BEL AIR BAUXITE MINE | BANKABLE FEASIBILITY STUDY (BFS) | 2011

NURIZON
CONSULTING ENGINEERS

ENGINEERING SOLUTIONS INSPIRED BY VISION

INTRODUCTION

PROVIDING UNIQUE, INNOVATIVE AND COST-EFFECTIVE ENGINEERING SOLUTIONS SINCE 2010

Nurizon Consulting Engineers was appointed by Alufer Mining Ltd. to undertake a Bankable Feasibility Study (BFS) for the Bel Air Bauxite Mine development in Guinea, West Africa.
This followed the 2012 Feasibility Study (FS) phase submission done by Nurizon.
Alufer is an independent mining company focused on the development of bauxite resources in Guinea.
The project is divided into two distinct geographical areas,
1) Mining operation areas and transport corridor, which links the mining areas with the export facility.
2) Export Facility, encompassing bulk materials handling, port loading and trans-shipping.

NURIZON SCOPE OF ACTIVITIES

- Mining - Conventional drill and blast and truck and shovel operations
- Haulage - Material is transported from the mine pit to the Mine Support Area at the coast
- Crushing - Two phased crushing of material from 500mm to 50mm
- Stacking and reclaiming - A 150,000t bulk storage facility
- Loading - 2.3km causeway/trestle with longitudinal shiploader for charging transhipment barges
- Transhipment - 15,000t, self propelled and self off loading barges transport and load Panamax/Capesize vessels at the transhipment zone
- Mine Support Area
- Power and water utilities
- The area houses all administrative complexes, fuel storage, power generation, stores and maintenance

bsi. ISO 9001:2015 Quality Management
FS 691370

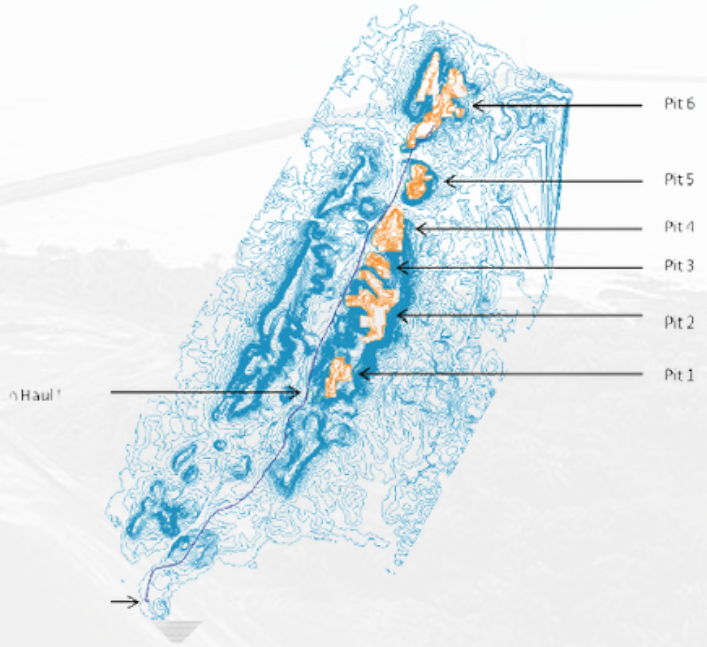
MINING

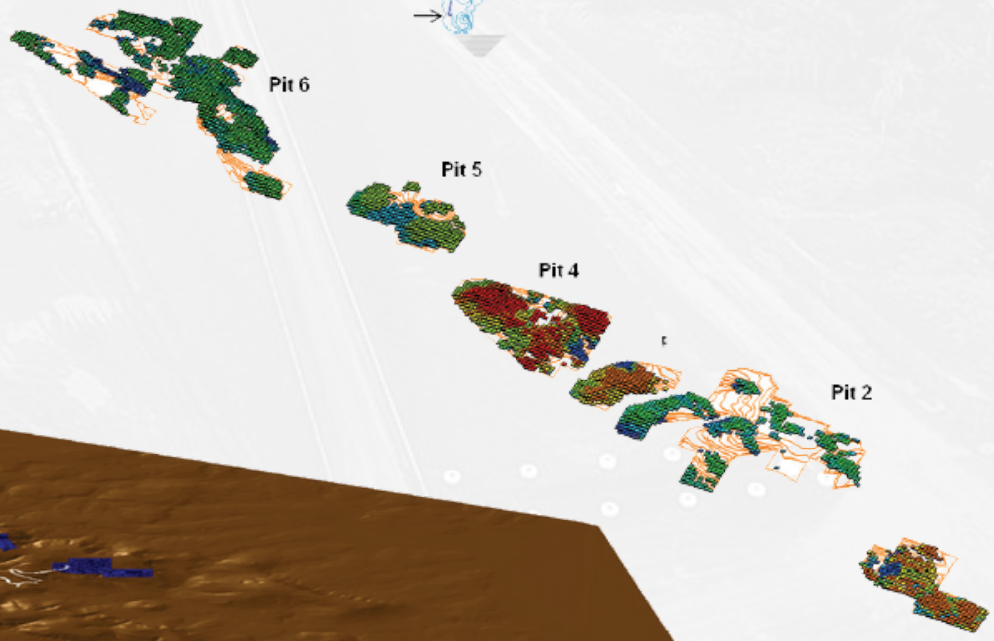
BULK EARTHWORKS AND PLATFORMS

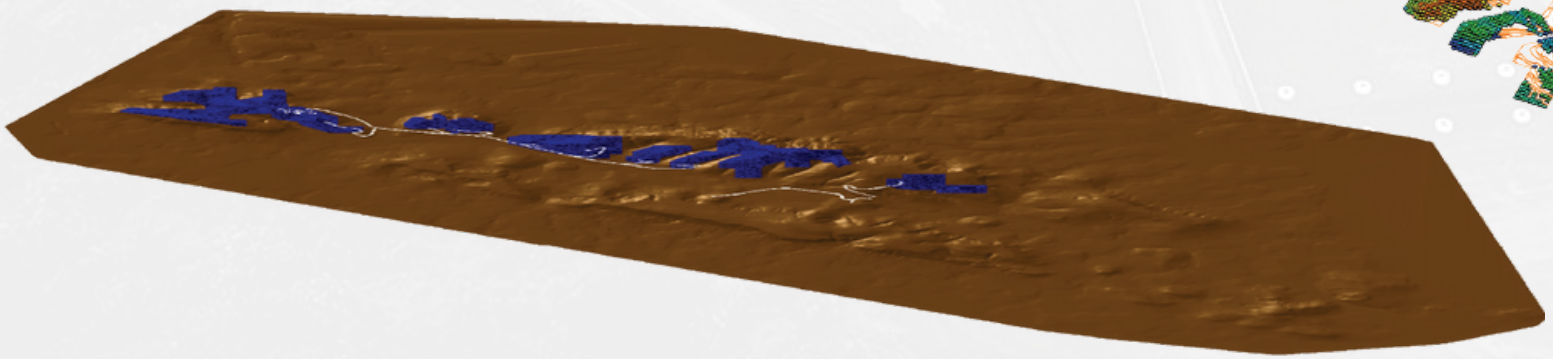
The bauxite deposit will be exploited for DSO (Direct selling ore), and transported with rigid back dump trucks to a main crusher located at the port area. The trade-off study topics were: Wirtgen vs. conventional mining, optimal crusher location study as well as a loading and hauling equipment selection study. The conclusions from the trade-off studies and the pre-feasibility study formed the basis of the mining method and material loading and hauling for the mining portion of the feasibility study. The initial strategy was to exploit DSO, ferrugenous- and latteritic bauxite. The pit designs was therefore designed for these indicated resources.

