ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

FOR A PROPOSED HUNDRED (100) TONS PER DAY PET RECYCLING PLANT IKORODU LOCAL GOVERNMENT AREA, LAGOS STATE

for

SONNEX

SONNEX PACKAGING NIGERIA LIMITED

Submitted to

FEDERAL MINISTRY OF ENVIRONMENT (FMEnv)

MARCH, 2023

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List of Abbreviations and Acronyms

AAS	-	Atomic Absorption Spectrophotometer
ALARP	-	As Low As Reasonably Practicable
APHA	-	American Public Health Association
ASTM	-	American Society for Testing and Materials
B-to-B	-	Bottle to Bottle
BOD	-	Biochemical Oxygen Demand
B.S	-	British Standard
CEC.	-	Cation Exchangeable Capacity
COD	-	Chemical Oxygen Demand
COVID19	-	Coronavirus Disease
CPT	-	Cone Penetrometer Testing
CSR	-	Corporate Social Responsibility
DCPT	-	Dutch Cone Penetrometer Testing
DMT	-	Dimethyl Terephthalate
EG	-	Ethylene glycol
EIA	-	Environmental Impact Assessment
EMP	-	Environmental Management Plan
EMS	-	Environmental Management System
ETP	-	Effluent Treatment Plant
FEPA.	-	Federal Environmental Protection Agency
FGD	-	Focus Group Discussion
FRCN	-	Federal Radio Corporation of Nigeria
FGN	-	Federal Government of Nigeria
FMCG	-	Fast Moving Consumer Goods
FMEnv	-	Federal Ministry of Environment
GIS	-	Geographic Information System
GMP	-	Good Manufacturing Practice
GPS	-	Global Positioning System
HMO	-	Health Maintenance Organization
HSE	-	Health Safety and Environment
HVAC	-	Heat Ventilation and Air Conditioning
IGR	-	Internally Generated Revenue
IKEDC	-	Ikeja Electricity Distribution Company
ILO-OSH	-	International Labor Organization - Occupational Safety and Health

IPAN	-	Institute of Public Analysts of Nigeria
ISO	-	International Organization for Standardization
ITCZ	-	Inter- Tropical Convergence Zone
IUCN	-	International Union for Conservation of Nature
KVA	-	Kilovolt Ampere
KW	-	Kilowatt
LASEPA	-	Lagos State Environmental Protection Agency
LASMEnv	-	Lagos State Ministry of Environment
LAWMA	-	Lagos Waste Management Authority
LGA	-	Local Government Area
LSBC	-	Lagos State Broadcasting Corporation
LTV	-	Lagos Television
NESREA	-	National Environmental Standards and Regulations Enforcement Agency
NiMet	-	Nigeria Meteorological Agency
NPC	-	National Population Commission
NPW	-	Non-biodegradable Plastics Wastes
ONIHL	-	Occupational Noise -Induced Hearing Loss
OSH	-	Occupational Safety and Health
PAH	-	Polycyclic Aromatic Hydrocarbons
PE	-	Polyethylene
PET	-	Polyethylene Terephthalate
PHC	-	Primary Health Care
PP	-	Polypropylene
PPE	-	Personal Protective Equipment
PP-HDPE	-	Polypropylene- High Density Polyethlene
PS	-	Polystyrene
PSP	-	Private Sector Participants
PTA	-	Purified Terephthalic Acid
PUR	-	Polyurethane
PVC	-	Polyvinyl chloride
RAAMP	-	Rural Access and Agricultural Marketing Project
RAM	-	Risk Assessment Matrix
rPET	-	Recycled Polyethylene Terephthalate
SCM	-	Standard Cubic Meter
SON	-	Standard Organization of Nigeria

SOP	-	Standard Operating Procedure
SPM	-	Suspended Particulate Matter
SPT	-	Standard Penetration Test
STI	-	Sexually Transmitted Infection
ToR	-	Terms of Reference
UN	-	United Nations
VON	-	Voice of Nigeria
WB	-	World Bank
WHO	-	World Health Organization

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8. EKELE Simon	(M.Sc., Environmental Toxicology)	Data Analyst and Field Assistant	Field Data Gathering (Soil and sediment)
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10. ELUWOLE Taofeek	M.Tech Geographic Information Technology B.Tech. Agric Engineering	Geology, Transport and Landuse Expert	Transport and Landuse
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Executive Summary

Background Information

Plastic waste is a representative waste product that originates from industrial development, and its discharge to the environment causes severe environmental problems. Plastics undergo slow degradation and can remain in the environment for at least decades or even hundreds of years; they are thus named non-biodegradable plastics and cause ever-increasing levels of global Non-biodegradable Plastics Wastes (NPW), thus bringing about various environmental issues. Due to the growing environmental problems associated with NPW, recycling methods have received widespread attention due to their environmental friendliness and economic benefits.

The Environmental Impact Assessment (EIA) for Sonnex Packaging Nigeria Limited proposed 100 ton per day PET recycling plant project was carried out in one season (wet season) and complemented with using existing baseline data of the Environmental & Social Impact Assessment for the proposed KCSSA West Africa Limited's Ikorodu Mill project as secondary data (dry season). The KCSSA Project location is about 5.36km from the proposed PET recycling plant project site.

The field sampling was carried out from 8th – 12th September 2022. For the biophysical components, a 2km radius from the centre of the Project site was selected as the spatial boundary while the socio-economic survey was extended to approximately 5km radius and were carried out in accordance with the FMEnv, National Environmental Standards and Regulations Enforcement Agency (NESREA), Lagos State Environmental Protection Agency (LASEPA), World Bank (WB) and other international standards and guidelines.

The Proponent

Sonnex Packaging Nigeria Limited, Lagos State was incorporated in Lagos, Nigeria with Registration Number RC 380220 and is a division of Mohinani Group, manufacturing flexible and rigid packaging solutions for industries with products such as PET PRE-Forms, PP-HDPE closure, polyethylene nylon and household plastics. Sonnex Packaging Nigeria Limited has its Head office at 1 Olorunfemi Street, off Kudirat Abiola way, Ojota Lagos State.

Proponent's Intent

Sonnex Packaging Nigeria Limited intends to establish a 100ton per day PET Recycling plant in Ikorodu LGA, Lagos State. As part of its Corporate Social Responsibility(CSR) of keeping the earth free of waste thereby protecting the Ozone layer and satisfy consumer needs. Sonnex

Packaging Nigeria Limited wants to commence recycling of PET to meet demand for PET flakes. The proposed project is an expansion of the company's other business ideas which is also profit driven. These clean PET flakes or pellets will then be processed by reclaimers or converters that will transform the flakes or pellets into a commodity-grade raw material form such as fiber, sheet, or engineered or compounded pellets, which is finally sold to end-users to manufacture new products. The proposed project will result in additional source of income to the proponent and accrue revenue for the three tiers of government (Local, State and Federal) as well as reduce plastic waste ending up in Landfills.

Legal Framework for the EIA Process

Applicable extant National, State and Local Government edicts including multilateral agreements to which Nigeria is a signatory that are relevant to the Sonnex Packaging Nigeria Limited's PET recycling plant project are reviewed and documented in this report. Some of the laws include but not limited to the following;

- National Environmental Protection (Effluent Limitation) Regulations S.I.8, 1991
- National Environmental Protection (Pollution Abatement in Industries and Facilities Generating Wastes) Regulations S.I.9, 1991
- National Environmental Protection (Management of Hazardous and Solid Wastes) Regulations S.I.15, 1991
- Environmental Impact Assessment Act Cap E12 LFN, 2004
- Factories Act CAP FI, LFN 2004
- SON Act 2015
- The Endangered Species Act, Cap E9, LFN 2004
- Land Use Act LFN 2004
- Forestry Law CAP 51 LFN 1994
- Labour Act, Cap L1 LFN 2004
- The Nigerian Urban and Regional Planning Act Cap N138, LFN 2004
- National Environmental Standards and Regulations Enforcement Agency (NESREA) Act of 2007
- National Environmental (Domestic and Industrial Plastic, Rubber and Foam Sector) Regulations, S.I. No. 17 of 2011
- Harmful Waste (Special Criminal Provisions) Act, Cap H1, LFN 2004
- National Policy on Plastic Waste Management 2020
- Lagos State Environment Protection Agency, Edict 1996

- Lagos State Environmental Protection and Management Law 2017
- Lagos State Environmental Sanitation Law, 2015
- Lagos State Waste Management Authority Law 2007
- International Standards, Treaties and Conventions etc.

Project Development Options and Alternatives

The site for the proposed recycling plant Project is within the Ikorodu industrial zone along the Ikorodu - Itoikin - Epe road in Ikorodu Local Government Area of Lagos State. The site is easily accessible through the existing road network in the area. The project development will not require the creation of an access route to the site. Alternative sites considered include parcels of land in Ojota and Ikeja areas of Lagos State but not chosen as the preferred option due to the significant associated environmental and social impacts including traffic as well as potential for physical and economic displacement.

Technical Alternatives

Generally, there are two (2) ways by which PET bottles can be recycled. They include:

- Chemical recycling back to the initial raw materials like purified terephthalic acid or dimethyl terephthalate and ethylene glycol where the polymer structure is destroyed completely or to in-process intermediaries like bis-β-hydroxyterephthalate.
- Mechanical recycling where the original polymer properties are maintained or reconstituted.

Sonnex Packaging Nigeria Limited plans to adopt the mechanical process offered by BoReTech PET for Recycling Equipment Company for the recycling of PET bottles at the proposed facility. The proposed Project will make use of Bottle to Bottle (B-to-B) grade and Fiber grade PET Bottle recycling lines. The selection of BoReTech PET recycling equipment for the proposed Project has taken into consideration some important factors such as availability of raw materials, manpower requirements, area of land available, energy and other utility required for operations, cost, etc.

Project Options

All available options were considered for the project, these include the no-project option, the delayed project option and the option to proceed with the project. The option to proceed with the Sonnex Packaging Nigeria Limited's PET recycling plant project was adopted as the preferred option based on its numerous favorable factors including improved environmental sustainability, creation of job opportunities and revenue generation to government in form of taxes.

Project Location

The site for the proposed Sonnex Packaging Nigeria Limited's plant Project is located at km 488A Ikorodu Industrial Estate, Parafa village, Ikorodu LGA, Lagos State. The location is a mixed used area in an industrial estate, along Ikorodu – Itoikin – Epe road. The Project site lies within Latitude 6°38'49.65'N and Longitude 3°33'48.54'E (SW), Latitude 6°38'50.29'N and Longitude 3°33'57.78'E (SE), Latitude 6°38'58.61'N and Longitude 3°33'50.94'E (NW), Latitude 6°38'58.57'N and Longitude 3°33'54.15'E (NE). The proposed recycling plant and its ancillary facilities will occupy a land mass of approximately 22,458sqm out of the total land size of 35,1355sqm acquired for the Project.

Land Acquisition

The proposed recycling plant Project site at Ikorodu is a Lagos State Government allocation which was acquired on lease for 99 years. However, the traditional owners of the expanse of land where the proposed project is located is Ilado descendants family, Parafa Alagemo.

Overview of Project Description

The key point of post-consumer PET bottle recycling is the removal percentage of impurities which is mixed in the duration from beverage factory to recycling plant. PET bottle recycling technology offered by BoReTech to be used at the proposed plant involves processes such as de-baling, label separation, metal separation, bottle pre-washing, crushing, hot flotation washing and glue-removing, continuous rinsing and drying, blending, dust removal, and packaging.

Environmental Baseline Data

The field sampling was carried out from 8th – 12th September 2022 (wet season) to cover all relevant aspects of the physico-chemical, bio-ecological, socio-economic and environmental health in the project area. All sampling and observation points were geo-referenced using the Garmin Global Positioning System (GPS) receiver (Garmin eTrex 10). Quality control/Quality assurance was ensured in all aspects including sample collection, handling, laboratory analysis, data coding/manipulation, statistical analysis, presentation and communication. Fieldwork activities/Laboratory analyses were carried out to complement secondary data in line with the FMEnv's EIA procedure.

Climate

Microclimatic data were acquired from the study area and thirty (30) years (1989-2019) long

term data (macroclimatic data) retrieved from the Nigerian Meteorological Agency, Oshodi Lagos and literature sources were used for the study. The study area is situated within the coastal climatic belt where the annual distribution begins with the early rains in March, which ceases in November. In general, there should be only two seasons, but in climatology four seasons are actually discernible for the area. They are the early rainy season (March-July), little dry season (August break), late rainy season and dry season (December-February). Highest rainfall value was obtained in June (374 mm) while the lowest rainfall value was obtained in January (19 mm) within the period under review.

The field study temperature recorded in the area was 27.1°C – 29.7°C and values of 27.7°C and 28.1°C were obtained at the control locations as compared with the trend for Lagos terrain within the period of 1989 -2019 which was 27.2°C – 30.1°C. Relative humidity was low during dry season and high during the peak of rainy season due to the influence of moisture laden south-westerly wind in the area. However, the relative humidity in the study area was in the range 77.4% - 98.5%. The recorded wind speed in the study area was in the range 0.9m/s – 3.2m/s with values of 1.2m/s and 4.4mls recorded at the control.
Generally, the weather condition in the study area during the period considered was cloudy and the average cloud cover was 6 oktas. Cloud cover is prominent during rainy periods and minimal during dry seasons.

Atmospheric pressure at sea level measured during the study period (1989 - 2019) was between 1010- 1013mbar and the normal range of the earth's air pressure is from 970mbar to 1050mbar. These differences are the results of low and high air pressure systems which are caused by unequal heating across surfaces. The study area features a humid tropical wet climate that is typical of the coastal areas in Nigeria.

Air Quality

Sampling took place at ten sampling locations strategically located at the site with two control stations outside the proposed site. Meanwhile, twenty seven points were recorded for the secondary data used. Nitrogen dioxide in the wet season was within FMEnv Limit (0.06ppm) and NESREA limit (0.20ppm) but the average value for dry season exceeded both limits. Sulphur dioxide was below detectable limit of the instrument used at all sampled locations including control for the wet season and were within the FMEnv statutory limit (0.01ppm) and NESREA limit (0.35ppm) as compared to an average of 0.05ppm recorded for the secondary data used which exceeded FMEnv limit but within NESREA limit. The ambient concentration of Carbon monoxide at sampling points within the project site range from 0.2ppm to 1.1ppm and values of 0.2ppm and 1.5ppm at the control locations during wet season as compared to an average

of 3.9ppm obtained for the secondary data. All sampled locations complied with FMEnv limit of 10.0ppm and NESREA limit of 8.73ppm for CO_2 in ambient air.

Oxygen at all sampled locations during the wet season study period was 21% across the board and was within **FMEnv** standard of **21.0%** and was within limits for all sampled locations. Ammonia levels within the site and control were below the detectable limit of the air monitoring equipment for wet season with an average of 0.24ppm recorded for the secondary data and were all within NESREA limit (0.86ppm). H_2S levels at the site and control are below the detectable limit of the measuring device used during wet season as compared to an average of 0.7ppm obtained for the secondary data and were below the FMEnv limit (14ppm). The Suspended Particulate Matter ($PM_{10.0}$) measured at selected sampling points during the wet season range from 6.4µg/m^3 to 52.7µg/m^3 and values of 8.5µg/m^3 and 12.6µg/m^3 for the control points as compared to an average of 24.54µg/m^3 obtained for the secondary data used. $PM_{10.0}$ results show that all sampled locations had values within **FMEnv** limit of **250.0µg/m^3** and **NESREA limit** (150 µg/m^3).

Geotechnical Test for subsoil

The investigation was carried out using 8 No. Cone Penetration Tests and 5 No. Boreholes. The findings include;

- With groundwater occurring below the recommended foundation level, excavations for shallow foundations are not expected to be problematic, except possibly for coping with the high strength of the material.
- Temporary unsupported vertical excavation walls within the laterite shall be possible and stable.
- Where excavation floors are inevitably disturbed in the course of excavation, it is advisable to compact the floor adequately prior to the application of the blinding course to avoid a degree of settlement or a general appreciable differential settlement between the different parts of the structure.
- Adequate drainage facilities should be provided for the proposed structures to avoid scouring of the soil and undermining the foundations.
- For all concrete works normal Portland cement may be used. However a dense concrete mix is recommended. Adequate cover should be provided for all reinforcement bars to avoid corrosion.

Land Use

There are five land use and land cover categories distinguished in Ikorodu LGA where the proposed project is located namely; forest vegetation, grass land, water body, built ups and bare land. There is pressure on forest vegetation and water body in the phase of industrialization and urbanization in the area. Also, increase in human population, rapid growth of industrialization and urbanization and weak environmental policy were the major drivers of land use land cover changes in the study area. The need for proper land use and land cover planning and management are required in Ikorodu LGA. Therefore, the concept of sustainable development should be adopted in the area.

Water Quality

One ground water sample was collected from the borehole at the project site as well as a control point and a sample was also collected for the secondary data. Similarly, one surface water sample was collected along Oluweri lake during wet season study period which has several tributaries in Ikorodu. **The lake at the time of sampling was already receding which could be due to the activities going on around the lake such as sand mining and pig rearing**. This explains why water could not be sampled at different transect considering activity areas. **Also, sediment and hydrobiology study was not carried out due to the low depth of the lake at the time of the study.** The water samples were analysed at a FMEnv accredited and Institute of Public Analysts of Nigeria (IPAN) registered laboratory **Azmarineberg Limited 242A, Ganiyu Alimi Crescent Gbagada phase II, *Lagos*** for physico-chemical and microbial parameters.

The ground water samples were within stipulated limits by FMEnv and NESREA except for low pH values in both seasons and it was above limit for colour in wet season as well as nitrate and turbidity as recorded in the secondary data. Total coliform was within NESREA limit for both seasons but exceeded FMEnv's limit for the wet season. Likewise, surface water analysed in wet season had low pH value with no *E.Coli* detected while Total coliform was within specified NESREA limit. The absence of E.coli and minimal Total Coliform in the surface water sampled in the wet season inspite of human activities around the area could be due to the rains resulting in run-offs flooding to other locations in the study area and proper housekeeping observed at the piggery along the path to the lake. For the secondary data, all parameters were within limits except sulphate, biochemical oxygen demand, Iron, cadmium, zinc and chromium. It should be noted that surface water analysed for both seasons are not from the same source but they are in same terrain exposed to similar industrial pollution in the area.

Soil Study

Five soil samples and one control location were sampled within and around the facility. Meanwhile one soil sample was recorded for the secondary data used for comparison. Soil samples were taken at up to 0-15cm depth for top soil and 15-30cm depth for subsoil. The soil samples were taken to Federal Ministry of Environment (FMEnv), accredited and Institute of Public Analysts of Nigeria registered laboratory – ***Azmarineberg Limited, 242A, Ganiyu Alimi Crescent street, Gbagada Phase II, Lagos*** laboratory for analysis. The pH of the soil samples for both seasons were a bit of acidity and slightly alkaline. The soil texture falls within the clay soil category. The heavy metals in the soil were within Alloway limits for soil metal content. Also total coliform and E.coli were not detected in the samples.

Vegetation Study

As observed during wet season study period some of the flora species were; Banana trees, African almond tree, elephant grass, spear grasses, Neem tree etc.

Combination of field observation and literature review shows that the proposed project area comprised of secondary (dry and swamp forest) and mangrove forest. The highest diversity of 66 species, 59 genera in 34 families were identified in the study area during wet season as compared to secondary regrowth species, mostly grasses such as *Andropogon gayanus*, *Axonopus compressus* and C*ommelina spp* recorded for the secondary data.

The dominant family for the wet season period was C*yperaceae,* (seven spp.) while most species were forbs (n=20 species [30%], Also recorded were four mangrove species (*A. aureum*, *D. lunatus R. racemosa* and *P. reclinata*) and long stretch of *R. hookeri* along the wetland/swamp. Species diversity was higher in the wet season period (n=61 species [62%]) *Panicum maximum* is the most dominant species.

Wildlife Study

During the wet season study period, the following animals were observed; Ants(*Formicidae*), white butterfly(*Pieris rapae*), Agama lizard(*Agama Agama)*, Grasshoppers (*Caelifera*), Squirrel (*Sciuridae*), housefly (*Musca domestica*), pigeon (*Columbidae*), and laughing dove (*Spilopelia senegalensis)*. Similar, as recorded in the secondary data used actual sighting of wildlife species in the Project area were limited to avian species in flight and along pools of water in the area. In addition, one or two reptilian species, especially a small Monitor Lizard were seen.

Socio Economics

The identified communities within 5km radius of the Project site are Parafa Arodelufin, Parafa Lolu, Parafa Itamope, Parafa Balogun, Parafa Latona, Parafa Ikusami and Parafa Alagemo. However, Prafa Alagemo which is the headquarters of all the sub communities is the host community where the proposed project is located along Ikorodu-Itoikin-Epe road, Ikorodu LGA, Lagos State. The community is under Lapega Ilado Community Development in Ikorodu LGA. The 2006 National census placed the population of Ikorodu LGA at 527,917 people with male to female ratio of 51% to 49% respectively. World Population review estimated the population of Ikorodu at 937, 615 peoples, while its forecast show that the population of Ikorodu could rise to 1,453,781 in 2030.

This study used data collected at the individual level with the use of questionnaires, key informant interviews, and Focus Group Discussions to assess the socio-economic and health status of the community. A total of 350 questionnaires were administered amongst people in seven (7) most proximal sub communities to the project area. However, 330 questionnaires were completed while 20 were returned uncompleted as some of the community dwellers were not available due to their various trades while others wanted monetary reward to grant individual interviews during the study. Meaningful consultations were held with the community leaders using the Key Informant Interview engagement approach. In addition, direct observations were conducted by survey enumerators in addition to the review of relevant secondary information acquired using desktop reviews. The target population for this study was men, women, and youths.

Ikorodu is dominated by Ijebu speaking sub-group of Yoruba ethnic group who emigrated from Sagamu in Ogun state. Oba Kabir Adewale Shotobi the Ayangburen of Ikorodu and the Adegorushen IV of Ikorodu kingdom is the paramount traditional ruler in Ikorodu division. Meanwhile, the host community Parafa Alagemo has a traditional head known as Baale (Chief Afolabi) ably supported by his chiefs like Ashipa Parafa Alegemo, Balogun Okunrin Parafa Alagemo, Balogun Obirin Parafa Alegemo, Jagun Alagemo etc.

Inhabitants of the project area include devotees to several religions, including Christianity, Islam, and traditional worship. Notable festivals in the area are Eluku(Yoruba Oro festival) and Agemo. The indigenes of Ikorodu LGA are mostly traders and farmers while fishing (not peculiar with people in the host community) thrives mostly along the Lagos Lagoon foreshore on the Cradoo (Ikorodu) Lake waterfront. A Nigerian Ports Authority Lighter Port Terminal is located in Ipakodo where fishing activities also take place. Occupational structure of the area is consistently dominated by traders and farmers that generated daily income levels just enough

to cover household daily expenditure requirements. Some residents engage in Artistry, such as mechanics, bricklaying, tricycling, food vendors and block molding industries.

In Parafa Alegemo and the sub-communities, the dominant respondents in terms of gender are male (55%) while female respondents are lower (45%). Also, the dominant respondents in terms of age, (55.90%) are between 20 years and 39years followed by respondents whose age bracket fall within 40 years to 59 years (47%) and the respondents within the age bracket of 60 years and above have 2% of the in-scope individuals and households. Parafa Alagemo communities have access to IKEDC (National grid) with transformers being installed to power the community although they are sufficiently inadequate in the proposed project area. However, some residents utilize generator as source of electricity supply for household uses while majority utilize bush lamp/lanterns

Most of the inhabitants live in sub-standard houses as these buildings generally lacked in- house facilities such as modern toilets and water. Majority of the residents of the community depend on boreholes, well, Municipal water, while streams and storm water are used as seasonal sources of water. Households travel a great distance especially during dry season to obtain fresh water thereby wasting precious time that could be used for other productive activities. Majority of the respondents claim they patronize private cart pushers to dispose their waste while others use Private Sector Partnership (PSP). A handful claim they burn their waste as need arises.

Needs of the community

A scoping workshop was done at Parafa Community Town Hall on **8th December, 2022.** The entire community showed enthusiasm towards the establishment of the proposed PET recycling plant Project which was clearly stated from their reactions when the FMEnv delegates' team present asked for their perception towards the proposed project. They all responded; "YES" to the establishment of the project. However, some of their expectations include;

- Employment opportunities for indigenes
- Financial assistance during traditional festivals (such as AGEMO happening annually between August and September)
- Granting supply and distributorship of the project's finished goods to members of the community
- Sharing of end of year incentives to community members during festive periods
- Assign car/truck park management to indigenes in partnership with the proponent as a way to further enhance security around the vicinity

- Purchase of transformer and general illumination of the project area for security
- Boreholes drilling for the use of the community
- Provide insurance cover for workers in the facility
- Ensure community health from eventual waste water from the facility due to the topography of the project area further compounded by sand mining activities around the site
- Ensure emissions emanating from the facility which they described as smoke does not have any serious health challenges to the community and
- Provide educational facilities for the community

Health Impact Study

Prevalent ailments in the communities includes but not limited to; chest pain, common cold, high blood pressure, malaria and typhoid fever 30% of the respondents considered their health as being good, fair or poor. Also it was observed that about 33% of the respondents preferred Primary Health Care centers near them. Others patronize chemist shops for treatment when ill (36%). Similarly, about 11% claim to patronize Private hospitals/Clinics. The low percentage might be due to cost of using such facilities considering the average income rate in the area. However, 19% of the respondents visit traditional medicine practitioners as there is strong presence of traditional religion and practice in the area (Alagemo).

Potential and Associated Impacts

ISO 14001 method of quantification and rating of impacts was used for the Sonnex Packaging Nigeria Limited's proposed PET recycling plant study. The Impact Assessment of the proposed PET recycling project (interaction of different Phases and Project activities/Environmental Aspects) resulted in Seventy-eight (78) impacts with different impact significance ratings including Beneficial, Low, Medium and High. The summary of impact significance ratings in the report shows that 39.8% of the identified impacts fall within the category of beneficial and low impacts, while the other 45% fall within the medium category that can be easily mitigated for environmental benefits. Only 15% of the impacts are of High category. A summary of the impacts in the pre-construction, construction and operation phases of the proposed PET recycling plant project are hereby as follows;

Potential negative impacts include;

Reduction in air quality and noise, impact on workers' health and safety, loss of biodiversity, impact on soil and ground water quality, Impact on community health safety and security, fire and explosion.

Potential positive impacts include;

Reduction of environmental pollution associated with used plastic bottles, job opportunities and increase in revenue generation to the three tiers of government through taxes and revenues.

Cumulative Impacts

Cumulative impacts are those impacts resulting from the combined effects of past, present or reasonably foreseeable actions owing to the project aspects and activities outside the project. The idea of cumulative effects is a significant one. Although impacts may be small individually, the overall impact of accumulated environmental changes affecting the receptors altogether can be significant. When a resource is nearing its tolerance threshold, a small change can push it over. Some of the identified cumulative impacts include; land-based traffic, Stress on Public utilities, soil and water quality as well as emissions into air and noise emanating from the different industrial equipment could have negative effects on the environment if proper mitigation measures are not in place

Mitigation Measures

Sonnex Packaging Nigeria Limited shall ensure compliance with the Environmental Management Plan and Monitoring Programme as presented in Chapter 7 of this report, and apply all mitigation measures recommended in the report to ensure the sustainable development of the proposed Sonnex Packaging Nigeria Limited 100 tonnes per day PET recycling plant project. Highlights of key mitigation measures for the project include; Provision of necessary PPEs for both workers and visitors to site, regular maintenance of generators, vehicles and haulage trucks, erection of barricades and proper signage in the project area especially during construction, Install and use pre-mobbed equipment and silencers, use private security outfits as well as engage law enforcement agents, ensure proper drainage within and around its premise and cover gulley from excavation also maintaining good housekeeping practices. Maintain waste area and spills from engines during maintenance and ensure adequate greenery in the project area etc.

Environmental Management Plan (EMP)

An EMP has been developed to satisfy long-term objectives of managing and monitoring the environment, health, safety, security and socio-economic impacts of the proposed project. This

plan has been designed to achieve, enhance and demonstrate good environmental performance, in accordance with National and International standards and regulations. The EMP covers an environmental audit and monitoring programme, waste handling, waste segregation and waste minimization guidelines.

Decommissioning and Abandonment

The project is expected to last for about thirty (30) years. At the end of the life span of the project or upon a decision to demobilize the project, a proper site closure will occur involving environmentally and physically safe demolition, clearing, and disposal of all materials. Prior to decommissioning and rehabilitation activities, a monitoring program shall be developed and submitted to the Federal Ministry for approval, as a part of the final decommissioning plan. This shall be done to cover proposed monitoring during and after the closure of the facility.

Conclusion

The EIA study carried out for the proposed Sonnex Packaging Nigeria Limited 100tons per day PET recycling plant project was prepared in accordance with the provisions of the EIA Act CAP E12 LFN, 2004 by the FMEnv and other extant National, State and international requirements. The study provided all necessary information which are expected to satisfy all stakeholders as objective evidence required for developing the EIA. In order to achieve this, the study identified all the relevant environmental regulations that would affect the project, establish the baseline conditions of the project area, and ensure that potential environmental, social and health impacts of the proposed project were fully assessed. Also, practicable mitigation measures were recommended to manage the impacts associated with the project while a workable management plan was equally developed to mitigate unforeseen impacts that may arise.

Recommendation

The management of Sonnex Packaging Nigeria Limited shall ensure that the proposed PET plant Project is developed and operated in an environmentally sustainable manner, in accordance with extant National and International standards by properly managing the activities that may bring about disorder to the environment. Sonnex shall abide with extant laws as relevant to the proposed project and ensure implementation of the recommended mitigation measures and the developed EMP for the project. There would be continuous monitoring of environmental and social performance of the proposed Project, including periodic consultation with the relevant stakeholders.

Acknowledgement

Sonnex Packaging Nigeria Limited wishes to recognize the cooperation and support of the Federal Ministry of Environment, Lagos State Ministry of Environment and Ikorodu Local Government Area officials during the preparation of this Environmental Impact Assessment (EIA) report.

We also express our gratitude to the management and staff of Azmarineberg Limited (Environmental Consultant) for their commitment towards the successful preparation of this EIA report which was carried out with the highest level of precision and in line with local and international standards.

CHAPTER ONE

INTRODUCTION

1.1 Background Information

The development of industry results in not only many products for human activities but also a large amount of wastes to the environment because used products are discharged after human activities. These wastes include gas wastes, water wastes, and solid wastes (Tang et al., 2020; Zhang et al., 2018; Zhao et al., 2020). Plastic waste is a representative waste product that originates from industrial development, and its discharge to the environment causes severe environmental problems. Currently, plastic products are an indispensable part of people's daily lives and are applied in various industries, such as construction, healthcare, electronic components, agriculture, automotive, and packaging (Anuar Sharuddin et al., 2016). The demand of plastic mainly comprises polyethylene (PE), polypropylene (PP), polyvinyl chloride (PVC), polyethylene terephthalate (PET), polyurethane (PUR) and polystyrene (PS) (Rodrigues et al., 2019).

Plastics undergo slow degradation and can remain in the environment for at least decades or even hundreds of years; they are thus named non-biodegradable plastics and cause ever-increasing levels of global Non-biodegradable Plastics Wastes (NPW), thus bringing about various environmental issues (Garcia and Robertson, 2017). Due to the growing environmental problems associated with NPW, recycling methods have received widespread attention due to their environmental friendliness and economic benefits (Howard, 2002).

The proposed Sonnex Packaging Nigeria Limited's 100 ton per day PET Recycling Plant in Ikorodu Local Government Area (LGA), Lagos State is a major developmental project that will have potential impacts (beneficial and adverse) on the environment, hence the need for Environmental Impact Assessment (EIA). EIA is mandatory in Nigeria for new developmental projects as stipulated by the Environmental Impact Assessment (EIA) Act Cap E12 LFN, 2004 of the Federal Ministry of Environment.

Therefore, in agreement with the EIA Act and other national and international regulations on Environmental Protection and Sustainable Development, **Sonnex Packaging Nigeria Limited** commissioned **Azmarineberg Limited** to carry out an EIA study for the proposed project at Ikorodu Industrial Estate, Parafa village, Ikorodu LGA, Lagos State.

1.2 Project Proponent

Sonnex Packaging Nigeria Limited, Lagos State was incorporated in Lagos, Nigeria with Registration Number RC 380220 and is a division of Mohinani Group, manufacturing flexible and rigid packaging solutions for industries with products such as PET PRE-Forms, PP-HDPE closure, polyethylene nylon and household plastics. Sonnex Packaging Nigeria Limited has its Head office at 1 Olorunfemi Street, off Kudirat Abiola way, Ojota, Lagos State.

1.3 The Proponent's Intent

Sonnex Packaging Nigeria Limited intends to establish a 100 ton per day PET Recycling plant in Ikorodu LGA, Lagos State. As part of its Corporate Social Responsibility(CSR) of keeping the earth free of waste thereby protecting the Ozone layer and satisfy consumer needs, the company wants to commence recycling of PET to meet demand for PET flakes. The proposed project is an expansion of the company's other business ideas which is also profit driven. These clean PET flakes or pellets will then be processed by reclaimers or converters that will transform the flakes or pellets into a commodity-grade raw material form such as fiber, sheet, or engineered or compounded pellets, which is finally sold to end-users to manufacture new products. The proposed project will result in additional source of income to the proponent and accrue revenue for the three tiers of government (Local, State and Federal) as well as reduce plastic waste ending up in Landfills.

1.4 Terms of Reference/Objectives of the EIA

The terms of reference (ToR) for the EIA of the proposed 100 ton per day PET Recycling plant at Parafa village, Ikorodu LGA, Lagos State, Nigeria was prepared and submitted by Azmarineberg Limited to the Federal Ministry of Environment (FMEnv) for their approval. This ToR was derived primarily from regulatory laws and requirements of the FMEnv, Lagos State Ministry of Environment and Water Resources and relevant Lagos State Environmental Protection Agency's laws, were also taken into full cognizance, in developing the ToR for this study. Consultations with the regulators and other stakeholders were organized in order to identify and define the project activities and aspects that may have significant environmental effects on the scope of the environmental baseline data needed as basis for impact assessment.

The EIA is anticipated to establish the environmental issues associated with the project; predict their impacts and magnitude; suggest and evaluate project alternatives; and recommend mitigation measures in addition to developing an Environmental Management Plan (EMP) to ensure environmental friendliness and sustainable development.

1.5 Scope of the EIA

The summary of the scope of the EIA as contained in the approved ToR includes:

- Project screening and site visit;
- Review of national and international environmental regulations guiding the project;
- Preparation of Terms of Reference (ToR) for the study in accordance with FMEnv and relevant Lagos State Environmental Laws
- Literature search and field observations of existing baseline data, as well as undertaking fieldwork and laboratory analysis to fill information/data gaps
- Full description of project activities and identification of potential impacts associated with logistic, site preparation, construction, new installations, operation, abandonment and specific risk/hazards at each stage
- Qualification of potential impacts, their prediction and evaluation of their significance using appropriate models
- Identification of effective mitigation measures for the project activities
- Stakeholders engagement (Consultation with regulatory agencies, participation in field data gathering, open fora etc) and Identification of all communities within the project location for effective consultation, including regulatory bodies such as FMEnv, National Environmental Standards and Regulations Enforcement Agency(NESREA), Lagos State Environmental Protection Agency(LASEPA) as well as Lagos State Ministry of Environment and Water Resources.
- Development of a comprehensive Environmental Management Plan, as well as monitoring, decommissioning/abandonment and remediation plans
- Remediation Plan after Decommissioning, Closure or Abandonment
- Preparation of a report that conforms to standards and guidelines set by the regulators, international bodies (e.g. World Bank).

1.6 EIA Methodology

The EIA study was carried out in line with the FMEnv's EIA procedure. Adopted EIA flow chart in Nigeria is shown as figure 1.1. The study involved combination of multidisciplinary studies (science, engineering, law and social sciences). Information on the project area, project design as well as past project experience were used for impact identification and evaluation as well as to establish mitigation and improvement measures.

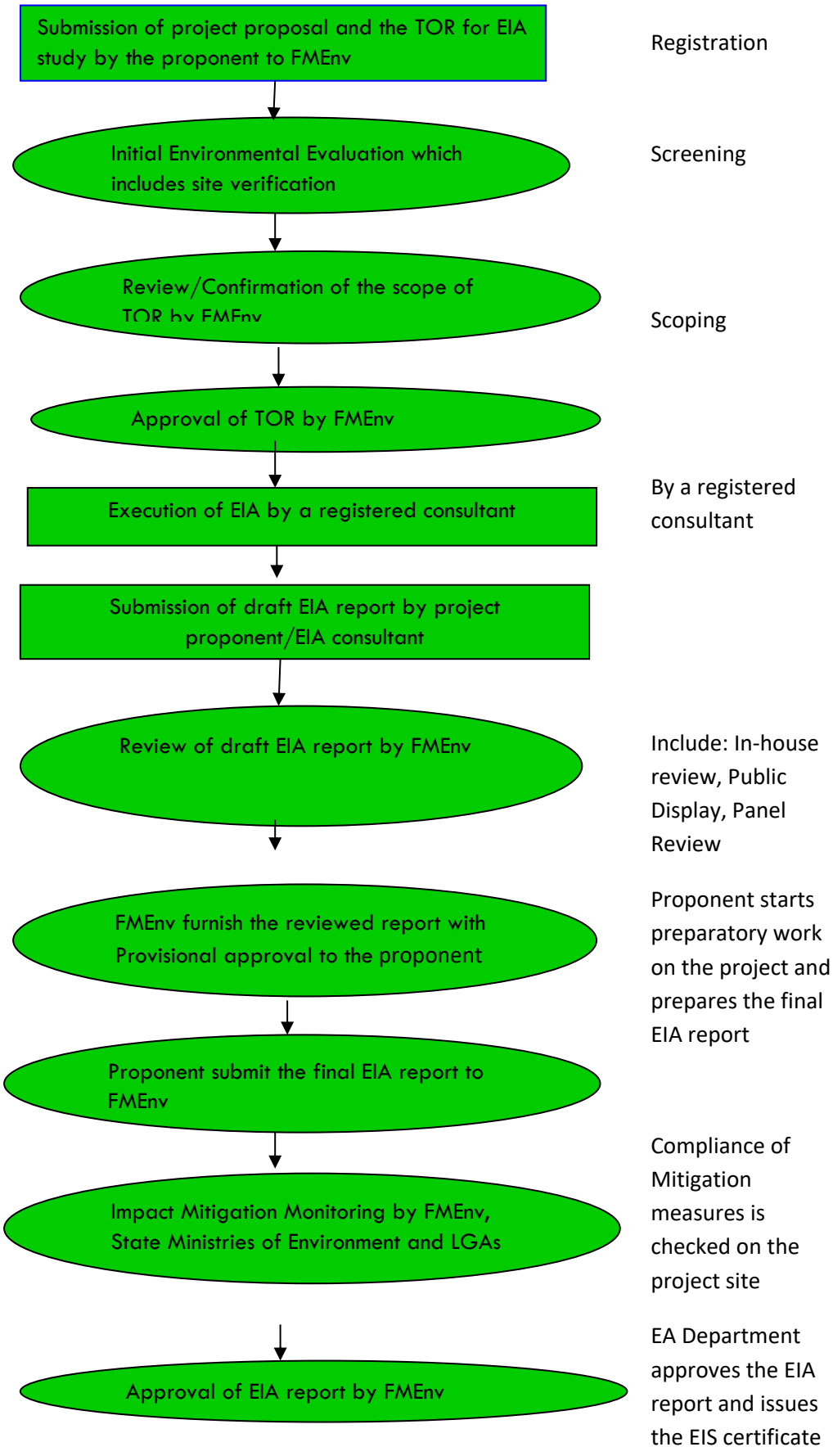


Figure 1.1: FMEnv Environmental Impact Assessment (EIA) Process Flow Chart in Nigeria

1.7 Legal and Administrative Framework for the EIA Process

Applicable extant National, State and Local Government edicts including multilateral agreements to which Nigeria is a signatory that are relevant to the Sonnex Packaging Nigeria Limited's project have been reviewed and presented in this Chapter of the report. The laws include;

1.7.1 National Laws

1.7.1.1 National Regulatory Requirements

The FMEnv formerly known as Federal Environmental Protection Agency (FEPA), established by Act No. 58 of 1988 and the States Ministries of Environment are the bodies responsible for environmental matters in Nigeria. Consequently, the following policies and regulations of these regulatory bodies are the major driving forces for this EIA study.

1.7.1.2 National Policy on the Environment, 1989(revised in 1999 and 2017)

The National Policy on Environment, 1989, defines guidelines and strategies for achieving the policy goal of sustainable development by:

- Securing for all Nigerians a quality of environment adequate for their health and well-being.
- Conserving and using the natural resources for the benefit of present and future generations.
- Restoring, maintaining and enhancing the ecosystem and ecological processes essential for the preservation of biological diversity.
- Raising public awareness and promoting understanding of the essential linkages between the environment, resources and development.

Nigeria formulated its first national policy on the environment in 1989. It was revised in 1999, and 2017. Thus, the purpose of this National Policy on the Environment is to define a new holistic framework to guide the management of the environment and natural resources of the country. As a framework document, it prescribes sectoral and cross-sectoral strategic policy statements and actions for the management of the country's environment for sustainable development. In addition to the existing 1989 and 1999 policy documents, this Policy derives its strength from the fundamental obligation for the protection of the environment as stated in section 20 of the Constitution of the Federal Republic of Nigeria 1999 which provides that the "State shall protect and improve the environment and safeguard the water, air and land, forest and wild life of Nigeria". In addition, Nigeria is party to several international treaties and conventions

governing environmental issues. It is on the combined thrust of these instruments that the National Policy on the Environment rests.

The goal of the National Policy on the Environment is to 'ensure environmental protection and the conservation of natural resources for sustainable development'

The strategic objective of the National Policy on the Environment is to coordinate environmental protection and natural resources conservation for sustainable development.

1.7.1.3 National Environmental Protection (Effluent Limitation) Regulations, S.I.8, 1991

The National Effluent Limitation Regulation, S.1.8 of 1991 (No. 42, Vol. 78, August, 1991) makes it mandatory for industries as waste generating facilities to install anti-pollution and pollution abatement equipment on site.

1.7.1.4 National Environmental Protection (Pollution Abatement in Industries and Facilities Generating Wastes) Regulations, S.1.9, 1991

The Pollution Abatement Regulation, S.1.9 of 1991 (No.42, Vol. 78, August, 1991) imposes restrictions on the release of toxic substances and stipulates requirements for pollution monitoring units, machinery for combating pollution and contingency plan by industries; protection of workers and safety requirements; environmental audit (or environmental impact assessment for new industries) and penalty for contravention.

1.7.1.5 National Environmental Protection (Management of Hazardous and Solid Wastes) Regulations S.I.15, 1991

The Management of hazardous and Solid Waste Regulation, S.1.15 of 1991 (No.102, Vol. 78, August, 1991) defines the requirements for groundwater protection, surface impoundment, land treatment, waste piles, landfills, incinerators etc. It states procedure for inspection, enforcement and penalty.

1.7.1.6 Environmental Impact Assessment Act Cap *E12 LFN, 2004*

The Environmental Impact Assessment (EIA) Act Cap E12 LFN, 2004 makes EIA a mandatory requirement before the approval for implementing all new major public and private projects in Nigeria is given. The EIA Act sets out to:

- Consider the likely impacts and the extent of these impacts on the environment before embarking on any project or activity;
- Promote the implementation of appropriate policy in all federal lands consistent with all laws and decision-making processes through which the goal of this Act may be realized;

- Encourage the development of procedures for information exchange, notification and consultation between organizations and persons when the proposed activities are likely to have significant environmental effects on boundary or trans-state or on the environment of bordering towns and villages.

1.7.1.7 Factories Act CAP FI, LFN 2004

An Act to provide for the registration, etc., of factories; to provide for factory workers and a wider spectrum of workers and other professionals exposed to occupational hazards, but for whom no adequate provisions had been formerly made; to make adequate provisions regarding the safety of workers to which the Act applies and to impose penalties for any breach of its provisions.

1.7.1.8 SON Act 2015

An Act to repeal the Standard Organization of Nigeria Act, CAP S9 Laws of the Federation of Nigeria, 2004 and enact the Standards Organization of Nigeria Act, 2015 for the purpose of providing additional functions for the organization, increasing penalty for violations: and for related matters

1.7.1.9 The Endangered Species Act, Cap E9, LFN 2004

This Act focuses on the protection and management of Nigeria's wildlife and some of their species in danger of extinction as a result of overexploitation. These sections are noteworthy:

- **Section 1** prohibits, except under a valid license, the hunting, capture or trade in animal species, either presently or likely to be in danger of extinction.
- **Section 5** defines the liability of any offender under this Act.
- **Section 7** provides for regulations to be made necessary for environmental prevention and control as regards the purposes of this Act

1.7.1.10 Land Use Act LFN 2004

An Act to Vest all Land compromised in the territory of each State (except land vested in the Federal government or its agencies) solely on the Governor of the State , who would hold such Land in trust for the people and would henceforth be responsible for allocation of land in all urban areas to individuals resident in the State and to organizations for residential, agriculture, commercial and other purposes while similar powers will with respect to non-urban areas are conferred on Local Governments (27th March 1978) Commencement. The main objectives of the Land Use Act were:

- effect structural change in the system of land tenure;

- achieve fast economic and social transformation;
- negate economic inequality caused by the appropriation of rising land values by land speculators and landholders and;
- Make land available easily and cheaply, to both the government and private individual developers.

1.7.1.11 Forestry Law CAP 51 LFN 1994

This Act provides for the preservation of forests and the setting up of forest reserves. It is an offence, punishable with up to 6 month imprisonment, to cut down trees over 2ft in height or to set fire to the forest except under special circumstances. RAAMP interventions which focus on rural areas must ensure that the intervention does not violate the forestry act except under special circumstances as stated in the Act.

1.7.1.12 Criminal Code Act, Cap C38 LFN 2004

The Act contains the basic criminal law offences that relate to damage to the environment, public health and natural resources. Some environmental offences include: causing a public nuisance; fouling the water of any spring, stream, well or reservoir of a place; and violating the atmosphere in any place so as to make it noxious to the health of persons in general in the neighborhood.

1.7.1.13 Labour Act, Cap L1 LFN 2004

Provide comprehensive legislation on conditions of work and employment. Part I sets out general provisions relating to wages, contracts and terms of employment. Employers shall not advance more than one month's wages to an employee (s. 4). Section 8 requires that workers entering a contract be medically examined at the employer's expense. Section 20 governs redundancy. Part II regulates recruiting, including the licensing of recruiters (s. 25), and the right to be accompanied by family (not exceeding 2 wives) (s. 34). Part III relates to special classes of workers, including apprentices (ss. 49-53), women (ss. 54-58), and young persons (ss. 59-64). In general, women and young persons are prohibited from performing underground and night work. Section 73 prohibits forced labour. Part IV contains supplemental provisions relating to administration and the settlement of disputes. Section 90 repeals the Labour Code Act.

1.7.1.14 The Nigerian Urban and Regional Planning Act Cap N138, LFN 2004

The Urban and Regional Planning Act is aimed at overseeing a realistic, purposeful planning of the country to avoid overcrowding and poor environmental conditions. In this regard, the following sections become instructive:-

- Section 30 (3) requires a building plan to be drawn by a registered architect or town planner.
- Section 39 (7) establishes that an application for land development will be rejected if such development will harm the environment or constitute a nuisance to the community.
- Section 59 makes it an offence to disobey a stop-work order. The punishment under this section, is a fine not exceeding N10, 000 (Ten thousand naira) and in the case of a company, a fine not exceeding N50, 000.
- Section 72 provides for the preservation and planting of trees for environmental conservation.

1.7.1.15 National Environmental Standards and Regulations Enforcement Agency (NESREA) Act of 2007

An Act that provided for the establishment of the National Environmental Standards and Regulations Enforcement Agency charged with responsibility for the protection and development of the environment in Nigeria; and for related matters. The applicable NESREA regulations to the proposed project are as follows;

1.7.1.15.1 National Environmental (Domestic and Industrial Plastic, Rubber and Foam Sector) Regulations, S.I. No. 17 of 2011:

The principal thrust of this Regulation is to prevent and curtail pollution of the Nigerian environment from all operations and ancillary activities of the domestic and industrial plastic, rubber and foam sector.

1.7.1.15.2 National Environmental (Surface and Groundwater Quality Control) Regulations, S. I. No. 22 of 2011

The purpose of this Regulation is to restore, enhance and preserve the physical, chemical and biological integrity of the nation's surface waters, and to maintain existing water uses.

1.7.1.15.3 National Environmental (Permitting and Licensing System) Regulations 2009

This addresses the need to obtain permits from the agency to cover various environmental licenses to operate as regards the safety and care of the environment. Such permits include: Effluent discharge permit, Air quality permit, Waste and toxic substance permits.

1.7.1.15.4 National Environmental (Noise Standards and Control) regulations 2009

The purpose of this regulation is to ensure maintenance of a healthy environment for all people in Nigeria, the tranquility of their surroundings and their psychological well-being by regulating noise levels and generally, to elevate the standard of living of the people by;

- Prescribing the maximum permissible noise levels a facility or activity to which a person may be exposed
- Providing for the control of noise and for mitigating measures for the reduction of noise and
- Generally for giving effect to the provisions of section 22 of the Act.

1.7.1.15.5 National Environmental (Air Quality Control) Regulations, 2014

The purpose of this regulation is to provide;

- Improved control of the nation's air quality to such an extent that would enhance the protection of flora and fauna, human health, and other resources affected by air quality deteriorations.
- For all users the right to
- Clean air
- Utilise and benefit from all natural resources managed according to the principles of sustainable development
- Be informed of the nature and extent of the potential hazard of any activity, undertaking or project and to be served timely notice of any significant rise in the level of pollution and the accidental or deliberate release into the atmosphere of harmful or hazardous substances; and
- The cleanup and rehabilitation of the affected area.

1.7.1.16 Harmful Waste (Special Criminal Provisions) Act, Cap H1, LFN 2004

The Harmful Waste Act prohibits, without lawful authority, the carrying, dumping or depositing of harmful waste in the air, land or waters of Nigeria. The following sections are notable:

- Section 6 provides for a punishment of life imprisonment for offenders as well as the forfeiture of land or anything used to commit the offence.
- Section 7 makes provision for the punishment accordingly, of any conniving, consenting or negligent officer where the offence is committed by a company.
- Section 12 defines the civil liability of any offender. He will be liable to persons who have suffered injury as a result of his offending act.

1.7.1.17 National Health Act 2014

First proposed in 2004, the development and enactment of a legal framework for health in Nigeria took close to a decade following the eventual signing into law of the National Health Bill on October 31, 2014. The Act provides a framework for the regulation, development and management of a National health system and set standards for rendering health services in the federation and other matters connected therewith.

1.7.1.18 National Policy on Plastic Waste Management 2020

This policy aims at raising the need for plastic waste Management taking cognizance of lifecycle approach in Nigeria to develop systemic solutions that make, use, reuse and prevent plastic from becoming waste.

1.7.2 State Environmental Legislations

The Lagos State regulations guiding Environmental management includes but not limited to the following:

1.7.2.1 Lagos State Environment Protection Agency, Edict 1996 (LASEPA)

The Lagos State Environmental Protection Agency (LASEPA) is the environmental regulator for Lagos State of Nigeria. Whose responsibility is to safeguard environmental quality that is consistent with the social and economic needs of the State, so as to protect health, welfare, property and quality of life.

1.7.2.2 *Lagos State Environmental Protection and Management Law 2017*

The Lagos State Ministry of Environment was established to carry out the following functions:

1. Ensure sustainable development of the environment of the State.
2. Ensure a qualitative and healthy environment thereby ensuring the well-being of the people of Lagos State.
3. Conserve and use the environment and the natural resources for the benefit of the people of the State.
4. Cooperate and collaborate with the Federal, Local Governments and non-governmental organizations, private sector and individuals on environmental matters.
5. Conserve, protect and enhance the environment, the ecosystem and ecological processes essential for the preservation of biological diversity.
6. Control and monitor all forms of environmental degradation from agricultural, industrial and governmental activities.
7. Ensure sustainable management of the forest to meet economic, social and ecological needs of the people of the state.

For Lagos State, all environmental protection issues are under the supervision of State Ministry of Environment and Lagos State Environmental Protection Agency (LASEPA).

1.7.2.3 Lagos State Safety Commission Law Cap No 6, 2011

This law was established to develop policies and strategies that will build a sustainable safety culture through a regulated and coordinated safety system in Lagos State.

The functions include:

- Formulating, advisory regulatory body for the co-ordination of all government Ministries, Agencies, Parastatals and all relevant bodies on matters relating to safety of lives and property at all levels and other safety related issues.
- Set safety standards for all sectors involved in socio-economic activities in the state
- Responsible for the issuance or withdrawal of overall safety compliance certificate at all levels where necessary.
- Promote safety culture through sustained public and institutional enlightenment strategies and programmes.
- Conduct investigations, research and evaluations on safety issues and make recommendations accordingly.
- Give out safety alerts and signals.
- Conduct and review risk management reports.
- Periodically review and update set standards.
- Maintain constant links with collaborating ministries, agencies, Local Government and Local Council Development Areas.
- Register Safety practitioners in the state.
- Perform such other duties or functions as may be required to give effect to provisions of this law.

1.7.2.4 Lagos State Physical Planning and Urban Development Law of 2010

Lagos State Physical Planning and Urban Development are mandated to ensure a sustainable physical planning and urban development that will provide an enabling environment for social economic activities through a dedicated workforce.

1.7.2.5 Lagos State Environmental Sanitation Law, 2015

The Sanitation environmental law dictates the requirements of all owners, tenants and occupiers of any building to ensure cleanliness of their premises. It includes the following amongst other;

cleanliness of toilets, backyards, sanitary litter bins, disposal of refuse, maintenance of drains, sewage and septic tanks.

1.7.2.6 Lagos Waste Management Authority Law 2007

The Authority was established by Lagos State Government to be in charge of controlling solid waste such as household, industrial, construction, commercial or healthcare waste. The functions of the Authority include:

- Make regulations for the standard of collection and disposal of the controlled waste collected in the State by the Authority, Local Government Areas and waste disposal contractors or by any other person authorized by it within the State.
- Define environmental aspects of the State waste management sector strategy in close collaboration with other key stakeholders. Collect and dispose of waste from public institutions.

1.7.2.7 Lagos State Ministry of Environment 2005

The Lagos State Ministry of Environment mandate is to foster a clean, healthy, sustainable Environment for the well-being of citizenry through the application of best practices in Environmental Management. Other functions of the Ministry include: provision of regulatory framework for environmental protection and conservation; urban sewerage management and control; urban sanitation and beautification; erosion control; liaise with Federal agencies on environmental programmes.

1.7.3 International Standards, Guidelines and Principles

Nigeria plays active roles in international collaboration for the protection of the environment. The country is a signatory to some international laws and conventions, which are targeted towards conservation and protection of the environment in order to ensure sustainable development. Some of the conventions and treaties to which Nigeria is a signatory are highlighted below.

International Union for Conservation of Nature and Natural Resources (IUCN) Guidelines (1996)The World Conservation Union – IUCN Red List of Threatened Animals provides taxonomic, conservation status and distribution information on species that have been evaluated using the IUCN Red List categories. This system is designed to determine relative risk of extinction and the main purpose of the red list is to catalogue the species that are regarded as threatened at the global level, that is, at risk of overall extinction. The 1996 red list also included information on species that are categorized as extinct; on species that cannot be assessed because of insufficient data; and on certain species in the lower risk category. Nigeria, as a member of this body, categorizes species using the red list.

United Nations Framework Convention on Climatic Change (1992)In order to achieve sustainable social and economic development, energy consumption for developing countries needs to grow taking into account the possibilities for achieving greater energy efficiency and for controlling greenhouse.

The Rio Declaration on Environment and Development (1992) Environmental issues are best handled with the participation of all concerned citizens, at the relevant level. At the national level, each individual shall have appropriate access to information concerning the environment that is held by public authorities, including information on hazardous materials and activities in their communities, and the opportunity to participate in decision-making processes. States shall facilitate and encourage public awareness and participation by making information widely available.

Guidelines on Occupational Safety and Health Management Systems and Health Management System, ILO-OSH 2001

These guidelines should contribute to the protection of workers from hazards and to the elimination of work-related injuries, ill health, diseases, incidents and deaths. At national level, the guidelines should:

(a) Be used to establish a national framework for OSH management systems, prefer-ably supported by national laws and regulations;

(b) Provide guidance for the development of voluntary arrangements to strengthen compliance with regulations and standards leading to continual improvement in OSH performance; and

(c) Provide guidance on the development of both national and tailored guidelines on OSH management systems to respond appropriately to the real needs of organizations, according to their size and the nature of their activities.

At the level of the organization, the guidelines are intended to:

(a) Provide guidance regarding the integration of OSH management system elements in the organization as a component of policy and management arrangements; and

(b) Motivate all members of the organization, particularly employers, owners, managerial staff, workers and their representatives, in applying appropriate OSH management principles and methods to continually improve OSH performance.

1.7.4 Health Safety and Environment (HSE) Policy of Sonnex Packaging Nigeria Limited

Sonnex Packaging Nigeria Limited's Health Safety and Environment Policy is as stated below (See scanned and signed copy of the policy in the appendix of this report).

- It is the policy of Mohinani group of companies (Nigeria) to manage its operations in such a manner as to protect the health of its staff, customers and the general public. We believe in maintaining a clean and orderly work place and in promoting high standards of personal hygiene throughout the organization.
- We consider health, safety and environmental control measures to be fundamental components of effective productivity. A committee comprising of management and other staff members holds "Safety Meeting" regularly to deliberate and monitor progress.
- We are committed to training our employees to arouse health and safety consciousness. This process starts at induction and continues through on-the-job training, supplemented by regular safety campaigns particularly during the yearly 'Health, Safety and Environmental Week'.
- We endeavour to minimize the exposure of staff to danger through the use of appropriate plant and equipment under strictly observed Standard Operating Procedures (SOPs). The compulsory use of safety wears and equipment is specified wherever this is appropriate.
- We are conscious that external contractors constitute a major hazard if not properly selected and supervised. We ensure that jobs are awarded to contractors who demonstrate a commitment to observe our safety procedures.
- We are committed to record all accidents and "near miss" incidents, to document and circulate details widely within the company so that we can learn from them.
- We undertake to adhere to the Factory Decree Regulations and to the guidelines published by FEPA striving to improve on their minimum standard wherever possible.
- We are conscious that objective dialogue with the general public is an important instrument in imparting and propagating knowledge on environmental protection and product safety. Hence, we will make use of this instrument at all times.
- We are committed to continuously improve our production processes to ensure minimal waste generation and to recycle such material wherever possible to prevent environmental pollution
- Mohinani group's Health, Safety and Environmental Policy is "Total Commitment to Health and Safe Environment"

1.8 Structure of the Report

The EIA report is presented in nine chapters preceded by an Executive Summary as follows;

- Chapter One - an Introduction stating the background information about the project and the proponent, Terms of Reference (ToR), Objectives and scope of the EIA study, with legal/administrative framework for EIA in Nigeria as related to the project.
- Chapter Two - discusses the project justification and presents the need/value and the envisaged sustainability of the project as well as the project development options considered
- Chapter Three - details the project description, operation and maintenance and the project execution schedule.
- Chapter Four - describes the existing (baseline) environmental conditions of the study area(s) including the socio-economic status of the inhabitants of the project area and details of the consultations held with the stakeholders.
- Chapter Five - identifies and predicts the associated and potential environmental impacts of the proposed Sonnex Packaging Nigeria Limited's PET Recycling plant project.
- Chapter Six - presents the mitigation and ameliorative measures.
- Chapter Seven - presents the Environmental Monitoring Plan (EMP) that will be adopted throughout the project lifecycle. It also includes the Environmental Management Plan that will ensure the effectiveness of the mitigating measures and the remediation plans after de-commissioning/closure
- Chapter Eight - is about remediation plan after decommissioning and
- Chapter Nine - concludes the EIA report with the key findings of the study presented therein and appropriate recommendations.

1.9 Declaration

Sonnex Packaging Nigeria Limited confirms that this report has been prepared by AZMARINEBERG Limited on its behalf and therefore takes responsibility for the implementation of the approved Environmental Management Plan contained in the report.

CHAPTER TWO

PROJECT JUSTIFICATION

2.1 Need for the Project

Recycling is a form of waste management that involves converting waste and other used materials into reusable products. A well-operated recycling plant is unlikely to cause any harm to the environment and will only help to preserve the flora and fauna of our planet. All forms of pollution in the modern world emanate from industrial waste. Recycling of these industrial wastes such as plastics, go a long way towards considerably cutting back on levels of pollution because these waste products are reused rather than just being thrown away recklessly.

Recycling reduces the environmental impacts of the PET industry in different ways like the reduction in the use of raw materials: new bottle preforms can be made with approximately 35% regranulate, with a consequent saving of the crude oil that would have been used to produce new granulate. In addition, recycling plastic requires 88% less energy than producing plastics from new raw materials (source: "An Overview of Plastic Recycling" by Rick Leblanc – the balance small business). Based on the aforementioned, need for the proposed PET recycling Plant Project will include but not limited to the following;

- Job creation opportunities for the communities, Ikorodu LGA, Lagos State and Nigeria at large
- Removal of plastic waste from the environment (such as drainages and waterbodies)
- The Project would support one of the government ways to improve the local content initiative of small scale businesses in the society
- Help to improve climate change through the reduction in raw material usage for production through its proposed technology for the project
- Increase the Internally Generated Revenue (IGR) in the State

2.2 Project Benefits

One of the most important characteristics of PET is that it is fully recyclable. However, there are other national development benefits the country would derive from the proposed 100 ton per day PET Recycling plant in Ikorodu which includes;

- Recycling can help to prevent indiscriminate use of natural resources. By recycling plastics, several tons of fossil fuel can be saved for other purposes thus conserving the natural resources.
- Reducing the negative impact on terrestrial and aquatic ecosystems and helps preserve the Environment
- Saving in electricity consumption of non-renewable fossil origin

- Recycled Products are budget friendly creating savings in households, since recycled plastics can allow many products to have a significantly lower final cost for consumers.
- Recycled plastics gives rise to a material called rPET that has multiple applications in sectors such as food and beverages or the pharmaceutical segment.
- Recycled plastics reduce pollution as the recycling process involves recovering used materials from the plastic waste, which is then used in the manufacturing industry.
- Lowers Carbon Footprint as recycling conserves energy, it results in less fuel being utilized for both its production and transportation. Thus, a lower amount of carbon dioxide will be released into the environment.

Basically, the specific benefits of the proposed PET recycling plant Project in Ikorodu would include but not limited to;

- Increase in job opportunities to the host communities, LGA as well as Lagos State(such as supply of construction materials and logistics during operation phase of the project)
- Avenue for skill acquisition prospects by qualified locals
- Increase in revenue generation for both the proponent and the three tiers of government (i.e local, State and Federal)
- Improvement in infrastructure for the communities through Sonnex Packaging Nigeria Limited Corporate Social Responsibility initiatives during the lifespan of the project
- Increase in revenue for reclaimers and scavengers of waste plastic bottles in the community

2.3 Value of the Project

The cost of the proposed Project is approximately **₦500,000,000 (Five Hundred Million naira)**.A substantial amount of this fund will be injected into the local economy through various contracts and sub-contracts. In addition, the Project has local and national economic values in terms of employment opportunities for various categories of Nigerian professionals, skilled and semi-skilled craftsmen.

2.4 Envisaged Sustainability

The envisaged sustainability for the proposed project is as discussed below.

2.4.1 Technical Sustainability

The design, construction and operation of the proposed recycling plant Project shall be handled by well trained and experienced personnel according to the existing standard methods and procedures. The building construction will be in line with the Nigerian Building code as appropriate. In addition, standard operating procedures (SOPs) and appropriate

documentation regarding the operation and maintenance of the facility shall be developed by Sonnex Packaging Nigeria Limited in partnership with the equipment supplier. This will ensure that the needed technical support is available, including supply of spare parts for routine maintenance and turnaround maintenance as required. The SOPs will be used as the basis for providing facility-specific training to relevant personnel prior to start-up to further ensure technical sustainability of the Project.

2.4.2 Economic sustainability

The use of PET entails a series of benefits, both from an economic point of view and associated with the material itself. Basically PET flakes produced from this recycling plant would be used as raw materials for other plastic containers. The proposed Sonnex Packaging Nigeria Limited's recycling plant project will be financed by a combination of Equity and loan.

Sonnex Packaging Nigeria Limited shall partner with off-takers in the Fast Moving Consumer Goods (FMCG) Sector to ensure economic sustainability of the Project. This sector has high demand for recycled PET products for packaging of its finished products. To ensure sustained availability of raw materials (post-consumer PET bottles), Sonnex Packaging Nigeria Limited shall establish a collection point in addition to supply from individuals and private sector participants.

2.4.3 Social sustainability

A detailed Stakeholder consultation process would be implemented throughout the EIA process to assist in ensuring that the identified stakeholders had the opportunity to provide input into the Project planning process. This would also assist in maintaining good relationships with the stakeholders. Sonnex Packaging Nigeria Limited shall ensure that the stakeholder consultation process is sustained throughout the Project life cycle. In addition, the social sustainability of the Project will be achieved through continuous implementation of Corporate Social Responsibility Plan that will be put in place for local communities in the Project area.

2.4.4 Environmental Sustainability

The process of recycling protects the environment and can also help reduce the amount of greenhouse gas emissions, thereby helping to mitigate global warming effects. The proposed recycling plant Project would improve environmental protection by decreasing plastic pollution. Also the facility shall ensure the following during its operations;

- All facility machinery shall be designed and constructed to maintain environmental impacts at the minimum and acceptable levels.
- A comprehensive Health, Safety and Environment (HSE) system shall be implemented for the proposed project.

- Strict adherence to the procedures in the Company's HSE policy to ensure the facility is developed and operated in a safe and environmentally responsible manner.
- All operations shall be carried out to conform to all relevant extant local, state, national and international environmental regulations and standards.
- Handling, storage and disposal of waste shall be in accordance with the regulatory requirements of Lagos Waste Management Authority (LAWMA) and other relevant national and international laws on waste management.

2.5 Project Alternatives and Development Options

2.5.1 Project Alternatives

2.5.1.1 Site Alternatives - The site for the proposed recycling plant Project is within the Ikorodu industrial zone along the Ikorodu - Itoikin - Epe road in Ikorodu Local Government Area of Lagos State. The site is easily accessible through the existing road network in the area. Therefore, the Project development will not require the creation of an access route to the site. The Project site is located in Parafa village, Ikorodu LGA, Lagos State. Alternative sites considered included parcels of land in Ojota and Ikeja areas of Lagos State but they were not chosen as the preferred options due to the significant associated environmental and social impacts including traffic issues as well as potential for physical and economic displacement.

2.5.1.2 Technology Alternative

Generally, there are two (2) ways by which PET bottles can be recycled. They include:

- Chemical recycling back to the initial raw materials like purified terephthalic acid (PTA) or dimethyl terephthalate (DMT) and ethylene glycol (EG) where the polymer structure is destroyed completely or to in-process intermediaries like bis-β-hydroxyterephthalate.
- Mechanical recycling where the original polymer properties are maintained or reconstituted (Nabeel B., 2010).

Chemical recycling of PET bottles: This method of recycling PET bottles is cost efficient when applied to high capacity recycling lines of more than 50,000 tons/year. Such lines are usually seen, if at all, within the production sites of very large polyester producers. Several attempts of industrial magnitude to establish such chemical recycling plants have been made in the past but without resounding success (Nabeel B., 2010). Chemical recycling of PET bottles also utilizes processes such as hydrolysis, methanolysis, glycolysis, ammonolysis, and aminolysis. These processes require the use of catalysts, some of which have associated effects and impacts including toxicity, non-biodegradability and non-selectivity of the final product (Mohammad et al., 2015). Not considered as the preferred option for the proposed project.

Mechanical recycling of PET bottles: This method (also known as direct circulation of PET in the polymeric state) is operated in most diverse variants today. This process is typical of small and medium-sized industry and cost-efficiency can easily be achieved with plant capacities within a range of 5,000 – 20,000 tons/year (Nabeel B., 2010). It involves the recycling into "new" (secondary) raw materials without changing the basic structure of the material. Its main advantage is that part of the resources consumed for the production is not wasted, but preserved for use in the same, similar or different application. Due to the advantages of mechanical recycling of PET bottles over chemical recycling as discussed above, Sonnex Packaging Nigeria Limited plans to adopt the mechanical process offered by BoReTech PET for recycling equipment company for the recycling of PET bottles at the proposed facility.

The proposed Project will make use of Bottle to Bottle (B-to-B) grade and Fiber grade PET Bottle recycling lines from BoReTech PET recycling equipment. BoReTech is a pioneer of B-to-B and fiber grade recycling systems with professional plant design. The PET bottle recycling technology offered by BoReTech involves processes such as de-baling, label separation, metal separation, bottle pre-washing, crushing, hot flotation washing and glue-removing, continuous rinsing and drying, blending, dust removal, and packaging.

The selection of BoReTech PET recycling equipment for the proposed Project has taken into consideration some important factors such as availability of raw materials, manpower requirements, area of land available, energy and other utility required for operations, cost, etc.

2.5.2 Project Options

2.5.2.1 No Project Option

The no project option implies that the proposed Project will not be executed hence there is no need to carry out the EIA study. This option is not environment friendly as it will defeat the contribution of the proposed recycling plant Project in reducing the volume of non-biodegradable PET bottles that usually end up in dumpsites or water bodies, leading to environmental pollution. It is also not economically viable, as no economic returns shall accrue to the three tiers of Government (Local, State and Federal) and the proponent. However, substantial amount of money had already been spent on the feasibility studies, planning and logistics for the Project. Taking the no project option will mean a loss of preliminary investments made by the proponent on the Project. It will also mean that potential benefits to the prospective customers and the associated employment opportunities will be lost. Similarly, such a decision will not be in accordance with the Federal Government's efforts to support fight against environmental pollution. Thus, the option is

Not Recommended.

2.5.2.2 Delayed Project Option

This option means that the planned Project will be delayed until a much later date. Such option is usually taken when conditions are unfavourable to project implementation such as in a war situation, or where the host community is deeply resentful of the Project. Besides, if the prevailing economic or physical climate is not quite favourable to the Project, then delayed project option may be feasible. These conditions are not applicable for this particular project rather both the economic and the political environments are most favourably disposed towards the Project. The implication of delayed project option will mean that all the preliminary work and associated efforts/costs incurred would have come to nothing. It would also mean that the positive environmental impacts of establishing the proposed PET recycling plant are lost. Again, due to inflationary trends, such a delay may result in unanticipated increase in project costs, which may affect the final profits accruable from the Project. The delayed option is considered unviable for the proposed Project and hence

Not Recommended.

2.5.2.3 Go ahead with Project option

The essential benefits of allowing the Project to go ahead as planned are diverse both to the proponent, host community, State and the Nigerian public. Job opportunities for Nigerian professionals, skilled and semi-skilled craftsmen in the budding waste management sector will increase. The proposed Project is aimed at recycling used PET bottles, thereby reducing the quantity of non-biodegradable PET bottle wastes that end up in the environment. This option is **Recommended**

CHAPTER THREE

PROJECT AND PROCESS DESCRIPTION

3.1 Project Overview

Polyethylene terephthalate (PET) bottles are not waste. A PET plastic bottle has many potential after life uses and its status as one of the most used plastic packaging materials in the world is due to its performance qualities and its highly recyclable nature. (http://www.recycletheone.com). PET is the name of a type of clear, strong, lightweight and 100% recyclable plastic. Unlike other types of plastic, PET plastic is not single-use but 100% recyclable, versatile, and made to be remade. This chapter provides the detailed description of the proposed Project.

3.2 Project Location

The site for the proposed Sonnex Packaging Nigeria Limited's plant Project is located at kilometre 488A Ikorodu Industrial Estate, Parafa village, Ikorodu LGA, Lagos State. The location is a mixed used area in an industrial estate, along Ikorodu – Itoikin – Epe road. The Project site lies within Latitude 6°38'49.65'N and Longitude 3°33'48.54'E (SW), Latitude 6°38'50.29'N and Longitude 3°33'57.78'E (SE), Latitude 6°38'58.61'N and Longitude 3°33'50.94'E (NW), Latitude 6°38'58.57'N and Longitude 3°33'54.15'E (NE). The proposed recycling plant and its ancillary facilities will occupy a land mass of approximately 22,458sqm out of the total land size of 35,1355sqm acquired for the Project. The entire Project site is entirely fenced round with brick walls and about 13% greenery area.

The administrative map of Nigeria showing Lagos State is shown in Figure 3.1, while the administrative map of Lagos State showing Ikorodu LGA and that of Ikorodu LGA showing the proposed Project site are presented in Figures 3.2 and 3.3 respectively. Plate 3.1 shows the google earth imagery of the Project site and its surrounding environment while the layout plans for the proposed Project are presented in Figures 3.4

Notable land marks around the proposed Project site include; Watchman Catholic Church, Parafa Oluwakemi Central Mosque, Total Energies Service station Itoikin road, Maya Community Junior Grammar school, Hypo Home Care Product Ltd and Hypo hygiene Products Ltd. A setback of about 85m will be given from the centre of the existing road to the perimeter fence of the facility to ensure uninterrupted flow of traffic and minimal obstruction of visibility on the Ikorodu – Itoikin – Epe road as a result of the facility structures and/or vehicles branching-off into or out of the facility (Figure 3.5 to 3.7).

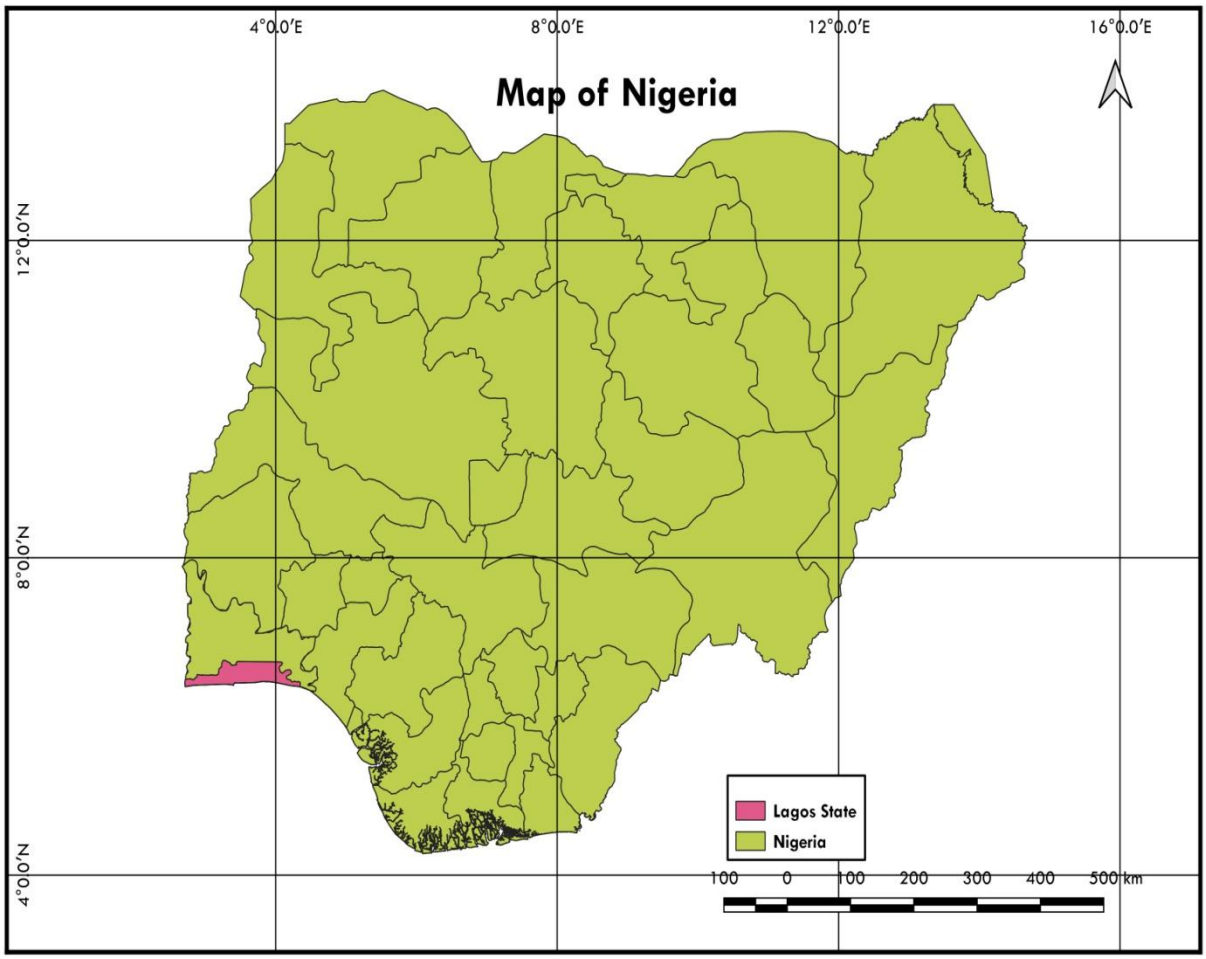


Figure 3.1: Map of Nigeria showing Lagos State in pink

3.3 Land Acquisition

The proposed recycling plant Project site at Ikorodu is a Lagos State Government allocation which was acquired on lease for 99 years. However, the traditional owners of the expanse of land where the proposed project is located is Ilado descendants family, Parafa Alagemo.

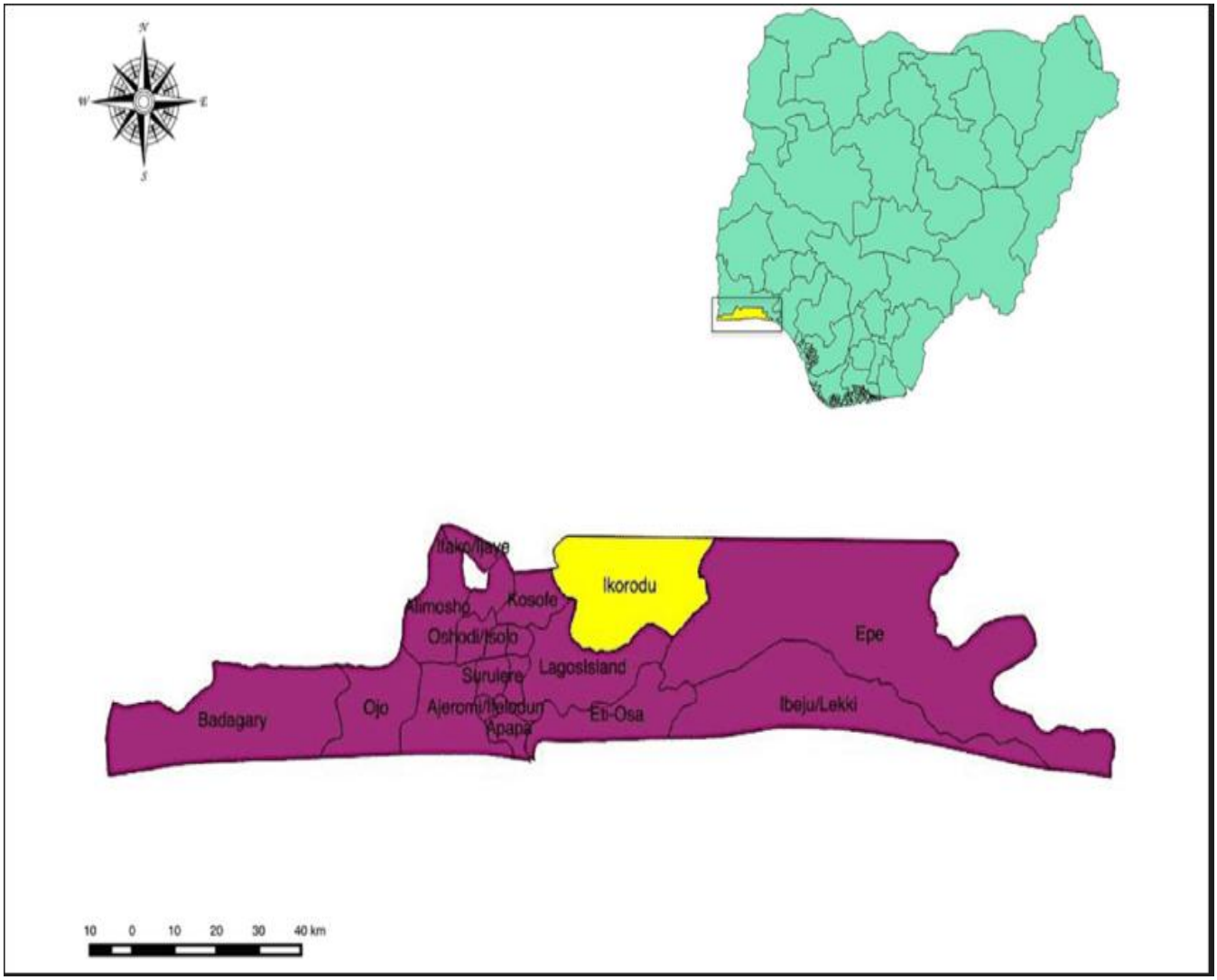


Figure 3.2: Administrative map of Lagos State showing Ikorodu LGA

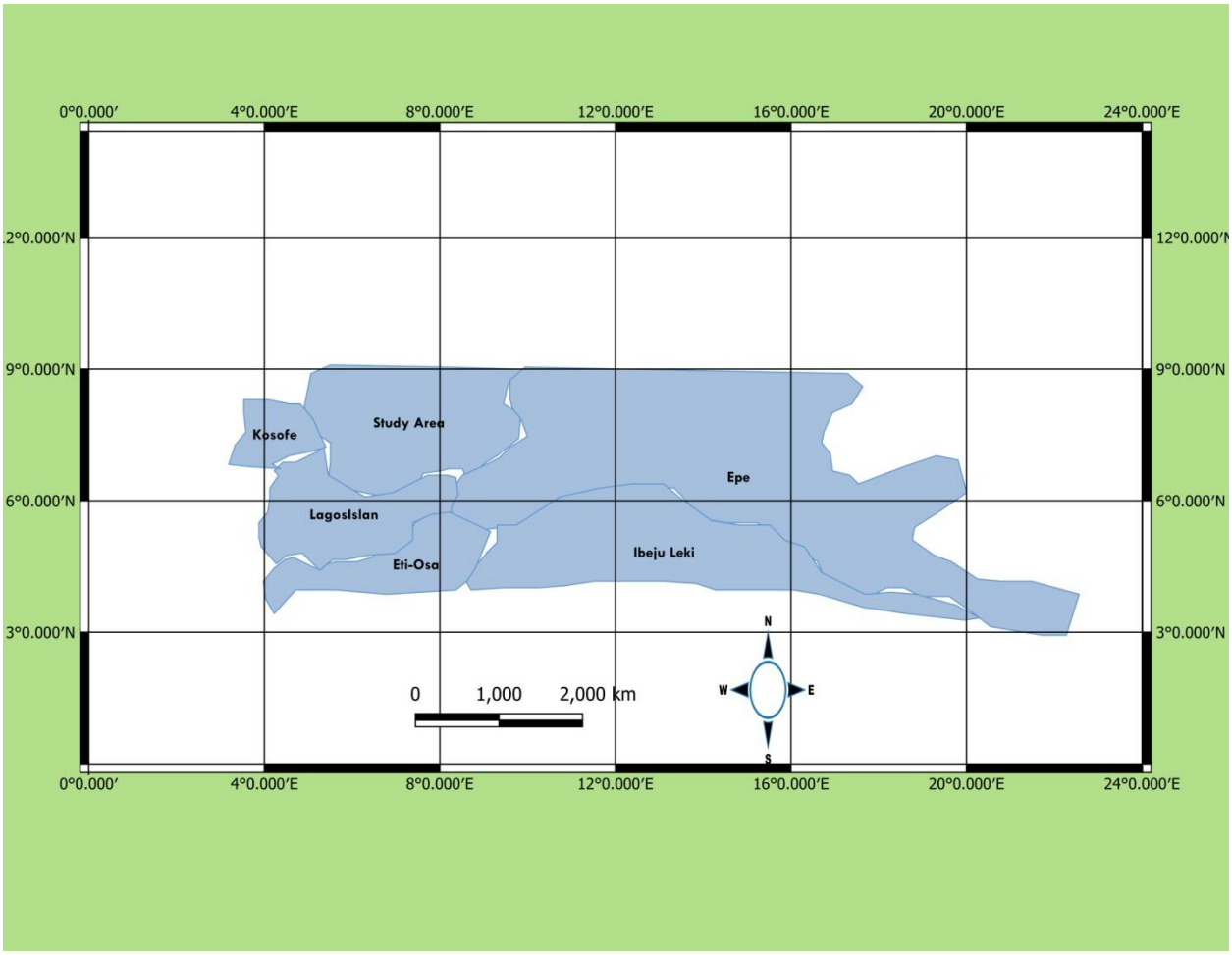


Figure 3.3: Map of Ikorodu LGA showing the proposed Project site



Plate 3.1: The Google earth imagery of the Sonnex Packaging Nigeria Limited proposed recycling plant Project site

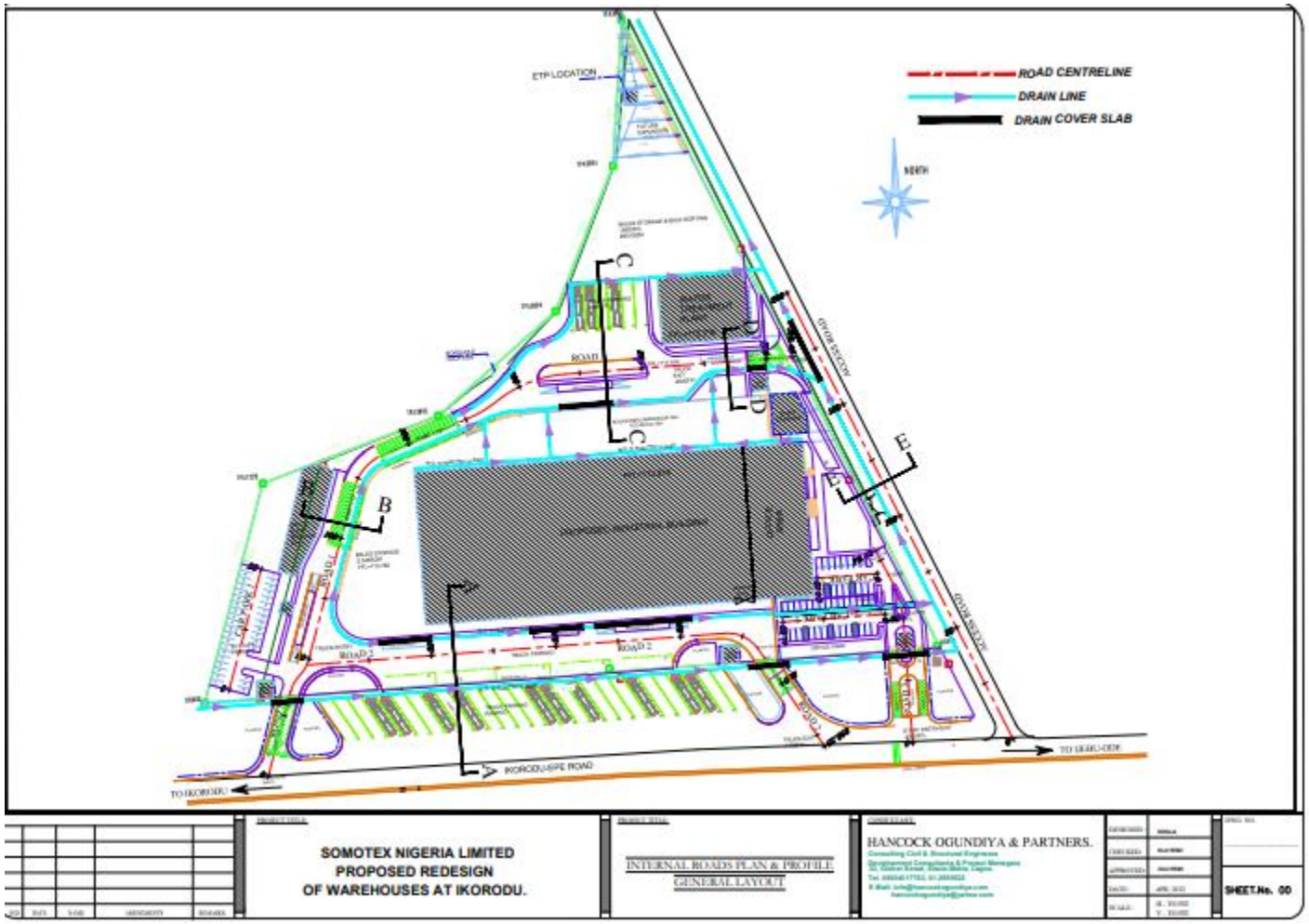


Figure 3.4: The general layout plans for the proposed Project

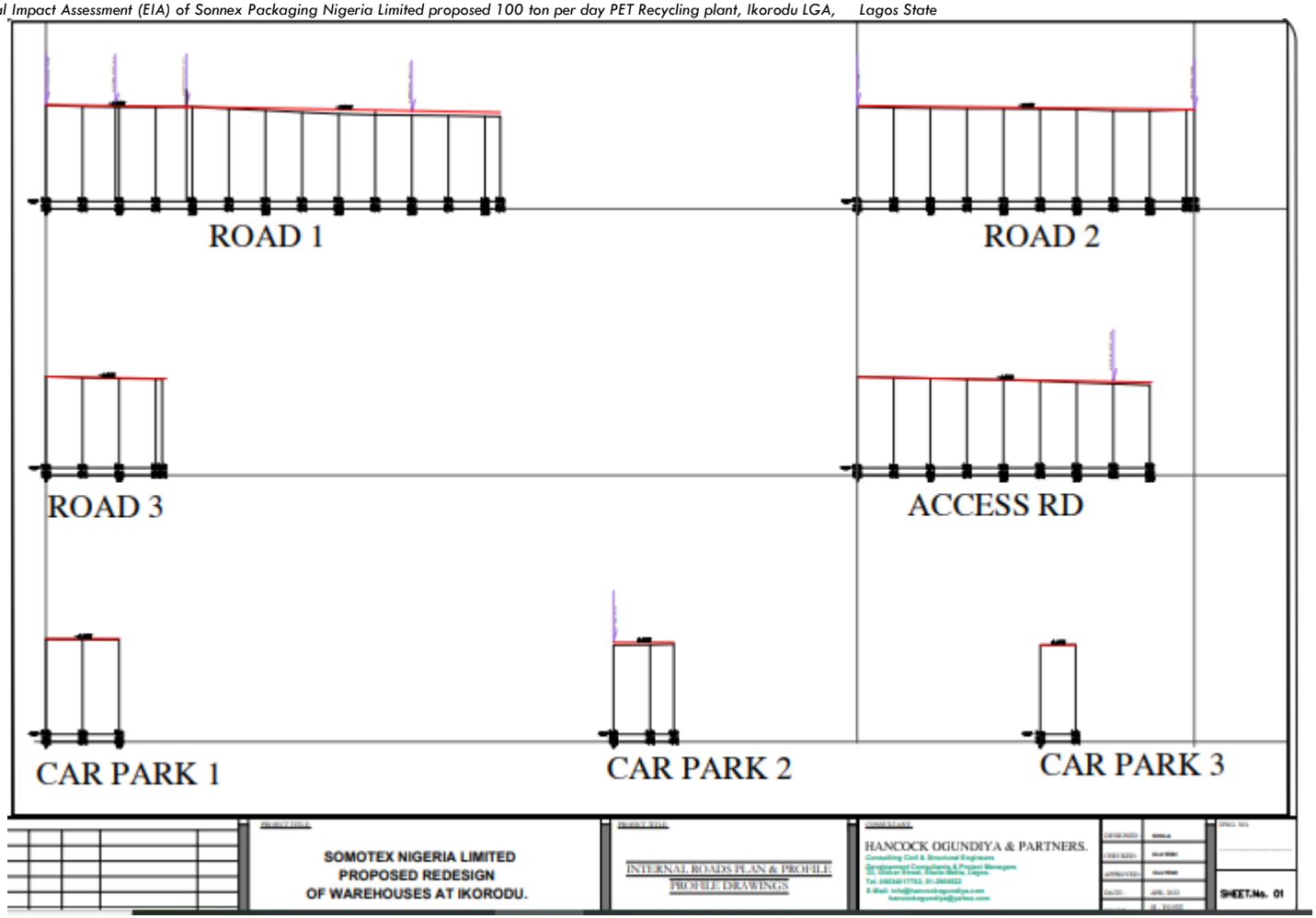


Figure 3.5: Internal Roads plan for the proposed project

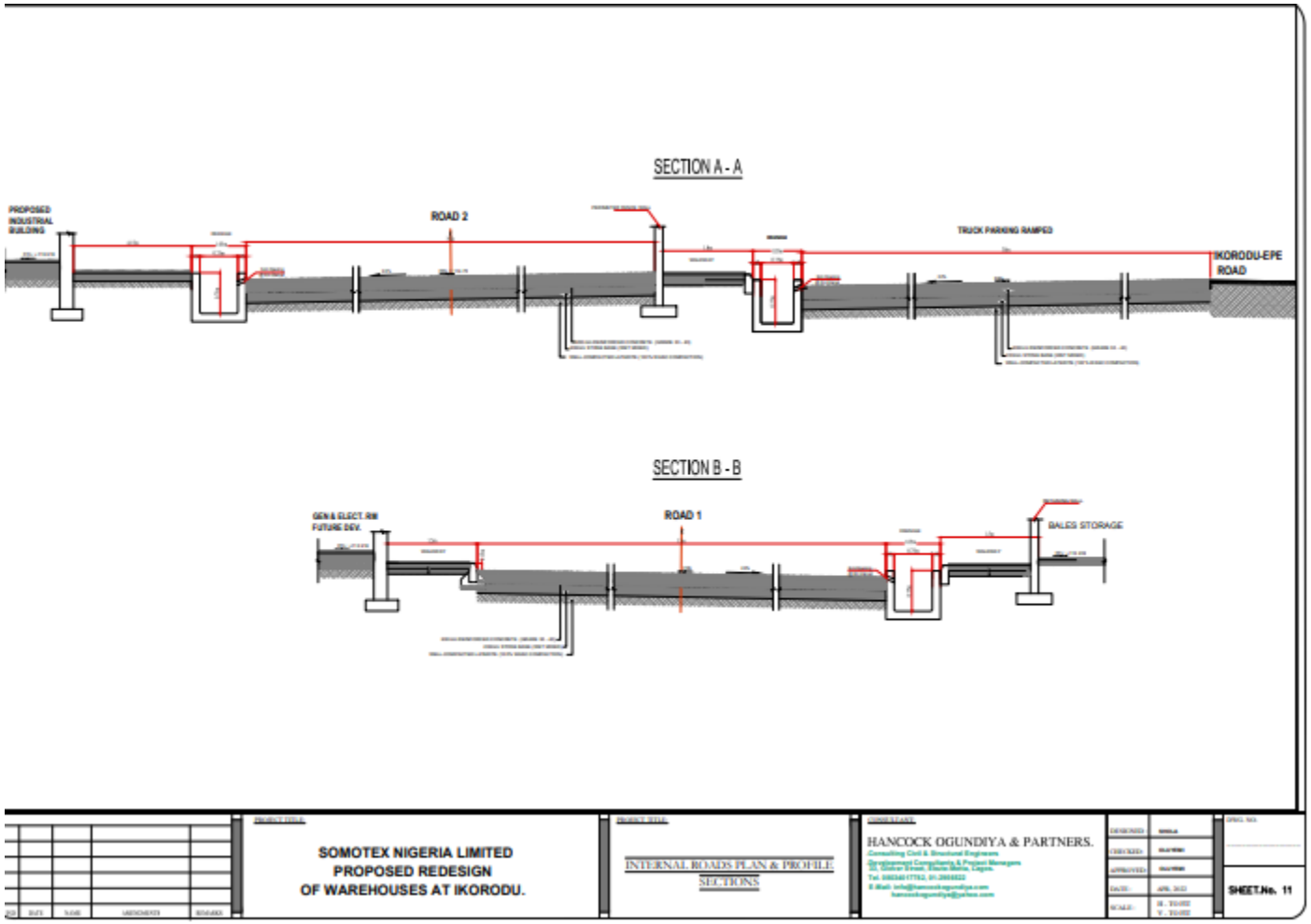


Figure 3.6a: Schematic diagram of Internal roads and profile sections for the proposed recycling plant project

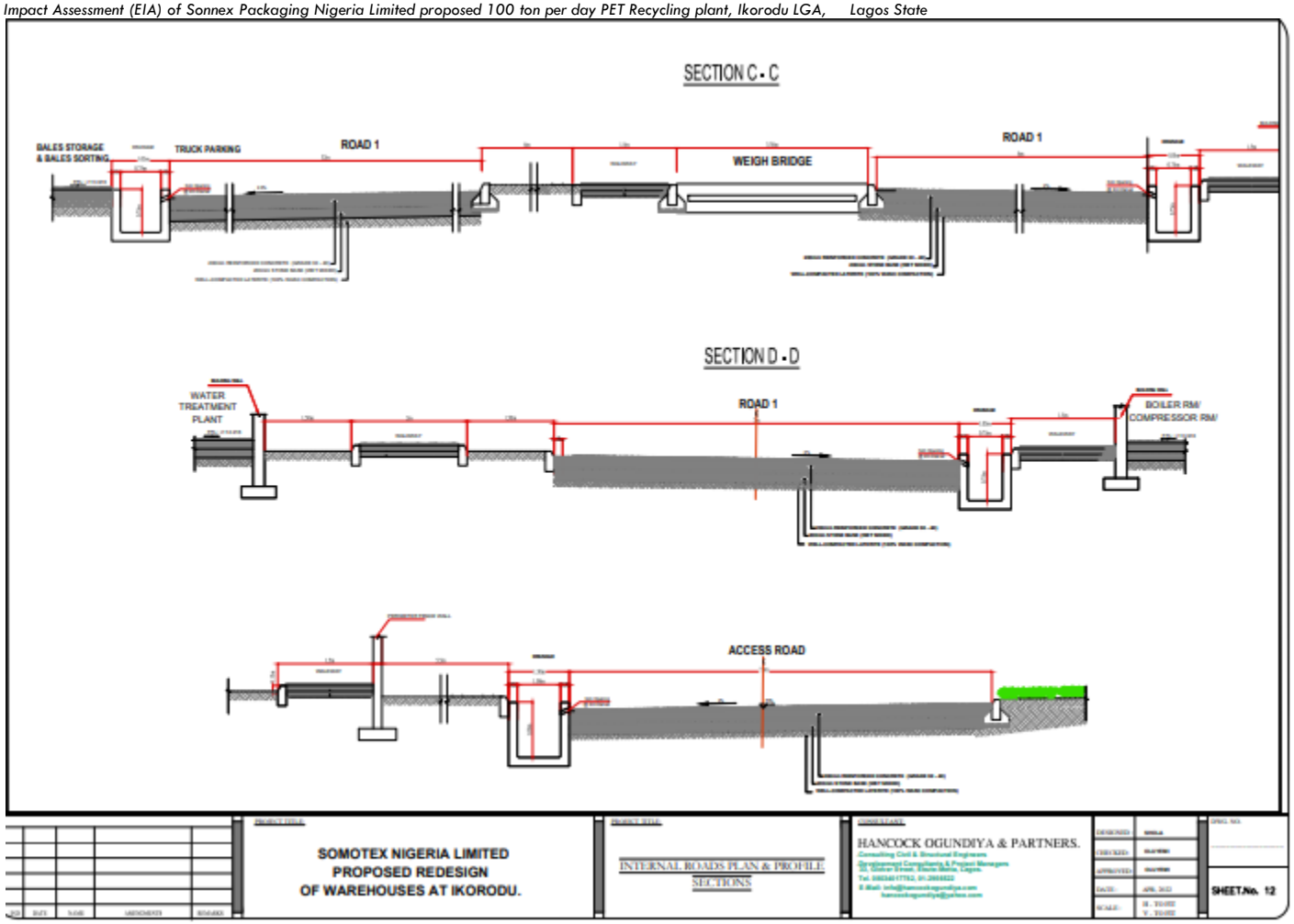


Figure 3.6b: Internal roads and profile sections for the proposed recycling plant project

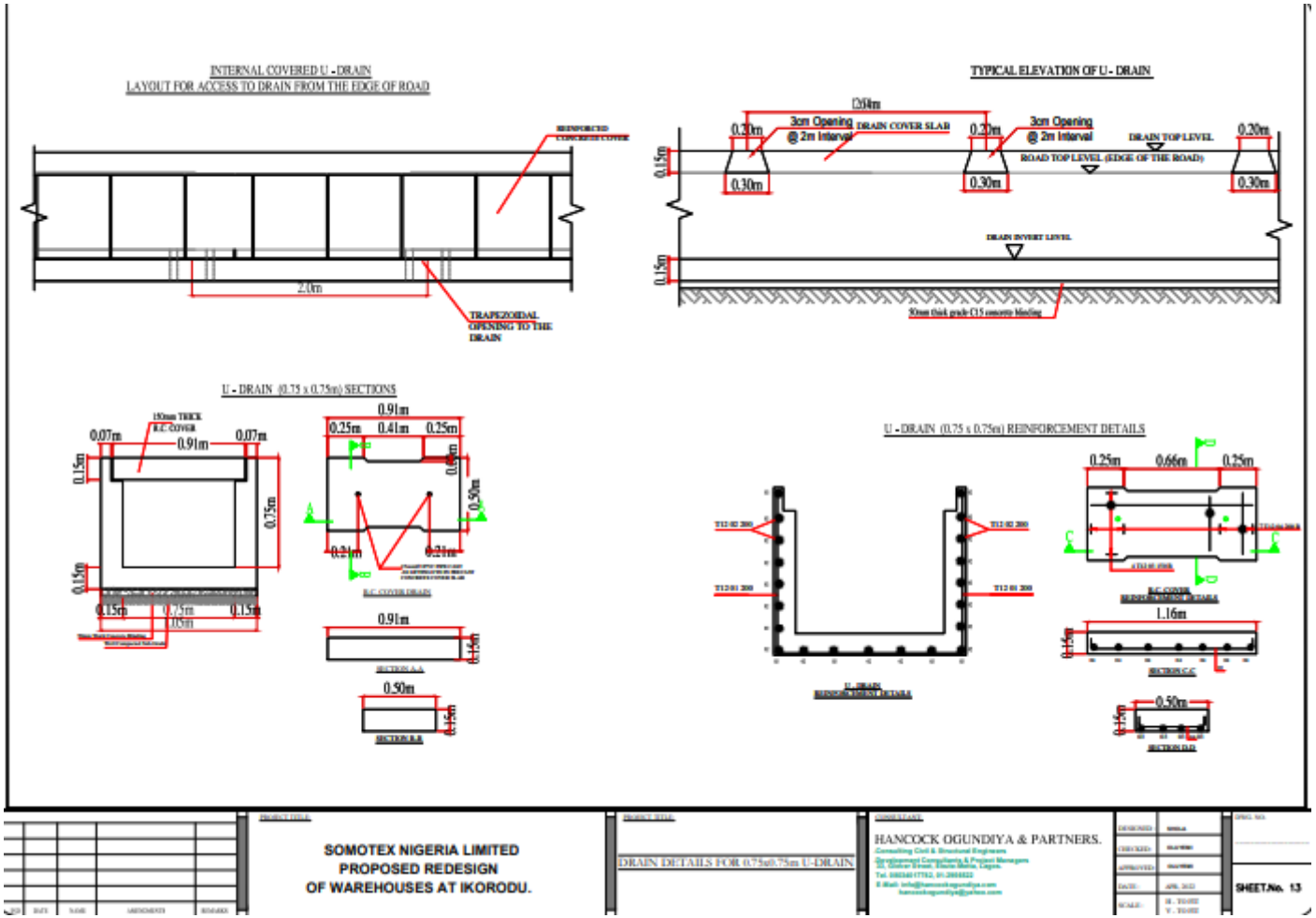


Figure 3.7: Schematic diagram for the internal drain layout at the proposed site

3.4 Project Components

The key components of the proposed facility are:

- Main Industrial Building
- Service and Technical Building section
- Water Treatment Plant and Borehole area
- Effluent Treatment Plant
- Residential area
- Staff canteen
- Truck Parking section
- Fire-fighting and suppression system (e.g. fire-extinguishers, water hydrants, etc.) at strategic locations
- Generator House
- Bale storage and sorting section
- Greenery area

3.4.1 Main Industrial Buildings

The main industrial building will house the production lines as well as the boiler room, compressor room and store. The Administrative office will also be attached to the factory building. The Administrative building will have the following sections: reception and waiting area, canteen, male and female changing rooms, first aid bay and electrical room on the ground floor; and offices, conference room and restrooms on the first and last floor. In addition, dedicated conveniences will be provided at the canteen/reception area, changing rooms, security houses etc. in order to enhance the sanitary conditions for workers, suppliers and visitors. The main industrial building structure will be built with brick walls and steel trusses with corrugated aluminium roofing sheets, and will be fitted with fire protection system such as sprinkler and hose rail. Ventilation for the buildings will include installation of Heat Ventilation and Air Conditioning (HVAC) in the adjoining administrative building, while natural vents coupled with the installation of heat extractors will provide ventilation for the main production hall.

