	601145
16	3095097	600884
17	3095372	600718
18	3095921	601163
19	3096383	601543

Source: *ACE analysis*

viii.	Settlements & existing condition of site	• There are few settlements around the site within 4 km radius; the same are listed below: o West Side: Pairan, Napla, Ghatesar, Chhilro, Nizampur o North Side: Talot, Kaloli, Maloli, Bashi o East Side: Tazpur, Mukandpura, Tehla and Narnaul o South Side: Berondla. • Few seasonal agricultural activities have been found within the site boundary. An irrigation canal is passing through the site from Northern side towards the South 4 km. The southern boundary of the site abuts a hillock, some part of the hill falls within the project site. • A village road starting from MDR 128 is passing through the site from West to East direction. Along with the village road three cart crossing the site along North to Southwest direction, second cart track is crossing the site on west side and the third cart track is crossing the site on the southern

		side. These physical features shall be considered in preparing the structural plan. The same is highlighted in the map below.
ix.	Nearest town where social amenities and labour is available	• Proximity to population centres: The towns such as Rewari, Bawal, Narnaul, Nizampur, Pawera and cities such as Jaipur, Haryana, Sikar, and from New Delhi, which are located around the IMLH site provides a competent work force and, to a lesser extent, a market to supply or consume a portion of the goods. The economic benefits are best derived with this in place.
B. Connectivity		
x.	Nearest main road and distance	• The site has access to major National Highways (NH), State Highways (SH) and Major District Roads. NH148B is located towards the Eastern side of the site at a radial distance of 7km which provides excellent connectivity to Gurgaon through Dharuhera and Rewari. In addition to this, NH148B also provides access to the northern regions of Rajasthan, Punjab and Himachal Pradesh and Jammu and Kashmir. • NH 11 is located towards the North-Eastern side of the site at approximately 10 km. • NH 48 is located towards the Southern side of the site at a radial distance of 24km connecting the site to Gurgaon, Delhi and Uttar Pradesh. This axis also connects the site to major industrial nodes like Bawal, Neemrana, Ghilot and Behror. • The SH-17 is adjacent to the site, which is located towards the Northern side at a distance less than 0.5 km. SH-26 is located on the North-Eastern side of the site at a radial distance of 11km and SH 37B is located on the Southern side of the site at a radial distance of 20km. • MDR128 also known as Nizampur –Nangal Chaudhary Road is located towards the Western side of the site at a distance of 4km. MDR 129 is located towards the Eastern side of the site and connects to NH 48 which is located towards the Southern side of the site. • The site is located along the Western Dedicated Freight Corridor (WDFC). The site falls near to the Western Railway Rewari Phulera Chord and is situated between proposed WDFC stations of Ateli Mandi (37.13 Km chainage from Rewari) and Dabla (76.94 Km chainage from Rewari). • The site's northern edge along the WDFC is about 24 Km from Ateli Mandi Railway station, while its southern edge is about 13 km from Dabla Railway station. The site is located at equidistance from Nizampur and Amarpur Jorasi railway stations.
xi.	Nearest airport and distance	• The site has good air connectivity. Two major international airports are located at equidistance from the site. • They are Indira Gandhi International Airport, Delhi at a distance of 145 kms towards the North-eastern side of the site which can be accessed by SH 26 and Jaipur international Airport is at a distance of 167 kms towards the southern side of the site, which can be accessed through NH 48. By this connectivity there is wide scope for international export and import.

xii.	Nearest port	• The site is 1350 km from JNPT which is the dedicated port for WDFC with 4 international port terminals. *Figure 12 Dedicated Freight Corridor – Wester Corridor map*  **Source:** *Dedicated Freight Corridor Corporation of India Limited*
xiii.	Nearest railway station	• Nizampur railway station at distance of at 4 km • Amarpur railway station at distance of at 5.5 km

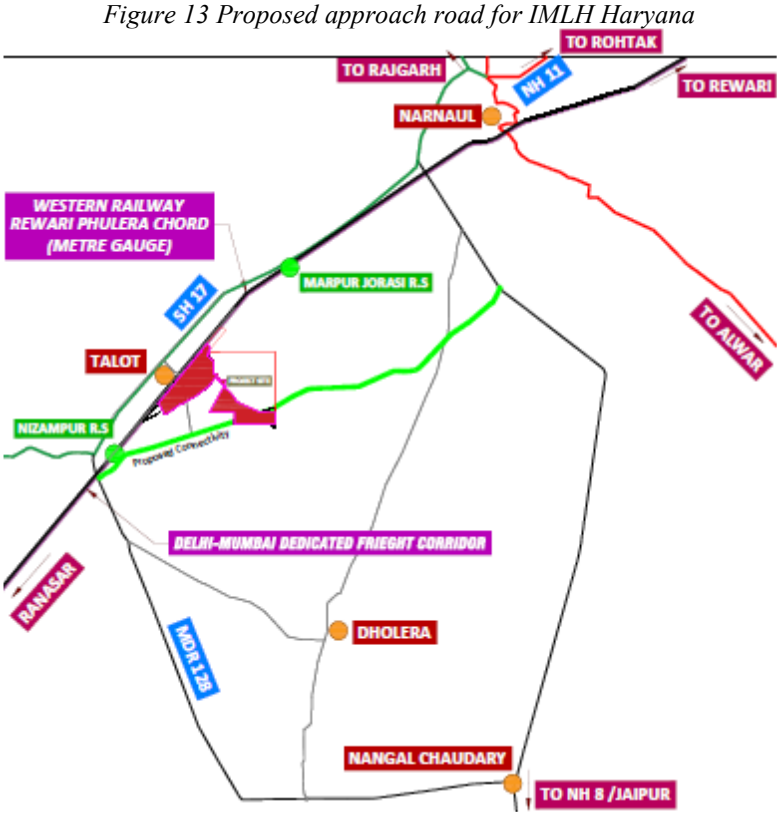
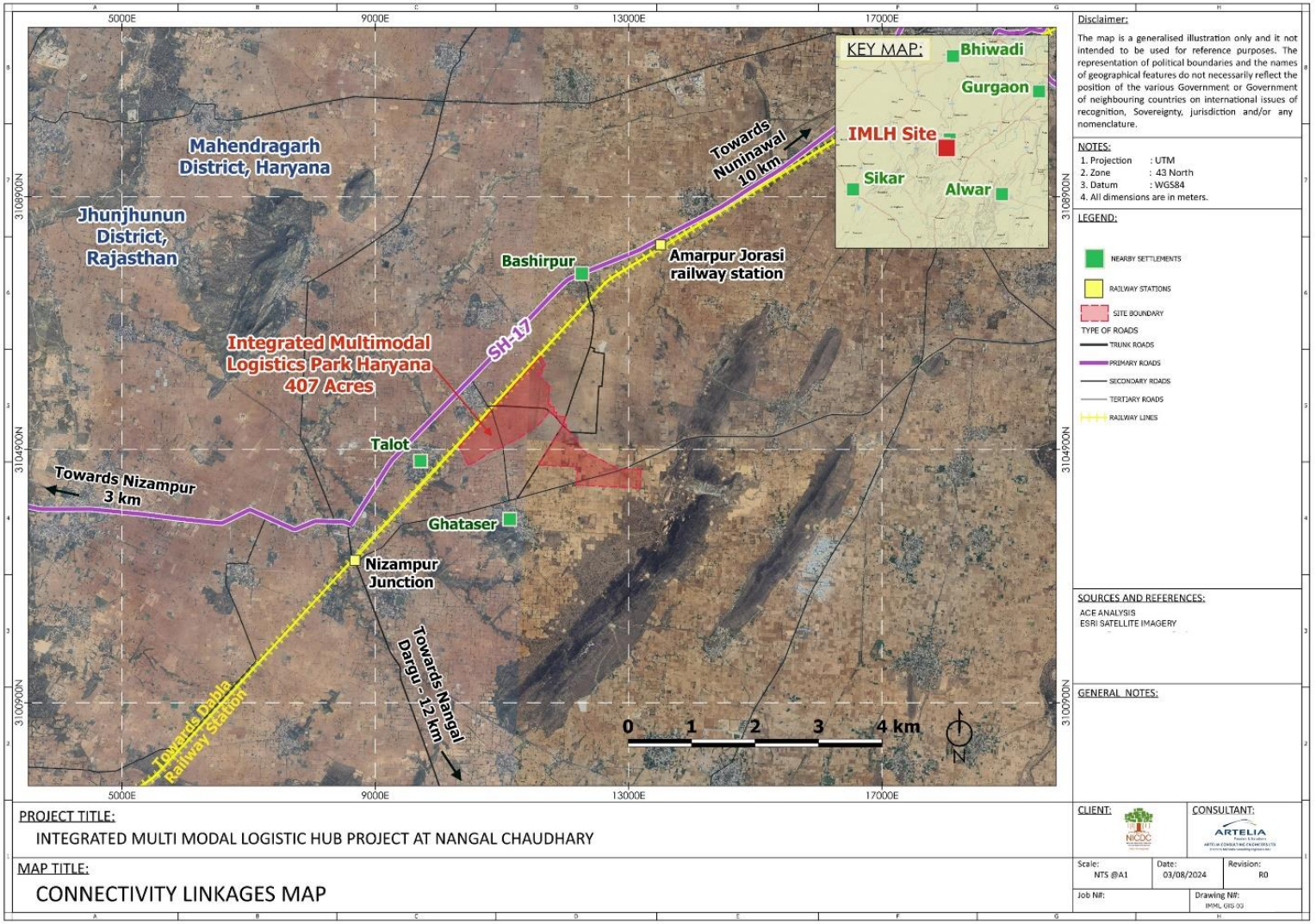
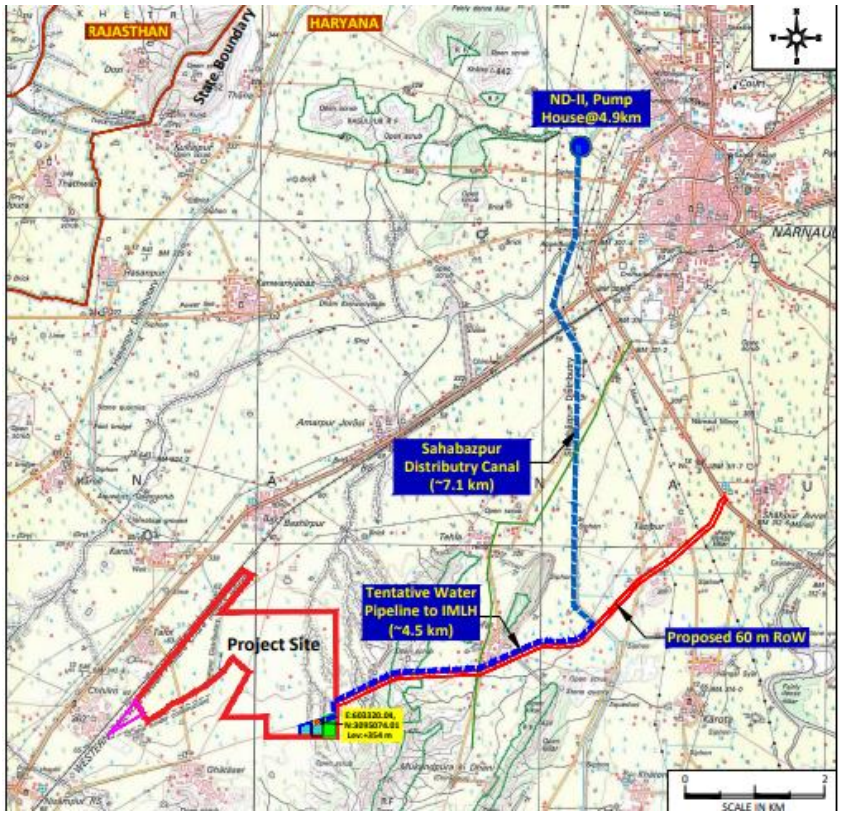
xiv.	Approach road	• There is an existing village road from MDR 128 to the site boundary towards the western side.
		  • The MDR 128 connects to the NH 48 located on the southern side of the site.
		  • The approach road via MDR 128 connects to SH 17 at 0.5km
		  • The length of this alignment is about 4km from the site to MDR 128.
		  • This alignment can be used as the main access road to the site.
		  • distance
		  • This road can be upgraded to 60m wide throughout and can be used as external linkage.
		  • At present the approach road along the Phase IA of IMLH has been upgraded to 60m wide road.
		
		Figure 13 Proposed approach road for IMLH Haryana
		 
		
		Source: *ACE analysis*

Figure 14Connectivity linkages map of IMLH Haryana

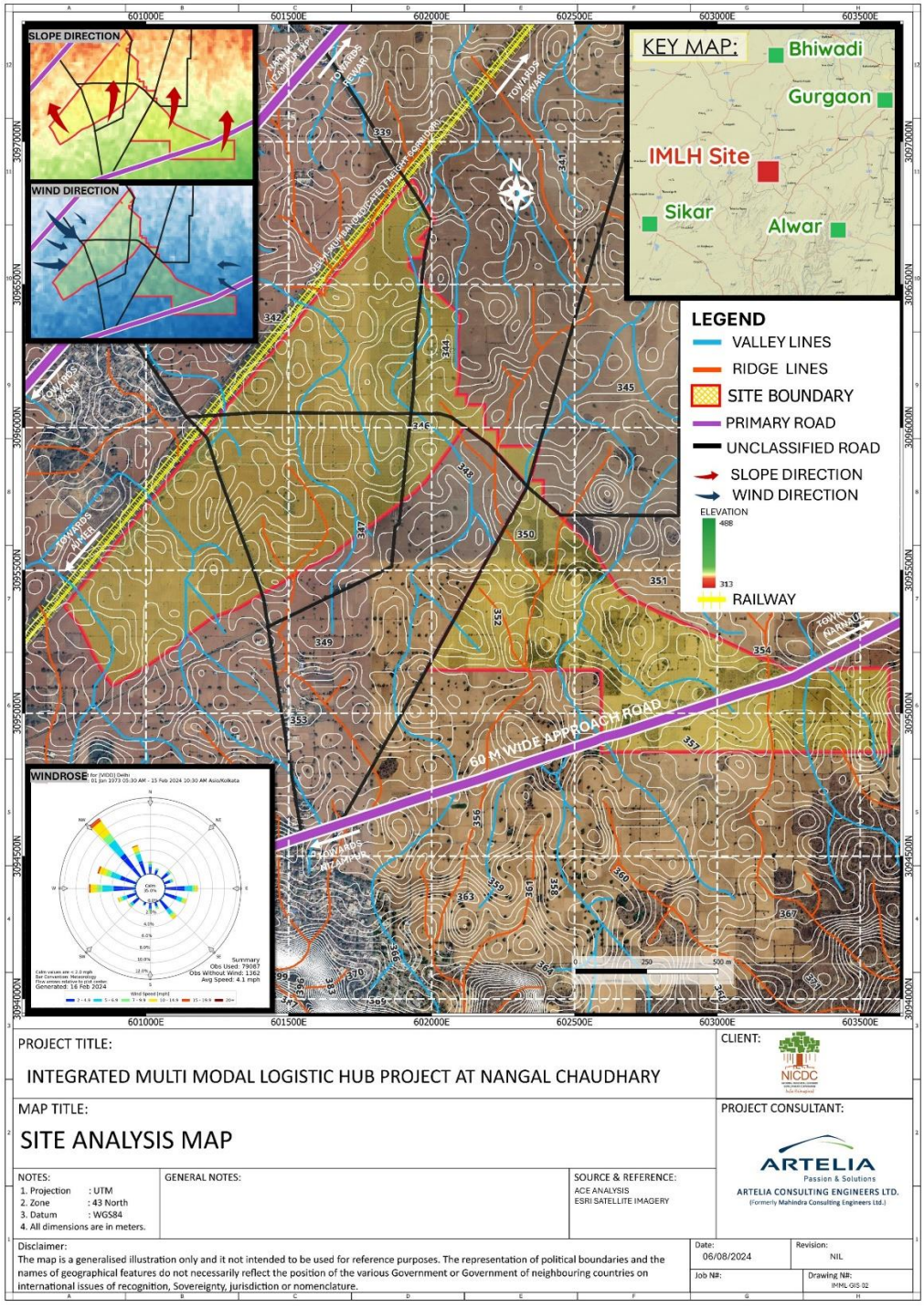


Source: *ACE analysis*

C. Water bodies and water source		
xv.	Water supply	• The main water source identified for the smooth functioning of the IMLH is drawing water from Narnaul Distribution ND II pump house located towards Northern side of the site. • The pipeline alignment is shown in the Figure below that shows the water connectivity to the site from ND II till the dedicated point at site via Sahabazpur distributary canal. The pipeline of 11 km has been laid by IMLH SPV for providing water to IMLH. The storage capacity for 20 days of water requirement within the site has to be designed taking it into consideration. • A designated point taking into consideration the topography of the site is identified and zoned for water utilities. The water pipeline/connectivity to that point and from that point water will be distributed within IMLH as per the requirement and land use. The external connectivity map of water as per TEFS is provided below: *Figure 15 External water supply connectivity map of IMLH Haryana*  Source: Authority
D. Stormwater drain		
xvi.	Stormwater drain	• An existing irrigation channel runs across the site and serves as the discharge point for the site's stormwater drainage system. Positioned at the lowest elevation of the site, it is the only viable natural outlet for stormwater discharge in the vicinity • Proper rainwater harvesting systems, groundwater recharge structures, and stormwater networks (internal and external), connecting the network to the irrigation canal during the planning stage.

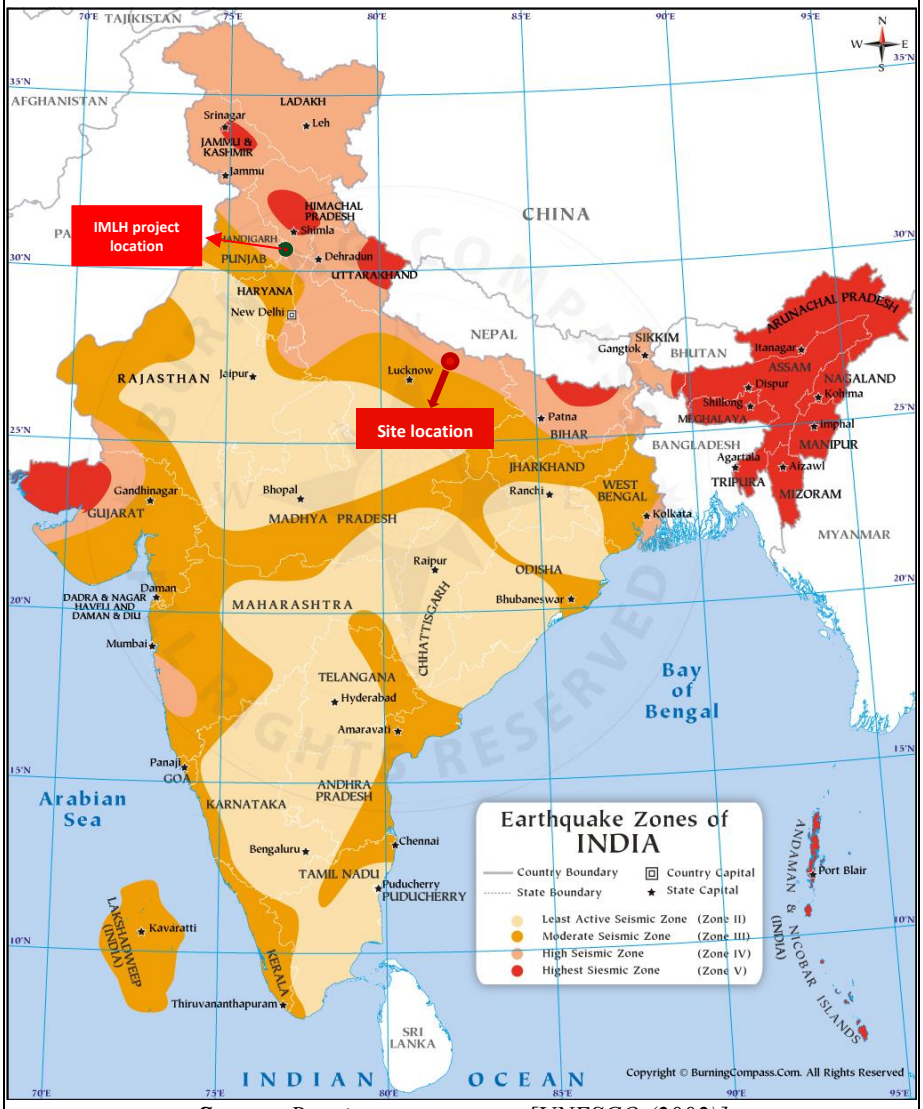
E. Sewer and treatment plants		
xvii.	Sewer and treatment plants	• STP for treating the sewage shall be planned and located after checking the wind directions and topography for gravity collection. A thick green cover will be planned around the treatment plants to avoid odour emanation • An appropriate water treatment processing plant shall be proposed considering the source of water and its characteristics.
F. Site investigation		
xviii.	Topography	• The profile of the site is flat with few/minor undulations. A few minor ridgelines run from South to North direction but does not have major impact on the contours of the site. • The southern boundary of the site abuts a hillock, and some part of the hill falls within the project site. • The profile of the site has sloping topography with the Eastern edge of the site having the highest elevation of 357m at the foothills of the hill. The site has few minor streamlines passing across the site from South to North direction. These are minor and are formed during monsoon season. • The topography of the site is about 357m at the Eastern edge of the site and further drops to 342m towards the Northwestern side of the site which has the envisaged railway siding facility. • The contour ranges from +342m to +357 m; and • Also, it is pertinent to note that the following considerations shall be incorporated during the master planning to take advantage of the existing gradients and to enhance the operational efficiency besides optimising the development and operational expenditures. o Road to be planned in alignment with the contours to avoid excessive cut and fill. o Individual parcels and zones shall be accordingly fixed with levels to optimize the cut and fill quantities. o Overhead water distribution system ensuring gravity flow and maintaining the supply pressure requirements of the industries; and o STP shall be located such that the collection is by gravity. • **Figure below** shows the site boundary, surrounding features, and topography of the IMLH Haryana site.

Figure 16 Site analysis map of IMLH Haryana



Source: *ACE analysis*

G. Power & Telecom		
xix.	Nearest substation	• Power can be drawn from two major lines - one line being the 220KV substation of HVPNL, and the other being LILO 132 KV line of Seka Nangal Chaudary. • The designated point is allotted within the IMLH site where the external power connectivity is provided by IMLH SPV, and these identified substations will cater to the demand of IMLH (both Phase IA & 2)

H. Environment data – general		
xx.	Earthquake	• The proposed site falls under Zone III classification which is marked as a Moderate zone. Hence, structures within the site can be designed with ideal standards with cost-efficiency as the impact of earthquake is low. *Figure 17: Seismic zone map of India*  ***Source:*** *Burningcompass.com [UNESCO (2002)]*

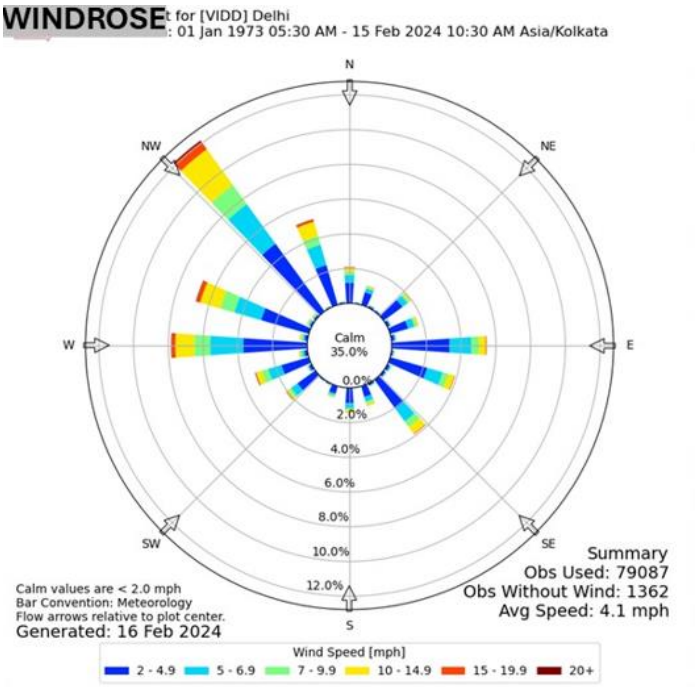
xxi.	Wind	• The predominant wind direction is from Northwest to Southeast. Hence, it is recommended for the treatment plants (solid waste treatment plant, STP) to be placed considering the wind direction to prevent any emissions or odour emanations that may cause pollution/nuisance. *Figure 18: Windrose map of site location*  ***Source:*** *IEM Windrose*
xxii.	Archaeological significance, cemeteries, burial grounds	• No major places of archaeological significance, cemeteries, or burial grounds were observed during the site visit.
I. Biological environment data		
xxiii.	Flora and fauna, protected areas, demarcated zones, wildlife	• The site is covered with bushes during the monsoon season, and it is unused and is used for agricultural cultivation during summer. • The site is not densely vegetated, but a few patches of plantations/ agricultural activities are seen around the site. • The site has hillock in the Southeastern portion of the site, therefore, the development of IMLH shall take incorporate sustainable measures to ensure no adverse impact on the surrounding environment.
xxiv.	Flood mitigation measures	• The water from the hillocks flows down through the site based on topography and the natural slope direction is from South to North. The natural drainage pattern is to be retained if it is major. However, the site does not have any major streams for water flow. During the monsoon, the site is prone to water stagnation, but efficient planning can mitigate this issue. • Proper rainwater harvesting systems, groundwater recharge structures, and stormwater networks connecting internal drains to the external drains should be planned to ensure no flooding is caused during wet/rainy seasons and that the run-off drains towards the barrage. It must also be ensured that no wastewater (domestic or industrial) is discharged onto the land or into nearby water bodies. An STP will be established for treating domestic sewage.

Figure 19 Site visit photos



Irrigation canal within site



Subway to the site via railway siding



Project site area



Railway siding portion – Site grading



Project site area



60m approach road to IMLH Phase IA

	
13m wide road connecting the site	13m wide road connecting the site

3 Market assessment

The project site is situated between major industrial clusters such as the leather industry in Bahadurgarh, Haryana and the handloom cluster in Churu, Rajasthan. It also benefits from proximity to the Manesar-Bawal and Kushkhera-Bhiwadi-Neemrana investment regions, which are expected to witness significant investments in the hinterland of the IMLH, as depicted in Figure .

The facility is connected by road (via Haryana State Highway 17) and rail, through a branch line to the IMLH. In the future, air cargo operations may be facilitated through the augmentation of the airport at Narnaul.

As such, high levels of economic and industrial activity are expected in the vicinity of the IMLH coupled with the presence of the Western Dedicated Freight Corridor has given rise to many competing facilities including DFCCIL cargo terminals at Rewari and Dabla. The cargo generating potential of the hinterland, and the characteristics of the project's competitors are discussed in this chapter.

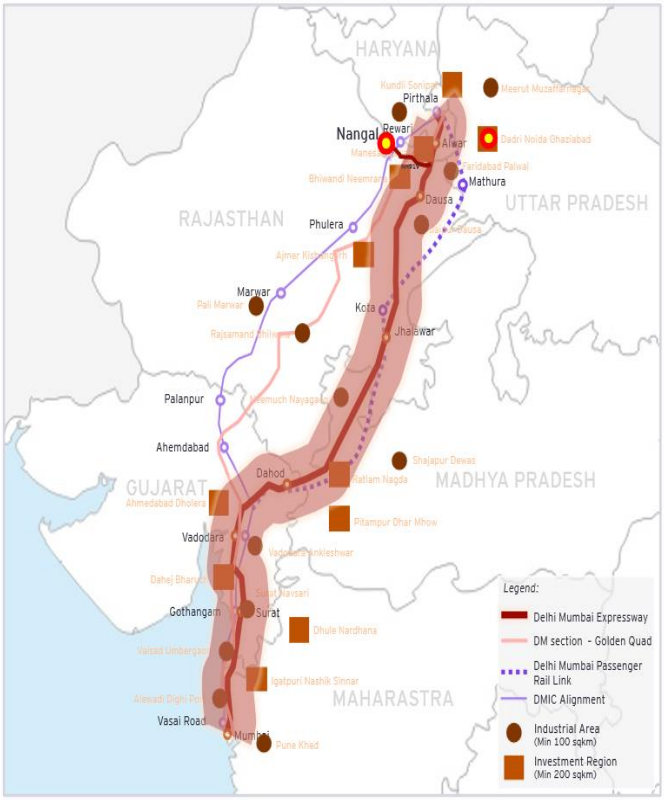


Figure 20 IMLH in Context of DMIC

3.1 Hinterland Potential

This section captures the potential catchment area and strategic advantages of establishing an Integrated Multi Modal Logistics Hub at Nangal, Mahendragarh. It highlights the connectivity benefits, regional trade dynamics, and economic advantages that makes Nangal Chaudhary a prime location for an IMLH.

- The IMLH will have **direct connectivity with the Western Dedicated Freight Corridor** (W-DFC), which will reduce lead times to reach the ports located on the western part of India.
- Located strategically in southwestern Haryana, the **IMLH will serve as a key entry point for cargo heading to the NCR region.**
- Due to **the absence of major ICDs in western Haryana region,** most cargo in and around Mahendragarh is likely exported or imported through Gateway's Garhi Harsaru ICD or through road logistics.
- Establishing an ICD at Nangal will reduce the First Mile Last Mile (FMLM) distance for



Figure 21*Project Hinterland*

EXIM customers (trading majorly Basmati Rice, Cereals and Tractors) of the Hisar, Bhiwani and western parts of Rewari District.

- Cargo currently stationed at railway goods sheds will be redirected to the IMLH, as it borders Rajasthan state, a region exporting **large volumes of cargo such as granite, marble, tiles, and stones.**
- In FY23, Haryana's total trade volume, including EXIM and domestic goods, reached **US $16 billion**, with an average annual growth rate of **5%** over the last five years. The top cargo exporting districts include **Gurugram, Faridabad, Karnal, Sonipat, Panipat, Rewari, and Jhajjar[10].**
- North India Container Market has experienced strong growth over the last decade, with traffic reaching approximately 4 million TEUs in 2024, making the IMLH at Nangal suitable to capture the ever-growing container market.

The districts constituting the project hinterland are tabulated below: -

Table 5 Primary Hinterland

Dist. Num.	Dist. Name	State	Dist. Num.	Dist. Name	State
1	Mahendragarh	Haryana	8	Alwar	Rajasthan
2	Rewari	Haryana	9	Nuh	Haryana
3	Jhajjar	Haryana	11	Gurugram	Haryana

Table 6 Secondary Hinterland

Dist. Num.	Dist. Name	State	Dist. Num.	Dist. Name	State
4	Charkhi Dadri	Haryana	28	Hapur	Uttar Pradesh
5	Jhunjhunun	Rajasthan	29	Meerut	Uttar Pradesh
6	Sikar	Rajasthan	30	Muzaffarnagar	Uttar Pradesh
7	Jaipur	Rajasthan	31	Bhagpat	Uttar Pradesh
10	Palwal	Haryana	32	Panipat	Haryana
12	Faridabad	Haryana	33	Saharanpur	Uttar Pradesh
13	Delhi (All Dist.)	Delhi	34	Karnal	Haryana
14	Rohtak	Haryana	35	Yamuna Nagar (New)	Haryana
15	Bhiwani	Haryana	36	Kurukshetra (New)	Haryana
16	Churu	Rajasthan	37	Ambala (New)	Haryana
17	Dausa (New)	Rajasthan	38	Agra (New)	Uttar Pradesh
18	Bharatpur (New)	Rajasthan	39	Firozabad (New)	Uttar Pradesh
19	Mathura (New)	Uttar Pradesh	40	Hathras (New)	Uttar Pradesh
20	Aligarh	Uttar Pradesh	41	SAS Nagar (New)	Punjab
21	Bulandshahr	Uttar Pradesh	42	Patiala (New)	Punjab
22	G.B. Nagar	Uttar Pradesh	43	Sangrur (New)	Punjab
23	Ghaziabad	Uttar Pradesh	44	Mansa (New)	Punjab

[10] niryat.gov.in

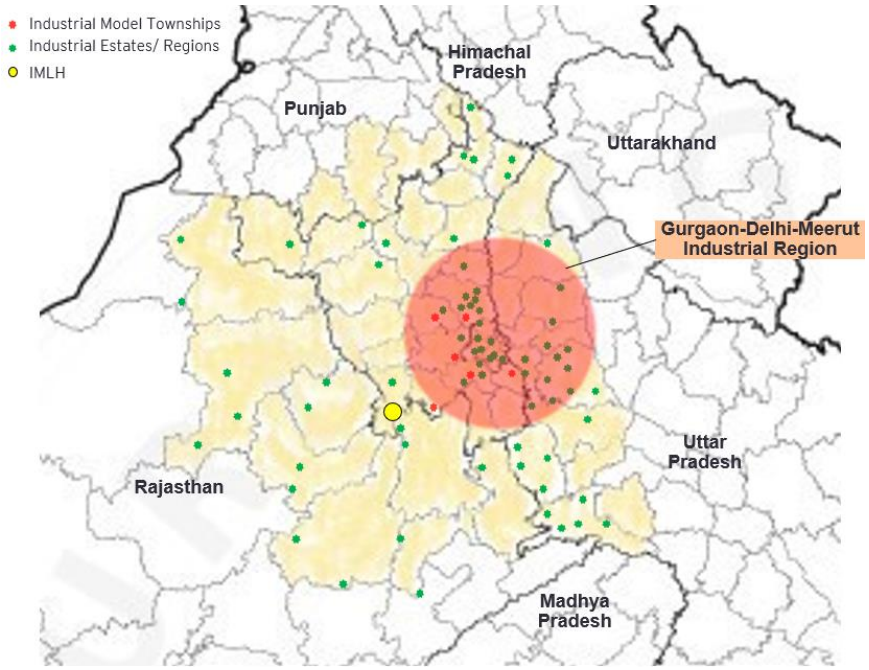
Dist. Num.	Dist. Name	State	Dist. Num.	Dist. Name	State
24	Sonipat	Haryana	45	Bathinda (New)	Punjab
25	Jind	Haryana	46	Sirsa (New)	Haryana
26	Hisar	Haryana	47	Hanumangarh (New)	Rajasthan
27	Kaithal (New)	Haryana	48	Chandigarh (New)	Chandigarh

The project site situated in Mahendragarh district, Haryana, near the Haryana-Rajasthan border, Nangal Chaudhary is adjacent to the Western Dedicated Freight Corridor (WDFC) and well connected to National and State Highways, including NH-148B. It lies near the Nizampur Railway station on the Rewari-Phulera chord of the WDFC. The catchment area for the Nangal Chaudhary logistics hub includes industrial and manufacturing clusters in nearby regions such as Neemrana, Khushkhera, Bhiwadi, and Bawal. These areas serve as huge source of freight (primarily container traffic) that will be aggregated and dispatched via the IMLH, particularly towards ports like Mumbai and Mundra along the DMIC route.

The IMLH holds significant potential to redirect a substantial portion of the container traffic currently utilizing the Delhi-Mumbai Expressway to rail transport, that are presently utilizing DPD services.The figure below highlights the location of the industrial clusters envisaged to benefit from the project. The classification is based on: -

- Overall economic activity, participation in EXIM trade and interstate domestic trade
- Access to the project site via both rail and road
- Requirement of specialised infrastructure, for example, cold chain and warehousing
- Transportation cost

Figure 22 *Industrial Concerns/ Estates in Project Hinterland (EY Analysis)*



The IMLH at Nangal will primarily cater to the industrial clusters in Haryana and Rajasthan, including Neemrana, Khushkhera, Bhiwadi, and Bawal regions. These regions are particularly known for manufacturing activities, especially in sectors such as **automotive, engineering goods, textiles/ garments, and consumer durables**.
The rail distance of key industrial areas in Haryana, Eastern Rajasthan and Western UP from the proposed facilities in Nangal and Dadri are highlighted in the table below:

Table 7 Distance from major Industrial Clusters

Name of Industrial Area	Distance from Nangal (km)	Distance from Dadri (km)
IMT Bahadurgarh	60	75
IMT Manesar, Gurugram	43	60
Kadipur Industrial Area, Gurugram	53	47
Bilaspur Industrial Area, Gurugram	48	65
Reliance MET City, Jhajjar	35	95
IMT Kharkhoda, Sonipat	75	85
Kundli Industrial Area, Sonipat	80	70
Udyog Vihar, Gurugram	56	48
Faridabad Industrial Area	70	35
Bawal Industrial Area, Rewari	30	100
Dharuhera Industrial Area, Rewari	25	95

An overview of the industrial units and their turnover in key districts surrounding Nangal, Mahendragarh, for the fiscal year 2023-24. The tables below detail the number of micro, small, medium, and large-scale units, as well as their respective turnover and export values, highlighting the region's industrial strength and export potential that the IMLH at Nangal can leverage.

Table 8: Number of Micro, Small, Medium, and Large Scale Units (2023-24) [11]

District	Micro Scale	Small Scale	Medium Scale	Large Scale	Grand Total
Mahendragarh	3,410	5	-	-	3,415
Rewari	3,410	6	1	-	3,417
Bhiwani	4,926	9	-	-	4,935
Jhajjar	4,012	11	1	-	4,024
Rohtak	4,918	7	1	-	4,926
Gurugram	17,119	42	7	-	17,168
Sonipat	5,891	23	1	-	5,915

Table 9: Turnover in Micro, Small, Medium, and Large Scale Units (2023-24, ₹ Crore)[12]

District	Micro Scale	Small Scale	Medium Scale	Large Scale	Grand Total	Export Value
Mahendragarh	168.1	37.6	-	-	205.7	54.7
Rewari	221.6	18.5	3.8	-	244	4,034

[11] Industries & Commerce and Micro, Small, Medium Enterprises (MSME), Departments, Haryana.
[12] Industries and Commerce department, Haryana

District	Micro Scale	Small Scale	Medium Scale	Large Scale	Grand Total	Export Value
Bhiwani	247.2	34.4	11	-	292.6	967
Jhajjar	213.5	200	-	-	413.5	3965
Rohtak	279.2	46.9	22.8	-	349	1,420
Gurugram	870.8	403.7	75	-	1,348	52,450
Sonipat	356	290.3	-	-	646.3	14,044.7

Major Commodities

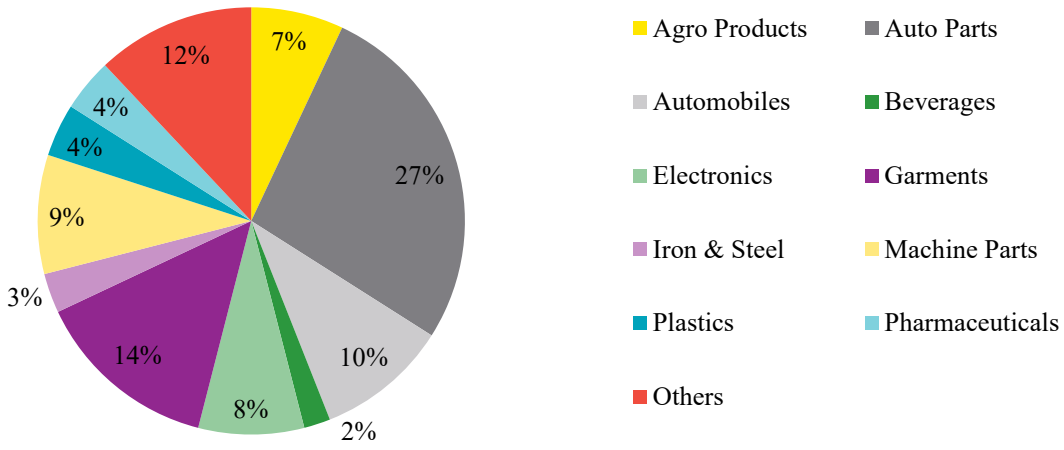
The district-wise listing highlights the diverse range of goods, from auto parts to precious metals, that contribute to the region's trade potential.

Table 10: District-wise movement of major commodities

CATCHMENT OF NANGAL
• **MAHENDRAGARH** Auto Parts, Boilers, Machinery Parts, Drive Axles Components, Gear Boxes, Intake Air Filters. • **CHAKRI DADARI** Hazardous chemicals, Extruders, Rice except parboiled, Leather, Machinery, Cane Molasse, Sugar • **BHIWANI** Leguminous vegetables, Guar gum, Guar seeds, guar meal, Dyed Fabric and Textile, Silicates and commercial metal Silicates, Other titanium oxides, Electronics and Parts, Dextrose chemical • **REWARI** Electric conductors, Transmission components, Catheters- Medical Equipment's, Auto parts, Refined Copper, Parts of articles in HDG, Cloxacillin and its salts- Chemicals • **JHAJJAR** Mounted brake linings, Decorative laminates, Brake linings and pads, Wire of stainless steel, Cannula, Auto parts, Guar gum treated, Automobile brake Parts • **SOUTH-WEST DELHI** Turbo-jets, Smartphones, Aircraft and auto parts, Accessories and equipment's, Air-craft engines, precious metals and Jewellery, Automobile parts • **WEST DELHI** Smartphones, Precious Metals and Jewellery, Synth Fibers and RMG, Man-Made Fibers & RMG, Jackets and Jerseys, Human Hairs, Cotton and RMG, Automobile Parts, Handloom and Cotton

The trend analysis based on the historical volumes in the project hinterland is represented in Figure below:

Figure 23 Trend Analysis of Historic Product Mix



Traffic assessment

India's container traffic has witnessed remarkable growth in recent years, setting the stage for a transformative era in the nation's trade and economic development. India transports approximately 6.3 billion tonnes[13] of freight annually. Within the container market, EXIM is a key driver of volume, consistently accounting for approximately 80% of total rail-based container freight volume in India[14]. Road dominates the freight market and handles approximately 65% of freight volume, followed by rail with a 26% share. Other modes of transport include coastal shipping, inland waterways and pipelines, which together handle the remaining 9% of the freight volume.

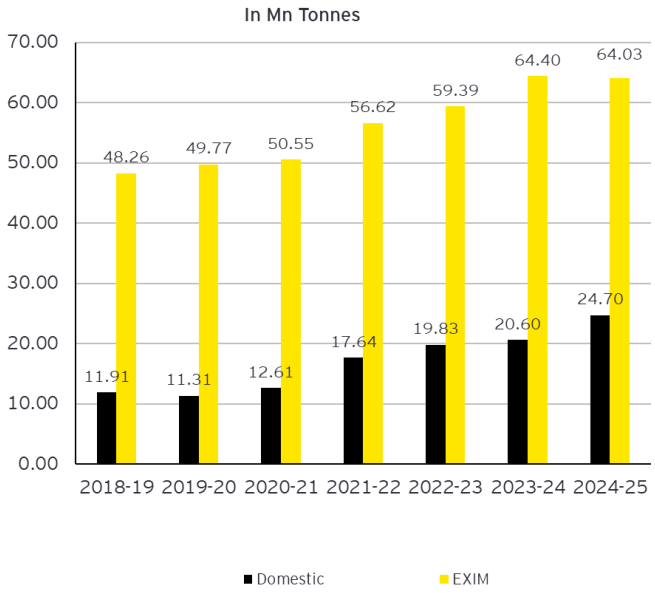
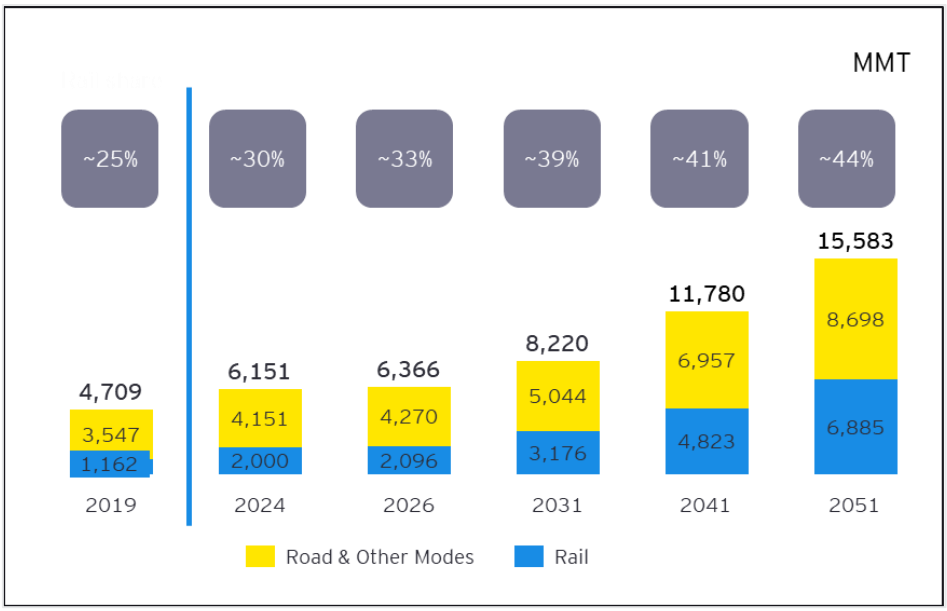


Figure 24 India's container traffic FY2019-25

The IR has invested significantly to promote sector growth, including investments in increased locomotive procurement and upgraded track infrastructure. It has undertaken initiatives such as the construction of dedicated freight corridors (DFCs), doubling of tracks on high-density routes and economic railway corridors aimed at improving freight flows on corridors of minerals, energy and cement, as well as port connectivity. Going forward, the Indian Railways (IR) has set an ambitious target of achieving a 45% share in the Indian freight market by 2040.[15]

Figure 25 Modal share of freight (historical and projected)

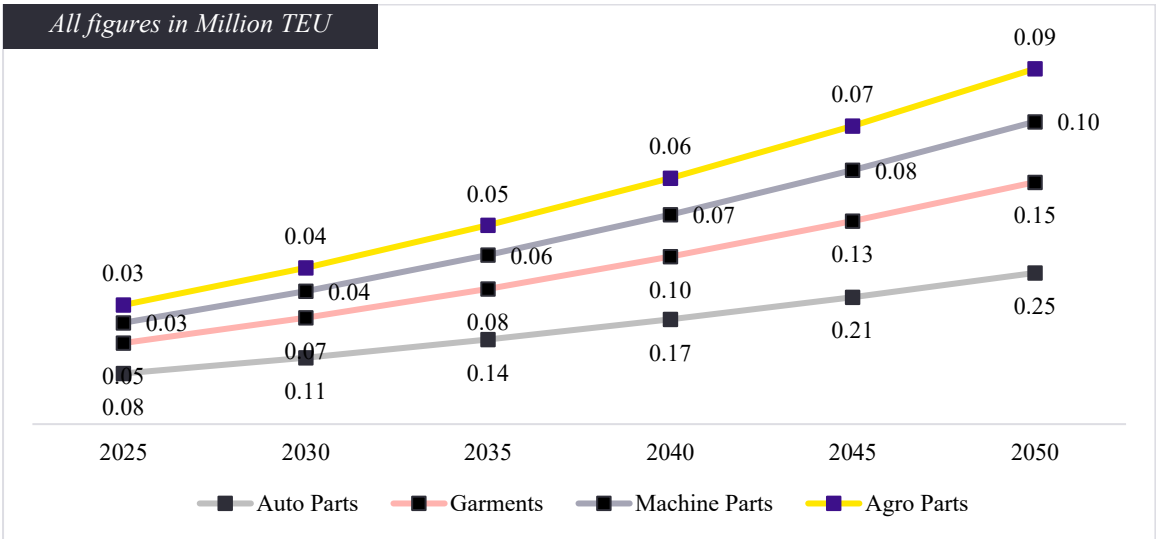


[13] FICCI Report titled "Container train operations after 20 years of deregulation"
[14] Indian Railways Yearbook, 2023–24
[15] National Rail Plan, 2020 published by Ministry of Railways

Observation

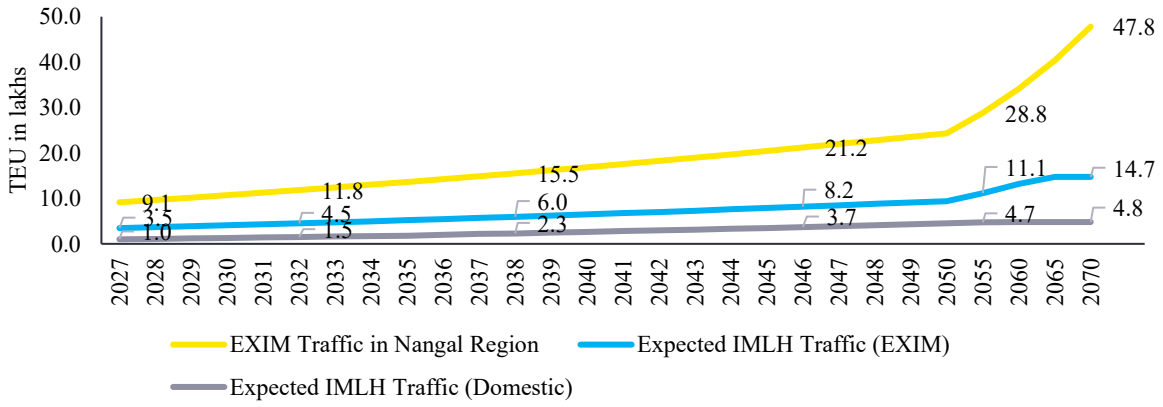
Based on the above analysis it can be observed that the chief commodities[16] are **Auto Parts, Garments, Machine Parts, and Agro Products**. Further, based on the growth trends prescribed by the National Rail Plan and International Monetary Fund, the prospective future volumes of the major commodities were observed as per the following, in figure below:

Figure 26 Commodities growth trends as per National Rail Plan



The resultant baseline has been tabulated as below in Table:

Figure 27 Project Baseline



Source: EY Analysis

The traffic growth has been projected up to FY2071 based on the growth correlated to the Annual GDP. This parameter considers the annual GDP forecast and draws a strong correlation between the GDP and the freight forecast in the National Rail Plan (approx., 0.98). For this purpose, the correlation is drawn from FY2001 onwards. The growth rate envisaged in this scenario from (i) FY 2025 - 2028 is 5.5%, (ii) from FY2029 – 2030 is, 5%, (iii) from FY2031-2036 is 4.5%, (iv) from FY2037-2040 is 4%, (v) from FY2041-2047 is 3.5%, and (iv) from FY2048-71 is 3%.

[16] DGCIS, 2024

4 Master Planning

4.1 Planning principles

The aim is to develop Integrated Multi Logistics Hub (IMLH) for logistic facilities in Haryana, India, with excellent state-of-the-art infrastructure facilities and professional management to attract and support investments in import and export sectors.

