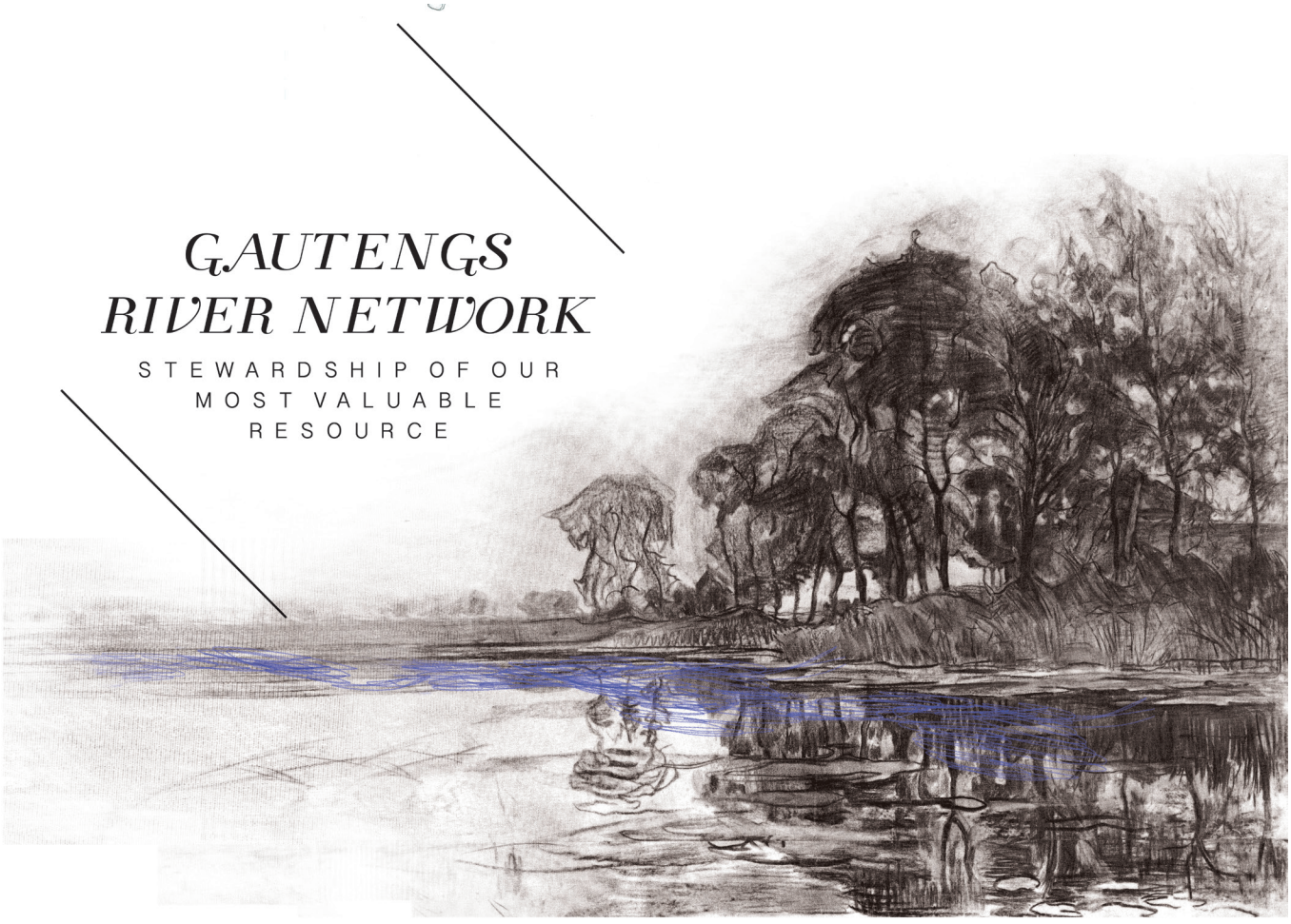
03

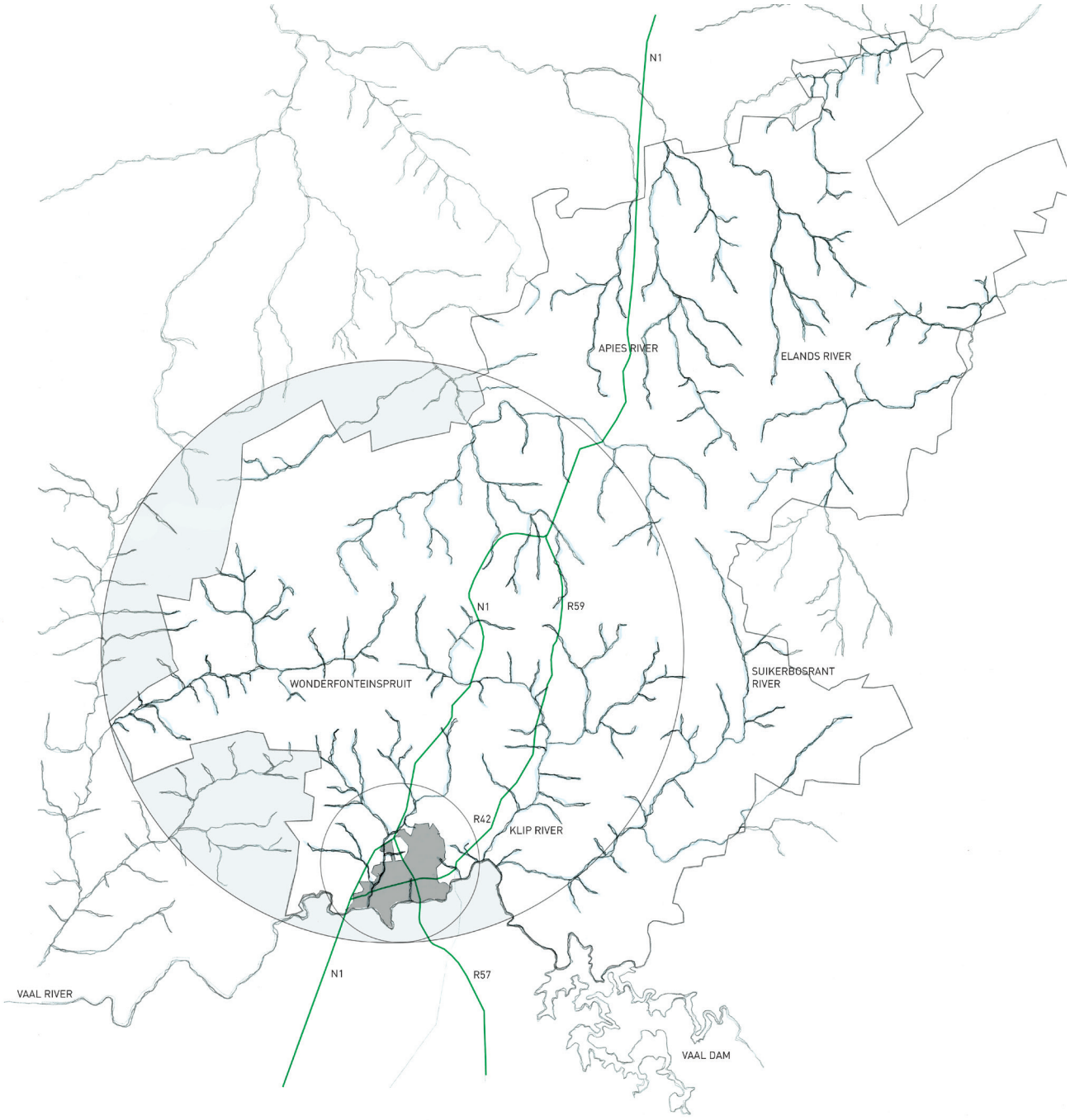
CHAPTER THREE

CONTEXTUAL UNDERSTANDING

3.1
THE VAAL RIVER

The Vaal River is the most important water supply in South Africa. It supplies water to large urban populations and economic sectors highlighting the importance of the quality of water flowing into the Vaal River system. This chapter reveals the importance of the river network and it's ability to enrich or destroy people's lives and biodiversity.





GAUTENG'S RIVER NETWORK

Figure 3.1: Gauteng's River Network traced from Google Maps (Author, 2016)

29 Cu COPPER

24 Cr CHROMIUM

82 Pb LEAD

THE RIETKUILSPRUIT

A POLLUTED TRIBUTARY OF THE VAAL RIVER

In Groenewald's water sampling conducted on the tributaries of the Vaal River System, Rietkuilspruit and the site location was within the catchment area sampled. The Rietkuilspruit was detected as a point source between VR24 and V17. (Groenewald, 2000:122)

