



*Chapter 3*

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*Context*

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## 03 Context

### *History of the old Johannesburg Gas Works*

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The old Johannesburg Gas Works has a unique character that is dictated by its primary landform and various climatic, historical, social and ecological forces. All these factors contribute to the sense of place that exists on site and provides a way in which to assess its intrinsic potential (Haggard, Reed & Mang 2006:2). It is this agglomeration of factors that creates a dynamic image of potential human activities that could match the land's aspirations in order to create a thriving marriage between natural and built systems.

After the discovery of gold in Johannesburg in 1886, news spread at a rapid rate and the area experienced an unparalleled gold rush (Jones 2003). The area which originated as a tented camp to service the needs of the Witwatersrand mines, managed to establish itself as the largest city in Southern Africa and assume its role

as a pioneer of industry, finance and commerce within a mere fourteen years after its establishment. The city's phenomenal growth led to the rapid transformation of Johannesburg as a tented camp, with temporary corrugated iron structures in 1886, to an agglomeration of permanent multi-storey buildings made from brick-and-mortar in 1890 (SAHO 2011).

Gas was the first form of power supplied to the Johannesburg mining camp, which at that point in time, had access to quite rudimentary services. With the rapid growth in population the need for gas became more evident (Tsica Heritage Consultants 2011: 7).

On 15 October 1888 the President of the Transvaal Republic, Paul Kruger, signed a concession giving William Edward Dawson and his business

*Figure 3.1: Left: Condensers (Author 2017)*

partner John James Hamilton exclusive rights to produce and distribute gas in Johannesburg for the next fifty years. The next 44 months saw the beginning of construction and the acquiring of the necessary machinery for the Gas Works. The first Gas Works in President Street was finally opened in 1892, but unfortunately this was the same year Dawson and Hamilton's company was dissolved and the Johannesburg Lighting Company took over the concession which was extended to 99 years. The Johannesburg Lighting Company commissioned a company in England to design the gas plant and shipped the machinery from England to East London, from where it was transported by ox wagon to Johannesburg (Tsica Heritage Consultants 2011: 7).

The President Street Gas Works situated in Newtown first started operating on 23 June 1892 and the plant continued to supply Johannesburg with gas until its closure on 23 December 1928. The need for the expansion of the Gas Works became apparent after World War I as the demand for gas increased. However the President Street site was found unsuitable for expansion and the search for a more appropriate site was initiated (Tsica Heritage Consultants 2011: 7).

After extensive consideration the Cottesloe site was finally deemed an appropriate site for the new gas works. Construction of the new Gas Works started in 1926 and it became operative on 23 December

1928, the same day the President Street Gas Works closed down (Tsica Heritage Consultants 2011: 8). The Cottesloe site had sufficient space, was located on the outskirts of town and according to the engineer's opinion, the slight slope aided the gravitational flow of the liquids involved in the process of making gas. The gas cylinders were positioned on the lowest part of the site out of public view, but the strategy for concealing the cylinders later became ineffective as additional cylinders of a much larger scale were constructed on site (Tsica Heritage Consultants 2011:8). The method of gas production eventually became antiquated and production was ceased with the plant's closure in 1992.

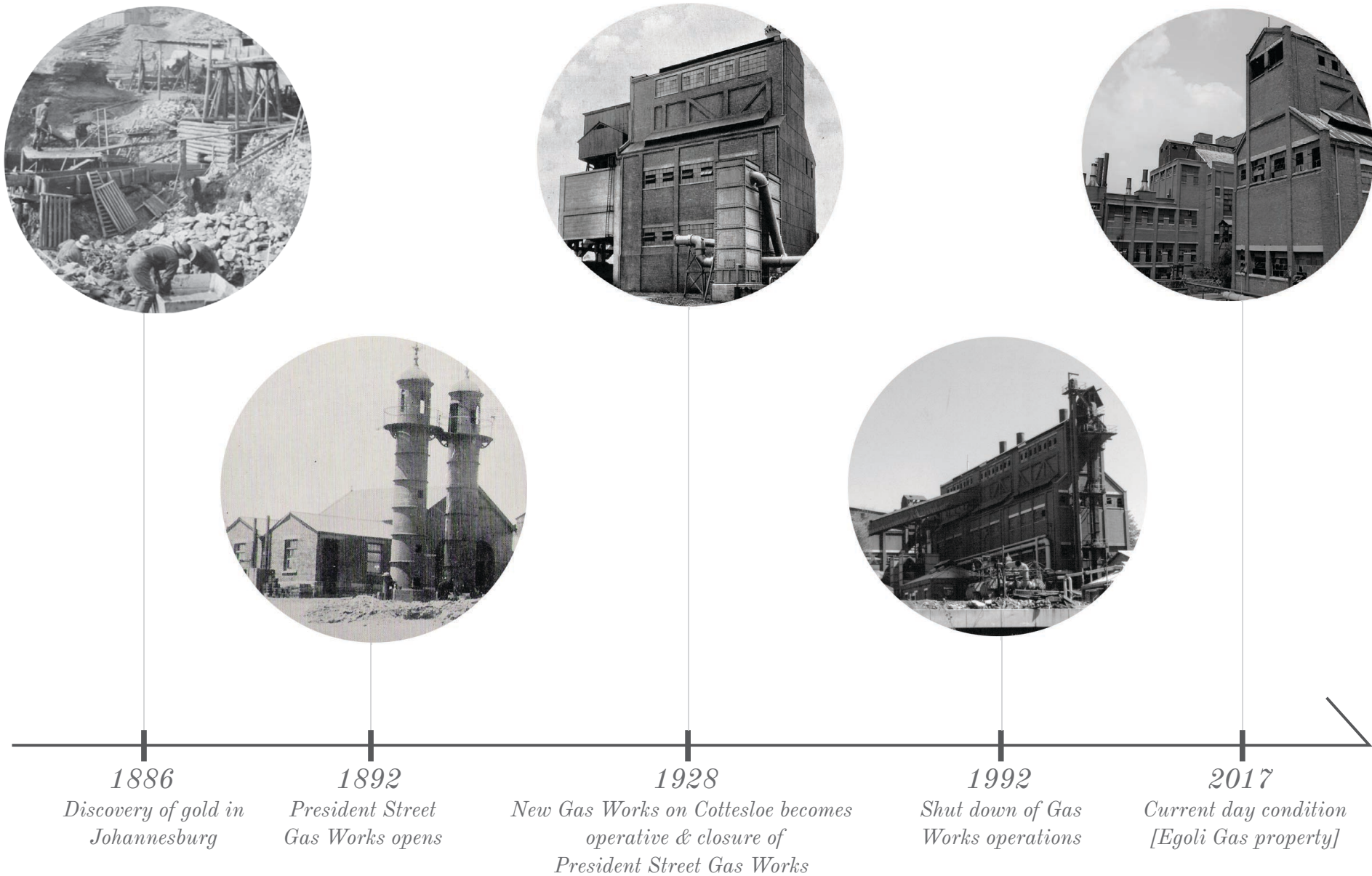
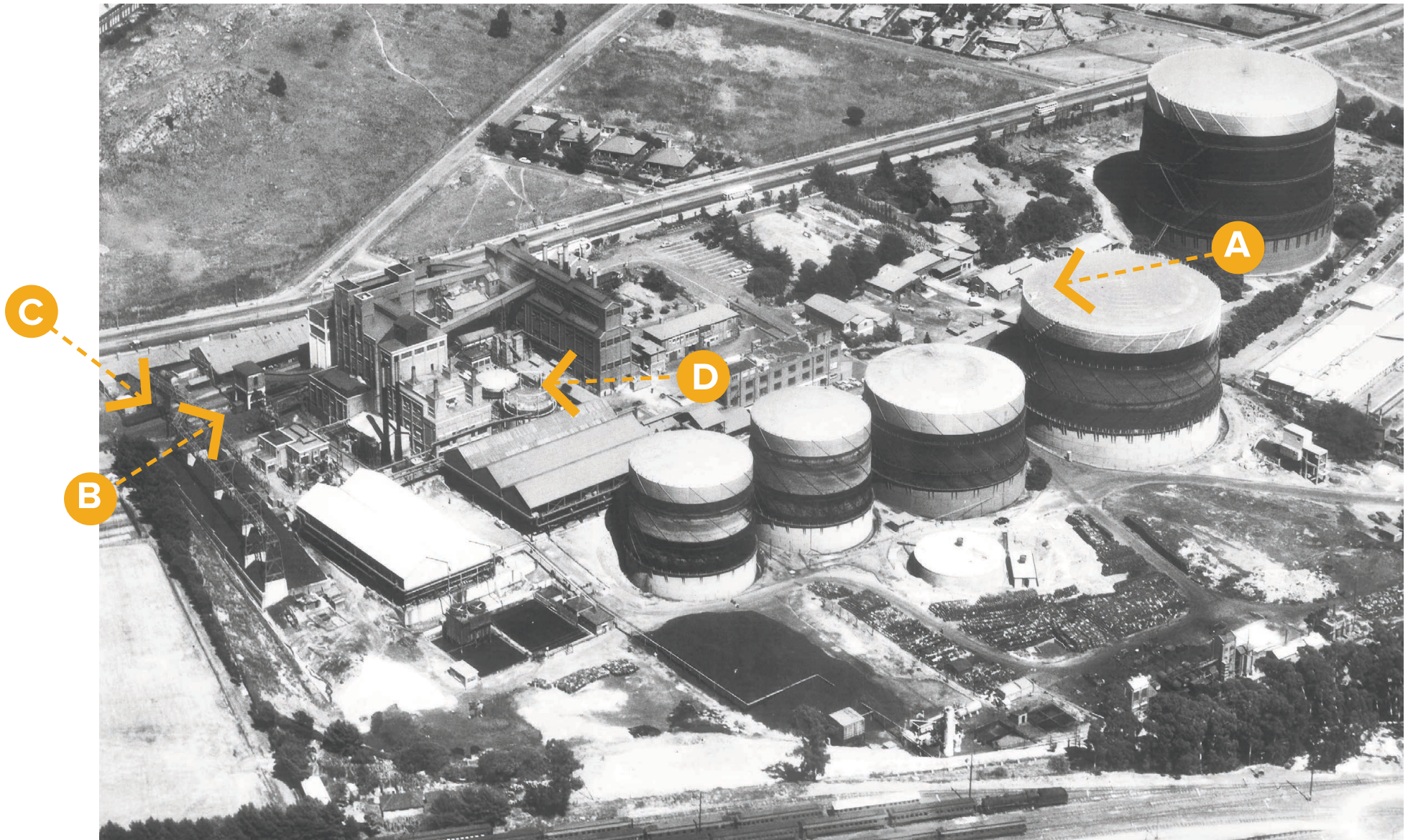


Figure 3.2: Timeline of Gas Works' development (Author 2017)

*1960 Aerial photograph of the Johannesburg Gasworks*



*Figure 3.3: Aerial photo of Gas Works in 1960 (City of Johannesburg Gas Department 1960, edited by Author)*

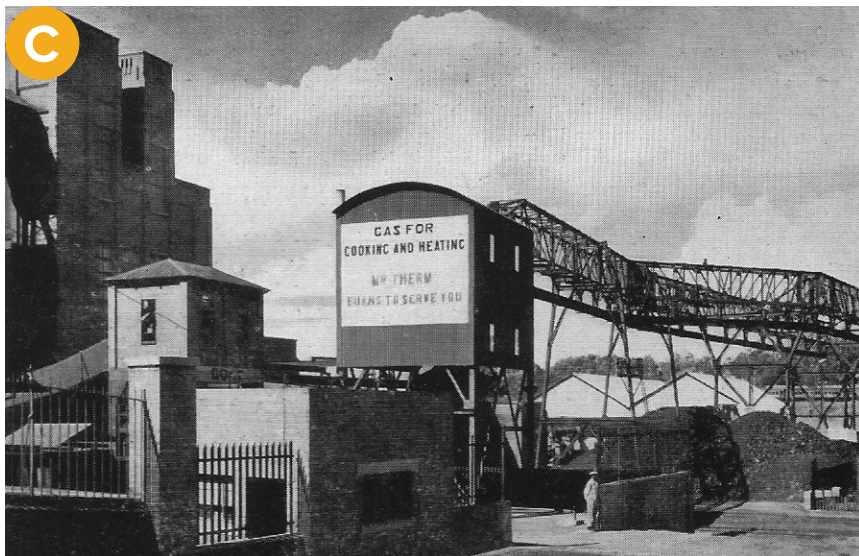
*Historic images of the Johannesburg Gasworks during the 1950s:*



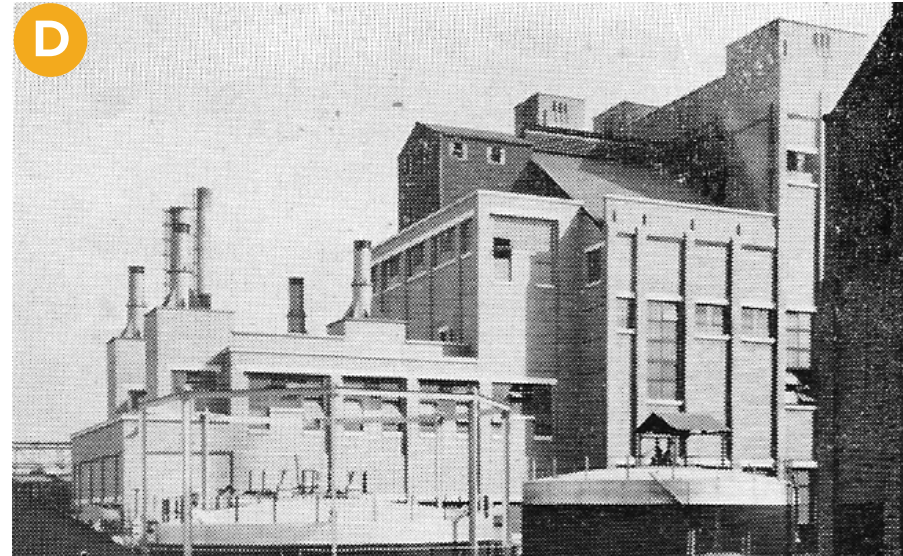
*Figure 3.4: View from gasholder towards retort 1 & 2 (City of Johannesburg Gas Department 1950's)*



*Figure 3.5: Coke screening & loading plant (City of Johannesburg Gas Department 1950)*