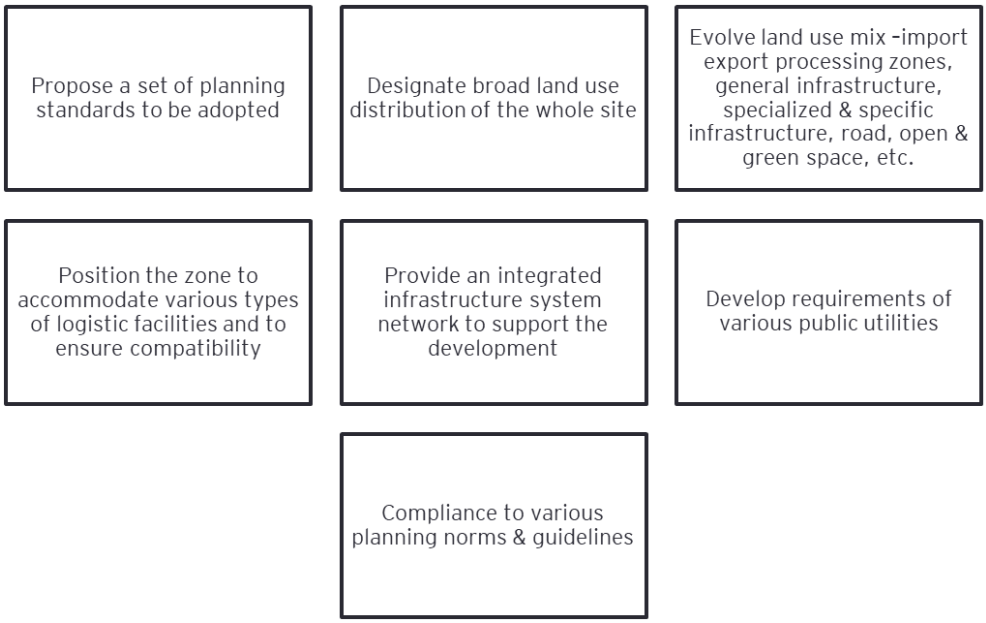
Hence, IMLH in the form of prepared land is proposed with general and specialized infrastructure facilities. It focuses on supply chains and trading patterns for the development of logistics facility to cater to the current and future logistics needs. All facilities required for targeted logistic facilities are planned for in the IMLH and will function as an integrated package having all the required facilities and service activities with sufficient provision for future growth and expansion.

Given the logistical sector's need & potential and the concept of logistic hub for taking regional advantage, the proposed project will further strengthen Haryana's position in the logistic sector of India and will contribute to the economy. A careful planning exercise has been done to position the project taking into account the geographic, demographic, economic and social characteristics of the region and it is in this context master planning of the project assumes significance.

The purpose is to create a thriving place where the focused stakeholders can work and create a sustainable logistic hub. It is important to develop the master plan to accommodate the logistics facility needs and the requirements of the various identified development components of the proposed IMLH.

To implement this uniquely conceived IMLH into a fully integrated functionally best facility and to promote a new logistics cluster image in Haryana, as well as to develop confidence among foreign and local investors to undertake the development of the project and subsequent operation of their businesses, certain planning objectives/principles are outlined in Figure below.

Figure 28 *Planning principles and objectives*



Source: ACE analysis

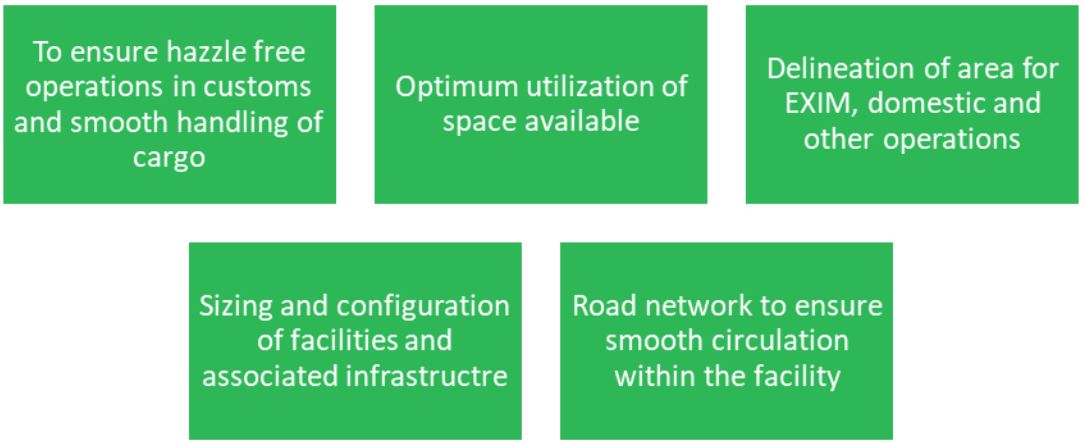
4.2 Objective of the Master Plan

The master plan for IMLH assumes importance in terms of planning and configuring the facilities for ensuring smooth and hassle-free operations. The operational requirements of the IMLH such as volume & type of cargo to be handled, dwelling time of cargo, material handling system, etc., and facility configuration such as warehouse, container yard, EXIM area, etc., will influence the planning process. Further, the location advantages and site-specific constraints will have to be considered and fully respected for achieving an optimum layout for the proposed IMLH (Phase IA).

The master plan for the IMLH facility is a planning tool, which is based on the broad objective of developing excellent infrastructure facilities to cater to the needs of cargo handling within the hub. It is important to develop a master plan which can accommodate and fulfil the requirements of logistics hub activities in an efficient manner.

The goals and objectives of the master plan and the vision for preparation of the master plan (Phase IA) are depicted in the following Figure .

Figure 29 *Goals and objectives of master plan*



Source: ACE analysis

4.3 Design objectives

The broad objective of the master plan is to ensure the development of the IMLH in a planned manner. The vision behind the master planning, right from its conception to operation is that there will be an intense and close interrelationship between the logistics requirements and infrastructure supporting facilities.

To implement this project into a fully integrated and functionally best facility, the following underlying planning objectives/principles are imperative:

- To transform the zone into a comprehensively planned Logistic Hub of international standard.
- To optimize on the location advantage of being cited in Haryana, India.
- To develop this project as a service-oriented self-contained estate concept and all the necessary infrastructure facilities are best designed and provided to create an ideal ambience and best environment. The infrastructure shall include general, specialized and specific Infrastructure.
- To designate broad and judicious land use distribution of the site.
- To provide an integrated infrastructure system network to support the development.

- Internal road network alignments and junction placements to meet balanced access, movement and safety.
- To accept and plan around the existing constraints within the site.
- Land use mix – EXIM area, container terminal, general infrastructure, roads & utilities, open & green spaces, etc.
- Aesthetic and environmental concept

4.4 Design influences

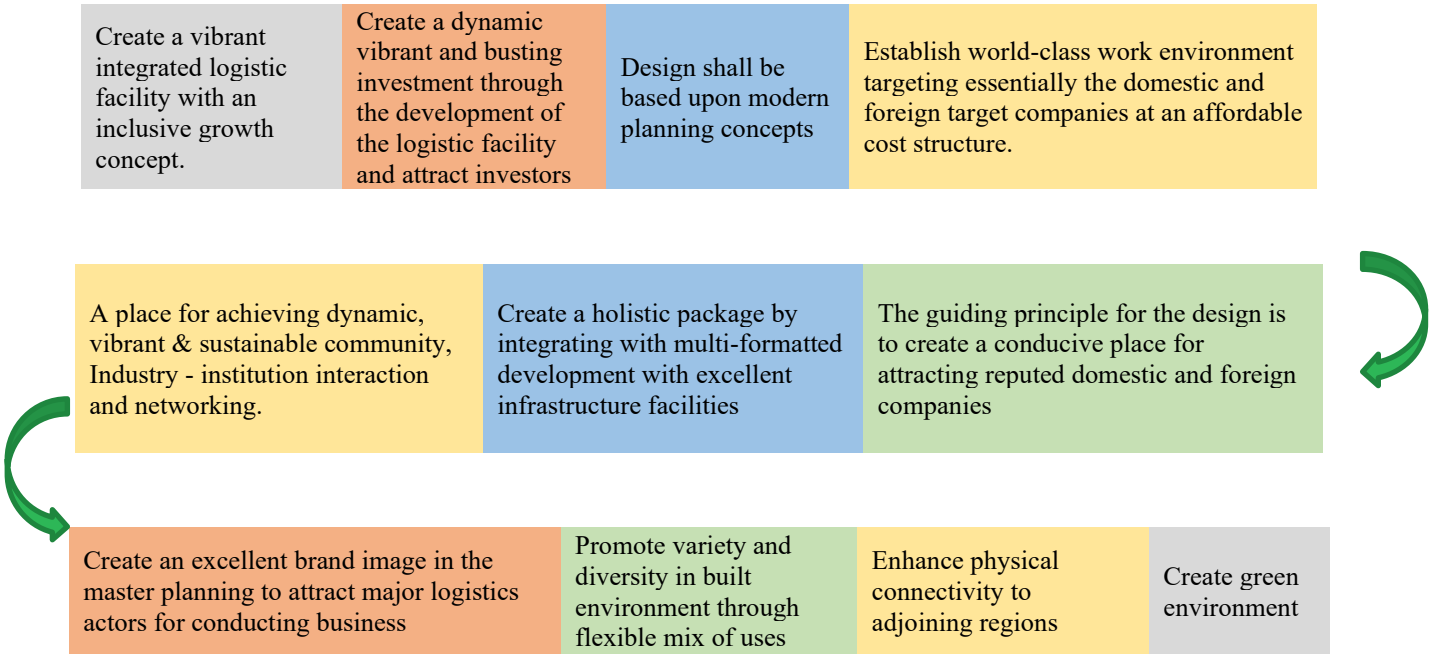
The following are the influencers in designing the facility:

- Site topography
- Programmatic requirements
- Climate
- Circulation and movement of vehicles within the facility
- Planning norms
- Sustainable design

4.5 Planning concept

The planning concepts for the proposed IMLH are as depicted in Figure below. The IMLH shall be a self-contained with a salubrious surrounding and is envisaged to be developed as a "sustainable-holistic-smart-intelligent-eco-logistic zone".

Figure 30 *IMLH planning concepts*



Source: ACE analysis

4.6 IMLH planning considerations

The planning for the proposed IMLH is based on the broad objective of establishing a world-class business environment targeted essentially at the high growth of the logistic sector. Each zone within the IMLH shall be planned to be dedicated to the specific sub-sector and would be a self-sufficient unit in terms of facilities, ability to attract investors and revenue generation. From the planning point of view, the IMLH houses a variety of import and export commodities.

The activities focus on value-added services for the commodities.

- Commercial amenities are also planned to provide convenience to visitors as well as to the working population within the IMLH. The project is planned to be housed in a green environment and accordingly, landscaping and greenery are planned.
- While planning the IMLH, the following vital issues were addressed along with strategies for successful implementation and sustained operation of the Logistic Hub:
- Land use and layout: The whole area is suitably divided into several identified activity centres of different sizes. The layout is developed with a complete understanding of the phasing program. The project is designed with a focus on Phase IA, ensuring that it includes provisions for seamless connectivity to future developments. This approach emphasizes a forward-thinking strategy, allowing for easy integration and expansion as the project evolves. By anticipating future needs and potential growth, the design incorporates flexibility and scalability, which will enable the incorporation of new technologies, systems, or phases with minimal disruption. This strategic planning ensures that the project remains relevant and adaptable, supporting long-term objectives and facilitating a smooth transition to subsequent development stages. Integration of the financial aspects with physical planning aspects is the most important factor for success in implementation.
- Constraints and core offering of the site: As enumerated earlier, all the site-specific constraints are fully respected, and mitigation measures are fully taken into consideration while developing the master plan. Similarly, the planning fully leverages the core and supplementary offering of the site.
- Services and amenities: The master plan takes into account planning for services and amenities.
- Conservation of groundwater & surface water resources: Sustainable infrastructure planning, incorporation of eco-friendly concepts and environment sustainability, water conservation schemes, environmental infrastructure, recycling and reuse options, etc. are incorporated in the IMLH development program.
- Transportation: The master plan looks at the transport linkages. As the IMLH will have regional, national as well as international linkages of freight movement and it generates a lot of traffic. A well-developed logistic facility for both export & import will cater to the transport systems.
- Environmental management: Various aspects such as adherence to pollution control norms & standards, control over goods, storage and handling of waste, common treatment, etc. are given paramount importance while planning.

4.7 Approach and design philosophy

- From the planning point of view, it is considered that the IMLH project is a package of several land uses. Warehousing facility, container handling and storage yard, are prime activities and the efficiency of operation is enhanced by ensuring a sequential flow of related activities.
- The existing constraints in the site have been identified and due consideration has been given while planning the developmental activities and formulating the master plan.
- In order to facilitate and to ensure smooth documentation activities; the administrative buildings, customs office, transport & communication, temporary parking, customs check post and security office, etc. are conveniently located at the entrance of the port and wherever required which would reduce the traffic congestion and facilitate smooth operations in the facility area. The area identified for the proposed IMLH is approximately 408 acres of land located in Haryana, India.

4.8 Zones spotting

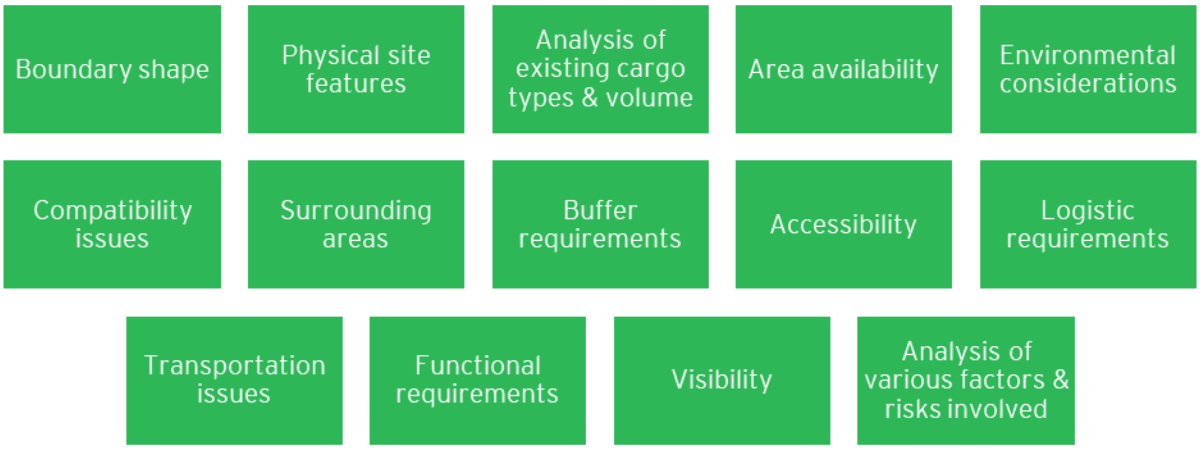
The whole area is divided into two zones – EXIM zone and warehouse & container yard zone with related activity centres. The zoning design has been done in order to have a smooth circulation within each zone and interconnectivity between the

EXIM zone and warehouse & container yard zone choosing to simplify the movement patterns and allow the inter-zone movement in a systematic way.

Clustering of warehousing activities based on the type of operation is also imperative from the point of view of administration and management. The planning considerations to spot the EXIM zone and warehouse & container yard zone are presented in the following Figure.

Following site parameters are considered while positioning the zones:

Figure 31 *Master plan design process*

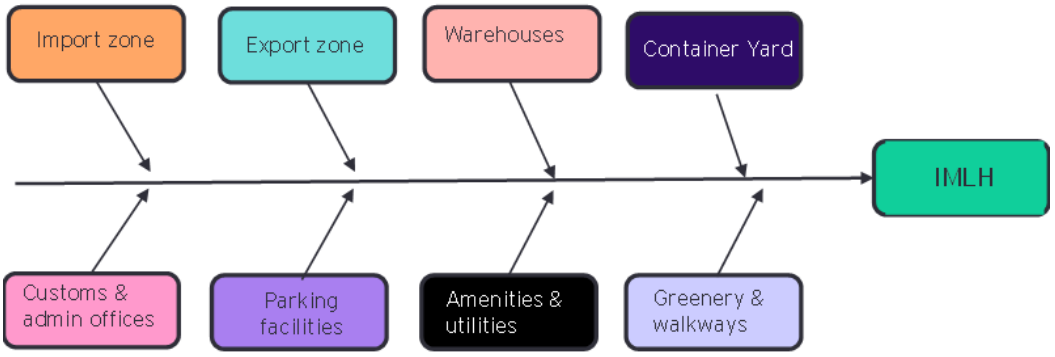


Source: ACE analysis

4.9 Zoning, product mix and facility configuration

Well-balanced land use is perceived with a judicial mix of import, export, warehouses, container yards, semi-public zones as illustrated below.

Figure 32 *Zoning, product mix and facility configuration*



Source: ACE analysis

Table 11 Description of IMLH zones, product mix and facility configuration

EXIM zone	Container yard	Warehouses
• Custom post, vehicle waiting zone, bonded zone containing bonded warehouse, inspection area for containers, container yard, oversized cargo yard, warehouses, empty container yard, custom clearance scanner, etc. • Custom & admin office zones has information kiosk, customs cell, other commercial offices etc.	• Container yards are provided both within and outside the EXIM zone. Containers yard stores the containers with goods from where it is taken to warehouses after custom clearance. Also, there is a provision provided for empty container yard	• General warehouses & Cold storage warehouse are located for various activities.

Parking facilities	Amenities & utilities	Greenery & walkways
• Truck parking area has been provided at various locations.	• STP, Water utilities (WTP, OHT & UG Sump), C & D Yard, Repair store, Maintenance yard, Substation, sewer network, communication network, street light, wastewater network, electrical substation, fuel station, etc.	• Green belt along the peripheral boundary, green buffer along the irrigation canal, green zones that are to be mergered with future expansion phase, lawns and parks, playground, tree plantation along proposed roads, internal walkways, etc.

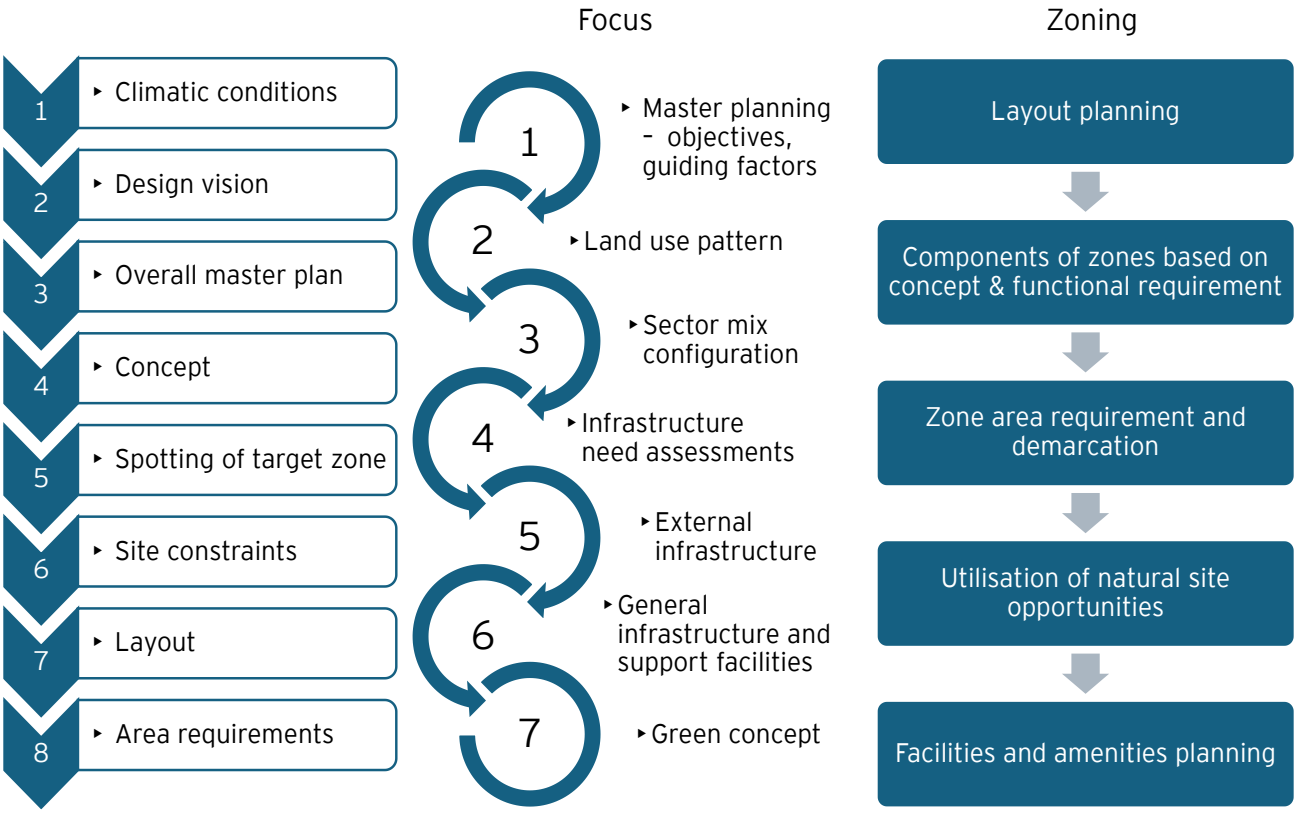
The support facilities, specialized and social infrastructure in the developing logistic facilities is depicted in Tables show the focus areas, zoning and considerations for the development of the master plan as depicted in Table below.

Table 12 Proposed infrastructure and support facilities

Support infrastructure	Specialized infrastructure	Social infrastructure
• Custom clearance area, Admin building, Equipment storage area, C & D Yard, Repair store, Maintenance Yard, Scrap handling yard etc.	• Storage warehouses, cold storage, bonded warehouse, loading and unloading area, container yards, empty container yards, oversized cargo area, custom clearance posts and check posts and others.	• Office areas, Banks, ATM, Poly clinic, food court, fuel station, commercial area and others.

Source: ACE analysis

Figure 33 Master planning considerations



Source: ACE analysis

4.10 Master plan components

Detailed master planning is done zone wise covering the following components:

- Land use plan - Detailing the locations and sizes of various land uses as per demand
- Utility mapping and schematic plans
- Greenery and open space plan
- Road category
- Views

The major outputs of the master plan are:

- Road network plan
- Land use plan
- Logistic facility plan
- Zoning (import, export, warehouse, container yards, semi-public zones)

4.11 Design basis

The site and its features along with, connectivity, contours, etc. are discussed in the earlier chapter. In order to arrive at the layout of the IMLH, an independent exercise was carried out correlating the demand assessment outputs to the area requirement within IMLH for the envisages zones. The area requirement for various type of cargo has been assessed and delineated in the Master plan.

Area requirement for cargo

The existing cargo types and their volumes are analysed based on the projection up to the year 2050 and the same is presented in ensuing sections.

The types of cargo are analysed in detail in the previous sections of the study which includes its classification into container cargo, and oversized cargo.

Commodities handled within IMLH

The commodities handled within the facility are segregated as import and export goods and they are handled in two different zones for a hassle-free process. The following are the commodities envisioned to be handled in the logistic hub are provided in section 3.1 of this report.

4.12 Demand assessment outcomes

- As per the demand assessment, the commodities that are envisaged to be handled at larger capacity in IMLH includes automobile (2,3 & 4 wheelers), mining, metal etc. These are to be stored in open storage yard.
- Warehouses & specifically cold storage warehouse are required at IMLH for handling commodities such as agro products, perishable items, etc that shall contribute to about 5-10% of logistic activity within IMLH Phase IA.
- Demand envisaged for the concession period (in TEUs) is presented in Table below.

Table 13Demand Envisaged for the Concession Period (in TEUs)

Particulars	2025	2030	2035	2040	2045	2050
Warehouse	34,751	46,201	60,192	76,672	94,964	115,080
Cold Storage	20,312	27,004	35,181	44,814	55,506	67,263
Open Storage	450,557	599,008	780,402	994,077	12,31,244	14,92,049
Container yard	16,519	21,961	28,612	36,446	45,141	54,703

Source: ACE analysis

4.13 Area requirement as per demand assessment

Based on the demand and the volume of cargo, the area computation is carried out and presented in the following Table.

Table 14 Area requirement as per demand assessment

In (Mn Sq Ft)	Year 5	Year 10	Year 15
Consumption-led general warehousing	0.07	0.07	0.20
Cold storage	0.07	0.07	0.07
Oversized cargo and open storage	1.33	1.33	2.85

In (Mn Sq Ft)	Year 5	Year 10	Year 15
Laden container yard & empty container yard	0.60	0.60	0.60
Total	**2.07**	**2.07**	**3.72**

Source: ACE analysis

From the above analysis, it can be observed that the demand and area requirement assessment has been carried out for the next 25 years till 2050. The area requirement has been assessed and based on the output the master plan layout has been designed. The area required for Warehousing (General & cold storage) is 21.72 acres by 2050. As per demand the maximum requirement is for open storage yard and requires up to 56.57 acres of land in IMLH. Also, due to the presence of railway siding facility within IMLH EXIM zone has also been taken into consideration for developing the master plan layout of IMLH.

Based on the above, EXIM zone comprising of container yard, standard warehousing, cold storage, temporary parking for container cargo, are planned within the IMLH area. Non-processing zone components such as administrative building, customs office, staff quarters, food court, driver's restroom, clinic, utilities, green pockets, etc., are planned in strategic locations with a clear demarcation from the processing zone.

4.14 Master plan

With the above objectives, the EXIM area is located near the railway siding facilities for ease movement of Cargo. The commercial & other support facilities are located at the entrance and in the areas as required.

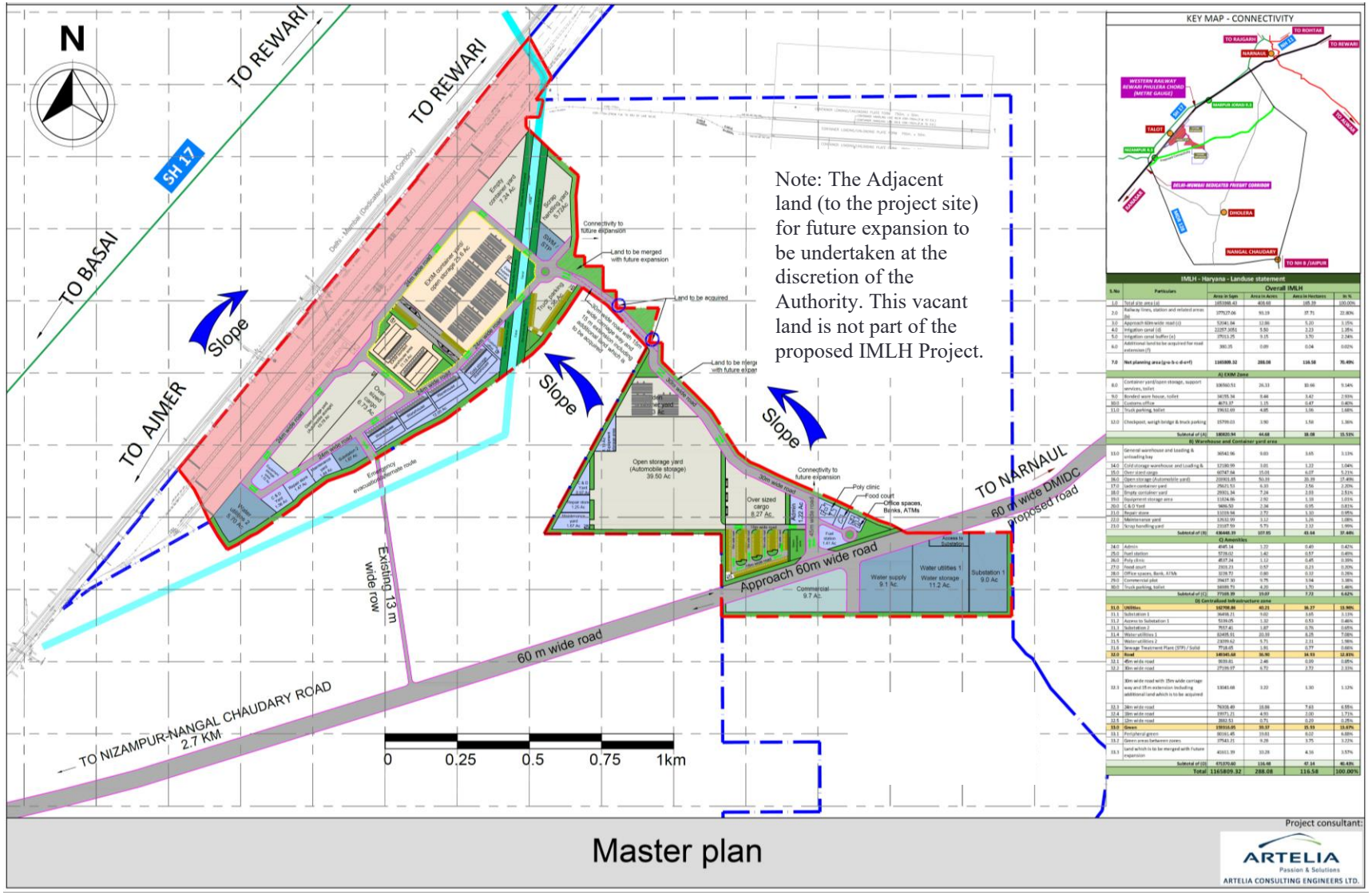
Master plan and land use pattern are presented in figures below.

4.15 Summary of land use area statement

Off the overall site area of 408.68 acres about 288.62 acres is available for the development of IMLH after detecting the railway siding facility and other natural features that are to be retained at site.

The overall logistic zone accounts for 55.33% of the net planning area available for the development of IMLH. More than 10% greenery is achieved in the master plan. Summary of land use area statement is presented in Table below.

Figure 34 IMLH Master Plan



Source: ACE analysis

Table 15 Overall Development- Land Use Pattern

S. No	Particulars	Area in Sqm	Area in Acres	Area in Hectares	In %
1.0	Total site area (a)	1653868.43	408.68	165.39	100.00%
2.0	Railway lines, station and related areas (b)	377127.06	93.19	37.71	22.80%
3.0	Approach 60m wide road (c)	52041.84	12.86	5.20	3.15%
4.0	Irrigation canal (d)	22257.3051	5.50	2.23	1.35%
5.0	Irrigation canal buffer (e)	37013.25	9.15	3.70	2.24%
6.0	Additional land to be acquired for road extension (f)	380.35	0.09	0.04	0.02%
7.0	**Net planning area (g=a-b-c-d-e+f)**	**1165809.32**	**288.08**	**116.58**	**70.49%**
A) EXIM Zone					
8.0	Container yard/open storage, support services, toilet	106560.51	26.33	10.66	9.14%
9.0	Bonded warehouse, toilet	34155.34	8.44	3.42	2.93%
10.0	Customs office	4673.37	1.15	0.47	0.40%
11.0	Truck parking, toilet	19632.69	4.85	1.96	1.68%
12.0	Check post, weigh bridge & truck parking	15799.03	3.90	1.58	1.36%
Subtotal of (A)		**180820.94**	**44.68**	**18.08**	**15.51%**
B) Warehouse and Container yard area					
13.0	General warehouse and loading & unloading bay	36542.96	9.03	3.65	3.13%
14.0	Cold storage warehouse and loading & unloading bay	12180.99	3.01	1.22	1.04%
15.0	Oversized cargo	60747.84	15.01	6.07	5.21%
16.0	Open storage (Automobile yard)	203901.85	50.39	20.39	17.49%
17.0	Laden container yard	25621.53	6.33	2.56	2.20%
18.0	Empty container yard	29301.34	7.24	2.93	2.51%
19.0	Equipment storage area	11824.86	2.92	1.18	1.01%
20.0	C & D Yard	9486.50	2.34	0.95	0.81%
21.0	Repair store	11019.94	2.72	1.10	0.95%
22.0	Maintenance yard	12632.99	3.12	1.26	1.08%
23.0	Scrap handling yard	23187.59	5.73	2.32	1.99%
Subtotal of (B)		**436448.39**	**107.85**	**43.64**	**37.44%**
C) Amenities					
24.0	Admin	4945.14	1.22	0.49	0.42%
25.0	Fuel station	5728.02	1.42	0.57	0.49%
26.0	Poly clinic	4537.24	1.12	0.45	0.39%
27.0	Food court	2303.23	0.57	0.23	0.20%
28.0	Office spaces, Bank, ATMs	3228.72	0.80	0.32	0.28%
29.0	Commercial plot	39437.30	9.75	3.94	3.38%
30.0	Truck parking, toilet	16989.73	4.20	1.70	1.46%
Subtotal of (C)		**77169.39**	**19.07**	**7.72**	**6.62%**
D) Centralized Infrastructure zone					
31.0	**Utilities**	**162708.86**	**40.21**	**16.27**	**13.96%**
31.1	Substation 1	36498.21	9.02	3.65	3.13%
31.2	Access to Substation 1	5339.05	1.32	0.53	0.46%
31.3	Substation 2	7557.41	1.87	0.76	0.65%
31.4	Water utilities 1	82495.91	20.39	8.25	7.08%
31.5	Water utilities 2	23099.62	5.71	2.31	1.98%
31.6	Sewage Treatment Plant (STP) / Solid Waste Management (SWM)	7718.65	1.91	0.77	0.66%
32.0	**Road**	**149345.68**	**36.90**	**14.93**	**12.81%**
32.1	45m wide road	9939.81	2.46	0.99	0.85%
32.2	30m wide road	27199.97	6.72	2.72	2.33%

S. No	Particulars	Area in Sqm	Area in Acres	Area in Hectares	In %
32.3	30m wide road with 15m wide carriage way and 15 m extension including additional land which is to be acquired	13043.68	3.22	1.30	1.12%
32.4	24m wide road	76308.49	18.86	7.63	6.55%
32.5	18m wide road	19971.21	4.93	2.00	1.71%
32.6	12m wide road	2882.53	0.71	0.29	0.25%
33.0	**Green**	**159316.05**	**39.37**	**15.93**	**13.67%**
33.1	Peripheral green	80161.45	19.81	8.02	6.88%
33.2	Green areas between zones	37543.21	9.28	3.75	3.22%
33.3	Land which is to be merged with Future expansion	41611.39	10.28	4.16	3.57%
Subtotal of (D)		**471370.60**	**116.48**	**47.14**	**40.43%**
Total		**1165809.32**	**288.08**	**116.58**	**100.00%**

Source: ACE analysis

Table 16 Summary of Land Use Area Statement

Particulars	Area in Acres	Area in Hectares	In %
Total site area	408.68	165.39	100.00%
Railway lines, station and related areas	93.19	37.71	22.80%
Approach 60m wide road	12.86	5.20	3.15%
Irrigation canal	5.50	2.23	1.35%
Irrigation canal buffer	9.15	3.70	2.24%
Additional land to be acquired for road extension (f)	0.09	0.04	0.02%
Net planning area	**288.08**	**116.58**	**70.49%**
EXIM Zone	**44.68**	**18.08**	**15.51%**
Warehouse, cold storage warehouse, open yard, oversized cargo yard, empty and laden container yard	**107.85**	**43.64**	**37.44%**
Social amenities	**19.07**	**7.72**	**6.62%**
Utilities	**40.21**	**16.27**	**13.96%**
Road	**36.90**	**14.93**	**12.81%**
Green	**39.37**	**15.93**	**13.67%**
Overall area	**288.08**	**116.58**	**100.00%**

	Logistic zone
	Support facilities

Figure 35 IMLH Phasing Plan – phased development

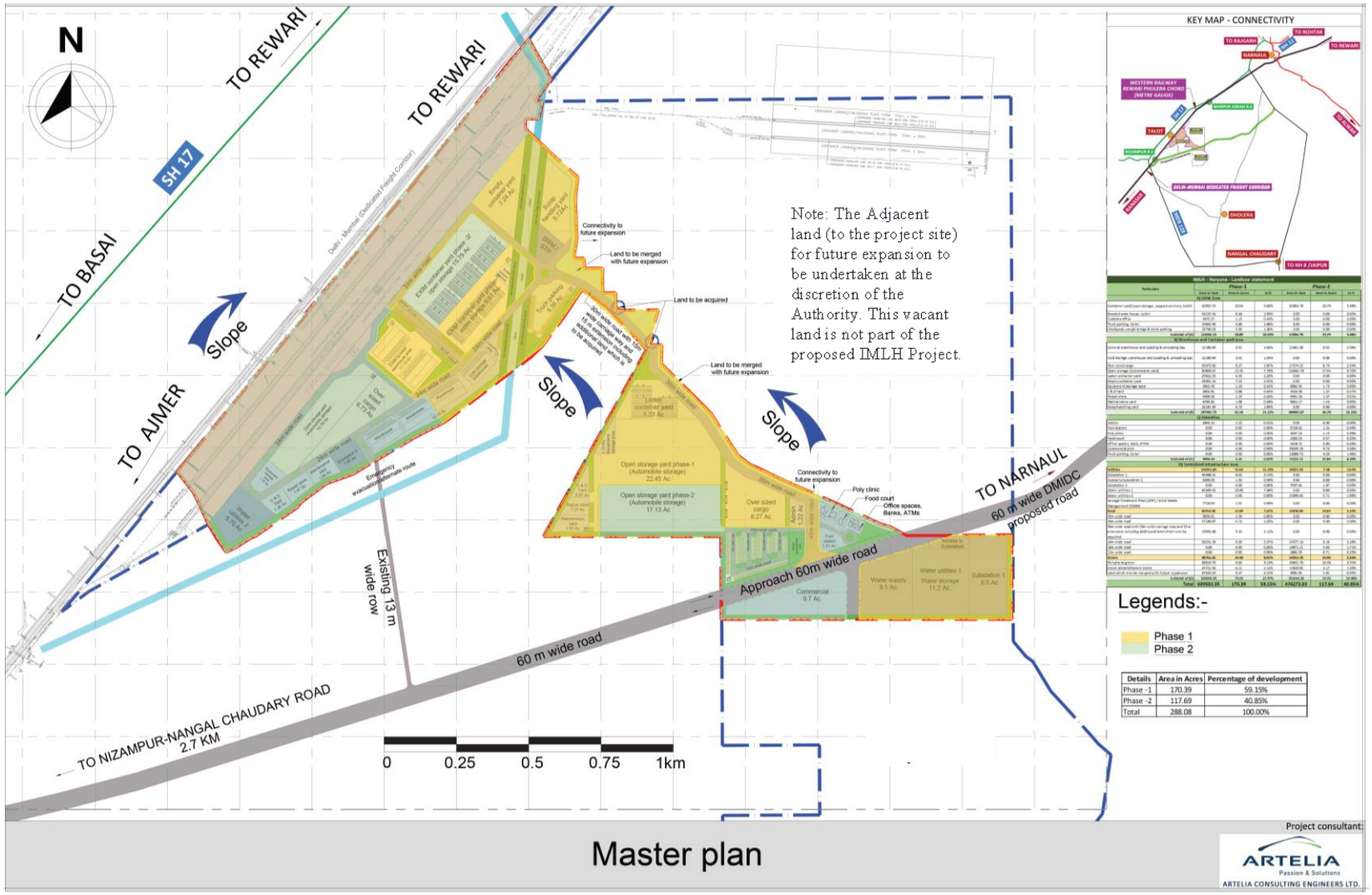


Table 17 Land Use Pattern – Phasing of development

Particulars	Overall IMLH				Phase-1			Phase-2		
	Area in Sqm	Area in Acres	Area in Hectares	In %	Area in Sqm	Area in Acres	In %	Area in Sqm	Area in Acres	In %
A) EXIM Zone										
Container yard/open storage, support services, toilet	106560.51	26.33	10.66	9.14%	42655.73	10.54	3.66%	63904.78	15.79	5.48%
Bonded warehouse, toilet	34155.34	8.44	3.42	2.93%	34155.34	8.44	2.93%	0.00	0.00	0.00%
Customs office	4673.37	1.15	0.47	0.40%	4673.37	1.15	0.40%	0.00	0.00	0.00%
Truck parking, toilet	19632.69	4.85	1.96	1.68%	19632.69	4.85	1.68%	0.00	0.00	0.00%
Check post, weigh bridge & truck parking	15799.03	3.90	1.58	1.36%	15799.03	3.90	1.36%	0.00	0.00	0.00%
Subtotal of (A)	**180820.94**	**44.68**	**18.08**	**15.51%**	**116916.15**	**28.89**	**10.03%**	**63904.78**	**15.79**	**5.48%**
B) Warehouse and Container yard area										
General warehouse and loading & unloading bay	36542.96	9.03	3.65	3.13%	12180.99	3.01	1.04%	24361.98	6.02	2.09%
Cold storage warehouse and loading & unloading bay	12180.99	3.01	1.22	1.04%	12180.99	3.01	1.04%	0.00	0.00	0.00%
Oversized cargo	60747.84	15.01	6.07	5.21%	33473.60	8.27	2.87%	27274.25	6.74	2.34%
Open storage (Automobile yard)	203901.85	50.39	20.39	17.49%	90839.07	22.45	7.79%	113062.79	27.94	9.70%
Laden container yard	25621.53	6.33	2.56	2.20%	25621.53	6.33	2.20%	0.00	0.00	0.00%
Empty container yard	29301.34	7.24	2.93	2.51%	29301.34	7.24	2.51%	0.00	0.00	0.00%
Equipment storage area	11824.86	2.92	1.18	1.01%	4842.40	1.20	0.42%	6982.46	1.73	0.60%
C & D Yard	9486.50	2.34	0.95	0.81%	3955.91	0.98	0.34%	5530.59	1.37	0.47%
Repair store	11019.94	2.72	1.10	0.95%	5068.50	1.25	0.43%	5951.44	1.47	0.51%
Maintenance yard	12632.99	3.12	1.26	1.08%	6790.82	1.68	0.58%	5842.17	1.44	0.50%
Scrap handling yard	23187.59	5.73	2.32	1.99%	23187.59	5.73	1.99%	0.00	0.00	0.00%
Subtotal of (B)	**436448.39**	**107.85**	**43.64**	**37.44%**	**247442.73**	**61.14**	**21.22%**	**189005.67**	**46.70**	**16.21%**

Particulars	Overall IMLH				Phase-1			Phase-2		
	Area in Sqm	Area in Acres	Area in Hectares	In %	Area in Sqm	Area in Acres	In %	Area in Sqm	Area in Acres	In %
A) EXIM Zone										
C) Amenities										
Admin	4945.14	1.22	0.49	0.42%	4945.14	1.22	0.42%	0.00	0.00	0.00%
Fuel station	5728.02	1.42	0.57	0.49%	0.00	0.00	0.00%	5728.02	1.42	0.49%
Poly clinic	4537.24	1.12	0.45	0.39%	0.00	0.00	0.00%	4537.24	1.12	0.39%
Food court	2303.23	0.57	0.23	0.20%	0.00	0.00	0.00%	2303.23	0.57	0.20%
Office spaces, Bank, ATMs	3228.72	0.80	0.32	0.28%	0.00	0.00	0.00%	3228.72	0.80	0.28%
Commercial plot	39437.30	9.75	3.94	3.38%	0.00	0.00	0.00%	39435.18	9.74	3.38%
Truck parking, toilet	16989.73	4.20	1.70	1.46%	0.00	0.00	0.00%	16989.73	4.20	1.46%
Subtotal of (C)	**77169.39**	**19.07**	**7.72**	**6.62%**	**4945.14**	**1.22**	**0.42%**	**72222.11**	**17.85**	**6.20%**
D) Centralized Infrastructure zone										
Utilities	**162708.86**	**40.21**	**16.27**	**13.96%**	**132051.83**	**32.63**	**11.33%**	**30657.03**	**7.58**	**2.63%**
Substation 1	36498.21	9.02	3.65	3.13%	36498.21	9.02	3.13%	0.00	0.00	0.00%
Access to Substation 1	5339.05	1.32	0.53	0.46%	5339.05	1.32	0.46%	0.00	0.00	0.00%
Substation 2	7557.41	1.87	0.76	0.65%	0.00	0.00	0.00%	7557.41	1.87	0.65%
Water utilities 1	82495.91	20.39	8.25	7.08%	82495.91	20.39	7.08%	0.00	0.00	0.00%
Water utilities 2	23099.62	5.71	2.31	1.98%	0.00	0.00	0.00%	23099.62	5.71	1.98%
Sewage Treatment Plant (STP) / Solid Waste Management (SWM)	7718.65	1.91	0.77	0.66%	7718.65	1.91	0.66%	0.00	0.00	0.00%
Road	**149345.68**	**36.90**	**14.93**	**12.81%**	**89414.85**	**22.09**	**7.67%**	**59930.84**	**14.81**	**5.14%**
45m wide road	9939.81	2.46	0.99	0.85%	9939.81	2.46	0.85%	0.00	0.00	0.00%
30m wide road	27199.97	6.72	2.72	2.33%	27199.97	6.72	2.33%	0.00	0.00	0.00%
30m wide road with 15m wide carriage way and 15 m extension including additional land which is to be acquired	13043.68	3.22	1.30	1.12%	13043.68	3.22	1.12%	0.00	0.00	0.00%

Particulars	Overall IMLH				Phase-1			Phase-2		
	Area in Sqm	Area in Acres	Area in Hectares	In %	Area in Sqm	Area in Acres	In %	Area in Sqm	Area in Acres	In %
A) EXIM Zone										
24m wide road	76308.49	18.86	7.63	6.55%	39231.39	9.69	3.37%	37077.10	9.16	3.18%
18m wide road	19971.21	4.93	2.00	1.71%	0.00	0.00	0.00%	19971.21	4.93	1.71%
12m wide road	2882.53	0.71	0.29	0.25%	0.00	0.00	0.00%	2882.53	0.71	0.25%
Green	**159316.05**	**39.37**	**15.93**	**13.67%**	**98762.65**	**24.40**	**8.47%**	**60553.39**	**14.96**	**5.19%**
Peripheral green	80161.45	19.81	8.02	6.88%	36519.75	9.02	3.13%	43641.70	10.78	3.74%
Green areas between zones	37543.21	9.28	3.75	3.22%	24722.56	6.11	2.12%	12820.65	3.17	1.10%
Land which is to be merged with Future expansion	41611.39	10.28	4.16	3.57%	37520.34	9.27	3.22%	4091.05	1.01	0.35%
Subtotal of (D)	**471370.60**	**116.48**	**47.14**	**40.43%**	**320229.33**	**79.13**	**27.47%**	**151141.26**	**37.35**	**12.96%**
Total	**1165809.32**	**288.08**	**116.58**	**100.00%**	**689533.35**	**170.39**	**59.15%**	**476273.83**	**117.69**	**40.85%**

Source: ACE analysis

4.16 Capacity of IMLH (Phase IA) as per derived master plan

The capacity of the IMLH (Phase IA) is worked out and presented in Table below.

Table 18 Overall Capacity assessment of IMLH Phase 1A

Estimated Container Cargo traffic at IMLH (In Mn TEU)		
Phasing	**Capacity**	**Trigger For Phasing**
PHASE 1	0.90	
PHASE 2	1.96	10th year after COD or 80% Traffic of Phase I capacity, whichever is earlier

Estimated Consumption led warehousing development (In Mn Sqft)			
Phasing	**General Warehousing**	**Cold Storage**	**Trigger For Phasing**
PHASE 1	0.07	0.07	
PHASE 2	0.20	0.07	10th year after COD or 80% Traffic of Phase I capacity, whichever is earlier

Source: ACE analysis

Though the demand and area assessment has been carried out till the year 2071, the IMLH shall reach its full capacity before that. As per the layout the General warehouse can handle approximately 76,672 TEUs. Similarly, 1 warehouse has been demarcated for cold storage warehouse which shall handle ~ 25,530 TEUs. A demarcated zone has been allotted for laden and empty container yard and can handle a capacity of 5,17,461 TEUs. The master plan is designed in a flexible manner so as to adopt to the any requirements and for sustained operation of IMLH.

The phase 1 area of 170.39 acres shall cater to the TEU capacities as provided in the table above. The phase 1 area shall at full capacity by 2037. Phase 2 construction shall be triggered upon the concessionaire achieving a traffic handled as a % of total capacity available at IMLH during Phase 1 at an average of 80%. As per the demand assessment the Phase 2 construction shall commence from 1 April 2036, which needs to be completed within 2 years, i.e. by 31 March 2038.

4.17 Design Basis Report for site grading and road

The proposed design basis including the approach methodology for the site grading and road works is covered in this report.

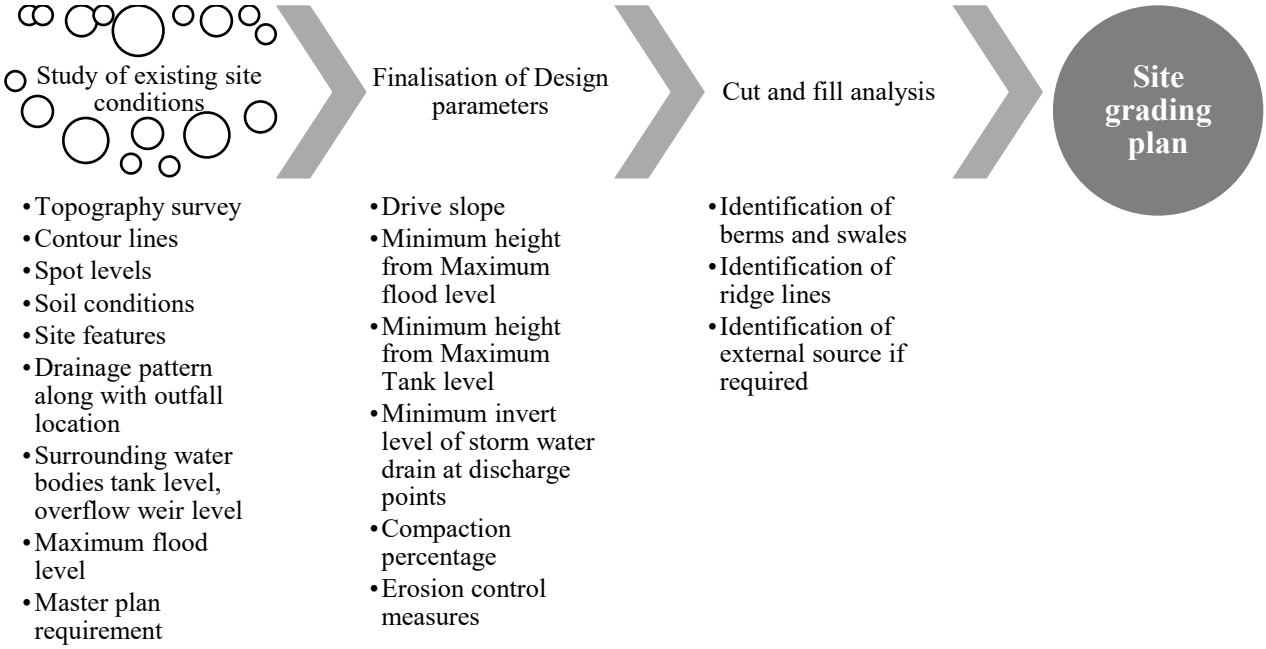
Site grading

The objective of this chapter is to deal with the design basis and requirement for finalizing the site grading works for the proposed Integrated Multi Model logistic hub (IMLH). The grading plan will attempt to minimize the following:

- The quantum of earth work at site
- The quantum of net requirement of soil to or from the site

The strategy to achieve the above is to carry out site grading works as per the existing profile of the site to the extent possible. The site grading plan is depicted in the Figure below:

Figure 36: Site Grading Plan



Design parameters

The proposed site grading shall comply with the following design parameters:

- The subgrade bottom level shall be minimum of 1.00 m above the maximum water table or high flood level.
- Site grading levels shall also be finalized based on the analysis of the proposed drain network and the invert level of all storm water drains.
- Limit of disturbance / transition between existing and new grade
- 95% Compaction of filled soil.

