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	<p><b>PURE FONTE LTÉE</b>  <b>PIG IRON PRODUCTION PLANT – FEASIBILITY STUDY</b>  <b>CUSTOMER N°: 1821</b></p>
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	<p>TENOVA          TECHINT ENGINEERING &amp; CONSTRUCTION</p>
	<p><b>FEASIBILITY STUDY</b>  <b>SECTION 7</b>  <b>PLANT LAYOUT</b></p>

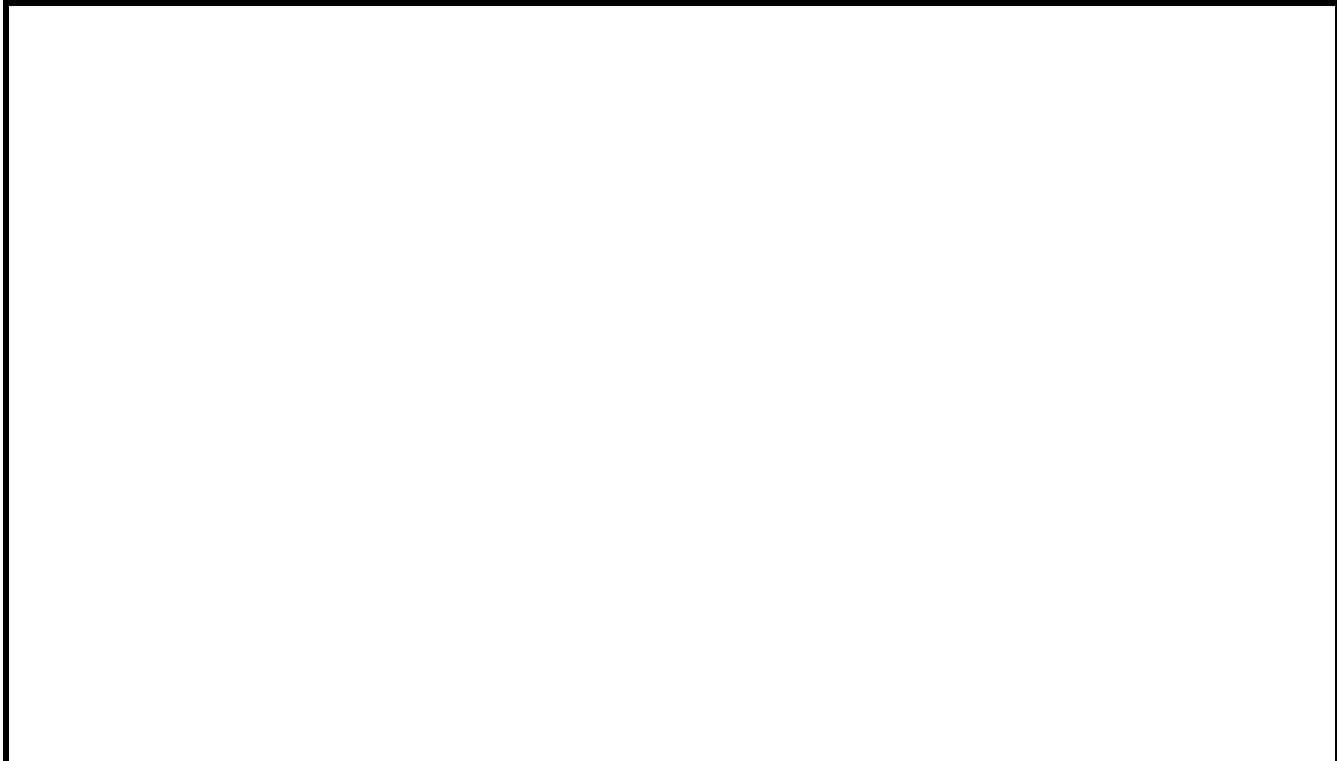
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**PURE FONTE LTÉE**  
**PIG IRON PRODUCTION PLANT – FEASIBILITY STUDY**  
**CUSTOMER N°: 1821**



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**SECTION 7 – PLANT LAYOUT**  
**CHAPTER 7.1**  
**LAYOUT DESCRIPTION**

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### Chapter's references:

- [1] Alain Duchesne, Martin Dolbec (SNC-Lavalin GEM Québec inc.), "Pig Iron Production Plant Port-Saguenay Chemin de la Grande-Anse Ville Saguenay (Québec) - Geotechnical Investigation," Jonquière (Québec) Canada, May 5th, 2016.
- [2] SNC Lavalin, "Agencement général de l'usine de fabrication de fonte en geuse," 2016/06/28.

## 7.1 Plant Layout

### 7.1.1 Layout Criteria

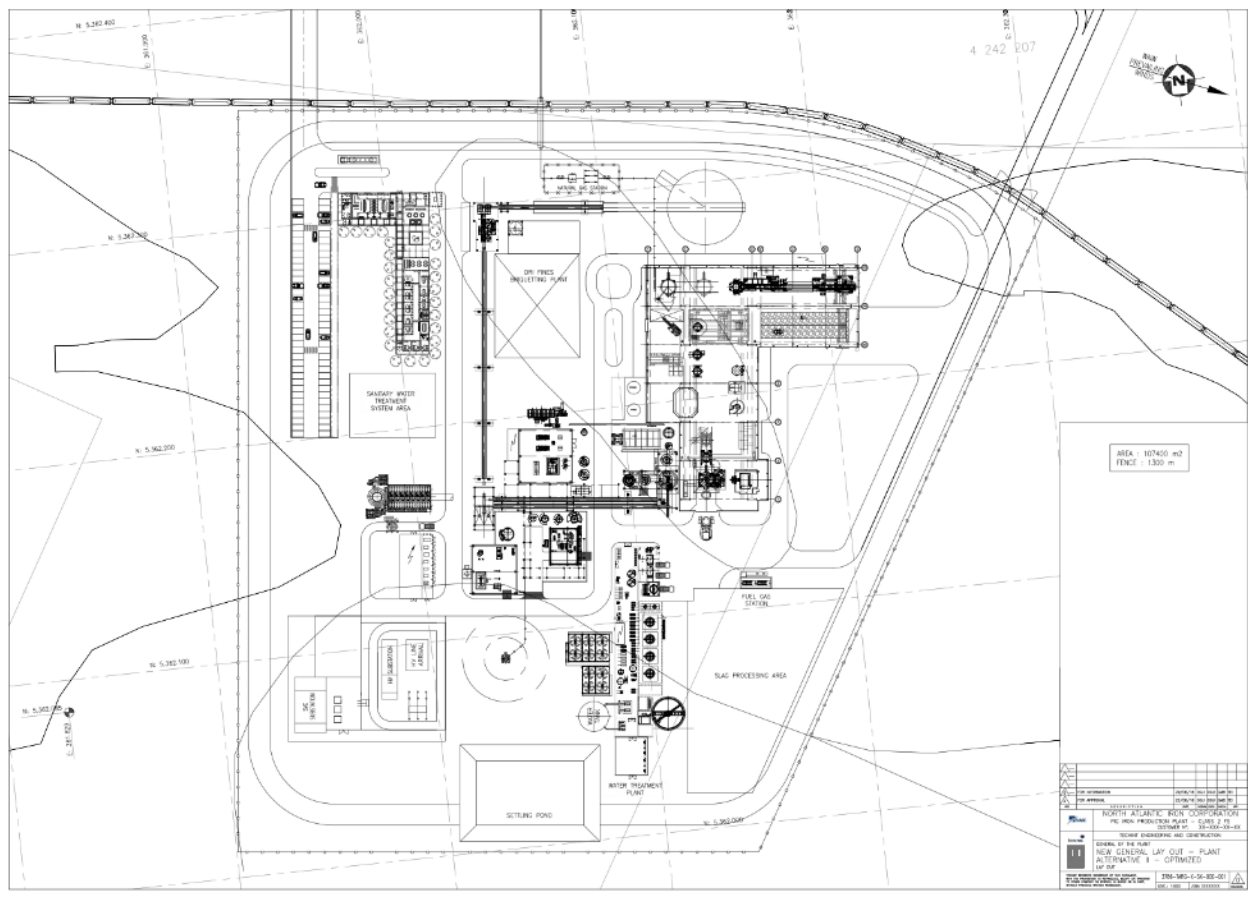







Figure 7.1-1: plan view of PURE FONTE LTÉE layout

PURE FONTE LTÉE layout has been defined by Tenova in cooperation with Techint and SNC Lavalin according to the following criteria:

-  Logic utilization of the site geotechnical characteristics
-  Best process flow of materials inside the plant
-  Compact building and civil construction
-  Minimized piping/cabling/wiring to reduce installation time/cost
-  Safety and ergonomic considerations for plant workers

## 7.1.2 The PURE FONTE LTÉE site at Port Saguenay

The PURE FONTE LTÉE plant site is located approximately 2.5 km from the dock at Port Saguenay. Material will be transported from the dock to the plant site and from the plant site to the dock either by truck or a conveyor to be constructed by APS.



Figure 7.1-2.: Aerial view of PURE FONTE LTÉE site

A large portion of the PURE FONTE LTÉE site location has already been cleared of trees, levelled and filled with crushed rock. APS has committed to preparing the remainder of the area required by PURE FONTE LTÉE to the same level prior to the beginning of construction. The site is accessible by both heavy haul truck and rail. The road to the dock is well maintained and is currently used to haul bulk materials to and from the dock. PURE FONTE LTÉE will be the first permeant tenant for this Port Location and will be the anchor tenant for the Grand-Anse Maritime Terminal development. The pig iron production facility will be constructed on a portion of the lots 4 012 437 and 4 012 436, which belong to the APS, who has reserved the full lots to PURE FONTE LTÉE. The project site will eventually cover an approximate area of 10.6 hectares.

