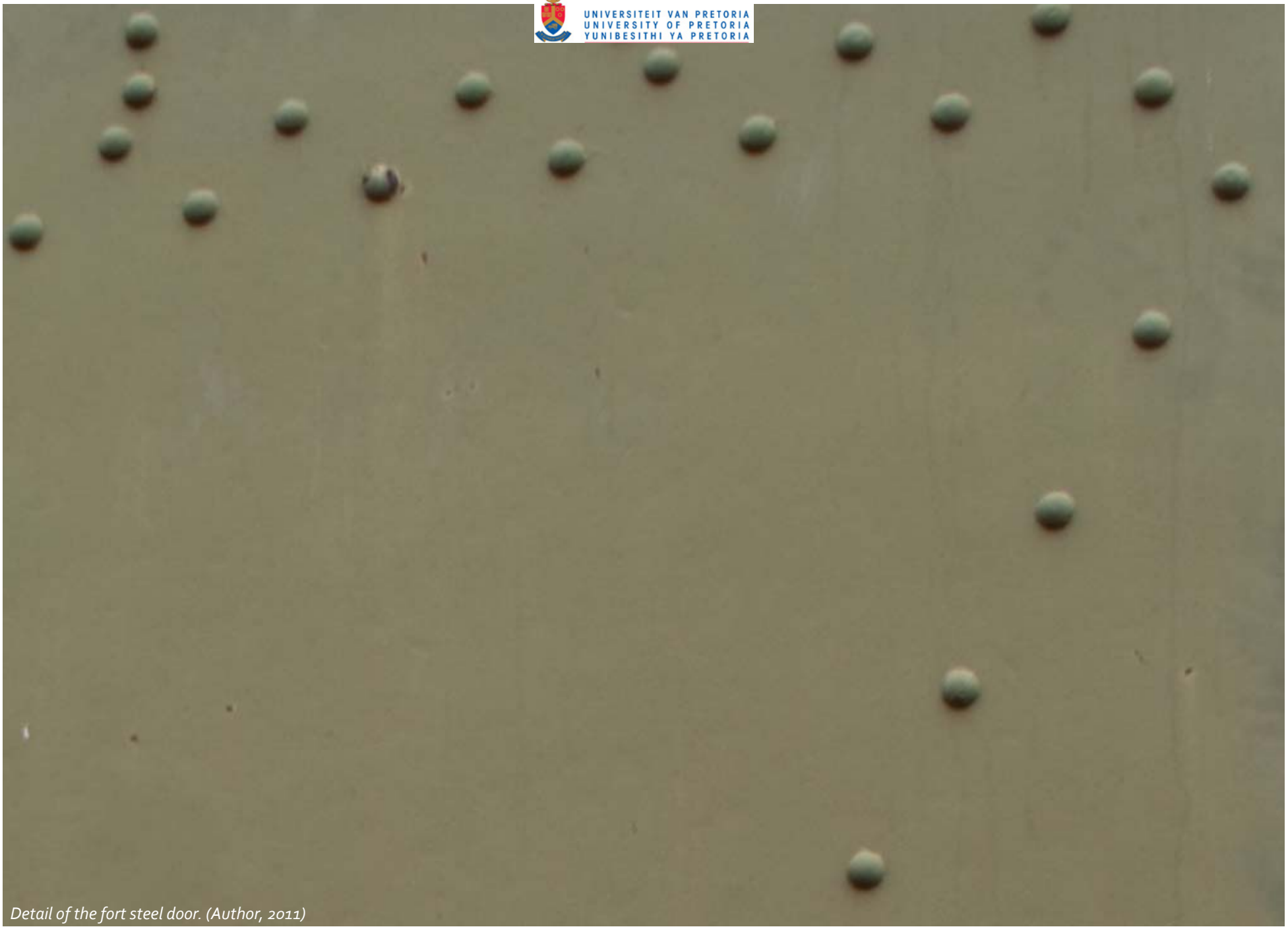

Detail of the fort steel door. (Author, 2011)

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TECHNICAL RESOLUTION 08

This chapter will focus on the technical resolution and clarrification of the sketchplan.

