02 CONTEXT ANALYSIS

The purpose of the Context Analysis is to provide a general understanding of the greater context within which the design intervention is proposed.

The background, climatic conditions, significance, vegetation and historical context is discussed to enable a greater insight and comprehension pertaining to the various design decisions that were taken.

2.1 Background

220 000 years ago a blazing meteorite crashed into the earth's crust. The collision resulted in an impact crater with a diameter of 1,13km and a depth of 200m. This crater is currently known as the Tswaing Crater, previously famous as the Pretoria Saltpan or Zoutpan crater [Reimold et al, 1999:1].

The site has strong associations with storytelling and mythological beliefs sparked by the significant magical realm presented by this unique and nearly perfectly circular structure. Some storytellers profess that a giant snake lives just below the gloomy waters of the crater lake and that this creature trains sangomas [traditional healers and prophets] in their skills [Reimold et al, 1999:1].

For many years scientists have struggled to determine the origin of this unique structure. It was much debated whether it was created by a volcanic eruption or a meteorite impact. After extensive testing and sampling by means of a drill core through the interior of the crater in the 1990's, it became clear, and is today accepted, that the crater originated by means of a violent explosion that was triggered by the hypervelocity impact of a large meteorite approximately 220 000 years ago [Reimold et al, 1999:1].

It is one of the best preserved impact craters in the world and the only crater that is accessible by foot right down to its centre. It is the fourth meteorite crater museum in the world, and the only one in Africa [others being the Meteor Crater in the United States, Ries Crater in Germany, and some exhibits in the town of Rochechouart in France] [Reimold et al, 1999:2].

Memorandums of Understanding have been concluded between the NFI [National Flagship Institute] and the City of Tshwane, and the NFI and GDACE [Gauteng Department of Agriculture, Conservation and Environment] in an attempt to ensure the effective management and development of Tswaing. Informal relationships exist between the NFI and the Council for Geoscience, the University of the Witwatersrand, the Scouting Association of South Africa, the Traditional Healers Association and various other community-based organisations [Bewsher, 2005:7].

Figure 2.01 Aerial photograph of the TMC [http://rst.gsfc.nasa.gov/Sect18/Sect18_6.html accessed 24.02.2009]

2.2 Meteoric impact craters

Meteorites are 'rocks from heaven' - the only samples available to us for direct study of the solid matter 'out there in space', besides a few kilograms of lunar rocks returned from the moon by astronauts and space probes, and tiny cosmic dust particles collected on high flying aircraft and spacecraft.

In recent years it has also been shown that Earth has 'collected' a few meteorites that originated from Mars. Today there are thousands of meteorites in museums, private collections, and research institutions throughout the world.
[www.saao.co.za accessed on 24.02.2009].

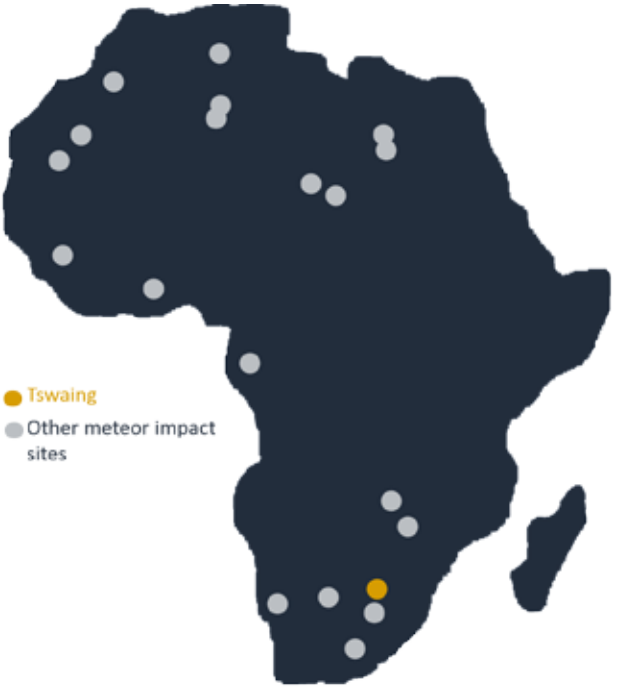


Figure 2.03 Meteor impact sites on the African continent [adapted from www.saao.co.za accessed 24.02.2009]