A typical mining sequence in the open pit environment will be as follows:

- Cleaning and scrubbing of the surface area
- Topsoil removal
- Free digging, loading and hauling of the overburden
- Drilling and blasting of overburden where required or ripping where possible
- Loading and hauling of overburden to waste dumps in close proximity to the pits
- Drilling and blasting of the ore body where required
- Loading and hauling of the DSO to the primary crusher located at the port
- Loading and hauling waste, BXF and BXL to waste dumps
- Concurrent rehabilitation of each pit as it is mined out.





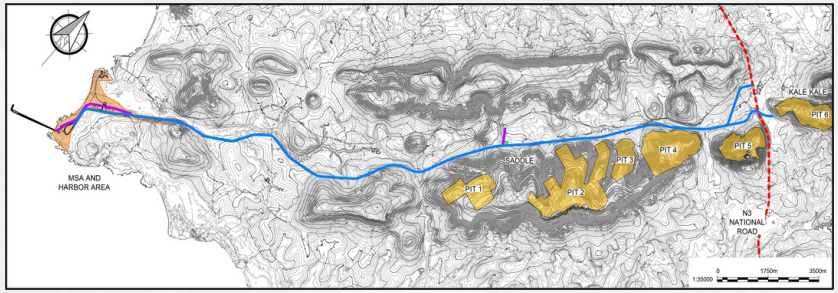


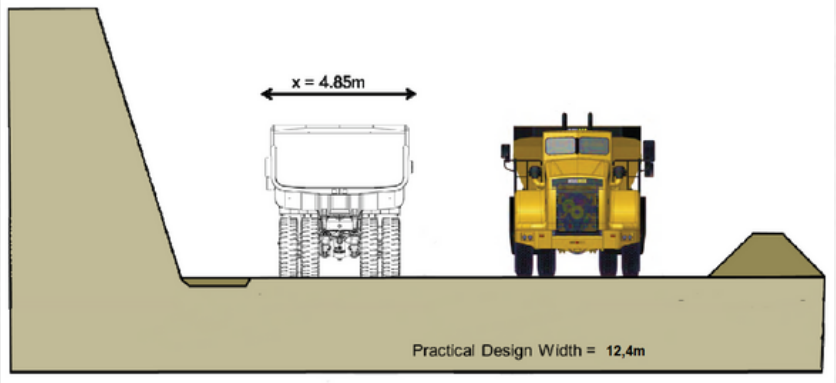
HAULAGE

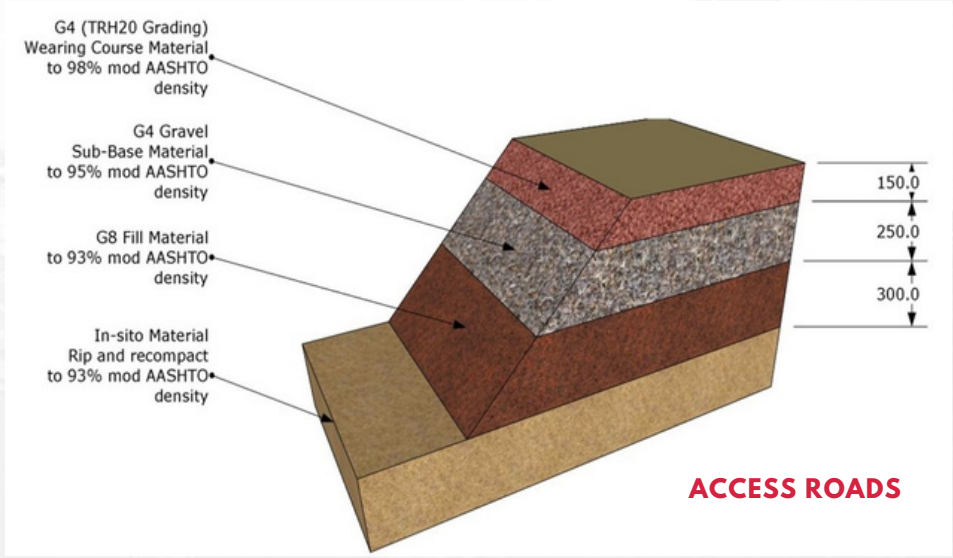
HAUL AND ACCESS ROAD INFRASTRUCTURE

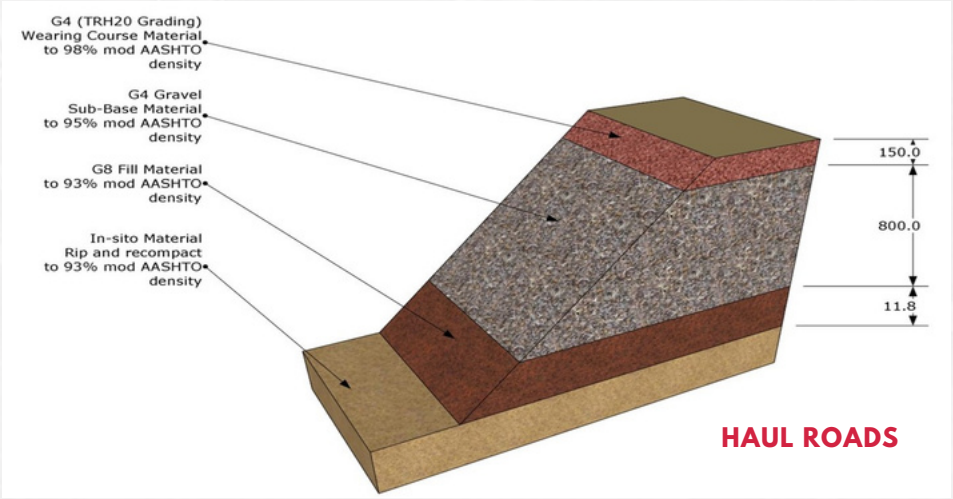
Access roads will typically be used by personal and stores deliveries to the site, whilst haul roads will be used to haul ore product from the pit areas to the ore handling terminal in the Export Facility. The haul road outside of MSA and Export Facility will also serve as access road.

- Main Haul Road to MSA (+-40km, 12,4 meter in width, 40 ton payload design)
- MSA to Harbour gravel access road with stormwater drainage (3.020km)
- MSA to Camp gravel access road with stormwater drainage (1.720 km)
- MSA and Export Facility Haul road with stormwater drainage (3.450 km).