### 7.1.3 Utilization of site characteristics

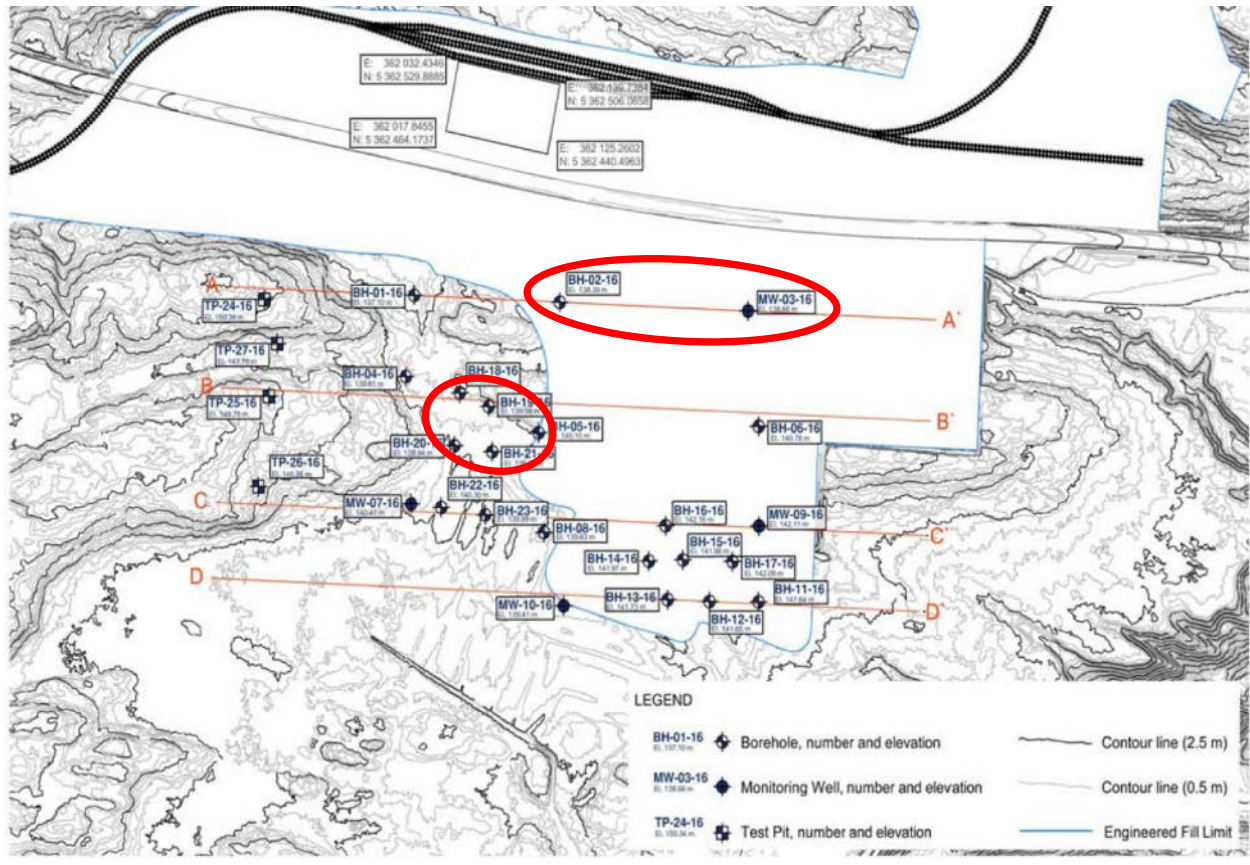
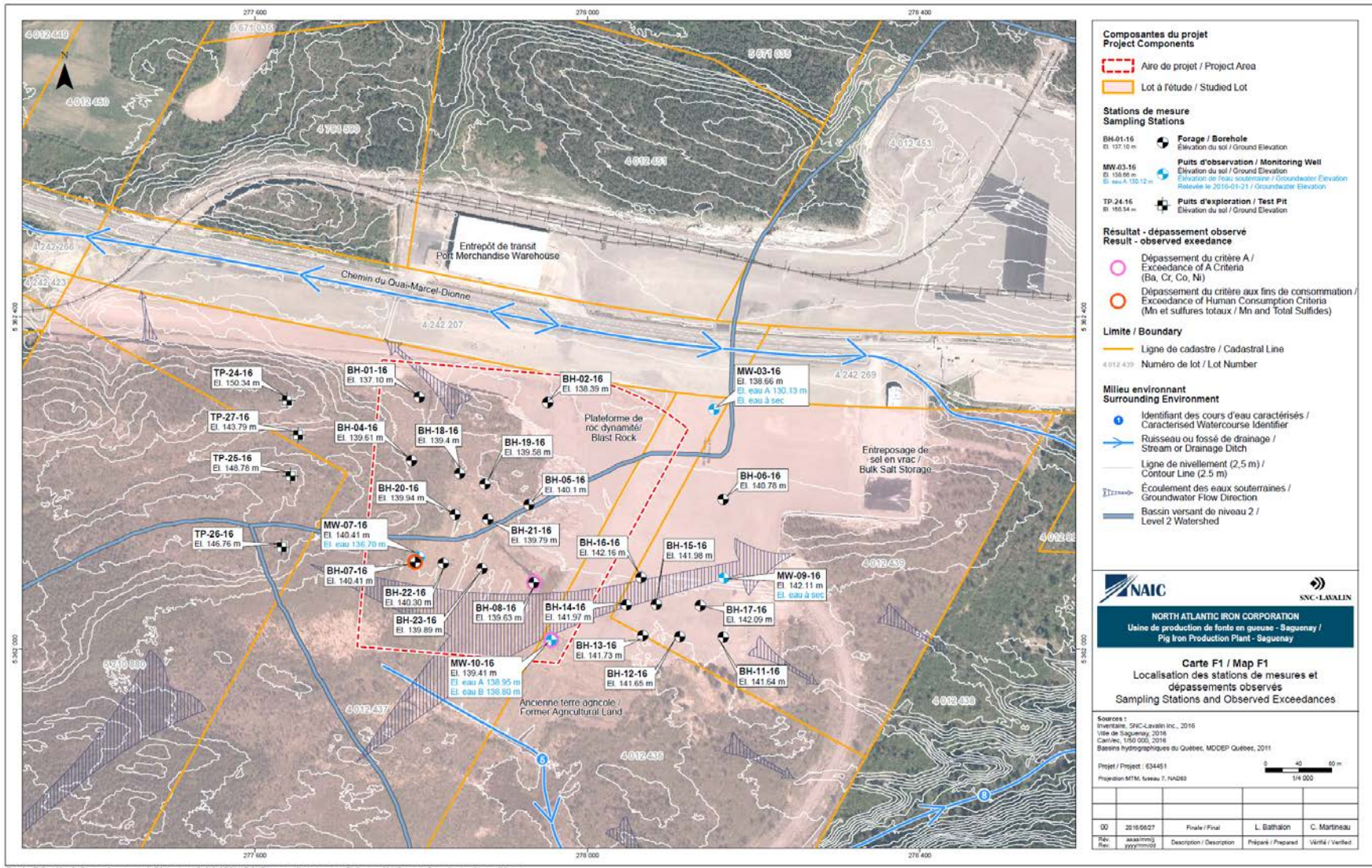


Figure 7.1-3.: Borehole location plan [1]

The PURE FONTE LTÉE site is characterized by a non-homogeneous soil with bedrock at different elevations below the surface. A detailed geotechnical report of the site was commissioned by PURE FONTE LTÉE and is included in this FS. Figure 3 is a map of the boreholes conducted as part of that study. The area around the boreholes indicated in the red circles has rock between 0.25 to 3.6 meters below surface.

The other areas of the lot reserved to PURE FONTE LTÉE have bedrock deeper below surface, and in some cases a layer of clay between the ground level and the bedrock.

Based on the data from the boreholes and to avoid additional cost from piling or other types of foundation consolidation, the position of the heaviest equipment and parts of the plant (Reactor tower, EAF and dome storage) have been located on the areas where bedrock is closest to surface.



## 7.1.4 Compact building and civil construction

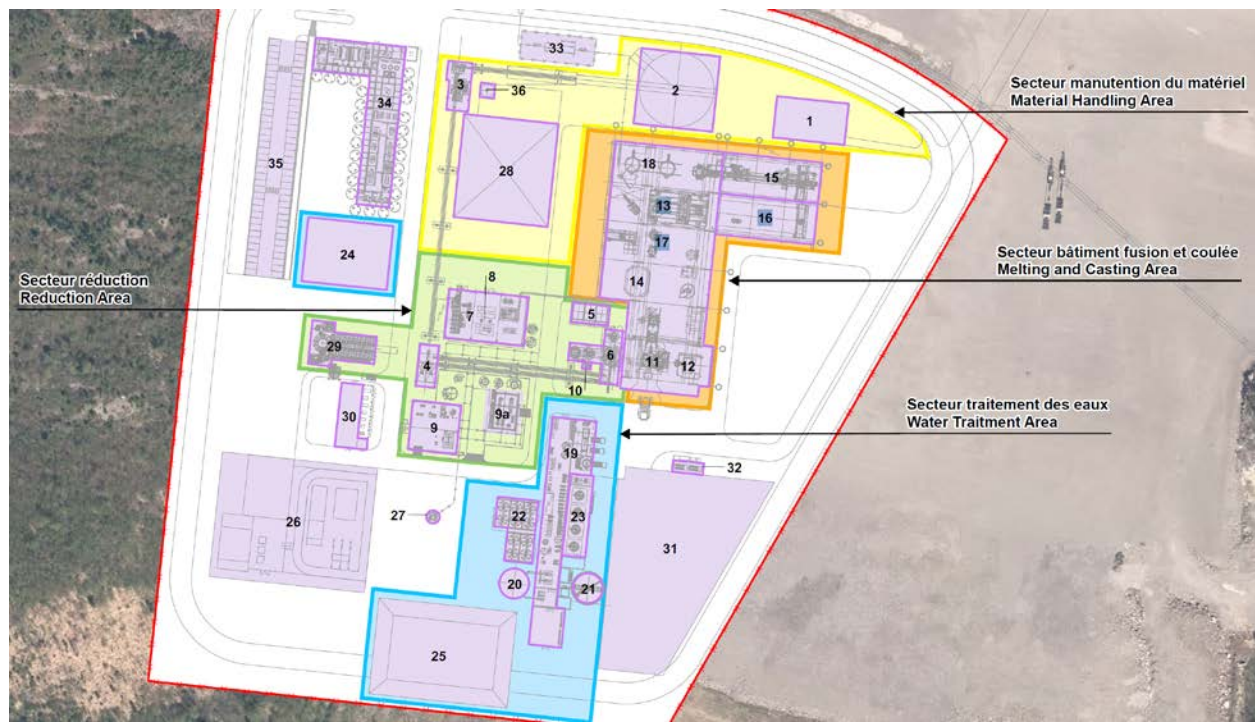


Figure 7.1-4.: Identification of buildings and other plant elements [2]

The PURE FONTE LTÉE layout is characterized by its compact design that utilizes a good part of the already levelled ground and does not require further rock blasting or deforestation.

Below is a list of the plant building groups:

- Storage and Material Handling buildings (yellow)
- Material Handling and Direct Reduction buildings and structures (green)
- Melting and casting building (orange)
- Water Treatment building (blue)
- Other buildings (not highlighted)

#### 7.1.4.1 Storage and material handling buildings

1. Transfer building (constructed when needed to connect to future belt conveyor by APS)
2. Pellet storage dome
3. Screening and coating building
28. Briquetting Plant
36. Screened fines storage silo

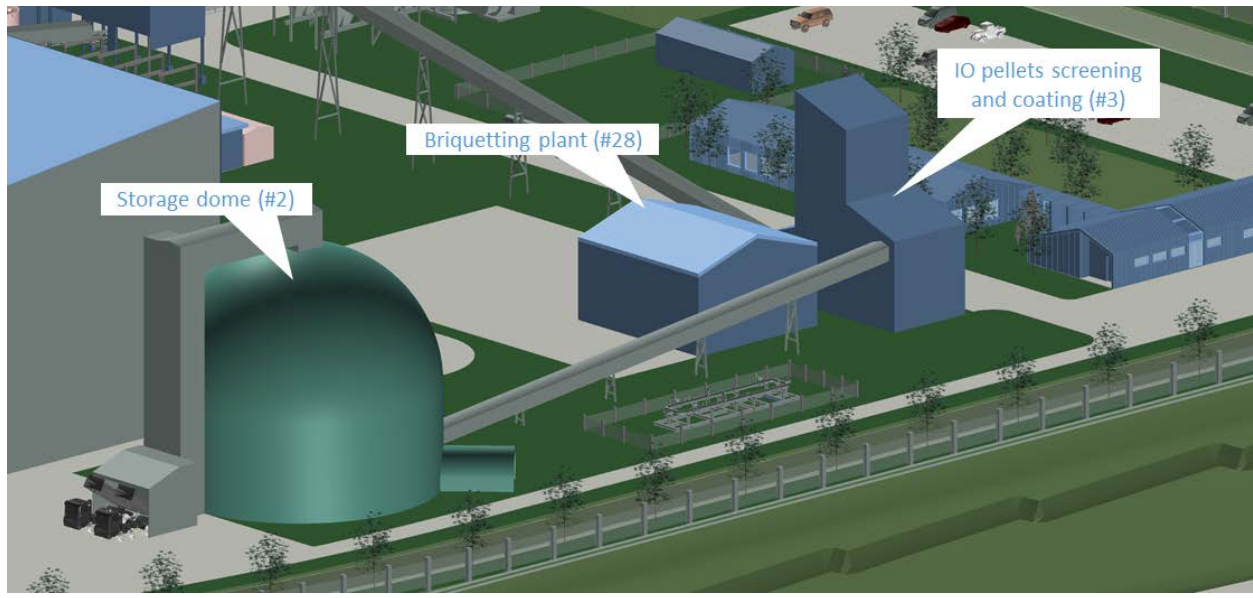


Figure 7.1-5.: 3D view of buildings for storage and material handling

#### 7.1.4.2 Material Handling and Direct Reduction buildings and structures

4. Curing bins / day bins
5. Process Gas Heater
6. DRI Reactor
7. Auxiliary equipment of the reduction area
8. Auxiliary boiler
9. CO2 removal unit
10. DMDS tank