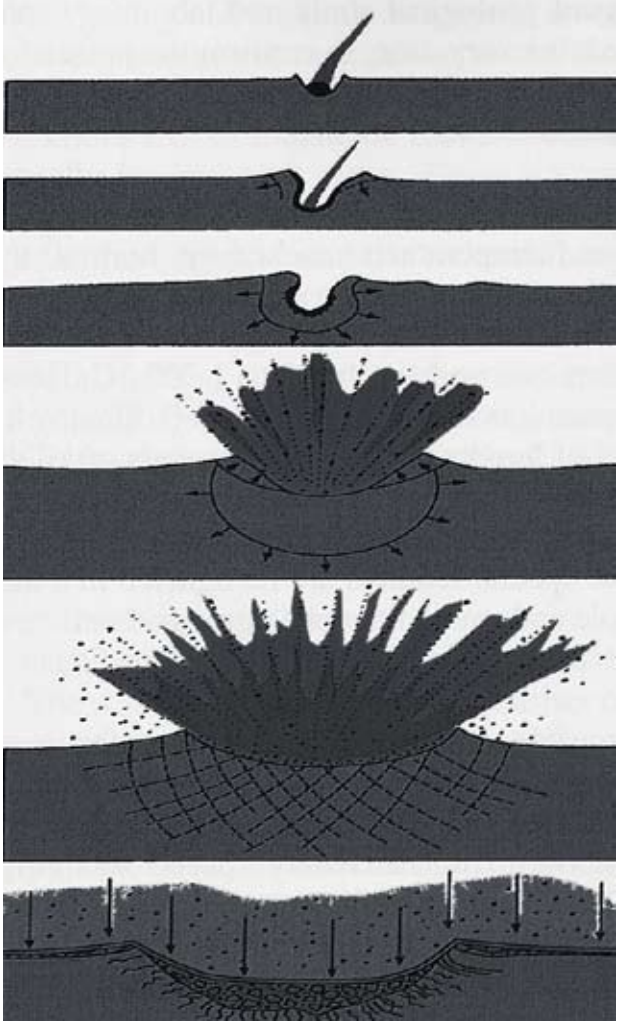


Figure 2.02 Schematic representation of the sequence of events during the formation of an impact crater. [Reimold, 1999:29]

The kinetic energy of the meteorite on reaching the Earth's surface is transferred into the ground as a shock wave. The rock is compressed as the shock wave moves downwards, with the rock at and near the point of impact experiencing the greatest pressures and temperatures. At the point of impact the rock is intensely fractured, fused, and, to some part, vaporised. The shock wave is reflected back and throws out large quantities of fragmented rock, known as fragmented breccia, or rock and mineral fragments mixed with melted material - a breccia known as suevite. The breccia outside the crater is referred to as the ejecta blanket. Large amounts of breccia also fall back into the crater. The crater rim is formed simultaneously by the solid bedrock being forced upwards and outwards. The last sketch is an envisaged section through the crater shortly [several minutes] after the impact.

Figure 2.04 The visitor centre at Vredefort dome [May 2009]

2.3 Regional Context

Site Location

Figure 2.05 Location map of the TMC in relation to the African continent

Accessibility

The Mabopane Centurion Development Corridor [MCDC] is proposed to run past Tswaing.

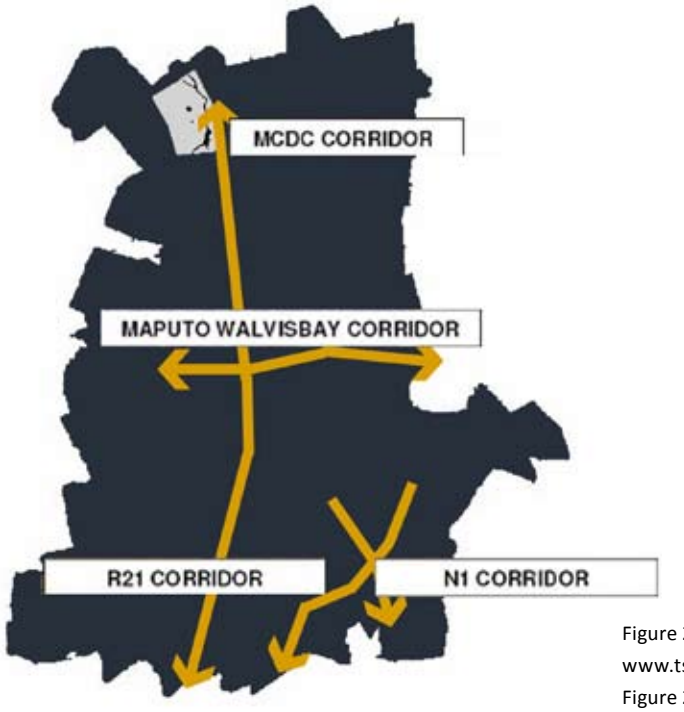
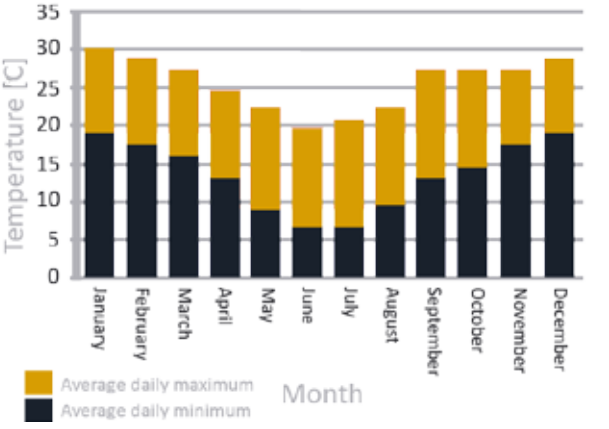
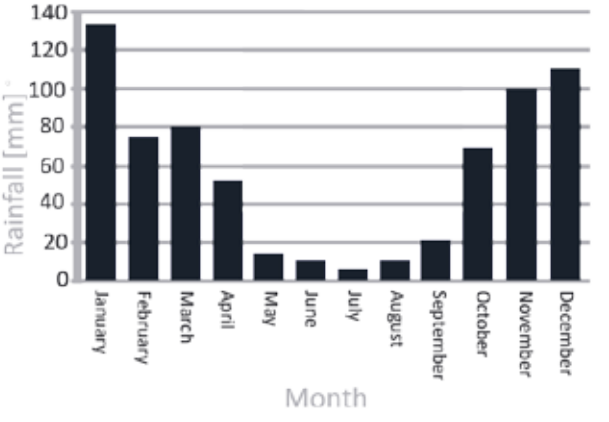


