Chapter 2

Theory

02 Theory

The Great Divide

The current difficulty we are experiencing in dealing with environmental and resource issues, stems from a concept of humans being the measure of all things (Lyle 1994:21). This notion, developed during the Renaissance, has shaped the landscapes and cities we live in today.

Renaissance buildings and landscapes were characterised by human beings assuming a central position within the environment (Lyle 1994:21). This relationship between human and nature can be seen in the strict geometrical layout of Renaissance gardens with a strong axial focus. Isaac Newton, René Descartes and Francis Bacon are just some of the 17th and 18th century thinkers who expanded on this new relationship between humans and nature that shaped a new mechanistic world view where earth was seen as one colossal machine and the idea that nature could be understood through an understanding of even the smallest part.

Descartes encouraged the collection of knowledge that could then be strategically applied through technology in an attempt to acquire power over nature and ultimately take control of the earth's processes.

Before these ideas could be further developed, fossil fuels and their potential to produce energy were discovered and along with that came the creation of machines that could harness that energy (Lyle 1994:22). This marked the beginning of Industrialization as the instigator for global transformation and unavoidably shaped the '*one-way throughput*'[4] world we know today.

A New Dawn

The 20th century brought about concepts aimed at challenging the assumptions developed in the 17th and 18th century regarding nature's underlying order (Lyle 1994:22). This new understanding of

Figure 2.1. Left: CWG Plant (Author 2017)

nature, inspired a perception of humanity as part of a complex and intricate world which is less deterministic and predominantly interdependent, bearing almost no resemblance to a machine. The Chaos Theory, Einstein's Theory of Relativity and Heisenberg's Uncertainty Principle are just some of the concepts of nature that emerged during the 20th century. These theories have been critical to the development of a new fundamental concept in the field of environmental design.

John Tillman Lyle (1994:ix) describes environmental design as the point where human behaviour and culture meets the earth's processes in order to create form. For this type of design to occur, connections that became estranged during the Renaissance and completely severed by the Industrial Revolution need to be reconciled. One of these connections is between nature and humans and the other connection is between science and art. Ultimately environmental design strives to provide a platform for humans and nature to meet and for art and science to join forces (Lyle 1994:ix).

A major shift in the field of environmental design has led to an increasing number of designers and builders coming to the realization that the solutions to current issues still elude us, amidst the various technological advances and increasing market demand (Haggard, Reed & Mang 2006:1). The conservation of energy, improvements to the quality of life and the reduction of waste are all qualities of a contemporary sustainable project, however these improvements are only slowing down the rate of degradation to the earth's ecosystems. John Tillman Lyle (1994:4) highlights the alarming rate of resource depletion and environmental degradation resulting from orthodox industrial development, in his book *Regenerative Design for Sustainable Development*. Haggard, Reed and Mang (2006:1) believe that instead of causing mass deterioration in our natural environment, development needs to promote ecological health. Simplification of complex living systems is at the heart of the emergent environmental crisis (Mang & Reed 2012:7) as nature's recurrent recycling of energy and materials has been replaced with linear flows, a degenerative system responsible for '*devouring its own sources of sustenance*' (Lyle 1994:5). In order to promote ecological health, these degrading patterns of linear flows require a radically different approach (Mang & Reed 2012:7).

Transformative resilience

'Transformative resilience' might be the key to achieving ecological health, as this approach aspires to discover and analyse the latent potential of each site or building in an attempt to identify possible opportunities for systems to share resources similar to the principles of 'industrial ecology' (Peres 2016:186). Re-envisioning these urban processes could result in enriched connections between nature, the built environment and the local community.

Transformative resilience focuses on renewing and recovering a system's health through the use of regenerative design (Peres, Barker & Du Plessis 2015:2) and inspires projects to become '*engines of positive or evolutionary change for the systems into which they are built*' (Haggard, Reed & Mang 2006:1).

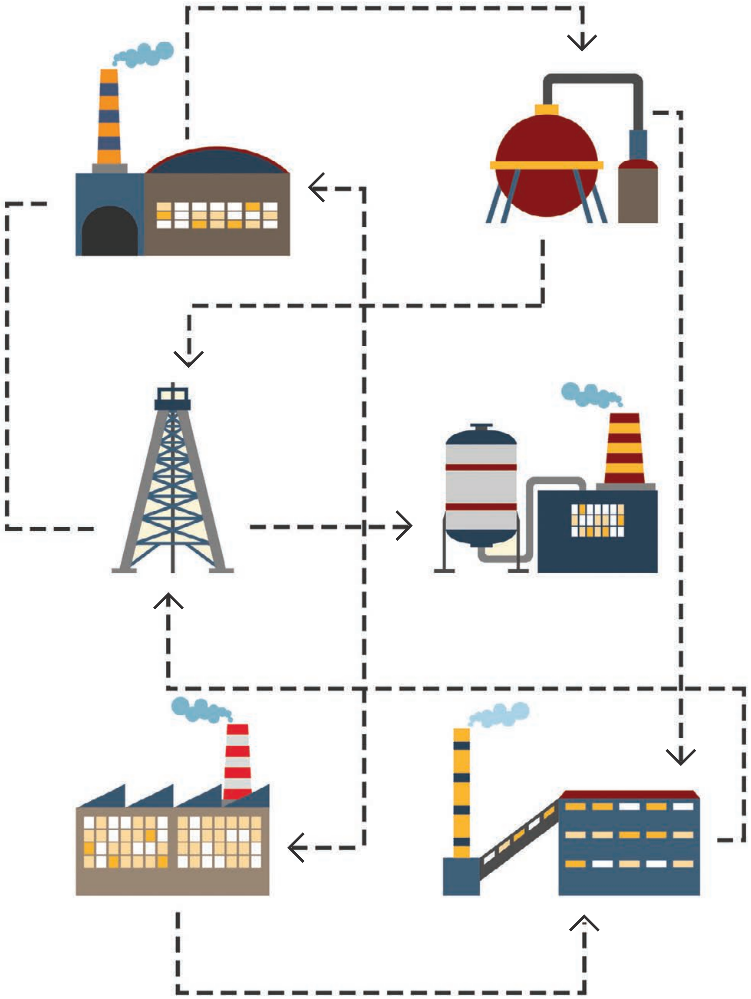

Figure 2.2.: Industrial Ecology (Author 2017, Images sourced from Freepik 2017)