Erosion control measures for slope exceeding 2:1 such as riprap, gabion baskets, paved or concrete finished slope and retaining walls shall be provided if warranted.

Site grading design procedure

Site grading design integrates the natural landforms of the site with the proposed program to create an aesthetically pleasing yet functional and cost-effective site plan considering the function and utility. The grading of a site serves three basic purposes.

- Reform the land surface to make it compatible with the intended land use.
- Establishes and controls the new drainage patterns.
- Helps to define the character and aesthetics of the site.

As far as possible the cutting and filling shall be maintained to an optimal level so as to minimize the borrowed earth from the external source and to minimize the cost of site grading.

Contour spacing and shape of contour lines needs to be studied to identify the shape and the inter-relationships of the landforms such as localized depression, valleys and ridges.

The drainage study sets the basic parameters for the grading design. The following is a list of goals for a site grading plan from a drainage perspective:

- Collect runoff and direct it safely to adequate outfall points at non-erosive velocities.
- Quickly convey runoff away from buildings to protect them from foundation damage and wet basements.
- Prevent the formation of unintentional wet areas that cause maintenance problems.

Graded areas will be smooth, compacted, free from irregular surface changes and sloped to drain. The final earth grade adjacent to equipment and buildings will be below finished floor elevations and will be sloped away from foundations as necessary to maintain proper drainage. Prior to any further construction, all graded areas under roadways, foundations or other supportive areas will have a compacted sub grade consisting of at least the top 500 mm scarified and compacted to 97% of the maximum dry density based on the modified proctor test (IS 2720 – part 8) density. Backfill for all embankments, non-supportive and unpaved areas need to be compacted to at least 95% of the maximum density based on the modified proctor test (IS 2720 – part 8).

Cut and fill analysis.

The quantity of earth work in cutting and filling for the site grading needs to be arrived by using civil 3D software or any suitable software.

Preservation of topsoil

The topsoil in the greenery areas shall be removed to a depth of 200 mm for the entire site, since the topsoil is rich in organic content and essential to establish new vegetation and shall be stockpiled to a height of 400 mm in designated areas and shall be reapplied to site by rolling and compacting to a minimum of 95% SPD to required level during plantation of the proposed vegetation. Topsoil shall be separated from subsoil debris and stones larger than 50 mm diameter and the stored topsoil shall be refilled in the site area as finished grade for planting areas. (As per NBC-part-10- 4.14).

Design basis for Roads, Culverts, and Footpath

The objective of this chapter is to deal with the design basis and requirement for finalizing the roads, footpath and cycle track design for the proposed IMLH. The design concept will attempt to maintain the following:

- Determination of the traffic condition and density of traffic.
- Flexible pavement design as per IRC-37-2018 (fourth revision).
- Roadside buffer requirements - The utilities services like water, sewer, power, telecom network, stormwater drain, cycle track and pedestrian walkway and roadside landscape shall be accommodated.

Flexible pavement road construction is considered with respect to durability, initial cost, periodical maintenance cost and best suiting to the area.

Design parameters - Road.

The Following road design parameters needs to be considered for road, footpath and cycle track design:

- The projected traffic volume needs to be considered.
- Soaked CBR test values needs to be considered for the design.
- The embankment top/ sub grade bottom level shall be formed by carrying out required cutting and filling based on the spot levels along the road alignment and finished road levels.
- The effective CBR needs to be arrived and considered for the design.
- The pavement composition of the road shall be as per IRC: 37- 2018 (fourth revision)
- Finished road level (FRL) for all the roads shall be based on site grading levels.
- Road camber of 2.5%, for carriageway needs to be considered as per IRC standards.
- Roadside kerb with top and bottom width of 115 mm and 165 mm respectively, and 325 mm high shall be provided.
- Construction of road, footpath and culverts shall be as per the specifications of Ministry of Road Transport & Highways (MORTH- fifth revision)

Foot path and cycle track:

- Footpath /cycle track and green buffer needs to be provided along both sides of the carriageway.
- 60 mm thick factory-made cement concrete interlocking paver block of M30 grade shall be laid over the foot path and cycle track.

- Clear demarcation between the foot path and cycle track shall be provided with paint marking wherever necessary.

Utilities

- Internal storm water drain needs to be provided on either side of all the road except for the 12 m wide road.
- Internal storm water drain needs to be provided on one side of the road in 12 m wide road with one side camber.
- Water supply network shall be provided on one side of road and sewerage network shall be provided on other side of road.
- Telecom services shall be provided on one side of the road.
- Power line on one side of the road shall be provided.

RCC Hume pipe of NP3 needs to be considered for providing road crossing at appropriate locations as per each network recommended.

Design basis for road.

Road- design traffic

The design traffic in terms of cumulative number of standard axles to be carried out during the design life of the road shall be computed using the following equation.

$N= (365 X ((1+r)^{n-1}) /r) X A X D X F$

where,

N = Cumulative number of standard axles to be catered for in the design in terms of MSA.

A = Initial traffic in the year of completion of construction in terms of number of Commercial Vehicles Per Day (CVPD).

D = Lane distribution factor

F = Vehicle Damage Factor (VDF)

n = Design life in years

r = Annual growth rate of commercial vehicles in decimal

Also, the traffic in the year of completion is estimated using the following equation.

$A = P (1+r)^{x}$

Where,

P = Number of commercial vehicles as per last count

x = Number of years between the last count and the year of completion of construction

IRC Pavement design – IIT PAVE software analysis

The flexible pavement design shall be carried out using the IIT pave software analysis available in the IRC: 37: 2018 (fourth revision), considering the project traffic and the soaked CBR value of the soil.

Also, In IRC: 37: 2018 (fourth revision), pavement compositions have been suggested in the form of design charts considering different combinations of traffic and material properties. The appropriate design chart shall be referred to suite for the project traffic and CBR value of the soil.

Project Information Memorandum

Road details

Different categories of roads are proposed for the internal road transportation network in the master plan and the details are given **in Table below.**

Table 19: Details of roads

Right of way (m)	Carriage way width (m)	Number of lanes	Total Road Length (m)
45	10.50 + 10.50	Six lanes - two way with 1.00 m wide median	443.30
30	7.00 + 7.00	Four lanes - two way with 1.50 m wide median	1070.81
24	5.50 + 5.50	Two intermediate lanes - two way with 1.00 m wide median	3119.98
18	7.00	Two lanes	227.26
15	14	Four lanes	263.86
12	5.50	Intermediate lane	227.97
Total length in M			**5353.18**

Road and foot path/cycle track salient features.

- Roads and footpaths are provided for easy movement of visitors with sufficient care so that no transport system comes in the way of pedestrians.
- Footpath and cycle track needs to be provided with the following layers.
  a. 60 mm thick interlocking concrete paver block of M30 grade
  b. 50 mm thick sand/ quarry dust filling below paver block
  c. 200 mm thick wet mix macadam
- Aesthetically designed walkways shall be provided along with lush green environment on either side of roads.
- Pedestrian walkways/ bicycle tracks shall be provided for all categories of roads.
- All services like storm water drain, sewer, water, power, and telecom shall be accommodated within the road right of way.
- Necessary signage, road marking and studs needs to be provided as per standards.

Advantages of flexible pavement

Flexible pavement structure is recommended for the following reasons:

- Ease of rehabilitation of pavement structure due to anticipated long-term settlement.
- Lower reinstatement cost to accommodate future laying of utility services.
- Durability, periodical maintenance cost and best suiting to the area.

4.18 Design Basis Report for Power Distribution and Street Lighting

Background

This section describes the design basis for the following components pertaining to electrical infrastructure planning for the proposed IMLH.

1. Estimation of the overall power demand
2. The power intake sub-stations and their installed capacity planning
3. Various types of consumers, the demand limitations, and the voltage levels at which these consumers are.

4. Site wide External power distribution network topology means of conveyance of power supply to various load zones and distribution substation capacity planning and zoning/siting.
5. Area lighting, Road lighting, and Street lighting

Approach to electrical infrastructure planning

Codes & standards and regulations

The approach to the planning of electrical infrastructure will essentially evolve around the above mentioned codes, rules, regulations, and guidelines:

1. IE Act, 1910
2. IE (supply) Act, 1948,
3. IE rules, 1956
4. CBIP manual
5. REC distribution codes & manuals
6. BIS / IEC standards
7. NBC

In addition to the above, the established in-house standards and database of Artelia Consulting Engineers (ACE) based on similar project experience shall be made use of wherever applicable.

Besides the above the best (good) engineering practices and the earlier experience and expertise of ACE in such similar electrical infrastructure planning exercises will also be followed, if required.

Basis of Power demand estimation

The electrical infrastructure planning exercise begins with power demand estimation. Given the complexity of electrical demand assessment for such large area with mixed type development and as there is no specific demand estimation "one fit for all" model, the power demand estimation is made using conventionally followed and proven benchmark practices as below.

- For industrial / Manufacturing zones - "Land acreage-based power density values" i.e., based on kVA/Ha of industrial land parcel.
- For non-industrial zones / residential / commercial zones - "Power density Unit built up area (BUA) based power density (kW/ Sq. Mtr of BUA)".

The peak demand of the system is the coincident demand of all customers. Not all the customer groups will peak at the same time. An analytical tool used to factor the peak demand is a coincidence factor or simultaneous factor. Hence, the simultaneous factor as relevant to the respective sectoral loads is also considered while working out the demand.

A notional value of 10 % is considered towards the line loss in the distribution network.

After factoring the simultaneous / diversity factor and the distribution line loss the ***After Diversity Maximum Demand (ADMD)*** arrives from the utility perspective.

Power density benchmark values

The power demand estimation is carried out based on published standards, guidelines, best industry standards and consultant's experience in similar projects and the same is presented in **Table below.**

Table 20: Load density demand benchmark values

Description of land use purpose	Power requirement			Simultaneous factor
Industrial area				
Logistic & warehousing	200 KVA / ha	-	-	0.7
Non-industrial area				
Commercial	250 KVA / ha	-	-	0.7

Description of land use purpose	Power requirement			Simultaneous factor
Institutional – Laboratories,	250 KVA / ha	-	-	0.7
Utilities				
Utilities – STP, WTP, water works, SWM and Substation	300 KVA / ha	-	-	0.8
Amenities and Facilities				
Amenities & Service buildings	200 KVA / ha	-	-	0.8
Green	4 KVA / ha	-	-	0.2
Road lighting / street lighting	30-50 KVA / ha	-	-	1.0

On application of the above benchmark load density values onto the land use pattern tabulation, the overall electrical power demand works out to about 8.5 MVA. The detailed workings are provided in the table below.

Table 21: Abstract - Estimated Power demand

Land use	Area in Acre	Total Power demand in MVA
EXIM Zone	44.68	01.21
Warehouse and Container yard area	107.85	03.72
Amenities	19.07	0.85
Centralized Infrastructure zone	40.21	2.04
Road	36.90	0.53
Green	39.37	0.199
Total	**288.08**	**8.5**

Power Supply Infrastructure

Power distribution to entire IMLH will be distributed from substation 1 and Substation 2 through underground cables in RCC Cable trench through available ROWs of the roads.

Design Basis for Electrical Power Distribution:

- All Designs are to be carried out based on the design principals of Infrastructure Master Plan as defined above and the supply of the power network should be as per the IS.
- At road crossings cable to pass through utility ducts (HDPE/HUME pipe)
- All MV (11 KV) Feeders emanating from 132/33/11 KV Substation, shall be by UG cable.
- Facility wise and schedules are to be arrived based on the land use classifications.

Internal power distribution

As the land use pattern in the IMLH site consists of consumers with various categories and with different demand values, the internal power distribution to various consumers shall be carried out based on the power requirement. The different voltage levels at which various demands are required to be met is as below:

Table 22 Voltage level requirements

Sl. No.	Supply Voltage level	Load / Demand limits	Remarks
Consumer Group-I	LT power supply at 415 / 240 Volts	Various commercial, amenities and other general buildings with load less than 75 kW (100 hp)	Up to 49 hp, the tariff metering shall be with CT. From 50 to 100 hp., the tariff meter shall be metering with PT and CT
Consumer Group-II	HT 11 kV power supply	Various commercial, amenities, and other industrial units with load greater	

Sl. No.	Supply Voltage level	Load / Demand limits	Remarks
		than 75 kW (100 hp) and with a demand up to 3000 kVA	
Consumer Group-III	HT 33 kV power supply	Various commercial, amenities and other industrial units with demand greater than 3000 kVA and up to 5000 kVA	Consumers who avail of dedicated feeder service can avail 33 kV supply up to 20 MVA

33 kV, 11 kV and 0.433 kV reticulations

A. For non-industrial areas

Based on the master plan, the overall site shall be divided into convenient service areas. A service area of any substation shall mean, an area where a sub-station normally supplies the load by one or more number of feeders, as required, without exceeding the specified KVA-KM Loading limit of any feeder within the area.

The layout shall generally conform to relevant Construction Standards of Rural Electrification Corporation Ltd, CBI&P manual on layout of substation as applicable and provisions in Indian Electricity Rules, 1956. The layout adopted shall include the following:

a. Independent Circuit Breaker control of 33 KV feeders and Transformers.
b. Independent control of 11 KV Feeders.
c. Single Bus sectionalized.
d. Spare bays for taking care of extension/augmentation of S/S capacity in the future.

To facilitate further distribution of LT, adequate Nos. of Unitized 11/0.433 kV sub-stations shall also be planned. These transformers' rating shall normally be in the order of 150 kVA to 250 kVA.

The distribution network fed from 33/11 kV transformers and 11/0.433 kV transformers shall be planned as independent networks within their respective service area. The design of the distribution lines shall incorporate features to enable their augmentation, in future, with minimum interruption to a power supply.

Shunt capacitors un switched /switched type, shall be installed in the Distribution System at suitable locations for improvement of Power Factor, voltage profile, and reduction of transmission and distribution losses.

The LT 415 / 240 Volts supply for site-wide power distribution to various consumers shall be carried out by underground cabling. Necessary feeder pillar boxes shall be provided. The service connection to the individual consumers shall be tapped from these feeder pillar boxes.

B. For common services, amenities, and utilities

The power distribution system for the proposed common services, amenities, and utilities such as WTP, STP, SWM, streetlight, etc., shall also be planned in as much as possible as a separate network from other consumers so as to offer a higher redundancy, maintainability, and control.

Design condition

A. Electrical system - HV supply

i. Nominal Voltage : 33 kV and 11 kV
ii. Frequency : 50 Hz $\pm$ 3%
iii. No. of phases : 3 phase, 3 W

B. LV supply

i. Nominal Voltage : 415 V / 240 Volts

ii.	Frequency	:	50 Hz.
iii.	No. of phases	:	3 phase, 4 W / single phase 3 wire
iv.	Earthing System	:	TN-S

The above voltages and frequency shall be subjected to permissible variations as per the IS / utility guidelines.

Standby / Emergency Power

As the IMLH site is planned with a dedicated 132/33/11 KVA substation, the power interruptions are considered very remote and if at all for a very short period. However, to take care of emergent situations, standby DG sets are considered only for critical utility infrastructures such as pump houses, sub-stations, WTP, STP, etc.

Streetlighting

- The average level of illumination for Carriageways, major intersections/junctions shall be a minimum of 20 lux. Streetlights will be proposed in single-row bottom and single-row top positions to achieve the desired illumination levels.

It is proposed to illuminate the area with energy-efficient LED lights will propose at the junctions with an auto ON/OFF arrangement. The design standards for the same are highlighted below.

Table 23: Design Standards

Code	Design Standards
IS/IEC 62271-201: 2006	Switchgear Protective Components.
IEC 60598– 2– 3 IUT (Institute of Urban Transport) CIE (Industrial commission of illumination)	Requirements luminaries for road& street lighting. The standard for road lighting. Road Transport Lighting for Developing Countries.
IEC 62305	Protection against lightning
IS 3043	Code of Practice for Earthing
IS 1944	Code of practice for the lighting of public thoroughfares
IS 1367 BSENISO1461 BSEN10025-1:2004	• Standards for Poles & Masts • Recommended practice for hot dip galvanizing of iron & steel. • Hot dip galvanized coatings on fabricated iron and steel articles. • Specifications and test methods • Hot rolled products of structural steels. General technical delivery conditions
IS 7098(Part-II &Part-III) 2003 IS 8130	• Standard for XLPE Cables, Part–II up to 3.3KV to 33 KV and Part–III from 33KV to220KV. • Specification for conductors for insulated electric cables & flexible cords.
IS 1554(Part I &Part–II)	• Specification for PVC insulated (Heavy Duty) electric cables • Part1 for working voltages up to and including 1100. • Part2 for working voltages from 3.3KV up to and including 11KV
IEC 61439 IEC 60947	• Feeder pillar &Switchgear (Totally Type Tested Assembly TTTA). Switchgear protective components
IEC 60598– 2– 3 IUT (Institute of Urban Transport) CIE (Industrial commission of illumination)	• Requirements luminaries for road& street lighting. Standard for road lighting. • Road Transport Lighting for Developing Countries.
IEC 62305	Protection against lightning
IS 3043	Code of practice for Earthing
IS 1944	Code of practice for lighting of public thorough fares

Code	Design Standards
IS 1367 BSENISO1461 BSEN10025-1:2004	• Standards for Poles & Masts • Recommended practice for hot dip galvanizing of iron & steel • Hot dip galvanized coatings on fabricated iron and steel articles. • Specifications and test methods • Hot rolled products of structural steels. General technical delivery conditions

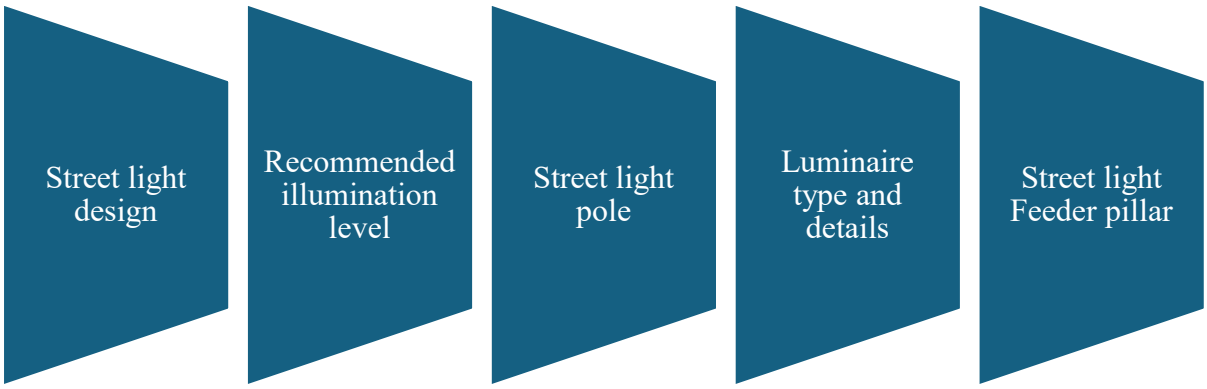
Table 24: Installation

Code	Standards for installation
IS 1255-1983 (Reaffirmed1995)	Code of practice for installation and Maintenance of power cables up to and including 33KV rating.
IEC 60947	Switch gear Protective Components.
IEC 60598– 2– 3 IUT (Institute of Urban Transport)	Requirements luminaries for road & street lighting. Standard for road lighting.
IEC 62305	Code of practice for Lightning Protection.
IS 3043	Code of practice for Earthing.

Street lighting system

The design and detailing street lighting system is subdivided into the following five components, as illustrated in figure below.

Figure 37: *Street Lighting*



1. Street light design

The road lighting / street lighting system shall be planned to achieve the recommended illumination levels in accordance with the road classifications and as the relevant governing IS codes.

2. Recommended illumination level.

The recommended average level of illuminance shall be as follows:

Table 25: Illumination level

Sl. No.	Type of road	Average Illumination level in lux
1	Road category	
2	45 Mtr Road	30
3	30 Mtr & 24 Mtr Road	20
4	18 Mtr Road	18

Sl. No.	Type of road	Average Illumination level in lux
5	Walk space	12
6	Cycle Track	12

3. Street light pole

Hot dip galvanized Octagonal /FRP pole to withstand wind speed 180km/hr was proposed. The poles shall be either single arm or twin arm based on their location and type of road.

The pole and arm configuration shall normally be as under

- For roads with ROW up to 18 Mtr – One single armed pole on one side of the road
- For roads with ROW > 18 m and < 32 Mtr – One single armed pole at either side of the road
- For roads with ROW > 32 m– One twin-armed pole on the center median or either side of the road.

Each street light pole shall be considered with an external Junction box with the necessary cable looping connector, and MCBs. The interconnection cable between the control box and the street light fitting is connected through an insulated copper conductor of adequate size with necessary end terminals.

4. Luminaire type and details

LED light fitting with an integral driver along with a heat sink of adequate capacity shall be used. The Illuminance of LED shall be above 80 lumens/watt. LED luminaire comprises of aluminium extruded channel with white powder coating body, IP 66 rating, high translucent frosted diffuser, and optical reflector sheet to give uniform glare-free light distribution.

5. Feeder pillar

Feeder pillar panel shall be outdoor type and fabricated out of CRCA sheet steel of thickness not less than 2 mm with a weatherproof canopy construction with IP 55 protection. The sheet steel shall be painted with two coats of anti-corrosive chemical-resistant paint over two coats of red-oxide primer. The feeder pillar incomer shall be TP MCCB with 16 KA breaking capacity and adequate capacity of TPN power contactor in the outgoing, operating time of streetlight is controlled automatically through a light dependent resistor with astronomical cyclic timer. Refer to Appendix - I for Typical details for street light poles and cross sections.

Incoming supply for the feeder pillar shall be fed from the MV panel located at the strategic location through an underground cable. The cable size shall be based on the load current, voltage drop, and fault level. The voltage drops for the incoming and outgoing feeders complying through IS: 12360.

The outgoing feeder shall be controlled through TPN MCCB. The feeder pillar shall have astronomical timer / Day –Night sensors and controllers for automatically switching ON / OFF the street lighting. The feeder pillars shall have a timer provision for auto-powering on- off the lighting circuit with preset time and control through a centralized control room through remote operation in the future if required.

The feeder pillar panel shall also supply power to other components like CCTV surveillance systems, road signals, etc.,

6. Underground power distribution

The street light system shall be powered through an underground cable from the feeder pillar.

The cable shall be laid at a depth of 750 mm from the finished ground level and directly buried in the ground with river sand cushion, and cable protection trough/bricks. Cable identification markers shall be provided at every 30-meter interval for identification purposes.

The power cable is confirming to be IS: 7098, Part I with 1100V grade, aluminium conductor, XLPE insulated, steel wire armoured, PVC sheathed and insulated cable. The cable termination shall be carried out using a single compression-type cable gland and crimping-type aluminium lugs of adequate capacity and size. All the end termination shall be properly earthed using the adequate size of copper/ G.I. conductor.

The external lighting layout and power distribution layout drawings are provided in the Drawing annexures.

4.19 Design Basis Report for Water Supply System

Background

This document intends to provide the design approach for the infrastructures such as Sourcing, conveyance system, pumping system, storage, and distribution of potable and non-potable water to the occupant units. It is presumed that the required water will be supplied at one point within the logistics Hub.

Design criteria

Design standards

The Manual on water supply and treatment issued by CPHEEO and the National Building Code (NBC) 2016 will serve as the baseline for the development of the design, along with the relevant latest Indian standards. Additionally, the consultant's in-house data shall be referred to wherever required.

The design shall ensure to incorporate good engineering practices and by default shall envisage value engineered solutions for cost and energy optimisation. **The tentative list of codes and references is provided in Annexure 1.**

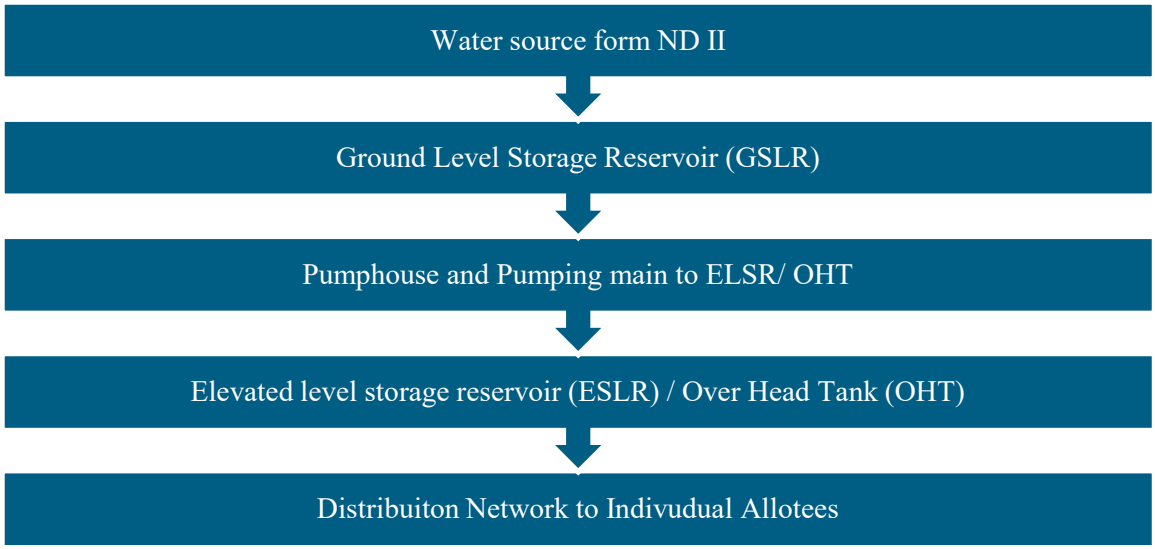
Design life

Design life of pumps and other mechanical, electrical & instrumentation works shall be 15 (Fifteen) years and civil and structural works associated with water supply system shall be 30 (Thirty) years, water supply pipeline shall be 30 (Thirty) years, with due note being taken of the operating regime and of the environmental conditions.

Approach to water supply system planning

The design approach for water supply system is depicted below in Figure below.

Figure 38 Water Supply System



Demand Estimation

Based on the final master plan the land use pattern depicted in the Table below, considers for arriving at the total water demand

Table 26: Land use pattern for overall area

Sl. No.	Land use	Area (Acres)
1	EXIM Zone	44.68
2	Warehouse and Container Yard Area	107.85
3	Amenities	19.07
4	Centralized Infrastructure	116.48
	Total	288.08

Basis

- The project shall have a 24/7 treated water supply adopting national and global standards with sufficient quantity.
- For bathing and washing clothes, cooking, drinking and washing vessels, the proposal contemplates the use of potable water.
- The usage of non-potable water includes processing, gardening, cleaning, cooling, firefighting and toilet flushing.

The norms considered for arriving at the water demand is depicted in the Table below.

Table 27 :Water Demand Estimation Basis

Type of land use	Water demand	Unit
Domestic water		
Office area/ Warehouses/ other amenities	45 (25 – Potable Water – 55%) (20 – Non-Potable Water – 45%)	Litres per capita per day (LPCD)
Road/green	0.73	m^3/acre

Source: ACE analysis, published standards, guidelines and best industry norms

The Table in the following sections depicts the water consumption pattern for potable and non-potable water for domestic and process water.

Table 28 :Water Consumption Pattern for Domestic Water

For areas with bathing facilities	
Potable water	70%
Non-potable water	30%
For areas without bathing facilities	
Potable water	55%
Non-potable water	45%

Source: ACE analysis

Table 29: Water Consumption Pattern for Process Water

Non-potable water	100%

Source: ACE analysis

Water Losses

Water losses occur in the distribution and transmission network. The percentage of loss depends on the pipe material, jointing system, etc. As per CPHEEO manual, 10% loss is considered.

Fire Protection Requirement - Non-Potable

Fire demand in litres per minute has been calculated based on the following formula:

QFD = 4000 x (P)0.5 x (1-0.01 x (P)0.5)

Where,

P = Population in thousands per ha

QFD = 812 litres per minute (LPM)

= 50 cum/hr

Considering two hours of fire demand requirement, the total quantity of water required for fire protection is 100 cum for handling both people and machineries for two hours; and

The consideration for the demand for firefighting include daily demand as onetime storage of 100 cum, i.e., 2 hours of fire demand will be created and maintained.

Non-potable water is considered for meeting the above calculated fire water requirements. It is proposed to provide stand post with valves in the non-potable water network at every 500 m interval. Fire tenders will be able to refill the fire water tanks as necessary from the above provided stand post points.

Average Water Demand

The total average water demand for IMLH based on computation and analysis are mentioned in the below Table.

Table 30: Water Demand for IMLH

S.no.	Description	Total	Unit
1	Total Potable Water Demand	117.81	cum/day
2	Total Non-potable Water Demand	180.66	cum/day
3	Total Water Demand	328.32	cum/day
4	Fire Water Requirement (One-Time)	100	cum

Source: ACE Analysis

The following Table depicts the detailed water demand estimation for different activities in the Integrated Multi-Modal Logistics Hub (IMLH).

Table 31: Water demand estimation - Overall development area

IMLH - Haryana - Land use Statement						Population Estimation (No.)				Domestic Water Demand Estimation (m3/day)						Total Water Demand for IMLH (m3/day)		
S. No	Particulars	Area in Sqm	Area in Acres	Area in Hectares	In %	Proposed Floor Space Index (FSI)	Population Density (Sqft Per Person)	Population Density (Sq.m Per Person)	Population (No.)	Basis for Domestic Water Consumption (LPCD)	Potable (LPCD)	Non-Potable (LPCD)	Domestic Water Consumption - Potable (m3/day)	Domestic Water Consumption - Non-Potable (m3/day)	Total Domestic Water (m3/day)	Total Potable Water Required (m3/day)	Total Non-Potable Water Required (m3/day)	Total Water Demand considering loss @ 10 % (m3/day)
1.0	Total site area (a)	1653868.43	408.68	165.39	100.00%													
2.0	Railway lines, station and related areas (b)	377127.06	93.19	37.71	22.80%													
3.0	Approach 60m wide road (c)	52041.84	12.86	5.20	3.15%													
4.0	Irrigation canal (d)	22257.3051	5.50	2.23	1.35%													
5.0	Irrigation canal buffer (e)	37013.25	9.15	3.70	2.24%													
6.0	Additional land to be acquired for road extension (f)	380.35	0.09	0.04	0.02%													
7.0	Net planning area (g=a-b-c-d-e+f)	1165809.32	288.08	116.58	70.49%													
A) EXIM Zone																		
8.0	Container yard/open storage, support services, toilet	106560.51	26.33	10.66	9.14%	0.5	2000	185.806	574	45	25	20	14.3	11.5	25.8	14.3	11.5	28.4
9.0	Bonded warehouse, toilet	34155.34	8.44	3.42	2.93%	0.5	2000	185.806	184	45	25	20	4.6	3.7	8.3	4.6	3.7	9.1
10.0	Customs office	4673.37	1.15	0.47	0.40%	0.5	200	18.5806	252	45	25	20	6.3	5.0	11.3	6.3	5.0	12.5
11.0	Truck parking, toilet	19632.69	4.85	1.96	1.68%				50			20		1.0	1.0		1.0	1.1
12.0	Check post, weigh bridge & truck parking	15799.03	3.90	1.58	1.36%													
Subtotal of (A)		180820.94	44.68	18.08	15.51%													
B) Warehouse and Container yard area																		
13.0	General warehouse and loading & unloading bay	36542.96	9.03	3.65	3.13%	0.5	3000	278.709	131	45	25	20	3.3	2.6	5.9	3.3	2.6	6.5
14.0	Cold storage warehouse and loading and unloading bay	12180.99	3.01	1.22	1.04%	0.5	3000	278.709	44	45	25	20	1.1	0.9	2.0	1.1	0.9	2.2
15.0	Oversized cargo	60747.84	15.01	6.07	5.21%	0.5	10000	929.03	65	45	25	20	1.6	1.3	2.9	1.6	1.3	3.2
16.0	Open storage (Automobile yard)	203901.85	50.39	20.39	17.49%	0.5	30000	2787.09	73	45	25	20	1.8	1.5	3.3	1.8	1.5	3.6
17.0	Laden container yard	25621.53	6.33	2.56	2.20%	0.5	3000	278.709	92	45	25	20	2.3	1.8	4.1	2.3	1.8	4.6
18.0	Empty container yard	29301.34	7.24	2.93	2.51%	0.5	10000	929.03	32	45	25	20	0.8	0.6	1.4	0.8	0.6	1.6
19.0	Equipment storage area	11824.86	2.92	1.18	1.01%	0.5	10000	929.03	13	45	25	20	0.3	0.3	0.6	0.3	0.3	0.6
20.0	C & D Yard	9486.50	2.34	0.95	0.81%	0.5	10000	929.03	10	45	25	20	0.3	0.2	0.5	0.3	0.2	0.5
21.0	Repair store	11019.94	2.72	1.10	0.95%	0.5	3000	278.709	40	45	25	20	1.0	0.8	1.8	1.0	0.8	2.0
22.0	Maintenance yard	12632.99	3.12	1.26	1.08%	0.5	3000	278.709	45	45	25	20	1.1	0.9	2.0	1.1	0.9	2.2
23.0	Scrap handling yard	23187.59	5.73	2.32	1.99%	0.5	5000	464.515	50	45	25	20	1.2	1.0	2.2	1.2	1.0	2.5
Subtotal of (B)		436448.39	107.85	43.64	37.44%													
C) Amenities																		
24.0	Admin	4945.14	1.22	0.49	0.42%	0.5	200	18.5806	266	45	25	20	6.7	5.3	12.0	6.7	5.3	13.2
25.0	Fuel station	5728.02	1.42	0.57	0.49%	0.5	500	46.4515	123	45	25	20	3.1	2.5	5.5	3.1	2.5	6.1
26.0	Poly clinic	4537.24	1.12	0.45	0.39%	0.5	200	18.5806	244	45	25	20	6.1	4.9	11.0	6.1	4.9	12.1

IMLH - Haryana - Land use Statement						Population Estimation (No.)				Domestic Water Demand Estimation (m3/day)						Total Water Demand for IMLH (m3/day)		
S. No	Particulars	Area in Sqm	Area in Acres	Area in Hectares	In %	Proposed Floor Space Index (FSI)	Population Density (Sqft Per Person)	Population Density (Sq.m Per Person)	Population (No.)	Basis for Domestic Water Consumption (LPCD)	Potable (LPCD)	Non-Potable (LPCD)	Domestic Water Consumption - Potable (m3/day)	Domestic Water Consumption - Non-Potable (m3/day)	Total Domestic Water (m3/day)	Total Potable Water Required (m3/day)	Total Non-Potable Water Required (m3/day)	Total Water Demand considering loss @ 10 % (m3/day)
27.0	Food court	2303.23	0.57	0.23	0.20%	0.5	200	18.5806	124	45	25	20	3.1	2.5	5.6	3.1	2.5	6.1
28.0	Office spaces, Bank, ATMs	3228.72	0.80	0.32	0.28%	0.5	200	18.5806	174	45	25	20	4.3	3.5	7.8	4.3	3.5	8.6
29.0	Commercial plot	39437.30	9.75	3.94	3.38%	0.5	200	18.5806	2122	45	25	20	53.1	42.4	95.5	53.1	42.4	105.1
30.0	Truck parking, toilet	16989.73	4.20	1.70	1.46%				50			20		1.0	1.0		1.0	1.1
Subtotal of (C)		77169.39	19.07	7.72	6.62%													
D) Centralized Infrastructure zone																		
31.0	Utilities	162708.86	40.21	16.27	13.96%													
31.1	Substation 1	36498.21	9.02	3.65	3.13%				10	45	25	20	0.3	0.2	0.5	0.3	0.2	0.5
31.2	Access to Substation 1	5339.05	1.32	0.53	0.46%													
31.3	Substation 2	7557.41	1.87	0.76	0.65%				10	45	25	20	0.3	0.2	0.5	0.3	0.2	0.5
31.4	Water utilities 1	82495.91	20.39	8.25	7.08%				10	45	25	20	0.3	0.2	0.5	0.3	0.2	0.5
31.5	Water utilities 2	23099.62	5.71	2.31	1.98%				10	45	25	20	0.3	0.2	0.5	0.3	0.2	0.5
31.6	Sewage Treatment Plant (STP) / Solid Waste Management (SWM)	7718.65	1.91	0.77	0.66%				15	45	25	20	0.4	0.3	0.7	0.4	0.3	0.7
32.0	Road	149345.68	36.90	14.93	12.81%													
32.1	45m wide road	9939.81	2.46	0.99	0.85%									1.8			1.8	2.0
32.2	30m wide road	27199.97	6.72	2.72	2.33%									4.9			4.9	5.4
32.3	30m wide road with 15m wide carriage way and 15 m extension including additional land which is to be acquired	13043.68	3.22	1.30	1.12%	Requirement = 0.73 m3/ acre of non-potable water for Roads, Greens and other infrastructure								2.4			2.4	2.6
32.3	24m wide road	76308.49	18.86	7.63	6.55%									13.8			13.8	15.1
32.4	18m wide road	19971.21	4.93	2.00	1.71%									3.6			3.6	4.0
32.5	12m wide road	2882.53	0.71	0.29	0.25%									0.5			0.5	0.6
33.0	Green	159316.05	39.37	15.93	13.67%	Requirement = 0.73 m3/ acre of non-potable water for Roads, Greens and other infrastructure								28.7			28.7	31.6
33.1	Peripheral green	80161.45	19.81	8.02	6.88%									14.5			14.5	15.9
33.2	Green areas between zones	37543.21	9.28	3.75	3.22%									6.8			6.8	7.4
33.3	Land which is to be merged with Future expansion	41611.39	10.28	4.16	3.57%									7.5			7.5	8.3
Subtotal of (D)		471370.60	116.48	47.14	40.43%													
Total		1165809.32	288.08	116.58	100.00%				4812				117.81	180.66				328.32
									Total Population (No.)				Total Potable water demand (m3/day)	Total non-potable water demand (m3/day)				Total Water Demand per day from IMLH including losses (m3/day)

Water Source

Table 32 Water Source

Water bodies and water source		
1.	Presence of water body and water source	• Main water source identified for the IMLH is from ND II

Water Treatment Plant (WTP)

Suitable water treatment plant is envisaged to treat the water to meet the acceptable limits of water quality as per IS 10500: 2012. Water Treatment required for different sources of Water are highlighted in Table below. The method of treating the water will be decided after receipt of water quality parameters from source. The proposed water plant capacity is 120 m3/day.

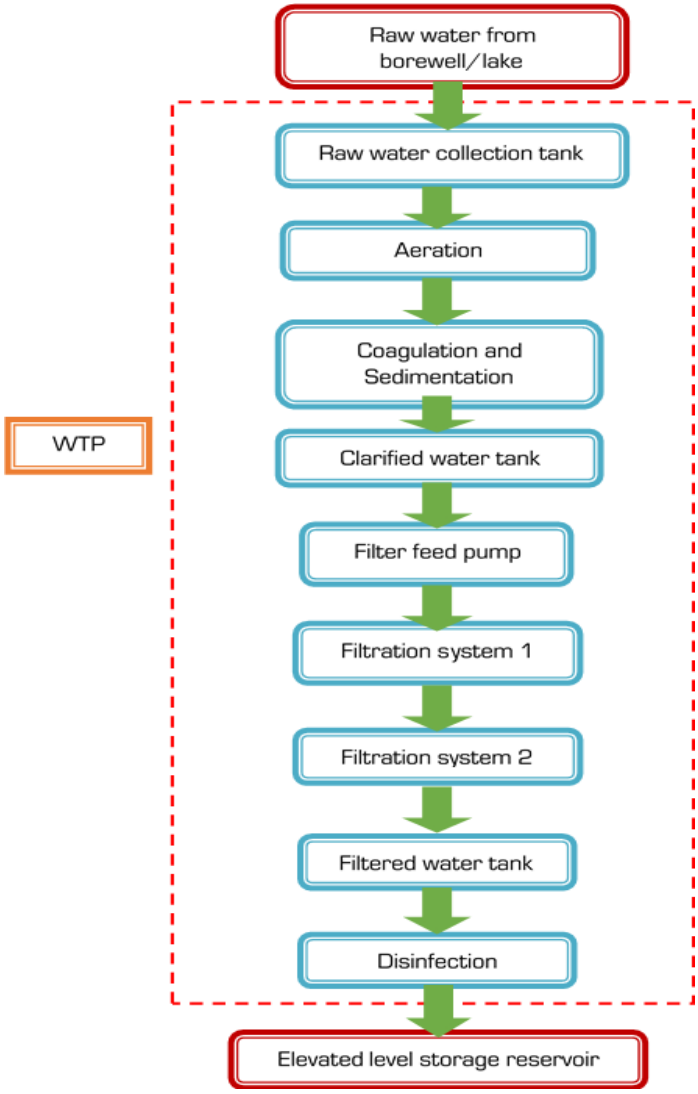
Table 33: Water Treatment required for different sources of Water

Source	Quality	Process Required
Ground Water with protected storage	Low turbidity, free from colour & odor	Plain Chlorination
Ground Water	Having iron, turbidity, Odor	Aeration, coagulation, sand filtration and chlorination
Pond, Lake with surface runoff	Turbidity, suspended solids, algae	Coagulation, sedimentation, sand filtration and chlorination

- The system selected shall ensure that the Quality of water is within the Drinking water Standards
- For WTP with source of water as Storage tanks, coagulation, sand filtration & chlorination are suggested.
- Depending on the actual quality of raw water, the system shall be optimized.

The water treatment plant is planned in the water utility station. The raw water from IND II scheme is processed in the WTP. Typical WTP process flow diagram is given below in Figure below.

Figure 39 Typical WTP Process Flow Diagram



Public water supply schemes, such as ND II, typically aim to meet specific water quality standards. Based on the water quality analysis report, the detailed design of the water treatment plant (WTP) must be adopted by the client to ensure compliance with these standards

Water Storage

It is proposed to provide ground level storage reservoir based on demand, based on the requirement potable and non-potable water and elevated level storage based on demand for IMLH. The envisaged storage capacity of GLSR or UGS and OHT are depicted in **Table below.**

Ground Level Storage Reservoir (GLSR) – Potable Water

The fresh water from ND2 will be stored in Ground Level Storage Reservoir (GLSR). The total storage capacity of the GLSR has arrived based on requirements of Potable & Process water demand. Daily Potable Water Requirement of IMLH is 118 m3/day (Table 5 refers). Since ND II supplies water for 8 days and is closed for 22 days the GLSR is designed to cater to store water requirement of 20 days capacity for uninterrupted supply of water for IMLH.

Elevated level service reservoir (ELSR) – Potable

The potable water from the GLSR is pumped to an Elevated Service Reservoir of 100 cum capacity to meet the 24 hrs demand for logistics hub. The staging height of ELSR is fixed as 12 m as per the distribution network design and minimum residual pressure as per CPHEEO manual is envisaged.

UG Sump – Non-Potable Water (including one time Fire demand)

At the Sewage Treatment Plant Location, UG sump of 200 m3 shall be designed to store the treated effluent to supply the non-potable water to the users also to the external fire hydrants using Pneumatic pumping arrangement with required pressure at the tail end as per the norms.

Table 34 :Water Storage Infrastructure

S. No	Description	Source	Type of structure	Storage capacity	Unit
1	Potable water	ND2 through Water Treatment Plant (WTP)	Ground Level Service Reservoir (GSLR)	2000	cum
2			Elevated level service reservoir/ Over Head Tank	100	cum
3	Non-potable water including fire demand	STP	Underground sump	200	cum

Source: ACE analysis

Design Criteria for Gravity Distribution Network

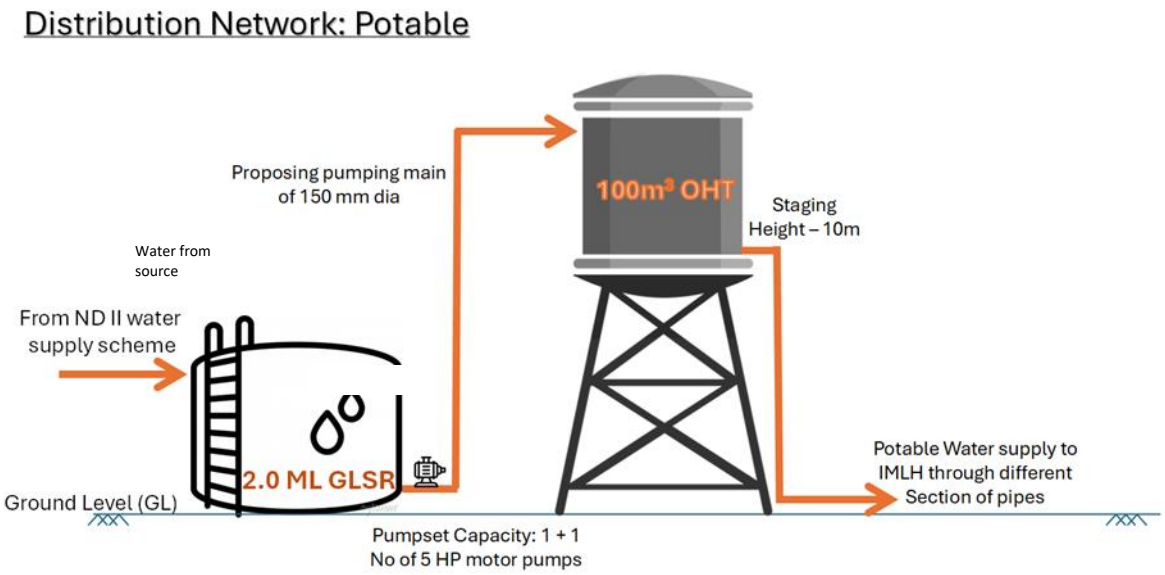
- It is proposed to provide a separate water distribution network for potable and non-potable supply.
- The design criteria for the design of water supply network include:
  - Demand computed based on the analysis.
  - Working hours per day – 24
  - Pipe material.
    - Pipe material: **OPVC** for all networks and **DI** for pump house and headworks
    - Pipe roughness coefficient - 140 for DI and - 145 for OPVC.
    - The formula used for friction loss - Hazen Williams.
    - The minimum residual pressure at all tapping points - 10 m or 1 kg/cm^2.
    - Overhead Tank staging height – 10m.

Distribution network

The water distribution network is planned based on the ground profile, peak flow, minimum residual pressure and pipe material. The water distribution network will be through buried pipe network on the utility corridor and necessary sluice valve, scour valve & air valve is considered along the network

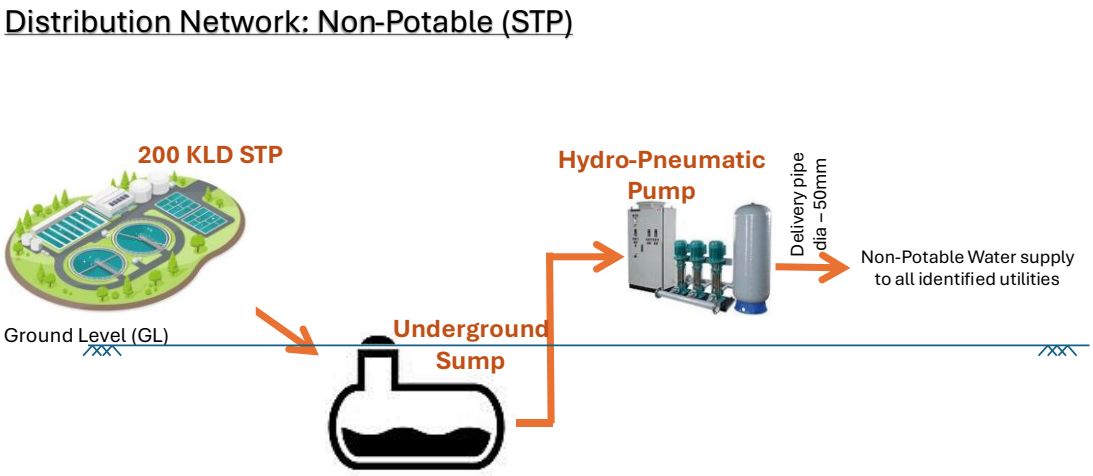
Distribution Network Potable

Figure 40 Potable water supply scheme for IMLH



Distribution Network Non-Potable water

Figure 41: Non-potable water supply scheme



- The potable water from ND2 upon suitable pre-treatment within the IMLH, is planned to be collected in the proposed Ground Level Storage Reservoir (GLSR). The water thus collected shall be pumped to the proposed Overhead Tank and then distributed through gravity pipelines to the individual plots.
- The non-potable water shall be sourced in the form of secondary treated effluent from the 215 KLD treated water from STP with in IMLH.
- The secondary treated effluent thus collected shall be stored in the proposed Under Ground Sump (UGS) within IMLH. Subsequently, the water thus collected shall be pumped to the proposed ELSR and then distributed through gravity at required zones for the logistic facility
- As per standard norms, the tail end should have a minimum residual pressure of 10 m or 1kg/cm^2. The staging height of Overhead Tank has been designed accordingly.
- The UG sump shall be planned within the STP plot in IMLH. The treated water from the STP shall be stored in the dedicated underground sump and will be supplied to the respective zones through hydro-pneumatic pumps. The minimum area required for the UG sump for one day storage shall be 60 sqm.