3.4.2: Effluent Treatment Plant (ETP)

As part of the ancillary facilities for the proposed Project, a 250m^3/day ETP will be installed onsite to treat the process wastewater generated from the facility in order to ensure that the quality of the generated wastewater meets the relevant extant local and international effluent quality standards. The treatment of wastewater generated from the facility will involve stages such as:

- Preliminary Treatment: For physical separation of large sized contaminants such as paper, plastics, wood, etc.
- Primary Treatment: For the removal of floating and settleable materials such as suspended solids and organic matter using both physical and chemical methods.
- Secondary or Biological Treatment: For further treatment of the effluent from primary treatment to remove suspended solids and residual organics.
- Tertiary/advanced/disinfection treatment: To provide a final treatment stage to raise the effluent quality to the desired level this complies with the regulatory standards. At the end of treatment process, the treated wastewater will be used for gardening within the site while the generated sludge will be compacted, dried and disposed of at a government approved dumpsite through an accredited third party waste contractor. Periodic monitoring of the treated effluent shall be carried out to ensure its quality meets the relevant local and international effluent quality standards.

3.4.3: Fire Fighting and Suppression System

The facility will be equipped with smoke detectors and automatic fire alarm system for early warning in the event of fire emergency. Adequate fire suppression and critical loss prevention equipment such as fire hydrant ring system with fire hose reel, fire extinguishers (which will be serviced regularly every six months) will be provided and placed at strategic locations within and around the facility. The factory building and office area will also be fitted with automatic sprinklers for suppression in case of fire emergency. To ensure that staff members are trained on fire fighting and prevention by carrying out regular drills, Sonnex Packaging Nigeria Limited will organize regular training in collaboration with Lagos State Fire service.

3.4.4: Staff canteen

The proposed Sonnex Packaging Nigeria Limited PET recycling plant project will have a canteen for both senior and junior staff members within its premises where hygienic meals will be served by regularly trained kitchen staff. The canteen will have capacity to accommodate between 15 -20 staff members at a time. The area will also be equipped with fly traps and necessary conveniences for a standard canteen.

3.4.5: Truck Parking section

The proposed PET recycling plant will have a designated Truck Parking section which will be constructed close to the proposed plant with an entrance gate which will serve as a loading bay for both raw material offloading and finished goods loading. The truck park will be able to accommodate close to 20 trucks at a time with each having a waiting period of 3 hours in a day. This will prevent indiscriminate parking on the Expressway which is the only access to the site. The park will be operated with good traffic management plan in place for the project.

3.4.6: Water Treatment Plant and Borehole

At full operation, water requirements will be sourced from three (3) boreholes to be sunk within the facility. Abstracted water from the boreholes will be routed to a 120,000-litres water storage tanks after passing through a filtration system.

3.4.7 Generator house

Electricity supply to the facility would be through a gas generator with capacity 1125kW (Model MWM Germany) and two diesel generators as backup (Capacity: 150 kVA, 60kVA). It is estimated that approximately 124,800SCM/month of gas would be consumed during operation phase. The Generators will be installed at the Utility Area of the complex in soundproof enclosure.

3.4.8 Green Area

Sonnex Packaging Nigeria Limited will maintain up to 20% greenery for the proposed recycling plant project. This will include green area as well as ornamental plants to augment a good aesthetics in the premise.

3.4.9 Residential area

The facility will have a designated area for residential quarters of its staff members. This is a future expansion plan by the management that will not commence with project commissioning.

3.4.10 Bale storage and sorting section

The recycling plant will have a bale storage section where raw materials are initially stored after offloading from vendors. They are later sorted in this area before it goes to the production line for other processes.

3.5 Process Description

The key point of post-consumer PET bottle recycling is the removal percentage of impurities which is mixed with the waste plastic bottles during the process of conveying the raw materials from beverage factory to the recycling plant. BoReTech realizes the core character of different impurities based on their 30 years experience of practical PET bottle recycling business. The design concept of their different functional processes is to set up the best environment for separating impurities. However, the recycling line is designed on module basis, for future expansion, it can be improved to get higher capacity and more stable quality with minimum investment cost.

The stages involved in PET recycling are as described below;

3.5.1 De-baling

This is the first stage of the recycling process and it involves the unbundling of large bales of tightly compressed used PET bottles supplied to the recycling facility by waste collectors (also known as Private Sector Participants, PSPs) who specialize in the collection of used PET bottles. The debaler is a mechanical structure with high automation technology and simple operation process. It uses low power consumption and equipment abrasion to break up the PET bales. The de-baler is the entry point of raw material (post-consumer PET bottles) into the processing line.

3.5.2: Label Separating Section

There are many types of labels used for covering bottles. Most labels will be removed in bottle prewashing process except the PVC labels which is formed by thermal shrinkage. At this stage, labels on the used PET bottles will be removed, including heat shrinkable labels which are difficult to remove through bottle pre-washing. The label separation unit consists of a label scrapping machine and a label blower. The label scrapping machine tears the label from adhesive on the surface of the bottle, allowing the label blowing unit to completely separate the bottles from the labels under the influence of adjustable wind-force. The bottles with PVC label will be separated by the PVC bottle sorting machine, workers will pick out the PVC bottle by hand, and the PVC label bottles will go to the PVC label scrapper, before the labels are removed in the label blower.

3.5.3 Metal Separation

Presence of metal impurities can negatively affect the production and quality of recycled PET bottle products. The metal separation process involves the removal of metallic impurities through a belt conveyor device to separate the ferrous and non-ferrous metals from the raw material – used PET bottles. The process involves the following;

- A strong magnetic separator is hanged over the belt conveyer, the ferrous metal would be adsorbed to the magnetic separator, and it could be auto discharging for metal or manually.
- The bottles would be laid on the moving belt conveyer with metal detector, the bottle and metal would be discharged by a three way flap. An additional step on the sub-line would recover the bottles discharged with metal.
- Metal detector would be installed on the sorting conveyer to prevent any metal going to the crusher. Sorting person can find the metal and pick it out if the conveyer is stopped by metal.
- A Metal separator is installed to remove all metals before packing the nuzzles with high press air which would eject the metal with some flakes when metal is detected by high sensitive metal detector.

3.5.4: Bottle Pre-washing

Bottle pre-washing helps to remove external impurities from the used PET bottles before crushing them to ensure high quality of the final products. Features of the bottle pre-washing unit include automated water circulation, continuous feeding and washing. The unit is specially designed to cause friction between PET bottles inside the machine, and it utilizes boiled water to remove the labels, dirt, sand, glues, rubbers, metal and other impurities on the bottle surfaces. High-temperature washing can also make changes in the appearance of non-PET bottles, making it easy to distinguish between PET bottles and other bottles during manual sorting. A dry trammel can be added to do try bottle prewashing to remove most of the solid objects from the bottle's surface to reduce the chemical and water consumption.

3.5.5: Wet Crushing Section

This Section is specially designed for crushing PET bottles into flakes. Water is added in the grinder to allow the flakes carry out the first friction cleaning while reducing the temperature in the crushing room and abrasion of the blades. The machine is designed to input smoothly and output stably with low power consumption, low noise and vibration, strong structure, low maintenance cost.

3.5.6: Hot Flotation and Glue-removing

In order to further remove impurities from the final PET products to as low as 50ppm, secondary washing of the flakes after crushing will be carried out. The hot flotation unit is composed of automatic water filtration system supported with hot washing, turbo friction washing and automatic detergent dosing system. The crushed flakes are mixed with Polyolefins material; this section is using the gravity difference of PET (~1.3) and Polyolefins (~0.9), and water (gravity

1) as a media to let PET sink and Polyolefins float on the water. This effective will make PET more purified, and collected Polyolefins flakes can be sold as byproduct. With chemical, friction and heat power, the glue will be entirely separated from flakes. The horizontal centrifugal dryer will remove the glue, mud from the flakes.

3.5.7: Rinsing and Drying section

The main purpose of the continuous rinsing and drying process is the further separation of impurities. Clean water will be added to the process for thorough cleaning of the PET flakes to remove any detergent left on the flakes surfaces from the hot flotation friction process to ensure cleanliness and transparency of the flakes. This is then followed by high-speed centrifugal dewatering (drying) so that the moisture content of the flakes will be reduced to between 1 and 2 percent as a hot air conveying system is required to remove the moisture. To homogenize the impurities and get a higher acceptable product ratio, the mixing silo is to blend and store flakes. Mixing is done by an internal screw.

3.5.8: Blending, Dust Removal and Packing

A standard for measuring the quality of PET flakes is the impurity content and flakes index. The blending and dust removal unit ensures that the right flake index is achieved and that impurities (free dust, small plastic labels or film, etc.) are reduced to as low as possible by taking advantage of gravity and internal structure of the dust removal unit; while the packing unit uses a vibrating system to ensure that the flakes reach the fixed weight and that packing density is maximized to reduce packaging and transportation cost. To achieve extremely low impurity content, optical sorting can be installed after drying section to eject color PET, non-PET as well as metals.

Figure 3.10 below show the process flow chart for the proposed PET recycling plant process.

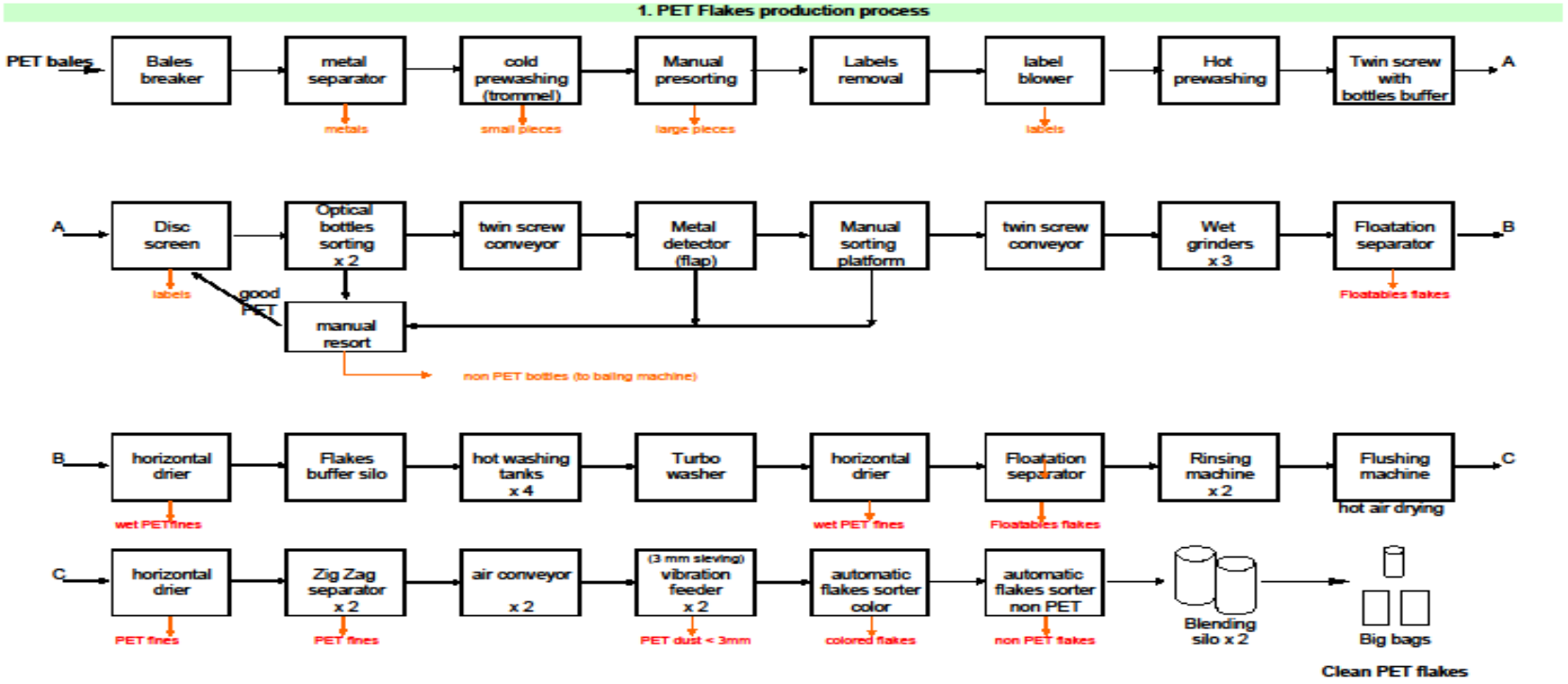


Figure 3.8: Sonnex Packaging Nigeria Limited washline and PET recycling process for the proposed project

3.6 Project Execution, Operation and Maintenance

3.6.1 Project Execution

The proposed project activities can be grouped into 4 phases namely:

- Pre- construction
- Construction
- Operation and
- Site Closure

3.6.1.1 Pre-Construction Phase

Activities during this phase will include site clearing and preparation including mobilization of personnel and equipment to site in readiness for construction activities. Out of the total land mass of 35,145sqm acquired for the Project, a total net area of 22,458sqm would be utilized for the various components of the project. The area to be cleared for the proposed recycling facility is a modified habitat, mainly characterized by secondary vegetation consisting of herbs, shrubs and grasses as further discussed in chapter 4.

3.6.1.2 Construction Phase

The construction activities for the proposed project will include the following:

- Civil, mechanical and electrical works, including construction of main industrial and residential as well as service and technical buildings.
- Equipment installation (PET recycling lines, pelletizing and preform line, boilers, compressors, ETP, etc.).
- Demobilization of personnel and construction equipment from site. No construction worker's camp is planned during the construction phase of the Project. It is planned that the facility construction would take approximately 3 months after obtaining relevant approvals for the project while equipment installation would last for about 4 months. The construction activities would include careful approach and appropriate safety procedures on site.

Sonnex Packaging Nigeria Limited will make available first aid boxes with trained first aiders on site per time.

3.6.1.2.1 Site closure

Construction site clean-up would include builder's scrap materials, demolition debris; all scrap materials, if any, shall be removed from the area by tidying up of the entire site area prior to demobilization. Scrap metals shall be collected for recycling while the general non-reusable

wastes shall be evacuated for disposal at a dumpsite approved by the Lagos Waste Management Authority (LAWMA) through an accredited third party waste contractor.

3.6.1.3 Operational Phase

The proposed Sonnex Packaging Nigeria Limited's facility operations will include production activities such as recycling of used PET bottles into fibre grade PET flakes of food grade PET perform. Moreover, other activities that will take place during this phase are;

3.6.1.3.1 Equipment maintenance and occasional repairs

Preventive and corrective maintenance shall be carried out on all facility equipment to ensure their optimal performance.

3.6.1.3.2 Workforce

Sonnex Packaging Nigeria Limited's management will ensure total grasp over labour and working conditions for all phases of the Project. It is envisaged that during pre construction and construction phases, about forty (40) people would be employed. The majority of low skilled employment opportunities associated with the proposed Project will be obtained from the local communities in the Project area. A total of about 200 workers will be employed during the operational phase, including skilled and semi-skilled labour (such as electrical and mechanical technicians) and unskilled labour (such as cleaners and security personnel). The workers will be divided into two (2) shifts per day of 8 hours duration per shift and an hour break within each shift. Sonnex Packaging Nigeria Limited shall ensure that the workforce is managed in accordance with the requirements of the Nigerian Labour Act 2004. The proposed Project will not involve the use of child labour during construction and operation phases as the approved age bracket for staff would be 18-55years. Similarly, Sonnex Packaging Nigeria Limited shall ensure that occupational health and safety plan that is proportionate with the level of activities planned for the Project is developed and implemented.

The proposed recycling project has as part of its future expansion, an area of 387.07sqm earmarked to build residential quarters for its staff members across the board for all staff cadres.

Also, there will be an in-house clinic (to be manned by a Registered Nurse and a Doctor on ground) and trained first aiders with well equipped first aid boxes strategically placed within the facility during this phase. The facility has planned for this phase a standby vehicle for emergencies and Health Maintenance Organization (HMO) facilities for staff members in approved hospitals nearby.

3.6.1.3.3 Utilities Consumption

3.6.1.3.3.1Water Use

Water is required during construction and operational phases of the Project. During construction, water is needed to make concrete for piled concrete mounting structure foundations and for staff sanitation. The main use of water during the operational phase is for steam production, intermittent washing of raw materials (post-consumer PET bottles) on the production lines, cleaning and sanitary uses. At full operation, water requirements will be sourced from three (3) boreholes to be sunk within the facility. Abstracted water from the boreholes will be routed to a 120,000-litres water storage tanks after passing through a filtration system. Wastewater generated during the production process is planned to be treated through a filtration system and re-used for about 5 cycles of washing. After re-use for 5 cycles, the process water will be channeled to the ETP for treatment. At full operation, water requirement for production process is envisaged as approximately $9m^3$/hr ($216m^3$ per day).

3.6.1.3.3.2 Energy Source and Consumption

The electricity supply to the area is by Ikeja Electricity Distribution Company (IKEDC). The facility will however not be connected to the national grid to avoid interruption in the company's production process due to incessant power outage in the area. Electricity supply to the facility would be through a gas generator with capacity 1125kW (Model MWM Germany) and two diesel generators as backup (Capacity: 150 kVA, 60kVA). It is estimated that approximately 124,800SCM/month of gas would be consumed during operation phase. There is an existing Right of Way (ROW) about 20m away from the site for gas line in the area by Falcon Petroleum Limited which the facility intends to tap into for its use. The facility will also have bund wall constructed around the diesel storage area in the facility.

Other ancillary structures within the facility will include; a canteen space for staff where food will be brought into the premise by food vendors with proper certification like regular food handlers training from a recognized body. There would be parking lots for cars as well as trucks with a capacity to hold 10 trucks and 15 cars. The maximum waiting time for trucks at the loading bay is 24hours. The facility will develop a traffic management plan for the proposed project.

3.6.1.4 Decommissioning Phase

The project is expected to last for about thirty (30) years. At the end of the life span of the project or upon a decision to demobilize the project, a proper site closure will occur involving environmentally and physically safe demolition, clearing, and disposal of all materials. The estimated workers for this phase are about forty (40) workers.

3.6.1.5 Associated Waste Streams

Waste management principles and priorities shall be based on an integrated approach which involves using a combination of techniques and programs to manage waste. Source reduction is at the top of the approach, followed by reuse as preferred options to disposal. The waste streams associated with the proposed recycling plant Project are as follows:

Pre-construction Phase

The waste streams associated with the pre-construction phase of the proposed Project include cleared vegetation (from site preparation), food waste, and general rubbish. The cleared vegetation will be moved to the part of the Project site left for future development to dry off while the general rubbish will be disposed of at a government-approved dumpsite through a LAWMA accredited third party waste contractor.

Construction Phase

The planned activities during the construction phase include foundation works, civil and mechanical works, and equipment installation. The activities will result in the generation of construction waste materials as well as waste generated by construction workers. The waste streams include non-hazardous (solid) wastes such as refuse, garbage, inert construction materials, metal scraps, concrete waste, food waste and empty containers. All concrete mixing will be undertaken on impermeable plastic lining to prevent contamination of the surrounding areas. All scrap metals generated during the construction phase will be collected for recycling. Excavated soil generated during the foundation work will be reused to backfill the area as much as possible. All solid waste materials that cannot be reused or recycled will be placed in appropriate on-site storage containers (colour-coded waste receptacles) and periodically disposed of (at least once a week throughout the construction period or on the need basis depending on the volume of the waste) at a designated dumpsite approved by LAWMA through an accredited waste contractor. Hazardous wastes that could be generated during the construction activities include used oil rags, and spent filters from onsite diesel generator for power source during construction. The quantity is envisaged to be minimal. Hazardous wastes shall be stored in a manner that prevents the commingling or contact between incompatible wastes, and stored in properly labeled, closed containers prior to evacuation by a LAWMA accredited contractor for treatment. Mobile toilets will be provided and installed onsite for use by construction workers. Sewage generated from the use of sanitary facilities will be evacuated by a sewage evacuation and disposal contractor approved by Lagos State Ministry of Environment Sewage Department.

Operations Phase

The major waste associated with the facility's operation is process wastewater. It is estimated that at full capacity, approximately 216m^3 of water per day will be utilized during the PET bottles recycling process, majorly for washing. The generated wastewater will be treated onsite and reused for at least 5 cycles of washing before it would be channeled to the ETP prior to being discharged, once its quality has been confirmed to meet the relevant local and international effluent quality standards. Sanitary wastes (sewage) generated during the facility operation shall be channeled to a septic tank to be installed onsite. The septic tank shall be of reinforced concrete and will be located away from the groundwater source onsite. The contents of the septic tank shall be evacuated by an accredited waste contractor for treatment at a sewage treatment plant approved by the sewage department of the Lagos State Ministry of Environment and Water Resources. Non-reusable waste materials that would be generated during operation include office waste such as paper, cardboard, and some food waste. Such wastes will be placed in appropriate on-site storage containers (colour-coded waste receptacles) at a designated area within the site and periodically disposed of (at least once a week or on the need basis depending on the volume of the waste) at a government approved dumpsite by an accredited vendor.

The storm water will be channeled to drainage networks constructed within and around the facility.

Emissions

The potential source of air emissions during the facility operation are the gas-fired generator to be installed onsite for electricity generation, back up diesel generators and minimum of 2 forklifts that will be run on both diesel and gas for its operations. The air emissions associated with the gas-fired generators would be less when compared to the diesel fuelled generators. The emission associated with the production activities (PET bottles recycling) is considered to be negligible considering the technology adopted for the Project which involves wet drying. Sonnex Packaging Nigeria Limited will ensure necessary controls like regular provision and enforcement of the use of appropriate Personal Protective Equipment (PPE), installing generator exhaust with standard heights etc. are in place throughout the project lifecycle.

3.7 Project Schedule

The proposed project plans to be operational in 2023 following obtaining necessary approvals and permits

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Activity	TIMELINE																
	2022								2023								
	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Designig & processing of permits																	
EIA Study for Project																	
Facility Construction																	
Equipment procurement & Installation																	
Commissioning & Pre-Operation																	
Operations																	
Project Schedule for the Proposed SONNEX Packaging Nigeria Limited Recycling Plant in Ikorodu																	

Figure 3.9: Project schedule for the proposed Sonnex Packaging Nigeria Limited PET recycling plant in Ikorodu

CHAPTER FOUR

DESCRIPTION OF THE ENVIRONMENT

This chapter provides a description of the existing environmental and socioeconomic conditions of the proposed Project site and its area of influence against which the potential and associated impacts of the Project have been assessed. Data and information for the environmental description of the study area were based on field data gathering (primary data) as well as review of relevant literature (secondary data). The field sampling was carried out from 8th – 12th September 2022 (wet season). For the biophysical components, a 2km radius from the centre of the Project site was selected as the spatial boundary while the socio-economic survey was extended to approximately 5km radius. The Project's area of influence for this study specifically covers the proposed Project site (direct footprint Plate 4.1), the immediate surroundings of the Project site boundary, and the wider area of Project influence which extends up to about 5km. This also includes the areas where the cumulative impacts of the Project may be experienced.

The main environmental components considered in the environmental baseline study include:

- Climate and meteorology;
- Geology and hydrogeology;
- Air quality and noise;
- Groundwater;
- Surface water
- Soil;
- Terrestrial flora;
- Terrestrial fauna;
- Land use and drainage patterns;
- Socio-economics and health.

The company carried out a one season field sampling complemented with existing baseline data for KCSSA West Africa Limited's Environmental & Social Impact Assessment for the proposed Ikorodu Mill project as secondary data for the dry season. The secondary data location is about 5.36km to the proposed project site.

The field work activities was carried out in accordance with the FMEnv, National Environmental Standards and Regulations Enforcement Agency (NESREA), Lagos State Environmental Protection Agency (LASEPA), World Bank (WB) and other international standards and guidelines. Similarly, Consultations and meetings with State environmental regulators and host communities will be a continuous process throughout the project execution.

4.1 Baseline Data Acquisition Methods

4.1.1 Literature/Data Review

During the EIA data gathering exercise, all the aforementioned environmental components were covered, in addition to consultation with stakeholders and the project proponent (Sonnex Packaging Nigeria Limited). Field surveys and review of existing reports, maps and literature were followed by detailed ecological sampling and laboratory analyses as appropriate using recommended standard analytical methods. Details of the data gathering methods employed are presented below.



Plate 4.1: A view of the proposed project site in Ikorodu

4.2 Consultation with Stakeholders and Experts

Experts in relevant fields, and representatives of the host communities were consulted on issues relating to the likely ecological and socio-economic impacts of the proposed project. Moreover, regulatory bodies were well consulted at Federal, State and Local Government levels to ensure agreement and support during the execution of the project (Plates 4.2).



Plate 4.2: The regulators and Project proponent during site verification exercise

4.3 Field visit and Desktop Research

Field investigations were carried out for baseline data gathering from 8th – 12th September 2022 (wet season). Geography, relevant environmental and socio-economic information on the proposed project locations were gathered from site visits, maps, charts, articles, previous study reports in the area, photographs, textbooks, etc. The information generated enabled definition of limits of the areas to be surveyed or assessed. Data gap analysis was carried out to identify areas where additional information was required and the result used in planning the execution of field sampling/measurement aspects of the EIA study.

The field study carried out by a multi-disciplinary team of experts was designed and executed within the proposed project premises and surrounding area. The field work covered all relevant aspects of the physico-chemical, bio-ecological, socio-economic and environmental health in the project area. All sampling and observation points were geo-referenced using the Garmin Global Positioning System (GPS) receiver (Garmin eTrex 10). Quality control/Quality assurance was ensured in all aspects including sample collection, handling, laboratory analysis, data coding/manipulation, statistical analysis, presentation and communication.

Fieldwork activities/Laboratory analyses were carried out to complement secondary data

gathered from literature and to collect new and additional primary data to fill information gaps. The activities were carried out in accordance with FMEnv and recommended international methods.

4.4 Data Collection

The study involved a multidisciplinary team approach; with standard methods from pure and applied sciences, engineering, sociological studies, development economics and health sciences leveraged in order to obtain basic data for impact identification and establishment of mitigation and amelioration measures. Information gathered from desktop, consultation and site identification were used in categorizing the major habitats in the areas, and their respective sampling requirements defined to effectively collect qualitative and quantitative data on the flora and fauna of the project area.

Reconnaissance survey and delineation of the study areas was carried out before data collection, with the objectives of setting boundaries of the study area. Visual observation within 2km radius of project site was made to determine resources, population, land forms, feature, ecological characteristics, drainage, biological and human communities within and about the project area. This was done to ensure adequate planning for the main fieldwork.

The Health Safety and Environment (HSE) Policy of Azmarineberg Limited were used as a guide to ensure safety of personnel and equipment on the field. However, sampling of the environmental components was used to gather information on the environmental setting of the project area. The methods considered include:

- Phasing of sampling to identify the areas of interest.
- Collection of soil samples: surface soil (depth of 0-15cm) and sub soil depth of (15-30cm) to obtain data on the quality of soil.
- Water samples were collected from borehole within the site and nearby Lake.
- Samples storage and preservation was ensured prior to transportation of environmental samples to Azmarineberg Limited at Plot 242A Alhaji Ganiyu Alimi Crescent, Off Baptist Church Street, Gbagada Phase 2, Lagos State a FMEnv accredited and Institute of Public Analyst of Nigeria (IPAN) registered laboratory for analysis.
- Geographic co-ordinates of the sampling locations were obtained with the aid of a Garmin eTrex 10, a Global Positioning System (GPS), with accuracy of about a meter.
- Control locations were selected and taken from a distance of 1.5-2km away from the project site and 5-8km from the communities. The geographic coordinates of the control location were also taken.

4.4.1 Laboratory Analysis

The method, guideline and standards used are those acceptable to American Society for Testing and Materials (ASTM), American Public Health Association (APHA), United States Environmental Protection Agency (USEPA), International Standard Organization (ISO), World bank (WB) and Federal Ministry of Environment (FMEnv).

The quality control of laboratory analysis was in accordance with ASTM and APHA recommended methods and included blank analyses to establish analytical level, duplicate analysis to establish analytical precision, spiked and blank sample analyses to determine analytical accuracy. Meanwhile, Insitu measurement of unstable physico-chemical parameter like pH was carried out using calibrated portable meters during the study. This is to ensure reliability and accuracy of the analysis. Some of the analytical methods used are highlighted in Table 4.1.

Table 4.1: Standard Reference Test Methods and their Parameters.

PARAMETERS	STANDARD REFERENCE	TEST METHODS	PRESERVATION
pH	APHA 4500-H B	Electrometric Method	Analyze immediately.
Conductivity	APHA 2510-B	Electrometric Method	Analyze immediately.
Turbidity	APHA 2130 B	Nephelometric Method	Analyze same day; store in dark up to 24h, Cool ≤6^{0}C
Total hardness	APHA 2340-C	EDTA Titrimetric Method	Add HNO_3 to H_2SO_4 to pH <2
Dissolved Oxygen	APHA 4500-O G	Membrane Electrode Method	Analyze immediately.
Fluoride	APHA 4500-F C	Ion-Selective Electrode Method	None
Chloride	APHA 4500-Cl B	Argentometric Titration Method	None
Acidity	APHA 2310-B	Titrimetric Method	Cool ≤6^{0}C
Salinity	APHA 2520 B	Electrical Conductivity Method	Analyze immediately.
Alkalinity	APHA 2320-B	Titrimetric Method	Cool ≤6^{0}C
Nitrate	APHA 4500 NO_3-B	UV Spectrometric Method	Analyze as soon as possible; Cool ≤6^{0}C
Nitrite	APHA 4500 NO_2-B	Colorimetric Method	Analyze as soon as possible; Cool ≤6^{0}C
Sulphate	APHA 4500 S0 E	UV Spectrometric Method	Cool ≤6^{0}C
Total solids	APHA 2540 B	Gravimetric Method	Cool ≤6^{0}C
Total Dissolved Solids	APHA 2540 C	Gravimetric Method	Cool ≤6^{0}C
Total Suspended Solids	APHA 2540 D	Gravimetric Method	Cool ≤6^{0}C
Total Phosphorus	APHA 4500-P E	Ascorbic Acid Method	Add H_2SO_4 to pH <2, Cool ≤6^{0}C
Total Nitrogen	APHA 4500-N C	Persulphate Digestion Method	Add H_2SO_4 to pH <2, Cool ≤6^{0}C
Total Hardness	APHA 2340 B	EDTA Titrimetric Method	Add HNO_3 or H_2SO_4 to pH <2
Chemical Oxygen Demand	HACH	Closed Reflux, Colorimetric Method	Analyze as soon as possible or add H_2SO_4 to pH <2, Cool ≤6^{0}C
Biochemical Oxygen Demand	APHA 5210 B	Closed Reflux, Colorimetric Method	Cool ≤6^{0}C
Oil & Grease	APHA 5520 B	Gravimetric Method	Add HCl or H_2SO_4 to pH <2, Cool ≤6^{0}C
BTEX	APHA 5520 B	Gas Chromatographic-Mass Spectrometric Method	Add HCl or H_2SO_4 to pH <2, Cool ≤6^{0}C
PAHs	APHA 6440 C	Gas Chromatographic-Mass Spectrometric Method	Add HCl or H_2SO_4 to pH <2, Cool ≤6^{0}C
Calcium	APHA 3500-Ca B	Titrimetric Method	Cool ≤6^{0}C
Sodium	APHA 3500-Na B	Flame Photometric Method	Cool ≤6^{0}C
Potassium	APHA 3500-K B	Flame Photometric Method	Cool ≤6^{0}C
Magnesium	APHA 3500-Mg B	Atomic Absorption Spectrophotometry	Cool ≤6^{0}C
Zinc	APHA 3111 B	Atomic Absorption Spectrophotometry	Add HNO_3 to pH <2
Nickel	APHA 3111 B	Atomic Absorption Spectrophotometry	Add HNO_3 to pH <2
Mercury	APHA 3112	Atomic Absorption Spectrophotometry	Add HNO_3 to pH <2
Manganese	APHA 3111 B	Atomic Absorption Spectrophotometry	Add HNO_3 to pH <2
Lead	APHA 3111 B	Atomic Absorption Spectrophotometry	Add HNO_3 to pH <2

PARAMETERS	STANDARD REFERENCE	TEST METHODS	PRESERVATION
Iron	APHA 3111 B	Atomic Absorption Spectrophotometry	Add HNO_3 to pH <2
Copper	APHA 3111 B	Atomic Absorption Spectrophotometry	Add HNO_3 to pH <2
Chromium	APHA 3111 B	Atomic Absorption Spectrophotometry	Cool $\leq 6^0C$
Cadmium	APHA 3111B	Atomic Absorption Spectrophotometry	Add HNO_3 to pH <2
Barium	APHA 3113 B	Atomic Absorption Spectrophotometry	Add HNO_3 to pH <2
Arsenic	APHA 3113 B	Atomic Absorption Spectrophotometry	Add HNO_3 to pH <2
Aluminum	APHA 3113 B	Atomic Absorption Spectrophotometry	Add HNO_3 to pH <2
Total Coliform Count	APHA 9221 B	Pour Plate Method	Cool 6^0C
Faecal Coliform	APHA 9221 E	Pour Plate Method	Cool 6^0C

Source: APHA 2017, 23rd Edition

The laboratory analysis for the proposed PET recycling plant project was witnessed by a FMEnv representative (Plate 4.3).



Plate 4.3: Laboratory witnessing of Environmental samples collected at Sonnex Packaging Nigeria Limited's project site by FMEnv officials

Table 4.2: Field Equipment for Sampling

S/N	Environmental component	Equipment/Tool
1	Ambient Air Quality (Total Volatile Organic Compounds (TVOC) and Formaldehyde (HCHO))	**Oceanus Henan Gas Detector (OC-1000)** Temperature and Humidity Testing Range T: 40-120^{0}C; H: 0-100% RH precision: ±3% F.S (or customized).
2	Suspended Particulate Matter(SPM)	**METONE Handheld Air Borne particulate counter** (HPPC 6+) Counting Efficiency – 50% at 0.3 um; 100% for particles > 0.45 um (ISO 21501-4)
3	Temperature, Relative Humidity and Dew point, NO, SO_2, CO_2, NH_3, H_2S, NO_2, CO and O_2.)	**Oceanus Henan Gas Detector (OC-1000)** Temperature and Humidity Testing Range T: 40-120^{0}C; H: 0-100% RH precision: ±3% F.S (or customized).

4	Soil	Stainless Steel Augers
5	Ground water (in-situ water testing for parameters with short holding time namely pH, electrical conductivity, DO, Salinity, TDS, temperature)	pH – Milwaukee HT1000 -Multimeter
6	Ambient Noise Levels	UNI-T UT352 Sound Level Digital Survey Meter. Detection limit of 30 – 130dB (with best accuracy of ±1.5dB)
7	Vegetation (Flora) and Wildlife (Fauna)	Visual Identification, camera, etc.

Source: Azmarineberg Limited 2022

4.4.2 Quality Control/Assurance

Standard Quality Assurance and Quality Control Procedures was applied in carrying out the study, to eliminate ambiguous data, improve interpretation and ensure conferment of data validity and reliability during sample collection, preservation, storage, transportation, laboratory analysis and data generation and presentation.

The data gathering approach is summarized below:

- Climate and Meteorology

The regional long-term climatic data of the Project area was sourced from NiMet and spanned from 1989 to 2019. This was supplemented with Insitu climatic and meteorology characteristics of the Project area collected from ten (10) locations and two (2) control locations.

- Air Quality and Noise

Ten (10) ambient air quality and noise measurements including two control points were conducted with the use of pre- calibrated digital hand-held monitoring equipment for Sulphur dioxide (SO_2), Nitrogen dioxide ($NO_{2)}$, Oxygen (O_2), Ozone (O_3) Carbon Monoxide (CO), Carbon dioxide (CO_2), Volatile Organic Compounds (VOC), Ammonia (NH_3), Hydrogen Sulphide (H_2S) and Suspended Particulate Matter.

The noise level monitoring was done using the UNI – T UT352 sound detector to measure the maximum and minimum noise levels from strategic points within the facility. The average noise levels were computed and compared with the noise level standards. Noise sampling locations were co-located with air quality locations.

- Groundwater and Surface water Sampling

Groundwater samples were collected from three (3) different boreholes within the Project area inclusive of the control point. At each sampling location, groundwater samples were collected into a 2-litre sampling bottle for general physico-chemical analysis, while samples for Oil & Grease determination were collected in 1-litre glass bottle and preserved with concentrated sulphuric acid. Samples for heavy metals were fixed with concentrated nitric acid. Pre-sterilized sampling bottles were used for samples meant for microbial analysis. *In-situ* measurements of pH, Conductivity, Total Dissolved Solids (TDS), Temperature, and Dissolved Oxygen (DO) were taken at each location using pH – Milwaukee and HT1000 –Multimeter respectively. Similarly, one(1) surface water sample was collected for analysis as the lake was already receding due to human activities around the area at the study period.

- Soil Sampling

A total of five (5) soil sampling locations at two depths, top soil(0-15cm) and subsoil (15-30cm) were established at the study area including a control point resulting into a total of twelve (12) samples. Soil sampling was carried out using a stainless-steel auger and transferred to an aluminum foil. The soil samples were collected with aluminum foil sheet for microbial and physico-chemical analysis. All samples collected were preserved and transported to the laboratory for analysis.

- Terrestrial Flora and Fauna

A flora assessment of the Project was undertaken with a view to providing information on the following: vegetation types, floristic composition, species diversity, inventory of economic/medicinal plants and general biodiversity assessment. The survey was conducted in accordance with the standard botanical field sampling procedures. Plant species encountered were identified to species level both *insitu* and *exsitu* using appropriate references, manuals and monographs. The ecological status of the species was evaluated and classified appropriately according to the International Union for Conservation of Nature (IUCN).

Sampling techniques for terrestrial fauna assessment include footprint, nest type feeding site, voice, physical appearance, faecal samples, and shell types. All these were combined with comprehensive information from literature search of studies done in the terrain.

- Socio-economics and Health Survey

The study methodologies employed for socio-economics and health baseline data gathering include questionnaire administration, key informants' interviews, focus group discussions, field observations and literature review.

4.5 Description of the Baseline Environment

4.5.1 Climate and Meteorology

Climate describes the average weather conditions for a particular location and over a long period of time. Meteorological variables such as wind speeds and direction, relative humidity, temperature are crucial in the evaluation of pollutant dispersions and effluents from both anthropogenic and natural induced activities that take place in any environment. The atmosphere serves as sink or a medium of transfer through meteorological activities for these impacts. Rainfall is a key climatic variable and there are distinct fluctuations of wet and dry seasons in most areas. Two air masses controls rainfall namely – moist northward moving maritime air coming from the Atlantic Ocean and the dry continental air coming from the African Landmass. The climate of the area is affected by ocean and atmospheric interactions both within and outside its environment, in which the Inter-Tropical Convergence Zone (ITCZ) plays a controlling factor. The movement of the ITCZ is associated with the warm humid maritime Tropical air mass with its south-western winds as well as the hot and dry continental air mass with its dry north-easterly winds.

The climate of proposed project study area falls under the humid tropical rainy climates classified by Koppen and Geiger 1954 as Aw (winter dry season). The extent of rainfall periods ranges from 119 – 220 days, with the highest number recorded between the months of July and September, while the lowest is recorded during December and January. A brief dry spell is recorded between the months of August. However, this has not been the trend as August within the last few years has produced high amount of rainfall in the area when compared to peak rainfall periods. The mean annual rainfall for Lagos is above 1,600mm with dominant wind direction being south-westerly during the wet season and northwesterly during the main dry season. The mean daily minimum temperature is about 23°C and a mean daily maximum temperature of about 31°C. The mean monthly relative humidity of the area varies from 70 - 89 %. Microclimatic data were acquired from the study area and thirty (30) years (1989-2019) long term data (macroclimatic data) retrieved from the Nigerian Meteorological Agency, Oshodi Lagos including literature sources were used for the study.

Table 4.3 summarizes the monthly mean climatic characteristics of Lagos State where the proposed project is located (1989 to 2019).

Table 4.3: Average Weather Trend for Lagos (1989-2019)

S/N0	Month	Average Temp (°C)	Rainfall (mm)	Cloud Cover (Oktas)	Pressure (mbar)	R/H (%)	Wind Speed (m/s)	Wind Dir.
1	January	29.5	19	5	1009	77	2.9	NE
2	February	30.1	49	6	1008	81	3.4	SW
3	March	30.1	85	6	1008	84	3.8	SW
4	April	29.6	137	6	1008	85	3.8	SW
5	May	29.3	245	6	1009	85	3.6	SW
6	June	28.2	374	7	1011	87	4.2	SW
7	July	27.3	237	7	1012	87	4.8	SW
8	August	27.7	98	7	1012	88	4.8	SW
9	September	27.2	188	7	1011	89	4.3	SW
10	October	28.5	165	6	1010	87	3.5	SW
11	November	29.5	64	6	1009	83	2.8	SW
12	December	29.6	21	5	1009	78	2.5	NE

Source : Nimet 2020

4.5.1.1 Rainfall Pattern

The study area is situated within the coastal climatic belt. In this belt, rainfall variation is the most important variable for the determination of season. The annual distribution begins with the early rains in March, which ceases in November. In general, there should be only two seasons, but in climatology four seasons are actually discernible for the area. These seasons too are differentiated by rainfall and they are the early rainy season (March-July), little dry season (also called August break), late rainy season and dry season (December-February). The mean annual rainfall for the study area is above 1600mm and mean monthly rainfall distribution for a synoptic station to survey area as retrieved from existing 30 years (1989-2019) data are shown in Table 4.3. Highest rainfall value was obtained in June (374 mm) while the lowest rainfall value obtained in January (19 mm) within the period under review.

4.5.1.2 Air Temperature

During the field study period the temperature range recorded in the area was 27.1°C – 29.7°C and values of 27.7°C and 28.1°C were obtained at the control locations. Meanwhile, the trend for Lagos terrain within the period of 1989 -2019 was in the range 27.2°C – 30.1°C (Table 4.3). Lagos exhibits a stable condition at nights that inhibits emission dispersion and slightly unstable/moderate stability condition during the day periods that enhances emission dispersions.

4.5.1.3 Relative Humidity

Relative humidity which measures water vapour in the atmosphere is noted to be low during dry season and high during the peak of rainy season due to the influence of moisture laden south-westerly's as seen from the macro average monthly results (Table 4.3). Figure 4.1 shows relative humidity and temperature values moving in opposite directions. Basically, as ambient

temperature increases, percentage humidity decreases and vice-versa. However, the relative humidity in the study area was in the range 77.4% - 98.5%.

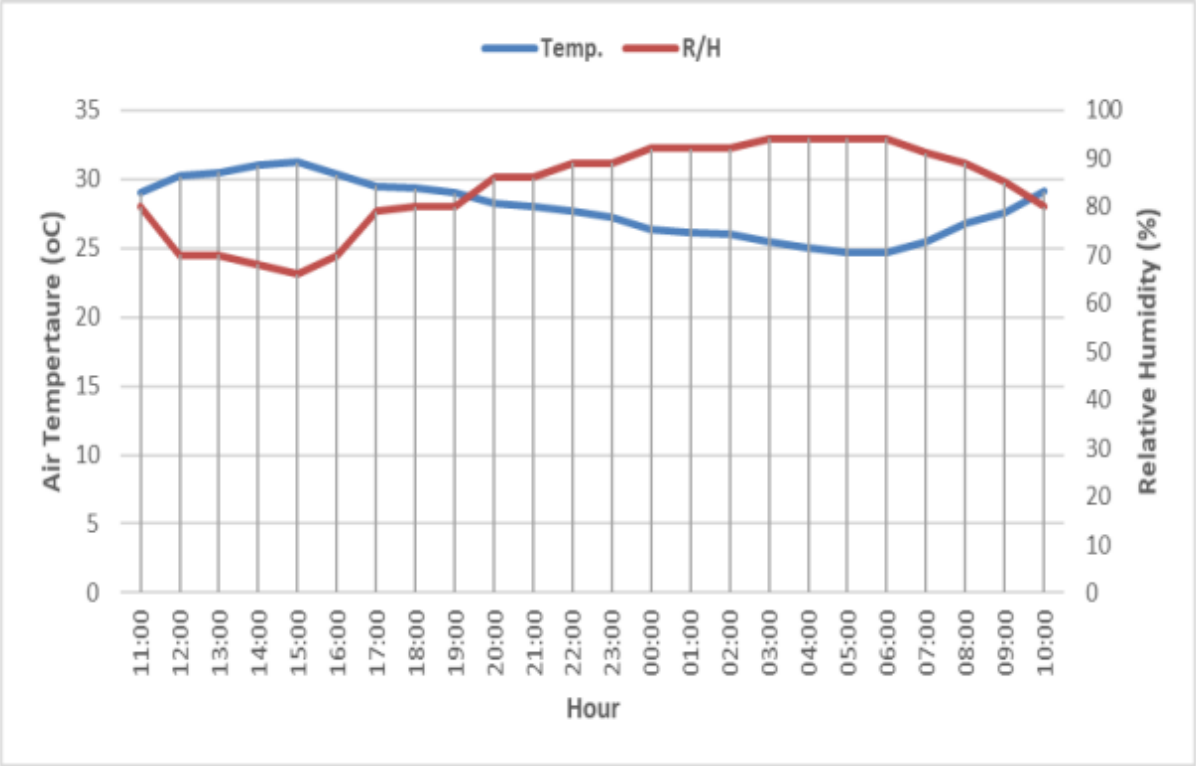


Figure 4.1: Diurnal temperature and relative humidity variations in the project area

4.5.1.4 Wind Speed/Direction

The prevailing wind direction in the area was the south-westerly winds as presented in the wind rose below (Figure 4.2). This implies that emissions will be transferred towards the north-east and eastern direction of the study environment. In pollution meteorology calms are associated with inversions (temperature increasing with height). Inversion may result in fumigation; meaning that emissions are trapped at ground level close to their source as against other situations where it is dispersed and diluted much more easily. Inversion is widely known to be frequent during the early hours in the seasons' transition periods. The recorded wind speed in the study area was in the range 0.9m/s – 3.2m/s with values of 1.2m/s and 4.4m/s recorded at the control locations.

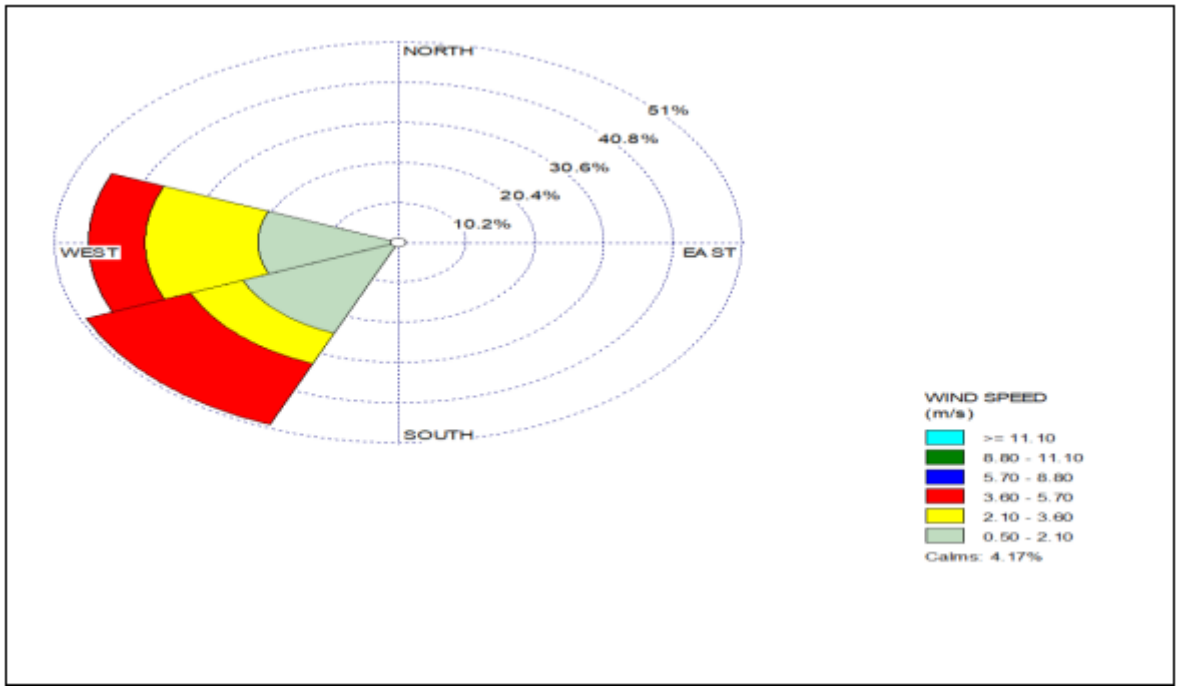


Figure 4.2: Diurnal wind rose pattern of project area during fieldwork

4.5.1.5 Cloud Cover

Generally, the weather condition in the study area during the period considered was cloudy and the average cloud cover was 6 oktas. High amounts of cloud inhibit instability that enhances the dispersion of plumes and lower amounts promote atmospheric dispersion of plumes. Cloud cover is prominent during rainy periods and minimal during dry seasons which either allow or hinder the penetration of solar energy which increases/decreases heat during these periods.

4.5.1.6 Atmospheric Pressure

Atmospheric pressure at sea level measured during the study period (1989 - 2019) was between 1010- 1013mbar. An important characteristic of the atmosphere is its pressure as it often determines wind and weather pattern across an area. The normal range of the earth's air pressure is from 970mbar to 1050mbar. These differences are the results of low and high air pressure systems which are caused by unequal heating across surfaces. Low pressure areas are usually associated with high winds, warm air and atmospheric lifting. Because of this, low pressure normally produces clouds, precipitation and other bad weather such as tropical storms and cyclones. Unlike areas of low pressure, the absence of clouds means that areas prone to high pressure experience extremes in diurnal and seasonal temperatures since there are no clouds to block incoming solar radiation or trap outgoing long wave radiation. The study area features a humid tropical wet climate that is typical of the coastal areas in Nigeria.

4.6 Hydrogeology of Lagos Metropolis

Ikorodu is a city and local government Area in Lagos state, Nigeria, located along Lagos lagoon, it shares a boundary with Ogun state. The geologic succession in Lagos spans through the Cretaceous Abeokuta Formation, which unconformably overlies the rocks of the Basement Complex, to the Quaternary Deltaic Plain Sands Lagos state is principally a sedimentary region located within the western part of Nigeria; a zone of coastal creek and lagoon. The area is also developed by barrier beaches associated with sand deposition [O.S. Adegoke *et al*. 1980]. The sub-surface geology reveals two basic lithologies; clay and sand deposits. These deposits may be interbedded in places with vegetable remains and peak. The water bearing strata of Lagos state consists of sand, gravel or admixtures from fine through medium to coarse sand and gravel [Longe et al 1987].

There are four main aquiferous units that are being tapped for water supply within Lagos metropolis. The first aquifer extends from ground level to roughly 12m below ground. It consists of alternation layers of clay and sand. This upper aquifer is prone to contamination because of its limited depth. The second aquifer is encountered between 20m and 100m below sea level and it can be found around Ikeja and Ojota axis of Lagos State. This aquifer is of greater importance for water supply purposes throughout Lagos metropolis [Jones H, & Hockey R 1964]. The third aquifer in the central part of Lagos has a depth ranging from 130m-160m below the sea level and the fourth aquifer is located at an elevation of approximately 450 m below sea level. It is separated from the third aquifer by a rather thick layer of shale of the Ewekoro formation. Only a few boreholes tap water from this aquifer [Jones H, & Hockey R 1964]. Until fairly recently, surface water was the major source of water supply for domestic and industrial influence on groundwater in the state.

During the rains and at some unprotected times, parts of the city become flooded as a result of heavy rainfall, low relief, high tides, and poor structural planning of buildings and drainage facilities. Lagos is highly industrialized and the discharge of industrial effluents into surface water bodies makes the water a lot more saline, and so, more costly to treat for public supplies. The Lagos State Water Corporation therefore embarks on the use of groundwater to augment supplies from surface water. Groundwater is often considered pure and therefore can be served with little or no treatment. This may be true for deep boreholes.

The problem of saline water intrusion and aquifer contamination through anthropogenic activities such as the disposal of domestic wastes may, however, endanger the use of shallow groundwater in Lagos. Generally in Nigeria, shallow groundwater is synonymous with shallow dug-wells and boreholes while deep groundwater is associated with deep boreholes. “The definition of

'shallow' or 'deep' water well will vary with the hydrogeological conditions considered to be standard within an area" (Clark 1996).

The basic problem with the construction of deep boreholes in Ikorodu is the location of the aquifer to supply and sustain the need for which such boreholes are intended. Ikorodu which is the project area is directly underlain by the Benin Formation. The Benin Formation consists largely of sands/ sandstones with lenses of shales and clays. The formation is thin in Ikorodu and this, therefore, does not favor it as an important aquifer. Elsewhere in Lagos, it "provides a ready answer to the groundwater problems"; and where pebbly beds occur, they give "rise to high yielding boreholes" (Offodile 2002). In addition to the thinness of the aquifer in Ikorodu, the arenaceous nature of the Benin formation makes it susceptible to contamination from anthropogenic sources.

4.7 Air Quality Assessment & Noise level Assessment

Air Quality Monitoring involves the assessment and evaluation of the Pollutants/Contaminants in the atmosphere to which the general public and workers may be exposed. A valuation of baseline air quality was carried out to establish the status of exposure of the major sensitive receptors and to identify the main air pollution sources and their impacts on the proposed project site and surroundings. Sampling took place from 8th – 12th September 2022 at ten (10) sampling locations which were strategically located at the site including two (2) control stations outside the proposed site during the wet season study period.

Table 4.4: Coordinates of Sampling Locations for Air and noise level at the PET recycling plant project site

S/N	SAMPLING CODE	COORDINATES		ELEVATION
		Latitude	Longitude	
1.	AN1	06°38.948'	003°33.885'	32m
2.	AN2	06°38.914'	003°33.887'	34m
3.	AN3	06°38.886'	003°33.886'	37m
4.	AN4	06°38.901'	003°33.868'	36m
5.	AN5	06°38.910'	003°33.919'	30m
6.	AN6	06°38.842'	003°33.833'	46m
7.	AN7	06°38.879'	003°33.824'	41m
8.	AN8	06°38.833	003°33.851'	44m
9.	AN9	06°38.843'	003°33.953'	39m
10.	AN10	06°38.830'	003°33.818'	49m
11.	ANC1	06°38.829'	003°34.107'	34m
12.	ANC2	06°38.667'	003°33.383'	40m

Source: Azmarineberg Limited, 2022



Plate 4.4: Air quality and noise level monitoring at the proposed project site

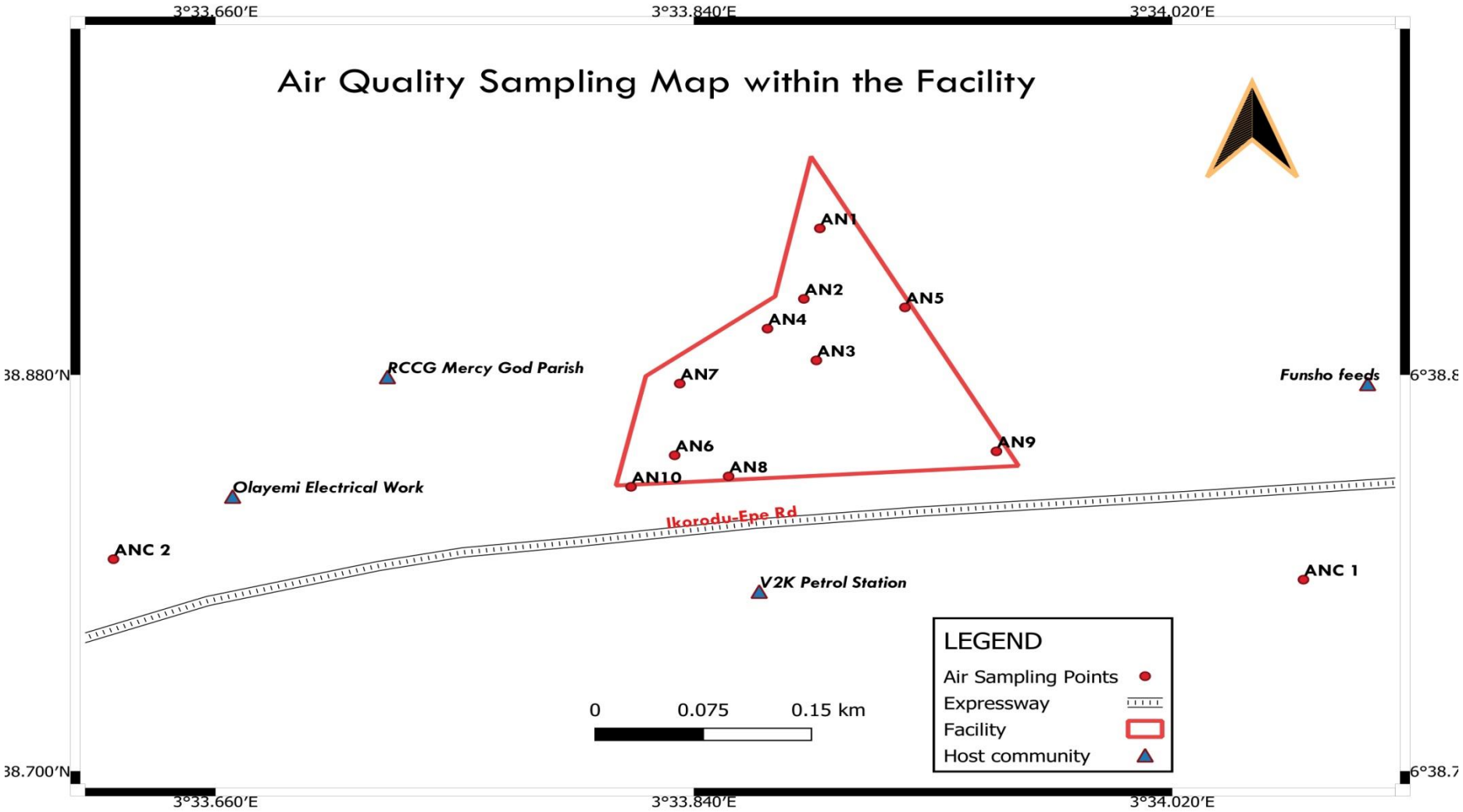


Figure 4.3: Air quality and Noise sampling locations for proposed Sonnex Packaging Nigeria Limited's project (wet season)

Ambient Air Quality and Noise Assessment Study Approach

The present air quality status and airshed classification at the project area were determined using the Federal Environmental Protection Agency (FEPA) now Federal Ministry of Environment's (FMEnv) national air quality standards (Table 4.5) and NESREA's National Environmental (Air Quality control) Regulations, 2014 (Table 4.6) air quality standard. The measured noise levels were also compared with the permissible noise levels of the Federal Ministry of Environment (Table 4.7) and NERSEA's National Environmental (Noise standards and control) Regulations 2009(Table 4.11).

Table 4.5: Nigerian Ambient Air Quality Standards considered in the Study

Pollutants	Time Average	FMEnv Limit
Particulates	Daily average of daily values 1 hour	250ug/m^3 *600 ug/m^3
Sulphur oxides(Sulphur dioxide)	Daily average of hourly values 1 hour	0.01ppm(26 ug/m^3) 0.1ppm(26 ug/m^3)
Non-methane Hydrocarbon	Daily average of 3-hourly values	160 ug/m^3
Carbon monoxide	Daily average of hourly values 8- hourly average	10ppm(11.4 ug/m^3) 20ppm (22.8 ug/m^3)
Nitrogen oxides (Nitrogen dioxide)	Daily average of hourly values (range)	0.04ppm-0.06ppm (75.0 ug/m^3 - 113 ug/m^3)
Photochemical oxidant	Hourly values	0.06ppm

Source: FEPA, 1991

Table 4.6: National Environmental (Air Quality Control) Regulations, 2014

Pollutants	Time Weighted Average	NESREA Limit
Particulates (PM_{10})	Daily average of daily values 24 hours	150ug/m^3
Sulphur oxides(Sulphur dioxide)	Daily average of hourly values 1 hour	0.35ppm(350 ug/m^3)
Carbon monoxide	Daily average of hourly values 1 hour	8.73ppm(10 mg/m^3)
Nitrogen oxides (Nitrogen dioxide)	Daily average of hourly values 1 hour	0.20ppm(200 ug/m^3)
Ammonia	Daily average of hourly values 24 hours	0.86ppm(0.6 mg/m^3)

Source: NEAREA 2014

Table 4.7 Nigeria's Standard Noise Levels (FEPA, 1991)

Duration per Day, hour	Permissible Exposure Limit, dB (A)
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110
0.25 or less	115

Source: FEPA, 1991

Table 4.8: Maximum Permissible Noise Levels (Continuous or intermittent noise) for a factory or workshop.

COLUMN 1 Leq dB (A)	COLUMN 2 Duration (Daily)	COLUMN 3 Duration (Weekly)
85	8 Hours	40 Hours
88	4 Hours	20 Hours
31	2 Hours	10 Hours
94	1 Hours	5 Hours
97	30 Minutes	2.5 Hours
100	15 Minutes	1.25 Hours
106	7.5 Minutes	37.5 Minutes
109	1.875 Minutes	9.375 Minutes

Source: National Environmental (Noise Standards and Control) Regulations, NESREA, 2009

Note: ***Leq =Equivalent sound level.***

Noise Levels shall not exceed Leq of;

I. Factory/Workshops 85dB (A).
II. Offices 50dB(A)
III. Factory/Workshop Compound 75dB(A)

4.7.1. Gaseous Pollutants

The measured gaseous concentrations in each of the 12 sampled locations including control as obtained during the field study for wet season and the twenty seven (27) points for secondary data from ESIA for the proposed Ikorodu Mill, Odogunyan, Ikorodu LGA, Lagos State used as secondary data are summarized in Tables 4.9 and 4.10.

Table 4.9: Measured Ambient Air quality Levels at Sonnex Packaging Nigeria Limited Study Area (wet season)

LOCATIONS	Temp. (°C)	SO_2 (ppm)	NO_2 (ppm)	H_2S (ppm)	O_2 (ppm)	RH (%)	DP (°C)	CH_2O (ppm)	CO (ppm)	CO_2 (ppm)	NO (ppm)	TVOC (ppm)	NH_3 (ppm)	O_3 (ppm)	PM2.5 (µg/m³)	PM10.0 (µg/m³)	Wind Speed (m/s)
AN1	27.2	<0.01	<0.01	<0.01	21.0	98.4	22.3	0.03	0.0	322	<0.1	<0.01	<0.01	<0.01	105.7	19.1	1.2
AN2	27.1	<0.01	<0.01	<0.01	21.0	98.5	22.4	0.05	0.5	289	<0.1	0.08	<0.01	<0.01	76.0	14.5	1.3
AN3	29.5	<0.01	<0.01	<0.01	21.0	77.4	78.1	0.04	0.5	242	<0.1	<0.01	<0.01	<0.01	45.6	6.4	1.5
AN4	28.9	<0.01	<0.01	<0.01	21.0	83.3	78.2	0.03	0.4	303	<0.1	<0.01	<0.01	<0.01	108.1	25.1	0.9
AN5	29.7	<0.01	<0.01	<0.01	21.0	81.3	99.3	0.05	0.6	267	<0.1	0.17	<0.01	<0.01	179.2	52.7	2.8
AN6	28.9	<0.01	<0.01	<0.01	21.0	79.2	79.1	0.05	0.9	255	<0.1	<0.01	<0.01	<0.01	152.7	34.6	1.4
AN7	29.1	<0.01	<0.01	<0.01	21.0	75.9	77.7	0.04	0.6	245	<0.1	<0.01	<0.01	<0.01	101.8	20.5	3.2
AN8	27.3	<0.01	<0.01	<0.01	21.0	92.0	78.2	0.04	1.0	269	<0.1	0.14	<0.01	<0.01	143.5	34.3	1.4
AN9	29.0	<0.01	<0.01	<0.01	21.0	80.0	78.8	0.05	1.1	259	<0.1	0.13	<0.01	<0.01	129.0	31.8	0.9
AN10	29.1	<0.01	<0.01	<0.01	21.0	82.8	79.4	0.03	0.7	303	<0.1	<0.01	<0.01	<0.01	72.8	18.0	1.0
Average	**28.58**	**-**	**-**	**-**	**21.0**	**84.88**	**69.35**	**0.04**	**0.63**	**275.4**	**-**	**0.052**	**-**	**-**	**111.44**	**25.7**	**1.56**
ANC1	28.1	<0.01	<0.01	<0.01	21.0	85.8	79.1	0.03	0.2	284	<0.1	<0.01	<0.01	<0.01	61.5	8.5	1.2
ANC2	27.7	<0.01	<0.01	<0.01	21.0	85.6	78.1	0.05	1.5	279	<0.1	0.69	<0.01	<0.01	37.5	12.0	4.4
Average control	**27.9**	**-**	**-**	**-**	**21**	**85.7**	**78.6**	**0.04**	**0.85**	**281.5**	**-**	**0.35**	**-**	**-**	**49.5**	**10.25**	**2.8**
FMEnv Limit	**32**	**0.01**	**0.06**	**14.0**	**21.0**	**-**	**-**	**-**	**10**	**NS**	**NS**	**NS**	-	-	-	**250**	-
NESREA Limit		**0.35**	**0.20**						**8.73**				**0.86**			**150**	

Source: Azmarineberg Limited Fieldwork, 2022

Table 4.10: Measured Ambient Air quality Levels for secondary data used as dry season

LOCATIONS	Temp. (°C)	SO_2 (ppm)	NO_2 (ppm)	H_2S (ppm)	O_2 (ppm)	RH (%)	CO (ppm)	CO_2 (ppm)	NO (ppm)	TVOC (ppm)	NH_3 (ppm)	PM2.5 (µg/m³)	PM10.0 (µg/m³)
AQ/N1	32.7	0.0	0.14	0.06	0.03	66	0.0	657	0.0	3.39	0	452.6	21.11
AQ/N2	33.9	0.0	0.23	0.32	0.1	64.1	0.0	655	0.0	0.28	0.3	136.92	23.03
AQ/N3	33.9	0.0	0.25	1.54	0.07	62	0.0	655	0.0	0.56	0.1	126.11	22.26
AQ/N4	32.9	0.0	0.28	0.46	0.12	65.2	0.0	656	0.0	0.26	0.1	161.82	51.34
AQ/N5	35.4	0.0	0.43	12	0.19	57.4	0.6	651	3.7	0.3	0.0	155.57	42.86
AQ/N6	33.9	0.0	0.3	0.28	0.11	62.4	5.2	653	3.8	0.48	0.0	133.47	30.16
AQ/N7	35.5	0.42	0.31	1.72	0.3	50.8	33.4	651	4	0.95	0.0	279.67	86.13
AQ/N8	34.7	0.0	0.28	0.09	0.12	50.7	1.9	659	3.8	0.86	0.1	123.57	22.16
AQ/N9	34.3	0.0	0.32	0.04	0.13	53.1	2.4	644	3.7	0.88	0.0	128.06	21.96
AQ/N10	33.7	0.0	0.27	0.02	0.09	53.4	0.7	611	3.7	0.79	0.2	198.02	21.95
AQ/N11	34	0.0	0.24	0.04	0.1	55	2.1	544	3.6	0.7	0.1	127.43	21.56
AQ/N12	33.8	0.0	0.29	0.47	0.1	55.7	7.8	542	3.6	0.73	0.0	127.95	21.63
AQ/N13	34.8	0.0	0.24	0.15	0.09	56.6	0.6	2252	15.4	1	0.1	150.26	19.56
AQ/N14	34.4	0.0	0.19	0.04	0.09	59.9	0.0	2254	13.2	0.92	0.1	150.95	19.65
AQ/N15	34.1	0.0	0.18	0.01	0.11	60.2	3.2	2255	13.2	0.95	0.4	151.13	19.68
AQ/N16	32	0.18	0.23	0.41	0.06	66.5	6	657	8.7	0.61	0.1	116.89	17.78
AQ/N17	31.6	0.06	0.21	0.26	0.11	70.8	6.8	660	6.4	0.93	0.3	132	18.75
AQ/N18	31.4	0.08	0.22	0.43	0.12	68.9	8.6	257	5.7	1.12	0.5	87.38	14.34
AQ/N19	31.4	0.0	0.24	0.31	0.11	65.8	4.7	621	5.6	1.01	0.4	87.56	14.38
AQ/N20	30.4	0.0	0.23	0.41	0.27	73.5	5.2	633	5.7	1.25	1.1	87.97	14.44
AQ/N21	30.3	0.4	0.27	0.04	0.0	69.2	3.7	614	5	0.97	0.0	88.1	14.46
AQ/N22	29.6	0.11	0.23	0.07	0.16	68.5	2.5	656	4.8	0.97	0.5	98.69	38.35
AQ/N23	29.8	0.0	0.26	0.34	0.07	71.2	3.9	664	4.8	1.04	0.3	139.88	23.4
AQ/N24	29.6	0.0	0.37	0.04	0.18	71.4	4.1	653	4.7	1.06	0.7	101.52	18.16
AQ/N25	29.6	0.01	0.27	0.01	0.15	71.1	2.1	664	4.6	1.02	0.5	138.95	18.1
AQ/N26	29.4	0.0	0.3	0.03	0.07	70.8	0.2	676	4.6	1.21	0.4	42.88	12.68
AQ/N27	29.1	0.0	0.16	0.01	0.0	71	0.1	687	4.5	0.99	0.1	70.3	12.9
Average	**32.5**	**0.05**	**0.26**	**0.7**	**0.11**	**63.5**	**3.9**	**797.3**	**5.07**	**0.93**	**0.24**	**140.58**	**24.54**
FMEnv Limit	**32**	**0.01**	**0.06**	**14.0**	**-**	**-**	**10**	**NS**	**NS**	**NS**	-	-	**250**
NESREA Limit		**0.35**	**0.20**				**8.73**				**0.86**		**150**

Source: Eco Pro Field Studies 2021

4.7.1.1 Discussion on Air quality and Noise results

Nitrogen dioxide

Nitrogen dioxide, or NO_2, is a gaseous air pollutant composed of nitrogen and oxygen and is one of a group of related gases called nitrogen oxides, or NOx. NO_2 forms when fossil fuels such as coal, oil, gas or diesel are burned at high temperatures. NO_2 and other nitrogen oxides in the outdoor air contribute to particle pollution and to the chemical reactions that make ozone. It is one of six widespread air pollutants that have national air quality standards to limit them in the outdoor air. Elevated levels of nitrogen dioxide can cause damage to the human respiratory tract and increase a person's vulnerability to severe respiratory infections and asthma. Long-term exposure to high levels of nitrogen dioxide can also cause chronic lung disease. The ambient concentration of Nitrogen dioxide (NO_2) at the site including control was below the detectable limit of the equipment used as compared to an average of 0.26ppm recorded for the secondary data used as dry season. All values for the wet season study period including control were within FMEnv Limit (0.06ppm) and NESREA limit (0.20ppm) but the average value for dry season exceeded both limits.

Nitric oxide (NO)

Nitric oxide is a colourless gas with a sharp odour. It is the main component of photochemical smog and occurs as a by-product of tobacco smoke, and propane, diesel and gasoline engine exhaust. Inhaling Nitric oxide can irritate the nose and throat; higher exposures may cause a build-up of fluids in the lungs (Pulmonary oedema) and also reduces the ability of blood to transport oxygen. Nitric oxide was not detected by the method used at all sampled locations including control within the proposed project site during the wet season as compared to an average of 5.07ppm recorded for the secondary data.

Total Volatile Organic Compounds (TVOC)

Total volatile organic compounds (TVOC) are emitted as gases from certain solids or liquids. TVOC include a variety of chemicals, some of which may have short- and long-term adverse health effects. Concentrations of many TVOC are consistently higher indoors (up to ten times higher) than outdoors. Organic chemicals are widely used as ingredients in household products. Paints, varnishes and wax all contain organic solvents, as do many cleaning, disinfecting, cosmetic and degreasing products. Fuels are made up of organic chemicals. All of these products can release organic compounds while you are using them, and to some degree, when they are stored. Health effects of exposure to TVOC include; eye, nose and throat irritation, headaches, loss of coordination and nausea, damage to liver, kidney and central nervous system and in some cases may lead to cancer. As with other pollutants, the extent and nature of the health

effect will depend on many factors including level of exposure and length of time exposed. TVOC levels at the site range between <0.01ppm to 0.17ppm and values of <0.01ppm and 0.69ppm at the control points as compared to an average of 0.93ppm recorded for the secondary data.

Sulphur dioxide (SO_2): SO_2 is a colourless, pungent, irritating water-soluble and reactive gas. The gas is generated through the combustion of petroleum products, burning of refuse and from domestic burning of fuels. As it is highly reactive, SO_2 has a highly non-uniform dose distribution along the conductive airways of the respiratory tract. Its inhalation by humans will lead to increase breathing rate and feeling of air-starvation; suffocation; aggravation of asthma and bronchitis; impairment of pulmonary functions, respiratory irritation; sensory irritation and the irritation of eyes and the throat. Sulphur dioxide was below detectable limit of the instrument used at all sampled locations including control for the wet season period and were within the FMEnv statutory limit of 0.01ppm and NESREA limit (0.35ppm) as compared to an average of 0.05ppm recorded for the secondary data used which exceeded FMEnv limit but within NESREA limit.

Carbon monoxide (CO): Carbon monoxide levels normally present in the atmosphere are unlikely to cause ill effects. Concentration of CO can be high in vehicles, underground parks, power generators, and in other indoor environments where combustion engines operate with inadequate ventilation. This is usually due to incomplete combustion of fuels. Carbon monoxide is a silent killer. It exerts its toxic effects after binding with haemoglobin in the capillaries of the lungs to form carboxyhaemoglobin (COHb). The affinity of haemoglobin for CO is 200-250 times that of oxygen. Formation of carboxyhaemoglobin impairs the release of oxygen from haemoglobin and these are main causes of tissue hypoxia. Severe hypoxia due to acute CO poisoning may cause both reversible, short-lasting, neurological deficits and severe, often delayed, neurological damage. The ambient concentration of Carbon monoxide at sampling points within the project site range from 0.2ppm to 1.1ppm and values of 0.2ppm and 1.5ppm at the control locations during wet season as compared to an average of 3.9ppm obtained for the secondary data. All sampled locations complied with FMEnv limit of 10.0ppm and NESREA limit of 8.73ppm.

Oxygen: Oxygen is the only component present in air we breathe capable of supporting life. Workers can become asphyxiated by exposure to atmosphere deficient of oxygen that can lead to serious injury or loss of life. The concentration of Oxygen at all sampled locations during the wet season study period was 21.0% across the board and was within **FMEnv** standard of **21.0%**. Oxygen was within limits for all sampled locations.

Ammonia (NH_3)

Ammonia (NH_3) is used in industry and commerce, and also exists naturally in humans and in the environment. Ammonia is an important gas for many metabolic processes; it serves as a precursor for amino acid and nucleotide synthesis. It is also part of the nitrogen cycle in the environment. Ammonia is a colourless gas with a pungent, suffocating smell. Most of the ammonia produced by industry is used in agriculture as fertilizer. Ammonia is also used as a refrigerant gas, for purification of water supplies, and in the manufacture of plastics, explosives, textiles, pesticides, dyes and other chemicals. It is found in many household and industrial-strength cleaning solutions. The widespread use of ammonia on farms, industries and commercial locations has increase the rate of pollution by ammonia gas.

Ammonia on contact with moisture on skin surfaces, respiratory tracts, reacts to form caustic ammonium hydroxide. Ammonium hydroxide causes the necrosis of tissues through disruption of cell membrane lipids (saponification) leading to cellular destruction. Exposure to high concentrations of ammonia in air causes immediate burning of the nose, throat and respiratory tract. This can eventually lead to bronchiolar and alveolar edema, and airway destruction resulting in respiratory distress or failure. Inhalation of lower concentrations can cause coughing, and nose and throat irritation. Ammonia levels within the site and control were below the detectable limit of the air monitoring equipment and within regulatory limit set by NESREA (0.86ppm). An average of 0.24ppm was recorded for the secondary data and was within NESREA limit.

Hydrogen Sulphide (H_2S)

Hydrogen sulfide is a colorless, flammable, extremely hazardous gas with a “rotten egg” smell. Naturally, It occurs in fossil fuels like petroleum, natural gas, and in hot springs. The gas is produced by bacterial breakdown of organic materials (human and animal wastes (e.g., sewage). Anthropogenic activities such as petroleum/natural gas drilling and refining, wastewater treatment, coke ovens, tanneries, and kraft paper mills also leads to the formation of this gas. Hydrogen sulfide is denser than air and can travel long distances over land. The primary route of exposure of hydrogen sulphide gas is inhalation and the gas is rapidly absorbed by the lungs. Absorption through the skin is minimal and can be explosive. It may travel to sources of ignition and flash back. If ignited, the gas burns to produce toxic vapors and gases, such as sulfur dioxide. Low concentrations of the gas irritate the eyes, nose, throat and respiratory system (e.g., burning/ tearing of eyes, cough, shortness of breath). Sensitive people such as asthmatics may experience difficulties in breathing after exposure. Continuous or prolonged exposures can lead to eye inflammation, headache, fatigue, irritability, insomnia, digestive disturbances and weight loss. Moderate concentrations can cause more severe eye

and respiratory irritation (including coughing, difficulty breathing, and accumulation of fluid in the lungs), headache, dizziness, nausea, vomiting, staggering and excitability. High concentrations can cause shock, convulsions, inability to breathe, extremely rapid unconsciousness, coma and death. H_2S levels at the site and control are below the detectable limit of the measuring device as compared to an average of 0.7ppm obtained for the secondary data. The levels were below the FMEnv limit for ambient air quality (14ppm).

Suspended Particulate Matter (PM) or Dust:

The suspended particulate matters are tiny dust particles that may be inhaled into lungs causing lung damage. These particles come from shredded or crushed materials, dust generally blown by wind, smoke, or dust from construction activities. The particles can also include soot, dirt, or liquid droplets emitted from chimney stacks and other sources. The dust particles from construction activities contain particles of a wide range of sizes. The behavior, deposition and fate of any particular particle after entry into the human respiratory system and the body response depend on the particle size. In this case, the particle size that negatively affect human is the total inhalable dust (dust less than10µ diameter). The majority of the dust particles do not remain in air but fall as dust on the floor, unused accessories and on top of buildings. The active component of the dust is that dust fraction that remains in air and is capable of being breathed into the lungs. However, the body is also capable of filtering out large particles while the smaller particles are inhaled to cause lung damage, breathing problems, and may also trigger asthmatic attack including diseases of the respiratory systems such as dysponea, emphysema and chronic bronchitis. The occurrence of these conditions in human depends on dust concentration and duration of exposure to the person. To control exposure to workers during working hours, protective breathing masks must be used at areas of noticeable concentrations.

The Suspended Particulate Matter ($PM_{10.0}$) measured at selected sampling points during the wet season range from 6.4µg/m^3 to 52.7µg/m^3 and values of 8.5µg/m^3 and 12.6µg/m^3 for the control points as compared to an average of 24.54µg/m^3 obtained for the secondary data used. $PM_{10.0}$ results show that all sampled locations had $PM_{10.0}$ values within **FMEnv** limit of **250.0µg/m^3** and **NESREA limit** (150 µg/m^3). $PM_{2.5}$ values recorded ranged from 45.6µg/m^3 to 179.2µg/m^3 for the wet season and values of 61.5µg/m^3 and 37.5µg/m^3 at the control locations as compared to an average of 140.58 µg/m^3 recorded for the secondary data used.

4.7.1.2 Noise Level Analysis

Human ears perceive certain modulations of the atmospheric pressure as sound. Such modulations result from a propagated vibration of an elastic medium or superposition of such vibrations. These vibrations cause an alteration in pressure, stress, particle displacement, or particle velocity of the medium. Human ears or microphones detect this pressure change as sound. Whenever the sound is irritating, annoying, unpleasant and unwanted, it is called noise.

Hearing plays an important role in behavioral and psychological activity of humans. Hearing loss is one of the most important consequences of noise exposure. Occupational noise -induced hearing loss (ONIHL) is an acquired hearing deficiency directly attributable to excessive workplace noise exposure. The potential health effects of noise pollution are numerous, pervasive, persistent, medically and socially significant. Noise produces direct and cumulative adverse effects that impair health and that degrade working environment with corresponding real (economic) and intangible (well-being) losses (Cheung, 2004). Noise represents an important public health problem that can lead to hearing loss, sleep disruption, cardiovascular disease, social handicaps, reduced productivity, negative social behaviour, annoyance reactions, absenteeism and accidents. It can impair the ability to enjoy one's property and leisure time and increases the frequency of antisocial behaviour. Noise adversely affects general health and well-being in the same way as does chronic stress. The location of machinery, and their movements, as well as road and traffic patterns in an industrial complex, are planned according to technological and economic requirements. If the acoustic qualities of these are not properly analyzed, the prevailing noise levels in the neighborhood may be adversely affected and the scope for future expansion or modification may be limited. Noisy workings may lead to violation of environmental guidelines, industrial disputes, and compensation claims.

The ambient noise levels within the study area were determined in some strategic and selected locations with the use of UNI-T UT352 sound Level digital survey meter. The equipment consists of several parts mainly Microphone, Pre-amplifier, frequency weighting, Processor, Display System, Communication system and Power supply. The dB(A) Leq denotes the time weighed weighted average of "A", which denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear. The minimum and maximum noise level (N_{min} and N_{max}) was taken, from whence; the mean of the noise levels which covers a specific period (Leq) was measured.

Table 4.11: Maximum Permissible Noise Levels (Continuous or intermittent noise) from a factory or workshop

COLUMN 1 Leq dB(A)	COLUMN 2 Duration (Daily)	COLUMN 3 Duration (Weekly)

85	8 Hours	40 Hours
88	4 Hours	20 Hours
31	2 Hours	10 Hours
94	1 Hours	5 Hours
97	30 Minutes	2.5 Hours
100	15 Minutes	1.25 Hours
106	7.5 Minutes	37.5 Minutes
109	1.875 Minutes	9.375 Minutes

Source: National Environmental (Noise Standards and Control) Regulations, NESREA, 2009

Note: ***Leq =Equivalent sound level.***

Noise Levels shall not exceed Leq of;

Factory/Workshops 85 dB(A).

Offices 50 dB(A)

Factory/Workshop Compound 75 dB(A)

Table 4.12: Noise level Results of different sampled locations at Sonnex Packaging Nigeria Limited Project site (wet season)

LOCATION	Minimum Noise dB(A)	Maximum Noise dB(A)	AVERAGE NOISE LEVEL dB(A)
AN1	40.7	47.8	44.3
AN2	42.0	71.9	57.0
AN3	55.0	57.4	56.2
AN4	51.8	59.0	55.4
AN5	54.0	65.2	59.6
AN6	53.6	67.5	60.6
AN7	43.2	60.0	51.6
AN8	64.2	80.3	72.3
AN9	53.8	76.3	65.1
AN10	62.3	78.8	70.6
Average	**52.1**	**66.4**	**59.27**
ANC1	66.2	83.4	74.8
ANC2	67.1	85.6	76.4
Average control	**66.7**	**84.5**	**75.6**
FMEnv LIMIT	-	-	90
NESREA Limit	-	-	85

dB(A)= decibel ***Source: AZMARINEBERG Limited Fieldwork, 2022***

Table 4.13: Noise level Results at different sampled locations secondary data used (dry season)

LOCATION	Minimum Noise dB(A)	Maximum Noise dB(A)	AVERAGE NOISE LEVEL dB(A)

AQ/N1	70.5	78.4	74.45
AQ/N2	49.6	66.8	58.2
AQ/N3	52.1	66.9	59.5
AQ/N4	54.1	56.7	55.4
AQ/N5	78.1	80.4	79.25
AQ/N6	69	71.4	70.2
AQ/N7	57.9	79.8	68.85
AQ/N8	57.8	77.6	67.7
AQ/N9	62.4	69.4	65.9
AQ/N10	50.8	64.7	57.75
AQ/N11	68.4	80.4	74.4
AQ/N12	63.8	74.4	69.1
AQ/N13	60.3	72.4	66.35
AQ/N14	51.4	57.6	54.5
AQ/N15	64.7	68.4	66.55
AQ/N16	63.7	79.4	71.55
AQ/N17	64.5	81.5	73
AQ/N18	45.9	50.2	48.05
AQ/N19	64.7	77.1	70.9
AQ/N20	55	68.4	61.7
AQ/N21	48.9	56	52.45
AQ/N22	46.9	63.9	55.4
AQ/N23	52.6	64.5	58.55
AQ/N24	59.2	72.4	65.8
AQ/N25	52.5	72.1	62.3
AQ/N26	69.9	72.1	71
AQ/N27	61.5	70.1	65.8
Average	**59.12**	**70.11**	**64.61**
FMEnv LIMIT	-	-	*90*
NESREA Limit	-	-	**85**

The Noise level measured at different selected sampled locations range from 44.3dB(A) to 72.3dB(A) and values of 74.8dB(A) and 76.4 dB(A) at the control locations as compared to an average of 64.61**dB(A**) obtained for the secondary data. All sampled locations were within **FMEnv** limit of **90.0 dB(A**) and **NESREA** limit of **85dB(A).**

4.8 Geotechnical Test for subsoil

The investigation was carried out to provide information on both the surface and sub-surface conditions of the site as it suits the design and construction of the foundation for the proposed PET recycling plant building. Some of the information provided by this investigation includes:

- The general topography of the site as it affects foundation design and construction.
- The general geology of the area with particular reference to the formation underlying the site.
- Detailed record of the soil strata and groundwater conditions.
- Recommendations of allowable bearing pressures for shallow foundations.
- Deep foundation analysis.

The investigation was carried out using 8 No. Cone Penetration Tests and 5 No. Boreholes. Details of the field work are given in the report, together with comments relating to standard code of construction practice (See detailed report in Appendix).

4.8.1 Site description and Geomorphology

The general area at the time of the investigation was relatively developing, and like many similar outskirts of Lagos metropolis the buildings were observed to be planned for both residential and commercial purposes.

At the time of the field work the property was fenced round with block walls. The site was a virgin expanse of land devoid of any forms of infrastructure. Also, parts of the project site were used for agricultural purposes for the production of various types of vegetable products.

The ground surface within the site was relatively flat and even in some places, it was also observed to be slightly undulating and slopes gently to the rear. The vegetation within the general area was mainly of the thick rain forest type, though vegetation on the site was in the forms of planted vegetables, weeds and grasses as parts of the site had been cleared prior to the investigation.

4.8.2 Work Methodology

The investigation was carried out in three parts namely:-

- Field studies
- Laboratory analysis
- Data analysis of tests results and compilation of a geotechnical report of findings.

4.8.2.1 Field studies

The fieldwork involved the drilling of 5No. Boreholes (BH1 – BH5) and carrying out 8No. Dutch Cone Penetration Tests (P1- P8). The test points were located to give a fair enough coverage of the site.

The Dutch Cone Penetration Tests

The cone penetration tests were carried out using the 10Ton testing equipment. The basic principle of the test is that a rod is pushed into the ground and the resistance on the tip (cone) of the rod is measured by a hydraulic system. The tests were terminated when the end and side resistance against the cone and the rods made the testing machine anchors to yield within the near surface material.

The cone, with a cross-sectional area of 1000mm^2 and a cone apex angle of 60^0, is pushed to the required depth, at an approximate rate of 20mm/s, in the closed position by exerting pressure on the outer sounding tube. The force on the cone is then measured while the cone is pushed downward by means of the inner pressure rod independently of the outer sounding tube. This procedure is repeated at regular intervals of every 0.25m depth.

The Geotechnical Borehole

The boreholes drilling were carried out using the light cable percussion (shell and auger) technique with a fully equipped hydraulic Pilcon wayfarer drilling rig. The boreholes were terminated at depths of 25.0m beneath the existing ground level. Sampling and *in situ* tests were carried out progressively with the advancement of the borehole through the overburden sediments. These were done as follows:-

- Disturbed samples were taken within the project site at regular intervals and at change of strata as deemed necessary. These samples were selected so that they are as far as possible representative of the materials encountered in the course of drilling. Materials from the split spoon sampler of the Standard Penetration Tests and the cutting shoe of the 100mm sampler were also taken as disturbed samples.
- In the cohesive material undisturbed samples were taken by driving a 100mm diameter sampler through a total of 450mm. These samples were taken at relevant depths.
- Standard Penetration Test (SPT) was carried out in the cohesionless soils at 1.5m - 2.0m intervals. A 50mm diameter split spoon sampler is driven 450mm into the soil using a 65kg hammer with a 760mm drop, and the penetration resistance is expressed as the number of blows (N-value) required to obtaining 300mm penetration below an initial 150mm penetration through any disturbed ground at the bottom of the borehole.

4.8.2.2 Laboratory Analysis

Laboratory tests were carried out on some selected disturbed samples recovered from the borehole on site. All these were carried out in accordance and compliance with the specifications contained in –**BS 1377: Methods of Tests for Soils for Civil Engineering Purposes.**

The tests were carried out as follows:-

- Soil classification tests: These were carried out on disturbed samples and include inter alia the determination of the natural moisture content, the Atterberg (liquid and plastic) limits and the particle size distribution.
- Soil strength tests: Involve essentially the determination of the relevant strength parameters through the Quick Undrained Triaxial Compression Tests on undisturbed cohesive materials.
- Soil deformation tests: These determine the consolidation (settlement) characteristics through the one-dimensional consolidation (oedometer) tests.

4.8.2.2.1 Subsoil Analysis and Descriptions

The analysis given in this report is based entirely on the results of the field and laboratory work carried out within, and on the subsoil samples collected from the project site. The levels given are with reference to the elevation of the existing ground surface at the test locations at the time of the investigation. A simple subsoil situation was proved in the course of the investigation. Clayey and sandy materials were encountered within the investigated depth.

The subsoil materials encountered from the ground surface to the end of the investigation appears to be uniform, being made up mainly of the lateritic clay and sands. These materials are commonly found occurring in the Quaternary Coastal Plain Sands, a geological Formation of extensive occurrence in southwestern Nigeria.

The lateritic clay, which occurs from the ground surface to depths between 10.00m and 13.5m in the boreholes, is appreciably sandy in places and exhibits a firm/stiff becoming very stiff/hard consistency. Although the material exhibits good foundation properties even at shallow depths, a general improvement in subsoil engineering properties with depth was observed.

Two zones of subsoil were encountered within the clay. The first occurs within the first 1.50m from the surface. The material encountered is reddish brown silty lateritic clay. With end resistance, q_c, values, as low as 18kgf/cm^2 and $SPT_{N\text{-values}}$ of between 5 and 11, this subsoil zone is considered firm becoming stiff in consistency.

The relatively poor state as compared with the underlying zone is assumed to have resulted from the exposure of the near surface subsoil to weathering and erosional effects, which

ultimately resulted to stress release due to overburden removal, and softening due to the action of surface water percolating into the soil from the ground surface.

From about 1.50m depth, the strength properties of the clay improve very rapidly to depths between 10.00m and 13.50m. This indicates the limit of the zone adversely affected by weathering effects. End resistance, q_c values in excess of 270kgf/cm^2 and $SPT_{N\text{-values}}$ between 10 and 33 were recorded.

As earlier discussed, the clay shows stiff/very stiff becoming hard in consistency. The material is considered very good for foundation purposes. It exhibits high shear strength and low volume compressibility potential. It may therefore be used to safely support significant superstructure loads via the use of conventional shallow foundations on this site. It is within this clay layer that all the penetrometer tests were terminated.

Table 4.14: layer's summary 1 at the proposed PET recycling plant site

LAYER DESCRIPTION	**Reddish brown silty lateritic CLAY**
LAYER THICKNESS (m)	BH3 = 10.00m (0.00 -10.00) BH1, BH2 & BH4 = 10.50m (0.00 – 10.50) BH5 = 13.50m (0.00 – 13.50)
CPT VALUES RANGE (Qc)	18kgf/cm^2 - 270kgf/cm^2
BOREHOLE SPT VALUES RANGE (N)	5 - 25
LAYER'S PROPERTIES	**FIRM/STIFF/VERY STIFF/HARD**

Source: Earthdata Integrated Services Limited 2019

Beneath the lateritic clay, a layer of sand was encountered to depths between 15.0m in BH1 and 19.50m in BH4 with $SPT_{N\text{-values}}$ of between 24 and 35, the sand layer is considered medium dense but becoming dense in relative density. It exhibits a high shear strength and low propensity for volume compressibility on load application and is therefore considered very good as an appropriate medium within which deep foundations in the form of piles may be terminated.

Table 4.15: layer's summary 2 at the proposed PET recycling plant site

Source: Earthdata Integrated Services Limited 2019

LAYER DESCRIPTION	**Light and yellowish brown silty fine and medium SAND.**
LAYER THICKNESS (m)	BH1 = 4.50m (10.50 -15.00) BH2 = 6.50m (10.50 – 17.00) BH3 = 7.00m (10.00 – 17.00) BH4 = 9.00m (10.50 – 19.50) BH5 = 4.50m (13.50 – 18.00)
CPT VALUES RANGE (Qc)	-
BOREHOLE SPT VALUES RANGE (N)	24 - 35
LAYER'S PROPERTIES	**MEDIUM DENSE/DENSE**

Beyond the sand, another layer of clay was encountered to the end of the boreholes at 25.00m. The clay which represents the third subsoil zones is considered very stiff becoming hard in consistency as shown by the $SPT_{N\text{-values}}$ that ranges between 22 and 35.

Table 4.16: layer's summary 3 at the proposed PET recycling plant site

LAYER DESCRIPTION	**Light and greyish brown silty CLAY**
LAYER THICKNESS (m)	BH1 = 10.00m (15.00 - 25.00) BH2 & BH3 = 8.00m (17.00 – 25.00) BH4 = 5.50m (19.50 – 25.00) BH5 = 7.00m (18.00 – 25.00)
CPT VALUES RANGE (Qc)	-
BOREHOLE SPT VALUES RANGE (N)	22 - 35
LAYER'S PROPERTIES	**VERY STIFF/HARD**

Source: Earthdata Integrated Services Limited 2019

4.8.2.2.2 Groundwater level

In the course of the investigation, groundwater was only encountered at depths of 12.00m in BH4 and 14.00m in BH5.

4.8.2.2.3 Foundation Recommendation and Conclusion.

The type(s) and depth of foundations to be adopted on this site shall be determined by the bearing pressure requirements.

The first step in site preparation shall be to completely remove the vegetation. There shall be need in the process of ground preparation to level the ground surface within the area earmarked for construction.

Shallow Foundation

As observed in the last section, the subsoil encountered at shallow depths within the site is considered very suitable for use as a foundation medium as it exhibits good foundation properties. This makes possible the utilization of shallow foundations in supporting the structures proposed for this site.

SHALLOW FOUNDATIONS MAY BE USED IN SUPPORTING THE STRUCTURES PROPOSED FOR THE SITE

Using average q_c values of between 15kgf/cm^2 and 35kgf/cm^2 for the clay at depths between 500mm and 2000mm respectively and allowable bearing pressures at different depths are as given below.

Table 4.17: Allowable bearing pressures at different depths

Depth (mm)	Foundation Type/Width	Allowable Bearing Pressure (kN/m^2)
500	Shallow Footing	**93**
	Raft	**121**
1000	Shallow Footing	**124**
	Raft	**161**
1500	Shallow Footing	**186**
	Raft	**242**
2000	Shallow Footing	**217**
	Raft	**282**

Source: Earthdata Integrated Services Limited 2019

These allowable bearing capacity values are calculated for shallow strips, pads or spread footings and raft placed at these depths with a factor of safety of 3 and expected maximum settlement not exceeding 25mm. and 50mm respectively. In the course of the investigation it was observed that the groundwater was encountered at a depth around 12.0m and 14.0m beneath the ground surface. This means that excavations to the recommended foundation level for shallow foundations may not be problematic provided the groundwater is not encountered.

Comments:

- With groundwater occurring below the recommended foundation level, excavations for shallow foundations are not expected to be problematic, except possibly for coping with the high strength of the material.

- Temporary unsupported vertical excavation walls within the laterite shall be possible and stable.
- Where excavation floors are inevitably disturbed in the course of excavation, it is advisable to compact the floor adequately prior to the application of the blinding course to avoid a degree of settlement in excess of the values given above or a general appreciable differential settlement between the different parts of the structure.
- Adequate drainage facilities should be provided for the proposed structures to avoid scouring of the soil and undermining the foundations.
- For all concrete works normal Portland cement may be used. However a dense concrete mix is recommended. Adequate cover should be provided for all reinforcement bars to avoid corrosion.

4.9 Land use and Land cover

Land-use and Land-cover are two different concepts that has become a central component in current strategies for managing natural resources and monitoring environmental change. According to Turnerll (1995) land-use refers to the purpose or activities for which land is used. It emphasizes more on land's social properties, that is, the output of reconstruction activities that human adopts to manipulate, manage and regulate the land chronically and periodically according to determinate economic and social purpose. Thus, land-use is a process of manipulating the natural ecosystem into social ecosystem, and the process is a complicated procedure by the synthetic effect from nature, economy and society.

The manner, degree, structure, area distributing and benefit of land-use are not only affected by natural condition but also restricted by diversified natural, economic and technologic condition, and in sometimes among all factors the social production form is determinant land use is the most direct and leading driving factor to the land cover change (Brandon, 2000). Land-cover on the other hand refers to the physical and biological cover over the earth surface of land, including water, vegetation, bare soil and artificial structures (Ellis, 2010). It emphasizes particularly on its natural properties, it is defined as the biophysical cover of the earth's surface, and it is the expression of human activities and synthetically reflection of various elements in global surface covered with natural body or synthetic features.

In most developing economies, sustainability challenges emanating from sprawling expansion of cities are synonymous with informal land use and tenure. Disorderly subdivision layout patterns, lack of public infrastructure and services, poverty, informal livelihood, increased social and economic costs, environmental degradation, loss agricultural land and diminution of natural

resources like forest and high-biodiversity wetlands are also obvious problems (Acey, Keller, & Commins, 2005; Agbola & Agunbiade, 2009; Lawanson, Yadua, & Salako, 2012; Pickett, et al.,

The study area Ikorodu is a local government area (municipality) within the Lagos megacity and the only surviving administrative area of Lagos State since its creation in 1968. With an area of approximately 396.5 sq. Km., Ikorodu was known for extensive farmlands and has derived its name from 'Oko-Odu' meaning vegetable farm. Due to its farming significance, the defunct Western Nigerian government acquired and designated several hectares of land for one of its farm settlements. Apart from farming, fishing and trading, which are basic sources of livelihood by indigenes, Ikorodu houses the largest industrial estate in Lagos and Nigeria as a whole with the acquisition of 1,582.27 hectares of land for industrial uses by the Lagos State Government in 1976.

This has served as a population magnet for those seeking employment with light and heavy manufacturing from agro-allied to metal products. The dualization of the Lagos-Ikorodu road in 1998 and the establishment of secondary and tertiary sector activities have also boost population and economic growth. The municipality had a 186-percentage population growth between the 1991 and 2006 censual years (i.e., from 184,674 to 527,917). As noted in the Lagos Metropolitan Master Plan 1980-2000, Ikorodu forms part of the Lagos Metropolitan Area and this is seen in the daily high commuter traffic, especially during peak periods. Ikorodu serves as a gateway to the country and its hinterland by the development of a light port terminal at Ipakodo. Also located in the area is the national broadcasting gangway as the transmitters of the Federal Radio Corporation of Nigeria (FRCN), Voice of Nigeria (VON) and Lagos State Broadcasting Corporation, LSBC (Radio Lagos/EKO F.M. and LTV). In order to forestall the sprawling development in Ikorodu town, it is pertinent that comprehensive and consistent spatial planning framework be in place.

According to a study by Ubaekwe, R.E and Engwoh I.M 2020, between the years 1984 and 2020, there were significant changes in land use land cover in the project area. Within these periods, 220.35km^2 of forest vegetation areas and 7.25km^2 of water body were lost or converted to other land use land cover in the study area, whereas total areas of 128.06km^2, 68.46km^2 and 27.07km^2 were gained by built-ups, bare lands and grass lands respectively. This exposes the pressure on forest vegetation and water body in the phase of industrialization, urbanization and human population explosion. However, if these patterns of land use and land cover change continue in the study area, it is likely that in the nearest future the remaining forest vegetation would be wiped out and the environmental crisis would be aggravated. The analysis

of land use land cover dynamics is thus a vital tool for sustainable forest management and environmental planning.

Five land use and land cover categories were distinguished during the cited study namely: forest vegetation, grass land, water body, built ups and bare land. Ground truth data were used to check the accuracy of the classification. The result showed changes in land use and land cover within the study periods. As at 1984, forest vegetation dominated the area by 66.88% but has reduced to 6.94% in 2020. Built-up area was least in 1984 (4.16%) but dominates the area (40.07%) in 2020. Grass land area was 4.41% in 1984 and has increased to 11.77% in 2020, while water body area was 4.44% in 1984 but has decreased to 2.46% in 2020. Also, bare land increased from 20.12% in 1984 to 38.73% in 2020.

Table 4.18: Area and Percentage cover of Land Use, Land Cover classes for 1984, 2004, 2012 and 2020

Class	1984 Area (km^2)	% Cover	2004 Area(km^2)	% Cover	2012 Area (km^2)	% Cover	2020 Area (km^2)	% Cover	%Change 1984 -2020	Remark
Forest	245.88	66.88	113.02	30.74	78.82	21.44	25.53	6.94	-59.94	Decreased
Grass	16.22	4.41	37.93	10.32	44.33	12.06	43.29	11.77	7.36	Increased
Built-up	15.29	4.16	75.10	20.43	99.05	26.94	147.35	40.07	35.91	Increased
Bare land	73.96	20.12	133.12	36.21	135.05	36.73	142.42	38.73	18.61	Increased
Water	16.32	4.43	8.50	2.30	10.43	2.83	9.07	2.49	-1.94	Decreased
Total			367.67		367.67					
	367.67	100.00		100.00		100.00	367.67	100.00		

Source: Ubaekwe, R.E and Engwoh I.M 2020

Increase in human population, rapid growth of industrialization and urbanization and weak environmental policy were the major drivers of land use land cover changes in the study area. The need for proper land use and land cover planning and management are implicated in the study. Therefore, the concept of sustainable development should be adopted in the study area. However, Land use cover within 2km of the project site is typically a replica of the one discussed above.

4.10 Vegetation at Sonnex Packaging Nigeria Limited's proposed project site

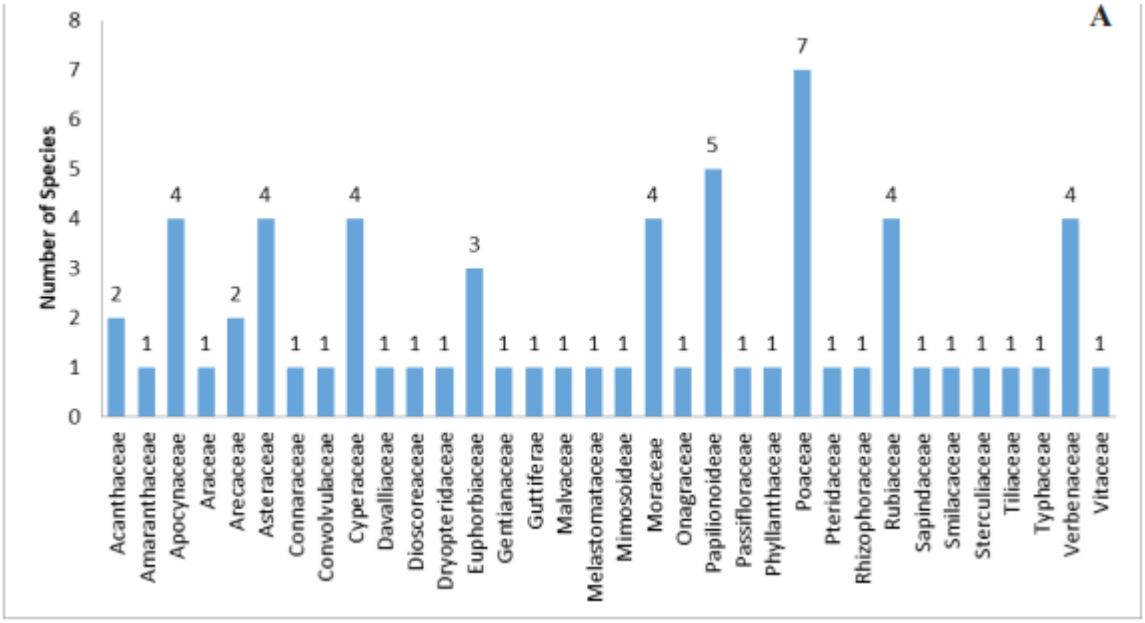
Nigeria, the largest in West Africa, has an array of different vegetation types with an extensive wetland distribution in the South-Western zones particularly Lagos State. Different from the natural wetlands, are artificial wetland consequent to creation of ponds and dams with limited diversity studies (Zakari, 1992; Eni et al., 2011; Olubode et al., 2011). Lagos is characterized by coastal environment (sandy barrier beaches, low-lying tidal flats, and estuaries) with three vegetation types (Mangrove, Secondary Rain Forest and Freshwater Swamp).