Illus. 293: Existing material detail in one of the fort rooms. Note the steel column, deteriorating concrete floor and ruined walls. (Author: 2011)

Introduction

This chapter investigates the technical resolution of the proposed design. The site location and site in context plans are presented to orientate the reader. The final sketch-plans are presented followed by the following:

- Soft materials
- Hard materials
- Sustainability strategies
- Reference plan
- Lighting plan (atmosphere and technical)
- Stormwater management plan
- Stormwater calculations
- Technical sections and details

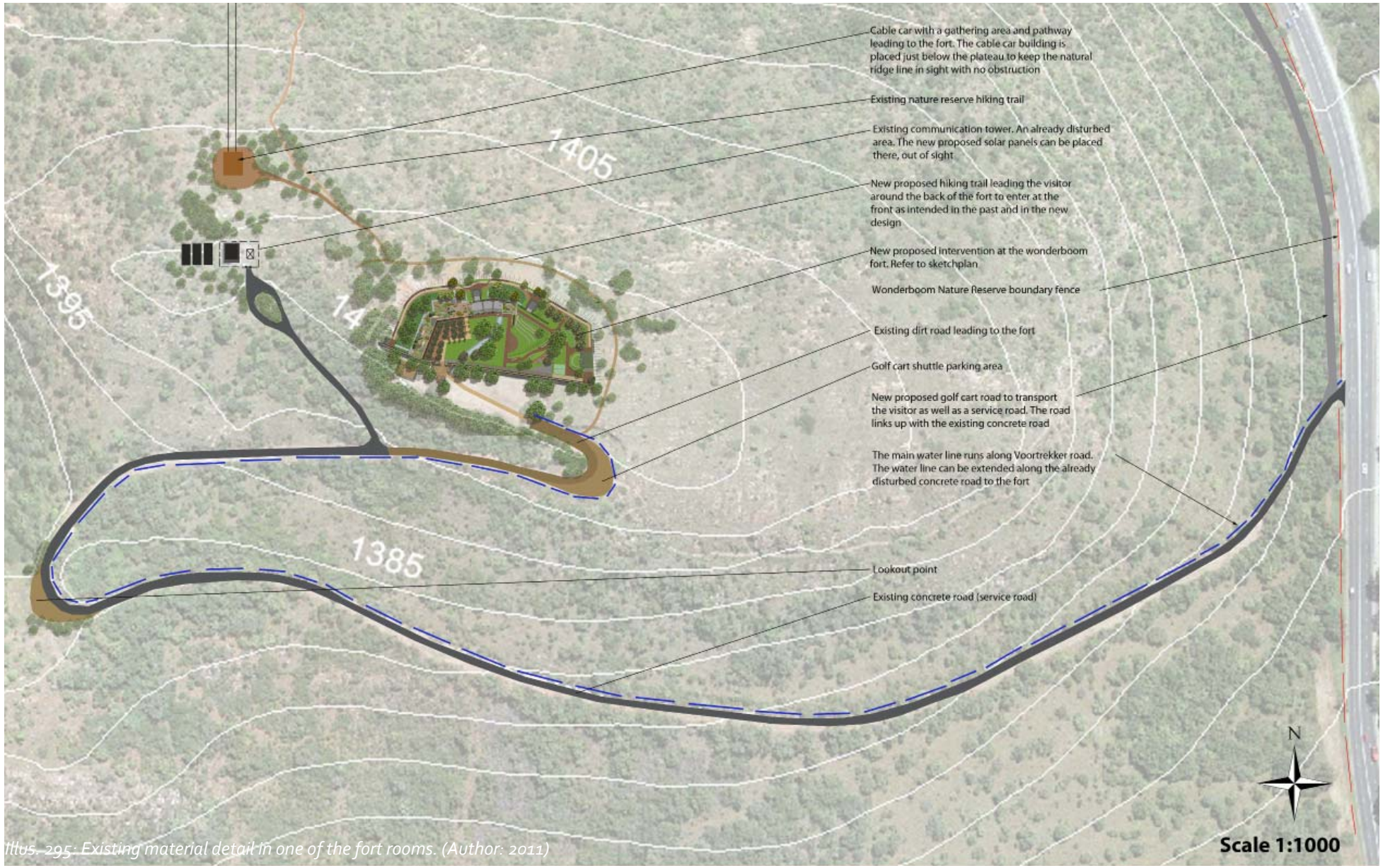
The sections reference the details, which explain how the design would be implemented and constructed.