Gravity distribution

The design of distribution network is carried out by using EPANET or other Hydraulic Software. The design has been carried out based on the estimated potable water demand and the Hydraulic design, highlighted in Table below.

Table 35 Pipe sizing for proposed water distribution in IMLH – Potable Network & Non-Potable

Pipe material	Nominal dia. (mm)	Network Length	
		Potable Network Length (m)	Non- Potable Network Length (m)
DI / OPVC PIPE	75 to 110	4,690	4,651

Source: ACE analysis

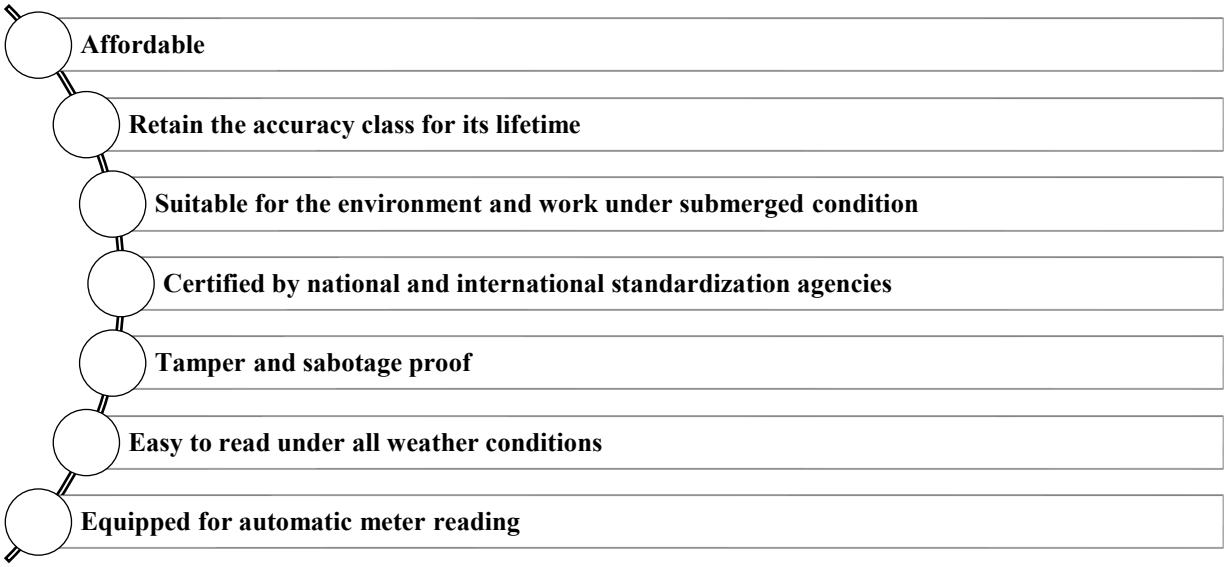
Table 36 Pump capacity in IMLH

Description	Capacity (cum/hour)	Head (m)	Number of pumps	The power requirement of each pump - (in HP)
Potable water	30	10	1+1	5
Non- potable water	Pneumatic Pump	50	1+1	10

Control system near the delivery points

The water meter is selected based on the nominal flow, minimum flow, cost, maintenance and availability. The meter is selected based on the criteria presented in figure below**.**

Figure 42 Water Meter Selection Criteria



The following water meters are analysed to select the suitable water meter for this purpose,

1. Mechanical water meter with AMR provision
2. Electro Magnetic flow meter
3. Ultrasonic flow meter with AMR provision.

Considering these aspects, it is proposed to provide an Ultrasonic water meter with Automatic meter reading (AMR) facility at the delivery of each plot to measure the quantity of water utilised. The water meter readings shall be compatible for integration with SCADA SYSTEM (if required in future) for automatic meter reading and billing purpose.

Water meter size has been calculated with reference to ISO: 4064 and tabulated below in Table.

Table 37 ISO standard

Maximum flow, Qmax (m3/h)	Nominal flow, Qn (m3/h)	Minimum flow, Qmin (m3/h)	DN (mm)	Type	Features
3	1.5	0.15	15	Ultrasonic	• EEC/ MID approved • Class - B & C; accuracy as per international standard ISO :4064 Part I • Double end threaded. • IP-68 protection • AMR compatible
5	2.5	0.25	20		
7	3.5	0.35	25		
12	6	0.6	32		
20	10	1	40		
30	15	1.5	50	Woltmann	

Fire hydrant

It is proposed to provide fire hydrant at every 45 m in the Non potable water distribution network.

Pipe materials selection

Detailed analysis has been carried out to select the suitable pipe material based on the criteria mentioned below. Ductile iron pipe, Mild steel pipe, Glass reinforced plastic pipes, prestressed concrete pipe and high-density polyethylene pipes are considered for this analysis. Detailed analysis is shown in the below in Table.

Considering the selection criteria pipe material may be selected as follows, as illustrated Figure below:

- For transmission / pumping network - Ductile iron pipe
- For distribution network
- Ductile iron for pipe for size above 200 mm
- OPVC pipe for pipe for sizes up to 180 mm

Figure 43 *Criteria for pipe material selection*

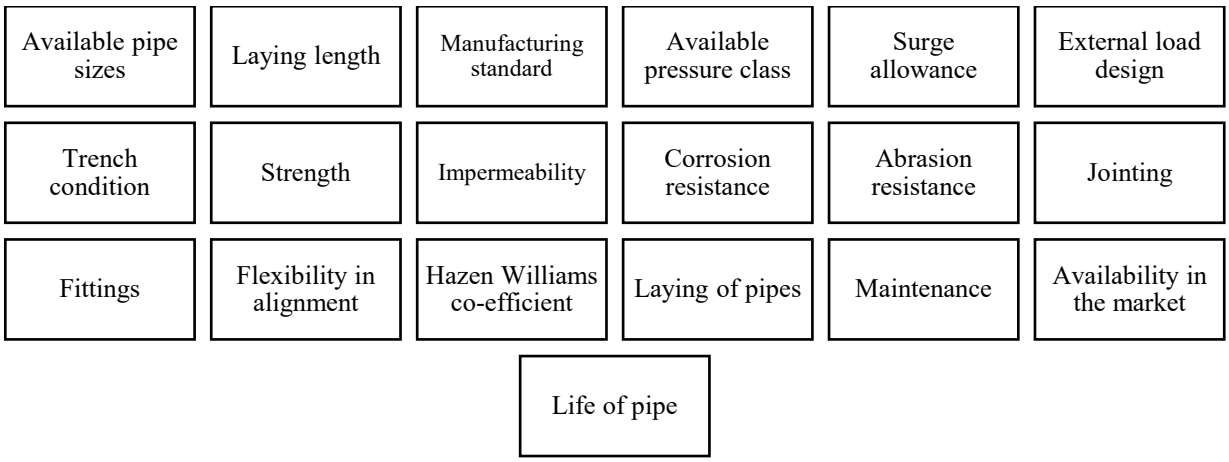


Table 38 : Comparison of different type of pipe

Sl. No.	Description	Ductile iron pipe	Mild steel pipe	Glass reinforced plastic pipe	Prestressed concrete pipe	High density polyethylene	OPVC
1	Available pipe sizes	80 NB to 1600 NB	150 NB to 2000 NB and custom sizes	100 NB to 2000 NB	100 NB - 1000 NB	Manufactured up to 2000 mm as per Indian & International Standards (Design easiness)	Manufactured up to 630 mm only as per Indian & International Standards
2	Laying length	5.4m & 6.0m	6.0m& 12.0m	6.0m& 12.0m	6.0 m	12.0 m	6.0 m
3	Manufacturing standard	IS 8329:2000	IS 3589: 1991 & IS 5504:1997	AWWA m45 / BS 5480 /IS 12709	IS: 784 & IS 7322	IS 4984:1995	IS 4985:2000
4	Available pressure class	K7 & K9 class	Any pressure class	Up to 15 KG/sq. cm	Up to 6 KG / sq. cm	Up to 16 KG/sq. cm	Up to 12.5 KG/sq. cm
5	Surge allowance	Nominal surge allowance is included	To be considered during design and special attention is required	Up to 40% of working pressure is included	Special attention is required	Due to inherent Flexibility available in PE pipes, it can sustain Water Hammer / Surge Pressure	Due to Rigidity, it cannot sustain Water Hammer Pressure/ Surge pressure
6	External load design	Thickness computed based on prism load + truck load, ring bending stress, etc	To be considered during design	To be verified with respect to the manufacturing process during design	To be considered during design	Easily accommodate soil settlement. Suitable in Black Cotton/Expansive Soil	Due to its rigidity, Earth movement, Soil settlement, will affect joints of pipe. Joints cannot sustain the effects because of Earth Movement
7	Trench condition	Flat bottom trench and no bedding is required	Flat bottom trench and no bedding is required	Flat bottom trench and sand bedding is required	Flat bottom trench and sand bedding is required	Being Flexible it can Bend up to 20 times Outer Diameter, thereby eliminating requirement for Bends, Elbows. Because of lesser nos of fittings, friction losses are minimized	Being Rigid required fittings at change in direction are mandatory. (Need Bend, Elbow). Because of nos of Bends friction losses increase
8	Strength	Can withstand the required operating pressure including the fluctuation of internal pressure due to surge	Can withstand the required operating pressure including the fluctuation of internal pressure due to surge	Can withstand the required operating pressure including the fluctuation of internal pressure due to surge	Cannot withstand the required operating pressure including the fluctuation of internal pressure due to surge	Cannot withstand the required operating pressure including the fluctuation of internal pressure due to surge	Cannot withstand the required operating pressure including the fluctuation of internal pressure due to surge
9	Implement ability	Impermeable to organic and inorganic ground contaminants	Impermeable to organic and inorganic ground contaminants	Permeable to sharp objects (puncturing of pipe may happen)	Impermeable to organic and inorganic ground contaminants	PE Raw material is a single source, i.e., Granules. Hence contamination in the Raw Material is Practically neglected	uPVC pipe Raw material is a combination of 4/5 ingredients. Any disproportion of any component will affect the end product

Sl. No.	Description	Ductile iron pipe	Mild steel pipe	Glass reinforced plastic pipe	Prestressed concrete pipe	High density polyethylene	OPVC
10	Abrasion resistance	Centrifugally lined metallic pipe will act as resistance to abrasion in addition to smoothness and prolong the life	Centrifugally lined metallic pipe will act as resistance to abrasion in addition to smoothness and prolong the life	Internal liner will act as resistance to abrasion in addition to smoothness and prolong the life	Abrasion resistance will be less when compared to centrifugally lined metallic pipe with Projection method lined metallic pipe	Internal surface will act as resistance to abrasion in addition to smoothness and prolong the life	uPVC as exceptional resistance.
11	Corrosion resistance	Good. As per AWWA manual M41 ductile iron pipe possesses the other superior properties of grey cast iron such as corrosion resistance etc and field studies also reflected the same	Among the metallic pipes, steel pipe is most corrosive as steel as material have lesser impurities and more pure ferrite structure. MS pipe life can be increased to some extent by providing cathodic protection. But there will be additional initial cost and maintenance	Good	Moderate	Good	Normal
12	Jointing	Push on type socket and spigot joints	Trained and accredited welders and welding equipment's is required for site welding of the joints all along the route	Jointing done with GRP sleeve coupling with elastic metric sealing ring, but it requires highly trained and accredited experience fitters in the same field are required for site jointing	Jointing of PSC pipes in India is done by "O" rubber rings against concrete surface. The "O" ring often slides out of its position due to ground movement after laying, causing massive leakages during operation.	Being material fusion process, the joints become Homogenous/ monolithic hence Joints are Guaranteed leakproof.	(Solvent joint), possibility of leak after a gradual time cannot be eliminated
13	Fittings	To be ordered along with pipe according to site condition	Can be fabricated at site	To be ordered along with pipe according to site condition	Can be fabricated at site	To be ordered along with pipe according to site condition	To be ordered along with pipe according to site condition
14	Flexibility in alignment	Offers min 2-5 deg of deviation between two pipe joints	Bend to be fabricated at site according to site condition	Offers min 2-5 deg of deviation between two pipe joints	Bend to be fabricated at site according to site condition	Flexible. Hence could take contour of land	Rigid. Hence could not be utilized in undulating terrain/Hilly areas
15	Hazen Williams co-efficient	140	140	150	140	150	150

Sl. No.	Description	Ductile iron pipe	Mild steel pipe	Glass reinforced plastic pipe	Prestressed concrete pipe	High density polyethylene	OPVC
16	Laying of pipes	Will be laid faster when compared to MS pipe	Welding consumes more time	Will be laid faster when compared to MS pipe	Welding consumes more time	Welding consumes more time	Solvent joints consume less time
17	Maintenance	Maintenance free	Patch welding repairs are expected due to thermal stress	Requires due to settlement of ground especially in the nullah portions	Patch welding repairs are expected due to thermal stress	The leak-proof joints results in 100 years of maintenance free service life	Although uPVC pipes look to be Economical compared with HDPE the Frequent Joint failures if not made with proper grade of solvent cement & joint surface preparations makes it uneconomical. This has been solved by integral rubber ring joints which are flexible and leak-proof and can take soil Settlement even due to earth quacks.
18	Availability in the market	Only two manufacturers are available	Lot of manufacturers available	4 - 5 manufacturers are available	2- 3 manufacturers are available	4 - 5 manufacturers are available	Manufacturers are available
19	Life of pipe	As per pipe material selection handbook by NEERI - 80 years	As per pipe material selection handbook by NEERI - 30 years	50 years	As per NEERI - 10-20 years	50 years	25 Years
20	Cost per unit meter of same diameter	Rs 1200 to Rs 1800	Rs 700 to Rs 1200	Rs 2500 to Rs 3000	Rs 1500 to Rs 2500	Rs 200 to Rs 500	Rs 150 to 400

Note: Potable & non-potable water supply layout is provided in the Technical Drawing Annexure.

4.20 Design report for storm water drain

Design planning approach

Discharge points

Detailed study of site ground profile and existing nearby water bodies has been carried out during site visit to understand general drainage pattern of the site. Further the topographical survey details are considered to finalise discharge points. After the detailed study, multiple discharge points to the maximum possible extent were finalised.

As per the site condition, internal drain and Peripheral drain discharges into existing canal which runs through the site and used for irrigation purpose at northwest side of the site and the same has been shown in the storm water drain network drawing.

Storm water drain flow direction

The flow direction of storm water drains towards the site boundary from outside catchment area based on topographical survey details and GIS in addition to the project area. The flow direction of storm water drains within the site area based on site grading level & road network has been prepared as indicated in the drawing.

Storm water drain network

Considering both, the multiple discharge points and flow direction of storm water, the drain network has been prepared.

Peripheral drain has been proposed along the boundary to discharge the storm water collected from outside catchment area.

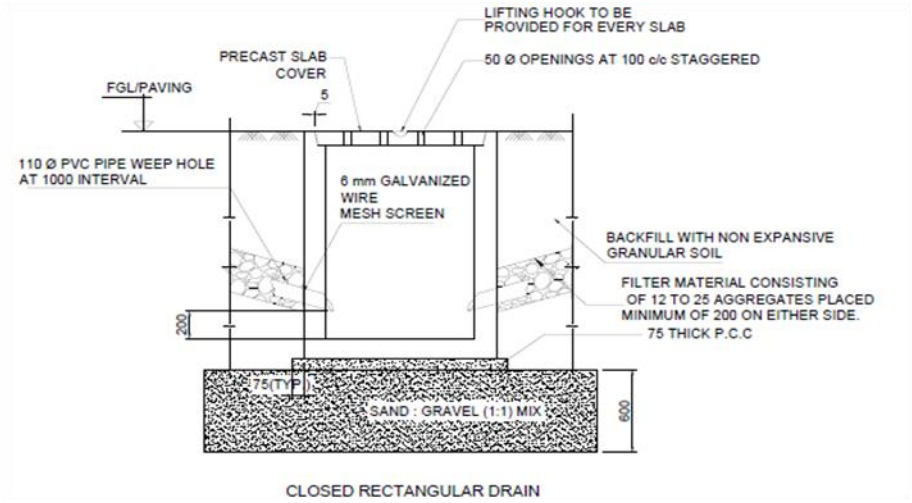
Internal drain along the road has been proposed to discharge the storm water collected from site area.

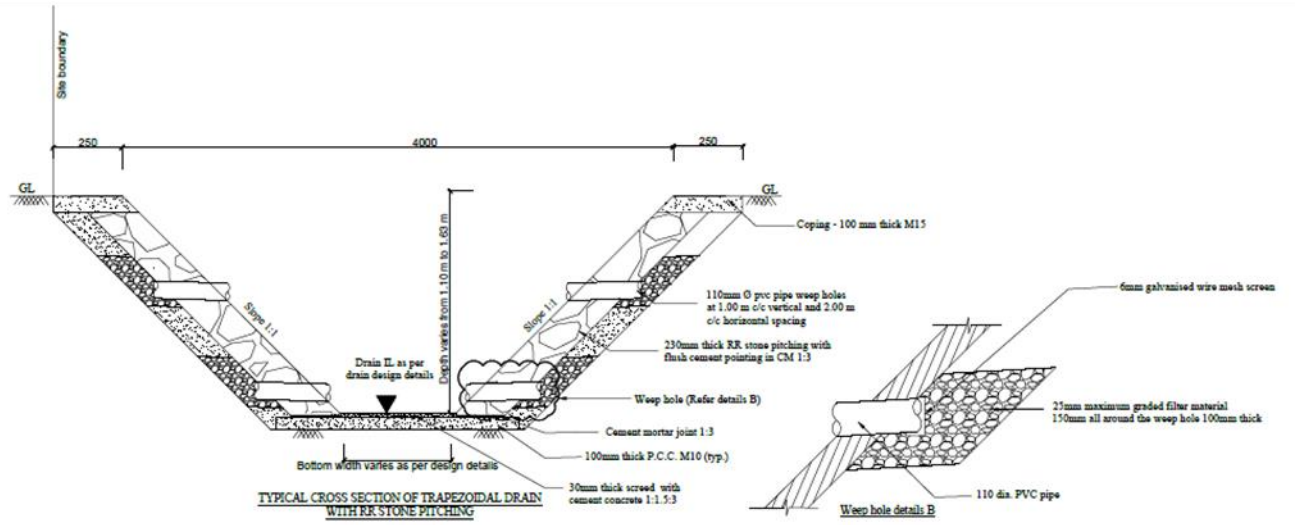
Storm water drain - types

The following types of drain, as illustrated Figure below, have been proposed for

- Earthen trapezoidal shape drains for peripheral with 1:1.5 side slope maintaining the width as drain design details.
- Internal RCC rectangular drain with M25 grade concrete.

Figure 44*: Drain type configuration*





Design concept

The following are design concept to maintain invert level of storm water drain:

- Maintaining proposed internal drain invert level at discharge points either matching with Canal water level or above the water level.
- Maintaining proposed peripheral drain invert level at discharge points in such a way to avoid water stagnation during peak intensity of rainfall.

The strategy to achieve the above is to carry out drain design as per the existing profile of the site to the extent possible.

Design parameters

Following are the design parameters considered for storm water design:

- Run off co-efficient for greenery and open space is 0.50 and for roads and utilities is 0.70 as per CPHEEO manual.
- Rainfall intensity considered as 58.5 mm/hour
- Road levels as per site grading plan
- The drain bottom slope considered in general as 1: 1000
- Free board of 200 mm considered for storm water drain

- Side slope of trapezoidal shape drain is 1:1.5.
- Roughness co-efficient considered for rubble masonry is 0.020 and concrete surface is 0.015 as per CPHEEO manual.
- The minimum velocity of 0.30 m/sec and maximum velocity of 2.50 m/Sec shall be maintained.

Storm water drain design procedure

The peak runoff and discharge capacities are computed based on the following design parameters. The proposed conceptual internal and peripheral drainage system is designed to cater for the surface runoff from both project area and outside watershed by gravity flow.

Peak runoff

The peak runoff has been computed based on rational formula: -

Q = C I A divided by 360

Where,

Q = Quantity of runoff, m^3/s

C = Coefficient of runoff

I = Intensity of rainfall, mm/hr

A = Catchment area, Ha

Run off Coefficient

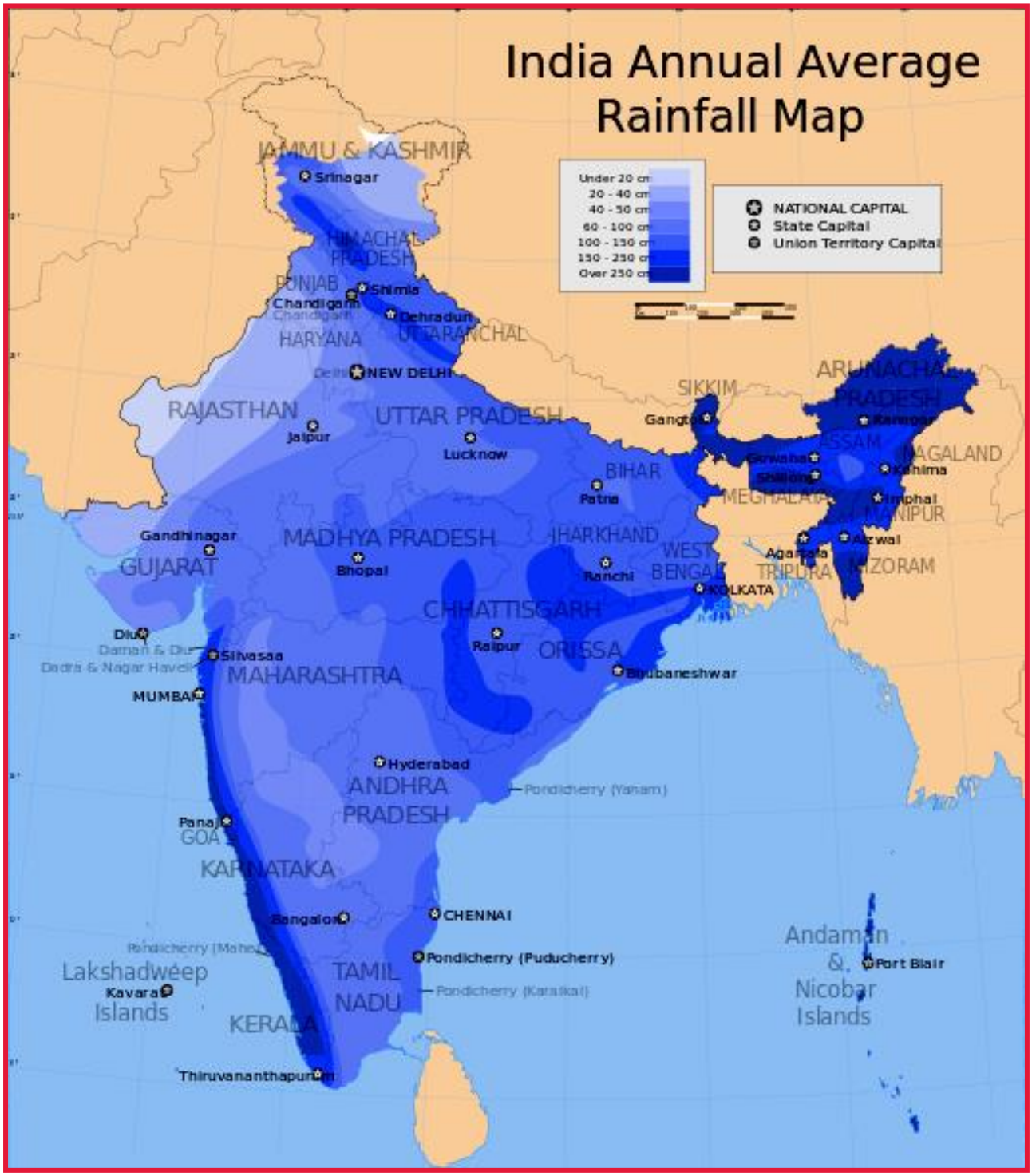
The co-efficient of runoff adopted in the drainage computation is 50% considering the nature of soil, covered and open areas, slope and existing and proposed green cover and 70% for road, utilities and amenities area.

Rainfall intensity

To identify the rainfall intensity of Nangal Chaudhary, near Narnaul, India, isopluvial maps purchased from IMD are considered and from the 100 years - 24 hours isopluvial maps of Haryana, it is observed that the project site falls under the 240 mm isopluvial region.

The average annual rainfall of the project area in 2023 is about 425.5mm. The average Annual rainfall map of India is shown in the below Figure.

Figure 45*: Average annual rainfall map of India*



Source: ACE

Based on this value and using basic log-log based equation as mentioned below, the intensity of rainfall I (in mm/hr) arrived and Intensity – Duration - Frequency Curve (IDF Curve) was created. The details are given in the following sections.

The intensity of rainfall I in mm/hr = P/T*60

Here

P = 10^ (a. log (T) + log (b))

P = Precipitation (mm) for time T

I = Intensity (mm/ hour) for time T

T = time (minutes)

Where

a = Delta log (D)/ Delta log (T)

Delta log (T) = log (T2) – log (T1)

Delta log (D) = log (D2) – log (D1)

log (b) = log (D2) – log (T2). a

Di = rainfall depth for T

I = time interval number

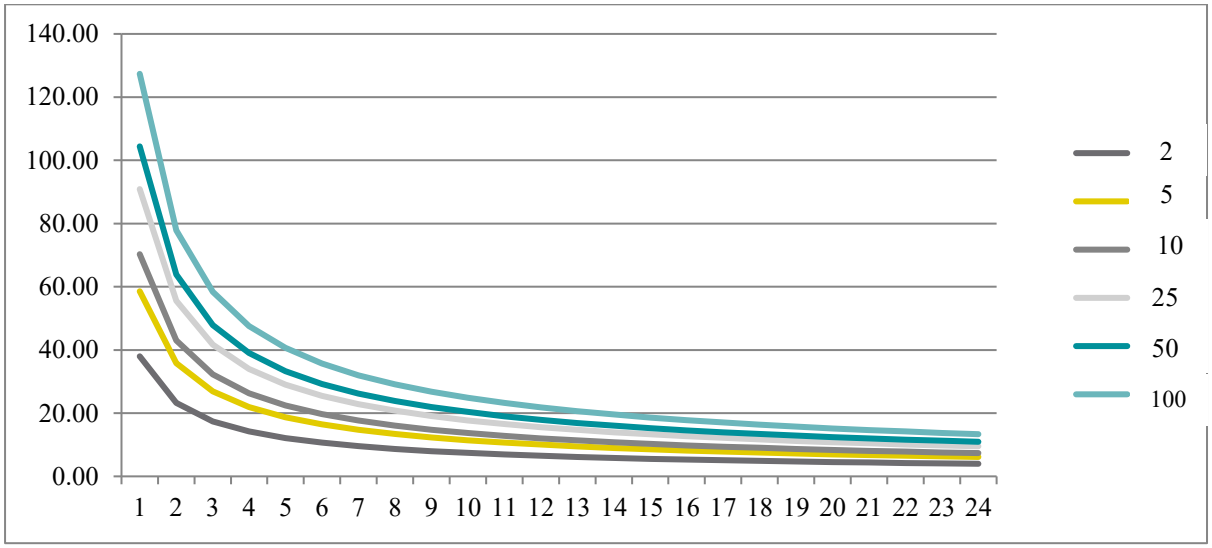
The rainfall depth of 240 mm based on the available 100 years - 24 hours rainfall data from isopluvial map and interpolated for the remaining values are illustrated in below Table and Figure below.

Table 39: Intensity duration

	T – Return period in years					
T - Duration in hours	1	5	10	25	50	100
1	37.98	58.56	70.30	90.89	104.41	127.37
2	23.22	35.80	42.98	55.56	63.83	77.86
3	17.41	26.84	32.23	41.67	47.86	58.39
4	14.20	21.89	26.27	33.97	39.02	47.60
5	12.12	18.68	22.42	28.99	33.30	40.63
6	10.64	16.41	19.70	25.47	29.26	35.69
7	9.54	14.71	17.66	22.83	26.22	31.99
8	8.68	13.38	16.06	20.77	23.85	29.10
9	7.98	12.31	14.77	19.10	21.94	26.76
10	7.41	11.42	13.71	17.72	20.36	24.84
11	6.92	10.67	12.81	16.56	19.03	23.21
12	6.51	10.03	12.04	15.57	17.89	21.82
13	6.15	9.48	11.38	14.71	16.90	20.61
14	5.83	8.99	10.79	13.96	16.03	19.56
15	5.55	8.56	10.28	13.29	15.27	18.62
16	5.30	8.18	9.82	12.69	14.58	17.79
17	5.08	7.83	9.40	12.16	13.97	17.04
18	4.88	7.52	9.03	11.68	13.41	16.36

	T – Return period in years					
T - Duration in hours	1	5	10	25	50	100
19	4.70	7.24	8.69	11.24	12.91	15.75
20	4.53	6.98	8.38	10.83	12.45	15.18
21	4.37	6.74	8.09	10.47	12.02	14.67
22	4.23	6.52	7.83	10.13	11.63	14.19
23	4.10	6.32	7.59	9.81	11.27	13.75
24	3.98	6.13	7.36	9.52	10.93	13.34

Figure 46 Intensity duration - frequency curve



The isopluvial maps for the state of Haryana for a period of 2, 5, 10, 25, 50 and 100 years are shown in the following Figures.

Figure 47: Haryana - 2 years 24 hours Isopluvial map

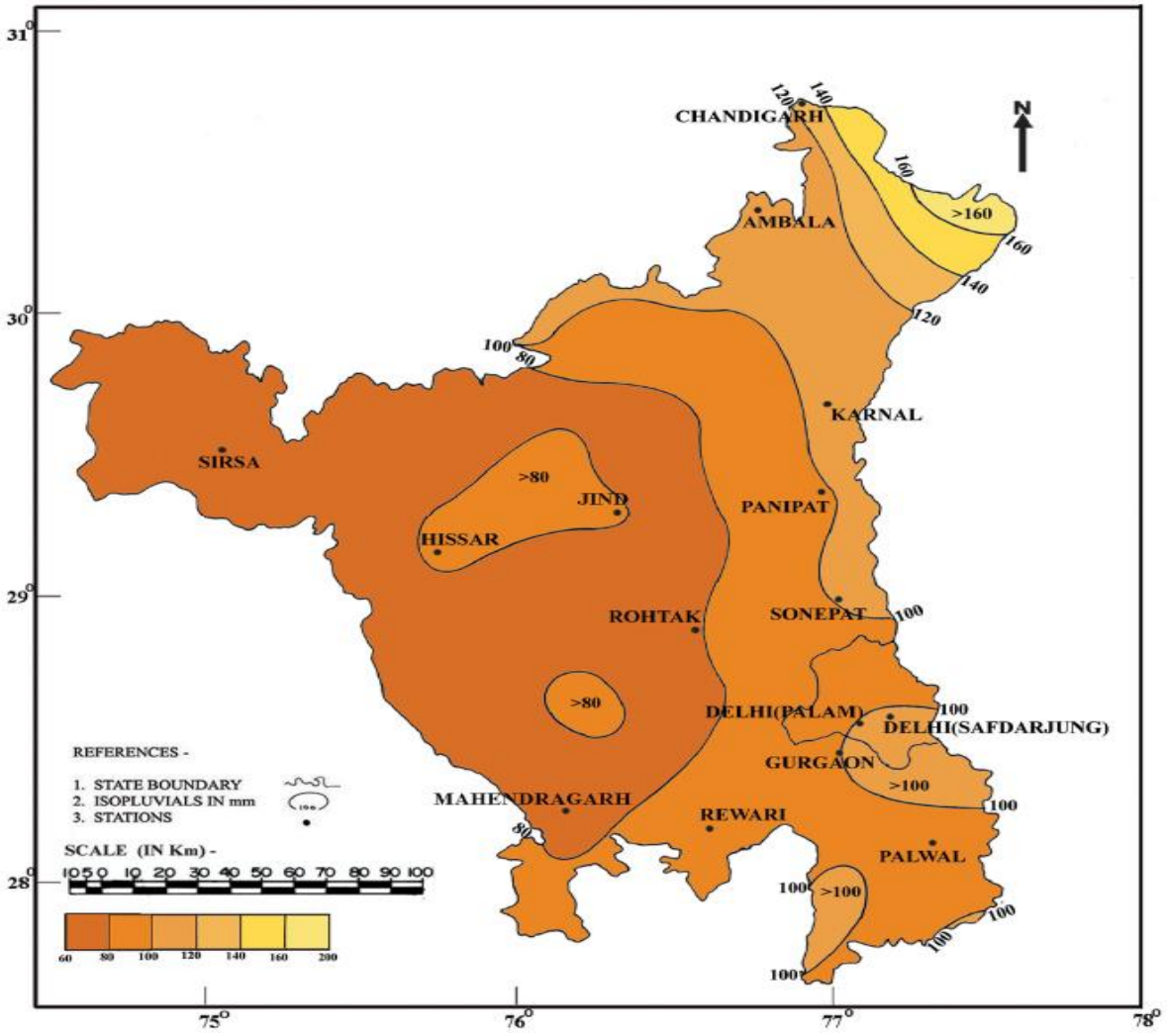


Figure 48: Haryana - 5 years 24 hours Isopluvial map

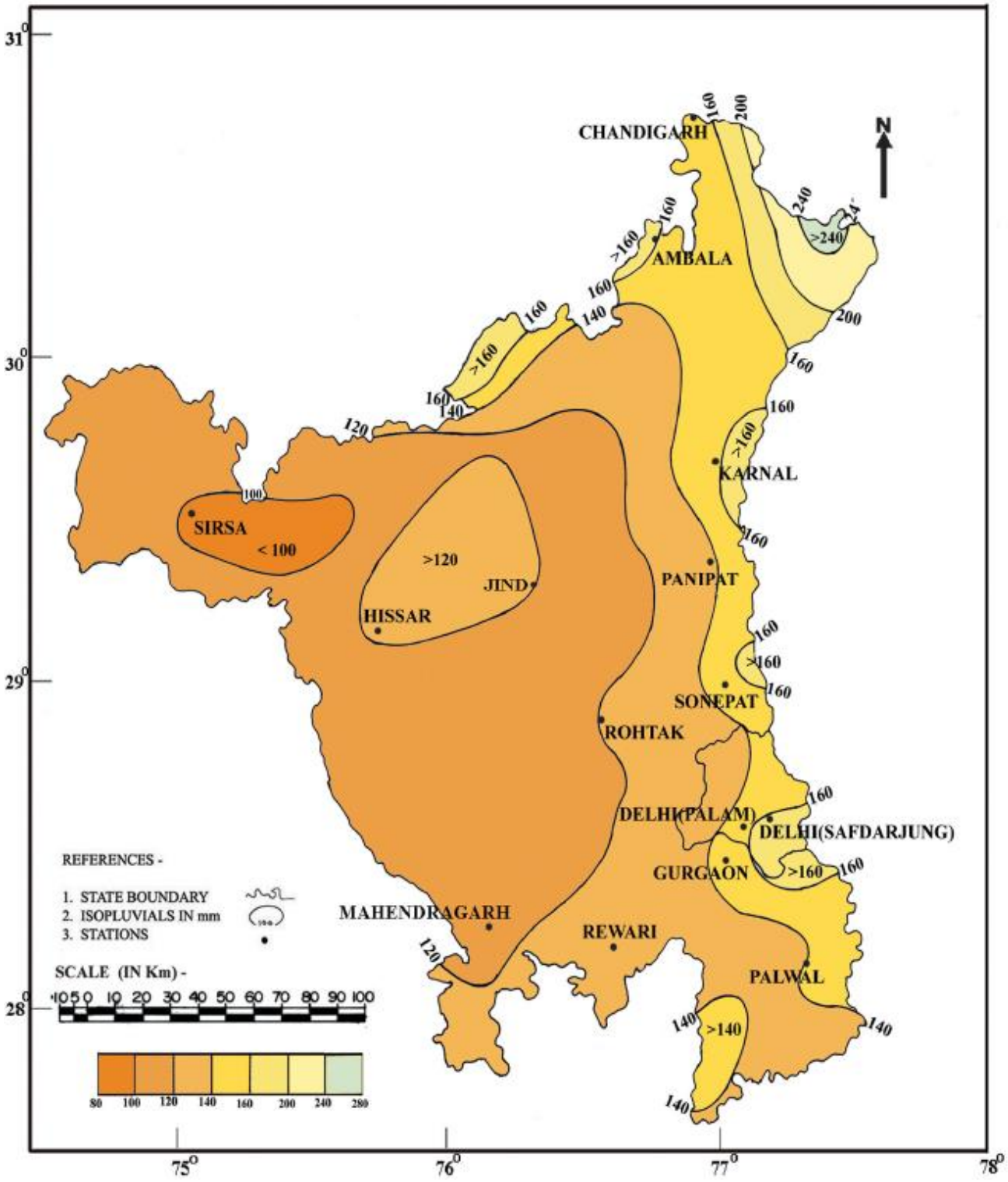


Figure 49*: Haryana - 10 years 24 hours Isopluvial map*

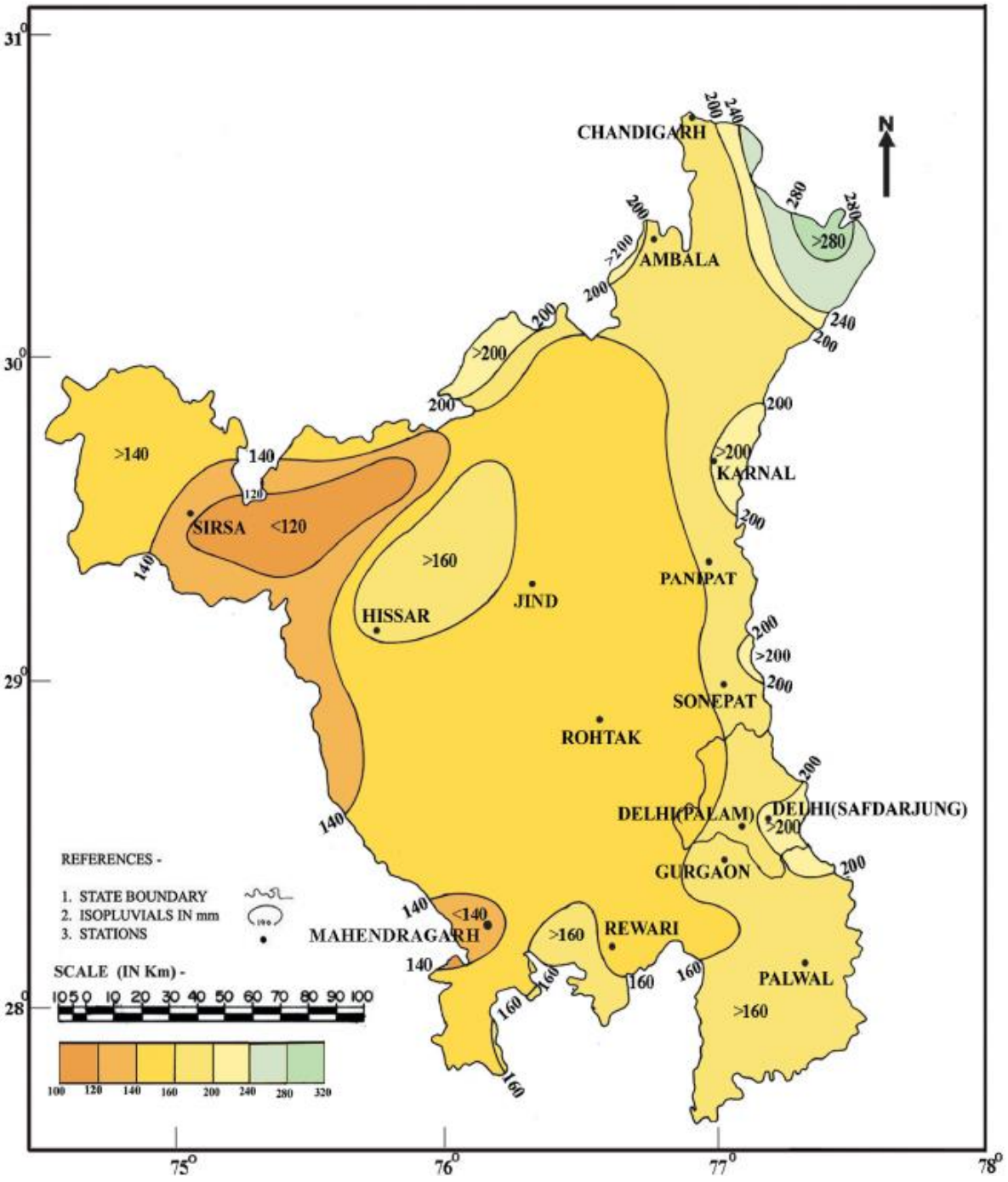


Figure 50*: Haryana - 25 years 24 hours Isopluvial map*

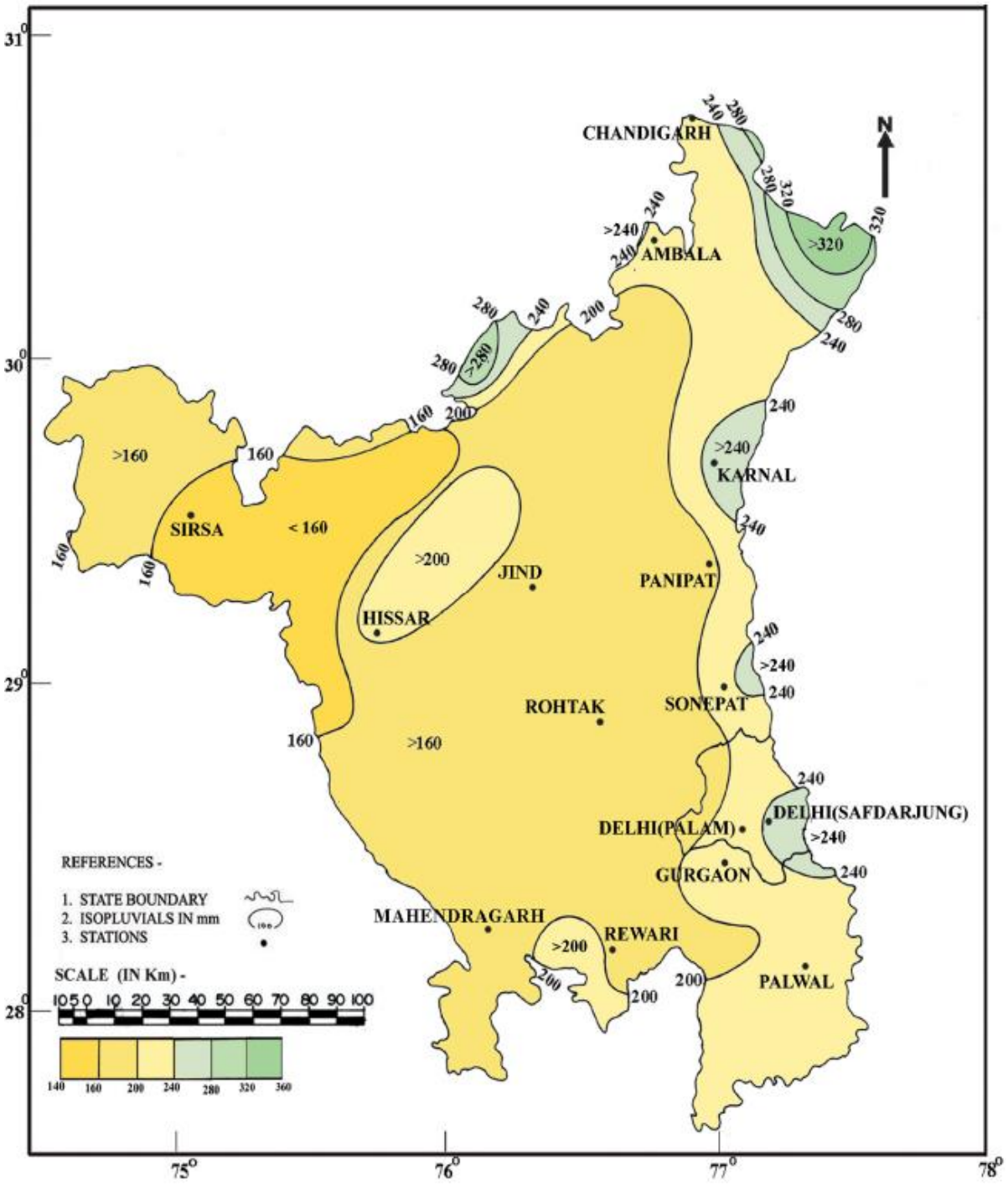


Figure 51: Haryana - 50 years 24 hours Isopluvial map

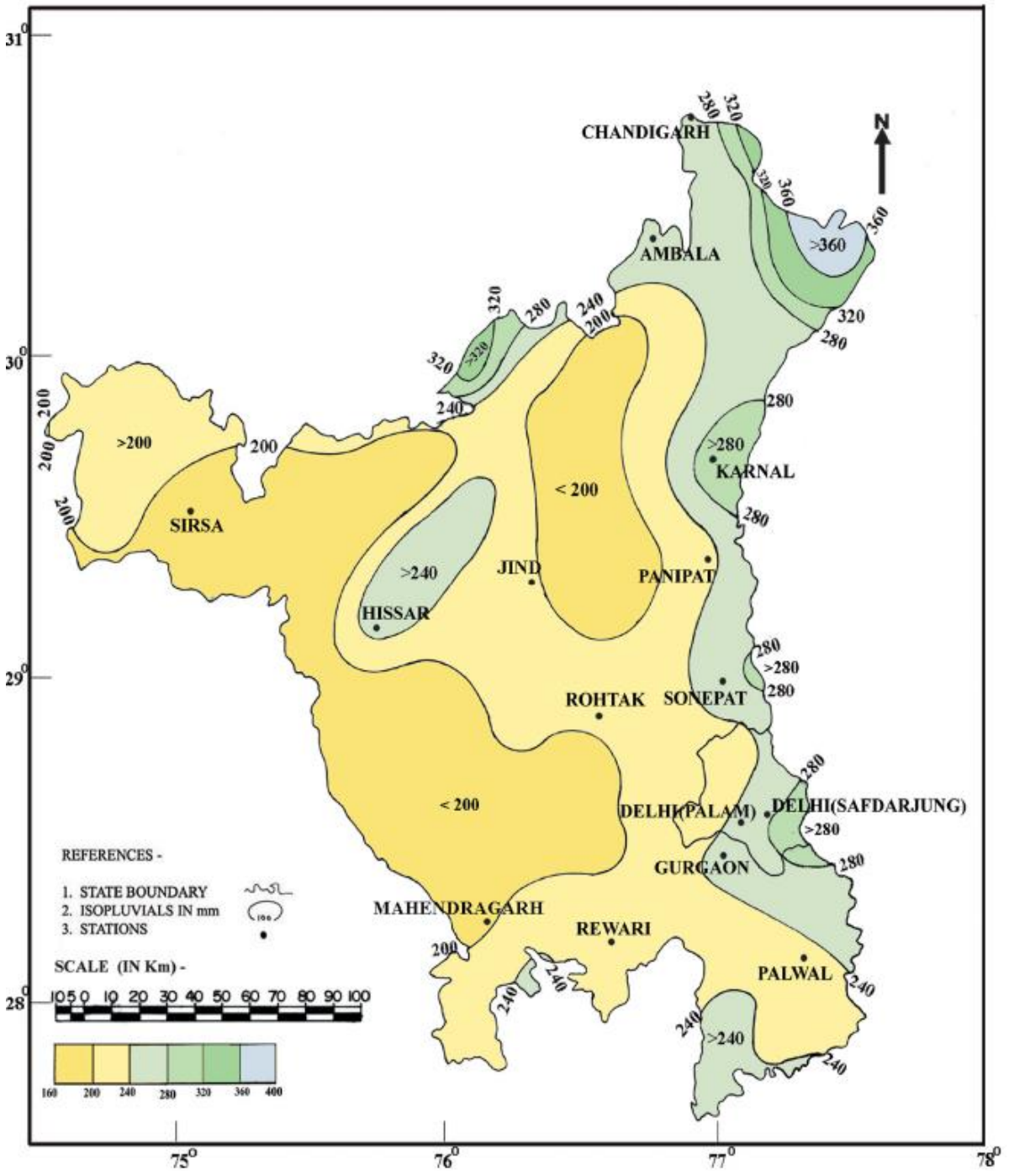
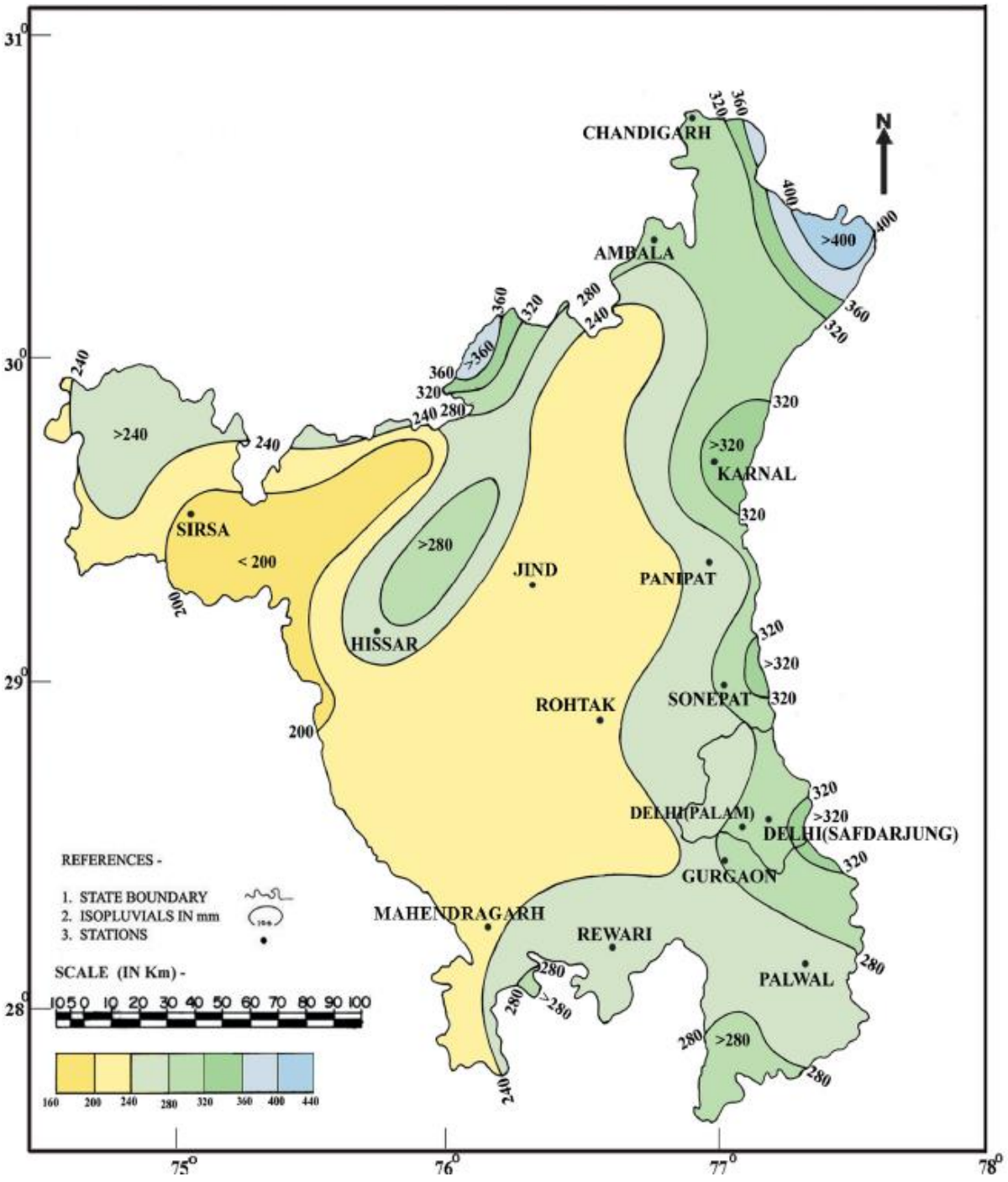


Figure 52: Haryana - 100 years 24 hours Isopluvial map



From the isopluvial maps of Haryana state, the precipitation values have been obtained and shown in the following Table.