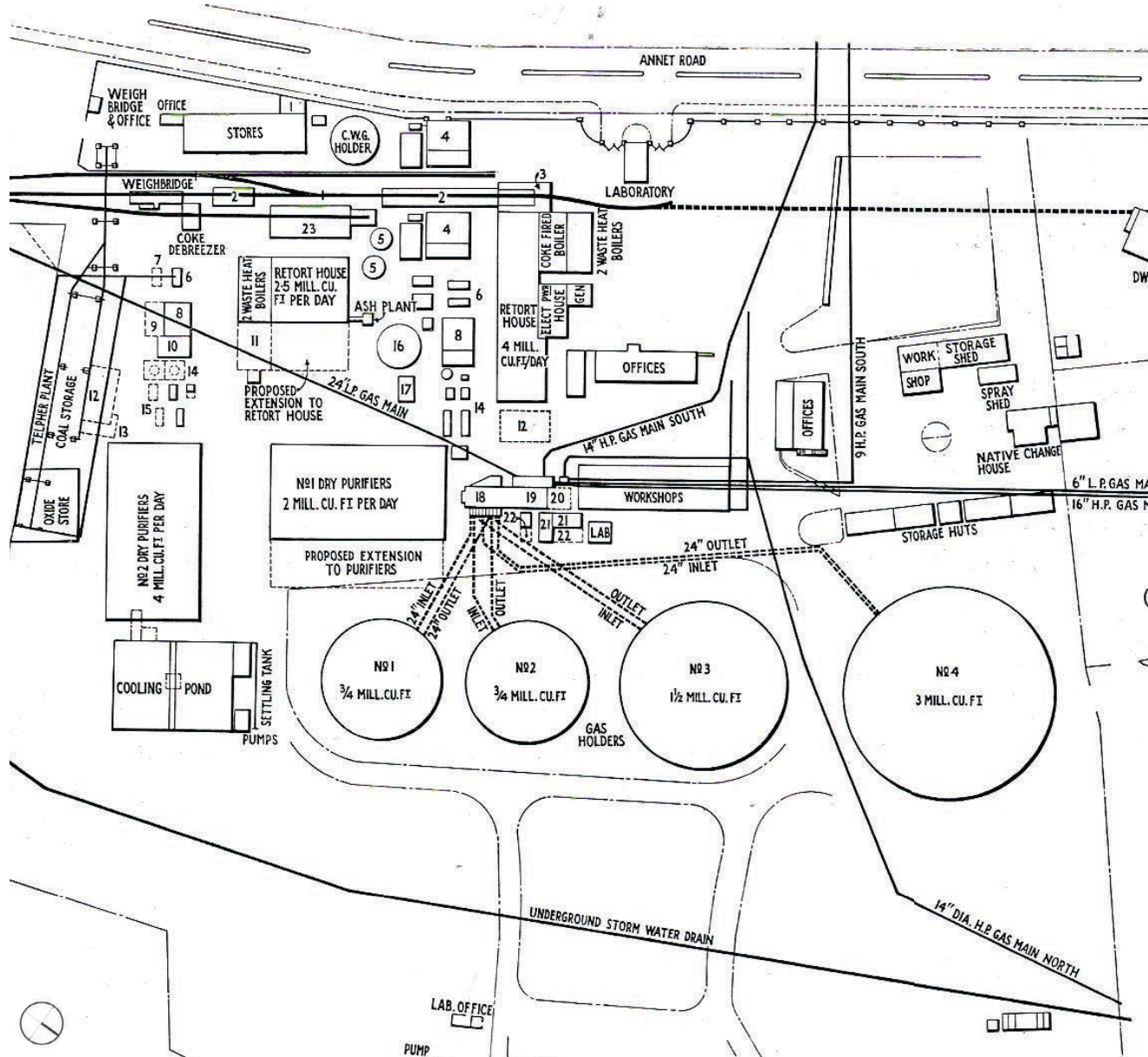


*Figure 3.6: Coke handling plant with weighbridge in foreground (City of Johannesburg Gas Department 1950's)*



*Figure 3.7: Exterior of Tully gasification plant in 1959 (City of Johannesburg Gas Department 1959)*

# 1954 Block plan of the Johannesburg Gasworks



## Legend:

1. Oil store
2. Coal hoppers
3. Coke storage (210 tons)
4. C.W.G. plant
5. Fule oil tanks
6. Condensers
7. Future condensers
8. Exhausters
9. Future Exhausters
10. Powerhouse
11. Proposed future boiler house
12. Underground tar and liquor wells
13. Underground pump house
14. Future detarrers
15. Livesey and static washers
16. No. 1 C.W.G. holder
17. Detarrer generator house
18. Meters
19. Boosters
20. Pumps
21. Dehydration plant
22. Future dehydration plant
23. Cake grading and storage

Figure 3.8: Block plan of Johannesburg gasworks (City of Johannesburg Gas Department 1954, edited by Author)

*Historic images of the partial demolition of Johannesburg Gasworks during the 1990s:*



*Figure 3.9: Tully plant and Retort 2 (Peter Finsen 1990s, edited by Author)*



*Figure 3.10: Tully plant (Peter Finsen 1990s, edited by Author)*



*Figure 3.11: Retort 2 and Tully plant (Peter Finsen 1990s, edited by Author)*



*Figure 3.12: Coke grading & storage, Retort 2 and power house (Peter Finsen 1990s, edited by Author)*



## *The Gas Works Today*

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The expansion of Johannesburg has left the gasworks site nestled between the University of Johannesburg to its west and the University of the Witwatersrand to its east. The buildings on site, some of which date back to as early as the 1920s, are constructed in a Pre-World War II Industrial style (Munro 2016) with the two retort<sup>3</sup> houses constructed from red brick with enormous steel beams stretching from floor to ceiling, reaching a height of up to six storeys (Joburg 2011). Since the closure of the gasworks the buildings have been inactive, desolate and neglected.

The hazardous process of coal to gas has left remnants of its destruction on the Old Johannesburg Gas Works site, in the

form of tar and other harmful pollution.

The site is currently isolated and the empty shells of industry are abandoned and left to be consumed by nature and the clutches of time. This creates a visual contrast between the buildings and the landscape, surrendering to that which it once oppressed. This site provides the perfect opportunity for restitution between not only industry and nature but also industrial heritage and the city dwellers. This is in an attempt to reactivate the site's latent potential of being a productive and relevant site once again. Applying the principles of ecosystemic and living systems thinking, the challenge arises for the development of a new typology for

abandoned industrial heritage sites such as the Old Johannesburg Gas Works.

Heritage consultants are trying to prove the importance of these industrial structures and the vital role they play in providing the city scape of Johannesburg with visual and historical landmarks. Läuferfs Le Roux & Mavunganidze (2009:533) believe that including these buildings in the city's regeneration will aid in protecting the cultural heritage of the city. They urge the City of Johannesburg to look beyond its boundaries in order to grasp the importance of re-using industrial heritage (Läuferfs Le Roux & Mavunganidze 2009:533).

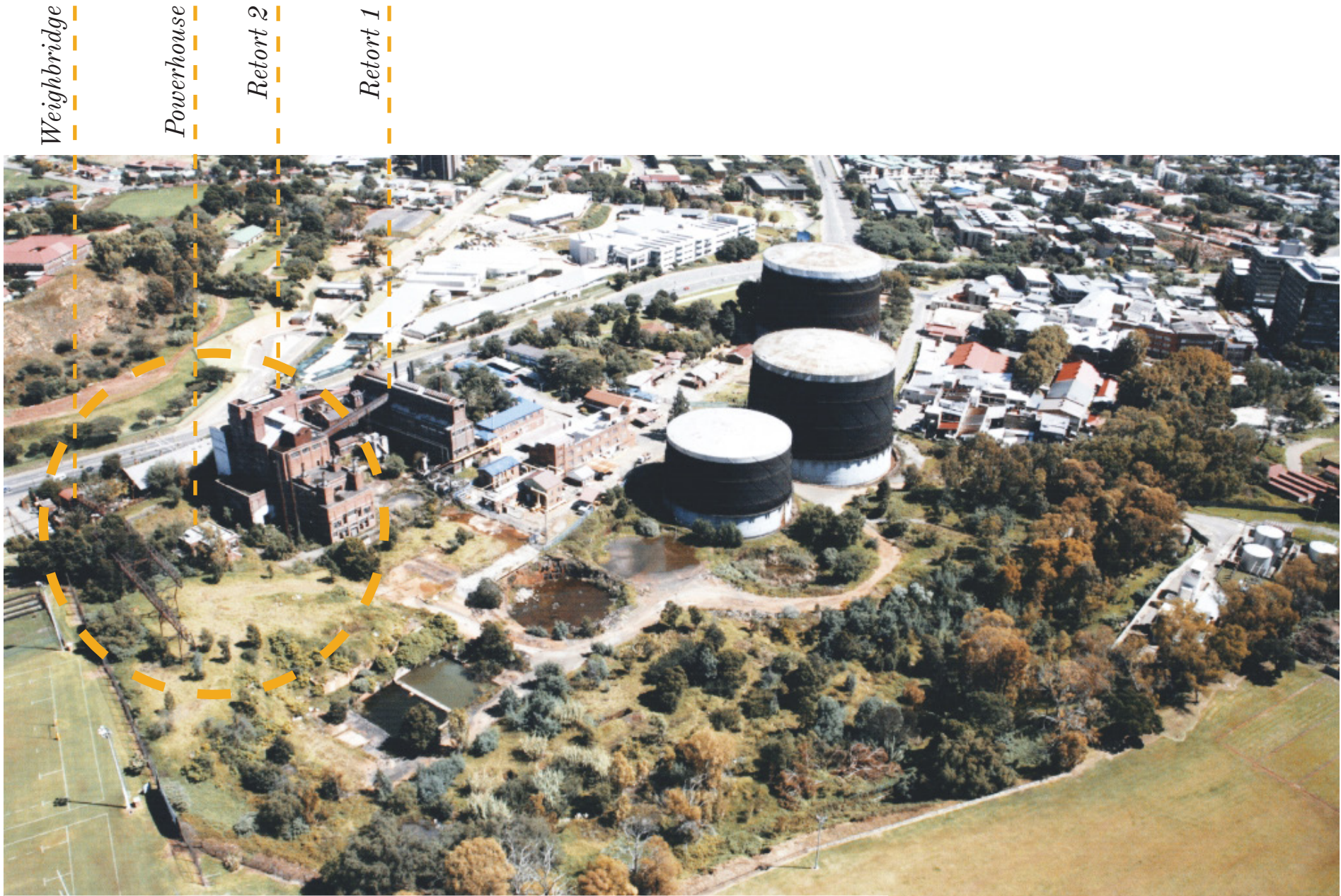


Figure 3.13: Aerial view of Johannesburg Gasworks 2009 (Egoli Gas 2009, Edited by Author)

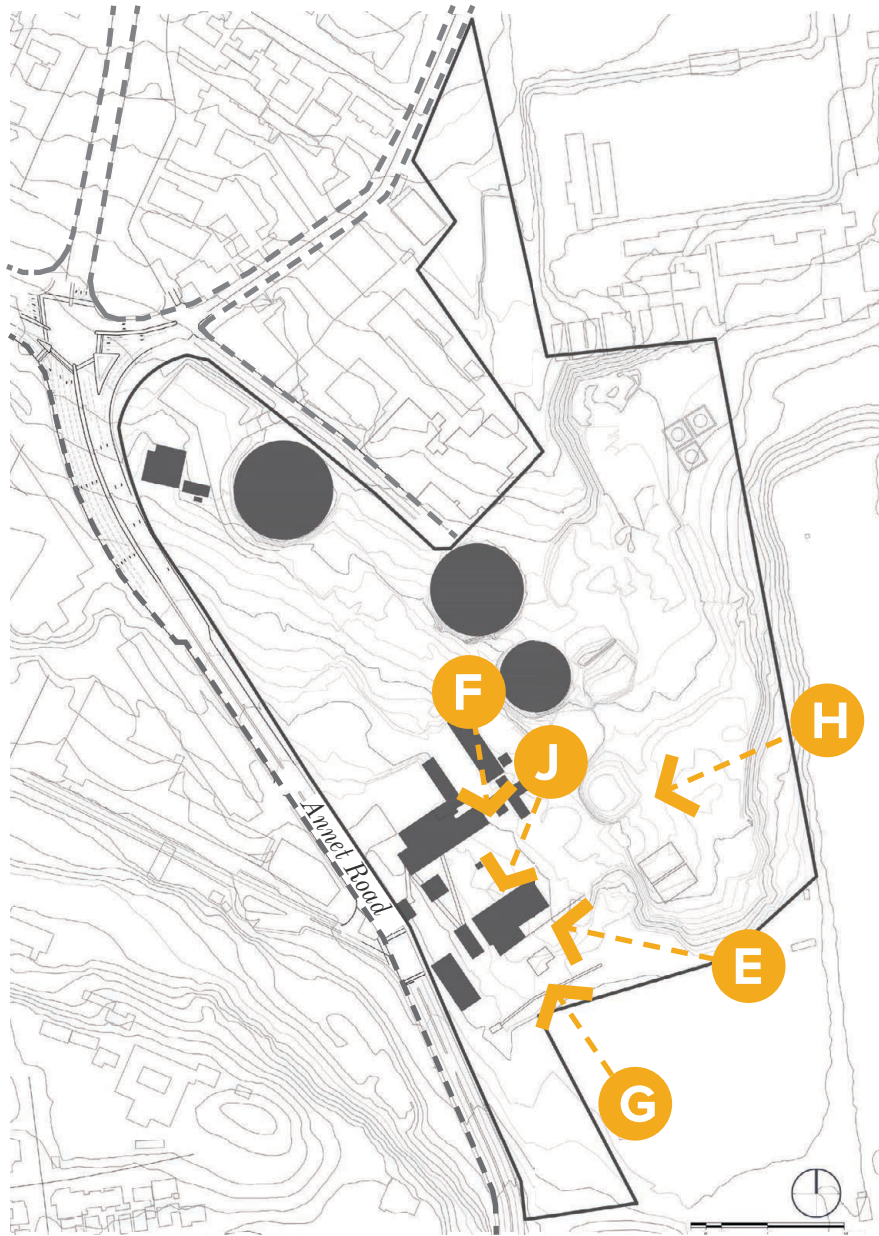


Figure 3.14: Site map of Gas Works (Author 2017)



Figure 3.15: View E (Author 2017)



F

Figure 3.16: View F (Author 2017)



H

Figure 3.18: View H (Author 2017)



G

Figure 3.17: View G (Author 2017)



J

Figure 3.19: View J (Author 2017)



Figure 3.20: Spatial economy (Author 2017)

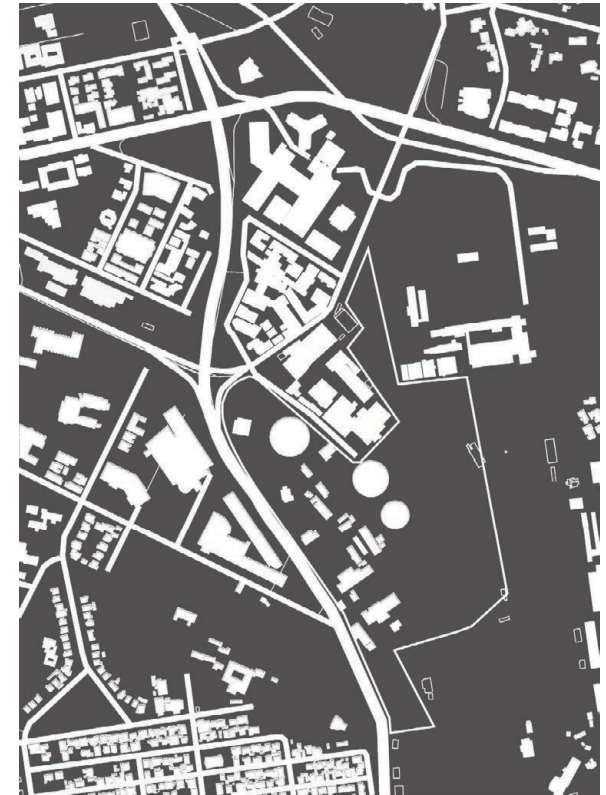


Figure 3.21: Nolli map (Author 2017)

- Old Johannesburg Gasworks buildings
- Educational buildings
- Public transport
- Residential
- Mixed use buildings
- CSIR
- Commercial
- Religious buildings

## *The old Johannesburg Gas Works's Latent Potential*

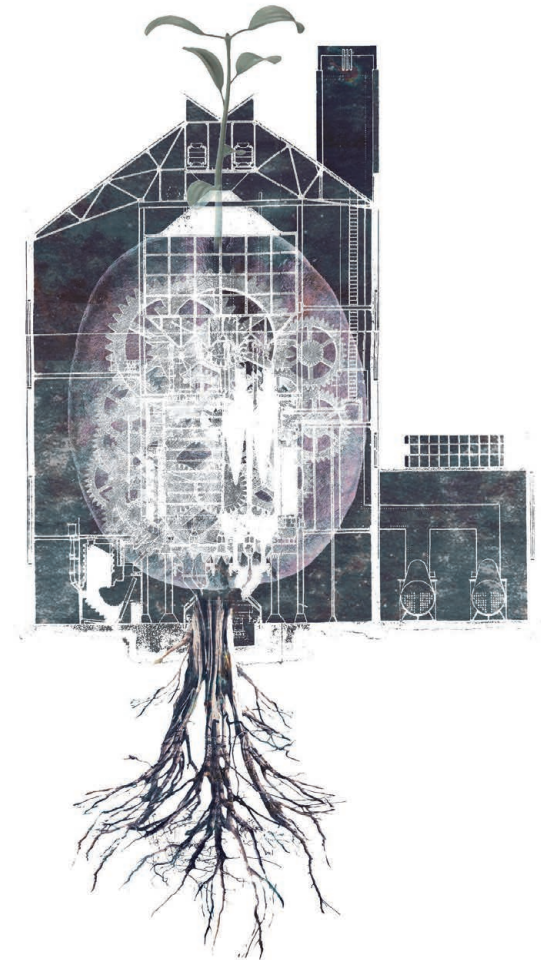
When applying regenerative and resilience thinking to create a thriving city, the professional is endowed with the responsibility of identifying certain aspects or systems that may need to collapse in order to make way for new life to sprout from the site's latent potential (Du Plessis 2013:38).