8.2 Location map

Illus. 294: Location map of Wonderboom fort (Author: 2011)

8.3 The site in context

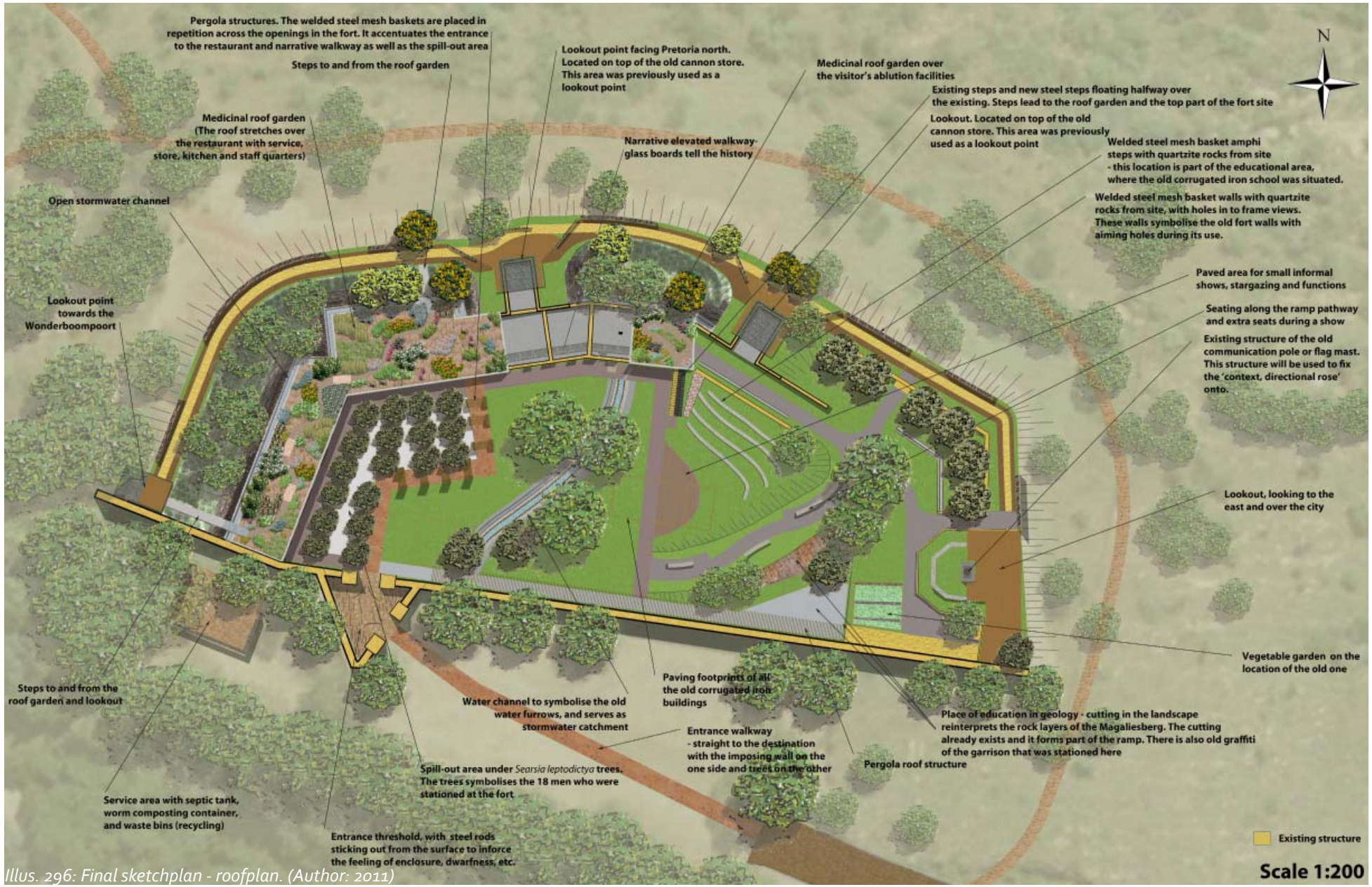
This plan refers to the context in which the Wonderboom fort is located and gives a general understanding of the surrounding area. It indicates the existing concrete road leading to the fort and the golf cart road linking with it. The proposed municipal waterline will run along the concrete road (already disturbed area). The location of the proposed solar pannels are indicated near the existing communication tower. This area is easily accessible and out of sight. The location of the cable car is also shown.



Illus. 295: Existing material detail in one of the fort rooms. (Author: 2011)

8.4 Final sketchplan - roof plan

This plan illustrates the roof plan of the site where the landscape intervention is illustrated on a detail level and the various components of the design are indicated.