Systems thinking as facilitator for regenerative design

Regenerative thinking is based on the notion that there is no great divide between nature and humans and that instead of ruling above it, humanity is a part of nature. This notion is derived from whole systems thinking; which believes that all things are connected as a single system and that each part of the system is vital in ensuring the health of the entire system (Littman 2009:15).

The beginnings of regenerative design stretch as far back as the 1880s with Ebenezer Howard's expressions of ecological thinking. Other contributors include Patrick Geddes with his take on cities as living organisms in 1915, Arthur Tansley's definition of ecosystems as the interaction between living things with their non-living habitat and even Ludwig von Bertalanffy's work on systems theory in 1968, which would later go on to inspire John Tillman Lyle's work on regenerative design. Charles Krone also made a significant contribution to systems thinking in the 1960s and 1970s which formed the foundation for the Regenesis Collaborative Development Group's research in the 1990s (Mang & Reed 2012:3-5).

The approach to living systems thinking which Charles Krone developed, could be applied to natural as well as human-social systems (Mang & Reed 2012:5). The purpose of the development processes and systemic frameworks Krone created, was to understand communities, businesses and nature as living systems in order to inspire mutually beneficial relationships through well integrated community, industrial and natural processes (see Fig.2.3.)

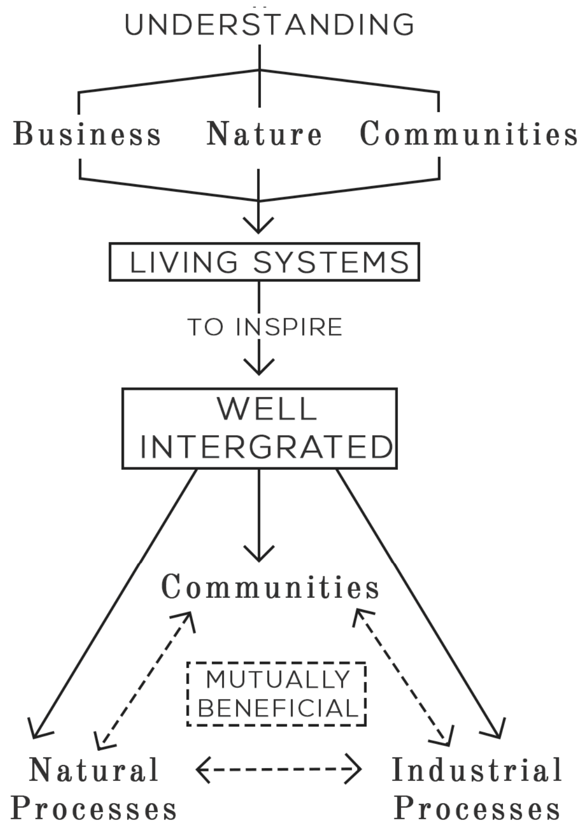

Figure 2.3: Living systems thinking summary diagram (Author 2017)

Regenerative and Industrial systems

Regenerative and industrial systems make use of the same basic processes in order to function, however the way in which they do, differs dramatically (Lyle 1994:24). One of the fundamental differences between industrial and regenerative systems is the way in which industrial systems attempt to bypass natural flows through the extraction of energy or materials like fossil fuels, that have been accumulated by the earth over decades. These processes are classified as degenerative practices as they fail to replenish the sources they exploit. Regenerative technologies on the other hand collaborate with nature's flow systems in order to replenish resources on a maintainable basis respecting the system's functional integrity (Lyle 1994:24). Replacing degenerative linear flows (Fig.2.4) with cyclical flows (Fig.2.5) could ensure continuous replacement of materials and energy used in the operation by means of their own unique functioning processes (Lang 1994 cited in Mang & Reed 2012:7).

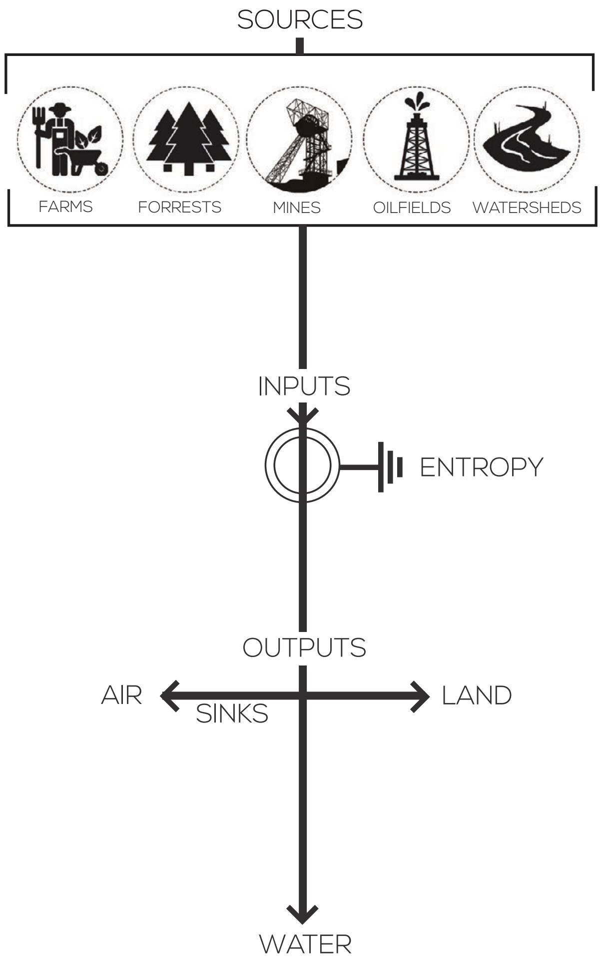

Figure 2.4: Degenerative linear flows (Author 2017, Adapted from Lyle 1994:5)