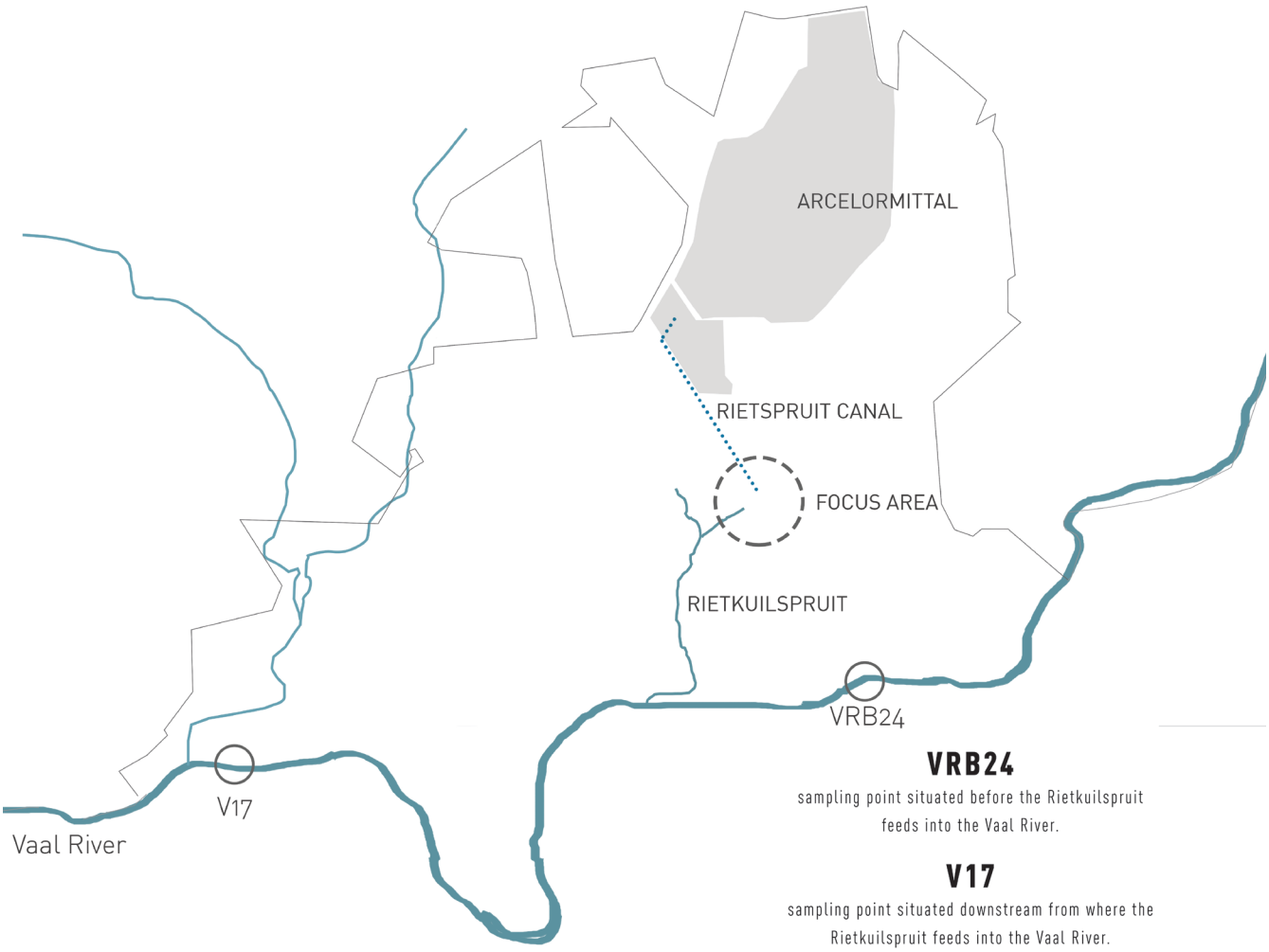


Figure 3.3: Rietkuilspruit tributary leading into Vaal River showing water sample points extracted from Groenewald's Magister Scientiae in Zoology (Author, 2016)

3.2
THE RIETKUILSPRUIT

The deterioration in the water quality of the Vaal river system can be largely attributed to the quality of the water of the rivers and tributaries feeding into the Vaal River. Industrial and mining activities in the Vaal Triangle form part of the main contributors for the deterioration of the water quality.

In Groenewald's water sampling conducted on the tributaries of the Vaal River System, Rietkuilspruit and the site location was within the catchment area sampled. Groenewald's research explores the aquatic environment's adult fish communities which are bio-accumulators of heavy metals and are good biological indicator organisms for the assessment of chronic environmental stress. VRB24 is a sampling point situated before the Rietkuilspruit feeds into the Vaal River. V17 is a sampling point situated downstream from where the Rietkuilspruit feeds into the Vaal River.