The latent potential of the old Johannesburg Gas Works is rooted in its industrial heritage and its legacy of production. However, the historical process of coal to gas is no longer relevant and the remnants of pollution on site, exposes the dichotomous relationship between industry and nature and exemplifies the need for restitution between these two opposites in order for the system's health to regenerate.

Regenerative projects not only focus on the natural environment, but also strive to

deliver new capabilities to the communities that surround them. They understand the need for the integration of economic activities that accompany development into the continuous stability and health of local communities (Haggard, Reed & Mang 2006:1). An appropriate programme for the Old Johannesburg Gas Works will therefore have to be of a productive nature, providing the architecture with an opportunity to mediate between industry and nature whilst regenerating living and socio-economic systems on site.

In order to identify which socio-economic systems to regenerate, the context of Johannesburg's inner city should be analysed to identify shortcomings and opportunities for socio-economic growth.



*Figure 3.22: Latent productive potential of Gas Works (Author 2017)*

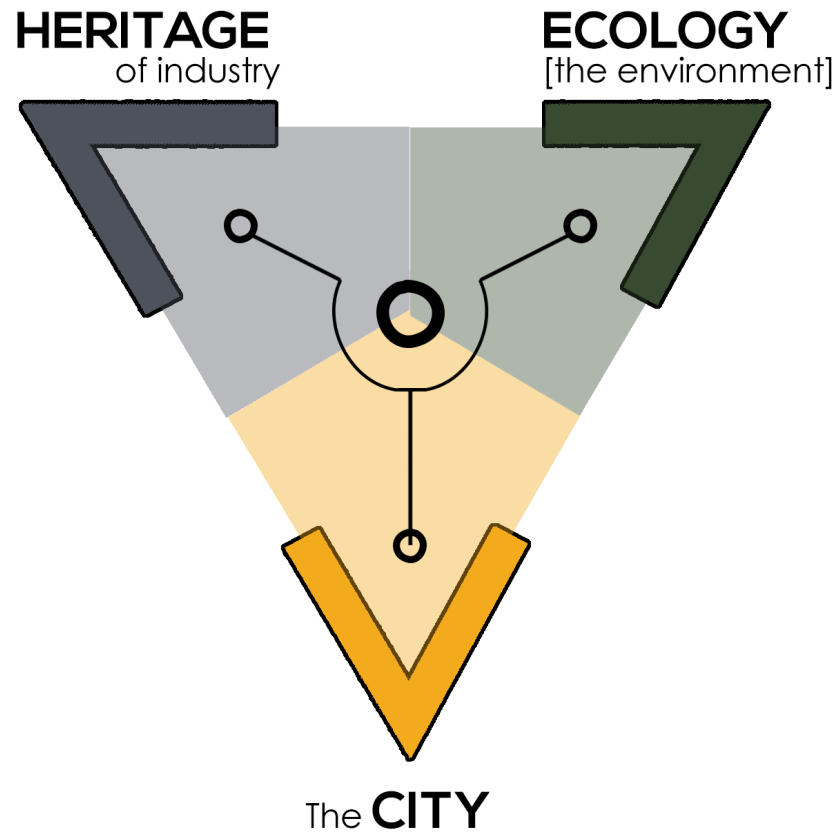


Figure 3.23: Restitutive relationships (Gaswork's group 2017)

## Urban Vision

### *Restitution Park*

The current degenerative conditions on site have prompted the need for restitution of various relationships before the site can achieve its maximum regenerative potential. Three dominant categories were identified in the latent potential of the site. These categories include, industrial heritage, ecology and the city dwellers. In order for the site to develop into a future regional node as proposed in the 2040 Spatial Development Framework for Johannesburg, the severed relationships that exist between these main categories need to be restituted. The group proposes that this be achieved through the development of architectural interventions focused on providing a platform for restitution to occur.

The site was analysed and zoned according to the categories most prevalent in that particular zone and the opportunity for restitution between contiguous categories (see Fig.3.25). Each group member was assigned a site from where individual project programmes were developed according to the relationships in need of restitution.

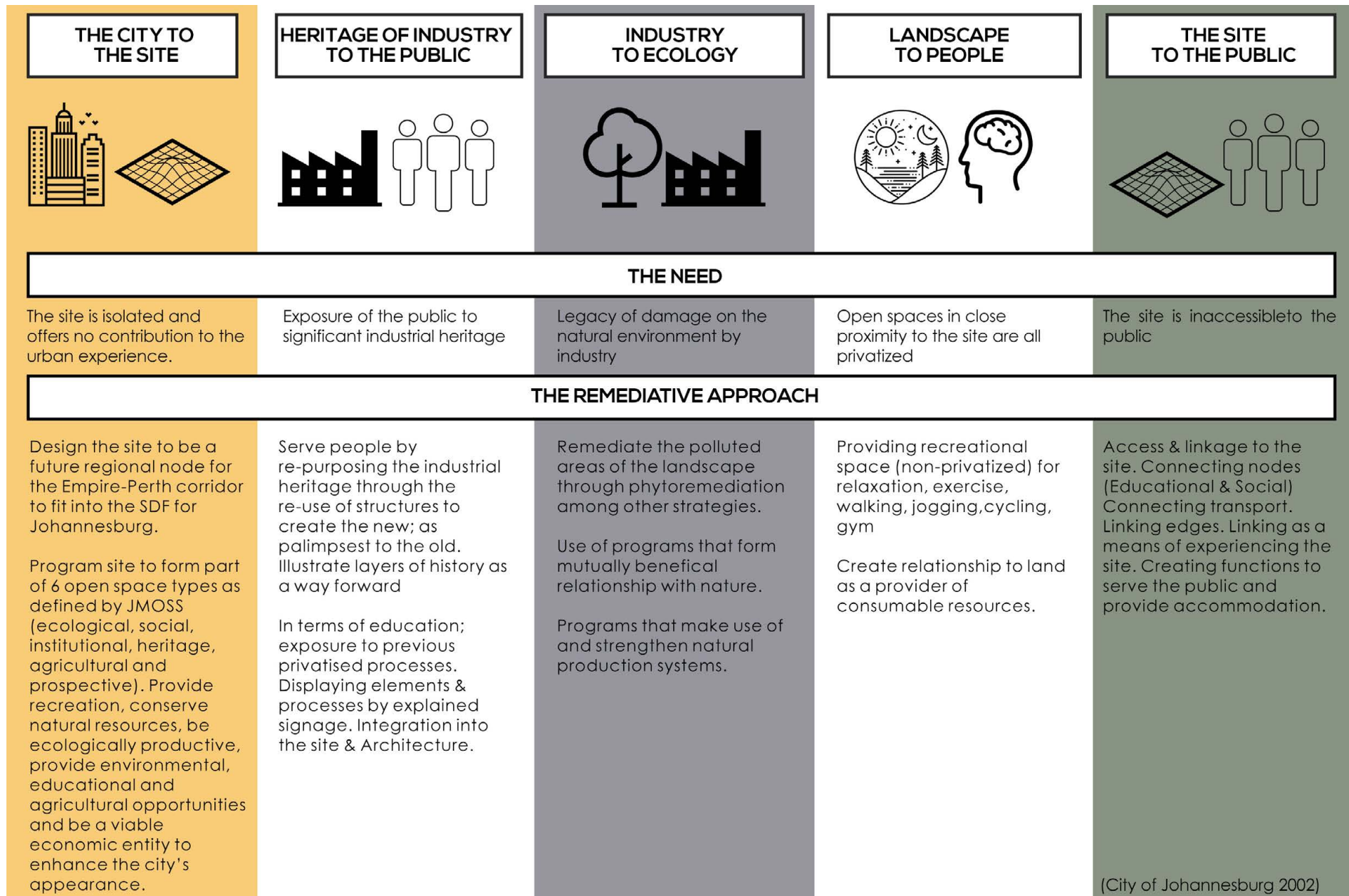


Figure 3.24: Relationships in need of restitution (Gaswork group 2017)



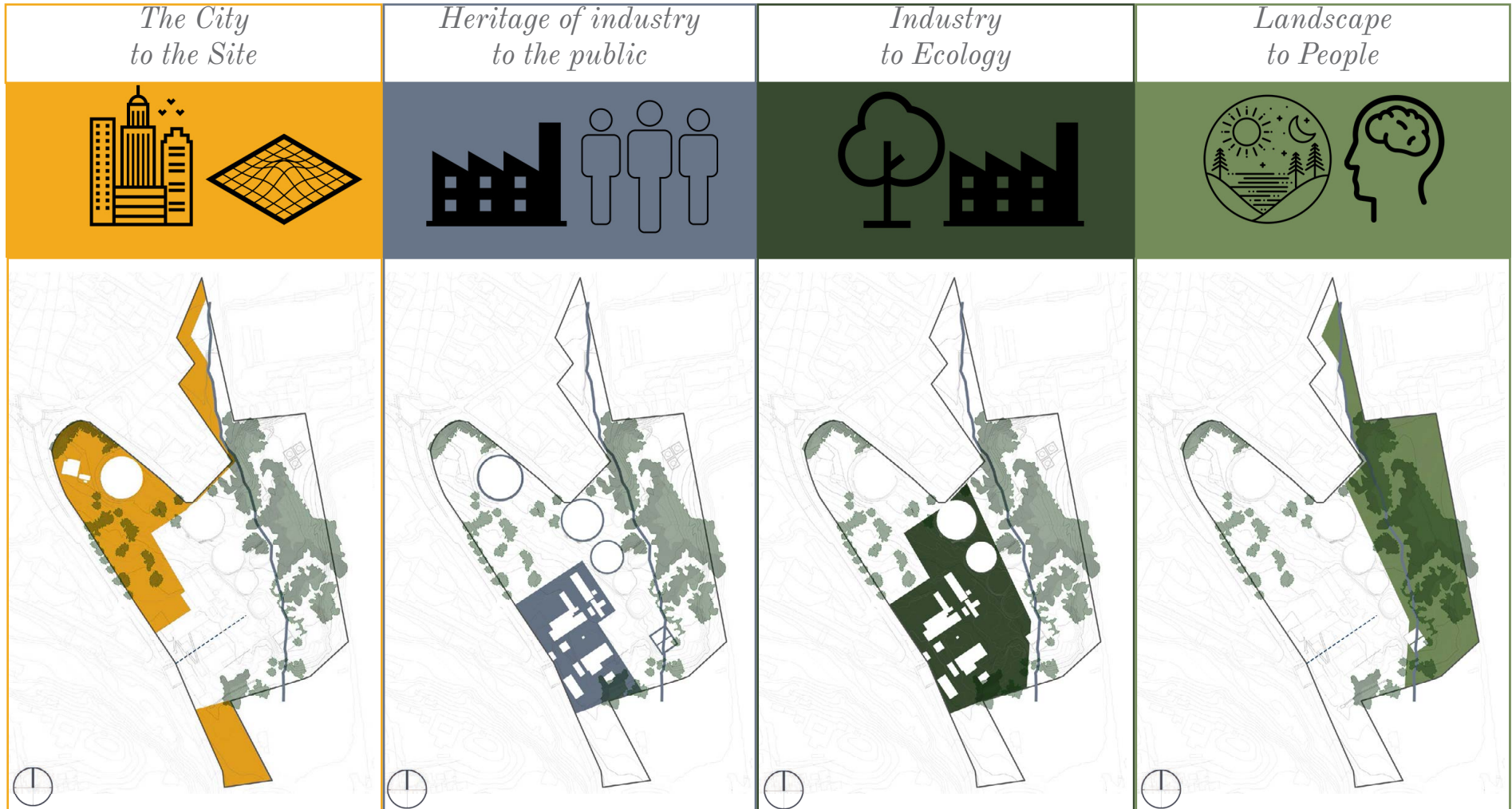


Figure 3.25: Restitution zones (Gasworks group 2017)

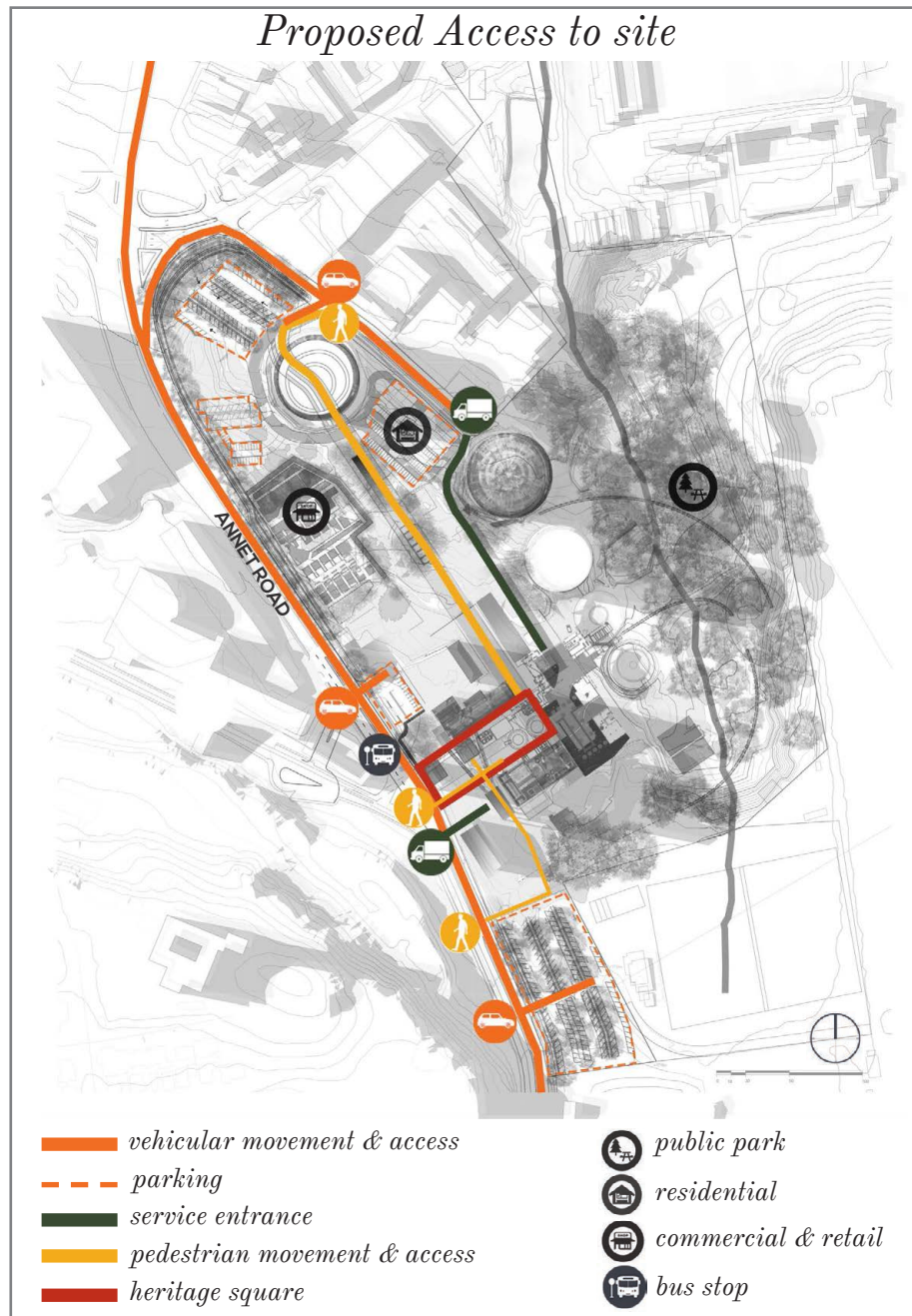


Figure 3.26: Site entrances (Gaswork group 2017)