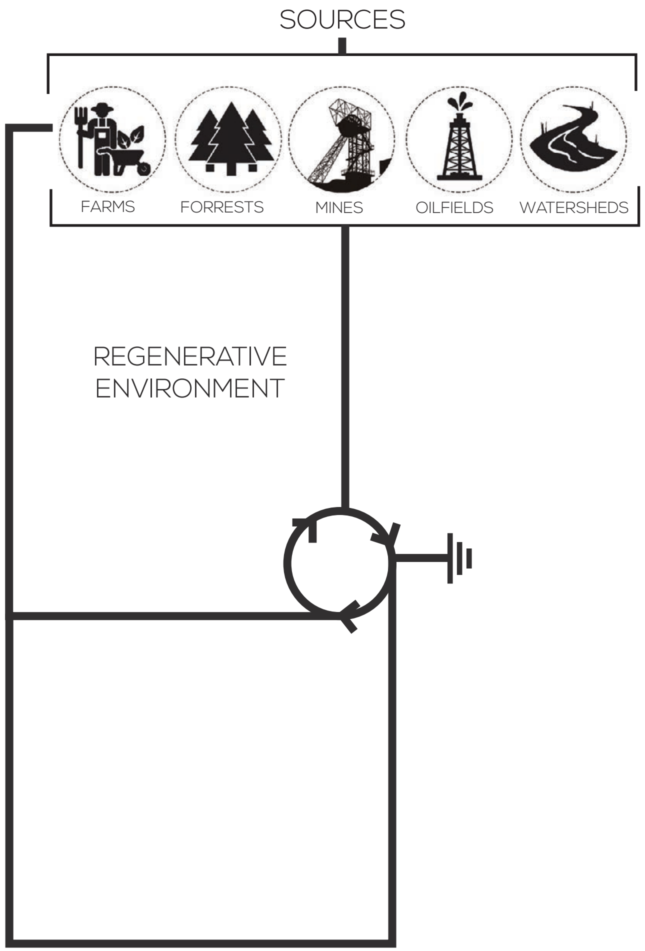

Figure 2.5: Regenerative cyclical flows (Author 2017, Adapted from Lyle 1994:10)

An Ecosystemic approach as conceptual model

In order to create entirely comprehensive architecture, capable of reintegrating into the surrounding urban context, Kirovová and Sigmundová (2014:433) propose that industrial sites be seen as ecosystems comprising various dynamic and complex systems resulting from diverse subsystems with distinguishable metabolic cycles, interacting with one another.

Comparing these industrial sites to ecosystems is not too far removed, as many of these industrial plants were '*operated according to a model of rational metabolic cycles representing technological flows*' (Kirovová & Sigmundová 2014:433).

This could be the key to understanding complex issues and ascertaining sustainable strategies for the re-appropriation of these redundant industrial sites.