The V17 catchment area was surveyed and identified as an area in the Vaal aquatic system where fish have high metal levels in their tissues and organs, which can be directly linked to the high levels of contaminants entering the system as part of the industrial run off. Metals which attatch to sediment particles are more persistent and pose a threat to the aquatic environment. These contaminants have affected the ecology of the area as the health of the fish is linked to human health risks. (Groenewald, 2000:122)

Sample point V17 also had the highest correlation of pollutants which pose the biggest threat to the health of the entire body of water, showing high levels of chromium, copper and lead. These levels did not comply with recommended safe water values. During periods of high rainfall, lower concentrations of pollutants were recorded highlighting a point source that is contaminating the water. Amongst the main point sources identified, Groenewald noted the effluent flowing from the immediate industrial area as a prominent contributor. (Groenewald, 2000:122)

This data links the Rietspruit canal which is polluted with heavy metals from the industrial area to the Rietkuilspruit that feeds into the Vaal River. The objectives of this dissertation will be to intercept and remediate the contaminated water prior to it entering the Vaal River system, preventing heavy metals from entering the water system.

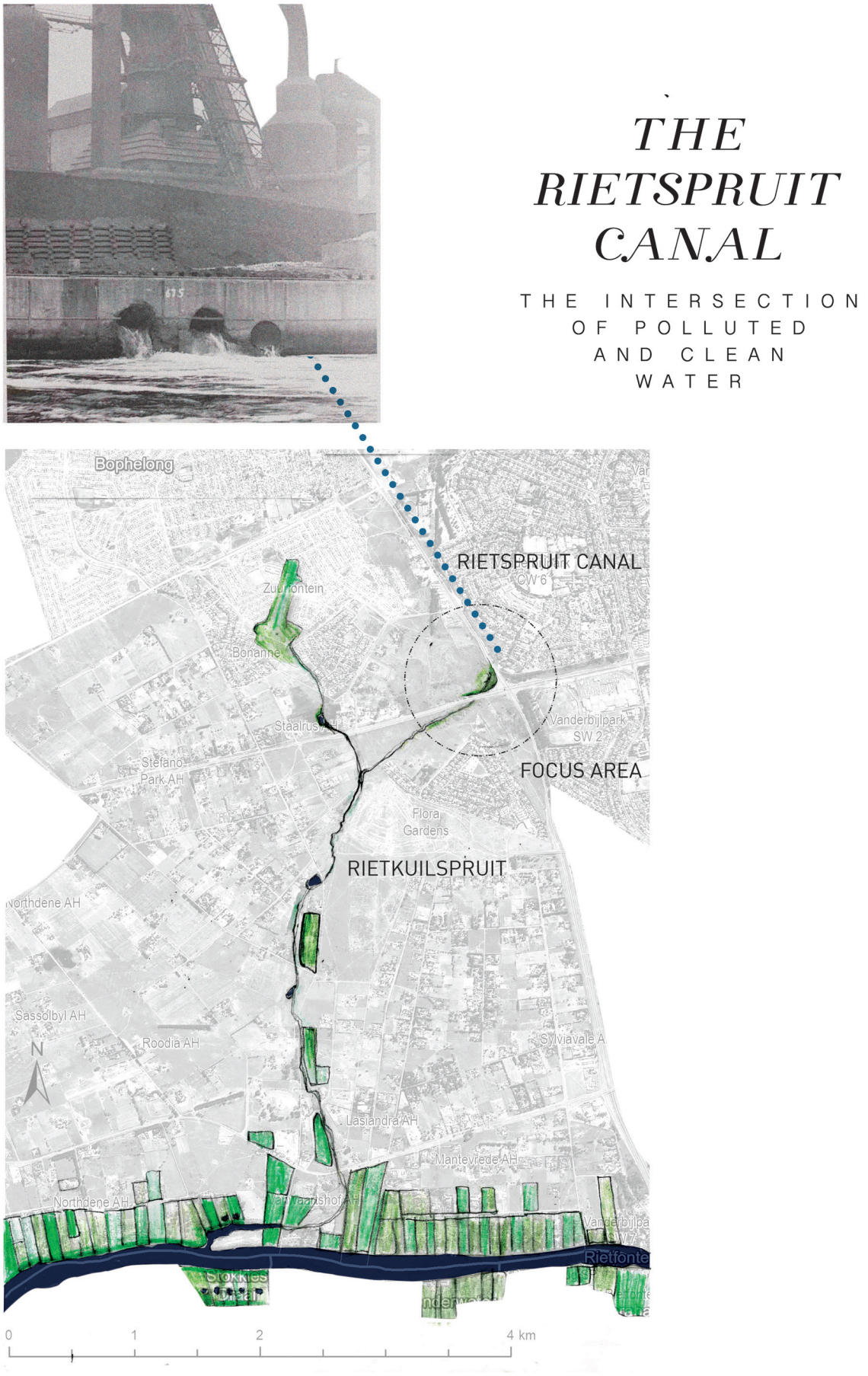


Figure 3.2: Water Network boundaries of the site traced from Google Maps. (Author, 2016)