Thus, the vegetation is still under constant threat with major causes of biodiversity loss being indiscriminate land reclamation for development (urbanization) and anthropogenic functions (Dixon & Sherman, 1991, Filmer and Pritchett, 2002; Oramah, 2006; Pascual & Barbier, 2006). Abegunde (1988) reported that subcomponents of urbanization such as sand filling of lagoon shores, excessive dredging, extensive reclamation of wetlands, encroachment on natural drainage channel and unrestrained deforestation, have become frequent activities that characterize Lagos State. Unfortunately, this has been the case in the last three decades and its impact on Lagos vegetation cannot be overemphasized. Just as in many coastal cities around the globe, a full grasp of the effect of anthropogenic factors on coastal vegetation is yet to be properly assessed and quantified. Ecologists and environmental scientists have expressed more concerns on the post effect(s) of rapidly disappearing vegetation rather than vegetation analysis which may provide a clue to the causes of plant diversity loss.

During the site visit, the different biodiversity features and habitat at and around the site were identified and mapped. Walk-through-surveys were conducted across the site and all plant species observed were recorded. Searches for listed and protected plant species at the site were conducted. Although a visual inspection was done to gain an overall impression of the habitats and communities present in the area under study, a comprehensive literature search on study carried out on vegetation of Ikorodu(study area) was used for the purpose of this report for the wet season study period (Figure 4.4).

Combination of field observation and literature review shows that the proposed project area comprised of secondary (dry and swamp forest) and mangrove forest (Plates 4.5-4.12). The highest diversity of 66 species, 59 genera in 34 families were identified in the study area during wet season (Table 4.19) as compared to secondary regrowth species, mostly grasses such as *Andropogon gayanus, Axonopus compressus* and *Commelina spp* recorded for the secondary data.

The dominant family for the wet season period was *Cyperaceae,* (seven spp.) while most species were forbs (n=20 species [30%], Also recorded were four mangrove species (**A.** *aureum, D. lunatus R. racemosa and P. reclinata)* and long stretch of R. hookeri along the wetland/swamp. Species diversity was higher in the wet season period (n=61 species [62%]) *Panicum maximum* is the most dominant species. As observed during wet season study period some of the flora species were; Banana trees, African almond tree, elephant grass, spear grasses, Neem tree etc.



B

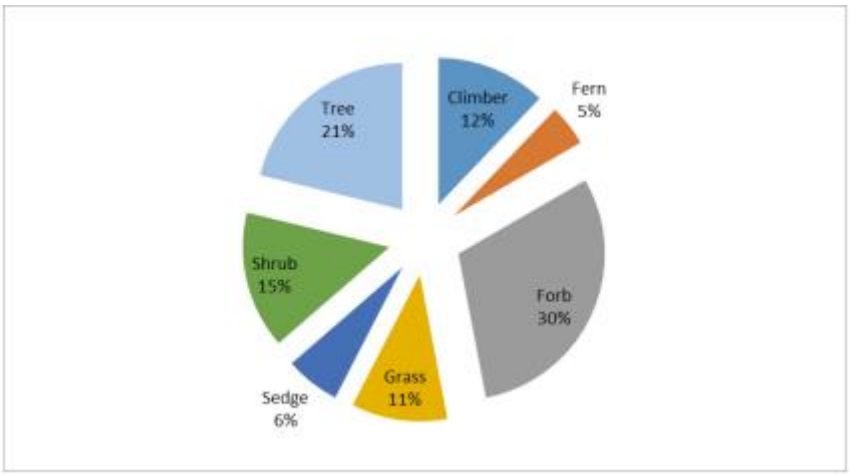


Figure 4.4: Distribution of species in Ikorodu, Lagos state, Nigeria. A: Family distribution; B: Percentage distribution of Plant life-forms
Source: Adeonipekun, Adegbenga P.; Oyebanji, Oyetola O. and Adebayo, Michael B. Mediterranean Botany 40(1) 2019: 53-70
Azmarineberg fieldwork 2022

Table 4.19: List of flora Species and their conservation status in Ikorodu, the PET recycling plant project area

S/N	Species name	Family	Common name	Frequency of Occurrence	%Relative Frequency of Occurrence	Habit Type	IUCN Conversation status
1.	*Asystasia gangetica (L.) T. Anderson,*	Acanthaceae	Coromandel, Chinese Violet, Creeping Foxglove, Ganges Primrose	2	50	Forb	NE
	Commelina diffusa Burm. f		Climbing dayflower or Spreading dayflower	1	25	Forb	LC
2.	*Cyathula prostrata (L.) Blume*	Amaranthaceae	Prostrate pastureweed	1	25	Forb	NE
	Gomphrena celosioides Mart.		Bachelor's Button, Prostrate Globe-Amaranth,			Forb	NE
3.	*Alstonia boonei De Wild.*	Apocynaceae	Stool wood, Pattern wood, Cheese wood, God's tree	1	25	Tree	NE
	Holarrhena floribunda (G.Don)		False Rubbertree.	1	25	Tree	NE
	T.Durand & Schinz		False Rubbertree.			-	-
	Landolphia dulcis (Sabine ex G.Don) Pichon		Liana	1	25	Climber	NE
	Rauvolfia vomitoria Afzel		Poison devil's-pepper	2	50	Tree	NE
4.	*Cyrtosperma senegalense Schott Engl.*	Araceae	Swamp Arum	1	25	Forb	LC
	Elaeis guineensis Jacq.		African oil palm	1	25	Tree	LC
5.	*Phoenix reclinata Jacq.*	Arecaceae	Wild date palm	1	25	Tree	NE
	Raphia hookeri G.Mann & H.Wendl.		Raffia Palm	1	25	Tree	NE
	Raphia vinifera P. Beauv		Wine Raffia Palm			Tree	NE
6.	*Ageratum conyzoides L*	Asteraceae	Goat weed, Billygoat-weed, chick weed, whiteweed.			Forb	NE
	Aspilia africana (Pers.) C. D. Adams		Wild sunflower	2	50	Forb	NE
	Chromolaena odorata (L.) R. King & H. Rob.		Devil weed	9	15	Forb	NE
	Emilia coccinea (Sims) G. Don		Scarlet tassel flower	2	50	Forb	NE
	Erigeron floribundus (Kunth) Sch. Bip.		Bilbao fleabane			Forb	NE
	Mikania tomentosa (Lam.) Willd.		Bitter vine, American rope			Climber	NE

S/N	Species name	Family	Common name	Frequency of Occurrence	%Relative Frequency of Occurrence	Habit Type	IUCN Conversation status
	Vernonia cinerea (L.) Less		Little Iron Weed	1	25	Forb	NE
7.	*Senna occidentalis (L.)Link*	Caesalpinioideae	Coffee senna			Shrub	NE
	Senna rotundifolia Pers		Round-leaf cassia.			Forb	NE
8.	*Brysocarpus coccineus Shum. & Thonn.*	Connaraceae	Crimson thyme. Local names: Amuje wewe, ade,Kimbar maharbe,Oka abole	1	25	Shrub	NE
9.	*Ipomoea aquatica Forssk.*	Convolvulaceae	Swamp Cabbage, Swamp Morning-glory, Water Morning Glory, Water Spinach, Chinese Water-spinach, Water Bindweed, Water Convolvulus	2	50	Climber	LC
	Ipomoea involucrata Beauv.		Frog's gourd	2	50	Climber	NE
10.	*Costus afer Ker Gawl.*	Costaceae	Spiral Ginger, Ginger lily, White spiral costus	1	25	Shrub	NE
11.	*Lagenaria breviflora (Benth.) Roberty*	Cucurbitaceae	Denni biram dau, denni: water melon			Climber	NE
12.	*Cyperus articulata L.*	Cyperaceae	Nutgrass, flatsedge	1	25	Sedge	NE
	Cyperus difformis L		Small-flowered umbrella sedge	1	25	Sedge	LC
	Cyperus distans L.f.		Slender cyperus	1	25	Sedge	LC
	Cyperus iria L.		Rice flatsedge	1	25	Sedge	LC
	Eleocharis cf. geniculata		Bent Spike-rush	1	25	Sedge	LC
	(L.) Roem. & Schult		Common spike-rush	1	25	Sedge	NE
	Mariscus alternifolius Vahl		Cyperus cyperoides Kuntze	1	25	Sedge	NE
	Mariscus flabelliformis Kunth		**SIERRA LEONE**: *MENDE* ndɔgbɔ niwi, ndɔgbɔ: **NIGERIA**: *IGBO (Agukwu)*			Sedge	NE
	Pycreus sp. P. Beauv.		Malagasy			Sedge	NE
	Pycreus smithianus (Ridl.) C.B.Clarke		Cyperus Smithianus, Ridl.			Sedge	NE
	Scleria depressa (C.B.Clarke) Nelmes		Riceweeds			Sedge	NE
13.	*Nephrolepis biserrata (Sw.) Schott*	Davalliaceae	Giant swordfern	1	25	Fern	NE
14.	*Dioscorea alata L.*	Dioscoreaceae	Water yam	1	25	Climber	NE
15.	*Dryopteris marginalis (L.) Gray*	Dryopteridaceae	Marginal Shield Fern	1	25	Fern	NE
16.	*Alchornea cordifolia Müll.Arg.*	Euphorbiaceae	The Christmas bush	3	75	Shrub	NE
	Caperonia palustris (L.) A.St.-Hil.		Texasweed			Forb	NE
	Maesobotrya barteri (Baill.) Hutch.		Baill	1	25	Tree	NE
	Microdesmis puberula Hook.f. ex Planch.		Microdesmis	1	25	Shrub	NE
	Securinega virosa (Roxb. ex Willd.) Baill		Carnal (JMD; J&D) cambe	1	25	Shrub	NE

S/N	Species name	Family	Common name	Frequency of Occurrence	%Relative Frequency of Occurrence	Habit Type	IUCN Conversation status
	Spondianthus preussii Engl		Protomegabaria stapfiana (Beille) Hutch			Shrub	NE
17.	*Anthocleista djalonensis A. Chev*	Gentianaceae	Guinea-Bissau			Tree	NE
	Anthocleista vogelii Planch.		Murderer's Mat	2	50	Tree	NE
18.	*Harungana madagascariensis Poir*	Guttiferae	Dragon's blood tree, orange-milk tree	1	25	Tree	
19.	*Hoslundia opposita Vahl*	Lamiaceae	Orange bird berry, bird gooseberry	1	25	Shrub	NE
	Solenostemon monostachyus (P.Beauv.) Briq.		Monkey's Potato	1	25	Shrub	NE
20	*Heteropterys leona (Cav.) Exell*	Melastomataceae				Shrub	NE
21	*Sida acuta Burm. fil*	Malvaceae	Common wireweed	2	50	Forb	NE
	Urena lobata L		Caesarweed or Congo jute			Forb	NE
22	*Dissotis rotundifolia (Smith) Triana*	Melastomataceae	Pink lady, Spanish Shawl, or rockrose			Forb	NE
23	*Mimosa pudica L*	Mimosoideae	Humble plant, Shy plant	1	25	Forb	LC
24	*Ficus eriobotryoides Kunth & Bouche*	Moraceae	Loquat-leaved fig, loquat-leaf fig, old Calabar fig			Tree	NE
	Ficus sp. L		Weeping fig	1	25	Tree	NE
	Ficus sur Forssk.		Cape fig and broom cluster fig	1	25	Tree	NE
	Ficus trichopoda Bak.		Swamp fig, Hippo fig			Tree	NE
	Musanga cecropioides R. Br. apud Tedlie		African corkwood tree or umbrella tree	1	25	Tree	NE
25	*Ludwigia abyssinica A. Rich.*	Onagraceae	KORANKO kogbuse (NWT) LOKO njarɔnbwe (NWT)	1	25	Forb	NE
26	*Calopogonium mucunoides Desv*	Papilionoideae	Calopo and wild ground nut	1	25	Climber	NE
	Centrosema pubescens Benth.		Butterfly pea	1	25	Climber	NE
	Desmodium ramosissimum G.Don		*HAUSA* waken zoomoo (JMD) *IGBO* = bean of the hare oganana (NWT) *IGBO (Awka)* obi n	1	25	Forb	NE
	Desmodium tortuosum (Sw.) DC.		Beggarweed	1	25	Forb	NE
	Desmodium triflorum (L.) DC		Three flower beggarweed	1	25	Forb	LC
	Drepanocarpus lunatus (L.f.)G.Mey		-	1	25	Shrub	NE
	Indigofera arrecta A.Rich		Bengal Indigo			Forb	NE
	Mucuna pruriens (L.)DC		Velvet bean			Climber	NE
	Zornia latifolia Sm.		Maconha brava			Forb	NE

S/N	Species name	Family	Common name	Frequency of Occurrence	%Relative Frequency of Occurrence	Habit Type	IUCN Conversation status
27	*Passiflora foetida L*	Passifloraceae	Running Pop, Love-in-a-mist, Wild Water Lemon, Stinking Passionflower			Climber	NE
28	*Phyllanthus muellerianus (Kuntze) Exell*	Phyllanthaceae	Asante-Twi	1	25	Shrub	NE
29	*Axonopus compressus (Sw.) P. Beauv*	Poaceae	Blanket grass			Grass	NE
	Brachiaria deflexa (Schumach.) C.E.Hubb. ex Robyns		Guinea millet	1	25	Grass	NE
	Digitaria horizontalis Willd.		Crabgrass, finger-grass, and fonio.	1	25	Grass	NE
	Oplismenus burmannii (Retz.) P.Beauv.		Burmann's basketgrass	1	25	Grass	NE
	Panicum maximum Jacq.		Guinea grass	4	100	Grass	NE
	Paspalum sp. L		Paspalum, bahiagrasses, crowngrasses or dallis grasses	2	50	Grass	-
	Paspalum vaginatum		Biscuit grass, saltwater couch, silt grass, and swamp couch	2	50	Grass	LC
	Pennisetum sp. Rich.		Desho or as desho grass	1	25	Grass	-
	Sacciolepis africana C. E. Hubb. & Snowden		Riceweeds			Grass	NE
	Sporobolus pyramidalis P.Beauv.		Giant rat's tail grass	2	50	Grass	NE
30	*Acrostichum aureum L.*	Pteridaceae	Leather Fern, Paku Laut, Mangrove Fern, Coarse Swamp Fern, Golden Leather Fern			Fern	LC
31	*Rhizophora racemosa G. Mey.*	Rhizophoraceae	Red mangrove			Tree	LC
32	*Hallea stipulosa (DC.) Leroy*	Rubiaceae	False opepe (Nigeria, from Yoruba: òpepe			Tree	VU
	Morinda morindoides (Baker) MilneRedh.		Morinda morindoides	1	25	Shrub	NE
	Mussaenda polita Hiern			1	25	Shrub	NE
	Pentodon pentandrus (Schumach. & Thonn.) Vatke		Hales's Pentodon			Forb	LC
	Psychotria sp. L.		Wild coffee			Shrub	-
	Spermacoce ocymoides Burm.f		Purple-leaved Button Weed			Forb	NE
	Spermacoce ruelliae DC.		Keredaka (A Chev. fide JMD) kuguruba (JB)	1	25	Forb	NE
	Zanthoxylum zanthoxyloides (Lam.)B. Zepernick & F.K		Timler root bark	1	25	Tree	NE
33	*Allophylus africanus P. Beauv*	Sapindaceae	African allophylus, African false currant			Shrub	NE
34	*Scoparia dulcis L.*	Scrophulariaceae	Licorice weed, goatweed, scoparia-weed and sweet-broom			Forb	NE
35	*Smilax anceps Willd.*	Smilacaceae	Smilax, Wild sarsaparilla	2	50	Tree	NE
36	*Sterculia tragacantha Lindl.*	Sterculiaceae	Sterculia			Forb	NE
	Waltheria indica L.		Sleepy morning				
37	*Triumfetta cordifolia A. Rich.*	Tiliaceae	Burbark	1	25	Forb	NE

S/N	Species name	Family	Common name	Frequency of Occurrence	%Relative Frequency of Occurrence	Habit Type	IUCN Conversation status
	Triumfetta pentandra A. Rich. ex Guill. & Perr.		Triumfetta pentandra	1	25	Forb	NE
38	*Typha domingensis Pers.*	Typhaceae	Southern cattail or cumbungi				NE
39	*Clerodendrum polycephalum Bak*	Verbenaceae	Glorybower, bagflower and bleeding-heart.	1	25	Shrub	NE
	Stachytarpheta cayennensis (Rich.) Vah		Blue snakeweed			Forb	NE
	Stachytarpheta jamaicensis (L.) Vahl		Blue porter weed	1	25	Forb	NE
	Vitex grandifolia Gürke		Black plum	1	25	Tree	NE
	Cissus aralioides (Welw. ex Bak.) Planch.					Climber	NE
40	*Cissus sp. L.*	Vitaceae	Veldt grape, winged treebine or adamant creeper	1	25	Climber	NE

Source: Adeonipekun, Adegbenga P.; Oyebanji, Oyetola O. and Adebayo, Michael B. Mediterranean Botany 40(1) 2019: 53-70
Azmarineberg fieldwork 2022



Plate 4.5: African Oil Palm at the Project area



Plate 4.6: Purple –leaved Button weed



Plate 4.7: Common Wire weed



Plate 4.8: Poison Devils Pepper



Plate 4.9: Blanket grass in the study area



Plate 4.10: Picture of Morning Glory in the area





Plate 4.11: Picture of Wild sarsaparilla Plate 4.12: Picture of Guinea Grass

4.11 Wildlife at Sonnex Packaging Nigeria Limited's proposed project site

Wildlife refers to undomesticated animal species, but has come to include all organisms that grow or live wild in an area without being introduced by humans. They can be found in all ecosystems including deserts, forests, rainforests, plains, grasslands and other areas as well as the most developed urban areas which have distinct forms of wildlife(Table 4.20; Plates 4.13-4.20).

Table 4.20: List of Fauna Species utilized as bushmeat in the area

S/N	Local Name	Common name	Scientific name	Class	Frequency	% Relative Frequency
	Igala	Bush Buck	Tragelaphus scriptus	Mammalia	93	13.66
	Oya	Canerat	Thryonomis swinderianus	Mammalia	107	15.71
	Ooni	Crocodile	Crocodilus niloticus	Reptalia	34	4.99
	Olufa	African rock python	Python sebae	Reptalia	66	9.69
	Oore	Brush-tailed porcupine	Atherurus africanus	Mammalia	48	7.05
	Alegba	Nile Monitor lizard	Veranus niloticus	Reptalia	30	4.41
	Elede Egan	Red River hog	Potamochoerus porcus	Mammalia	64	7.93
	Etu	Duiker	Cephalophus spp	Mammalia	54	7.93
	Okete	Giant rat	Crycetomis gambianus	Mammalia	31	4.55
	Egbin	Kob	Kobus kob	Mammalia	38	5.58
	Okere	Squirrel	Xerus erytropus	Mammalia	31	4.55
	Akiti	Chimpanzee	Pan troglodytes	Mammalia	25	3.67
	Aparo	Francolin	Francolinus bicalcaratus	Aves	28	4.11
	Aaya	Pafas Monkey	Erythrocebus patas	Mammalia	10	1.47
	Akika	Giant pangolin	Manis gigantea	Mammalia	32	4.70
	Total				691	100

Source: African Journal of Agriculture, Technology and Environment Vol. 5(1): 15-28 June, 2016

Moreover, during the wet season study period the following animals were seen namely Ants(Formicidae), white butterfly(Pieris rapae), Agama lizard(Agama Agama), Grasshoppers (Caelifera), Squirrel (Sciuridae), housefly (Musca domestica), pigeon (Columbidae), and laughing dove (Spilopelia senegalensis). Similar, as recorded in the secondary data used actual sighting of wildlife species on the site were limited to avian species in flight and along pools of water in the area. In addition, one or two reptilian species, especially a small Nile Monitor Lizard were seen.



Plate 4.13:Agama Lizard at site



Plate 4.14:Female lizard at the site



Plate 4.15: Laughing dove at the site



Plate 4.16: Picture of White butterfly



Plate 4.17: Picture of Grasshopper



Plate 4.18: Picture of Squirrel at the site



Plate 4.19: Picture of pigeon at the site



Plate 4.20: Picture of housefly at the site

4.12: Water quality study

Water safety and quality are fundamental to human development and well-being. Providing access to safe water is one of the most effective instruments in promoting health and reducing poverty. The international authority on public health and water quality, WHO leads global efforts to prevent transmission of waterborne disease by promoting health-based regulations to governments and working with partners to promote effective risk management practices to water suppliers, communities and households. Water is essential to human life and the health of the environment as a valuable natural resource, it comprises of surface and groundwater environment that stretch across coastal and inland areas used for various purposes such as commercial/industrial, domestic, agricultural, recreational, scientific research and transportation. One water sample was collected from the borehole at the project area (Plate 4.25-4.26) using transparent sampling bottles (1litre) as well as a control point. Similarly, one (1) surface water

sample was collected along Oluweri lake which has several tributaries in Ikorodu. **The river at the time of sampling was already receding (Plate 4.21) which could be due to the activities going on around the river such as sand mining and pig rearing (Plates 4.22 - 4.24)**. This explains why water could not be sampled at different transect considering activity areas. **Also, sediment and hydrobiology study was not carried out due to the very shallow depth of the lake at the time of the study(Plate 4.21).** A hand-held Global Positioning System (GPS), Garmin eTrex 10 was used in determining the coordinates of the sampling points in the area. The water samples were well lidded and put into ice chest before being transported to the FMEnv accredited and Institute of Public Analyst of Nigeria (IPAN) registered laboratory **Azmarineberg Limited 242A, Ganiyu Alimi Crescent Gbagada phase II, *Lagos*** for physico-chemical and microbial analysis having taken insitu readings of parameters such as pH, conductivity, salinity and dissolved oxygen on field (Plate 4.27). The results (Tables 4.21 - 4.22) are discussed below.

Surface water quality

Availability of water for human consumption has always been unequally distributed from place to place and from season to season (Hoekstra et al, 2012). Water availability is primarily enhanced by water resource. Water resource is regarded as the total collection of natural waters that are found in an environment. Ikorodu LGA is one of the twenty LGAs in Lagos State, Nigeria. It is strategically located within the Lagos East Senatorial District. The area is a rapidly developing residential, commercial, and industrial hub within the economic and commercial capital of Nigeria. Although Ikorodu LGA is endowed with enormous natural water resources (Figure 4.5 below is a map showing the networks of rivers in the LGA), the rapid process of urbanization has contributed to the problem of water scarcity within the area. Since the colonial era, governments at the federal, state, and local levels have implemented different policies to enhance water availability and supply within the LGA. Despite these efforts however, availability of potable drinking water was often scarce subjecting residents to wander and stress. Many factors such as population growth, pollution, profligate use, climate change, inadequate water infrastructures, and mismanagement have been attributed as the major causes of water scarcity in different parts of the world (WHO, 2019).

Ikorodu LGA is blessed with abundant natural water resources. It is one of the areas that possess enormous and quality water resources within Lagos State. It was for this quality and quantity that the government wanted to secure a source of fresh water supply for the rapidly expanding Lagos city from Ikorodu (Olukoju, 2003). The attempt was thwarted by the far distance and the presence of various water bodies such as Odo-Ogun, Owode-Elede, and Majidun that separated Ikorodu from Lagos. A good number of surface waters such as rivers, streams, spring,

and other tributaries exist within Ikorodu LGA (Boge, 2021). In Ikorodu, township, for instance, water bodies such as Eturenren, Melegoke, Yewa Kekere, Yewa Nla, Eri-Ijomu, Erikorodo, Odo-Ota, Apeka, Olori, Onisigida, Odo Lakayo, Odo Alagbafo, and Eruwen are located. Other towns within the LGA also house a number of rivers and streams which include the Majidun creek, Oriya stream, Odoro spring in Ijede, Yewa river in Igbogbo, Arobi brook in Isiu, Omitoro river along Ijede road, Agudugbu river in Imota, Agbowa stream in Ibeshe, and the **Oluweri lake in Oke-Agbo which is about 0.55km from the proposed site**. There were also rivers in Oreta, Ofin, and Baiyeku areas of the LGA.

Traditionally, these water bodies served numerous socio-economic purposes including domestic activities, agricultural activities, fishing, transportation, and pottery making activities among others. In addition, some of these water bodies served spiritual and religious purposes where people attend for spiritual cleansing and perform sacrifices during traditional festivals. Though these tributaries continued to be sources of water supply within the LGA, some of them became polluted owing to the increasing commercial and industrial activities. Others, such as Onisigida, dried up as time went by due to blockage of their sources, draining, and sand-filling for construction activities. **It should be noted that surface water analysed for both seasons are not from the same source but they are in same terrain exposed to similar industrial pollution in the area.**



Plate 4.21: Oluweri lake in the proposed project area



Plate 4.22: Sampling at Oluweri lake



Plate 4.23: Pig rearing farm near the lake



Plate 4.24: Heaps of sand from sand mining activities in the area

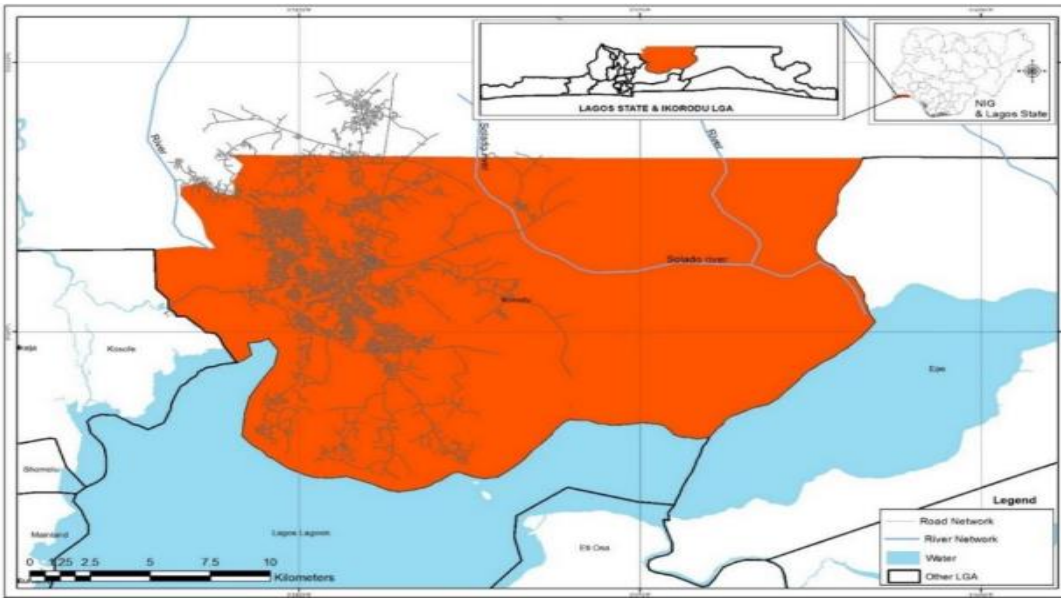


Figure 4.5: Map showing the networks of rivers in Ikorodu LGA

Table 4.21: Physico-chemical Analysis report of Ground water samples at the proposed site (wet season)
GW: 06⁰38.869'N 003⁰33.825'E GWC: 06⁰38.794'N 003⁰33.615'E

S/N	PARAMETERS	GROUNDWATER	GROUNDWATER CONTROL	NESREA LIMIT	FMEnv LIMIT
1	pH @25⁰C	**4.80**	**4.70**	6.5-9.2	6.5-8.5
2	Temperature (⁰C)	23.70	25.40	NS	NS
3	Salinity (ppt)	0.01	0.01	NS	NS
4	Electrical Conductivity (µs/cm)	14.58	160.8	NS	NS
5	Total Dissolved Solid (mg/L)	7.26	79.60	NS	500
6	Total Suspended Solid (mg/L)	4.00	0.00	NS	10.0
7	Dissolved Oxygen (mg/L)	3.30	3.10	NS	7.5
8	Color (Pt.Co)	**23.00**	0.00	50	15.0
9	Turbidity (NTU)	1.00	0.00	NS	1.0
10	Acidity (mg/L)	10.38	11.02	NS	NS
11	Nitrate (mg/L)	7.45	8.18	50	10.0
12	Nitrite (mg/L)	0.83	0.27	2	1.0
13	Free Chlorine (mg/L)	0.07	0.05	NS	0.4
14	Phosphate (mg/L)	0.29	0.35	NS	5
15	Ammonia (mg/L)	0.00	0.00	NS	1.0
16	Sulphate (mg/L)	12.00	15.00	400	500
17	Chloride (mg/L)	5.54	8.19	600	250
18	Sodium (mg/L)	2.70	3.16	NS	200
19	Oil & Grease (mg/L)	0.00	0.00	NS	0.05
20	Iron (mg/L)	0.380	0.255	1.0	1.0
21	Lead (mg/L)	<0.001	<0.001	NS	0.05
22	Copper (mg/L)	0.060	0.083	1.5	0.1
23	Cadmium (mg/L)	<0.001	<0.001	NS	0.01
24	Chromium (mg/L)	<0.001	<0.001	NS	0.05
25	Barium (mg/L)	0.025	0.019	NS	1.0
26	Arsenic (mg/L)	<0.001	<0.001	NS	0.2
27	Zinc (mg/L)	0.061	0.049	15	5.0
28	Nickel (mg/L)	<0.001	<0.001	NS	0.05
29	Mercury (mg/L)	<0.001	<0.001	NS	0.001
30	Manganese (mg/L)	0.012	0.038	0.5	0.05
	MICROBIOLOGY TEST (cfu/ml)				
32	Total Heterotrophic Bacteria	72	75	NS	NS
33	Total Hydrocarbon Utilizing Bacteria	0	0	NS	NS
34	Total Heterotrophic Fungi	71	69	NS	NS
35	Total Hydrocarbon Utilizing Fungi	0	0	NS	NS
36	Total Coliform Count	**7**	0	10	0
37	*E. coli*	0	0	0	0

Source: AZMARINEBERG Limited Fieldwork, 2022

Table 4.22: Physico-chemical Analysis report of Ground water samples for secondary data (dry season)

S/N	Parameters	GROUNDWATER	NESREA LIMIT	FMEnv LIMIT
1	pH @25^{0}C	**4.98**	6.5-9.2	6.5-8.5
2	Temperature (^{0}C)	35.30	NS	NS
3	Dissolved Oxygen (mg/L)	3.90	NS	7.5
4	Total Dissolved Solid (mg/L)	38.36	NS	500
5	Electrical Conductivity (µs/cm)	57.60	NS	NS
6	Salinity (ppt)	0.02	NS	NS
7	Turbidity (NTU)	**2.00**	NS	1.0
8	Chloride (mg/L)	7.50	600	250
10	Nitrate (mg/L)	**12.41**	50	10.0
11	Sulphate (mg/L)	0.00	400	500
12	Phosphate (mg/L)	0.24	NS	5
13	Sodium (mg/L)	70.39	NS	200
14	Magnesium (mg/L)	0.78	150	NS
15	Calcium (mg/L)	0.80	200	NS
16	Chromium (mg/L)	<0.001	NS	0.05
17	Lead (mg/L)	<0.001	NS	0.05
18	Cadmium (mg/L)	<0.001	NS	0.01
19	Copper (mg/L)	0.050	1.5	0.1
20	Iron (mg/L)	0.350	1.0	1.0
21	Manganese (mg/L)	0.030	0.5	0.05
22	Zinc (mg/L)	0.040	15	5.0
	Microbiology Test (cfu/ml)			
23	Total Heterotrophic Bacteria	2.50×10^5	NS	NS
24	Total Heterotrophic Fungi	2.50×10^2	NS	NS
25	Total Coliform Count	0	10	0
26	Total Hydrocarbon Utilizing Bacteria	1.3×10^2	NS	NS
27	Total Hydrocarbon Utilizing Fungi	1.0×10^1	NS	NS

Source: Eco Pro Field Studies 2021

Table 4.23: Physico-chemical Analysis report of Surface water samples at the proposed site (wet season) 06^{0}39.095'N 003^{0}33.837'E

/N	PARAMETERS	SURFACE WATER	NESREA LIMIT	FMEnv LIMIT
1	pH @25^{0}C	**4.10**	6.5-8.5	6.0-9.0
2	Temperature (^{0}C)	24.10	NS	33
3	Salinity (ppt)	0.00	NS	NS
4	Electrical Conductivity (µs/cm)	43.30	NS	NS
5	Total Dissolved Solid (mg/L)	21.90	NS	NS
6	Total Suspended Solid (mg/L)	0.15	0.75	NS
7	Dissolved Oxygen (mg/L)	5.30	4.0 (min)	7.5
8	Color (nm)	8.00	NS	NS
9	Turbidity (NTU)	1.00	NS	NS
10	Total Hardness (mg/L as $CaCO_3$)	1.26	NS	NS
11	Acidity (mg/L)	5.43	NS	NS
12	Nitrate (mg/L)	1.09	40.0	NS
13	Nitrite (mg/L)	0.02	0.08	0.06
14	Free Chlorine (mg/L)	0.00	NS	2.0
15	Phosphate (mg/L)	3.65	3.5	NS
16	Sulphate (mg/L)	10.00	500	NS
17	Sulphide (mg/L)	0.09	NS	NS
18	Chloride (mg/L)	5.54	350	NS
19	Calcium (mg/L)	0.94	180	NS
20	Magnesium (mg/L)	0.32	40.0	NS
21	Sodium (mg/L)	6.11	120	NS

22	Cyanide (mg/L)	<0.001	0.05	5.0
23	Fluoride (mg/L)	0.012	NS	NS
24	Ammonia (mg/L)	0.23	2.0	2.2
25	Phenol (mg/L)	0.00	0.001	NS
26	Iron (mg/L)	0.287	0.5	1.0
27	Lead (mg/L)	<0.001	0.1	1.7
28	Copper (mg/L)	0.001	0.01	4
29	Cadmium (mg/L)	<0.001	0.01	1.8
30	Chromium (mg/L)	0.039	0.5	2.0
31	Barium (mg/L)	<0.001	NS	NS
32	Arsenic (mg/L)	<0.001	0.05	0.5
33	Zinc (mg/L)	0.155	0.2	50.0
34	Nickel (mg/L)	<0.001	0.1	150
35	Mercury (mg/L)	<0.001	0.0005	1.0
36	Manganese (mg/L)	0.042	NS	NS
37	Aluminum (mg/L)	<0.001	0.2	0.005
38	Total Hydrocarbon Content (mg/L)	0.000	NS	NS
	MICROBIOLOGY TEST (cfu/ml)			
38	Total Coliform Count	22	5000	NS
39	*E. coli*	0	NS	NS
40	Total Plate Count	28	NS	NS
41	*Faecal streptococcus*	0	NS	NS
42	Clostridium perfrigens	0	NS	NS
43	Total hydrocarbon utilizing bacteria	0	NS	NS
44	Total hydrocarbon utilizing fungi	0	NS	NS

Source: AZMARINEBERG Limited Fieldwork, 2022

Table 4.24: Physico-chemical Analysis report of Surface water samples for secondary data (dry season)

S/N	PARAMETERS	SURFACE WATER	NESREA LIMIT	FMEnv LIMIT
1	pH @25^{0}C	6.84	6.5-8.5	6.0-9.0
2	Temperature (^{0}C)	30.10	NS	33
3	Dissolved Oxygen (mg/L)	6.00	4.0min	7.5
4	Turbidity (NTU)	85.40	NS	NS
5	Total Dissolved Solid (mg/L)	373.4	NS	NS
6	Electrical Conductivity (mg/L)	642.3	NS	NS
7	Salinity (ppt)	31.50	NS	NS
8	Chloride (mg/L)	201.0	350	NS
9	Sulphate (mg/L)	20.40	500	NS
10	Phosphate (mg/L)	0.270	3.5	NS
11	Nitrate (mg/L)	0.390	40.0	NS
12	Biochemical Oxygen Demand (mg/L)	**4.40**	6.0	4.0
13	Potassium (mg/L)	31.00	50.0	NS
14	Magnesium (mg/L)	2.75	40.0	NS
15	Sulphate (mg/L)	20.40	500	NS
16	Iron (mg/L)	**7.27**	0.5	1.0
17	Cadmium (mg/L)	**0.13**	0.01	1.8
18	Zinc (mg/L)	**103.4**	0.2	50.0
19	Chromium (mg/L)	**116.5**	0.5	2.0
20	Manganese (mg/L)	301.0	NS	NS

Source: Eco Pro Field Studies 2021

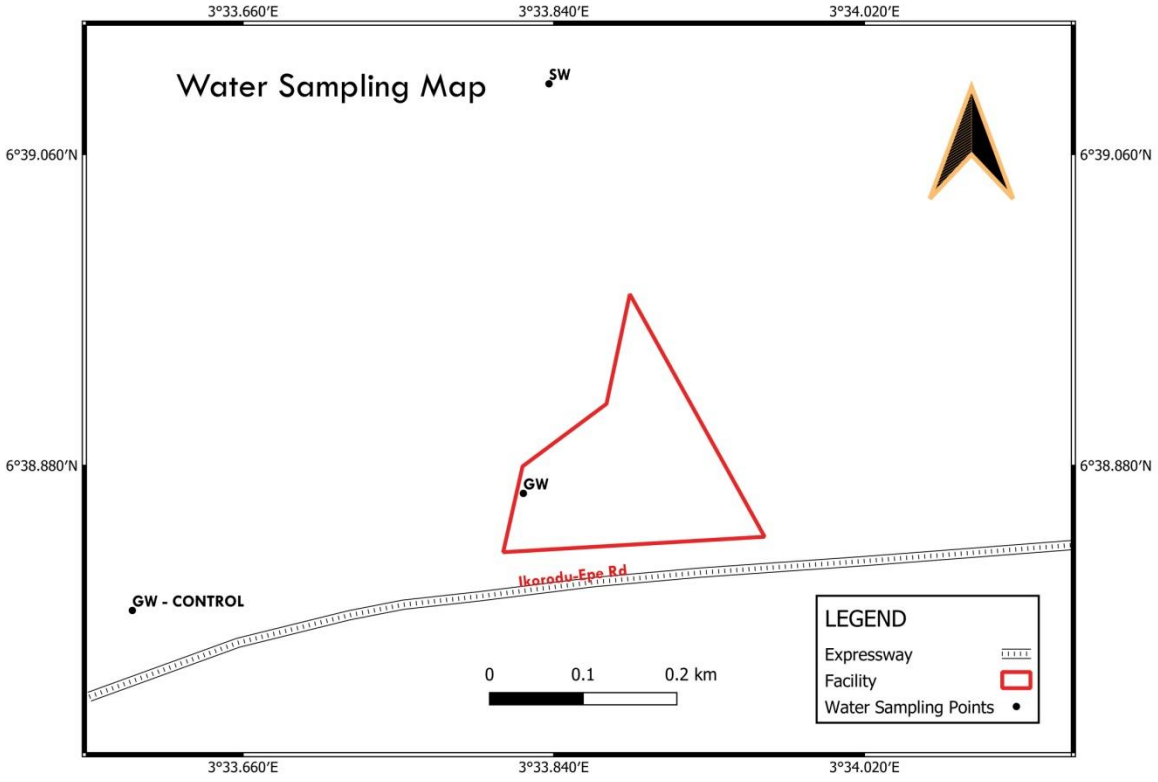


Figure 4.6: Groundwater and Surface water quality sampling map during wet season at the Project site

Comments for groundwater

pH: The pH of water is a measure of the degree of its acidity and alkalinity. During the wet season, the pH values of the groundwater and control sample were recorded as 4.80 and 4.70 respectively. For the secondary data gathered during the dry season, the mean pH value of the groundwater was recorded as 4.98. The values were below **NESREA** and **FMEnv limits** of **6.5-9.2** and **6.5-8.5**.

Dissolved Oxygen: The dissolved oxygen is a measure of the amount of oxygen dissolved in the water sample. During the wet season, the dissolved oxygen values of the groundwater and control sample were recorded as 3.30mg/L and 3.10mg/L. For the secondary data gathered during the dry season, the mean dissolved oxygen value of the groundwater was recorded as 3.90mg/L. The values were within **FMEnv limit** of **7.5mg/L**.

Conductivity: Conductivity is the ability of any medium to carry an electric current. The presence of dissolved solids such as calcium, chloride, and magnesium in samples carries the electric current through it. During the wet season, the conductivity values of the groundwater and control sample

were recorded as 14.58µs/cm and 160.8µs/cm. For the secondary data gathered during the dry season, the mean conductivity value of the groundwater was recorded as 57.60µs/cm.

Total Dissolved Solids (TDS): It is a measure of all dissolved substances in water, including organic and suspended particles that can pass through a very small filter. TDS is an indicator of how much ions are dissolved in the sample. During the wet season, the total dissolved solid of the groundwater and control samples were recorded as 7.26mg/L and 79.60mg/L. For the secondary data gathered during the dry season, the total dissolved solid value was recorded as 38.36mg/L. The values were within **FMEnv limit** of **500mg/L**.

Total Suspended Solids (TSS): It is a measure of the dry weight of suspended particles that are not dissolved, in a sample of water that can be trapped by a filter that is analyzed using a filtration apparatus. During the wet season, the mean total suspended solid of the groundwater and control samples were recorded as 4.00mg/L and 0.00mg/L. The values were within **FMEnv limit** of **10mg/L**. For the secondary data gathered during the dry season, total suspended solid was not analyzed.

Nitrate: Nitrate is a chemical which includes nitrogen and oxygen, often used as a fertilizer. During the wet season, the nitrate concentrations of the groundwater and control sample were recorded as 7.45mg/L and 8.18mg/L. The values were within **NESREA** and **FMEnv limits** of **50mg/L** and **10mg/L** respectively. For the secondary data gathered during the dry season, the mean nitrate concentration was recorded as 12.41mg/L and was above the FMEnv limit of 10mg/L.

Nitrite: During the wet season, the nitrite concentrations of the groundwater and control samples were recorded as 0.83mg/L and 0.27mg/L. The values were within **NESREA** and **FMEnv limits** of **2mg/L** and **1.0mg/L.** For the secondary data nitrite was not analyzed.

Free Chlorine: It is the available chlorine in the water after treatment has been done. During the wet season, the free chlorine concentration was recorded as 0.07mg/L and 0.05mg/L for the groundwater and control samples. The values were within **FMEnv limit** of **0.4mg/L.** For the secondary data free chlorine was not analyzed.

Heavy Metals: During the wet season, the heavy metals in the groundwater and control samples such as lead, cadmium, chromium, arsenic, nickel and mercury were recorded below the detection limit of the Atomic Absorption Spectrophotometer (AAS) used for the analysis. For the secondary data gathered during the dry season, the heavy metals such as chromium, lead and cadmium

were recorded below the detection limit of the Atomic Absorption Spectrophotometer (AAS) used for the analysis.

Iron: During the wet season, the iron concentrations of the ground water and control samples were recorded as 0.380mg/L and 0.255mg/L. For the secondary data gathered during the dry season, the iron value was recorded as 0.350mg/L. The values were within **NESREA** and **FMEnv limits** of **1.0mg/L** respectively.

Copper: During the wet season, the copper concentrations of the ground water and control sample were recorded as 0.060mg/L and 0.083mg/L. For the secondary data gathered during the dry season, the copper value was recorded as 0.05mg/L. The values were within **NESREA** and **FMEnv limits** of **1.5mg/L** and **0.1mg/L.**

Barium: During the wet season, the barium concentrations of the ground water and control samples were recorded as 0.025mg/L and 0.019mg/L. The values were within **FMEnv limit** of **1.0mg/L.** For the secondary data barium was not analyzed.

Zinc: During the wet season, the zinc concentrations of the ground water and control samples were recorded as 0.061mg/L and 0.049mg/L. For the secondary data gathered during the dry season, the zinc value was recorded as 0.040mg/L. The values were within **NESREA** and **FMEnv limits** of **15mg/L** and **5.0mg/L**.

Microbial Characteristics of the Groundwater and Control Samples

During the wet season, Total hydrocarbon utilizing bacteria, Total hydrocarbon utilizing fungi and *E. coli* were not detected in the groundwater and control samples.

Total Heterotrophic Bacteria: During the wet season, the total heterotrophic bacteria of the groundwater and control samples were recorded as 72cfu/ml and 75cfu/ml. *Lactobacillus spp and micrococcus spp* were identified as the isolates present. For the secondary data gathered during the dry season, the total heterotrophic bacteria of the groundwater was recorded as 2.50×10^5cfu/ml. *Bacillus spp, Staphylococccus aureus* and *Lactobacillus spp* were identified as the isolates present. There is no limit stated by NESREA and FMEnv for total heterotrophic bacteria.

Total Heterotrophic fungi: During the wet season, the total heterotrophic fungi of the groundwater and control samples were recorded as 71cfu/ml and 69cfu/ml. *Aspergillus spp and Candida spp* were identified as the isolates present. For the secondary data gathered during the dry season, the total heterotrophic bacteria of the groundwater was recorded as 2.50×10^2cfu/ml. *Rhizopus stolonifer*, *Fusarium spp, Aspergillus niger and mucor spp* were

identified as the isolates present. There is no limit stated by NESREA and FMEnv for total heterotrophic bacteria.

Total Coliform Count was recorded as 7cfu/ml for the ground water sample but was 0cfu/ml at the control location. Total coliform was within limit during the wet season except for the ground water sample which exceeded FMEnv limit of 0cfu/ml but was within NESREA limit of 10cfu/ml. The Total coliform count recorded for the secondary data was within both FMEnv and NESREA limits.

RECOMMENDATION

Proper treatment of groundwater is necessary to improve the quality of the ground water samples.



Plate 4.25: Sampling of water for heavy metals at the Project site



Plate 4.26: Sampling of water for physicochemical parameters at the site



Plate 4.27: Insitu parameters monitoring at the site

Comments for surface water

pH: The pH of water is a measure of the degree of its acidity and alkalinity. During the wet season, the pH value of the surface water was recorded as 4.10. For the secondary data gathered during the dry season, the pH value of the surface water sample was recorded as 6.84. The value recorded during the wet season was below **NESREA** and **FMEnv** limits of **6.5-8.5** and **6.0-9.0**. The value recorded during the dry season was within the limits.

Dissolved Oxygen: The dissolved oxygen is a measure of the amount of oxygen dissolved in the water sample. During the wet season the dissolved oxygen value of the surface water was recorded as 5.30. For the secondary data gathered during the dry season, the dissolved oxygen value of the surface water sample was recorded as 6.00mg/L. The values were within **FMEnv** and **NESREA limits** of **7.5mg/L** and **4.0mg/L**.

Conductivity: Conductivity is the ability of any medium to carry an electric current. The presence of dissolved solids such as calcium, chloride, and magnesium in a sample carries the electric current through it. During the wet season, the conductivity value of the surface water was recorded as 43.30µs/cm. For the secondary data gathered during the dry season, the conductivity value of the surface water sample was recorded as 642.3µs/cm. There are no standards specified by **NESREA** and **FMEnv** for conductivity.

Total Dissolved Solids (TDS): It is a measure of all dissolved substances in water, including organic and suspended particles that can pass through a very small filter. TDS is an indicator of how much ions are dissolved in the sample. During the wet season, the total dissolved solid of the surface water 21.90mg/L respectively. For the secondary data gathered during the dry season, the total dissolved solid of the surface water sample was recorded as 373.4mg/L. There are no standard specified by **NESREA** and **FMEnv** for total dissolved solids.

Total Suspended Solids (TSS): It is a measure of the dry weight of suspended particles that are not dissolved, in a sample of water that can be trapped by a filter that is analyzed using a filtration apparatus. During the wet season, the total suspended solid of the surface water sample was recorded as 0.15mg/L. For the secondary data gathered during the dry season, total suspended solid was not analyzed. The values were within **NESREA** limit of **0.75mg/L**. There is no standard specified by **FMEnv** for total suspended solids.

Nitrate: Nitrate is a chemical which includes nitrogen and oxygen, often used as a fertilizer. During the wet season, the nitrate value of the surface water sample was recorded as 1.09mg/L. For the secondary data gathered during the dry season, the nitrate value of the surface water sample was recorded as 0.39mg/L. The values were within **NESREA** limit of **40.0mg/L**. There is no standard specified by **FMEnv** for nitrate.

Nitrite: During the wet season, the nitrite value of the surface water was recorded as 0.02mg/L. For the secondary data gathered during the dry season, nitrite was not analyzed. The values were within **NESREA** and **FMEnv** limits of **0.08mg/L** and **0.06mg/L**.

Magnesium: During the wet season, the magnesium value of the surface water sample was recorded as 0.32mg/L. For the secondary data gathered during the dry season, the magnesium value of the surface water sample was recorded as 2.75mg/L. The values were within **NESREA** limit of **40mg/L**. There is no standard specified by **FMEnv** for magnesium.

Hardness: Water described as "hard" is high in dissolved minerals, specifically calcium and magnesium. The degree of hardness becomes greater as the calcium and magnesium content increases. During the wet season, the hardness value of the surface water sample was recorded as 1.26mg/L. For the secondary data gathered during the dry season, hardness was not analyzed. There are no limits specified by **NESREA** and **FMEnv** for hardness.

Chloride: During the wet season, the chloride value of the surface water sample was recorded as 5.54mg/L. For the secondary data gathered during the dry season, the chloride value of the groundwater sample was recorded as 201.0mg/L. The values were within **NESREA** limit of 350mg/L. There is no standard specified by **FMEnv** for chloride.

Free Chlorine: It is the available chlorine in the water after treatment has been done. During the wet season, free chlorine was not detected. For the secondary data gathered during the dry season, free chlorine was not analyzed. The values were within **FMEnv** limit of **2.0mg/L.** There is no standard specified by **NESREA** for free chlorine.

Heavy Metals: During the wet season, the heavy metals in the surface water such as lead, cadmium, barium, arsenic, nickel, aluminum and mercury were recorded below the detection limit of the Atomic Absorption Spectrophotometer (AAS) used for the analysis.

Iron: During the wet season, the iron value of the surface water sample was recorded as 0.287mg/L. For the secondary data gathered during the dry season, the iron value of the surface water sample was recorded as 7.27mg/L. The value recorded during the wet season was within **NESREA** and **FMEnv** limits of **0.5mg/L** and **1.0mg/L** respectively unlike the value recorded during the dry season which was above the limits.

Copper: During the wet season, the copper value of the surface water sample was recorded as 0.001mg/L. For the secondary data gathered during the dry season, copper was not analyzed. The value was within **NESREA** and **FMEnv** limits of **0.01mg/L** and **4mg/L** respectively.

Chromium: During the wet season, the chromium value of the surface water sample was recorded as 0.039mg/L. For the secondary data gathered during the dry season, the chromium value of the surface water sample was recorded as 116.5mg/L. The value recorded during the

wet season was within **NESREA** and **FMEnv** limits of **0.5mg/L** and **2.0mg/L** respectively unlike the value recorded during the dry season which was above the limits.

Zinc: During the wet season, the zinc value of the surface water sample was recorded as 0.155mg/L. For the secondary data gathered during the dry season, the zinc value of the surface water sample was recorded as 103.4mg/L. The value recorded during the wet season was within **NESREA** and **FMEnv** limits of **0.2mg/L** and **50mg/L** respectively unlike the value recorded during the dry season which was above the limits.

Microbial Characteristics of the Surface water sample

In the surface water sample, during the wet season total hydrocarbon utilizing bacteria, total hydrocarbon utilizing fungi, *Clostridium perfringes, Faecal streptococcus and E. coli* were not detected.

Total plate count: Total plate counts are bacteria that require organic nutrient for growth. Heterotrophs are not taxonomically defined but are a broad heterogeneous group. During the wet season, the total plate count of the surface water sample was recorded as 28cfu/ml. There is no standard specified by **NESREA** and **FMEnv** for total plate count.

Total coliform count: Coliforms are faecal indicators and are used to monitor the sanitary quality of the surface water sample. During the wet season, the total coliform count of the surface water sample was recorded as 22cfu/ml. The value was within **NESREA** Limit of 5000cfu/ml. There are no standards specified by **FMEnv** for total coliform count. The water quality sampling map is shown as figure 4.6.

4.13: Soil quality study

Soil is an important component of the ecosystem that serves as a footprint of impacts. Therefore, it is imperative that soil environmental conditions are one of the baselines upon which potential impacts of an activity can be measured. The critical properties of soil that usually form the basis for impact evaluation include: physical properties, fertility indices, chemical and microbial composition

Soil sampling was done using a stainless-steel auger. Soil samples up to 15cm depth for top soil sampling and 30cm depth for subsoil sampling were collected at the project site to investigate the physico-chemical and microbial properties of the soil at the proposed site(Plate 4.28). The soil samples were scooped and collected in Aluminum foil sheet to analyze for physico-chemical and microbial analysis. The soil samples were taken to Federal Ministry of Environment (FMEnv), accredited and Institute of Public Analysts of Nigeria registered laboratory – ***Azmarineberg Limited, 242A, Ganiyu Alimi Crescent street, Gbagada Phase II, Lagos*** laboratory for analysis.

Five (5) soil samples and one control (1) location were sampled within 2km radius to the facility. Meanwhile one (1) soil sample was recorded for the secondary data used for comparison. The

results for soil quality assessment for both study period and secondary data used for comparison are as presented in Tables 4.25,4.26 and 4.27 below.

Table 4.25: Physico-chemical and microbial analysis of top soil samples at the Project site (wet season)

S/N	PARAMETERS	SOIL SAMPLES					MEAN	CONTROL SAMPLES	ALLOWAY 1995
		TS1	TS2	TS3	TS4	TS5	TS	TSC	
1	pH (soil: water ratio, 1:2)	7.20	7.00	7.10	7.30	7.00	7.12	7.50	NS
2	Color (Munsell color chat)	Reddish brown	Reddish brown	Reddish brown	Reddish brown	Reddish brown	-	Brown	NS
3	Conductivity (µs/cm)	72.34	89.11	75.08	85.40	74.28	79.24	81.30	NS
4	Porosity (%)	3.39	5.06	4.55	4.21	3.80	4.20	3.91	NS
5	Permeability (cm/s)	1.1×10^{-5}	1.4×10^{-5}	1.2×10^{-5}	1.0×10^{-5}	1.1×10^{-5}	1.16×10^{-5}	$\times 10^{-5}$	NS
6	Bulk Density (g/cm^3)	1.25	1.77	1.64	2.15	1.92	1.75	2.38	NS
7	Moisture Content (%)	1.03	1.54	1.38	1.41	1.19	1.31	1.90	NS
8	Total Organic Carbon (%)	1.10	1.26	1.03	1.35	1.16	1.18	1.85	NS
9	Cation-Exchange-Capacity (meq/100gm)	3.44	3.18	2.90	3.06	3.25	3.17	3.61	NS
10	Clay(%)	82.37	79.18	80.06	81.25	80.53	80.68	84.10	NS
11	Sand (%)	9.95	11.47	10.88	9.81	10.15	10.45	8.82	NS
12	Silt (%)	7.68	9.35	9.06	8.94	9.32	8.87	7.08	NS
13	Sulphate (mg/kg)	10.29	8.40	9.32	9.59	10.10	9.54	7.24	NS
14	Phosphate (mg/kg)	5.21	4.76	5.11	4.92	5.38	5.08	6.33	NS
15	Nitrate (mg/kg)	6.38	6.12	6.46	6.20	6.04	6.24	7.15	NS
16	Calcium (mg/kg)	1.17	1.01	1.50	1.36	1.22	1.25	2.06	NS
17	Magnesium (mg/kg)	2.40	2.23	2.75	2.51	2.36	2.45	3.32	NS
18	Sodium (mg/kg)	9.13	8.84	9.02	9.34	9.25	9.12	10.57	NS
19	Potassium (mg/kg)	5.10	4.77	5.25	4.91	4.83	4.97	5.63	NS
20	Zinc (mg/kg)	1.29	1.56	1.41	2.03	1.91	1.64	2.18	1000
21	Chromium (mg/kg)	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	NS
22	Copper (mg/kg)	0.631	0.604	0.582	0.593	0.618	0.606	0.624	50
23	Lead (mg/kg)	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	65
24	Nickel (mg/kg)	0.110	0.129	0.145	0.102	0.134	0.124	0.103	NS
25	Mercury (mg/kg)	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	NS
26	Cadmium (mg/kg)	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	1
27	Arsenic (mg/kg)	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	NS
28	Iron (mg/kg)	0.233	0.265	0.240	0.257	0.261	0.251	0.318	NS
29	Total hydrocarbon content (mg/kg)	0.0000	0.0000	0.0000	0.0000	0.0000	-	0.0000	NS
	MICROBIOLOGY TEST (cfu/g)								
30	Total Heterotrophic Bacteria	150×10^2	52×10^2	119×10^2	94×10^2	53.5×10^2	93.7×10^2	170×10^2	NS
31	Total Hydrocarbon Utilizing Bacteria	0	0	0	0	0	-	0	
32	Total Heterotrophic Fungi	71×10^2	9.5×10^2	19.5×10^2	89×10^2	8.5×10^2	39.5×10^2	99.5×10^2	NS
33	Total Hydrocarbon Utilizing Fungi	0	0	0	0	0	-	0	
34	Total Coliform Count	0	0	0	0	0	-	48.5×10^2	NS
35	*E. coli*	0	0	0	0	0	-	0	NS

Source: AZMARINEBERG Limited Fieldwork, 2022

Table 4.26: Physico-chemical and microbial analysis of sub soil samples at the Project site (wet season)

S/N	PARAMETERS	SOIL SAMPLES					MEAN	CONTROL SAMPLES	ALLOWAY 1995
		SS1	SS2	SS3	SS4	SS5	SS	SSC	
1	pH (soil: water ratio, 1:2)	7.00	7.10	7.20	7.00	7.10	7.08	7.30	NS
2	Color (Munsell color chat)	Reddish brown	Reddish brown	Reddish brown	Reddish brown	Reddish brown	-	Brown	NS
3	Conductivity (µs/cm)	91.10	85.32	90.45	81.26	83.17	86.26	85.38	NS
4	Porosity (%)	4.33	3.87	4.75	3.98	4.19	4.22	5.10	NS
5	Permeability (cm/s)	1.1×10^{-5}	1.4×10^{-5}	1.0×10^{-5}	1.2×10^{-5}	1.3×10^{-5}	1.2×10^{-5}	1.0×10^{-5}	NS
6	Bulk Density (g/cm^3)	1.06	1.52	1.33	1.80	1.64	1.47	2.05	NS
7	Moisture Content (%)	2.15	2.38	2.01	2.46	2.23	2.25	2.30	NS
8	Total Organic Carbon (%)	1.41	1.27	1.08	1.35	1.19	1.26	1.54	NS
9	Cation-Exchange-Capacity (meq/100gm)	3.20	3.04	3.29	3.18	3.35	3.21	3.32	NS
10	Clay (%)	82.75	81.06	80.21	80.83	82.45	81.46	86.42	NS
11	Sand (%)	10.14	10.57	11.23	10.19	10.28	10.48	9.18	NS
12	Silt (%)	7.11	8.37	8.56	8.98	7.27	8.06	4.40	NS
13	Sulphate (mg/kg)	10.17	12.65	9.20	13.48	11.09	11.32	8.13	NS
14	Phosphate (mg/kg)	5.43	4.18	4.75	5.09	5.22	4.93	6.21	NS
15	Nitrate (mg/kg)	6.11	5.72	5.89	6.23	6.04	5.99	7.04	NS
16	Calcium (mg/kg)	1.30	1.04	1.16	1.45	1.09	1.21	1.92	NS
17	Magnesium (mg/kg)	2.67	2.28	2.43	2.10	2.31	2.35	3.15	NS
18	Sodium (mg/kg)	9.28	9.01	8.72	8.94	9.35	9.06	9.83	NS
19	Potassium (mg/kg)	4.76	5.29	5.02	4.93	5.11	5.02	5.45	NS
20	Zinc (mg/kg)	2.44	1.85	2.13	2.25	1.70	2.07	2.33	1000
21	Chromium (mg/kg)	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	NS
22	Copper (mg/kg)	0.545	0.581	0.604	0.592	0.568	0.578	0.626	50
23	Lead (mg/kg)	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	65
24	Nickel (mg/kg)	0.086	0.103	0.092	0.118	0.107	0.101	0.129	NS
25	Mercury (mg/kg)	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	NS
26	Cadmium (mg/kg)	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	1
27	Arsenic (mg/kg)	<0.05	<0.05	<0.05	<0.05	<0.05	-	<0.05	NS
28	Iron (mg/kg)	0.203	0.221	0.236	0.212	0.219	0.218	0.284	NS
29	Total hydrocarbon content (mg/kg)	0.0000	0.0000	0.0000	0.0000	0.0000	-	0.0000	NS
	MICROBIOLOGY TEST (cfu/g)								
30	Total Heterotrophic Bacteria	190×10^2	46.5×10^2	111×10^2	81.5×10^2	58.5×10^2	97.5×10^2	211×10^2	NS
31	Total Hydrocarbon Utilizing Bacteria	0	0	0	0	0	0	0	
32	Total Heterotrophic Fungi	68.5×10^2	4×10^2	15×10^2	17.5×10^2	6×10^2	22.2×10^2	74×10^2	NS
33	Total Hydrocarbon Utilizing Fungi	0	0	0	0	0	0	0	
34	Total Coliform Count	0	0	0	0	0	0	89×10^2	NS
35	*E. coli*	0	0	0	0	0	0	0	NS

Source: AZMARINEBERG Limited Fieldwork, 2022

Table 4.27: Physico-chemical and microbial analysis of soil samples at the Project site(secondary data)

S/N	PARAMETERS	TOP SOIL	SUBSOIL	ALLOWAY 1995
1	pH (soil: water ratio, 1:2)	6.47	6.27	NS
2	Conductivity(µs/cm)	392.2	233.2	NS
3	Organic Matter(%)	3.71	3.09	NS
11	Sand (%)	22.15	20.79	NS
12	Silt (%)	5.23	5.72	NS
13	Clay (%)	72.62	73.49	NS
14	Chloride (mg/kg)	25.269	22.398	NS
16	Sulphate (mg/kg)	21.981	17.798	NS
19	Phosphate (mg/kg)	2.109	1.229	NS
20	Nitrate (mg/kg)	0.842	0.832	NS
21	Calcium (mg/kg)	3.66	3.81	NS
22	Magnesium (mg/kg)	6.88	6.41	NS
23	Potassium (mg/kg)	8.59	8.25	NS
29	Chromium (mg/kg)	<0.04	<0.04	NS
30	Copper (mg/kg)	0.160	0.005	50
31	Iron (mg/kg)	54.23	42.28	NS
32	Nickel (mg/kg)	0.02	0.04	NS
33	Lead (mg/kg)	0.43	0.44	65
34	Zinc (mg/kg)	1.648	0.875	1000
35	Manganese (mg/kg)	3.36	3.74	NS
Microbiology (cfu/g)				
36	Total Heterotrophic Bacteria	1.29×10^{10}	2.18×10^{10}	NS
37	Total Heterotrophic Fungi	12.6×10^{4}	6.6×10^{4}	NS
38	Total Coliform Count	0	0	NS
39	Total Hydrocarbon Utilizing Bacteria	81.4×10^{4}	64.2×10^{4}	NS
40	Total Hydrocarbon Utilizing Fungi	5.8×10^{2}	2.6×10^{2}	NS

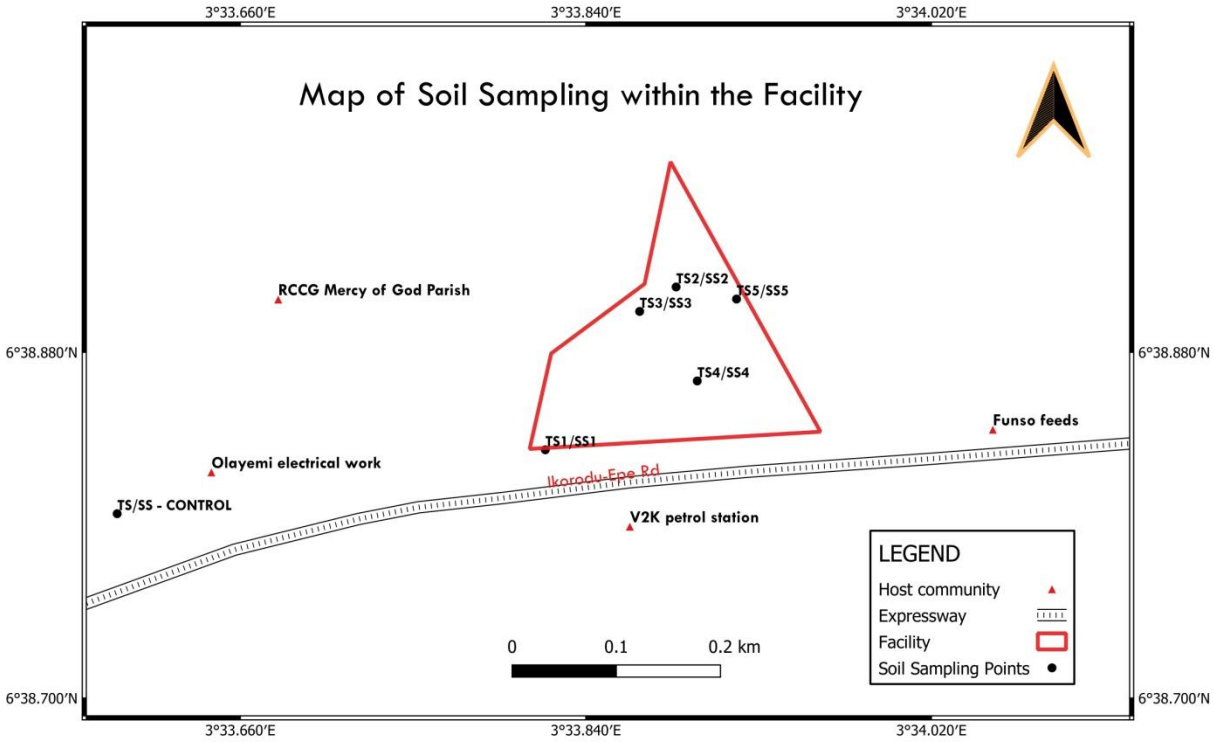


Figure 4.7: Sampling map for soil quality at the site during wet season

pH: The pH of a substance is a measure of the degree of its acidity and alkalinity. During the wet season, the mean pH values of the top soil and sub soil samples were recorded as 7.12 and 7.08 with control as 7.50 and 7.30 respectively. For the secondary data gathered during the dry season, the pH value of the soil sample was recorded as 6.47 and 6.27 for topsoil and subsoil respectively.

Conductivity: Conductivity is the ability of any medium to carry an electric current. The presence of dissolved solids such as calcium, chloride, and magnesium in samples carries the electric current through it. During the wet season, the mean conductivity values of the top soil and sub soil samples were recorded as 79.24µs/cm and 86.26µs/cm with control as 81.30µs/cm and 85.38µs/cm respectively. For the secondary data gathered during the dry season, the conductivity value of the topsoil and subsoil sample was recorded as 392.2µs/cm and 233.2µs/cm.

Porosity: It is the quality of being porous, or full of tiny holes. Liquids go right through things that have porosity. During the wet season, the mean porosity values of the top soil and sub soil samples were recorded as 4.20% and 4.22% with control sample as 3.91% and 5.10%

respectively. For the secondary data the porosity value of the topsoil and subsoil sample was not analyzed.

Magnesium: During the wet season, the mean magnesium values of the top soil and sub soil samples were recorded as 2.45mg/kg and 2.35mg/kg with control as 3.32mg/kg and 3.15mg/kg respectively. For the secondary data the magnesium value of the soil sample was recorded as 6.88mg/kg and 6.41mg/kg.

Heavy Metals: This refers to any metallic chemical element that has a relatively high density and is toxic or poisonous at low concentrations. During the wet season, the heavy metals in the soil samples such as chromium, mercury, arsenic, cadmium and lead were recorded below the detection limit of Atomic Absorption Spectrophotometer (AAS) used for the analysis while chromium was recorded below the detection limit of Atomic Absorption Spectrophotometer (AAS) used for analysis as recorded in the secondary data.

Iron: During the wet season, the mean iron concentrations of the top soil and sub soil samples were recorded as 25.10mg/kg and 21.80mg/kg with control as 31.80mg/kg and 28.40mg/kg respectively. For the secondary data gathered during the dry season, the iron concentrations of the soil samples were recorded as 54.23mg/kg and 54.23mg/kg.

Zinc: During the wet season, the mean zinc concentrations of the top soil and sub soil samples were recorded as 1.64mg/kg and 2.07mg/kg with control as 2.18mg/kg and 2.33mg/kg respectively. For the secondary data gathered during the dry season, the zinc concentration of the soil sample was recorded as 1.648mg/kg and 0.875mg/kg. The values were within **ALLOWAY limit** of 1000mg/kg

Copper: During the wet season, the mean copper concentrations of the top soil and sub soil samples were recorded as 0.606mg/kg and 0.578mg/kg with control as 0.624mg/kg and 0.626mg/kg respectively. For the secondary data gathered during the dry season, the copper concentration of the soil sample was recorded as 0.160mg/kg and 0.005mg/kg for topsoil and subsoil. The values were within **ALLOWAY limit** of 50mg/kg

Soil Microbiology

Total Heterotrophic Bacteria (THB)

During the wet season, the mean total heterotrophic bacteria of the top soil and sub soil samples were recorded as 93.7×10^2cfu/g and 97.5×10^2cfu/g with control as 170×10^2cfu/g and 211×10^2cfu/g respectively. *Micrococucus spp, corynebacterium spp* and *Bacillus spp* were identified as the isolates present. For the secondary data gathered during the dry season, the total heterotrophic bacteria count was recorded as 1.29×10^{10}cfu/g and 2.18×10^{10} cfu/g for topsoil and subsoil. *Micrococcus spp*, *Bacillus spp, flavobacterium spp and Nocardia spp* were identified as the isolates present.

Total Heterotrophic Fungi (THF)

During the wet season, the mean total heterotrophic fungi of the top soil and sub soil samples were recorded as 39.5 × 10^2cfu/g and 22.2 × 10^2cfu/g with control as 99.5 × 10^2cfu/g and 74 × 10^2cfu/g respectively. *Rhizopuz stolonifer*, *Penicillium spp*, and Aspergillus spp were identified as the organism present. For the secondary data gathered during the dry season, the mean total heterotrophic fungi count was recorded as 12.6 ×10^4cfu/g and 6.6 ×10^4cfu/g for topsoil and subsoil respectively. *Trichoderma spp*, *Rhizopus stolonifer*, *Aspergillus spp*, *Mucor spp* and *Fusarium spp* were identified as the organisms present.



Plate 4.28: Soil quality monitoring at the Project site during wet season

4.14 Socio-economics studies

This section provides information on the socio-economics conditions of the community identified within 5km radius of the Project site. The baseline provides a description of existing conditions, which is essential to the identification and assessment of the potential impacts of the proposed Project. The identified communities at the Project site are Parafa Arodelufin, Parafa Lolu, Parafa Itamope, Parafa Balogun, Parafa Latona, Parafa Ikusami and Parafa Alagemo. However, Prafa Alagemo which is the headquarters of all the sub-communities is the host community where

the proposed project is located along Ikorodu-Itoikin-Epe road, Ikorodu LGA, Lagos State. The community is under Lapega Ilado Community Development in Ikorodu LGA.

4.14.1 Study Approach and Methodology

This study used data collected at the individual level, use of questionnaires, key informant interviews, and Focus Group Discussions to assess the socio-economic and health status of the community. A total of 350 questionnaires were administered amongst people in seven (7) most proximal sub-communities to the project area. The sub-communities included: Parafa Lolu, Parafa Latona, Parafa Itamope, Parafa Ikusami, Parafa Balogun, Parafa Awotehufu and Parafa Alagemo (Host community). However, 330 questionnaires were completed while 20 were returned uncompleted as some of the community dwellers were not available due to their various trades while others wanted monetary reward to grant individual interviews during the study. Meaningful consultations were held with the community leaders using the Key Informant Interview engagement approach. In addition, direct observations were conducted by survey enumerators in addition to the review of relevant secondary information acquired using desktop reviews. The target population for this study was men, women, and youths.

All interviews were undertaken with the informed verbal consent of participants. Confidentiality and anonymity were maintained through secure storage of data in password-protected computers. Participation was voluntary and respondents were allowed to withdraw at any point they feel uncomfortable to continue with the interview. This study itself does not have any negative consequences nor would cause any embarrassment or discomfort to study participants.

4.14.2 History of Ikorodu

Ikorodu Town is the second most populous and largest Local Government Area in Lagos state with a population estimated at about 2 million people. Ikorodu is dominated by Ijebu speaking sub-group of Yoruba ethnic group who emigrated from Sagamu in Ogun state. Originally, the name "Ikorodu" was derived from the two words OKO-ODU meaning the farm (OKO) of (ODU) a kind of plant. The word ODU means something that blackens, and it was discovered that the plant had blackening power used in dyeing cloths. The early trade of Ikorodu women was cloth dyeing, with the discovery of the dyeing power of ODU plant.

Ikorodu is bounded to the south by the Lagos Lagoon, to the north by a boundary with Ogun State, and to the east by a boundary with Agbowa-Ikosi, a town in Epe division of Lagos State. The main occupation in Ikorodu area are trading, farming and manufacturing. Major towns in Ikorodu include; Imota, Isiu, Liadi, Egbin, Ijede, Igbogbo and Bayeku, all of which constitute their own Local Council Development Area with their own traditional rulers (Baales). Together these areas make up Ikorodu division.

Ikorodu division has a large industrial area containing several factories and home to branches of several established Nigerian banks. Ikorodu is the fastest growing part-exurb of Lagos metropolis, owing in part to increasing influx of people from Ikorodu's surrounding towns and villages attracted by the town's proximity to Lagos.

4.14.3 Traditional hierarchy and festivals in Ikorodu area

Oba Kabir Adewale Shotobi is the paramount traditional ruler in Ikorodu division. He is the Ayangburen of Ikorodu and the Adegorushen IV of Ikorodu kingdom. In 2003, the existing Ikorodu LGA was split for administrative purposes into Local Council Development Areas. These lower-tier administrative units now number 6: Imota, Igbogbo/Bayeku, Ijede, Ikorodu North, Ikorodu West and Ikorodu.

Inhabitants of Ikorodu include devotees to several religions, including Christianity, Islam, and traditional worship. The Eluku Festival is an event celebrated by towns and villages in Ikorodu area of Lagos state. It is an annual traditional festival that is of patriarchal nature, as it is only celebrated by male descendants who are paternal natives to the town. The Eluku festival is a version of the general Yoruba Oro festival. During the festival, females and non-natives stay indoors usually for 24 hours, but the economic growth of the town has restricted the time to around 12 hours and also to some selected locations in the township; around the palace and the shrine. It is sacred to the Natives. Another festival in the area is the Asa festival in which major towns like Ijede, Agura, Okeletu, Ipakodo, Odonla in Ikorodu LGA participate in the event which is also meant to unify people in Ikorodu division. The proposed project's host community is Parafa Alegemo. The peculiar festivals in Parafa Alagemo community are Eluku (Oro) and Agemo which usually take place between August and September(Figure 4.11).

Tourist attractions in Ikorodu include;

- Cradoo Lake Waterfront, Ipakodo and Ibeshe.
- Egbin Thermal Station, Egbin, largest thermal power facility in Africa [home to Lagos Independent Power Project].
- Ijede Warm Springs
- Ikorodu Lighter Port Terminal, Ipakodo
- Iledi Oshugbo Abalaiye Ikorodu: sacred groove for the installation of Ikorodu Kings
- Palace of the Ayangburen of Ikorodu.
- Voice of Nigeria [VON] Transmitting Station, Ikorodu

Erunrenren spring water is a very significant and historical cultural heritage in Ikorodu whose existence dates back to so many years ago.

Meanwhile, Parafa Alagemo community has a traditional head known as Baale (Chief Afolabi) ably supported by his chiefs: Ashipa Parafa Alegemo, Balogun Okunrin Parafa Alagemo, Balogun Obirin Parafa Alegemo, Jagun Alagemo etc.

4.14.4 Demographic Profile of the Study Area

4.14.4.1 Population Distribution

The proposed site is an industrial area with residential structures in the nearby communities. The 2006 National census placed the population of Ikorodu LGA at 527,917 people with male to female ratio of 51% to 49% respectively. World Population review estimated the population of Ikorodu at 937, 615 peoples, while its forecast show that the population of Ikorodu could rise to 1,453,781 in 2030.

The population of Ikorodu LGA consists predominantly of the Ijebu and Remo groups residing in Ikorodu, Egbin, Igbogbo, Imota, Ijede, Maya Adio, Odogunyan, Isiu, Igbokuta, Ewu-Elepe, Baiyeku, Oreta, Ofin, Gberigbe, Erikorodo and Igbalu. Meanwhile, along the riverine border of Ipakodo, Ibese, Ebute, Majidun, Itowolo, and other coastal communities, there is a strong presence of Eko-Awori population. The indigenes of Ikorodu LGA are mostly traders and farmers while fishing thrives mostly along the Lagos Lagoon foreshore on the Cradoo (Ikorodu) Lake waterfront. A Nigerian Ports Authority Lighter Port Terminal is located in Ipakodo where fishing activities also takes place.

4.14.4.2 Age and Gender Profile

In Parafa Alagemo and sub-communities, as illustrated in Figure 4.8, the dominant respondents in terms of gender are male (55%) while female respondents are lower (45%). Also the dominant respondents in terms of age, (55.90%) are between 20 years and 39years followed by respondents whose age bracket fall within 40 years to 59 years (47%) and the respondents within the age bracket of 60 years and above have 2% of the in-scope individuals and households. Respondents below 18 years (0%) which may be as a result of being in school since the study period was during an existing school calendar year forming the least of the total sampled frame (Figure 4.9). The implication of this is that the community has able-bodied labour force that could participate actively in the various productive activities that will take place in the PET recycling plant.

In anticipation of the upcoming booming economic activities usually associated with industries, the proposed project is expected to further accelerate the population growth in the study area. This in addition may disrupt sex ratio, since more able-bodied men are likely to immigrate into the area, in search of jobs and employment opportunities. Thus, there may be a further skew in favour of the male population.

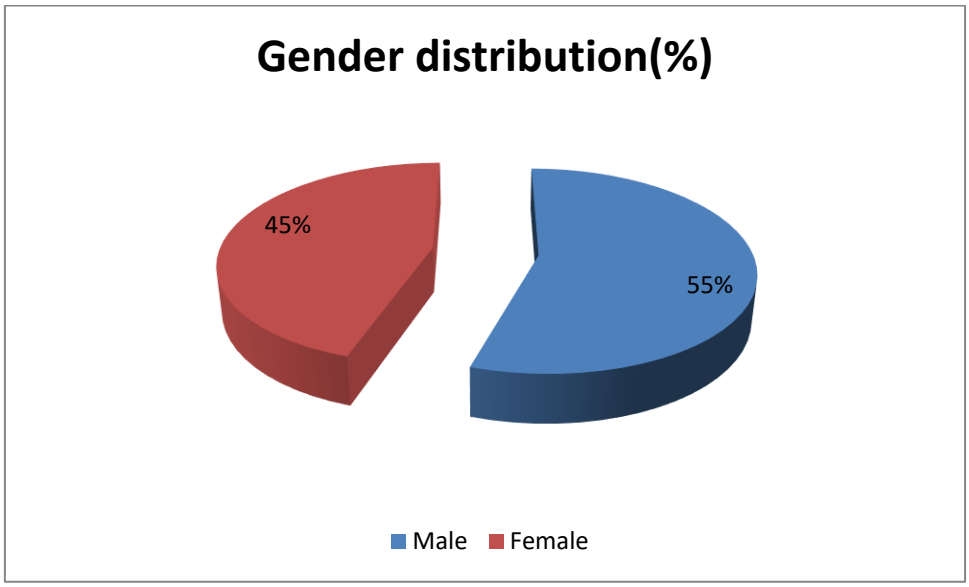


Figure 4.8.: Gender Profile of Respondents
Source: field study, 2022

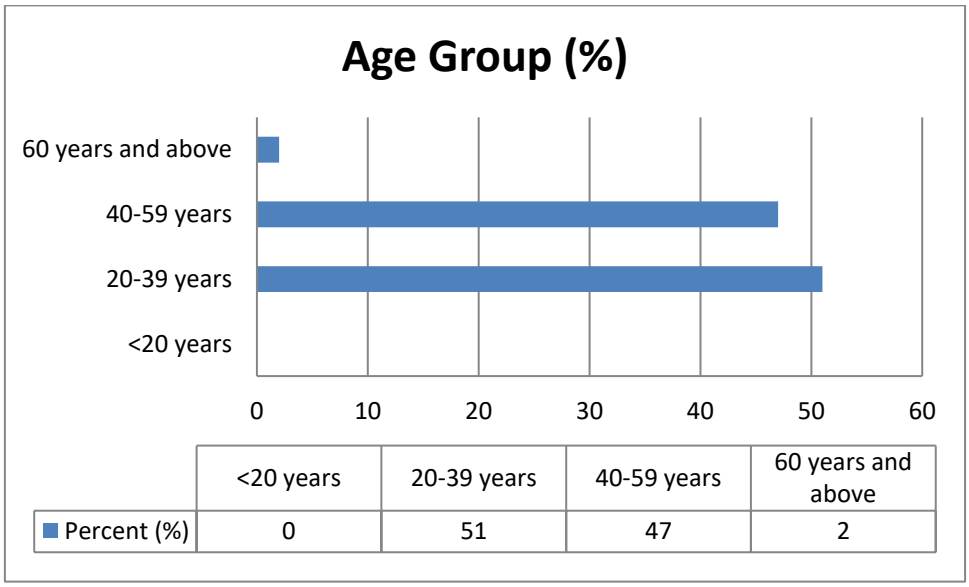


Figure 4.9: Age Profile of Respondents
Source: field study, 2022

4.14.4.3 Marital Status of Respondents

Married people account for 56% which constitutes the majority of the respondents while 39% are single, 1% divorced/separated and 4% are widow/widower (Figure 4.10). The study observed high proportion of polygamists among the respondents which could be attributed to the Muslims that dominate the population in the studied area. It was observed that there was no evidence of family planning in the community although the various birth control measures appear known but rarely practiced.

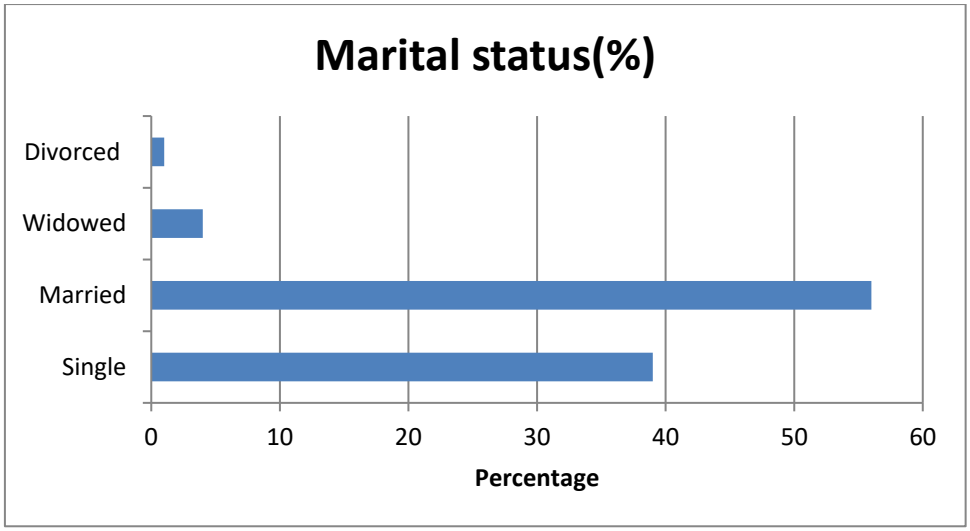


Figure 4.10: Marital Status of Respondents
Source: Field study, 2022

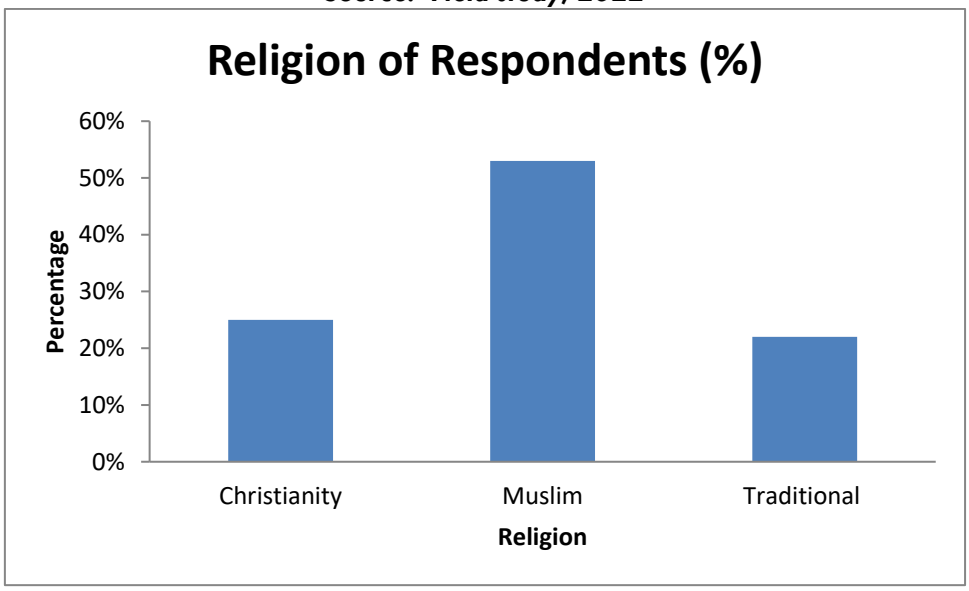


Figure 4.11: Religion of Respondents
Source: Field study, 2022

4.14.4.4 Socio-Economic and Livelihoods of Households Occupation

Occupational structure is consistently dominated by trading and farming that generated daily income levels just enough to cover household daily expenditure requirements. Also fishing was noticed in some areas in Ikorodu LGA but was not peculiar with people in the host community and sub-communities. Some residents are artisans such as mechanics, bricklayers, tricyclers, food vendors and others in block molding industries. The presence of road side vendors and retail outlet was observed within the community.

4.14.4.4.1 *Means of livelihood of in-scope individuals*

The residents of the host community mostly depend on trading and other commercial activities. More than half of the entire populations of the people are traders which reflected on the total respondents 54%. Salary earners had 10% of the population and stand to be the second most crucial means of livelihood of the people. About 14% of the people living in the study area engaged in driving, managerial duties, and professional and delivery services. Farming and fishing had 12% with fishing activities being done within the LGA with close proximity to surface water. However, about 11% of the youths interviewed were unemployed despite being educated (Figure 4.12).

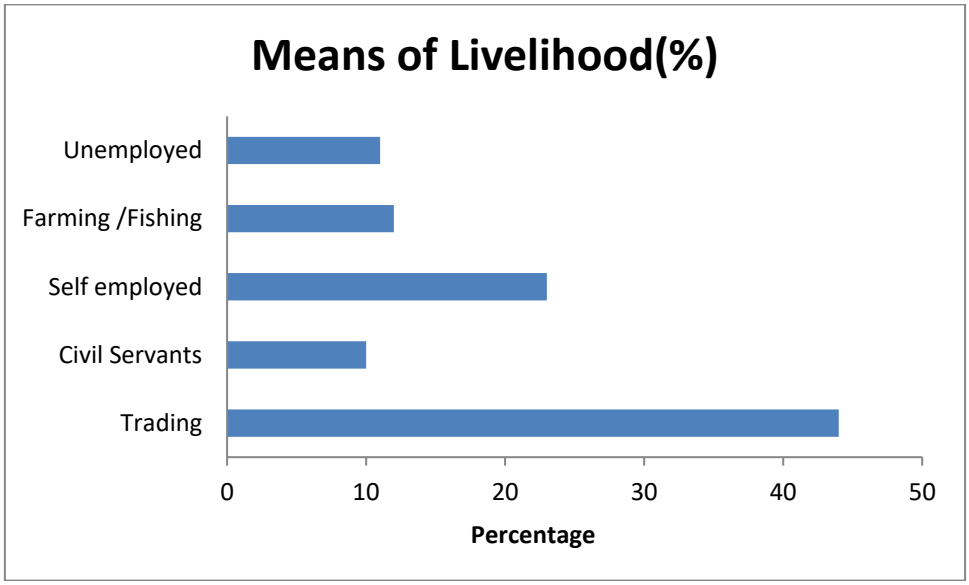


Figure 4.12.: Households means of livelihood
Source: field survey, 2022

4.14.4.5 Household Income per month

Survey shows the average monthly income of individuals to be between N10, 000.00 and over N250,000 naira. Majority of the inhabitants earn between N10,000.00 and N99,000.00 as their monthly income and this translates into 53% of the population which is about half the entire population interviewed and this category of people are mostly junior civil servants and petty-traders. This is followed by people who earn monthly between N100, 000.00 and N250,000.00 (22%). About 19% of the people earn <N10, 000.00 monthly and this category of people are mostly peasant farmers. Only about 6% of the entire inhabitants earn above N250,000.00 and this category of people are entrepreneurs who own schools and hotels within the study area (Figure 4.13). The implication of low income per annum of most of the inhabitants indicates low standard of living as well as social status of the people.

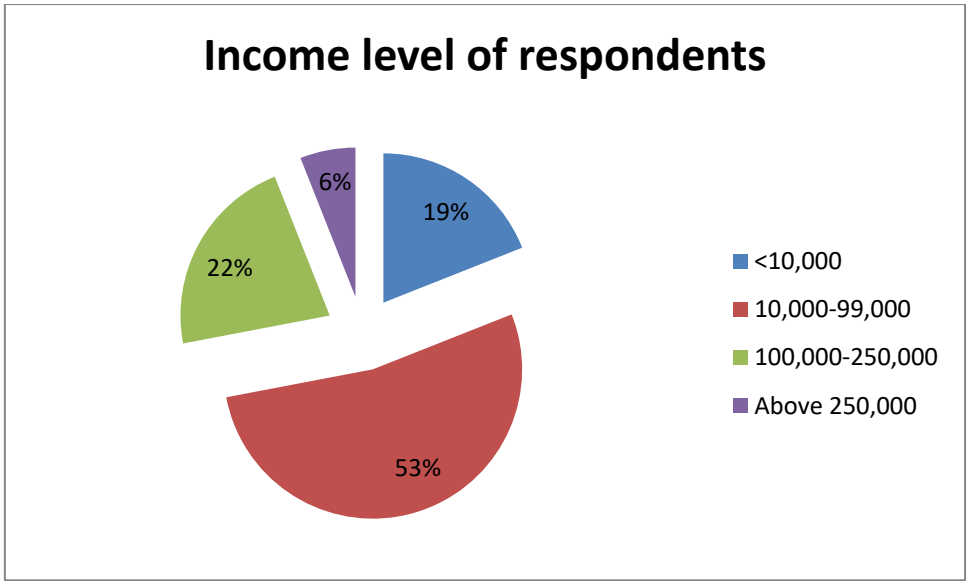


Figure 4.13: Average Income of Respondents
Source: Field study, 2022

Employment

Less than 30% of the population of people who have attained 18 years and above are gainfully employed, hence the unemployment rate is generally high in the community. Greater percentage of the youths in the community claimed to be unemployed because those who are engaged in petty trading did not regard it as their primary occupation. With this level of unemployment in the communities, there is great potential for increased social vices such as bullying, prostitution, armed robbery etc. This unemployment scenario is instrumental to the wide acceptance of the proposed Sonnex Packaging Nigeria Limited's PET recycling plant project as the unemployed believed that the project would offer them necessary relief. The major hindrances to the economic development identified in the study area include inadequate illumination of the project area particularly for security reasons, lack of drinking water and boreholes for the use of the community.

Nonetheless, through the Corporate Social Responsibility (CSR) programmes of the proposed project in collaboration with other industries within the vicinity, these economic hindrances to a large extent could be addressed.

It is envisaged that through the proposed project there would be strong basis for effective community participation in any strategic intervention of community development, as they would be critically required in identification of development needs and approaches for meeting such needs.

4.14.4.6 Quality of life and Social Amenities

Quality of life measures the amount and distribution of socio-economic variables such as electricity, quality water supply system, access road (transportation), educational institutions, health facilities, housing type and a market for the exchange of goods and services. The general quality of life measured in terms of housing types, productive and household asset ownership and presence of functional government institution in the communities was noted to be very low.

4.14.4.6.1 Electricity Supply

Parafa Alagemo communities have access to IKEDC (National grid) with transformers being installed to power the community although they are sufficiently inadequate in the proposed project area. However, some residents utilize generator as source of electricity supply for household uses while majority utilize bush lamp/lanterns. A large number of the inhabitants still depend on fire woods (37%) as the source of energy especially for cooking. About 36% claim to use gas while the remaining 27% use kerosene for cooking. The impact of the adoption of firewood for these purposes is too critical to deforestation and climate change phenomena to be so neglected.

4.14.4.7 Literacy level of respondents

In Ikorodu, there are 69 public primary schools and 12 secondary schools. There are also several private nurseries, primary and secondary schools, and two tertiary institutions. The educational status of the in-scope individuals and households is shown in Figure 4.14. The high proportion of the respondents of approximately 47% had secondary education while tertiary and primary education had an estimated figure of 14%, and 11% respectively. The respondents with vocational education were 28% of the total sampled frame.

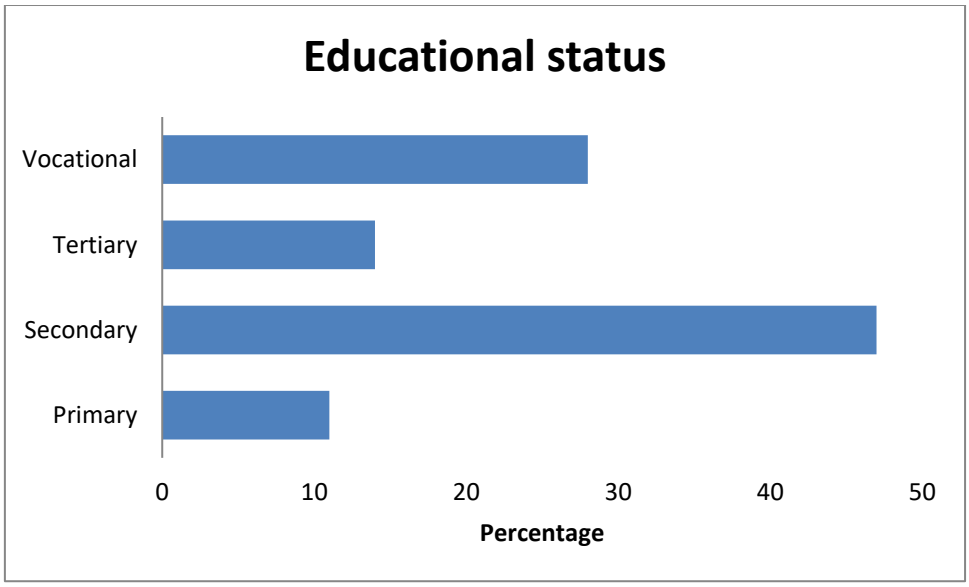


Figure 4.14: Literacy level of Respondents
Source: field Study 2022

The observed scenario is a direct consequence of the dearth of educational facilities in the communities. The youth restiveness that is envisaged from this large amount of uneducated youths in this community could constitute a constraint to economic growth and peace if urgent actions are not taken by both the government and development partners.



Plate 4.29: Lagos State University of Science and Technology Ikorodu (tertiary institution)

4.14.4.8 Housing Condition

The micro-economic and livelihood structure in the area is common to the general structure of unplanned residential area with scattered market setting and dilapidated buildings which were clustering each other at edges. Housing is a fundamental component of quality of life influencing health, sanitation, social environment and community wellbeing. Few of the houses are still roofed with zinc. Most of the inhabitants live in sub-standard houses as these buildings generally lacked in-house facilities such as modern toilets and water with some households disposing of their human waste by unsanitary methods while only a few has access to improved drinking water. No doubt, the observed housing standard could be assumed to be a vivid reflection of the households' income level and the challenge posed by the environment in the study area.



Plates 4.30: Picture showing housing condition of the host community

4.14.4.9 Sources of water

Majority of the residents of the community depend on boreholes, Well, Municipal water, while streams and storm water are used as seasonal sources of water. Households travel a great distance especially during dry season to obtain fresh water thereby wasting precious time that could be used for other productive activities. Such unnecessary energy dispensation also usually leads to ill health. In general, majority of the inhabitants in the community have access to well and borehole water while a few of the respondents claim they have access to public water supply.

A greater number of the inhabitants at the study area depend on well as their major source of water. This is showed in the respondent's view of 34.7% on borehole as source of water. Those that depend on rainfall as their source of water account for 20.4% of the entire population whereas those that account for pipe borne water, stream and sachet water account for14.4% 11.1 % and 3.7% respectively (Figure 4.15).

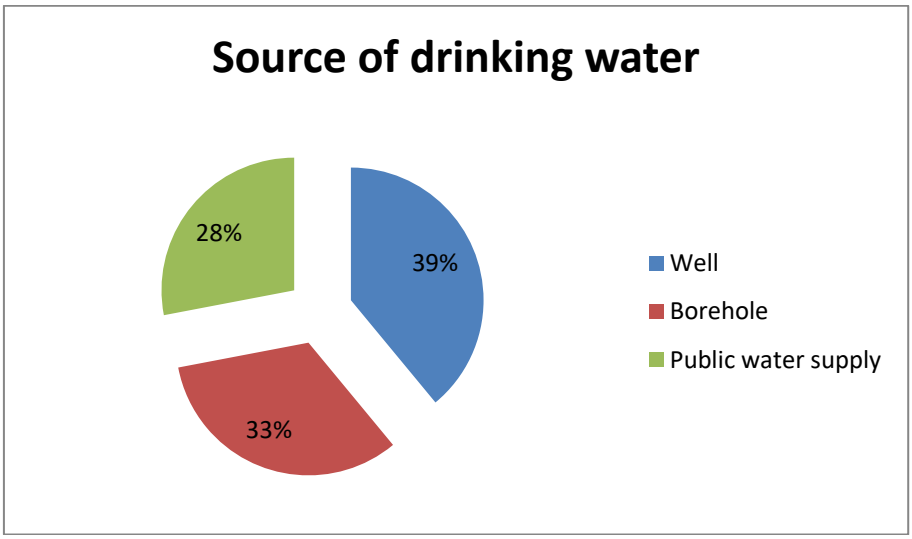


Figure 4.15.: Sources of water
Source: Field survey, 2022

4.14.4.10 Transportation

The major access road is the Ikorodu-Itoikin-Epe Expressway giving access to other towns and villages in the environs. Public buses, cars and motorcycles are the major means of transportation in the project area. Public motor vehicles ply roads that link the project communities to major towns such as Itoikin, Epe etc. while motorcycle transport is used for shorter shuttles between and within smaller towns in the project area. Motorcycles, tricycles and shuttle buses are the most commonly owned means of transportation in the project area, while a small percentage own cars. Plate 4.31 and 4.32 depicts existing transportation system and access road to the project area.



Plate 4.31: Some transportation modes at Ikorodu



Plate 4.32: A view of Ikorodu-Itoikin-Epe Expressway

4.14.4.11 Market in the Project area

Market facilities are important for trading of goods among the rural dwellers. A standard market facility will attract other people to trade. The community has a well-defined market structure (Plate 4.33). Other forms of market that exist in this part of the community are retail outlet, roadside sellers and street hawkers.



Plate 4.33: Picture showing shops at the market, retail outlet and road side traders at Parafa Alagemo community

4.14.4.12 Sanitation and Waste management Practices

Majority of the respondents claim they patronize private cart pushers to dispose their waste while others use Private Sector Partnership (PSP). A handful claim they burn their waste as need arises. A large area of the community was seen littered with dirt from inadequate disposal of refuse into the bin container provided by the waste management agency, which made the air quality around such areas offensive to breathe.

Besides, Information available showed that most of the people in the area use pit latrines. Domestic wastewater (liquid) is channel into the street or just by the house. Others dispose their sanitary waste into streams and rivers around their place of abode, while only few claimed they use water system in their houses. This puts a greater proportion of the people at risk in terms of epidemic that may result from improper disposal of human feaces.

4.14.4.13 Quality of Health services

Prevalent ailment in the communities includes but not limited to; chest pain, common cold, high blood pressure, malaria and typhoid fever. 30% of the respondents considered their health as

being good, fair or poor. Also it was observed that about 33% of the respondents preferred Primary Health Care centers near them. Others patronize chemist shops for treatment when ill (36%). Similarly, about 11% claim to patronize Private hospitals/Clinics. The low percentage might be due to cost of using such facilities considering the average income rate in the area. However, 19% of the respondents visit trado medical practitioners as there is strong presence of traditional religion and practice in the area (Alagemo).

4.14.5 EIA Scoping Workshop

Stakeholder engagement is an ongoing process of sharing project information, understanding stakeholder concerns, and building relationships based on collaboration. Stakeholder consultation is a key element of engagement and essential for effective project delivery. Relevant stakeholders were consulted as part of this EIA process. The general objective of the consultations was to intimate the stakeholders about the proposed Sonnex Packaging Nigeria Limited PET recycling plant project and discuss the potential benefits and possible negative impacts on the society and people, as well as the roles the project proponent and the stakeholders would need to play to ensure sustainable development and operation of the plant. Other objectives for the workshop include;

- Gather local knowledge to improve the understanding of the proposed project's environmental and social context
- Provide a means for stakeholders to have input into the project planning process;
- Take into account the views of stakeholders in the development of effective mitigation measures and management plans
- lay the foundation for future stakeholder engagement

The meeting started exactly **13:04pm** at Parafa Community Town Hall on **8th December, 2022** with over Sixty (60) people in attendance comprising of Men, Women, and Youths etc. The meeting had in attendance different relevant stakeholders ranging from Federal Ministry of Environment (FMEnv) delegates, Lagos State Environmental Protection Agency (LASEPA), Lagos State Ministry of Environment and Water Resources, Azmarineberg Limited (Environmental Consultant) Team, Baale of the community (Chief Afolabi Arinola), High Chiefs of the community, members of the community and the Proponent.

Alhaji Apanishile Olatunji, the Secretary of Parafa Alagemo Village (host community) was bestowed the responsibility of introducing the community leaders on the high table with their

chieftaincy title and position in the community as presented in the attendance list attached as appendix.

4.14.5.1 Community Perception

The entire community showed enthusiasm towards the establishment of the proposed PET recycling plant Project which was clearly stated in their reactions when the FMEnv team present asked for their perception towards the proposed project. They all responded; "YES" to the establishment of the project.