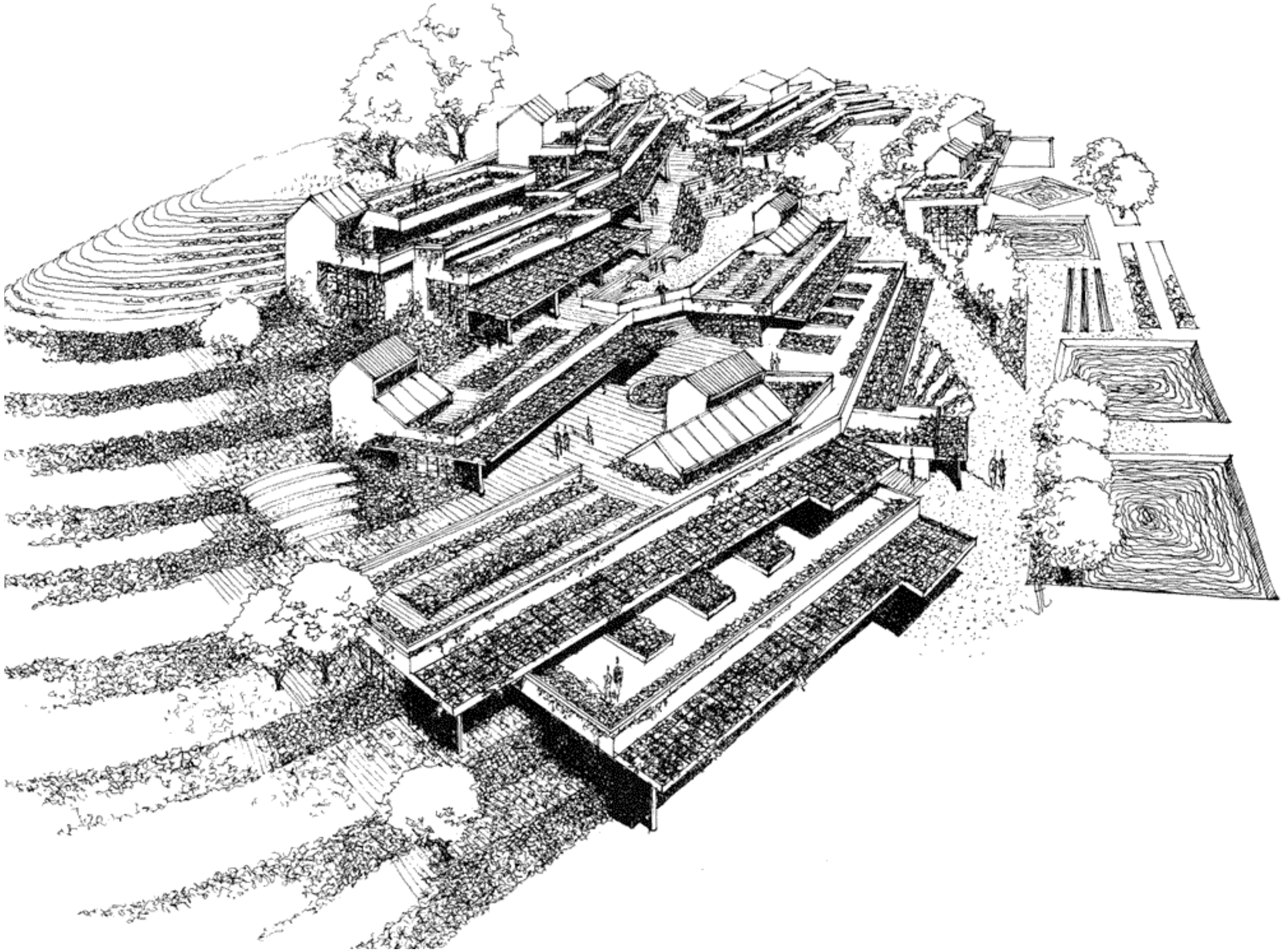

Figure 2.6: Centre for Regenerative Studies perspective sketch (Lyle 1994:279)

Theoretical precedent (Environmental)

The Centre for Regenerative Studies

Lyle (1994:23) categorised ecosystems into three modes of order namely structural order, functional order and locational order. Through an understanding of ecosystems and the three modes of order, a strong conceptual model could be formulated of the world in order to create a solid foundation for regenerative design.

Lyle (1994:23) defines structural order as '*the composition of living and nonliving elements*' this includes soil, rocks, animal and plant species. When considering an ecosystem's structure it is vital to be mindful of all the interactions between living and non-living elements.

Functional order assumes the role as the second mode within an ecosystem. It is defined as '*the flow of energy and materials that distribute the necessities of life to all of the species within an ecosystematic structure*' (Lyle 1994:23).

The energy that a landscape receives from the sun on a daily basis and the transformations it undergoes as it is reflected, absorbed or photosynthesised is a good example of this. Unlike energy, nutrients, water and various other materials do not have a continuous source of supply, instead they are regularly recycled. This cyclical system is also evident in the food web, relating closely to energy flows, as it provides living creatures with the necessary materials for effective body functioning (Lyle 1994:23).

Locational patterns form the third and final ecological order. All ecosystems are unique to their specific location and the number and type of species that can be supported by an ecosystem depends heavily on the environment created by the unique local conditions in the form of soil, climate and topography (Lyle 1994:24).

A single site often comprises of varying conditions such as microclimates and topographical differences creating complex patterns and laying the foundation for opulent patterns of development to transpire. This provides the perfect opportunity for the restoration of lost connections between place and people and the connection between natural processes and people.

The design of The Centre for Regenerative Studies is based around the concept of a human ecosystem. Although the landscape was developed to serve human purposes, the system is ecological in nature and comprises of processes that support life and function the same as natural systems (Lyle 1994:31). The basic principles of ecological order in the form of structural, functional and locational patterns were used in the design of the centre.