3.3
THE RIETSPRUIT CANAL

The Rietspruit Canal forms part of the tributary network of the Rietkuilspruit which feeds into the Vaal River system. The Rietspruit Canal accumulates the run-off from industry with storm water networks precipitating a natural wetland at the intersection of the R42 and R57. The quality and impact of the industrial water of the Rietspruit Canal has been recorded as unacceptable by the Bophelong community speared headed by Vaal Environmental Justice Alliance (The Bench Marks Foundation, 2013).

Currently there are no interventions, water treatment works or filtration infrastructure to act as an ecological safe-guard prior to the water entering the Vaal River System. This established wetland serves as a potential restorative interception within the tributary network and has the potential to play a further critical role in treating the industrial effluent, yet a more intensive approach is needed to address the removal of heavy metals. This undeveloped site presents an opportunity to intercept the Rietspruit Canal's industrial effluent before it enters a more complex water network. .

Unknown
(unknown)
Plant Type: Shrub
Found on neglected sites

Goats Foot
(Ipomoea pes-caprae)
Plant Type: Shrub with long stems
Indigenous to South Africa

River Reeds
(unknown)
Plant Type: Reed
Unknown

Simon Poplar
(Populus)
Plant Type: Large tree

Honey Locust
(Gleditsia triacanthos)
Plant Type: Medium to large tree
Indigenous to South Africa

Mulberry Tree
(Morus nigra)
Plant Type: Medium to large tree
Tolerates wetland

Garden Privet
(Ligustrium Ovalifolium)
Plant Type: Medium Tree
Invasive

Tall Verbena
(Verbena bonariensis)
Plant Type: Shrub
Common weed

White Stinkwood
(Celtis africana)
Plant Type: Medium to large tree
Indigenous to South Africa

River Bush Willow
(Combretum erythrophyllum)
Plant Type: Medium to large tree
Indigenous to South Africa

POINT OF INTERCEPTION

STRENGTHENING AN EXISTING ESTABLISHED ECOLOGY

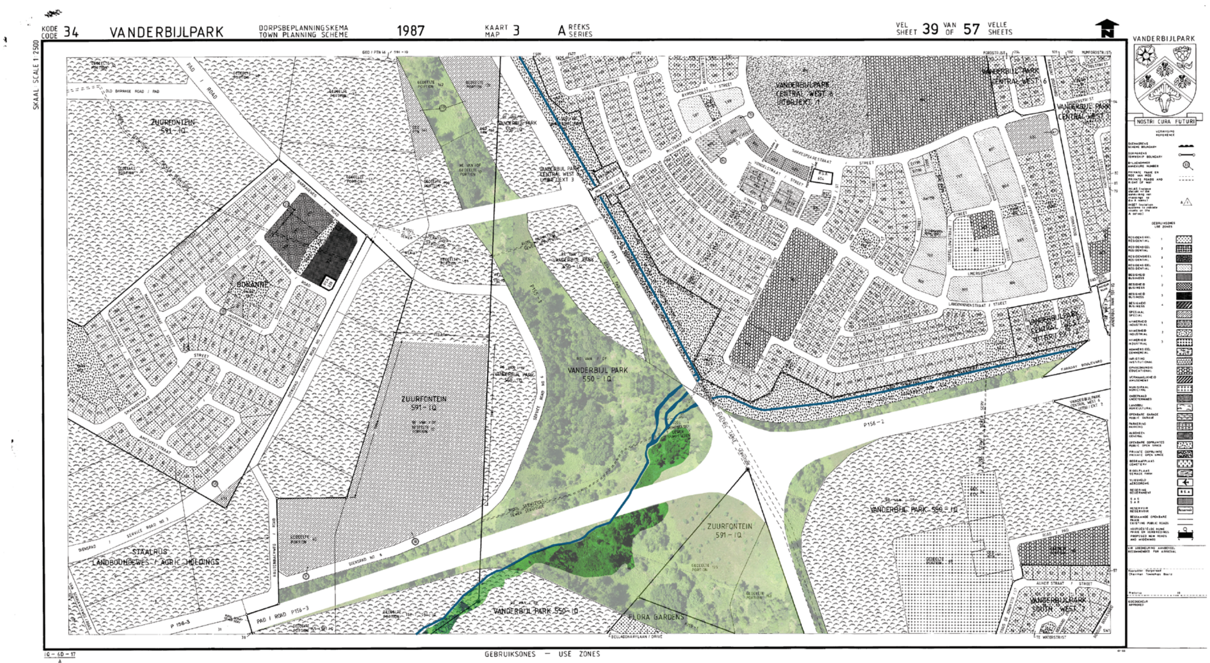


Figure 3.4: Site Mapping of rezoned road reserve with wetland and hydrology network. (Author,2016)