Illus. 296: Final sketchplan - roofplan. (Author: 2011)

8.5 Final sketchplan - building plan

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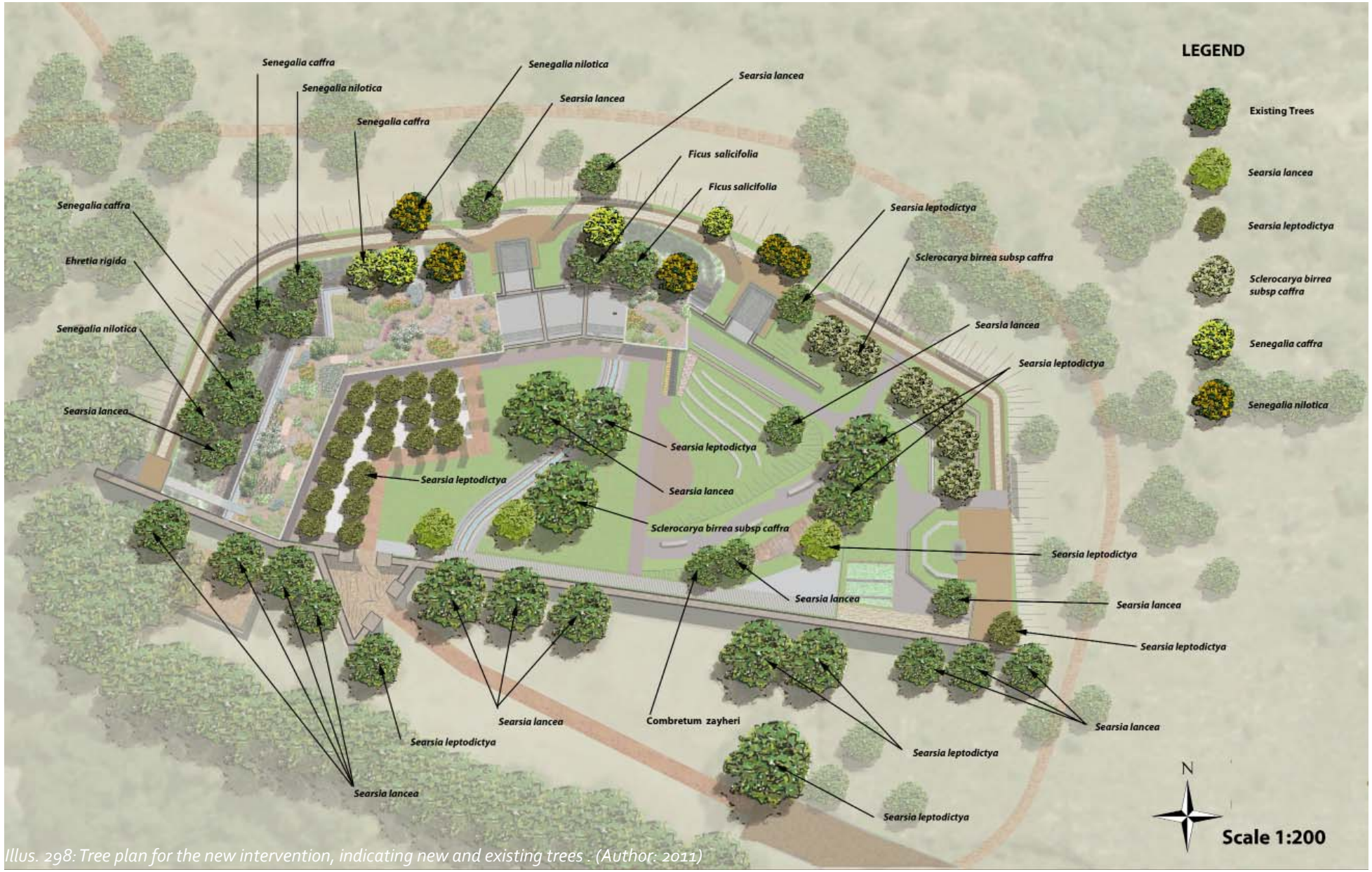
This plan illustrates the building plan of the site where the landscape intervention is illustrated on a detail level.

Illus. 297: Final sketchplan - building plan (Author: 2011)

8.6 Soft Materials
Tree plan

The tree plan indicates the position and type of tree species specified for the design as well as the existing tree locations on site.



Illus. 298: Tree plan for the new intervention, indicating new and existing trees : (Author: 2011)

Tree list

Locally indigenous trees were selected and trees occuring on site. This ens[illegible]e the character of the place and won't detract from it and that the trees will fit into context. The trees chosen also has a medicinal value which enhances the medicinal garden narrative. See the tree description list below.