4.14.5.2 Community expectations

The community through the secretary demanded for;

- Employment opportunities for indigenes
- Financial assistance during traditional festivals (such as AGEMO happening annually between August and September)
- Granting supply and distributorship of the project's finished goods to members of the community
- Sharing of end of year incentives to community members during festive periods
- Assign car/truck park management to indigenes in partnership with the proponent as a way to further enhance security around the vicinity
- Purchase of transformer and general illumination of the project area for security
- Boreholes drilling for the use of the community
- Provide insurance cover for workers in the facility
- Ensure community health from eventual waste water from the facility due to the topography of the project area which would be further compounded by sand mining activities around the site
- Ensure emissions emanating from the facility which they described as smoke does not have any serious health challenges to the community and
- Educational facilities for the community



Plate 4.34: A cross section of the community leaders, Regulators, Project proponent and Environmental Consultant during scoping workshop



Plate 4.35: A representative of the Federal Ministry of Environment addressing the community during the workshop



Plate 4.36: A cross section of participants from the community during the scoping workshop



Plate 4.37:The representative of the proponent (Barrister Toluwaleke) responding to community members during the exercise



Plate 4.38: Mrs. Bolu Ajayi from Parafa community raising a point during the exercise



Plate 4.39: A community high chief emphasizing a point during the exercise



Plate 4.40: Alhaji Olatunji highlighting the community's demands from the proponent during the exercise



Plate 4.41: Azmarineberg Limited's EIA presentation during the workshop

The Federal Ministry of Environment's representative however stressed that if there are disputes as regards the proposed project, the community should speak up as the relationship between the community and the proponent should not be all about money but welfare of the people.

4.14.5.3 Proponent Response

The proponent's perspective on the concerns was stated through the legal adviser, Barr. Toluwaleke made it known that the community demands will be treated as a matter of utmost priority in their order of importance. Execution of the demands will be decided by the top management of Sonnex Packaging Nigeria Limited PET recycling plant that will be given feedback on the scoping exercise outcome.

CHAPTER FIVE

ASSOCIATED AND POTENTIAL ENVIRONMENTAL IMPACTS

5.1 OVERVIEW

This chapter discusses the associated and potential impacts of the Sonnex Packaging Nigeria Limited proposed 100 ton/day PET recycling facility, on the biophysical, social and health environmental characteristics of the surrounding area. It presents the methods used to identify, screen, analyze and rank the potential and associated impacts of the proposed project. Both associated impacts (i.e., those that will occur) and potential impacts (i.e., those that could occur) were assessed.

The impact assessment approach utilizes elements of various impact identification and prediction methods that have been developed and tested over time and are internationally recognized, such as checklists, matrices, flowcharts, mathematical and statistical models, as well as overlays. The approach used is a mixture of elements drawn from these techniques, and it meets the criteria for the EIA methodology as identified by the Scientific Committee on the Problems of the Environment (SCOPE, 1979). It is important that the approach used is;

- Comprehensive;
- Selective;
- Mutually exclusive;
- Objective;
- Predicts interactions; and
- Gives confidence limits to the predictions;

The impact assessment methodology is discussed further in Section 5.2 and the results of the impact assessments are discussed in subsequent sections of this chapter.

5.2 METHODOLOGY

This section discusses the overall methodology used to identify, qualify and quantify the impacts of the proposed field development activities on the host environment. The methodology can be divided into five stages (**Figure 5.1**).

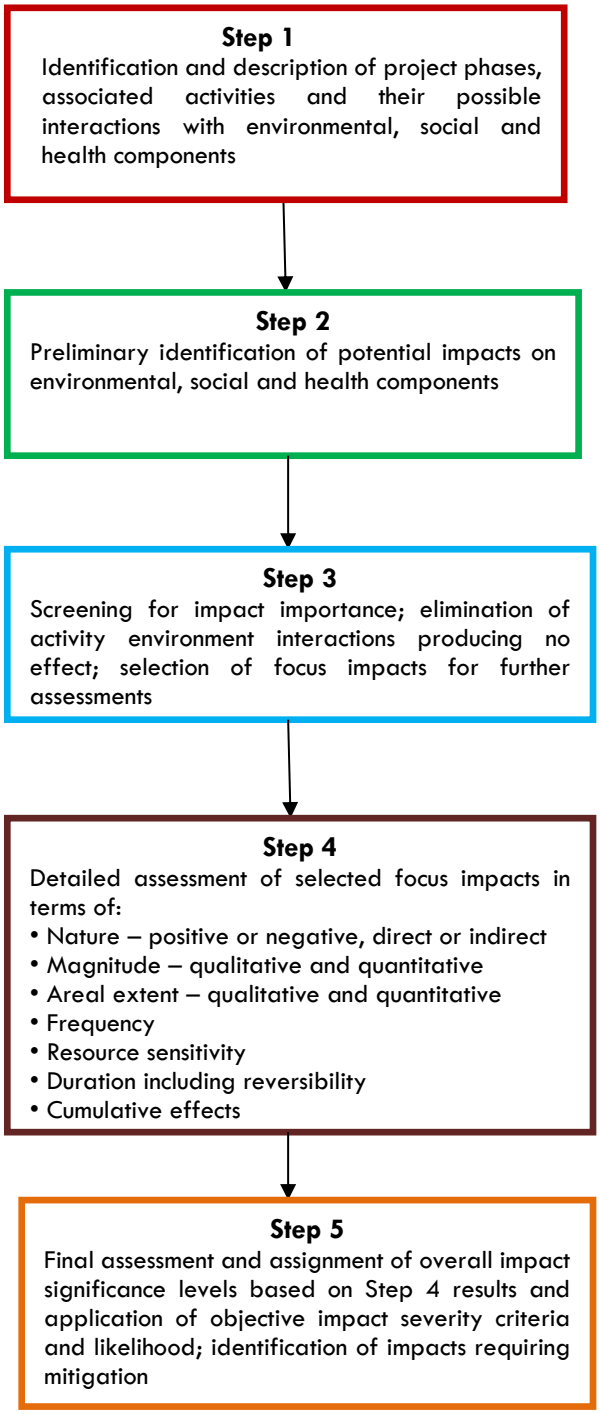


Figure 5.1: Impact Assessment Methodology

5.2.1 Basis for Screening

Activities that will, or could occur as a result of site acquisition, site clearance, construction, transportation, operation and maintenance, decommissioning and abandonment were screened. Other relevant and well-known EIA guidelines and tools were consulted for the screening. Also screened were components of the environment for assessing the potential Impact of the proposed PET recycling project which are climate, ambient air, noise levels, water, soil and land use,

vegetation, socio-economics and health. Screening was based on the following information and variables.

- Knowledge of project activities
- Knowledge of the work equipment for the proposed project, where and when undertaken.
- Experience from similar EIA projects
- Comparison with FMEnv guidelines and standards
- Sources of discussions and consultation

The EIA team identified all potential interactions between the project including the biophysical and socio-economic environments. These interactions were identified as a result of several key activities as follows;

- Bibliographical studies and reviews were conducted to identify and determine existing baseline information; existing information requiring updating or improving; information gaps; and the requirements for the collection of additional information to properly identify and assess potential interactions between the proposed project and the environment.
- A variety of consultation activities were also undertaken to:
    1. Determine the nature and characteristics of the proposed PET recycling plant infrastructural facilities, their processes and extent;
    2. Identify issues that the regulatory bodies consider to be of greatest concern;
    3. Discuss the level and nature of information that the regulatory authorities require to be included in the EIA; and
    4. Identify, define and review the relevant regulatory and legislative framework with which the project would be required to comply.

The study team conducted field studies to link identified information/data gaps relevant for a comprehensive impact evaluation and formulation of mitigation measures. Identification of these interactions was based on the worst-case scenario, that the project is implemented without any environmental mitigation (without any emission control technology or waste management procedures). It was ensured that all potential interactions are identified and that effective mitigation are designed and implemented at the appropriate time throughout the project's life cycle. The changes to the environment (whether adverse or beneficial, wholly or partially) arising from these interactions (Impact) were identified and assessed in the following subsections. The indicators for the various environmental components are shown in **Table 5.1**.

Table 5.1: Biophysical, Social and Health, Environmental Components and Impact Indicators

Environmental Components	Impact Indicators
Climate	Humidity, Temperature, Rainfall, Wind Speed and Direction
Air Quality	Particulate Matter($PM_{2.5}$, PM_{10}), Nitrogen Oxides(NO_X), Sulphur dioxide (SO_X), Carbon Monoxide(CO), Carbon dioxide, Ammonia, Hydrogen Sulphide, Formaldehyde and Lower Explosive Limit concentrations of flammable gases.
Water Quality	Dissolved and Suspended solids, Turbidity, pH, DO, BOD, COD, Toxicity, Pb, Cd, As, Ni, Fe, Hg, Mn. Microbial analysis like Total Heterotrophic bacteria and fungi, Hydrocarbon Utilizing bacteria and fungi and Coliform, Hydrocarbon Utilizer
Soil and land use	Soil type, Soil pH, Soil texture, Total Organic Carbon (TOC), Soil Nutrients, Total Heterotrophic bacteria and fungi, Hydrocarbon Utilizing bacteria and fungi and Total Coliform, Hydrocarbon Utilizer; Soil topography
Archaeology	Cultural relics, shrines and taboos
Noise	Day and night disturbance, hearing loss communication
Socio-economic	Population income, settlement pattern, health, safety security, and standard of living
Wildlife and Vegetation	Species No, diversity, health, endangered species
Hydrogeology	Pollution, water abstraction, aquifer recharge rate

5.3 IMPACT IDENTIFICATION AND EVALUATION

The following basic steps were adopted for identification and evaluation of impacts in adherence to general guidelines:

- Impact identification;
- Impact qualification;
- Impact rating; and
- Impact description

5.3.1 Impact Identification

The aim of impact identification is to account for the entire cumulative associated bio-physical, social and health impacts making sure that both significant and insignificant impacts are accounted for. The impacts were determined based on the interaction between project activities and environmental sensitivities.

5.3.2 Impact Qualification

Four criteria used to qualify the identified impacts of the project were:

- Positive or negative
- Short-term or long-term
- Reversible or irreversible
- Direct or indirect

Negative impacts are those that adversely affect the biophysical, health, and social environments, while positive impacts are those which enhance the quality of the environment. For this study, short term means a period of time less than three months while any period greater than three months is considered long term. Reversible/irreversible referred to whether the environment can either revert to previous conditions or remain permanent when the activity causing the impact is terminated. Direct impacts are primary impacts which occur as a result of a specific project activity, while indirect impacts refer to secondary effects – the consequence of a primary impact.

5.3.3 Impact Rating

This stage involves evaluation of the impact to determine whether or not it is significant. The quantification scale of 0, 1, 3 and 5 was used. The ratings adapted from The International Organization for Standardization ISO 14001– Environmental Management System Approach are as described below. The criteria and weighing scale used in evaluating significance are:

- Legal/regulatory requirements (L)

- Risk factor (R)
- Frequency of occurrence of impact (F)
- Importance of impact on an affected environmental component (I),
- Public perception/interest (P)

5.3.3.1 Legal /Regulatory Requirements (L)

This asks the question 'is there a legal/regulatory requirement or a permit required?' The scoring is as follows:

0= There is no legal/regulatory requirement

3= There is legal/regulatory requirement

5= There is a legal/regulatory requirement and permit required

The legal/regulatory requirements were identified based on national laws/guidelines/standards (FMEnv and Lagos State Environmental Protection Agency) relating to the project activity.

5.3.3.2 Risk (R)

This uses a matrix based on the interaction of the probability of occurrence of the impact (**Table 5.2**) against consequences (**Table 5.3**). The matrix (**Figure 5.2**) is referred to as the Risk Assessment Matrix (RAM). Five probability categories were interacted against four groups of consequences. The resultant outcomes were given scores with colour-coding. High-risk categories are red; intermediate risks, yellow and low risk, green as follows:

1=Low risk (green)

3=Intermediate risk (yellow)

5=High risk (red)

Table 5.2: Probability of Occurrence

Probability Category	Definition
A	Possibility of Repeated Incidents
B	Possibility of Isolated Incidents
C	Possibility of Occurring Sometime
D	Not Likely to Occur
E	Practically Impossible

Table 5.3: Consequence Categories

Consequence Category	Considerations			
	Safety / Health	Public Disruption	Environmental Aspects	Financial Implications
I	Fatalities / Serious Impact on Public	Large Community	Major/Extended Duration/Full Scale Response	High
II	Serious Injury to Personnel / Limited Impact on Public	Small Community	Serious / Significant Resource Commitment	Medium
III	Medical Treatment for Personnel / No Impact on Public	Minor	Moderate / Limited Response of Short Duration	Low
IV	Minor Impact on Personnel	Minimal to None	Minor / Little or No Response Needed	None

	A	B	C	D	E
I					
II					
III					
IV					

Figure 5.2: Risk Assessment Matrix

5.3.3.3 Frequency of Impact (F)

Frequency of impact refers to the number of occurrences of impact. The frequency of impact was determined using impacts historical records of occurrence and consultation with experts and local communities. The criteria for rating the frequency of impacts are outlined in **Table 5.4**.

Table 5.4: Frequency Rating and Criteria

Frequency	Rating	Criteria
Low	1	Rare, not likely to happen within project lifespan
Medium	3	Likely to happen ≥ 5 years
High	5	Very likely to happen throughout the project lifespan

5.3.3.4 Importance of Affected Environmental Component and Impact (I)

The importance of the affected environmental components was determined through consultation and consensus of opinions. This was also further facilitated by information on experiences on the impacts of already existing facilities in the proposed project area. The rating of the importance of impacts is summarized in **Table 5.5**.

Table 5.5: Importance Criteria

Importance	Rating	Criteria
Low	1	• Imperceptible outcome • Insignificant alteration in value, function or service of impacted resource • Within compliance, no controls required
Medium	3	• Negative outcome • Measurable reduction or disruption in value, function or service of impacted resource • Potential for non-compliance
High	5	• Highly undesirable outcome (e.g., impairment of endangered species and protected habitat) • Detrimental, extended animal behavioral change (breeding, spawning, molting) • Major reduction or disruption in value, function or service of impacted valued ecosystem resource • Impact during environmentally sensitive period • Continuous non-compliance with existing statutes

5.3.3.5 Public Perception (P)

The consensus of opinions among the project stakeholders were used to determine the public perception on the associated impacts and the criteria applied are summarized in **Table 5.6**. The combination of the five impact rating weight forms the basis for judging the level of significance of each impact. A matrix displaying the combination based on the ISO 14001 tool is shown in **Table 5.7**.

Table 5.6: Public Perception Criteria

Public Perception	Rating	Criteria
Low	1	• No risk to human health, acute and/or chronic • No possibility of life endangerment for residents, associated communities • Minor reduction in social, cultural, economic values • Unlikely adverse perception among population
Medium	3	• Limited incremental risk to human health, acute and/or chronic • Unlikely life endangerment for residents, communities • Some reduction in social, cultural, economic value • Possibility of adverse perception among population. • Potential for non-compliance
High	5	• Elevated incremental risk to human health, acute and/or chronic • Possibility of life endangerment for residents, abutting communities • Major reduction in social, cultural, economic value • Continuous non-compliance with statute • Any major public concern among population in study area

Table 5.7: Impact Value and Rating Colour Code

Impact value	Cut off values	Impact Rating
L+R+F+I+P	<8	Low
L+R+F+I+P	≥8 but <15	Medium
L+R+F+I+P	≥15	High
F + I	>6	
P	= 5	
Positive		Positive

The final ratings of the identified impacts are presented in **Tables 5.8 - 5.10.** In this study, medium and high significant negative impacts were judged to require mitigation, and all positive impacts required enhancement.

5.3.4 Summary of Impact Significance Ranking

The Impact Assessment of the proposed PET recycling project (interaction of different Phases and Project activities/Environmental Aspects) resulted in Seventy eight (78) impacts with different impact significance ratings including Beneficial, Low, Medium and High. The summary of impact significance ratings as summarized in Table 5.12 shows that 39.8% of the identified impacts fall within the category of beneficial and low impacts, while the other 45% fall within the medium category that can be easily mitigated for environmental benefits. Only 15% of the impacts are of High category.

Table 5.8: Potential and Associated Impacts of Sonnex Packaging Nigeria Limited Project–Pre- Construction Phase

Project Activity	Receptors	Description of Impact	Impact Qualification								Impact Quantification							
			Positive	Negative	Direct	Indirect	Short term	Long term	Reversible	Irreversible	L	R	F	I	P	Total	F+I	Impact Rating
Feasibility studies for the proposed project	Host community	• Increased demand on infrastructure		√	√		√		√		0	0	0	1	1	2	2	L
		• Increase in sexually transmitted disease		√	√		√		√		0	0	0	1	1	2	2	L
		• Increase in social vices		√	√		√		√		0	0	0	1	1	2	2	L
		• Influx of migrant workers		√	√		√		√		0	0	0	1	1	2	2	L
Engagement and mobilization of workers and materials to site	Social infrastructure and community health and safety	• Increase in traffic volume including potential for road accident		√	√		√		√		0	1	1	1	1	4	2	L
Site clearing and preparation	Terrestrial flora and fauna	• Vegetation loss		√	√			√		√	0	3	1	5	5	14	6	M
		• Loss of individual or localized population of fauna species including disturbance to avifauna species		√	√				√	√	0	5	1	5	3	14	6	M
	Soil	• Soil compaction and degradation		√	√		√		√	0	1	1	3	1	1	7	4	L
		• Increased erosion potential		√	√		√		√	0	3	1	1	1	1	7	2	L

Project Activity	Receptors	Description of Impact	Impact Qualification								Impact Quantification							
			Positive	Negative	Direct	Indirect	Short term	Long term	Reversible	Irreversible	L	R	F	I	P	Total	F+I	Impact Rating
		• Reduction in structural stability as well as soil percolation ability.		√	√		√		√		0	1	1	3	1	6	4	L
	Air Quality	• Decease in ambient air quality Increase in noise level with its associated effects on the nearby sensitive receptors		√	√		√		√	0	1	1	1	1	1	5	2	L
		• Increased employment and business opportunities especially for low income earners	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	P

Table 5.9: Potential and Associated Impacts of Sonnex Packaging Nigeria Limited Project–Construction Phase

Project Activity	Receptors	Description of Impact	Impact Qualification								Impact Quantification							
			Positive	Negative	Direct	Indirect	Short term	Long term	Reversible	Irreversible	L	R	F	I	P	Total	F+I	Impact Rating
• Earth and Pavement works	Air Quality	• Decrease in ambient air quality		√	√		√		√		0	3	3	3	3	12	6	M
• Welding and installation works		• Increase in noise level with potential impact on the nearby sensitive receptors		√	√		√		√		0	3	3	3	3	12	6	M

Project Activity	Receptors	Description of Impact	Impact Qualification								Impact Quantification							
			Positive	Negative	Direct	Indirect	Short term	Long term	Reversible	Irreversible	L	R	F	I	P	Total	F+I	Impact Rating
		• Influx of migrant workers leading to increase in STDs and other communicable diseases		√	√		√		√		0	1	1	3	1	6	4	L
• Stripping of Top soil • Debris generation from construction waste • Vehicular movement	Soil	• Soil compaction		√	√			√		√	0	3	3	3	3	12	6	M
		• Reduction in structural stability and percolation ability of soil		√	√			√	√		0	3	1	3	3	10	4	L
		• Loss of soil dwelling organisms		√	√			√		√	0	1	1	1	3	6	2	L
		• Decrease in soil quality		√	√		√		√		0	1	3	3	1	8	6	L
		• Blocking of existing drainage facility in the area		√	√		√		√		0	1	3	1	1	6	4	L
• Drainage works • Solid waste generation	Groundwater	• Groundwater contamination		√	√		√		√		0	3	3	3	3	12	6	M
		• Clogging of existing drainage		√	√		√		√		0	3	3	3	3	12	6	M
		• Contamination of groundwater and surface water where applicable through erosion during the rains		√	√		√		√		0	3	3	5	3	14	8	M

Project Activity	Receptors	Description of Impact	Impact Qualification								Impact Quantification							
			Positive	Negative	Direct	Indirect	Short term	Long term	Reversible	Irreversible	L	R	F	I	P	Total	F+I	Impact Rating
• Infrastructure such as housing for construction workers	• Socioeconomic and health	• Influx of people, increase in sexual transmitted diseases; pressure on existing infrastructure		√	√		√		√		0	5	3	5	5	18	8	H
		• Road damage due to movement of heavy trucks,		√	√		√		√		0	3	3	5	5	16	8	H
• Employment and Business Opportunities for the community	• The host community and general public	• Increased traffic and safety impacts		√	√		√		√		0	5	3	3	5	16	6	H
		• Increased employment and business opportunities especially for low income earners	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	P
• Use of construction equipment • Work on height and use of hot objects during construction	Occupational Health and Safety (health, safety, and	• Injury to construction workers due to construction activities		√	√		√		√		0	5	3	3	1	12	6	M
		• Poor and direct handling of construction wastes		√	√		√		√		0	3	3	3	3	12	6	M
		• Poor welfare and working conditions for both skilled and unskilled workers engaged during construction phase		√	√		√		√		0	3	3	3	3	12	6	M

Project Activity	Receptors	Description of Impact	Impact Qualification								Impact Quantification							
			Positive	Negative	Direct	Indirect	Short term	Long term	Reversible	Irreversible	L	R	F	I	P	Total	F+I	Impact Rating
	welfare of construction workers)	• Impairment of aesthetics of the environment with human waste where toilet facilities are not provided for construction workers		√	√		√		√		0	3	3	3	3	12	6	M
		• Fall from height and possibility of workers getting burns while on site		√	√		√		√		0	5	3	3	1	12	6	M
		• Increase Employment Opportunities for skilled and unskilled workers as well as business opportunities	√	-	-	-	-	-	-	-	-	--		--		-	-	P
Demobilization of workers	• Socioeconomic and health	• Air Quality and Noise Level		√	√		√		√		0	3	5	3	1	12	8	M
		• Transportation		√	√		√		√		0	3	3	3	3	12	6	M
		• Public Health (loss of job)		√	√			√		√	0	3	1	5	5	14	6	M

Table 5.10: Potential and Associated Impacts of Sonnex Packaging Nigeria Limited Project–Operation Phase

Project Activity	Receptors	Description of Impact	Impact Qualification								Impact Quantification							
			Positive	Negative	Direct	Indirect	Short term	Long term	Reversible	Irreversible	L	R	F	I	P	Total	F+I	Impact Rating
• Production Machines Operations	Socio -economy	• Job creation for workers and logistics providers	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	P
		• Business growth for local raw materials suppliers	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	P
		• Revenue to Government in taxes and duties	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	P
		• Revenue generation for the Project proponent	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	P
	Air Quality and Noise	• Noise from production activities could impact hearing of workers and surrounding public and impairment of air quality		√	√		√		√		0	5	3	5	3	16	8	H
	Water quality, Soil quality and Public Health	• Waste generated from the production process if improperly managed or disposed could affect land use		√	√		√		√		0	3	3	3	3	12	6	M

Project Activity	Receptors	Description of Impact	Impact Qualification								Impact Quantification							
			Positive	Negative	Direct	Indirect	Short term	Long term	Reversible	Irreversible	L	R	F	I	P	Total	F+I	Impact Rating
		• Reduce aesthetics		√	√				√	√	0	3	3	3	3	12	6	M
		• Reduction in groundwater recharge through infiltration as a result of abstraction for washing of the PET bottles		√	√			√	√		0	5	5	5	3	18	10	H
		• Reduction in soil quality through infiltration as a result of water abstraction for washing of the PET bottles		√	√			√	√		0	3	3	3	3	12		M
		• Pose risk to public health and plant materials		√	√			√	√		0	1	1	1	1	5	2	L
• Transportation of Raw Materials and Finished Products	Air quality, noise and Road traffic	• Traffic congestion due to additional vehicles on adjoining roads to the site		√	√		√		√		0	1	3	3	3	10	6	M
		• Noise and noxious gas emissions from vehicles		√	√		√		√		0	3	3	3	1	10	6	M
		• Business opportunities for scavengers and PET bottle collectors	√	-	-	-	-	-	-	-	-	-	-	-	-	--	-	P

Project Activity	Receptors	Description of Impact	Impact Qualification								Impact Quantification							
			Positive	Negative	Direct	Indirect	Short term	Long term	Reversible	Irreversible	L	R	F	I	P	Total	F+I	Impact Rating
		• Job creation for worker and transporters	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	P
		• Revenue to Government in taxes and duties	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	P
• Gas and Diesel (As backup) Generators operation	Socio - economic	• Increased business opportunity for the gas and diesel suppliers	√	-	-	-	-	-	-	-	-	-	-	-	-	-		P
		• Increased gaseous emissions from diesel generator back-up		√	√		√		√		0	5	3	3	3	17	6	H
		• increased noise level for the Generator sets operations		√	√		√		√		0	3	3	3	3	12	6	M
• Wastewater Management		• Untreated or improperly treated wastewater discharged into the environment through the outfalls could contaminate the soil and ground water		√	√		√		√		0	3	1	3	3	10	4	M

Project Activity	Receptors	Description of Impact	Impact Qualification								Impact Quantification							
			Positive	Negative	Direct	Indirect	Short term	Long term	Reversible	Irreversible	L	R	F	I	P	Total	F+I	Impact Rating
	Soil and groundwater	• Poor wastewater treatment or sludge discharges could contaminate soil and groundwater as well as constitute nuisance and pose as health risks.		√	√		√		√		0	3	1	3	3	10	4	M
• Solid and other Wastes Management	Soil and Ground water	• Odour and aesthetic devaluation may result from improper handling. Increase in disease if dumped in water		√	√				√	√	0	3	3	3	3	12	6	M
		• Improperly managed solid and liquid wastes could release toxins into the existing food chain		√	√			√		√	0	5	3	5	5	18	8	H
		• Create breeding grounds for disease vectors and rodents that pose health risks		√	√			√	√		0	5	5	5	5	20	10	H
		• Release of gases into the atmosphere		√	√		√		√		0	3	3	3	3	12	6	M

Project Activity	Receptors	Description of Impact	Impact Qualification								Impact Quantification							
			Positive	Negative	Direct	Indirect	Short term	Long term	Reversible	Irreversible	L	R	F	I	P	Total	F+I	Impact Rating
		• Improper discharge of solid and liquid wastes into the environment would alter land use, contribute toxic materials that enter the soil, and groundwater through percolation, drainages, and leachates.		√	√		√		√		0	3	3	5	3	17		H
		• Removal of non-biodegradable PET containers from the Environment and creating avenues for business opportunities	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	P
• Machines and Generator set Maintenance		• Contamination of soil and water system with effluent and used oil resulting from maintenance activities		√	√		√			√	0	5	3	3	3	14	6	M
		• Accidental damage to equipment leading to fire incident		√	√		√			√	0	5	1	5	1	12	6	M

Project Activity	Receptors	Description of Impact	Impact Qualification								Impact Quantification							
			Positive	Negative	Direct	Indirect	Short term	Long term	Reversible	Irreversible	L	R	F	I	P	Total	F+I	Impact Rating
	Soil and Ground water	• Contamination of soil and water system with effluent and used oil resulting from maintenance activities		√	√		√			√	0	3	3	5	3	17	8	H
		• Used oils and toxic materials waste during maintenance of machines and generator sets could release toxic materials including hydrocarbons into the soil and groundwater under extensive conditions.		√	√		√			√	0	3	3	5	3	17	8	H
		• Improper disposal and management of disused machine parts could alter land used, affect aesthetics, and contribute contaminants to the environment		√	√		√		√		0	3	3	3	3	12	6	M
• Health, safety and welfare of staff		• Fall, slips and trips Injuries, electric shocks, etc.		√	√		√		√		0	3	3	3	3	12	6	M
		• Work related issues such as discrimination, denial of rights, unfair treatment, poor working conditions		√	√		√		√		0	3	3	3	3	12	6	M

Table 5.11: Potential and Associated Impacts of Sonnex Packaging Nigeria Limited Project–Decommissioning Phase

Project Activity	Receptors	Description of Impact	Impact Qualification								Impact Quantification							
			Positive	Negative	Direct	Indirect	Short term	Long term	Reversible	Irreversible	L	R	F	I	P	Total	F+I	Impact Rating
Dismantling of Structures	Air Quality and Noise	• Dismantling activities could increase particulates in the air and background noise level		√	√		√		√		0	3	3	3	3	12	6	M
	General aesthetics	• Lack of adequate planning and implementation in structure dismantling could leave rubbles and wastes lying around on the premise and reduce aesthetics		√	√		√		√		0	1	1	3	1	6	4	L
	Land Use	• Discharge of rubbles and wastes into the environment would alter land use and affect topography in the area		√	√			√		√	0	1	1	1	3	6	2	L

Project Activity	Receptors	Description of Impact	Impact Qualification								Impact Quantification							
			Positive	Negative	Direct	Indirect	Short term	Long term	Reversible	Irreversible	L	R	F	I	P	Total	F+I	Impact Rating
		• Blockage of existing drainage in the area and contamination of groundwater		√	√		√		√		0	3	3	3	3	12	6	M
		• Loss of jobs		√	√			√		√	0	5	1	5	5	16	6	H
Removal of materials form site	Transportation	• Traffic congestion due to additional vehicles on the road to site		√	√		√		√		0	3	3	3	3	12	6	M
	Air Quality and noise	• Noise and noxious gas emissions from vehicles and generators		√	√		√		√		0	3	3	3	3	12	6	M
	Socio-economics	• Health impact from air contamination from vehicle emissions, and stress due to traffic jam		√	√		√		√		0	1	1	3	3	8	4	L
		• Increase in Business opportunities from sale of scraps and equipment	√	-	-	-	-	-	-	-	-	-	-	-	-	-	-	P

Table 5.12: Summary of Impact Significance Ranking

Project Phase	Project Activity	Number of Identified Impacts	Impact Significance Ranking			
			Beneficial	Low	Medium	High
Pre-construction	Feasibility studies for the proposed project	4	-	4	-	-
	Engagement and mobilization of workers and materials to site	1	-	1	-	-

	Site clearing and preparation	7	1	4	2	-
Construction Phase	• Earth and Pavement works • Welding and installation works	3	-	1	2	-
	• Stripping of Top soil • Debris generation from construction waste • Vehicular movement	5	-	4	1	-
	• Drainage works • Solid waste generation	3	-	-	3	-
	• Infrastructure such as housing for construction workers • Employment and Business Opportunities for the community	4	1	-	-	3
	• Use of construction equipment • Work on height and use of hot objects during construction	6	1	-	5	-
	• Demobilization of workers	3	-	-	3	-
Operation Phase	• Production Machines Operations	10	4	1	3	2
	• Transportation of Raw Materials and Finished Products	5	3	-	2	-
	• Gas and Diesel (As backup) Generators operation	3	1	-	1	1
	• Wastewater Management	2	-	-	2	-
	• Solid and other Wastes Management	6	1	-	2	3
	• Machines and Generator set Maintenance	5	-		3	2
	• Health, safety and welfare of staff	2	-	-	2	-
Decommissioning Phase	• Dismantling of Structures	5	-	2	2	1
	• Removal of materials form site	4	1	1	2	-
Total		**78**	**13**	**18**	**35**	**12**
Percent Significance			**16.7%**	**23.1%**	**45%**	**15%**

5.4 Summary of Impacts as they relate to various aspects of the Project

5.4.1 Potential Negative Impacts

The potential negative impacts associated with the proposed PET recycling plant Project are discussed in the sub-sections below. However, implementation of necessary mitigation measures during the lifespan of the proposed Project are expected to reduce the impact ratings to as low as reasonably practicable.

5.4.1.1 Pre-Construction Phase

5.4.1.1.1 Mobilization of Personnel, Materials and Equipment to Site

Impact on air quality

Heavy-duty and other pieces of equipment will be moved to the Project site prior to the commencement of construction activities. The potential impacts associated with the mobilization activities include decrease in air quality of the Project area as a result of emissions from vehicles (such as trucks) that will convey materials and equipment to the Project site including potential for dust generation.

Impact on noise

High noise levels from vehicular movement may also be pronounced during the mobilization activities. Since the mobilization activities will be intermittent and the trucks that will transport construction equipment and materials to site will not be driven at the same time, the potential impact is short term, reversible, and localized. Also, there is a good road network (Ikorodu-Itoikin-Epe) in the area that can be used to gain easy access to the site. The impact magnitude is rated to be medium.

Public and workers health and safety

Regarding social infrastructure and community health and safety, mobilization activities during the pre-construction phase of the proposed Project could potentially increase traffic volume in the Project area (and potential for road accident and annoyance from other road users). The potential impact is considered to be negative and localized. The magnitude of the impact is considered low given that the mobilization activities would be short term and intermittent. However, the sensitivity of the receptor is adjudged to be medium. Meanwhile, the mobilization activities are not envisaged to cause any significant increase to the existing traffic volume occasionally experienced along the Expressway. Thus, the impact significance is rated minor.

5.4.1.1.2 Clearing and Preparation

As part of pre-construction activities, the Project site would be cleared and prepared for construction works. Site clearing will be done with the use of earth moving equipment such as tractor and bulldozer. The potential impacts associated with the proposed site clearing activities on the biophysical and socio-economic environment are as follows;

Potential Impact on Terrestrial Flora and Fauna

Site preparation will involve the clearing of vegetation on the Project site. The site clearing activities would lead to loss of terrestrial flora (vegetation) and potential negative impacts on terrestrial fauna species. The potential impact on the terrestrial flora is considered to be negative, direct, and site specific. However, the impact magnitude is considered to be high since part of the vegetation are of economic value and its removal may affect the integrity of the plant population in the study area. The clearing will be restricted to the apportioned area for the project. This activity will also affect the faunal breeding area within the site. The potential impact significance of site clearing on terrestrial flora of the Project site is rated major. While the plant species are unable to avoid the point of impact, most fauna species may be able to migrate away from unfavorable areas.

Animals are generally mobile and, in most cases, can move away from any potential threat. The tolerance levels of some animal species are of such a nature that surrounding areas will suffice in habitat requirements of species forced to move from areas of impact. Concerning clearing of the Project site for construction purpose, the potential impact on terrestrial fauna species may include loss of individual or localized population of fauna species or disturbance to avifauna species. The impact magnitude is considered major but because of the restriction of activities to the land size the receptor sensitivity is considered medium. Therefore, the impact significance of clearing activities on the fauna species within the Project site is thus rated medium.

Potential Impact on Soil

The soil environment of the Project site would be directly impacted during the site clearing activities. The potential effects include alteration, or damage to soil and associated soil forming processes. The disturbance to the natural ground level over disturbance areas will negatively affect soil formation, moisture levels, soil density, soil chemistry, and biological activity. No heavy metal pollution was recorded in the soil samples from the Project site. Thus, the sensitivity of the soil is regarded as low. The overall impact significance is rated as minor given that the impact magnitude is medium due to the size of the site that would be cleared.

Potential Impact on Air Quality

The pollutants which could impair air quality during site clearing activities are particulate matter in form of dust, and NOx, CO, SOx from combustion engines of the earth moving equipment that will be used for clearing. The impact magnitude is considered to be low since the impact will be short term, intermittent, localized and reversible. The sensitivity of the air shed of the Project site and its surrounding environment is regarded as low based on the results of air quality measurements conducted in the area (Chapter 4). Thus, the impact significance of site clearing activities on the ambient air quality of the Project area is rated minor.

Potential Noise Impact

The site clearing activity has the potential to generate noise emissions which could have impact on the nearby facilities and some local residents within the Project area of influence. However, the impact magnitude is considered to be low since the potential noise impact would be intermittent and the generated noise level during the site clearing activity is not expected to result in a maximum increase in background noise levels. The overall impact significance is rated minor.

5.4.1.2 Construction Phase

The construction phase of the proposed Project will entail activities such as civil and mechanical works including construction of service and technical buildings as well as administrative buildings, drainage channels and installation of equipment. Waste generation is also associated with the construction activities which could be significant if not properly managed. The potential environmental and social impacts associated with the construction phase of the proposed Project include;

Potential Impact on Air Quality

The ambient air quality of the Project site and its surrounding environment could be impacted due to emissions such as SO_2, CO, NOx, VOC generated from internal combustion engines of some of the equipment and machinery that would be used for construction activities, as well as odour generation from solid waste if not properly managed. Dust is also likely to be generated during extraction and removal of overlying materials as well as a windblown dust generated from cleared land and exposed material stockpiles. The emissions from the construction equipment could increase the concentrations of ambient air quality of the Project area. The potential impact is considered to be short term, intermittent, localized and reversible. The impact magnitude is rated medium.

Potential Noise Impacts

The planned activities during the construction phase of the proposed PET recycling plant Project has the potential to increase the noise levels in the Project area which could lead to adverse noise impacts (such as annoyance and disturbance) to the surrounding sensitive receptors. These activities include civil works, vehicular movement and operation of construction equipment and machinery. The noise level associated with the construction phase of the Project would be intermittent and is not expected to result in a maximum increase in background noise levels beyond the permissible limit. The potential impact magnitude is regarded low.

Potential Impacts on Soil

During construction, soil environment of the proposed PET plant Project site could be directly impacted in terms of removal of topsoil and soil compaction, reduction in structural stability and percolation ability of soil, loss of soil dwelling organisms resulting from compaction during excavation activities, foundation works, and erection of buildings. Waste streams (general refuse, food wastes, etc.) associated with the construction activities if not properly handled could also lead to soil contamination. No elevated heavy metal concentrations were recorded in the soil samples from the Project site. Adequate drainage will be provided at the facility for storm water control. The overall impact significance is rated minor.

Potential Impact on Groundwater Quality

The quality of groundwater resources in the proposed PET recycling plant Project area could potentially be impacted due to infiltration of contaminants associated with spills or leaks of fuels, oils and lubricants from construction equipment, as well as improper handling of construction wastes. Considering that the sensitivity of the receptor is low, the impact significance is rated minor.

Potential Social Impacts (Community Health, Safety and Security)

The main negative impacts associated with the construction phase of the Project on community health, safety and security are those related to the presence of construction workers on site (influx of workers); impact of heavy vehicles, including damage to roads, safety, noise and dust generation. As regards the presence of construction workers on site, the workers conduct on site can affect the local community in terms of disruption of existing family structures and social networks. The behaviour of workers, most particularly male construction workers, may lead to increase in levels of crime, drug and alcohol abuse including increase in incidence of sex workers and casual sexual relations, which may result in increase in sexually transmitted diseases and unwanted pregnancies. There will be pressure on existing infrastructure. The potential risk to the community is regarded as medium. However, majority of the construction workers, especially

unskilled labour force would come from the local community; hence impact significance is considered to be minor. There are no plans for construction camps onsite during this phase.

Public Health and safety

During construction, there will be an increase in vehicle movement to and from the Project site. The movement of project vehicles during the construction phase may pose safety risks to other road users in the area. Therefore, the potential impact significance (prior to mitigation measures) is considered to be moderate.

Construction Workers Health, Safety and Welfare

Construction sites are categorized as hazardous places. Occupational accidents may occur especially when those involved are unskilled. Such occupational accidents may result in loss of man-hours which may ultimately affect the schedule date of completion of the project development especially if the man-hour losses are high. Potential impacts to construction workers include increased noise level and air emissions from construction activities (resulting from the use of heavy duty equipment and construction vehicles), injuries, electrical shocks, accident, and denial of rights. Workers may also be impacted due to direct contact with construction wastes. Although the majority of the construction workers will be unskilled, the overall unmitigated impact significance is considered moderate.

Workers may be exposed to occupational hazards when working at elevation during construction. The construction of new facility and installation of machineries can pose a physical hazard to workers using elevated platforms and those located below due to the potential for falling objects. Also, there could be trench collapse, scaffold collapse and electrical hazards to workers. Common electrical accidents result in shocks and/or burns. The likelihood of the hazards occurring is considered to be possible while its severity may lead to reportable injury and limited damage to property. The overall significance is rated moderate.

5.4.1.3 Operation Phase

The major activities during the operational phase of the Project include PET bottles recycling, transportation of raw materials (used plastic bottles) and finished goods in and out of the Project site, equipment maintenance and occasional repairs, utilities (diesel, water and gas) consumption, waste generation and disposal. The potential impacts associated with the facility operations are as follows;

Impact on Air Quality

The source of air emission during the facility operation is from vehicular movement in and out of the Project site. It is estimated that the facility will have an inflow of several trucks daily supplying used PET bottles to the site for recycling and several containerized trucks will pick up

finished products from the facility on a weekly basis as well. This activity has the potential to impact the ambient air quality of the proposed Project area. Similarly, fugitive emissions from storage of gas onsite to fuel gas generators for electricity production at the facility. The overall potential impact on air quality during the operational phase would be localized and reversible. However, considering that impact would be long term (throughout the operating lifespan of the facility); the impact significance is rated moderate.

Impact on Noise

The sources of noise during this Project phase include PET bottle recycling operations, generators and vehicular movements. Noise emissions from these sources will be site specific, permanent and reversible thus the impact significance is considered to be moderate.

Impact on Soil

Impacts on soil may occur as a result of contamination during equipment maintenance, occasional repairs and waste storage. More so, the surrounding of the facility would be concretized during the operational phase thus minimizing the potential for soil contamination. Thus, the anticipated impact of the facility's operations on soil environment of the project area is considered minor.

Impact on Groundwater Quality

The sources of potential impacts on groundwater quality and quantity during the operational phase of the Project include washing of used PET bottles before processing which will lead to reduction in groundwater recharge through infiltration as a result of paved surfaces and seepage of contaminants from liquid wastes (such as sanitary waste, process wastewater etc.). Waste water generated from the PET bottles recycling operation is planned to be treated and reused for five (5) cycles of washing before it would be sent to the ETP prior to being discharged into the environment. This would minimize the possibility of groundwater contamination. Also, sanitary waste generated during the facility operation is planned to be channeled to a dedicated septic tank (reinforced concrete) that will be located far away from groundwater source onsite. The proposed Project site plans to install three boreholes which would serve as the source of water for the facility operation. The potential impact of the facility operation on groundwater source is rated to be of minor significance. Also the potential impact on underground water aquifer as a result of the water requirement for the Project which could affect the availability of potable water to local community is considered negligible.

Potential Impact on Socio-economic

The potential negative impacts to the socio-economic environment during the facility operation are related to impact on road (road traffic). During the facility operations, the number of trucks

that will move to and from the facility on weekly basis is estimated to be much. The potential traffic impacts will however be localized and intermittent as all the trucks will not move to the site at the same time. The proposed facility also plans to have a designated park for its trucks. The impact significance is considered minor.

Occupational Health, Safety and Welfare during Operation

During plant operations, workers may be exposed to occupational health and safety issues (e.g. electrical hazards and mechanical injuries) including work related issues such as discrimination, denial of rights, unfair treatment, poor working conditions etc. The impact significance is considered to be moderate.

Fire and explosion

The major risk associated with the facility operation is fire and explosion. The major raw material (PET bottle) to be used at the facility is combustible, as well as the use of highly combustible gas for powering the generator with a diesel back - up generator on site. Also, the production equipment to be installed is subject to electrical faults like any other electrical installation such as short circuits, ground faults and reverse currents. These faults can result in hot spots that can ignite combustible material in their vicinity. Any outbreak of uncontrolled fire in the facility can escalate to dangerous dimensions which could lead to reportable injury and damage to property. The overall significance is high. Careful handling is necessary to mitigate fire risks

Security Threat and Attack

The proposed facility may be subject to sabotage or attack and thus result in low production than planned as a result of uprising. The current insurgency in the country is fast spreading amongst states in the country and the likelihood of a coordinated terrorist attack at the Project site is considered to be possible. Necessary mitigations will be put in place as discussed in chapter six of this report.

5.4.2 Potential Positive Impacts

The proposed PET recycling plant Project is aimed at reducing environmental pollution associated with indiscriminate disposal of used plastic bottles by installing and operating a PET bottle recycling plant with a designed capacity of 100 tons per day in Parafa village, Ikorodu LGA, Lagos State. Again, the Project will provide employment opportunities for various Nigerians (skilled and semi-skilled) in the Project area and beyond. This employment opportunity will lead to acquisition of new skills and introduction of all manners of income generating spill-over effects. During operation phase of the Project, it is envisaged that approximately 200 workers would be engaged, divided into two (2) shifts. Other benefits of the proposed Project

include: revenue generation to the Government (through taxes and revenues); and increase in local and regional economy through award of contracts for Project development.

5.4.3 Cumulative Impacts

Cumulative impacts are those impacts resulting from the combined effects of past, present or reasonably foreseeable actions owing to the project aspects and activities outside the project (GSI, 2003). The idea of cumulative effects is a significant one. Although impacts may be small individually, the overall impact of accumulated environmental changes affecting the receptors altogether can be significant. When a resource is nearing its tolerance threshold, a small change can push it over. Some of the identified cumulative impacts include;

Land Based Traffic

The Project site is located along Ikorodu-Itoikin-Epe Expressway in Parafa village, Ikorodu Local Government Area of Lagos State. The potential cumulative traffic impacts may occur especially during construction and operation phases of the Project with reference to the existing facilities and the number of vehicles (trucks, cars, motorbike etc.) that daily ply the Expressway. During the operational phase of the Project, it is expected that there will be several trucks visiting the facility per week and other vehicles for staff and visitors related to the Project, in addition to other trucks from the neighbouring facilities and those plying the Expressway. However, the proposed Project is not envisaged to generate traffic that would be incompatible with existing traffic patterns. The Project will have sufficient parking space in its assigned truck park. It is unlikely that the rate of motor vehicle accidents would increase due to the Project and there would be no reasonable foreseeable substantial risks to health and safety from transporting project construction materials. The potential cumulative transportation impact in the study area as a result of the proposed Project is considered to be minor.

Public Utilities

The Project will not introduce any additional long-term population into the area, and thus, would not result in any additional long-term demand for police or fire services or the need for new or altered facilities. The construction activities will not require roadway lane closures and detour. Fire, emergency, medical, and police services would be appropriately informed of relevant aspects of the Project. No damage to roadways is expected beyond that which would be considered normal wear and tear. In addition, the proposed Project would result in negligible impact on public utilities like housing as the proponent is proposing residential quarters for its staff in the nearest future asides employing locals already living in the area.

Contamination of soil and water quality

There are several companies in Ikorodu such as PZ Cussons factory, Sunflag, Pulkit & Landcraft, KSSA West Africa Ikorodu mill etc. while Hypo Hygiene Products and Lucky fiber are not too far from the proposed facility. Waste water discharges from these industries could have cumulative negative effects on the soil and water quality in Ikorodu area. The proposed project could also add to the waste water discharges but necessary mitigation measures would be put in place to curtail this impact on the environment.

Impacts on air quality and noise

Emissions from industrial equipment as well as vehicular movement over time as a result of activities from the growing Industrial and human activities as well as noise emanating from production equipment in Ikorodu LGA could have detrimental effects on the inhabitants if necessary mitigation measures are not put in place.

CHAPTER SIX

MITIGATION MEASURES

6.1 Introduction

Mitigation measures are means to prevent, reduce or control adverse environmental effects of a project, and include restoration for any damage to the environment caused by those effects through replacement, compensation or any other means. Mitigation measures are a critical part of the EIA process, as these actions aim to prevent adverse impacts from the planned project on the environment and people, ensuring that unavoidable impacts are maintained within acceptable levels.

The measures that Sonnex Packaging Nigeria Limited intends to take to reduce (or eliminate) negative impacts and promote positive Environmental and Health limpacts of the proposed project are presented in this chapter. In preparing these mitigation measures, emphases are placed on those negative impacts rated as significant. These measures are aimed at reducing the impacts to As Low As Reasonably Possible (ALARP). The residual impacts that could arise despite these mitigation measures were also noted. Significant negative impacts are expected to be mitigated through effective implementation of Health, Safety and Environment (HSE) policies put in place during the different phases of the project.

6.2 Mitigation Approach

The mitigation requirements for each of the impacts of the project were determined using a risk assessment matrix (Figure 6.1). The frequency, severity, sensitivity scale, longevity, legal/Permit requirement and communication/complaints were factors taken into consideration during these assessments.

The primary objectives of the mitigation measures were:

- ✓ ***Prevention*** – ensuring that significant and adverse potential impacts and risks do not occur.
- ✓ ***Reduction*** – ensuring that the effects or consequences of those significant associated and potential impacts that cannot be prevented are reduced to as low as reasonably practicable. Reasonable practicability was determined in reference to best industry practice and to economic, environmental, technical, health and safety considerations.
- ✓ ***Control*** – ensuring that residual associated impacts are reduced to a level as low as reasonably practicable.

The proposed mitigation measures for the Project would be Specific, Measurable, Achievable, Realistic, and Time-based (SMART). Mitigation measures proposed shall include:

- ✓ Recommendations on feasible and cost-effective measures to prevent or reduce significant negative impacts to acceptable levels;
- ✓ Suggestion of strategies to enhance beneficial impacts of the project;
- ✓ Determination of the non-mitigable impacts (residual);
- ✓ Evaluation of the effectiveness of any mitigation measures identified; and
- ✓ Provision of a comprehensive and detailed plan covering mitigation of impacts.

The classification of the mitigation requirements (formal control, informal control, physical control, training and avoidance) is presented below.

Formal control

This involves the application of documented policies, process or procedure in mitigating the impacts of the project activities.

Informal Control

This involves the application of sound judgment and best practice in mitigating the impacts of project activities.

Physical control

This involves the application of physical processes or instruments (pegs, flags, sign post etc), not necessarily requiring any special technology, in order to mitigate the impacts of a project.

Avoidance

This involves the modification of plans, designs or schedules in order to prevent the occurrence of an impact or impacts.

Training

This involves personnel awareness in specific / specialized areas.

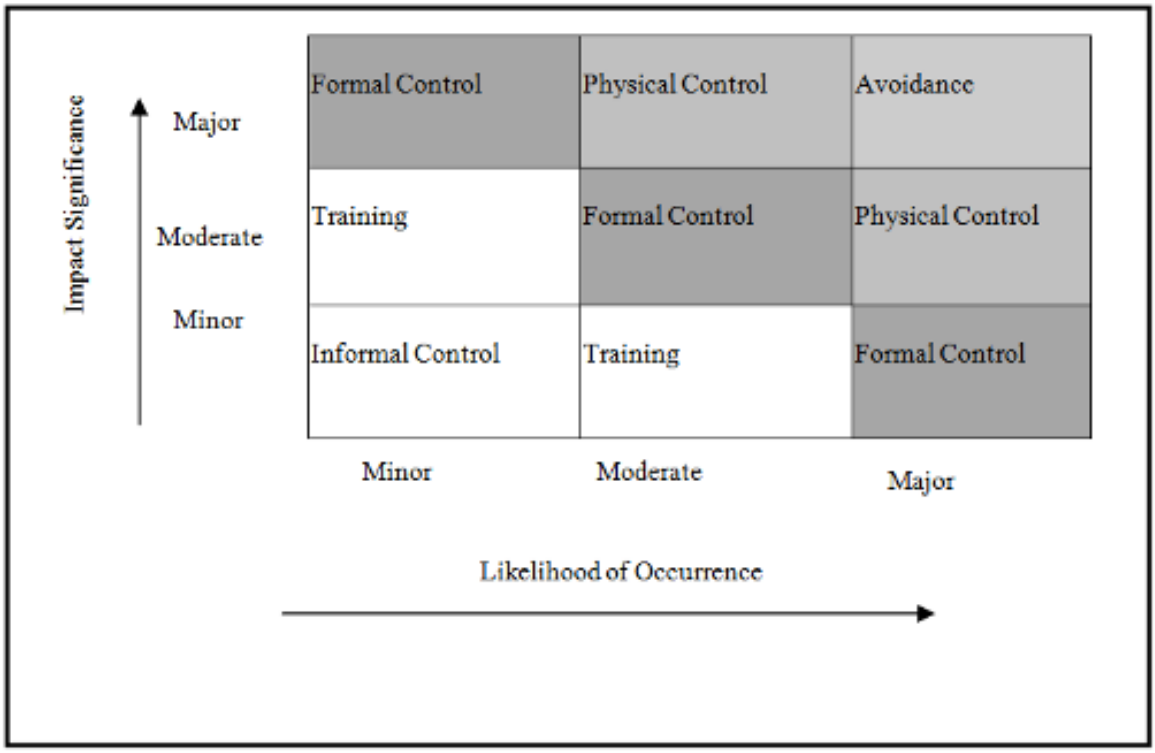


Figure 6.1: Matrix for Determination of Mitigation Measure

6.3 Mitigation Measures

Cost-effective measures that are environmentally, socially and technically acceptable to manage and mitigate the identified project impacts have been defined, developed and highlighted in this chapter. These very important procedures will ensure that adverse environmental impacts of the proposed project are properly managed.

6.4 MITIGATION MEASURES BASED ON THE PROJECT PHASE

Summarized in Tables 6.1 – 6.4 are the detailed mitigation and enhancement measures identified and recommended to ameliorate all the significant associated and potential impacts envisaged for the different phases of the proposed Sonnex Packaging Nigeria Limited PET recycling plant Project.

Table 6.1: Mitigation Measures for the Potential Negative Impacts of the proposed PET bottles recycling facility for Pre-construction phase

Project Activity	Receptors	Potential impacts	Impact before mitigation	Mitigation measures	Impact after mitigation
Engagement and mobilization of workers and materials to site	Social infrastructure and community health and safety	• Increase in traffic volume including potential for road accident	L	• Drivers shall be provided with traffic information to enable them take routes of least traffic volume. • Only qualified drivers with relevant licenses and trainings shall convey personnel and equipment to site • Project vehicles shall only operate at stipulated periods strategically planned to occur during low traffic hours.	Negligible
Site clearing and preparation		• Vegetation loss	M	Sonnex shall ensure • Clearing of vegetation shall be limited to the Project site. • Use of herbicides for vegetation clearing shall be avoided.	L

	Terrestrial flora and fauna	• Loss of individual or localized population of fauna species including disturbance to avifauna species	M	• Areas that are cleared but not used for operations shall be restored and re-vegetated with native plant species.	L
	Soil	• Soil compaction and degradation	L	• Vehicular and personnel movement shall be restricted to road areas • All project vehicles shall be properly serviced and maintained • The Non- valuable wastes shall be properly collected in impervious materials and removed from vehicles and project site by accredited contractors for disposal.	Negligible
		• Increased erosion potential	L	• Areas that are cleared but not used for operations shall be restored and re-	L

				vegetated with native plant species.	
		• Reduction in structural stability as well as soil percolation ability.	L	• Clearing of vegetation shall be limited to the Project site.	L
	Air Quality	• Decease in ambient air quality Increase in noise level with its associated effects on the nearby sensitive receptors	L	• All project vehicles shall be properly serviced and maintained • Appropriate use of Personal Protective equipment shall be enforced • Noise impacts shall be reduced by enclosing and insulating noise emitting equipment. • Site clearing equipment/machinery shall be turned off when not in use. • Site clearing activities shall be limited to daytime as much as possible.	L

Key: L –Low; M- Medium; H-High

Table 6.2: Mitigation Measures for the Potential Negative Impacts of the proposed PET bottles recycling facility for Construction phase

Project Activity	Receptors	Potential Impact	Impact before mitigation	Mitigation measures	Impact after mitigation
• Earth and Pavement works Welding and installation works	Air Quality	• Decrease in ambient air quality	M	• Measures to reduce dust, such as water suppression, shall be used where possible. • Regular maintenance and servicing of construction equipment that contribute to air emission shall be implemented. • Only modern and well maintained equipment and machinery shall be used for construction activities	L
				• All equipment shall be maintained in line with manufacturer's specifications.	

Project Activity	Receptors	Potential Impact	Impact before mitigation	Mitigation measures	Impact after mitigation
		• Increase in noise level with potential impact on the nearby sensitive receptors	M	• Construction activities with high levels of noise shall be limited to daytime • Noise attenuators like mufflers shall be installed on equipment casing noise. • Personal Protective Equipment shall be used as appropriate	L
		• Influx of migrant workers leading to increase in STDs and other communicable diseases	L	• The local communities shall be engaged more in Project activities (unskilled workers) • There shall be regular sensitization of workers on health issues.	L

Project Activity	Receptors	Potential Impact	Impact before mitigation	Mitigation measures	Impact after mitigation
• Stripping of Top soil • Debris generation from construction waste • Vehicular movement	Soil	• Soil compaction	M	• Excavation shall be restricted only to marked out areas • Stockpiles shall be well covered to reduce soil loss as a result of wind or water erosion. • Disturbed areas shall be rehabilitated as soon as possible to prevent erosion.	L
		• Reduction in structural stability and percolation ability of soil	L	Soil conservation measures shall be implemented such as stockpiling topsoil for the remediation of disturbed areas	Negligible
		• Loss of soil dwelling organisms	L	• Work areas shall be clearly defined using barricades with appropriate buffer	Negligible

Project Activity	Receptors	Potential Impact	Impact before mitigation	Mitigation measures	Impact after mitigation
				zone from the host community • Fuel and lubricants storage shall be in tanks with bund wall built as appropriate	
		• Decrease in soil quality	L	• Waste storage areas shall be designated and paved to prevent percolation before being carted away by a LAWMA approved vendor. • There shall be spill control measures in place to curtail spills	Negligible
		• Blocking of existing drainage facility in the area	L	• Sonnex contractor shall avoid blocking of existing drains while regular cleaning and desilting will also be carried out	Negligible

Project Activity	Receptors	Potential Impact	Impact before mitigation	Mitigation measures	Impact after mitigation
• Drainage works Solid waste generation	Groundwater	• Groundwater contamination	M	• Sonnex contractor ensure safe storage and handling practices including rapid spill response and clean-up	L
		• Clogging of existing drainage	M	• Sonnex contractor shall ensure regular cleaning and desilting of drains	L
		• Contamination of groundwater and surface water where applicable through erosion during the rains	M	Sonnex shall ensure • Proper waste containment and designated storage areas on site • Solid waste storage areas shall be paved with prompt evacuation by an accredited LAWMA vendor	L

Project Activity	Receptors	Potential Impact	Impact before mitigation	Mitigation measures	Impact after mitigation
• Infrastructure such as housing for construction workers	• Socioeconomic and health • The host community and general public	• Influx of people, increase in sexual transmitted diseases; pressure on existing infrastructure	H	• Sonnex contractor shall ensure employment of its workers from the host community who stay around	M
		• Road damage due to movement of heavy trucks,	H	• Although there is a road network leading to the site, Sonnex shall ensure maintenance of damaged areas like potholes to prevent unnecessary road delays in the terrain	M

Project Activity	Receptors	Potential Impact	Impact before mitigation	Mitigation measures	Impact after mitigation
		• Increased traffic and safety impacts	H	• Project vehicles shall only operate at stipulated periods strategically planned to occur during low traffic hours • Only qualified drivers with relevant licenses and trainings shall convey personnel and equipment to site	M
• Use of construction equipment Work on height and use of hot objects during construction	Occupational Health and Safety (health, safety, and welfare of construction workers)	• Injury to construction workers due to construction activities	M	• Sonnex contractor shall Implement its Health and Safety policy as well as have daily tool box meeting on site Provision and enforcement of appropriate PPE use by workers on site	L

Project Activity	Receptors	Potential Impact	Impact before mitigation	Mitigation measures	Impact after mitigation
		• Poor and direct handling of construction wastes	M	• Safety training focused on operational procedures of equipment shall be encouraged • Sonnex shall address all issues concerning staff welfare as appropriate on site	L
		• Poor welfare and working conditions for both skilled and unskilled workers engaged during construction phase	M	• Sonnex shall incorporate Nigerian labour law as appropriate for its site workers	L
		• Impairment of aesthetics of the environment with human waste where toilet facilities are not provided for construction workers	M	• Sonnex shall ensure mobile toilets are provided on site where toilets cannot be provided immediately	L

Project Activity	Receptors	Potential Impact	Impact before mitigation	Mitigation measures	Impact after mitigation
		• Fall from height and possibility of workers getting burns while on site	M	• Sonnex shall provide necessary PPEs like safety harness and coveralls to enhance personnel safety on site	L
Demobilization of workers	• Socioeconomic and health	• Air Quality and Noise Level	M	• Project vehicles shall only operate at low traffic hours • All vehicles and machinery shall be properly serviced and maintained •Appropriate use of Personal Protective equipment shall be enforced	L
		• Transportation	M	• Drivers shall be provided with traffic information to enable them take routes of least traffic volume	L

Project Activity	Receptors	Potential Impact	Impact before mitigation	Mitigation measures	Impact after mitigation
				• Project vehicles shall only operate during low traffic hours	
		• Public Health (loss of job)	M	• Sonnex shall inform its workers early before disengagement with appropriate compensation as stipulated by extant laws	L

Key: L –Low; M- Medium; H-High

Table 6.3: Mitigation Measures for the Potential Negative Impacts of the proposed PET bottles recycling facility for Operation phase

Project Activity	Receptors	Potential Impact	Impact before mitigation	Mitigation measures	Impact after mitigation
Production Machines Operations		• Noise from production activities	H	• Sonnex shall carry out regular maintenance of machines and generators	M

Project Activity	Receptors	Potential Impact	**Impact before mitigation**	**Mitigation measures**	**Impact after mitigation**
	Air Quality and Noise	could impact hearing of workers and surrounding public		• Noise attenuators like mufflers shall be installed in noisy equipment and machines • Use of appropriate PPE shall be instilled on all staff and visitors to site. • There shall be regular maintenance of the facility machines and generators (Gas and diesel backup). • Vehicles shall be used off during unloading and offloading of materials	
	Water quality, Soil quality and Public Health	• Waste generated from the production process if improperly managed or disposed could affect land use	M	• Impermeable bunds shall be built around fuel storage containers to avoid spillage into soil	L

Project Activity	Receptors	Potential Impact	**Impact before mitigation**	**Mitigation measures**	**Impact after mitigation**
				• There shall be proper contingency plan in place for prompt cleanup of spills • Materials Safety and Data Sheet of all toxic liquid/chemicals shall be kept on site • Sonnex shall segregate its waste and those for landfill kept in impervious materials and removed from the site by a LAWMA accredited contractor	
		• Reduce aesthetics	M	• Waste receptacles shall be provided within the facility with a designated	L

Project Activity	Receptors	Potential Impact	**Impact before mitigation**	**Mitigation measures**	**Impact after mitigation**
				well maintained solid waste area • Proper housekeeping shall be maintained within the site	
		• Reduction in groundwater recharge through infiltration as a result of abstraction for washing of the PET bottles	H	• Hydrocarbons, fuels, and lubricants to be used shall be stored in properly labeled oil storage tanks (surrounded with bund wall) • Waste and storage areas for hazardous substances shall be separated on site • Waste storage areas shall be located on paved surfaces • Covered waste receptacles shall be	M

Project Activity	Receptors	Potential Impact	**Impact before mitigation**	**Mitigation measures**	**Impact after mitigation**
				provided within a secured area	
		• Reduction in groundwater recharge through infiltration as a result of abstraction for washing of the PET bottles	H	• An Effluent Treatment Plant (ETP) shall be installed onsite for wastewater treatment prior to discharge. Absorbent kits shall be provided for prompt clean up in case of occasional oil spills • Sonnex shall ensure proper backfilling and landscaping of some portion of the facility to retain a means to recharge the underground aquifer during rainfall.	M

Project Activity	Receptors	Potential Impact	**Impact before mitigation**	**Mitigation measures**	**Impact after mitigation**
		• Pose risk to public health and plant materials	L	• An Effluent Treatment Plant (ETP) shall be installed onsite for wastewater treatment prior to discharge. Absorbent kits shall be provided for prompt clean up in case of occasional oil spills	Negligible
		• Waste generated from the production process if improperly managed or disposed could affect land use		• Waste and storage areas for hazardous substances shall be separated on site • Waste shall be segregated and	

Project Activity	Receptors	Potential Impact	**Impact before mitigation**	**Mitigation measures**	**Impact after mitigation**
				storage areas shall be located on paved surfaces • Covered waste receptacles shall be provided within a secured area	
ransportation of Raw Materials and Finished Products	Air quality, noise and Road traffic	• Traffic congestion due to additional vehicles on adjoining roads to the site	M	• Only contractor and distributors with qualified drivers and relevant licenses and trainings shall be engage for haulage service • Proper traffic management plan shall be developed for the proposed project • Adequate parking space shall be provided for loading and unloading trucks	L

Project Activity	Receptors	Potential Impact	**Impact before mitigation**	**Mitigation measures**	**Impact after mitigation**
				with indiscriminate parking on the road dissuaded	
		• Noise and noxious gas emissions from vehicles	M	• There shall be regular maintenance of plant machineries • Acoustic enclosures shall be installed on noisy equipment • Sonnex shall ensure provision and enforcement of use of appropriate PPE • There shall be regular maintenance of back-up gas fired generator well as diesel back- up generator	L
Gas and Diesel (As backup) Generators operation		Increased gaseous emissions from diesel generator back-up	H	• Regular maintenance of generator shall be done	M

Project Activity	Receptors	Potential Impact	**Impact before mitigation**	**Mitigation measures**	**Impact after mitigation**
				• Installed stack height for generator shall be according to extant standard specifications	
		• increased noise level for the Generator sets operations	M	• Regular maintenance of generator as at when due shall be maintained • Generators with sound proof or those installed with attenuators shall be installed for use	L
Wastewater Management		• Untreated or improperly treated wastewater discharged into the environment through the outfalls could contaminate the soil and ground water	M	• An Effluent Treatment Plant (ETP) shall be installed onsite for wastewater treatment prior to discharge.	L

Project Activity	Receptors	Potential Impact	**Impact before mitigation**	**Mitigation measures**	**Impact after mitigation**
	Soil and groundwater	• Poor wastewater treatment or sludge discharges could contaminate soil and groundwater as well as constitute nuisance and pose as health risks.	M	• An Effluent Treatment Plant (ETP) shall be installed onsite for wastewater treatment prior to discharge. • Sludge shall be collected, squeezed and bagged for proper disposal by an accredited LAWMA contractor	L
Solid and other Wastes Management		• Odour and aesthetic devaluation may result from improper handling. Increase in disease if dumped in water	M	• Waste and storage areas for hazardous substances like spent oil shall be separated on site • Waste shall be segregated and storage areas shall	L

Project Activity	Receptors	Potential Impact	**Impact before mitigation**	**Mitigation measures**	**Impact after mitigation**
				be located on paved surfaces • Covered waste receptacles shall be provided within a secured area	
		• Improperly managed solid and liquid wastes could release toxins into the existing food chain	H	• The waste area shall be paved and covered from rain with regular disposal done by a LAWMA accredited vendor • Covered bins shall be provided in strategic areas of the facility • Spent oil shall be containerized and disposed of in an environmentally friendly manner	M
		• Create breeding grounds for disease	H	• Covered bins shall be provided in strategic areas of the facility	M

Project Activity	Receptors	Potential Impact	**Impact before mitigation**	**Mitigation measures**	**Impact after mitigation**
		vectors and rodents that pose health risks			
		• Release of gases into the atmosphere	M	• The waste area shall be paved and covered from rain with regular disposal done by a LAWMA accredited vendor	L
		• Improper discharge of solid and liquid wastes into the environment would alter land use, contribute toxic materials that enter the soil, and groundwater through percolation, drainages, and leachates.	H	• Waste and storage areas for hazardous substances like spent oil shall be separated on site • Waste shall be segregated and storage areas shall be located on paved surfaces Covered waste receptacles shall be provided within a secured area	M

Project Activity	Receptors	Potential Impact	**Impact before mitigation**	**Mitigation measures**	**Impact after mitigation**
Machines and Generator set Maintenance		• Contamination of soil and water system with effluent and used oil resulting from maintenance activities	M	• Spent oil shall be containerized and disposed of in an environmentally friendly manner • There shall be good housekeeping as well as spill containment kit in place	L
		• Accidental damage to equipment leading to fire incident	M	• Sonnex shall equip its facility with regularly serviced fire extinguishers • There shall be a designated muster point • Regular training of staff members as safety marshals shall be ensured	L

Project Activity	Receptors	Potential Impact	**Impact before mitigation**	**Mitigation measures**	**Impact after mitigation**
		• Contamination of soil and water system with effluent and used oil resulting from maintenance activities	H	• An Effluent Treatment shall be installed in the facility for effluent treatment. • Spent or used oil shall be containerized and disposed of in an environmental friendly manner	M
		• Used oils and toxic materials waste during maintenance of machines and generator sets could release toxic materials including hydrocarbons into the soil and groundwater under extensive conditions.	H	• Spent or used oil shall be containerized and disposed of in an environmental • Proper housekeeping shall be maintained during maintenance activities	M

Project Activity	Receptors	Potential Impact	**Impact before mitigation**	**Mitigation measures**	**Impact after mitigation**
		• Improper disposal and management of disused machine parts could alter land used, affect aesthetics, and contribute contaminants to the environment	M	• Sonnex shall regularly segregate its waste and scrap metals or used machine parts shall be reused or recycled	L
Health, safety and welfare of staff		• Fall, slips and trips Injuries, electric shocks, etc.	M	• Sonnex shall ensure personnel are provided with safety harness while climbing heights • Proper signage like wet floor etc shall be in place during domestic housekeeping • Electrical fittings shall be well insulated • Snnnex shall have a clinic facility as well as trained first aiders	L

Project Activity	Receptors	Potential Impact	**Impact before mitigation**	**Mitigation measures**	**Impact after mitigation**
				with well equipped first aid boxes	
		• Work related issues such as discrimination, denial of rights, unfair treatment, poor working conditions	M	• Sonnex shall ensure proper working conditions which is line with extant labour laws for its workers • There shall be methods for grievance resolution in place in the facility	L

Key: L –Low; M- Medium; H-High

Table 6.4: Mitigation Measures for the Potential Negative Impacts of the proposed PET bottles recycling facility for Decommissioning phase

Project Activity	**Receptors**	**Potential impacts**	**Impact before mitigation**	**Mitigation measures**	**Impact after mitigation**
Dismantling of Structures	Air Quality and Noise	• Dismantling activities could increase particulates in the air and background noise level	M	Sonnex shall • Use well maintained vehicles for its activities and shall have regular maintenance culture	L

				• Barricade work areas and create a buffer zone between the area and the surrounding environment • Use water sprinkling at intervals to suppress particulate caused by the decommissioning activities • Maintain proper cleanliness and housekeeping on site • Ensure transportation of scraps and debris should shall be in enclosed container trucks with proper PPEs enforced on site	
	General aesthetics	• Lack of adequate planning and implementation in structure dismantling could leave rubbles and wastes lying	L	• Maintaining cleanliness around and within the plant • Proper fencing and landscaping	Negligible

		around on the premise and reduce aesthetics			
	Land Use	• Discharge of rubbles and wastes into the environment would alter land use and affect topography in the area	L	Sonnex shall ensure • Proper segregation of waste shall be carried out on site • Waste disposal of waste going to the landfill shall be handled by a LAWMA accredited vendor. • The decommissioned area shall be refilled and re-vegetated to stall possible erosion due to removal of structures	Negligible
		• Blockage of existing drainage in the area and contamination of groundwater	M	Sonnex shall ensure • Regular desilting of surrounding drainage throughout the	L

				decommissioning activities • Proper maintenance of the waste and good housekeeping at the site	
		• Loss of jobs	H	Sonnex shall • Notify the workers on time of its intention to decommission the project • Avail the disengaged workers relevant compensation and allowances as appropriate	M
Removal of materials from site	Transportation	• Discharge of rubbles and wastes into the environment would alter land use and affect topography in the area	M	Sonnex shall • Create and monitor waste collection schedules • Proper routing of material delivery trucks limiting collection of dismantled materials and daytime hours • Only modern and well maintained equipment	L

				and machinery shall be used	
	Air Quality and noise	• Noise and noxious gas emissions from vehicles and generators	M	Sonnex shall • Limit collection and disposal of waste materials to daytime hours • Incorporate use of low-noise equipment • Locate mechanical equipment in proper acoustically lined enclosures • Proper fencing of work area shall be done at the site	L
	Socio-economics	• Health impact from air contamination from vehicle	L	Sonnex shall • Restrict unattended public access • Provide adequate safety measures and Personal Protective	Negligible

				• Implement its health and safety policy standards	

Key: L –Low; M- Medium; H-High

CHAPTER SEVEN

ENVIRONMENTAL MANAGEMENT PLAN

7.1 Introduction

This chapter presents the Environmental Management Plan (EMP) for the proposed Sonnex Packaging Nigeria Limited 100 tons/day PET recycling plant, Ikorodu LGA, Lagos State. Environmental Management Plan is an important management tool, which demonstrates how the environmental impacts identified for the proposed Project in which mitigation measures have been proffered shall be managed as the proposed project progresses. It states categorically how commitments will be implemented to ensure wholesome environmental practice. The EMP has been designed in line with the Environmental Policy of Sonnex Packaging Nigeria Limited and also in accordance with ISO 14001 Environmental Management System requirements. However, the EMP for the proposed PET recycling plant project in conjunction with the various mitigation measures for potential impacts shall form the basis for the actual project implementation.

7.2 Objectives of Environmental Management Plan

The objectives of the EMP include:

- To ensure that all mitigation measures proffered in the EIA document for eliminating, minimizing and enhancing the projects adverse and beneficial effects respectively are fully implemented.
- To provide basis and standards needed for the overall planning, monitoring auditing and review of environmental and socio-economic performance throughout the project life cycle.
- Address concerns and issues raised by the relevant stakeholders and those that will likely continue to arise during the project's lifetime;
- Prepare and maintain records of project environmental performance (i.e. monitoring, audits and non-compliance tracking).

7.3 Environmental Monitoring Programme

Environmental monitoring programme serves as key part of the operational activities, and it is likely to generate the necessary information for environmental management and information dissemination. It is expected that monitoring of key environmental parameters will be conducted during the key phases of the project: design, construction and operation. This plan will play a fundamental role in ensuring that the trends for specific parameters are tracked and it will provide information on compliance with regulations, set guidelines or desirable operational

limits; and form the basis for corrective actions and modification of project activities if necessary. The intensity of sampling will depend on the time and location of the activities and results derived from monitoring data.

7.3.1 Monitoring Objectives

The aim of the monitoring is to establish proper monitoring criteria to verify the predicted impact of the project, and to ensure that any unpredicted impacts are detected, and the mitigation measure are adjusted where needed at an early stage. The monitoring will keep relevant records to ensure compliance with exhaustive environmental procedures recommended. The monitoring plan will ensure that mitigating measures and impacts of the project during construction and operation phases are implemented.

The monitoring needs of the project will address the negative impacts to be generated during the implementation of the project at rehabilitation and operational phases. The key components of the proposed environmental monitoring plan are as follows:

- Demonstrate that the project activities (construction and operation) are carried out in accordance with the prescribed mitigation measures and existing compliance regulatory procedures.
- Provide early warning signals whenever an impact indicator approaches a critical level and
- Check the effectiveness of suggested mitigation measures

Impact indicators are therefore defined in terms of carrying capacity, threshold levels, and regulation and enforcement standards. Implementation of the EMP will allow Sonnex Packaging Nigeria Limited to actually control and manage the timing, location and level of impacts and provide the cause and effect data for the observed confirmation or validation of various analytical models of action/impact relationships.

Construction Phase

During the construction phase of the project, the mitigation measures for noise, water quality, dust, air quality and public safety would be assessed using visual assessment by the management and feedback from the other stakeholders. The nature and extent of pollution observed will be determined by laboratory analyses of samples taken from site. Appropriate measures shall then be taken to rectify the problem.

Operation Phase

The monitoring plan at this phase will ensure that the negative impacts of the operation and maintenance of the machines and equipment as well as other ancillary facilities are reduced to barest minimum. This will guarantee the safety and health of employees and the public at large.

7.3.2 Monitoring Requirements

A monitoring program requires a number of components to ensure effective results. These include:

- Relevant baseline data against which to benchmark and monitor project results;
- Verifiably objective indicators for each project and project component for which monitoring will be conducted;
- An independent body (Consultant) responsible for monitoring on a regular basis and those responsible for monitoring must have the technical capability and necessary equipment for such;
- An effective monitoring reporting mechanism including feedbacks and commitment to action on monitoring results and recommendations.

The Environmental Monitoring Programme identifies the environmental monitoring requirements to ensure that all the mitigation measures identified in this EMP are implemented effectively. Environmental monitoring methodology for this project includes:

- Audit of detailed designs
- Audit and approval of site environmental planning documents
- Consultations with members of the host LGA (Ikorodu LGA) and village(Parafa Village) other project affected communities in the area as well as other stakeholders as required
- Routine inspection to confirm or otherwise the implementation and effectiveness of required environmental mitigation measures

Non-compliance to environmental mitigation measures identified in the EMP will be recommended to the concerned parties by the HSE Department of Sonnex Packaging Nigeria Limited as required. The non-compliance notification will identify the problems, including the actions the concerned parties must take with time frame for implementing the corrective action.

The monitoring plan defines roles and responsibilities distinguishing between the routine monitoring of the project. Routine monitoring focuses mainly on construction supervision and raising awareness in the perspective of human health and safety and environmental protection. Where applicable monitoring costs are estimated and roles and responsibilities for monitoring

are also defined.

7.3.3 Roles and Responsibilities

The execution of this EMP and its requirements shall be the responsibility of Sonnex Packaging Nigeria Limited and all the contractors and subcontractors engaged in the three phases of the proposed PET recycling plant project. Also, Sonnex shall ensure adequate collaboration with relevant government agencies with specific responsibilities as assigned in this document.

Sonnex Packaging Nigeria Limited through its HSE Department shall also be responsible for the implementation and supervision of social and environmental check-list and for the overall supervision of both the contractors and the consultants during the entire project phases. A summary of roles and responsibilities are as presented in Tables 7.1 – 7.5.

7.3.4 Training and Capacity Building

The HSE Unit shall work alongside the Human Resources Department of Sonnex Packaging Nigeria Limited to build employees capacity and raise contractors' environmental awareness. This is to ensure adequate understanding of the project environmental aspects and how their roles impact on the environment. A training budget must be put aside to empower this regular capacity building.

7.3.5 Complaints and Incident Reporting

Environmental complaints and incidents shall be referred to the HSE Manager for undertaking complaint/incident investigation procedures. All complaints shall be acknowledged and worked on promptly. Overall, the following procedures shall be followed:

- Identify and undertake any action required, communicate response action to complainant (if requested by complainant)
- Log complaint/incident, date of receipt and acknowledge complaint receipt
- Investigate the complaint/incident to determine its validity and to assess the source of the problem
- Log the date of resolution
- Report the complaint in monthly monitoring report including actions, resolution status and any outstanding actions required.

7.3.6 Monitoring Plan Reporting

The HSE Department and Environmental Consultant of Sonnex Packaging Nigeria Limited shall include results of the EMP monitoring in a monthly report for submission to the concerned regulatory agencies throughout the proposed project's lifespan. The format of the monthly report shall be as recommended by the relevant agencies with the following aspects inclusive:

- Key environmental problems encountered, and actions taken to rectify problems.
- Status of implementation of relevant environmental mitigation measures pertaining to the works
- Description and results of environmental monitoring activities undertaken during the month.
- Key environmental issues to be addressed in the coming month.

7.3.7 Reporting procedure

The HSE Department of Sonnex Packaging Nigeria Limited shall prepare a bi-annual Environmental Report that will form the basis of assessing environmental performance. The report shall contain the results of the environmental monitoring and the need for plan adjustment. A regular environmental report comprising of the results of the monitoring will be prepared and made available to the Federal and State Ministry of Environment in the areas of influence as follows;

- Air quality and Noise monitoring report - Quarterly
- Soil Monitoring - Biannually
- Groundwater - Monthly
- Effluent water - Monthly

During the construction phase, Sonnex Packaging Nigeria Limited shall ensure that the contractors implement the mitigation measures recommended in the EIA report. Again, the company HSE Department shall ensure that construction workers are briefed with respect to possible environmental risks and their obligation to prevent or minimise them.

7.3.8 Environmental Awareness Training

It is the responsibility of Sonnex Packaging Nigeria Limited to ensure contractors provide adequate environmental awareness through tool box meetings and regular training for site personnel and that all construction workers receive an induction presentation on the importance and implications of the EMP. For the employees during the operation phase, adequate and regular environmental awareness trainings shall be provided with respect to individual and collective responsibilities in relation to their specific roles in the company.

Sonnex Packaging Nigeria Limited shall identify, plan, monitor, and record training needs for personnel whose work may have a significant adverse effect on the environmental or social conditions. The project identifies that it is important that all employees are aware of the

company's environmental policy; potential impacts of their activities; as well as their roles and responsibilities in achieving conformance with the policy and procedures.

Mostly, training should include:

- The importance of complying with the EMP
- The potential environmental impacts of project activities
- Benefits of improved personal performance
- Employees' roles and responsibilities, including emergency preparedness
- Mitigation measures that must be implemented when carrying out these activities
- Specifics of this EMP (e.g. the must dos and no-go areas, etc.)
- Management structure of individuals responsible for matters pertaining to the EMP

The HSE and Human Resources Departments shall keep records of all environmental training sessions, including names, dates, and the information presented.

7.3.9 Community consultation meetings

During public consultative meetings with all affected communities, the HSE department of Sonnex Packaging Nigeria Limited shall interact with the community by organising stakeholder's consultation meetings on issues that should be considered and investigated under the project.

7.3.10 Monitoring: Measurements and Procedures

Regular observation and measurement of selected variables shall be undertaken in order to identify the nature and magnitude of longer-term impacts of the project. Hence, the regulatory authorities with responsibility for oversight functions, in the monitoring and enforcement of environmental quality at the Federal Level (FMEnv, NESREA) and State Level (Lagos State Ministry of Environment & Water Resources and LASEPA) shall work in collaboration with Sonnex Packaging Nigeria Limited HSE department during the project operation phase to ensure compliance with relevant extant national and international legislations with respect to the mitigation measures ensuring monitoring indicators during the project phases are within permissible limits.

Table 7.1: Environmental Management Plan for the proposed PET bottles recycling facility for Pre-construction phase

Project Activity	Receptors	Potential impacts	Impact before mitigation	Mitigation measures	Impact after mitigation	Monitoring	Time/Frequency	Responsibility
Mobilization of workers and materials to site	Social infrastructure and community health and safety	• Increase in traffic volume including potential for road accident	L	Sonnex shall • Drivers shall be provided with traffic information to enable them take routes of least traffic volume. • Only qualified drivers with relevant licenses and trainings shall convey personnel and equipment to site • Project vehicles shall only operate at stipulated periods	Negligible	• Records of journey management plan implementation	Weekly during mobilization	Construction Contractor, HSE Manager for the Project

				strategically planned to occur during low traffic hours.				
Site clearing and preparation	Terrestrial flora and fauna	• Vegetation loss	M	Sonnex shall ensure • Clearing of vegetation shall be limited to the Project site. • Use of herbicides for vegetation clearing shall be avoided.	L	• Site surveys and photographic records of the cleared site	• Weekly during site clearing	Construction Contractor, HSE Manager for the Project
		• Loss of individual or localized population of fauna species including disturbance to	M	• Areas that are cleared but not used for operations shall be restored and re-vegetated with native plant species.	L	• Site surveys and photographic records of the cleared site	• Weekly during site clearing	Construction Contractor, HSE Manager for the Project

		avifauna species						
	Soil	• Soil compaction and degradation	L	• Vehicular and personnel movement shall be restricted to road areas • All project vehicles shall be properly serviced and maintained • All kinds of wastes shall be properly collected in impervious materials and removed from vehicles and project site by accredited contractors	Negligible	• Monitoring the quantity of excavated soil generated and reused for backfilling	• Weekly during site clearing	Construction Contractor, HSE Manager for the Project
			L	• Areas that are cleared but not used for	L	• Monitoring the quantity of	• Weekly during site clearing	Construction Contractor, HSE Manager for the Project

		• Increased erosion potential		operations shall be restored and re-vegetated with native plant species.		excavated soil generated and reused for backfilling		
		• Reduction in structural stability as well as soil percolation ability.	L	• Clearing of vegetation shall be limited to the Project site.	L	• Monitoring the quantity of excavated soil generated and reused for backfilling	• Weekly during site clearing	Construction Contractor, HSE Manager for the Project
	Air Quality	• Decease in ambient air quality Increase in noise level with its associated effects on the	L	• All project vehicles shall be properly serviced and maintained • Appropriate use of Personal Protective equipment shall be enforced • Noise impacts shall be reduced by enclosing and insulating	L		• Weekly during mobilization	Construction Contractor, HSE Manager for the Project

		nearby sensitive receptors		noise emitting equipment. • Site clearing equipment/machinery shall be turned off when not in use. • Site clearing activities shall be limited to daytime as much as possible.				

Key: L-Low; M-Medium; H-High

Table 7.2: Environmental Management Plan for the proposed PET bottles recycling facility for Construction phase

Project Activity	Receptors	Potential Impact	Impact before mitigation	Mitigation measures	Impact after mitigation	Monitoring	Timeline /Frequency	Responsibility
• Earth and Pavement works Welding and installation works	Air Quality	• Decrease in ambient air quality	M	• Measures to reduce dust, such as water suppression, shall be used where possible. • Regular maintenance and servicing of construction equipment that contribute to air emission shall be implemented. • Only modern and well maintained equipment and machinery shall be used	L	• Air quality in -situ sampling and measurement methods. Air monitoring parameters shall include SPM, NOx, CO, CO_2 and SO_2,	• Monthly throughout construction	Construction Contractor, HSE Manager for the Project

Project Activity	Receptors	Potential Impact	Impact before mitigation	Mitigation measures	Impact after mitigation	Monitoring	Timeline /Frequency	Responsibility
				for construction activities				
		• Increase in noise level with potential impact on the nearby sensitive receptors	M	• All equipment shall be maintained in line with manufacturer's specifications. • Construction activities with high levels of noise shall be limited to daytime • Noise attenuators like mufflers shall be installed on equipment casing noise.	L	• Noise monitoring/ measurement methods will follow Nigerian guidelines. • Noise monitoring locations will cover within and around the Project site	• Monthly throughout construction	Construction Contractor, HSE Manager for the Project

Project Activity	Receptors	Potential Impact	Impact before mitigation	Mitigation measures	Impact after mitigation	Monitoring	Timeline /Frequency	Responsibility
				• Personal Protective Equipment shall be used as appropriate				
• Stripping of Top soil • Debris generation from construction waste • Vehicular movement	Soil	• Soil compaction	M	• Excavation shall be restricted only to marked out areas • Stockpiles shall be well covered to reduce soil loss as a result of wind or water erosion. • Disturbed areas shall be rehabilitated as soon as possible to	L	• Monitoring the quantity of excavated soil generated and reused for backfilling • Soil quality monitoring (parameters to be analysed include: pH, conductivity, cations, anions, hydrocarbons, heavy metals, microbial organisms	• Weekly throughout construct • Monthly through construction	Construction Contractor, HSE Manager for the Project

Project Activity	Receptors	Potential Impact	Impact before mitigation	Mitigation measures	Impact after mitigation	Monitoring	Timeline /Frequency	Responsibility
				prevent erosion.				
		• Reduction in structural stability and percolation ability of soil	L	Soil conservation measures shall be implemented such as stockpiling topsoil for the remediation of disturbed areas	Negligible	• Soil quality monitoring (parameters to be analyzed include: pH, conductivity, cations, anions, hydrocarbons, heavy metals, microbial organisms	• Monthly through construction	Construction Contractor, HSE Manager for the Project

Project Activity	Receptors	Potential Impact	Impact before mitigation	Mitigation measures	Impact after mitigation	Monitoring	Timeline /Frequency	Responsibility
		• Blocking of existing drainage facility in the area	L	• Sonnex contractor shall avoid blocking of existing drains while regular cleaning and desilting will also be carried out	Negligible	• Daily desilting of surrounding drainage	• Daily through construction	Construction Contractor, HSE Manager for the Project
• Drainage works Solid waste generation	Groundwater	• Groundwater contamination	M	• Sonnex contractor ensure safe storage and handling practices including rapid spill response and clean-up	L	• Daily desilting of surrounding drainage • Regular disposal of solid waste by an accredited vendor	Daily through construction Weekly	Construction Contractor, HSE Manager for the Project

Project Activity	Receptors	Potential Impact	Impact before mitigation	Mitigation measures	Impact after mitigation	Monitoring	Timeline /Frequency	Responsibility
		• Clogging of existing drainage	M	• Sonnex contractor shall ensure regular cleaning and desilting of drains	L			
		• Contamination of groundwater and surface water where applicable through erosion during the rains	M	Sonnex shall ensure • Proper waste containment and designated storage areas on site • Solid waste storage areas shall be paved with prompt	L	• Groundwater monitoring at the nearby communities • Parameters to be monitored include: ground water level, pH, TDS, turbidity, electrical conductivity	• Monthly during construction Weekly	Construction Contractor, HSE Manager for the Project HSE Manager for the Project Accredited LAWMA vendor

Project Activity	Receptors	Potential Impact	Impact before mitigation	Mitigation measures	Impact after mitigation	Monitoring	Timeline /Frequency	Responsibility
				evacuation by an accredited LAWMA vendor				
• Infrastructure such as housing for construction workers	• Socioeconomic and health • The host community and general public	• Influx of people, increase in sexual transmitted diseases; pressure on existing infrastructure	H	• Sonnex contractor shall ensure employment of its workers from the host community who stay around	M	• Formal and informal feedback from locals Maintain Grievance logbook	Monthly	Construction Contractor, HSE Manager for the Project
		• Increased traffic and safety impacts	H	• Project vehicles shall only operate at stipulated periods strategically planned to occur during low traffic hours	M		• Formal and informal feedback from locals • Compilation of statistics on numbers of accidents in conjunction	Construction Contractor, HSE Manager for the Project

Project Activity	Receptors	Potential Impact	Impact before mitigation	Mitigation measures	Impact after mitigation	Monitoring	Timeline /Frequency	Responsibility
				• Only qualified drivers with relevant licenses and trainings shall convey personnel and equipment to site			with local authorities	
• Use of construction equipment Work on height and use of hot objects during construction	Occupational Health and Safety (health, safety, and welfare of construction workers)	• Injury to construction workers due to construction activities	M	• Sonnex contractor shall Implement its Health and Safety policy as well as have daily tool box meeting on site • Provision and enforcement of appropriate PPE use by workers on site	L	• Emergency Response Plan • Incident and accident records • Grievance Logbook	Quarterly • Daily	Implementation monitoring) HSE Manager for the Project

Project Activity	**Receptors**	**Potential Impact**	**Impact before mitigation**	**Mitigation measures**	**Impact after mitigation**	**Monitoring**	**Timeline /Frequency**	**Responsibility**
		• Fall from height and possibility of workers getting burns while on site	M	• Sonnex shall provide necessary PPEs like safety harness and coveralls to enhance personnel safety on site	L	• Incident and accident records	Quarterly	HSE Manager for the Project
Demobilization of workers	• Socioe conomi	• Air Quality and Noise Level	M	• Project vehicles shall only operate at low traffic hours • All vehicles and machinery shall be properly serviced and maintained •Appropriate use of Personal Protective	L	• Throughout the construction period		Construction Contractor

Project Activity	Receptors	Potential Impact	Impact before mitigation	Mitigation measures	Impact after mitigation	Monitoring	Timeline /Frequency	Responsibility
	c and health			equipment shall be enforced				
		• Transportation	M	• Drivers shall be provided with traffic information to enable them take routes of least traffic volume • Project vehicles shall only operate during low traffic hours	L			

Table 7.3: Environmental Management Plan for the proposed PET bottles recycling facility for Operation phase

Project Activity	Receptors	Potential Impact	**Impact before mitigation**	**Mitigation measures**	**Impact after mitigation**	**Monitoring**	**Timeline /Frequency**	**Responsibility**
Production Machines Operations	Air Quality and Noise	• Noise from production activities could impact hearing of workers and surrounding public	H	• Sonnex shall carry out regular maintenance of machines and generators • Noise attenuators like mufflers shall be installed in noisy equipment and machines • Use of appropriate PPE shall be instilled on all staff and visitors to site. • There shall be regular maintenance of the facility machines and generators (Gas and diesel backup).	M	• Air quality in-situ sampling and measurement methods. • Air monitoring parameters will include CO, TSP, NOx, CO_2, SO_2 • Noise monitoring/ measurement methods shall follow Nigerian guidelines • Noise monitoring locations will cover within and around the Project site	Quarterly Quarterly	HSE Manager FMEnv, NESREA, Lagos State Ministry of Environment, Ikorodu LGA

Project Activity	Receptors	Potential Impact	**Impact before mitigation**	**Mitigation measures**	**Impact after mitigation**	**Monitoring**	**Timeline /Frequency**	**Responsibility**
				• Vehicles shall be used off during unloading and offloading of materials				
	Water quality	• Waste generated from the production process if improperly managed or disposed could affect land use	M	• Impermeable bunds shall be built around fuel storage containers to avoid spillage into soil • There shall be proper contingency plan in place for prompt cleanup of spills • Materials Safety and Data Sheet of all toxic liquid/chemicals shall be kept on site	L	• Groundwater sampling and laboratory analysis. • The ground water monitoring parameters shall include heavy metals and hydrocarbons among others.	Monthly	HSE Manager FMEnv, NESREA, Lagos State Ministry of Environment, Ikorodu LGA

Project Activity	Receptors	Potential Impact	**Impact before mitigation**	**Mitigation measures**	**Impact after mitigation**	**Monitoring**	**Timeline /Frequency**	**Responsibility**
				• Sonnex shall segregate its waste and those for landfill kept in impervious materials and removed from the site by a LAWMA accredited contractor				
		• Reduction in groundwater recharge through infiltration as a result of abstraction for washing of the PET bottles	H	• An Effluent Treatment Plant (ETP) shall be installed onsite for wastewater treatment prior to discharge. Absorbent kits shall be provided for prompt clean up in case of occasional oil spills	M	• Treated Effluent sampling and laboratory analysis. • The Effluent water monitoring parameters shall include heavy metals Chemical and Biochemical Oxygen Demand and	Monthly	HSE Manager FMEnv, NESREA, Lagos State Ministry of Environment, Ikorodu LGA

Project Activity	Receptors	Potential Impact	**Impact before mitigation**	**Mitigation measures**	**Impact after mitigation**	**Monitoring**	**Timeline /Frequency**	**Responsibility**
				• Sonnex shall ensure proper backfilling and landscaping of some portion of the facility to retain a means to recharge the underground aquifer during rainfall.		hydrocarbons among others.		
		• Waste generated from the production process if improperly managed or disposed could affect land use	M	• Waste and storage areas for hazardous substances shall be separated on site • Waste shall be segregated and storage areas shall be located on paved surfaces • Covered waste receptacles shall	L	• Daily gathering and disposal to designated waste dump	Weekly	HSE Manager, accredited LAWMA contractor

Project Activity	Receptors	Potential Impact	**Impact before mitigation**	**Mitigation measures**	**Impact after mitigation**	**Monitoring**	**Timeline /Frequency**	**Responsibility**
				be provided within a secured area				
Transportation of Raw Materials and Finished Products	Air quality, noise and Road traffic	• Traffic congestion due to additional vehicles on adjoining roads to the site	M	• Only contractor and distributors with qualified drivers and relevant licenses and trainings shall be engage for haulage service • Proper traffic management plan shall be developed for the proposed project • Adequate parking space shall be provided for loading and unloading trucks with indiscriminate parking on the road dissuaded	L	• Air quality in-situ sampling and measurement methods. • Air monitoring parameters will include CO, TSP, NOx, CO_2, SO_2	Quarterly	HSE Manager FMEnv, NESREA, Lagos State Ministry of Environment, Ikorodu LGA

Project Activity	Receptors	Potential Impact	**Impact before mitigation**	**Mitigation measures**	**Impact after mitigation**	**Monitoring**	**Timeline /Frequency**	**Responsibility**
		• Noise and noxious gas emissions from vehicles	M	• There shall be regular maintenance of plant machineries • Acoustic enclosures shall be installed on noisy equipment • Sonnex shall ensure provision and enforcement of use of appropriate PPE • There shall be regular maintenance of back-up gas fired	L	• Noise monitoring/ measurement methods will follow Nigerian guidelines • Noise monitoring locations will cover the Project site and the nearest residential houses	Quarterly	HSE Manager FMEnv, NESREA, Lagos State Ministry of Environment, Ikorodu LGA

Project Activity	Receptors	Potential Impact	**Impact before mitigation**	**Mitigation measures**	**Impact after mitigation**	**Monitoring**	**Timeline /Frequency**	**Responsibility**
				generator well as diesel back- up generator				
Gas and Diesel (As backup) Generators operation		Increased gaseous emissions from diesel generator back-up	H	• Regular maintenance of generator shall be done • Installed stack height for generator shall be according to extant standard specifications	M	• Air quality in-situ sampling and measurement methods. • Air monitoring parameters will include CO, TSP, NOx, CO_2, SO_2	Quarterly	HSE Manager FMEnv, NESREA, Lagos State Ministry of Environment, Ikorodu LGA
		• increased noise level for the Generator sets operations	M	• Regular maintenance of generator as at when due shall be maintained	L	• Noise monitoring/ measurement methods will follow Nigerian guidelines	Quarterly	HSE Manager FMEnv, NESREA, Lagos State Ministry of Environment, Ikorodu LGA

Project Activity	Receptors	Potential Impact	**Impact before mitigation**	**Mitigation measures**	**Impact after mitigation**	**Monitoring**	**Timeline /Frequency**	**Responsibility**
				• Generators with sound proof or those installed with attenuators shall be installed for use		• Noise monitoring locations will cover the Project site and the nearest residential houses		
Wastewater Management	Soil and groundwater	• Untreated or improperly treated wastewater discharged into the environment through the outfalls could contaminate the soil and ground water	M	• An Effluent Treatment Plant (ETP) shall be installed onsite for wastewater treatment prior to discharge.	L	• Waste water sampling and laboratory analysis. • The waste water monitoring parameters will include heavy metals, biochemical oxygen demand and hydrocarbons among others.	Monthly	HSE Manager FMEnv, NESREA, Lagos State Ministry of Environment, Ikorodu LGA
Solid and other Wastes Management		• Odour and aesthetic devaluation	M	• Waste and storage areas for hazardous	L	• Proper daily waste	Weekly	HSE Manager, LAWMA

Project Activity	Receptors	Potential Impact	**Impact before mitigation**	**Mitigation measures**	**Impact after mitigation**	**Monitoring**	**Timeline /Frequency**	**Responsibility**
		may result from improper handling. Increase in disease if dumped in water		substances like spent oil shall be separated on site • Waste shall be segregated and storage areas shall be located on paved surfaces • Covered waste receptacles shall be provided within a secured area		segregation and waste storage		accredited waste contractor
Health, safety and welfare of staff		• Fall, slips and trips Injuries, electric shocks, etc.	M	• Sonnex shall ensure personnel are provided with safety harness while climbing heights • Proper signage like wet floor etc shall be in place during domestic housekeeping	L	Incident and accident ecords Grievance Log	Quarterly	HSE Manager for the Project

Project Activity	Receptors	Potential Impact	**Impact before mitigation**	**Mitigation measures**	**Impact after mitigation**	**Monitoring**	**Timeline /Frequency**	**Responsibility**
				• Electrical fittings shall be well insulated • Snnnex shall have a clinic facility as well as trained first aiders with well equipped first aid boxes				

Table 7.4: Environmental Monitoring Programme during Operations

Environmental Component	**Indicator (Parameters to be Monitored)**	**Sampling Location**	**Frequency**	**Responsibility**	**Monitoring**
Air Quality	CO, SO_2, NO_2, SPM,H_2S,CO_2,$PM_{2.5}$,PM_{10}	Within and around the factory	Quarterly	Sonnex Packaging Nigeria Limited HSE department,	FMEnv. NESREA, Lagos State Ministry of Environment Ikorodu LG
Noise	Ambient Noise Level (dBA)	At various intervals (e.g. 5, 10m) from the generator area	Quarterly		
Soil	Hydrocarbons, heavy metals, pH, TOC, cations and anions, Texture	Around the factory area	Biannually		
Groundwater	Sulphate, Phosphate, Nitrate, TS,TSS,TDS, pH, Conductivity, Chloride, heavy metals, hydrocarbons	Existing groundwater sources within site and project area of influence	Monthly		

Environmental Component	Indicator (Parameters to be Monitored)	Sampling Location	Frequency	Responsibility	Monitoring
Effluent water	Sulphate, Phosphate, Nitrate, TS,TSS,TDS, pH, Conductivity, Chloride, BOD,COD, heavy metals, hydrocarbons	Effluent Treatment Plant	Monthly		
Socio-economic and health	Concerns on the environmental / health status or public nuisance that may emanate from the factory operations	Communities around the factory	Every 3 years (during Environmental Audit)		

Table 7.5: Monitoring Variables, Indicators to be considered

Summary of Action Plan for Significant Areas of Non-Conformance				
Issue	**Action/Measures**	**Responsibility**	**Parameter**	**Duration**
Environmental Audit Report	Submission to the Regulatory Agency	Environmental Consultant and Sonnex Packaging Nigeria Limited HSE Manager	Evidence of submission	A month from submission by Consultant
Environmental Safeguard Instrument	Disclosure of all the Safeguard instruments in line with relevant regulations	Sonnex Packaging Nigeria Limited HSE Manager		Six months from the submission of this report, and when projects are to be implemented
Capacity building	Train staff and contractors in Environmental and issues such as Environmental components	Sonnex Packaging Nigeria Limited HSE Manager	Capacity to follow through	

Summary of Action Plan for Significant Areas of Non-Conformance				
Issue	**Action/Measures**	**Responsibility**	**Parameter**	**Duration**
	affected by project activities, Pollution monitoring and reporting system, Train employees and contractors on general environnemental management practices			
Working with other Ministries Developments and Agencies	Ensure adequate and proper linkage	Sonnex Packaging Nigeria Limited HSE Manager	Good synergy	On going
Work Site Management, Site drainage Management, Erosion and sedimentation control	Follow the Mitigation measures Suggested. Ensure proper drainage channels that do not constitute nuisance to surrounding neighbors Designs and actual installation must ensure prevention of downstream erosion by stabilizing disturbed soil areas. Maintain a high degree of orderliness and housekeeping to ensure there are no opportunities for fires to start, minimize tripping hazards, reduce double handling of trash and materials, and contribute to the effective way of doing business and a positive safe work environment through cleanliness shall be promoted always.	Contractors monitored by Sonnex Packaging Nigeria Limited	Zero incident, support from the community, aesthetics	During work

Summary of Action Plan for Significant Areas of Non-Conformance				
Issue	**Action/Measures**	**Responsibility**	**Parameter**	**Duration**
Contractor Responsibility	Ensure contractors submit work plan proposal that include how HSE issues will be handled in the course of project execution	Sonnex Packaging Nigeria Limited HSE Manager	Compliance with Sonnex Packaging Nigeria Limited HSE Policy	During work
Noise	Measurement of levels	Lagos State Ministry of Environment and or LASEPA, Sonnex Packaging Nigeria Limited		During construction and operation phases
Emission	Measurement of dust levels	Lagos State Ministry of Environment and or LASEPA, Sonnex Packaging Nigeria Limited		During civil works
Solid waste	Ensure evacuation from point of generation	Contractor and by Consultant	aesthetics	Throughout project lifecycle
Poor Record Keeping	Develop mechanism for proper paper trail and documentation for environmental management issues	HSE Officer	Document control	Throughout project lifecycle
Risk/Hazard Identification	Ensure hazards and risks are routinely assessed at the project site and arising issues dealt with. Ensure Safe system to eliminate the risk wherever possible and where elimination is not possible then other means adopted including engineering and management	Sonnex Packaging Nigeria Limited /Contractor	Zero incident	Throughout project lifecycle

Summary of Action Plan for Significant Areas of Non-Conformance				
Issue	**Action/Measures**	**Responsibility**	**Parameter**	**Duration**
	techniques to reduce the risks to As Low As is Reasonably Practicable (ALARP)			
PPE & First Aid	Adequate Provision and use for contractor staff	Sonnex Packaging Nigeria Limited /Contractor	Zero incident	Throughout project lifecycle
Disordered work sites	Good housekeeping	Contractors	Zero incident,	Construction phase
Public Concerns/Complaints	Put mechanism in place for responding quickly to reports of the public	Sonnex Packaging Nigeria Limited	Support from the community	Throughout project lifecycle

Key: L-Low; M-Medium; H-High

7.4 Waste Management

The management of waste that is associated with the project shall be in accordance with FMEnv's principle/guidelines. The principle of waste reduction, recycling, recovery and reuse shall be practiced. All waste materials, which cannot be reused, will be managed and disposed of in accordance with FMEnv and Lagos Waste Management Authority's (LAWMA) waste management guidelines. The nature of waste materials and disposal methods that must be considered for the proposed project are;

- Monitoring of alterations in the existing physical, chemical, biological and socio-economic characteristics of the environment
- Ascertaining whether any detected changes in the biophysical and socio-economic environment were caused by the project or by other natural factors.
- Monitoring and control of emissions and discharges and ensure compliance with local, national and international standards.
- Determination of effectiveness of the mitigation/enhancement measures for adverse and beneficial impacts respectively.
- Assurance of continual interactions and flow of information between Sonnex Packaging Nigeria Limited and relevant stakeholders.
- Measurement of long term impacts of the project.