Table 40: Precipitation values

Years	Precipitation value in mm
2	100
5	140
10	160
25	200
50	200
100	240

As per Kothyari and Garde, the Rain fall Intensity based on India Metrological Department- isopluvial map for 100 Year return period is calculated using the formula mentioned below.

$I^T t = C * T^{0.20}/t^{0.71} * R^{100}{}_{24}{}^{0.33}$

Here

$I^T t$ = Rainfall intensity mm/hr for T-year return period & t – hours duration

C = Constant having value 8.31 for the whole of the considered stations

$R^{100}{}_{24}$ = 100-year return period & 24 hr. rainfall in mm

T- Return period = 100 year and

t – Duration = 3 hours

Rainfall in 24 hours for 100 year return period = 240 mm

Considering the above, intensity of rainfall is

$I^T t = 8.31 * (100^{0.20})/ (3^{0.71}) * (240^{0.33})$

$I^{100}{}_4$ = 58.39 mm/hr

The intensity calculation based on basic log-log equation and Kothyari & Garde were compared and the higher value is considered for storm water drain design. Based on Kothyari and Garde method and the rainfall intensity for 100 years return period with 3 hours duration of 58.50 mm/ hr is considered for storm water drain design.

Discharge capacity

The sizing of the open drains is designed to the discharge capacity of Qc to cater adequately for the estimated peak runoff using Manning's formula: -

$Qc = 1/n\ A\ R^{2/3}\ S^{½}$ (m^3/sec)

Where

A = Area of cross-section of drain (m^2)

R = Hydraulic mean radius (m)

S = Hydraulic gradient

n = roughness coefficient = 0.017 for earthern and 0.020 for brick work & concrete as per CPHEEO (Central Public Health and Environmental Engineering Organisation) manual

Drainage schemes

The proposed drainage system is designed to cater for the entire project area by gravity flow. The subject site drain water is planned to converge in the lowest points.

Internal drain length – 10400 m

Peripheral drain length – 4000 m

Hume pipe drain length – 711 m

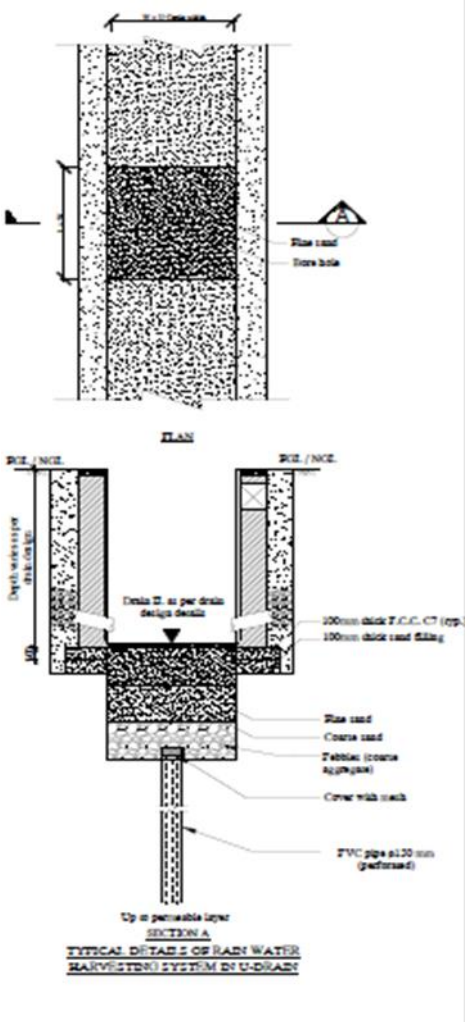
Culverts:

It is proposed to construct 7 nos. of internal box culverts wherever the drain crosses the roads and 2 nos of box culvert for canal crossing the road area. The type of culvert i.e. box is adopted based on the site condition. The location of the culverts has been indicated in the drain network drawing.

Rainwater harvesting

Rainwater harvesting structure is proposed all along the drain at every 100 m interval, illustrated in Figure below.

Figure 53: Rainwater Harvesting Pit



The storm water drain network drawing is provided in the drawing annexure.

4.21 Design report for sewerage

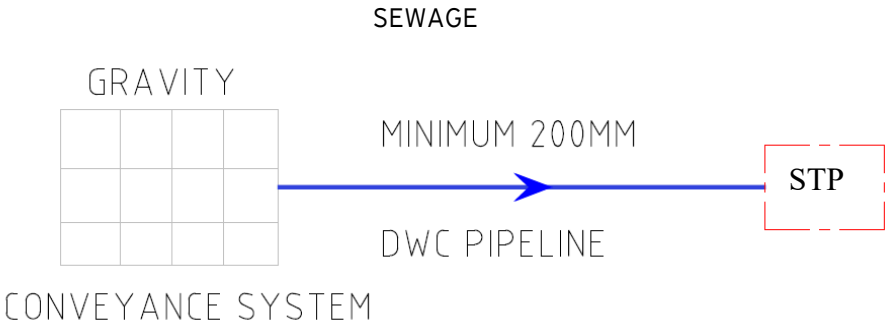
Sewerage System

In the proposed IMLH phase 1, adequate Sewage management system is primary requirement for hygienic environmental condition.

Sewage Generation

Sewage generation is estimated based on the water demand envisaged from the Logistic zone as well as other activities proposed in the site master plan. Sewage generation depends primarily upon water supply consumption and interception factor. As per similar studies carried out, sewage or Sewage generation for the IMLH project had been estimated based on the following assumptions and presented in this report:

- Sewage generated by the working population has been calculated as 80% of the water demand in accordance with the Manual on Sewerage and Sewage Treatment, published by CPHEEO.
- The total water demand for flushing, washing, open spaces, green areas, and roads may be met by treated Sewage (recycled water).



Sewage Conveyance Network System

The Sewage conveyance system for the project shall consist of Gravity Sewage networks laid underground to collect and carry the Sewage generated from the various industries to STP proposed in project area.

Design standards

The CPHEEO guidelines and National Building Code will serve as the baseline for development of the design criteria.

The design shall ensure to incorporate good engineering practices and by default shall envisage value engineered solutions for cost and energy optimization.

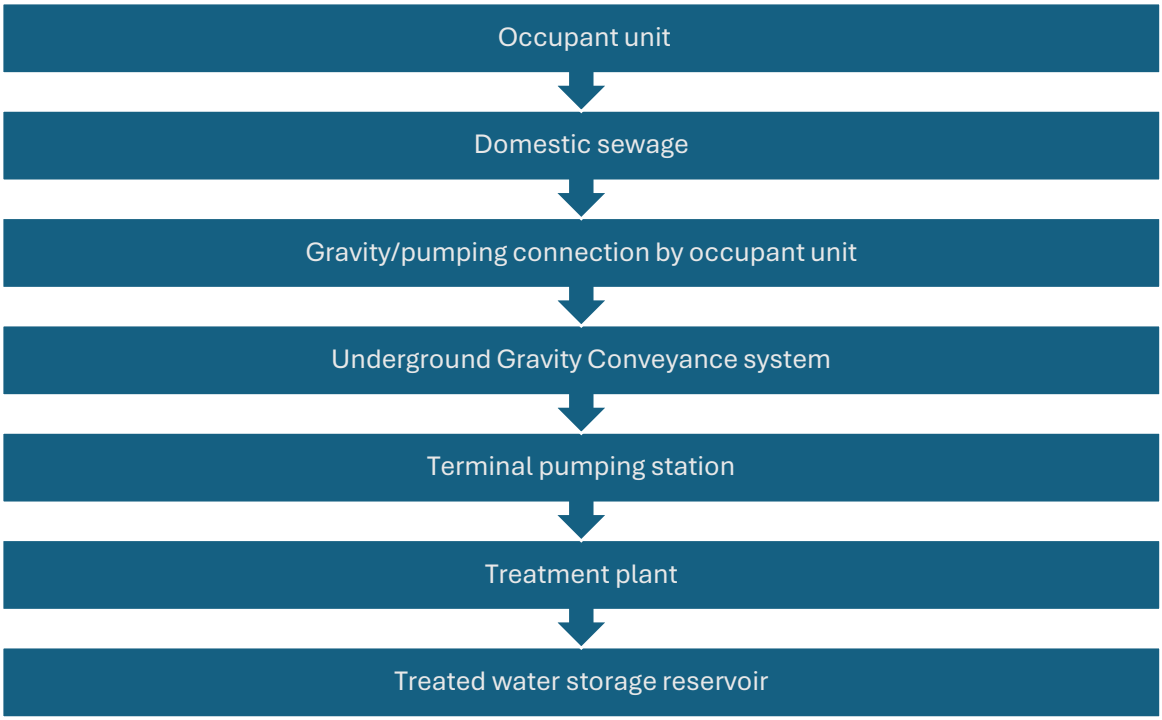
Design life

As per CPHEEO manual, the design life of pumps and other mechanical, associated piping, fittings, electrical, instrumentation works shall be 15 (Fifteen) years and civil and structural works associated with Sewage system shall be 30 (Thirty) years with due note being taken of the operating regime and of the environmental conditions.

Approach to Sewage planning

Based on the available information, it is understood that the Logistic Hub shall generate only Sewage.

The design approach for Sewage collection system is depicted below:



Sewage Scheme

Sewage from EXIM Zone, Warehouse and Container yard area, Amenities and Centralized Infrastructure zone is conveyed through buried network of trunk Sewage provided with a series of inspection chambers or manholes. It will be finally discharged / connected into Sewage treatment plant (STP), location of the same is depicted in Figure below.

Figure 54: Location of STP

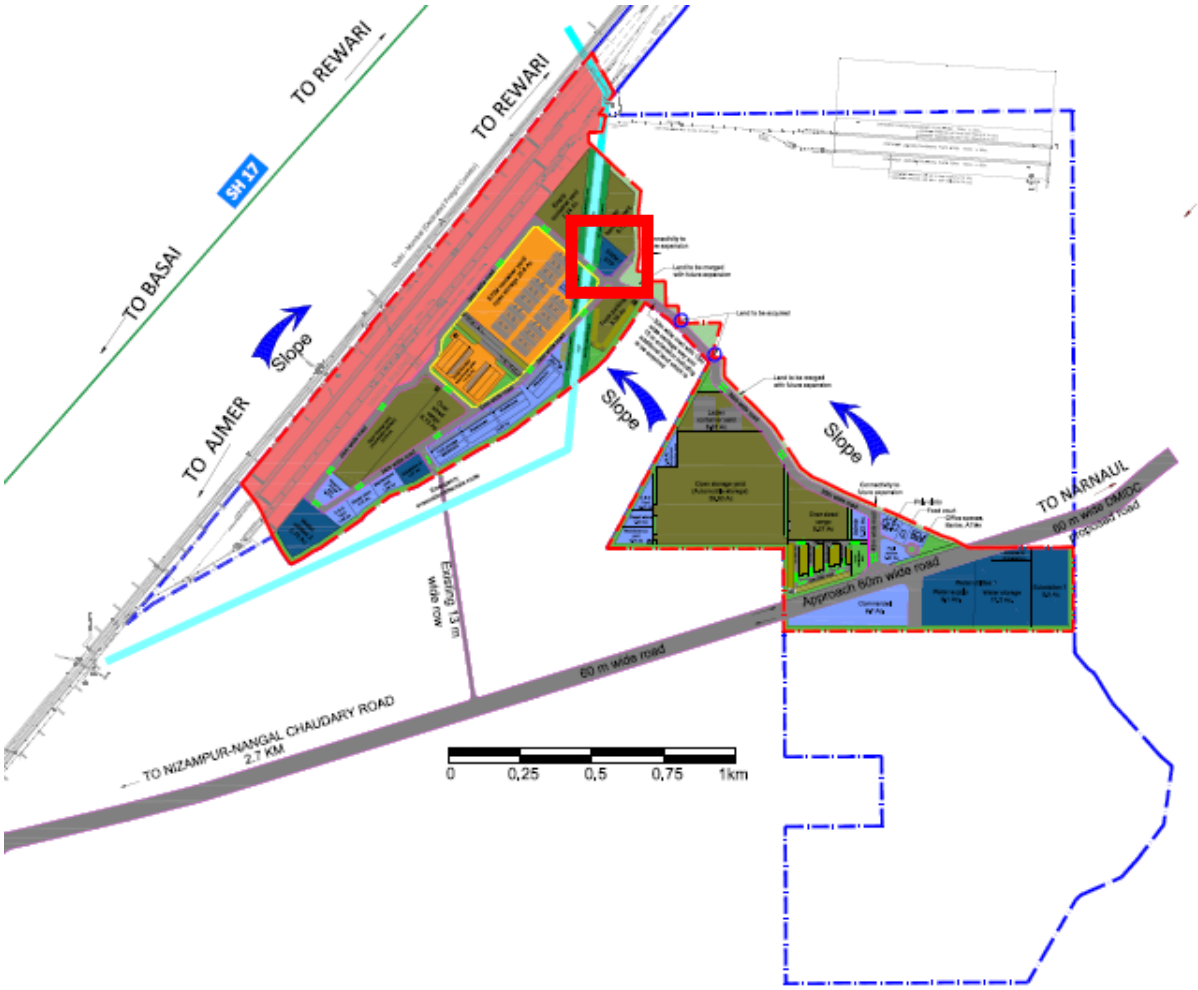


Table 41: Sewage generation

IMLH - Haryana - Land use Statement						**Population Estimation (No.)**				**Domestic Water Demand Estimation (m^3/day)**						**Total Water Demand for IMLH (m^3/day)**			**Sewage Generation (including 10% infiltration) (m^3/day)**	
S. No	Particulars	Area in Sqm	Area in Acres	Area in Hectares	In %	Proposed Floor Space Index (FSI)	Population Density (Sqft Per Person)	Population Density (Sq.m Per Person)	Population (No.)	Basis for Domestic Water Consumption (LPCD)	Potable (LPCD)	Non-Potable (LPCD)	Domestic Water Consumption - Potable (m^3/d)	Domestic Water Consumption - Non-Potable (m^3/d)	Total Domestic Water (m^3/day)	Total Potable Water Required (m^3/d)	Total Non-Potable Water Required (m^3/day)	Total Water Demand considering loss @ 10 % (m^3/d)	Sewage Generation (including 10% infiltration) (m^3/d)	Treated Water to individual units
1.	Total site area (a)	1653868.43	408.68	165.39	100.00%															
2.	Railway lines, station and related areas (b)	377127.06	93.19	37.71	22.80%															
3.	Approach 60m wide road (c)	52041.84	12.86	5.20	3.15%															
4.	Irrigation canal (d)	22257.3051	5.50	2.23	1.35%															
5.	Irrigation canal buffer (e)	37013.25	9.15	3.70	2.24%															
6.	Additional land to be acquired for road extension (f)	380.35	0.09	0.04	0.02%															
7.	Net planning area (g=a-b-c-d-e+f)	1165809.32	288.08	116.58	70.49%															
A) EXIM Zone																				
8.	Container yard/open storage, support services, toilet	106560.51	26.33	10.66	9.14%	0.5	2000	185.806	574	45	25	20	14.3	11.47	25.81	14.34	11.47	28.39	24.98	11.47
9.	Bonded warehouse, toilet	34155.34	8.44	3.42	2.93%	0.5	2000	185.806	184	45	25	20	4.6	3.68	8.27	4.60	3.68	9.10	8.01	3.68
10.	Customs office	4673.37	1.15	0.47	0.40%	0.5	200	18.5806	252	45	25	20	6.3	5.03	11.32	6.29	5.03	12.45	10.96	5.03
11.	Truck parking, toilet	19632.69	4.85	1.96	1.68%				50			20		1.00	1.00		1.00	1.10	0.97	1.00
12.	Check post, weigh bridge & truck parking	15799.03	3.90	1.58	1.36%															
Subtotal of (A)		**180820.94**	**44.68**	**18.08**	**15.51%**															
B) Warehouse and Container yard area																				
13.	General warehouse and loading & unloading bay	36542.96	9.03	3.65	3.13%	0.5	3000	278.709	131	45	25	20	3.3	2.62	5.90	3.28	2.62	6.49	5.71	2.62
14.	Cold storage warehouse and loading & unloading bay	12180.99	3.01	1.22	1.04%	0.5	3000	278.709	44	45	25	20	1.1	0.87	1.97	1.09	0.87	2.16	1.90	0.87
15.	Oversized cargo	60747.84	15.01	6.07	5.21%	0.5	10000	929.03	65	45	25	20	1.6	1.31	2.94	1.63	1.31	3.24	2.85	1.31
16.	Open storage (Automobile yard)	203901.85	50.39	20.39	17.49%	0.5	30000	2787.09	73	45	25	20	1.8	1.46	3.29	1.83	1.46	3.62	3.19	1.46
17.	Laden container yard	25621.53	6.33	2.56	2.20%	0.5	3000	278.709	92	45	25	20	2.3	1.84	4.14	2.30	1.84	4.55	4.00	1.84
18.	Empty container yard	29301.34	7.24	2.93	2.51%	0.5	10000	929.03	32	45	25	20	0.8	0.63	1.42	0.79	0.63	1.56	1.37	0.63
19.	Equipment storage area	11824.86	2.92	1.18	1.01%	0.5	10000	929.03	13	45	25	20	0.3	0.25	0.57	0.32	0.25	0.63	0.55	0.25
20.	C & D Yard	9486.50	2.34	0.95	0.81%	0.5	10000	929.03	10	45	25	20	0.3	0.20	0.46	0.26	0.20	0.51	0.44	0.20
21.	Repair store	11019.94	2.72	1.10	0.95%	0.5	3000	278.709	40	45	25	20	1.0	0.79	1.78	0.99	0.79	1.96	1.72	0.79
22.	Maintenance yard	12632.99	3.12	1.26	1.08%	0.5	3000	278.709	45	45	25	20	1.1	0.91	2.04	1.13	0.91	2.24	1.97	0.91
23.	Scrap handling yard	23187.59	5.73	2.32	1.99%	0.5	5000	464.515	50	45	25	20	1.2	1.00	2.25	1.25	1.00	2.47	2.17	1.00
Subtotal of (B)		**436448.39**	**107.85**	**43.64**	**37.44%**															
C) Amenities																				
24.	Admin	4945.14	1.22	0.49	0.42%	0.5	200	18.5806	266	45	25	20	6.7	5.32	11.98	6.65	5.32	13.17	11.59	5.32
25.	Fuel station	5728.02	1.42	0.57	0.49%	0.5	500	46.4515	123	45	25	20	3.1	2.47	5.55	3.08	2.47	6.10	5.37	2.47
26.	Poly clinic	4537.24	1.12	0.45	0.39%	0.5	200	18.5806	244	45	25	20	6.1	4.88	10.99	6.10	4.88	12.09	10.64	4.88
27.	Food court	2303.23	0.57	0.23	0.20%	0.5	200	18.5806	124	45	25	20	3.1	2.48	5.58	3.10	2.48	6.14	5.40	2.48
28.	Office spaces, Bank, ATMs	3228.72	0.80	0.32	0.28%	0.5	200	18.5806	174	45	25	20	4.3	3.48	7.82	4.34	3.48	8.60	7.57	3.48
29.	Commercial plot	39437.30	9.75	3.94	3.38%	0.5	200	18.5806	2122	45	25	20	53.1	42.45	95.51	53.06	42.45	105.06	92.46	42.45
30.	Truck parking, toilet	16989.73	4.20	1.70	1.46%				50			20		1.00	1.00		1.00	1.10	0.97	1.00
Subtotal of (C)		**77169.39**	**19.07**	**7.72**	**6.62%**															
D) Centralized Infrastructure zone																				
31.	Utilities	162708.86	40.21	16.27	13.96%															
31.1	Substation 1	36498.21	9.02	3.65	3.13%				10	45	25	20	0.3	0.20	0.45	0.25	0.20	0.50	0.44	0.20
31.2	Access to Substation 1	5339.05	1.32	0.53	0.46%															

IMLH - Haryana - Land use Statement						**Population Estimation (No.)**				**Domestic Water Demand Estimation (m^3/day)**						**Total Water Demand for IMLH (m^3/day)**			**Sewage Generation (including 10% infiltration) (m^3/day)**	
S. No	Particulars	Area in Sqm	Area in Acres	Area in Hectares	In %	Proposed Floor Space Index (FSI)	Population Density (Sqft Per Person)	Population Density (Sq.m Per Person)	Population (No.)	Basis for Domestic Water Consumption (LPCD)	Potable (LPCD)	Non-Potable (LPCD)	Domestic Water Consumption - Potable (m^3/d)	Domestic Water Consumption - Non-Potable (m^3/d)	Total Domestic Water (m^3/day)	Total Potable Water Required (m^3/d)	Total Non-Potable Water Required (m^3/day)	Total Water Demand considering loss @ 10 % (m^3/d)	Sewage Generation (including 10% infiltration) (m^3/d)	Treated Water to individual units
31.3	Substation 2	7557.41	1.87	0.76	0.65%				10	45	25	20	0.3	0.20	0.45	0.25	0.20	0.50	0.44	0.20
31.4	Water utilities 1	82495.91	20.39	8.25	7.08%				10	45	25	20	0.3	0.20	0.45	0.25	0.20	0.50	0.44	0.20
31.5	Water utilities 2	23099.62	5.71	2.31	1.98%				10	45	25	20	0.3	0.20	0.45	0.25	0.20	0.50	0.44	0.20
31.6	Sewage Treatment Plant (STP) / Solid Waste Management (SWM)	7718.65	1.91	0.77	0.66%				15	45	25	20	0.4	0.30	0.68	0.38	0.30	0.74	0.65	0.30
32.	Road	149345.68	36.90	14.93	12.81%															
32.1	45m wide road	9939.81	2.46	0.99	0.85%	Requirement = 0.73 m3/ acre of non-potable water for Roads, Greens and other infrastructure								1.79			1.79	1.97		1.79
32.2	30m wide road	27199.97	6.72	2.72	2.33%									4.91			4.91	5.40		4.91
32.3	30m wide road with 15m wide carriage way and 15 m extension including additional land which is to be acquired	13043.68	3.22	1.30	1.12%									2.35			2.35	2.59		2.35
32.3	24m wide road	76308.49	18.86	7.63	6.55%									13.77			13.77	15.14		13.77
32.4	18m wide road	19971.21	4.93	2.00	1.71%									3.60			3.60	3.96		3.60
32.5	12m wide road	2882.53	0.71	0.29	0.25%									0.52			0.52	0.57		0.52
33.0	Green	159316.05	39.37	15.93	13.67%									28.74			28.74	31.61		28.74
33.1	Peripheral green	80161.45	19.81	8.02	6.88%	Requirement = 0.73 m3/ acre of non-potable water for Roads, Greens and other infrastructure								14.46			14.46	15.91		14.46
33.2	Green areas between zones	37543.21	9.28	3.75	3.22%									6.77			6.77	7.45		6.77
33.3	Land which is to be merged with Future expansion	41611.39	10.28	4.16	3.57%									7.51			7.51	8.26		7.51
Subtotal of (D)		471370.60	116.48	47.14	40.43%															
Total		**1165809.32**	**288.08**	**116.58**	**100.00 %**				**4812**				**117.81**	**180.66**				**328.32**	**207.20**	**180.66**

4.22 Sewage Conveyance Network System

- The Sewage conveyance system for the project shall considered by gravity system laid below ground level to collect and carry the Sewage generated from the various Zones to STP proposed in project area.

Design Basis and design criteria

The design shall be carried out with following important considerations: -

- Pipeline is designed to sustain the ultimate peak flow at any point of time in the network.
- The Sewage conveyance is proposed to be laid along the utility corridors in RoW for easy and hassle-free access.

Following design criteria is proposed for effluent collection system, demand computed based on the analysis.

- Working hours per day - 24
- Pipe material - DWC HDPE for all areas and NP4 RCC with DWC HDPE pipe for road crossing
- Pipe roughness coefficient - 0.011
- Peak flow factor - 3.00 as per CPHEEO manual
- Formula used to calculate friction loss - Manning's formula.
- Infiltration - 10%
- Self-cleansing velocity - 0.6 m/s
- Minimum cover - 0.9 m
- Manhole spacing - 30 m
- Minimum pipe size - 200mm

The Sewage is designed to the discharge capacity of Q_c (m£ / sec) to cater adequately for the estimated peak flow using Manning's formula.

$$Q_c = \frac{1}{n} A R^{(2/3)} S^{(1/2)}$$

Where,

A = Flow area (m²)

R = Hydraulic mean radius (m)

S = Bed gradient

n = Roughness coefficient

= 0.013 for reinforced concrete pipes

= 0.011 for DWC HDPE pipes

The design of Collection network shall be carried out using Inhouse software.

It is proposed single collection networks to collect sewage & sullage. The network is divided into trunk main and sub mains according to the natural topography, formation level and other site constraints. Minimum pipe size used is 200 mm for sewerage network. Pipe spanning between plot manhole and the trunk/main line shall be 150 mm diameter.

Table 42: Sewerage Pipe Length Details

PIPE Dia in mm	Pipe Material	Total Length in m
		Sewerage Network
200	DWC HDPE	5180

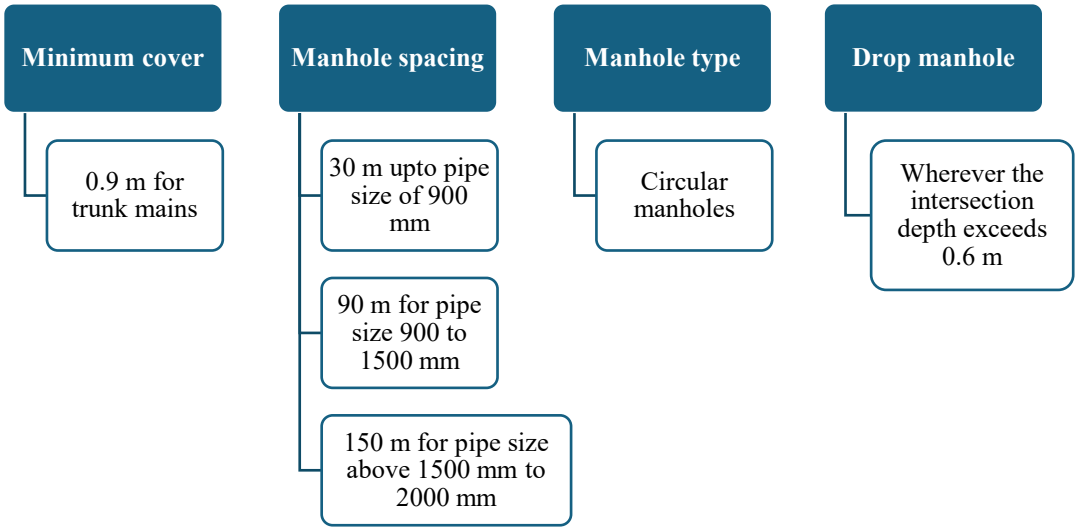
PIPE Dia in mm	Pipe Material	Total Length in m Sewerage Network
150	DWC HDPE	500
Total length in m		5680

Circular manholes are stronger than rectangular and arch type manholes and thus these are preferred. Circular manhole can be provided for all depth. Size of manhole as per CPHEEO manual is depicted in the table below.

Table 43: Size of manhole as per CPHEEO manual

Depth of manhole in m	Minimum diameter of manhole in m
Up to 2	1.2
2 – 9	1.5

- **Drop manhole**: wherever the intersection depth exceeds 0.6 m
- **Flush manholes**: where self-cleansing velocity of 0.3 m is not achievable due to low flow by means of providing flushing hydrant in the water supply line. Generally, it is located on the upstream end of the effluent line.



Features of different pipe materials

Table 44: Comparison Between the Pipe Materials

S. No	Properties	DWC HDPE Pipes	HDPE Pipes	UPVC Pipes	RCC Pipe
1	Length of Straight Pipe	6 m	5m – 20m	6 – 12 m	2 to 2.5 m
2	Composition of Material	Polyethylene (PE) or Poly Propylene (PP)	Polyethylene (PE)	Poly Vinyl Chloride	Cement concrete
3	Nominal Diameter Available in the market (Haryana)	100mm – 1000mm	20mm – 1000mm	20mm – 355mm	150mm – 2000mm
4	Roughness Co-efficient	0.011	0.011	0.011	0.011
5	Life expectancy	50+ years	50+ years	50+ years	30 years
6	Weight	Less when compared to	Less	Light	Heavy

S. No	Properties	DWC HDPE Pipes	HDPE Pipes	UPVC Pipes	RCC Pipe
		HDPE solid wall pipes			
7	Chemical Resistance	Chemically inert to waste water/industrial ingredients and 'crown corrosion' is non-existent.	Excellent chemical resistance properties, making them suitable for various industrial applications. They are resistant to most acids, including sulfuric, hydrochloric, and phosphoric acids. HDPE pipes are also resistant to alkalis, salts, and most organic solvents.	Excellent	Moderate. The resistance can be increased by increasing the cover, and Geopolymer concrete mixes.
8	Corrosion	Nil	Nil	Nil	Subjected to H_2S. Corrosion due to acids, highly septic sewage and by highly acidic or highly sulphate soils and where velocities are not efficient to prevent septic conditions. To increase corrosion SRC is used along with the mix.
9	Stiffness	Additional stiffness when compared to normal HDPE Pipes	Excellent	Excellent	Good
10	Fatigue Resistance	Not Susceptible to Fatigue	Not Susceptible to Fatigue	-	-
11	Operating Temperature	-40 Degree Celsius to 60 Degree Celsius	Upper Limit for Structural and Gravity services is 70 Degree Celsius for long term exposure and up to 80 degrees Celsius for short term intermittent exposures. The low temperature limit is -90 degree Celsius	maximum temperature is up to 60 Degree Celsius.	-
12	Leak Proofing	Excellent	Excellent	Excellent	Excellent and moderate at joints
13	of joint used	Elastomeric rubber rings & couplers	Butt Fusion, Electrofusion or mechanical fasteners	Solvent Cement joint and Rubber Ring Joint	Collar and S&S Joint
14	No of Joints required	Less	Less	Very Less	High
15	Cost of Material	Marginally High	Marginally High	Marginally High	Higher
16	Maintenance Cost	Low	Low	Low	High
17	Duration required for	Short	Short	Short	Very long

S. No	Properties	DWC HDPE Pipes	HDPE Pipes	UPVC Pipes	RCC Pipe
	Erection & commission				
18	Duration required for maintenance	Short	Short	Short	long
19	Manpower required for Erection & repair works	Very less	Very less	Very Less	high
20	Permeability	Nil	Nil	Nil	Moderate in joints
21	Frictional loss	Less	Less	Less	Moderate
22	Water contamination	Nil	Nil	Nil	Possible
23	Scale formation	Nil	Nil	Nil	Moderate
24	Transportation Cost	Less	Less	Less	High
25	Delivery of Pipe Material	10 – 15 days)	10 – 15 days	10 to 15 days	45 to 60 days

Pipe to be selected based on durability, performance, cost, maintenance, joints, availability, and speed of construction. Considering the selection criteria, pipe material may be selected as follows: DWC HDPE 200 mm for all areas except road crossing and NP4 RCC with sulphate resistant cement for road crossing.

Smart elements-Sewage scheme

- Sewage levels can be monitored at strategic locations in the Sewage pipe network through ultrasonic level sensors (smart manhole cover, which is being explored) which mitigates risk in the operation phase and acts as secondary containment.
- When the level in manholes exceeds the permissible limits, alarm signal will be given to the central monitoring stations.
- Sensor in sewer line infrastructure to help quick detection of leakage and blockages in sewer line to avoid flooding and overflow.

Table 45: Design Criteria for Sewage Conveyance Network

S. No	Parameter	Design Criteria
1	Peak factor	3.00
2	Maximum Pressure at the Junctions	15 m of H_2O
3	Maximum velocity	3.0 m/sec
4	Minimum conduit Diameter	200mm
5	Coefficient of Roughness	0.010
6	Pipe Material for all trunk Main lines (irrespective of diameter)	DWC HDPE
7	Design period	30 Years
8	Plot Connection	150 dia DWC HDPE

The sewage network layout is provided in the drawing Annexure.

4.23 Design report for Sewage Treatment Plant

Objective

To design an efficient Sewage Treatment Plant (STP) utilizing the suitable technology to treat wastewater to meet regulatory discharge standards.

Key Parameters for STP Design

Wastewater Characteristics:

- **Influent Flow Rate:** Average and peak flow rates (m^3/day).
- **Influent Quality:** Concentrations of BOD (Biological Oxygen Demand), COD (Chemical Oxygen Demand), TSS (Total Suspended Solids), TN (Total Nitrogen), and TP (Total Phosphorus).

The same are illustrated in Table and Figure below:

Table 46: Quality parameters of domestic sewage

Sl. No.	Parameters	Unit	Raw sewage	Tertiary treated sewage
1	Ph	-	6.0 – 8.5	5.5 – 9.0
2	Suspended solids	Mg/l	250 – 300	< 100
3	Biochemical oxygen demand	Mg/l	250 - 350	< 30
4	Chemical oxygen demand	Mg/l	400 - 600	< 250
5	Oil & grease	Mg/l	<50	< 10
6	Total residual chlorine	Mg/l		<1
7	Ammonical nitrogen (as N)	Mg/l		<50
8	Total kjeldahl nitrogen (as N)	Mg/l	45	< 100
9	Sulphate (as S)	Mg/l		< 2
10	Nitrate nitrogen	Mg/l		<10
11	Total phosphorus	Mg/l		< 1
12	Faecal coliform	MPN/100 ml	1×10^6	Nil
13	Total coliform	MPN/100 ml	1×10^7	Nil

(Source: CPCB general standards)

Sewage generation estimation for IMLH development

Figure 55*: Sewage generation*

IMLH - Haryana - Land use Statement						Population Estimation (No.)				Domestic Water Demand Estimation (m3/day)						Total Water Demand for IMLH (m3/day)			Sewage Generation (including 10% infiltration) (m3/day)	
S. No	Particulars	Area in Sqm	Area in Acres	Area in Hectares	In %	Proposed Floor Space Index (FSI)	Population Density (Sqft Per Person)	Population Density (Sq.m Per Person)	Population (No.)	Basis for Domestic Water Consumption (LPCD)	Potable (LPCD)	Non-Potable (LPCD)	Domestic Water Consumption - Potable (m3/d)	Domestic Water Consumption - Non-Potable (m3/d)	Total Domestic Water (m3/day)	Total Potable Water Required (m3/d)	Total Non-Potable Water Required (m3/day)	Total Water Demand considering loss @ 10 % (m3/d)	Sewage Generation (including 10% infiltration) (m3/d)	Treated Water to individual units
1.	Total site area (a)	1653868.43	408.68	165.39	100.00%															
2.	Railway lines, station and related areas (b)	377127.06	93.19	37.71	22.80%															
3.	Approach 60m wide road (c)	52041.84	12.86	5.20	3.15 %															
4.	Irrigation canal (d)	22257.3051	5.50	2.23	1.35 %															
5.	Irrigation canal buffer (e)	37013.25	9.15	3.70	2.24 %															
6.	Additional land to be acquired for road extension (f)	380.35	0.09	0.04	0.02 %															
7.	Net planning area (g=a-b-c-d-e+f)	1165809.32	288.08	116.58	70.49%															
A) EXIM Zone																				
8.	Container yard/open storage, support services, toilet	106560.51	26.33	10.66	9.14 %	0.5	2000	185.806	574	45	25	20	14.3	11.47	25.81	14.34	11.47	28.39	24.98	11.47
9.	Bonded warehouse, toilet	34155.34	8.44	3.42	2.93 %	0.5	2000	185.806	184	45	25	20	4.6	3.68	8.27	4.60	3.68	9.10	8.01	3.68

IMLH - Haryana - Land use Statement						Population Estimation (No.)				Domestic Water Demand Estimation (m3/day)						Total Water Demand for IMLH (m3/day)			Sewage Generation (including 10% infiltration) (m3/day)	
S. No	Particulars	Area in Sqm	Area in Acres	Area in Hectares	In %	Proposed Floor Space Index (FSI)	Population Density (Sqft Per Person)	Population Density (Sq.m Per Person)	Population (No.)	Basis for Domestic Water Consumption (LPCD)	Potable (LPCD)	Non-Potable (LPCD)	Domestic Water Consumption - Potable (m3/d)	Domestic Water Consumption - Non-Potable (m3/d)	Total Domestic Water (m3/day)	Total Potable Water Required (m3/d)	Total Non-Potable Water Required (m3/day)	Total Water Demand considering loss @ 10 % (m3/d)	Sewage Generation (including 10% infiltration) (m3/d)	Treated Water to individual units
10.	Customs office	4673.37	1.15	0.47	0.40 %	0.5	200	18.5806	252	45	25	20	6.3	5.03	11.32	6.29	5.03	12.45	10.96	5.03
11.	Truck parking, toilet	19632.69	4.85	1.96	1.68 %				50			20		1.00	1.00		1.00	1.10	0.97	1.00
12.	Check post, weigh bridge & truck parking	15799.03	3.90	1.58	1.36 %															
Subtotal of (A)		180820.94	44.68	18.08	15.51%															
B) Warehouse and Container yard area																				
13.	General warehouse and loading & unloading bay	36542.96	9.03	3.65	3.13 %	0.5	3000	278.709	131	45	25	20	3.3	2.62	5.90	3.28	2.62	6.49	5.71	2.62
14.	Cold storage warehouse and loading & unloading bay	12180.99	3.01	1.22	1.04 %	0.5	3000	278.709	44	45	25	20	1.1	0.87	1.97	1.09	0.87	2.16	1.90	0.87
15.	Oversized cargo	60747.84	15.01	6.07	5.21 %	0.5	10000	929.03	65	45	25	20	1.6	1.31	2.94	1.63	1.31	3.24	2.85	1.31
16.	Open storage (Automobile yard)	203901.85	50.39	20.39	17.49%	0.5	30000	2787.09	73	45	25	20	1.8	1.46	3.29	1.83	1.46	3.62	3.19	1.46
17.	Laden container yard	25621.53	6.33	2.56	2.20 %	0.5	3000	278.709	92	45	25	20	2.3	1.84	4.14	2.30	1.84	4.55	4.00	1.84
18.	Empty container yard	29301.34	7.24	2.93	2.51 %	0.5	10000	929.03	32	45	25	20	0.8	0.63	1.42	0.79	0.63	1.56	1.37	0.63
19.	Equipment storage area	11824.86	2.92	1.18	1.01 %	0.5	10000	929.03	13	45	25	20	0.3	0.25	0.57	0.32	0.25	0.63	0.55	0.25
20.	C & D Yard	9486.50	2.34	0.95	0.81 %	0.5	10000	929.03	10	45	25	20	0.3	0.20	0.46	0.26	0.20	0.51	0.44	0.20

IMLH - Haryana - Land use Statement						Population Estimation (No.)				Domestic Water Demand Estimation (m3/day)						Total Water Demand for IMLH (m3/day)			Sewage Generation (including 10% infiltration) (m3/day)	
S. No	Particulars	Area in Sqm	Area in Acres	Area in Hectares	In %	Proposed Floor Space Index (FSI)	Population Density (Sqft Per Person)	Population Density (Sq.m Per Person)	Population (No.)	Basis for Domestic Water Consumption (LPCD)	Potable (LPCD)	Non-Potable (LPCD)	Domestic Water Consumption - Potable (m3/d)	Domestic Water Consumption - Non-Potable (m3/d)	Total Domestic Water (m3/day)	Total Potable Water Required (m3/d)	Total Non-Potable Water Required (m3/day)	Total Water Demand considering loss @ 10 % (m3/d)	Sewage Generation (including 10% infiltration) (m3/d)	Treated Water to individual units
21.	Repair store	11019.94	2.72	1.10	0.95 %	0.5	3000	278.709	40	45	25	20	1.0	0.79	1.78	0.99	0.79	1.96	1.72	0.79
22.	Maintenance yard	12632.99	3.12	1.26	1.08 %	0.5	3000	278.709	45	45	25	20	1.1	0.91	2.04	1.13	0.91	2.24	1.97	0.91
23.	Scrap handling yard	23187.59	5.73	2.32	1.99 %	0.5	5000	464.515	50	45	25	20	1.2	1.00	2.25	1.25	1.00	2.47	2.17	1.00
Subtotal of (B)		436448.39	107.85	43.64	37.44%															
C) Amenities																				
24.	Admin	4945.14	1.22	0.49	0.42 %	0.5	200	18.5806	266	45	25	20	6.7	5.32	11.98	6.65	5.32	13.17	11.59	5.32
25.	Fuel station	5728.02	1.42	0.57	0.49 %	0.5	500	46.4515	123	45	25	20	3.1	2.47	5.55	3.08	2.47	6.10	5.37	2.47
26.	Poly clinic	4537.24	1.12	0.45	0.39 %	0.5	200	18.5806	244	45	25	20	6.1	4.88	10.99	6.10	4.88	12.09	10.64	4.88
27.	Food court	2303.23	0.57	0.23	0.20 %	0.5	200	18.5806	124	45	25	20	3.1	2.48	5.58	3.10	2.48	6.14	5.40	2.48
28.	Office spaces, Bank, ATMs	3228.72	0.80	0.32	0.28 %	0.5	200	18.5806	174	45	25	20	4.3	3.48	7.82	4.34	3.48	8.60	7.57	3.48
29.	Commercial plot	39437.30	9.75	3.94	3.38 %	0.5	200	18.5806	2122	45	25	20	53.1	42.45	95.51	53.06	42.45	105.06	92.46	42.45
30.	Truck parking, toilet	16989.73	4.20	1.70	1.46 %				50			20		1.00	1.00		1.00	1.10	0.97	1.00
Subtotal of (C)		77169.39	19.07	7.72	6.62 %															
D) Centralized Infrastructure zone																				

IMLH - Haryana - Land use Statement						Population Estimation (No.)				Domestic Water Demand Estimation (m3/day)						Total Water Demand for IMLH (m3/day)			Sewage Generation (including 10% infiltration) (m3/day)	
S. No	Particulars	Area in Sqm	Area in Acres	Area in Hectares	In %	Proposed Floor Space Index (FSI)	Population Density (Sqft Per Person)	Population Density (Sq.m Per Person)	Population (No.)	Basis for Domestic Water Consumption (LPCD)	Potable (LPCD)	Non-Potable (LPCD)	Domestic Water Consumption - Potable (m3/d)	Domestic Water Consumption - Non-Potable (m3/d)	Total Domestic Water (m3/day)	Total Potable Water Required (m3/d)	Total Non-Potable Water Required (m3/day)	Total Water Demand considering loss @ 10 % (m3/d)	Sewage Generation (including 10% infiltration) (m3/d)	Treated Water to individual units
31.	Utilities	162708.86	40.21	16.27	13.96%															
31.1	Substation 1	36498.21	9.02	3.65	3.13 %				10	45	25	20	0.3	0.20	0.45	0.25	0.20	0.50	0.44	0.20
31.2	Access to Substation 1	5339.05	1.32	0.53	0.46 %															
31.3	Substation 2	7557.41	1.87	0.76	0.65 %				10	45	25	20	0.3	0.20	0.45	0.25	0.20	0.50	0.44	0.20
31.4	Water utilities 1	82495.91	20.39	8.25	7.08 %				10	45	25	20	0.3	0.20	0.45	0.25	0.20	0.50	0.44	0.20
31.5	Water utilities 2	23099.62	5.71	2.31	1.98 %				10	45	25	20	0.3	0.20	0.45	0.25	0.20	0.50	0.44	0.20
31.6	Sewage Treatment Plant (STP) / Solid Waste Management (SWM)	7718.65	1.91	0.77	0.66 %				15	45	25	20	0.4	0.30	0.68	0.38	0.30	0.74	0.65	0.30
32.	Road	149345.68	36.90	14.93	12.81%															
32.1	45m wide road	9939.81	2.46	0.99	0.85 %	Requirement = 0.73 m3/ acre of non-potable water for Roads, Greens and other infrastructure								1.79			1.79	1.97		1.79
32.2	30m wide road	27199.97	6.72	2.72	2.33 %									4.91			4.91	5.40		4.91
32.3	30m wide road with 15m wide carriage way and 15 m extension including additional land which is to be acquired	13043.68	3.22	1.30	1.12 %									2.35			2.35	2.59		2.35

IMLH - Haryana - Land use Statement						Population Estimation (No.)				Domestic Water Demand Estimation (m3/day)						Total Water Demand for IMLH (m3/day)			Sewage Generation (including 10% infiltration) (m3/day)	
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32.3	24m wide road	76308.49	18.86	7.63	6.55 %									13.77			13.77	15.14		13.77
32.4	18m wide road	19971.21	4.93	2.00	1.71 %									3.60			3.60	3.96		3.60
32.5	12m wide road	2882.53	0.71	0.29	0.25 %									0.52			0.52	0.57		0.52
33.0	Green	159316.05	39.37	15.93	13.67%									28.74			28.74	31.61		28.74
33.1	Peripheral green	80161.45	19.81	8.02	6.88 %	Requirement = 0.73 m3/ acre of non-potable water for Roads, Greens and other infrastructure								14.46			14.46	15.91		14.46
33.2	Green areas between zones	37543.21	9.28	3.75	3.22 %									6.77			6.77	7.45		6.77
33.3	Land which is to be merged with Future expansion	41611.39	10.28	4.16	3.57 %									7.51			7.51	8.26		7.51
Subtotal of (D)		471370.60	116.48	47.14	40.43%															
Total		1165809.32	288.08	116.58	100.00%				4812				117.81	180.66				328.32	207.20	180.66

As per the Demand estimation it is rounded up for 215 KLD STP Plant.

Sewage treatment methods

Sewage treatment is the process of removing contaminants from wastewater, comprising of sullage, domestic sewage and primary treated effluent. It includes physical, chemical and biological processes to remove various contaminants.

Various sewerage treatment systems considered for selection of treatment system are given in the table below.

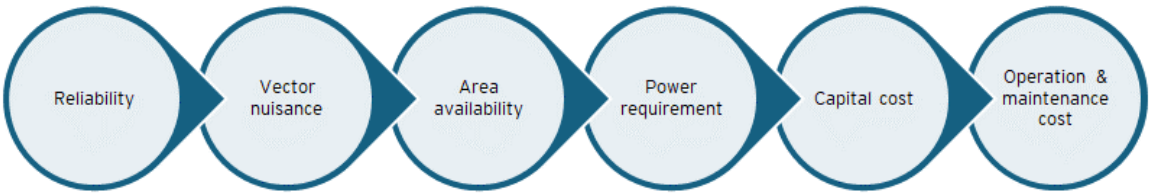
Table 47: Various sewerage treatment systems

Sl. No.	Process	Units required	Accessories
1	Activated sludge – extended aeration	Aeration tank & secondary clarifier	Surface aerators or membrane diffuser system for oxygen supply
2	Aerated lagoon	Earthen bund basins	Fixed or floating aerators for oxygen supply
3	Up-flow Anaerobic Sludge Blanket (UASB)	Reactor with liquid, solid & gas separation facilities	Gas collector, burner and influent distribution system
4	Trickling filters	Circular tanks with media, under drain & secondary clarifier	Rotary distributor for influent and re-circulation pumps
5	Rotating Biological Contactors (RBC)	Trough with PVC/plastic discs, secondary clarifier	Drive mechanism for rotating the discs
6	Fluidized aerobic bio reactor	Reactor tank with poly propylene media and diffusers followed by secondary clarifier	Blowers for supply of oxygen through membrane diffusers
7	Sequencing Batch Reactor (SBR)	It uses deep RCC basins, and very efficient oxygen transfer equipment's (diffused aeration mechanism)	Diffusers, blowers and aeration grid, which provides highest aeration and oxygen transfer efficiency. Decanter assembly in Stainless steel equipped with variable frequency drive to automatically control rate of decanting based on input feed condition
8	Membrane Bio Reactor (MBR)	Aeration tanks followed by balancing tank and membrane bio reactor	Diffusers, blowers to supply oxygen, air compressors for backwashing, chemical dosing for pre-treatment.