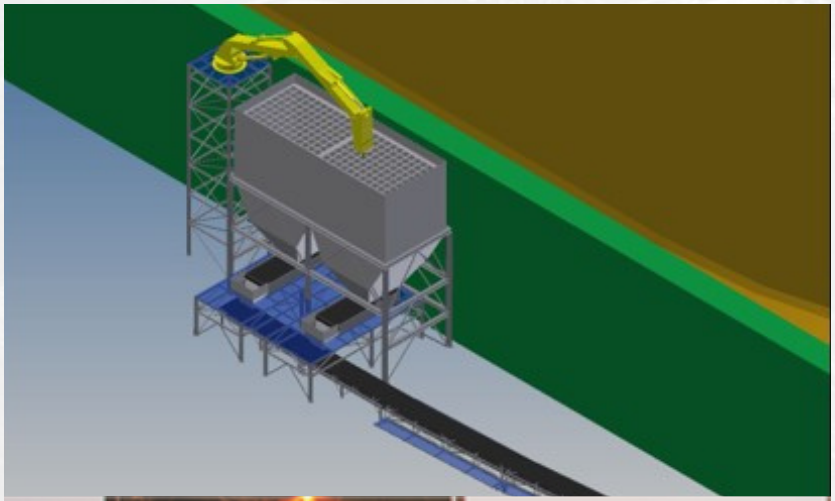




CRUSHING

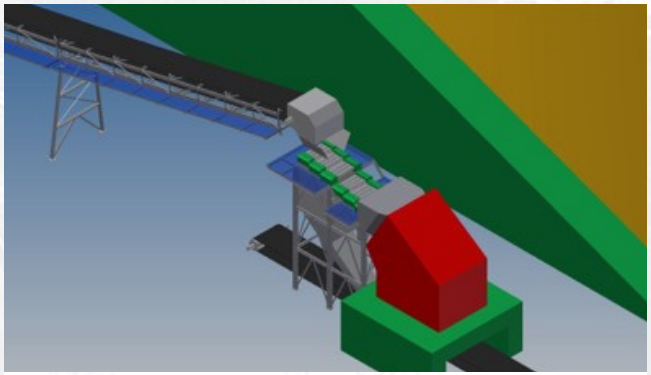
ROM FEED BIN

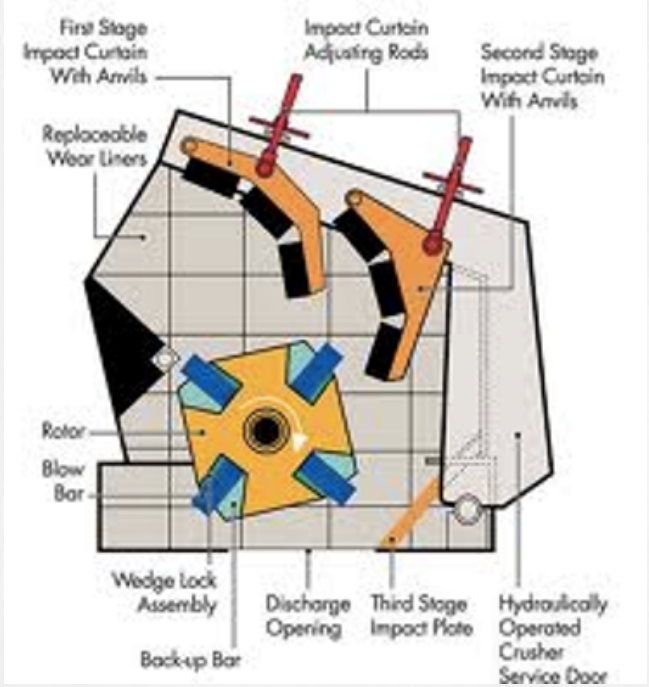
- Primary tip consists of a truck ramp with traffic light system
- 2 x static grizzlies with 500mm x 500mm apertures and a static rock breaker
- 2 x primary tip bins of 150m3 each
- 2 x apron feeders feed the conveyor from the tip bins



PRIMARY CRUSHER

- 2x wobbler feeders in series feed primary crusher
- +150mm oversize material is passed through impact crusher
- Crusher capacity 2000tph

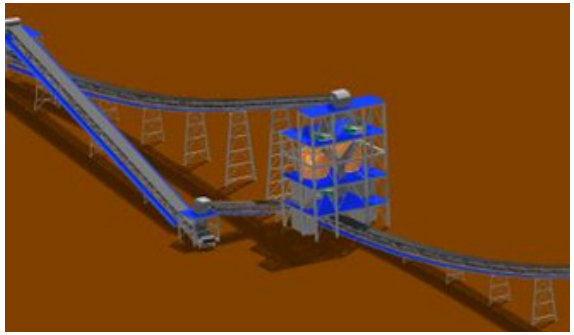


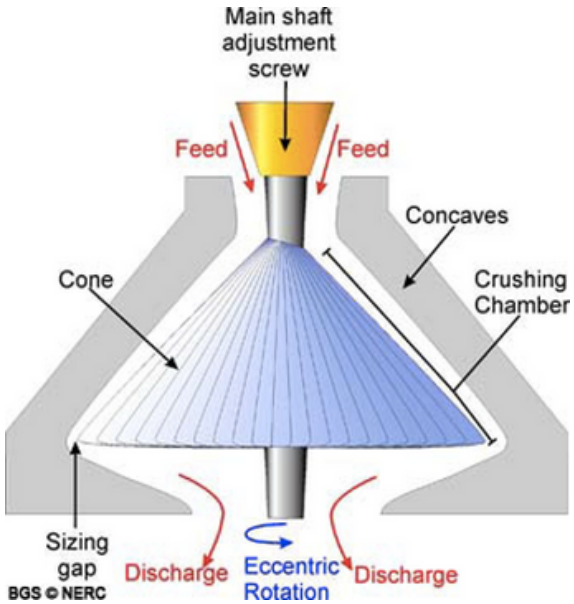


CRUSHING

SECONDARY CRUSHER

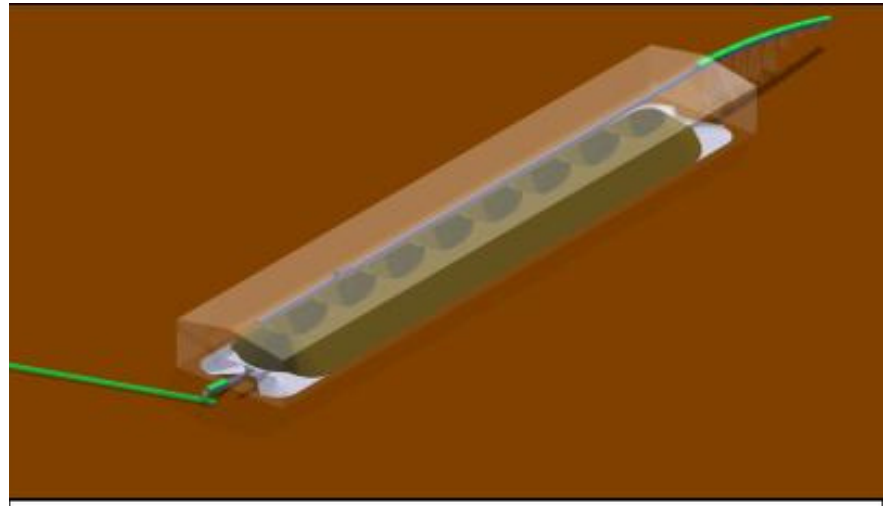
- Secondary screens scalp off -150mm/+40mm
- Oversize passes to secondary crusher
- Closed loop whereby passes back for oversize to be screened gain to -40mm
- Undersize passed directly to stockpile facility
- Cone crusher selected as the secondary crushers
- Weightometers are utilised on the recycle conveyors

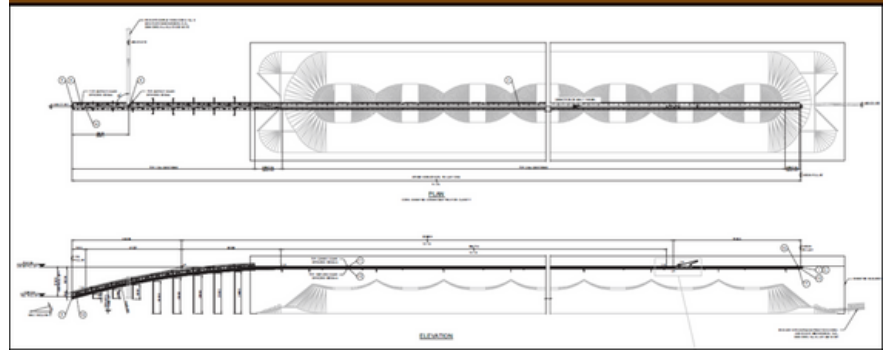




PLANT LAYOUT

- Covered 150000t stockpile
- Overhead tipper conveyor, bottom extraction
- 8 x extraction points feeding apron feeders
- Weightometers installed on tripper conveyor