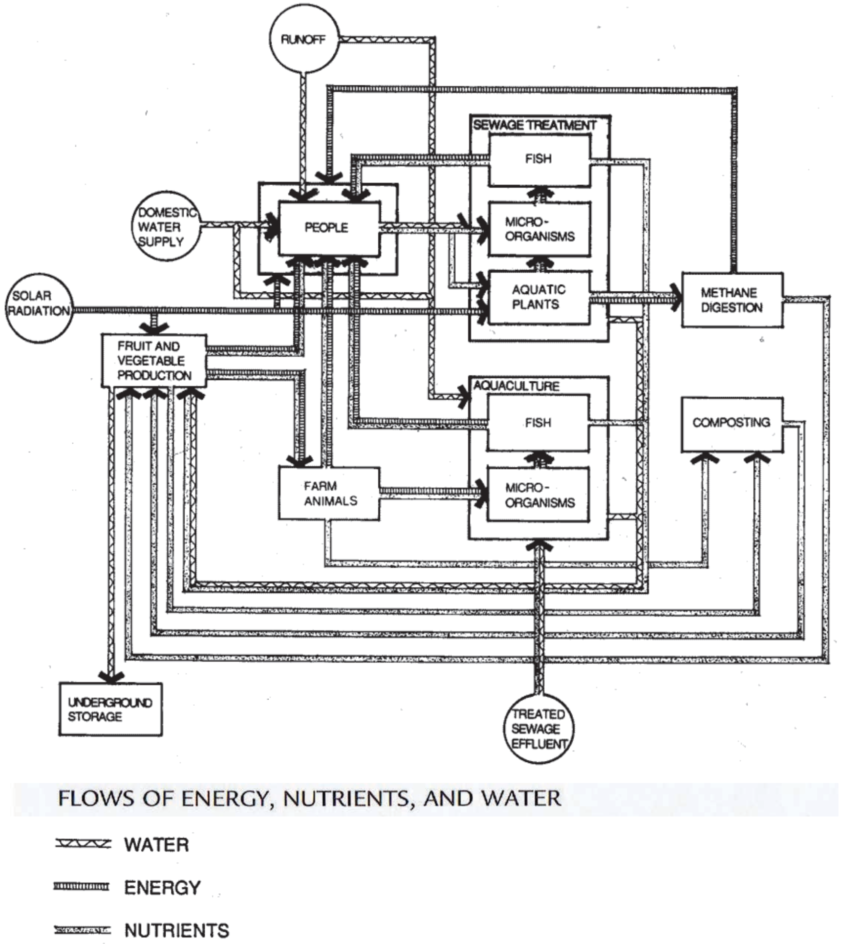

Figure 2.7: Network diagram depicting the functional order of the Centre for Regenerative Studies (Lyle 1994:33)

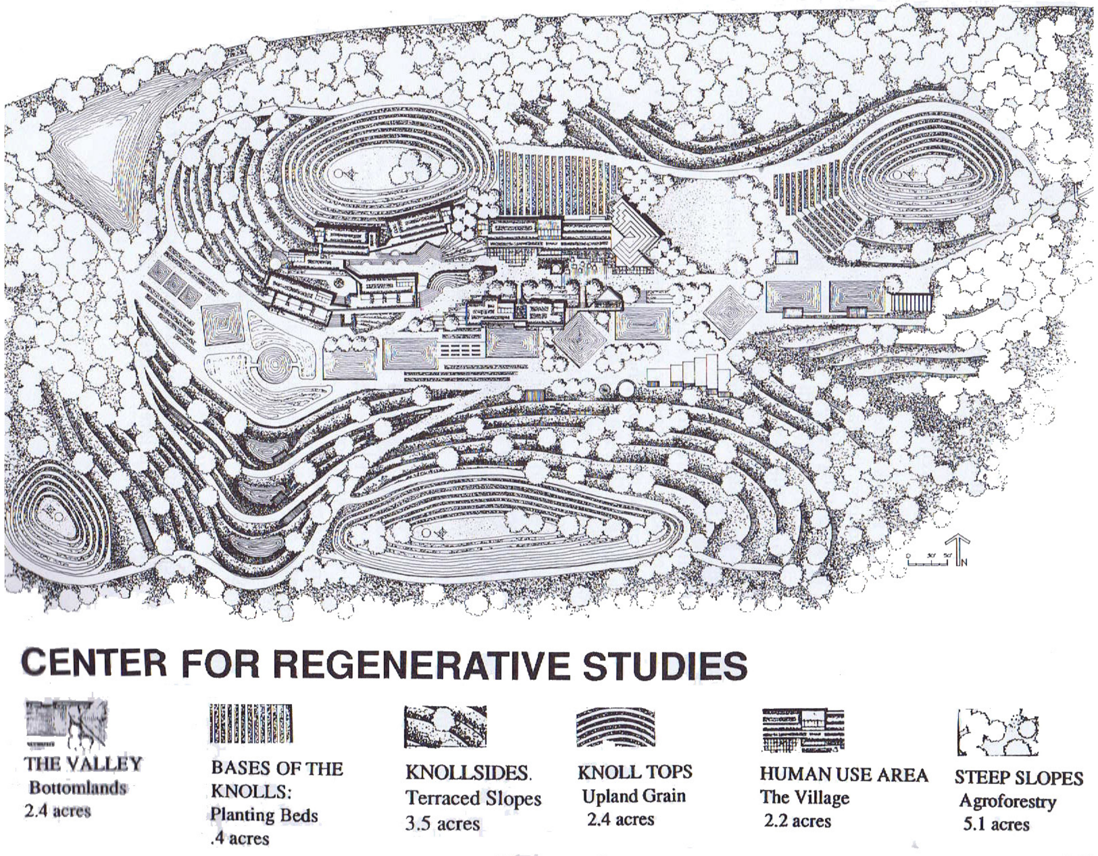

Figure 2.8 Above: Centre for Regenerative studies site plan (Lyle 1994:47)

In terms of structural order, the site was developed according to the principles of interactive diversity, with an array of cultural and biological activities housed on the site (Lyle 1994:31). The crops are grown in a dramatically different manner than conventional industrial agricultural farms. Instead of having single-crop monocultures, the complex topography lent itself to the planting of five different cropping systems consisting of polycultural combinations, encouraging species diversity. The complex polycultural structures need little energy to remain stable and require no chemicals. The rationale behind this type of cropping system is rooted in the regenerative systems' diverse structural nature, which offers various ways of achieving a specific task, at the same time using the interactions between species or elements to strengthen the system in its entirety. This creates a level of resilience within the structure.

The functional patterns of a natural system have the same general operational flow to that of an intricate assembly of diverse species, connected through a network of material and energy flows (Lyle 1994:32).

The species used in these systems are quite diverse and mostly controlled by human management. Figure 2.7 illustrates the various flows of nutrients, energy and water, working together to form a complex functional structure.

After the site's locational patterns were analysed, it was identified as a '*microcosm of the global agricultural landscape*' and through a very selective process, locations on site were identified where the various food-growing conditions could be imitated (Lyle 1994:34). The site was categorized into six areas as illustrated in Figure 2.8 and a specific use was allocated to each, in order to maximize the category's potential. 'Knolltops' were identified as areas for energy generation, 'flatter knollsides' were used for grain-growing and 'knollsides' for terraced agriculture. The 'valley bottoms' were identified as areas for aquaculture and any water-related crops, 'steep slopes' for agroforestry as a means of stabilizing the soil and the 'south-facing knollsides' as the location for the village (see Fig.2.9).