Wonderboom Fort - Tree species (proposed and existing on site)								
Num	**Scientific name**	**Common names**	**Family**	**Botanical description**	**Medicinal use**	**Plant parts used**	**Distribution**	**Flower**
1	*Combretum molle*	Velvet Bushwillow	Combretaceae	Soft velvety leaves, often contorted trunks and deep-red four-winged papery fruits. Dark brown to blackish bark breaks up into small blocks that peel off. Dense spreading crown. Leaves are velvety above and slightly rough below. The foliage turns yellow to bronze in autumn before falling. Spikes of tiny honey-scented yellowish flowers.	In Venda the roots are used to treat infertility. Parts of the tree are used to treat fever and stomach complaints. The trunks are used for grain stamping mortars. Leaves provide red dye and roots a yellow dye for weaving.	Roots mainly and other parts of the tree	Distributed to the east of south africa. Open woodland and on rocky hillsides - often quartzite	Flowering time: Sept - Nov
2	*Combretum zeyheri*	Large - fruited bushwillow	Combretaceae	It is common on crests . A indicator of sourveld. It has huge, brown, four-winged pods for most of the year. It is a single or multi-stemmed tree with large, drooping leaves. The leaves are darkish-green, leathery and dull. The branches curve downwards and may hang to the ground. The bark is brownish-grey to grey, smooth to finely fissured and flaking in small pieces, giving it a mottled look. Flowers - Single, sweet-smelling, yellow-green, with orange anthers in axillary spikes are borne at the base of the leaves, just before or after the first leaves. Medium size tree with yellow flowers. Deciduous.	Leaf extracts are used to treat backaches and eye ailments.	Leaves	Distributed in South Africa	Flowering in the summer, from Sept - Nov
3	*Sclerocarya birrea subsp. Caffra*	Marula	Anacardiaceae	The marula is a medium-sized tree of up to 15m in height. The rough bark is flaky, with a mottled appearance due to contrasting grey and pale brown patches. The flowers are borne in small, oblong clusters. Male and female flowers occur separately, usually but not always on separate trees. The flowers are small, with red sepals and yellow petals. Large, rounded, slightly flattened fruites are much sought after for their delicious pulp, high vit c content and edible nuts.	In SA, diarrhoea, dysentery and unspecified stomach problems are treated with the bark, with the bark, which is believed to be of value in combatting fever and in the treatment of malaria. It is also used as a general tonic. Chewing the fresh leaves and swallowing the astringent juice will help with indigestion. Numerous other traditional uses have been recorded. Treatment of diabetes.	The bark, roots or leaves are the medicinal products	Widely distributed in African continent. In southern africa, only the subspecies caffra is found	Feb - June
4	*Searsia leptodictya*	Mountain karee	Anacardiaceae	Reddish branches and a rounded, drooping crown of light-green leaves. The greyish to dark-brown trunk is rough and deeply furrowed. Sprays of very tiny yellowish flowers are followed by small shiny edible flattened fruits that ripen yellow-brown to brown. Non aggressive root system. Evergreen. Can reach 8m in height.			Open woodland, on forest margins and rocky hillsides.	Flowering time: Jan - Apr
5	*Searsia lancea*	Karee	Anacardiaceae	It has a drooping crown of glossy olive-green foliage, and a contorted rough black-brown trunk. Sprays of minute, sweetly scented greenish-yellow flowers, followed by small shiny slightly flattened, rounded fruits that are brown and sometimes sticky when ripe. Evergreen. Non aggressive root system. 7 - 9 m high			Widely distributed throuhout south AfricaVariety of habitats	Flowering time: Jul- Sept