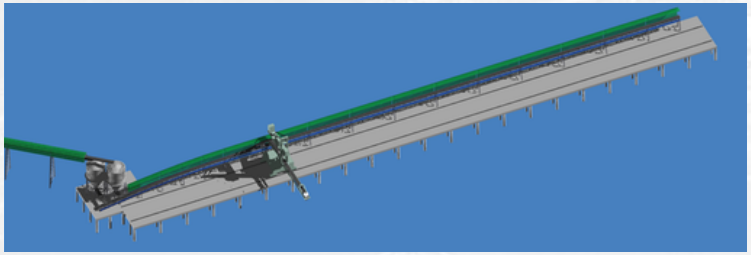


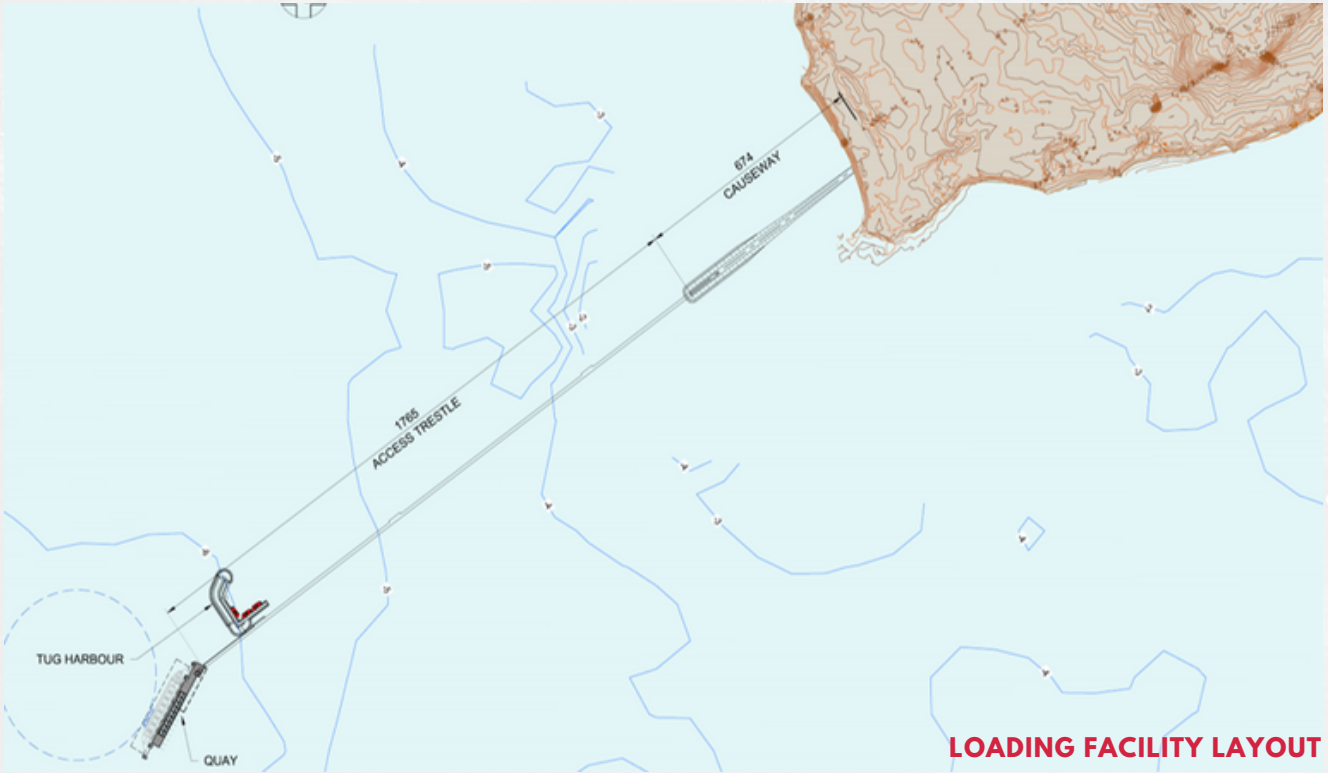


SHIPLOADING

PLANT LAYOUT - SHIP LOADER

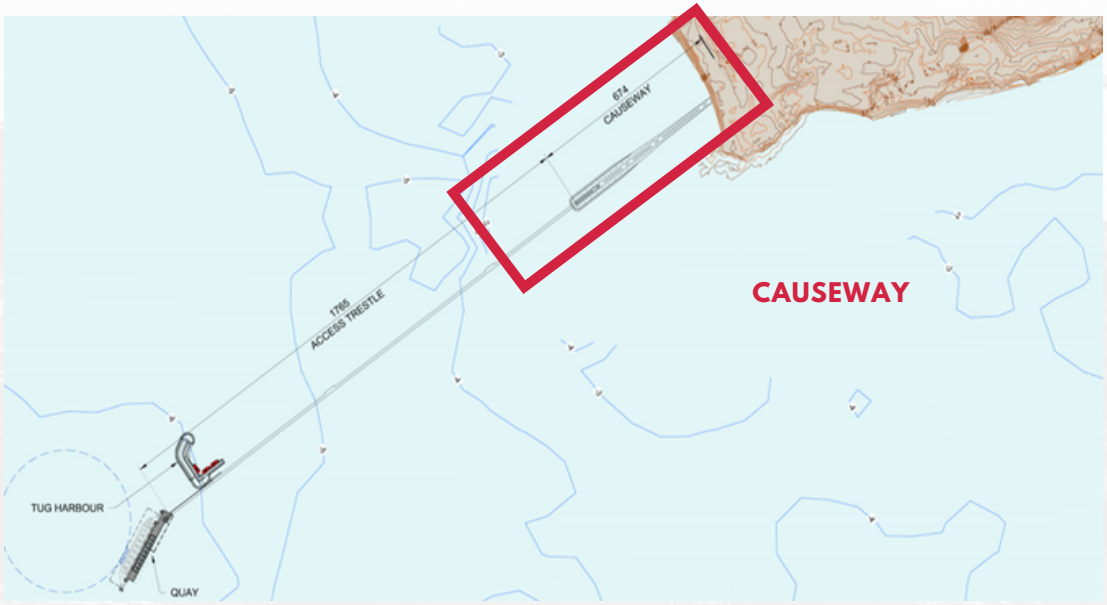
- Longitudinal travelling ship loader, on rails
- Ship loader as luffing and telescopic capabilities
- Can load Panamax as well as up to 15,000t barges