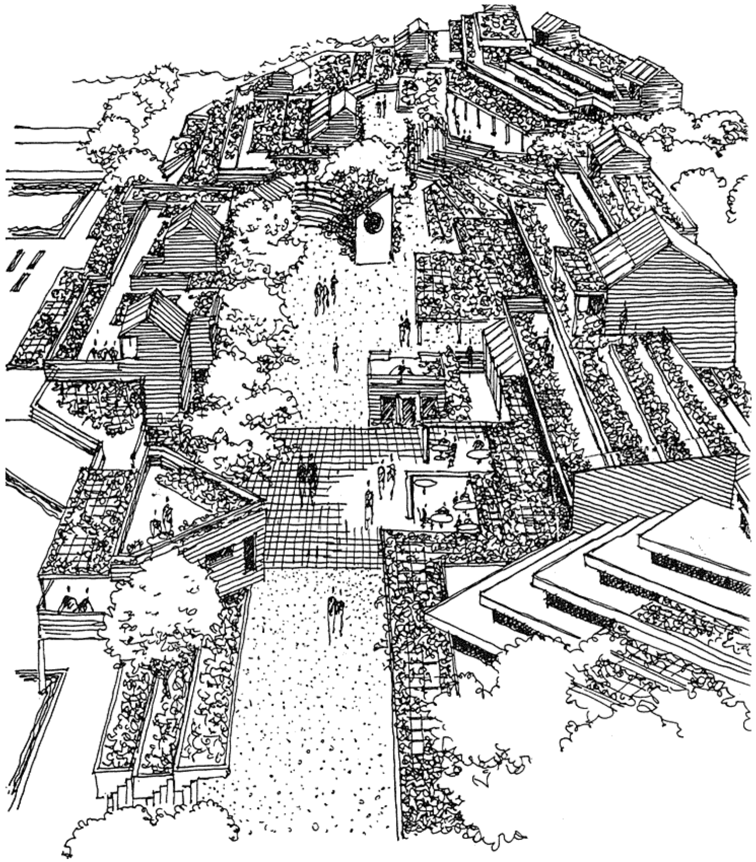

Figure 2.9: Perspective of the village at the Centre for Regenerative Studies (Lyle 1994:136)

Heritage

The value of Industrial Heritage

The value of industrial heritage is multifaceted as it is not rooted purely in the rarity of particular processes, the intrinsic value of the site itself or the historical consequences left by these industrial activities, but also by the invaluable sense of identity asserting significant social value as it exposes fragments of the lives of ordinary men and woman (TICCIH 2003:171).

Kirovová and Sigmundová (2014:433) believe industrial sites have the potential to mitigate and possibly resolve social as well as environmental issues arising from the past. In order for these former industrial sites to be reintegrated into the surrounding urban and socio-economic structure, appropriate principles of sustainability for adaptive re-use need to be identified and applied (Kirovová and Sigmundová 2014:433). By identifying these principles, the possibility of new functions achieving sustainability and catalysing regeneration and habitability of these previous industrial sites, increases.

Unfortunately South Africa, like many other developing countries, has failed to recognize the value of our industrial heritage and this has led to an absence in the protection of heritage with the necessary measures. This has awoken the fear that industrial buildings might be in danger of extinction if attention and awareness of their value are not brought to the table. Industrial heritage buildings, no longer in use, are often left abandoned leading to deterioration and frequently resulting in the demolition of these structures, leaving only '*ruins of the past*' (Läuferts Le Roux & Mavunganidze 2009:533).

The only legislation currently safeguarding these buildings in South Africa is the National Heritage Resources Act no. 25 of 1999 which states "*No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority*" (South Africa 1999:58) and the only guideline given in terms of how a building may be altered for re-use is stipulated in the general notice 218 of 2017 published in the Government Gazette (2017:111), which states that in cases where heritage resources are adapted for re-use, it should enhance the life span of the resource and help generate the necessary income to aid in the conservation of said resources. However, measures should be taken to prevent adaptive re-use from impacting the heritage significance of the resource in a negative way. The Nizhny Tagil Charter was specifically developed for the protection of industrial heritage and was adopted in July 2003 by the International Committee for the Conservation of the Industrial Heritage (TICCIH). The charter classifies industrial heritage as the remnants of industrial culture, possessing significant technological, historical, scientific, social or architectural value (The Nizhny Tagil Charter 2003:170). Mines, factories, mills, workshops and sites where energy used to be generated and transmitted can be classified as part of these remnants. The charter emphasises the importance of the material remnants left by this rapid growth in industry and the need for it to be studied and preserved, as it holds significant human value on an international scale (TICCIH 2003:169).