Num	Scientific name	Common names	Family	Botanical	Medicinal use	Plant parts used	Distribution	Flower
6	*Ficus salicifolia*	Wonderboom fig	Moraceae	Typically a spreading medium sized tree, seldom exceeding 9m. Dark grey and rough, but paler grey to smooth bark in young trees. Leaves are ovate to elliptic, or obling, sides almost parallel, and clear green, thick leathery leaves. Figs massed along the branches in the leaf axils.			Distributed to the north east of south africa	
7	*Senegalia nilotica*	Scented thorn	Fabaceae	Can reach a height of 10 m, with an average of 4-7 m in height. The crown is somewhat flattened or rounded, with a moderate density. The branches have a tendency to droop downwards if the crown is roundish. The bark is blackish grey or dark brown in mature trees and deeply grooved, with longitudinal fissures. The young branches are smooth and grey to brown in colour. The young twigs are covered in short hairs. Paired, slender, straight spines grow from a single base and sometimes curve backwards, are up to 80 mm long and whitish but often reddish brown in colour. The leaves are twice compound. It bears single to several, bright, golden yellow, globose, scented inflorescences between the leaves. The flower stalks are hairy.	Parts of the tree were used to treat eye diseases, as a tranquiliser, and as an aphrodisiac. A root extract was used to treat tuberculosis, impotence, diarrhoea, sores caused by leprosy, stomach ulcers, indigestion and haemorrhage. The Voortrekkers made ink and dyes from the pods (red, black and yellow).	Parts of the tree, especially roots	Occurs in the northern part of Gauteng	Flowering time: Sept - Jan
8	*Senegalia caffra*	Common hook-thorn	Fabaceae	Pale-green, soft and feathery drooping spring foliage and fluffy flower-spikes are paticularly pleasing. The rough red-brown bark has shallow grooves and furrows and tends to peel off in rectangular flakes and strips. The hard brown hook-thorns are in pairs and do not shed easily. Cream-to pale-yellow sweetly scented flowers are followed by straight flat brown pods, up to 10cm long. Aggressive root system. 9 x9 m high			Woodland and wooded grassland, mountain slopes, along streams and rivers, and in coastal scrub. Distributed to the east of south africa	Flowering time: Sept - Oct
9	*Dodonaea viscosa*	Cape sand olive	Sapindaceae	Can grow into a small tree of 6m high. Can be a good hedge. Bark is dark grey and stringy and its droopy, shiny new leaves are covered in a resinous substance. Small yellow-green flowers are followed by decorative clusters of winged greenish-red fruits.	A traditional remedy for fever, colds, throat infections, flu and arthritis is prepared from the new leaf tips. The plant was also used to cure pneumonia, tuberculosis and skin rashes.	New leave tips and other parts of the shrub/tree	A variety of habitats, from arid semi-desert regions to the margins of moist evergreen forest, from the south-western cape northwards into tropical Africa.	Flowering time: Apr - Aug

Table 6: List of trees in table format with their botanical description and medicinal value. (Author: 2011)

Medicinal roof garden planting plan

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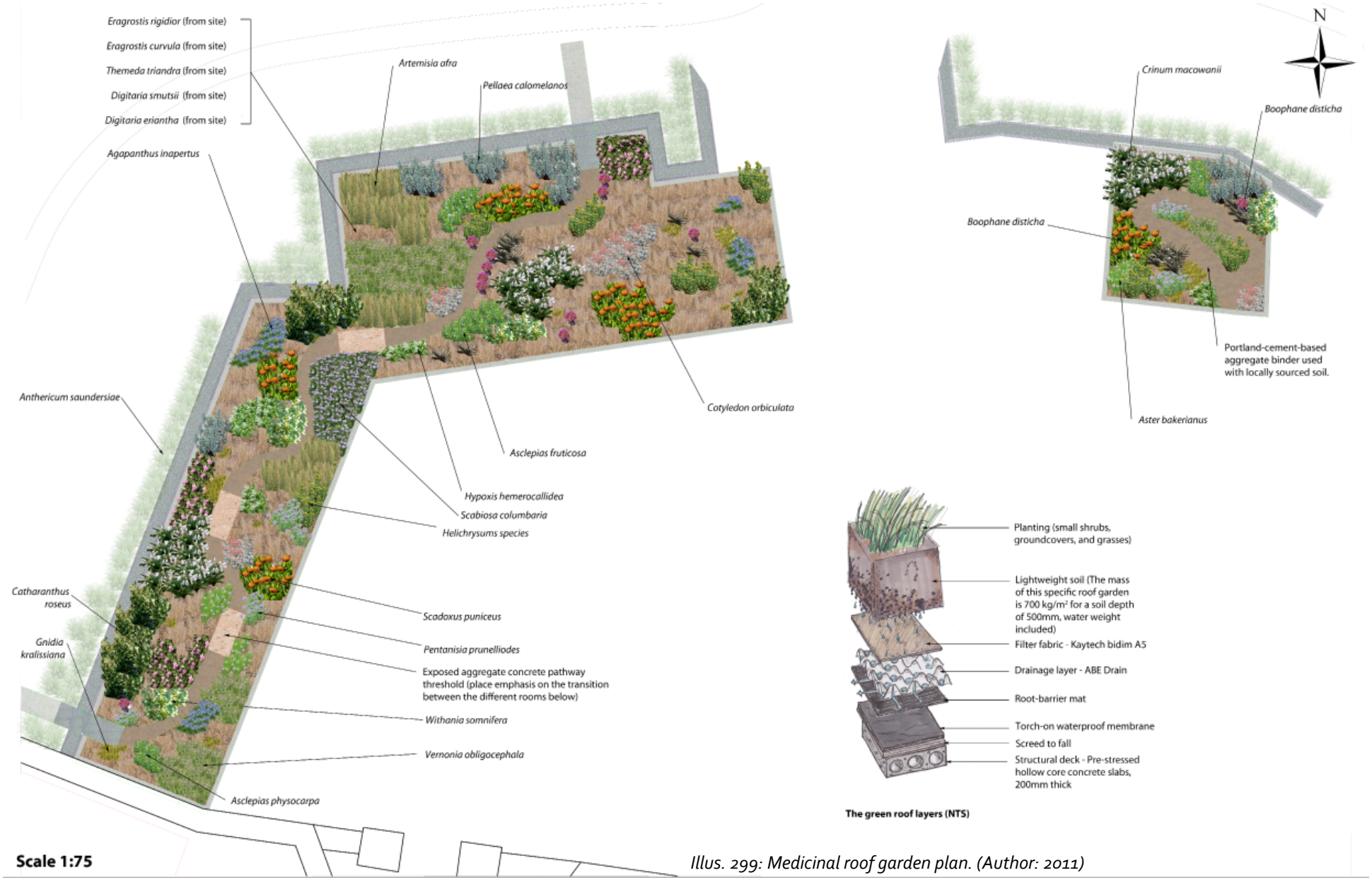
The medicinal plants used in the design are all locally indigenous and will thrive with minimum water after establishment. All the plants can grow in a 500mm soil depth. The medicinal garden serves as a life exhibition of past remedies. The plants provide for an interesting experience for the visitor with different textures, colours, forms and smells.