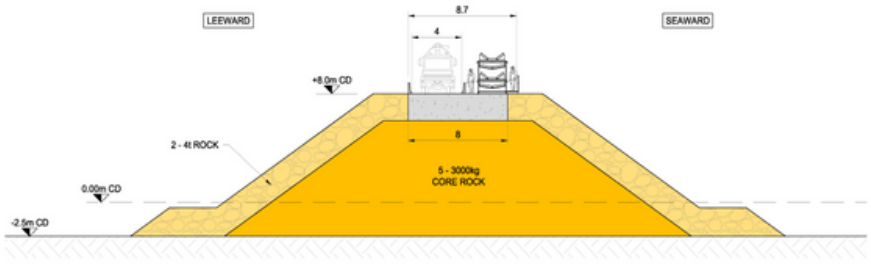


LOADING FACILITY LAYOUT

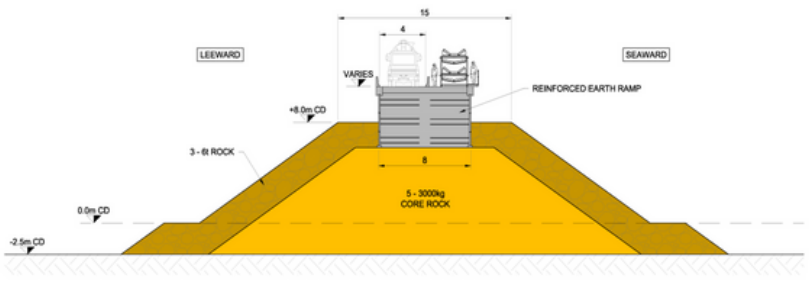
SHIPLOADING



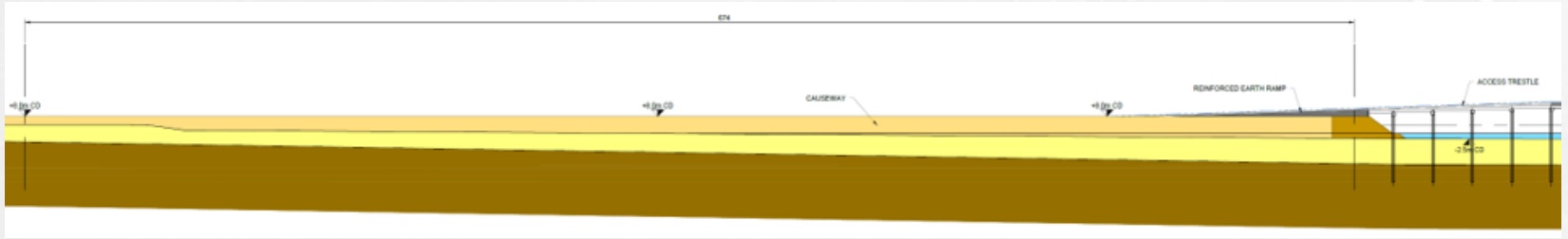
CAUSEWAY TRUNK CROSS SECTION



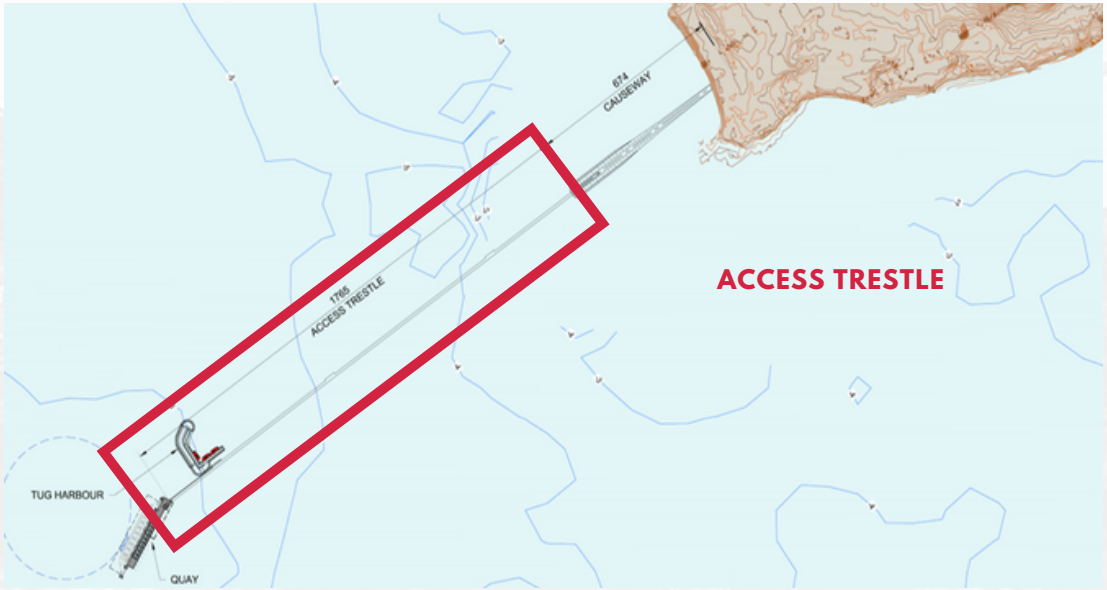
CAUSEWAY ROUNDHEAD CROSS SECTION



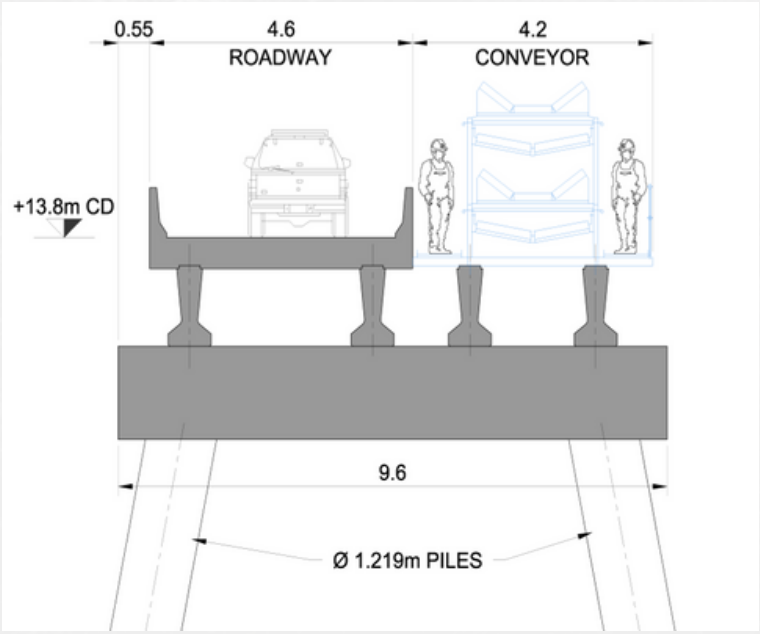
CAUSEWAY SIDE ELEVATION



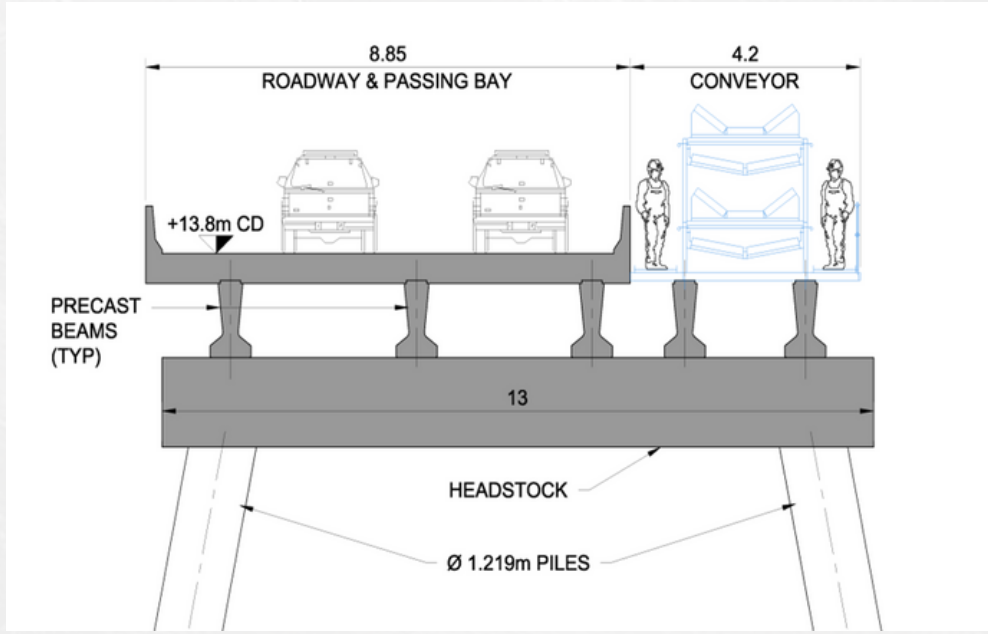
SHIPLOADING



ACCESS TRESTLE - SINGLE LANE

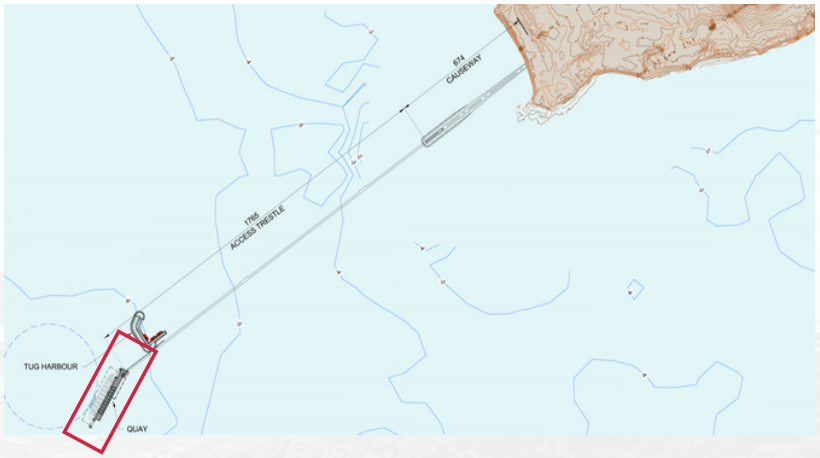


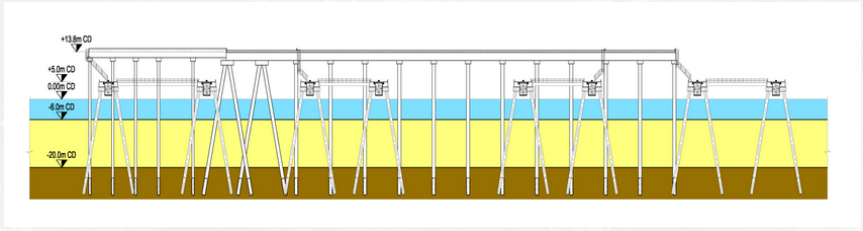
ACCESS TRESTLE – PASSING BAY

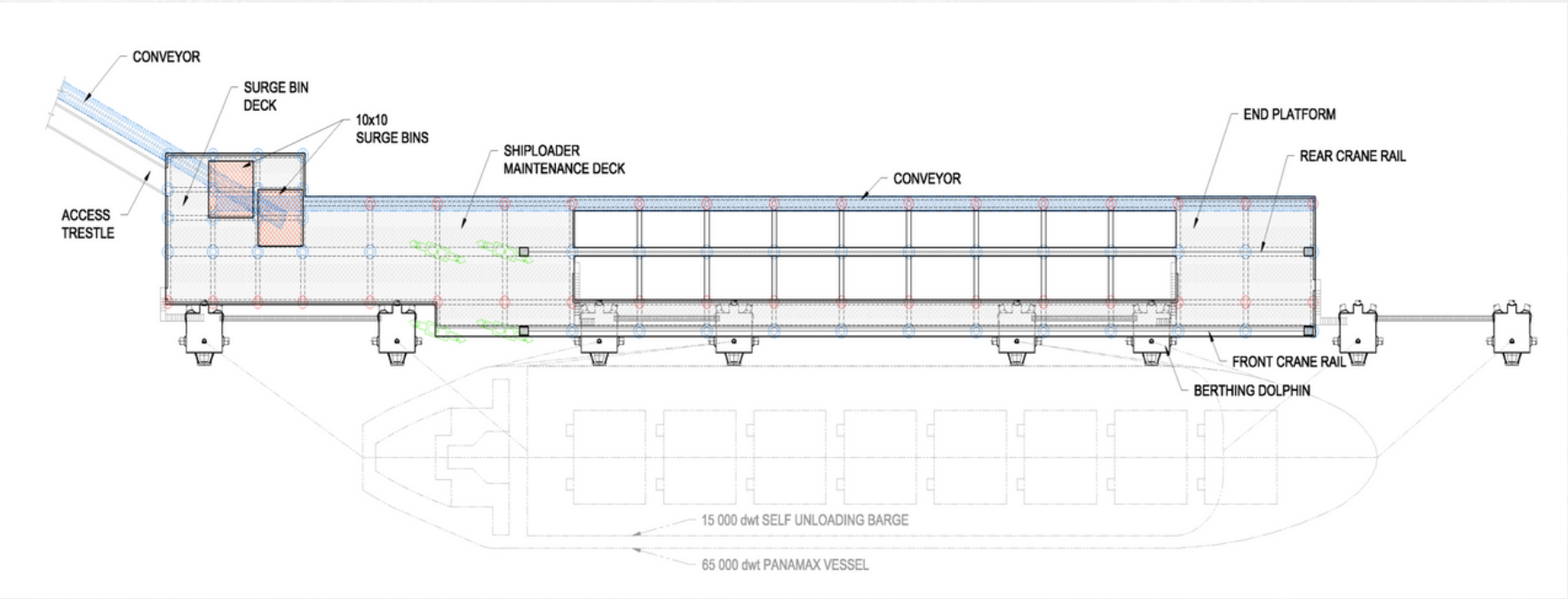


SHIPLOADING

QUAY STRUCTURE - PLAN VIEW