3.4

THE VALUE OF URBAN-RURAL LAND

"... Nature ... a certain appreciation for what it represents; that we come from nature and we have to understand what it is. There is an importance to have a certain reverence for what nature is, because we are connected to it and we are part of it. And if we destroy nature, we destroy ourselves. Maybe the new landscape of our time... is the landscape that we change. The one that we disrupt in pursuit of progress... look at the industrial landscape as a way of defining who we are and our relationship to the planet. It is this thing that is growing and part of our economy, it is part of our politics, and it is part of how we elect our governments, it is part of everything we do. It is this big machine that started rolling..." Burtynsky, E. 2006

Urban-Rural land refers to the parcels of land left behind, the spaces which have never been exploited, most commonly situated between the built environment and agricultural land. This fragmented territory of undecided, residual and suspended space is in most instances uncultivated, open land which highlights the flaws of urban planning logic and the effects of urban sprawl. Urban-rural land is with and not against nature, observing, complying and intervening as little as possible. The value that can be ascribed to these natural parcels of land lies in their unadulterated attestation to the indigenous environment's ability to restoratively adapt to the external pollutants posed by the encroaching urban and industrial sprawl. The resident ecology including plants, algae, micro-organisms, etc within the developed wetland showcases nature's ability to adapt to external stresses in an attempt to address the pollutants. The natural wetland and the associated fauna and flora act as a restorative urban rural interception of the water network in this context. It exists with the intention to correct the damage done by the industrial landscape. (Quodlibet, 2005)

The author is looking to explore the lessons observed in these urban-rural parcels, taking key notes from the adaptation of the natural environment to address the external factors. The intention is to leverage off these lessons, replicating these restorative interventions by proposing dynamic infrastructure as part of the development.

FRAGMENTS OF PLACE

THE VALUE OF URBAN-RURAL LAND IN A CONTAMINATED WATER NETWORK

Figure 3.5: Site mapping of urban land use outlining rezoned road reserve. (Author, 2016)

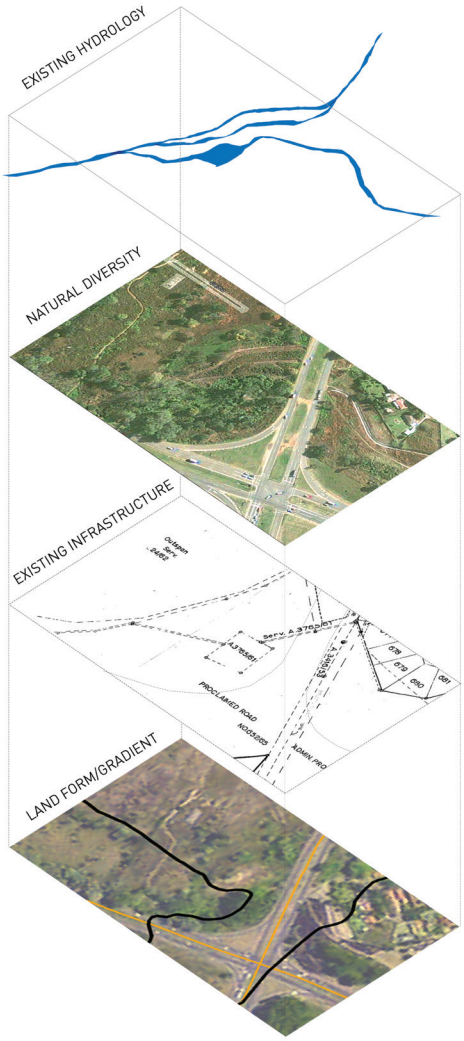
3.5
IDENTIFYING A SITE

In Vanderbijlpark an urban-rural site has been selected which is an example of the urban-rural. The main reasons that this specific site has been selected is due to its geographic position within the water network, the potential area available for development of the intervention, the revised intention of the town planners for the site and the proximity of the site to the affected community.