Figure 2.06 Transport and development corridors of the greater Tshwane [Adapted from www.tshwane.gov.za accessed 15.03.2009]





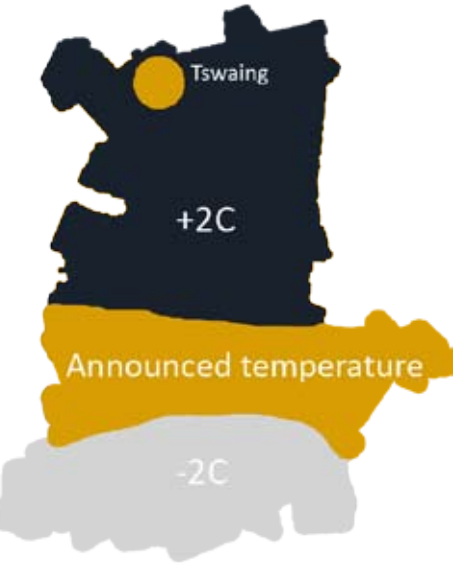


Figure 2.07 Annual precipitation graph for Tshwane [Adapted from www.tshwane.gov.za accessed 15.03.2009]

Figure 2.08 Annual temperature graph for Tshwane [Adapted from www.tshwane.gov.za accessed 15.03.2009]

Figure 2.09 TMC Temperature in relation to Pretoria CBD [Adapted from www.tshwane.gov.za accessed 15.03.2009]

2.4 Climate

Zoning

Because of its long-standing status as an agricultural research station Tswaing is currently protected from encroaching urbanisation. It forms a largely pristine island in a very densely populated area. This area consists primarily of informal housing and therefore lacks much in terms of educational and research facilities [Reimold et al, 1999:2].

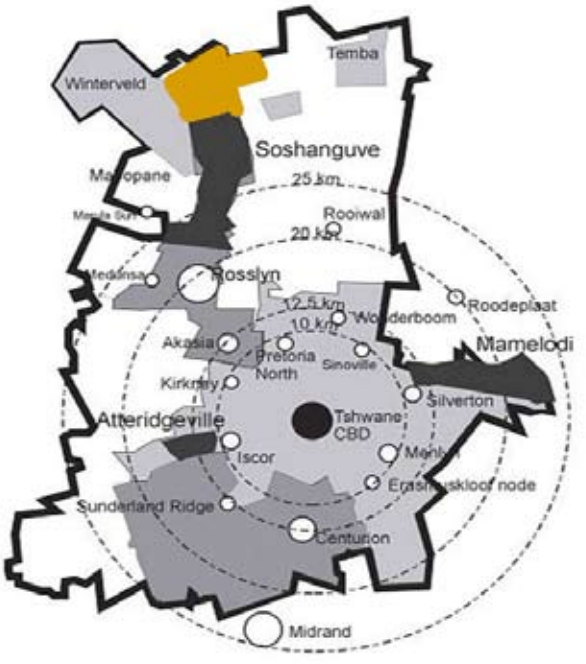


Figure 2.10 Economic development of the greater Tshwane region in relation to Pretoria CBD [Adapted from www.tshwane.gov.za accessed 15.03.2009]

The surrounding area: Soshanguve

According to Mmule, the guide from the TMC, the name Soshanguve is derived from the mixture of cultures it contains: Sotho, Shangani, Nguni and Venda. There are an estimated 1 000 000 people living in the surrounding area.

The settlement of Soutpan, located across from the existing Tswaing reception building, is part of an extension of Soshanguve. Currently no water or electricity is being provided for the Soutpan community.