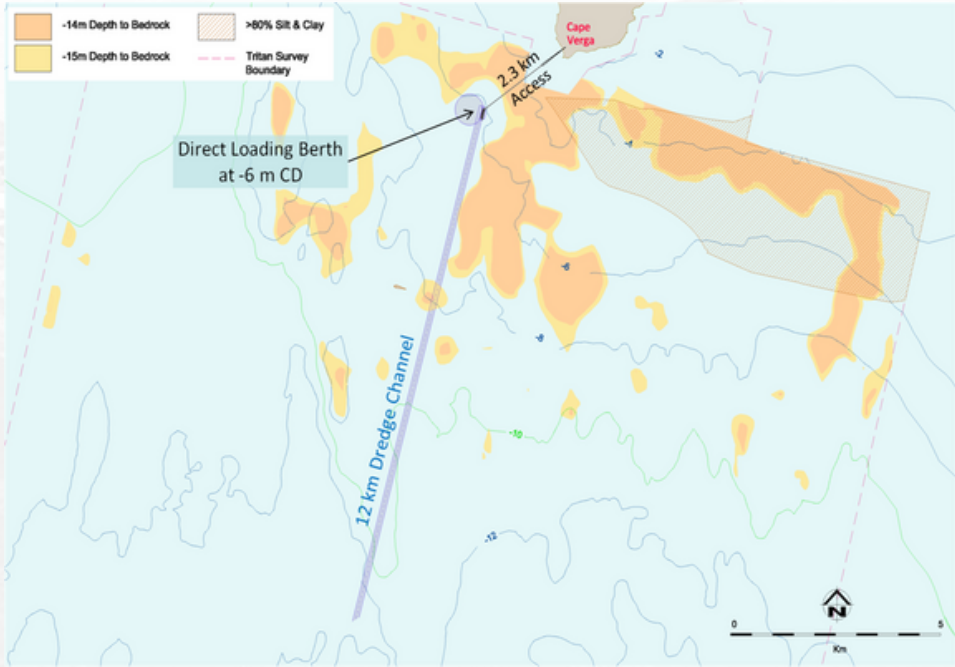




TRANSHIPMENT

DESIGN PROCESS AND OVERVIEW

- Factors driving loading facility design at Cap Verga
  - Shallow coastline
  - Metocean conditions
  - Sedimentation rates
- Two design options considered to marry Panamax vessel with a 6m berth:
  - 12km dredged channel or
  - Transhipment
- Final option considered:
  - 2.3km causeway trestle structure
  - Open berth which can accommodate both transhipment barge and Panamax vessel
  - Tug harbour
  - Multipurpose import berth
- Final option provides flexibility to dredge channel in future and land Panamax vessels directly at the berth