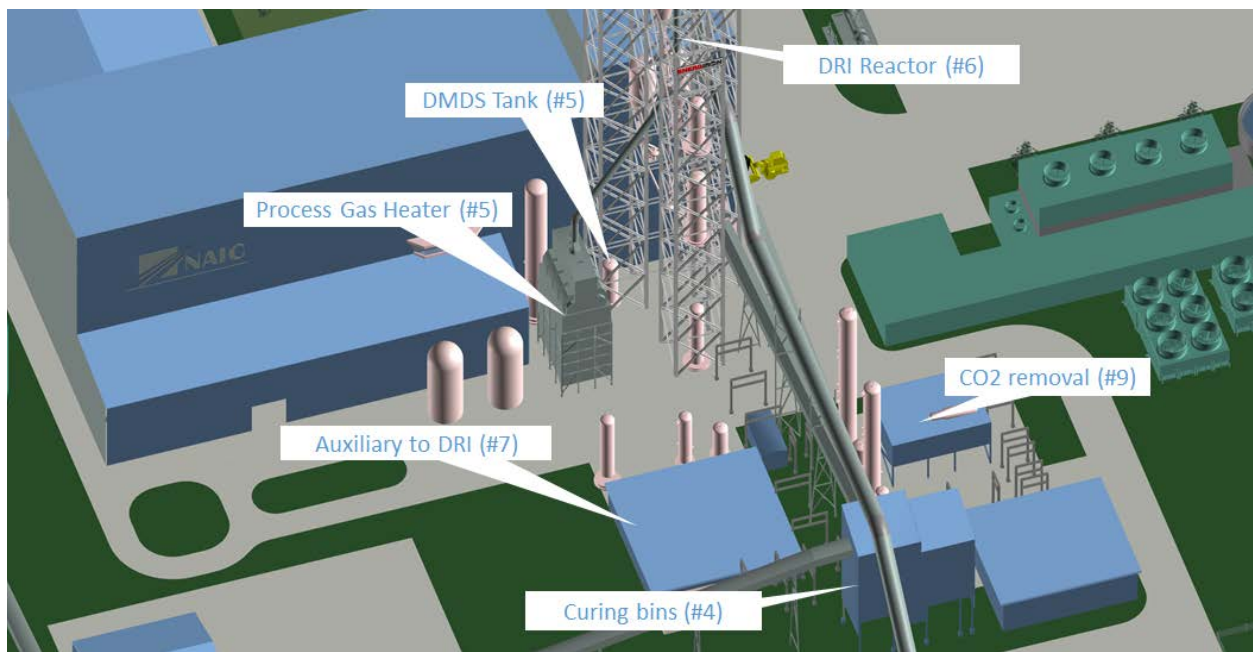


Figure 7.1-6.: 3D view of the buildings and structures for Material Handling and Direct reduction.

### 7.1.4.3 Melting and casting building

- 11. EAF area
- 12. EAF transformer
- 13. Ladle refractory maintenance area
- 14. Control room
- 15. Pig caster
- 16. Pig iron storage
- 17. Ladle preheater
- 18. Furnace shell refractory maintenance
- 29. Pulse-jet baghouse

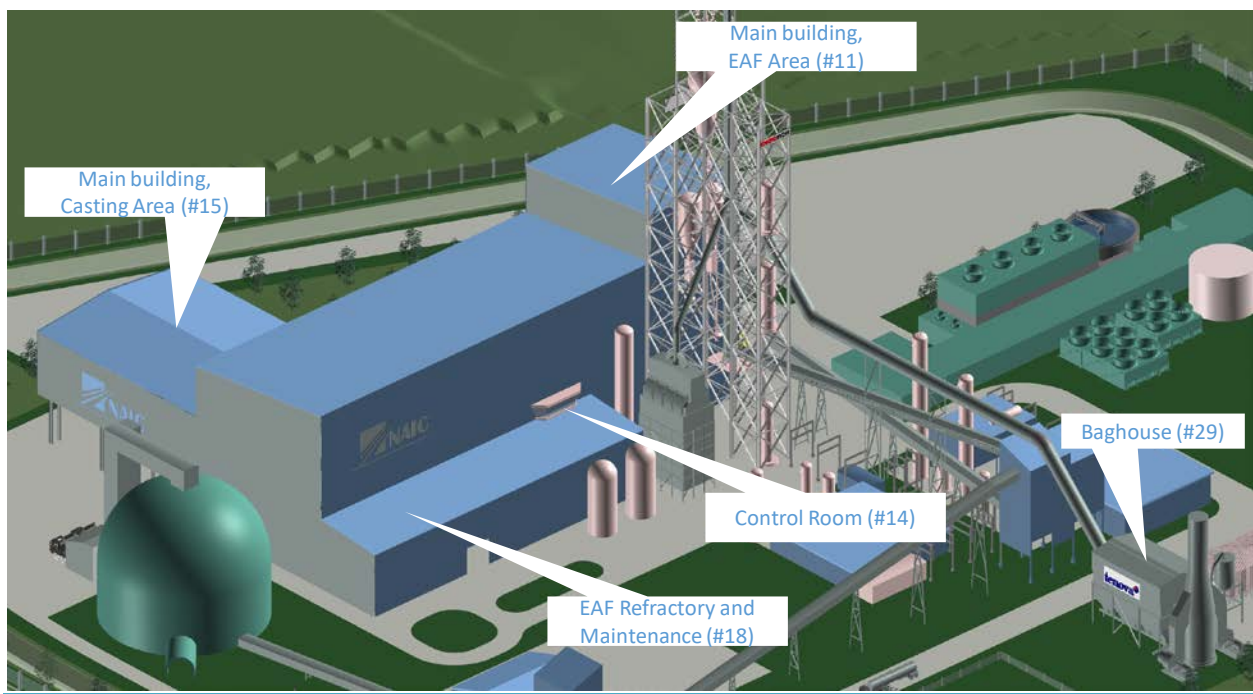


Figure 7.1-7.: 3D view of the melting and casting building and relevant services

#### 7.1.4.4 Water Treatment building

- 19. Water treatment plant
- 20. Water tank
- 21. Clarifier
- 22. Air coolers
- 23. Cooling towers
- 24. Sanitary water treatment area
- 25. Settling pond

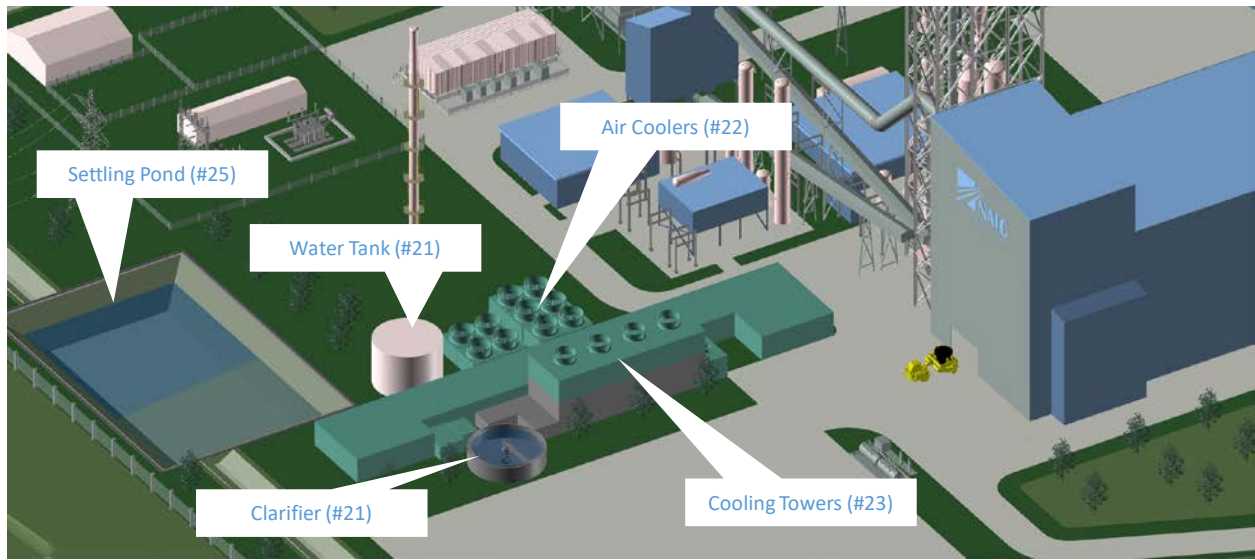


Figure 7.1-8.: 3D view of the WTP

Other areas

- 26. Electrical Sub Station
- 27. Flare
- 30. Electrical room for the baghouse motors
- 31. Slag storage
- 32. Fuel station for mobile equipment
- 33. Natural gas station
- 34. Administrative buildings
- 35. Parking