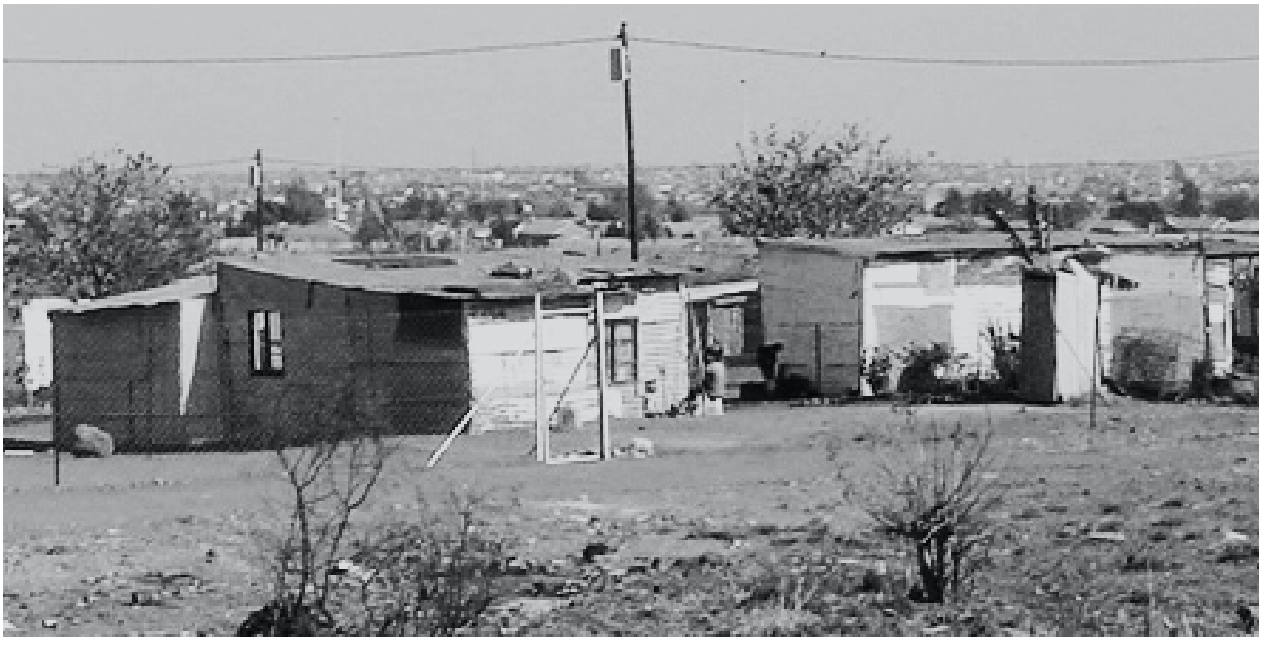


Figure 2.11 Soshanguve - informal housing [February 2009]

2.5 Context of the study area

Site significance

The TMC has a unique conservation value as a rare and extremely well preserved geological feature [Bewsher, 2005:4].

Figure 2.12 Green nodes and conservation areas within the greater Tshwane [Adapted from www.tshwane.gov.za accessed 15.03.2009]

Figure 2.13 Crater lake, view towards eastern rim of crater [February 2009]

Figure 2.14 Pink Nebo Granite at TMC [February 2009]

Biodiversity

The Tswaing area is located in a Mixed Bushveld zone. Its altitude varies between 1140 and 1100 metres above sea level [Reimold et al, 1999:2]. The dominating rock type is pink Nebo Granite. The most prominent feature is the crater with its saline lake. The water of the lake is derived from groundwater and rainfall. Annual precipitation and evaporation determines the water level of the crater lake [Reimold et al, 1999:133].

The Soutpanspruit feeds an extensive wetland system that is very rare in South Africa. It is a natural habitat for a variety of animal species and hosts a unique composition of floral species [Bewsher, 2005:4].

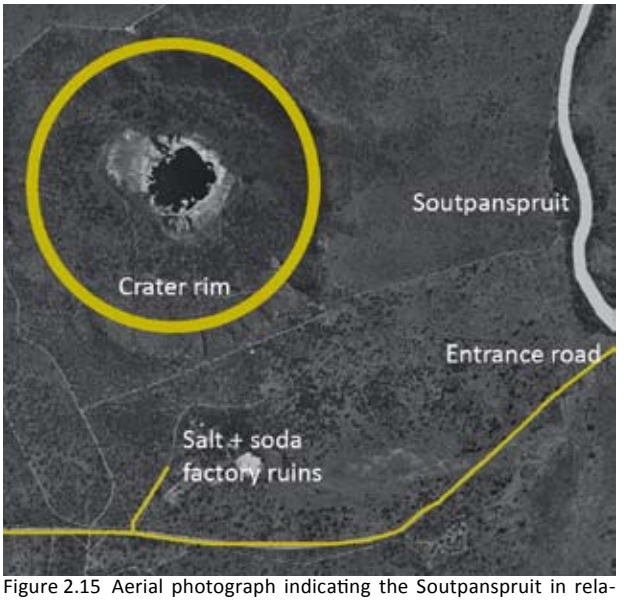


Figure 2.15 Aerial photograph indicating the Soutpanspruit in relation to the crater rim

Figure 2.16 Soutpanspruit [February 2009]

Geological significance

The large bowl-shaped feature was caused by the impact of the meteorite. The crater rim was formed when rocks and gravel were thrown outwards and deposited around the impact hole. Initially the crater rim was approximately 250m higher than it is presently. Over the years the rim weathered, causing the crater to fill with deposits of sand and gravel, resulting in a rim that is at its highest point approximately 120m from the crater floor [Reimold et al, 1999:133].

Only the Meteor Crater in Arizona surpasses the TMC in scientific, educational and tourism appeal. Tswaing is also one of the best studied and most accessible craters in the world due to the extensive tests conducted to determine the origin of the structure.

The site has been proposed as a National Monument and site museum. Tswaing is one of the country's prime geological heritage sites and is the only impact crater in Africa that is being developed to benefit environmental education, tourism and local communities [Bewsher, 2005:4-5].

The sacred nature of the site

People from the local communities come specifically for the water from the crater, as they believe that the water can spiritually cleanse them. Certain people use the rocks from the crater, heating them, adding some hot water, and covering them with a blanket. The resultant steam is believed to provide spiritual purification.

Selected communities come to the crater to slaughter animals such as chickens in accordance with their ancestral rituals. The site is admired by the Zionists, and traditional healers from all over the world gather at Tswaing as it is regarded to be an extraordinary place. People of different religions visit the site and pray to give thanks for its beauty and majesty.

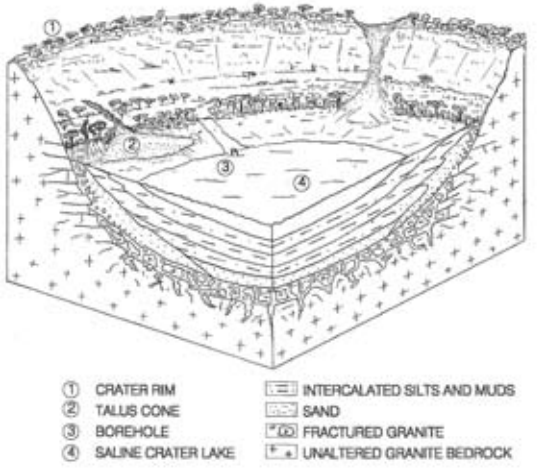


Figure 2.17 Schematic block diagram [cross-section through the crater] showing different features of the crater environment and interior, as well as some sedimentary characteristics [Reimold et al, 1999:62]

Figure 2.18 View of crater floor and Southern crater rim from Northern rim [February 2009]

2.6 Fauna and Flora

Fauna

A variety of animal life is found within the Tswaing conservation area. Approximately 35 mammal species that include shrews, genets, mongooses, porcupines, moles, bats, field mice, impala, black-backed jackal, common duiker, steenbok, kudu, eland, zebra and the red hartebeest are found at the TMC.