Meanwhile, Sonnex Packaging Nigeria Limited shall comply with the FMEnv regulatory controls as well as monitor specific environmental parameters at the various phases of the Project. The monitoring programme will include biodegradable, non-biodegradable and industrial wastes. Non-hazardous and non-biodegradable waste, such as; paper, plastics bottles waste etc. that will require pre-collection in appropriate sized waste bins and collection for transportation to an approved dumpsite. While disposal of biodegradable wastes will require pre-collection in marked or colored waste bins. Solid wastes will include: metal scraps, woods and high molecular weight plastic materials that must be collected in skips of the right sizes. This will be collected and transported for sorting, reuse and/or disposal according to the FMEnv and LAWMA waste management guidelines.

Process Wastewater from the production process shall not be allowed in the public drain channels but directed for treatment in the company's Effluent Treatment Plant (ETP), tested to ensure compliance with relevant regulatory standards before final discharge into public drains.

7.5 Contingency/Emergency Plans

In addition to the above mitigation measures, Sonnex shall put in place contingency plan in case of emergency which shall be addressed in the design consideration of the facility. During operation phase the production hall will be hot but there shall be adequate ventilation plan & installation of heat extractors and industrial fans in place. This area shall be equipped with blowers to ensure proper aeration. Moreover Heat Ventilation and Air Conditioning system shall be provided in the administrative section and other areas where applicable. Emergency evacuation plan shall be put in place to ensure that personnel and visitors to the factory are not trapped. These preventive measures and design considerations will ensure a continuous and uninterrupted operation in the facility. However, the following emergency/contingency plans shall also be in place:

- Installation of fire suppression system
- Design of emergency evacuation routes and adequate safety signs shall be in place to ensure safety on site and easy evacuation
- Regular training of workforce and visitors on the emergency preparedness within the facility
- Constitute an in-house emergency committee coordinated by the Health and Safety department to manage any emergency
- Incorporate the community and relevant government bodies in its emergency response plan.
- Carry out regular inspection of the contingency management system.
- Create good access and aisle area with a designated muster point shall be available at the proposed site
- Installation of CCTV cameras to aid security measures in addition to use of corporate security outfits in collaboration with the police.

7.6 Audit Plan

An audit programme shall be in place to revive and verify effectiveness of the EMP and EMS in general. It shall include audits by auditors independent of the process or facility audited. Audit follow -up shall be timely and thorough. A schedule of environmental audits/reviews will be developed for all phases of the project to monitor site activities and the effectiveness of the EMP. Reviews and audits will be carried out including review of design drawings, specifications and other documents to verify that environmental objective and requirements will be satisfied. Audits of site operations at key stages during the construction phase.

7.7 Resourcing

Sonnex Packaging Nigeria Limited shall consider environmental management as an important aspect of project procedures. Therefore, in any project an Environmental Consultant is always an integral part of the team. In the proposed PET recycling plant project, an environmental main point has been appointed to liaise between the engineering project managers and the Environmental Consultants as well as advise on all environmental issues in conformity with Sonnex Packaging Nigeria Limited company policy.

CHAPTER EIGHT

REMEDIATION PLAN AFTER DECOMMISSIONING/CLOSURE

8.1 Site Restoration

Sonnex Packaging Nigeria Limited is committed to responsible sustainable growth as stewards of the environment by ensuring protection of habitat for vegetation and wildlife. The project area on decommissioning will be restored to pre-development conditions, subject to environmental requirements and any conditions or agreements made with the Federal Ministry of Environment. The Sonnex Packaging Nigeria Limited proposed PET recycling plant project will develop a Rehabilitation Plan, which will be designed to restore habitat in areas that were affected by the facility infrastructure. This plan will be developed in consultation with appropriate agencies, prior to commencement of decommissioning works. It is expected that a Rehabilitation Plan will include, but not limited to;

- Removal of any impacted soils, if any, and replacement with suitable clean fill material
- Re-vegetation of the project location using native plant material and seeds as appropriate
- Removal of all containers and heavy vehicles from the project site

The rehabilitation plan will also involve a monitoring period which would allow for the project area to experience seasonal changes and help to determine if additional restoration is required.

8.2 Management of Waste and Excess Materials after Decommissioning

Decommissioning of the project will result in the production of waste and excess materials. Waste streams will be disposed of in accordance with State and Federal regulations in effect at the time of decommissioning as applicable. Since the project would include buildings requiring demolition and containers used for office purposes, the Contractor would be required to perform the following:

- Prior to demolition work, conduct a waste audit, covering the waste that would be generated in the demolition project
- Prepare a written report of the waste audit
- Prepare a written waste reduction work plan based on the waste audit to reduce, reuse and recycle waste generated in the demolition project
- Implement the waste reduction work plan

- Implement measures to communicate the plan to workers at the demolition site

As part of the waste reduction work plan, efforts will be made to find industry users that could benefit from waste materials generated during demolition, including:

- Concrete and aggregate manufacturers
- Electrical equipment manufacturers and resellers
- Mechanical equipment manufacturers and resellers
- Metal recycling facilities

All excess materials and waste will be transported off-site by transport trailer or dump truck as required, by a licensed hauler to licensed facilities. Any hazardous wastes that are used on site, such as lubricating oils, will be removed and disposed at a licensed facility.

Table 8.1: Environmental and Social Management Measures for the Decommissioning Phase

Project Activity	Potential impacts	Impact before mitigation	Mitigation measures	Impact after mitigation	Monitoring	Time/Frequency	Responsibility
Demolition activities	• Soil contamination due to waste generation; soil compaction	L	Sonnex shall ensure • Machinery, and dismantled materials are taken offsite for appropriate recycling. • Major electrical items are removed from site and recycled appropriately. • All impacted soil area shall be re-vegetated with native plant species • Waste receptacles shall be provided within a secured	Negligible	• Soil quality monitoring (parameters to be monitored include pH, TOC, heavy metals and hydrocarbons)	Twice during decommissioning	Sonnex HSE Unit FMEnv, NESREA, Lagos State Ministry of Environment and Ikorodu Local Government

			area within the project site for collection of solid waste and periodically evacuated and disposed of at a government approved dumpsite by an accredited waste contractor				
Dismantled equipment and materials from site including wastes	• Air quality impairment by gaseous and particulate pollutants; increase in dust level.	M	Sonnex shall ensure • An approved decommissioning plan by the regulatory bodies shall be implemented. • Regular cleaning of equipment to avoid excessive build- up of dirt and mud • Project vehicles with efficient	L	• Dust mitigation programme as part of Site Closure and Restoration Plan	• Monthly during decommissioning	HSE Department, FMEnv, NESREA, Lagos State Ministry of Environment and Ikorodu Local Government

			engine performance and with minimal emissions shall be selected and used through regular servicing and maintenance. • All materials with potential to result in dust emissions shall be covered during transport				
	• Discomforting noise from equipment and related activities with attendant health effects.	M	Sonnex shall ensure • Equipment with sound power levels are used and well maintained. • Acoustic enclosures shall be installed on equipment casing radiating noise. • Installation of suppression	L	• Noise monitoring at sensitive receptors in and around the site during decommissioning • Measurements of noise levels will be conducted using an ambient noise meter	• Monthly during decommissioning	Sonnex HSE Unit FMEnv, NESREA, Lagos State Ministry of Environment and Ikorodu Local Government

			equipment (e.g. mufflers) • Provision and use of appropriate PPE by site workers				
	• Groundwater contamination from spills	L	• Training shall be provided for workers on safe storage and handling practices • Rapid spill response and clean-up techniques shall be done during induction. • Spill control and response plans to respond to spills and leaks shall be implemented. • Waste receptacles shall be provided	Negligible	• Groundwater monitoring Parameters to be monitored include: ground water level, pH, TDS, turbidity, electrical conductivity, DO, COD, BOD, TSS, alkalinity, acidity, heavy metals, cations, anions, hydrocarbon, microbial	• Twice during decommissioning	Sonnex HSE Unit FMEnv, NESREA, Lagos State Ministry of Environment and Ikorodu Local Government

			within a secured area within the project site for collection of solid waste. • General wastes that cannot be reused shall be periodically evacuated and disposed of at a government approved dumpsite by an accredited waste contractor				
Removal of Plant's associated components; transportation of dismantled equipment and materials	• Traffic due to transportation of dismantled equipment and materials	L	• Journey management plans with particular attention to peak hour • Sonnex shall engage relevant local authorities to repair any	L	• Sonnex shall collect formal and informal feedback from locals	• Monthly throughout decommissioning	Sonnex HSE Department FMEnv, NESREA, Lagos State Ministry of Environment and Ikorodu Local Government

from site including wastes	from site including wastes		damage to the road as a result of the project activities. • Trained and licensed drivers shall be used on site				
	• Reduction in structural stability as well as soil percolation ability.	L	• Clearing of vegetation shall be limited to the Project site.	L	• Monitoring the quantity of excavated soil generated and reused for backfilling	• Weekly during site clearing	Construction Contractor, HSE Manager for the Project
	• Exposure to injuries, electrical shock, falling from height; slip, trip	L	• Occupational Health and Safety Management System of Sonnex Packaging Nigeria Limited shall be adopted	L	• Incident and accident records	• Weekly throughout decommissioning	Sonnex HSE Department FMEnv, NESREA, Lagos State Ministry of Environment and Ikorodu Local Government

	and fall, etc.		and implemented. • Appropriate PPE shall be provided and enforced • First aid box and trained first aiders shall be provided on field with retainership with approved hospitals				

CHAPTER NINE

CONCLUSION & RECOMMENDATION

9.1 Conclusion

The EIA study carried out for the proposed Sonnex Packaging Nigeria Limited 100tons per day PET recycling plant project was prepared in accordance with the provisions of the EIA Act CAP E12 LFN, 2004 by the FMEnv and other extant National, State and international requirements.The study provided all necessary information which are expected to satisfy all stakeholders as objective evidence required for developing the EIA. In order to achieve this, the study identified all the relevant environmental regulations that would affect the project, establish the baseline conditions of the project area, and ensure that potential environmental, social and health impacts of the proposed project were fully assessed. Also, practicable mitigation measures were recommended to manage the impacts associated with the project while a workable management plan was equally developed to mitigate unforeseen impacts that may arise.

The essence of the EIA study is aimed at ensuring informed decision-making and environmental accountability, and to assist in achieving environmentally sound operation throughout the Project life cycle. Consistent with the regulatory standards, the assessment of the environmental status and the socio-economic aspects of the proposed Project's area of influence have been carefully carried out using universally accepted methodology. Evaluation of associated and potential impacts of the Project identified both positive and negative interactions with the receiving biophysical and socio-economic environment. The positive impacts associated with the Project include;

- Acquisition of new skills through technology transfer.
- Revenue generation to the Government through taxes.
- Reduction in the volume of used PET bottle waste which often contributes nuisance to the environmental
- Direct and indirect employment opportunities.

However, the proposed site does not have persons domiciled on the site that would be permanently displaced and no relocation of community residents is required. There are no culturally significant sites or heritage resources within the Project area that would be negatively impacted. The potential negative effects identified were mostly of minor to moderate significance. The identified negative impacts can generally be reduced by implementing the recommended mitigation measures in this report. The necessary controls and mitigation measures as highlighted in chapter 6 of this report would help reduce the identified negative impacts to

as low as reasonably practicable. Similarly, an Environmental Management Plan (EMP) has been developed for the proposed project to assess the efficiency and effectiveness of the recommended mitigation measures and ensure long-term monitoring of the Project.

9.2 Recommendation

The management of Sonnex Packaging Nigeria Limited shall ensure that the proposed PET recycling plant Project is developed and operated in an environmentally sustainable manner, in accordance with extant National and International standards by properly managing the activities that may bring about disorder to the environment. Sonnex shall abide with extant laws as relevant to the proposed project and ensure implementation of the recommended mitigation measures and the developed EMP for the project. There would be continuous monitoring of environmental and social performance of the proposed Project, including periodic consultation with the relevant stakeholders.

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(http://www.recycletheone.com

APPENDIX

NO. RC. 380220

CORPORATE AFFAIRS COMMISSION
FEDERAL REPUBLIC OF NIGERIA

Certificate of Incorporation

I HEREBY CERTIFY that

BONNEK PACKAGING NIGERIA LIMITED

is this day Incorporated under the COMPANIES AND ALLIED MATTERS ACT 1990 and that the Company is Limited by Shares

Given under my hand at Abuja this 15TH **day of** MAY **Two Thousand**

Fees and Deed Stamps ₦150,100.00K

Stamp Duty on Capital ₦375,000.00K

U. F. ABDULLAHI

Registrar-General

FEDERAL MINSTRY OF ENVIRONMENT
ENVIRONMENTAL IMPACT ASSESSMENT DEPARTMENT
EIA SITE VERIFICATION ATTENDANCE

PROJECT PROPONENT: SONNEX PACKAGING NIGERIA LIMITED

PROJECT TITLE: 100 TONNES/DAY PET RECYCLING PLANT

LOCATION: IKORODU LGA, LAGOS STATE.

DATE: 08 / 09 /2022.

'N	Names of Participants	Organization	Phone Nos.	E-Mail	Signature
1	AGBENLA OLUWATOYIN	FMENV	08035489539	ooagbenle 2013@gmail.com	
2	Ajani Omotolani	LSMOEPWR	08021234463	gaususamani @ gmail.com	
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4.	KEHINDE TINUADE	—	08032040955	anseltennek@gmail.com	
5	ONANUSI SOLA	Armour weberg Ltd	08023313330	oonanusi@a2armweberg.com	
	OPAKUNLE RUTH	"	08164225748	danny@armourweberg.com	
7	Obisesan Oreoluwa	FMENV, Abj	08036597579	oredoll@yahoo.com	
8	Engr. Yahaya Sabo	—	08175236 28	Saboleso @gmail.com	
9.	Toluwaleke Abimbola Esq.	Sonnex	08066446839	toluwaleke.abimbola@sonnex.ng	
10	Adeyeni Aromolaran	Sonnex	07033168226	adeyeni.aromolaran@sonnex-nig.com	
11	Adesiyan Adeoye	Sonnex	07012317076	adesiyan.adeoye@sonnexng.com	

FEDERAL MINSTRY OF ENVIRONMENT
ENVIRONMENTAL ASSESSMENT DEPARTMENT
BASELINE DATA GATHERING ATTENDANCE SHEET

PROJECT PROPONENT: SONNEX PACKAGING NIGERIA LIMITED
PROJECT TITLE: 100 TONNES/DAY PET RECYCLING PLANT
LOCATION: IKORODU LGA, LAGOS STATE.
DATE: 08/09/2022

S/N	NAMES	ORGANIZATION	TELEPHONE NO.	E-MAIL ADDRESS	SIGNATURE
1.	Omodaratan Opeoluwa	Azmarineberg	09067950576	ayomideope@azmarineberg	
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5.	Adewale Lawal	Azmarineberg	08107250396	Adewalelawal0225@gmail.com	
6.	Adedeji Bidemi	Azmarineberg	09095474382	Bidemi@azmarineberg.com	
7	Engr. Yakubu Sabo	FMENV. Abuja	08175238728	SaboKe@gmail.ca	
8.	Obisesan Oredola m	fmEnv, Abuja	08036597579	oredoll@yahoo.com	
9	Akintoye Oyindamola	Azmarineberg	08179436974	Oyindamola@azmarineberg	
10	OJO Miracle	Azmarineberg	08130279379	ojomiracleone@gmail.com	
11	Bolaji Kofoworola	Azmarineberg	07037819295	Bolajikofoworola@gmail.com	

FEDERAL MINSTRY OF ENVIRONMENT
ENVIRONMENTAL ASSESSMENT DEPARTMENT
LABORATORY WITNESSING ATTENDANCE SHEET

PROJECT PROPONENT: SONNEX PACKAGING NIGERIA LIMITED
PROJECT TITLE: 100 TONNES/DAY PET RECYCLING PLANT
LOCATION: IKORODU LGA, LAGOS STATE
DATE: 08/09/2022

S/N	NAMES	ORGANIZATION	TELEPHONE NO.	E-MAIL ADDRESS	SIGNATURE
1	Sola Onanuga	Azmarineberg .com	08023313330	onanuga@azmarineberg .com	
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5	OJO Miracle	Azmarineberg	08130279379	ojomiracleone@gmail.com	
6	Obisesan Oreoluwa	FMEnv, Abuja	08036597579	Oredoll@yahoo.com	
7	Akintoye Oyindamola	Azmarineberg	08179436974	oyindam@azmarineberg.com	

AZMARINEBERG LIMITED
(FMEnv, NESREA, DPR, LASEPA and OGEPA accredited Environmental Consultants)
Plot 242A, Ganiyu Alimi Crescent, Gbagada Phase II, Gbagada, Lagos State.
Tel: 08021229523, 08038622956, 08055229091, www.azmarineberg.cominfo@azmarineberg.com

AZL/7.4/F1:CHAIN OF CUSTODY FORM

PROJECT INFORMATION	SAMPLING PERIOD	
	Date	Time
Project Name		
SONNEX PACKAGING NIGERIA LIMITED	8/9/22	
Project Location		
IKORODU, LAGOS STATE		

SAMPLE INFORMATION

SAMPLE ID	NATURE OF SAMPLE	NUMBER OF SAMPLES
GW Sonnex	Ground water	1
GWC Sonnex	Ground water	1
TS1 Sonnex	Top Soil	1
TS2 Sonnex	Top Soil	1
TS3 Sonnex	Top Soil	1
TS4 Sonnex	Top Soil	1
TS5 Sonnex	Top Soil	1
SS1 Sonnex	Sub Soil	1
SS2 Sonnex	Sub Soil	1
SS3 Sonnex	Sub Soil	1
SS4 Sonnex	Sub Soil	1
SS5 Sonnex	Sub Soil	1
TSC Sonnex	Sub Soil	1
SSC Sonnex	Sub Soil	1

REQUIRED PARAMETERS

pH	Aluminium
Colour	Free chlorine
Temperature	Potassium
Dissolved oxygen	Ammonia
Turbidity	Nitrite
Total dissolved Solid	Chemical oxygen
Total Suspended Solid	demand
Conductivity	Alkalinity
Biochemical	Salinity
Oxygen demand	Acidity
Total Hardness	
Chloride	
Sulphate	
Phosphate	
Calcium	
Magnesium	
Nitrate	
Arsenic	
Iron	
Mercury	
Cadmium	
Chromium	
Lead	
Manganese	
Copper	
Zinc	
Nickel	

FOR LABORATORY USE ONLY

RECEIVED BY: Akintoye Oyundando	DATE ANALYZED	CONDITION OF SAMPLE UPON ARRIVAL
DATE /SIGNATURE: 8/9/22	09/09/2022	well preserved & labelled

Obisesan Oreoluwa
08/09/22

Technical Manager

AZMARINEBERG LIMITED

Environmental Consultants

(FMEnv, NESREA, DPR, LASEPA and OGEPA accredited Environmental Consultant)

Plot 242A Ganiyu Alimi Crescent, Gbagada Phase 2, Lagos State.

Tel: 08021229523, 08038622956, 08055229091; www.azmarineberg.cominfo@azmarineberg.com

INSTITUTE OF PUBLIC ANALYST'S DECREE 1992

PUBLIC ANALYST CERTIFICATE

No Ref: AZM/GW/220908/396

To: Sonnex Packaging Nigeria Limited, Ikorodu, Lagos State.

I, the undersigned **PUBLIC ANALYST**, Registration number: **00610**, of **AZMARINE BERG LIMITED**, do hereby certify that on **08/09/2022**, a sample marked: **GW SONNEX; 08/09/2022**, weighing **1 LITRE**, was submitted to me by you as a sample of **GROUNDWATER** for analysis. The said sample while in the same condition as received by me was analyzed/examined by me, or under my direction. My findings findings are stated hereunder:

PHYSICO-CHEMICAL AND MICROBIOLOGY ANALYSIS REPORT

S/N	PARAMETERS	GROUND WATER	NESREA LIMIT	FMEnv LIMIT	STANDARD REFERENCE
1	pH @25°C	**4.80**	6.5-9.2	6.5-8.5	APHA 4500-H B
2	TEMPERATURE (°C)	23.70	NS	NS	APHA 2550 B
3	SALINITY (ppt)	0.01	NS	NS	APHA 2520 B
4	ELECTRICAL CONDUCTIVITY (µs/cm)	14.58	NS	NS	APHA 2510-B
5	TOTAL DISSOLVED SOLID (mg/L)	7.26	NS	500	APHA 2540 C
6	TOTAL SUSPENDED SOLID (mg/L)	4.00	NS	10.0	APHA 2540 D
7	DISSOLVED OXYGEN (mg/L)	3.30	NS	7.5	APHA 4500-O G
8	COLOR (Pt.Co)	**23.00**	50	15.0	APHA 2120 D
9	TURBIDITY (NTU)	1.00	NS	1.0	APHA 2130 B
10	ACIDITY (mg/L)	10.38	NS	NS	APHA 2310 B
11	NITRATE (mg/L)	7.45	50	10.0	APHA 4500 NO_3 B
12	NITRITE (mg/L)	0.83	2	1.0	APHA 4500 NO_2 B
13	FREE CHLORINE (mg/L)	0.07	NS	0.4	APHA 4500-Cl G
14	PHOSPHATE (mg/L)	0.29	NS	5	APHA 4500 P G
15	AMMONIA (mg/L)	0.00	NS	1.0	APHA 4500-NH_3 B
16	SULPHATE (mg/L)	12.00	400	500	APHA 4500 S0 E
17	CHLORIDE (mg/L)	5.54	600	250	APHA 4500-Cl B
18	SODIUM (mg/L)	2.70	NS	200	APHA 3500-Na B
19	OIL & GREASE (mg/L)	0.00	NS	0.05	APHA 5520 B
20	IRON (mg/L)	0.380	1.0	1.0	APHA 3111 B
21	LEAD (mg/L)	<0.001	NS	0.05	APHA 3111 B
22	COPPER (mg/L)	0.060	1.5	0.1	APHA 3111 B
23	CADMIUM (mg/L)	<0.001	NS	0.01	APHA 3111 B
24	CHROMIUM (mg/L)	<0.001	NS	0.05	APHA 3111 B
25	BARIUM (mg/L)	0.025	NS	1.0	APHA 3111 B
26	ARSENIC (mg/L)	<0.001	NS	0.2	APHA 3113 B
27	ZINC (mg/L)	0.061	15	5.0	APHA 3111 B
28	NICKEL (mg/L)	<0.001	NS	0.05	APHA 3111 B
29	MERCURY (mg/L)	<0.001	NS	0.001	APHA 3112
30	MANGANESE (mg/L)	0.012	0.5	0.05	APHA 3111 B
31	TOTAL HYDROCARBON CONTENT (mg/L)	0.0000	NS	NS	APHA 5520 F
	MICROBIOLOGY TEST (cfu/ml)				
32	TOTAL HETEROTROPHIC BACTERIA	72	NS	NS	APHA 9215 B
33	TOTAL HYDROCARBON UILIZING BACTERIA	0	NS	NS	APHA 9215 B
34	TOTAL HYDROCARBON UTILIZING FUNGI	0	NS	NS	APHA 9225 B
35	TOTAL HETEROTROPHIC FUNGI	71	NS	NS	APHA 9225 B
36	TOTAL COLIFORM COUNT	**7**	10	0	APHA 9215 B
37	*E. coli*	0	0	0	APHA 9225 B

COMMENTS

- The result of physico-chemical analysis of the groundwater sample was not in conformity with standards specified by NESREA and FMEnv for groundwater quality due to its low pH value. However, it exceeded FMEnv limit for color but within NESREA limit.
- Microbial analysis of the sample show that total coliform count was detected and was above specified limit by FMEnv for total coliform count although it was within NESREA limit.
  E.coli was not detected and was within specified limit by NESREA and FMEnv.

RECOMMENDATION

- Proper treatment of the groundwater may improve the quality of the water.

Laboratory conditions
Temperature: 25°C
Labelling: Good

Abbreviations
NS: Not Stated
CFU: Colony Forming Unit

As witness by my hand this 22/09/2022

INSTITUTE OF PUBLIC ANALYSTS OF NIGERIA
(Established by Decree No. 100 of 1992)
Practice Licence No.00610
Signature: .....
Date: 22/09/2022

AZMARINEBERGLIMITED

Environmental Consultants

(FMEnv, NESREA, DPR, LASEPA and OGEPA accredited Environmental Consultant)

Plot 242A Ganiyu Alimi Crescent, Gbagada Phase 2, Lagos State.

Tel: 08021229523, 08038622956, 08055229091; www.azmarineberg.cominfo@azmarineberg.com

INSTITUTE OF PUBLIC ANALYST'S DECREE 1992

PUBLIC ANALYST CERTIFICATE

Ref No: AZM/GWC/220908/397

To: Sonnex Packaging Nigeria Limited, Ikorodu, Lagos State.

I, the undersigned **PUBLIC ANALYST**, Registration number: **00610**, of **AZMARINE BERG LIMITED**, do hereby certify that on **08/09/2022**, a sample marked: **GWC SONNEX; 08/09/2022**, weighing **1 LITRE**, was submitted to me by you as a sample of **GROUNDWATER** for analysis. The said sample while in the same condition as received by me was analyzed/examined by me, or under my direction. My findings are stated hereunder:

PHYSICO-CHEMICAL AND MICROBIOLOGY ANALYSIS REPORT

S/N	PARAMETERS	GROUNDWATER CONTROL	NESREA LIMIT	FMEnv LIMIT	STANDARD REFERENCE
1	pH @25°C	**4.70**	6.5-9.2	6.5-8.5	APHA 4500-H B
2	TEMPERATURE (°C)	25.40	NS	NS	APHA 2550 B
3	SALINITY (ppt)	0.01	NS	NS	APHA 2520 B
4	ELECTRICAL CONDUCTIVITY (µs/cm)	160.8	NS	NS	APHA 2510-B
5	TOTAL DISSOLVED SOLID (mg/L)	79.60	NS	500	APHA 2540 C
6	TOTAL SUSPENDED SOLID (mg/L)	0.00	NS	10	APHA 2540 D
7	DISSOLVED OXYGEN (mg/L)	3.10	NS	7.5	APHA 4500-O G
8	COLOR (Pt.Co)	0.00	50	15.0	APHA 2120 D
9	TURBIDITY (NTU)	0.00	NS	1.0	APHA 2130 B
10	ACIDITY (mg/L)	11.02	NS	NS	APHA2310 B
11	NITRATE (mg/L)	8.18	50	10.0	APHA 4500 NO_3 B
12	NITRITE (mg/L)	0.27	2	1.0	APHA 4500 NO_2 B
13	FREE CHLORINE (mg/L)	0.05	NS	0.4	APHA 4500-Cl G
14	PHOSPHATE (mg/L)	0.35	NS	5	APHA 4500 P G
15	AMMONIA (mg/L)	0.00	NS	1.0	APHA 4500-NH_3 B
16	SULPHATE (mg/L)	15.00	400	500	APHA 4500 S0 E
17	CHLORIDE (mg/L)	8.19	600	250	APHA 4500-Cl B
18	SODIUM (mg/L)	3.16	NS	200	APHA 3500-Na B
19	OIL & GREASE (mg/L)	0.00	NS	NS	APHA 5520 B
20	IRON (mg/L)	0.255	1.0	1.0	APHA 3111 B
21	LEAD (mg/L)	<0.001	NS	0.05	APHA 3111 B
22	COPPER (mg/L)	0.083	1.5	0.1	APHA 3111 B
23	CADMIUM (mg/L)	<0.001	NS	0.01	APHA 3111 B
24	CHROMIUM (mg/L)	<0.001	NS	0.05	APHA 3111 B
25	BARIUM (mg/L)	0.019	NS	1.0	APHA 3111 B
26	ARSENIC (mg/L)	<0.001	NS	0.2	APHA 3113 B
27	ZINC (mg/L)	0.049	15	5.0	APHA 3111 B
28	NICKEL (mg/L)	<0.001	NS	0.05	APHA 3111 B
29	MERCURY (mg/L)	<0.001	NS	0.001	APHA 3112
30	MANGANESE (mg/L)	0.038	0.5	0.05	APHA 3111 B
31	TOTAL HYDROCARBON CONTENT (mg/L)	0.0000	NS	NS	APHA 5520 F
	MICROBIOLOGY TEST (cfu/ml)				
32	TOTAL HETEROTROPHIC BACTERIA	75	NS	NS	APHA 9215 B
33	TOTAL HYDROCARBON UTILIZING BACTERIA	0	NS	NS	APHA 9215 B
34	TOTAL HETEROTROPHIC FUNGI	69	NS	NS	APHA 9225 B
35	TOTAL HYDROCARBON UTILIZING FUNGI	0	NS	NS	APHA 9225 B
36	TOTAL COLIFORM COUNT	0	10	0	APHA 9215 B
37	*E. coli*	0	0	0	APHA 9225 B

COMMENTS

- The result of physico-chemical analysis of the groundwater sample was not in conformity with standards specified by NESREA and FMEnv for groundwater quality due to its low pH value.
- Microbial analysis of the sample show that total coliform count and *E.coli* were not detected and were within specified limits by FMEnv and NESREA.

RECOMMENDATION

- Treatment of the groundwater may improve the quality of the water.

Laboratory conditions
Temperature: 25°C
Labelling: Good

Abbreviations
NS: Not Stated
CFU: Colony Forming Unit

As witness by my hand this 22/09/2022

INSTITUTE OF PUBLIC ANALYSTS OF NIGERIA
(Established by Decree No. 100 of 1992)
Practice Licence No.00610
Signature: ..... Date: 22/09/2022

AZMARINEBERG LIMITED
Environmental Consultants

(FMEnv, NESREA, DPR, LASEPA and OGEPA accredited Environmental Consultant)
Plot 242A Ganiyu Alimi Crescent, Gbagada Phase 2, Lagos State.
Tel: 08021229523, 08038622956, 08055229091; www.azmarineberg.cominfo@azmarineberg.com

INSTITUTE OF PUBLIC ANALYST'S DECREE 1992
PUBLIC ANALYST CERTIFICATE

Ref No: AZM/SS/220908/398-403

To: Sonnex Packaging Nigeria Limited, Ikorodu, Lagos State.

I, the undersigned **PUBLIC ANALYST**, Registration number: **00610**, of **AZMARINE BERG LIMITED**, do hereby certify that on **08/09/2022**, samples marked:, **TS1-TS3, SS1-SS3 SONNEX; 08/09/2022**, weighing **100g each**, was submitted to me by you as a sample of **SOIL** for analysis. The said sample while in the same condition as received by me was analyzed/examined by me, or under my direction. My findings are stated hereunder:

PHYSICO-CHEMICAL AND MICROBIOLOGY ANALYSIS REPORT

S/N	PARAMETERS	SOIL SAMPLES						ALLOWAY 1995
		TS1	SS1	TS2	SS2	TS3	SS3	
1	pH (soil: water ratio, 1:2)	7.20	7.00	7.00	7.10	7.10	7.20	NS
2	COLOR (Munsell color chat)	Reddish brown	Reddish brown	Reddish brown	Reddish brown	Reddish brown	Reddish brown	NS
3	CONDUCTIVITY (µs/cm)	72.34	91.10	89.11	85.32	75.08	90.45	NS
4	POROSITY (%)	3.39	4.33	5.06	3.87	4.55	4.75	NS
5	PERMEABILITY (cm/s)	1.1×10^{-5}	1.1×10^{-5}	1.4×10^{-5}	1.4×10^{-5}	1.2×10^{-5}	1.0×10^{-5}	NS
6	BULK DENSITY (g/cm^3)	1.25	1.06	1.77	1.52	1.64	1.33	NS
7	MOISTURE CONTENT (%)	1.03	2.15	1.54	2.38	1.38	2.01	NS
8	TOTAL ORGANIC CARBON (%)	1.10	1.41	1.26	1.27	1.03	1.08	NS
9	CATION-EXCHANGE-CAPACITY (meq/100gm)	3.44	3.20	3.18	3.04	2.90	3.29	NS
10	CLAY (%)	82.37	82.75	79.18	81.06	80.06	80.21	NS
11	SAND (%)	9.95	10.14	11.47	10.57	10.88	11.23	NS
12	SILT (%)	7.68	7.11	9.35	8.37	9.06	8.56	NS
13	SULPHATE (mg/kg)	10.29	10.17	8.40	12.65	9.32	9.20	NS
14	PHOSPHATE (mg/kg)	5.21	5.43	4.76	4.18	5.11	4.75	NS
15	NITRATE (mg/kg)	6.38	6.11	6.12	5.72	6.46	5.89	NS
16	CALCIUM (mg/kg)	1.17	1.30	1.01	1.04	1.50	1.16	NS
17	MAGNESIUM (mg/kg)	2.40	2.67	2.23	2.28	2.75	2.43	NS
18	SODIUM (mg/kg)	9.13	9.28	8.84	9.01	9.02	8.72	NS

COMMENTS

- The result of metal analysis in the soil samples are in compliance with standards specified by ALLOWAY 1995.
- No specified limit for soil microbiology by ALLOWAY 1995.

Laboratory conditions
Temperature: 25°C
Labelling: Good

As witness by my hand this 22/09/2022

INSTITUTE OF PUBLIC ANALYSTS OF NIGERIA
(Established by Decree No. 100 of 1992)
Practice Licence No.00610
Signature: .....
Date: 22/09/2022

19	POTASSIUM (mg/kg)	5.10	4.76	4.77	5.29	5.25	5.02	NS
20	ZINC (mg/kg)	1.29	2.44	1.56	1.85	1.41	2.13	NS
21	CHROMIUM (mg/kg)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	NS
22	COPPER (mg/kg)	0.631	0.545	0.604	0.581	0.582	0.604	2-50
23	LEAD (mg/kg)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	2-65
24	NICKEL (mg/kg)	0.110	0.086	0.129	0.103	0.145	0.092	10-1000
25	MERCURY (mg/kg)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	NS
26	CADMIUM (mg/kg)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.1-1
27	ARSENIC (mg/kg)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	NS
28	IRON (mg/kg)	0.233	0.203	0.265	0.221	0.240	0.236	NS
29	TOTAL HYDROCARBON CONTENT (mg/kg)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	NS
	MICROBILOGY TEST (cfu/g)							
30	TOTAL HETEROTROPHIC BACTERIA	150×10^2	190×10^2	52×10^2	46.5×10^2	119×10^2	111×10^2	NS
31	TOTAL HYDROCARBON UTILIZING BACTERIA	0	0	0	0	0	0	NS
32	TOTAL HETEROTROPHIC FUNGI	71×10^2	68.5×10^2	9.5×10^2	4×10^2	19.5×10^2	15×10^2	NS
33	TOTAL HYDROCARBON UTILIZING FUNGI	0	0	0	0	0	0	NS
34	TOTAL COLIFORM COUNT	0	0	0	0	0	0	NS
35	*E.coli*	0	0	0	0	0	0	NS

AZMARINEBERG LIMITED

Environmental Consultants

(FMEnv, NESREA, DPR, LASEPA and OGEPA accredited Environmental Consultant)

Plot 242A Ganiyu Alimi Crescent, Gbagada Phase 2, Lagos State.

Tel: 08021229523, 08038622956, 08055229091; www.azmarineberg.cominfo@azmarineberg.com

INSTITUTE OF PUBLIC ANALYST'S DECREE 1992

PUBLIC ANALYST CERTIFICATE

Ref No: AZM/SS/220907/404-409

To: Sonnex Packaging Nigeria Limited, Ikorodu, Lagos State.

I, the undersigned **PUBLIC ANALYST**, Registration number: **00610**, of **AZMARINE BERG LIMITED**, do hereby certify that on **08/09/2022**, samples marked:, **TS4-TS5, SS4-SS5, TSC-SSC SONNEX; 08/09/2022**, weighing **100g each**, was submitted to me by you as a sample of **SOIL** for analysis. The said sample while in the same condition as received by me was analyzed/examined by me, or under my direction. My findings are stated hereunder:

PHYSICO-CHEMICAL AND MICROBIOLOGY ANALYSIS REPORT

S/N	PARAMETERS	SOIL SAMPLES				CONTROL SAMPLES		ALLOWAY 1995
		TS4	SS4	TS5	SS5	TSC	SSC	
1	pH (soil: water ratio, 1:2)	7.30	7.00	7.00	7.10	7.50	7.30	NS
2	COLOR (Munsell color chat)	Reddish brown	Reddish brown	Reddish brown	Reddish brown	Brown	Brown	NS
3	CONDUCTIVITY (µs/cm)	85.40	81.26	74.28	83.17	81.30	85.38	NS
4	POROSITY (%)	4.21	3.98	3.80	4.19	3.91	5.10	NS
5	PERMEABILITY (cm/s)	1.0×10^{-5}	1.2×10^{-5}	1.1×10^{-5}	1.3×10^{-5}	1.2×10^{-5}	1.0×10^{-5}	NS
6	BULK DENSITY (g/cm^3)	2.15	1.80	1.92	1.64	2.38	2.05	NS
7	MOISTURE CONTENT (%)	1.41	2.46	1.19	2.23	1.90	2.30	NS
8	TOTAL ORGANIC CARBON (%)	1.35	1.35	1.16	1.19	1.85	1.54	NS
9	CATION-EXCHANGE-CAPACITY (meq/100gm)	3.06	3.18	3.25	3.35	3.61	3.32	NS
10	CLAY (%)	81.25	80.83	80.53	82.45	84.10	86.42	NS
11	SAND (%)	9.81	10.19	10.15	10.28	8.82	9.18	NS
12	SILT (%)	8.94	8.98	9.32	7.27	7.08	4.40	NS
13	SULPHATE (mg/kg)	9.59	13.48	10.10	11.09	7.24	8.13	NS
14	PHOSPHATE (mg/kg)	4.92	5.09	5.38	5.22	6.33	6.21	NS
15	NITRATE (mg/kg)	6.20	6.23	6.04	6.04	7.15	7.04	NS
16	CALCIUM (mg/kg)	1.36	1.45	1.22	1.09	2.06	1.92	NS
17	MAGNESIUM (mg/kg)	2.51	2.10	2.36	2.31	3.32	3.15	NS

COMMENTS

- The result of metal analysis in the soil samples are in compliance with standards specified by ALLOWAY 1995.
- No specified limit for soil microbiology by ALLOWAY 1995.

Laboratory conditions

Temperature: 25°C

Labelling: Good

As witness by my hand this 22/09/2022

INSTITUTE OF PUBLIC ANALYSTS OF NIGERIA
(Established by Decree No. 100 of 1992)
Practice Licence No:00610
Signature:
Date: 22/09/2022

18	SODIUM (mg/kg)	9.34	8.94	9.25	9.35	10.57	9.83	NS
19	POTASSIUM (mg/kg)	4.91	4.93	4.83	5.11	5.63	5.45	NS
20	ZINC (mg/kg)	2.03	2.25	1.91	1.70	2.18	2.33	NS
21	CHROMIUM (mg/kg)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	NS
22	COPPER (mg/kg)	0.593	0.592	0.618	0.568	0.624	0.626	2-50
23	LEAD (mg/kg)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	2-65
24	NICKEL (mg/kg)	0.102	0.118	0.134	0.107	0.103	0.129	10-1000
25	MERCURY (mg/kg)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	NS
26	CADMIUM (mg/kg)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.1-1
27	ARSENIC (mg/kg)	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	NS
28	IRON (mg/kg)	0.257	0.212	0.261	0.219	0.318	0.284	NS
29	TOTAL HYDROCARBON CONTENT (mg/kg)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	NS
	MICROBILOGY TEST (cfu/g)							
30	TOTAL HETEROTROPHIC BACTERIA	94×10^2	81.5×10^2	53.5×10^2	58.5×10^2	170×10^2	211×10^2	NS
31	TOTAL HYDROCARBON UTILIZING BACTERIA	0	0	0	0	0	0	NS
32	TOTAL HETEROTROPHIC FUNGI	89×10^2	17.5×10^2	8.5×10^2	6×10^2	99.5×10^2	74×10^2	NS
33	TOTAL HYDROCARBON UTILIZING FUNGI	0	0	0	0	0	0	NS
34	TOTAL COLIFORM COUNT	0	0	0	0	48.5×10^2	89×10^2	NS
35	*E.coli*	0	0	0	0	0	0	NS

SOCIO- ECONOMIC AND HEALTH ASSESSMENT QUESTIONNAIRE FOR THE ENVIRONMENTAL IMPACT ASSESSMENT OF SONNEX PACKAGING NIGERIA LIMITED, IKORODU, LAGOS

Name of Community.....

L.G.A.....

Date .....

DEMOGRAPHICS

Sex a) Male b) Female

Age a) <20years b) 20-39years c) 40-59years d) >60years

Education a) Primary b) Secondary/Vocational c) Tertiary d) No formal Education

Religion a) Christian b) Muslim c) Traditional

Marital Status a) Single b) Married c) Widowed/Widower d) Divorced

Ethnic Group a) Yoruba b) Hausa c) Igbo d) other (specify)

What is the size of your household?.....

What do you do in this area?

a) Live here b) work here c) Live & Work here d) Visiting

How long have you lived/worked here?

a)<1yr b) 1-2yrs c) 3-5yrs d) 6-10yrs e) 11-20yrs f) 21-30yrs g)>30years

Source of Income

Respondent's primary occupation/main source of income

a) Student b) Trading c) Artisan d) Farming e) Civil Servant f) Private sector g) Self-employed h) Unemployed i) Others (specify).....

Monthly Income range

a) < 10,000 b) 10,000-99,000 c) 100,000-250,000 d) above 250,000

STANDARD OF LIVING

What type of Housing do you live in

Construction material (wall)	Construction material (roof)	Construction material (floor)	Toilet facility	Tenure of Housing
Plastered mud	Corrugated Aluminum/Zinc	Concrete	Pit latrine	Owner
Cement blocks	Asbestos	Tiles/Terrazzo	Water Closet	Rent/Lease
Wood	Tiles	Wood/ Mud/Asphalts	Others (specify)	Non-Rent Payment Occupier

Source of power supply

Environmental Consultants
(FMEnv, NESREA, NMDPRA, LASEPA and OGEPA accredited Environmental Consultants)
Lagos Head Office: 242A Alhaji Ganiyu Alimi Crescent, Gbagada Phase 2, Lagos State, Nigeria.
Abeokuta Branch Office: 1B, Olorumbe Close, Ibara Housing Estate, Abeokuta Ogun State, Nigeria.
Tel: 08021229523, 08038622956, 08055229091, www.azmarineberg.com; info@azmarineberg.com

ATTENDANCE SHEET

Name: SCOPING WORKSHOP FOR SONNEX PACKAGING NIG LTD
Address: MAYA, IKORODU, LAGOS
Date: 01 Dec 2022

Full Name	Organization	Phone Number	Email Address	Signature
Nwagbi Augustine	FMEnv. Abuja	08184090012	augustinenwagbi@yahoo.com	
Lawal Saheed Alani	MOE&WR. Lagos St.	08023166067	alanisaheedlawal@gmail.com	
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John Olanrewaju	Sonnex	08081892010		
Chinaka Omolola	Azmarineberg	08133008285		
Mary Onyenedo	Azmarineberg	08155769075	maryony@azmarineberg.com	
Adewale Lawal	Azmarineberg			

Environmental Consultants
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Lagos Head Office: 242A Alhaji Ganiyu Alimi Crescent, Gbagada Phase 2, Lagos State, Nigeria.
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ATTENDANCE SHEET

Name: SCOPING WORKSHOP FOR SOMNEX PALKAEMOG NLA LTD
Address: IKORODU, LAGOS.
Date: 8th December, 2022

Full Name	Organization	Phone Number	Email Address	Signature
APANISILE OLATUNJI	NLI SECRETARY	08023345946		
CHIEF AFOGABI	BAALE	08089815867		AFOGABI
Chief Mrs YABO	Baloguen Ajiran	08159523313		
CHIEF Ogunnawole	BASHOgun of Ikorodu	08023952982		
Mrs Alebogun	Retiree	08028640183		
Mrs Baluwo Ajayi	Retiree	08167677608		
Mr Nurudeen Sanda	Retiree	08085296299		
CHIEF Lukman Iyiola	Chairman Mainland	07025219101		
Chief Ahmeed Ajisebutu		08057262510		
CHIEF Idowu Oredegbin		08133996948		
Mrs Oredegbin	Business woman	07084952130		
Mr Fatai Ajayi	Business man	08133255116		
Mrs Latifat Akebenu	WO SHOdeny Business	09026741687		
Tawo.	Business man	09151924915		
Apanisile Adekemi	Business woman	08054308246		
Temiloluwa	Student	09157535547		
Rasheed mariam	business woman	09034273692 2024		
olaoluwa Ajavid	Business Lady	09152563 2019		
Adesanya BUSAYO	Fashion designer	09034273692		
Mariam Dolili	Business woman	08159267454		
Mrs Adeeoye Idowu	Business woman	09023531977		
OwoSeni Anuoluwapo	Student	08025673865		
Iribo Isaac	Student	09017019135		
Alade - Simbiat	Business Lady	07089338713		
Odus - deborah	Business lady	09071939481		
Miss Bashiru Abimbola	student	09153261298		
Mrs Abisola Folarin	Business	08022300907		
mrs mustapha	kafayatu	08060545834		
Mrs Rausatu NOSIRU	Business woman	09018635413		

Full Name	Organization	Phone Number	Signature
Fatimah Ibrahim	Business	08075788804	
Ayorinde Ajoke	Teacher	08030693099	
Odeleye Omowumi	Business	09018635413	
ABolatito madashira	Business	07013819765	
Adekoya Bola	Business Woman	07085809500	
Owolabi Fatimo	Business woman	08089803780	
Tiamiyu Ike	Business woman	09022307813	
Akanfala Akanfala	Business woman	08127111143	
Ahmed Aderonke	Business woman	07032785137	
Ganiyu Jemilat	Business woman	07026515375	
Mr. Samuel	Business man	07062369156	
Mowosu I. Jeremiah	Business man	08023915035	
Emmanuel Oluwaseun	engineer	08051331051	
Esther	Ebas	09033523973	
Olayiwola Temi-Tope	Trader	09013733390	
Mr Hamzat-Abayomi	catering	09013733390	
Obadati Toyin	Fashion Designer	08028331055	
Opadoyin Bolukatife	Hair Dresser	08184758184	
Lateef-Muritala	Engineering	09136577738	
Adebayo Fola Shade	fola shade	08086858084	
Mrs Solomon	Taiwo	08148880140	
mrs Adekola Rachel	Business	08058206686	
Adebayo Abdulahi Ehinde	HASSAN	09065117646	
Raine	Hassan	08123753811	
Oluwabi olaitan	Hairdresser	09027379425	

Full Name	organization	Phone Number	Signature
Yusuf Afolayan	Trader	08068452643	
Tanwa Saba	Trader	08052061826	
Olaide Shoderu	Student	09033130601	
Arowolo Rasheedat	Trader	08025409246	
Olaoluwa Edu	Trader	08038029772	
Oredeyin Zainab	Student	07049452199	
Chief Balogun Wasiu	Balogun Parafa	07059457152	
Chief Sakiru Asipa	Asipa Parafa Alagemo	08023647038	
		08028793660	

STRUCTURAL ENGINEERING DRAWINGS
(FOR APPROVAL)

PROPOSED INDUSTRIAL DEVELOPMENT

FOR

HERMES RESOURCE NIGERIA LIMITED

AT

IKORODU INDUSTRIAL SCHEME, PLOT 488A LAGOS

IKORODU LOCAL GOVT. AREA, IKORODU, LAGOS STATE.

HANCOCK OGUNDIYA & PARTNERS

- Consulting Civil & Structural Engineers

33, Glover Street, Ebute–Metta, Lagos.

Tel. 08034017782, 01–295622

E–mail info@hancockogundiya.com

hancockogundiya@yahoo.com

GENERAL CONSTRUCTION NOTES

GENERAL

A1. ALL STRUCTURAL DRAWINGS AND SKETCHES MUST BE READ IN CONJUNCTION WITH RELEVANT ARCHITECTS AND SERVICES ENGINEERS AND SPECIALIST DRAWINGS. WHERE DISCREPANCIES OCCUR, THESE ARE TO BE BROUGHT TO THE ATTENTION OF THE ARCHITECTS AND/OR ENGINEERS FOR RESOLUTION PRIOR TO EFFECTING CONSTRUCTION.

A2. WORK TO FIGURED DIMENSIONS ONLY. ALL DIMENSIONS ARE TO BE CHECKED ON SITE.

A3. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.

A4. FOR DETAILS OF FLOOR SCREED AND FINISHES, WATERPROOFING E.T.C. AND CONCRETE FINISHES, SEE ARCHITECTS DETAILS.

REINFORCEMENT

B1. STEEL TO HAVE A MINIMUM YIELD STRESS OF BAR AS DESIGNATED:
Y = 410 N/mm^2 , R = 250 N/mm^2.
BARS DESIGNATED "Y" TO BE THE DEFORMED TYPE BARS.

B2. 'R" DENOTES PLAIN ROUND HOT-ROLLED MILD STEEL REINFORCEMENT ACCORDING TO BS 4449 AND BARS ARE IN MILLIMETER SIZE.
"Y" DENOTES DEFORMED HIGH BOND HOT-ROLLED HIGH YIELD STRESS REINFORCEMENT TO BS 4449 AND 4461.
ADDITIONAL ABBREVIATIONS USED ON DRAWINGS ARE AS FOLLOWS:
AS = ALTERNATELY STAGGERED
AP = ALTERNATELY PLACED
NF = NEAR FACE
FF = FAR FACE
EF = EACH FACE

B3. NOTATIONS USED AS FOLLOWS: 11 Y1009 - 150 C/C B, IMPLY
11 - NUMBER OF BARS
Y10 - TYPE AND DIAMETER OF BARS
09 - BAR MARK
150 C/C - SPACING OF BARS IN MILLIMETRES
B - LOCATION OF BAR E.G. BOTTOM, T - TOP.

B4. WHERE HOLES, FIXING, ETC. ARE REQUIRED, BARS MAY BE DISPLACED SLIGHTLY TO ACCOMODATE THESE BUT THEY MUST NOT BE CUT OR REMOVED.

HOLLOW CLAY POT CONSTRUCTION

C1. CLASSIC HOLLOW CLAY POTS SHALL BE 200mm HIGH x 400mm WIDE x 230mm LONG WITH A UNIT WEIGHT OF 8.6kg PER PIECE.

C2. UNLESS NOTED OTHERWISE, CLASSIC RIB WIDTH SHOULD NOT BE LESS THAN 100mm.

C3. MESH REINFORCEMENT SPECIFIED TO BE LAID IN THE MIDDLE OF ALL HOLLOW CLAY POT FLOOR TOPPINGS WHICH SHOULD IN ANY CASE NOT BE LESS THAN 50mm THICK.

C4. ALTERNATE CLAY POTS MAY BE OMITTED AT SUPPORTS TO IMPROVE THE SHEAR RESISTANCE OF THE RIBS.

C5. CONCRETE MIXES IN ALL CASES ARE ADVISED TO BE WITH COARSE AGGREGATE SIZE NOT EXCEEDING 15mm, FOR EASE OF PLACEMENT AND COMPACTION.

C6. MID-SPAN CROSS SPREADER RIB IS TO BE USED FOR THE "CLASSIC" IN-SITU SYSTEMS TO IMPROVE LOAD DISTRIBUTION FOR LONGER SPANS. ON NO ACCOUNT SHOULD CLAY POT SYSTEMS BE USED AS A WAFFLE (TWO-WAY) SYSTEM WITHOUT THE ENGINEERS WRITTEN CONSENT.

C7. FOR VELOX SYSTEMS, IT IS RECOMMENDED THAT THE MAXIMUM SIZE OF BOTTOM BARS SHOULD BE Y16 OR R20.

C8. IT IS ESSENTIAL TO CONTROL AND SUPERVISE VERY CLOSELY THE GROUTING-UP OF THE MAIN BARS IN THE PRECAST VELOX RIBS. BARS PROJECTIONS SHOULD ALSO NOT INTERFERE AT THE SUPPORTS.

CONCRETE

D1. ALL STRUCTURAL CONCRETE TO BE GRADE 30 N/mm^2 IN FOUNDATIONS.
ALL STRUCTURAL CONCRETE TO BE GRADE 30N/mm^2 IN COLUMNS.
ALL STRUCTURAL CONCRETE TO BE GRADE 30N/mm^2 IN ALL OTHER SUPERSTRUCTURAL ELEMENTS, UNLESS OTHERWISE STATED.

D2. MINIMUM CEMENT AGGREGATE RATIO TO BE 1:6. MAXIMUM SIZE OF COARSE AGGREGATE TO BE 20MM.

D3. ALL AGGREGATE TO BE SUITABLY GRADED AND APPROVED BY THE ENGINEER PRIOR TO USE IN CONSTRUCTION.

D4. ALL CONCRETE TO BE SUITABLY AND FULLY COMPACTED AND CURED IN AN APPROVED MANNER TO THE SATISFACTION OF THE ENGINEER.

D5. MINIMUM CONCRETE COVER TO MAIN REINFORCEMENT TO BE AS FOLLOWS:
FOUNDATION : ..... 50MM, COLUMNS : 40MM,
BEAMS : ..... 35MM, SLABS : 20MM,
STAIRCASES, ETC..... 20MM, UNLESS OTHERWISE STATED.

D6. ALL MASS CONCRETE TO BE 1 : 3 : 6 MIX (CEMENT - SAND - COARSE AGGREGATE)
ALL BLINDING TO BE 1 : 6 MIX (CEMENT- SAND AGGREGATE).

D7. IN WATER-TIGHT CONSTRUCTION, JOINTS IN CONCRETE WORK ARE TO HAVE WATER BAR AND CONTRACTOR IS TO TAKE SPECIAL CARE WITH THE CONCRETE SO AS TO PRODUCE A WATER-TIGHT CONSTRUCTION.
AN ADMIXTURE OF A PROPRIETARY BRAND MAY BE USED IF AGREED BY THE ENGINEER. HOWEVER, IF USED ADEQUATE CARE SHOULD BE EXERCISED THAT IT IS PLACED STRICTLY IN ACCORDANCE WITH THE MANUFACTURERS INSTRUCTIONS.

D8. ALL CONSTRUCTION JOINT POSITIONS ARE TO BE APPROVED BY THE ENGINEER PRIOR TO CASTING WHERE NOT INDICATED ON THE DRAWING. THESE SHOULD NOT EXCEED 10.0m APART.

D9. CONCRETE SHALL NOT BE POURED THROUGH REINFORCING STEEL SO AS TO CAUSE SEGREGATION OF AGGREGATES. HOPPERS, VERTICAL CHUTES OR TRUNKS SHALL BE USED IN SUFFICIENT NUMBERS SO THAT THE FREE UNCONFINED FALL OF CONCRETE SHALL NOT EXCEED 1800mm & TO ENSURE THAT THE CONCRETE IS KEPT LEVEL AT ALL TIMES.

D10. BEFORE FRESH CONCRETE IS POURED AGAINST CONCRETE IN-PLACE, THE CONTACT SURFACES OF CONCRETE IN-PLACE SHALL BE THOROUGHLY CLEANED, ALL LAITANCE SHALL BE REMOVED & THE CONTACT SURFACES SHALL BE THOROUGHLY SLOSHED WITH GROUT CONSISTING OF ONE PART SAND TO ONE PART CEMENT WITH A MINIMUM AMOUNT OF WATER.

D11. CONCRETE CAST ON SLOPED SURFACES SHALL BEGIN AT THE LOWEST ELEVATION & CONTINUE MONOLITHICALLY TOWARD THE HIGHER ELEVATION UNTIL THE INTENDED POUR IS COMPLETED.

BLOCKWORK

E1. CAVITIES OF HOLLOW BLOCKWALLS BELOW GROUND SLAB LEVEL ARE TO BE FILLED WITH MASS CONCRETE. BACKFILLING TO EXCAVATED TRENCHES ARE TO BE CARRIED OUT SIMULTANEOUSLY ON BOTH SIDES OF WALL.

E2. THE WALL THICKNESS OF THE BLOCKS SHOULD NOT BE MORE THAN 25mm.

E3. THE MINIMUM CRUSHING STRENGTH OF THE NON-LOAD BEARING HOLLOW SANDCRETE BLOCKS IS TO BE 2.1 N/mm2 OF THE GROSS AREA OF BLOCK AT 28 DAYS.

E4. BLOCKWORK TIES BETWEEN BLOCKWALLS AND COLUMNS/STANCHIONS ARE TO BE PROVIDED AT EVERY COURSE. TIES TO BE 6mm BAR STRAPS 700mm LONG INTO THE BLOCKWORK.

E5. MAXIMUM POUR HEIGHT FOR ALL FILLED BLOCKWORK TO BE 2 COURSES AT A TIME.

E6. ALL LOAD-BEARING SANDCRETE BLOCKWALLS TO HAVE A MINIMUM STRENGTH OF 3.2 N/MM2 OF NETT AREA OF BLOCKWALL AT 28 DAYS.

E7. BLOCKWORK INDICATED THUS ⊠⊠⊠⊠⊠ ON THESE DRAWINGS ARE LOAD BEARING AND ARE TO BE CONCRETE FILLED TO THE SPECIFIED OR SHOWN LEVEL(S) WITH CONCRETE AS IN D1 WITH 10MM MAXIMUM COARSE AGGREGATE SIZE.

E8. BLOCKWORK INDICATED THUS ⊠⊠⊠⊠⊠ ON DRAWINGS ARE LOAD BEARING, CONCRETE FILLED AS IN D1 WITH 10MM MAX. COARSE AGGREGATE SIZE, AND WITH CAVITIES REINFORCED AS SPECIFIED.

E9. CONCRETE FILLED LOAD-BEARING BLOCKWORKS ARE TO ACHIEVE A MINIMUM CRUSHING STRENGTH OF 6.5 N/MM2.

STRUCTURAL STEELWORK

F1. ALL STRUCTURAL STEELWORK DESIGN, FABRICATION AND ERECTION TO BE IN ACCORDANCE WITH BS 5950 : PARTS 1 - 7 : 1990 OR EQUIVALENT OTHER STANDARDS.

F2. ALL STRUCTURAL STEELWORK SHALL BE MILD STEEL TO BS 4360 GRADE 43A EXCEPT HOLLOW SECTIONS WHICH SHALL COMPLY WITH GRADE 43C.

F3. WELDING FABRICATION AND ERECTION OF STRUCTURAL STEELWORK SHALL CONFORM TO BS 449 PART 2.

F4. BEFORE COMMENCING FABRICATION OF STEELWORK THE SUPPLIER SHALL SUBMIT TWO COPIES OF HIS SHOP DRAWINGS FOR THE APPROVAL OF THE ENGINEER.

F5. ALL BOLTED CONNECTIONS TO BE CAPABLE OF TRANSMITTING THE FULL STRESS LOADS OF THE SECTIONS JOINED. THE TYPE OF BOLT USED TO BE CLEARLY STATED ON THE SHOP DRAWINGS AND ONLY ONE GRADE OF BOLT TO BE USED FOR THE COMPLETE WORKS.

F6. UNLESS WHERE OTHERWISE NOTED, ALL BOLTS SHALL BE BLACK BOLTS TO BS 4190 AND WASHERS TO BS 4320 SHALL BE PROVIDED FOR ALL BOLTS.

F7. ALL WELDED JOINTS TO BE FORMED WITH CONTINUOUS FILLET WELDS. ALL WELDS ARE TO BE 6mm FILLET WELDS CONTINUOUS UNLESS WHERE OTHERWISE INDICATED.

F8. ALL STEELWORK TO BE THOROUGHLY CLEANED AFTER FABRICATION AND COATED WITH AN APPROVED PRIMER. UPON COMPLETION OF ERECTION AND PRIOR TO HAND-OVER, THE SUPPLIER SHALL MAKE GOOD ANY DAMAGE TO THE PRIMER CAUSED DURING TRANSPORT AND ERECTION.

F9. UNLESS NOTED OTHERWISE THE COMPOSITION OF THE PROTECTIVE SYSTEM SHALL BE :-
(a) SURFACE TREATEMENT - D
(b) METAL COATING - NONE
(c) PRE-TREATMENT - NONE
(d) PRIMING PAINT - 1H
(e) FINISHING PAINT - 2T
AS CLASSIFIED IN TABLE 4 KEY TO TREATMENT CP 2008 1966.

F10. THE FIRST BAY OF ERECTED STEELWORK IS TO BE LINED AND LEVELLED BY MEANS OF TEMPORARY BRACING, BEFORE FURTHER ERECTION SHALL CONTINUE.

F11. ANTI-SAG RODS ARE TO BE PROVIDED AS SHOWN ON DRGS. WHERE ANTI-SAG RODS ARE NOT SHOWN ON THE DRGS., THEY ARE TO BE PROVIDED AND PLACED AT MID-SPAN OF PURLINS OR TO PURLIN MANUFACTURERS SPECIFICATION.

F12. ALL STEEL SURFACES IN CONTACT WITH ALUMINIUM SHEETING ARE TO BE GIVEN TWO COATS OF AN APPROVED BITUMASTIC PAINT BEFORE FIXING SHEETING.

F13. ALL BOLTS IN TENSION SHOULD BE PROVIDED WITH EITHER DOUBLE COILED SPRING WASHERS OR LOCK NUTS.

EARTHWORK

G1. CONTRACTOR SHALL BE FULLY RESPONSIBLE FOR SHORING AND BRACING OF THE BUILDING EXCAVATIONS & EMBANKMENTS, INCLUDING EXCAVATION FOR UTILITIES, AND IS ALSO FULLY RESPONSIBLE FOR THE DESIGN & PERFORMANCE OF SHORING AND BRACING DURING CONSTRUCTION.

G2. CONTRACTOR SHALL COORDINATE THE EXTENT OF THE EXCAVATION, SHORING AND BRACING WITH CIVIL DRAWINGS. CONTRACTOR SHALL ALSO REFER TO CIVIL DRAWINGS, SPECIFICATIONS & GEOTECHNICAL REPORT FOR DEWATERING AND RELATED INFORMATION NOT COVERED IN THE STRUCTURAL DRAWINGS.

G3. EARTHWORK COMPACTION SHALL BE IN ACCORDANCE WITH CIVIL DRAWINGS AND SPECIFICATIONS AS WELL AS WITH THE GEOTECHNICAL REPORT.

FOUNDATION

H1. FOR SHALLOW FOUNDATIONS, THE DETAILS INDICATED ON THE RELEVANT DRAWINGS HAVE BEEN BASED ON ASSUMED/CONFIRMED GROUND BEARING CAPACITIES OF 120 kN/M2 OF 180 kN/M2 RESPECTIVELY. WHERE THIS IS AN ASSUMPTION, IT IS TO BE CONFIRMED BY A SUBSOIL INVESTIGATION PRIOR TO THE COMMENCEMENT OF CONSTRUCTION WORKS AND/OR TO THE SATISFACTION OF THE SUPERVISING ENGINEER.

H2. FOR PILED FOUNDATIONS, THE DETAILS INDICATED ON THE RELEVANT DRAWINGS HAVE BEEN BASED ON CONFIRMED DEEP SUBSOIL CONDITIONS AND THE RECOMMENDATIONS OF A SPECIALIST SUBSOIL INVESTIGATION.

H3. SITE PREPARATION AND TREATMENT TO BE CONFIRMED ON SITE BY SUPERVISING ENGINEER AT COMMENCEMENT OF FOUNDATION CONSTRUCTION.

H4. RELATIONSHIP OF THE GROUND FLOOR SLAB, EXISTING GROUND LEVEL AND THE FOUNDATION FORMATION LEVEL ARE TO BE CONFIRMED ON SITE AND APPROVED PRIOR TO CONSTRUCTION OF THE FOUNDATION.

H5. ALL SOLID BLOCKWORK BELOW GROUND FLOOR SLAB TO BE CONCRETE FILLED WITH GOOD QUALITY CONCRETE AS PER NOTE E7 .

SITE PREPARATION

J1. REMOVE ALL EXISTING TOPSOIL UNDER SLABS, PROVIDE 150mm WELL RAMMED AND CONSOLIDATED NATURALLY OCCURRING HARDCORE MATERIAL OR ROCK LATERITE UNDER ALL GROUND BEARING SLAB. WELL CONSOLIDATED SELECTED FILL OR MASS CONCRETE TO BE USED TO MAKE UP LEVELS WHERE NECESSARY AS AGREED WITH THE ENGINEER. WHERE LEVELS ARE TO BE MADE UP USING FILL, THICKNESS OF LAYERS SHOULD NOT EXCEED 225mm.

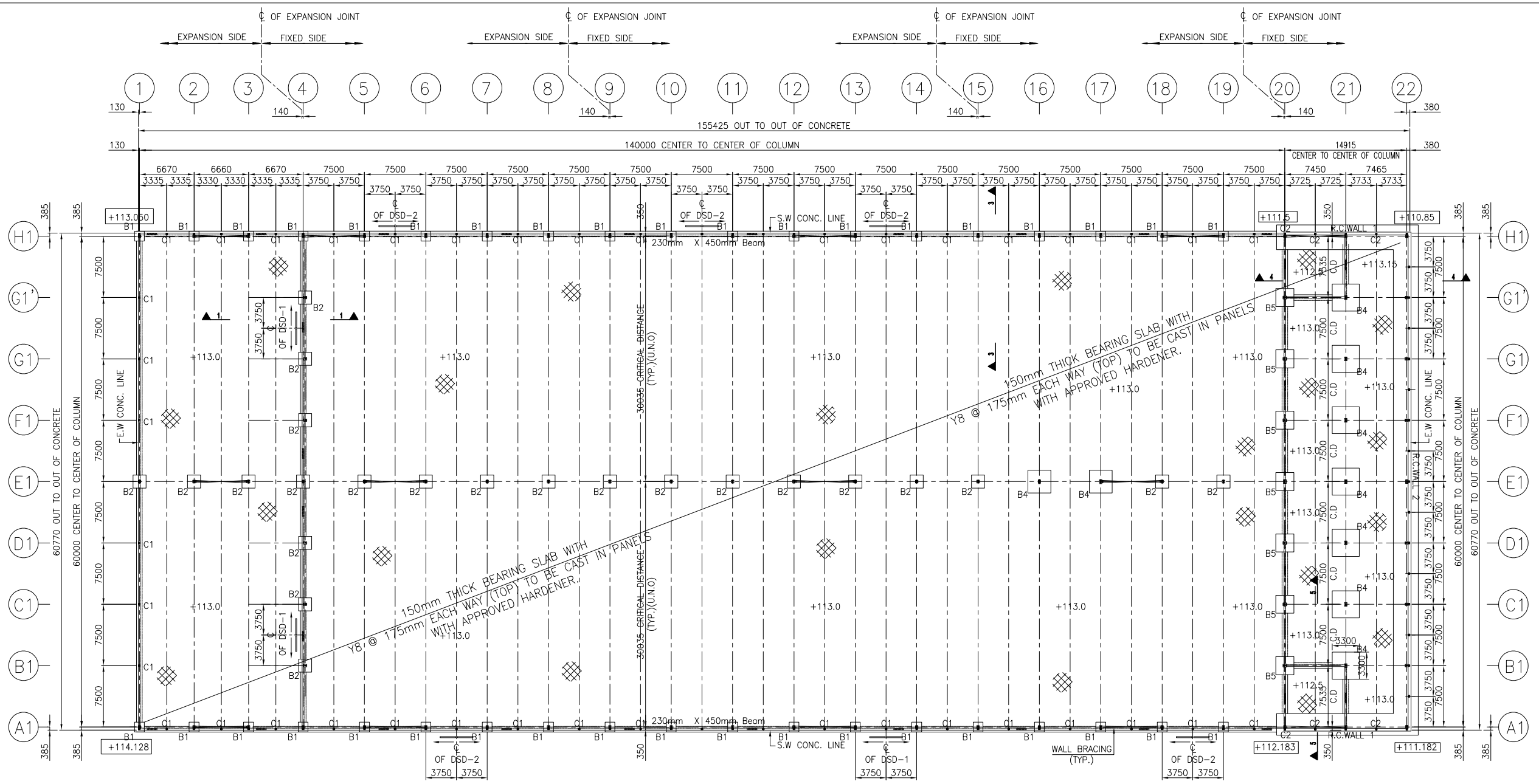
J2. WHERE BAD GROUND IS ENCOUNTERED BELOW FOUNDATION LEVEL, THE DIFFERENCE IN LEVEL BETWEEN APPROVED BEARING STRATUM AND ORIGINAL LEVEL IS TO BE MADE UP USING MASS CONCRETE TO THE APPROVAL OF THE SUPERVISING ENGINEER.

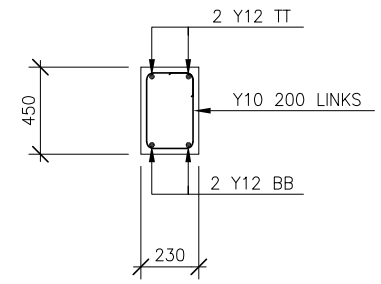
J3. EXTERNAL WALL STRIP FOOTING TO BE 1000mm MINIMUM DEPTH BELOW EXISTING GROUND LEVEL OR FINAL GROUND LEVEL WHICHEVER IS LOWER, UNLESS OTHERWISE STATED.

J4. ALL MATERIAL TESTS SHALL BE CARRIED OUT AT THE DEPARTMENT OF CIVIL ENGINEERING MATERIALS LABORATORY UNIVERSITY OF LAGOS.

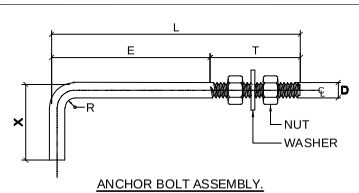
J5. ALL STEEL RODS DHALL BE TESTED AFTER SUPPLY TO THE SITE

J6. THE CONTRACTOR SHALL MAINTAIN AT LEAST 6NO STEEL CUBE MOULDS AND A POND ON SITE FOR THE CONCRETE TESTS.





BEAM TYPICAL DETAILS



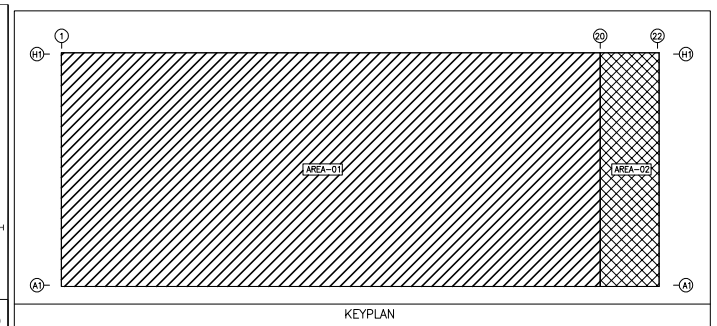
ANCHOR BOLT ASSEMBLY.

NOTE:-
EACH SUPPLIED ASSEMBLY CONSISTS OF
1 - 'L' SHAPED ANCHOR BOLT
2 - HEXAGONAL NUTS AND
1 - WASHER

LEGEND :-
QTY :- QUANTITY
T :- THREADED BOLT PROJECTION
E :- UNTHREADED STRAIGHT LENGTH
L :- VERTICAL LENGTH
X :- HOOK LENGTH
Lo :- OVERALL LENGTH
Wt :- WEIGHT
R :- BEND RADIUS
Lc :- CENTERLINE LENGTH

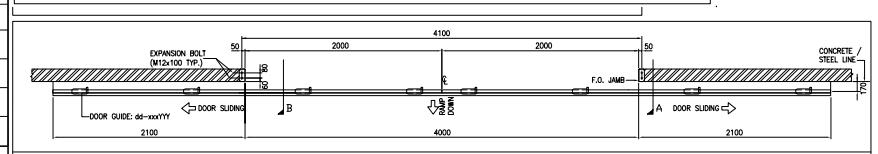
PART MARK	DIAMETER (D)	QTY	T (mm)	E (mm)	L (mm)	X (mm)	Lo (mm)	Wt (kg)	R (mm)	Lc (mm)
SANB051	16 mm	24	100	275	375	120	495	0.828	40	458
SANB052	20 mm	182	150	300	450	175	625	1.599	50	579
SANB053	24 mm	192	150	375	525	205	730	2.665	60	675
SANB054	30 mm	00	200	550	750	265	1015	5.778	75	946
SANB055	36 mm	00	200	850	1050	295	1345	11.112	90	1262

ANCHOR BOLT SCHEDULE

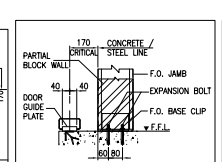


KEYPLAN

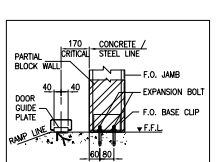
BASE TYPE SIZES			
S/N	TYPE	SECTION SIZE	COLUMN SIZE
1	B.1	1200 x 1200 x 350mm	450mm x 450mm
2	B.2	1700 x 1700 x 350mm	450mm x 500mm
3	B.3	R.C.WALL FOOTING	500mm x 400mm
4	B.4	3300 x 3300 x 500mm	700mm x 450mm



DSD GUIDE SETTING PLAN (DSD-1 & DSD-2)



SECTION – A



SECTION – B

REVISIONS		
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2636112, 2637519 Fax. 2637519
E-Mail: info@hancockogundiya.com
hancockogundiya@yahoo.com

Drawing Title

GROUND FLOOR PLAN LAYOUT

Drawn	Date	Scale	Designed	Checked
MUKADAS	JAN. 2022	1:100 :1:50	AL-AMEEN	OLUYEMI

Drawing No.: HOP/202002R/F01A

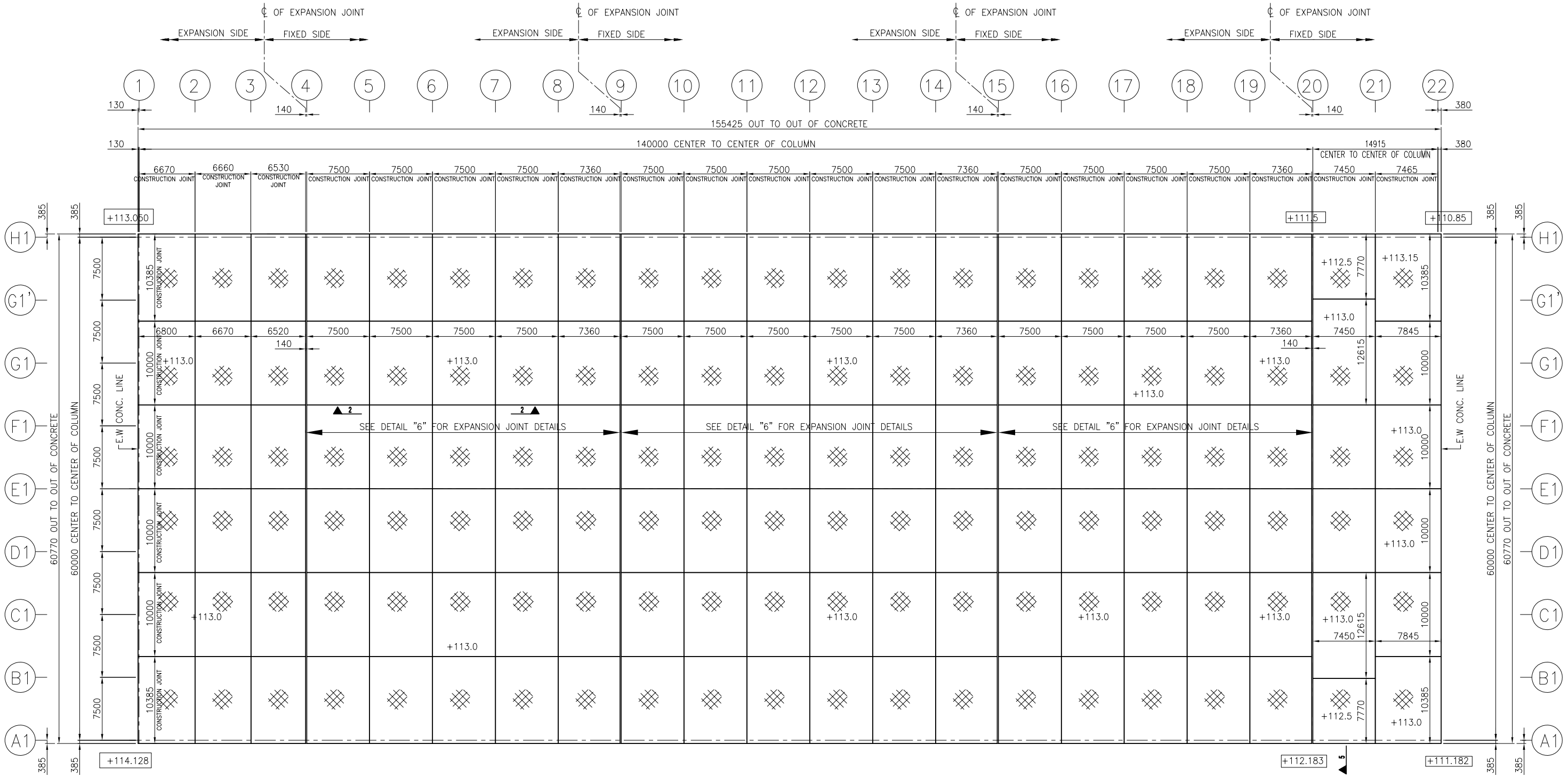
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E-Mail: info@hancockogundiya.com
hancockogundiya@yahoo.com

Drawing Title
LOCATION OF CONSTRUCTION CONSTRUCTION & EXPANSION JOINT IN GROUND FLOOR PLAN.

Drawn	Date	Scale	Designed	Checked
MUKADAS	JAN. 2022	1:100 :1:50	IFEANYI	OLUYEMI

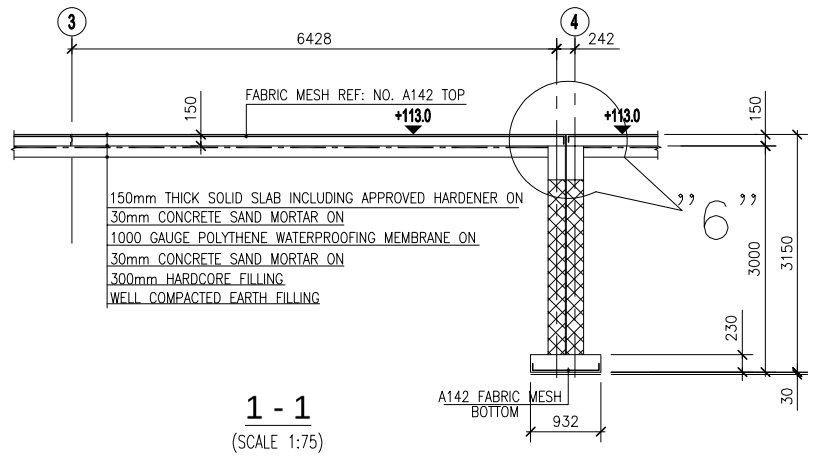
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Revision Suffix:

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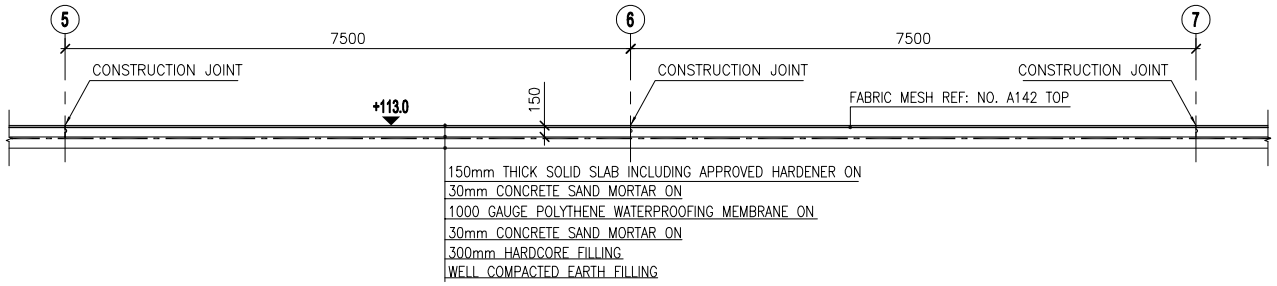
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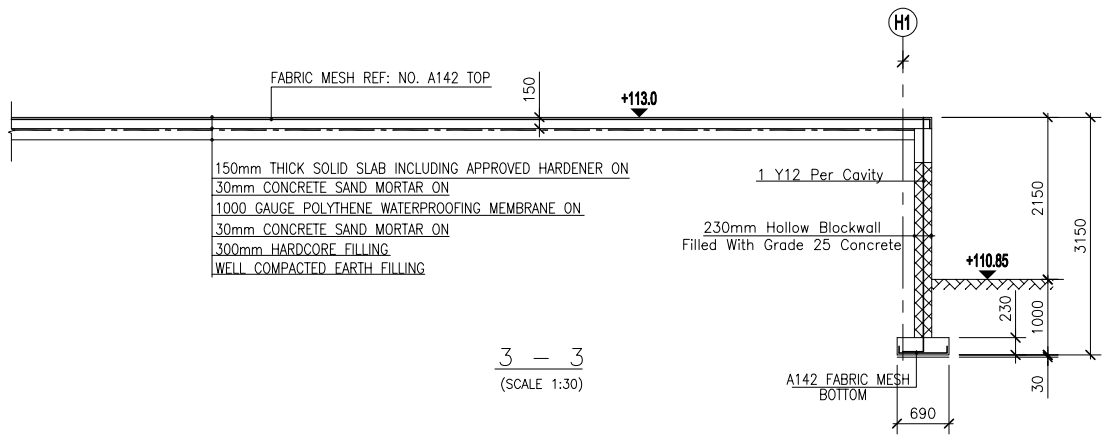
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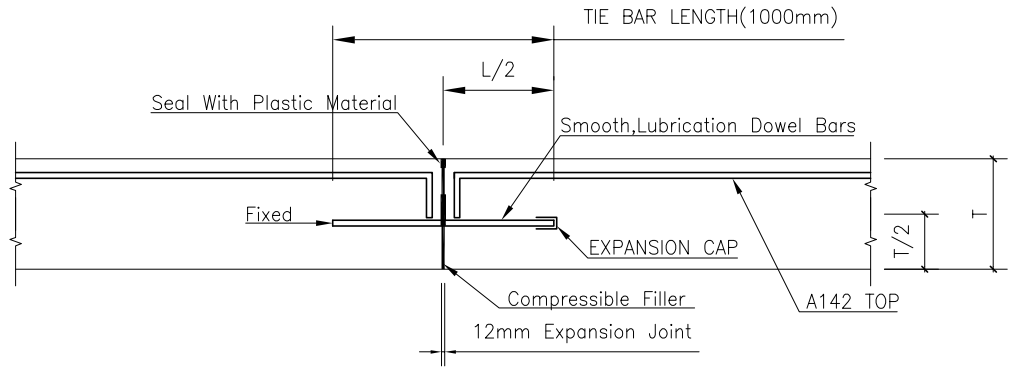
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(SCALE 1:75)



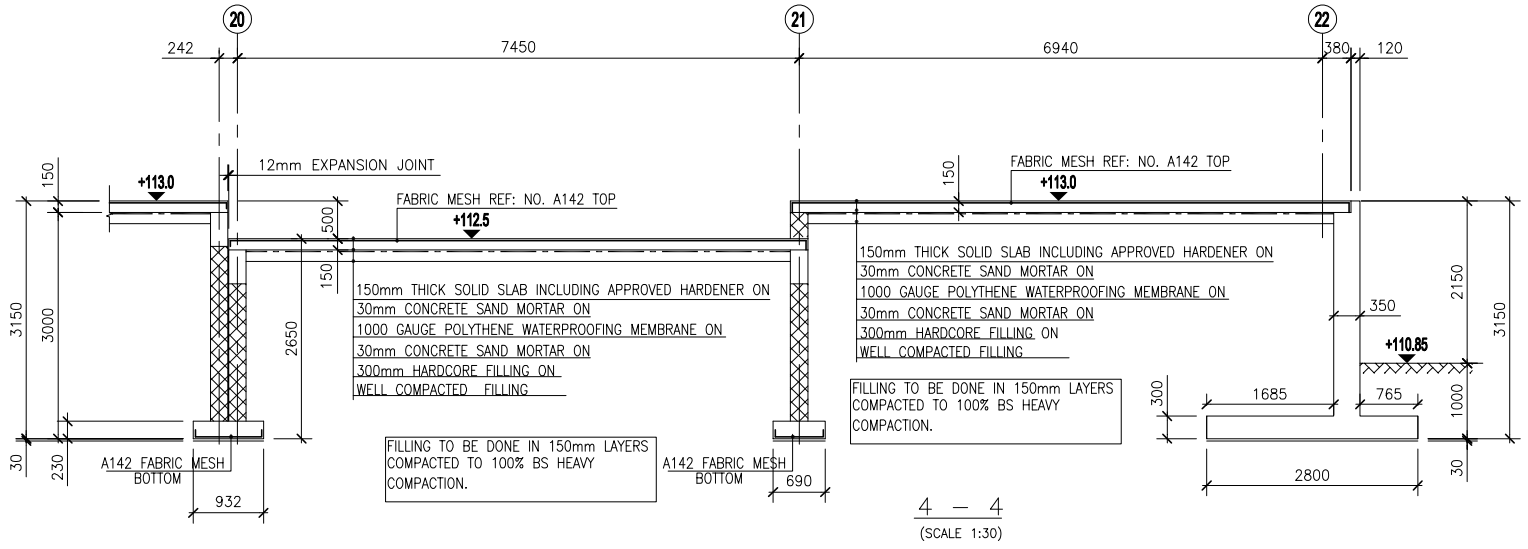
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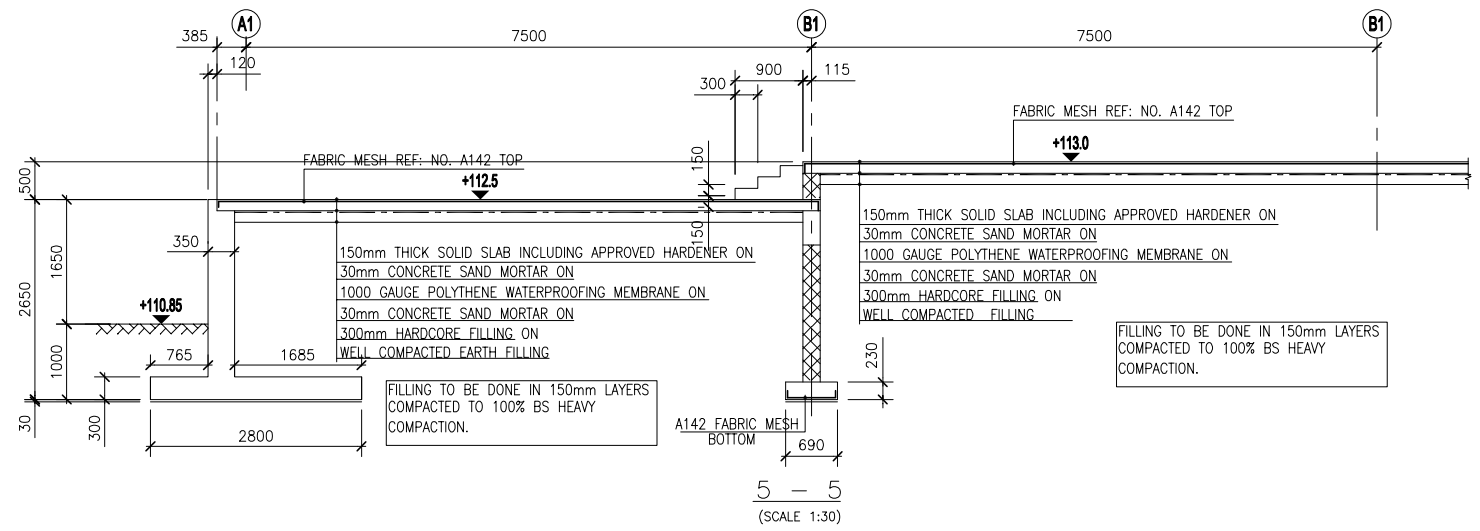
3 – 3
(SCALE 1:30)



DETAILS "6"
EXPANSION JOINT DETAILS



4 – 4
(SCALE 1:30)



5 – 5
(SCALE 1:30)

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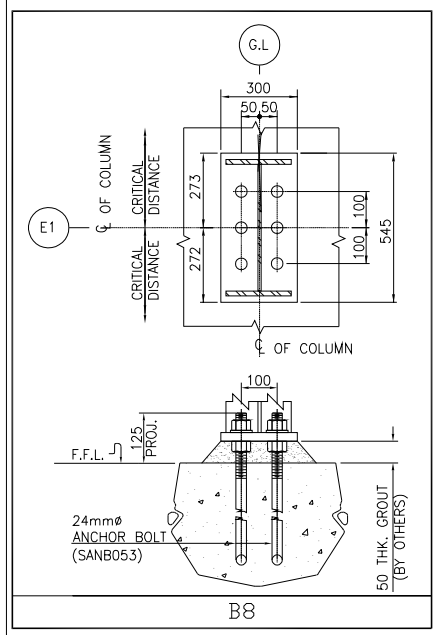
Drawing Title
GROUND FLOOR PLAN LAYOUT

Drawn	Date	Scale	Designed	Checked
MUKADAS	JAN. 2022	1:100 :1:50	AL-AMEEN	OLUYEMI

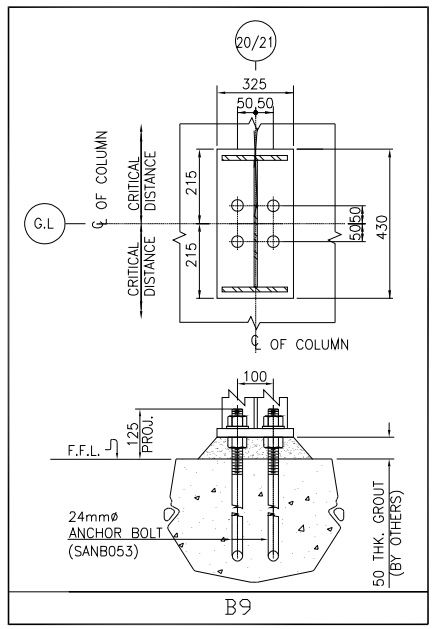
Drawing No.: HOP/202002R/F01C
Revision Suffix:
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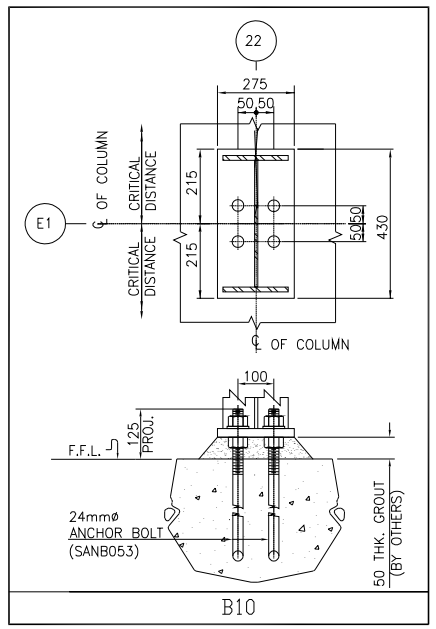
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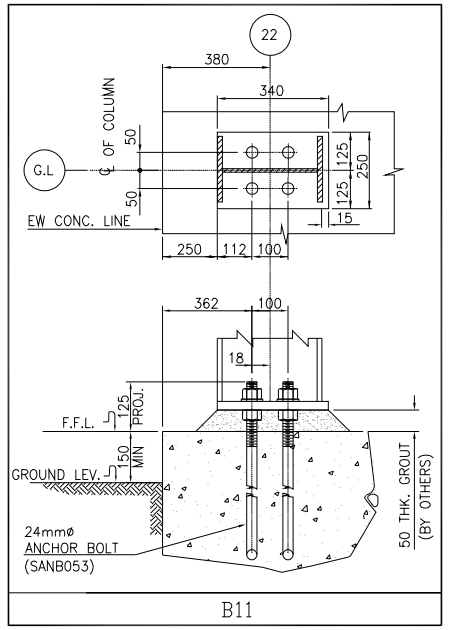
B8



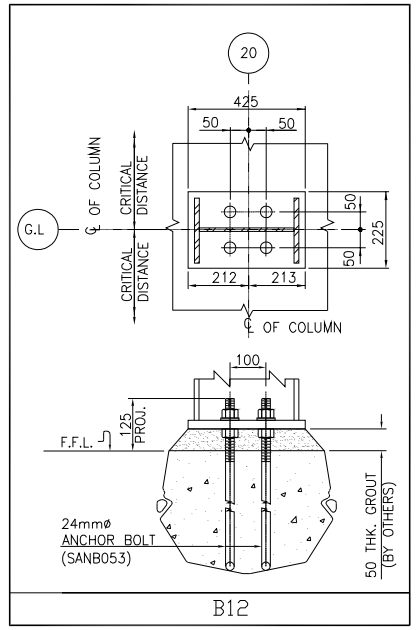
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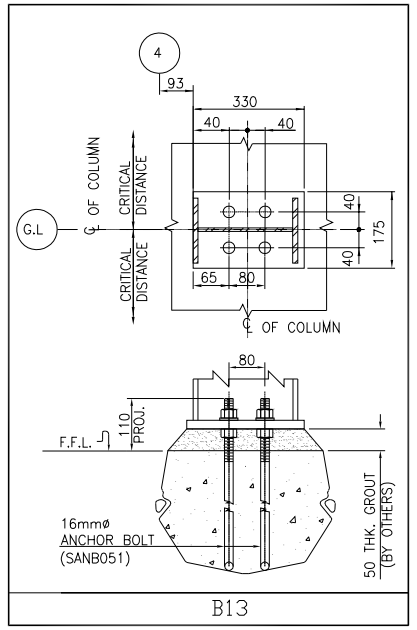
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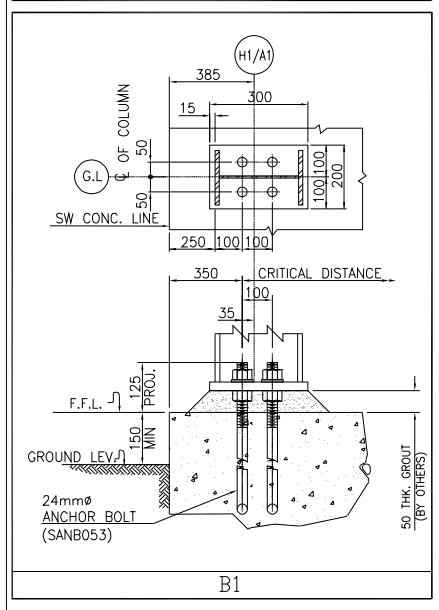
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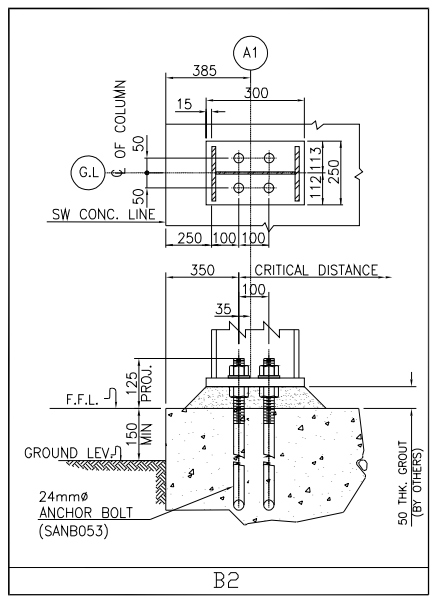
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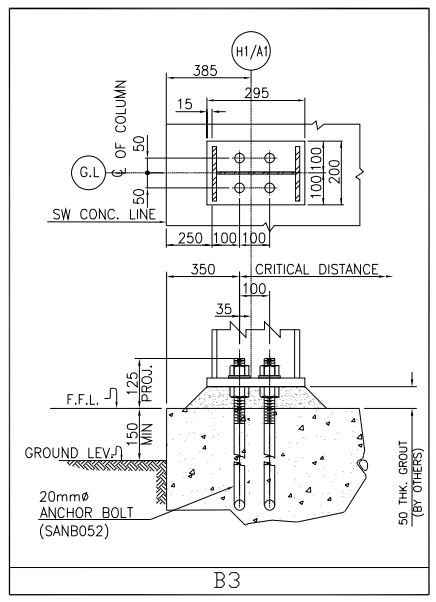
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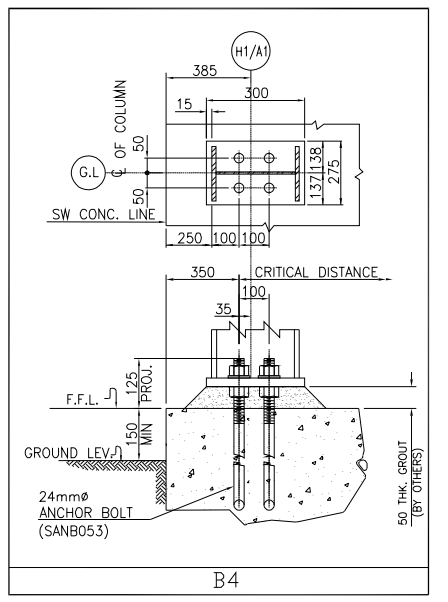
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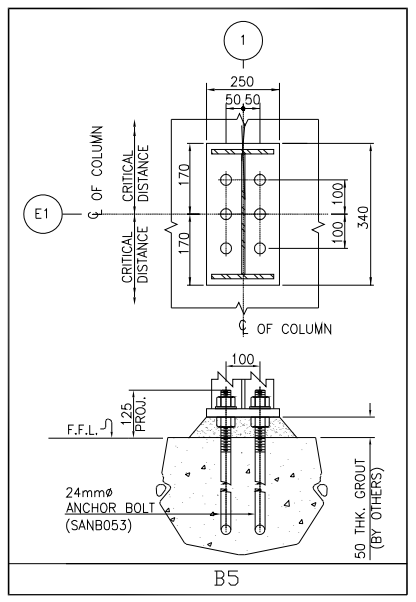
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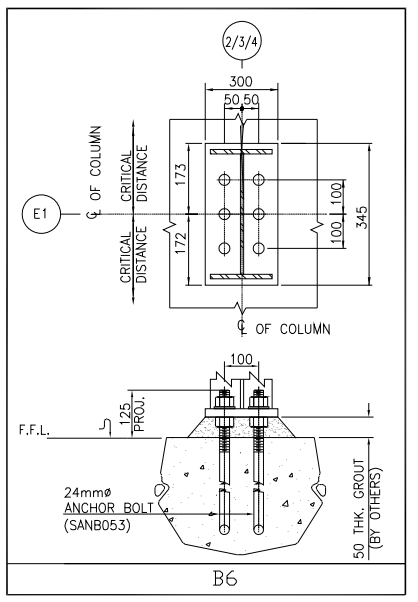
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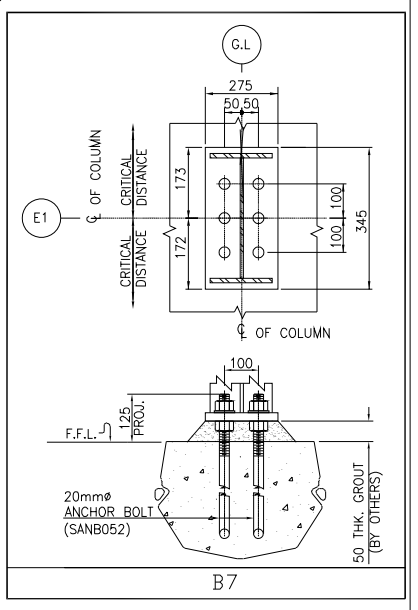
B4



B5



B6



B7

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hancockogundiya@yahoo.com

Drawing Title

BASE PLATE DETAILS

Drawn	Date	Scale	Designed	Checked
MUKADAS	JAN. 2022	1:100 :1:50	AL-AMEEN	OLUYEMI

Drawing No.: HOP/202002R/F02

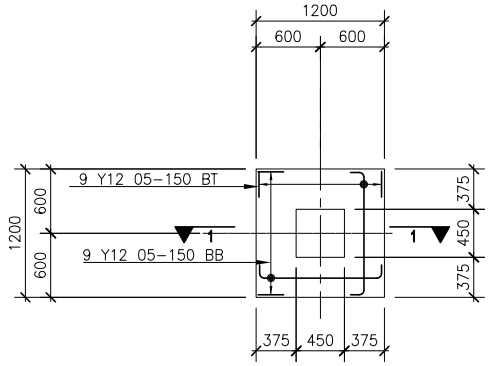
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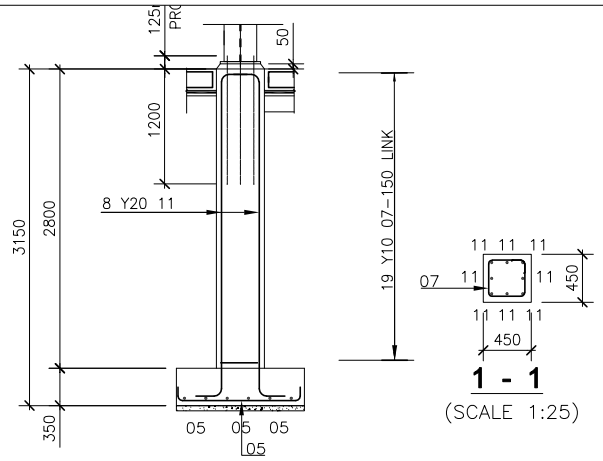
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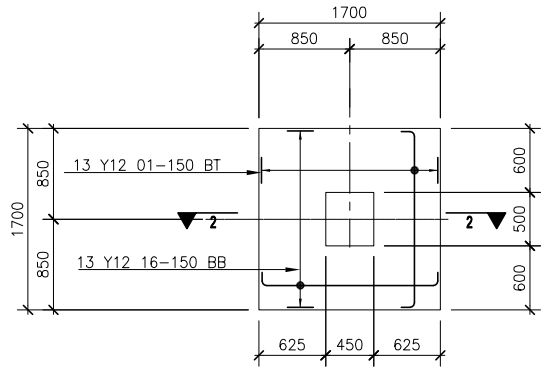
COLUMNS BASE 1

38Nos. THUS(SCALE 1:25)



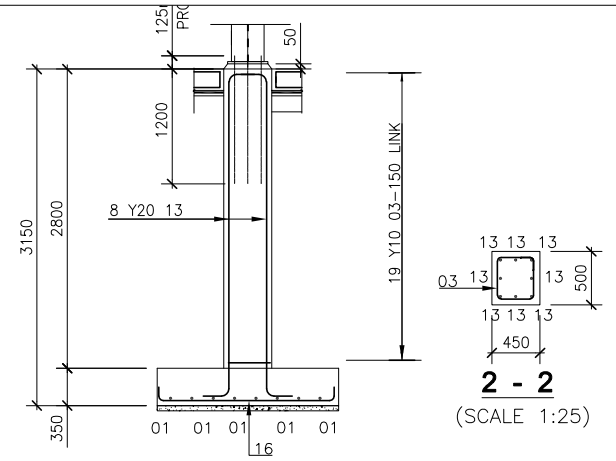
1 - 1

(SCALE 1:25)



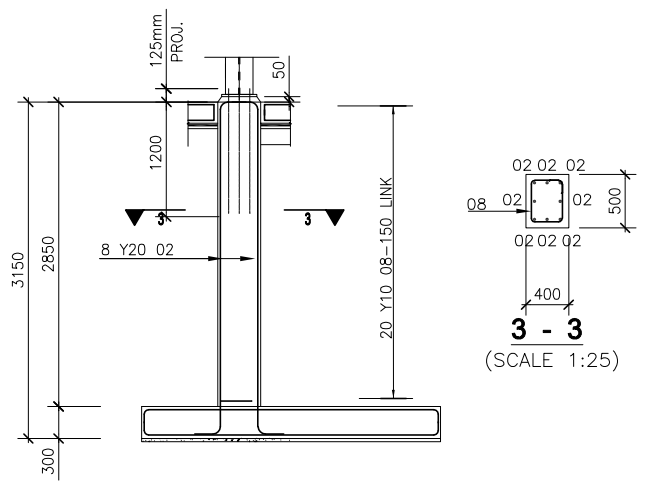
COLUMNS BASE 2

23Nos. THUS(SCALE 1:25)



2 - 2

(SCALE 1:25)

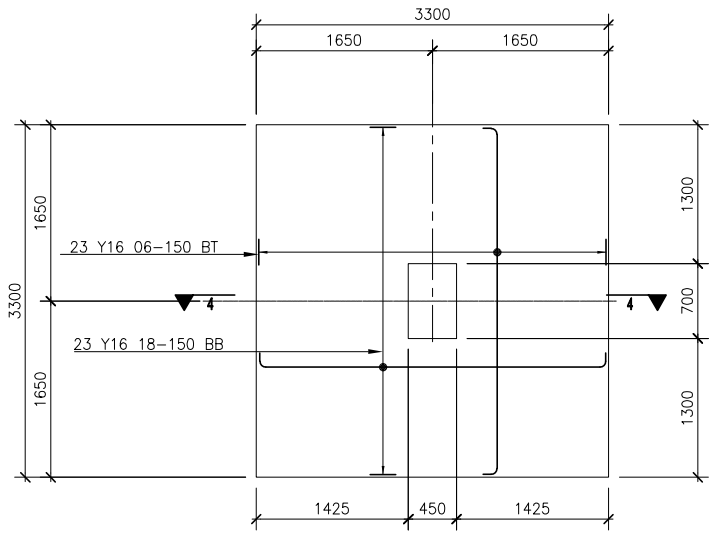


STUB COLUMN 3

11NOS THUS(SCALE 1:25)

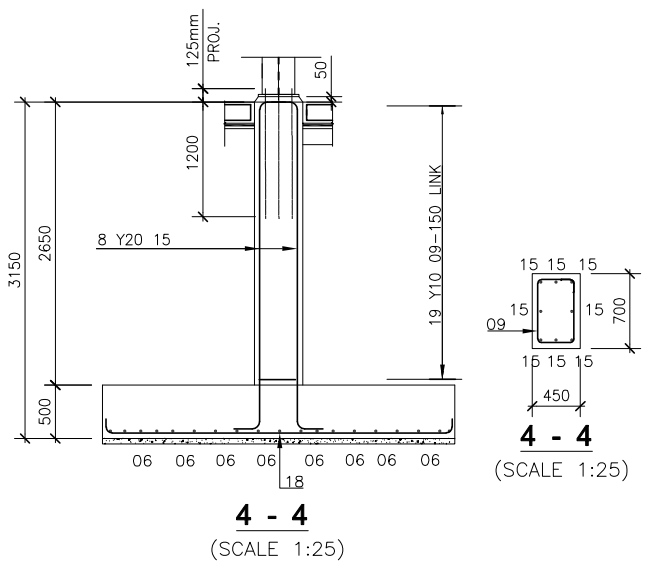
3 - 3

(SCALE 1:25)



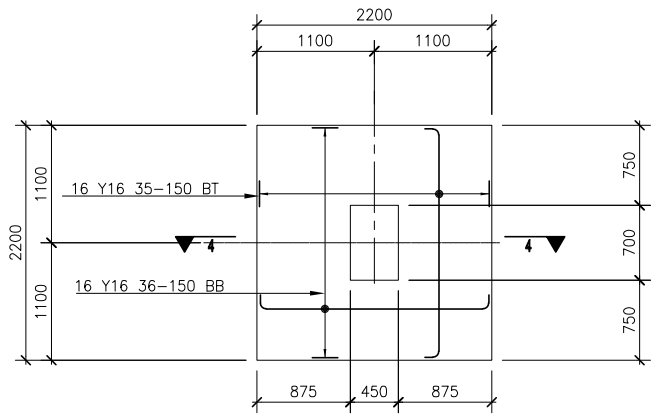
COLUMNS BASE 4

9Nos. THUS(SCALE 1:25)



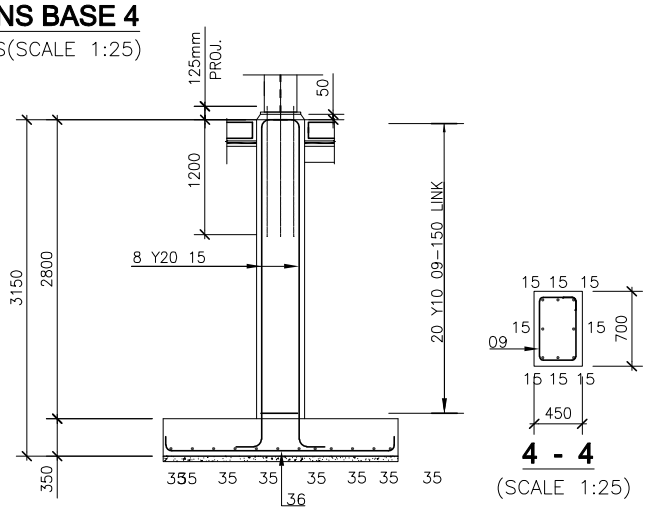
4 - 4

(SCALE 1:25)



COLUMNS BASE 5

7Nos. THUS(SCALE 1:25)



4 - 4

(SCALE 1:25)

REVISIONS		
Revision	Description	Date
A		
B		
C		
D		
E		
F		

client:

HERMES RESOURCE NIGERIA LIMITED

project:

PROPOSED INDUSTRIAL DEVELOPMENT AT
IKORODU INDUSTRIAL SCHEME
PLOT 488A LAGOS
IKORODU LOCAL GOVT. AREA,IKORODU.

consultant:

HANCOCK OGUNDIYA & PARTNERS.
.Consulting Civil & Structural Engineers
.Development Consultants & Project Managers
33 Glover Street, Ebute-Metta, Lagos.
Tel. 08034017782, 08033348629, 01-8987545
2636112, 2637519 Fax. 2637519
E-Mail: info@hancockogundiya.com
hancockogundiya@yahoo.com

Drawing Title

STUB COLUMNS BASES DETAILS.