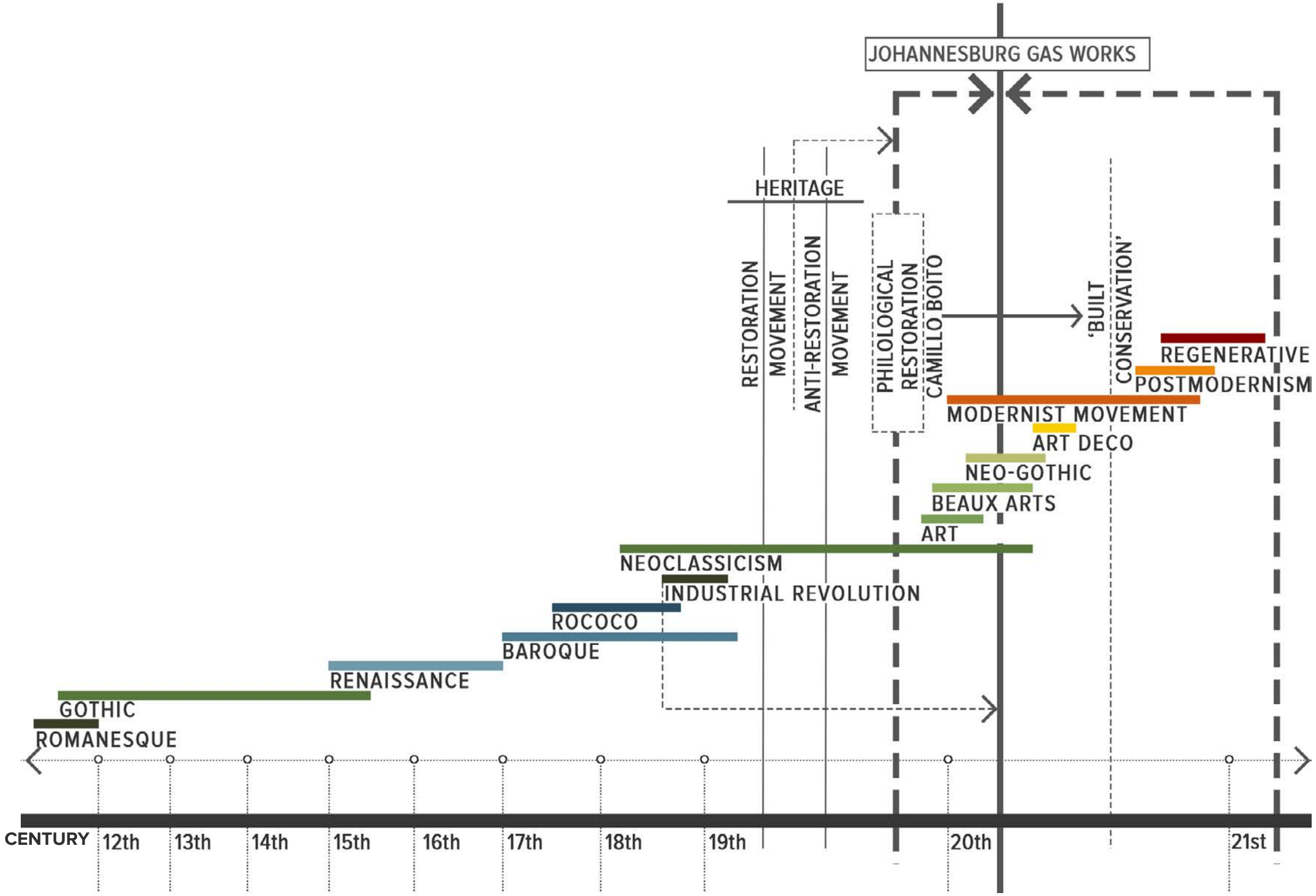

Figure 2.10: Position in the Continuum of Architectural thinking (Author 2017)

Martín-Hernández (2014:42-43) defines preservation as the act of keeping something alive. He argues that preservation is not purely a technique, but rather an approach used to understand the uniqueness of a building or monument in order to make it relevant in the current day and age. The point of departure for preservation is to acknowledge the various transformations buildings or monuments have undergone over time. Preservation protects the sustenance of a building's past exactly through transforming it, however these transformations require special care.

Paolo Torsello, an Italian preservationist, referred to the history of a building embedded in the architectural object itself, as its 'latent form' (Torsello 1989, cited in Martín-Hernández 2014:43). Martín-Hernández (2014:43) believes applying preservation transformations to architectural objects increases the possibility for the object's 'latent form' being exposed.

Henri Bergson believed that "*which does not change does not endure*" (Bergson 1911, cited in Martín-Hernández 2014:43).

Bergson's notion could be interpreted as "*the continuous unfolding of the past into the present and future*" (Martín-Hernández 2014:43) rather than the replacement of one moment in time with another. Retaining identity relies heavily on the ability to adapt the way in which a building or monument's latent form is expressed, in order for it to be understood in the contemporary moment (Martín-Hernández 2014:43).

Heritage conservation strategies have been widely debated for centuries. The 19th century brought about theoretical discussions regarding adaptive reuse as a means to preserve historic architecture. It was during this time that two opposing orthodoxies on the restoration of historic buildings were formed. The restoration-movement led by the French architect and theorist Eugène Emmanuel Viollet-le-Duc and the anti-restoration movement led by the English art critic Johan Ruskin and his apprentice William Morris (Plevoets & Van Cleempoel 2012:1). Amidst these two radical approaches a 'third way' (Hernández Martinez 2008:249) emerged.

The Italian architect Camillo Boito formulated a new theoretical approach which synthesized these opposing theories of Voillet-le-Duc and Ruskin. His approach became known as 'philological restoration', a term originating from the Latin classification of a monument as document or inscription. This implied that a monument could be seen as a document, constructed to convey a specific message and should therefore not be falsified (Stubbs & Makas 2011:16). Boito was clearly influenced more by the theories of Ruskin and Morris as he advocated conservation over restoration. Boito believed that restoration should only be used in cases where a monument is in grave danger of disappearing and even then, the intervention should be minimal and respect the epoch of the building by not attempting to recreate it stylistically. Boito believed that in order to prevent falsified stylistic recreations, any additions constructed in the restoration process should be done in a distinguishable architectural language, using materials and forms that were unlike those used in the original structure. Boito also advocated the use of contemporary architecture in restorations, possibly as an additional strategy to avoid falsification of the original architectural style (Hernández Martinez 2008:249).