Figure 3.27: Site project zones (Gaswork group 2017)



Figure 3.28: Site zones (Gaswork group 2017)

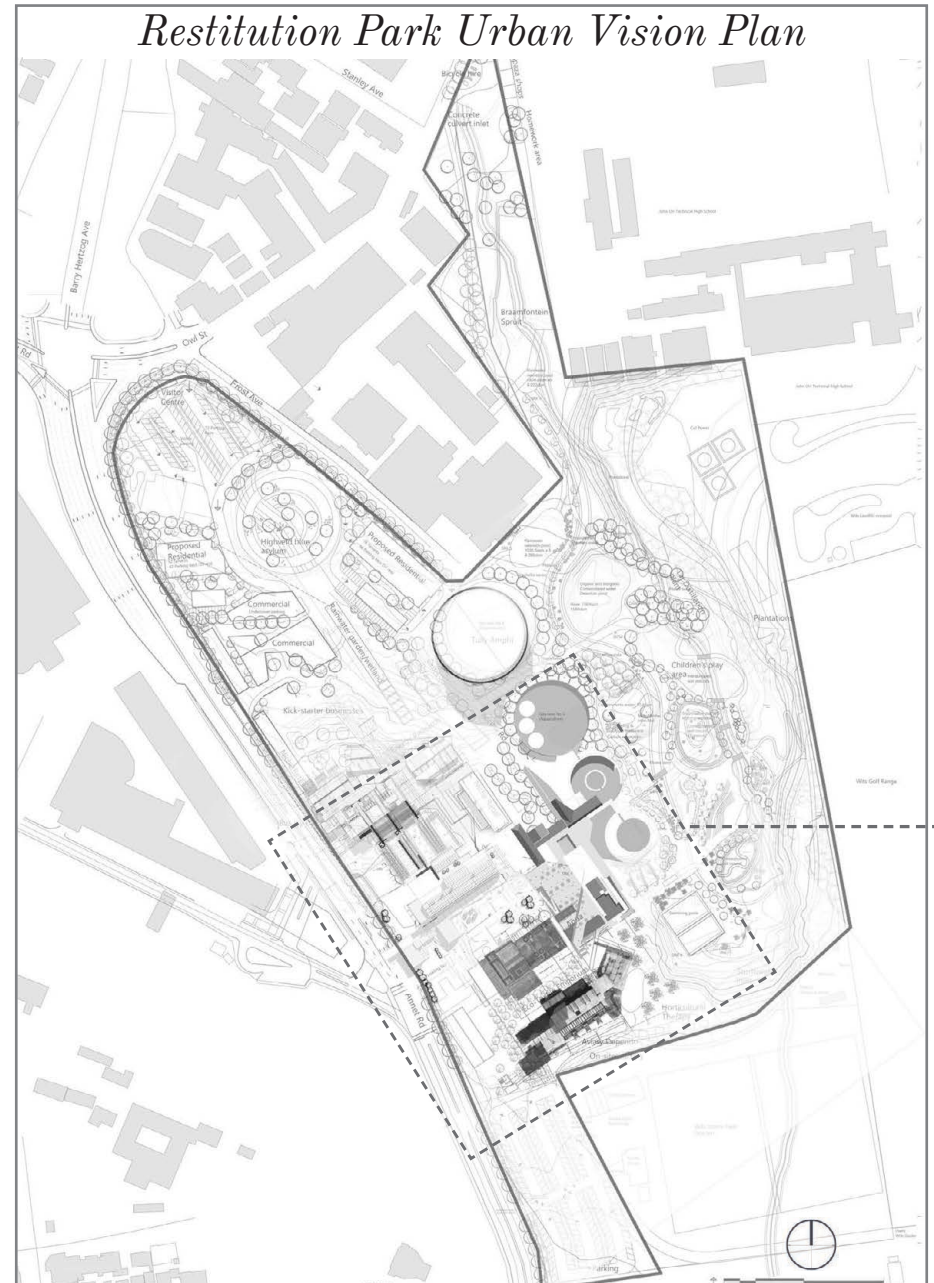


Figure 3.29: Urban Vision Plan (Gaswork group 2017)

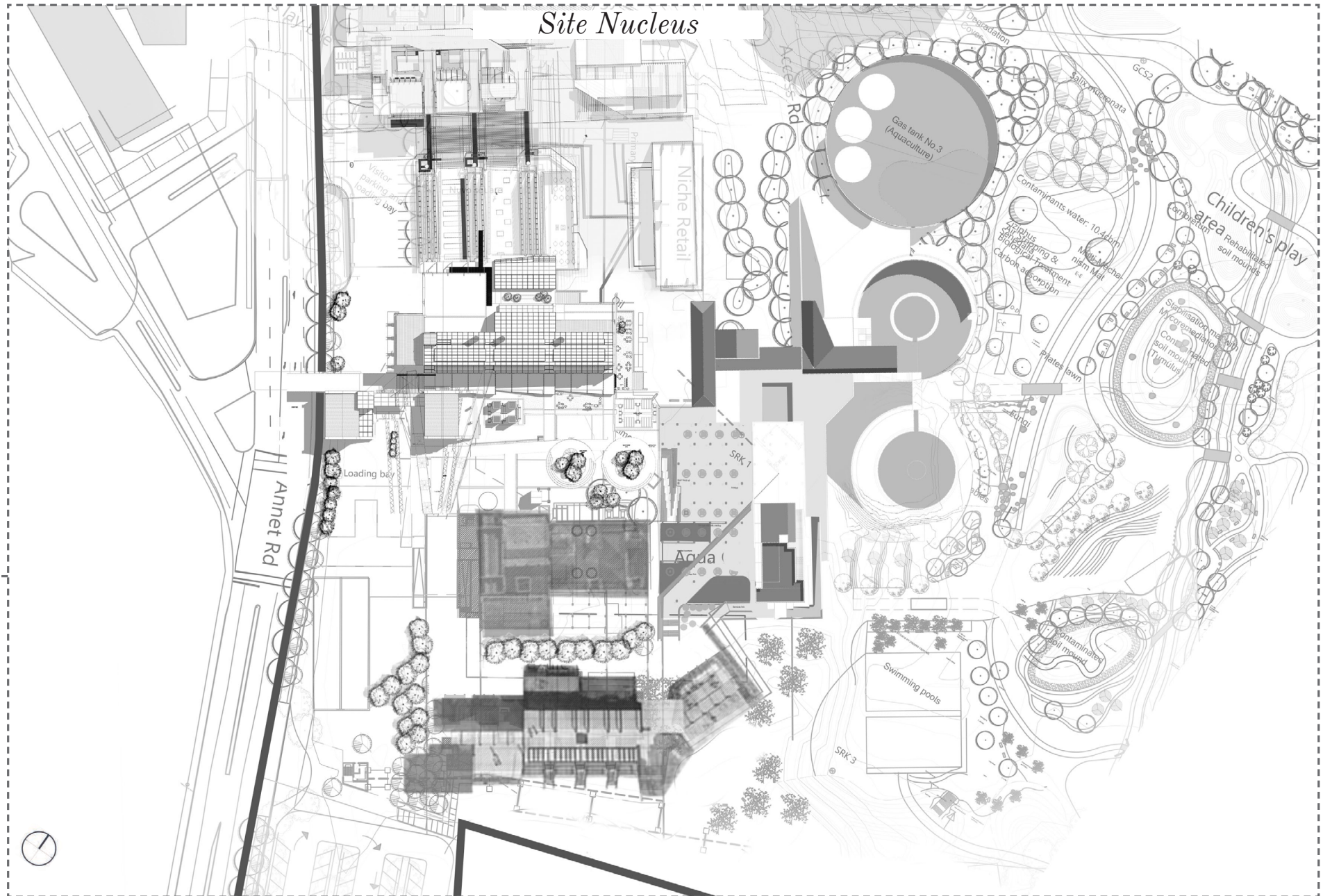
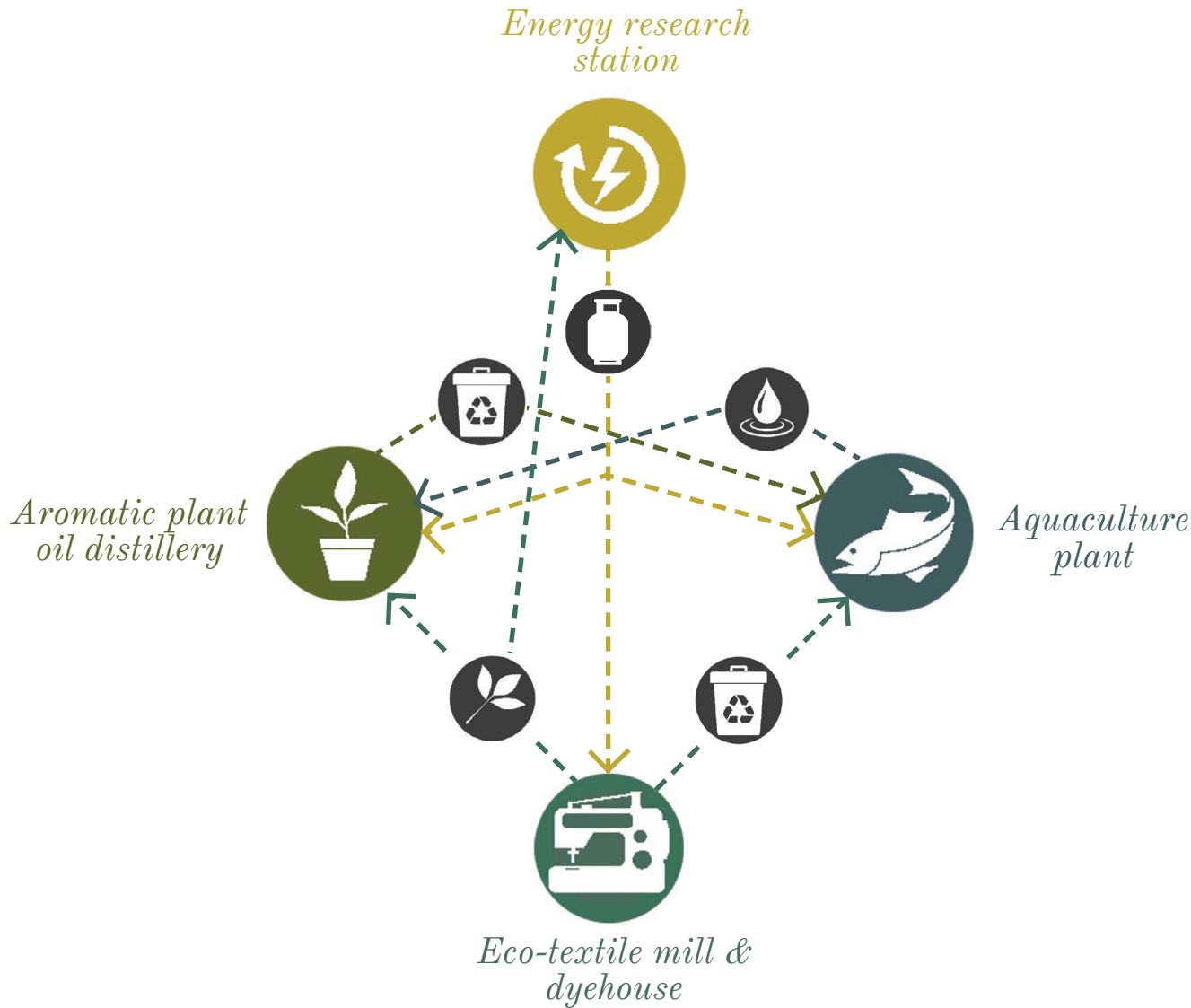






Figure 3.30: Site Nucleus Plan (Gaswork group 2017)

## Resource & waste exchange



## Resource legend

-  - Organic waste
-  - Water
-  - Gas
-  - Hemp & Flax seeds

## Industrial ecology strategy

In order to prevent industry from dominating and polluting the surrounding ecology once again, the urban vision proposes a strategy to share resources and waste which is similar to the principle of industrial ecology. This strategy ensures waste reduction and resource optimization through the implementation of mutually beneficial relationships between the proposed new industries on site.