Flora

The Tswaing area is located in a Mixed Bushveld zone. The vegetation varies between a dense, short bushveld and a rather open tree savanna. On shallow soils the red bushwillow [*Combretum apiculatum*] dominates the vegetation [Low and Rebelo, 1998:26].

The buffalo thorn [*Ziziphus mucronata*], also known as the blinkblaar-wag-'n-bietjie, is also found around Tswaing. The symbolism locally associated with this tree is that the long thorns symbolise the fact that one should focus on the future, while the short thorn is a reminder to remember one's roots.

Lichens are minute to microscopic-scaled plants which consist of algae and fungi living in symbiosis. These lichens cause weathering on the surfaces of rocks. Lichen species are divided into two major groups: an 'epilithic' group that grows on the surface, and an 'endolothic' group that grows inside the rock. Lichens display many colours such as yellow, brown, orange, red, green, grey and black. The variety of lichen species on the different sides of the rocks in this area clearly illustrates the differences in local temperature and moisture conditions [Reimold, 1999:132].

Figure 2.19 Lichens on the crater trail [February 2009]

Figure 2.20 Natural vegetation at TMC. View towards M35 and Pretoria North from north-eastern crater rim [February 2009]

Figure 2.21 View towards Southern rim of crater and Pretoria [February 2009]

Figure 2.22 Natural vegetation at the TMC [March 2009]

2.7 Historical Context

Thousands of years ago, after a blazing meteorite slammed into the Earth's crust, small nomadic Middle Stone Age tribes came to Tswaing from time to time to hunt, gather edible and medicinal plants, and collect salt. They made tools and weapons of stone, bone and wood. Remnants of these artefacts were found mainly along the riverbeds and in close proximity to the road leading to the crater floor. As the Tswaing rock is not really suitable for the making of these implements, they were probably brought from elsewhere.

A few small artefacts dating from the era between the Stone Age and Iron Age were found and are presumed to have been brought to Tswaing, possibly by ancestors of the San [Bushmen]. Shards of decorated clay pots found on the crater floor indicate that the Iron Age people were early Sotho or Tswana-speaking communities, also known as the Moloko.

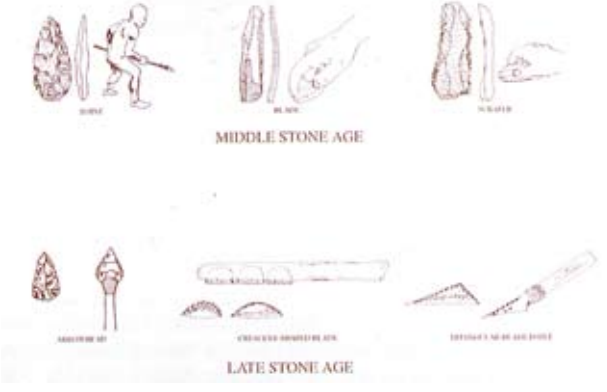


Figure 2.23 Middle and Late Stone Age artefacts found at Tswaing Crater [Reimold et al, 1999: 120]

Figure 2.24 Examples of decorated and undecorated potshards found at Tswaing [Reimold et al, 1999, :121]

During the 1850's, Boer settlers started dividing the region north of the Magaliesberg into farms. The crater was located on the Zoutpan farm. Animals came here for the salt, and lead bullets that are still being found on the crater floor indicate that Tswaing was a popular hunting area. Primitive salt extraction had already been established as the main activity at Tswaing. On 31 October 1876, ownership of the farm was formally vested in the ZAR Government through Deed of Grant 1419/1876.

During the 1890's, Zoutpan [Salt Pan] was properly surveyed and the north-eastern corner became a new separate farm named Uitspan [Resting Place].

Until 1902, salt was obtained from shallow evaporation ponds. A road for ox-wagons was constructed. Rights to obtain salt were leased to individuals by the government; these individuals then regulated the collection of salt by farmers and other private individuals.