One of the most important characteristics of the site is that it is currently a place of ecological diversity, performing complex environmental tasks of attempting to improve the quality of the water entering the Vaal River network. This is currently performed by the extensive wetland. The site's diversity has been established over many years of the parcels of land being neglected. The site is an example of an urban-rural land which over the decades of neglect has become an archive of untouched diversity of tomorrow's genetic heritage. (Quodlibet, 2005)

In an undisturbed ecosystem (pre-industrial and natural landscapes) everything is in balance. Since the industrial revolution, pollution and exploitation of resources have affected the ecosystems, creating disturbances which result in an imbalanced system. Human are now part of the ecosystem. The role of humans in their environment is to understand how it works to ensure it continues working. Humans need to understand how to tap into the environment without destroying the diversity or mechanisms. (Quodlibet, 2005)

As an urban-rural landscape the site's value lies in its deliberate intention to correct the damage done by the industrial activities. It currently plays an important role in the ecosystem by performing complex environmental through an extensive naturalized wetland.



THE SITES POTENTIAL

THE GREATEST POTENTIAL LIES IN THE SITES EXISTING QUALITIES

The greatest potential for the water treatment facility lies in the site's existing hydrology, natural diversity, existing infrastructure and land form. The project intends to protect the existing wetland as well as the established natural diversity by strengthening and activating the environmental potential of the neglected parcel of land.

Figure 3.6: The layers of the site's potential (Author, 2016)

3.6
THE SITE'S POTENTIAL

The potential of the site is currently overlooked and the town planners developing the emerging node at the R24 and R57 intersection run the risk of disregarding the site's natural wetland filtration role in the greater Vaal River system. The greatest potential for the water treatment facility lies in the site's existing hydrology, natural diversity, existing infrastructure and land form. The project intends to protect the existing wetland as well as the established natural diversity by strengthening and activating the environmental potential of the neglected parcel of land. The urban-rural nature of the site has the potential for the client to engage with the community of Bophelong by integrating a community development interface for job creation and stewardship which will nurture a sense of well-being for the people.

Figure 3.8: Established natural wetland. (Author, 2016)