Drawn	Date	Scale	Designed	Checked
MUKADAS	JAN. 2022	1:25	AL-AMEEN	OLUYEMI

Drawing No.: HOP/202002R/F01D

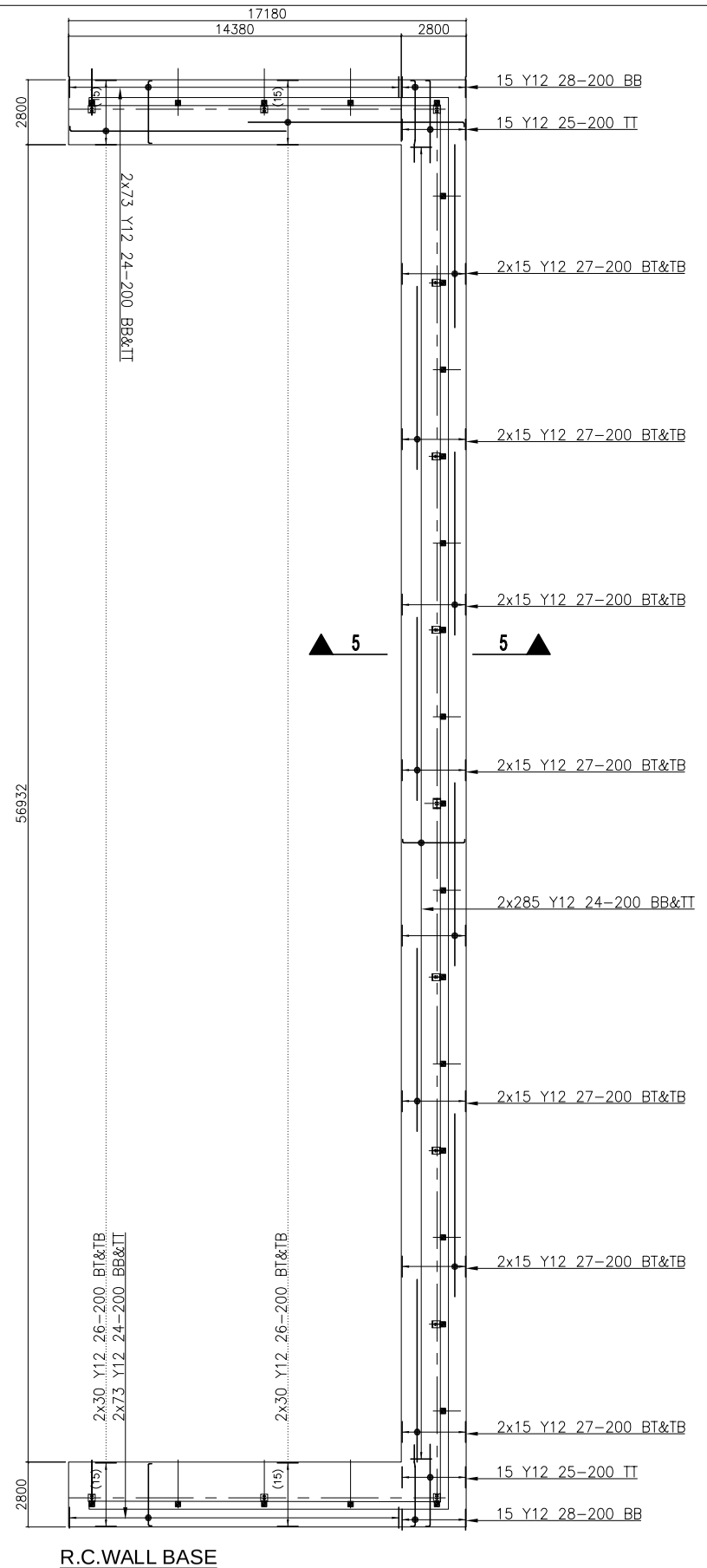
Revision Suffix:

FOR APPROVAL

ALL DIMENSIONS TO BE CONFIRMED ON SITE PRIOR TO COMMENCEMENT OF CONTRACT.

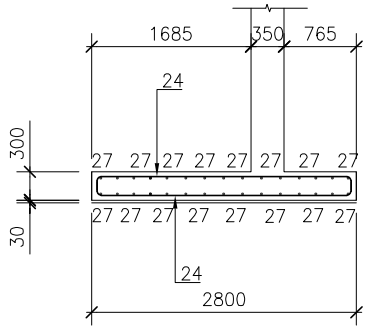
GENERAL NOTES

1. FOR GENERAL TECHNICAL CONSTRUCTION NOTES, REFER TO DRG. NO. XXXX-XX/XXX.
2. NO DIMENSION IS TO BE SCALED OFF THIS OR ANY OTHER DRAWING. ALL DIMENSIONS ARE TO BE TAKEN AS SPECIFIED AND CHECKED PRIOR TO USE IN CONSTRUCTION. ANY ERRORS, OMISSIONS OR DISCREPANCIES NOTED SHOULD BE BROUGHT IMMEDIATELY TO THE ATTENTION OF THE ARCHITECT AND/OR THE ENGINEER.
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R.C.WALL BASE

1Nos. THUS(SCALE 1:200)



5 – 5

(SCALE 1:30)

REVISIONS		
Revision	Description	Date
A		
B		
C		
D		
E		
F		

client:

HERMES RESOURCE NIGERIA LIMITED

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IKORODU LOCAL GOVT. AREA,IKORODU.

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2636112, 2637519 Fax. 2637519
E-Mail: info@hancockogundiya.com
hancockogundiya@yahoo.com

Drawing Title

R.C.DETAILS OF WALLS BASE.

Drawn	Date	Scale	Designed	Checked
MUKADAS	JAN. 2022	1:100 :1:50	AL-AMEEN	OLUYEMI

Drawing No.: HOP/202002R/F01G

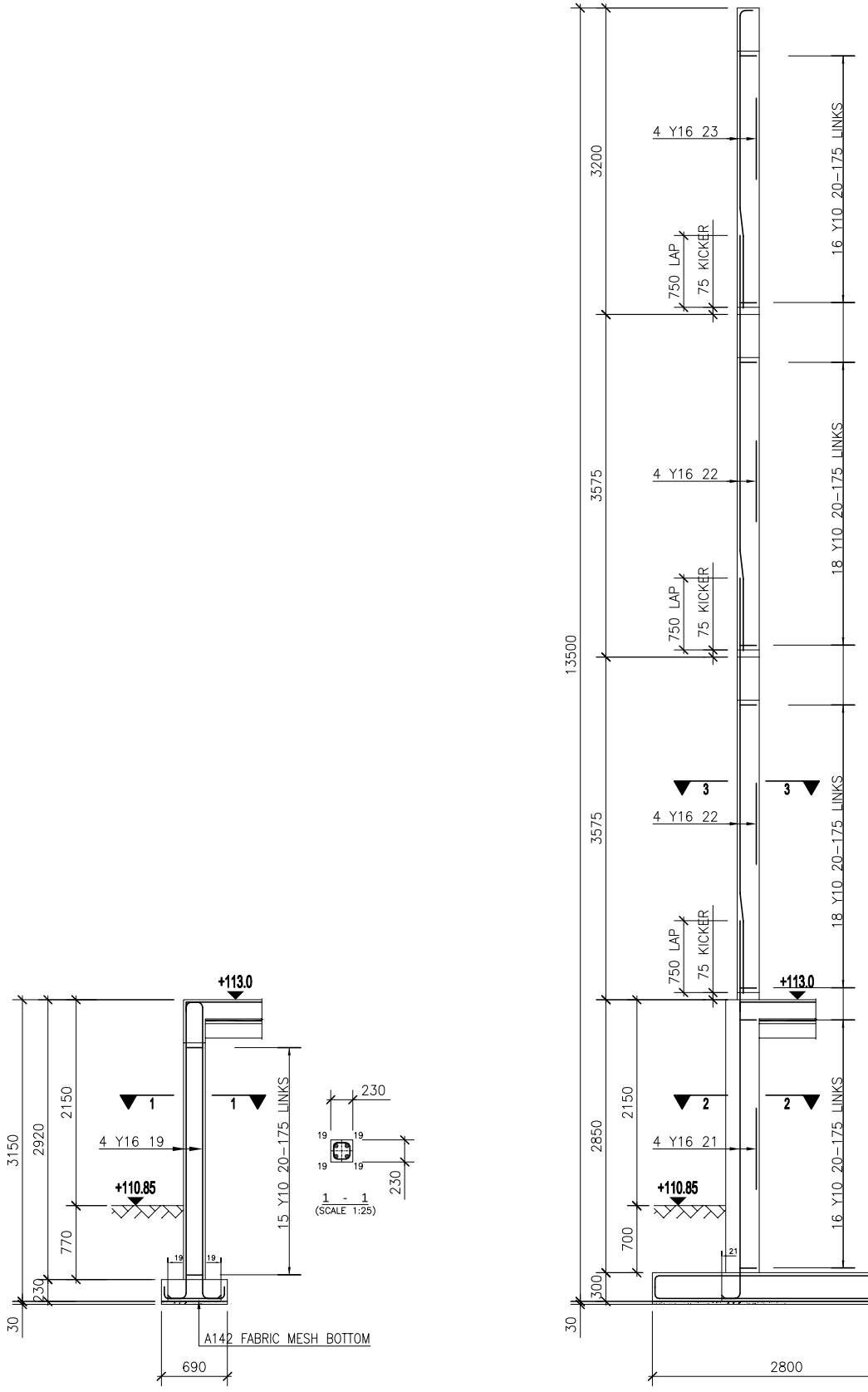
Revision Suffix:

FOR APPROVAL

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COLUMNS TYPE 1
86Nos THUS(SCALE 1:25)

COLUMNS TYPE 2
25Nos THUS(SCALE 1:25)

REVISIONS		
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A		
B		
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Drawing Title

R.C.DETAILS OF COLUMNS.

Drawn	Date	Scale	Designed	Checked
MUKADAS	JAN. 2022	1:25	AL-AMEEN	OLUYEMI

Drawing No.: HOP/202002R/F01E

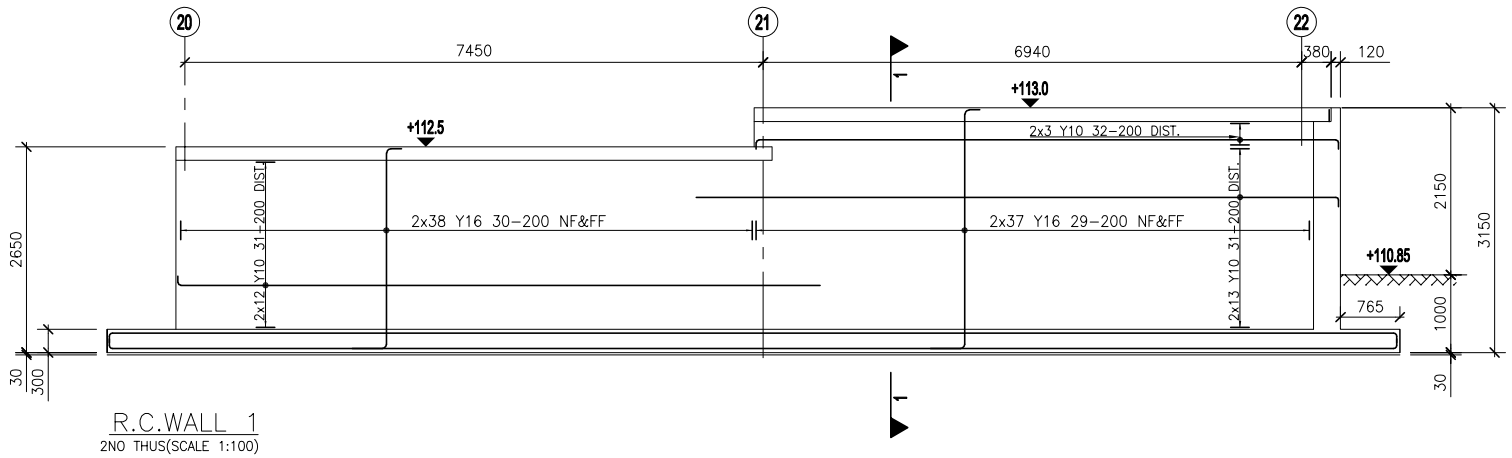
Revision Suffix:

FOR APPROVAL

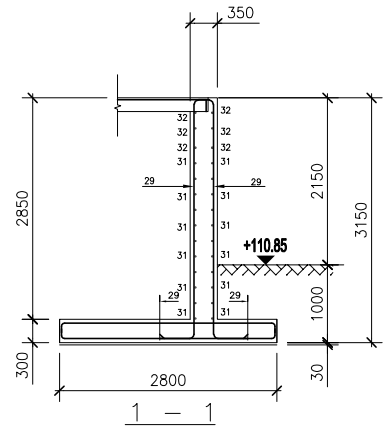
ALL DIMENSIONS TO BE CONFIRMED ON SITE PRIOR TO COMMENCEMENT OF CONTRACT.

GENERAL NOTES

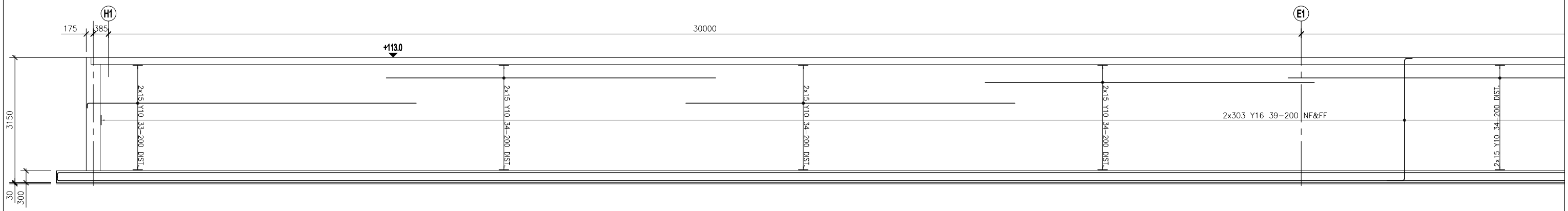
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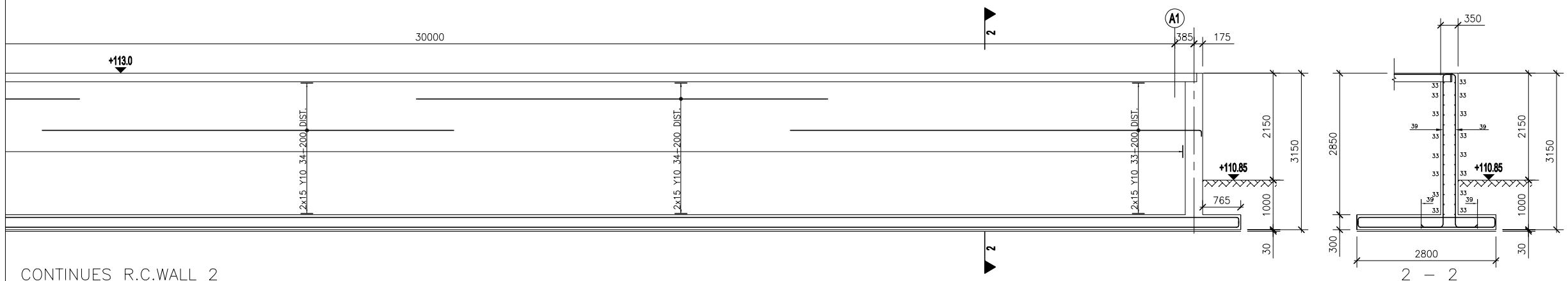
R.C.WALL 1
2NO THUS(SCALE 1:100)



1 – 1
(SCALE 1:100)



R.C.WALL 2
1NO THUS(SCALE 1:100)



CONTINUES R.C.WALL 2
(SCALE 1:100)

2 – 2
(SCALE 1:100)

REVISIONS		
Revision	Description	Date
A		
B		
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client:
HERMES RESOURCE NIGERIA LIMITED

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PROPOSED INDUSTRIAL DEVELOPMENT AT
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E-Mail: info@hancockogundiya.com
hancockogundiya@yahoo.com

Drawing Title
R.C.DETAILS OF WALLS

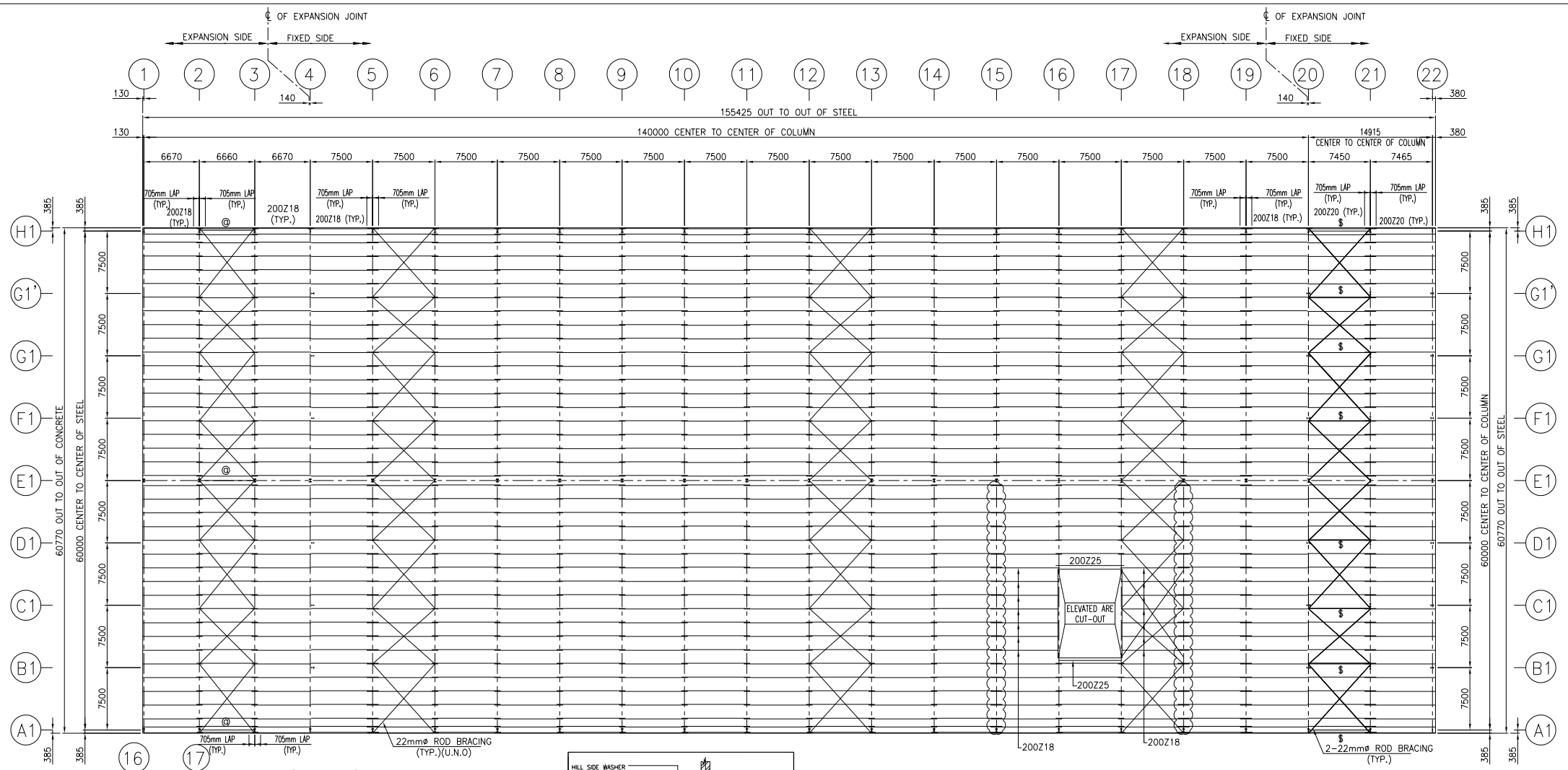
Drawn	Date	Scale	Designed	Checked
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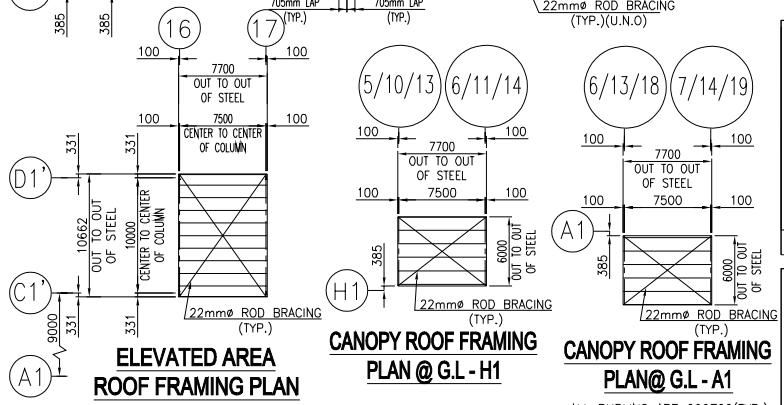
Drawing No.: HOP/202002R/F01F
Revision Suffix:
FOR APPROVAL

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ELEVATED AREA ROOF FRAMING PLAN

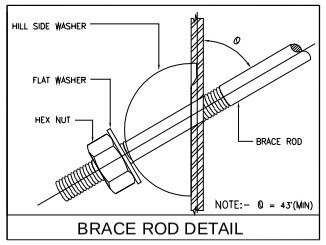
ALL PURLINS ARE 200Z25(TYP.)

CANOPY ROOF FRAMING PLAN @ G.L - H1

ALL PURLINS ARE 200Z22(TYP.)

CANOPY ROOF FRAMING PLAN@ G.L - A1

ALL PURLINS ARE 200Z22(TYP.)

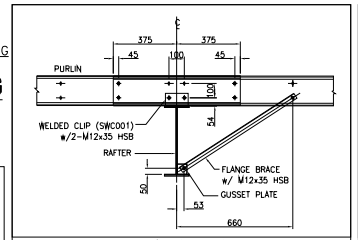


BRACE ROD DETAIL

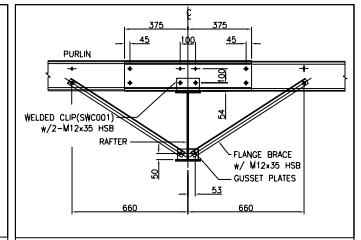
ROOF FRAMING PLAN

ALL PURLINS ARE 200Z15 w/375mm LAP. (TYP.)(U.N.O)
@ :- DENOTES STRUT TUBE OF SIZE SHS-125x125x3.2
$:- DENOTES STRUT TUBE OF SIZE SHS-150x150x4.5
⬭ :- DENOTES 705mm LAP.

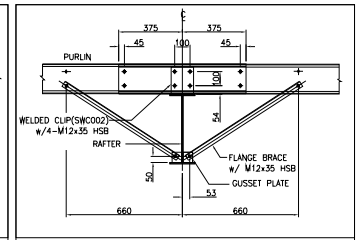
FOR OTHER DETAIL REFFER DWG. No : E13



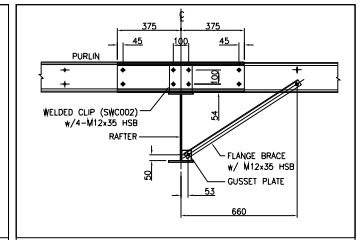
PURLIN LAP DETAIL WITH SINGLE SIDE FLANGE BRACE (200 Z)



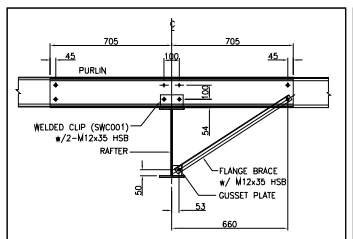
PURLIN LAP DETAIL WITH DOUBLE SIDE FLANGE BRACE (200 Z)



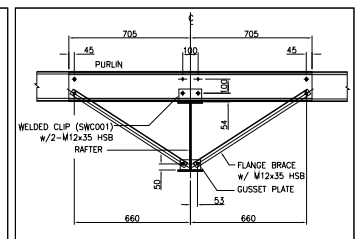
PURLIN LAP DETAIL WITH DOUBLE SIDE FLANGE BRACE @ EAVE, RIDGE & BRACING LOCATION (200 Z)



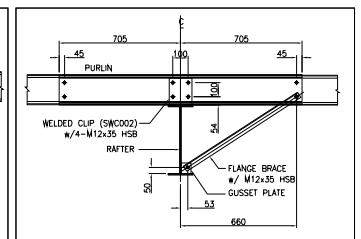
PURLIN LAP DETAIL WITH SINGLE SIDE FLANGE @ EAVE, RIDGE & BRACING LOCATION (200 Z)



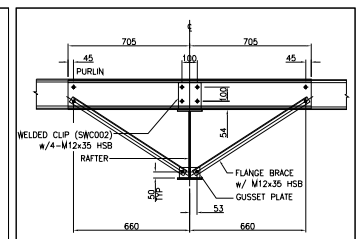
PURLIN LAP DETAIL WITH SINGLE SIDE FLANGE BRACE (200 Z)



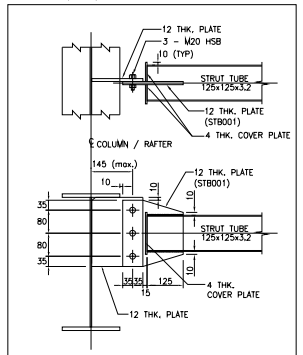
PURLIN LAP DETAIL WITH DOUBLE SIDE FLANGE BRACE (200 Z)



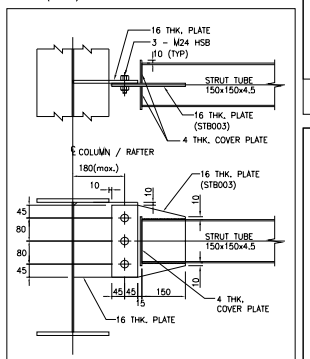
PURLIN LAP DETAIL WITH SINGLE SIDE FLANGE BRACE @ EAVE, RIDGE & BRACING LOCATION (200 Z)



PURLIN LAP DETAIL WITH DOUBLE SIDE FLANGE BRACE @ EAVE, RIDGE & BRACING LOCATION (200 Z)



STRUT TUBE 125x125 WEB CONNECTION



STRUT TUBE 150x150 WEB CONNECTION

REVISIONS		
Revision	Description	Date
A		
B		
C		
D		
E		
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client:

HERMES RESOURCE NIGERIA LIMITED

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Drawing Title

ROOF FRAME PLAN AND DETAILS

Drawn	Date	Scale	Designed	Checked
MUKADAS	JAN. 2022	1:100 :1:50	AL-AMEEN	OLUYEMI

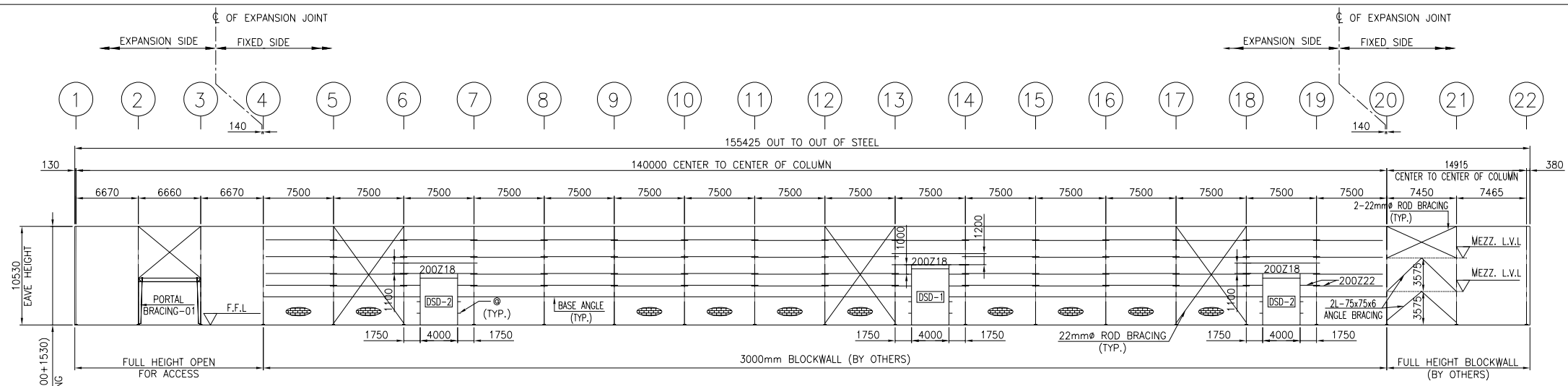
Drawing No.: HOP/202002R/E11 Revision Suffix

FOR APPROVAL

ALL DIMENSIONS TO BE CONFIRMED ON SITE PRIOR TO COMMENCEMENT OF CONTRACT.

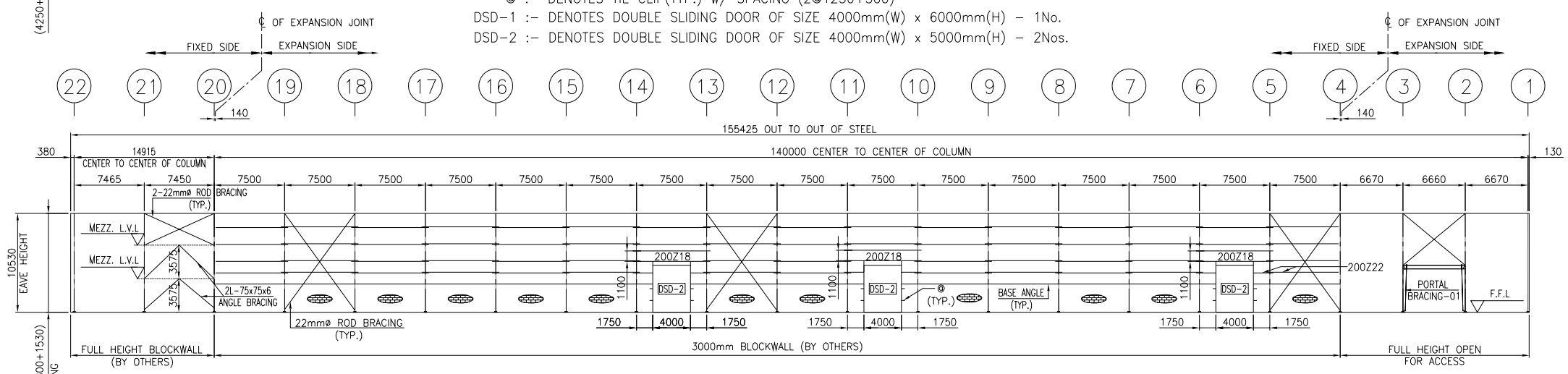
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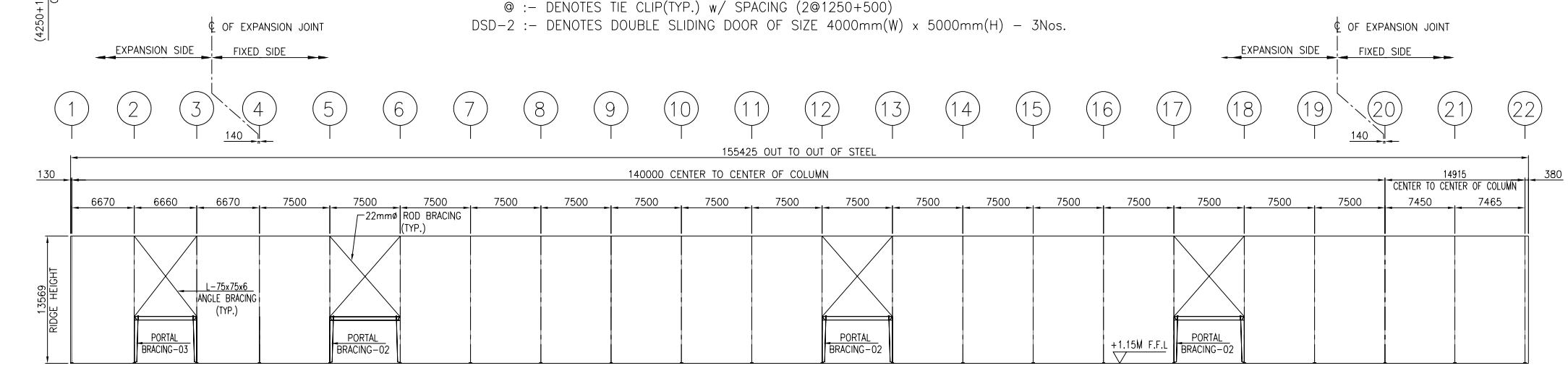
SIDEWALL FRAMING ELEVATION @ G.L - A1

ALL GIRTS ARE 200Z15 w/375mm LAP.(TYP.)(U.N.O.)
@ :- DENOTES TIE CLIP(TYP.) w/ SPACING (2@1250+500)
DSD-1 :- DENOTES DOUBLE SLIDING DOOR OF SIZE 4000mm(W) x 6000mm(H) - 1No.
DSD-2 :- DENOTES DOUBLE SLIDING DOOR OF SIZE 4000mm(W) x 5000mm(H) - 2Nos.



SIDEWALL FRAMING ELEVATION @ G.L - H1

ALL GIRTS ARE 200Z15 w/375mm LAP.(TYP.)(U.N.O.)
@ :- DENOTES TIE CLIP(TYP.) w/ SPACING (2@1250+500)
DSD-2 :- DENOTES DOUBLE SLIDING DOOR OF SIZE 4000mm(W) x 5000mm(H) - 3Nos.



SIDEWALL FRAMING ELEVATION @ G.L - E1

FOR PORTRAL AND OTHER WALL FRAMING DETAILS REFFER DWG. No.-E13

REVISIONS		
Revision	Description	Date
A		
B		
C		
D		
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F		

client:
HERMES RESOURCE NIGERIA LIMITED

project:
PROPOSED INDUSTRIAL DEVELOPMENT AT
IKORODU INDUSTRIAL SCHEME
PLOT 488A LAGOS
IKORODU LOCAL GOVT. AREA,IKORODU.

consultant:
HANCOCK OGUNDIYA & PARTNERS.
.Consulting Civil & Structural Engineers
.Development Consultants & Project Managers
33 Glover Street, Ebute-Metta, Lagos.
Tel. 08034017782, 08033348629, 01-8987545
2636112, 2637519 Fax. 2637519
E-Mail: info@hancockogundiya.com
hancockogundiya@yahoo.com

Drawing Title
WALL FRAME ELEVATIONS AND DETAILS

Drawn	Date	Scale	Designed	Checked
MUKADAS	JAN. 2022	1:100 :1:50	A.L-AMEEN	OLUYEMI

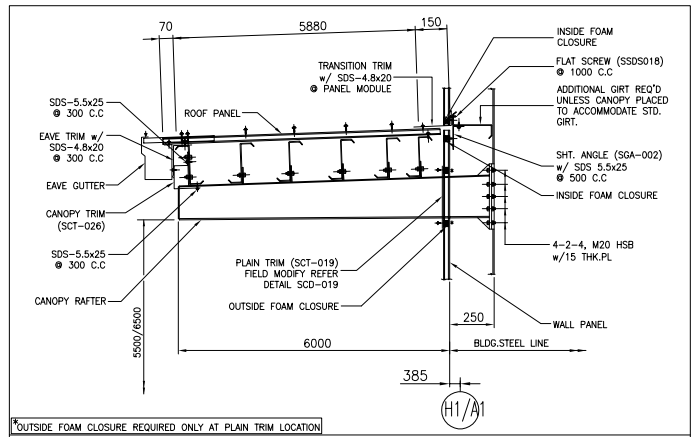
Drawing No.: HOP/202002R/E12
Revision Suffix:

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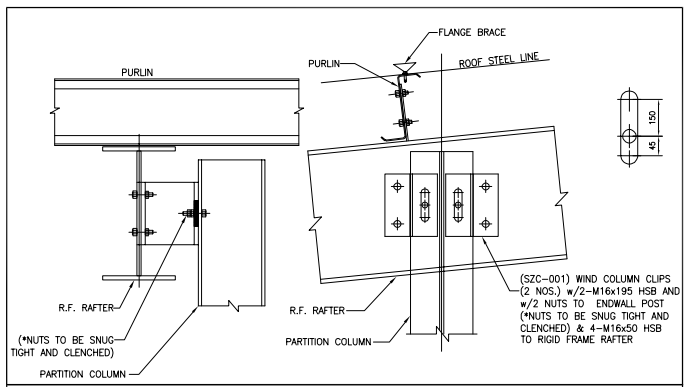
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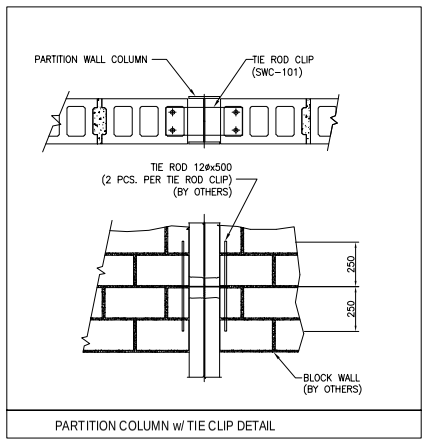


*OUTSIDE FOAM CLOSURE REQUIRED ONLY AT PLAIN TRIM LOCATION

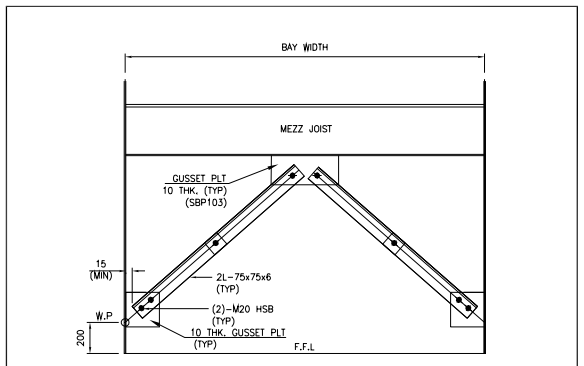
CANOPY w/ EAVE GUTTER @ BELOW ROOF LEVEL



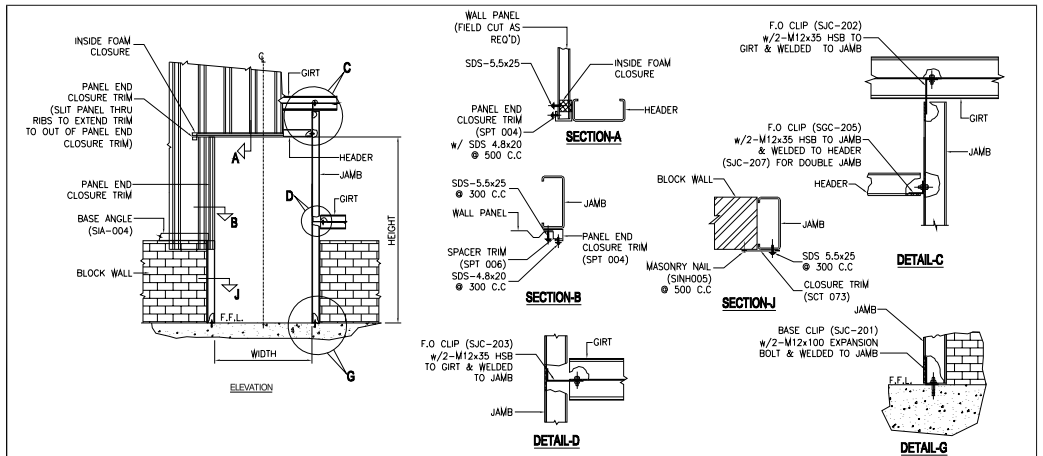
PARTITION COLUMN w/ R.F. RAFTER DETAIL @ SLOPE



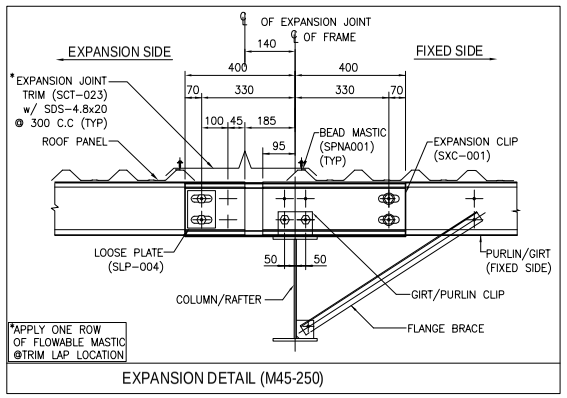
PARTITION COLUMN w/ TIE CLIP DETAIL



ANGLE BRACE DETAIL (75 x 75 x 6)

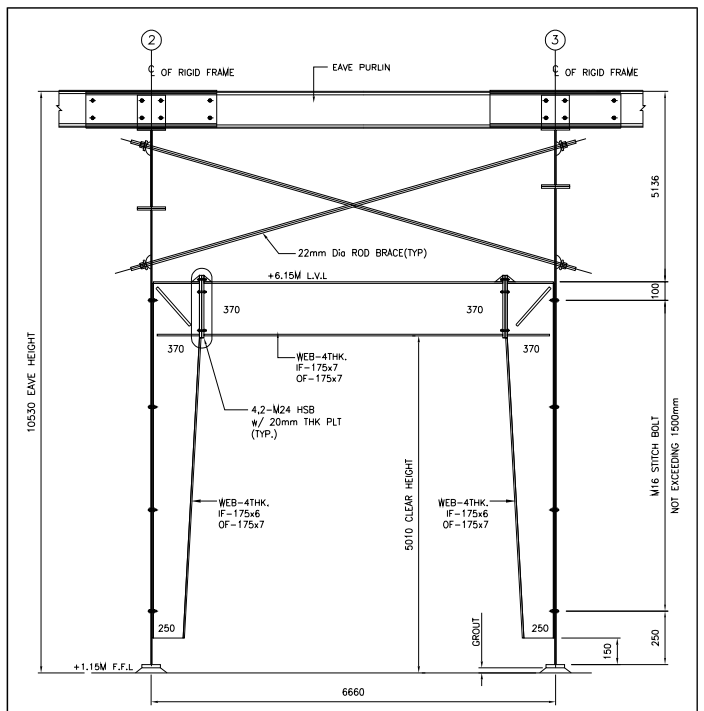


WALL FRAME OPENING w/ SINGLE SKIN & BLOCKWALL

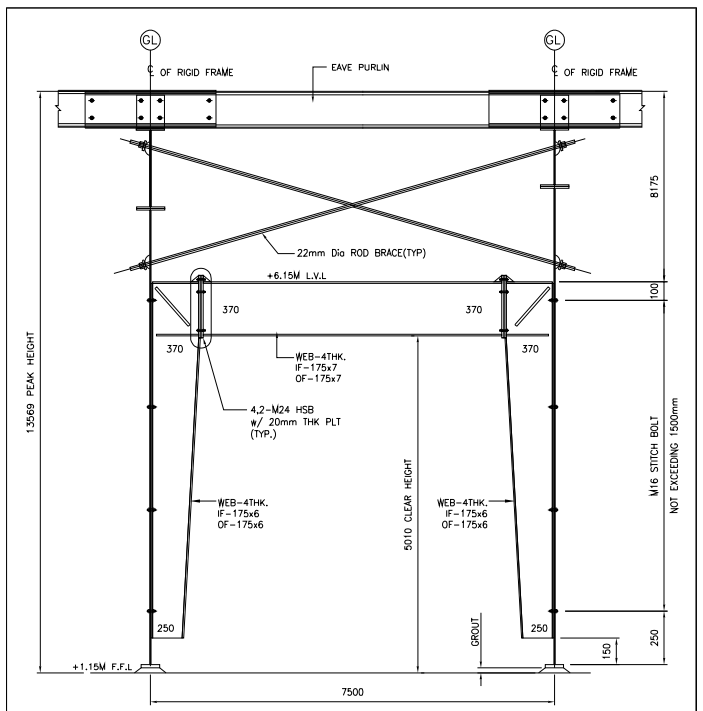


*APPLY ONE ROW OF FLOWABLE MASTIC @TRIM LAP LOCATION

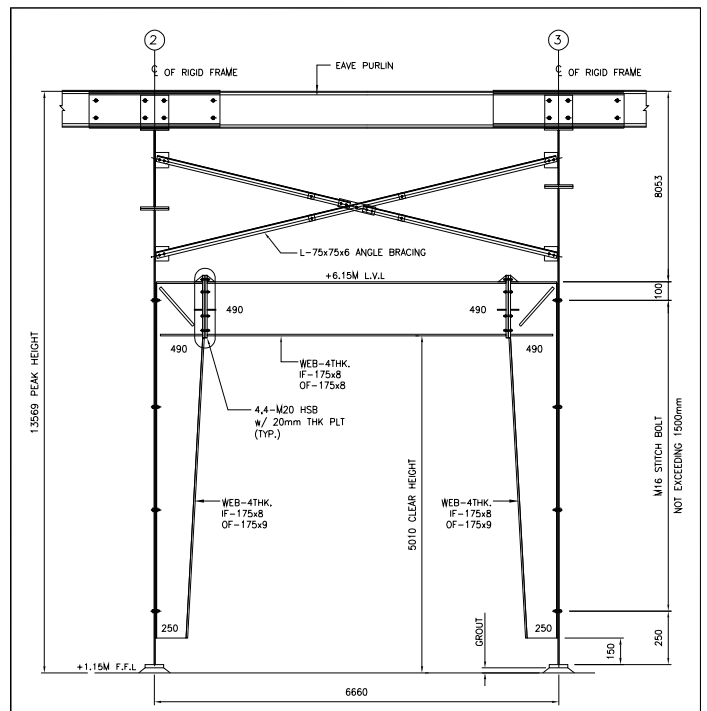
EXPANSION DETAIL (M45-250)



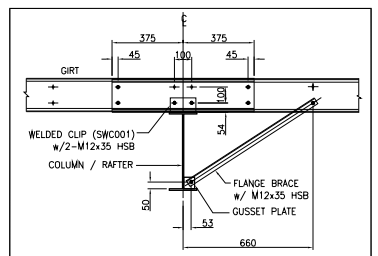
PORTAL FRAME DETAILS(PORTAL BRACING -01)



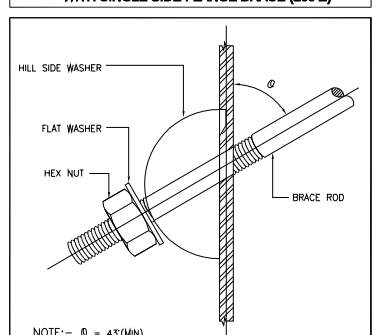
PORTAL FRAME DETAILS(PORTAL BRACING -02)



PORTAL FRAME DETAILS(PORTAL BRACING -03)



GIRT LAP DETAIL
WITH SINGLE SIDE FLANGE BRACE (200 Z)



BRACE ROD DETAIL

REVISIONS		
Revision	Description	Date
A		
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HERMES RESOURCE NIGERIA LIMITED

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2636112, 2637519 Fax. 2637519
E-Mail: info@hancockogundiya.com
hancockogundiya@yahoo.com

Drawing Title

FRAMING DETAILS

Drawn	Date	Scale	Designed	Checked
MUKADAS	JAN. 2022	1:100 :1:50	AL-AMEEN	OLUYEMI

Drawing No.: HOP/202002R/E13

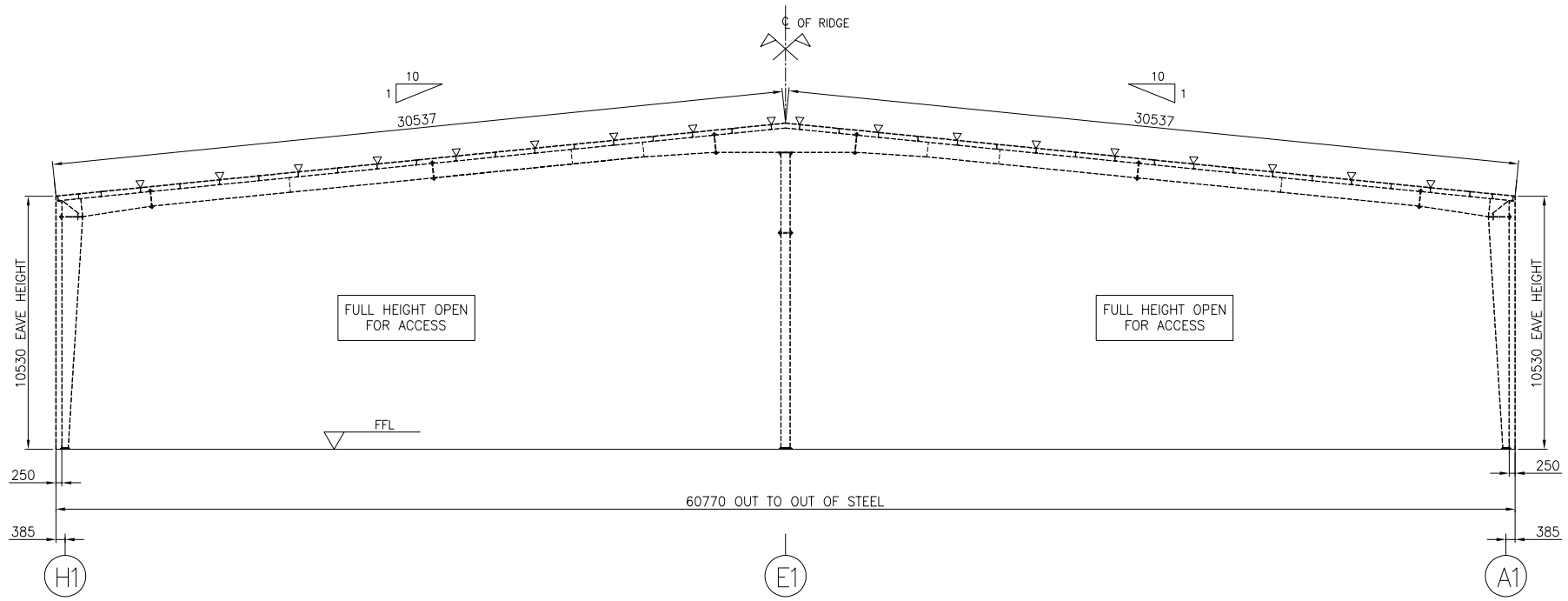
Revision Suffix:

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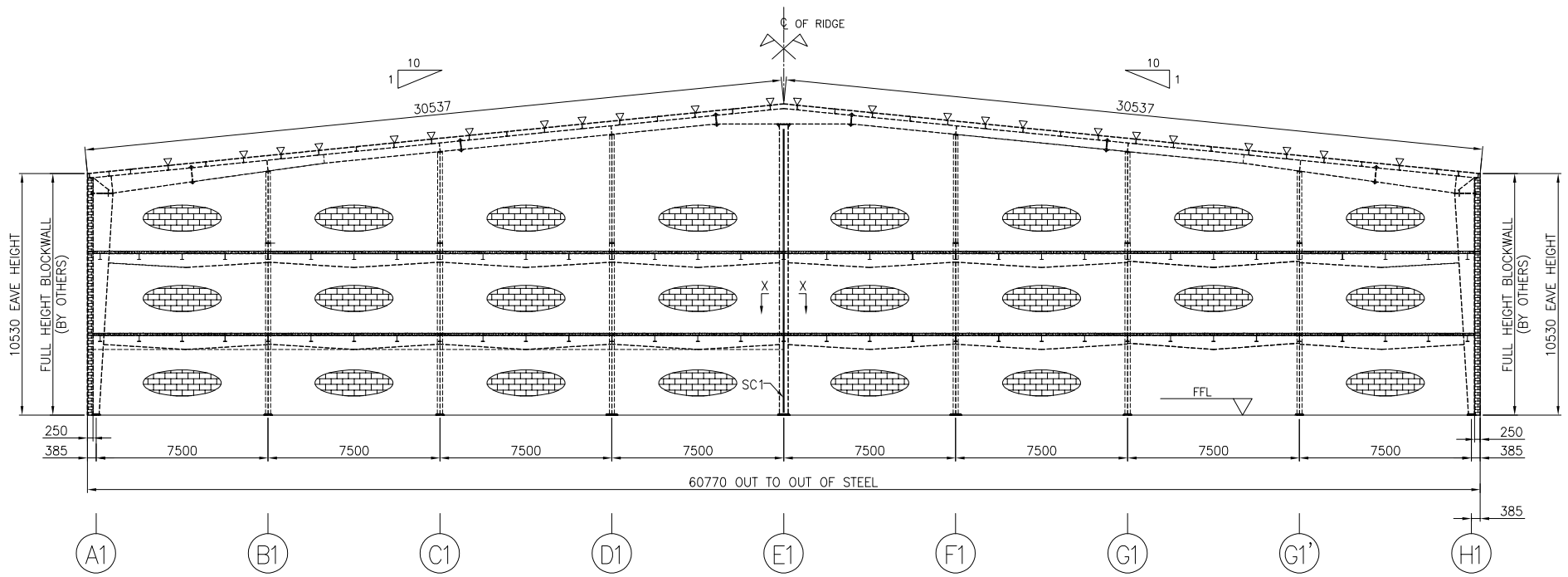
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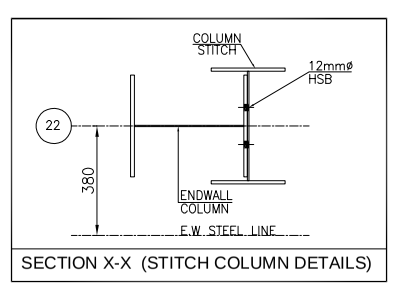


ENDWALL FRAMING ELEVATION @ GL - 1



ENDWALL FRAMING ELEVATION @ GL - 22

SC1 :– DENOTES STITCH COLUMN OF SIZE 295x5(W) X 250x12(FLANGES)



SECTION X-X (STITCH COLUMN DETAILS)

REVISIONS		
Revision	Description	Date
A		
B		
C		
D		
E		
F		

client:

HERMES RESOURCE NIGERIA LIMITED

project:

PROPOSED INDUSTRIAL DEVELOPMENT AT
IKORODU INDUSTRIAL SCHEME
PLOT 488A LAGOS
IKORODU LOCAL GOVT. AREA, IKORODU.

consultant:

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2636112, 2637519 Fax. 2637519
E-Mail: info@hancockogundiya.com
hancockogundiya@yahoo.com

Drawing Title

ENDWALL FRAME ELEVATIONS AND DETAILS

Drawn	Date	Scale	Designed	Checked
MUKADAS	JAN. 2022	1:100 ; 1:50	AL-AMEEN	OLUYEMI

Drawing No.: **HOP/202002R/E14** Revision Suffix:

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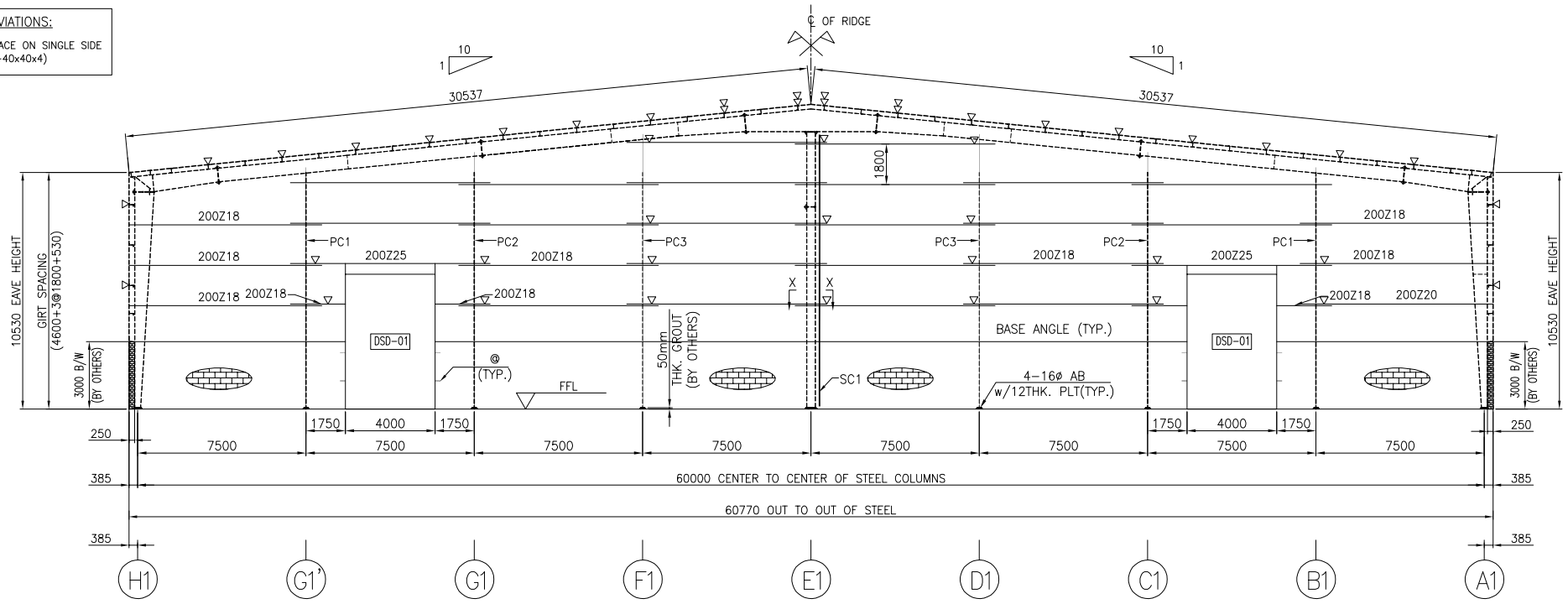
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LEGEND/ABBREVIATIONS:

▽ – FLANGE BRACE ON SINGLE SIDE (L–40x40x4)



PARTITION WALL FRAMING ELEVATION @ GL - 4

ALL GIRTS ARE 200Z15w/705mm LAP.(TYP.)(U.N.O)

SC1 :– DENOTES STITCH COLUMN OF SIZE 295x4(W) X 200x9(FLANGES)

DSD–1 :– DENOTES DOUBLE SLIDING DOOR OF SIZE 4000mm(W) x 6000mm(H) – 2Nos.

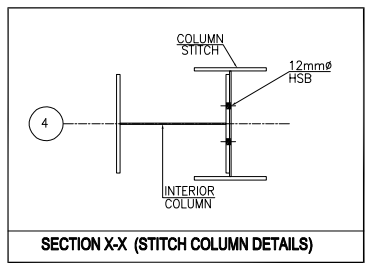
PC1 :– DENOTES PARTITION COLUMN OF SIZE 295x4mm(WEB) x 175x7(FLANGES)

PC2 :– DENOTES PARTITION COLUMN OF SIZE 295x4mm(WEB) x 175x8(FLANGES)

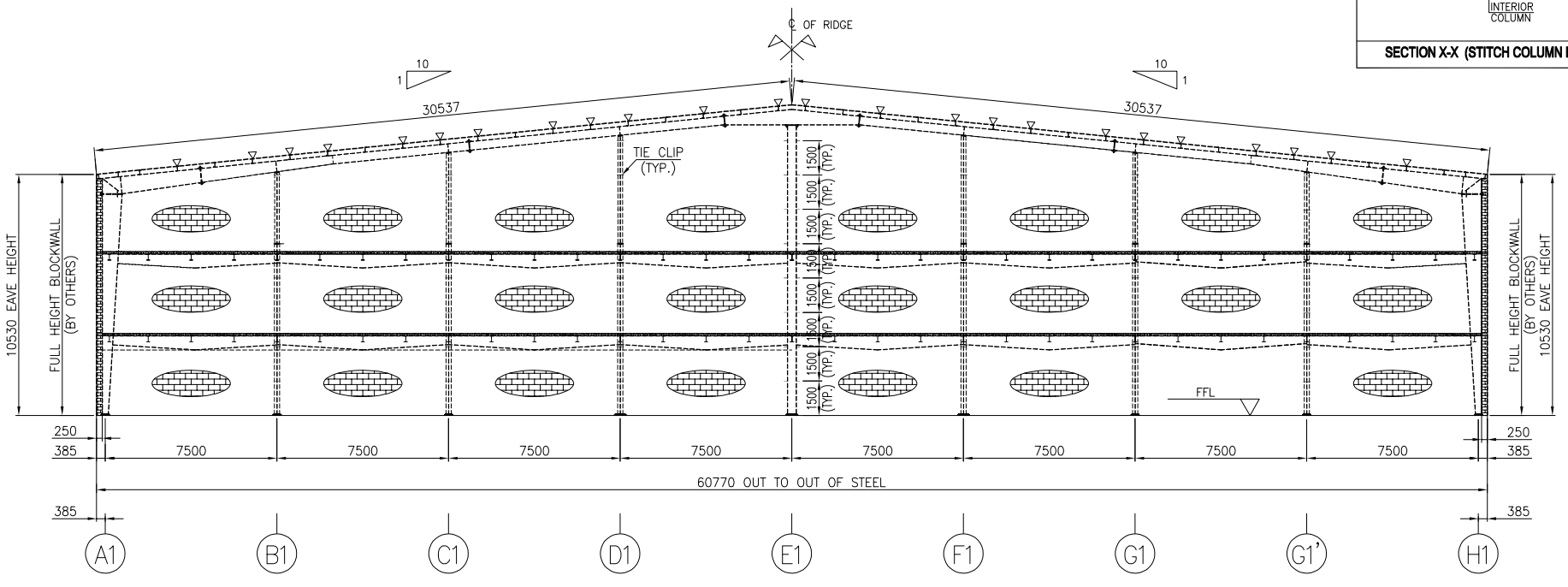
PC3 :– DENOTES PARTITION COLUMN OF SIZE 295x4mm(WEB) x 175x9(FLANGES)

@ :– DENOTES TIE CLIP(TYP.) w/ SPACING (2@1250+500)

FOR DETAILS REFFER DWG. No.– E13



SECTION X-X (STITCH COLUMN DETAILS)



END WALL FRAMING ELEVATION @ GL - 20

FOR DETAILS REFFER DWG. No.– E13

REVISIONS		
Revision	Description	Date
A		
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client:

HERMES RESOURCE NIGERIA LIMITED

project:

PROPOSED INDUSTRIAL DEVELOPMENT AT
IKORODU INDUSTRIAL SCHEME
PLOT 488A LAGOS
IKORODU LOCAL GOVT. AREA,IKORODU.

consultant:

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2636112, 2637519 Fax. 2637519
E-Mail: info@hancockogundiya.com
hancockogundiya@yahoo.com

Drawing Title: WALL FRAME ELEVATIONS AND DETAILS

Drawn	Date	Scale	Designed	Checked
MUKADAS	JAN. 2022	1:100 :1:50	AL-AMEEN	OLUYEMI

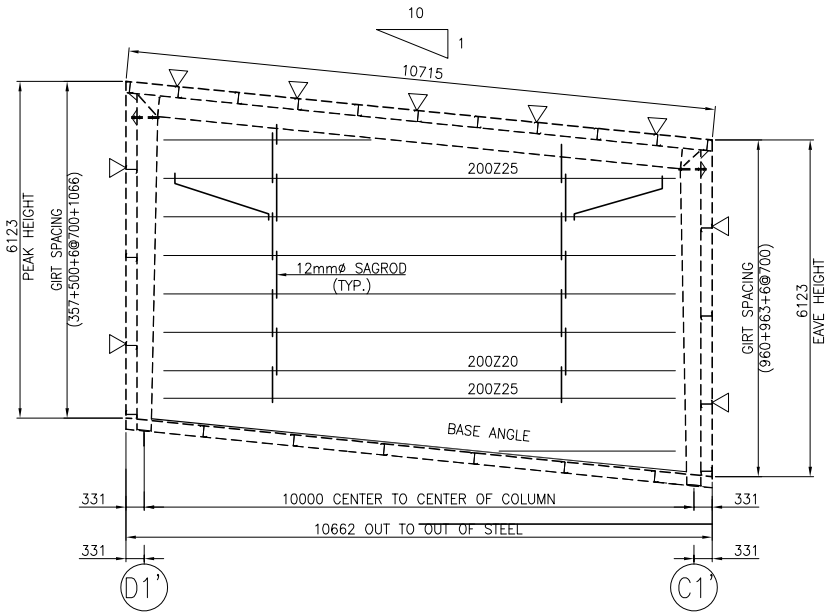
Drawing No.: HOP/202002R/E15 Revision Suffix:

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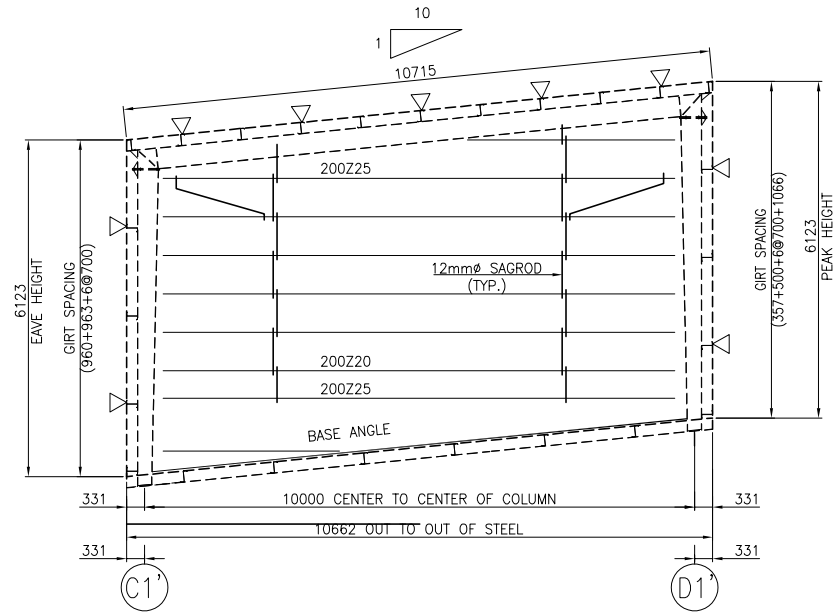
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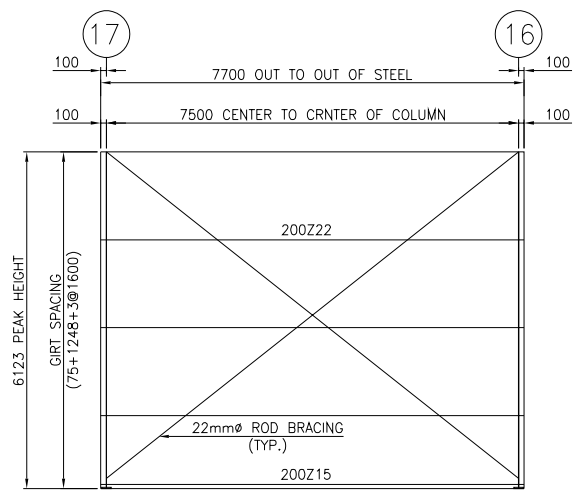
ELEVATED ARE ENDWALL FRAMING ELEVATION @ G.L - 16

ALL GIRTS ARE 200Z22(TYP.)(U.N.O)



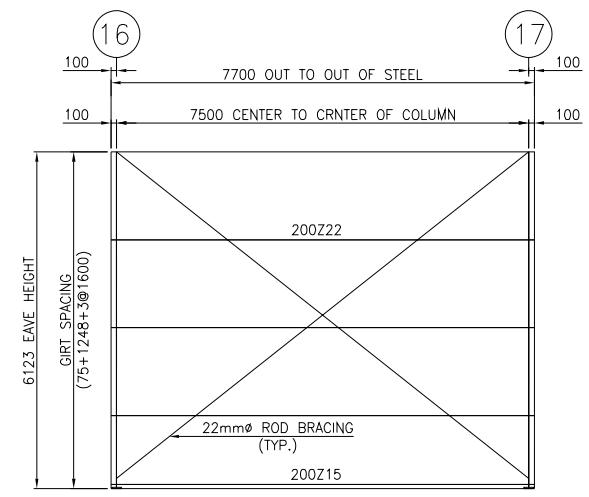
ELEVATED ARE ENDWALL FRAMING ELEVATION @ G.L - 17

ALL GIRTS ARE 200Z22(TYP.)(U.N.O)



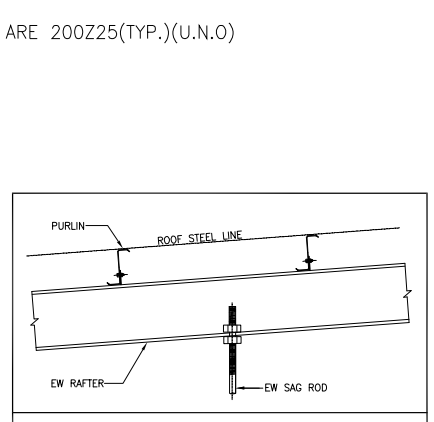
ELEVATED ARE SIDEWALL FRAMING ELEVATION @ G.L - D1'

ALL GIRTS ARE 200Z25(TYP.)(U.N.O)

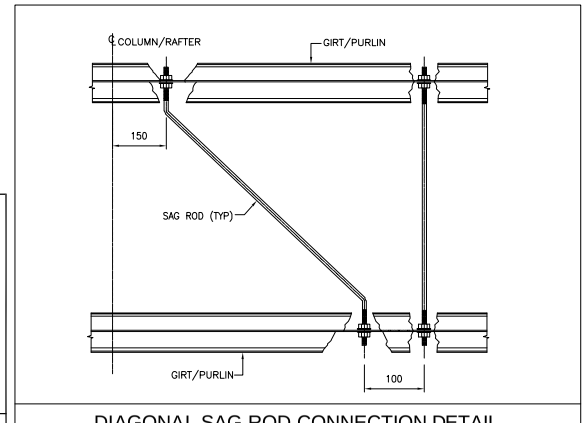


ELEVATED ARE SIDEWALL FRAMING ELEVATION @ G.L - C1'

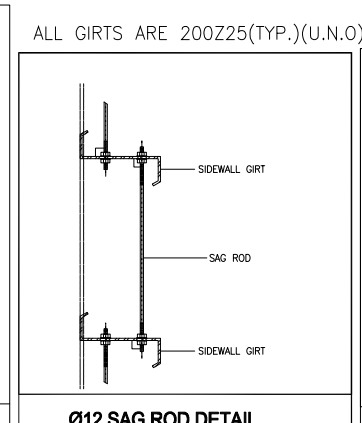
ALL GIRTS ARE 200Z25(TYP.)(U.N.O)



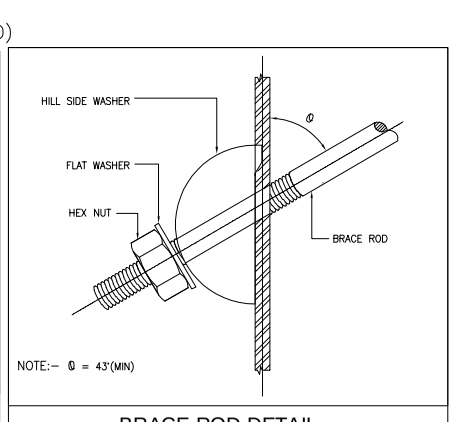
EW SAGROD DETAIL (FLUSH)



DIAGONAL SAG ROD CONNECTION DETAIL



Ø12 SAG ROD DETAIL



BRACE ROD DETAIL

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2636112, 2637519 Fax. 2637519
E-Mail: info@hancockogundiya.com
hancockogundiya@yahoo.com

Drawing Title

ELEVATED AREA WALL FRAMING ELEVATIONS AND DETAILS.

Drawn	Date	Scale	Designed	Checked
MUKADAS	JAN. 2022	1:100 ;1:50	AL-AMEEN	OLUYEMI

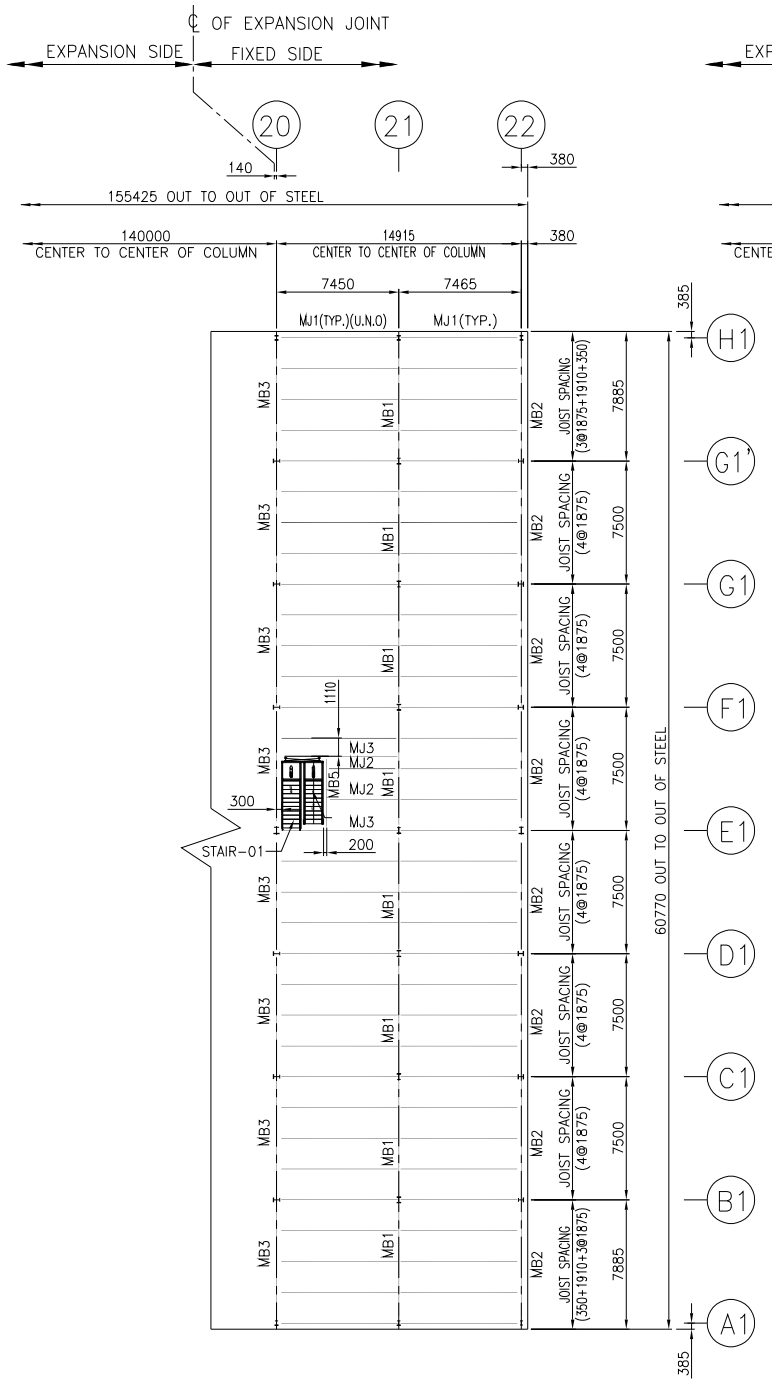
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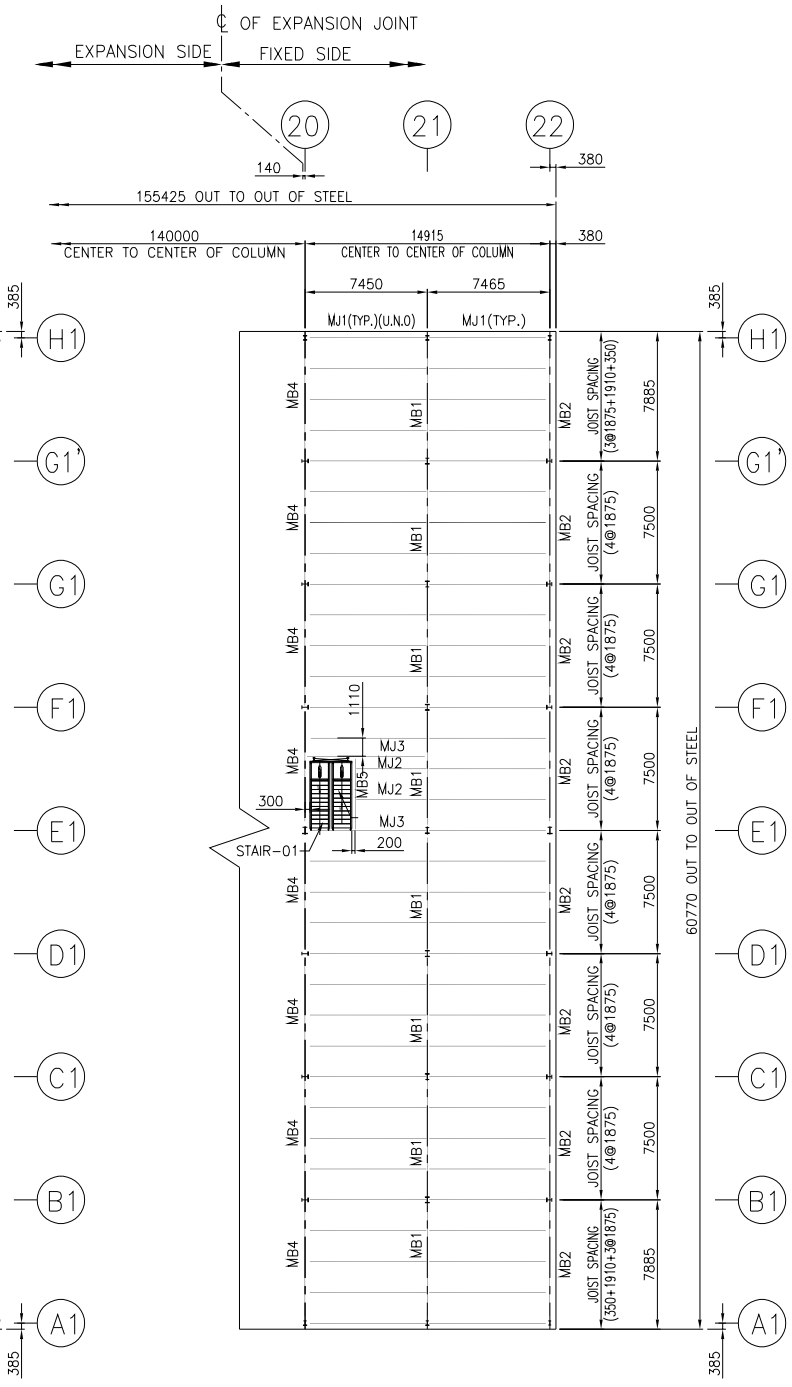
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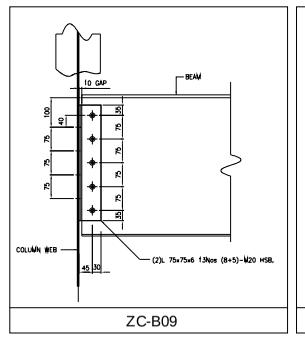
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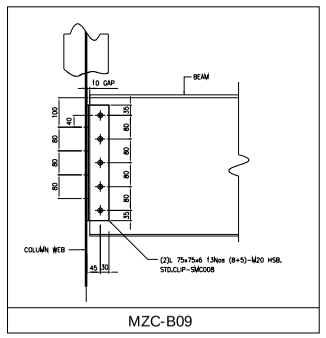
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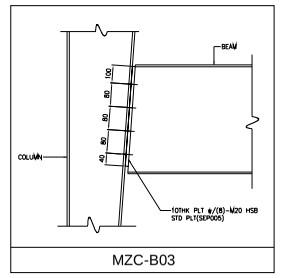




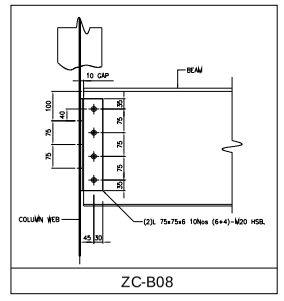
ZC-B09



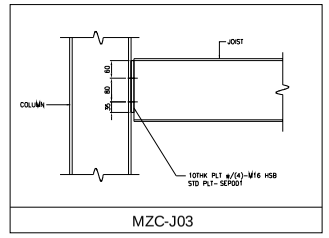
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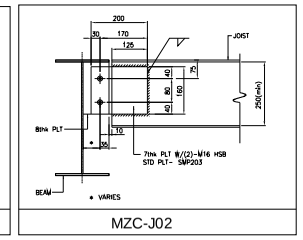
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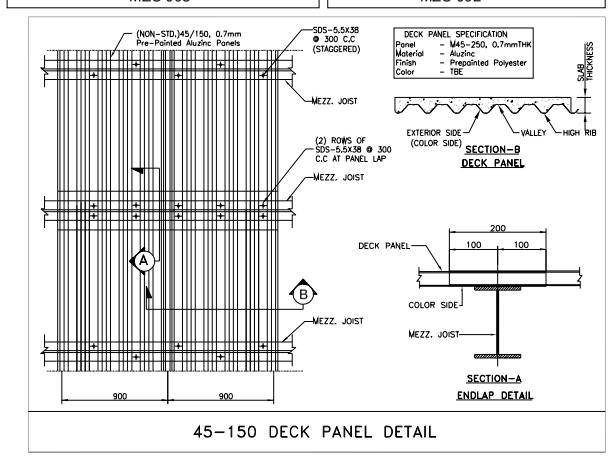
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MZC-J03



MZC-J02



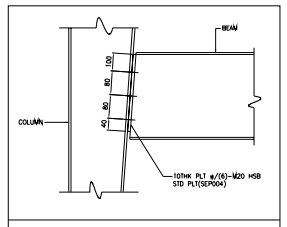
45-150 DECK PANEL DETAIL

1ST MEZZANINE LAYOUT L.V.L

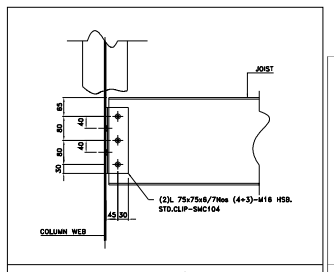
CLIENT/CONSULTANT TO CONFIRM LOCATION AND ORIENTATION OF STAIR

BLOCKWALL LOAD CONSIDERED AS PER BLOCKWALL LAYOUT PLAN

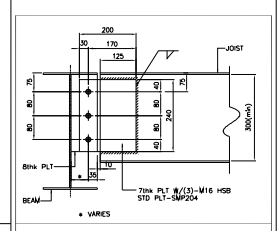
2ND MEZZANINE LAYOUT L.V.L



MZC-B02



MZC-J10



MZC-J08

MEZZANINE DESIGN SUMMARY : @ +4.725M LVL. & +8.30M L.V.L FROM F.F.L

MEZZANINE LIVE LOAD	5.00	(KN/M²)
TOTAL DEAD LOAD	3.00	(KN/M²)
COLLATERAL LOAD	0.15	(KN/M²)
TOTAL	8.15	(KN/M²)

MEZZANINE DEAD LOAD BREAKDOWN		
ITEM	LOAD	(KN/M²)
100 MM THK. CONC.+FINISH	2.50	(KN/M²)
DECKING	0.10	(KN/M²)
JOISTS	0.20	(KN/M²)
BEAMS	0.20	(KN/M²)
TOTAL	3.00	(KN/M²)

DECKING	0.7 THK. 45/150 GJ DECKING
CLEAR HEIGHT BELOW MEZZ.	2713mm

JOIST	WEB (DEPTH x THICK)	FLANGE (WIDTH x THICK)	MAXIMUM SPACING	STD.END CONNECTION	REMARKS
MJ1	250~490~250x4	150x7(OF), 150X6(IF)	1910	MZC-J02, MZC-J03	
MJ2	250x6	150x6(OF), 150X6(IF)	1910	MZC-J02, MZC-J03	
MJ3	350~6500~350x5	200x9(OF), 200X8(IF)	1910	MZC-J10	

BEAM	WEB DEPTH x THICK	FLANGE WIDTH x THICK	STD.END CONNECTION	REMARKS
MB1	400~740~400x7	200x12(OF), 200X10(IF)	MZC-B03	
MB2	325~600~325x5	200x9(OF), 200X7(IF)	MZC-B02, ZC-B08	
MB3	400~700~400x6	200x10(OF), 200X7(IF)	MZC-B02, ZC-B09	
MB4	450~700~450x7	200x12(OF), 200X8(IF)	MZC-B02, MZC-B09	
MB5	350x4	175x7(OF), 175X6(IF)	MZC-J08	

REVISIONS		
Revision	Description	Date
A		
B		
C		
D		
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F		

client:

HERMES RESOURCE NIGERIA LIMITED

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PROPOSED INDUSTRIAL DEVELOPMENT AT
IKORODU INDUSTRIAL SCHEME
PLOT 488A LAGOS
IKORODU LOCAL GOVT. AREA,IKORODU.

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2636112, 2637519 Fax. 2637519
E-Mail: info@hancockogundiya.com
hancockogundiya@yahoo.com

Drawing Title

MEZZANINE LAYOUT PLAN AND DETAILS

Drawn	Date	Scale	Designed	Checked
MUKADAS	JAN. 2022	1:100 :1:50	AL-AMEEN	OLUYEMI

Drawing No.: HOP/202002R/E17

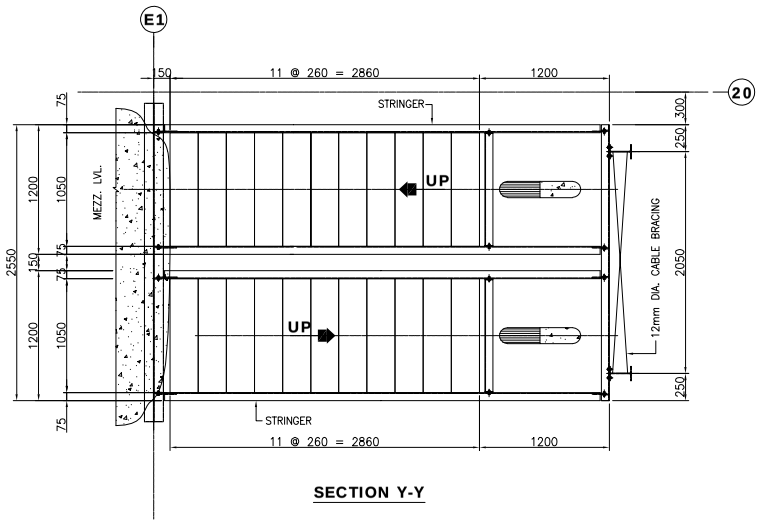
Revision Suffix:

FOR APPROVAL

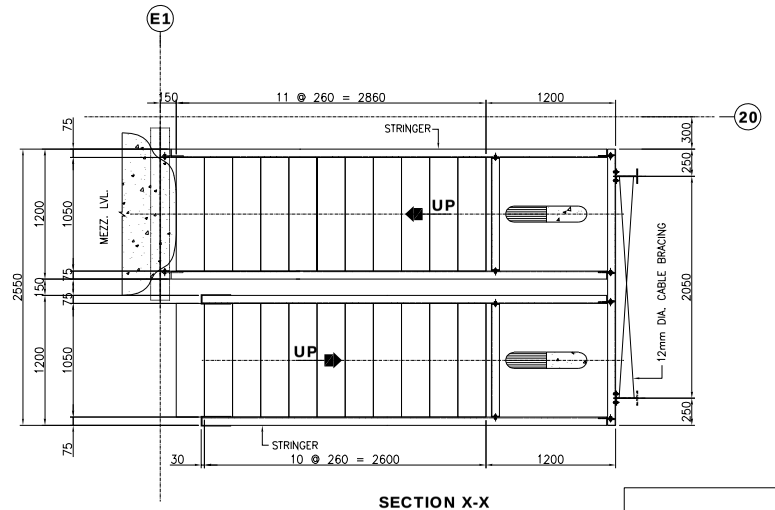
ALL DIMENSIONS TO BE CONFIRMED ON SITE PRIOR TO COMMENCEMENT OF CONTRACT.

GENERAL NOTES

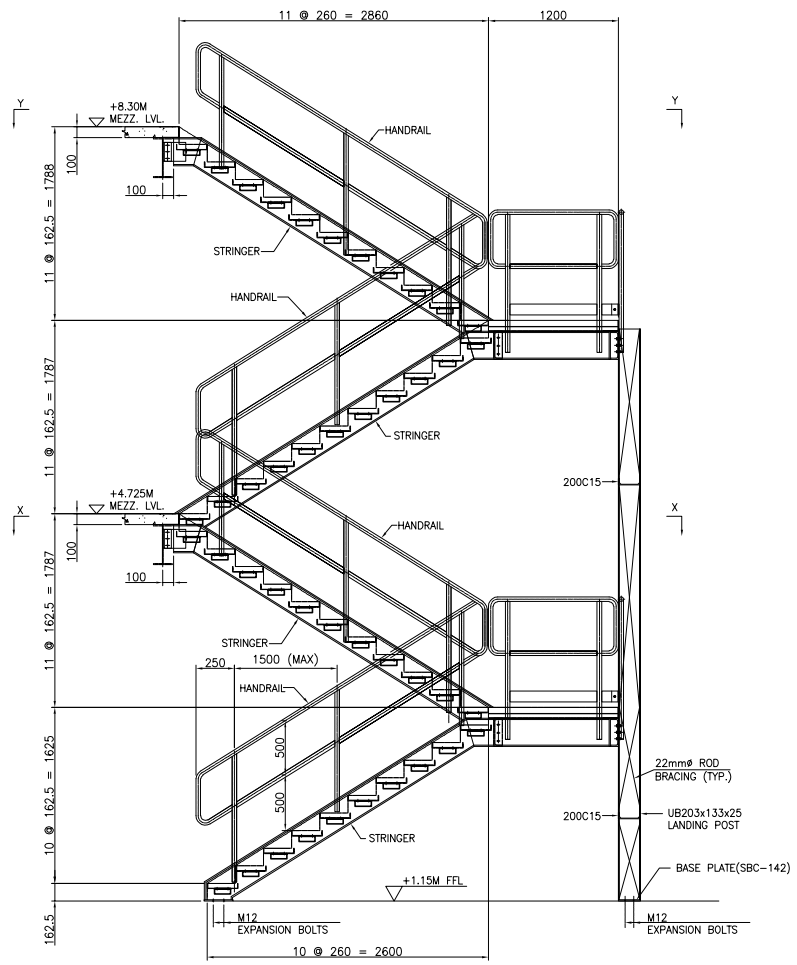
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SECTION Y-Y



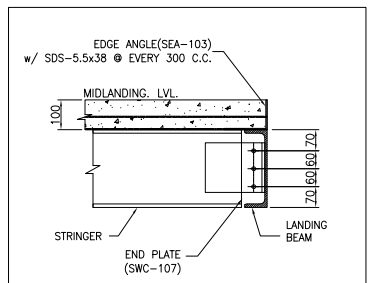
SECTION X-X



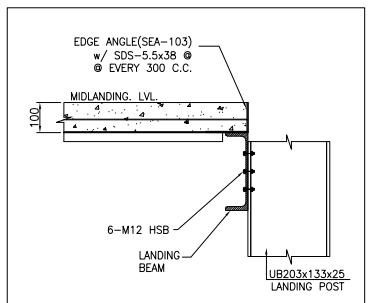
ELEVATION

STAIR-01

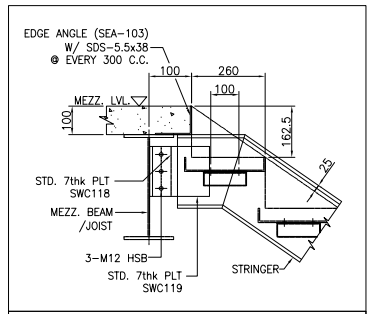
CLIENT/CONSULTANT TO CONFIRM LOCATION AND ORIENTATION OF STAIR



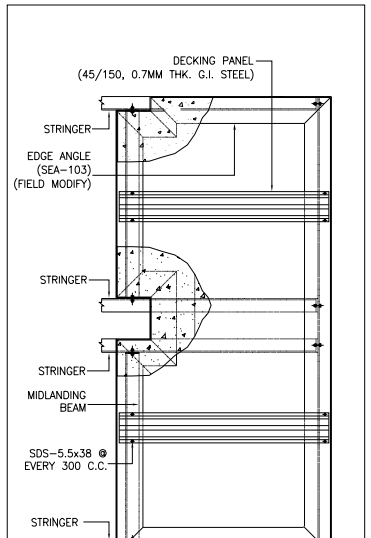
STRINGER CONN. @ LANDING BEAM



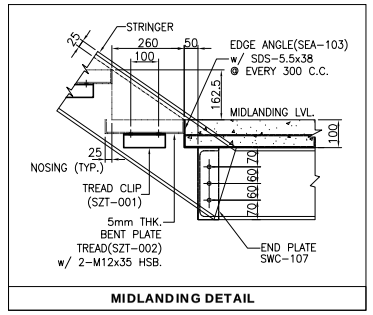
COLUMN CONN. @ LANDING BEAM



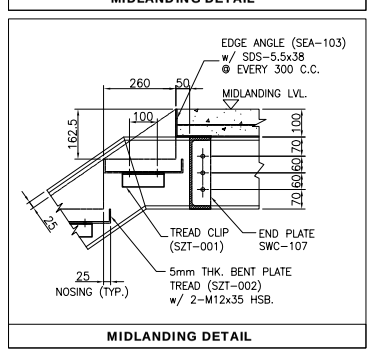
CONNECTION @ MEZZ. LEVEL



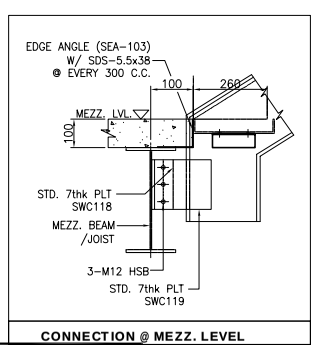
DECK PANEL FIXING DETAIL @ MID LANDING



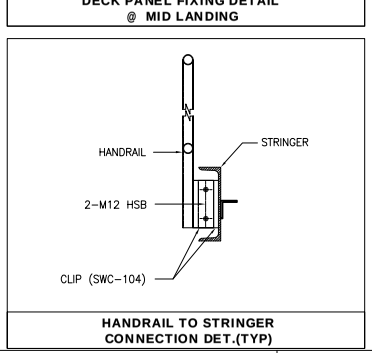
MIDLANDING DETAIL



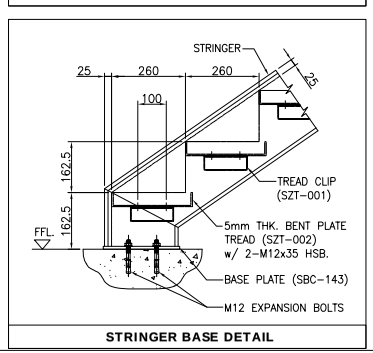
MIDLANDING DETAIL



CONNECTION @ MEZZ. LEVEL



HANDRAIL TO STRINGER CONNECTION DET.(TYP)



STRINGER BASE DETAIL

REVISIONS		
Revision	Description	Date
A		
B		
C		
D		
E		
F		

client:

HERMES RESOURCE NIGERIA LIMITED

project:

PROPOSED INDUSTRIAL DEVELOPMENT AT
IKORODU INDUSTRIAL SCHEME
PLOT 488A LAGOS
IKORODU LOCAL GOVT. AREA,IKORODU.

consultant:

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2636112, 2637519 Fax. 2637519
E-Mail: info@hancockogundiya.com
hancockogundiya@yahoo.com

Drawing Title

STAIRCASE ELEVATION AND DETAILS

Drawn	Date	Scale	Designed	Checked
MUKADAS	JAN. 2022	1:100 :1:50	AL-AMEEN	OLUYEMI

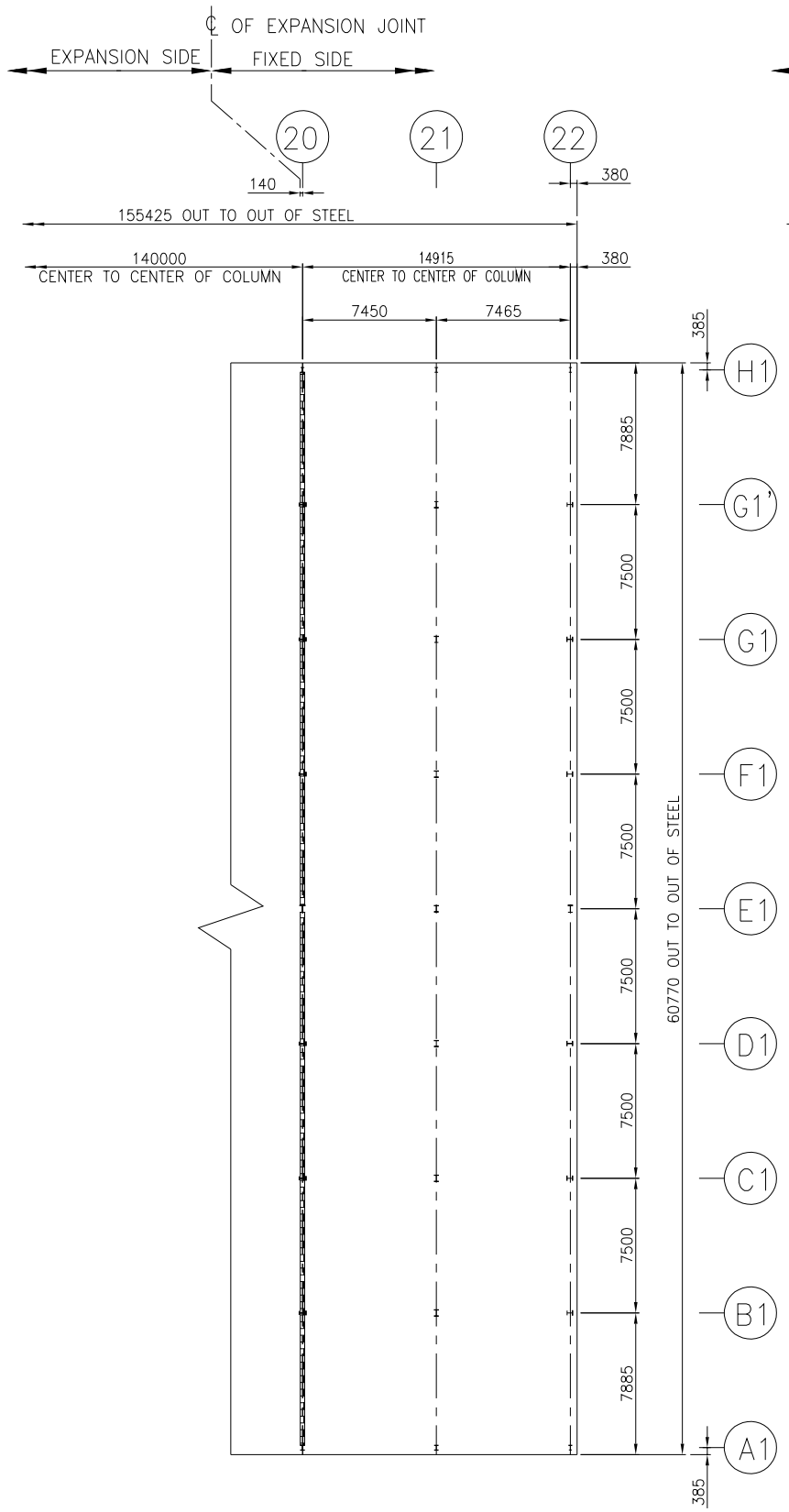
Drawing No.: HOP/202002R/02 Revision Suffix:

FOR APPROVAL

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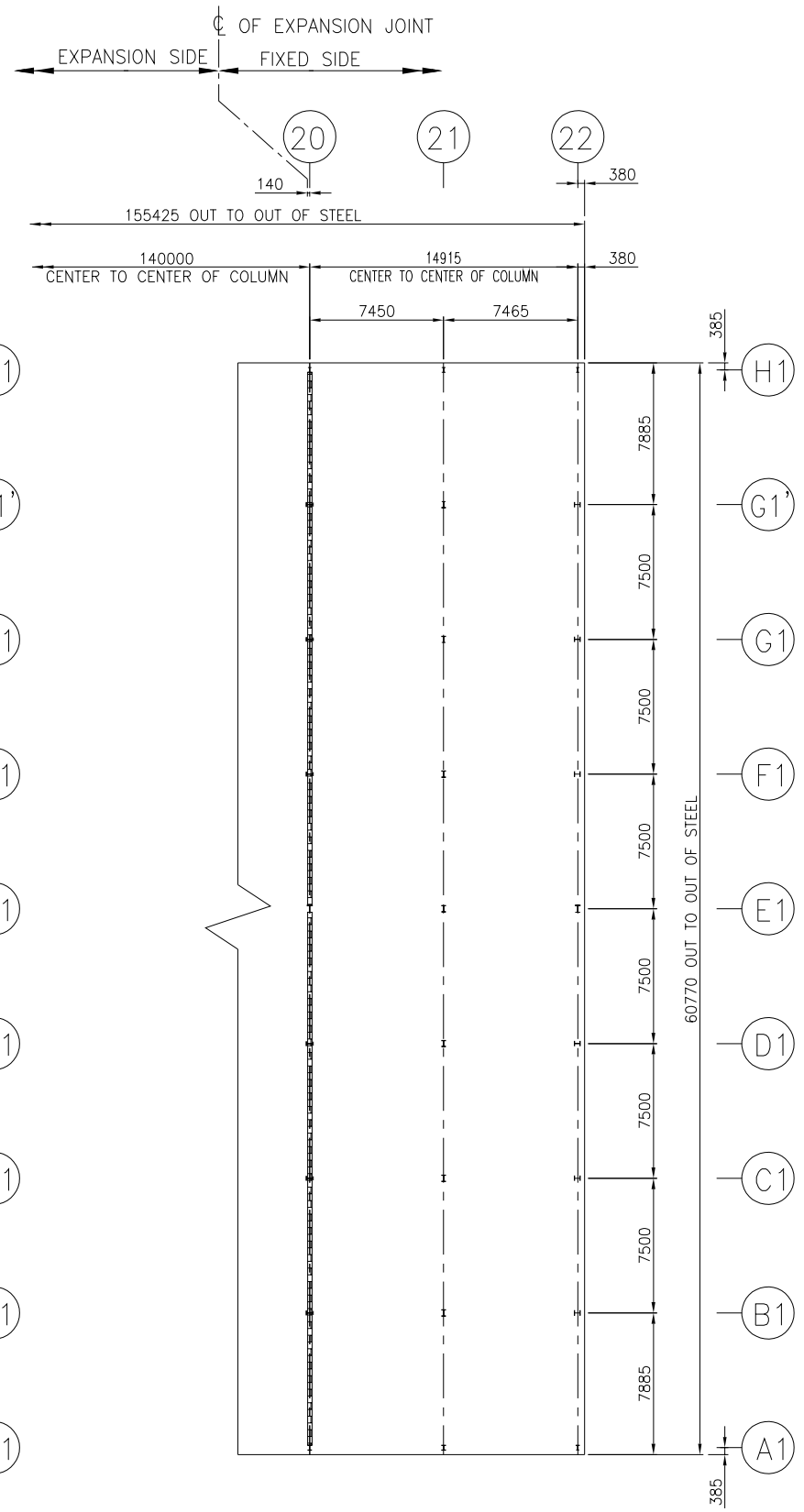
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MEZZANINE LAYOUT @ 3.575 FROM FFL

:– DENOTES 250mm FULL HEIGHT HOLLOW BLOCKWALL w/DENSITY 16kN/m³ (BY OTHERS)



MEZZANINE LAYOUT @ 7.150M FROM FFL

:– DENOTES 250mm FULL HEIGHT HOLLOW BLOCKWALL w/DENSITY 16kN/m³ (BY OTHERS)

REVISIONS		
Revision	Description	Date
A		
B		
C		
D		
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F		

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HERMES RESOURCE NIGERIA LIMITED

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IKORODU LOCAL GOVT. AREA,IKORODU.