Source: ACE analysis

Sewage treatment plant technology selection

Factors considered for selection of appropriate treatment system:



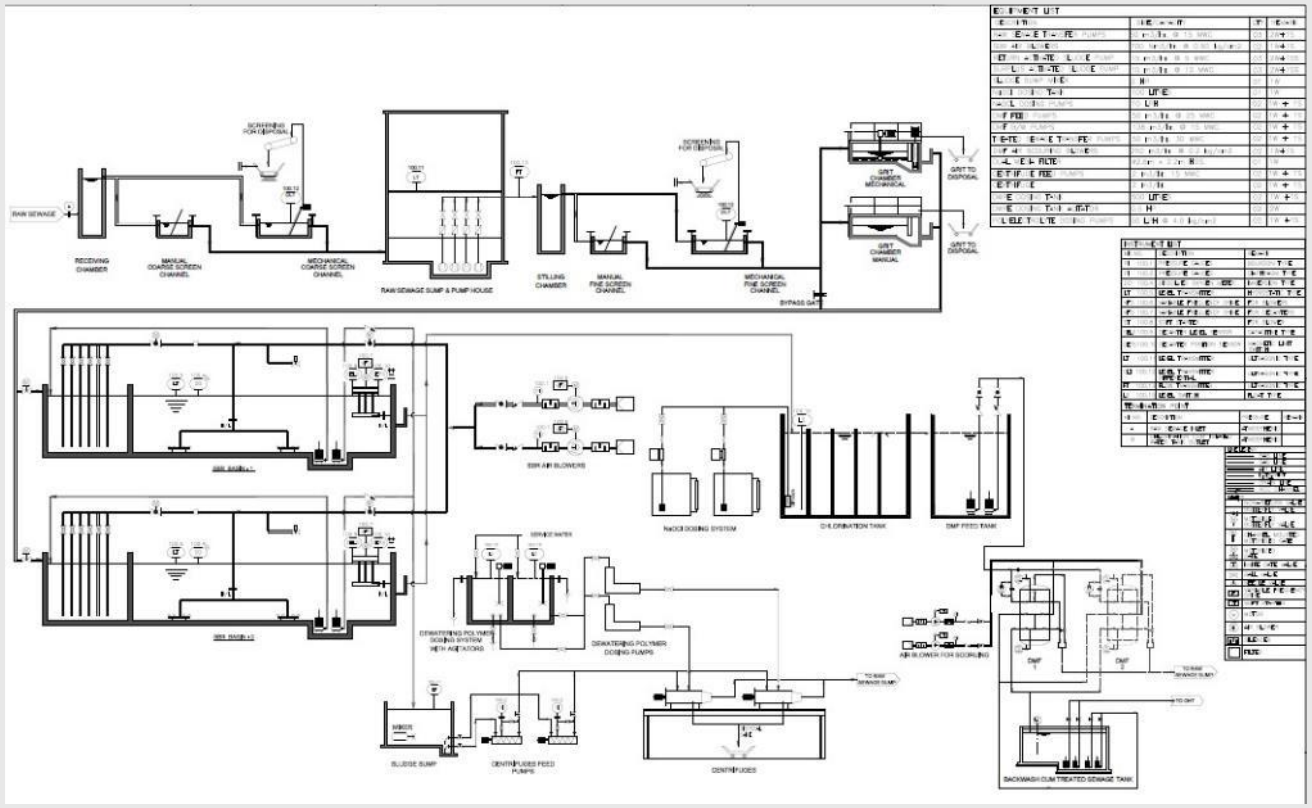
The above process technologies are analysed in terms of the performance and both capital and operating cost. Thus, SRB technology has been widely used for municipal and industrial wastewater treatment applications to meet specific discharge requirements.

SBR technology advantages/benefits:

- Consistent high-quality, low nutrient level effluent
- Tolerates wide swings in flow and organic loading
- No clarifier required
- Better control over filamentous growth and settling problems
- Nutrient removal without chemicals – nitrification and de-nitrification, phosphate removal
- The system can also work with sewage in flow of 20 to 30 percentage of designed capacity due to presence of variable frequency drive (VFD)

SBR system is a fill and draw activated sludge system. SBR process uses high-efficiency oxygen transfer aeration equipment to satisfy the high-rate oxygen consumption requirement at the beginning of the "fill" and "aeration" cycles. SBR is efficient in carbonaceous pollutant removal and is easily modified to satisfy nutrient removal of nitrogen (N) and phosphorous (P). Because the fill, aeration, settlement and draw take place in the same reaction tank, SBR tank itself would serve as the clarifier. Refer the following process flow diagram in Figure below.

Figure 56: STP process flow diagram (SBR technology)



Treatment process for a SBR based STP

a. Inlet chamber

An inlet chamber shall be provided ahead of the fine screen channels to receive the raw sewage and stabilize the flow.

b. Fine screen channels

Screening is an essential step in STP to remove large size floating materials like rags, wooden pieces, plastics, tobacco pouches, etc. which otherwise would damage pumps and interfere with the satisfactory operation of various treatment units. Fine Screen shall consist of Bars placed across the channel to trap

the floating materials. The spacing of Bars shall be kept depending on the degree of treatment required. The bars shall arrest the floating materials, which have to be removed periodically.

Mechanical fine screens are provided with manual fine screen as standby. The screening process is undertaken by bar screens consisting of 3 mm thick flats with 6 mm clear opening to trap the floating materials.

The mechanically operated screens are equipped with a mechanism, which will automatically rake at a pre-set timer control. The screenings are collected in a hopper located above the water level such that the screenings can be easily collected in a collection cart.

Standby screen channels have manually cleaned bar screen with 10 mm clear opening. Aluminium Sluice Gates are provided with RCC Platform and access Staircase. Hand Railing is also provided on all platforms.

c. Grit removal units

After passing through the screen, the screened sewage is allowed to flow through grit removal units consisting of Mechanical Grit Removal Mechanism in Grit Chambers. Grit in sewage consists of coarse particles of sand, ash and clinkers, eggshells and many inert materials which are inorganic in nature. Grit is not putrescible in nature and possesses a higher hydraulic subsidence value than organic solids. Hence, it is possible to separate the gritty material from organic solids by differential sedimentation in a grit channel.

Grit removal is necessary to protect the moving mechanical equipment and pumps from abrasion and accompanying abnormal wear and tear. It is separated in a Grit Chamber with designed detention period. The grit washing and removal mechanism shall be fully automatic.

d. SBR process

Raw sewage after Primary Treatment i.e. after removal of grits, shall is taken by gravity into the SBR Basins. The numbers of SBR basins are decided based on the plant capacity, with a minimum of 2 basins.

These SBR Basins are working in sequence and the influent flow is distributed using Automatic Sluice Gates provided in the Inlet Channel to SBR Basins. The SBR Basins are equipped with Air Blowers, Diffusers, Return Activated Sludge (RAS) Pumps, Surplus Activated Sludge (SAS) Pumps, Decanters, Auto Valves and programmable logic controller (PLC) etc. All cycles are automatically controlled using PLC.

Excess sludge at a consistency level of approx. 1% shall be pumped intermittently from SAS Pumps. The sludge shall then be taken for drying.

e. Function of SBR:

i. Removal of organics:

The raw sewage free from debris and grit is taken up for biological treatment in SBR Reactors for removal of organics, nitrogen and phosphorus.

The activated sludge bio system is designed using SBR which operates on extended aeration activated sludge principle for the reduction of carbonaceous biochemical oxygen demand (BOD), Nitrification, De-nitrification and Phosphorous removal, using energy efficient fine bubble membrane diffused aeration system with automatically controlled air supply based on Oxygen Uptake Rate (OUR) resulting in 20 – 30% power savings.

The practice of manipulating activated sludge reaction environments to obtain maximum nitrogen and phosphorous removal has been optimized using SBR by co-current nitrification & de-nitrification mechanism.

In its simplest form, the sequences of fill, aeration, settle and decant are consecutively and continuously operated all in the same Tank, allowing up to 30-40% space saving. No Secondary Clarifier shall be required to concentrate the sludge in the Reactor. The return sludge is recycled, and the surplus sludge is wasted from the SBR Basins itself.

The system makes use of the variable volume treatment in combination with a biological Selector and operated in a fed-batch Reactor mode. The complete biological operation is divided into cycles. A basic cycle comprises:



These phases in a sequence constitute a cycle, which is then repeated. During the period of a cycle, the liquid volume inside the Reactor increases from a set operating bottom water level. During the Fill- Aeration sequence mixed liquor from the aeration zone is recycled into the Selector. Aeration ends at a predetermined period of the cycle to allow the biomass to flocculate and settle under quiescent conditions. After a specific settling period, the treated supernatant is decanted, using a moving weir, Decanter. The liquid level in the Reactor is so returned to the bottom water level after which the cycle is repeated. Solids are wasted from the Reactor during the decanting phase. The system selected can achieve the following:

i) Anoxic de-nitrification of nitrates in the Biological Selector Zone of SBR (Anoxic Zone) using incoming wastewater
ii) Biodegradation of organics including phenol present in the wastewater by Extended Aeration Process
iii) Oxidation of sulphides in the wastewater
iv) Co-current nitrification and de-nitrification of Ammoniacal nitrogen in the aeration zone of SBR Basins
v) Removal of Phosphorous

ii. De-nitrification:

The wastewater enters the Selector Zone in the front end of the SBR, where anoxic conditions are maintained. Part of the treated wastewater along with return sludge from the aeration Basin is recycled here using RAS Pumps. With the incorporation of Biological Selector, there is no need for an Anoxic – Mixing sequence and is therefore replaced by a simple Fill – Aeration sequence.

As microorganisms meet high BOD & low dissolved oxygen (DO) condition in the Selector Zone, natural selection of phosphate accumulating microorganisms and floc-forming microorganisms takes place. This is very effective in containing all of the known low F/M bulking microorganisms and eliminates the problems of bulking and surface foaming. Also, due to the anoxic conditions in the Selector Zone, de-nitrification and phosphorous removal occurs by co-current nitrification & de-nitrification. Complete nitrification and de-nitrification pathways take place with nitrification taking place external to the activated sludge flocs and de-nitrification taking place within the interior of the flocs. This de-nitrification pathway is not bound to the absence of dissolved oxygen in the liquid phase but requires diffusion of nitrate into the anoxic parts of the floc with a probable use of stored intracellular carbon or adsorbed organic carbon for de-nitrification. During anaerobic conditions, all phosphorous that is released to the liquid phase is totally contained within the bio solids layer.

Biological de-nitrification in the Selector Zone by recycling of mixed liquor from aeration zone requires nitrification of all Ammoniacal nitrogen in the incoming wastewater in the aeration zone. This requirement of plant design is met by operating the SBR under Extended Aeration Process with higher qc values, which ensure co-current nitrification and de-nitrification in the aeration zone.

De-nitrification releases nitrogen which escapes as an inert gas to the atmospheres, while the oxygen released stays dissolved in the liquid and thus reduces the oxygen input needed for the aeration.

The process of de-nitrification of nitrates is represented as:

NO_3^- + BOD à N_2 + CO_2 + H_2O + OH^- + Cells

iii. Carbonaceous BOD removal:

The aeration zone of SBR is provided with diffused aeration to oxidize the organic matter including phenol, by Extended Aeration Process. An extended aeration activated sludge process operates in the endogenous respiration phase of the growth curve where the microorganisms are forced to metabolize their own protoplasm without replacement, since the concentration of food available is at a minimum. During this phase, the nutrients remaining in the dead cells diffuse out to furnish the remaining cells with food. This system has been developed for application where minimum solids production is desirable. Less solids production is achieved by using a larger fraction of the entering organic material for energy rather than for synthesis. This means that more oxygen will be consumed per unit mass of organic material removed.

The activated sludge process is capable of converting most organic wastes to more stable inorganic forms or to cellular mass. In this process, the soluble and colloidal organic material is metabolized by a diverse group of microorganisms to carbon dioxide and water. At the same time, a sizeable fraction of incoming organic matter is converted to cellular mass that can be separated from the effluent by settling.

Activated sludge comprises a mixed microbial culture wherein the bacteria are responsible for oxidizing the organic matter, while protozoa consume the dispersed un-flocculated bacteria and rotifers consume the unsettled small bio-flocs in the treated wastewater, performing the role of effluent polishers.

The utilization of substrate by a bacterial cell can be described as a three-step process:

1. The substrate molecule contacts the cell wall.
2. The substrate molecule is transported into the cell
3. Metabolism of the substrate molecule by the cell

However, as the bacteria require the molecule in the soluble form; colloidal, spherically incompatible molecules, which cannot be readily biodegradable, have to be first adsorbed to the cell surface and then broken down or transformed externally to transportable fractions by exoenzymes or wall-bounded enzymes. The organic matter will be utilized by the bacteria resulting in cell synthesis and energy for maintenance.

The following reactions best describe the organic utilization by the aerobic bacteria:

1. Oxidation

   COHNS + O_2 + Bacteria à CO_2 + NH_3 + other End Products + Energy

2. Synthesis

   COHNS + O_2 + Bacteria à $C_5H_7O_2N$ (New Bacterial Cell)

3. Endogenous Respiration

$$C_5H_7O_2N + 5O_2 \text{ à } 5CO_2 + NH_3 + 2H_2O + \text{Energy}$$

Nutrients available in the wastewater or from external source of supplements cater to the nutrient requirements of the aerobic microorganisms and to enhance the activity of the aerobic microbes.

In addition to the nutrient requirements, the aerobic microbes require oxygen to sustain their microbial activity. Oxygen also functions as a terminal electron acceptor in the energy metabolism of the aerobic Heterotrophic organisms indigenous to the activated sludge process. In other words, a portion of the organic material removed is oxidized to provide energy for the maintenance function and the synthesis function.

iv. Nitrification

Any oxidation must be coupled with reduction, and oxygen satisfies this requirement in the aerobic microorganisms. Extended Aeration system, with high qc values, ensures uniform nitrification performance. Nitrification results from the oxidation of ammonia present in the sewage by Nitrosomonas to nitrite and the subsequent oxidation of the nitrite to nitrate by Nitrobacter. The nitrifying organisms are strict aerobic autotrophies and use carbon source present in the sewage, in the presence of oxygen, maintained at 2 mg/l in the SBR to avoid oxygen limitation. The nitrification of ammonia can be represented as given below:

$$2\,NH_4^+ + 3O_2 \xrightarrow[\text{NITROSOMONAS}]{} 2NO_2^- + 2\,H_2O + 4\,H^+ + \text{New cells}$$

$$2\,NO_2^- + O_2 \xrightarrow[\text{NITROBACTOR}]{} 2NO_3^- + \text{New cells}$$

The diffused aeration system is sized so that sufficient oxygen is provided for carbonaceous treatment, sludge stabilisation, nitrification and maintaining the DO at the specified level of 2 mg/l, taking into account the reduction in oxygen demand due to de-nitrification. The capacity of diffused aeration in each SBR Basin will be sufficient to ensure good mixing conditions during Fill Aeration phase of the cycle of operation.

v. Phosphorous removal

The removal of phosphorous from the wastewater is accomplished by the consumption of phosphorous for the cell growth. During anoxic conditions, all phosphorous that is released to the liquid phase is totally contained within the bio solids layer.

vi. SBR process description:

The SBR system is operated in a batch Reactor mode, which eliminates all the inefficiencies of the continuous processes. A batch Reactor is a perfect Reactor, which ensures 100% treatment. Four modules are provided to ensure continuous treatment. The complete process takes place in a single Reactor, within which all biological treatment steps take place sequentially.

The complete biological operation is divided into cycles. Each cycle is of 3 – 5 hrs duration (3 hours as design basis), during which all treatment steps take place.

Explanation of cyclic operation

A basic cycle comprises:



These phases in a sequence constitute a cycle, which is then repeated.

A Typical cycle:

During the period of a cycle, the liquid is filled in the SBR Basin up to a set operating water level. Aeration Blowers are started for aeration of the effluent. After the aeration cycle, the biomass settles under perfect settling conditions. Once settled the supernatant is removed from the top using a Decanter. Solids are wasted from the tanks during the decanting phase.

These phases in a sequence constitute a cycle, which is then repeated.

The SBR system comprises the following features:

i) Biological Selector Zone- Ensures no foaming and bulking problems
ii) Dissolved Oxygen Control to automatically control and optimise power consumption-Ensures 20 - 30% power savings
iii) Co Current Nitrification and De nitrification, Phosphorous removal- Provides Nitrogen and Phosphorous removal to remove nutrients making the water safe for water discharge
iv) Diffusers for Aeration-Highest aeration and oxygen transfer efficiency
v) Decanter assembly in Stainless steel equipped with VFD to automatically control rate of decanting based on input feed condition-Ensures no corrosion, long equipment life, no maintenance.
vi) Return sludge (RAS) recycle and Surplus sludge (SAS) pumps for sludge wasting from Reactor only- **Reduces space requirement**
vii) No secondary clarifier is used which drastically reduces civil cost and construction cost
viii) PLC unit for complete automatic cycle control and operation- Reduces manpower cost. Complete operation can be hooked to central control desk
ix) Biological selector zone

The incorporation of a biological SELECTOR in the front end of the SBR distinguishes it from all other technologies. The raw effluent enters the SELECTOR Zone where ANOXIC MIX conditions are maintained. Part of the treated effluent along with return sludge from the aeration Basin is recycled here using RAS Pumps. As the microorganisms meet high BOD & low DO condition in the SELECTOR, natural selection of predominantly floc-forming microorganisms takes place. This is very effective in containing all of the known low F/M bulking microorganisms, eliminates problems of bulking and sludge foaming. This process ensures excellent settling characteristics of the bio sludge. Sludge volume index (SVI) of treated effluent of less than 120 is achieved in all seasons.

Also due to the anoxic conditions in the SELECTOR Zone, de-nitrification and phosphorous removal occurs in case the Ammonical nitrogen and phosphorous levels are high in the effluent. The figure below shows the experience with SVI developments in parallel operations with a wastewater that traditionally favours sludge.

x) Dissolved oxygen control

The SBR Process uses measurement of Dissolved Oxygen (DO) levels in the Basin to enhance treatment efficiency and optimise power consumption. The DO concentration in the Basin is continuously monitored using a DO Sensor. Once DO level is measured in the Basin, a Variable

Frequency Drive automatically alters the RPM of Aeration Blower to maintain desired DO levels in the Basin. This methodology provides a true in-basin method for the efficient use of energy.

vii. Decanter assembly

The clean supernatant is removed from the Basin using a Decanter assembly complete in stainless steel construction. During decanting, there is no inflow to the Basin. The moving weir DECANTER is motor driven and travels slowly from its "PARK" position to a designated bottom water level. Once the Decanting phase sets in, the Decanter automatically lowers to the required bottom level. Variable frequency drives are provided to control the rate of movement of the Decanters. After the required level of supernatant is removed, the Decanter is returned to its "park" position through reversal of the drive. The Basin is now ready for the next cycle to begin.

viii. Operational simplicity - fully PLC based intelligent control

The complete SBR plant operation is controlled automatically through a PLC system, which is a major factor in reducing Operating Costs. This also prevents mal operation of the various set process parameters within the plant. All key functions like sludge recycling, sludge wasting, aeration intensity, cycle time control and decanting rate etc. are automatically controlled as well as data logged. Complete historical records of plant operation are available on touch of a button.

ix. Sludge dewatering system

Sludge dewatering system shall consist of the following:

- Sludge sump and pump house
- Centrifuge & Polyelectrolyte dosing system

A Sludge Sump and Pump House are provided for collection and transfer of sludge from SBR Reactors to the Centrifuge for dewatering. Polyelectrolyte Dosing System comprising Solution Preparation Tanks with Agitators and Dosing Pumps shall be provided to enhance the dewatering efficiency of Centrifuge.

The dewatered sludge shall be transported in trucks for disposal to sanitary landfills or for use as manure on agricultural land.

The filtrate from the centrifuge shall be recycled to the Receiving Chamber.

x. Chlorination system

A chlorination system is provided to meet the faecal Coli form standards. Chlorination System includes mainly two units namely Chlorine Contact Tank and Chlorination system.

- Chlorine contact tank

In chlorine contact tank, actual disinfection of treated wastewater shall take place by keeping water in contact with chlorine.

- Chlorination system

Chlorination will be carried out by dosage of Chlorine with all accessories.

4. Design Considerations:

a. Flow Equalization:

- **Equalization Tank:** Sized to buffer fluctuations in influent flow and quality.

b. SBR Process Design:

- **Cycle Time:** Total cycle time typically ranges from 4 to 12 hours, depending on influent characteristics and effluent quality requirements. A common cycle includes:

  - **Fill:** 0.5-2 hours
  - **React:** 2-6 hours
  - **Settle:** 0.5-2 hours
  - **Decant:** 0.5-2 hours
  - **Idle:** Variable, to accommodate inflow variability
- **Number of Reactors:** Typically, 2-4 reactors to ensure continuous treatment.
- **Reactor Volume:** Calculated based on the influent flow rate and cycle time.

c. Aeration and Mixing:

- **Aeration System:** Provide sufficient oxygen transfer for biological processes, typically using fine bubble diffusers or mechanical aerators.
- **Mixing:** Ensure complete mixing during the fill and react phases to maintain uniform conditions.

d. Sludge Handling:

- **Waste Sludge:** Regularly remove excess sludge to maintain desired MLSS (Mixed Liquor Suspended Solids) concentration.
- **Sludge Storage:** Provide storage and handling facilities for waste sludge before disposal or further treatment.

e. Control System:

- **Automation:** Use PLC (Programmable Logic Controller) systems for cycle management, including filling, aeration, settling, decanting, and sludge wasting.
- **Sensors:** Include sensors for DO (Dissolved Oxygen), MLSS, pH, and ORP (Oxidation-Reduction Potential) for process monitoring and control.

5. Design Calculations:

a. Reactor Volume Calculation:

- Volume (V): $V = \frac{Q \times t_{\text{cycle}}}{N}$
  - Q: Influent flow rate (m^3/day)
  - t_{cycle}: Cycle time (hours)
  - N: Number of reactors

b. Aeration Requirements:

- **Oxygen Demand (OD):** Calculate based on influent BOD and ammonia concentrations.
- **Aeration Rate:** Determine the aeration rate to meet OD, considering oxygen transfer efficiency.

c. Settling and Decanting:

- **Settling Time:** Ensure adequate settling time to achieve desired effluent clarity.
- **Decanting Volume:** Decant volume should match the influent flow rate, adjusted for cycle time and reactor volume.

The drawings related to STP are provided in the drawing annexure.

4.24 Design Basis report for Solid Waste Management

Scope

The main purpose of this section is to plan a comprehensive solid waste management system for the proposed project. This includes an integrated system for the collection, transportation, and final disposal of solid waste.

Major Sources of Solid Waste Generation

The Solid waste generation inside the site would be mainly from the following sectors:

- E-Waste: This covers discarded electronic devices and components from the premises.
- Municipal Solid Waste: This category includes waste collected from public areas such as internal streets and gardens, as well as waste from the office workspace, kitchen and dining areas.
- The Solid waste generated can further be categorized according to their nature into various categories as mentioned in the following Table below.

Table 48: Solid waste types & Sources for IMLH

Types of Waste	Nature of Waste	Source of water generation
Bio-degradable	Fruit and vegetable peels, food leftovers, bones, meat, eggshells, office floor sweeping, green waste, landscape waste	Kitchen, dining, and landscape
Recyclable	Paper, cardboard, and bottles	Office
Soiled waste	Blood-stained cottons, sanitary napkins	Toilet
Domestic hazardous waste & toxic waste	Medication, e-waste, paints, chemicals, light bulbs, fluorescent tubes, spray cans, fertilizer and pesticide containers, batteries, shoe polish.	Office, utility, accommodation, terminal buildings
Inert waste	Construction and demolition waste, ashes, dirt, rocks, debris	During construction & renovation work

Municipal Solid Waste Generation

To plan, design, and operate a solid waste management system, understanding the quantity, composition, and characteristics of the generated waste is essential. This project will use guidelines from NEERI (2005), CPHEEO Manual (2016), and the National Building Code (NBC) (2016) to estimate the volume and composition of Municipal Solid Waste (MSW) generated. Standardized rates from these guidelines will determine MSW generation per capita or per unit area. The total projected quantity of MSW will be calculated based on these rates and the projected population or area of each category, as depicted in Table below.

Table 49: Municipal solid waste generated as per the guidelines

Per capita waste generation*	210	gm/capita/day
Green space	12.15	kg/acre/day
Roads	4.10	kg/acre/day

Source: As per Table 1.5, SWM 2016 (Part 2)

The estimated quantity of municipal waste generated from the IMLH site is given in Table below:

Table 50: Quantity of municipal waste generated from IMLH

IMLH – Haryana – Land use Statement						Population Estimation (No.)				Solid Waste Generation (Kg/day)				
S.No	Particulars	Area in Sqm	Area in Acres	Area in Hectares	In %	Proposed Floor Space Index (FSI)	Population Density (Sqft Per Person)	Population Density (Sq.m Per Person)	Population (No.)	Solid Waste Generation Basis	Unit	Total Solid Waste Generation (Kg/day)	Total Organic Waste (Kg/day)	Total Inorganic Waste (Kg/day)
1.0	Total site area (a)	1653868.43	408.68	165.39	100.00%									
2.0	Railway lines, station and related areas (b)	377127.06	93.19	37.71	22.80%									
3.0	Approach 60m wide road ©	52041.84	12.86	5.20	3.15%									
4.0	Irrigation canal (d)	22257.3051	5.50	2.23	1.35%									
5.0	Irrigation canal buffer ©	37013.25	9.15	3.70	2.24%									
6.0	Additional land to be acquired for road extension (f)	380.35	0.09	0.04	0.02%									
7.0	Net planning area (g=a-b-c-d-e+f)	1165809.32	288.08	116.58	70.49%									
A) EXIM Zone														
8.0	Container yard/open storage, support services, toilet	106560.51	26.33	10.66	9.14%	0.5	2000	185.806	574	210.00	gm/capita/day	120.4	72.3	48.2
9.0	Bonded warehouse, toilet	34155.34	8.44	3.42	2.93%	0.5	2000	185.806	184	210.00	gm/capita/day	38.6	23.2	15.4
10.0	Customs office	4673.37	1.15	0.47	0.40%	0.5	200	18.5806	252	210.00	gm/capita/day	52.8	31.7	21.1
11.0	Truck parking, toilet	19632.69	4.85	1.96	1.68%				50	210.00	gm/capita/day	10.5	6.3	4.2
12.0	Check post, weigh bridge & truck parking	15799.03	3.90	1.58	1.36%									
Subtotal of (A)		180820.94	44.68	18.08	15.51%									
B) Warehouse and Container yard area														
13.0	General warehouse and loading & unloading bay	36542.96	9.03	3.65	3.13%	0.5	3000	278.709	131	210.00	gm/capita/day	27.5	16.5	11.0
14.0	Cold storage warehouse and loading & unloading bay	12180.99	3.01	1.22	1.04%	0.5	3000	278.709	44	210.00	gm/capita/day	9.2	5.5	3.7
15.0	Oversized cargo	60747.84	15.01	6.07	5.21%	0.5	10000	929.03	65	210.00	gm/capita/day	13.7	8.2	5.5
16.0	Open storage (Automobile yard)	203901.85	50.39	20.39	17.49%	0.5	30000	2787.09	73	210.00	gm/capita/day	15.4	9.2	6.1
17.0	Laden container yard	25621.53	6.33	2.56	2.20%	0.5	3000	278.709	92	210.00	gm/capita/day	19.3	11.6	7.7
18.0	Empty container yard	29301.34	7.24	2.93	2.51%	0.5	10000	929.03	32	210.00	gm/capita/day	6.6	4.0	2.6
19.0	Equipment storage area	11824.86	2.92	1.18	1.01%	0.5	10000	929.03	13	210.00	gm/capita/day	2.7	1.6	1.1
20.0	C & D Yard	9486.50	2.34	0.95	0.81%	0.5	10000	929.03	10	210.00	gm/capita/day	2.1	1.3	0.9
21.0	Repair store	11019.94	2.72	1.10	0.95%	0.5	3000	278.709	40	210.00	gm/capita/day	8.3	5.0	3.3
22.0	Maintenance yard	12632.99	3.12	1.26	1.08%	0.5	3000	278.709	45	210.00	gm/capita/day	9.5	5.7	3.8
23.0	Scrap handling yard	23187.59	5.73	2.32	1.99%	0.5	5000	464.515	50	210.00	gm/capita/day	10.5	6.3	4.2
Subtotal of (B)		436448.39	107.85	43.64	37.44%									
C) Amenities														
24.0	Admin	4945.14	1.22	0.49	0.42%	0.5	200	18.5806	266	210.00	gm/capita/day	55.9	33.5	22.4
25.0	Fuel station	5728.02	1.42	0.57	0.49%	0.5	500	46.4515	123	210.00	gm/capita/day	25.9	15.5	10.4
26.0	Poly clinic	4537.24	1.12	0.45	0.39%	0.5	200	18.5806	244	210.00	gm/capita/day	51.3	30.8	20.5
27.0	Food court	2303.23	0.57	0.23	0.20%	0.5	200	18.5806	124	210.00	gm/capita/day	26.0	15.6	10.4
28.0	Office spaces, Bank, ATMs	3228.72	0.80	0.32	0.28%	0.5	200	18.5806	174	210.00	gm/capita/day	36.5	21.9	14.6
29.0	Commercial plot	39437.30	9.75	3.94	3.38%	0.5	200	18.5806	2122	210.00	gm/capita/day	445.7	267.4	178.3
30.0	Truck parking, toilet	16989.73	4.20	1.70	1.46%				50	210.00	gm/capita/day	10.5	6.3	4.2
Subtotal of (C)		77169.39	19.07	7.72	6.62%									
D) Centralized Infrastructure zone														
31.0	Utilities	162708.86	40.21	16.27	13.96%									
31.1	Substation 1	36498.21	9.02	3.65	3.13%				10	210.00	gm/capita/day	2.1	1.3	0.8
31.2	Access to Substation 1	5339.05	1.32	0.53	0.46%									
31.3	Substation 2	7557.41	1.87	0.76	0.65%				10	210.00	gm/capita/day	2.1	1.3	0.8
31.4	Water utilities 1	82495.91	20.39	8.25	7.08%				10	210.00	gm/capita/day	2.1	1.3	0.8
31.5	Water utilities 2	23099.62	5.71	2.31	1.98%				10	210.00	gm/capita/day	2.1	1.3	0.8
31.6	Sewage Treatment Plant (STP) / Solid Waste Management (SWM)	7718.65	1.91	0.77	0.66%				15	210.00	gm/capita/day	3.2	1.9	1.3
32.0	Road	149345.68	36.90	14.93	12.81%									
32.1	45m wide road	9939.81	2.46	0.99	0.85%	Requirement = 0.73 m3/ acre of non-potable water for Roads, Greens and other infrastructure				12.50	kg/acre/day	30.7	18.4	12.3
32.2	30m wide road	27199.97	6.72	2.72	2.33%					12.50	kg/acre/day	84.0	50.4	33.6
32.3	30m wide road with 15m wide carriage way and 15 m extension including additional land which is to be acquired	13043.68	3.22	1.30	1.12%					12.50	kg/acre/day	40.3	24.2	16.1
32.3	24m wide road	76308.49	18.86	7.63	6.55%					12.50	kg/acre/day	235.7	141.4	94.3
32.4	18m wide road	19971.21	4.93	2.00	1.71%					12.50	kg/acre/day	61.7	37.0	24.7
32.5	12m wide road	2882.53	0.71	0.29	0.25%					12.50	kg/acre/day	8.9	5.3	3.6
33.0	Green	159316.05	39.37	15.93	13.67%									
33.1	Peripheral green	80161.45	19.81	8.02	6.88%	Requirement = 0.73 m3/ acre of non-portable water for Roads, Greens and other infrastructure				12.50	kg/acre/day	247.6	148.6	99.0
33.2	Green areas between zones	37543.21	9.28	3.75	3.22%					12.50	kg/acre/day	116.0	69.6	46.4
33.3	Land which is to be merged with Future expansion	41611.39	10.28	4.16	3.57%					12.50	kg/acre/day	128.5	77.1	51.4

IMLH – Haryana – Land use Statement						Population Estimation (No.)				Solid Waste Generation (Kg/day)				
S.No	Particulars	Area in Sqm	Area in Acres	Area in Hectares	In %	Proposed Floor Space Index (FSI)	Population Density (Sqft Per Person)	Population Density (Sq.m Per Person)	Population (No.)	Solid Waste Generation Basis	Unit	Total Solid Waste Generation (Kg/day)	Total Organic Waste (Kg/day)	Total Inorganic Waste (Kg/day)
Subtotal of (D)		471370.60	116.48	47.14	40.43%									
Total		1165809.32	288.08	116.58	100.00%				4812			1963.98	1178.39	785.59

Thus, the total municipal solid waste generated from the proposed project is 1963.98 kg per day. The total organic and inorganic waste generated are given in the Table below.

Table 51: Categories of waste generated

Category	Waste in Kg
Organic waste	1178.39
Inorganic waste	785.59
Total waste generated	1963.98

Municipal Solid Waste Management System

A structured solid waste management system is essential for protecting public health and safety. Effective systems should be environmentally and economically sustainable, emphasizing waste reduction, reuse, and recycling to minimize landfill use, conserve resources, and reduce pollution. Implementing cost-effective solutions for collection, treatment, and infrastructure, and exploring revenue generation through recycling or waste-to-energy initiatives, are essential. By focusing on sustainability, solid waste management can promote a healthier environment. Effective systems may include:

i. **Source segregation** – biodegradable and recyclable waste (Wet and dry waste).
ii. Recover usable materials like paper, glass, and metals through sorting.
iii. Sweep and collect debris from roadways.
iv. The Collected organic and Inorganic waste transported for disposal through corporation.

Segregation of Waste

The process of categorizing municipal solid waste into recyclables, inorganic, and organic materials is known as segregation. Solid waste segregation is the initial stage of managing solid waste. Waste should be separated at the point of generation as much as possible. Every waste generation point, from premises, will have both wet and dry garbage collected separately apart from E-waste and hazardous waste.

Facility management teams will provide information on waste segregation at the point of generation and take necessary actions to ensure compliance at all levels. According to the Municipal Solid Wastes (Management and Handling) Rules, 2016, waste generators are responsible for ensuring garbage is delivered in accordance with the collection and segregation system and for preventing littering. Therefore, every individual should ensure that waste is not mixed, and that biodegradable and recyclable materials are separated properly.

Collection and Transportation of solid waste

According to the Municipal Solid Wastes (Management and Handling) Rules of 2016, the collection of municipal solid waste shall be implemented to avoid littering and assure compliance. This can be accomplished by, central bin collection, or collection at scheduled times.

Given that the project is an office building, a systematic waste management system shall be implemented. Wet and dry garbage shall be meticulously separated by the sweeper during the daily collection cycles. These wastes are then sorted and placed into designated bins or containers. This well-structured approach ensures effective waste segregation and encourages a cleaner, greener workspace.

The effective implementation of a waste management system relies on several key steps involved in waste collection, and that are:

i. Separating solid waste at the source is the fundamental principle of waste management. Solid waste should be separated as much as possible at the source, depending on the type of waste.
ii. Garbage should be separated using color-coded bins. At TIDEL IT Park, separate containers shall be available for dry and wet garbage.
iii. Green garbage is biodegradable, while blue or yellow waste is non-biodegradable.
iv. As required, the bins must be color-coded and shall have the required primary and secondary collection capacities

v. The storage capacity of bin shall be determined to ensure it can accommodate all the waste produced on-site within a single day.

vi. The waste storage system comprises two tiers. As specified, the bins shall be placed within the structures or near the trash generation source. Each facility utilizes the bins for primary collection, after which the garbage is transferred to the secondary collecting bins for storage. Subsequently, transport the waste to the waste handling unit.

vii. Each zone will feature a designated bin area, serving as the main collection point, capable of accommodating the waste generated within the building for at least a single day. This area, utilizing distinct bins for each category of garbage, will facilitate initial waste segregation.

viii. A solid waste collection crew will empty the main collection bins in each zone. Collection activities shall be scheduled outside of busy times to minimize inconvenience. The waste shall be gathered by the collection service using communal collection bins. Subsequently, the waste shall be handed over to the municipal corporation to the central waste processing plant.

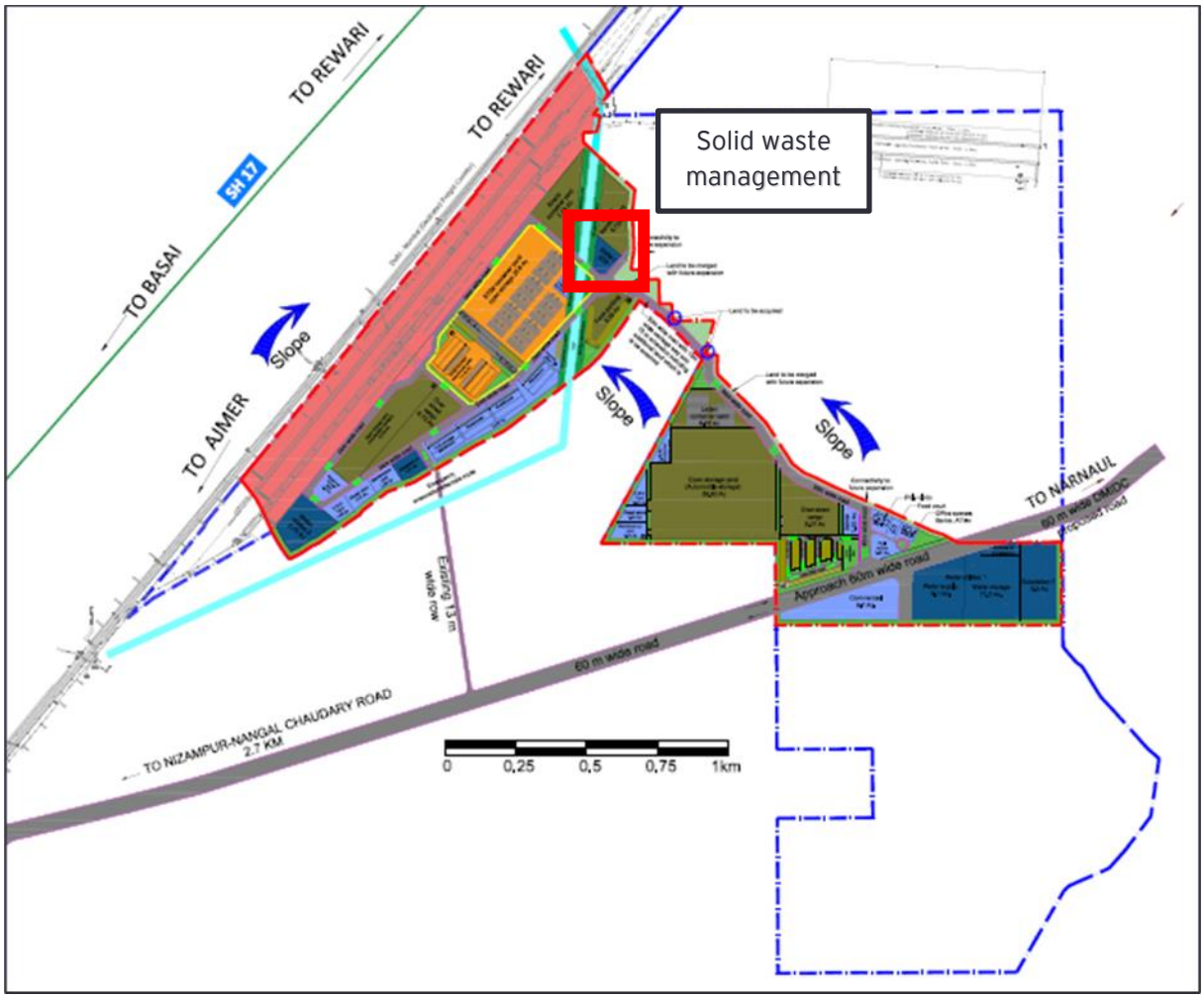
Maintaining Clean Roads and Walkways:

Implementing daily sweeping of all roads to remove debris and maintaining cleanliness. Placing color-coded litter bins strategically along roadsides and walkways, with bins located at appropriate distance depending on the location, for efficient waste collection. These bins will be clearly marked for biodegradables (green) and recyclables (blue) to encourage proper waste separation. Gathered waste shall be handed over to the municipal corporation which shall transfer the waste to the central waste processing plant.

Treatment of Bio-Degradable Waste

The collected organic bio-degradable waste from the development is collected and transferred to the treatment plant. Organic Waste Converter (OWC) is suggested for the collected organic waste inside the premises. The location of Solid Waste Management in depicted in below in Figure below:

Figure 57: Location of Solid waste management



Organic waste converter

The Organic Waste Converter (OWC) is a sophisticated machine designed to efficiently decompose organic waste into compost through a controlled process of aerobic decomposition. Unlike traditional methods of composting, which often require significant space, time, and manual labour, OWCs offer a compact, automated, and accelerated solution. These machines are equipped with shredders, mixers, heaters, and aeration systems, creating an optimal environment for microbial activity to break down organic matter effectively. Moreover, the production of high-quality compost presents revenue-generating opportunities through its sale to farmers, landscapers, and gardening enthusiasts.

1000-Kg capacity of OWC is proposed initially to handle -1178kg of wet waste generated as part of IMLH development. The tentative area, utility, cost requirements for organic waste converter of capacity 1,000 Kg is given in the Table below.

Table 52: Area Utility and Cost Requirement for Organic Waste Treatment for Capacity = 1000 kg/day.

Parameters	Organic Waste Converter
Capacity of OWC unit	1000 Kg/day
Area required for complete SWM facility	200 m2
End Product	Manure -350 – 400 kg/ day

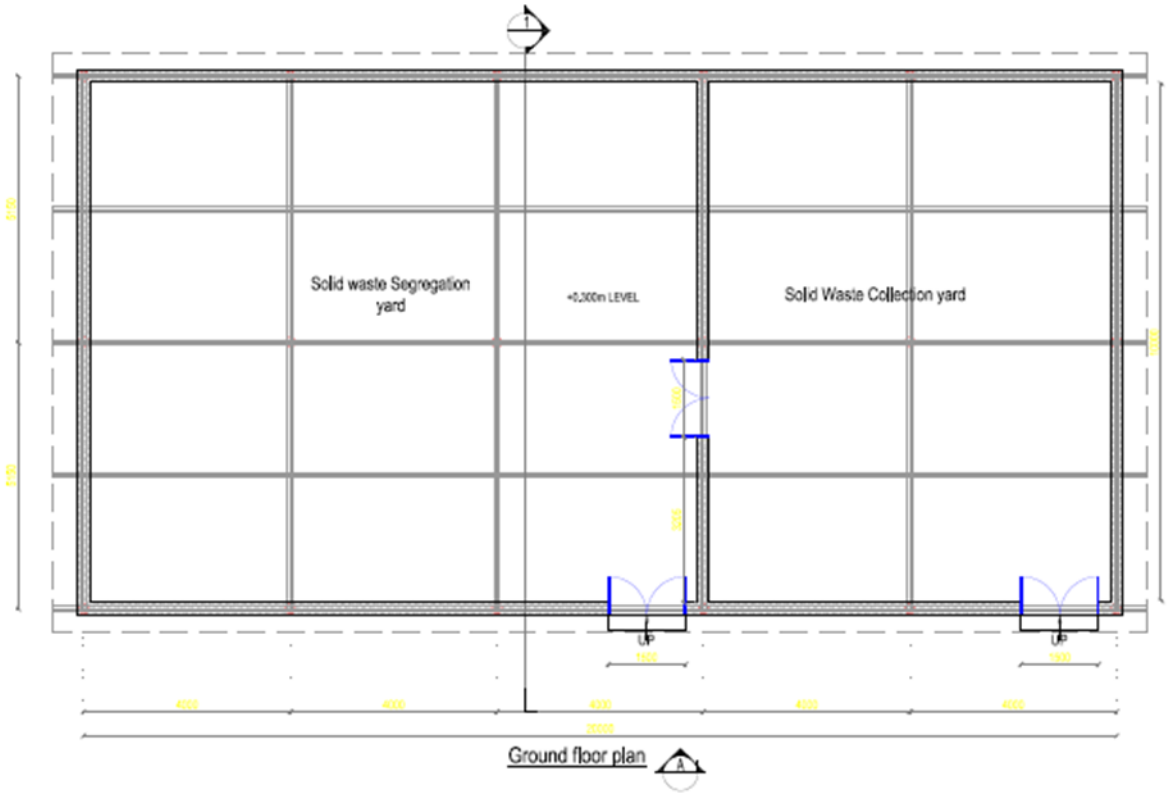
As per the analysis above, the organic waste generated inside the development (Phase 1) is low, since the recycling efficiency is 100% from the organic waste converter, the proposed development can also comply with IGBC and

other statutory norms. The End product from the organic waste converter (Manure) can generate revenue by selling them to vendors, farmers and can be used for landscaping inside the premises.

Collection and Segregation of Non-Biodegradable Waste

The inorganic waste collected inside the premises is transferred to the segregation platform. Figure below illustrates the Ground floor plan of the Solid Waste Management.

Figure 58: Ground floor plan of Solid waste management



Segregation of non-biodegradable waste

Non-biodegradable waste from the premises such as plastic bottles, plastic cover, paper, glass, scrap metals and others. Firstly, they are collected from the central bin collection and then transferred to the segregation platform. In the segregation platform the waste is separated into categories.

The plastic waste, glass, scrap metals, and papers are given to the secondary vendors, these vendors will collect the waste at the respective collection point. The inert material from the segregation is stored and disposed to the municipal landfills.

E-waste

Anticipating the generation of electronic waste (e-waste) in IMLH's commercial areas, a comprehensive plan will be implemented in accordance with the E-Waste (Management & Handling) Rules, 2016, to manage and handle this e-waste efficiently.

E-waste will undergo either trading with suppliers for reconditioned equipment or recycling by approved processors. If quick recycling or reuse is not feasible, e-waste will be safely stored in designated areas until appropriate disposal can be arranged. The collection and environmentally responsible management of e-waste will be outsourced to authorized recyclers. To monitor all types of garbage produced in the site, including e-waste, an inventory system will be established to ensure proper reporting and management.

Conclusion:

A solid waste management system is essential for establishing a safe and healthy environment for residents. This system will include several key elements:

i. Waste Segregation: Implementing processes to separate waste at the source into categories such as recyclables, organic waste, and non-recyclables.
ii. Collection Infrastructure: Establishing efficient collection mechanisms, including scheduled pick-ups and designated collection points, to gather waste from the IT Park.
iii. Transportation: Ensuring the proper transportation of waste from collection points to processing or disposal facilities, using suitable vehicles and logistics.
iv. Disposal: Safely disposing of waste that cannot be recycled or reused, using methods such as landfilling or incineration while adhering to environmental regulations.
v. Recyclable materials will be regularly collected and delivered to reputable recycling vendors according to a set schedule (weekly or monthly) determined by volume. This approach reduces dependence on virgin resources and fosters the principles of a circular economy.

Through the integration of these components into a comprehensive solid waste management system, communities can alleviate environmental risks, minimize pollution, and improve the overall quality of life for residents.

Drawings related to solid waste management are provided in drawing Annexure.

5 Estimated Project Cost

5.1 Estimated Project Cost for IMLH Project[17]

Based the market assessment and the master plan, we have assessed the base cost of the requisite infrastructure proposed at the site as part of the overall development of the IMLH Project. The cost breakdown is provided in the table below.

Table 53: Block Cost Estimates (for IMLH)

S. No		Infra Works	Unit	Quantity	Cost in Lakhs	Amount in Crore	
						Phase 1	Phase 2
I	**Cost of land**					0.00	0.00
	1	Processing area	Ha	116.58		0.00	0.00
	2	Non processing area	Ha	0.00		0.00	0.00
II	**Site grading**					29.97	20.70
	3	Considered area	Ha	116.58	43.46	29.97	20.70
III	**Compound wall, fencing and gates**					5.74	0.00
	4	Compound wall	RM	5,108.00	0.11	5.62	0.00
	5	Fencing all round	RM	1,800.00	0.01	0.13	0.00
IV	**Roads, RCC Pavements, paver blocks, culverts & drainage**					144.45	106.46
	6	Road carriageway & median along with foot path	RM	6,094.00	0.39	14.15	9.48
	7	Foot path and plot entry culvert	RM	6,094.00	0.08	2.76	1.85
	8	Drains, culvert and Bridge	RM	12,188.00	0.34	24.60	16.49
	9	Heavy duty paver for RTG and Container yard				0.00	0.00
	10	Heavy duty paver block for Loading & unloading area and empty container yards		5,54,440.62	0.03	102.95	78.63
V	**Decentralized water supply, treatment and distribution**					4.92	0.85
	11	Water supply network	RM	12,188.00	0.02	1.27	0.85
	12	Underground sump with pumps (including fire demand)	CUM	990.00	0.23	2.28	0.00
	13	Overhead service reservoir	CUM	123.00	0.34	0.42	0.00
	14	Pump house	SQM	60.00	0.36	0.21	0.00
	15	Water Treatment Plant	MLD	0.37	199.96	0.74	0.00
VI	**Electrical, street lighting & fire fighting**					45.50	17.09
	16	Internal power distribution	KM	6.67	404.67	16.15	10.83
	17	Distribution transformers	Nos	18.00	41.96	4.52	3.03
	18	AIS based 132/33/11 kv substation	Nos	1.00	2,000.00	20.00	0.00
	19	Streetlight & Area lighting	KM	9.48	55.50	3.15	2.11
	20	Roof top solar PV power plant	mW	8.00	0.00	0.00	0.00
	20	Fire hydrants	Nos	122.00	2.30	1.68	1.13
VII	**Telecom & communication systems**					0.00	0.00
	21	Telecom duct	RM		0.00	0.00	0.00
VIII	**Sustainable infrastructure elements, RW harvesting, summer storage tank & greenery**					1.34	0.88
	22	Percolation pits	Nos	122.00	0.20	0.15	0.10
	23	Landscape	Sqm	7,965.80	0.01	0.30	0.18
	24	Greenery along the road	RM	12,188.00	0.00	0.20	0.13

[17] Costs have been estimated as per the rates published by Central Public Works Department

S. No		Infra Works	Unit	Quantity	Cost in Lakhs	Amount in Crore	
						Phase 1	Phase 2
	25	Smart elements	LS	1.00	116.58	0.70	0.47
IX	**Decentralized wastewater, network and solid waste management**					14.41	0.54
	26	Sewerage Network	KM	6.09	22.18	0.81	0.54
	27	Sewage Treatment plant	MLD	0.61	500.00	3.04	0.00
	28	Solid Waste Management - Plant	TPD	3.02	350.00	10.56	0.00
X	**Buildings - industrial**					49.06	25.20
	29	Admin Building & customs	Sqm	1,939.00	0.90	17.43	0.00
	30	Truck maintenance depot	Sqm	710.00	0.21	1.49	0.00
	31	Toilet	Sqm	481.50	0.47	2.27	0.00
	32	Warehouse	Sqm	24,000.00	0.21	25.20	25.20
	33	Security cabin	Sqm	200.00	0.86	1.72	0.00
	34	Fire Pump House Including Pumps	Sqm	450.00	0.21	0.95	0.00
XI	**Buildings - Amenities**					1.05	12.05
	35	Ploy clinic	Sqm	1,500.00	0.35	0.00	5.25
	36	Food court	Sqm	642.00	0.35	0.00	2.25
	37	ATM & Bank	Sqm	1,300.00	0.35	0.00	4.55
	38	Security cabin	Sqm	100.00	0.35	0.35	0.00
	39	Weigh bridge control room	Sqm	200.00	0.35	0.70	0.00
XII	**Equipment cost for operation**					39.62	29.95
	Total infrastructure cost					**336.07**	**213.72**

Note: The above cost is estimated basis the schedule of rates as published by C.P.W.D. (2025)

Table 54: Equipment details

S. No	Equipment	Qty	Total amount in INR
1	Reach stacker	6	20,44,68,660
2	Weight scale x 1/100t capacity	1	18,27,065
3	Weight scale x 1/60t capacity	1	15,85,595
4	Forklift 2t Battery operated (with 4500 mm lift height)	6	1,00,74,226
5	Forklift 3t Battery operated (with 4500 mm lift height)	6	1,51,89,962
6	Reach truck 1.8 tones (with 6000mm mast height)	4	94,24,984
7	Tractor head	4	1,47,00,644
8	Chassis	4	82,74,199
9	Dock leveller	48	2,10,99,960
10	Hand pallet Truck (2.30 tonnes)	20	9,44,474
11	Pallet rack (20x2x6m)	300	13,82,29,857
12	Box Pallet	3,806	89,22,939
13	Wooden pallet	3,262	51,89,418
14	Plastic pallet	3,806	1,21,09,702
15	Weight scale 3 Tons	8	9,26,389
16	ERP	1	70,87,745
17	Bar Code System	4	8,61,749
18	Transmitter for bar code system -Wi-Fi for a single antenna point	4	5,16,782
19	Module security system	1	17,81,356
20	Container X-ray scanner	2	3,15,01,068
21	Fabrication & installation of Rack arrangement	24,000	20,09,52,000
	Total amount in INR Crore (for phase 1 and 2)		**69.57**

5.2 Construction Phasing

The concept of construction phasing varies with the entity and the type of option for executing the project, i.e. either Phase I & II or the entire area, which is represented as under in Table below:

Table 55: Construction Phasing for Phase I

Particular	Years										
	1	2	3	10	15	20	25	30	35	40	45
Construction Phase											
Operations Phase											

The project is proposed to be developed in 2 phases with a concession period of 45 years, includes the initial construction period of 2 years (for phase 1) for a rated capacity of 900,000 TEUs. Pursuant to completion of construction, the operations phase will start and the IMLH will be functioning (which is represented in the dark green colour in the above pictorial representation). The Concessionaire shall undertake the construction of phase 2 such that the Project Capacity shall have been augmented to 19,60,000 (nineteen lakhs and sixty thousand) TEUs on or before the earlier of (a) the 10th (tenth) anniversary of the Appointed Date and (b) the 1st (first) anniversary of the close of the Accounting Year in which the throughput has exceeded 80% (eighty per cent) of the existing Capacity of the IMLH.