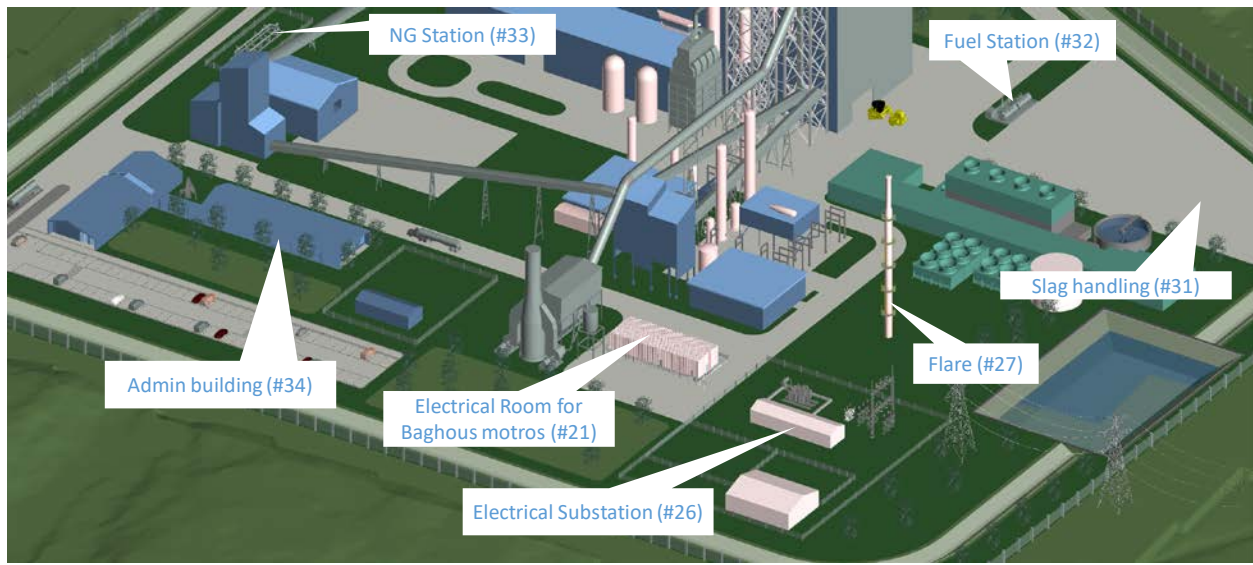


Figure 7.1-9.: 3D view of auxiliary buildings and services

## 7.1.5 Plant water and natural gas piping

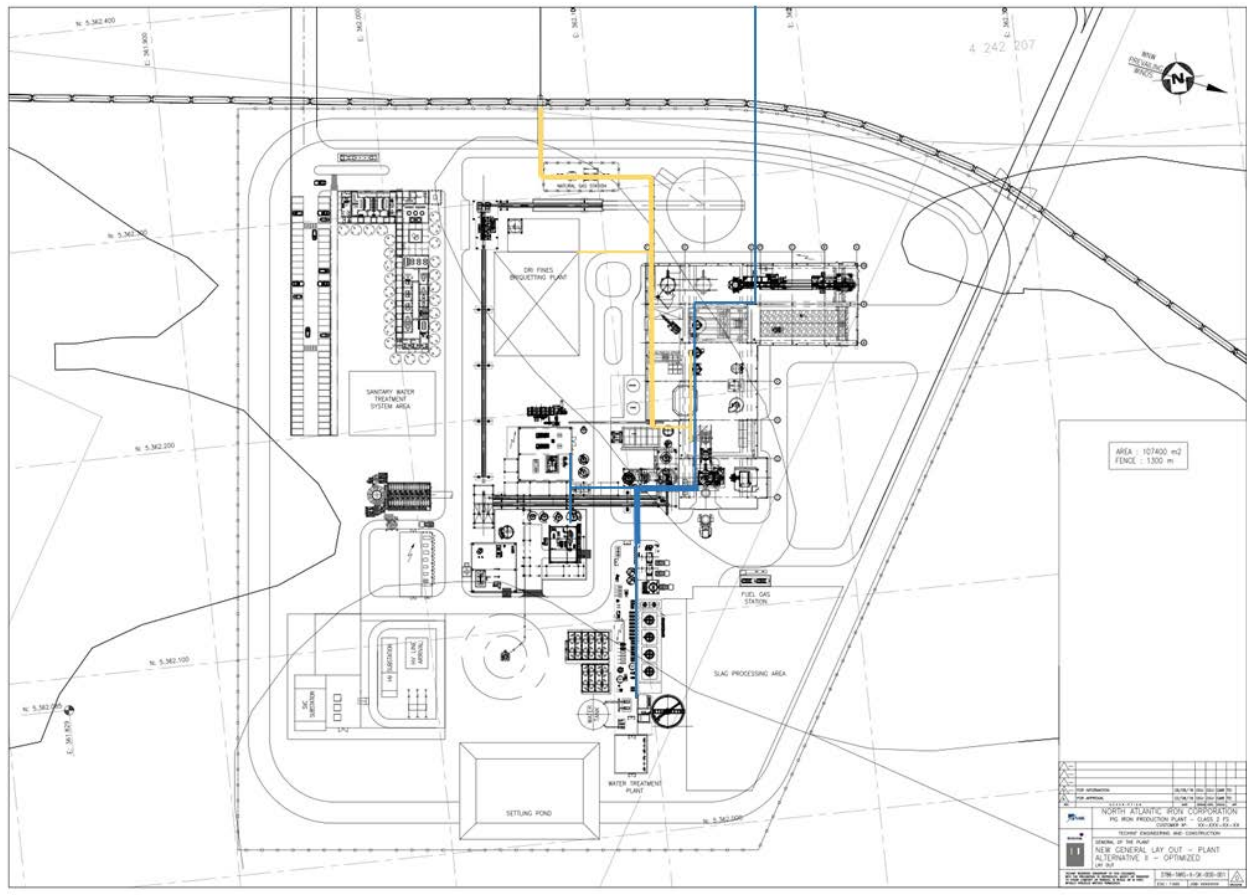


Figure 7.1-10.: Minimization of natural gas piping and water piping

When designing the plant layout, particular attention was paid to water and NG piping. Large diameter piping installation is expensive and has a large impact on the overall capex; therefore, the layout of the equipment has been designed so that the distance between the areas that require high flows of water (DR module in particular) and the Water Treatment Plant has been minimized (blue lines in the picture).

The same principle applied to the NG piping between the NG station and the Process Gas Heater.

The rest of the areas do not use water or NG or are connected with small diameter piping with a lower installation cost.

## 7.1.6 Safety and ergonomics

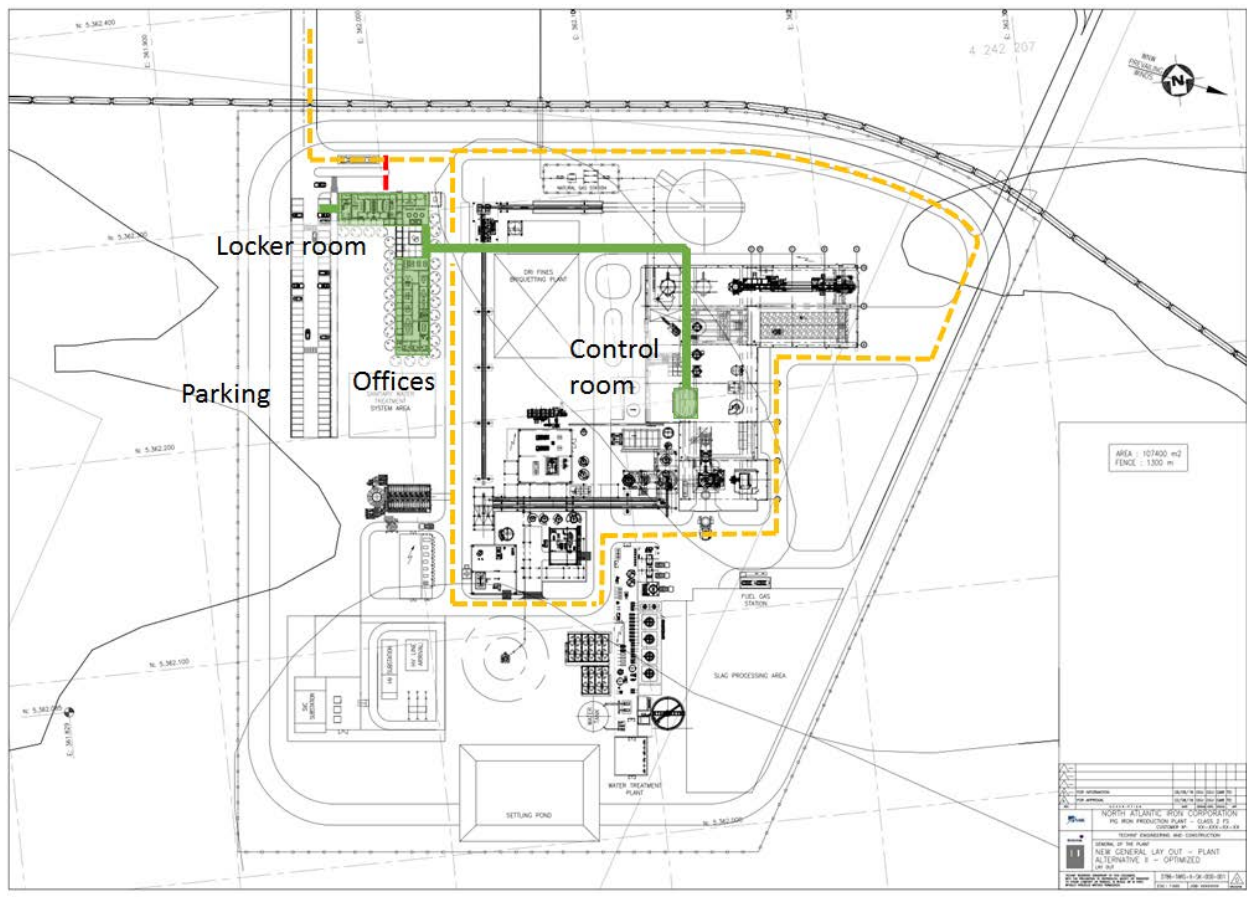


Figure 7.1-11.: paths for workers and trucks in the plant

Plant safety is both a key priority and requirement for the definition of the plant layout. With this in mind, Tenova has defined equipment that can all be controlled from a single location, accessible by workers through a short path (a straight east-west line from the locker room to the main building and from there a short north south line to the control room). No worker shall be allowed outside the control room or the walking path during normal plant operation. Private vehicles will not be allowed in the plant. The plant gate (red line in the figure) will only be opened to trucks and mobile equipment for plant operation. The plant road will be a ring surrounding the main operating equipment, where trucks will be allowed to transit in one-direction only enhancing traffic safety.

### 7.1.6.1 Plant access

The plant will have two access points from the public road, one main entrance and one secondary entrance. The main entrance will grant access to the workers and trucks for the daily operation. The secondary entrance will serve as emergency access/exit in case of need and may also serve to provide a second access point to trucks for IO pellets and pig iron, in case the main entrance is busy for other purposes, so that the daily operation will not be interrupted.

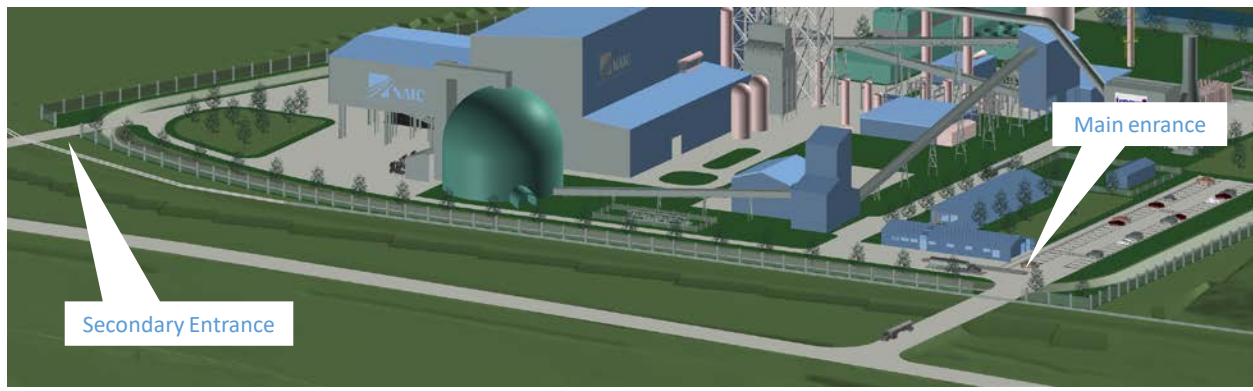


Figure 7.1-12.: 3D view of plant entrances

### 7.1.6.2 Safety characteristics of the layout

The plant layout has been designed in order to have a simple and easily executable safety plan in case of emergency. No private vehicle will be allowed in the plant, to reduce the risk of accidents. A simple straight path for workers to get access to the plant has been designed, It will have to be well indicated and illuminated during day and night. Two main assembly points for workers and employees in case of emergency have been considered in the design of this plant