Illus. 299: Medicinal roof garden plan. (Author: 2011)

Planting pallet

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The plant pallet indicates the proposed trees and medicinal shrubs and groundcovers. It illustrates the different colours, textures, shapes and forms of the plants. The plants and trees are locally indigenous not only for ecological benefits, but also because indigenous plants and trees require less water and maintenance.

Illus. 300: Planting pallet indicating the different plants, colours, textures, shapes and forms. (Author: 2011)

Plant list

The plant list below discusses each proposed plant species and its medicin

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Wonderboom Fort - Plant species (proposed and existing on site)								
Num	**Scientific name**	**Common names**	**Family**	**Botanical description**	**Medicinal use**	**Plant parts used**	**Distribution**	**Flower**
The shrubs and groundcovers are locally indigenous, drought resistant and grows in the sun								
10	*Agapanthus inapertus*	Blue lily (English)	Alliaceae or Agapanthaceae	Widely grown in gardens. They are all geophytes with thick tuberous rhizomes. Long narrow, strap-shaped leaves, some what fleshy, dark green and about 400mm long. Flowers are borne in a dense cluster (umbel) on a long slender stalk. Pale to dark blue colour, or white.	Used in so-called 'isicakathi', a decoction given orally or rectally as an antenatal and postnatal medicine, and also to the baby immediately after birth. It is mildly purgative and may also be used to ease a difficult labour and to ensure that the placenta is expelled.	Rhizomes and roots are used	widely distributed in the eastern parts of SA	Flowering time: Dec-March
11	*Artemisia afra*	African wormwood	Asteraceae	Highly aromatic plant. Erect multi-stemmed perennial shrub of up to 2m high. Feathery leaves, with greyish green colour. Pale yellowish and inconspicuous flowers.	Numerous ailments are treated with it, mainly coughs, colds and influenza, but also fever, loss of appetite, colic, headache, earache, malaria and intestinal worms, amongs others.	The leaves are mainly used, but sometimes also the roots	common species in SA	March - May
12	*Asclepias fruticosa*	Milkweed	Asclepiadaceae	Erect, multistemmed shrublet of up to 2m in height, with long thin stems and narrow, opposite leaves. All parts of the plant produce a white, milky latex when broken. The greenish-yellow flowers are borne in pendulous clusters, followed by large, bladdery seed pods. The surface is covered with sparse, wiry hairs. Each pod is much inflated, but ends in a narrow tip.	The dried leaves are finely ground and used as snuff, not only for headache, but also to treat tuberculosis and as an emetic to strengthen the body.	Leaves are mainly used, but sometimes the roots as well	Indigenous to South Africa, but it has become a weed in disturbed places.	Dec - March
13	*Asclepias physocarpa*		Asclepiadaceae	Erect, multistemmed shrublet, 2m in height, long thin stems and narrow, opposite leaves. All parts of the plant produce a white, milky latex when broken. The greenish-yellow flowers are borne in pendulous clusters, followed by large, bladdery seed pods. The surface is covered with sparse, wiry hairs. The pods are more strongly inflated and rounded, with no narrow tip.	The roots relieve stomach pain and a general ache in the body.	Leaves are mainly used, but sometimes the roots as well	Indigenous to South Africa, but it has become a weed in disturbed places.	Dec - March
14	*Boophane disticha*	Bushman poison bulb	Amaryllidaceae	Bulbous plant with strap-like leaves arranged in a very distinctive fan-shaped manner. Bulb partly exposed above the surface with numerous papery scale. The rounded inflorescence has numerous pink flowers all at an equal distance from the main flowering stalk.	The dry outer scales of the bulb are used as an outer dressing after circumcision and are also applied to boils or septic wounds to alleviate pain and to 'draw out' the pus. Weak decoctions of the bulb scales are administered by mouth or as an enema for various complaints such as headaches, abdominal pain, weakness and eye conditions. An old belief was that sleeping on a mattress filled with bulb scales will relieve hysteria and insomnia. Very weak decoctions of the bulb scales are used as an effective sedative. Higher doses induce visual hallucinations, which are sometimes used for divination and even higher doses can be fatal. The indigenous people used this plant to talk to their ancestors and to burry their bodies in.	The bulb scales are used	widely distributed in the southern and further north. Usually found in open grassland.n parts of SA	Spring