According to Hollis (2003:5) a philological approach to restoration does not focus purely on exposing the aesthetic unity of a historic building, but rather improving the legibility of the diverse fragments that constitute the whole. The consequences of philological restoration are not just prevalent in the debate on conservation, but also in the contemporary field of historic building extensions and alterations. According to Hollis, Italian architect Carlo Scarpa, was one of the most influential practitioners in this field.

Figure 2.11: Preservation through transformation (Author 2017)

Theoretical precedent (Heritage)

Castelvecchio by Carlo Scarpa

The alterations made to the Castelvecchio in Verona by Scarpa are binary (Hollis 2003:5). Scarpa exposed the historic layers of the structure through excavations, which had undergone various alterations over time, and at the same time added new layers to the structure to allow the Castelvecchio to adopt a new function as museum (see Fig.2.12).

The additions made by Scarpa seem to divert from the order prevalent in the old building and the distinctly modernist additions are in 'a dialectical relationship' (Hollis 2003:5) with the old due to the contrast created between the light asymmetrical modernist additions and the existing 'classical stereotomic mass' (Hollis 2003:5) .

Figure 2.13 illustrates the way in which Scarpa makes use of shadow lines and contemporary materials to create a distinct separation between the old and the new (Hollis 2003:5). By doing this, he is able to connect the two eras whilst exposing their inherent differences. This reveals Scarpa's ability to adapt existing buildings to foster new functions while still adhering to the principles of philological restoration.

Philological restoration, preservation and transformative resilience all have underlying similarities. Transformative resilience aspires to discover the latent potential of a building or site as a means to revive it. Preservation, as defined by Martín-Hernández, aims to protect a building's latent form, referring to the history embedded in the building itself, exactly through transforming it, in order to make it legible in the contemporary era. This creates a strong metaphor for a building as a document containing a specific message, linking back to the philological approach to heritage.

These collective theories create a strong visual of post-industrial sites possessing latent form, messages and potential just waiting to be resuscitated. The unifying factor being the stagnant nature in the potential of buildings in need of some sort of reaction to activate, expose or restore them. Regenerative theory could be the catalyst for this type of change.

Figure 2.12: Entrance at Castelvecchio (Tyler 2013)

Figure 2.13: Details of junction between old and new (Tyler 2013)

Locational precedent

Thesen Island - The Turbine Hotel

Background:
Thesen Island is located in the northern part of the Knysna lagoon. The Thesen family, who relocated from Norway to Knysna in 1870, played a vital role in the history of this island as well as the development of Knysna's timber industry (Hart & Halkett 1998:3).

The Thesen family was responsible for the advent of industrialization on the island with the establishment of the Thesen & Co sawmill operations. Milling operations were conducted in the sawtooth building (see Fig. 2.14) and a small power station (see Fig. 2.15) was erected in 1939 to power all the island's operations. (Edwards 2017:89).

For over a 100 years, Thesen Island was a hub for timber milling, power generation and ship building, aiding in the development and prosperity of Knysna. The island was purchased by the Barlow's Group in 1974 and timber milling continued until the 1980s when it was decided to close down all operations due to a decline in the lucrativeness of the business. The industrial buildings and machinery began to decay. The neglect of the island resulted in a wasteland posing serious health risks to the population still residing on the island as well as to the environment (Edwards 2017:90).

Heritage value:
Hart and Halkett (1998:12) acknowledges the fact that South Africa has often failed to comprehend the importance of industrial heritage which has led to an absence in creating the necessary measures to protect these structures.
The old power station, although much smaller in scale than most other power stations, had significant value in terms of its contribution to the socio-economic development of Knysna as well as the industrialisation of the island and its surrounding areas (Edwards 2017:94).

The Turbine Hotel:
The location of the abandoned industrial buildings relative to the sensitive ecology of the Knysna lagoon prompted the need for redevelopment of the island and its abandoned industrial buildings (Louw 2015:928). The island was redeveloped into a 'mixed-use marina' (Louw 2015:928) which is made up of 650 residential units and a central commercial zone referred to as Thesen Harbour Town. It is in this core that the old power station is situated. Outdated technology caused the old power station to become redundant and it was therefore proposed that it be converted into a hotel. The hotel is just one of the many industrial structures in the precinct to be adaptively re-used.

Preservation of the sense of place:
During the conversion of the old power station into the Turbine Hotel, the goal was to retain the sense of place of the powerhouse (Louw 2015:932). This was achieved by retaining as much of the original machinery and piping as possible. The piping was repainted to match the colour of the original pipes and new pipes were added in a different colour palette in order to follow the flow of both the old and new processes. One of the oldest boilers

was identified and refurbished with the guidance of heritage professionals. The vaulted furnaces were also refurbished into a bar that now serves the hotel's new conference rooms.

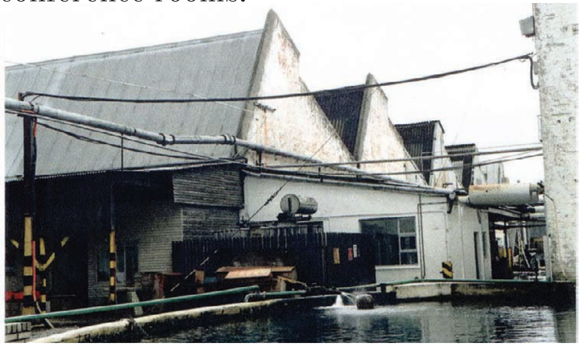
Figure 2.14: Sawtooth building (Hart & Halkett 1998:22)


Figure 2.15: Power station before adaptive reuse (Hart & Halkett 1998:24)

Figure 2.16: The Turbine Hotel (Stay Review 2012, edited by Author)