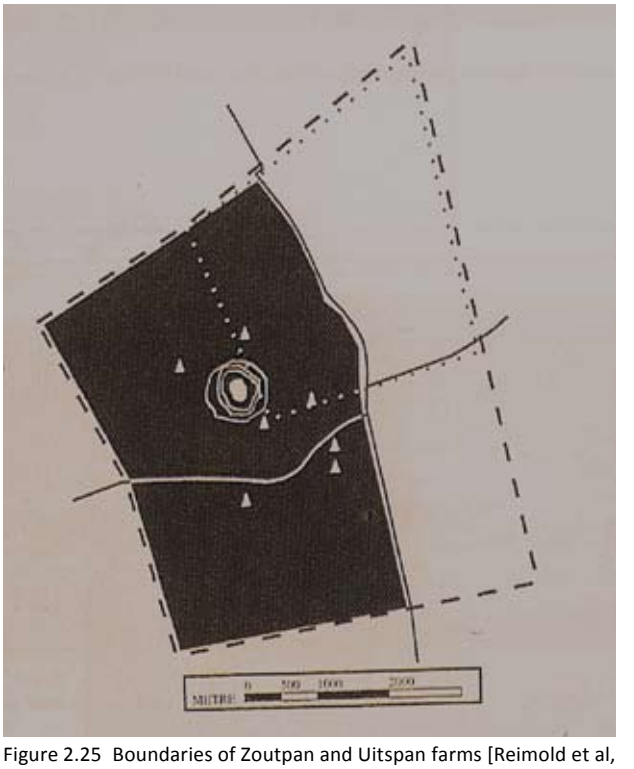


Figure 2.25 Boundaries of Zoutpan and Uitspan farms [Reimold et al, 1999: 121]

In 1912, South African Alkali Ltd started the systematic mining of soda deposits. In 1913 South African Alkali Ltd erected furnaces on the southeast rim of the crater to produce calcined trona, for which there was a big market on the Witwatersrand. A tram line was laid and a steam-powered hauling engine was put into operation.

In 1918, the first lease [started in 1912] was renewed for two successive periods of seven years. Production suffered dramatically due to the extensive exploitation of the rich trona deposits on the surface. W. Mauss, a German consulting chemical engineer, was employed and he reported that the Windram-Williams process was effective and recommended the construction of a new factory.

In October 1918, the process to obtain soda from the brine instead of the mud was perfected and the Windram-Williams process was abandoned. A patent application was made and plans to erect a new production factory were initiated. The factory site was chosen and construction began. A cutting [currently known as Mauss's cutting] was made in the southern crater rim to enable direct haulage between the crater floor and the new factory.

In 1921, more funds were procured, and the factory erected in 1919 was put in operation again. Production was not a success. H.R. Blumberg, a chemical engineer who later became the general manager, developed a method – later perfected by Clark and Partner – to extract all the salt and soda from the brine. The factory was gradually enlarged to accommodate these methods.

In 1949, five test wells, each with a diameter of 1m, were sunken into the crater floor to test its soda and salt content. Although there was sufficient soda and salt lower down, production costs would have been too high, and extraction was therefore not feasible.

Figure 2.26 The earliest known photograph of Tswaing, taken by H.F. Gros in 1889 [Reimold et al, 1999: 122]

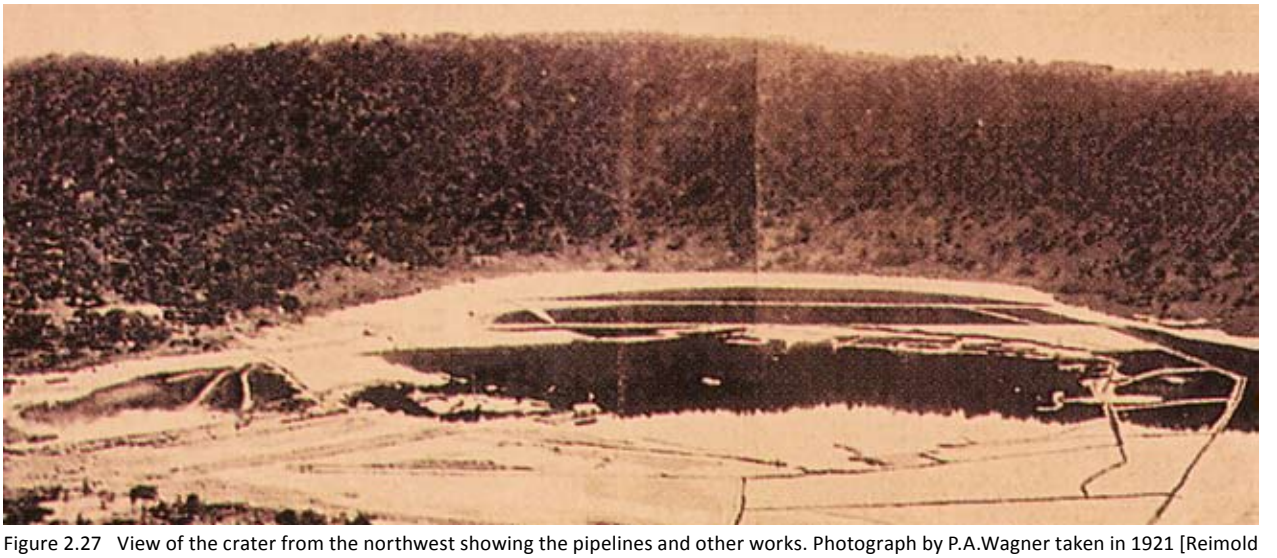


Figure 2.27 View of the crater from the northwest showing the pipelines and other works. Photograph by P.A.Wagner taken in 1921 [Reimold et al, 1999: 122]