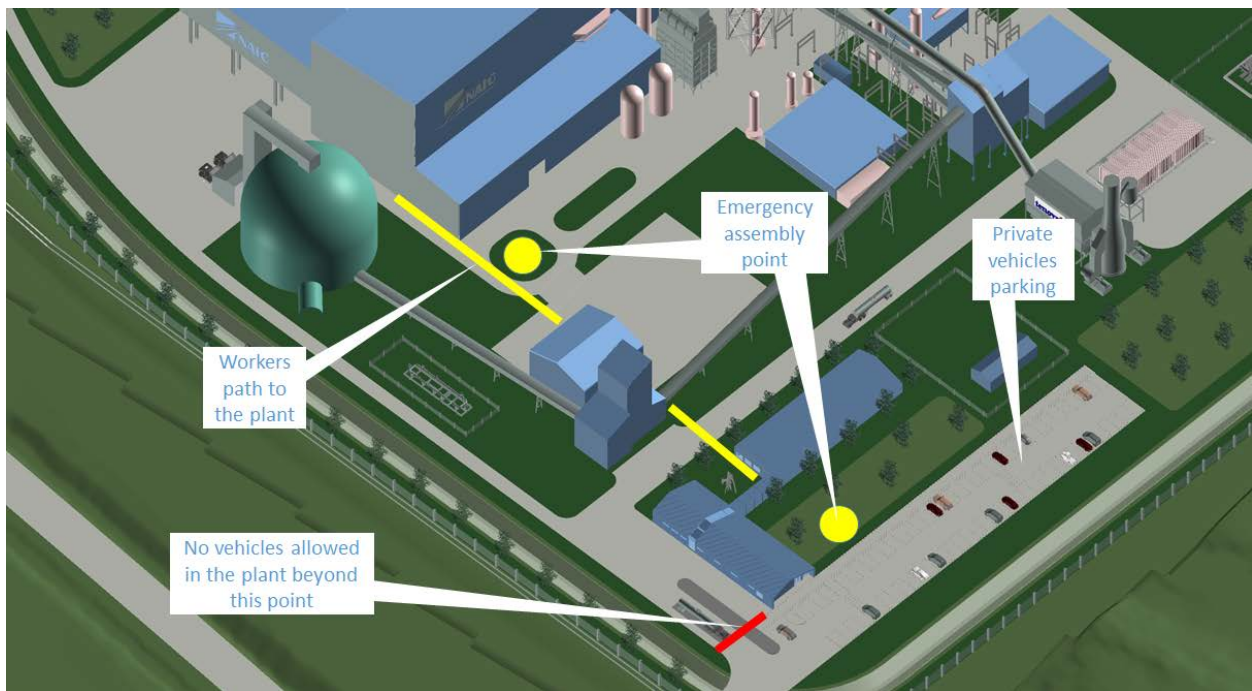
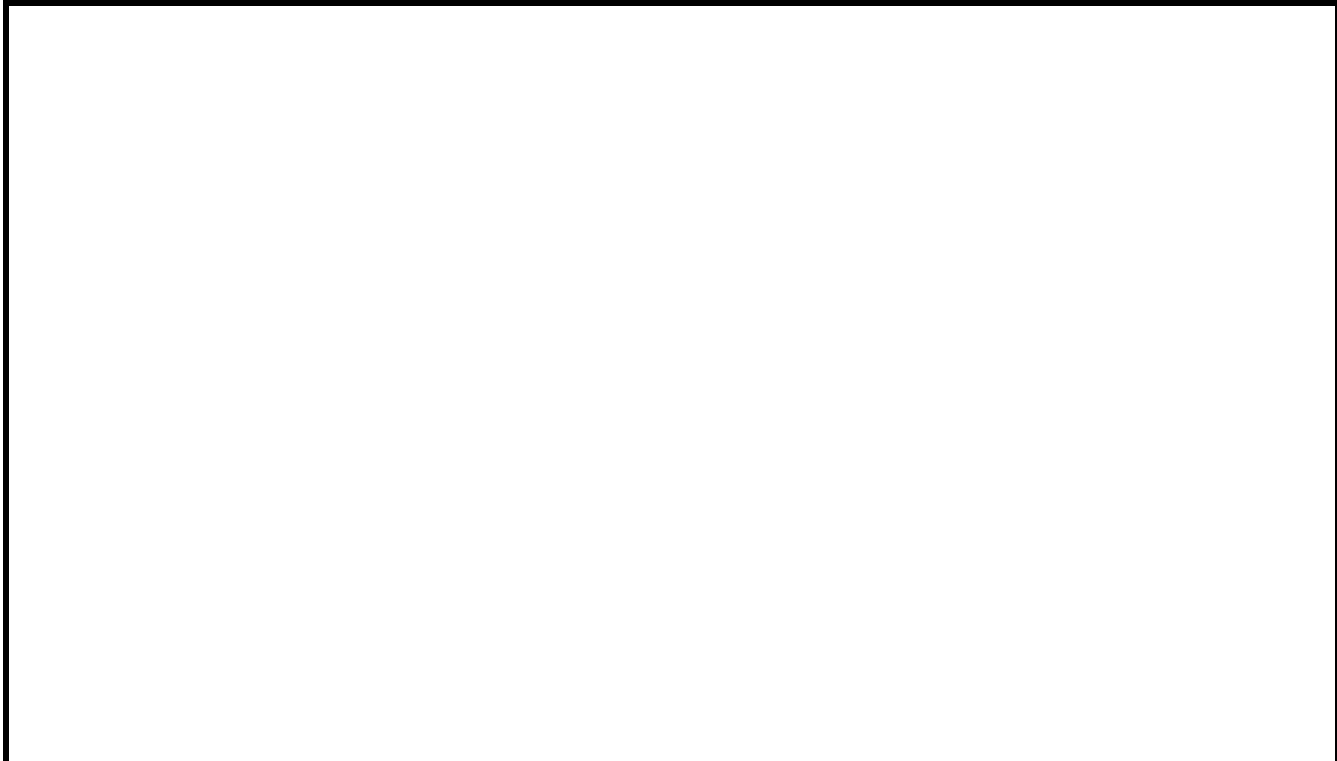


Figure 7.1-13.: safety characteristics of the layout



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**CUSTOMER N°: 1821**



TENOVA  
 TECHINT ENGINEERING & CONSTRUCTION

**SECTION 7 – PLANT LAYOUT**  
**CHAPTER 7.2**  
**MATERIAL FLOW**

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## 7.2 Material Flow

### 7.2.1 Process flow of materials

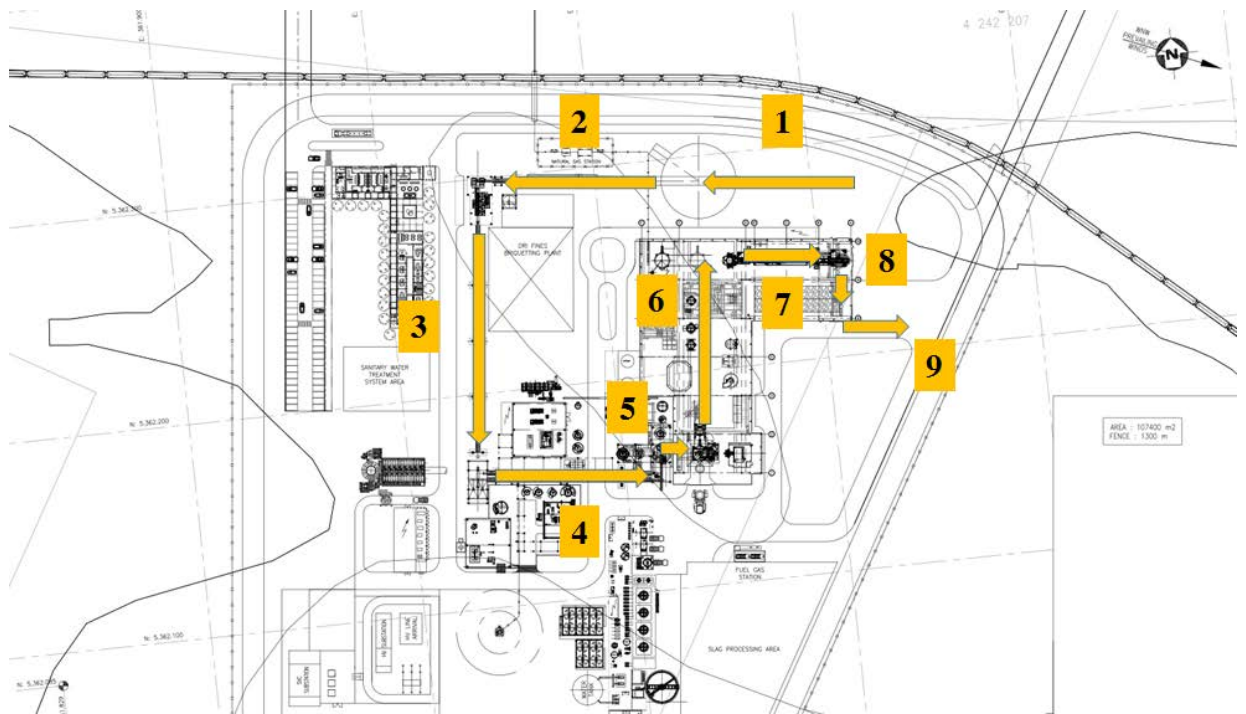











Figure 7.2-1.: Process flow of materials on the plan view

The PURE FONTE LTÉE layout will allow a simple flow of material, avoiding path crossing and maintaining operations in very well defined circle. This will allow material to arrive and depart on the same side of the plant.

-  [1] IO pellets arrive and are charged into the storage dome
-  [2] IO pellets transfer from the dome to screening/coating and
-  [3] Coated pellets transfer to curing bins
-  [4] Coated pellets transfer to DR module for reduction and
-  [5] Hot DRI pellets gravity hot charge to EAF
-  [6] Hot metal from EAF transferred in ladle to pig caster and
-  [7] casting of hot metal into pig iron ingots
-  [8] transfer to P.I. storage and
-  [9] shipping of P.I.

### 7.2.1.1 IO pellets arrival and storage

Plant layout has been studied so that the incoming traffic for trucks delivering IO pellets will be contained in the north part of the plant.

Trucks will enter the plant from the main entrance and get weighed at the truck scale in front of the guard gate, where plant personnel will conduct the weighing procedure. Then the truck will proceed to the dome charge area on the east side of the dome and back-up to unload the IO pellet charge into one of the two 5 x 5 unloading hoppers. Once the truck has emptied its charge, it will turn backward and proceed to the scale to be weighed before leaving the plant



Figure 7.2-2.: 3D representation of the IO pellets arrival and unloading into the dome.

### 7.2.1.2 IO pellets transfer from storage to screening/coating

The IO pellets that are charged into the dome will form a conic pile of up to 46 thousand tons. The dome is equipped with six gates at its bottom. Gates are aligned so that they can all discharge by gravity the IO pellets onto a belt conveyor running underneath of it. The gates will open alternatively, so that the pile will have an even usage. The belt conveyor is completely enclosed and will collect the IO pellets to run upwards with an inclination of about 12 degrees starting from the exit of the tunnel underneath the dome. The belt will then reach the screening station for IO pellets, followed by the coating station.

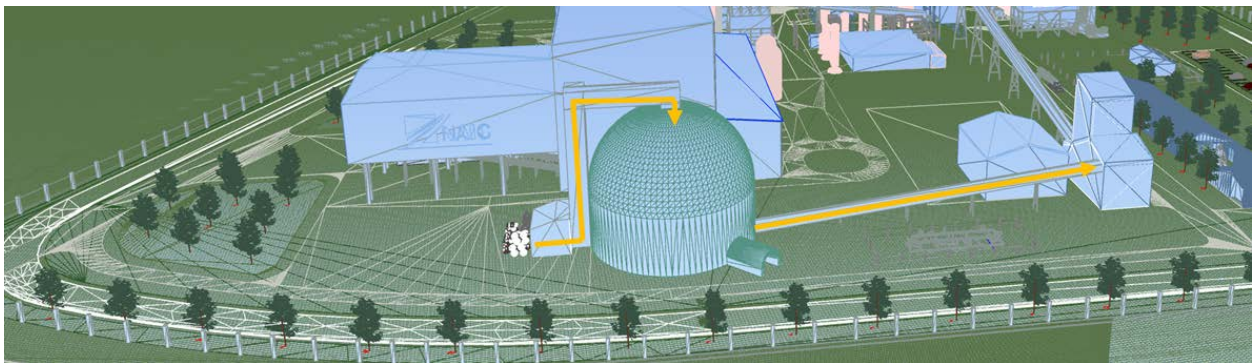


Figure 7.2-3.: 3D representation of the IO pellets transfer from the dome to the screening station

### 7.2.1.3 Coated pellets transfer to curing bins

The third step of material flow into the plant is the transportation of IO Pellets from the coating station to the curing bin.

This step is made through a second inclined belt conveyor running from the bottom of the coating station to the top of the three curing bins, where a shuttle conveyor will distribute the IO Pellets to the appropriate bin

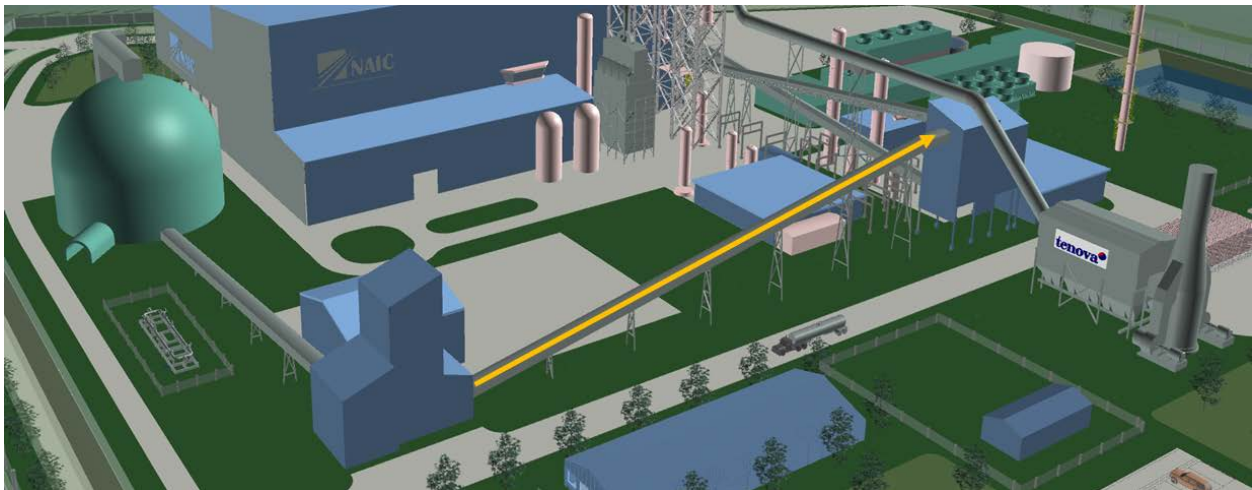


Figure 7.2-4.: 3D representation of the transfer of IO Pellets from the coating station to the curing bins

#### 7.2.1.4 Coated pellets transfer to DR module for reduction

The IO pellets will stay in the curing bins for about 4 hours before it is possible to charge them into the ENERGIRON DRI module. A weigh-belt feeder will get the cured IO pellets from the bin and discharge them onto a 12 degrees inclined belt conveyor that climbs up to the discharge point into the elevating belt conveyor.