Figure 3.31: Resource and waste exchange (Author 2017)

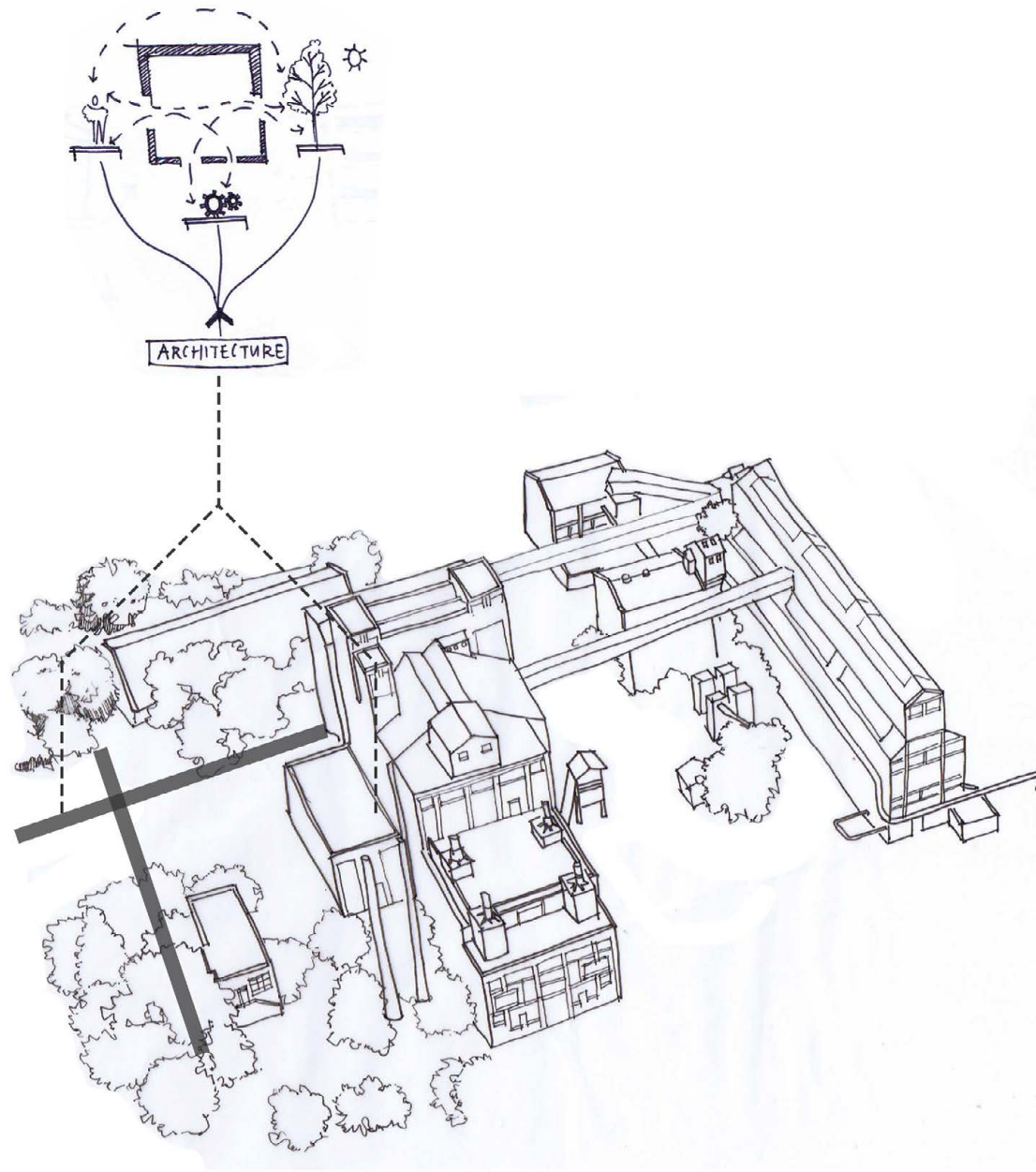


Figure 3.32: Mediation between industry and nature on site (Author 2017)

## Site Vision

### *Mediation between industry & nature*

From the preceding chapters it is evident that a new approach to industry is needed in order to prevent future industries from making the same mistakes and negatively impacting the environment that surrounds it. This project aims to use architecture as a tool to mediate between industry and nature with the hope of inspiring new archetypes of industries on abandoned industrial sites. In order for the site to regain its productive potential and to allow for the restitution between the three relationships identified in the urban vision, the repercussions of the old industrial process in the form of pollution needs to be remediated and a new approach is needed to prevent future industries from going down the same destructive path as conventional industrial processes.

This project hopes to inspire a new more mutually beneficial relationship between industry and nature through design. The architecture therefore hopes to act as a platform where interactions between industry and nature can occur, as well as to expose and celebrate the regenerative systems that feed these industrial processes.

# Site justification

## *Southern edge of the Gasworks precinct*

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A site analysis of the old Johannesburg Gasworks clearly highlighted the need for restitution between various relationships in order to allow regeneration to sprout from the site's latent potential. The urban vision identified various zones on the site where restitution between the most prevalent relationships in that area could occur. The relationships in need of restitution include industry, ecology and the city dwellers.

The proposed project vision aims to mediate between industry and nature. These project intentions therefore coincide with the objectives set out in the urban vision. The proposed project site was chosen according to the zone where industry and nature is most prevalent. The southern edge of the site provides the greatest opportunity for mediation

between these opposing entities, due to the dominant presence of both industrial artefacts and natural vegetation.

The southern edge (see Fig. 3.30) consists of an agglomeration of industrial buildings consisting of retort 2, the tully plant, the old powerhouse, the coke storage bunker and the telpher plant's weighbridge. This area creates a strong visual of nature's resilience, as nature encroaches on the existing built fabric amidst the disruption caused to the site by the old industrial processes in the form of pollution.

The motivation behind working with an existing building includes the opportunity to analyse and understand the dichotomy that exists between industry and nature and architecture's role in this severed relationship, in order to provide better

architectural solutions for future industries. The re-use of existing buildings also contributes to the principles of regenerative design as it aids in the reduction of waste and resource consumption while retaining the *genus loci* of the place (Heritage council Victoria 2014:14).

As highlighted in the theory chapter, Kirovová and Sigmundová (2014:433) believe that industrial sites have the potential to resolve or mitigate social and environmental issues from the past that have often caused these urban industrial sites to become isolated from the rest of the vibrant urban fabric. Kirovová and Sigmundová (2014:433) argue that in order to reintegrate these sites into the surrounding context, suitable principles of sustainability for adaptive re-use need to be applied.

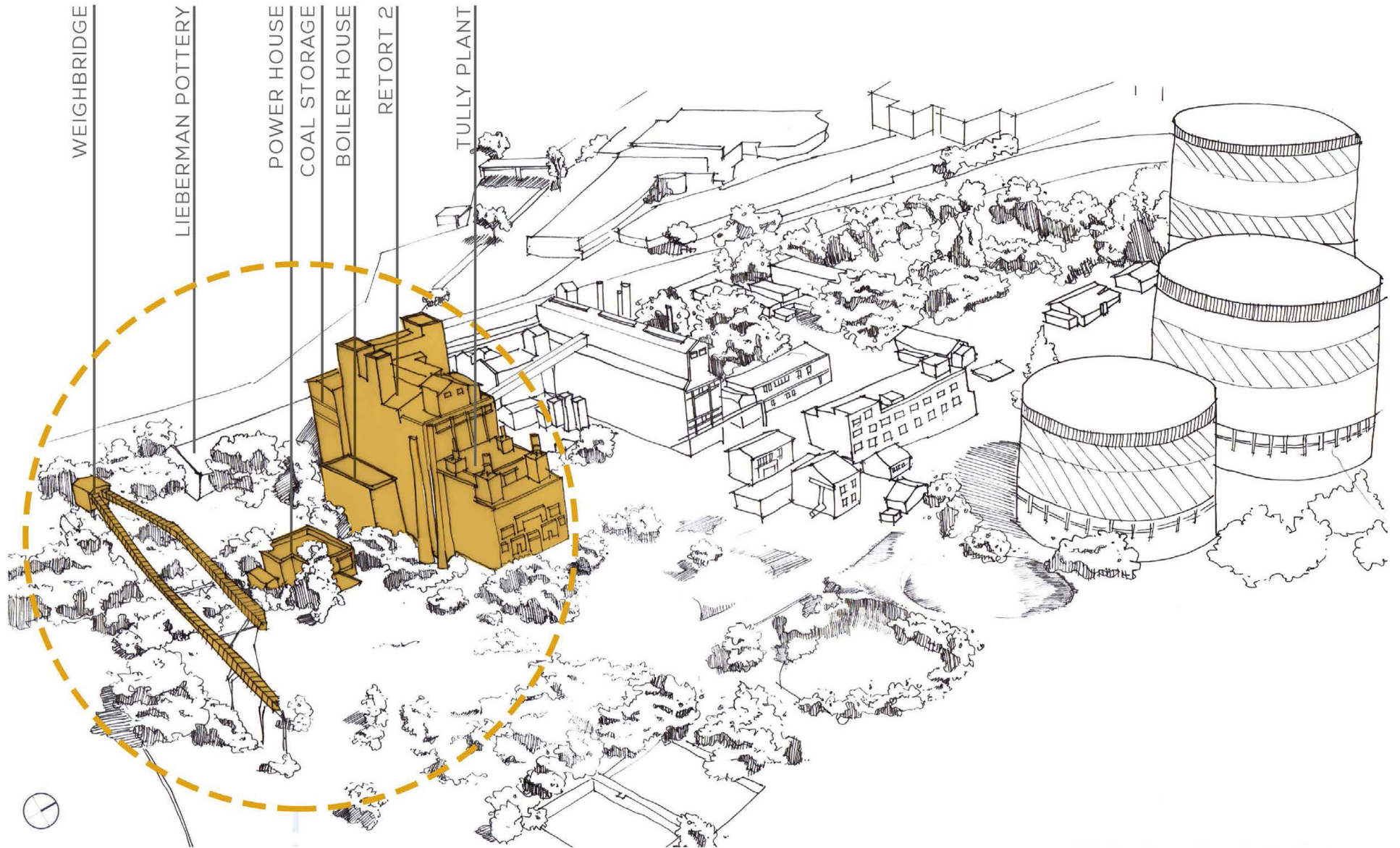


Figure 3.33: Project site position (Author 2017)



# The historic process

## *From coal to gas*

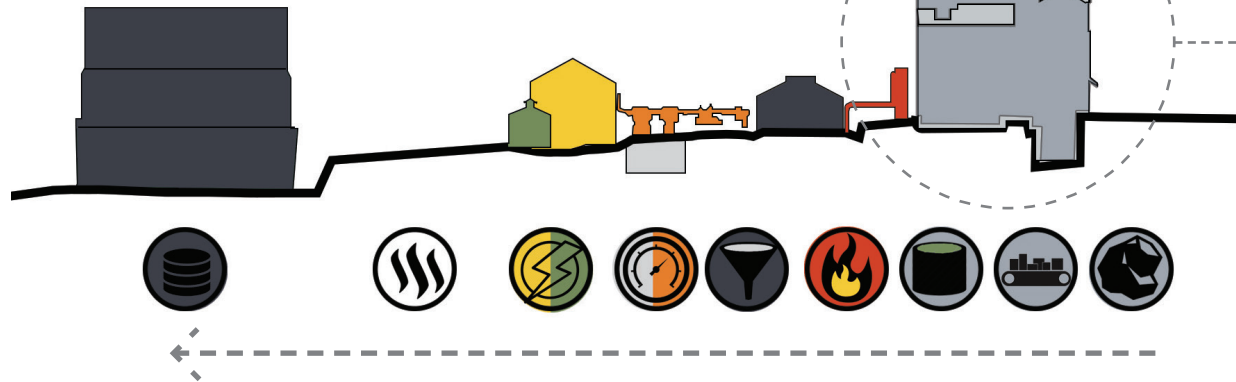
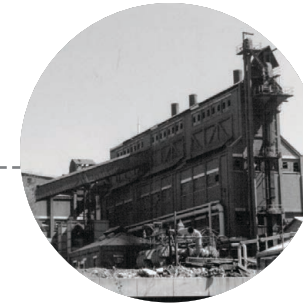


Figure 3.34: Visual representation of the coal to gas process (Gasworks Group 2017)

Coal was brought to site by rail. The raw coal was then taken to the carbonising plant (retort) from where it was transported by means of a bucket conveyor system to the coal bunkers, situated at the top of each retort. Each retort contained one coke extractor which regulated the rate at which the coal passed through the retort. Once inside the coal bunker, the coal was isolated from air while it was roasted, causing the coal to become pliable and to gravitate downward inside the retort. The pliable coal was then heated further, causing it to chemically break down into tar, coke and ‘foul gas’. The coke chambers were positioned directly below the coke

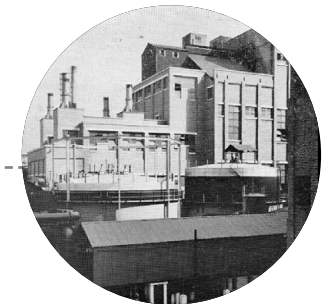
extractors to accumulate the coke excreted from the chemical process. The coke had to be removed every two hours and placed onto a rubber conveyor belt, from where it was sprayed with water to cool it off and then taken to the coke grading plant, situated right next to the retort. The coke bunkers equipped with chutes, allowed lorries to easily access the excreted coke for dispatch. A portion of the coke was kept in order to feed the producers, which were responsible for heating the retorts.

The ‘foul gas’ produced during the coal roasting process was then partially cooled down with the help of water sprays. This



*Retort house 1*  
*Built - 1927*

Figure 3.35: Retort 1  
(Gasworks Group 2017)



*Retort house 2*  
*Built - 1950*

Figure 3.36: View of  
Retort 2 & Tully plant  
(The old Johannesburg  
Gas Works book  
2015:42)

process caused tar vapour to condensate and flow along with the water to the tar and liquor wells. The extant gas then passed through the retort house governor, a machine responsible for controlling the vacuum in each retort. From here the gas was sent to the condensers in order to cool the gas down to air temperature causing it to condensate and separate into tar and ‘gas liquor’, which could then join the flow from the retort to the tar and liquor wells. Finally the gas was sent through the exhausters in order to gain the necessary pressure difference to drive the gas into the gas holders (Läuferts Le Roux & Mavunganidze 2015:23).

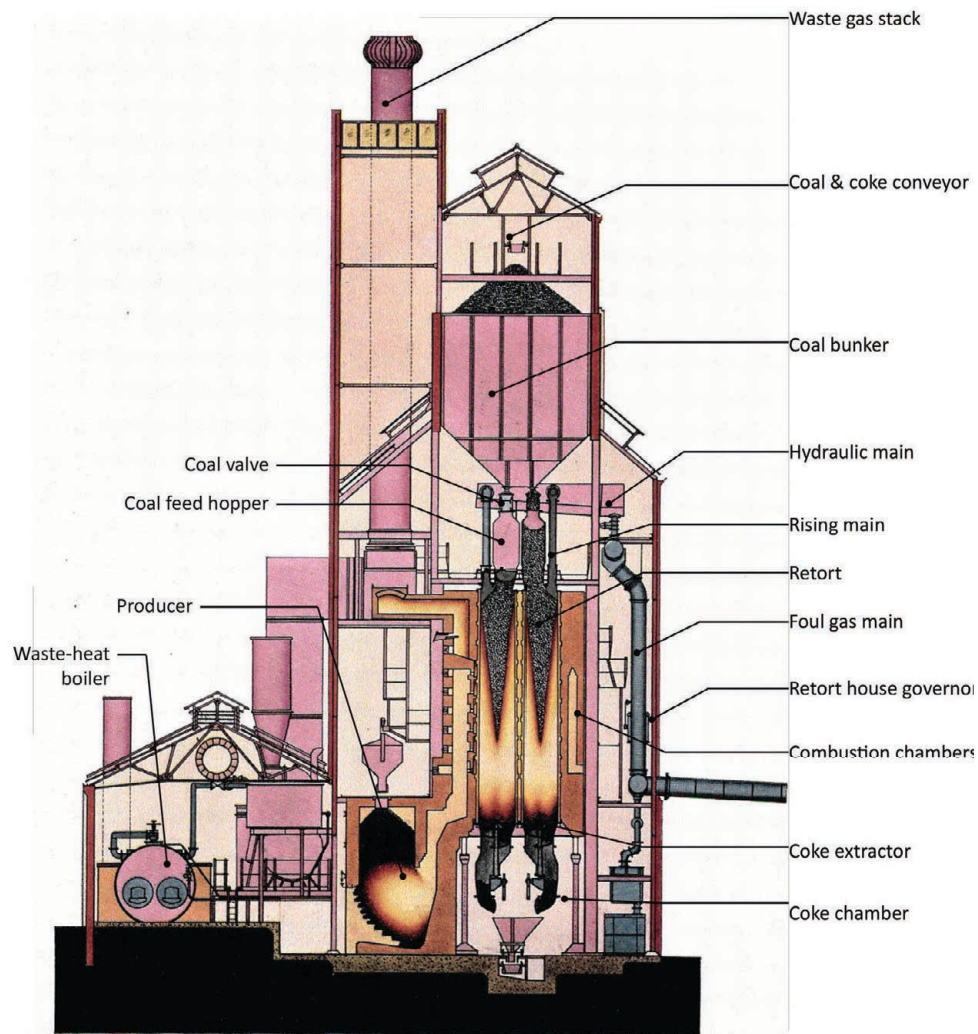


Figure 3.37: Cross section through Retort 1  
(City of Johannesburg Gas Department brochure 1929:15, labels by Peter Finsen)