BEL AIR - TRANSSHIPPING

- 6m draft loading platform designed to support loading of barges
- Self-unloading speed of 4,000tph
- Operating limit: 2m significant wave height
- System capacity between 10Mtpa and 12Mtpa, depending on OGV1 size; basis 250 operational days
- Floating cranes with smaller barges were also considered as an option but they do not meet capacity demands

SELF-UNLOADING BARGES

ANCILLARY

MINING VILLAGE

- The mining village has been designed to be sustainable and built using local materials and local contractors
- Accommodation for the mining staff
  - Will initially be utilised as a construction camp
  - Designed for a capacity of 500 workers scalable to 980
- Accommodation types:
  - Executive Housing Units
  - Technical Managers Housing
  - General Housing Units
  - Hotel type housing(Process of design)
  - Central Building
  - Power generation and other utilities
- The remote location of the Bel Air Project dictates that adequate housing is provided for the mining operations work force
- The provision of a well laid out residential or mining village with ample amenities and recreational facilities will contribute to the well-being of the workforce
- The village will also serve as accommodation for the construction staff during the construction phase

ANCILLARY

BUILDINGS

The following buildings were provided for in the MSA Area:

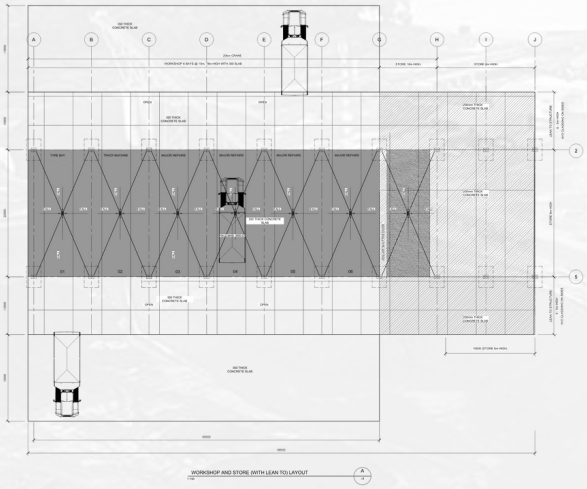
- Main Office
- Workshop Site Office
- Stores Site Office
- Lab Site Office
- Pit Site Office
- Fuel Site Office
- Clinic Site Office
- Security Site Office
- Training centre
- Change house

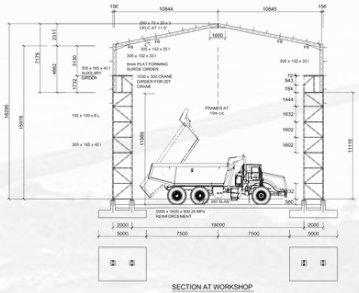
In the Export Facility:

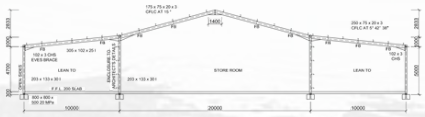
- Quayside Site Office
- Port Workshop Site Office
- Port Office

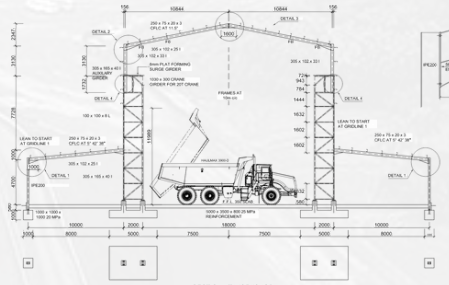
In the Mining Camp:

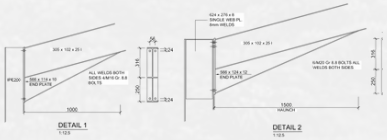
- Single Accommodation Units
- Double Accommodation Units
- Mess/ Kitchen
- Landry
- Ablution Units
- Camp Site Office