During the transition time of module start-up, the direct reduction process requires from 18 to 36 hours to get to the right process conditions. In this time IO cured pellets will keep flowing into the module, but their metallization rate at the exit of the module will not be the one of design conditions. This material, called 'remet', will be returned to one of the curing bins, that will serve as remet bin. Once the module has reached its design process conditions, the remet will be recharged into the process at a maximum rate of about 3%, so not to lose this valuable iron resource.

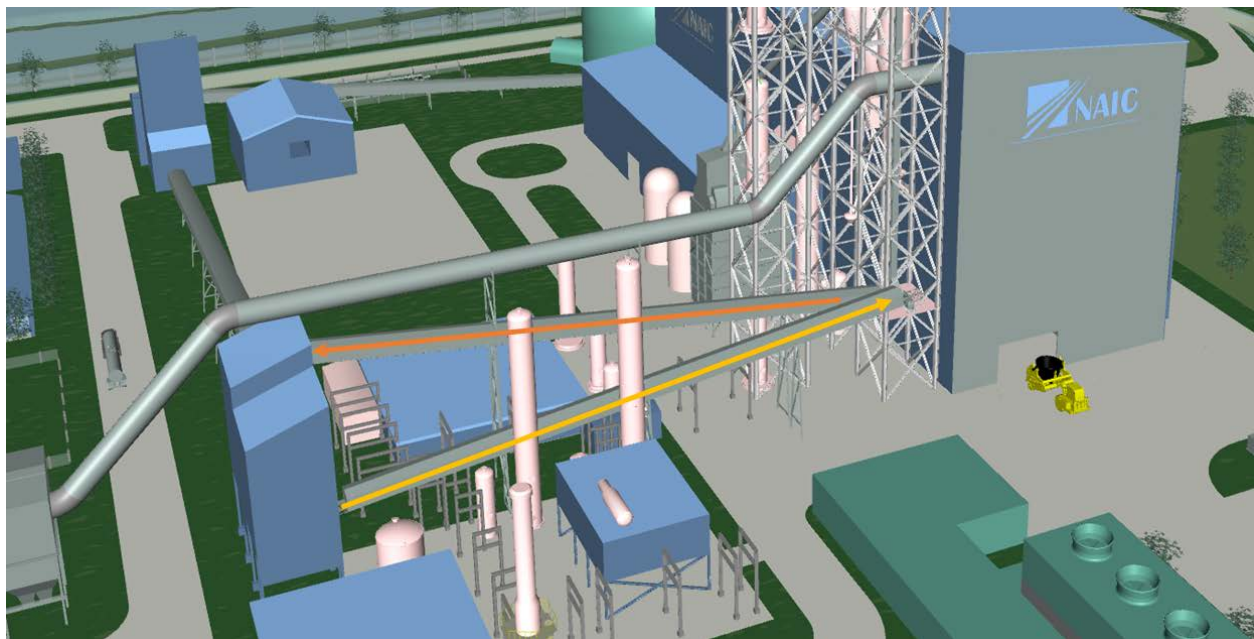


Figure 7.2-5.: 3D representation of the IO pellet transfer from the curing bins to the DRI module.

### 7.2.1.5 Hot DRI pellets gravity feed to EAF

Hot DRI at 600°C, 5% Carbon and 94% metallization will leave the module discharge section by gravity to reach the top of the roof on the EAF underneath it.

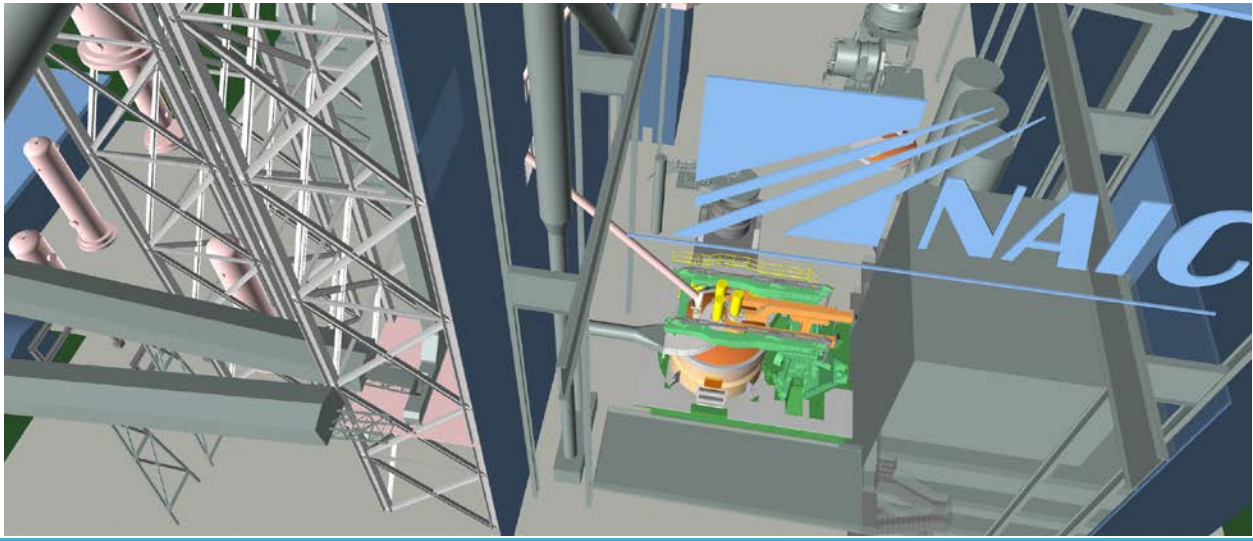


Figure 7.2-6.: 3D representation of the chute from the DRI module to the EAF

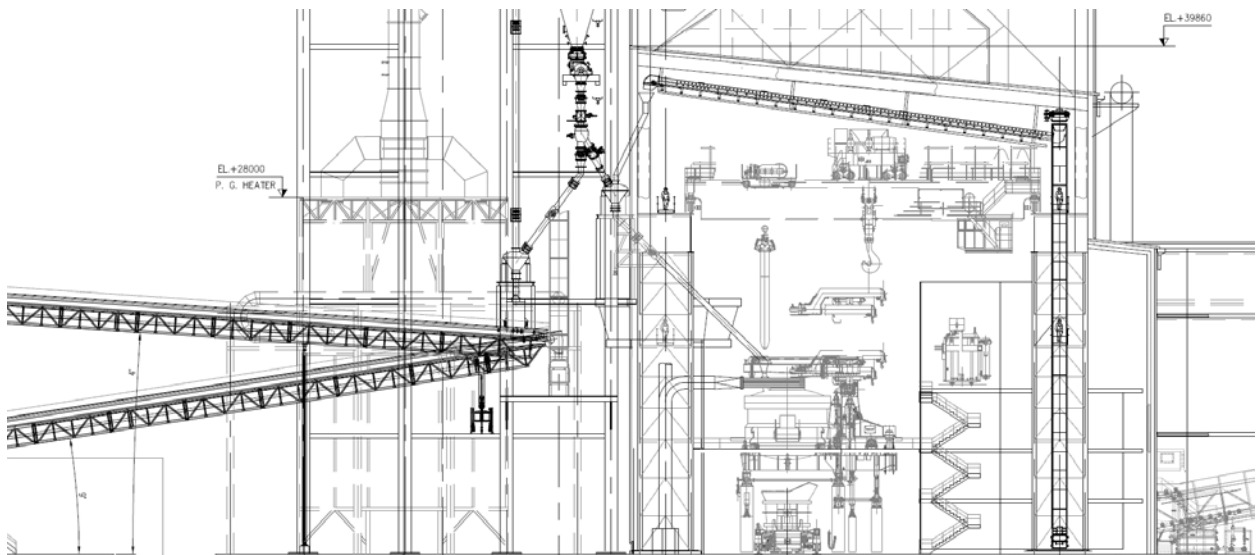


Figure 7.2-7.: Cross section of the plant showing the hot discharge chute from DRI module to EAF

### 7.2.1.6 Transfer of Hot metal from EAF to Pig Caster

Once tapped from the EAF into the 120-ton ladle, the hot metal will be transferred on the Pig Casting Machine with the hot metal crane, a crane with the capacity of 180 ton.

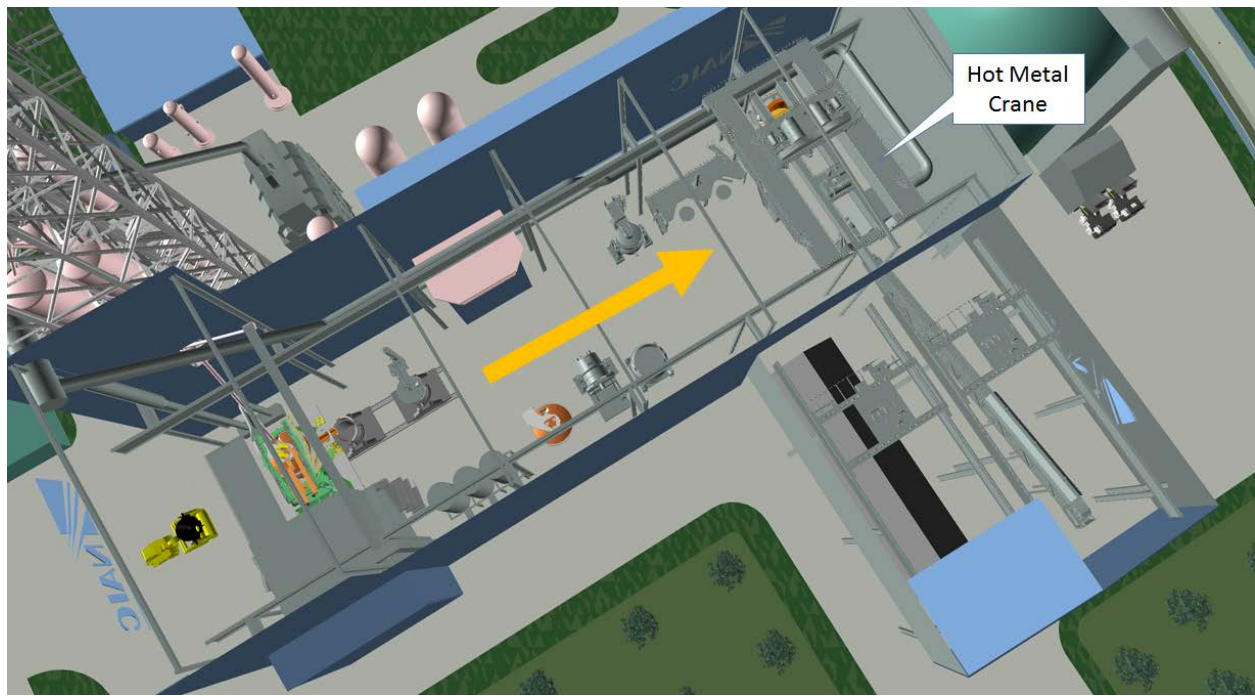


Figure 7.2-8.: #D view of the interior of the metal plant

### 7.2.1.7 Casting into pig iron ingots

Hot metal is casted on a building turned 90 degrees with the main EAF building. The ladle will pour hot metal, in the direction of the casting machine and the ingots of MPI will reach their solid state at the end of the casting machine, on the far east of the casting building, where they will drop onto buckets or on the ground, to be picked up by a front end loader.