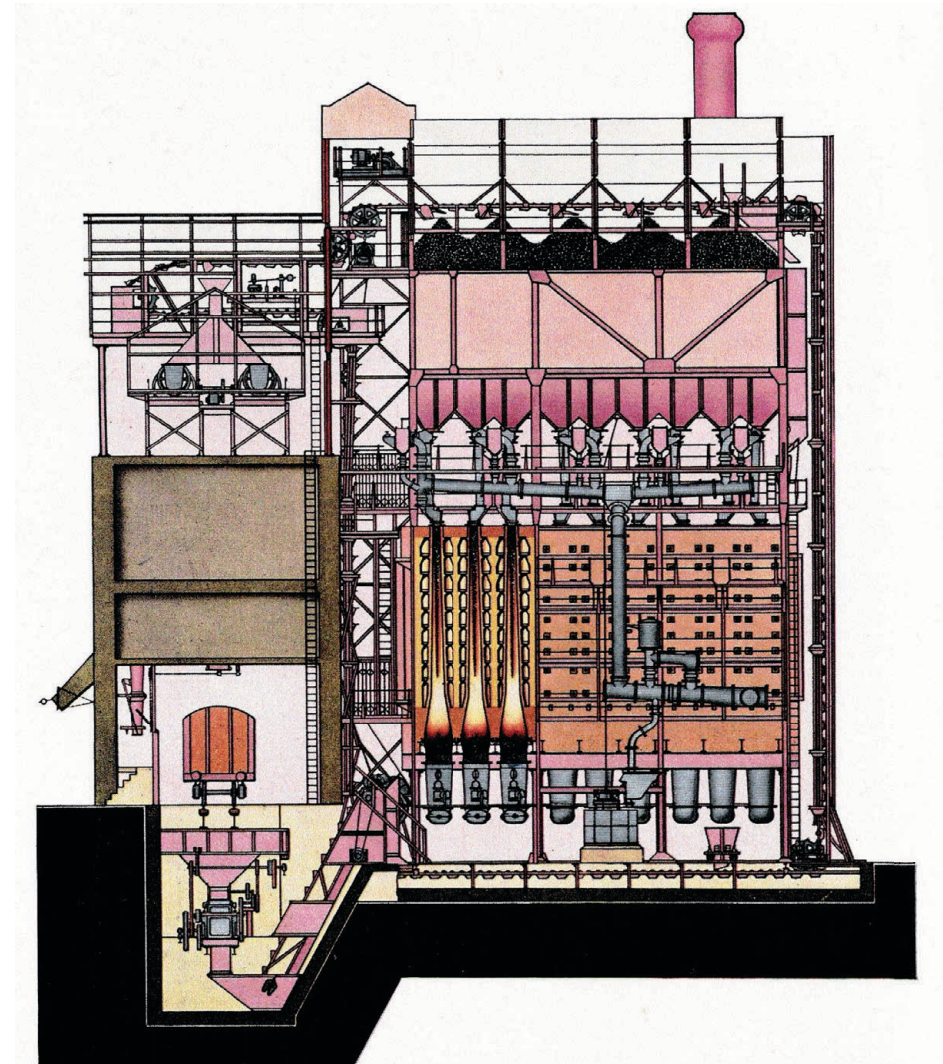


Figure 3.38: Longitudinal section through Retort 1  
(City of Johannesburg Gas Department brochure 1929:21)

# Heritage analysis

*of extant and demolished fabric on site*

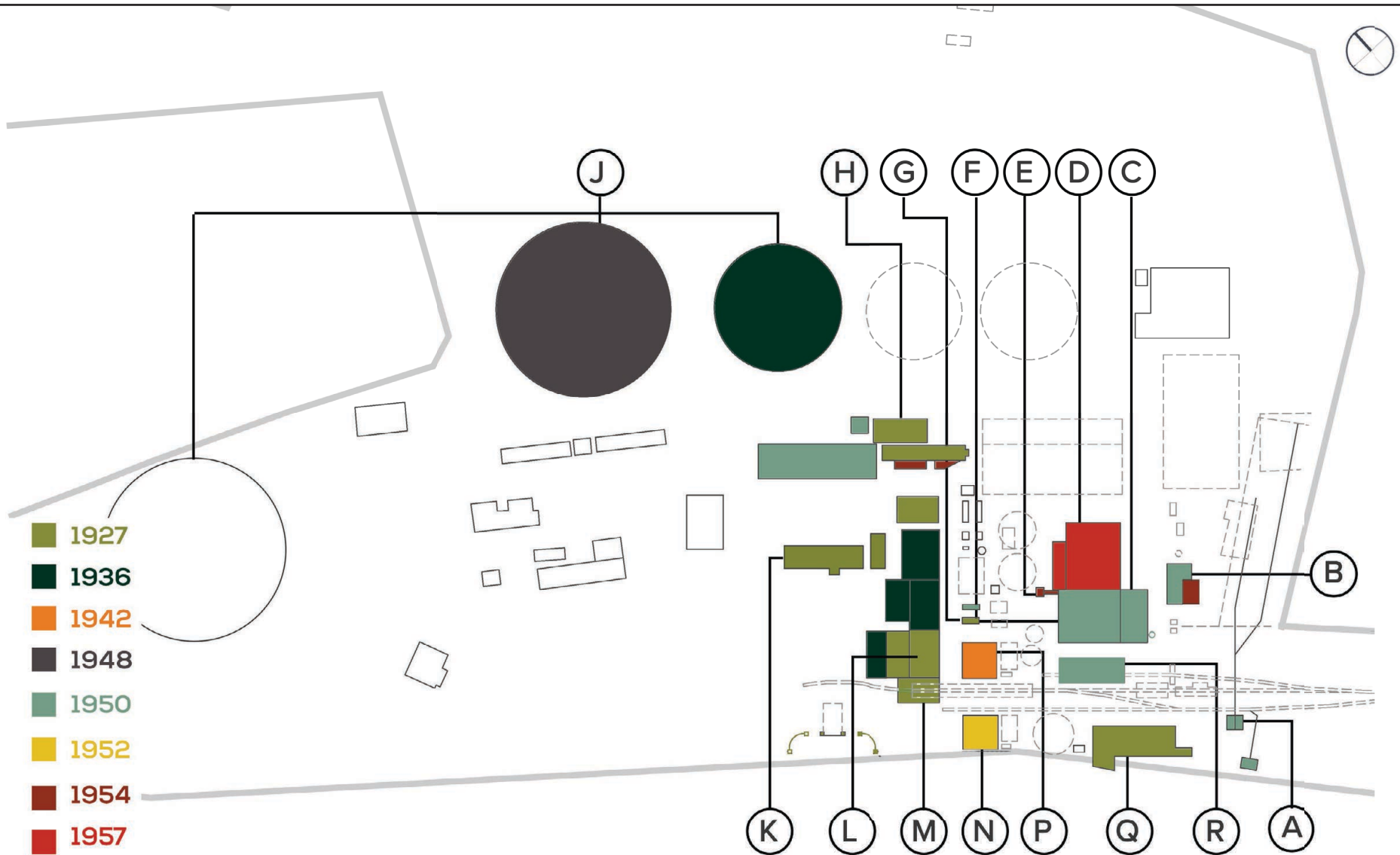


Figure 3.39: Heritage Analysis Map of Old Johannesburg Gas Works (Author 2017)

Project specific heritage fabric



Figure 3.40: Heritage Analysis - images of buildings on the old Johannesburg Gas Works Site (Author 2017)

# Site specific heritage analysis

## *Industrial heritage process value*

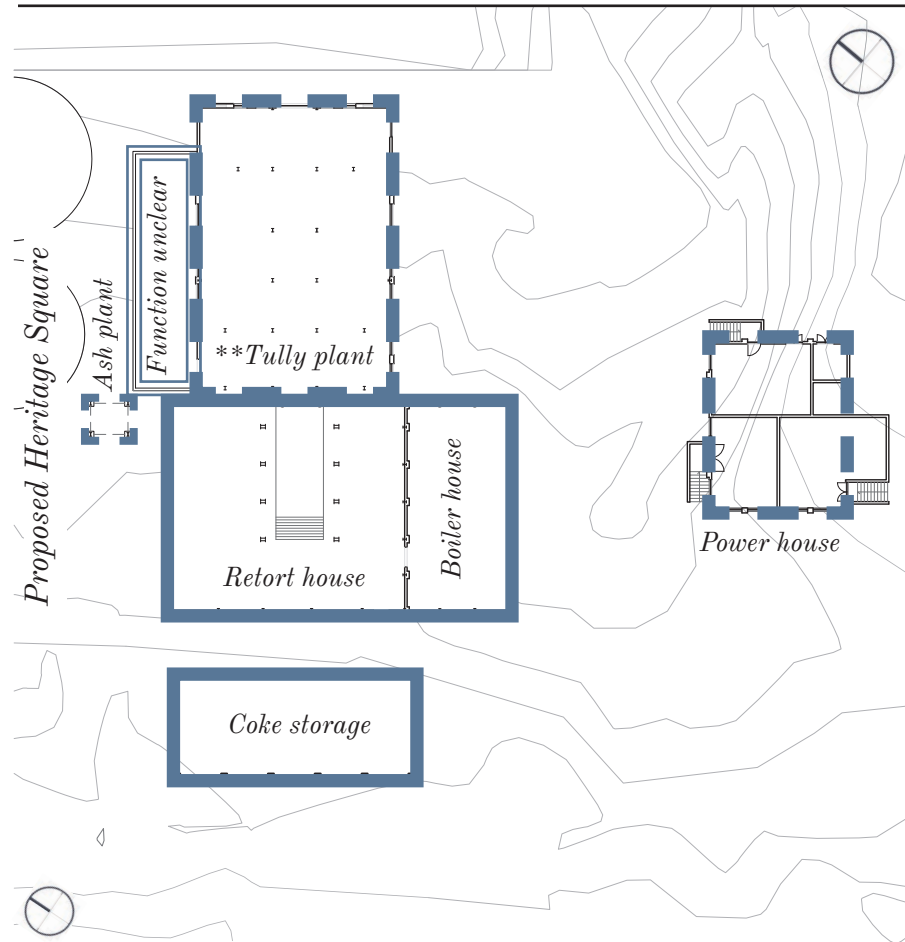


Figure 3.41: Industrial process value (Author 2017)

- Primary
- Secondary
- Tertiary

## *Architectural heritage value*

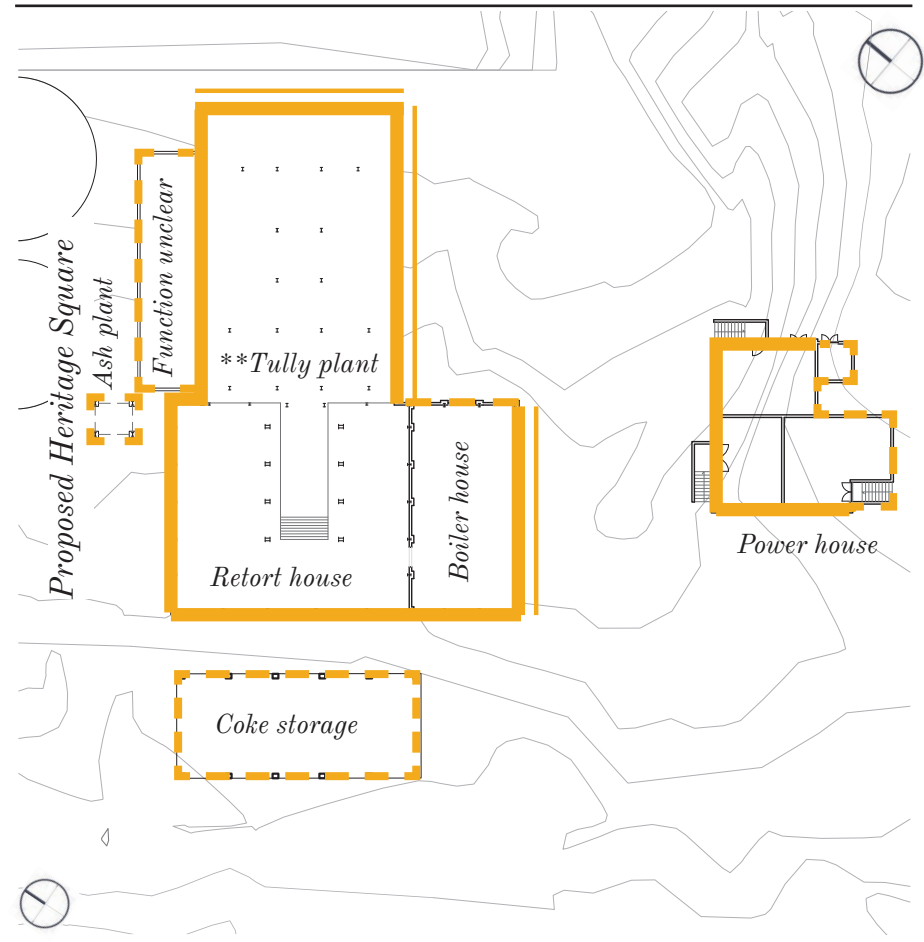


Figure 3.42: Architectural heritage value (Author 2017)

- Primary
- Secondary
- Tertiary

\*\*Tully plant constructed in 1957. The tully plant served the same purpose as the retort house, however it made use of newer technology.

### Vegetation growth between 1992-2017 on proposed site

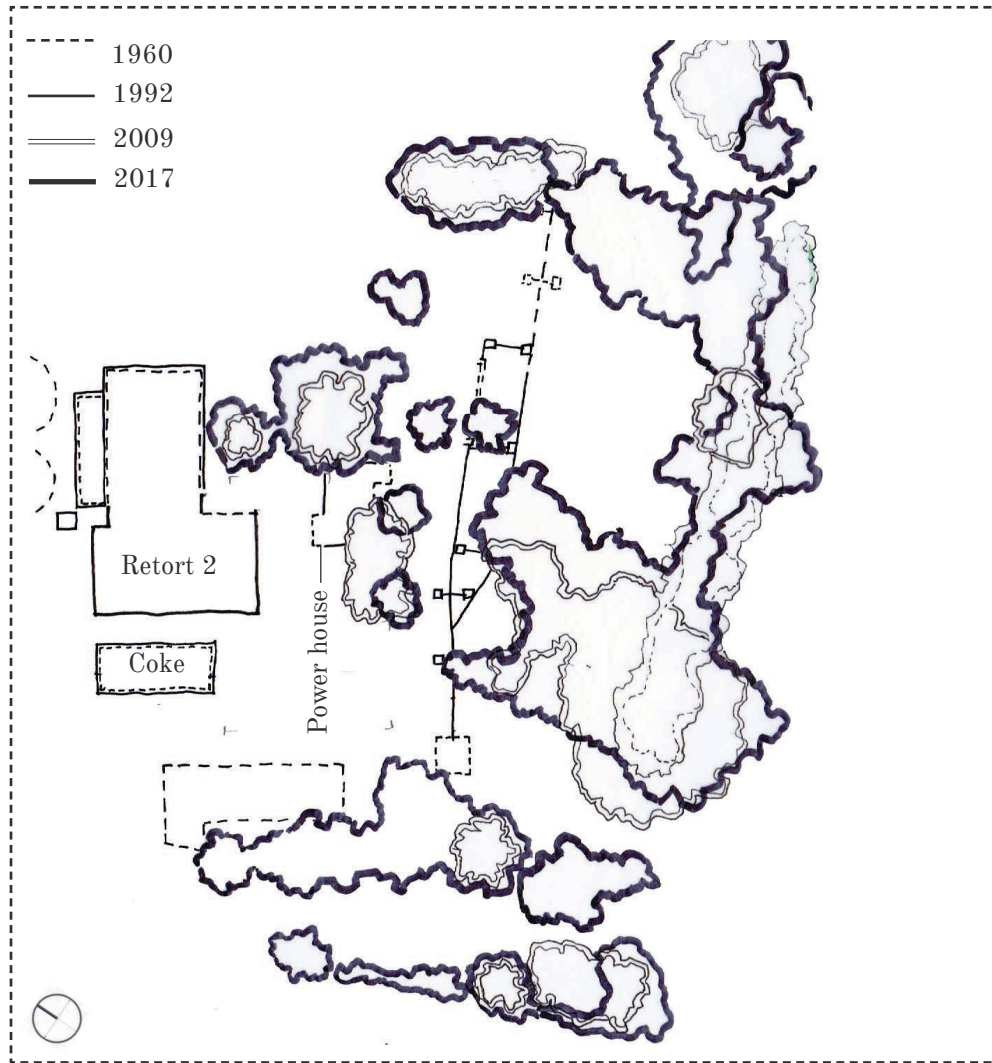


Figure 3.43: Map illustrating vegetation growth over time (Author 2017)