The key responsibilities of the SPV will be to provide common user facilities such as water supply & elevated surface reservoir (ESR) construction, power / electricity supply, and such other allied infrastructure provision up to the IMLH site. Also to provide robust support to the private entity for overall development of the IMLH and assist in successful operations at the IMLH as and when required. Whereas the key responsibilities of the developer or the private entity will be to construct and develop the core infrastructure such as ICD, custom yard, warehouses, etc. and such other allied core infrastructure required for the smooth functioning of the facility.

The land will be licensed to the developer for a period of 45 years limited to IMLH operations only which shall include Container Yard, Bonded Warehouse, Domestic Warehouse, Reefer stack(s) and open storage, details as provided in the Concession Agreement.

The developer shall also be allowed, in terms of the provisions of the Concession Agreement, to utilise space for commercial development. As per the master plan, an area of ~10 acres are available for commercial exploitation.

CAPEX Phasing

Table 56: CAPEX Phasing

Financial year			
CAPEX Components	**Total**	**Phase 1**	**Phase 2**
	INR Crore		
Site Grading	50.7	30.0	20.7
Compound Fencing and Gates	5.7	5.7	-
Roads, Pavements, Paver blocks, Culverts & Drainage	250.9	144.5	106.5
Decentralized Water supply, Treatment and Distribution	5.8	4.9	0.9
Electrical, Street lighting & fire fighting	62.6	45.5	17.1
Sustainable infrastructure elements, RW harvesting, summer storage tank & greenery	2.2	1.3	0.9
Decentralized wastewater, network and solid waste management	15.0	14.4	0.5
Buildings - industrial	74.3	49.1	25.2
Buildings - Amenities	13.1	1.1	12.1
Equipment cost for operation	69.6	39.6	30.0
Base cost of the project	**549.8**	**336.1**	**213.7**
Contingencies & Pre-Operative Expense @ 2%	5.5	3.4	2.1
Total base cost of the project	**555.29**	**339.42**	**215.86**
Other costs – contingency, pre-operative expenses, escalation and interest during construction	209.98	56.39	153.6
Total estimated project cost	**765.27**	**395.81**	**369.46**

6 Project Structuring

6.1 Background

Encouraging private sector in implementation of infrastructure assets allows the Authority to concentrate on its core responsibility of delivering public services.

This chapter outlines the proposed project structure, in line with industry needs and requirements, and define roles and responsibilities between the Authority and the selected private developer cum operator. It also includes broad contour of the project structure adopted by central and/or state governments in implementing similar projects.

Design Build Finance Operate and Transfer (DBFOT) Structure

This is the preferred option wherein the private sector will be responsible to develop the requisite infrastructure facilities including but not limited to civil, equipment, plant and machinery for creating an integrate multi modal logistics hub. The private sector shall also be involved in operating and maintaining the entire project site for the concession period which shall be defined in the draft Concession Agreement. Under this structure, the private sector shall be required to form a special purpose vehicle (SPV) to implement the project.

Several central and state authorities have implemented/ in the process to implement similar projects across India. As a benchmark, we have tabulated several cases which reflect the most optimum project structure, as depicted in Table below.

Table 57: Benchmarks of similar projects in India

Parameter	MMLP Nashik	Chennai, Bengaluru, Anantpur, Indore & Nagpur	CWC 11 Locations	Model Document - NHLML	MMLP, Jogighopa
Executing Authority	National Authority of India (NHAI)	NHLML[18]	Central Warehousing Corporation		NHIDCL[19]
Mode of Execution	DBFOT	DBFOT	DBFOT	DBFOT	DBFOT
Estimated Project Cost (INR Crore)	336.55	For Nagpur ▸ Phase 1: 226.55 ▸ Phase 2: 183.60 ▸ Phase 3: 192.64	13 – 78	-	640.57
Tenure of Concession (Years)	45	45	45	45	45
Extension provisions		Max 10% of original concession period allowed subject to conditions.			NA
Project implemented through SPV, also any share of Govt in SPV	SPV, no share of Govt.				SPV, Share of GoI- 93.53% & GoAssam- 6.47%

[18] National Highways Logistics Management Limited
[19] National Highways and Infrastructure Development Corporation Limited

Parameter	MMLP Nashik	Chennai, Bengaluru, Anantpur, Indore & Nagpur	CWC 11 Locations	Model Document - NHLML	MMLP, Jogighopa
Construction Period (Years)	2	2	5		
Total Area (acre)	109.97	For Nagpur 230.97	2 – 15.28		317
Project Components (SoW)	▸ Development, Operation and Maintenance of MMLP. ▸ Also envisages various related and allied infrastructure facilities.		▸ Development, Operation and Maintenance of warehouse and various related and allied infrastructure facilities.	▸ Development, Operation and Maintenance of MMLP. ▸ Also envisages various related and allied infrastructure facilities.	
Bidding Parameter	Minimum Guaranteed Revenue Share (MGRS)		▸ Minimum Guaranteed Revenue Share ▸ • Selection shall be on the bidder quoting the highest revenue share. ▸ • Revenue share payable to Authority shall be max. of 5% or the quoted MGRS.	Minimum Guaranteed Revenue Share	NA
Revenue share moratorium period (years)	NA	3 years	From the commercial operations date[20]	3 years	

Source: EY Analysis

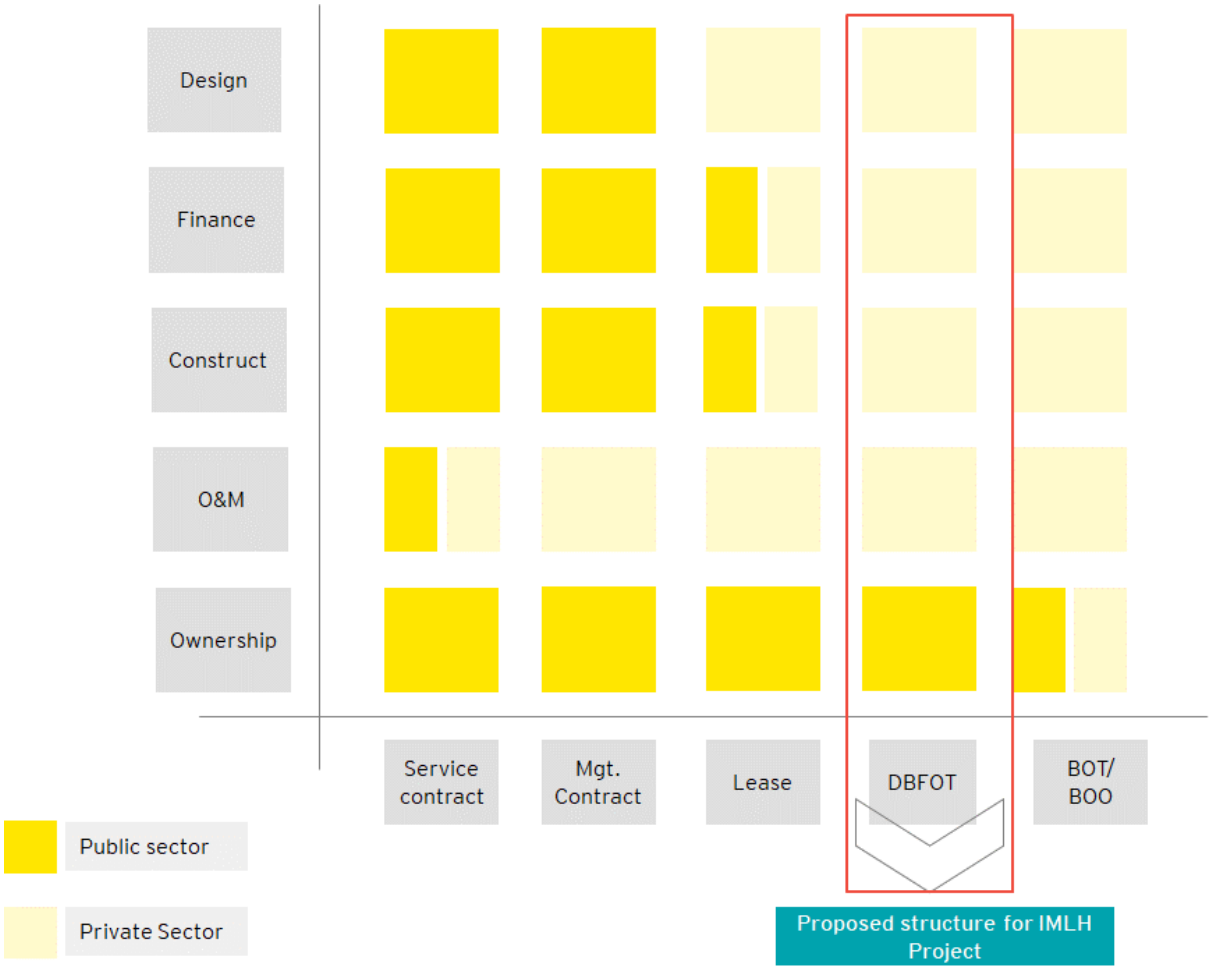
[20] Several site under CWC were of brownfield nature, hence the revenue share payable by the selected private operator was due with effect from the date of achieving the financial closure or the Appointed Date.

6.2 Proposed Project Structure

The PPP framework in India has evolved over a considerable period. There are several models based on which infrastructure projects have been implemented – primarily based on parameters like – vision of the project, objective, risk appetite of various stakeholders, maturity of the sector, financial and technical considerations etc.

The figure below elucidates the typical model and key responsibilities between the implementing authority and private sector for the proposed IMLH project.

Figure 59 *Responsibility Matrix of Authority and Private Operator*



The potential role allocation between the private sector and the concessioning authority is provided in the table below.

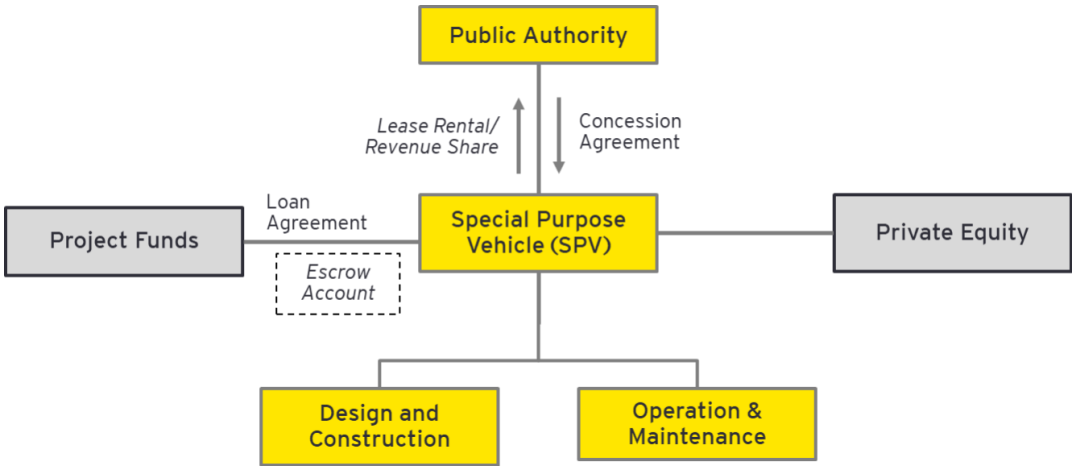
Table 58: Role allocation matrix between Government and Private Sector

SPV Concessionaire

S. No.	Project Component	Design	Built	Finance	Operate	Maintain
1	Land			SPV		
2	Land development and levelling for railway infrastructure	SPV	SPV	SPV		
3a	External connectivity of Road, Power and Water	SPV	SPV	SPV	SPV	SPV
3b	External connectivity of Rail (~7km spur line)	SPV	SPV	SPV		
4	Railway Yard including Platforms and Station & Ancillary Buildings	SPV	SPV	SPV		
5	Power Sub-station					
6	Boundary wall					
7	Site grading					
8	Buildings (industrial & amenities)					
9	Equipment					
10	Warehousing					
11	Commercial Area					
12	Other Capex Items (Paved Area, Landscaping, Utility (internal), Solid Waste Management, Sewage Treatment, Storm Drain and other Infrastructure)					

The proposed project structure is provided in the figure below.

Figure 60 *Diagrammatic representation of the project structure*

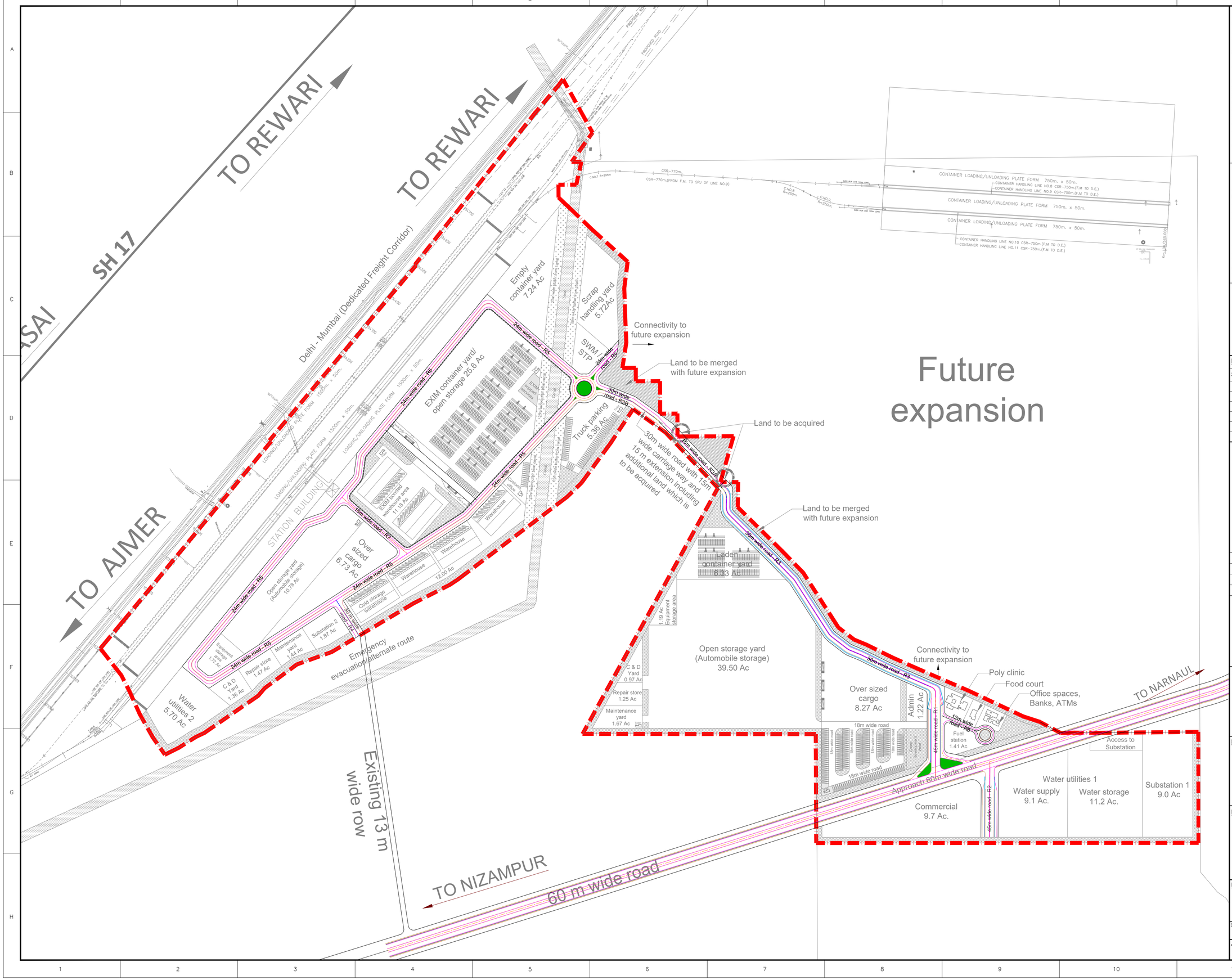


6.3 Key stakeholder for the Project

The key stakeholders relevant to the project will be:

- NICDC Haryana Multi Modal Logistic Hub Project Limited: The implementing authority, an SPV incorporated as a 50:50 joint venture of Government of India through National Industrial Corridor Development and Implementation Trust and Government of Haryana through Haryana State Industrial and Infrastructure Development Corporation for implementation of the Project.
- Private sector/ developer: to be selected for the project development through open competitive bidding process
- Project SPV: company formed for development and commercialisation of the project formed by single entity or consortium (selected private partner as above).

7 Technical Drawings



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Orientation:

North
W E
S

Road Length details:

Sl.No	Road category (ROW wise)	Length in m.
1	45m wide road	443.30
2	30m wide road	1070.81
3	24m wide road	3119.98
4	18m wide road	227.26
5	15m wide road	263.86
6	12m wide road	227.97

Rev	Description	Date

FOR APPROVAL PURPOSE ONLY

CLIENT :

National Industrial Corridor Development Corporation (NICDC)

PROJECT CONSULTANT :

ARTELIA
Passion & Solutions
ARTELIA CONSULTING ENGINEERS LTD.

PROJECT & LOCATION :

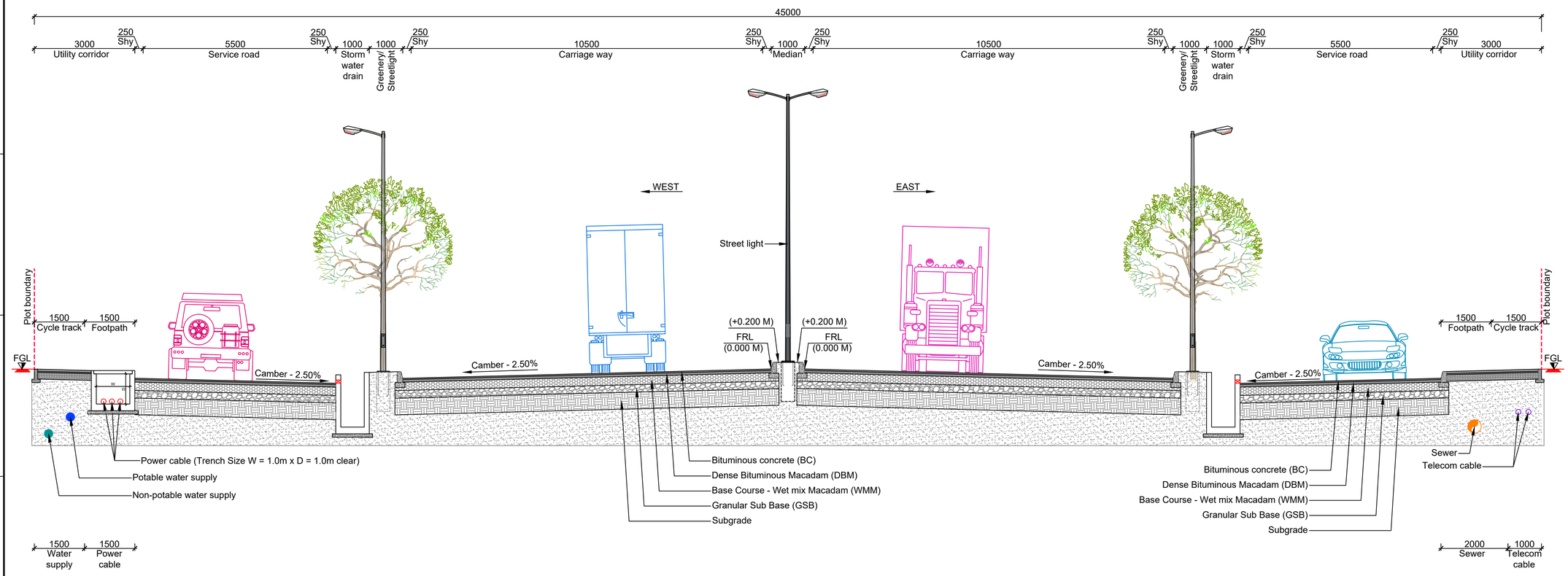
Multi Modal Logistic Hub Project (IMLH) Phase-1A, at Nangal Chaudhary

DRAWING TITLE :

Road Layout

Scale:	Date:	Rev:
NTS	11.09.2024	R0

Job No:	Drawing No:
P1063	ACE-P1063-IMLH-R001



TYPICAL CROSS SECTION OF 45M WIDE ROAD

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NOTES

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Rev	Description	Date

FOR APPROVAL PURPOSE ONLY

CLIENT :

National Industrial Corridor Development Corporation (NICDC)

PROJECT CONSULTANT :

ARTELIA Passion & Solutions
ARTELIA CONSULTING ENGINEERS LTD.

PROJECT & LOCATION :

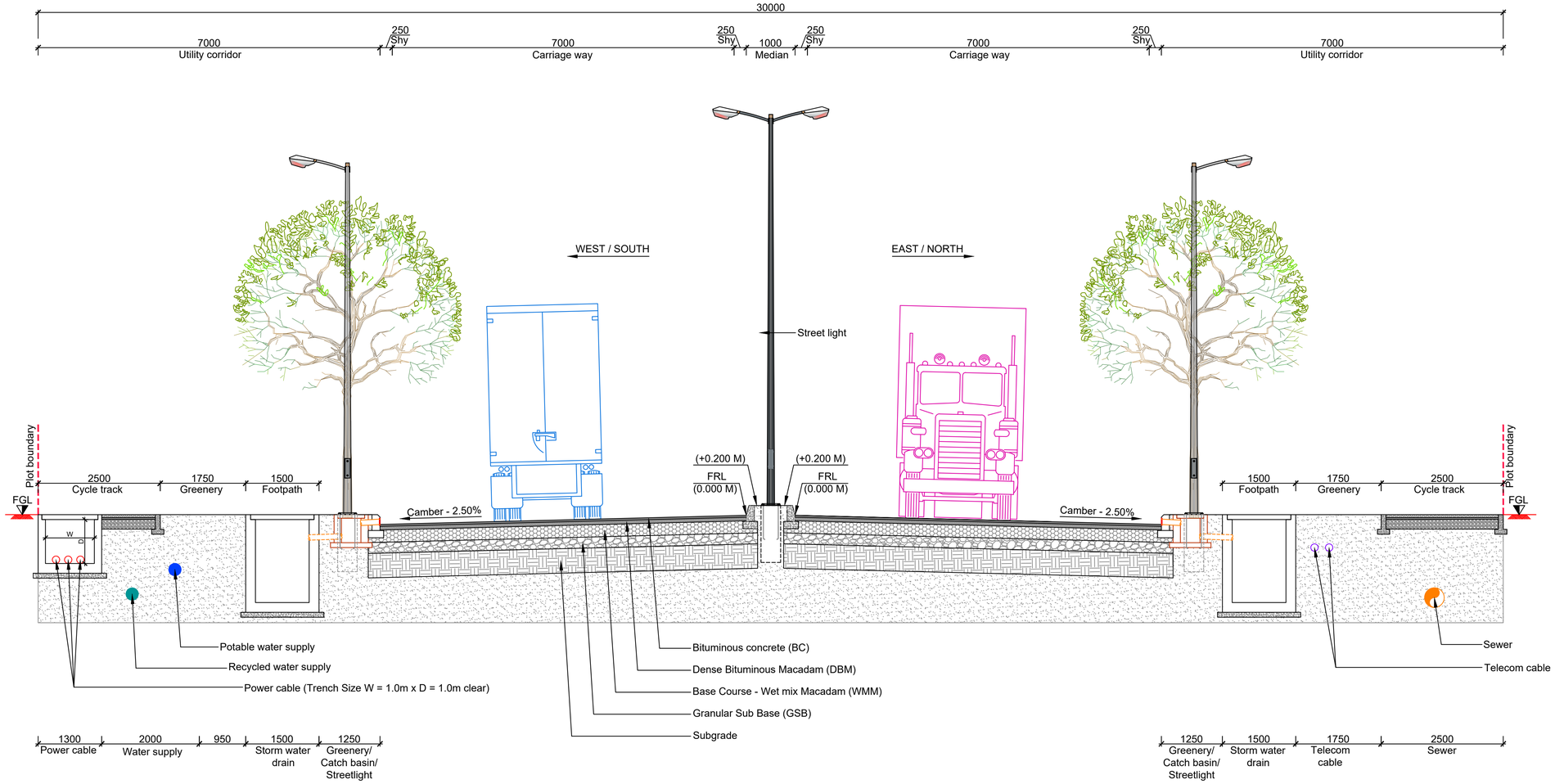
Multi Modal Logistic Hub Project (IMLH) Phase-1A, at Nangal Chaudhary

DRAWING TITLE :

Typical cross section of 45m wide road

Scale:	Date:	Rev:
NTS	11.09.2024	R0

Job No:	Drawing No:
P1063	ACE-P1063-IMLH-R002



TYPICAL CROSS SECTION OF 30M WIDE ROAD

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Rev	Description	Date

FOR APPROVAL PURPOSE ONLY

CLIENT :

National Industrial Corridor Development Corporation (NICDC)

PROJECT CONSULTANT :

ARTELIA
Passion & Solutions
ARTELIA CONSULTING ENGINEERS LTD.

PROJECT & LOCATION :

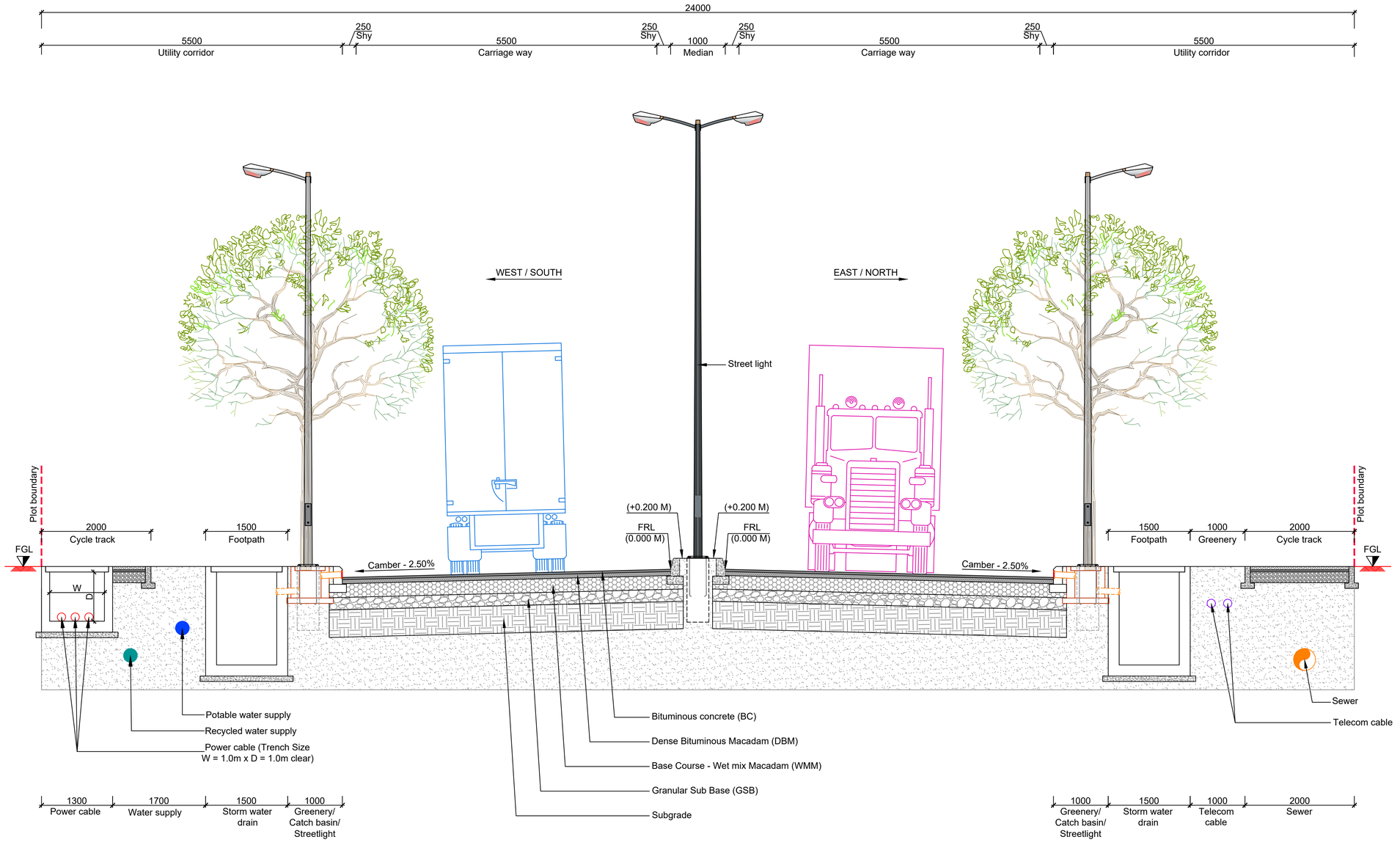
Multi Modal Logistic Hub Project (IMLH) Phase-1A, at Nangal Chaudhary

DRAWING TITLE :

Typical cross section of 30m wide road

Scale:	Date:	Rev:
NTS	11.09.2024	R0

Job No:	Drawing No:
P1063	ACE-P1063-IMLH-R003



TYPICAL CROSS SECTION OF 24M WIDE ROAD

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PROJECT CONSULTANT :

ARTELIA
Passion & Solutions
ARTELIA CONSULTING ENGINEERS LTD.

PROJECT & LOCATION :

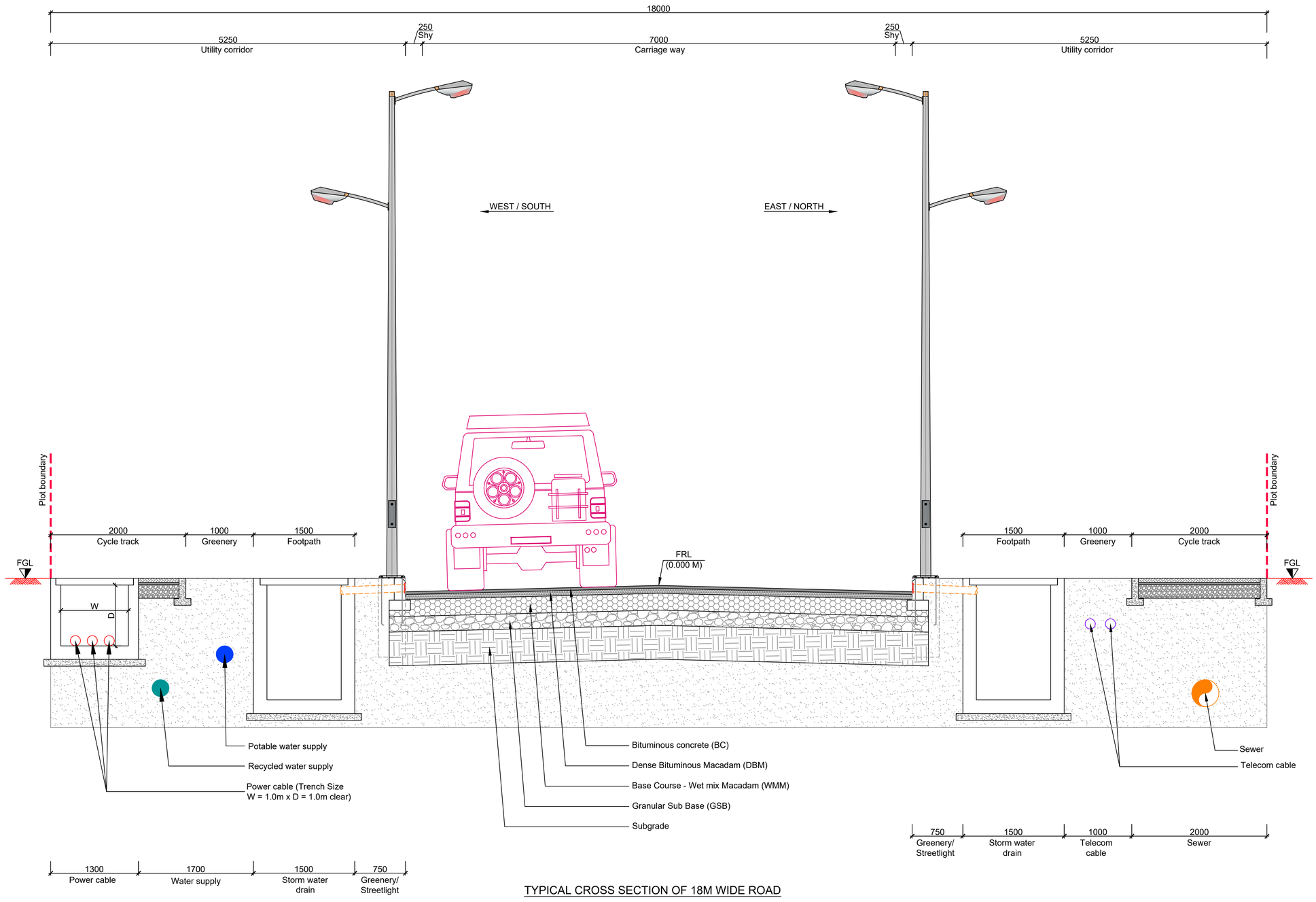
Multi Modal Logistic Hub Project (IMLH) Phase-1A, at Nangal Chaudhary

DRAWING TITLE :

Typical cross section of 24m wide road

Scale:	Date:	Rev:
NTS	11.09.2024	R0

Job No:	Drawing No:
P1063	ACE-P1063-IMLH-R004



TYPICAL CROSS SECTION OF 18M WIDE ROAD

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Rev	Description	Date

FOR APPROVAL PURPOSE ONLY

CLIENT :

National Industrial Corridor Development Corporation (NICDC)

PROJECT CONSULTANT :

ARTELIA
Passion & Solutions
ARTELIA CONSULTING ENGINEERS LTD.

PROJECT & LOCATION :

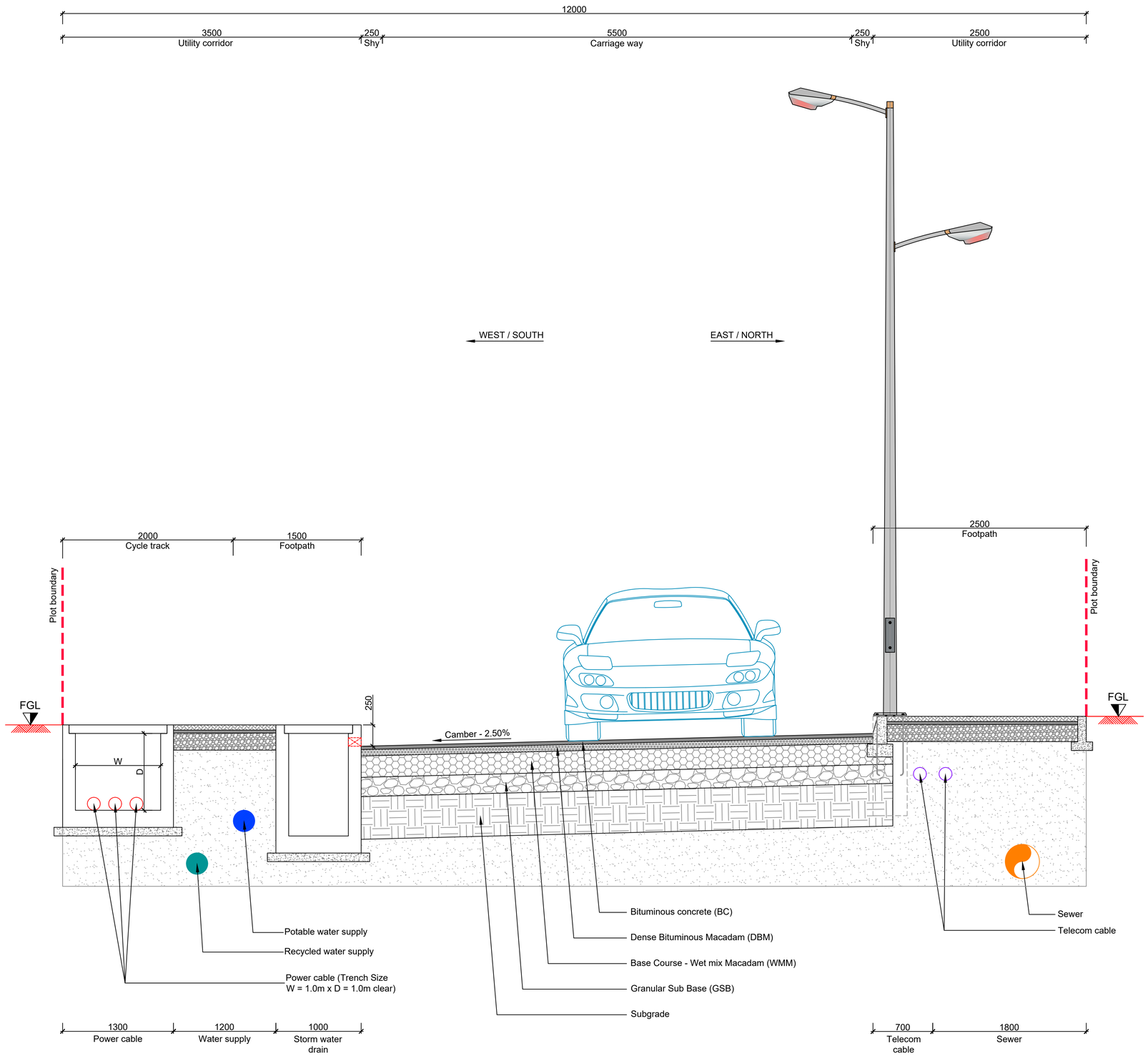
Multi Modal Logistic Hub Project (IMLH) Phase-1A, at Nangal Chaudhary

DRAWING TITLE :

Typical cross section of 18m wide road

Scale:	Date:	Rev:
NTS	11.09.2024	R0

Job No:	Drawing No:
P1063	ACE-P1063-IMLH-R005



TYPICAL CROSS SECTION OF 12M WIDE ROAD

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Rev	Description	Date

FOR APPROVAL PURPOSE ONLY

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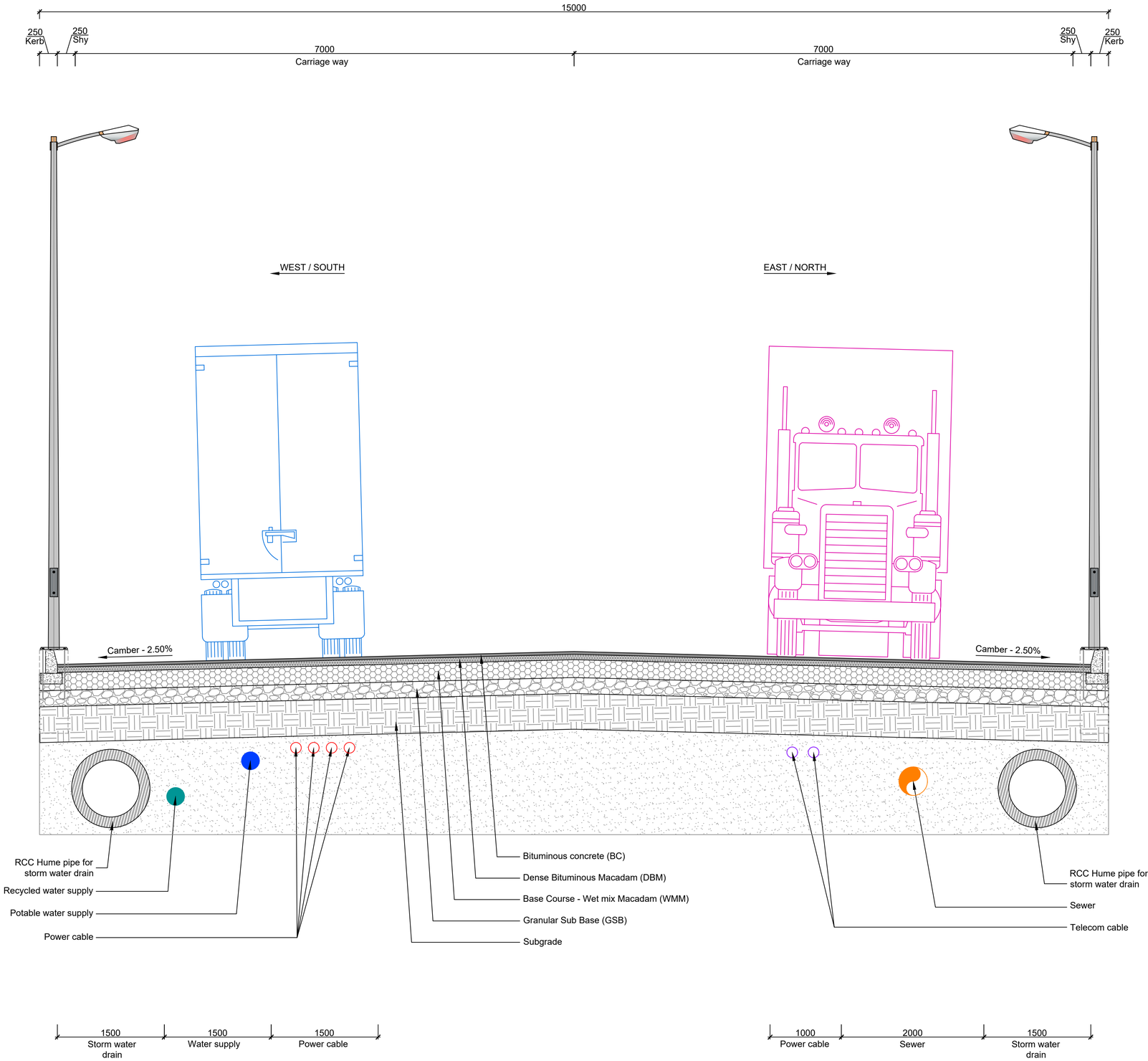
PROJECT CONSULTANT :
ARTELIA
Passion & Solutions
ARTELIA CONSULTING ENGINEERS LTD.

PROJECT & LOCATION :
Multi Modal Logistic Hub Project (IMLH) Phase-1A, at Nangal Chaudhary

DRAWING TITLE :
Typical cross section of 12m wide road

Scale:	Date:	Rev:
NTS	11.09.2024	R0

Job No:	Drawing No:
P1063	ACE-P1063-IMLH-R007



TYPICAL CROSS SECTION OF 15M WIDE ROAD

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Rev	Description	Date

FOR APPROVAL PURPOSE ONLY

CLIENT :

National Industrial Corridor Development Corporation (NICDC)

PROJECT CONSULTANT :

ARTELIA
Passion & Solutions
ARTELIA CONSULTING ENGINEERS LTD.

PROJECT & LOCATION :

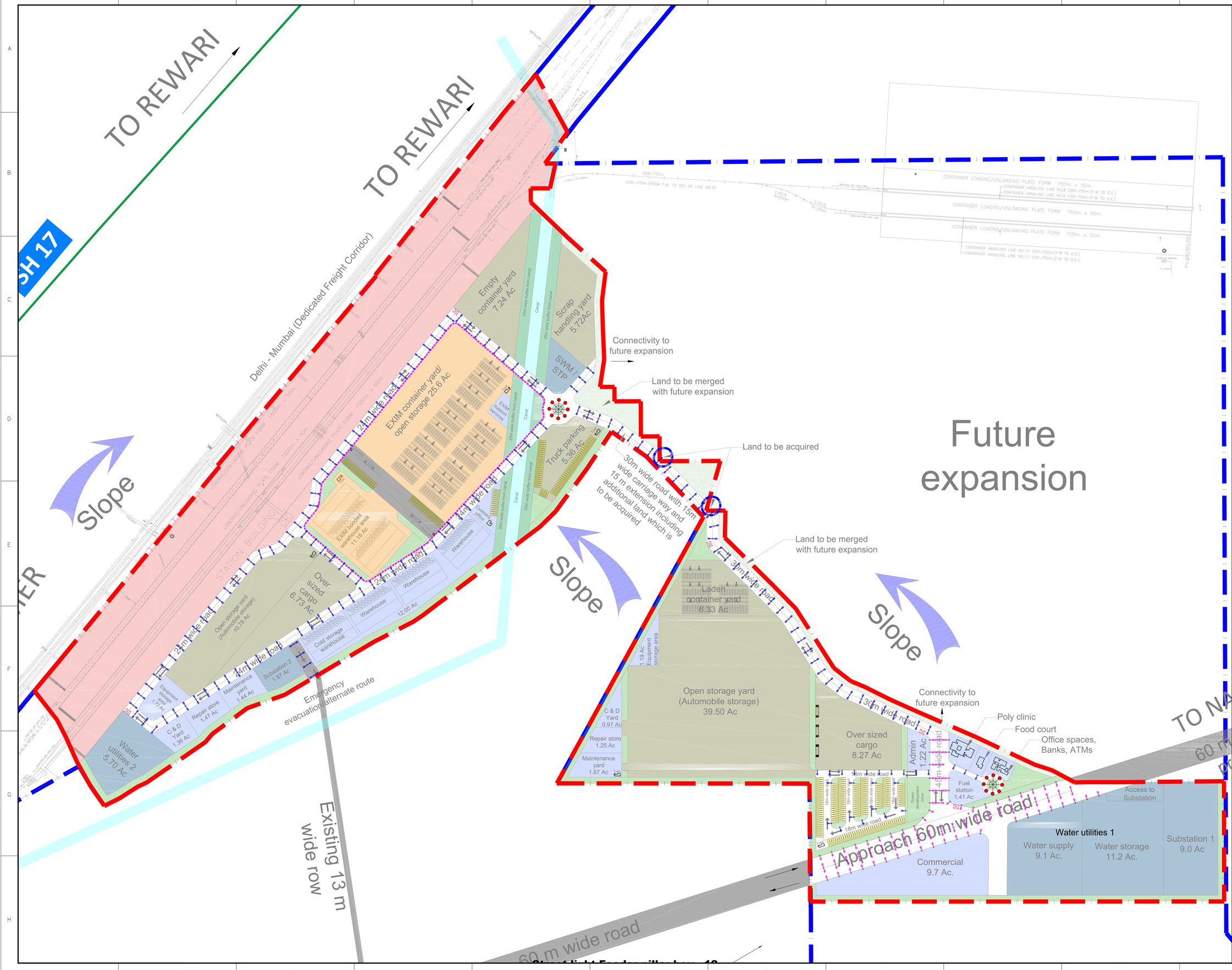
Multi Modal Logistic Hub Project (IMLH) Phase-1A, at Nangal Chaudhary

DRAWING TITLE :

Typical cross section of 15m wide road

Scale:	Date:	Rev:
NTS	11.09.2024	R0

Job No:	Drawing No:
P1063	ACE-P1063-IMLH-R006



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Orientation:

North
W E
S

LEGEND:

SYMBOLS	DESCRIPTION
	High mast 12.5 m height with 8X250W LED flood light
	8m street light pole with 1X120W LED street light fitting
	8m street light pole with 1X120W LED street light fitting
	10m street light pole with 1X150W LED street light fitting
	10m street light pole with 2X150W LED street light fitting
	Street light feeder pillar box

Rev	Description	Date

FOR APPROVAL PURPOSE ONLY

CLIENT :

National Industrial Corridor Development Corporation (NICDC)

PROJECT CONSULTANT :

ARTELIA
Passion & Solutions
ARTELIA CONSULTING ENGINEERS LTD.