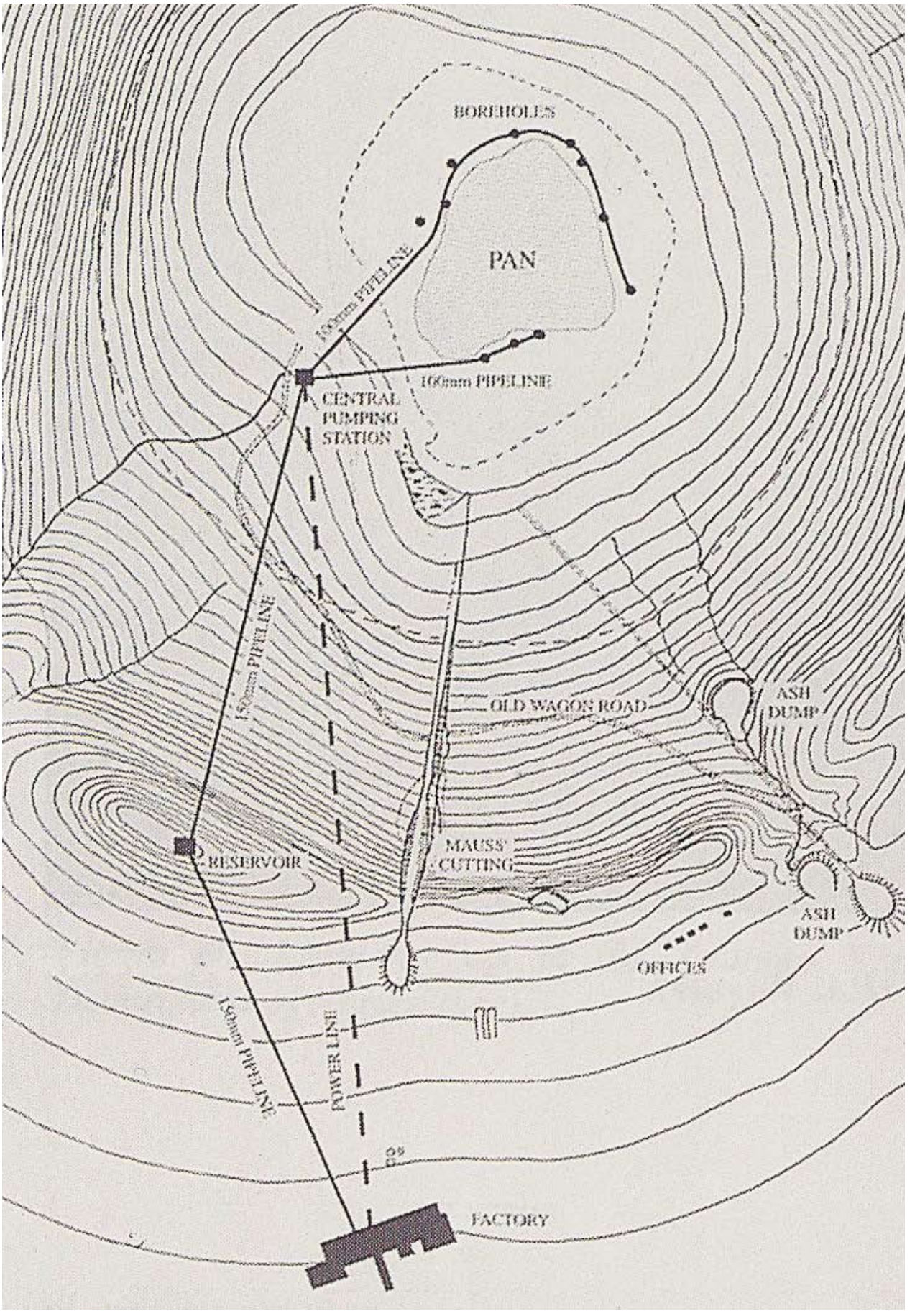


Figure 2.28 Plan of crater area showing bore holes, pipelines, central pumping station and reservoir [Reimold et al, 1999: 123]

In 1953, Zoutpan was resurveyed and subdivided into separate areas. The smallest area was leased to South African Alkali Ltd for the mining of soda and salt and for grazing the animals that were used, such as donkeys and mules. Grazing and other land-use rights of the 1 880 hectares, the largest part of Zoutpan, were transferred to the Department of Agriculture.

In the period between 1954 and 1956 the production of soda-ash resumed. Grazing camps were established on the remainder of the Zoutpan farm, water bore-holes were drilled, drinking troughs were built, a cattle herd was assembled, and staff was appointed to carry out experimental farming.

Mining at Tswaing came to an end in 1956.

Between 1958 and 1961, part of the old factory at Tswaing was used by a chemical engineering company, Palframan and Horner, who attempted to produce salt. All that remained was a stockpile of whitewash as a silent witness to the attempts to whiten the brownish colour of the small quantity of salt that was produced. The machinery was removed and sold or re-used elsewhere. All the roof plates, doors, windows, and any other useful items were removed from the houses.
The machinery was removed and sold or re-used elsewhere. All the roof plates, doors, windows, and any other useful items were removed from the houses.

During the 1970's all the houses were demolished, leaving only the foundations.

In 1992, The Zoutpan Experimental Farm was closed down, after which the National Cultural History Museum took it over.

On 30 March 1996 the Tswaing Crater Museum was officially opened.

During 2001, Gauteng Nature Conservation invested in the Tswaing area by providing infrastructure and staff members to monitor the wildlife. Game such as kudu, eland and zebra were resettled at Tswaing.

In 2003, the crater was drilled in collaboration with the international Continental Scientific Drilling Programme [ICDP] and Geoforschungszentrum [Potsdam, Germany] [Bewsher, 2005: 5].