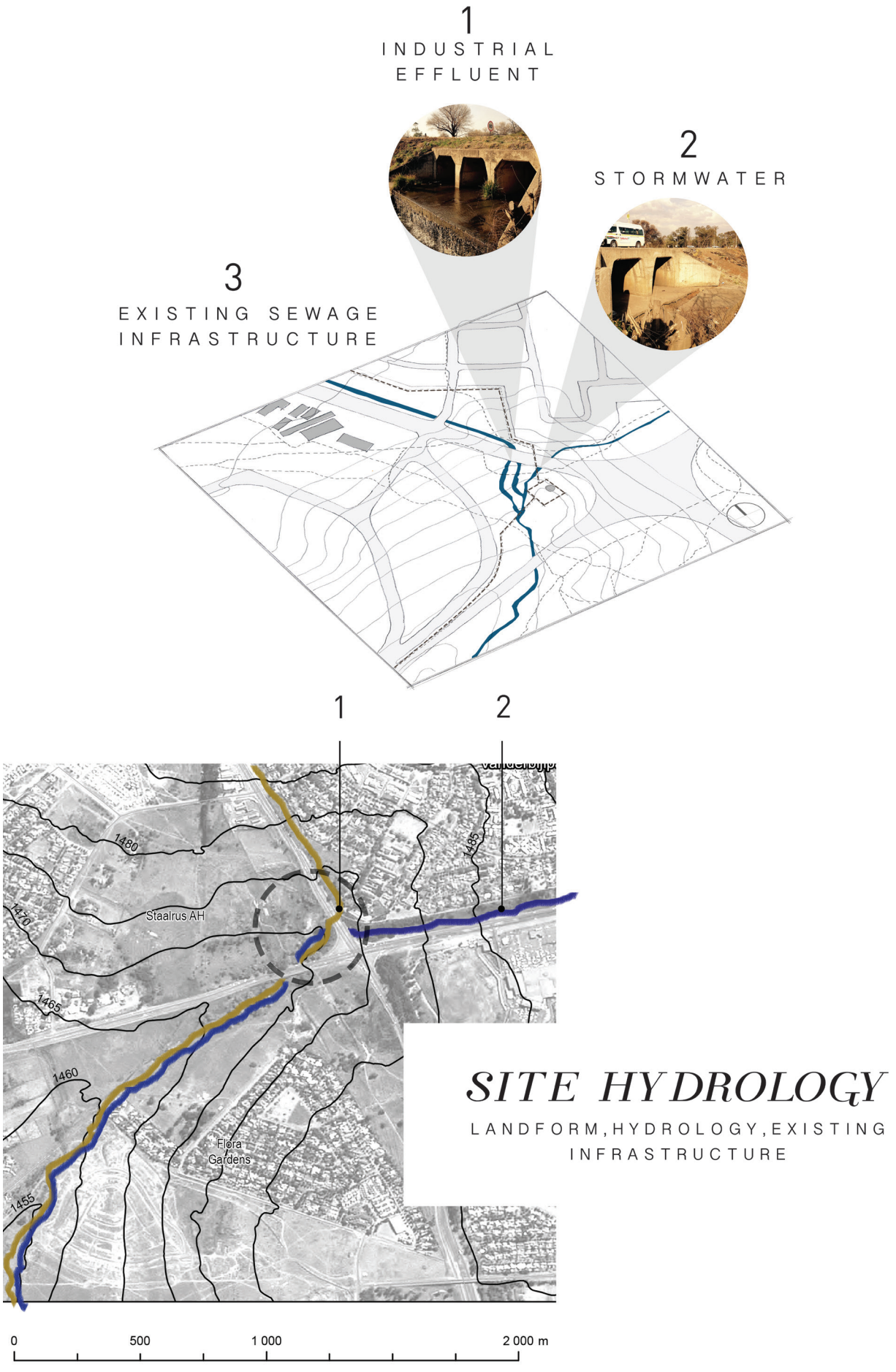


Figure 3.9: Sites hydrology showing natural movement of water through the site. (Author, 2016)

3.61

EXISTING HYDROLOGY NETWORK

The wetland accumulates water from the Rietspruit Canal and transfers it into Rietkuilspruit which feeds into the Vaal River System. The site's wetland is currently performing environmental tasks of water filtration and purification, yet these are not at a stage where all the contamination is removed as heavy metals remain untreated and are potentially entering the Vaal River network.

Water flow observations and documentation from the Rietspruit Canal were performed by the author in the year of the study, 2016. A steady flow of industrial effluent was noted by the author in August when the rainfall is the lowest in the Vanderbijlpark area. The rainfall is highest in the summer months posing a challenge of capacity of treatment for the volumes of water. The site's North to South gradient allows the water to flow through the wetland and into the Rietkuilspruit.

The site's existing hydrology can be analyzed and separated into three types of water which enter the site through 3 separate systems

1. Existing Sewage Infrastructure
2. Urban Storm Water
3. Industrial Effluent

EXISTING SEWAGE INFRASTRUCTURE

The R42/R57 intersection is the lowest point of the adjacent residential area and industrial area which houses a subsurface sewage lift station. The sewage is lifted and moved to the nearby sewage facility. The station is fully operational and fully contained resulting in no effluent/run off occurring from this facility into the wetland and or Rietkuilspruit system. The sub-station will however be taken into account in the design, layout and orientation of the intervention as it represents existing infrastructure that will remain.

URBAN STORMWATER

The storm water which flows from the residential area has a separate canal to the industrial effluent canal. Storm water contains floating debris, contaminants lighter than water (oil/grease), contaminants heavier than water (sediment) and dissolved minerals which can be treated by implementing a storm water wetland. (Vosloo, 2016) Constructed wetlands are designed to remove pollutants from storm water using several mechanism (microbial breakdown of pollutants, biological uptake by plants, retention, settling and absorption).

The intention is that the storm water will enter the site and flow directly into a constructed storage wetland which overflows directly into the Rietkuilspruit. This will allow the sediment to settle and grease to be removed.

INDUSTRIAL EFFLUENT

The water entering the site from the industrial area contains sediment contaminated with heavy metals, primarily chromium, copper and lead. The intervention's intention is to keep the industrial effluent separate from the storm water which will be treated separately. The position of the site for the intervention to treat the water quality is crucial. This point will become an ecological safeguard ultimately protecting the Vaal River System.

The site is considered an uncultivated parcel of land. The site was previously proclaimed as a reserved space for the expansion of the road infrastructure, however, the intervention proposes the rezoning the status of servitude for urban infrastructure. The site currently fulfills a hybrid role despite the current zoning classification. The site currently houses the local sewage lift pump which will remain where it is currently situated.

3.62

SERVITUDE WITH EXISTING INFRASTRUCTURE

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3.63

LANDSCAPE FORM

The natural contours have a north to south gradient, sloping down toward the Vaal River. The site has a low lying basin which has created a natural wetland. This makes it ideal for the proposed intervention as the contours facilitate a natural run off required for the treatment facility with minimal civil works, landscape disturbance or construction.

3.64

NATURAL BIOME & DIVERSITY

The site falls into the Grassland Biome of the Soweto Highveld Grassland and is the host to a variety of plant species making it rich in diversity. The various plant species collected by the author on site depicts the natural diversity.