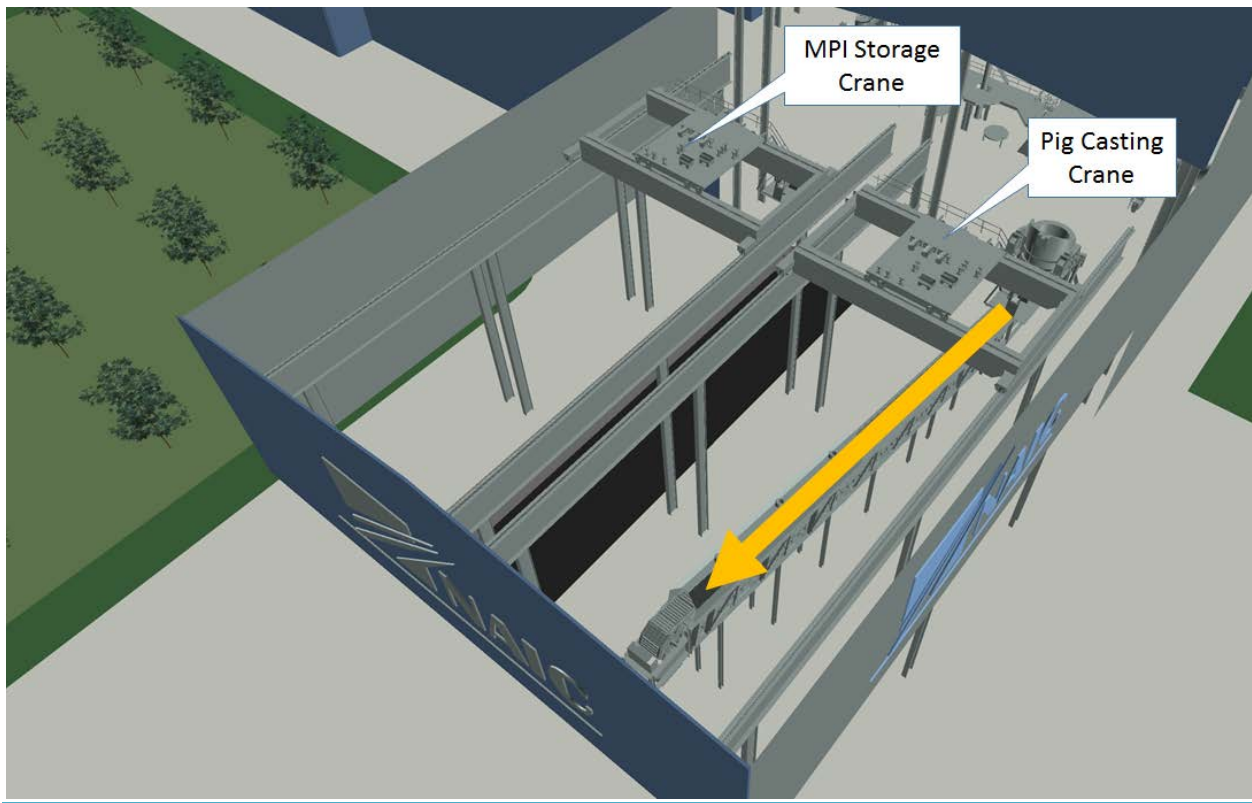


Figure 7.2-9.: 3D view of the Pig Casting bay and adjacent MPI storage building

### 7.2.1.8 Transfer to pig iron Storage

The pig iron ingots are transferred from the pig casting building on the storage pile in the adjacent storage building.

Pig iron will preferably be stored under a roof, to prevent rain and snow to oxidize its surface and so to maintain the integrity and chemical properties.

Pig iron will rest in the storage pile to for cooling purposes and to reach the appropriate pile size before delivering the material to the port for shipping it to clients.

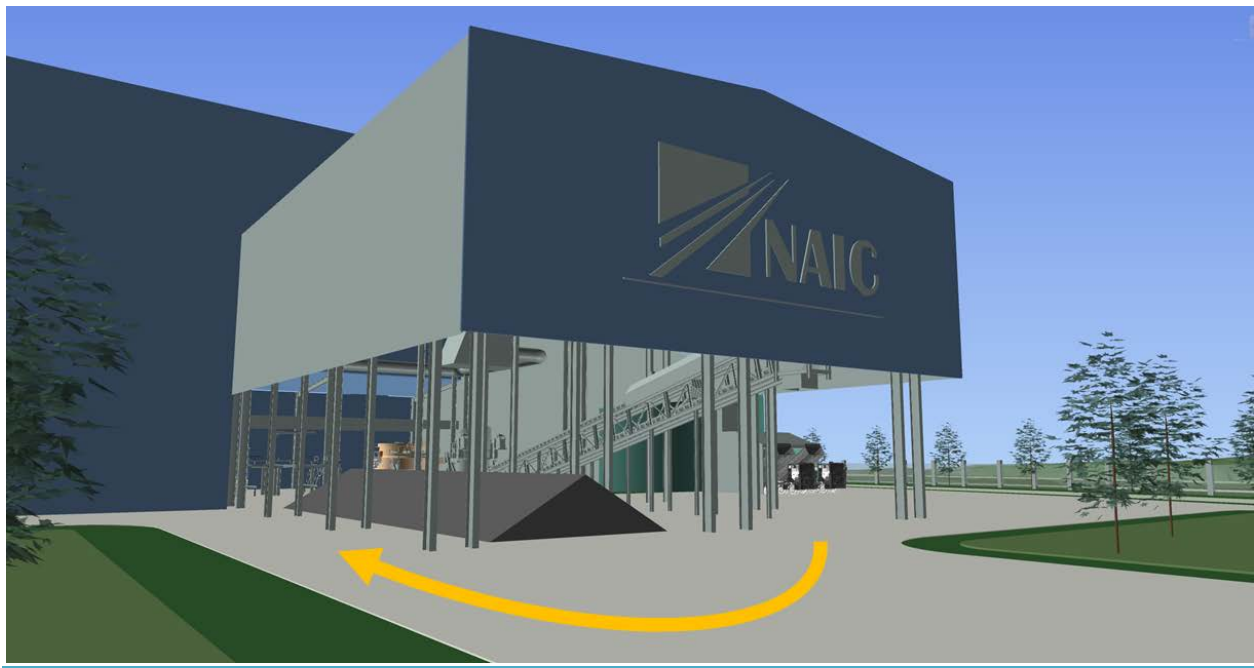


Figure 7.2-10.: 3D representation of the pig iron covered storage at the plant

### 7.2.1.9 Shipping of pig iron

The pig iron ingots are transferred from the pig casting building on the storage pile in the adjacent storage building. Once ready for delivery, a front-end loader will collect the MPI from the pile and drop it onto a truck that will be first weighed on the scale, then proceed clockwise as illustrated in Fig 7.2-12 here below, stop in the pig iron yard, receive the pig iron load, proceed clockwise to the exit of the plant to be weighed before exiting the plant premises to reach the port.



Figure 7.2-11.: plan view of the pig iron trucks plant route

## 7.2.2 Traffic into the plant

### 7.2.2.1 IO pellets trucks

IO pellets trucks will have two possible routes inside the plant: the one presented in chapter 7.2.1.1 and the alternative route presented in this chapter.

In case of high number of trucks in the plant, the alternative route is the preferred one, as the clockwise circular single way route does not allow for vehicles to cross each other, to increase the level of safety in the plant.

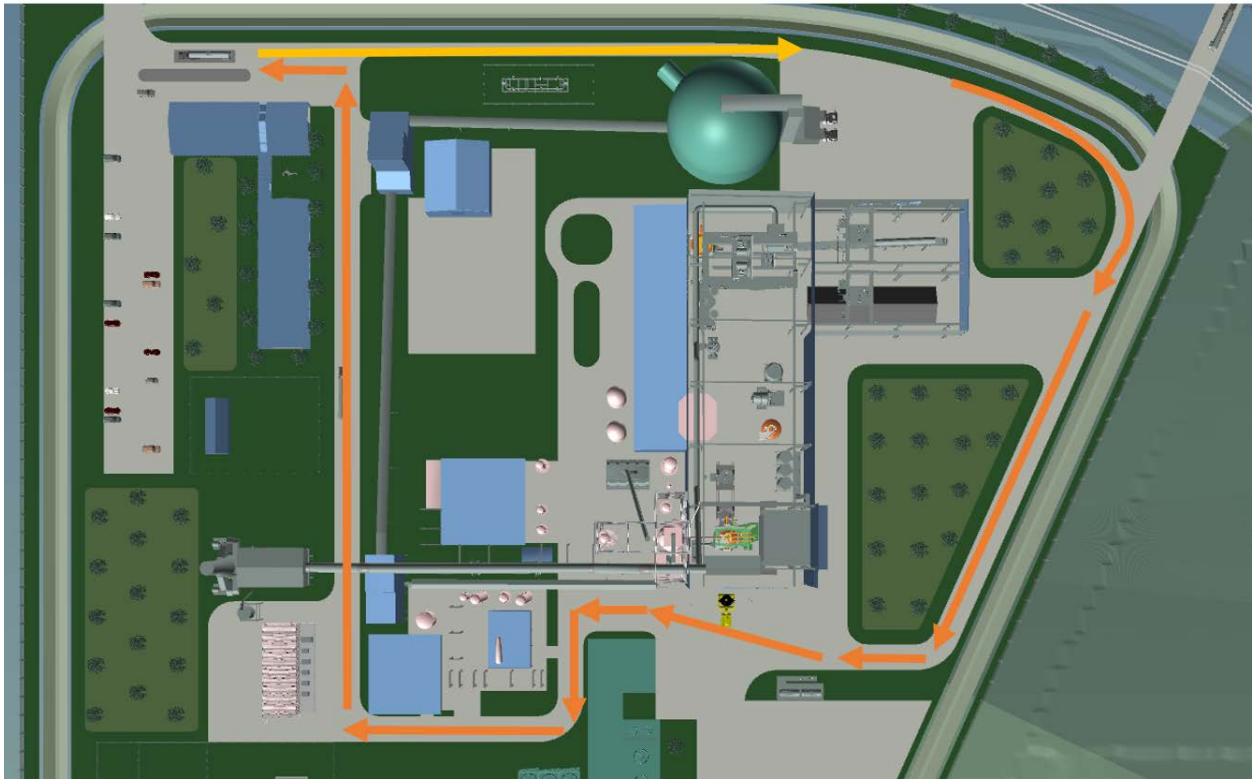


Figure 7.2-12.: plan view of the alternative route for three IO pellets trucks

### 7.2.2.2 Sludge, Baghouse dust and binder trucks

Baghouse dust and WTP sludge are collected at the Baghouse and water treatment plant points indicated in figure 7.2-13. Binder for briquetting plant will come from the outside of the plant.