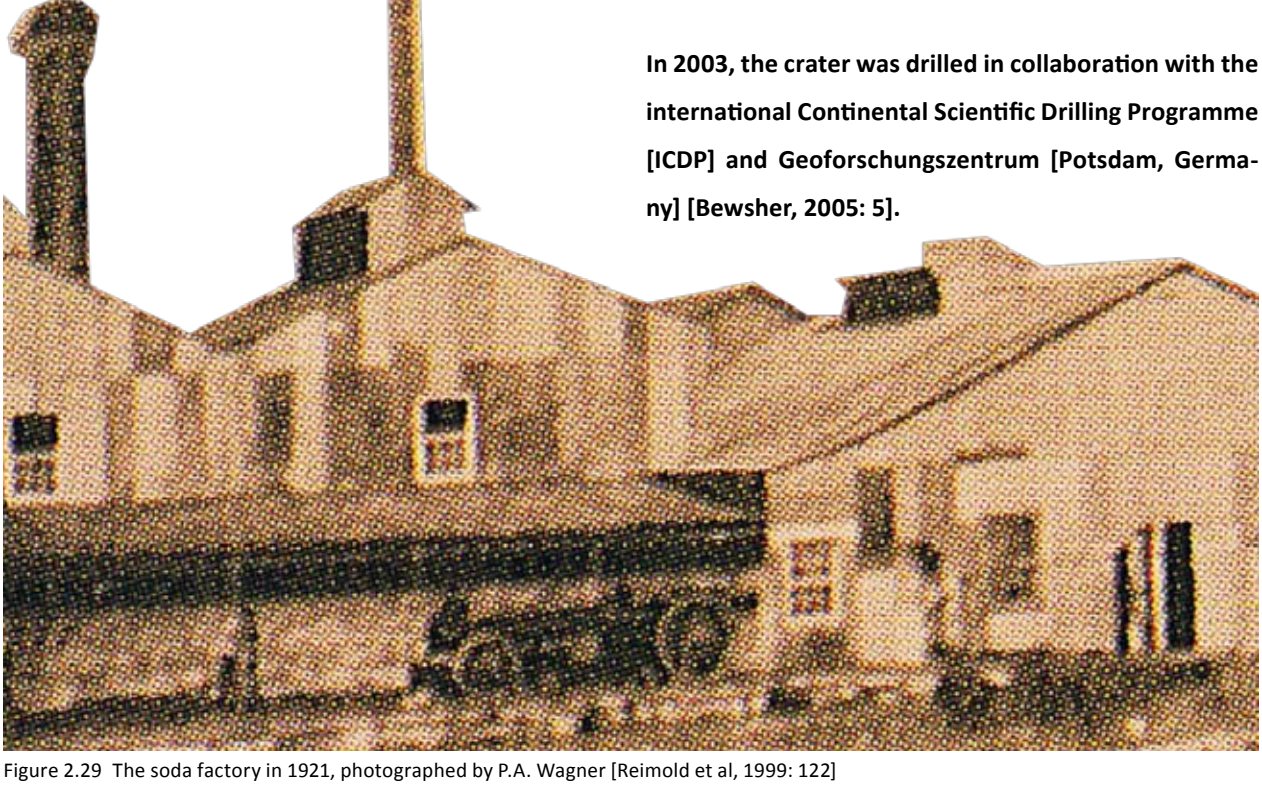


Figure 2.29 The soda factory in 1921, photographed by P.A. Wagner [Reimold et al, 1999: 122]

On 23 August 2009 a fire was started outside the fence of the TMC. The fire spread, burning down the visitor centre constructed in 1996, and 500ha of the nature reserve.

Figure 2.30 The TMC after the fire destroyed 500 ha and most of the existing visitor centre on 23 August 2009 [August 2009]

2.8 Environmental guidelines and policies

Environmental conservation

Tshwane Open Space framework [TOSF]

The Tshwane Open Space Framework endeavours to define and classify open spaces in Tshwane in order to provide a network of quality public spaces that fulfil the requirements of high environmental standards [Tshwane Municipality, 2005:5].

According to this framework, Tswaing Crater would be classified as a Green node, as it serves as a conservation area and is of irreplaceable value [Tshwane Municipality, 2005:24]. It states that the natural character of the site should be maintained and any human intervention should be sensitively located and have a minimum footprint. Activities suggested include research, education, conservation and eco-tourism [Tshwane Municipality, 2005:25-28].

Sites identified as protected and of irreplaceable value, such as Tswaing, will be subject to an Environmental Impact Assessment before human intervention may take place. Integrated Environmental Management Plans must be drafted in order to maintain the protected area [Tshwane Municipality, 2005:155].

Figure 2.31 Map of green nodes in Tshwane with Tswaing indicated. [Adapted from www.tshwane.gov.za accessed 15.03.2009]

World Cultural and Natural Heritage conventions

United Nations Education, Scientific and Cultural Organization [UNESCO]

In this document, UNESCO describes natural heritage as natural features or natural sites that are of outstanding universal value from the point of view of science, conservation or natural beauty [UNESCO, 1972:2].

As Tswaing is a young impact crater, it is very well preserved compared to the Vredefort Dome in the Free State which is 2020 million years old and severely eroded [Reimold, 1999:31]. For this and many other reasons it is of great importance that the Tswaing Crater is considered for declaration as a future World Heritage site, as this would imply stringent protection and conservation measures that will improve the chances of survival of this significant site.

Each site on the list of World Cultural and Natural Heritage sites is evaluated and treated individually by the World Heritage Committee. Concepts that are emphasised in the document are those of education and awareness. It clearly states that appreciation and respect for the site should be transferred in educational programmes and that the public be informed of the dangers that threaten heritage sites [UNESCO, 1972:13].