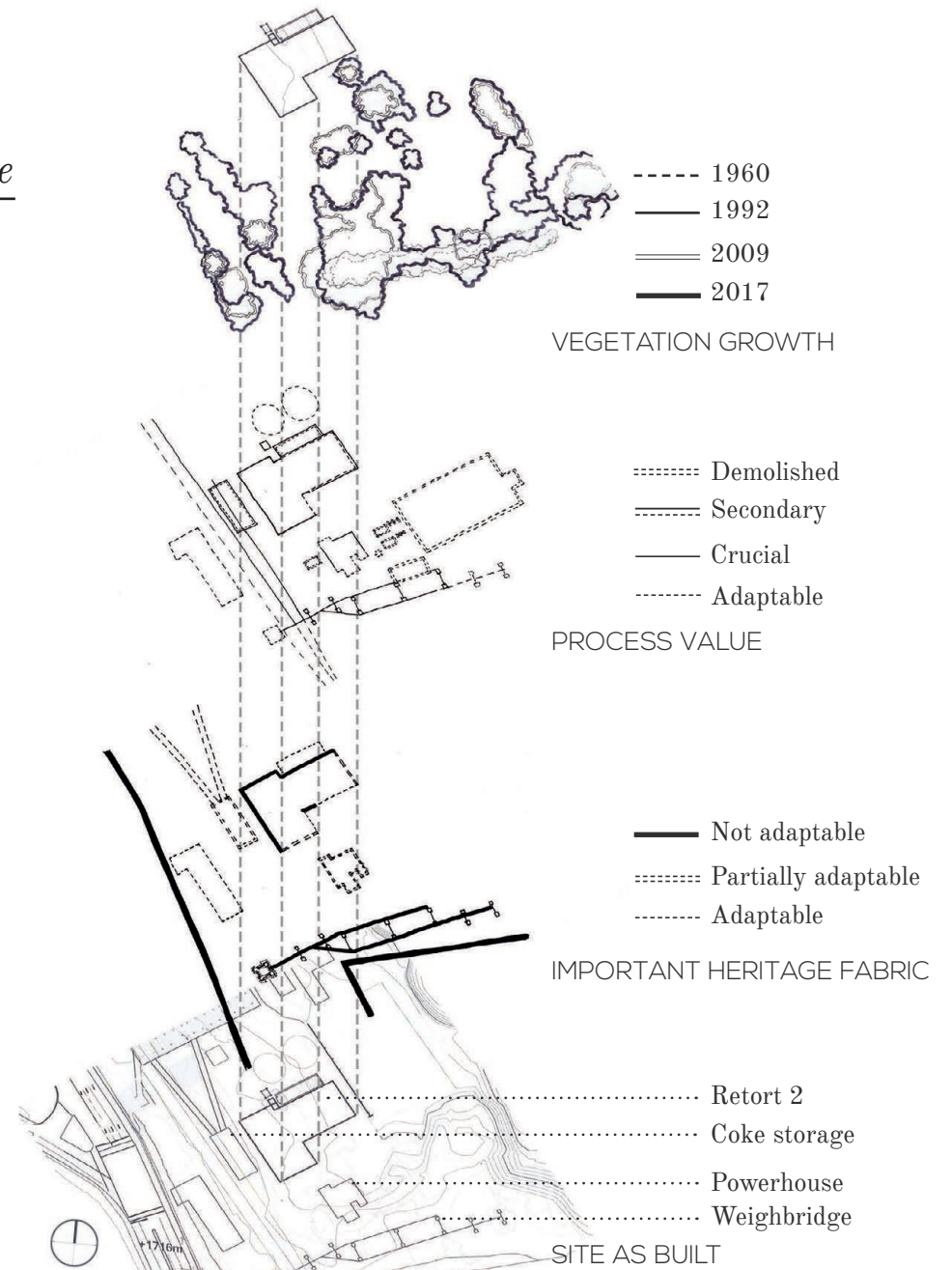


Figure 3.44: Axonometric of heritage analysis (Author 2017)

## Retort 2, Tully plant & Boiler house

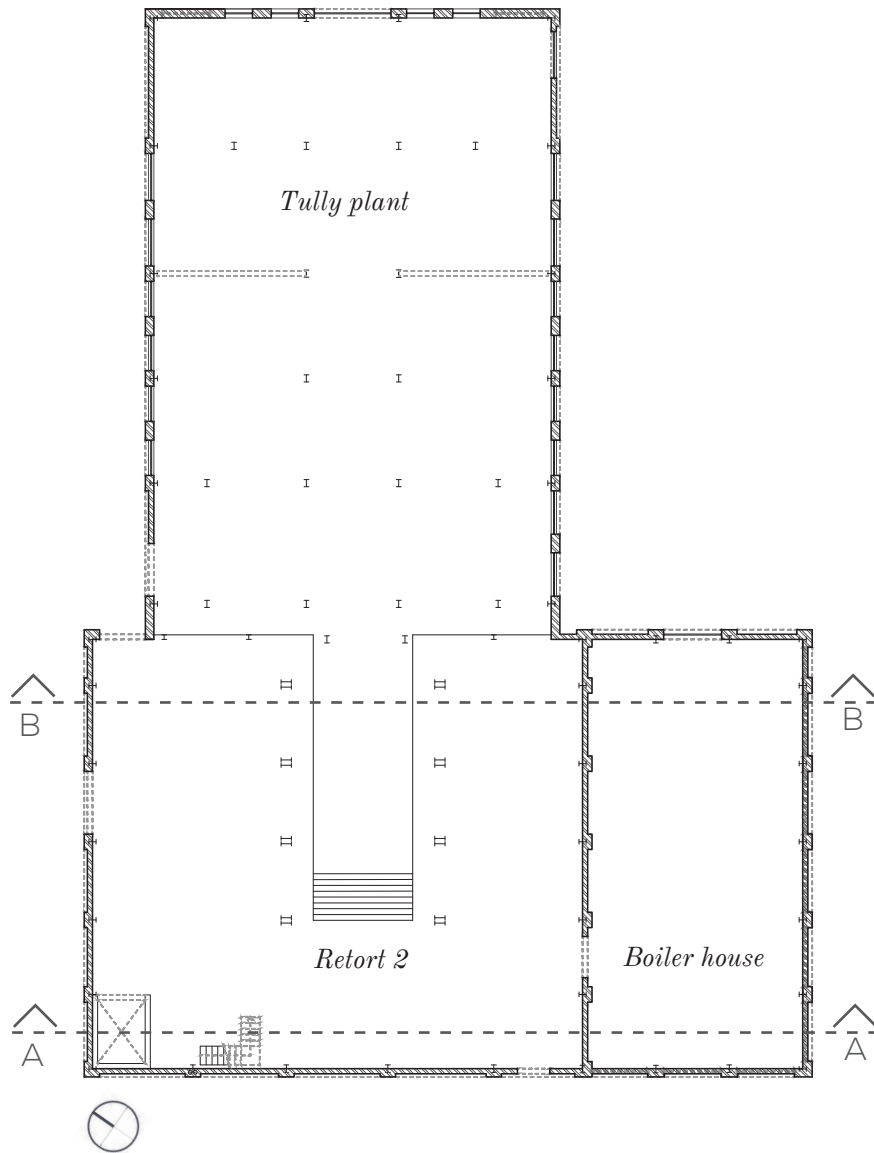


Figure 3.45: Retort 2 plan - not to scale (Author 2017)

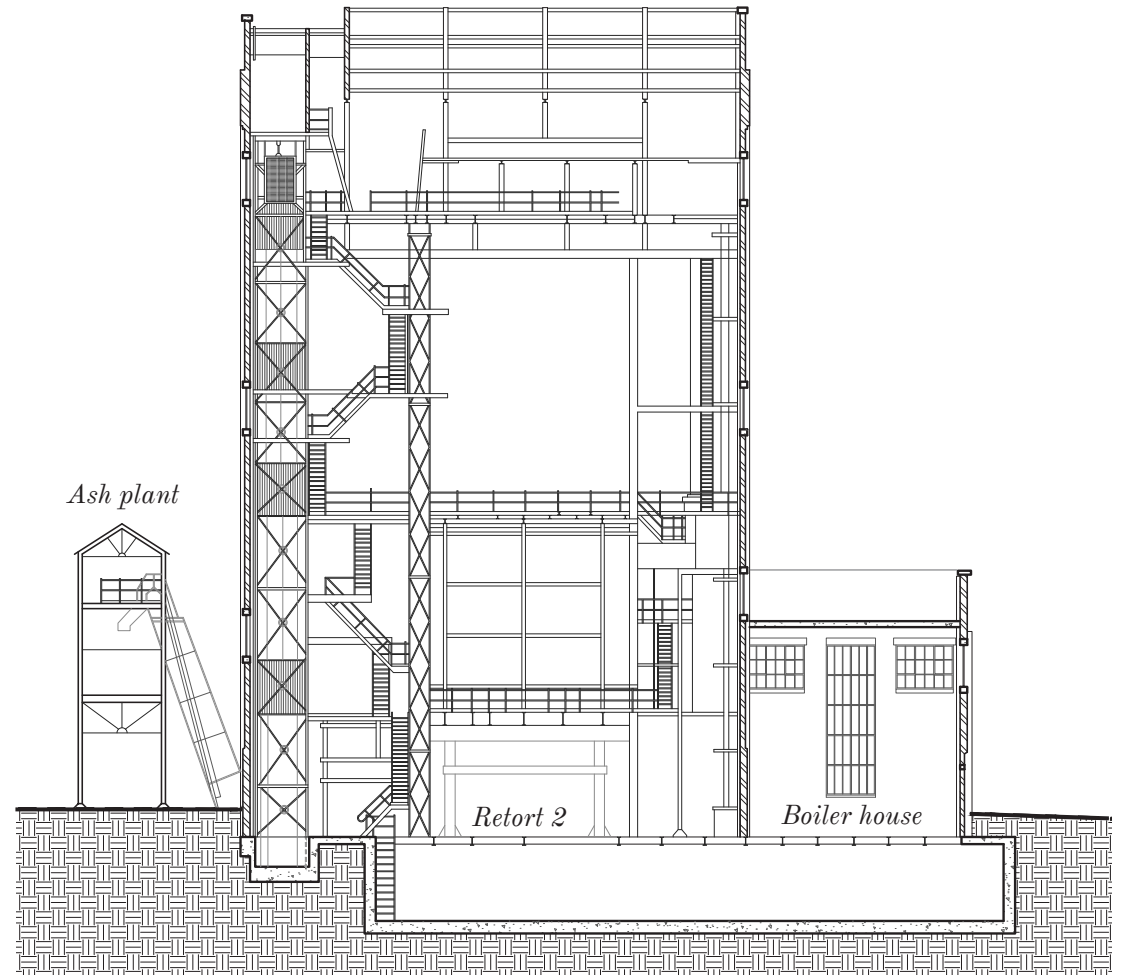


Figure 3.46: Retort 2 section A-A - not to scale (Author 2017)

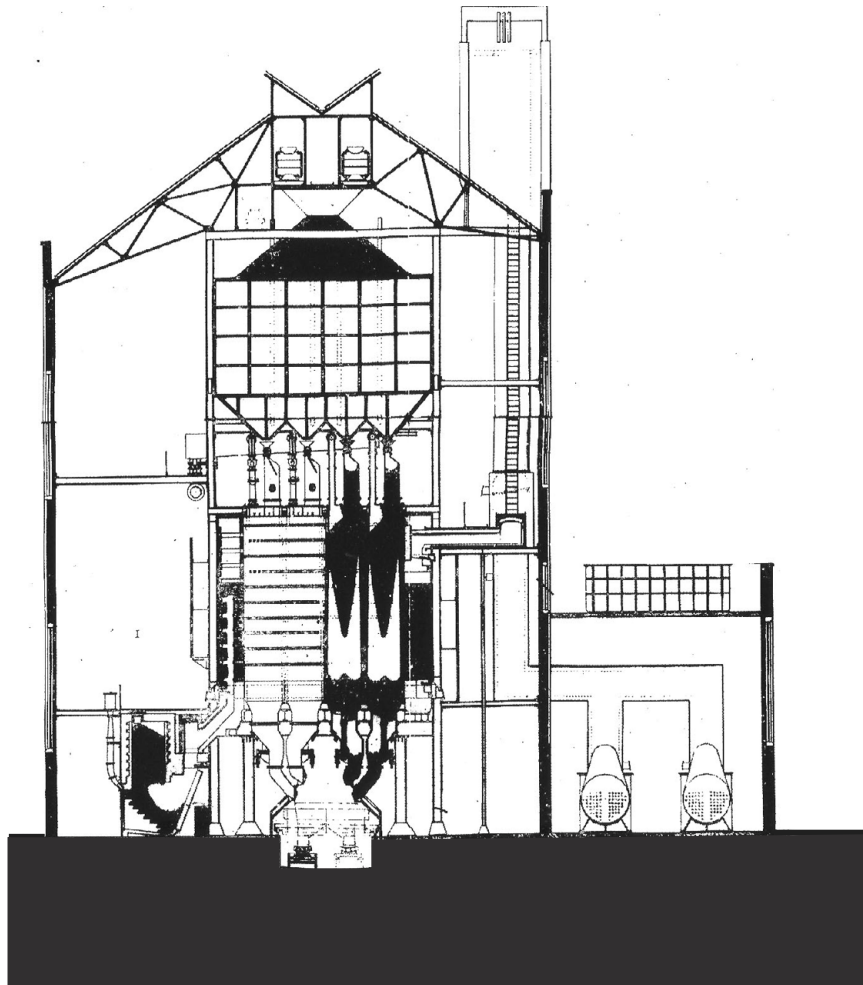


Figure 3.47: Retort 2 Section B-B - not to scale (City of Johannesburg Gas Department 1950, edited by Author)

## Power house

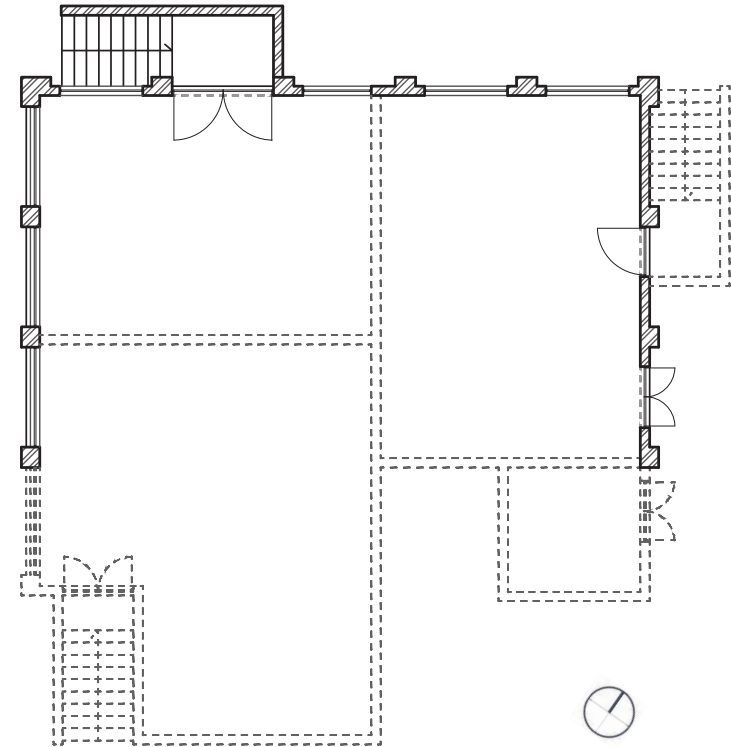


Figure 3.48: Powerhouse plan - not to scale (Author 2017)

--- Demolish

All interior walls to be demolished in order to allow for maximum floor area to grow plants for the use in the dye house. The southern edge of the powerhouse to be demolished in order to allow for a connection to the new proposed building. The aesthetic and structural integrity to be kept on the northern facade. Roof to be demolished in order to allow for a new glass roof to allow maximum sunlight for the growing of plants.