PROJECT & LOCATION :

Multi Modal Logistic Hub Project (IMLH) Phase-1A, at Nangal Chaudhary

DRAWING TITLE :

EXTERNAL LIGHTING LAYOUT

Scale:	Date:	Rev:
Scale @ A2	11.09.2024	R0

Job No:	Drawing No:
P1063	ACE-P1063-IMLH-EXL-E001

TO REWARI

TO REWARI

SH 17

Delhi - Mumbai (Dedicated Freight Corridor)

Slope

Slope

Slope

Slope

Empty container yard 7.24 Ac

Scrap handling yard 5.72Ac

SWM / STP

Connectivity to future expansion

Land to be merged with future expansion

Land to be acquired

30m wide road with 15m wide carriage way and 15 m extension including additional land which is to be acquired

Land to be merged with future expansion

Future expansion

24m wide road

EXIM container yard/ open storage 25.6 Ac

EXIM support services

Truck parking 5.36 Ac

EXIM bonded warehouse area 11.18 Ac

Warehouse

Warehouse

Warehouse

Warehouse

12.00 Ac

Over sized cargo 6.73 Ac

Open storage yard (Automobile storage) 10.78 Ac

Cold storage warehouse

Substation 2 1.87 Ac

Maintenance yard 1.44 Ac

Repair store 1.47 Ac

C & D Yard 1.35 Ac

Equipment storage area 1.71 Ac

Water utilities 2 5.70 Ac

Emergency evacuation/alternate route

Existing 13 m wide row

60 m wide road

Laden container yard 6.33 Ac

Open storage yard (Automobile storage) 39.50 Ac

Equipment storage area 1.19 Ac

C & D Yard 0.97 Ac

Repair store 1.25 Ac

Maintenance yard 1.67 Ac

Over sized cargo 8.27 Ac

Admin 1.22 Ac

45m wide road

30m wide road

Connectivity to future expansion

Poly clinic

Food court

Office spaces, Banks, ATMs

Fuel station 1.41 Ac

18m wide road

Approach 60m wide road

Access to Substation

Water utilities 1

Water supply 9.1 Ac.

Water storage 11.2 Ac.

Substation 1 9.0 Ac

Commercial 9.7 Ac.

TO NA

60 m

pr

CONTAINER LOADING/UNLOADING PLATE FORM 750m. x 50m.

CONTAINER HANDLING LINE NO.8 CSR-750m.(F.M TO D.E.)

CONTAINER HANDLING LINE NO.9 CSR-750m.(F.M TO D.E.)

CONTAINER LOADING/UNLOADING PLATE FORM 750m. x 50m.

CONTAINER LOADING/UNLOADING PLATE FORM 750m. x 50m.

CONTAINER HANDLING LINE NO.10 CSR-750m.(F.M TO D.E.)

CONTAINER HANDLING LINE NO.11 CSR-750m.(F.M TO D.E.)

CSR-770m.

CSR-770m.(FROM F.M. TO SRJ OF LINE NO.9)

C.NO.8 R=250m.

C.NO.9 R=250m.

C.NO.7 R=295m.

OVER RUN LINE 120m LONG

OVER RUN LINE 120m LONG

25m wide buffer from canal

Canal

Green development zone

STATION BUILDING

LOADING/UNLOADING PLATE FORM 1500m. x 50m.

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Orientation:

North

W E

S

LEGEND:

SYMBOLS	DESCRIPTION
	POWER CABLE

Rev	Description	Date

FOR APPROVAL PURPOSE ONLY

CLIENT : National Industrial Corridor Development Corporation (NICDC)

PROJECT CONSULTANT : ARTELIA Passion & Solutions ARTELIA CONSULTING ENGINEERS LTD.

PROJECT & LOCATION :

Multi Modal Logistic Hub Project (IMLH) Phase-1A, at Nangal Chaudhary

DRAWING TITLE :

POWER DISTRIBUTION LAYOUT

Scale:	Date:	Rev:
Scale @ A2	11.09.2024	R0

Job No:	Drawing No:
P1063	ACE-P1063-IMLH-PD-E001

IMLH - Non-Potable Water Supply Network - Design Calculation

S. No	Pipe Name	Start Node	End Node	Start Elevation	End Elevation	Pipe Length	Nominal Dia (mm)	Pipe Roughness Adopted	Pipe Material	Peak Flow (m3/day)	Velocity (m/s)	Pressure at Start node (in m)	Pressure at End node (in m)	Unit Headloss (m/km)	Friction Factor
1	Pipe P1	T1	J1	342.23	341.739	66	75	145	OPVC	7.83	0.02	50	50.49	0.01	0.037
2	Pipe P2	T1	J2	342.23	350.355	62.18	75	145	OPVC	295.9	0.78	50	39.44	8.69	0.021
3	Pipe P3	J2	J3	350.355	348.954	170.93	75	145	OPVC	7.03	0.02	39.44	41.07	0.01	0.037
4	Pipe P4	J2	J4	350.355	352.935	36.34	75	145	OPVC	101.67	0.27	39.44	36.9	1.2	0.025
5	Pipe P5	J4	J5	352.935	352.935	183.37	75	145	OPVC	95.84	0.25	36.9	36.9	1.08	0.025
6	Pipe P6	J5	J6	352.935	352.935	227.71	75	145	OPVC	57.01	0.15	36.9	36.9	0.41	0.027
7	Pipe P7	J6	J7	352.935	352.935	174.72	75	145	OPVC	41.98	0.11	36.9	36.9	0.23	0.028
8	Pipe P8	J7	J8	352.935	352.935	137.62	75	145	OPVC	32.95	0.09	36.9	36.9	0.15	0.029
9	Pipe P9	J8	J9	352.935	352.935	75.08	75	145	OPVC	26.72	0.07	36.9	36.9	0.1	0.03
10	Pipe P10	J9	J10	352.935	341.739	69.08	75	145	OPVC	19.99	0.05	36.9	50.49	0.06	0.032
11	Pipe P11	J10	J11	341.739	341.739	74.53	75	145	OPVC	12.46	0.03	50.49	50.49	0.02	0.034
12	Pipe P12	J11	J12	341.739	341.739	73.99	75	145	OPVC	6.23	0.02	50.49	50.49	0.01	0.036
13	Pipe P13	J2	J13	350.355	341.739	377.68	75	145	OPVC	180.77	0.47	39.44	50.49	3.49	0.023
14	Pipe P14	J13	J14	341.739	341.739	126.78	75	145	OPVC	99.31	0.26	50.49	50.49	1.15	0.025
15	Pipe P15	J14	J15	341.739	341.739	186.09	75	145	OPVC	89.88	0.24	50.49	50.49	0.96	0.025
16	Pipe P16	J15	J16	341.739	347.304	157.03	75	145	OPVC	81.05	0.21	50.49	42.62	0.79	0.026
17	Pipe P17	J16	J17	347.304	349.217	120.24	75	145	OPVC	73.82	0.19	42.62	40.63	0.66	0.026
18	Pipe P18	J17	J18	349.217	350.267	90.48	75	145	OPVC	57.39	0.15	40.63	39.54	0.42	0.027
19	Pipe P19	J18	J19	350.267	350.355	46.22	75	145	OPVC	41.76	0.11	39.54	39.44	0.23	0.028
20	Pipe P20	J19	J20	350.355	349.009	37.48	75	145	OPVC	30.93	0.08	39.44	40.78	0.13	0.03
21	Pipe P21	J20	J21	349.009	351.463	111.03	75	145	OPVC	18.1	0.05	40.78	38.32	0.05	0.032
22	Pipe P22	J21	J23	351.463	350.272	67.19	75	145	OPVC	1.44	0	38.32	39.51	0	0.057
23	Pipe P23	J21	J22	351.463	351.301	174.98	75	145	OPVC	10.83	0.03	38.32	38.48	0.02	0.035
24	Pipe P24	J23	J24	350.272	351.116	112.1	75	145	OPVC	-5.19	0.01	39.51	38.67	0	0.037
25	Pipe P25	J24	J25	351.116	352.652	185.55	75	145	OPVC	-11.02	0.03	38.67	37.14	0.02	0.035
26	Pipe P26	J25	J31	352.652	352.935	252.44	75	145	OPVC	-36.25	0.09	37.14	36.9	0.18	0.029
27	Pipe P27	J31	J30	352.935	350.781	197.86	75	145	OPVC	-42.08	0.11	36.9	39.1	0.23	0.028
28	Pipe P28	J30	J29	350.781	348.954	470.5	75	145	OPVC	-47.91	0.13	39.1	41.07	0.3	0.028
29	Pipe P29	J29	J28	348.954	348.601	86.28	75	145	OPVC	-55.54	0.15	41.07	41.45	0.39	0.027
30	Pipe P30	J28	J27	348.601	348.173	73.14	75	145	OPVC	-62.97	0.16	41.45	41.92	0.49	0.027
31	Pipe P31	J27	J26	348.173	347.429	147.13	75	145	OPVC	-69.2	0.18	41.92	42.75	0.59	0.026
32	Pipe P32	J26	J13	347.429	341.739	279.35	75	145	OPVC	-75.63	0.2	42.75	50.49	0.69	0.026

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Orientation:

North, W, E, S

LEGEND:

- Pipeline of Nominal Dia - 75 mm - OPVC
- Flow direction
- Pilot connection
- J-01 - Node number
- Node
- Butterfly Valve
- Air valve
- Thrust Block
- Pipe Bridge across Canal
- RCC Pipe (NP3 grade) for Road crossings
- External Fire Hydrant

Rev	Description	Date

FOR APPROVAL PURPOSE ONLY

CLIENT :

National Industrial Corridor Development Corporation (NICDC)

PROJECT CONSULTANT :

ARTELIA Passion & Solutions
ARTELIA CONSULTING ENGINEERS LTD.

PROJECT & LOCATION :

Multi Modal Logistic Hub Project (IMLH) Phase-1A, at Nangal Chaudhary

DRAWING TITLE :

Non - Potable Water Supply Network with Design Calculations

Scale:	Date:	Rev:
Scale @ A2	Date	R0

Job No:	Drawing No:
P1063	ACE-P1063-IMLH-WS-A002

IMLH - Potable Water Supply Network - Design Calculation

S. No	Pipe Name	Start Node	End Node	Start Elevation	End Elevation	Pipe Length	Nominal Dia (mm)	Pipe Roughness Adopted	Pipe Material	Peak Flow (m3/day)	Velocity (m/s)	Pressure at Start node (in m)	Pressure at End node (in m)	Unit Headloss (m/km)	Fiction Factor
1	Pipe P2	T1	J1	354.891	350.272	110.68	110	145	OPVC	236	0.29	10	14.52	0.88	0.023
2	Pipe P3	J1	J2	350.272	343.12	68.26	75	145	OPVC	90.48	0.24	14.52	21.14	0.97	0.025
3	Pipe P4	J2	J3	343.12	344.065	108.29	75	145	OPVC	84.28	0.22	21.14	19.99	0.85	0.026
4	Pipe P5	J3	J4	344.065	345.288	34.91	75	145	OPVC	75.68	0.2	19.99	18.76	0.69	0.026
5	Pipe P6	J4	J5	345.288	345.288	35.21	75	145	OPVC	69.48	0.18	18.76	18.76	0.59	0.026
6	Pipe P7	J5	J7	345.288	345.288	104.45	75	145	OPVC	57.28	0.15	18.76	18.76	0.41	0.027
7	Pipe P8	J7	J8	345.288	345.288	57.73	75	145	OPVC	43.88	0.11	18.76	18.76	0.25	0.028
8	Pipe P9	J8	J10	345.288	350.272	227.48	75	145	OPVC	42.28	0.11	18.76	14.52	0.24	0.028
9	Pipe P10	J10	J11	350.272	350.272	165.89	75	145	OPVC	42.28	0.11	14.52	14.52	0.24	0.028
10	Pipe P11	J11	J18	350.272	344.473	119.76	75	145	OPVC	37.68	0.1	14.52	19.94	0.19	0.029
11	Pipe P12	J18	J19	344.473	343.12	255.16	75	145	OPVC	71.7	0.19	19.94	21.14	0.63	0.026
12	Pipe P13	J19	J20	343.12	343.394	69.47	75	145	OPVC	71.7	0.19	21.14	20.82	0.63	0.026
13	Pipe P14	J20	J21	343.394	342.713	33.01	75	145	OPVC	3.8	0.01	20.82	21.5	0	0.05
14	Pipe P15	J21	J22	342.713	342.543	33.64	75	145	OPVC	3.8	0.01	21.5	21.67	0	0.033
15	Pipe P16	J22	J23	342.543	341.633	93.98	75	145	OPVC	2.4	0.01	21.67	22.58	0	0.044
16	Pipe P17	J22	J23	342.543	341.633	166.49	75	145	OPVC	0.6	0	21.67	22.58	0	0
17	Pipe P18	J20	J25	343.394	344.374	239.27	75	145	OPVC	67.9	0.18	20.82	19.7	0.57	0.026
18	Pipe P19	J25	J26	344.374	344.057	108.66	75	145	OPVC	26.7	0.07	19.7	20.01	0.1	0.03
19	Pipe P20	J26	J27	344.057	344.528	98.44	75	145	OPVC	24.5	0.06	20.01	19.53	0.09	0.031
20	Pipe P21	J27	J28	344.528	344.456	167.08	75	145	OPVC	10.9	0.03	19.53	19.6	0.02	0.035
21	Pipe P22	J28	J29	344.456	344.065	144.14	75	145	OPVC	7.1	0.02	19.6	19.99	0.01	0.037
22	Pipe P23	J29	J30	344.065	344.692	82.99	75	145	OPVC	6.5	0.02	19.99	19.36	0.01	0.036
23	Pipe P24	J30	J31	344.692	344.945	73.71	75	145	OPVC	4.3	0.01	19.36	19.11	0	0.041
24	Pipe P25	J31	J32	344.945	345.025	71.26	75	145	OPVC	1.5	0	19.11	19.03	0	0.05
25	Pipe P26	J32	J33	345.025	345.288	67.98	75	145	OPVC	0.6	0	19.03	18.76	0	0
26	Pipe P27	J2	J6	343.12	345.288	171.87	75	145	OPVC	6.2	0.02	21.14	18.76	0.01	0.037
27	Pipe P28	J1	J9	350.272	345.288	286.58	110	145	OPVC	144.32	0.18	14.52	18.76	0.36	0.025
28	Pipe P29	J9	J12	345.288	350.272	261.53	75	145	OPVC	38.12	0.1	18.76	14.52	0.2	0.029
29	Pipe P30	J12	J13	350.272	350.272	202.14	75	145	OPVC	38.12	0.1	14.52	14.52	0.2	0.029
30	Pipe P31	J13	J14	350.272	350.272	472.79	75	145	OPVC	38.12	0.1	14.52	14.52	0.2	0.029
31	Pipe P32	J14	J15	350.272	350.272	89.87	75	145	OPVC	36.92	0.1	14.52	14.52	0.18	0.029
32	Pipe P33	J15	J16	350.272	350.272	102.38	75	145	OPVC	34.92	0.09	14.52	14.52	0.17	0.029
33	Pipe P34	J16	J17	350.272	347.429	124.37	75	145	OPVC	34.32	0.09	14.52	17.03	0.16	0.029
34	Pipe P35	J17	J18	347.429	344.473	245.39	75	145	OPVC	34.02	0.09	17.03	19.94	0.16	0.029

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Orientation:

North
W E
S

LEGEND:

- Pipeline of Nominal Dia - 110 mm - OPVC
- Pipeline of Nominal dia - 75 mm - OPVC
- Flow direction
- Plot connection
- J-01 - Node number
- Node
- Butterfly Valve
- Air valve
- Thrust Block
- Pipe Bridge across Canal
- RCC Pipe (NP3 grade) for Road crossings

Rev	Description	Date

FOR APPROVAL PURPOSE ONLY

CLIENT :

National Industrial Corridor Development Corporation (NICDC)

PROJECT CONSULTANT :

ARTELIA
Passion & Solutions
ARTELIA CONSULTING ENGINEERS LTD.

PROJECT & LOCATION :

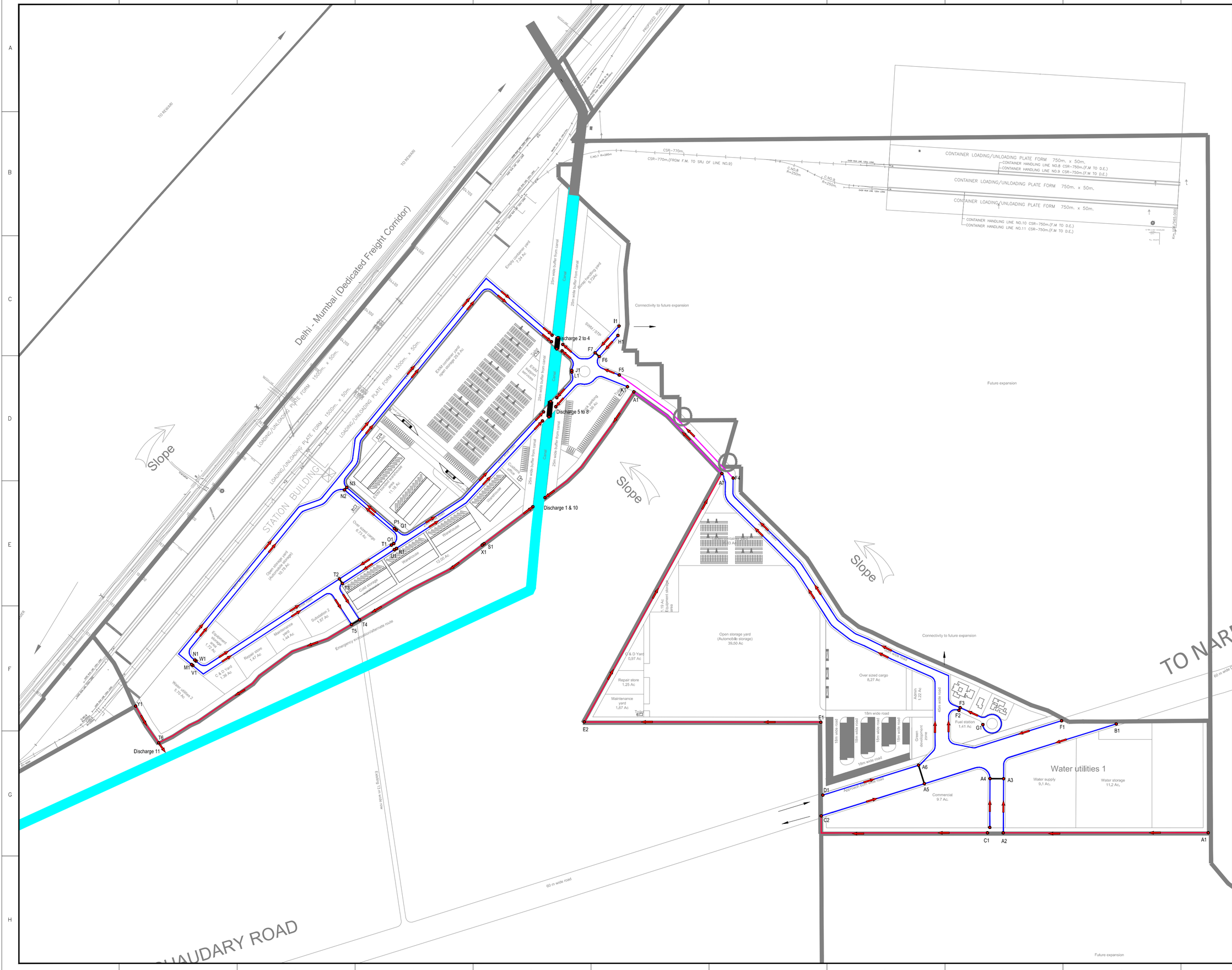
Multi Modal Logistic Hub Project (IMLH) Phase-1A, at Nangal Chaudhary

DRAWING TITLE :

Potable Water Supply Network with Design Calculations

Scale:	Date:	Rev:
Scale @ A2	Date	R0

Job No:	Drawing No:
P1063	ACE-P1063-IMLH-WS-A001



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Orientation:

North
W E
S

LEGEND:

SYMBOLS	DESCRIPTION
	Drain node
	Drain flow direction
	Internal drain network
	Peripheral drain network
	Pipe drain network
	Box culvert

Rev	Description	Date

FOR APPROVAL PURPOSE ONLY

CLIENT :

National Industrial Corridor Development Corporation (NICDC)

PROJECT CONSULTANT :

ARTELIA
Passion & Solutions
ARTELIA CONSULTING ENGINEERS LTD.

PROJECT & LOCATION :

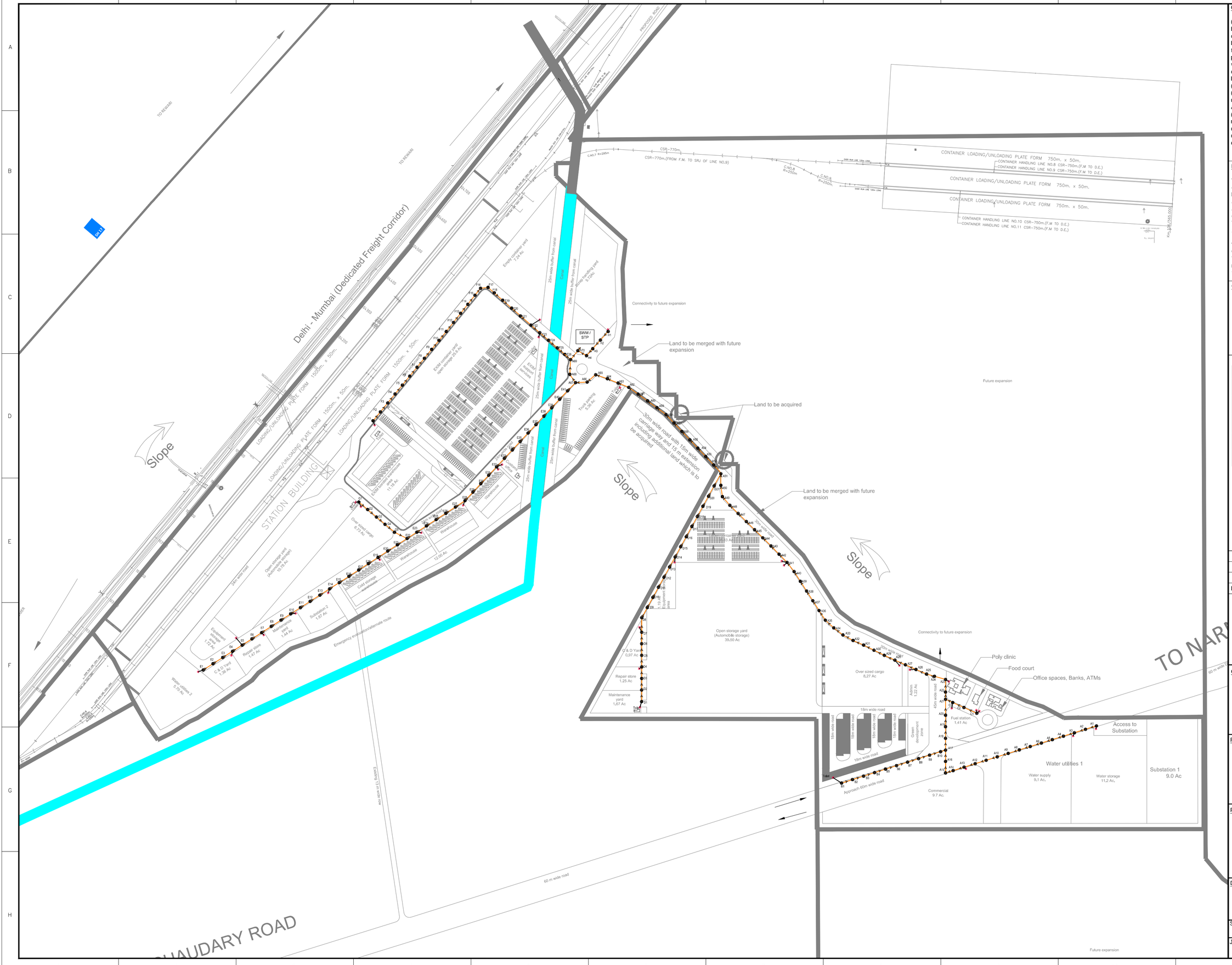
Multi Modal Logistic Hub Project (IMLH) Phase-1A, at Nangal Chaudhary

DRAWING TITLE :

Storm water drain network

Scale:	Date:	Rev:
NTS	12.09.2024	R0

Job No:	Drawing No:
P1063	ACE-P1063-IMLH-SWD-001



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Orientation:

North
W E
S

LEGEND:

SYMBOLS	DESCRIPTION
◎	Manhole
➤	Flow direction
▬	Sewerage network
☒	Plot Manhole
▬	Plot connection

Rev	Description	Date

FOR APPROVAL PURPOSE ONLY

CLIENT :

National Industrial Corridor Development Corporation (NICDC)

PROJECT CONSULTANT :

ARTELIA
Passion & Solutions
ARTELIA CONSULTING ENGINEERS LTD.

PROJECT & LOCATION :

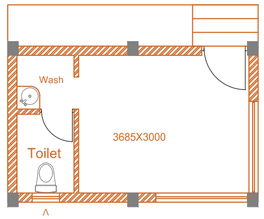
Multi Modal Logistic Hub Project (IMLH) Phase-1A, at Nangal Chaudhary

DRAWING TITLE :

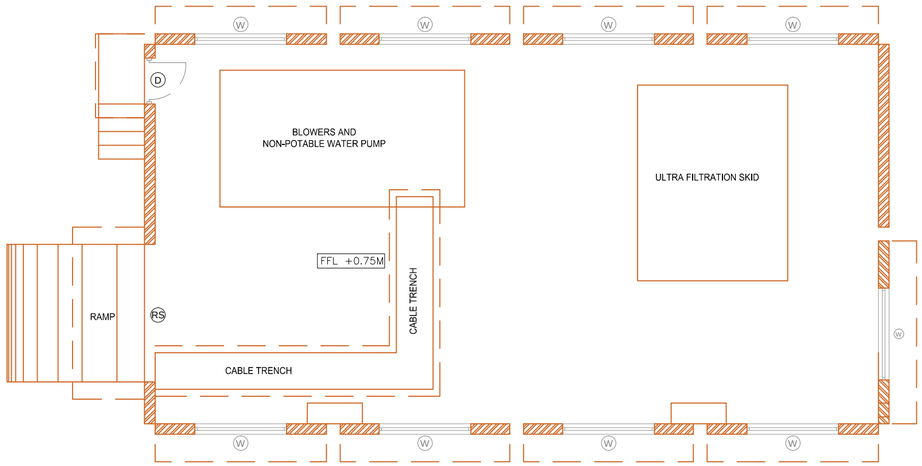
Sewerage network

Scale:	Date:	Rev:
NTS	12.09.2024	R0

Job No:	Drawing No:
P1063	ACE-P1063-IMLH-SW-001

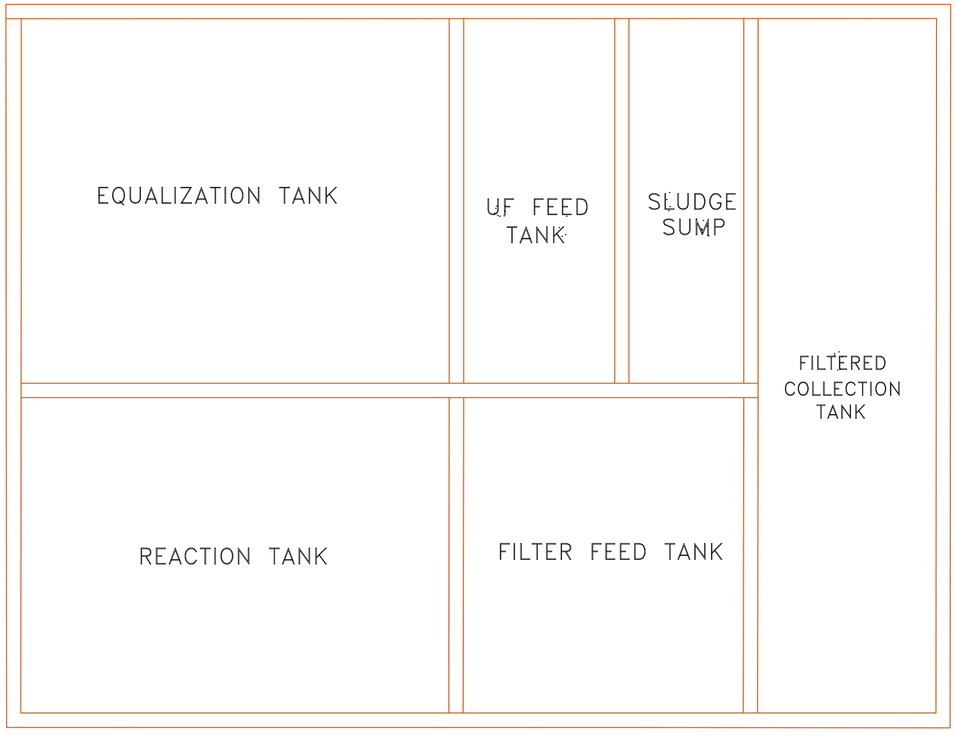


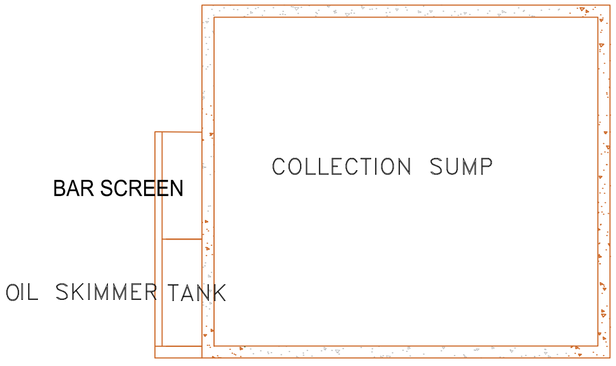
Security cabin



PUMP ROOM AND OPERATOR ROOM







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Rev	Description	Date

FOR APPROVAL PURPOSE ONLY

CLIENT :

National Industrial Corridor Development Corporation (NICDC)

PROJECT CONSULTANT :

ARTELIA
Passion & Solutions
ARTELIA CONSULTING ENGINEERS LTD.

PROJECT & LOCATION :

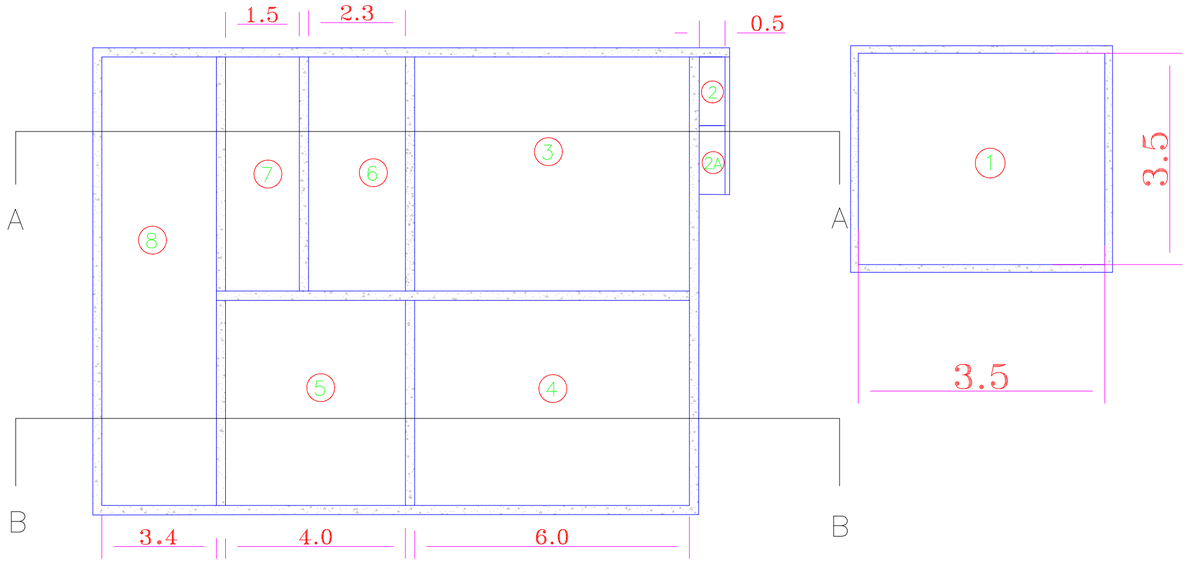
Multi Modal Logistic Hub Project (IMLH) Phase-1A, at Nangal Chaudhary

DRAWING TITLE :

Sewerage treatment plant layout - SBR - 215KLD

Scale:	Date:	Rev:
NTS	12.09.2024	R0

Job No:	Drawing No:
P1063	ACE-P1063-IMLH-STP-003

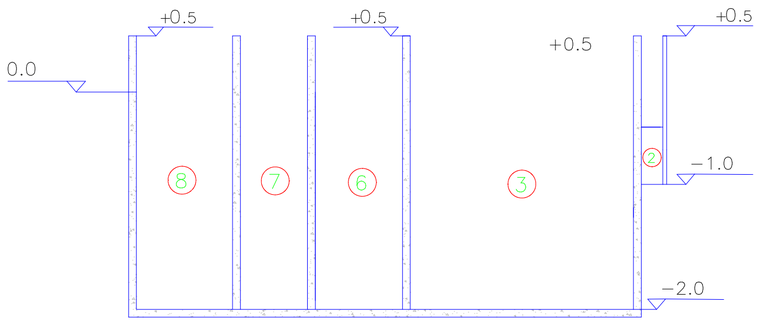


PLAN VIEW

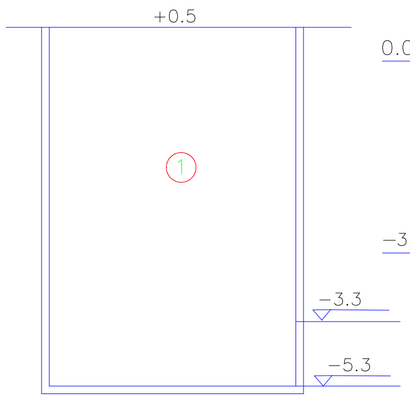
S.NO	DESCRIPTION	SIZE
1	COLLECTION SUMP	3.5 X 3.5 X 2.0 + FB
2	BAR SCREEN	0.50 X 1.50 X 1.50
2A	OIL SKIMME TANK	0.50 X 1.50 X 1.50
3	EQUALIZATION TANK	5.0 X 6.0 X 2.50 + 0.5
4	REACTION TANK	5.0 X 6.0 X 3.50 + 0.5
5	FILTER FEED TANK	5.0 X 4.0 X 3.00 + 0.5
6	UF FEED TANK	5.0 X 2.30 X 3.50 + 0.5
7	SLUDGE SUMP	1.50 X 5.00 X 3.00 + 0.5
8	FILTERED COLLECTION TANK	10.0 X 3.40 X 3.00 + 0.5

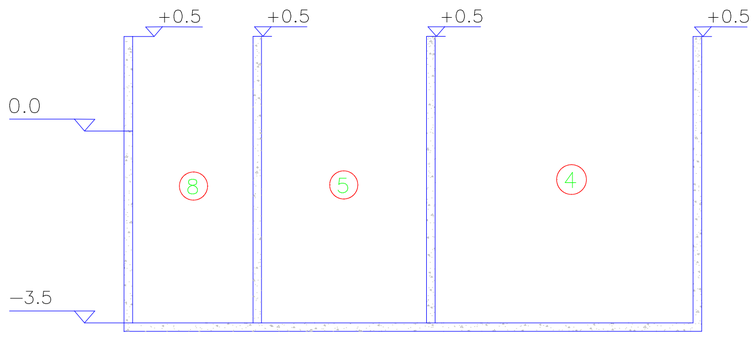
PER BATCH – 70 KL

NO OF BATCH – 3



SECTION VIEW AA





SECTION VIEW BB

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Rev	Description	Date

FOR APPROVAL PURPOSE ONLY

CLIENT :

National Industrial Corridor Development Corporation (NICDC)

PROJECT CONSULTANT :

ARTELIA
Passion & Solutions
ARTELIA CONSULTING ENGINEERS LTD.

PROJECT & LOCATION :

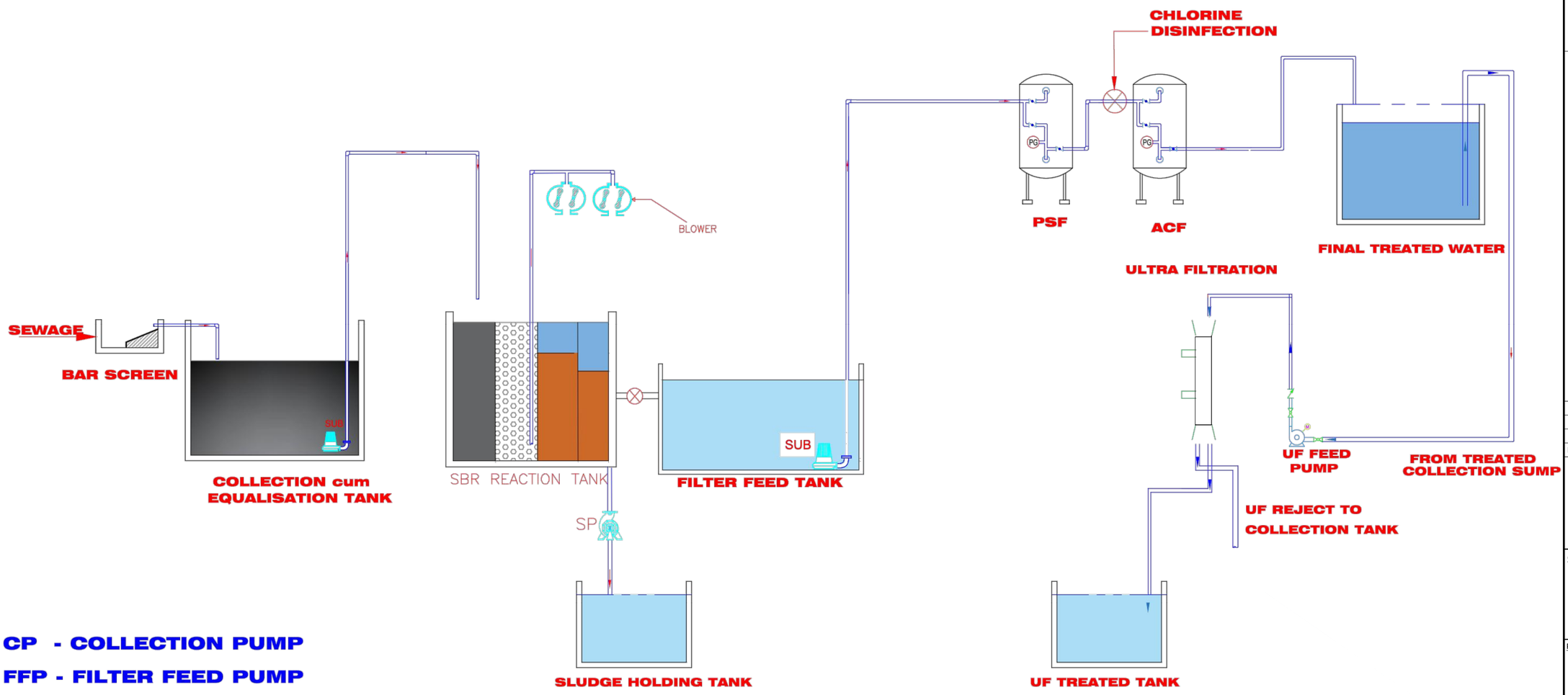
Multi Modal Logistic Hub Project (IMLH) Phase-1A, at Nangal Chaudhary

DRAWING TITLE :

General arrangement diagram for SBR - 215KLD

Scale:	Date:	Rev:
NTS	12.09.2024	R0

Job No:	Drawing No:
P1063	ACE-P1063-IMLH-STP-002



CP - COLLECTION PUMP

FFP - FILTER FEED PUMP

SP - SLUDGE PUMP

PSF - PRESSURE SAND FILTER

ACF - ACTIVATED CARBON FILTER

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PROJECT CONSULTANT :

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Passion & Solutions
ARTELIA CONSULTING ENGINEERS LTD.

PROJECT & LOCATION :

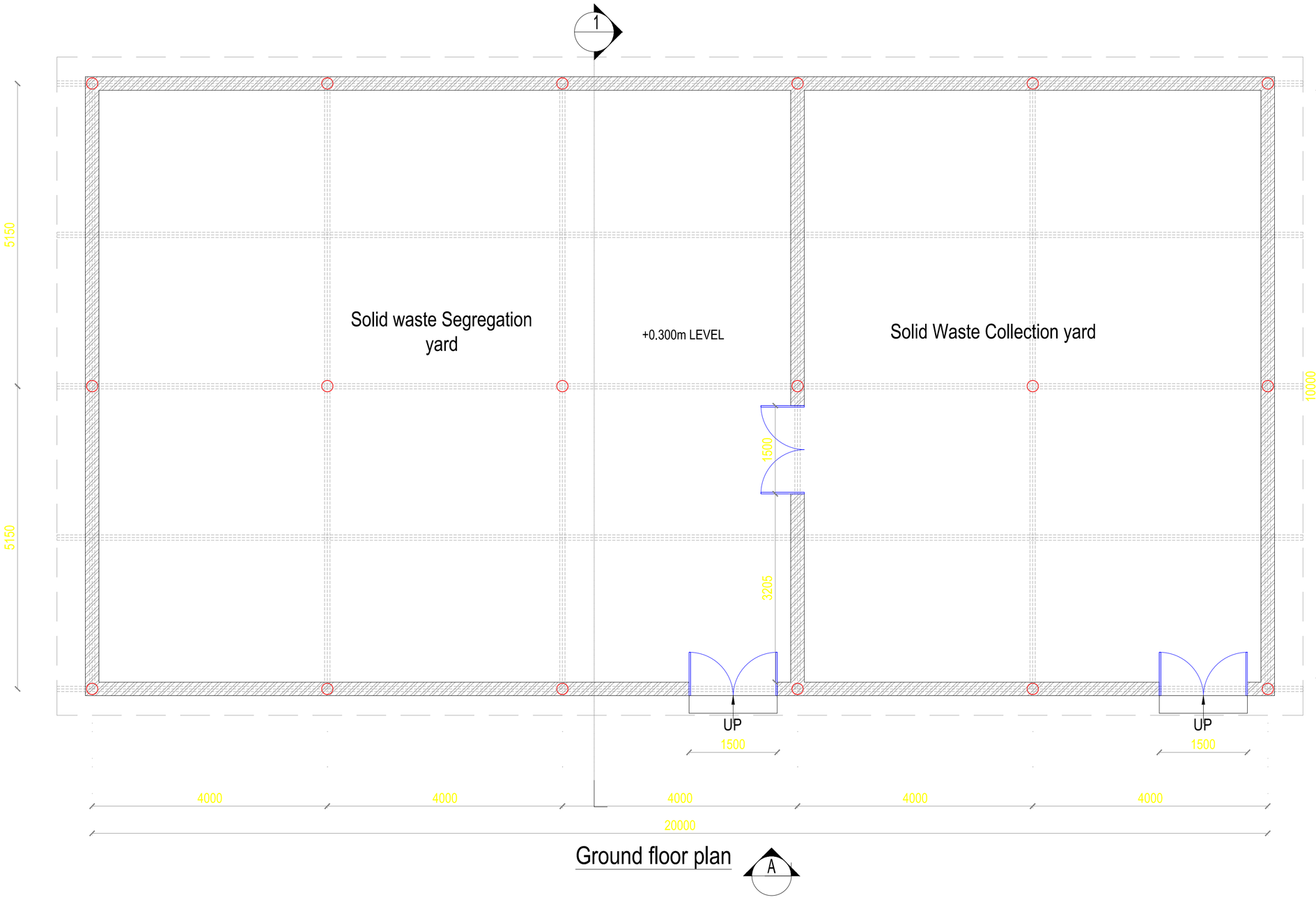
Multi Modal Logistic Hub Project (IMLH) Phase-1A, at Nangal Chaudhary

DRAWING TITLE :

Piping and instrumentation diagram for SBR 215KLD with Ultra filtration

Scale:	Date:	Rev:
NTS	12.09.2024	R0

Job No:	Drawing No:
P1063	ACE-P1063-IMLH-STP-001



Ground floor plan A

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PROJECT CONSULTANT :

ARTELIA Passion & Solutions
ARTELIA CONSULTING ENGINEERS LTD.

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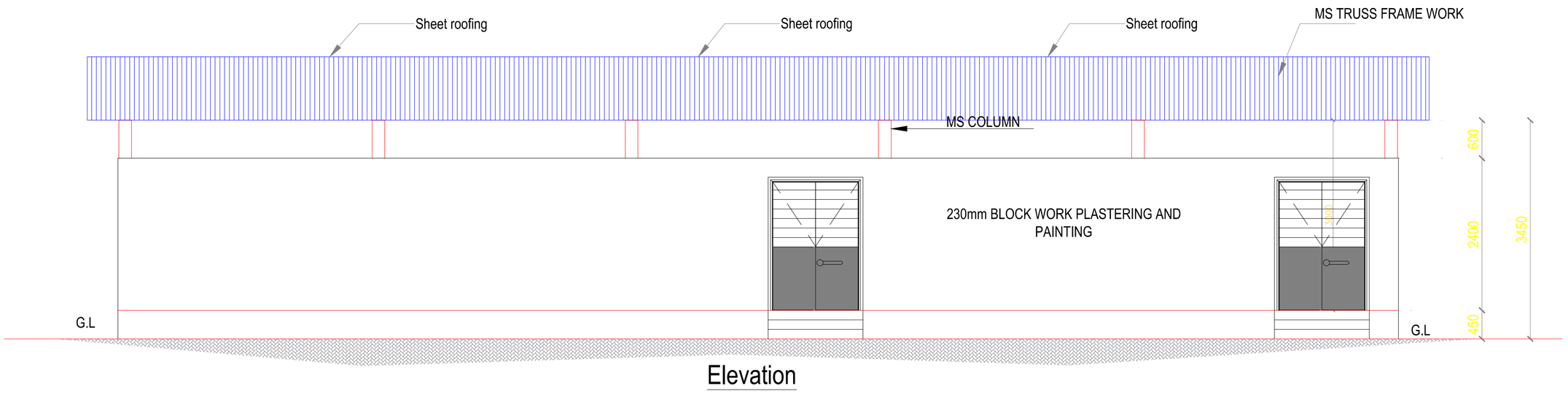
Multi Modal Logistic Hub Project (IMLH) Phase-1A, at Nangal Chaudhary

DRAWING TITLE :

Solid waste management
Collection shed - Floor plan

Scale:	Date:	Rev:
NTS	12.09.2024	R0

Job No:	Drawing No:
P1063	ACE-P1063-IMLH-SWM-003



Elevation

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"In the event of adopting the drawings for construction, the Client and or its implementation agency shall carry out Third Party design vetting through established national/Government approved institutions, and comply to the conditions therein**"**.

Rev	Description	Date

FOR APPROVAL PURPOSE ONLY

CLIENT :

National Industrial Corridor Development Corporation (NICDC)

PROJECT CONSULTANT :

ARTELIA
Passion & Solutions
ARTELIA CONSULTING ENGINEERS LTD.

PROJECT & LOCATION :

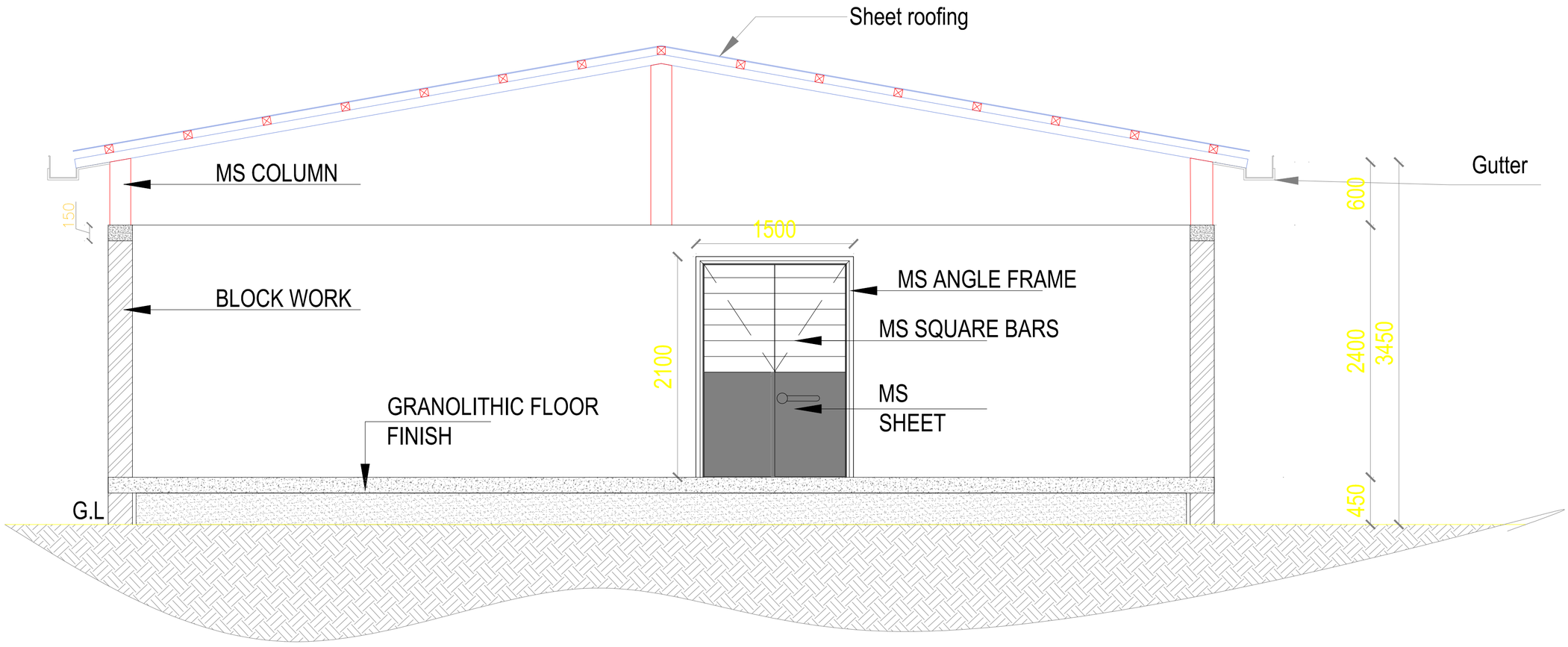
Multi Modal Logistic Hub Project (IMLH) Phase-1A, at Nangal Chaudhary

DRAWING TITLE :

Solid waste management
Collection shed - Elevation

Scale:	Date:	Rev:
NTS	12.09.2024	R0

Job No:	Drawing No:
P1063	ACE-P1063-IMLH-SWM-001



Section 1

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Rev	Description	Date

FOR APPROVAL PURPOSE ONLY

CLIENT :

National Industrial Corridor Development Corporation (NICDC)

PROJECT CONSULTANT :

ARTELIA
Passion & Solutions
ARTELIA CONSULTING ENGINEERS LTD.

PROJECT & LOCATION :

Multi Modal Logistic Hub Project (IMLH) Phase-1A, at Nangal Chaudhary

DRAWING TITLE :

Solid waste management
Collection shed - Section

Scale:	Date:	Rev:
NTS	12.09.2024	R0

Job No:	Drawing No:
P1063	ACE-P1063-IMLH-SWM-002

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