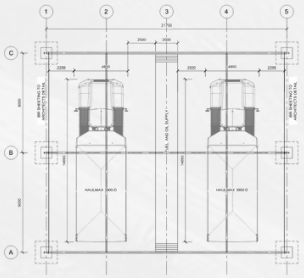


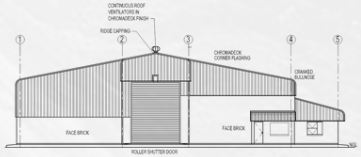


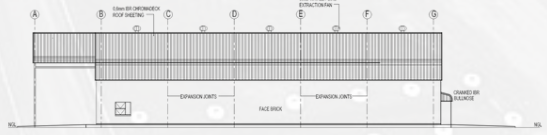


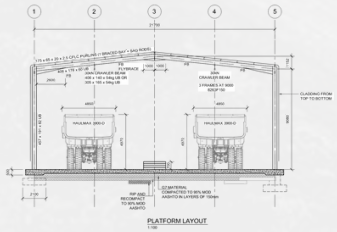


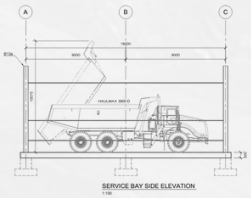


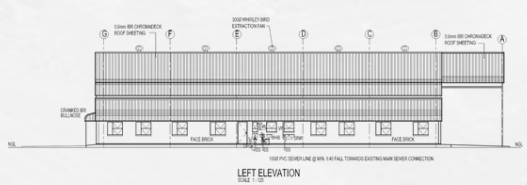








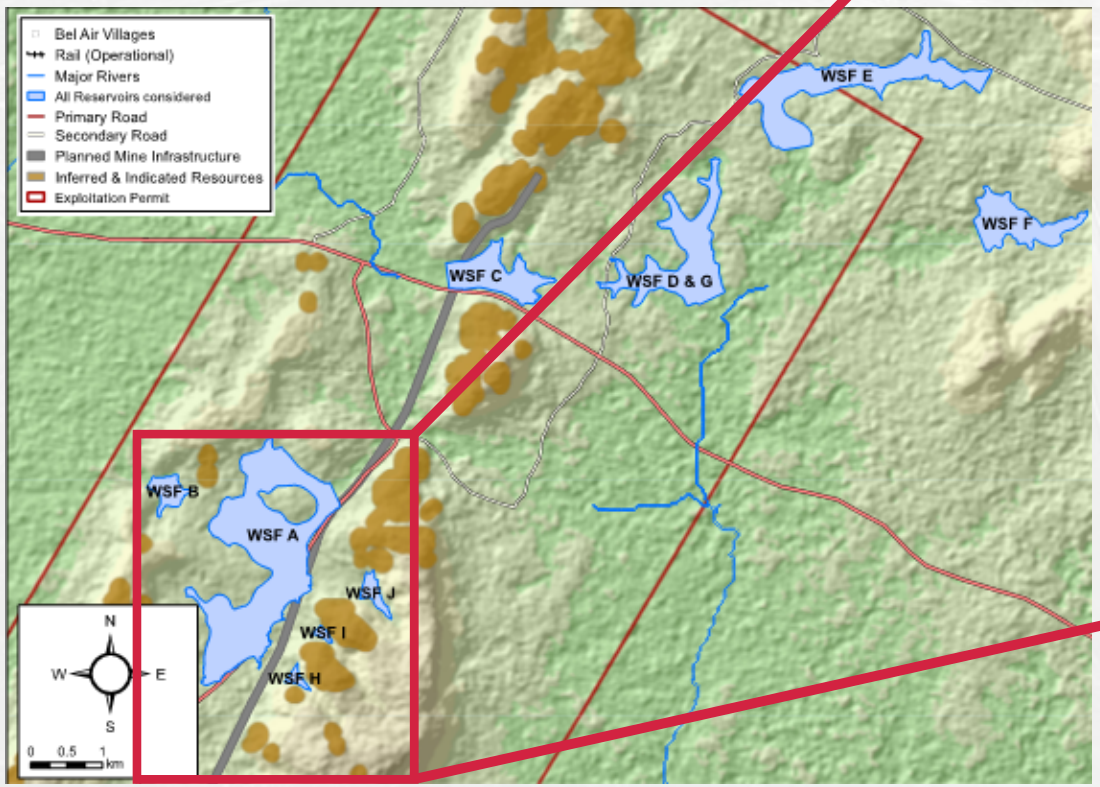


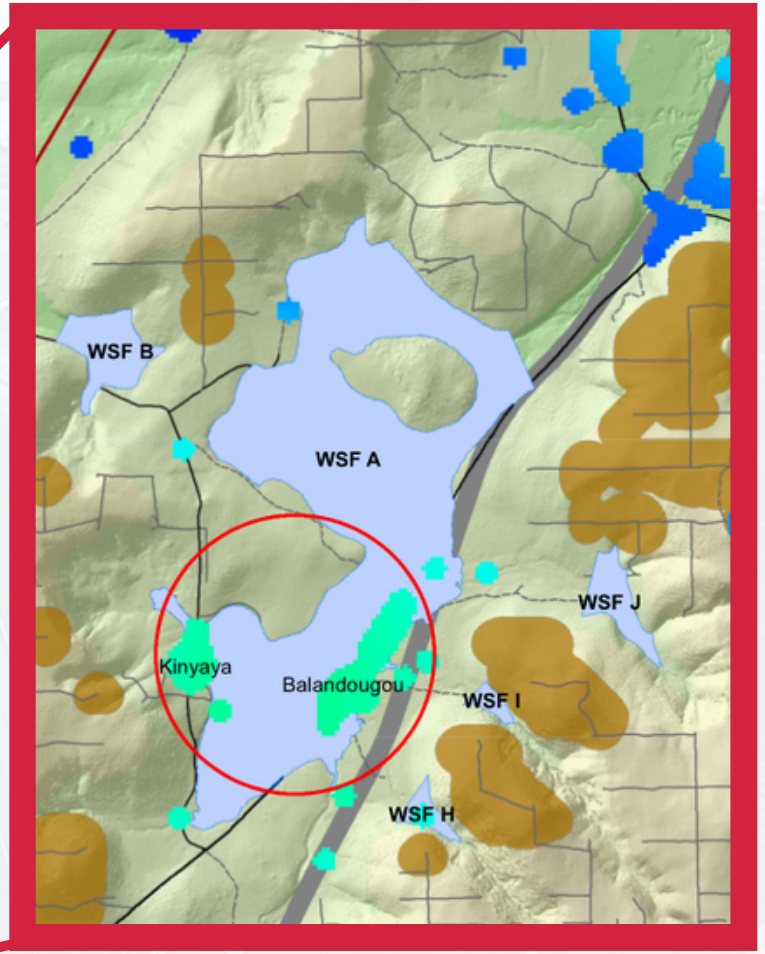


ANCILLARY

WATER SUPPLY AND CONSUMPTION

- WSF B was identified as the preferred option
  - No displacement of people.
- WSF E was identified as the preferred option during future expansion i.e. Refinery
- WSF A also considered but disrupted too many communities and existing infrastructure. It also interfered with planned mine infrastructure





YOUR **AFRICA** ENGINEERING EXPERTS

PROVIDING UNIQUE, INNOVATIVE AND COST-EFFECTIVE ENGINEERING SOLUTIONS SINCE 2010

Nurizon has been built on a solid foundation of three core values – Innovation, Professionalism and Openness. With these fundamentals in place, we have built invaluable trust-relationships with local and international clients, continually providing them with security, comfort and confidence as we continue to deliver quality integrated solutions for their projects.

With many years of combined experience, we are able to assist from the onset to completion of your project, to ensure the finest possible outcome. Our 'beyond boundaries' approach makes us renowned for our adaptability, as we naturally view every project with an element of uniqueness. Consistently maintaining remarkably high standards, we continue to thrive on repeat business, secured by work relationships built on integrity, by applying our core values in every aspect of conducting business.

AFRICA EXPERTS

Having completed numerous successful projects on the African continent over the past decade, with a head office based in South Africa, we understand the challenges in terms of logistics and politics within the African environment.

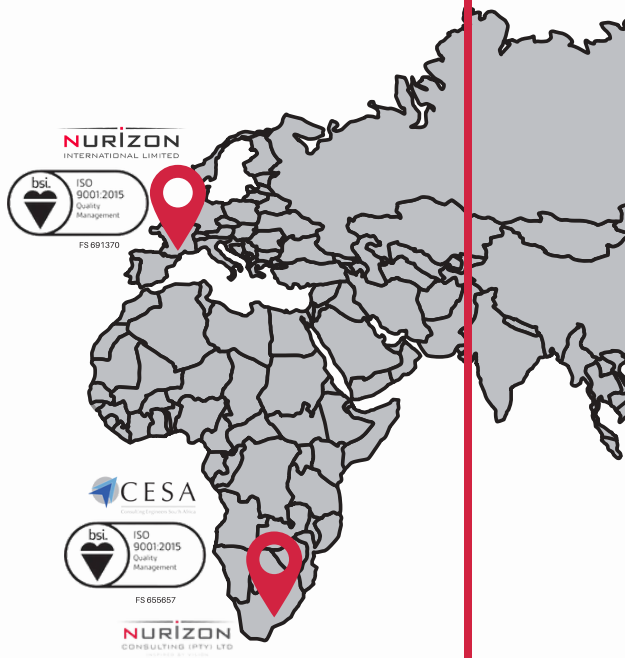
Our Directors and Senior staff members are hands-on from the onset to completion of each project and we pride ourselves on providing quality service.

MULTI-DISCIPLINARY

With our vibrant team of hand-picked engineers and support staff, well experienced in working **in various multidisciplinary engineering environments,** no challenge is too great for the NuTeam to take on!

INTERNATIONAL FOOTPRINT

Our project portfolio is exceptionally varied, with 430+ successfully completed **projects in 24+ different countries** across the African, European and Oceania continents. Our head offices in UK and South Africa provides for easy access to the African and European contents.



WHO WE ARE BY **NUMBERS**

430+ SUCCESSFULLY COMPLETED PROJECTS

ACROSS 24+ DIFFERENT COUNTRIES

10+ YEARS EXPERIENCE

1 VIBRANT, HAND-PICKED, AND EXPERIENCED **NU-TEAM**

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