# Site analysis

## *Vegetation & pollution*



Figure 3.49: Vegetation map (Gasworks Group 2017)



Figure 3.50: Areas of contamination (Gasworks Group 2017)

## Site Solar study

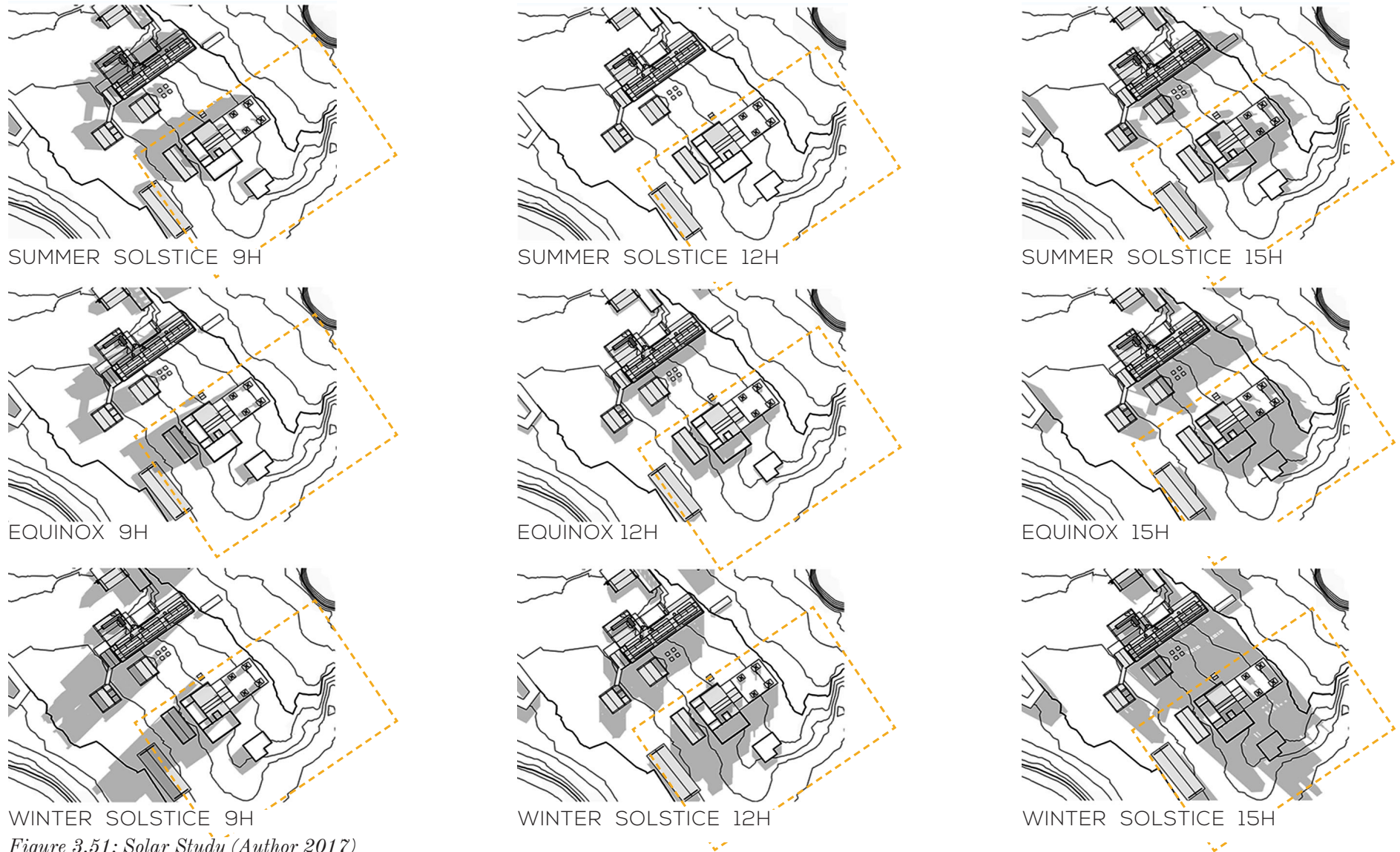


Figure 3.51: Solar Study (Author 2017)

## Braamfontein Climate Analysis

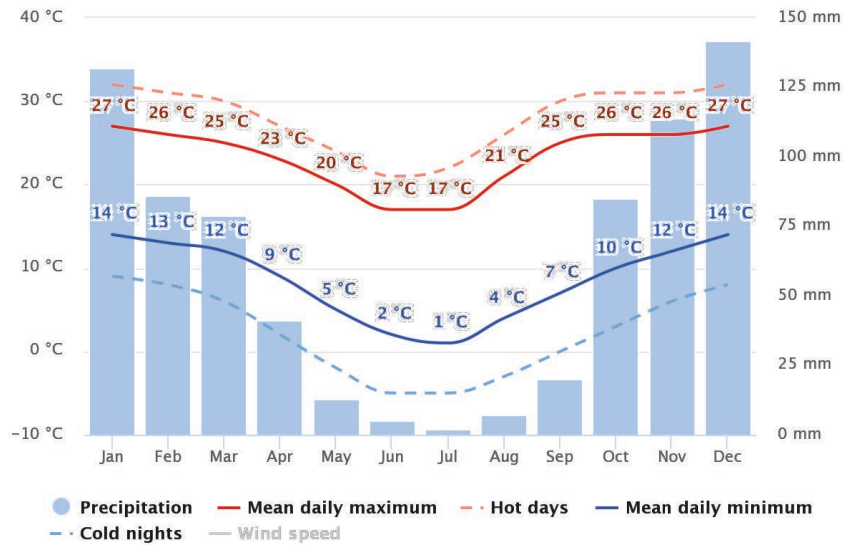


Figure 3.52: Average temperatures (Meteoblue 2017)

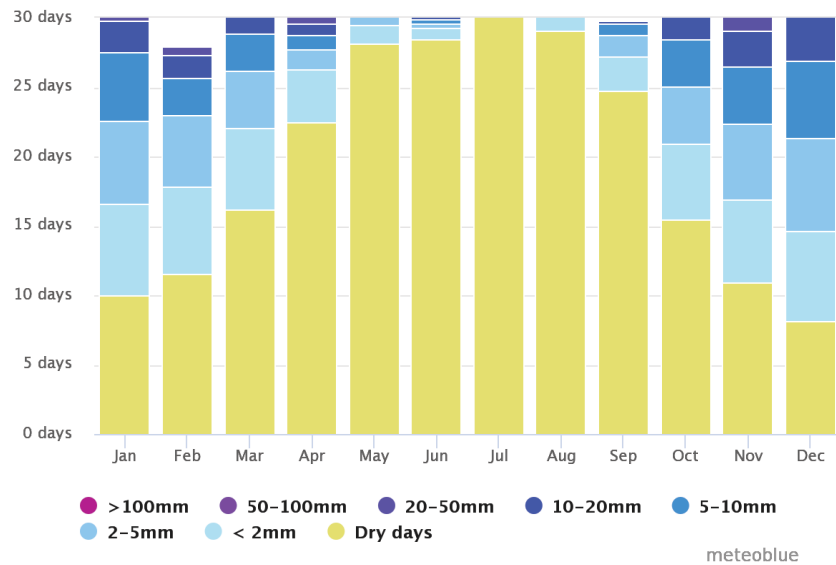


Figure 3.53: Average precipitation (Meteoblue 2017)

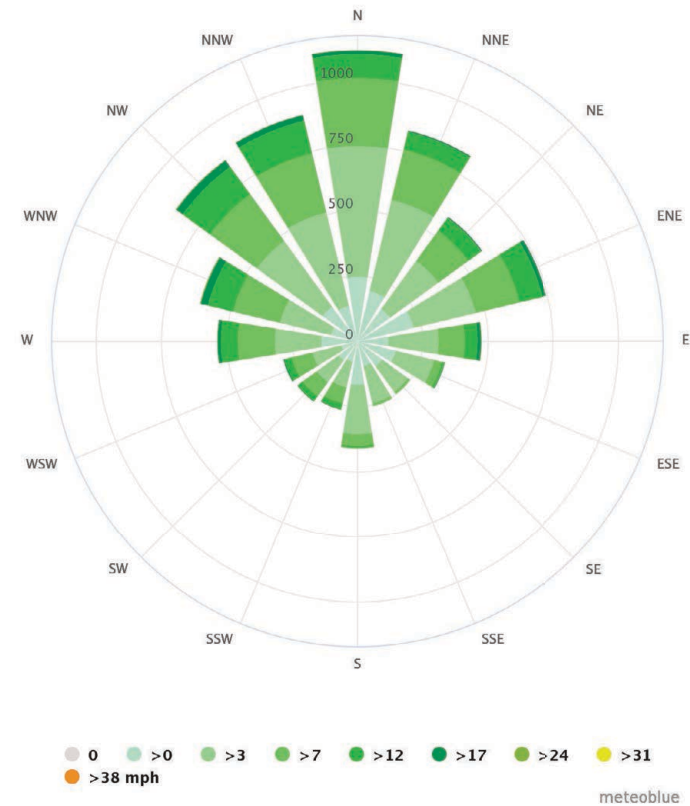


Figure 3.54: Braamfontein windrose (Meteoblue 2017)

## Johannesburg climate

Johannesburg has a mild, mostly warm and temperate climate. It receives most of its rainfall during the summer months, with an average of 790 mm per year and has an annual temperature of around 16°C (Climate-data.org [sa]).

## Change in landscape

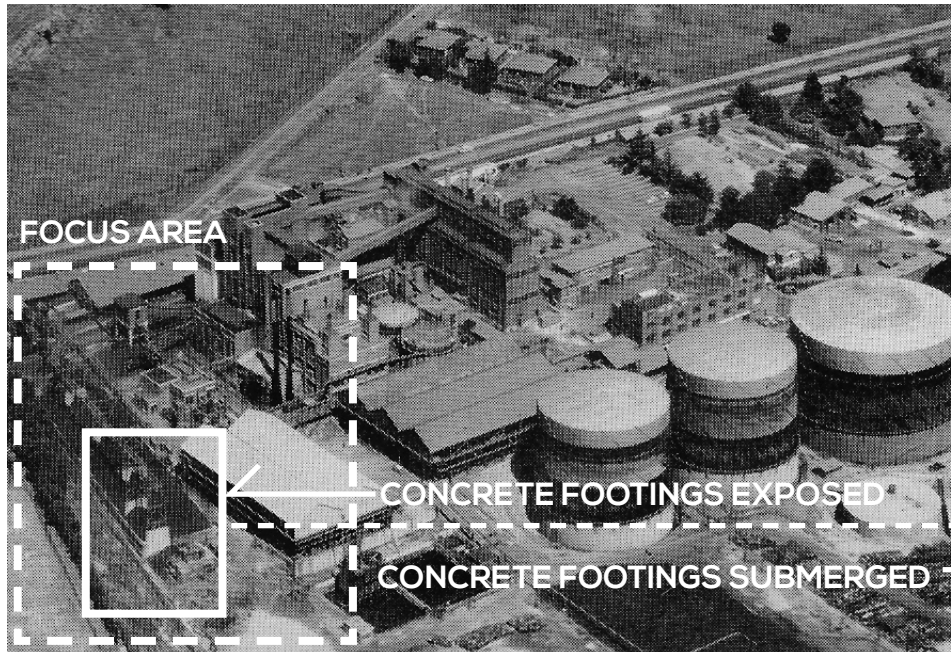


Figure 3.55: Aerial photograph of the Johannesburg Gasworks (City of Johannesburg Gas Department 1959)

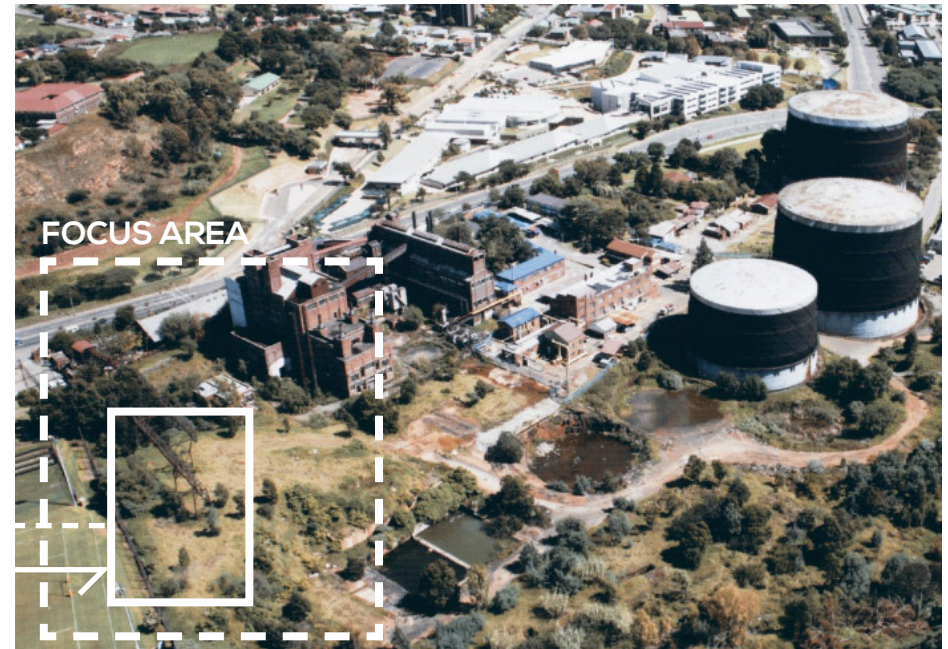


Figure 3.56: Aerial photograph of the old Johannesburg Gasworks in 2009 (Egoli Gas 2009, edited by Author)



Figure 3.57: 1992 Partial demolition (Peter Finsen 1992, edited by Author)



Figure 3.58 Footings (Läuferts Le Roux 2010, edited by Author)

### How the change in landscape informs the design approach

Although no record was kept of the change in landscape, it can be assumed that soil was used to cover the southern edge of the old Johannesburg Gasworks that possibly contained rubble from the partial demolition in 1992.

As the contours of the site have been altered from the original topography, it can be assumed that the site does not contain virgin soil. This allows for the adoption of a less sensitive architectural response towards the landscape and opens up the possibility to cut and fill.