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2636112, 2637519 Fax. 2637519
E-Mail: info@hancockogundiya.com
hancockogundiya@yahoo.com

Drawing Title

MEZZANINE LAYOUTS

Drawn	Date	Scale	Designed	Checked
MUKADAS	JAN. 2022	1:100 :1:50	AL-AMEEN	OLUYEMI

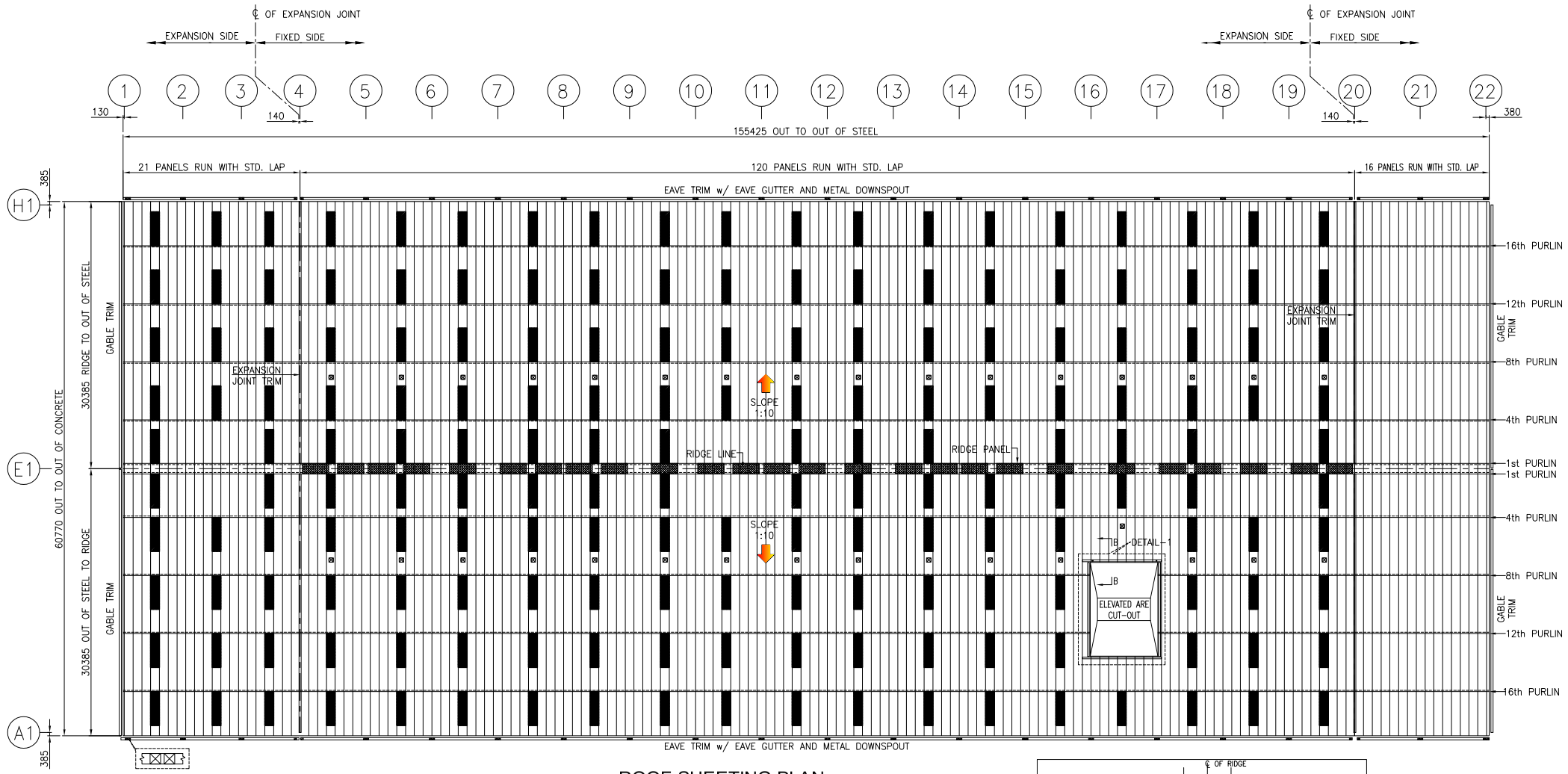
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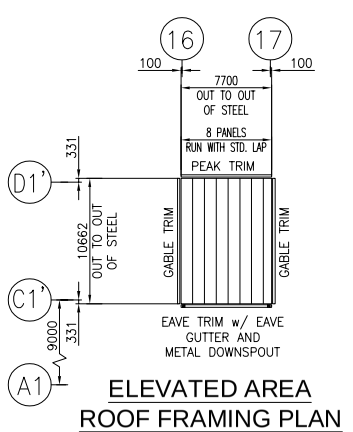


ROOF SHEETING PLAN

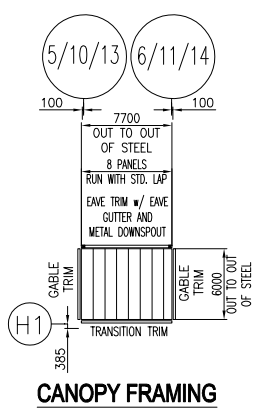
▨ :– DENOTES METAL DOWNSPOUT (2@ EACH FRAME LOCATION)
▬ :– DENOTES SINGLE SKIN GRP SKYLIGHT OF SIZE 3850mm(L)X1000mm(W) – 180Nos.
▩ :– DENOTES SINGLE RIDGE VENT – 26Nos.
⊠ :– DENOTES NATURAL WIND DRIVEN VENTILATOR OF 500mm(Dia.) – 32Nos.

CLIENT/CONSULTANT TO CONFIRM THE SKYLIGHT AND RIDGE VENT ARRANGEMENT

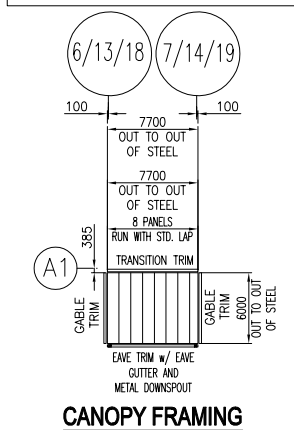
FOR SHEETING DETAILS REFFER DWG. No.– C07



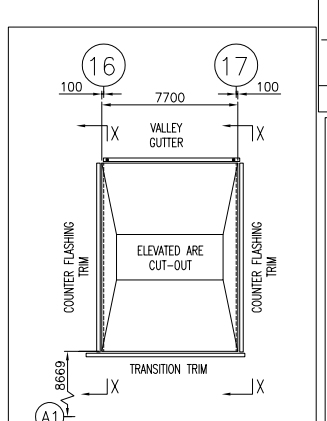
ELEVATED AREA ROOF FRAMING PLAN



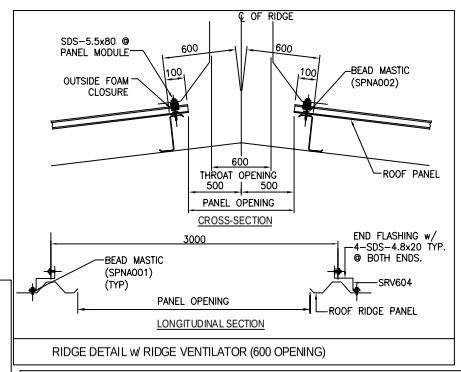
CANOPY FRAMING ELEVATION @ G.L - H1



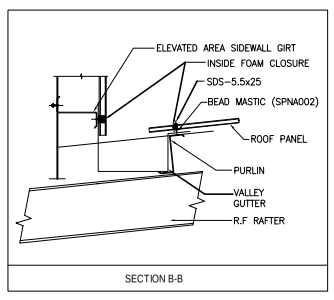
CANOPY FRAMING ELEVATION @ G.L - A1



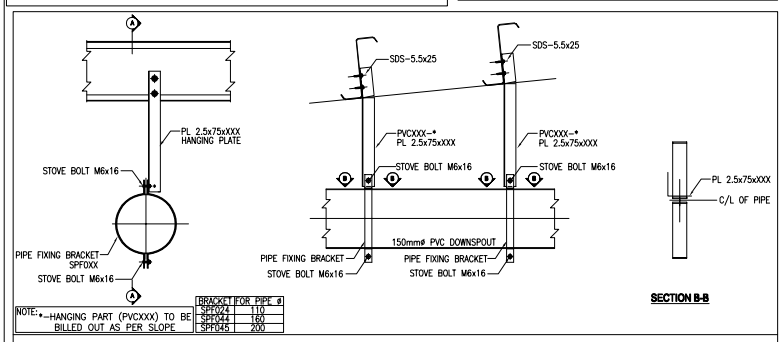
DETAIL-1



RIDGE DETAIL w RIDGE VENTILATOR (600 OPENING)



SECTION B-B



SECTION X-X

REVISIONS		
Revision	Description	Date
A		
B		
C		
D		
E		
F		

client:

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hancockogundiya@yahoo.com

Drawing Title

ROOF SHEETING PLAN & DETAILS

Drawn	Date	Scale	Designed	Checked
MUKADAS	JAN. 2022	1:100 :1:50	AL-AMEEN	OLUYEMI

Drawing No.: HOP/202002R/C01

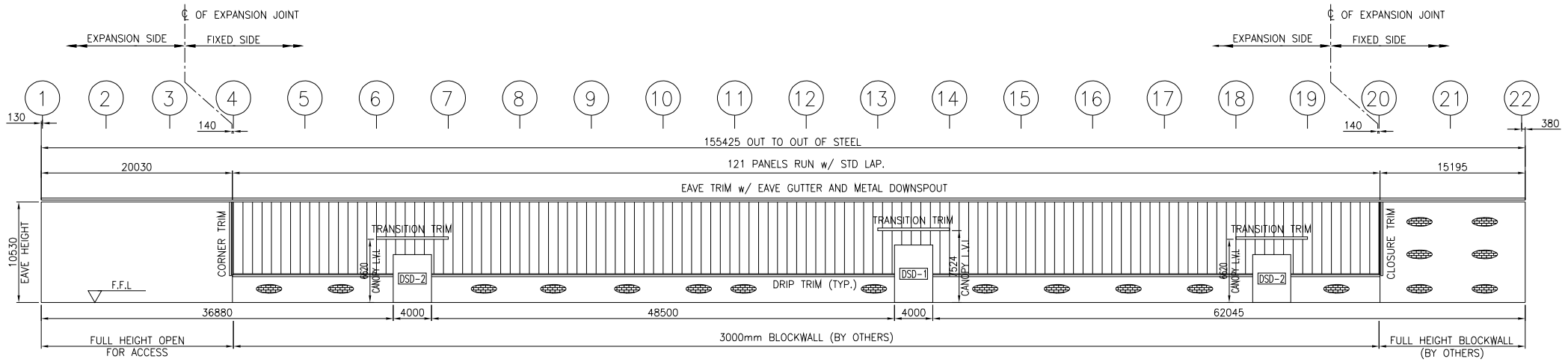
Revision Suffix:

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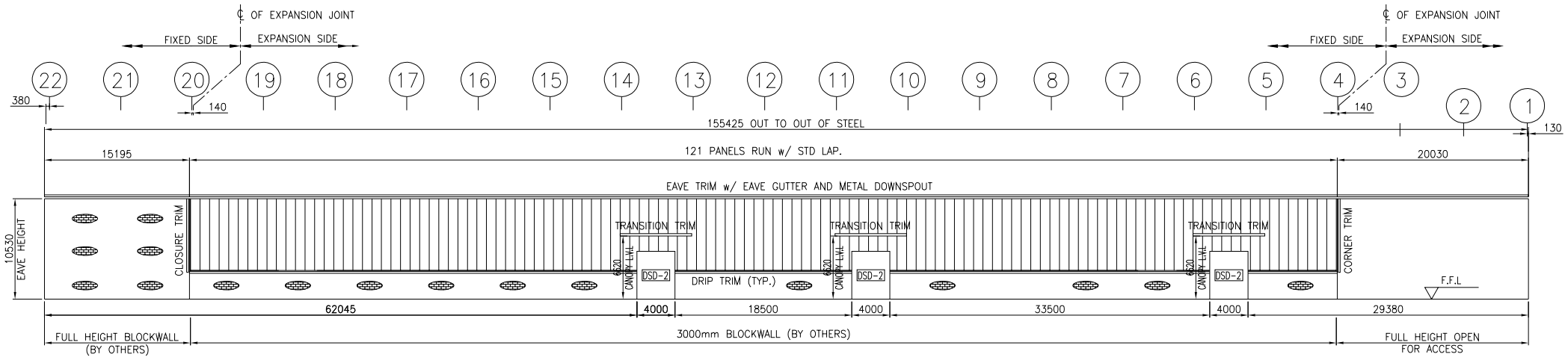
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SIDEWALL SHEETING ELEVATION @ G.L - A1

DSD-1 :- DENOTES DOUBLE SLIDING DOOR OF SIZE 4000mm(W) x 6000mm(H) - 1No.
DSD-2 :- DENOTES DOUBLE SLIDING DOOR OF SIZE 4000mm(W) x 5000mm(H) - 2Nos.



SIDEWALL SHEETING ELEVATION @ G.L - H1

DSD-2 :- DENOTES DOUBLE SLIDING DOOR OF SIZE 4000mm(W) x 5000mm(H) - 3Nos.

FOR SHEETING DETAILS REFFER DWG. No.- C07

REVISIONS		
Revision	Description	Date
A		
B		
C		
D		
E		
F		

client:

HERMES RESOURCE NIGERIA LIMITED

project:

PROPOSED INDUSTRIAL DEVELOPMENT AT
IKORODU INDUSTRIAL SCHEME
PLOT 488A LAGOS
IKORODU LOCAL GOVT. AREA,IKORODU.

consultant:

HANCOCK OGUNDIYA & PARTNERS.
.Consulting Civil & Structural Engineers
.Development Consultants & Project Managers
33 Glover Street, Ebute-Metta, Lagos.
Tel. 08034017782, 08033348629, 01-8987545
2636112, 2637519 Fax. 2637519
E-Mail: info@hancockogundiya.com
hancockogundiya@yahoo.com

Drawing Title

SIDE WALL SHEETING ELEVATIONS

Drawn	Date	Scale	Designed	Checked
MUKADAS	JAN. 2022	1:100 ;1:50	AL-AMEEN	OLUYEMI

Drawing No.: HOP/202002R/C02

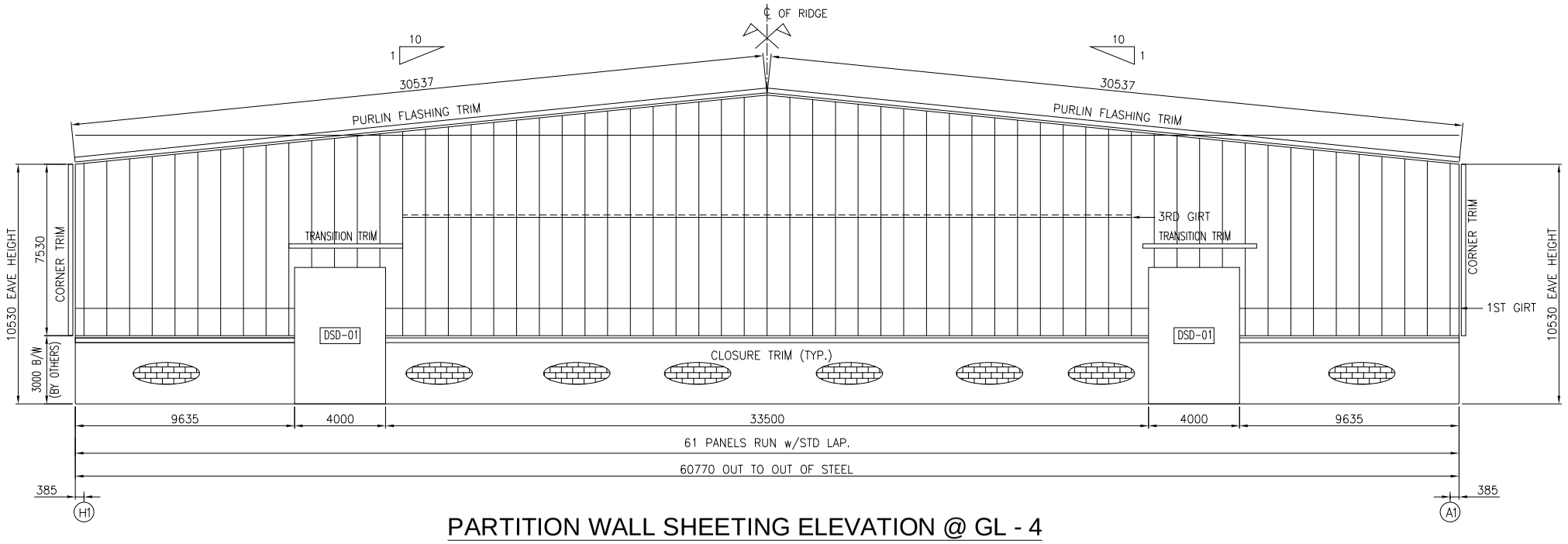
Revision Suffix:

FOR APPROVAL

ALL DIMENSIONS TO BE CONFIRMED ON SITE PRIOR TO COMMENCEMENT OF CONTRACT.

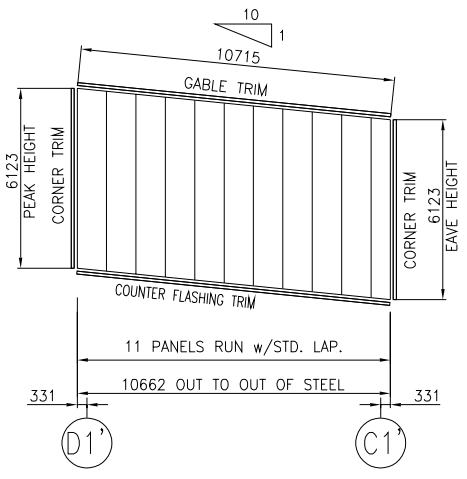
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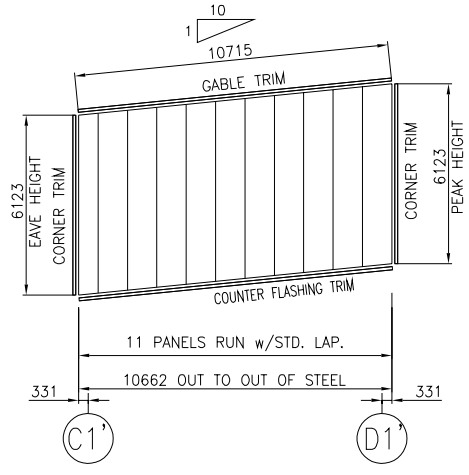


PARTITION WALL SHEETING ELEVATION @ GL - 4

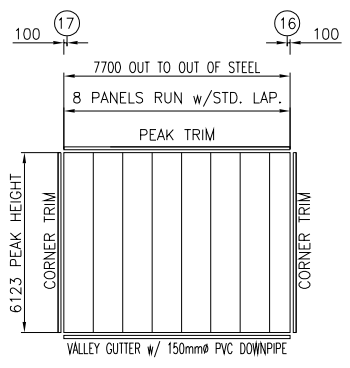
DSD–1 :– DENOTES DOUBLE SLIDING DOOR OF SIZE 4000mm(W) x 6000mm(H) – 2Nos.



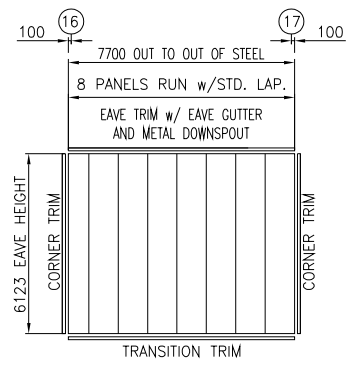
ELEVATED ARE ENDWALL SHEETING ELEVATION @ G.L - 16



ELEVATED ARE ENDWALL SHEETING ELEVATION @ G.L - 17

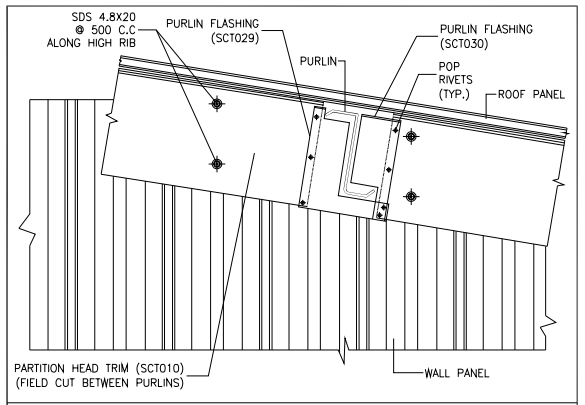


ELEVATED ARE SIDEWALL SHEETING ELEVATION @ G.L - D1'

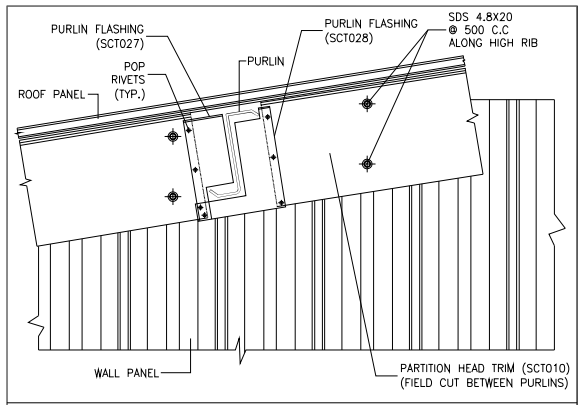


ELEVATED ARE SIDEWALL SHEETING ELEVATION @ G.L - C1'

FOR SHEETING DETAILS REFFER DWG. No.– C07



PURLIN FLASHING DETAIL (@ PARTITION WALL-RIGHT)



PURLIN FLASHING DETAIL (@ PARTITION WALL-LEFT)

REVISIONS		
Revision	Description	Date
A		
B		
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client:

HERMES RESOURCE NIGERIA LIMITED

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2636112, 2637519 Fax. 2637519
E-Mail: info@hancockogundiya.com
hancockogundiya@yahoo.com

Drawing Title

WALL SHEETING ELEVATION & DETAILS

Drawn	Date	Scale	Designed	Checked
MUKADAS	JAN. 2022	1:100 :1:50	AL- AMEEN	OLUYEMI

Drawing No.: HOP/202002R/C03

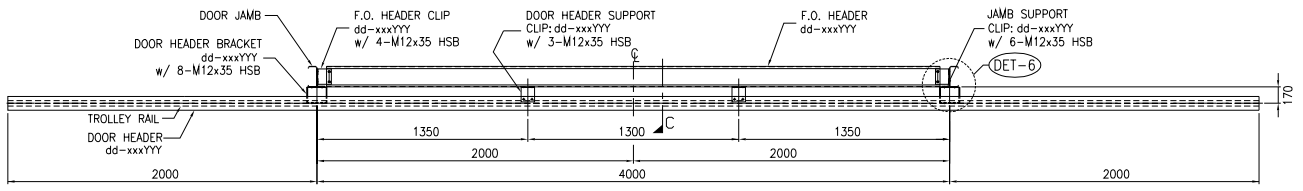
Revision Suffix:

FOR APPROVAL

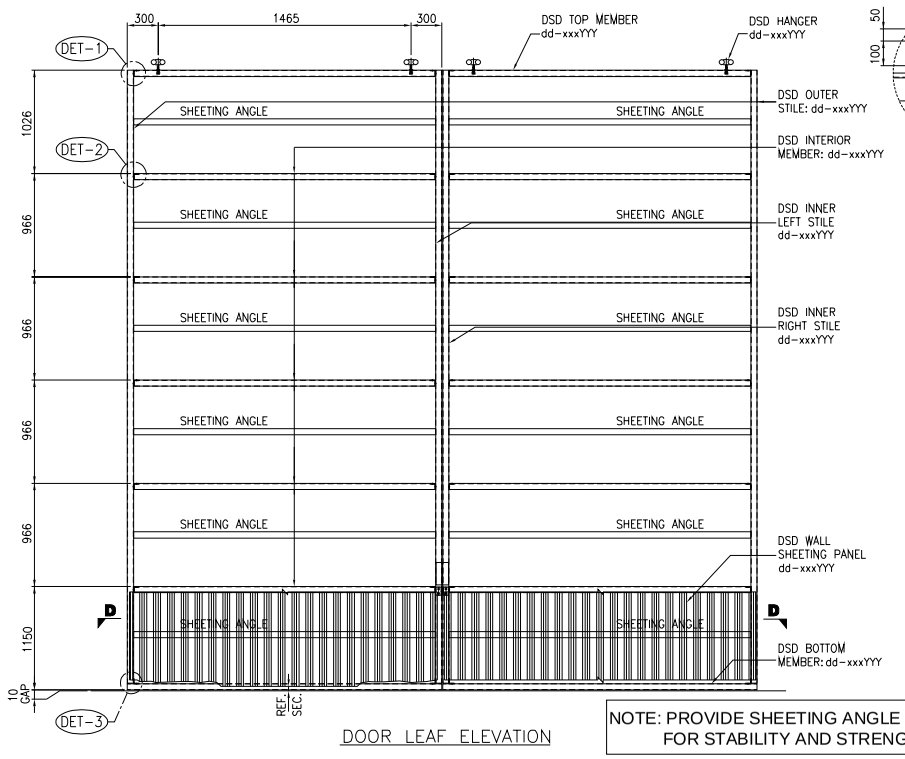
ALL DIMENSIONS TO BE CONFIRMED ON SITE PRIOR TO COMMENCEMENT OF CONTRACT.

GENERAL NOTES

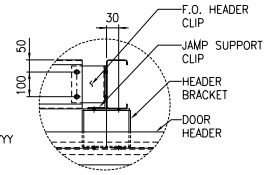
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HEADER PLAN

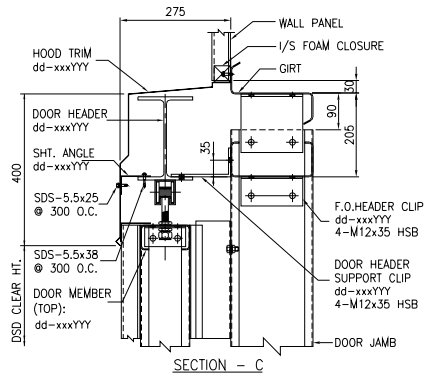


DOOR LEAF ELEVATION

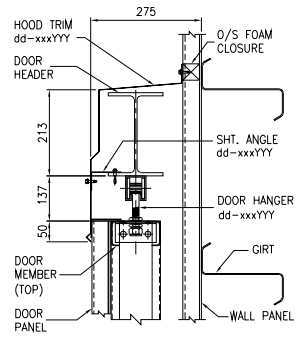


DETAIL – 6

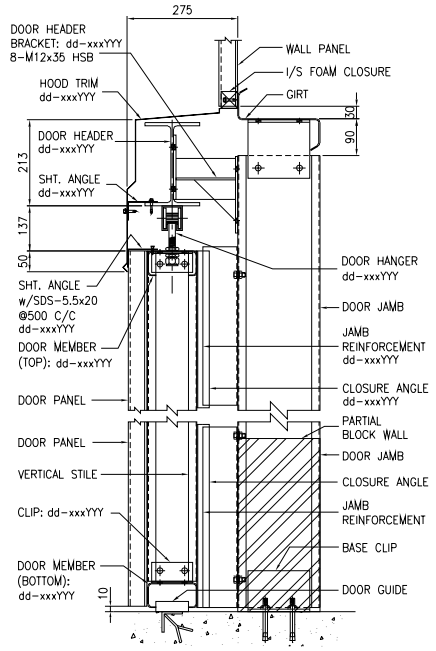
NOTE: PROVIDE SHEETING ANGLE @ 500mm (MAX.) SPACING FOR STABILITY AND STRENGTHENING OF DOOR



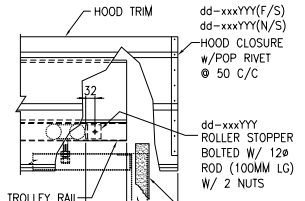
SECTION – C



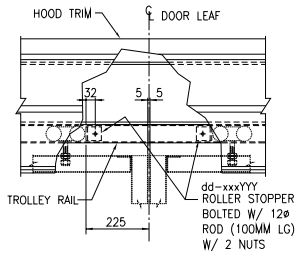
VERTICAL SECTION THROUGH DOOR (OUTSIDE DOOR OPENING)



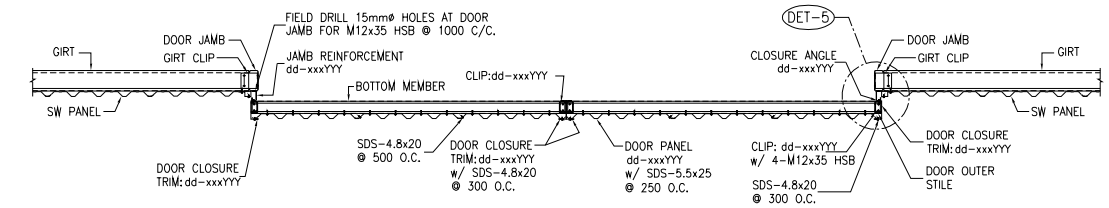
VERTICAL SECTION @ DOOR OPENING



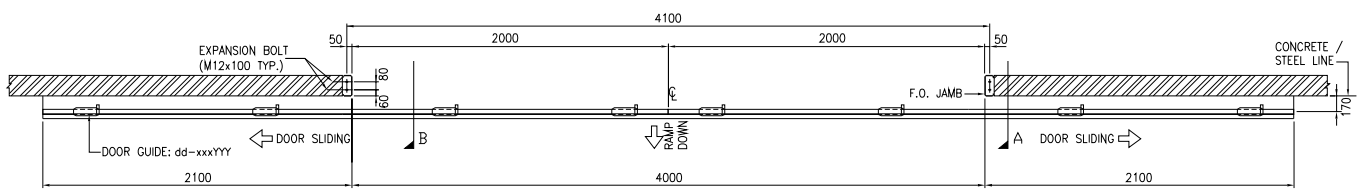
END DETAIL FOR HOOD TRIM AND TROLLEY RAIL



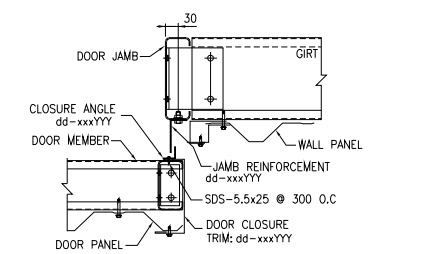
CENTER DETAIL FOR ROLLER STOPPER AND TROLLEY RAIL



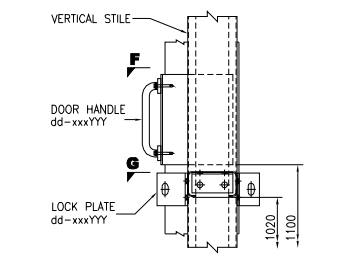
SECTION – DD



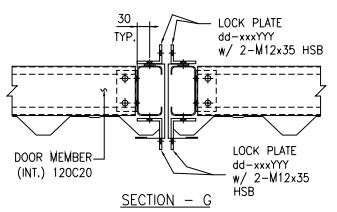
DSD GUIDE SETTING PLAN



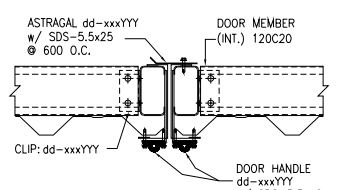
DETAIL – 5



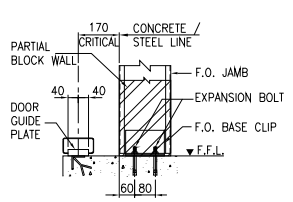
DOOR HANDLE & LOCK DETAIL @ CENTER



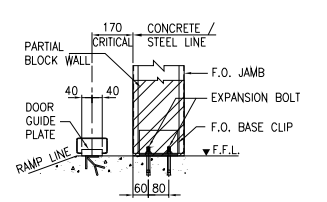
SECTION – G



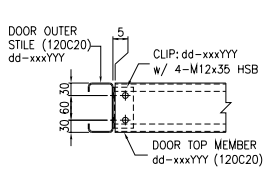
SECTION – F



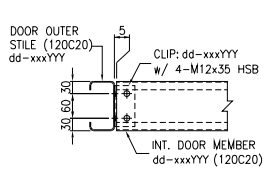
SECTION – A



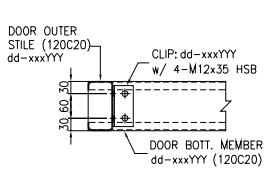
SECTION – B



DETAIL – 1



DETAIL – 2



DETAIL – 3

REVISIONS		
Revision	Description	Date
A		
B		
C		
D		
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client:

HERMES RESOURCE NIGERIA LIMITED

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hancockogundiya@yahoo.com

Drawing Title

ERECTION DETAILS OF DSD-1 DOOR SIZE 4000(W)x6000(H)-3 Nos

Drawn	Date	Scale	Designed	Checked
MUKADAS	JAN. 2022	1:100 :1:50	AL-AMEEN	OLUYEMI

Drawing No.: HOP/202002R/C04

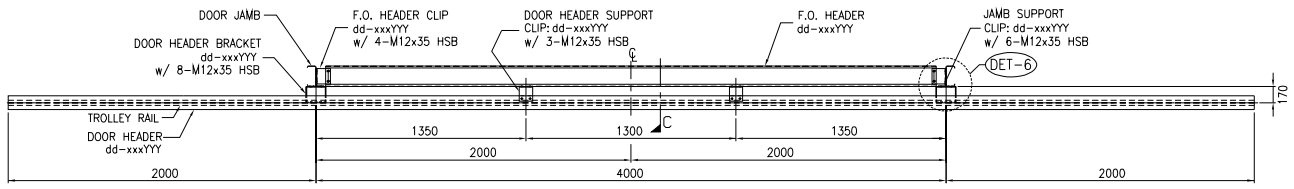
Revision Suffix.

FOR APPROVAL

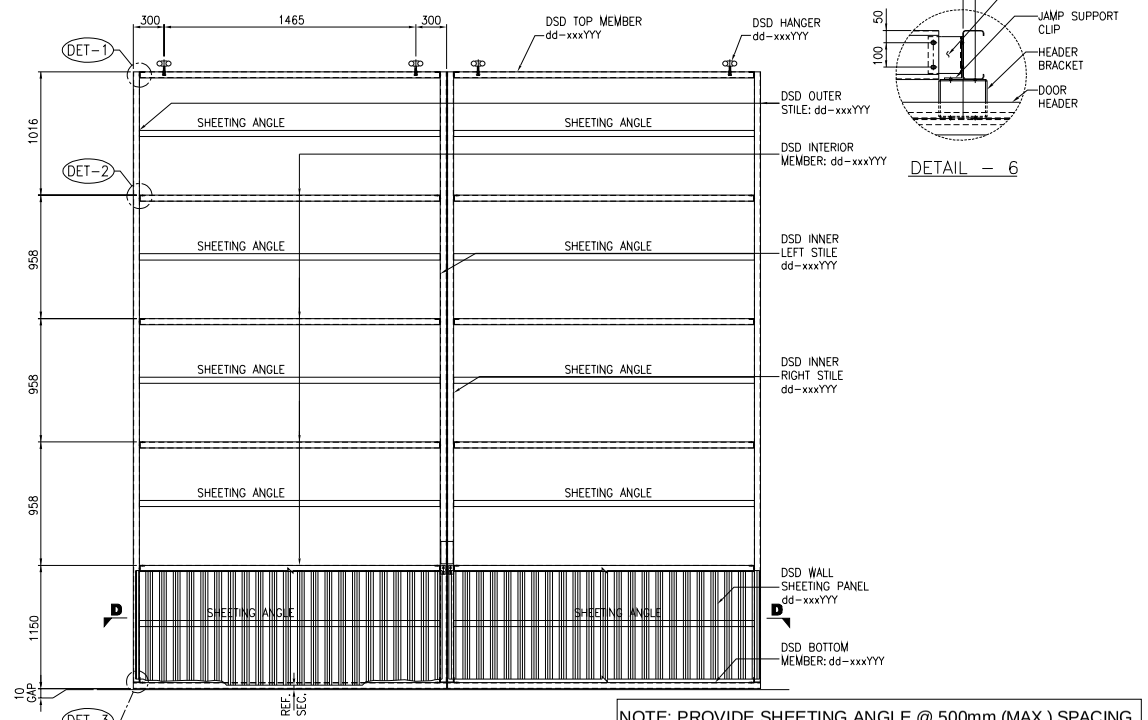
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GENERAL NOTES

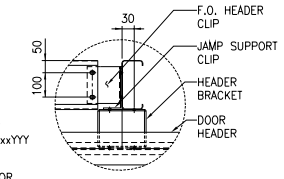
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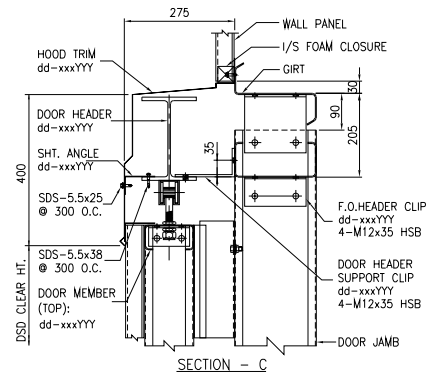


DOOR LEAF ELEVATION

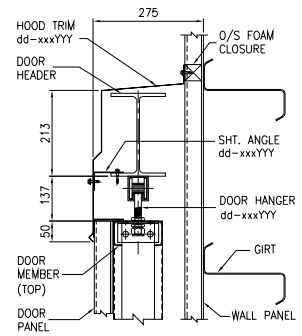


DETAIL – 6

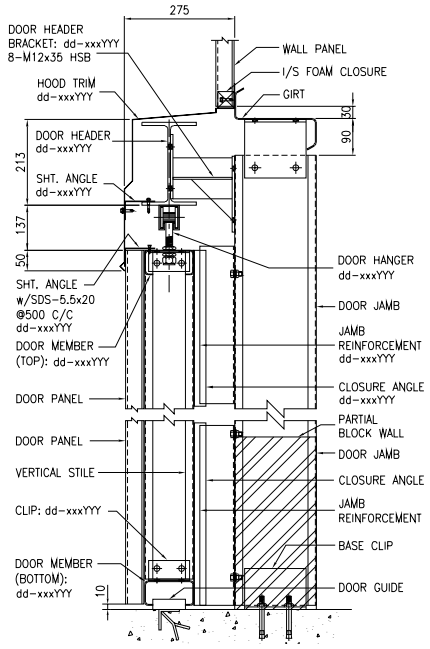
NOTE: PROVIDE SHEETING ANGLE @ 500mm (MAX.) SPACING FOR STABILITY AND STRENGTHENING OF DOOR



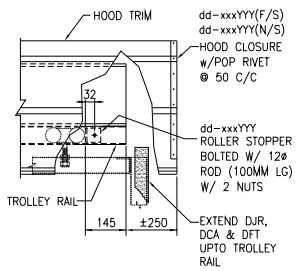
SECTION – C



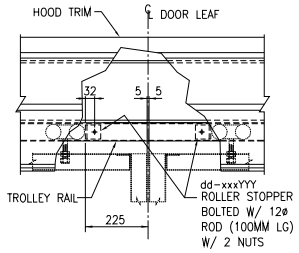
VERTICAL SECTION THROUGH DOOR (OUTSIDE DOOR OPENING)



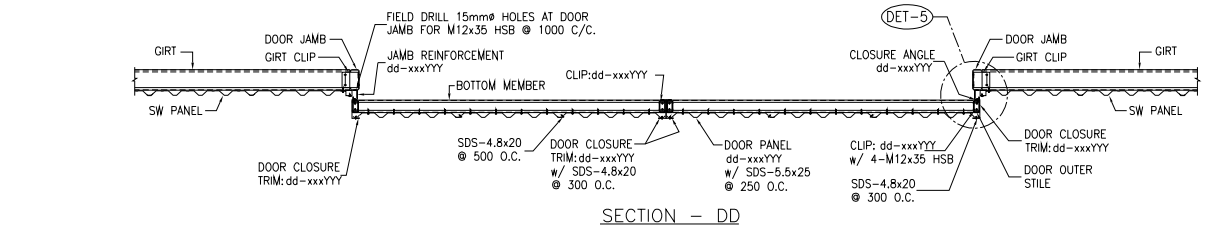
VERTICAL SECTION @ DOOR OPENING



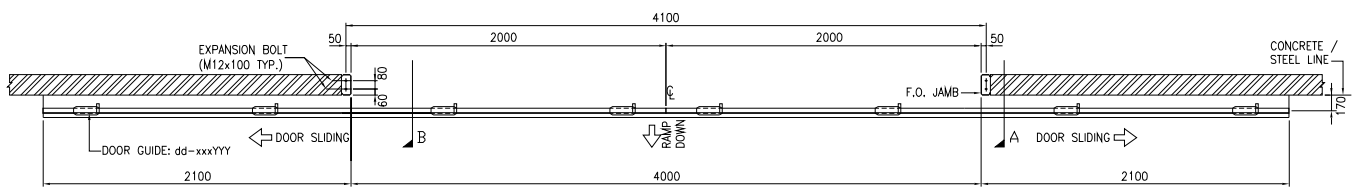
END DETAIL FOR HOOD TRIM AND TROLLEY RAIL



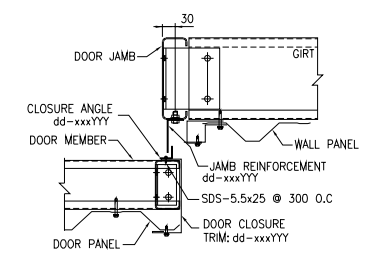
CENTER DETAIL FOR ROLLER STOPPER AND TROLLEY RAIL



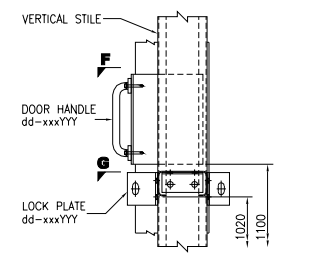
SECTION – DD



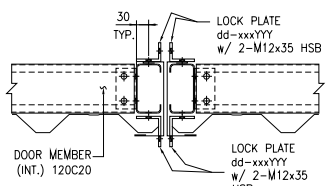
DSD GUIDE SETTING PLAN



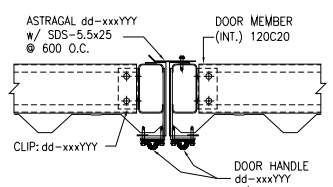
DETAIL – 5



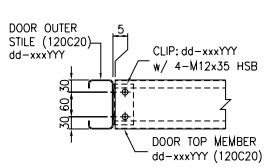
DOOR HANDLE & LOCK DETAIL @ CENTER



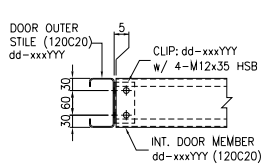
SECTION – G



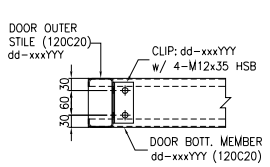
SECTION – F



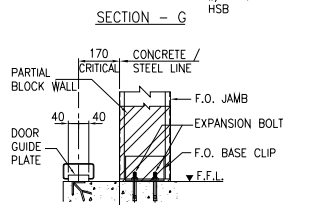
DETAIL – 1



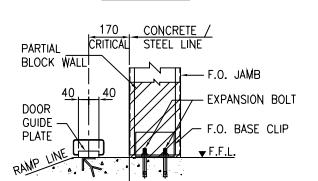
DETAIL – 2



DETAIL – 3



SECTION – A



SECTION – B

REVISIONS		
Revision	Description	Date
A		
B		
C		
D		
E		
F		

client:

HERMES RESOURCE NIGERIA LIMITED

project:

PROPOSED INDUSTRIAL DEVELOPMENT AT
IKORODU INDUSTRIAL SCHEME
PLOT 488A LAGOS
IKORODU LOCAL GOVT. AREA,IKORODU.

consultant:

HANCOCK OGUNDIYA & PARTNERS.
.Consulting Civil & Structural Engineers
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33 Glover Street, Ebute-Metta, Lagos.
Tel. 08034017782, 08033348629, 01-8987545
2636112, 2637519 Fax. 2637519
E-Mail: info@hancockogundiya.com
hancockogundiya@yahoo.com

Drawing Title

ERECTION DETAILS OF DSD-2 DOOR SIZE 4000(W)x5000(H)-5 Nos

Drawn	Date	Scale	Designed	Checked
MUKADAS	JAN. 2022	1:100 :1:50	AL- AMEEN	OLUYEMI

Drawing No.: HOP/202002R/C05

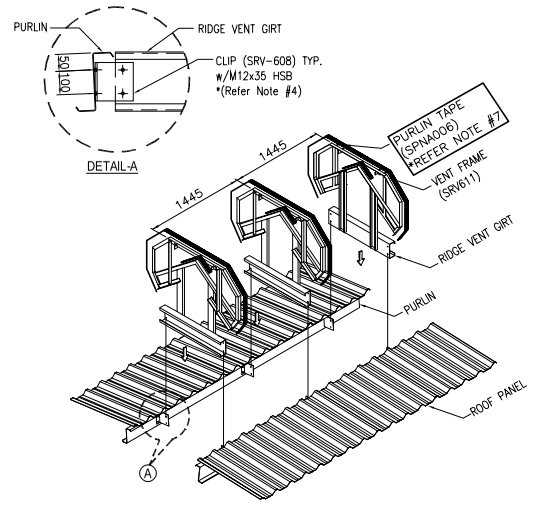
Revision Suffix:

FOR APPROVAL

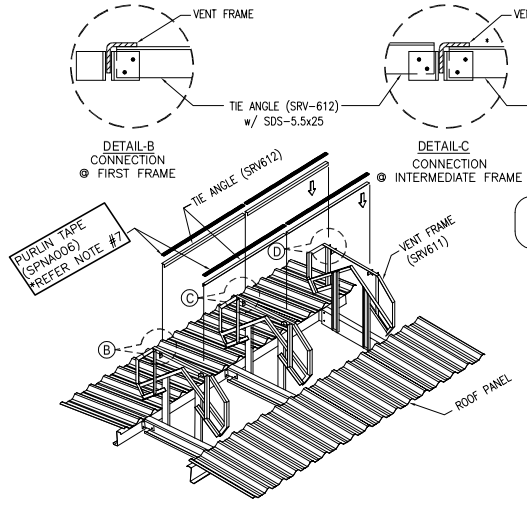
ALL DIMENSIONS TO BE CONFIRMED ON SITE PRIOR TO COMMENCEMENT OF CONTRACT.

GENERAL NOTES

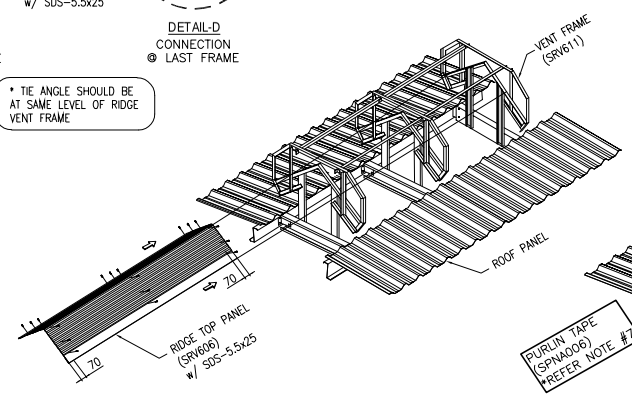
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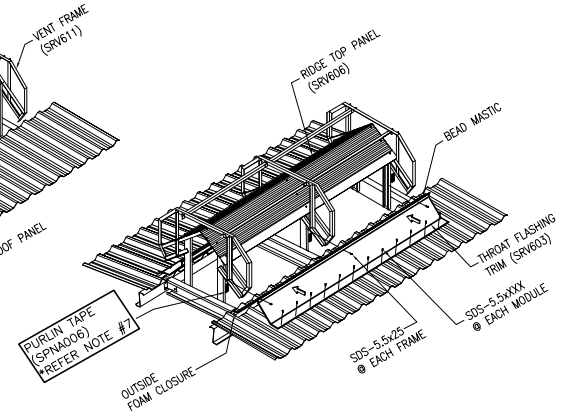
1. FIXING RIDGEVENT FRAME TO PURLIN



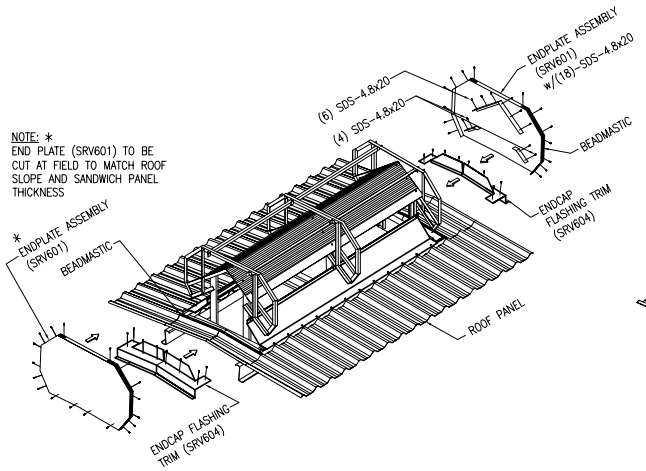
2. FIXING TIE ANGLE



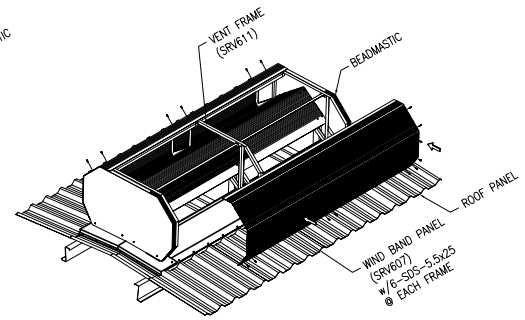
3. FIXING RIDGE TOP PANEL



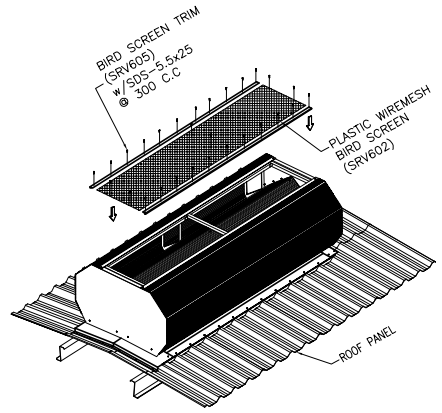
4. FIXING THROAT FLASH TRIM



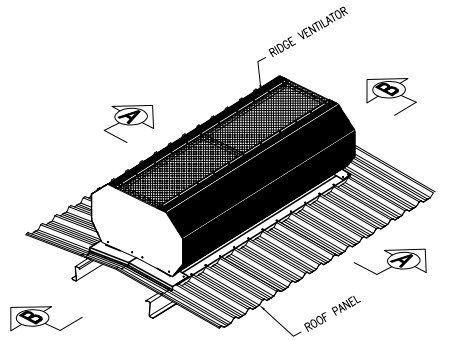
5. FIXING ENDPLATE ASSEMBLY



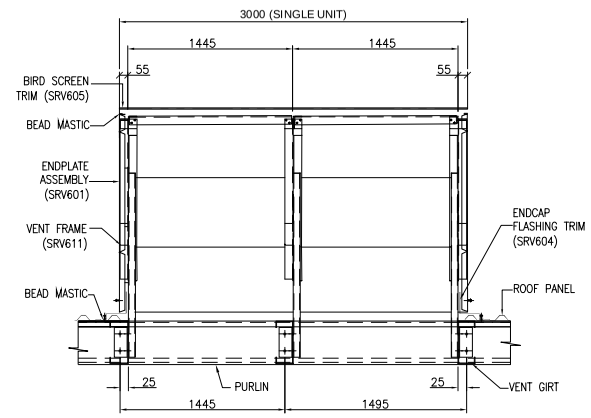
6. FIXING WIND BAND PANEL



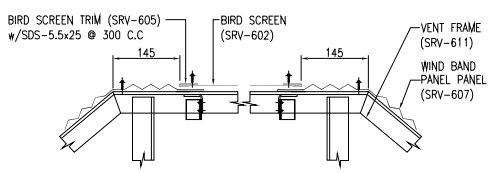
7. FIXING BIRDSCREEN



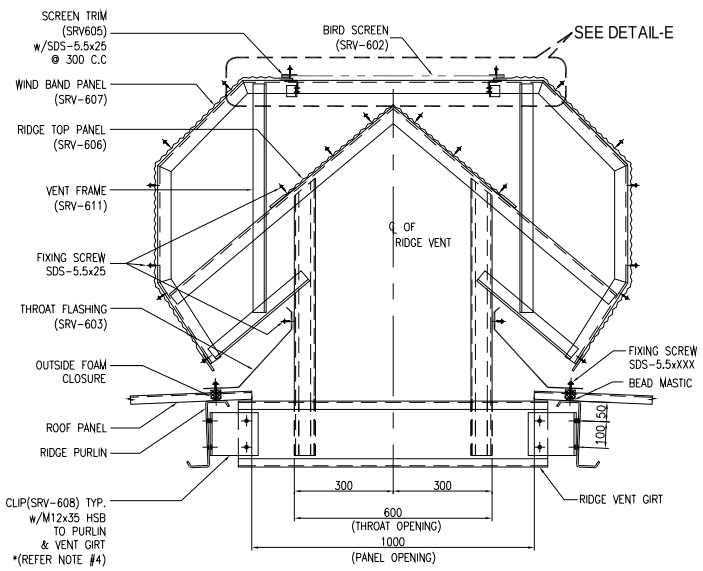
COMPLETE ASSEMBLY



SECTION B B



DETAIL-E



SECTION A A

REVISIONS		
Revision	Description	Date
A		
B		
C		
D		
E		
F		

client:

HERMES RESOURCE NIGERIA LIMITED

project:

PROPOSED INDUSTRIAL DEVELOPMENT AT
IKORODU INDUSTRIAL SCHEME
PLOT 488A LAGOS
IKORODU LOCAL GOVT. AREA,IKORODU.

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2636112, 2637519 Fax. 2637519
E-Mail: info@hancockogundiya.com
hancockogundiya@yahoo.com

Drawing Title

ASSEMBLING INSTRUCTION FOR 600mm SINGLE RIDGE VENTILATOR

Drawn	Date	Scale	Designed	Checked
MUKADAS	JAN. 2022	1:100 : 1:50	AL-AMEEN	OLUYEMI

Drawing No.: HOP/202002R/C06

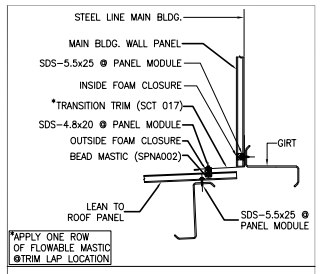
Revision Suffix:

FOR APPROVAL

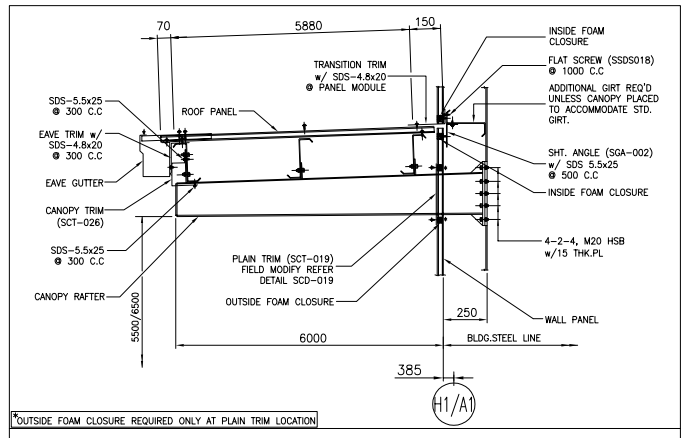
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GENERAL NOTES

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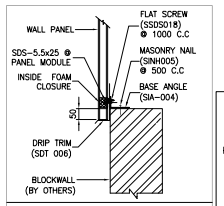


TRANSITION DETAIL

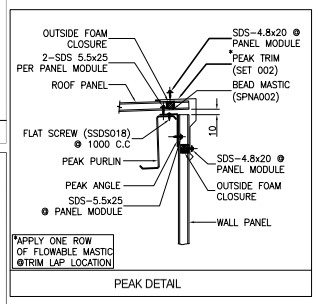


*OUTSIDE FOAM CLOSURE REQUIRED ONLY AT PLAIN TRIM LOCATION

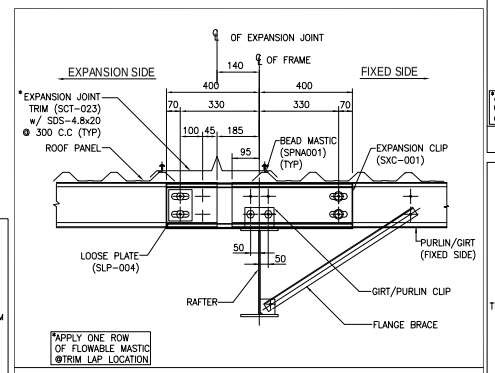
CANOPY w/ EAVE GUTTER @ BELOW ROOF LEVEL



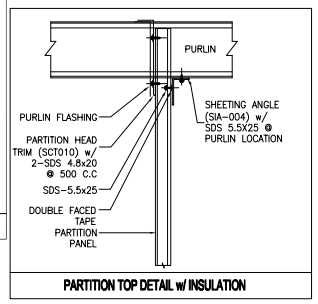
DRIP TRIM DETAIL



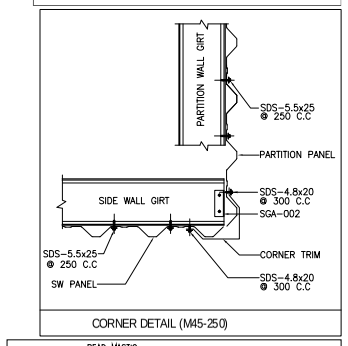
PEAK DETAIL



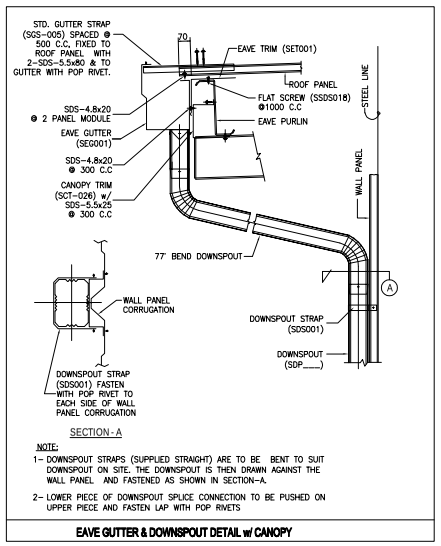
EXPANSION DETAIL (M45-250)



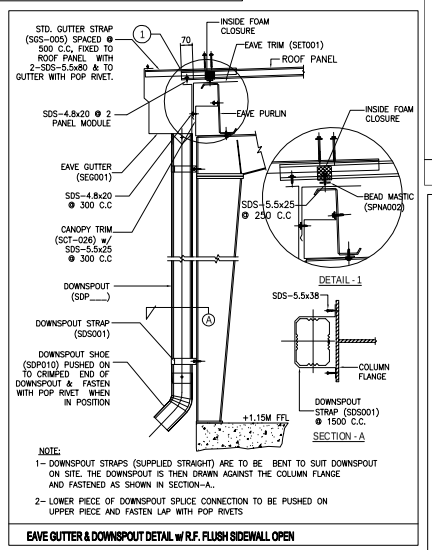
PARTITION TOP DETAIL w/ INSULATION



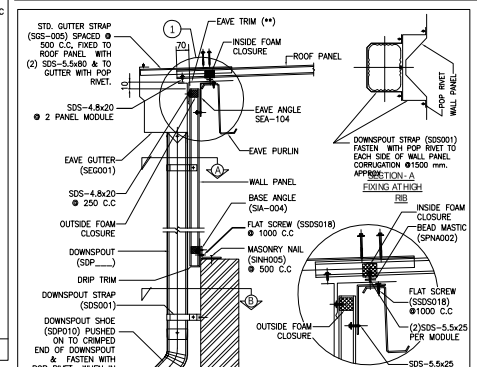
CORNER DETAIL (M45-250)



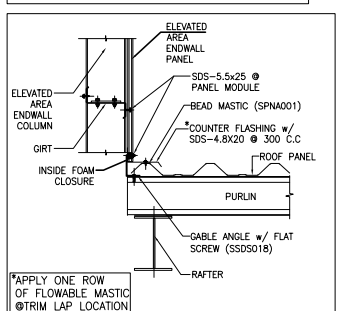
EAVE GUTTER & DOWNSPOUT DETAIL w/ CANOPY



EAVE GUTTER & DOWNSPOUT DETAIL w/ R.F. FLUSH SIDEWALL OPEN

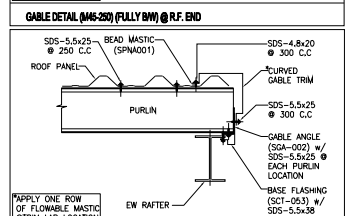


EAVE GUTTER & DOWNSPOUT DETAIL w/ PARTIALLY SHEETED BLOCK WALL (45-250)

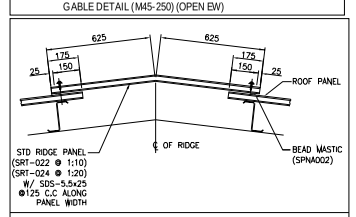


COUNTER FLASHING TRIM DETAIL

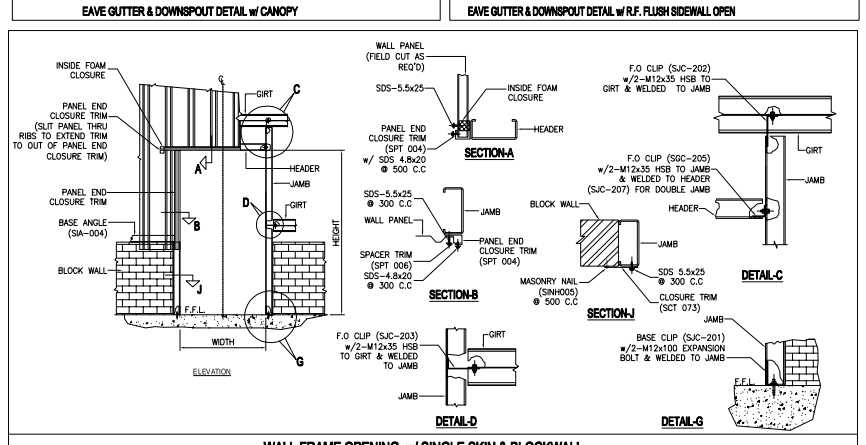
GABLE DETAIL (M45-250) (FULLY BW) @ R.F. END



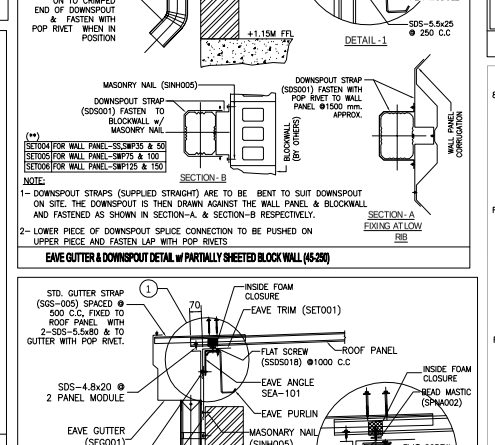
GABLE DETAIL (M45-250) (OPEN BW)



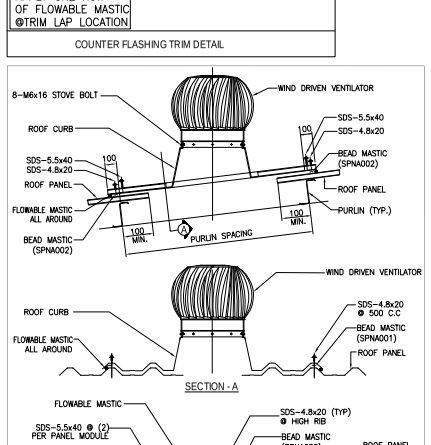
RIDGE PANEL LAP DETAIL (M45-250)



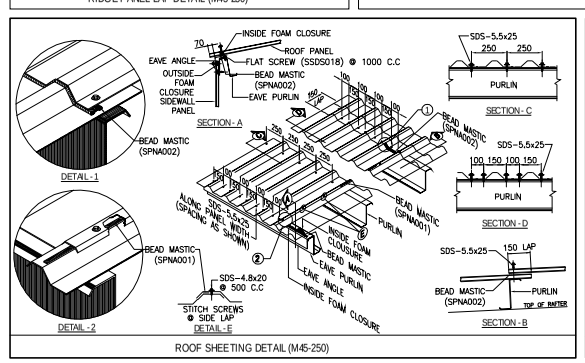
WALL FRAME OPENING w/ SINGLE SKIN & BLOCKWALL



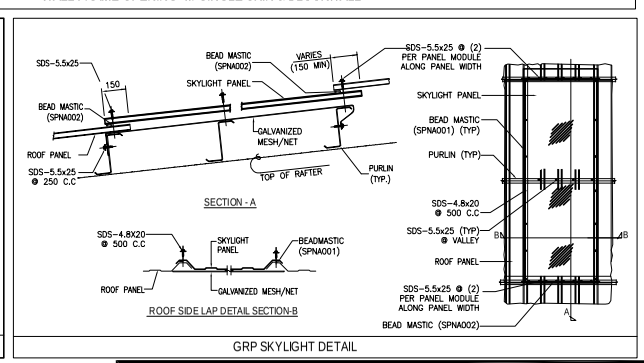
EAVE GUTTER & DOWNSPOUT DETAIL w/ FULL HEIGHT BLOCK WALL



WIND DRIVEN VENTILATOR AT SLOPE (w/o FRAMED OPENING) (M45-250)



ROOF SHEETING DETAIL (M45-250)



GRP SKYLIGHT DETAIL

REVISIONS		
Revision	Description	Date
A		
B		
C		
D		
E		
F		

client:

HERMES RESOURCE NIGERIA LIMITED

project:

PROPOSED INDUSTRIAL DEVELOPMENT AT
IKORODU INDUSTRIAL SCHEME
PLOT 488A LAGOS
IKORODU LOCAL GOVT. AREA,IKORODU.

consultant:

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Tel. 08034017782, 08033348629, 01-8987545
2636112, 2637519 Fax. 2637519
E-Mail: info@hancockogundiya.com
hancockogundiya@yahoo.com

Drawing Title

SHEETING DETAILS.

Drawn	Date	Scale	Designed	Checked
MUKADAS	JAN. 2022	1:100 ;1:50	AL-AMEEN	OLUYEMI

Drawing No.: HOP/202002R/C07 Revision Suffix:

FOR APPROVAL

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GENERAL NOTES

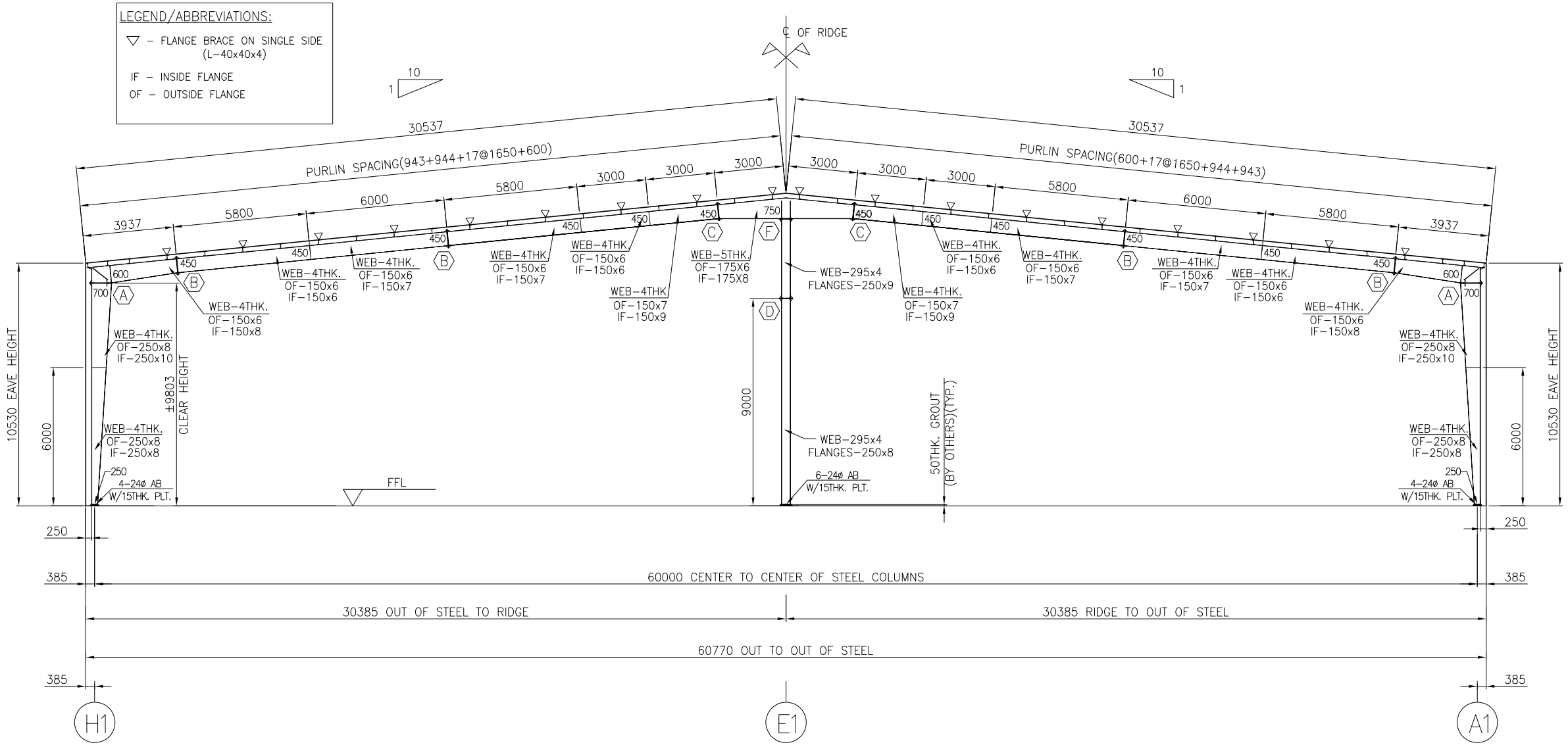
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LEGEND/ABBREVIATIONS:

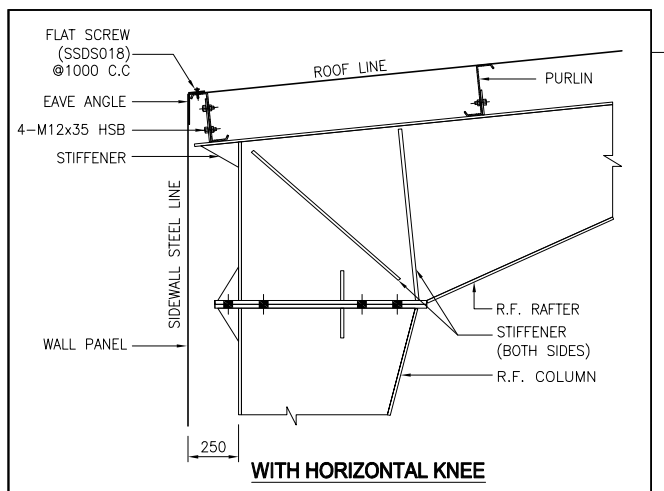
▽ – FLANGE BRACE ON SINGLE SIDE (L–40x40x4)

IF – INSIDE FLANGE

OF – OUTSIDE FLANGE

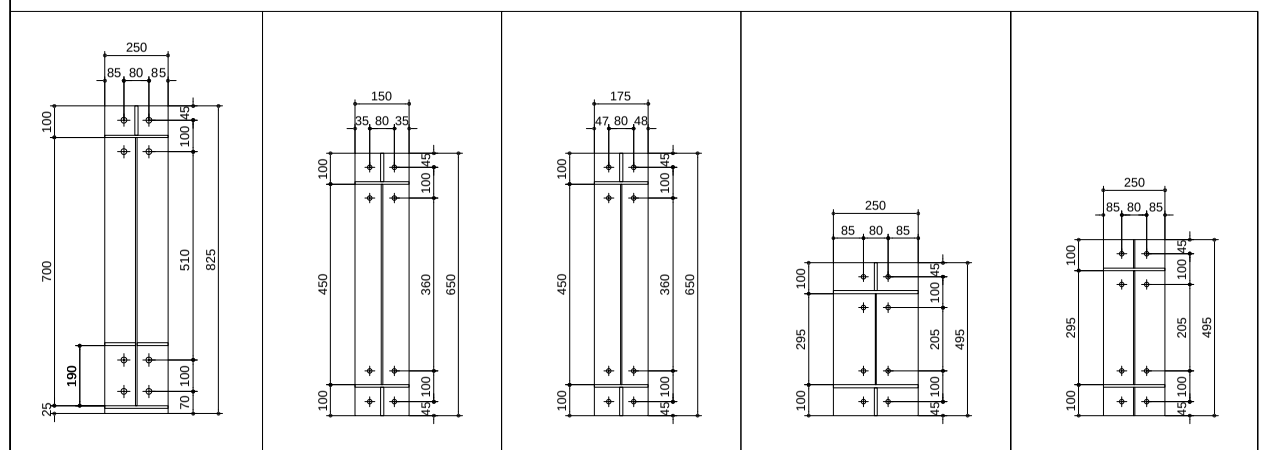


RIGID FRAME CROSS SECTION @ GL - 1



WITH HORIZONTAL KNEE

TYPICAL EAVE DETAIL



REVISIONS		
Revision	Description	Date
A		
B		
C		
D		
E		
F		

client:

HERMES RESOURCE NIGERIA LIMITED

project:

PROPOSED INDUSTRIAL DEVELOPMENT AT
IKORODU INDUSTRIAL SCHEME
PLOT 488A LAGOS
IKORODU LOCAL GOVT. AREA,IKORODU.

consultant:

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Tel. 08034017782, 08033348629, 01-8987545
2636112, 2637519 Fax. 2637519
E-Mail: info@hancockogundiya.com
hancockogundiya@yahoo.com

Drawing Title

RIGID FRAME CROSS SECTION @GL- 1

Drawn	Date	Scale	Designed	Checked
MUKADAS	JAN. 2022	1:100 ;1:50	AL-AMEEN	OLUYEMI

Drawing No.: HOP/202002R/E01

Revision Suffix:

FOR APPROVAL

ALL DIMENSIONS TO BE CONFIRMED ON SITE PRIOR TO COMMENCEMENT OF CONTRACT.

GENERAL NOTES

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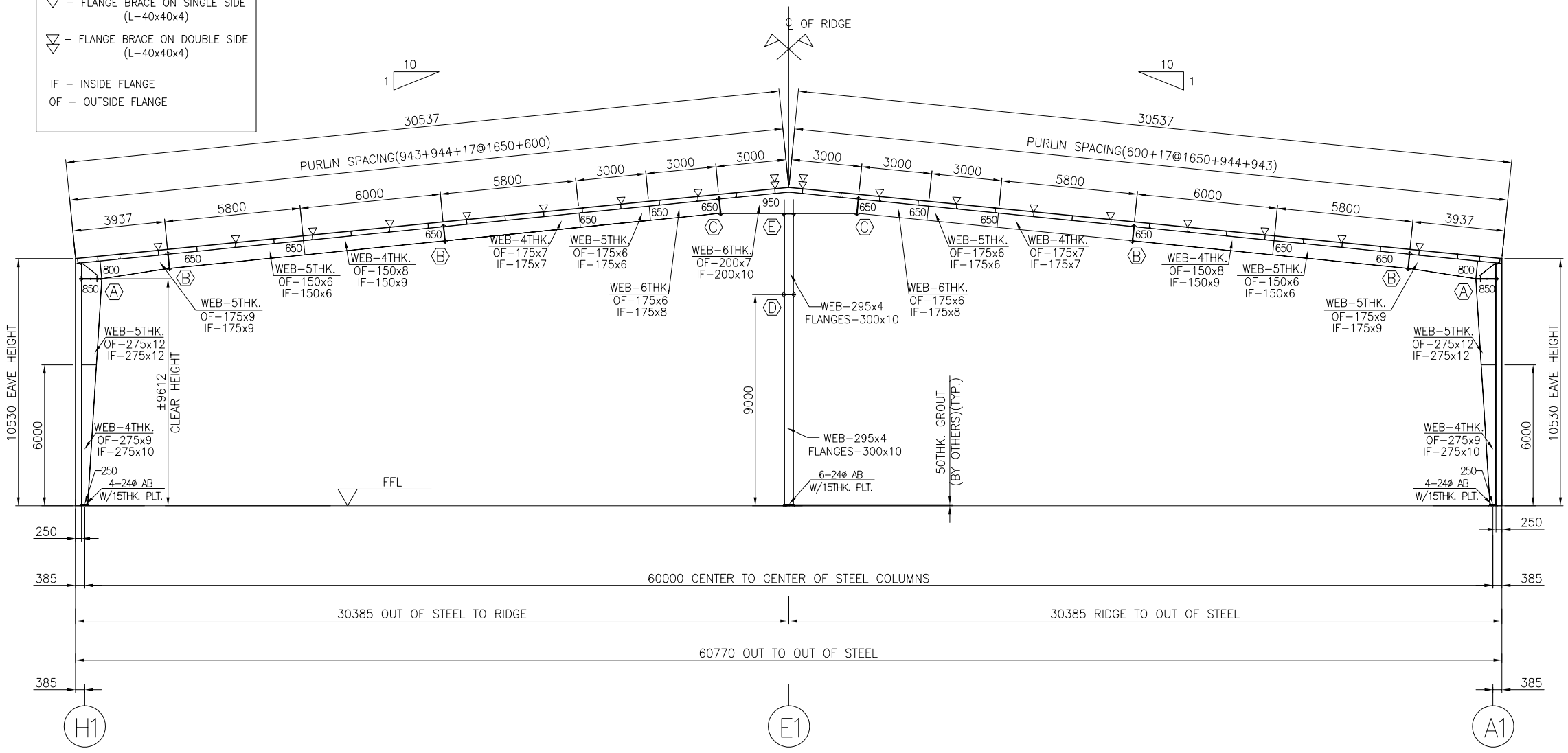
LEGEND/ABBREVIATIONS:

▽ – FLANGE BRACE ON SINGLE SIDE (L–40x40x4)

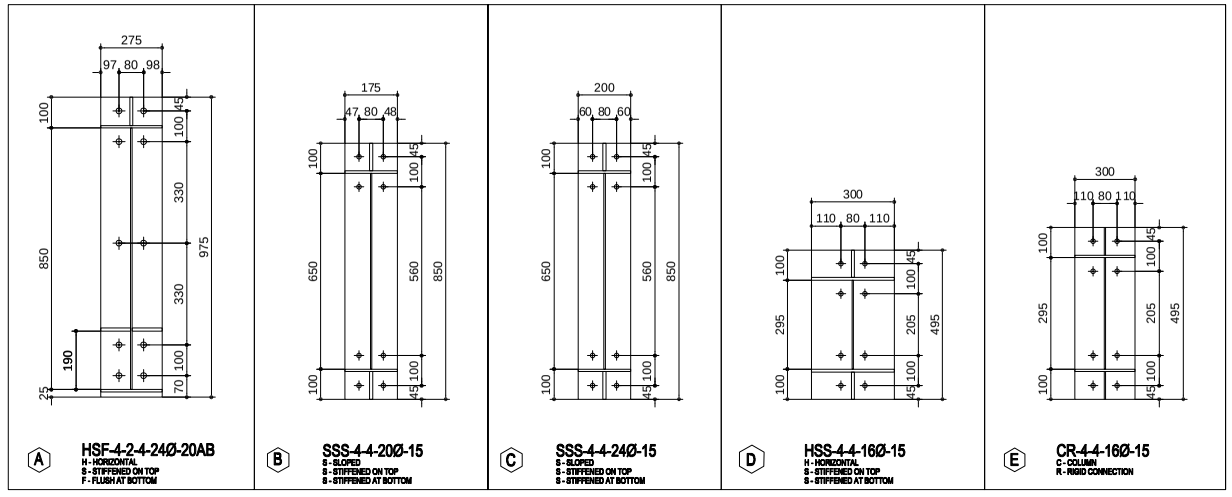
▽▽ – FLANGE BRACE ON DOUBLE SIDE (L–40x40x4)

IF – INSIDE FLANGE

OF – OUTSIDE FLANGE



RIGID FRAME CROSS SECTION @ GL -2 & 3



REVISIONS		
Revision	Description	Date
A		
B		
C		
D		
E		
F		

client:

HERMES RESOURCE NIGERIA LIMITED

project:

PROPOSED INDUSTRIAL DEVELOPMENT AT
IKORODU INDUSTRIAL SCHEME
PLOT 488A LAGOS
IKORODU LOCAL GOVT. AREA,IKORODU.

consultant:

HANCOCK OGUNDIYA & PARTNERS.
.Consulting Civil & Structural Engineers
.Development Consultants & Project Managers
33 Glover Street, Ebute-Metta, Lagos.
Tel. 08034017782, 08033348629, 01-8987545
2636112, 2637519 Fax. 2637519
E-Mail: info@hancockogundiya.com
hancockogundiya@yahoo.com

Drawing Title

RIGID FRAME CROSS SECTION @GL- 2 & 3

Drawn	Date	Scale	Designed	Checked
MUK ADAS	JAN. 2021	1:100 :1:50	AL-AMEEN	OLUYEMI

Drawing No.: **HOP/202002R/E02**

Revision Suffix

FOR APPROVAL

ALL DIMENSIONS TO BE CONFIRMED ON SITE PRIOR TO COMMENCEMENT OF CONTRACT.

GENERAL NOTES

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LEGEND/ABBREVIATIONS:

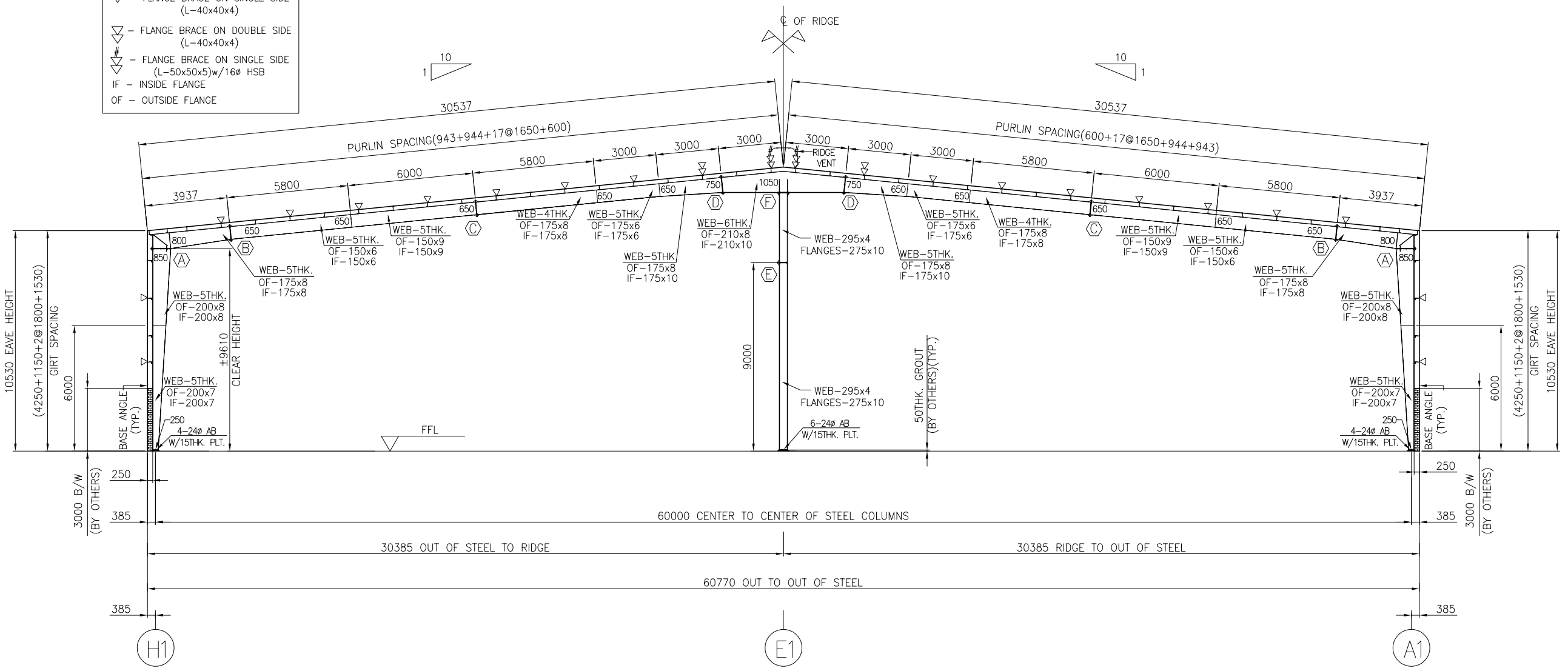
▽ – FLANGE BRACE ON SINGLE SIDE (L–40x40x4)

▽▽ – FLANGE BRACE ON DOUBLE SIDE (L–40x40x4)

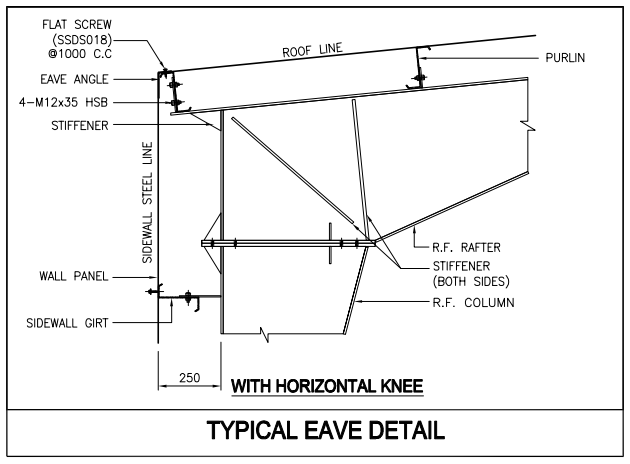
#▽▽ – FLANGE BRACE ON SINGLE SIDE (L–50x50x5)w/16ø HSB

IF – INSIDE FLANGE

OF – OUTSIDE FLANGE

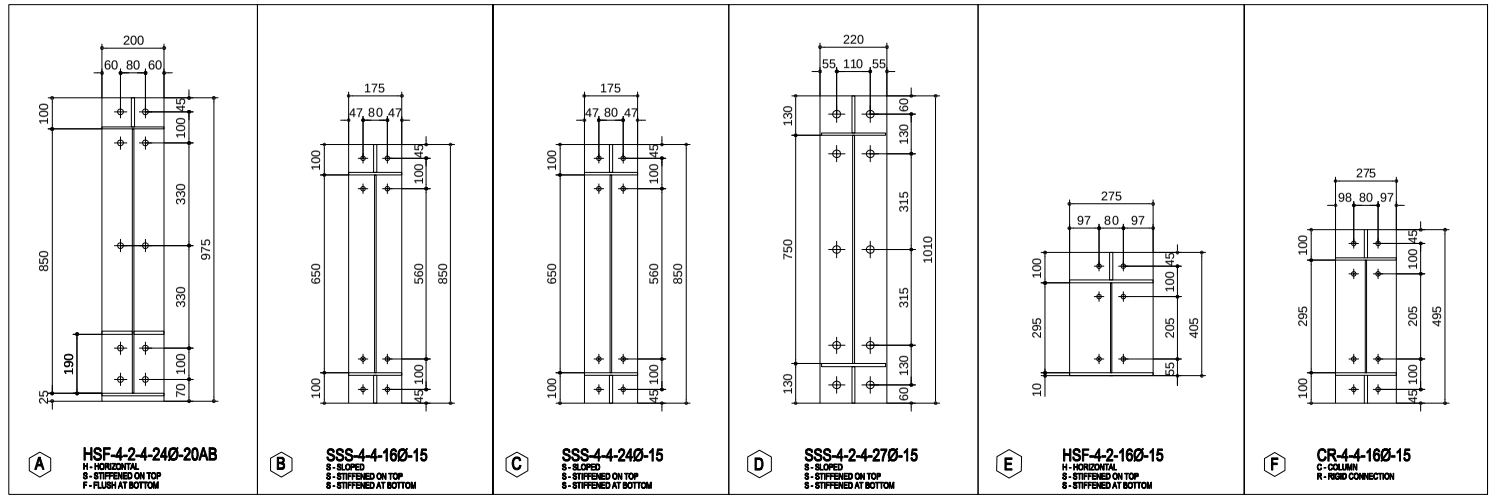


RIGID FRAME CROSS SECTION @ GL - 4



WITH HORIZONTAL KNEE

TYPICAL EAVE DETAIL



REVISIONS		
Revision	Description	Date
A		
B		
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D		
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F		

client:

HERMES RESOURCE NIGERIA LIMITED

project:

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PLOT 488A LAGOS
IKORODU LOCAL GOVT. AREA,IKORODU.

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2636112, 2637519 Fax. 2637519
E-Mail: info@hancockogundiya.com
hancockogundiya@yahoo.com

Drawing Title

RIGID FRAME CROSS SECTION @GL- 4

Drawn	Date	Scale	Designed	Checked
MUKADAS	JAN. 2021	1:100 :1:50	AL- AMEEN	OLUYEMI

Drawing No.: HOP/202002R/E03

Revision Suffix:

FOR APPROVAL

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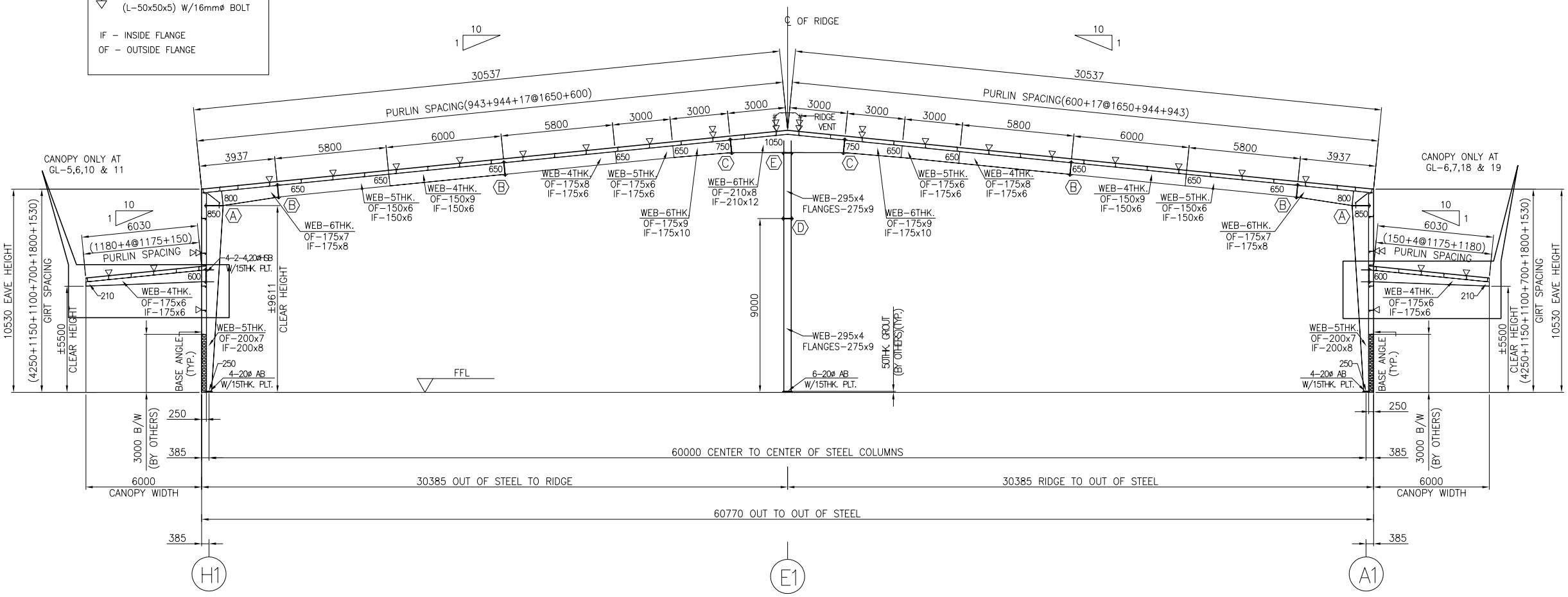
▽ – FLANGE BRACE ON SINGLE SIDE (L–40x40x4)

▽▽ – FLANGE BRACE ON DOUBLE SIDE (L–40x40x4)

#▽▽ – FLANGE BRACE ON DOUBLE SIDE (L–50x50x5) W/16mmø BOLT

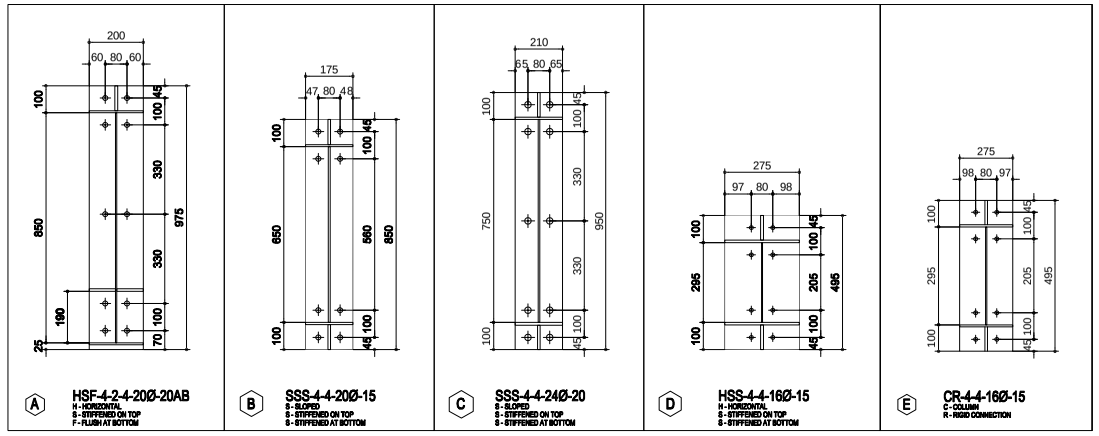
IF – INSIDE FLANGE

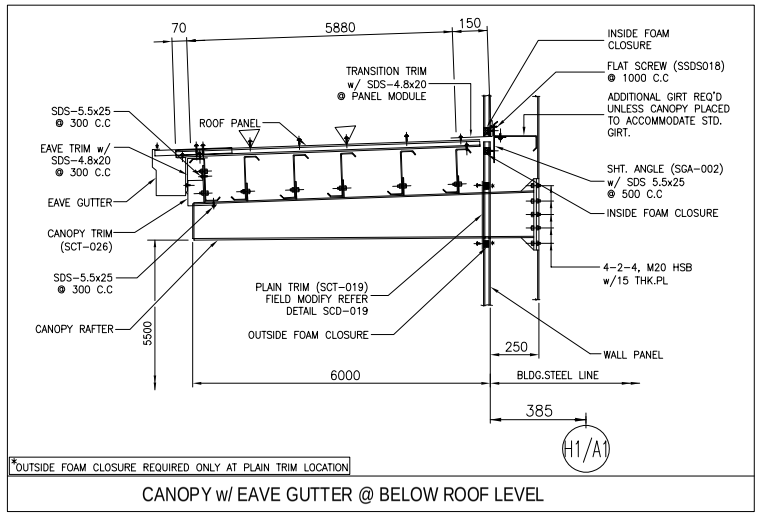
OF – OUTSIDE FLANGE



RIGID FRAME CROSS SECTION @ GL - 5,6,7,10,11,18 & 19

REFFER DWG. No. E11 FOR CANOPY LOCATIONS





CANOPY w/ EAVE GUTTER @ BELOW ROOF LEVEL

REVISIONS		
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A		
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hancockogundiya@yahoo.com

Drawing Title

RIGID FRAME CROSS SECTION @GL- 5,6,7,10,11,18 & 19

Drawn	Date	Scale	Designed	Checked
MUKADAS	JAN. 2021	1:100 :1:50	AL-AMEEN	OLUYEMI

Drawing No.: HOP/202002R/E04 Revision Suffix

FOR APPROVAL

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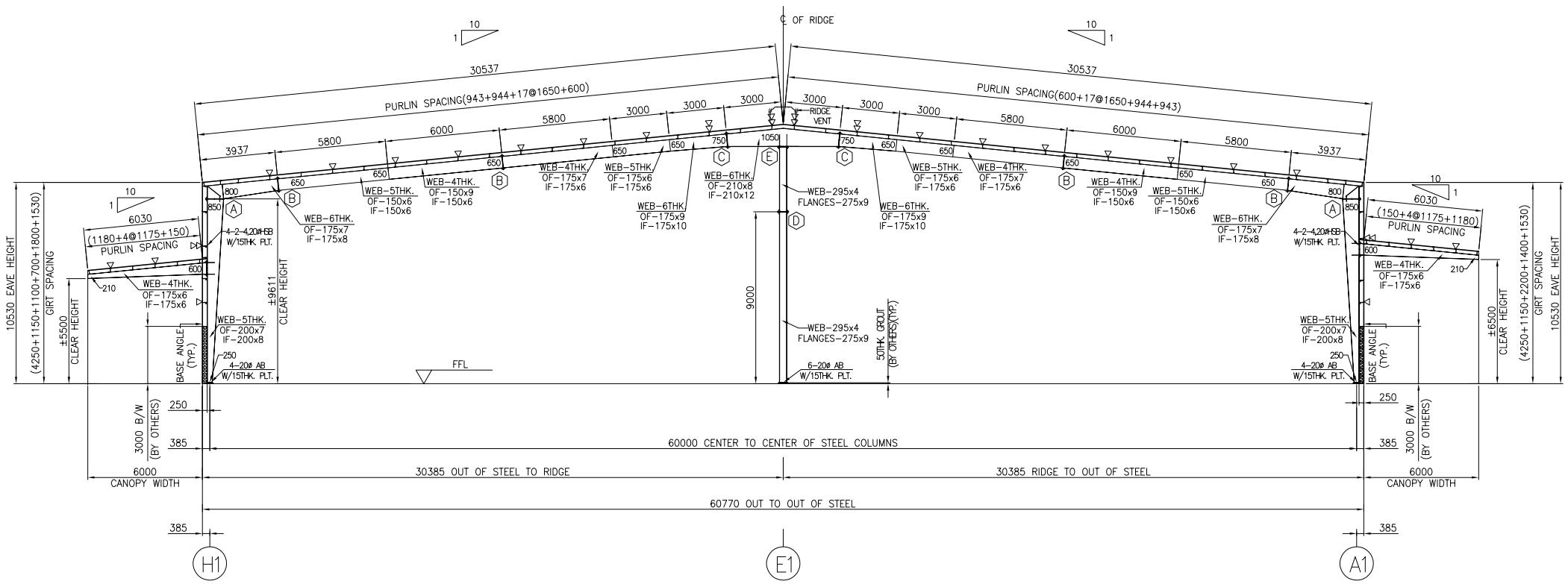
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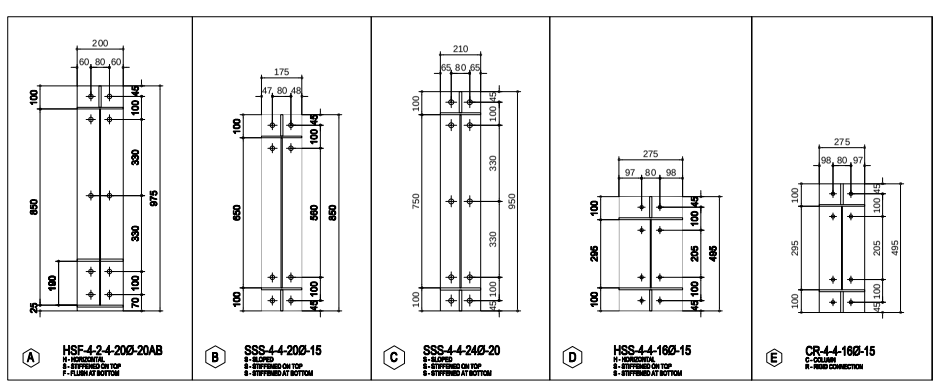
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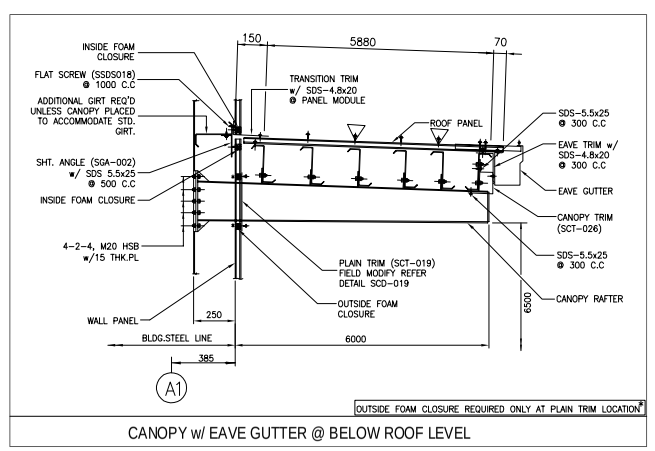
IF – INSIDE FLANGE

OF – OUTSIDE FLANGE



RIGID FRAME CROSS SECTION @ GL - 13 & 14





CANOPY w/ EAVE GUTTER @ BELOW ROOF LEVEL

REVISIONS		
Revision	Description	Date
A		
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client:

HERMES RESOURCE NIGERIA LIMITED

project:

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Drawing Title

RIGID FRAME CROSS SECTION @GL-13 & 14

Drawn	Date	Scale	Designed	Checked
MUKADAS	JAN. 2021	1:100 :1:50	AL-AMEEN	OLUYEMI

Drawing No.: HOP/202002R/E05

Revision Suffix:

FOR APPROVAL

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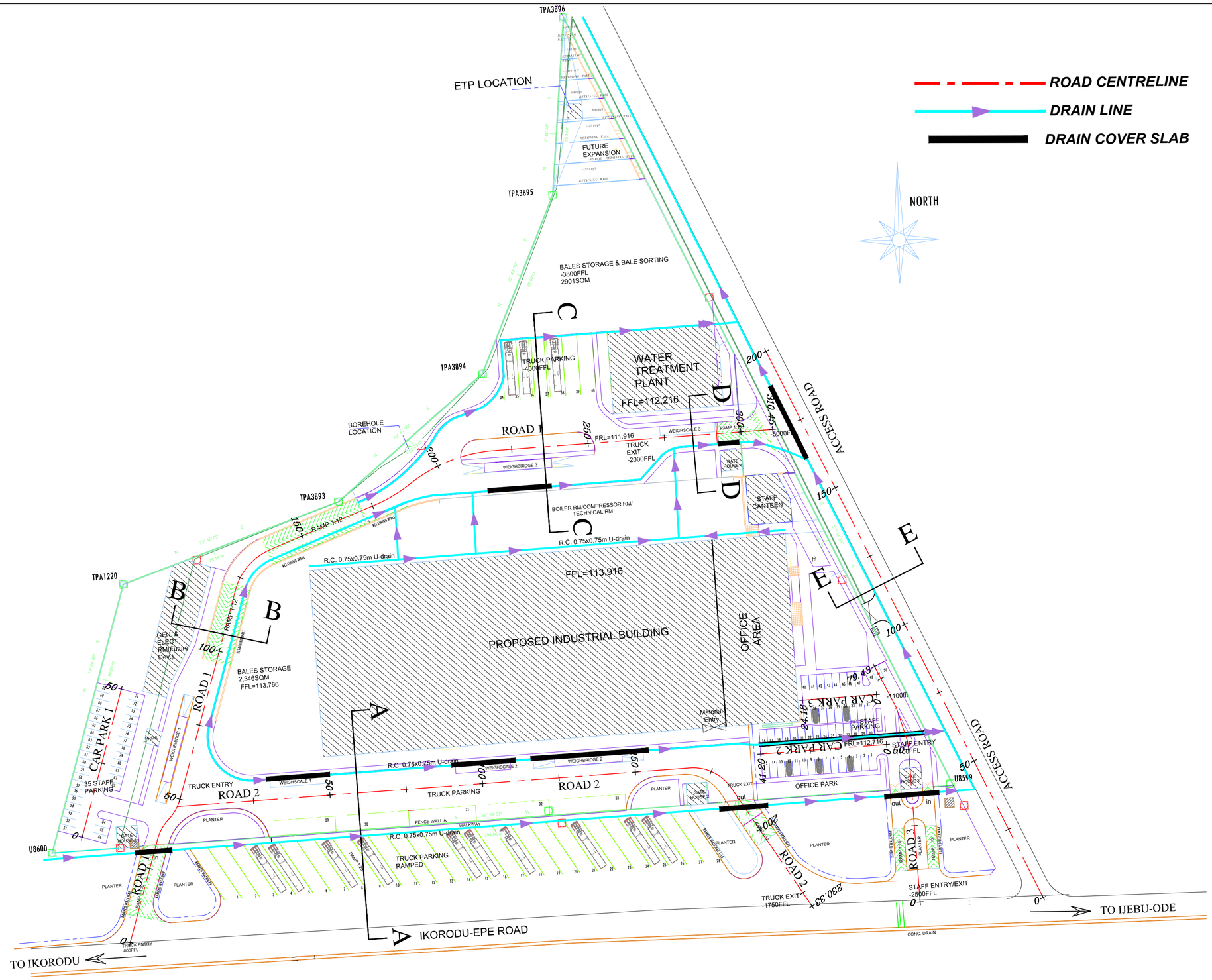
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SONNEX PACKAG ING NIGERIA LIMITED

HEALTH, SAFETY AND ENVIRONMENTAL POLICY

1. It is the policy of Mohinani group of companies (Nig.) to manage its operations in such a manner as to protect the health of its staff, customers and the general public. We believe in maintaining a clean and orderly work place and in promoting high standards of personal hygiene throughout the organization.
2. We consider health, safety and environmental control measures to be fundamental components of effective productivity. A committee comprising of management and other staff members holds "Safety Meeting" regularly to deliberate and monitor progress.
3. We are committed to training our employees to arouse health and safety consciousness. This process starts at induction and continues through on-the-job training, supplemented by regular safety campaigns particularly during the yearly 'Health, Safety and Environmental Week'.
4. We Endeavour to minimize the exposure of staff to danger through the use of appropriate plant and equipment under strictly observed Standard Operating Procedures (SOPs). The compulsory use of safety wears and equipment is specified wherever this is appropriate.
5. We are conscious that external contractors constitute a major hazard if not properly selected and supervised. We ensure that jobs are awarded to contractors who demonstrate a commitment to observe our safety procedures.
6. We are committed to record all accidents and **"near miss"** incidents, to document and circulate details widely within the company so that we can learn from them.
7. We undertake to adhere to the Factory Decree Regulations and to the guidelines published by FEPA striving to improve on their minimum standard wherever possible.
8. We are conscious that objective dialogue with the general public is an important instrument in imparting and propagating knowledge on environmental protection and product safety. Hence, we will make use of this instrument at all times.
9. We are committed to continuously improve our production processes to ensure minimal waste generation and to recycle such material wherever possible to prevent environmental pollution.
10. Mohinani group's Health, Safety and Environmental Policy is **"Total Commitment to Health and Safe Environment"**

Managing Director



IND	DATE	NAME	AMENDMENTS	REMARKS

PROJECT TITLE:

SOMOTEX NIGERIA LIMITED
PROPOSED REDESIGN
OF WAREHOUSES AT IKORODU.