Trucks in the plant have to follow the clockwise one-direction route, so the trucks delivering the above mentioned materials to the briquetting plant will follow the indicated route until reaching the internal road that gets to the briquetting plant

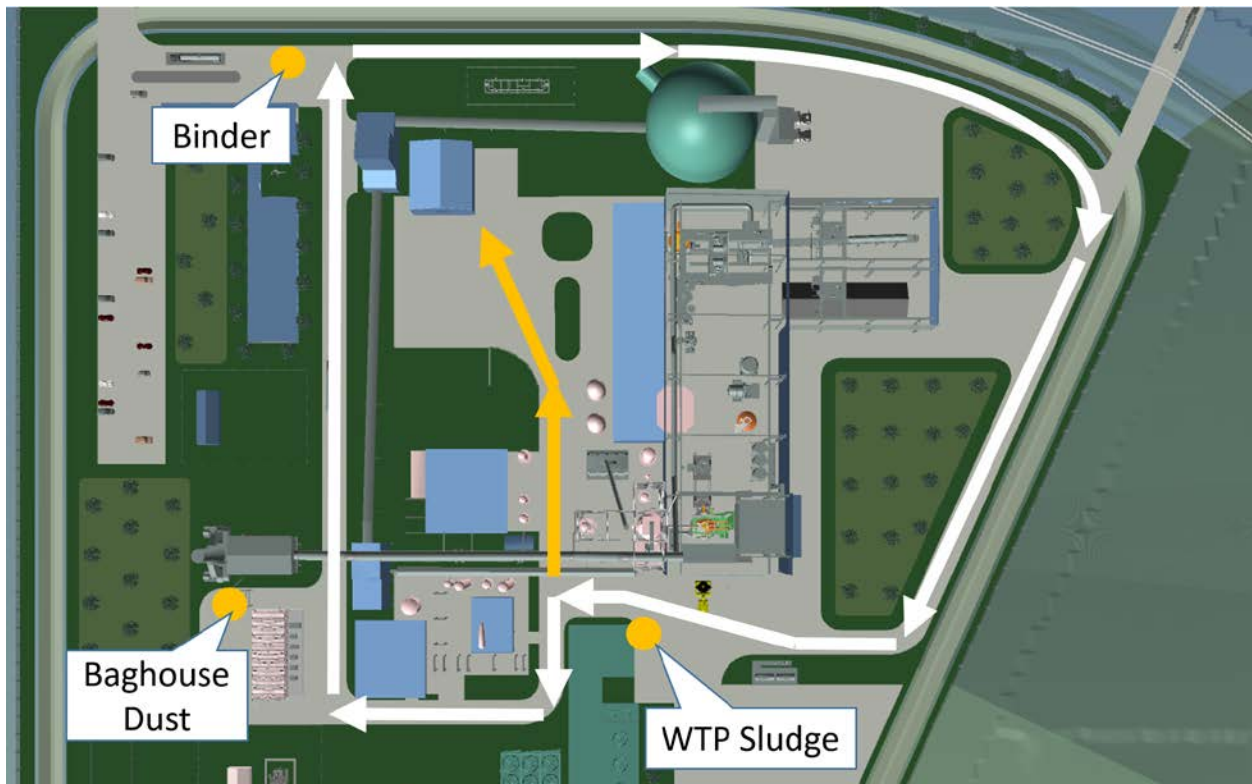


Figure 7.2-13.: plan view of the delivery of Baghouse dust, WTP sludge and binder

### 7.2.2.3 Slag handling

Slag handling service will be performed by a third party company. Slag pot vehicles (or front end loaders moving EAF slag, will have a very short and dedicated path in and out of the plant and to the slag yard, located on the south east corner of the plant

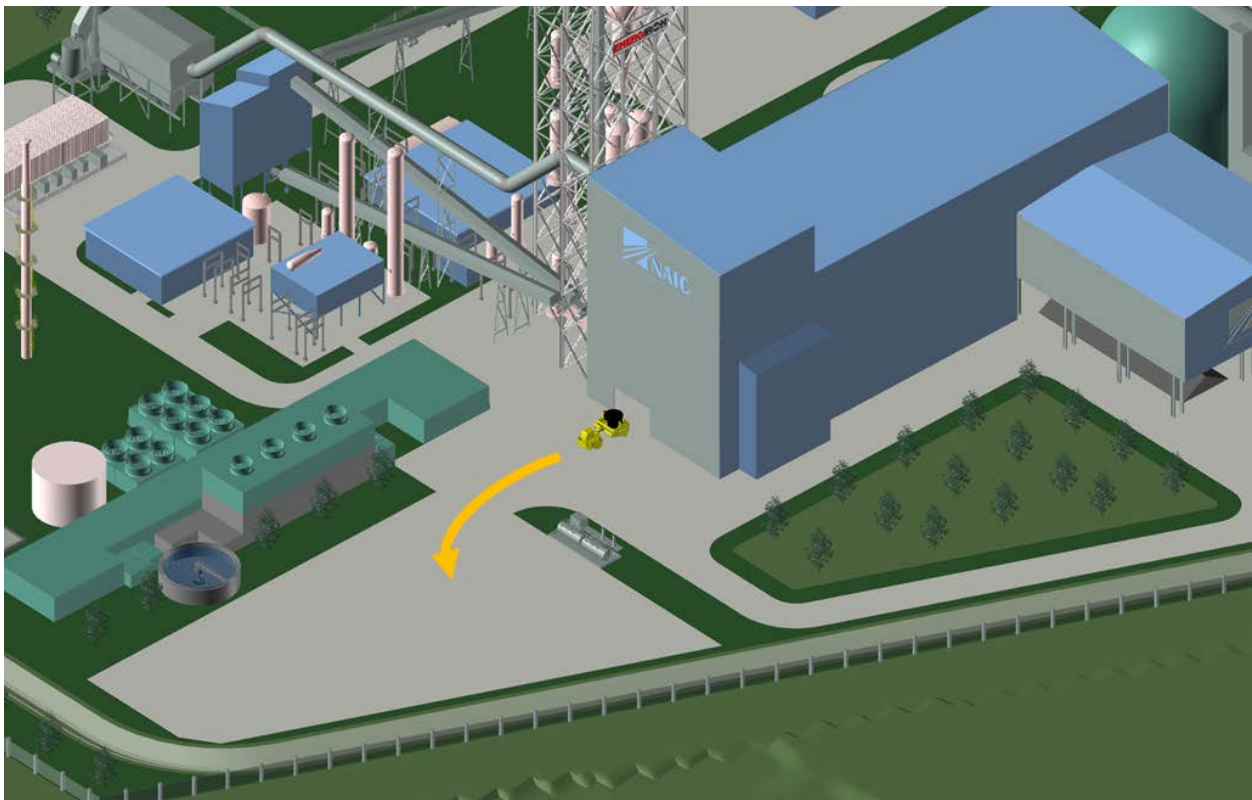


Figure 7.2-14.: 3D view of the path for slag vehicles

#### 7.2.2.4 Industrial gasses, spare parts, refractory, electrodes delivery trucks

Oxygen and nitrogen trucks delivering industrial gasses to the tanks inside the plant (owned by third party servicing the plant operation) will have to follow the clockwise one-direction route and enter the internal road to deliver gasses.

Same path will be followed by delivery trucks for spare parts, refractory, electrodes and other supplies.



Figure 7.2-15.: plan view of the delivery of O2 and N2



REV.	DESCRIPTION	DATE	PROJ.	EXEC.	CHECK.	APPR.
1	ISSUED	4/4/18	OGU	OGU	GMB	TEI
0	FOR INFORMATION	9/5/16	OGU	OGU	GMB	TEI



**PURE FONTE LTÉE**  
**PIG IRON PRODUCTION PLANT – FEASIBILITY STUDY**  
**CUSTOMER N°: 1821**



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SECTION 7 – PLANT LAYOUT  
**CHAPTER 7.3**  
**SECTION 7 DRAWINGS**

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# CHAPTER'S DRAWING LIST

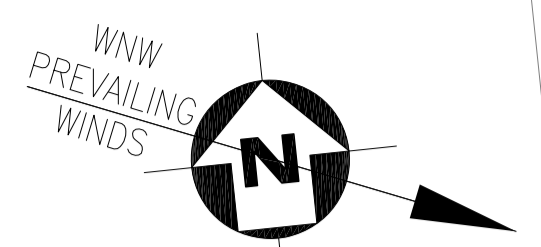
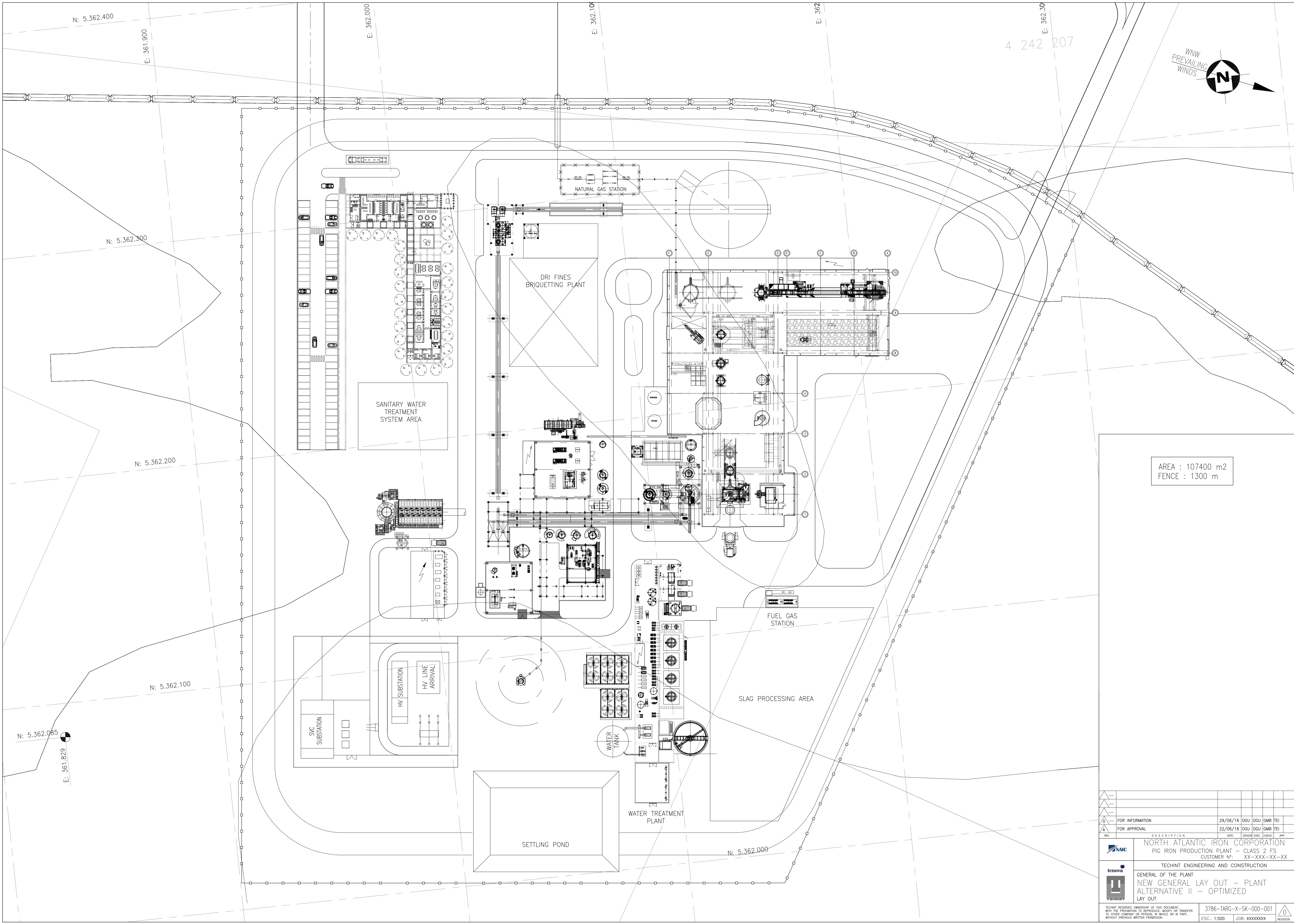
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**METAL PLANT**

3786-TARG-X-SK-000-001

NEW GENERAL LAYOUT – PLANT – ALTERNATIVE II- OPTIMIZED

Chapter 7.3



AREA : 107400 m2  
 FENCE : 1300 m

FOR INFORMATION	29/06/16	OGU	OGU	OMB	TEI	
FOR APPROVAL	22/06/16	OGU	OGU	OMB	TEI	
REV	DESCRIPTION	DATE	DESIGN	EXEC	CHECK	APP
<p><b>NORTH ATLANTIC IRON CORPORATION</b>          PIC IRON PRODUCTION PLANT – CLASS 2 FS          CUSTOMER N°: XX-XXX-XX-XX</p> <p>TECHINT ENGINEERING AND CONSTRUCTION</p> <p><b>tenova</b>          GENERAL OF THE PLANT          NEW GENERAL LAY OUT – PLANT          ALTERNATIVE II – OPTIMIZED          LAY OUT</p> <p><small>TECHINT RESERVES OWNERSHIP OF THIS DOCUMENT. WITH THE PROHIBITION TO REPRODUCE, MODIFY OR TRANSFER TO OTHER COMPANY OR PERSON, IN WHOLE OR IN PART, WITHOUT PREVIOUS WRITTEN PERMISSION.</small></p>						
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