PROJECT TITLE:

INTERNAL ROADS PLAN & PROFILE
GENERAL LAYOUT

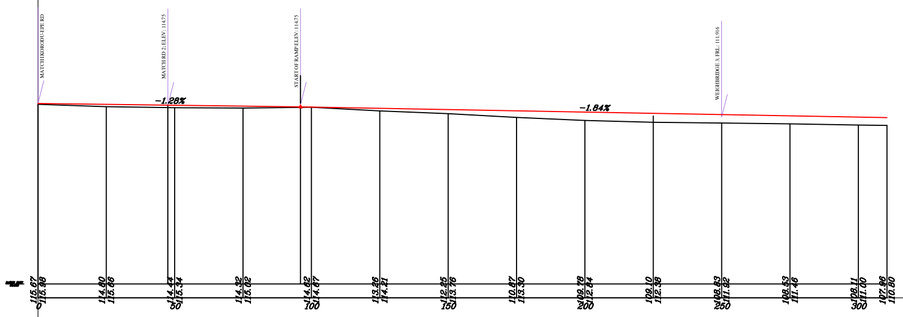
CONSULTANT:

HANCOCK OGUNDIYA & PARTNERS.
.Consulting Civil & Structural Engineers
.Development Consultants & Project Managers
33, Glover Street, Ebute-Metta, Lagos.
Tel. 08034017782, 01-2956522
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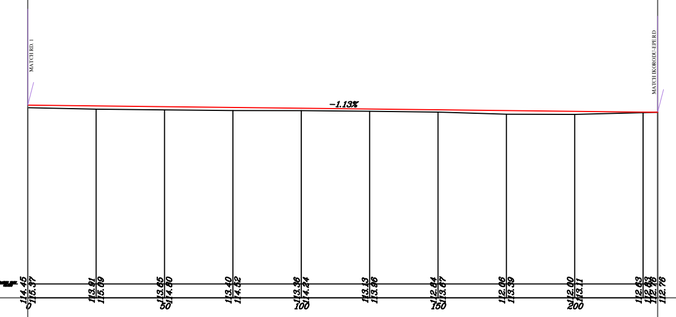
DESIGNED :	SHOLA
CHECKED:	OLUYEMI
APPROVED:	OLUYEMI
DATE :	APR, 2022
SCALE :	H - TO FIT V - TO FIT

DWG. NO. .....

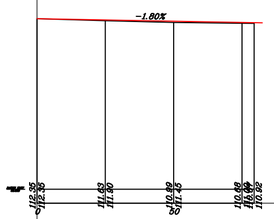
SHEET.No. 00



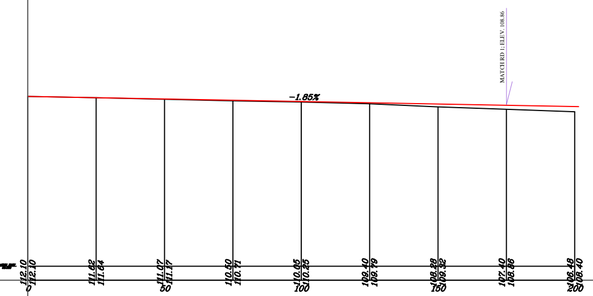
ROAD 1



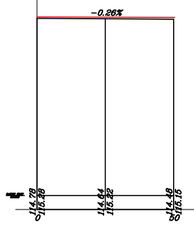
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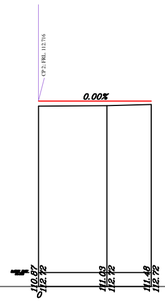
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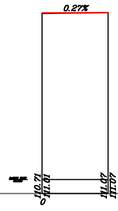
ACCESS RD



CAR PARK 1



CAR PARK 2



CAR PARK 3

IND	DATE	NAME	AMENDMENTS	REMARKS

PROJECT TITLE:

SOMOTEX NIGERIA LIMITED
PROPOSED REDESIGN
OF WAREHOUSES AT IKORODU.

PROJECT TITLE:

INTERNAL ROADS PLAN & PROFILE

PROFILE DRAWINGS

CONSULTANT:

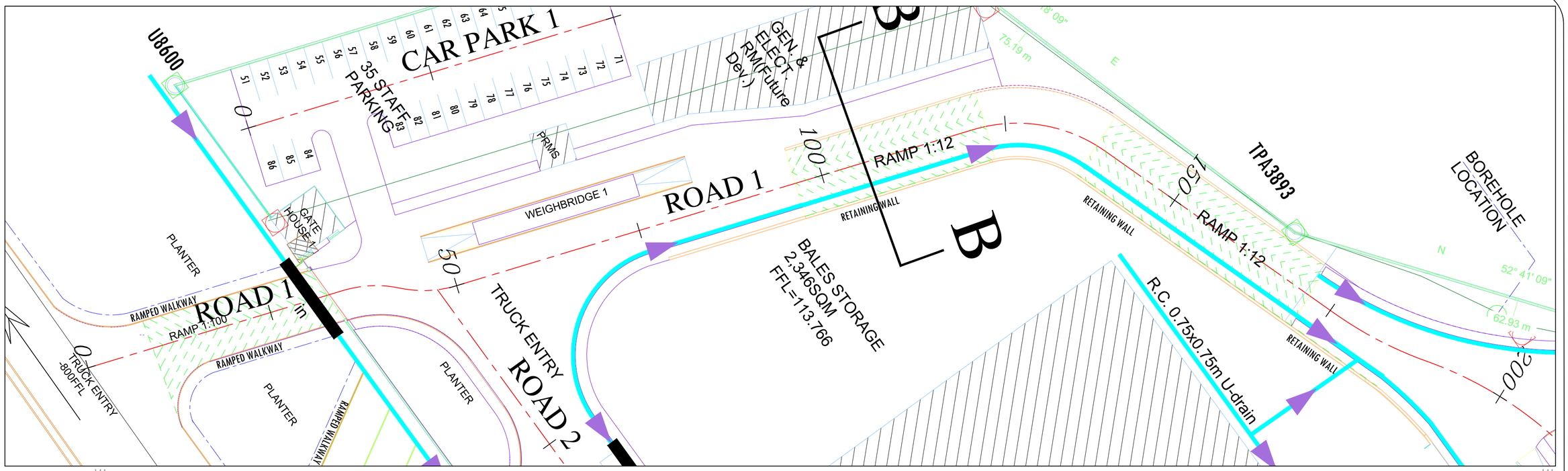
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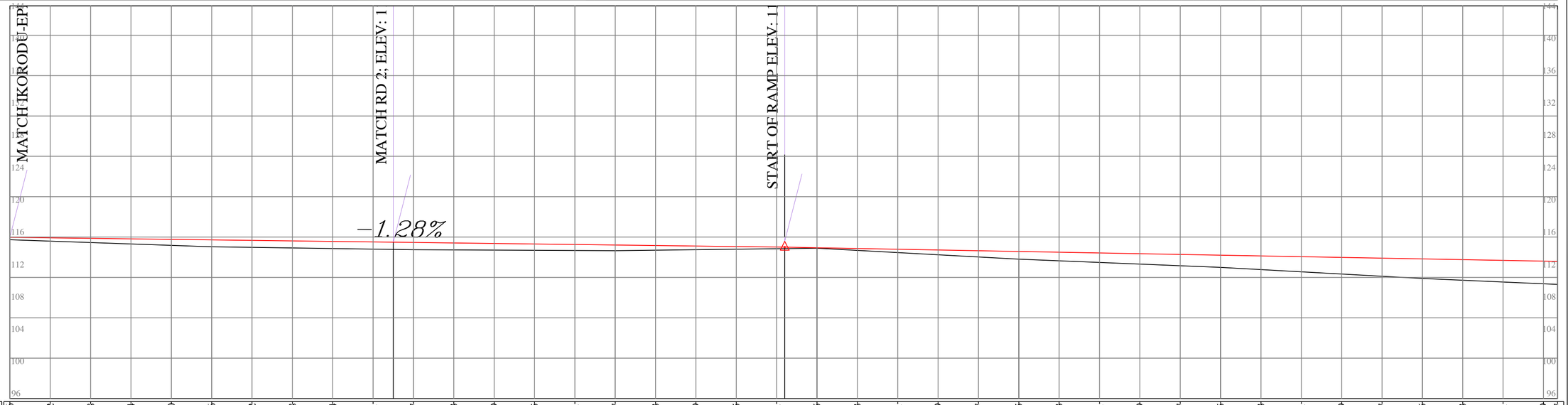
DESIGNED :	SHOLA
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APPROVED:	OLUYEMI
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SCALE :	H - TO FIT V - TO FIT

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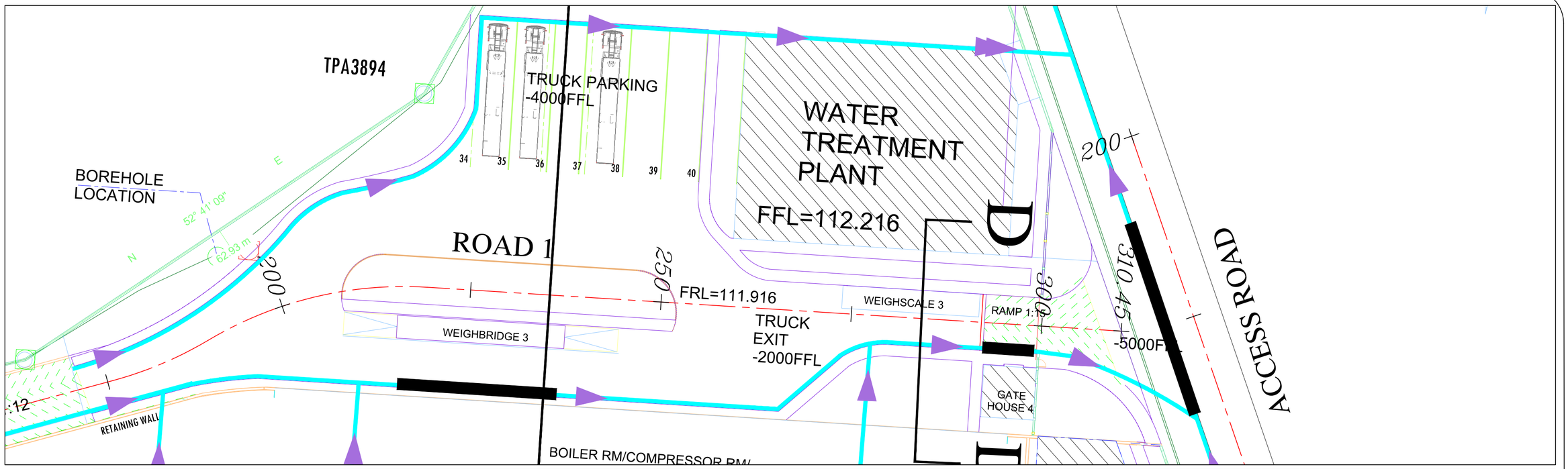
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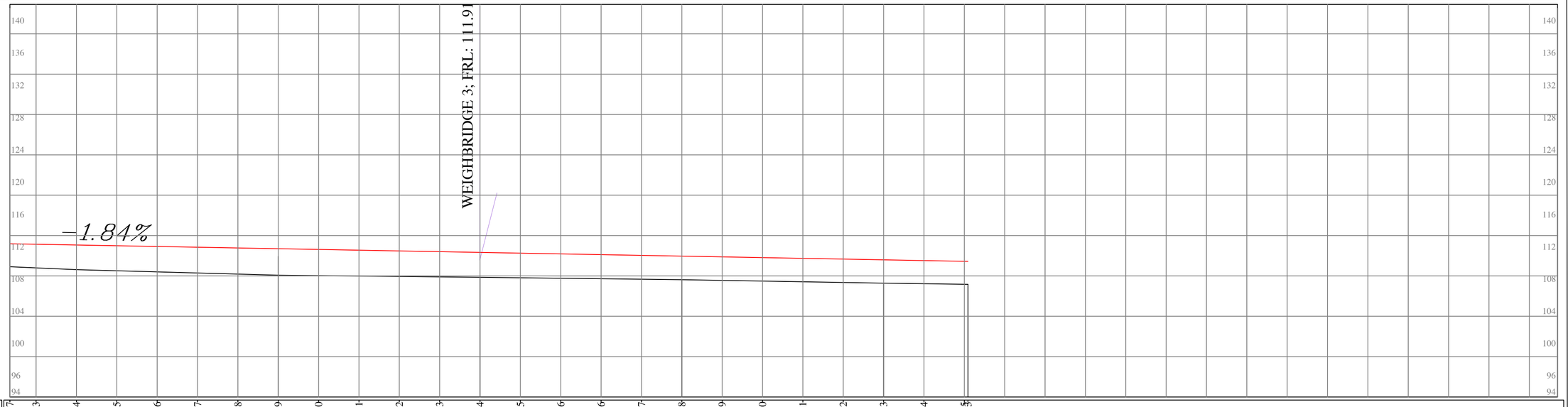
SHEET.No. 01


U8600
CAR PARK 1
35 STAFF PARKING
GEN. & ELECT. RM(Future Dev.)
PRMS
WEIGHBRIDGE 1
GATE HOUSE 1
ROAD 1
RAMP 1:12
RETAINING WALL
BALES STORAGE
2,346SQM
FFL=113.766
TPA3893
BOREHOLE LOCATION
75.19 m
52° 41' 09"
62.93 m
R.C. 0.75x0.75m U-drain
PLANTER
RAMPED WALKWAY
RAMP 1:100
TRUCK ENTRY
-800FFL
TRUCK ENTRY
ROAD 2
ROAD 1
0
50
100
150
200


MATCH IKORODU-EPE
MATCH RD 2; ELEV: 1
START OF RAMP ELEV: 11
-1.28%
144
140
136
132
128
124
120
116
112
108
104
100
96

| | | |





CHAINAGE (M)	191.7	195.0	200.0	205.0	210.0	215.0	220.0	225.0	230.0	235.0	240.0	245.0	250.0	255.0	260.0	265.0	270.0	275.0	280.0	285.0	290.0	295.0	300.0	305.0	310.3
GROUND LEVEL (M)	110.140	109.998	109.780	109.643	109.507	109.370	109.234	109.097	109.044	108.990	108.937	108.884	108.831	108.771	108.711	108.651	108.592	108.532	108.447	108.362	108.276	108.191	108.106	108.038	107.970
PROFILE LEVEL (M)	112.277	112.193	112.064	111.935	111.806	111.677	111.548	111.419	111.290	111.161	111.032	110.903	110.774	110.645	110.516	110.386	110.257	110.128	109.999	109.870	109.741	109.612	109.483	109.354	109.225

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OF WAREHOUSES AT IKORODU.

PROJECT TITLE:

INTERNAL ROADS PLAN & PROFILE
ROAD 1

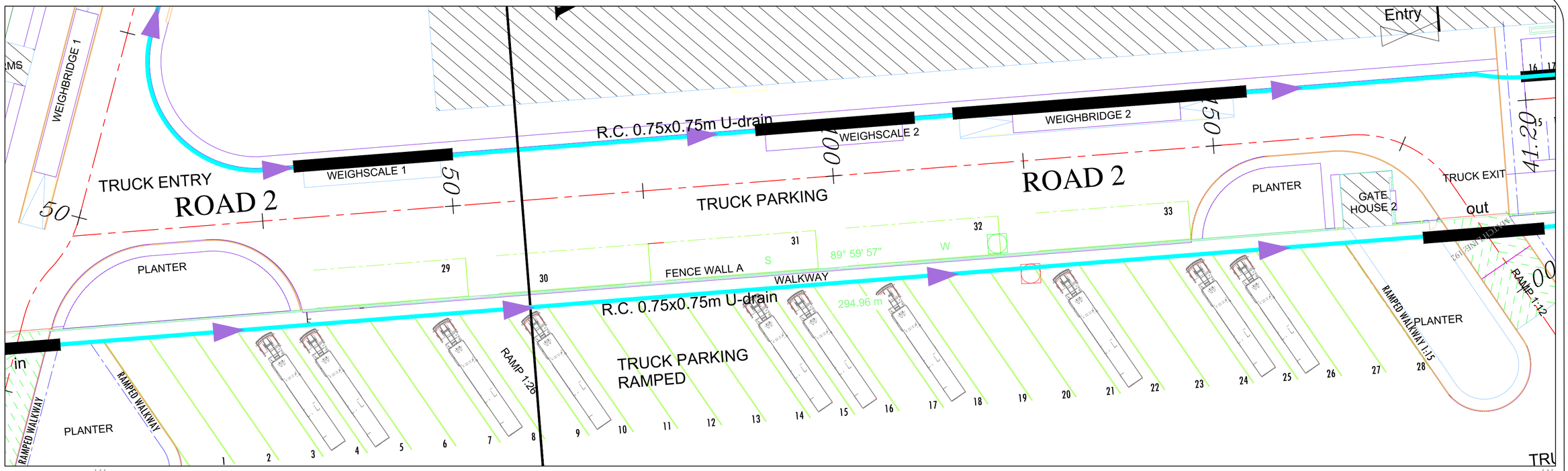
CONSULTANT:

HANCOCK OGUNDIYA & PARTNERS.
.Consulting Civil & Structural Engineers
.Development Consultants & Project Managers
33, Glover Street, Ebute-Metta, Lagos.
Tel. 08034017782, 01-2956522
E-Mail: info@hancockogundiya.com
hancockogundiya@yahoo.com

DESIGNED :	SHOLA
CHECKED:	OLUYEMI
APPROVED:	OLUYEMI
DATE :	APR, 2022
SCALE :	H - TO FIT V - TO FIT

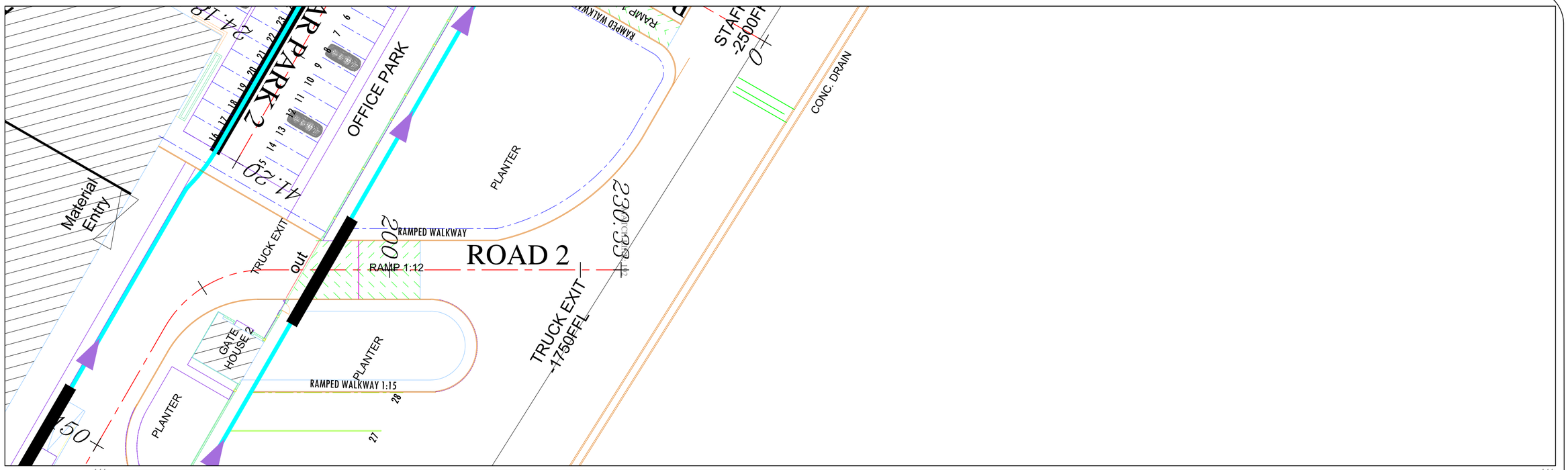
DWG. NO. .....

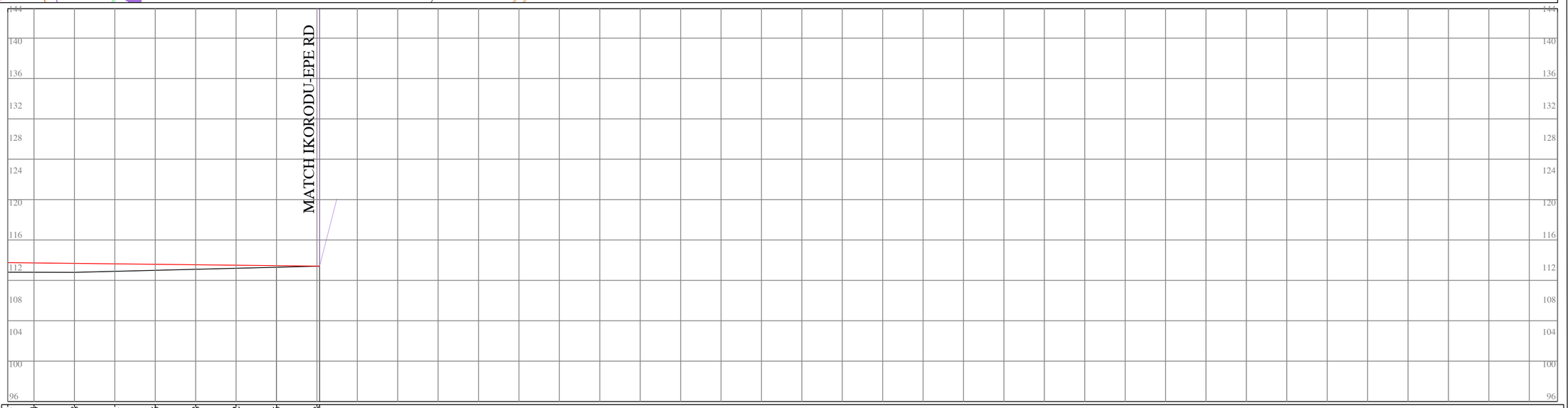
SHEET.No. 03


WEIGHBRIDGE 1
TRUCK ENTRY
ROAD 2
WEIGHSCALE 1
R.C. 0.75x0.75m U-drain
WEIGHSCALE 2
WEIGHBRIDGE 2
TRUCK PARKING
ROAD 2
Entry
PLANTER
GATE HOUSE 2
TRUCK EXIT
out
FENCE WALL A
89° 59' 57"
WALKWAY
294.96 m
R.C. 0.75x0.75m U-drain
RAMP 1:42
RAMPED WALKWAY 1:15
PLANTER
RAMP 1:20
TRUCK PARKING
RAMPED
RAMPED WALKWAY
PLANTER
RAMPED WALKWAY
in


MATCH RD. 1
−1.13%

| | | |





PROFILE LEVEL (M)	113.201	113.164	113.108	113.051	112.995	112.938	112.882	112.825	112.768	
GROUND LEVEL (M)	112.017	112.009	111.996	112.123	112.249	112.376	112.503	112.630	112.756	
CHAINAGE (M)	191.7	195.0	200.0	205.0	210.0	215.0	220.0	225.0	230.0	

IND	DATE	NAME	AMENDMENTS	REMARKS

PROJECT TITLE:

SOMOTEX NIGERIA LIMITED
PROPOSED REDESIGN
OF WAREHOUSES AT IKORODU.

PROJECT TITLE:

INTERNAL ROADS PLAN & PROFILE

ROAD 2

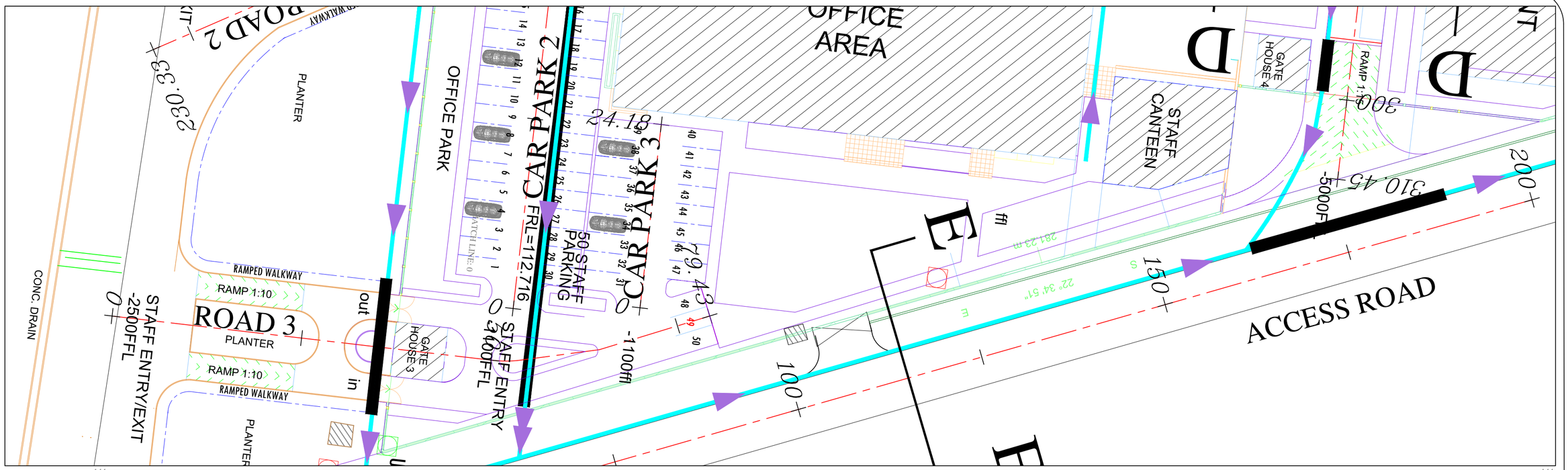
CONSULTANT:

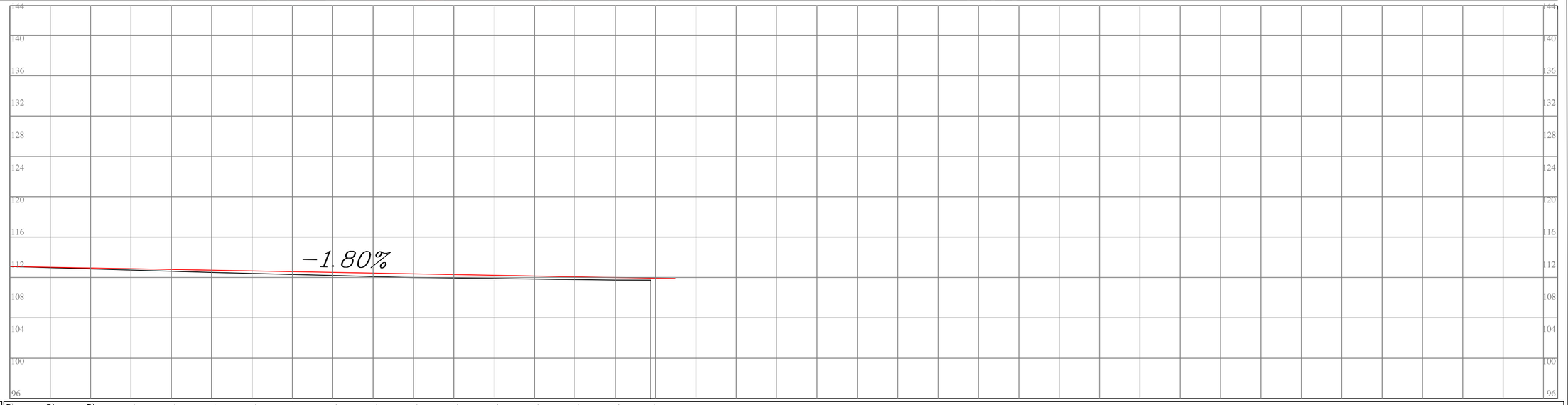
HANCOCK OGUNDIYA & PARTNERS.
.Consulting Civil & Structural Engineers
.Development Consultants & Project Managers
33, Glover Street, Ebute-Metta, Lagos.
Tel. 08034017782, 01-2956522
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hancockogundiya@yahoo.com

DESIGNED :	SHOLA
CHECKED:	OLUYEMI
APPROVED:	OLUYEMI
DATE :	APR, 2022
SCALE :	H - TO FIT V - TO FIT

DWG. NO. .....

SHEET.No. 05





PROFILE LEVEL (M)	112.352	112.262	112.172	112.081	111.991	111.901	111.811	111.721	111.631	111.541	111.451	111.361	111.271	111.181	111.091	111.001	110.921	
GROUND LEVEL (M)	112.352	112.206	112.061	111.916	111.771	111.626	111.500	111.373	111.247	111.121	110.995	110.933	110.870	110.808	110.745	110.683		
CHAINAGE (M)	0.0	5.0	10.0	15.0	20.0	25.0	30.0	35.0	40.0	45.0	50.0	55.0	60.0	65.0	70.0	75.0	79.4	

IND	DATE	NAME	AMENDMENTS	REMARKS

PROJECT TITLE:

SOMOTEX NIGERIA LIMITED
PROPOSED REDESIGN
OF WAREHOUSES AT IKORODU.

PROJECT TITLE:

INTERNAL ROADS PLAN & PROFILE
ROAD 3

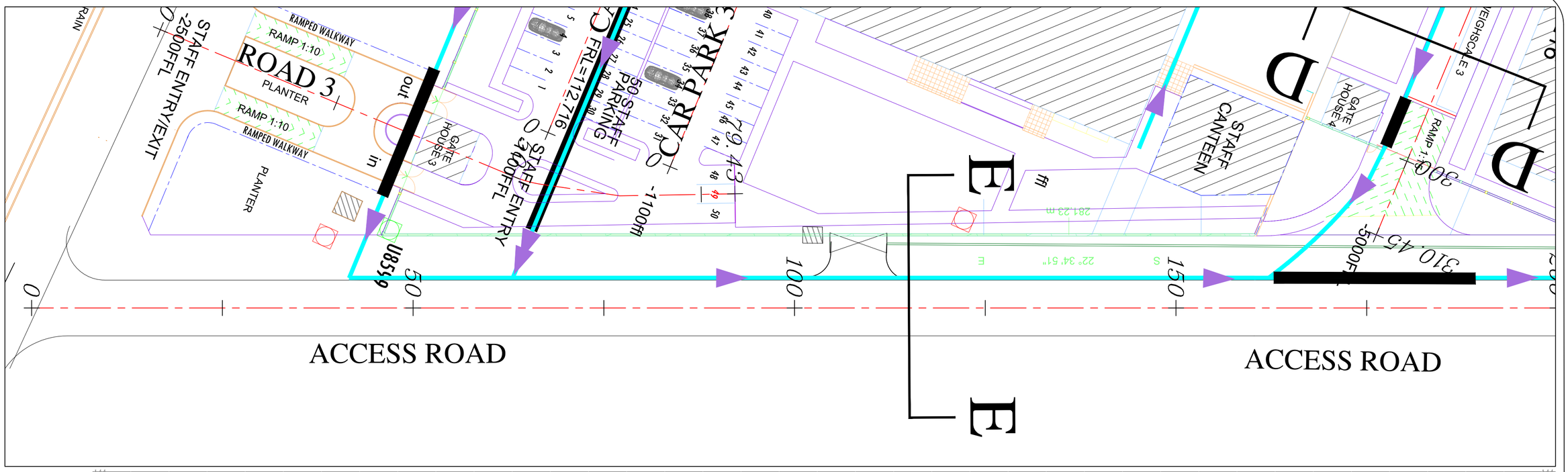
CONSULTANT:

HANCOCK OGUNDIYA & PARTNERS.
.Consulting Civil & Structural Engineers
.Development Consultants & Project Managers
33, Glover Street, Ebute-Metta, Lagos.
Tel. 08034017782, 01-2956522
E-Mail: info@hancockogundiya.com
hancockogundiya@yahoo.com

DESIGNED :	SHOLA
CHECKED:	OLUYEMI
APPROVED:	OLUYEMI
DATE :	APR, 2022
SCALE :	H - TO FIT V - TO FIT

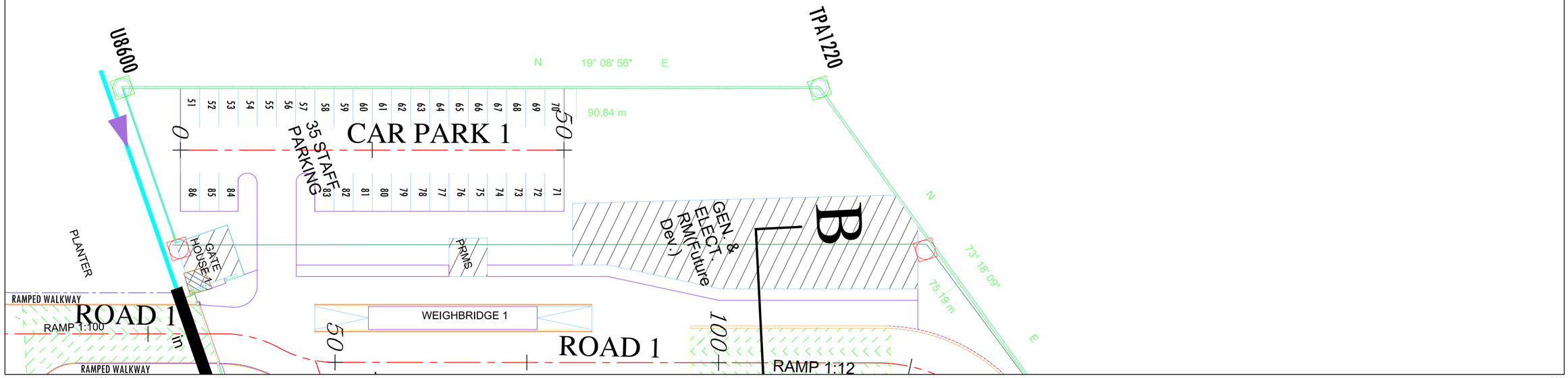
DWG. NO. .....

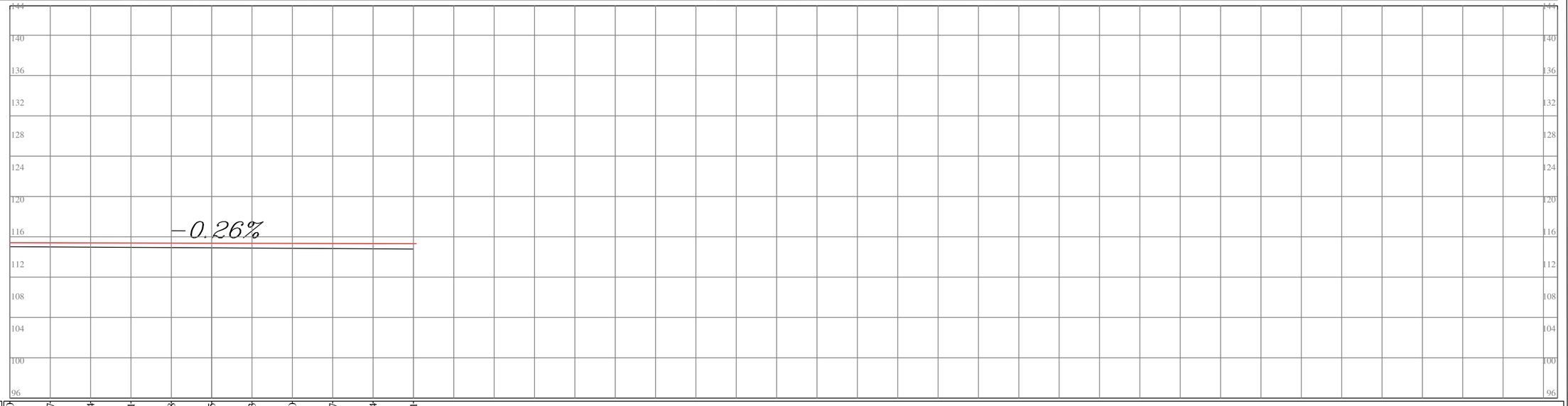
SHEET.No. 06


ROAD 3
PLANTER
RAMPED WALKWAY
RAMP 1:10
RAMP 1:10
RAMPED WALKWAY
PLANTER
STAFF ENTRY/EXIT
-250OFFL
out
in
GATE HOUSE 3
STAFF ENTRY
-200OFFL
FRL=112.776
50 STAFF PARKING
CAR PARK 3
-1100FFL
E
E
STAFF CANTEEN
GATE HOUSE 4
RAMP 1:10
-500OFFL
D
D
ACCESS ROAD
ACCESS ROAD
0
50
100
150
300
310.45


MATCH RD 1; ELEV. 108.98
-1.85%
144
140
136
132
128
124
120
116
112
108
104
100
96

| | | |





PROFILE LEVEL (M)	115.280	115.267	115.254	115.241	115.228	115.215	115.203	115.190	115.177	115.164	115.151
GROUND LEVEL (M)	114.779	114.751	114.724	114.696	114.669	114.641	114.609	114.577	114.546	114.514	114.482
CHAINAGE (M)	0.0	5.0	10.0	15.0	20.0	25.0	30.0	35.0	40.0	45.0	50.0

IND	DATE	NAME	AMENDMENTS	REMARKS

PROJECT TITLE:

SOMOTEX NIGERIA LIMITED
PROPOSED REDESIGN
OF WAREHOUSES AT IKORODU.

PROJECT TITLE:

INTERNAL ROADS PLAN & PROFILE
CAR PARK 1

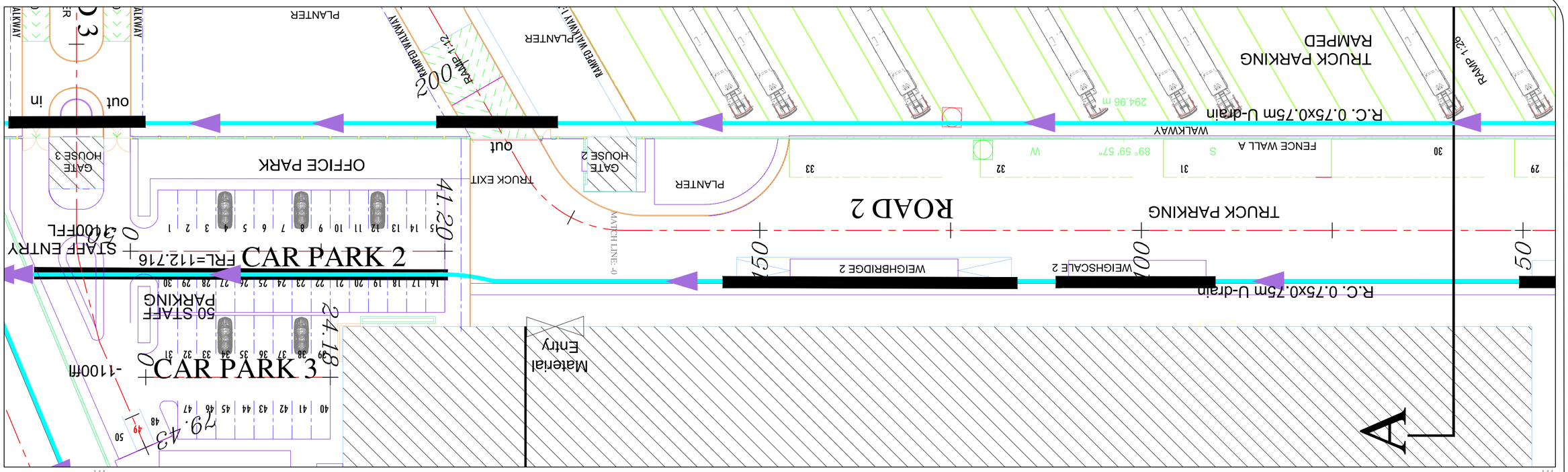
CONSULTANT:

HANCOCK OGUNDIYA & PARTNERS.
.Consulting Civil & Structural Engineers
.Development Consultants & Project Managers
33, Glover Street, Ebute-Metta, Lagos.
Tel. 08034017782, 01-2956522
E-Mail: info@hancockogundiya.com
hancockogundiya@yahoo.com

DESIGNED :	SHOLA
CHECKED:	OLUYEMI
APPROVED:	OLUYEMI
DATE :	APR, 2022
SCALE :	H - TO FIT V - TO FIT

DWG. NO. .....

SHEET.No. 08



PROFILE LEVEL (M)	112.716	112.716	112.716	112.716	112.716	112.716	112.716	112.716	112.716	112.716
GROUND LEVEL (M)	110.868	110.901	110.933	110.966	110.999	111.032	111.170	111.309	111.447	
CHAINAGE (M)	0.0	5.0	10.0	15.0	20.0	25.0	30.0	35.0	40.0	41.2

IND	DATE	NAME	AMENDMENTS	REMARKS

PROJECT TITLE:

SOMOTEX NIGERIA LIMITED
PROPOSED REDESIGN
OF WAREHOUSES AT IKORODU.

PROJECT TITLE:

INTERNAL ROADS PLAN & PROFILE
CAR PARK 2

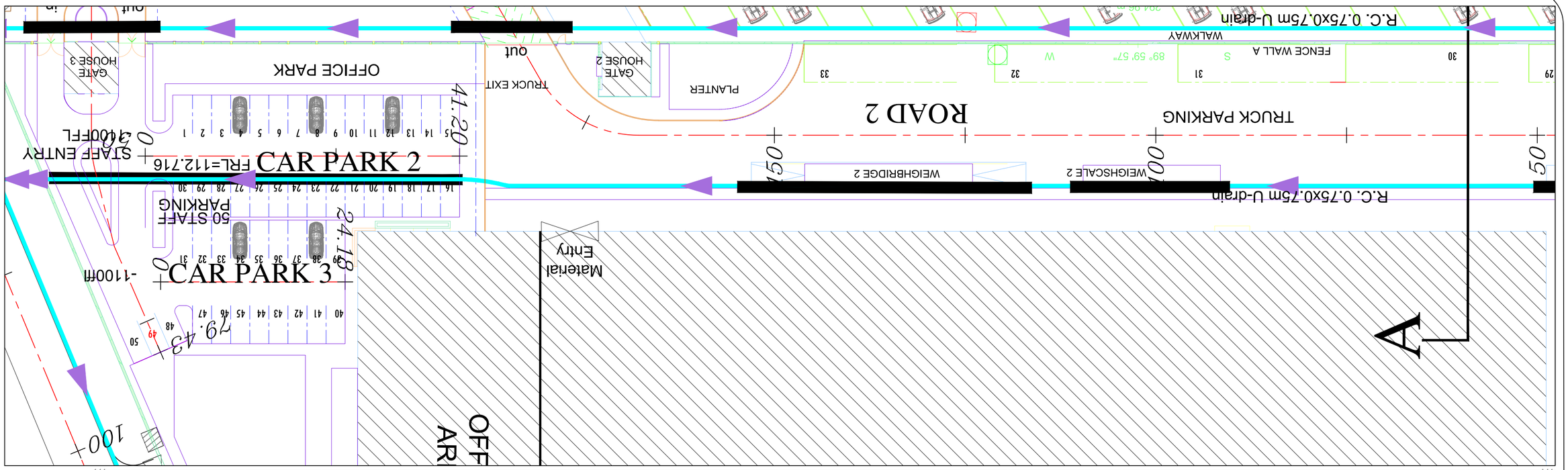
CONSULTANT:

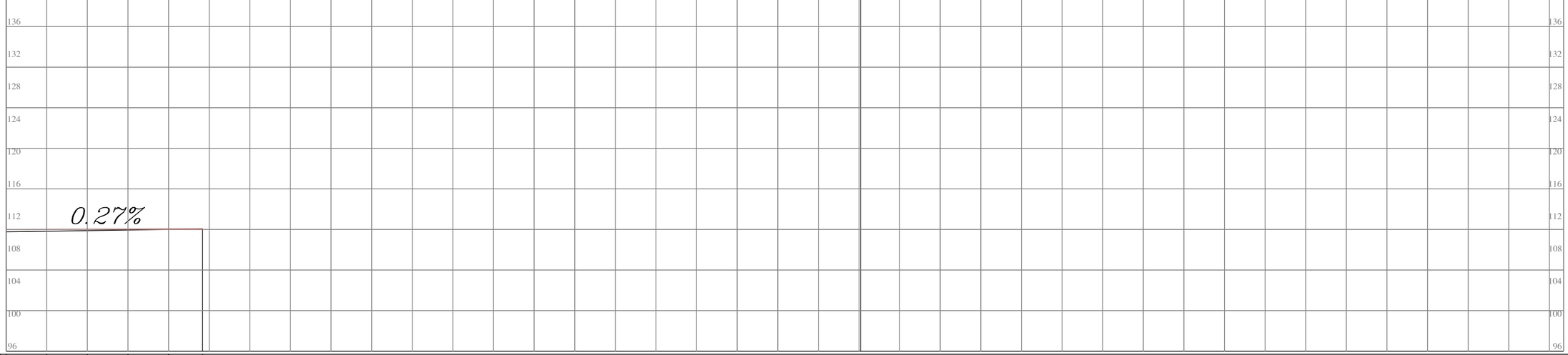
HANCOCK OGUNDIYA & PARTNERS.
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Tel. 08034017782, 01-2956522
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hancockogundiya@yahoo.com

DESIGNED :	SHOLA
CHECKED:	OLUYEMI
APPROVED:	OLUYEMI
DATE :	APR, 2022
SCALE :	H - TO FIT V - TO FIT

DWG. NO. .....

SHEET.No. 09





PROFILE LEVEL (M)	111.006	111.019	111.033	111.047	111.060	
GROUND LEVEL (M)	110.711	110.786	110.860	110.935	111.009	
CHAINAGE (M)	0.0	5.0	10.0	15.0	20.0	24.2

IND	DATE	NAME	AMENDMENTS	REMARKS

PROJECT TITLE:

SOMOTEX NIGERIA LIMITED
PROPOSED REDESIGN
OF WAREHOUSES AT IKORODU.

PROJECT TITLE:

INTERNAL ROADS PLAN & PROFILE
CAR PARK 3

CONSULTANT:

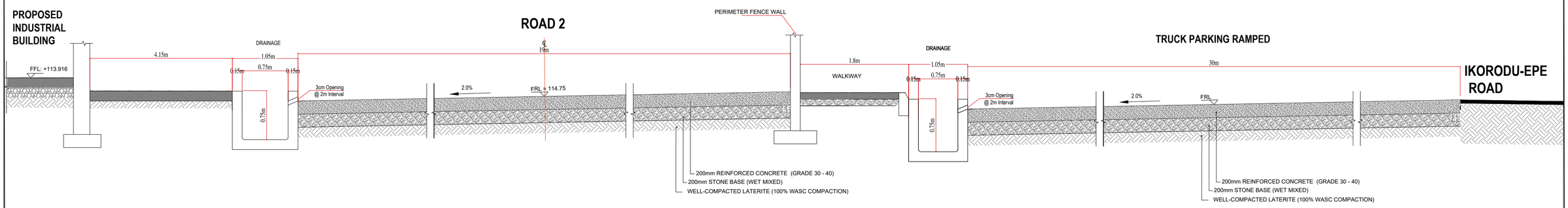
HANCOCK OGUNDIYA & PARTNERS.
.Consulting Civil & Structural Engineers
.Development Consultants & Project Managers
33, Glover Street, Ebute-Metta, Lagos.
Tel. 08034017782, 01-2956522
E-Mail: info@hancockogundiya.com
hancockogundiya@yahoo.com

DESIGNED :	SHOLA
CHECKED:	OLUYEMI
APPROVED:	OLUYEMI
DATE :	APR, 2022
SCALE :	H - TO FIT V - TO FIT

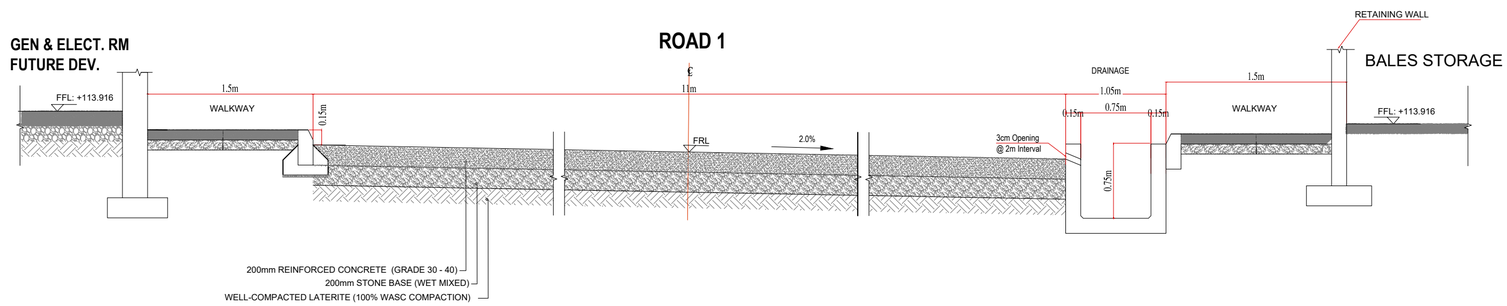
DWG. NO. .....

SHEET.No. 10

SECTION A - A



SECTION B - B



IND	DATE	NAME	AMENDMENTS	REMARKS

PROJECT TITLE:

SOMOTEX NIGERIA LIMITED
PROPOSED REDESIGN
OF WAREHOUSES AT IKORODU.

PROJECT TITLE:

INTERNAL ROADS PLAN & PROFILE
SECTIONS

CONSULTANT:

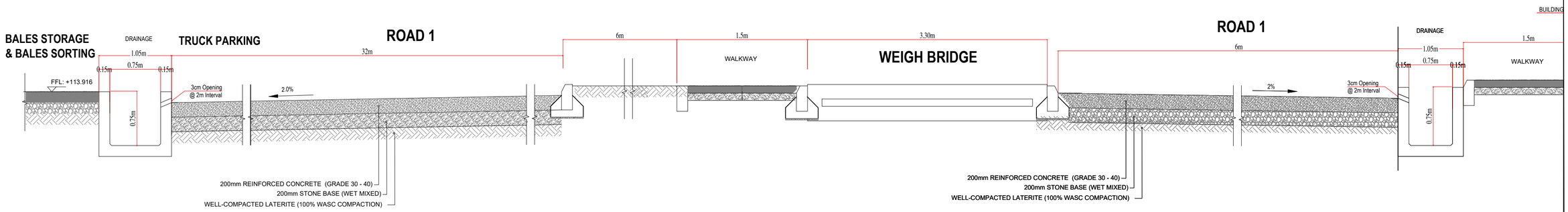
HANCOCK OGUNDIYA & PARTNERS.
.Consulting Civil & Structural Engineers
.Development Consultants & Project Managers
33, Glover Street, Ebute-Metta, Lagos.
Tel. 08034017782, 01-2956522
E-Mail: info@hancockogundiya.com
hancockogundiya@yahoo.com

DESIGNED :	SHOLA
CHECKED:	OLUYEMI
APPROVED:	OLUYEMI
DATE :	APR, 2022
SCALE :	H - TO FIT V - TO FIT

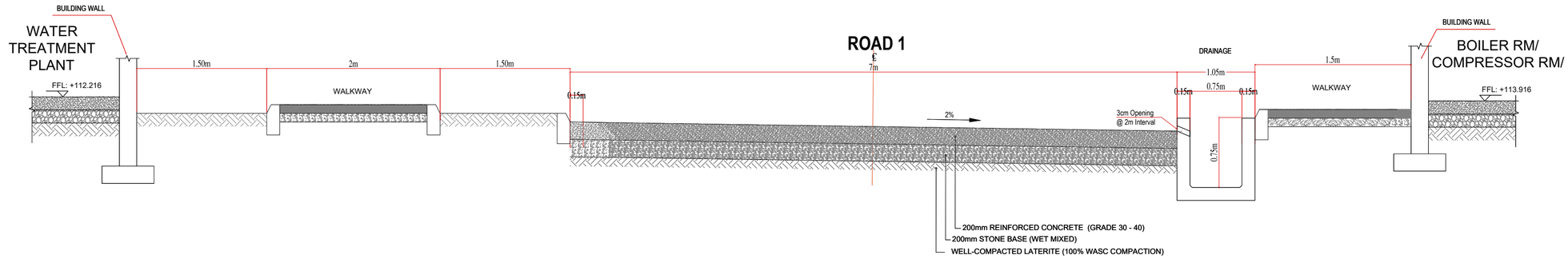
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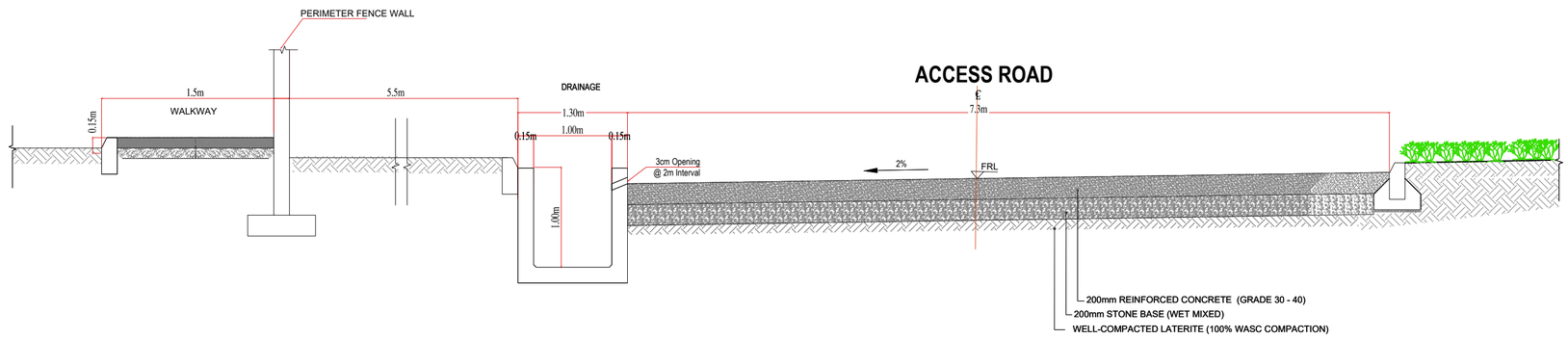
SHEET.No. 11

SECTION C - C



SECTION D - D





IND	DATE	NAME	AMENDMENTS	REMARKS

PROJECT TITLE:

SOMOTEX NIGERIA LIMITED
PROPOSED REDESIGN
OF WAREHOUSES AT IKORODU.

PROJECT TITLE:

INTERNAL ROADS PLAN & PROFILE
SECTIONS

CONSULTANT:

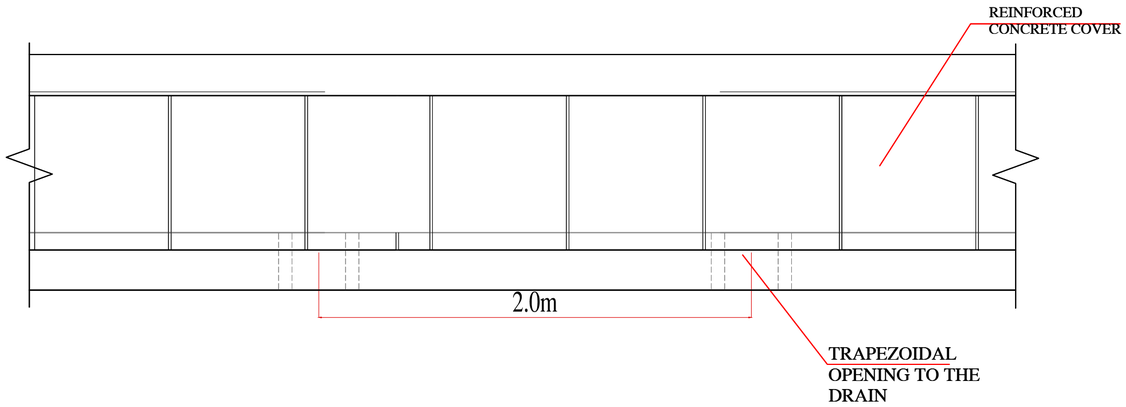
HANCOCK OGUNDIYA & PARTNERS.
.Consulting Civil & Structural Engineers
.Development Consultants & Project Managers
33, Glover Street, Ebute-Metta, Lagos.
Tel. 08034017782, 01-2956522
E-Mail: info@hancockogundiya.com
hancockogundiya@yahoo.com

DESIGNED :	SHOLA
CHECKED:	OLUYEMI
APPROVED:	OLUYEMI
DATE :	APR, 2022
SCALE :	H - TO FIT V - TO FIT

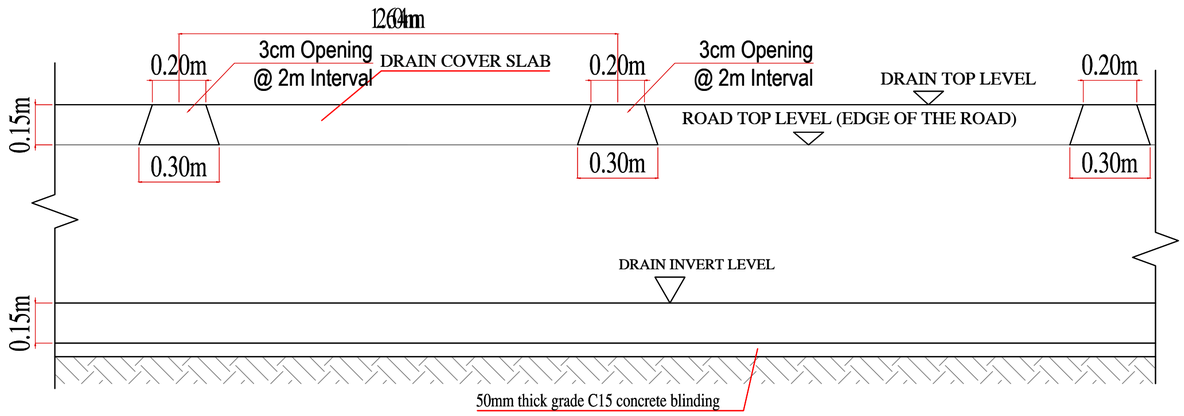
DWG. NO. .....

SHEET.No. 12

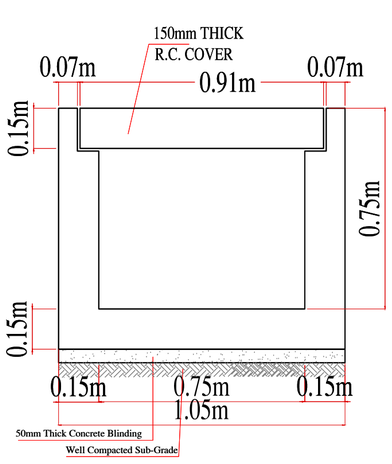
INTERNAL COVERED U - DRAIN
LAYOUT FOR ACCESS TO DRAIN FROM THE EDGE OF ROAD

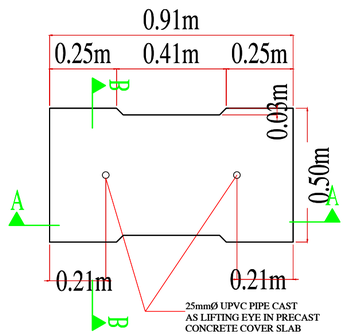


TYPICAL ELEVATION OF U - DRAIN

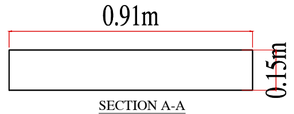


U - DRAIN (0.75 x 0.75m) SECTIONS

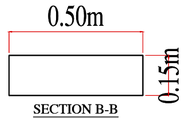




R.C. COVER DRAIN

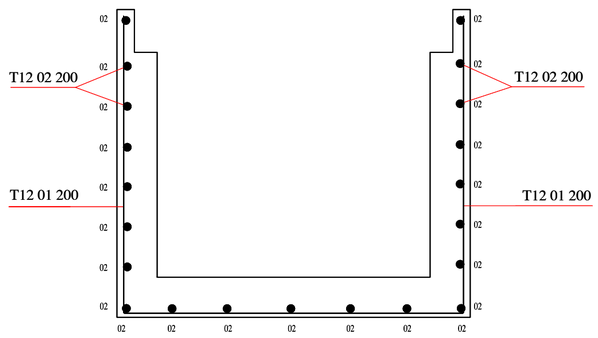


SECTION A-A

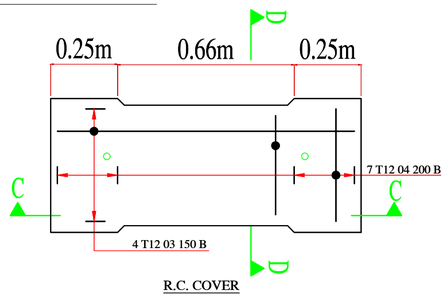


SECTION B-B

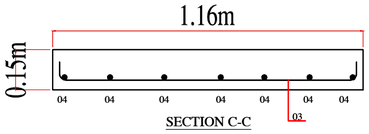
U - DRAIN (0.75 x 0.75m) REINFORCEMENT DETAILS



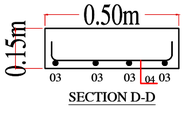
U - DRAIN
REINFORCEMENT DETAILS



R.C. COVER
REINFORCEMENT DETAILS



SECTION C-C



SECTION D-D

IND	DATE	NAME	AMENDMENTS	REMARKS

PROJECT TITLE:

SOMOTEX NIGERIA LIMITED
PROPOSED REDESIGN
OF WAREHOUSES AT IKORODU.

PROJECT TITLE:

DRAIN DETAILS FOR 0.75x0.75m U-DRAIN

CONSULTANT:

HANCOCK OGUNDIYA & PARTNERS.
.Consulting Civil & Structural Engineers
.Development Consultants & Project Managers
33, Glover Street, Ebute-Metta, Lagos.
Tel. 08034017782, 01-2956522
E-Mail: info@hancockogundiya.com
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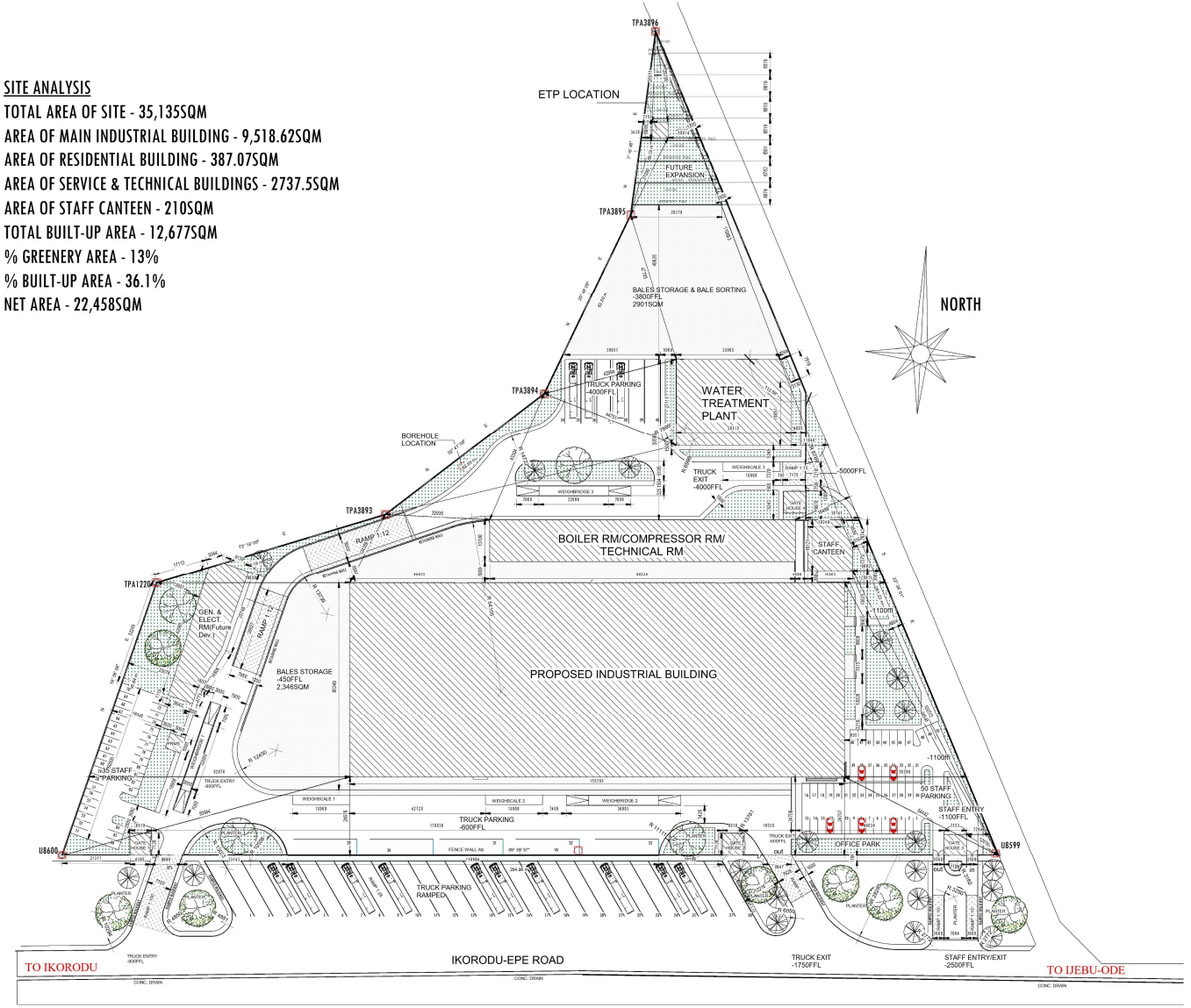
DESIGNED :	SHOLA
CHECKED:	OLUYEMI
APPROVED:	OLUYEMI
DATE :	APR, 2022
SCALE :	H - TO FIT V - TO FIT

DWG. NO. .....

SHEET.No. 13

SITE ANALYSIS

TOTAL AREA OF SITE - 35,135SQM
AREA OF MAIN INDUSTRIAL BUILDING - 9,518.62SQM
AREA OF RESIDENTIAL BUILDING - 387.07SQM
AREA OF SERVICE & TECHNICAL BUILDINGS - 2737.5SQM
AREA OF STAFF CANTEEN - 210SQM
TOTAL BUILT-UP AREA - 12,677SQM
% GREENERY AREA - 13%
% BUILT-UP AREA - 36.1%
NET AREA - 22,458SQM



APPROVAL COLUMN

NOTES — GENERAL NOTES TO CONTRACTOR

1.1. All dimensions are given in millimeters on architectural drawings
1.2. No scaling from any drawings allowed, and dimensions take precedence
1.3. Any discrepancies and or indistinctiveness should be referred to Prolifick Architects Ltd. before commencement of construction.
1.4. All dimensions to be verified and coordinated on site prior to construction.
1.5. All structural elements, steel, timber and concrete as per structural drawings, details and specifications.
1.6. For full and clear specification on all finishes refer to Finishing schedule.
1.7. If the Contractor wishes to use an equal specification instead of any given specification he must obtain the prior approval of Prolifick Architects Ltd

CLIENT
Hermes Resources Nig. Ltd.

ARCHITECT
PROLIFICK
ARCHITECTS LIMITED
ARCHITECTURE - INTERIOR DESIGN - PROJECT MANAGEMENT
Suite 310/311 Abia II Tora Shopping Complex Lagos Island
0909 209 5196, 0802 332 2747
info.pal@gmail.com, prolifick.mail.all@gmail.com

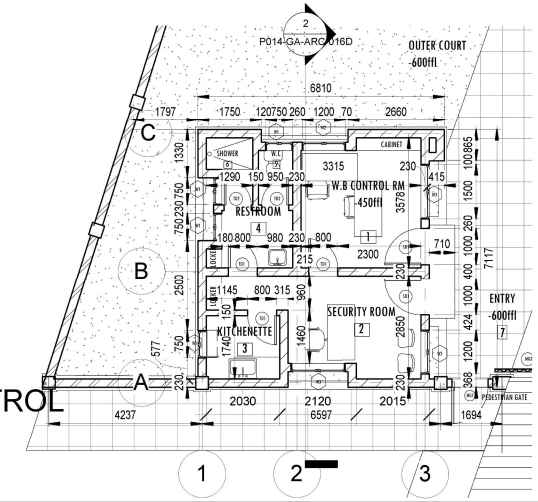
DRAWING STATUS: DESIGN

NO.	DATE	REVISION

PROJECT
PROPOSED INDUSTRIAL DEVELOPMENT
AT
IKORODU INDUSTRIAL SCHEME
PLOT 4084
LAGOS
IKURUDU LUCAL GOVT. AREA
IKORODU

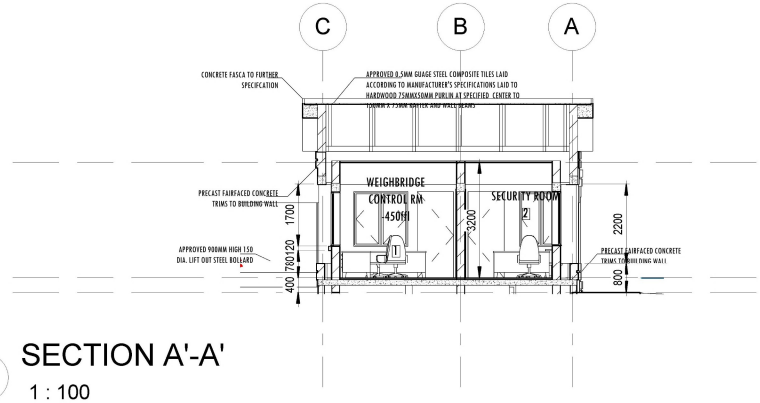
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DRAWING NO.: P014-GA-ARC-002	FILE REFERENCE: SITE LAYOUT
DESIGNED: BN	DRAWN: TCJ
CHECKED:	APPROVED: BN
SHEET SIZE: A2	SHT. NO.: 006
REVISION: H	



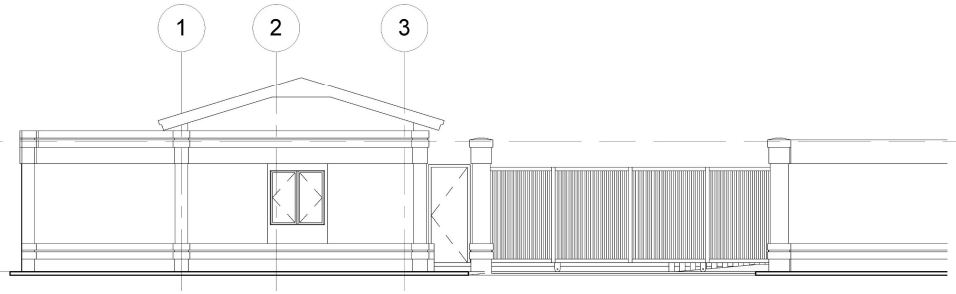
1 GATEHOUSE & CONTROL RM. FLOOR PLAN

1 : 100



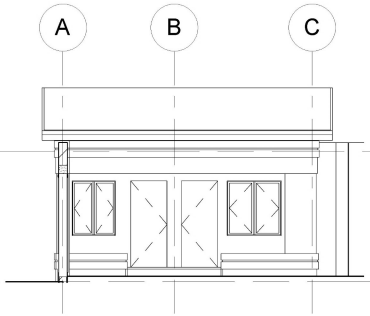
2 SECTION A'-A'

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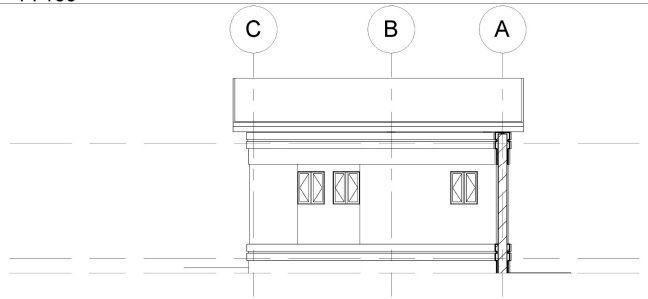
3 FRONT ELEVATION-GH1

1 : 100



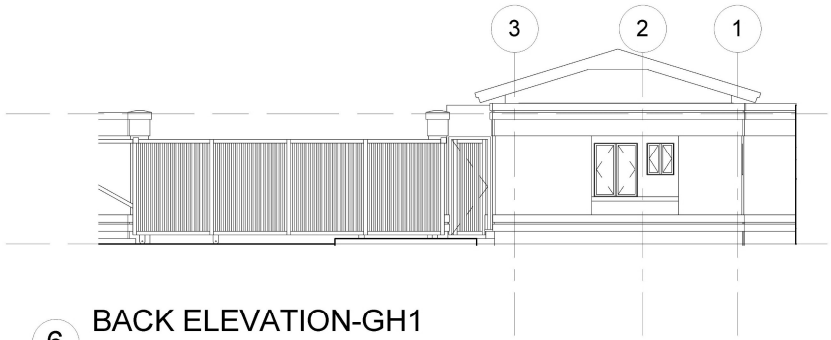
4 RIGHT-SIDE ELEVATION - GH1

1 : 100



5 LEFT-SIDE ELEVATION - GH1

1 : 100



6 BACK ELEVATION-GH1

1 : 100

APPROVAL COLUMN

NOTES

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DRAWING STATUS: DESIGN

NO.	DATE	REVISION
A	4/11/19	Schedule tags added, levels revised
B	20/12/19	Schedule tags revised
C	11/1/22	levels revised

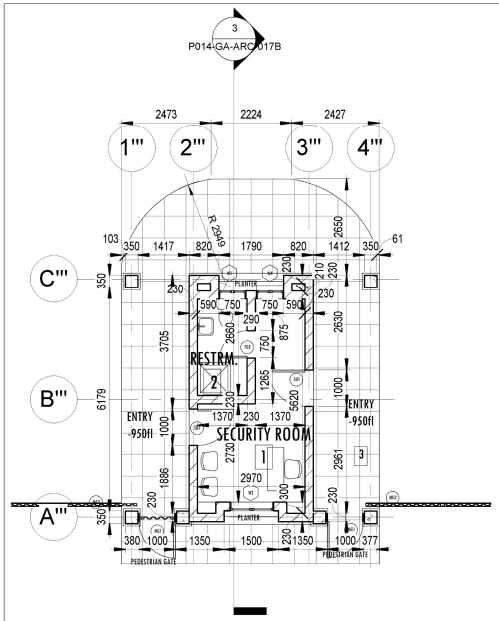
PROJECT

PROPOSED INDUSTRIAL DEVELOPMENT
AT
IKORODU INDUSTRIAL SCHEME
PLOT 4084
LAGOS
IKURUDU LUCAL GOVT. AREA
IKORODU

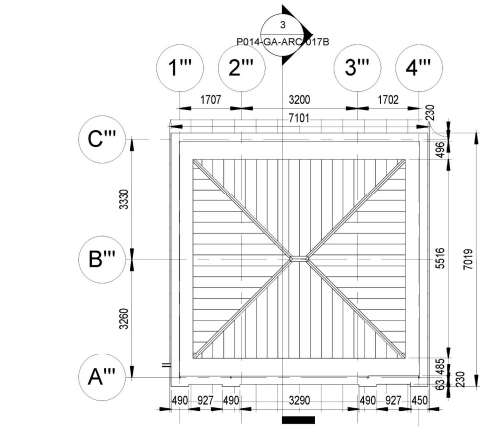
DRAWING TITLE

GATE HOUSE 1,2 & 4 - G.A. DRAWINGS

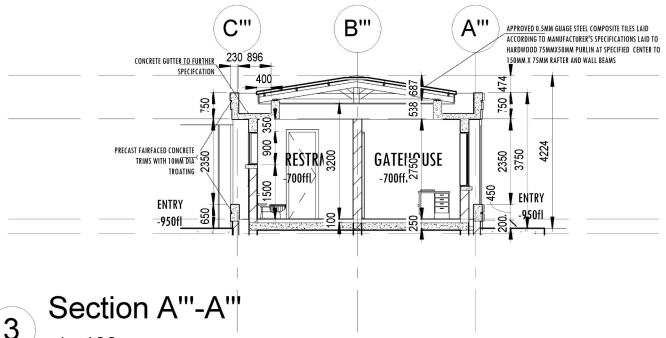
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DRAWN DATE	OCT. 2019
DRAWING NO.	P014-GA-ARC-0160
FILE REFERENCE	ANCILLARY BUILDING
DESIGNED	BN
DRAWN	
CHECKED	
APPROVED	BN
SHEET SIZE	A2
SHT. NO.	023
REVISION	C



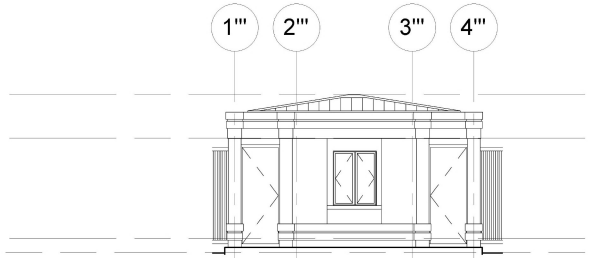
1 GATEHOUSE 3
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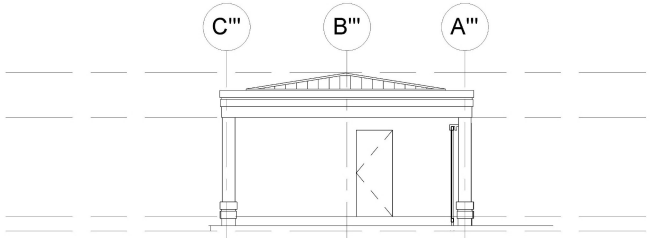
2 GH3 ROOF PLAN
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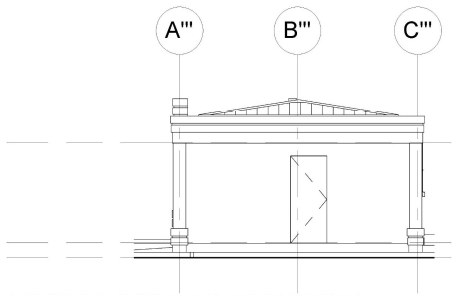
3 Section A'''-A'''
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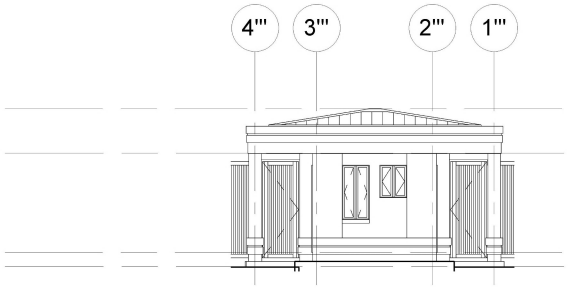
4 FRONT ELEVATION - GH3
1 : 100



5 LEFT-SIDE ELEVATION G.H3
1 : 100



6 RIGHT-SIDE ELEVATION -GH3
1 : 100



7 BACK ELEVATION - GH3
1 : 100

APPROVAL COLUMN

NOTES

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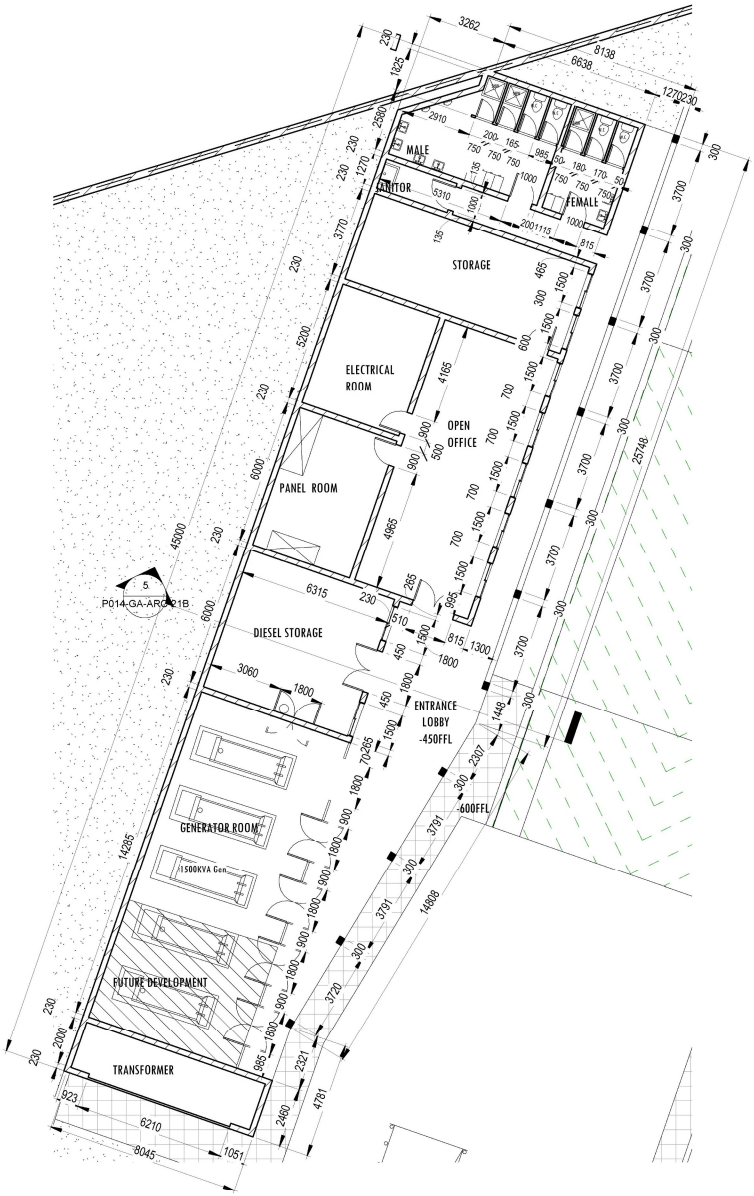
DRAWING STATUS:	DESIGN
NO.	DATE / REVISION
A	4/11/19 Schedule tags added, levels revised
B	20/12/19 Schedule tags revised
C	11/1/22 Levels revised

PROJECT
PROPOSED INDUSTRIAL DEVELOPMENT
AT
IKORODU INDUSTRIAL SCHEME
PLOT 4084
LAGOS
IKURUDU LUCAL GOVT. AREA
IKORODU

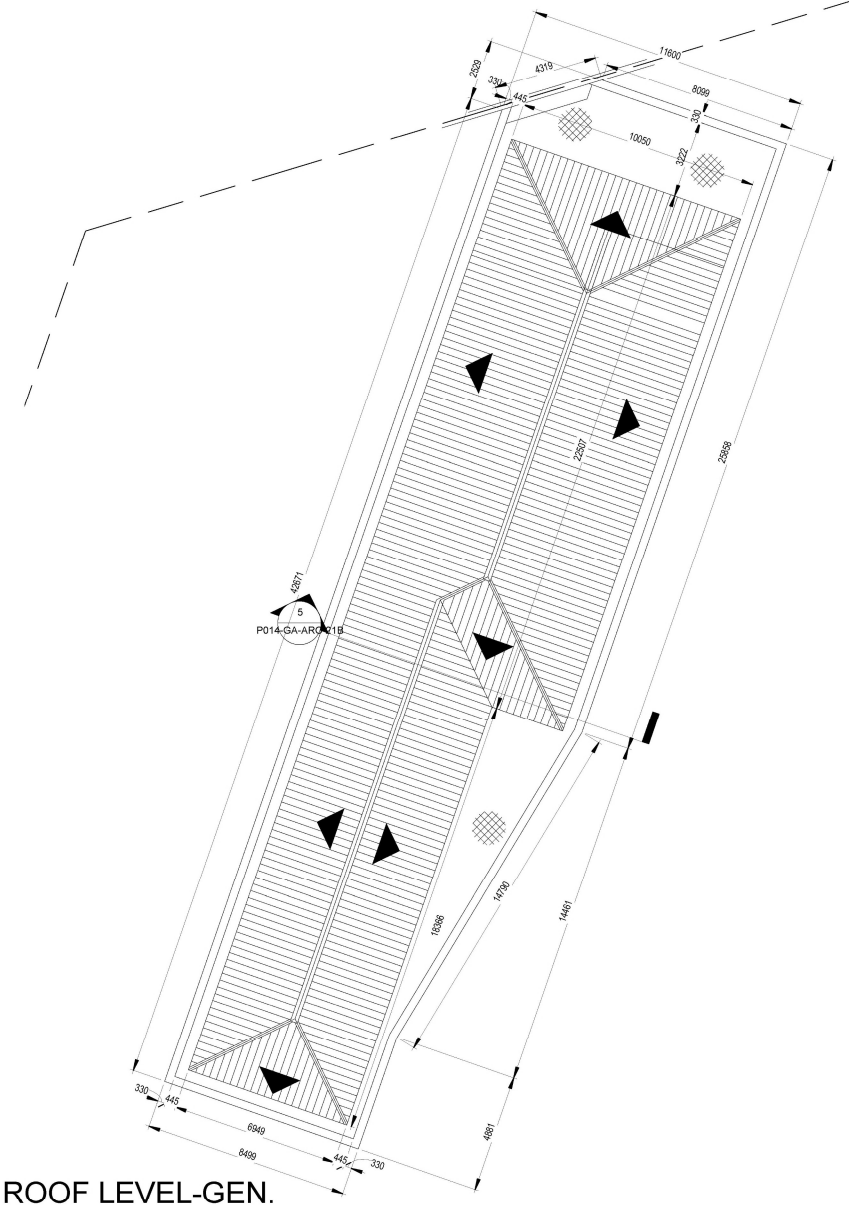
DRAWING TITLE
GATE HOUSE 3- G.A. DRAWINGS

DRAWING SCALE: 1:100	DRAWN DATE: OCT. 2019
DRAWING NO.: P014-GA-ARC-0160	FILE REFERENCE: ANCILLARY BUILDING
DESIGNED: BN	DRAWN:
CHECKED:	APPROVED: BN
SHEET SIZE: A2	SHT. NO.: 025
REVISION: C	

APPROVAL COLUMN



1 GENERATOR HOUSE
1 : 150



2 ROOF LEVEL-GEN. HOUSE
1 : 150

NOTES

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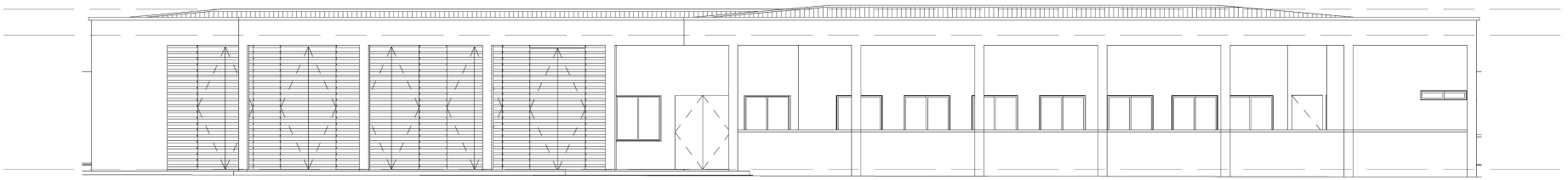
DRAWING STATUS		DESIGN
NO.	DATE	REVISION

PROJECT
PROPOSED INDUSTRIAL DEVELOPMENT
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IKORODU INDUSTRIAL SCHEME
PLOT 4084
LAGOS
IKURUDU LUCAL GOVT. AREA
IKORODU

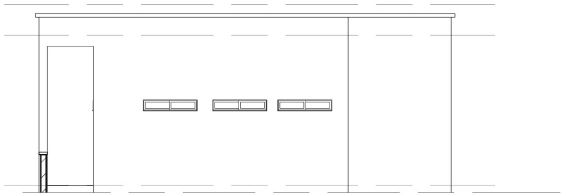
DRAWING TITLE
GEN. BUILDING- PLANS

DRAWING SCALE: 1:150	DRAWN DATE: JAN. 2022
DRAWING NO.: P014-GA-ARC-021A	FILE REFERENCE: ANCILLIARY BUILDING
DESIGNED: BN	DRAWN:
CHECKED:	APPROVED: BN
SHEET SIZE: A2	SHT. NO.: 027
	REVISION: -

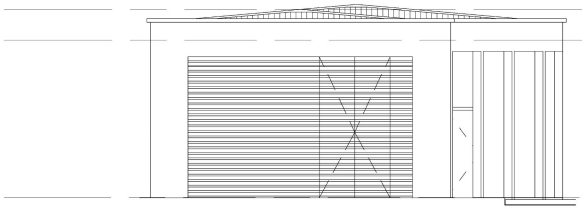
APPROVAL COLUMN



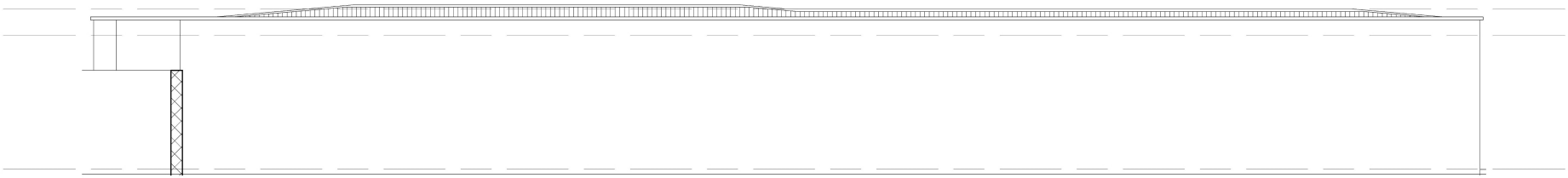
1 APPROACH VIEW - GEN. HOUSE
1 : 100



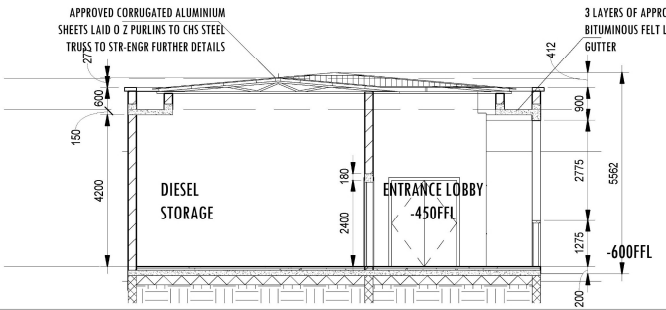
2 RIGHTSIDE VIEW-GEN.HOUSE
1 : 100



3 LEFTSIDE VIEW - GEN. HOUSE
1 : 100



4 BACKSIDE VIEW- GEN HOUSE
1 : 100



5 Section G-G
1 : 100

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DRAWING STATUS: DESIGN

NO.	DATE	REVISION

PROJECT
PROPOSED INDUSTRIAL DEVELOPMENT
AT
IKORODU INDUSTRIAL SCHEME
PLOT 4084
LAGOS
IKURUDU LUCAL GOVT. AREA
IKORODU

DRAWING TITLE
GEN. BLG- SECTION & ELEVATIONS

DRAWING SCALE	1:200
DRAWN DATE	JAN. 2022
DRAWING NO.	P014-GA-ARC-0218
FILE REFERENCE	ANCILLIARY BUILDING
DESIGNED	BN
DRAWN	
CHECKED	
APPROVED	BN
SHEET SIZE	A2
SHT. NO.	027
REVISION	-

PROCESS DESCRIPTION

The key point of post-consumer PET bottle recycling is the removal percentage of impurity which is mixed in the duration from beverage factory to recycling plant. We realize the core character of different impurities based on our 30 years experience of practical PET bottle recycling business. The design concept of our different functional processes is to set up the best environment for separating impurities.

And due to the recycling line is designed on module basis, for future expansion, it can be improved to get higher capacity and more stable quality with minimum investment cost.

Functional Section and Machinery

A. De-baling

After the PET bottle bales are placed on the feeding belt conveyer, the baling wire should be cut and removed manually. The bottle bale will be loosed by powerful rolling paddles. And then all bottles will be conveyed to next machine.

B. Bottle Prewashing Section

Under powerful stirring, the continuous bottle washing machine which combined the power functions of machinery, chemistry and heat energy will separate and remove over 90% impurities (including environment polluted substances and labels, but thermal shrinkage PVC labels excluded). Afterwards process equipment will be protected properly due to purified bottle bodies. Especially the crusher will less suffer because of those hard solid substances were removed.

A dry trammel can be added to do try bottle prewashing to remove most of the solid objects from the bottles surface to reduce the chemical and water consumption.

C. Label Separating Section

There are many types of label used for covering bottles. Most labels will be removed in bottle prewashing process except the PVC labels which is formed by thermal shrinkage. The PVC label scrapping machine is used to tear PVC labels and other plastic labels, and broken labels

will be separated from the PET bottles by pneumatic power in Label blower.

The bottles with PVC label will be separated by the PVC bottle sorting machine, People will pick out the PVC bottle by hand, and the PVC label bottles will go to the PVC label scrapper, and then the labels will be removed in the label blower.

D. Bottle Sorting Section

There are two kings of bottle sorting in the system.

One sorting is done by optical sorting. The NIR technology is used to do polymer sorting , color sorting can be processed by CCD or Visible light technology. The detected objected would be ejected by nuzzles with high press air.

The other is to do sorting manually as final bottle quality inspection before it goes to crusher. The requirement of the labors can be adjusted according to the input bottle quality.

E. Metal Separation Section

Metal separation can be processed in different process.

1. A strong magnetic separator can be hang over the belt conveyer, the ferrous metal would be adsorbed to the magnetic separator, it could be auto discharging for metal or manually.
2. The bottles would be lay on the moving belt conveyer with metal detector, the bottle and metal would be discharged by a three way flap. One more step on the sub-line would recover the bottles discharged with metal.
3. Metal detector would be installed on the sorting conveyer to prevent any metal going to the crusher. Sorting person can find the metal and pick it out if the conveyer is stopped by metal.
4. A Metal separator is installed to remove all metals before packing, the nuzzles with high press

   Air would ejected the metal with some flakes when metal is detected by high sensitive metal detector.

F. Wet Crushing Section

This Section is specially designed for crushing PET bottles, which have following characteristics:

input smoothly and output stably, low power consumption, low noise and vibration, strong structure, low maintenance cost. It's designed by a wet grinding way.

It can be designed for two steps grinding or one step grinding.

If need to 24hour non-stop running, one crusher would be designed for standby.

G. Flotation & Friction Washing Section

The crushed flakes are mixed with Polyolefins material; this section is using the gravity difference of PET(~1.3) and Polyolefins(~0.9), and water (gravity 1) as a media to let PET sink and Polyolefins float on the water. This effective will make PET more purified, and collected Polyolefins flakes can be sold as byproduct.

With chemical, friction and heat power, the glue will be entirely separated from flakes. The horizontal centrifugal dryer will remove the glue, mud from the flakes.

H. Rinsing Section

After the centrifugal drying, some chemical is residual on the flakes surface. The fresh water would be add to rinse the flakes to reduce the caustic content and give natural PH value of the flakes.

In the meanwhile, any floatable material would be removed with the overflowing water.

I. Drying, Mixing & Packing Section

High speed mechanical dryer is used to remove most of the moisture on the flakes surface, to achieve lower than 1% moisture, a hot air conveying system is required to remove the moisture.

To homogenize the impurities and get a higher acceptable product ratio, the mixing silo is to blend and store flakes. Mixing is done by an internal screw.

With a vibration system, 20% packing cost and transportation cost can be reduced.

J. Dust Separation & Optical Sorting Section

Because of weight difference, the air going up from the bottom would take away the dust,

light material and an cyclone would collect the dust and light material. Flakes would go down because of gravity.

To achieve extremely low impurity content, optical sorting can be installed after drying section to eject color PET, non-PET as well as metals.

G. Process Water and Chemical Solution Circulation Section

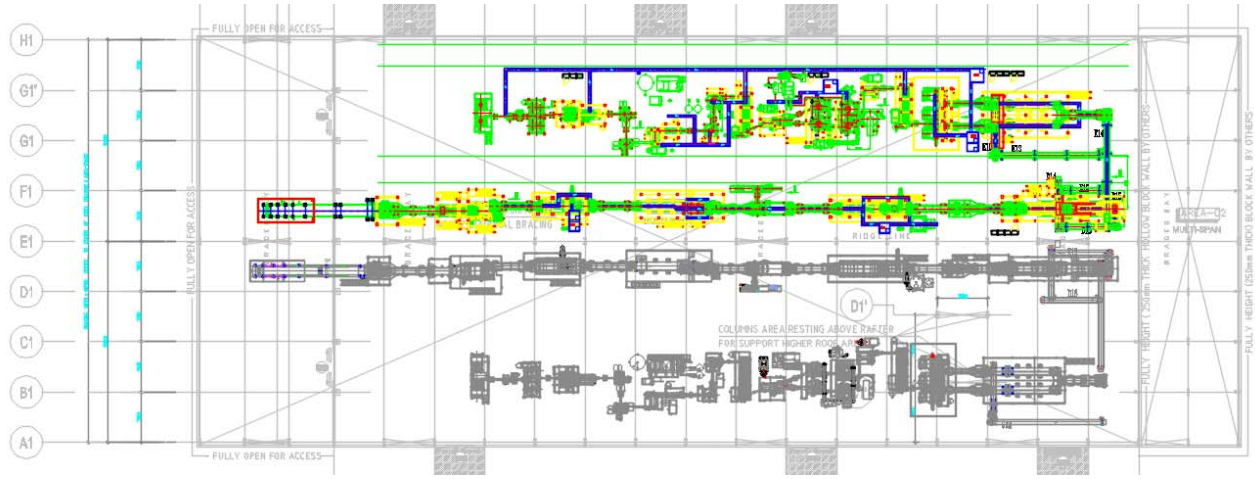
Fresh water is applied at the final rinsing machine only. The water would be used to do second or more rinsing to remove the chemical residual and floatable material. Then water would be applied for floating separator and crusher.

Extra water can be used to prepare the chemical water for hot washing and bottle prewashing.

One set of sludge removal system each for bottle prewashing system and flakes washing system is configured to reduce to chemical consumption in the line.

The sludge and powder would be removed by machines which are discharged from the centrifugal machines.

Preliminary Equipment Layout



Shall be revised as per mutual confirmation.

1. PET Flakes production process