Num	Scientific name	Common names	Family	Botar	Medicinal use	Plant parts used	Distribution	Flower
The shrubs and groundcovers are locally indigenous, drought resistant and grows in the sun								
15	*Cotyledon orbiculata*	Pigs's ear	Crassulaceae	Succulent small shrub with woody branches and thick fleshy leaves. The leaves are bright green to grey, often with a reddish margin and usually covered with a waxy layer on the surface. Orange or red tubular flowers are borne on a long , slender stalk 300mm - 450mm.	The fleshy part of the leaf is applied to corns and warts to soften and remove them. A single leaf is eaten as a vermifuge. The warmed leaf juice is used as drops for earache and toothache. It may also be applied in the form of a hot poultice to treat voils, earache or inflammation. The juice has been used to treat epilepsy.	Leaves or leaf juice	Widely distributed over the almost the whole of south africa	Flowering time: Aug - Sept
16	*Crinum macowanii*	River lily/ Umduze (Zulu)	Amaryllidaceae	This geophyte has a large bulb of about 200mm in diameter, with long, strap-shaped leaves radiating from it. The leaf margins are undulating and the tips end abruptly as a result of frost damage. The wide open trumpet-shaped flowers with their black anthers are characteristic of this species.	The plant is a zulu remedy for various complaints, mainly scrofula, micturition and rheumatic fever. It is also used for blood cleansing, kidney and bladder disease, glandular swelling, fever and skin problems such as sores, boils and acne.	Bulbs and leaves are used	Indigenous to southern africa	Flowering time: Oct - Feb
17	*Ehretia rigida*	Puzzle bush	Boraginaceae	Many stemmed shrub has a slightly weeping habit, its arching branches spread and curve stiffly downwards, giving it a rigid, tangled and untidy appearance. Clusters of small sweetly scented lilac flowers are followed by edible berries which are orange red to black when ripe.	This tree is traditionally considered a good luck charm, and powdered root is used to treat gall-sickness in cattle. Another remedy deals with chest pains.	Root	Widely distributed throughout south Africa. Variety of habitats	Flowering time: Spring
18	*Gnidia kraussiana*	Yellow heads	Thymelaeaceae	Dense shrublet, 300mm high, with numerous erect,hairy stems arising from a woody base. The small oblong leaves are about 30mm long and 10mm wide and usually have silky hairs on the upper and especially the lower surfaces. Dense rounded heads of small, yellow, tubular flowers are produced in spring	Highly toxic plant, ranging from the topical treatment of burns and snake bites to enemas for stomack complaints and decoctions used to ensure an easy childbirth.	Rootstock and roots are used	Widely distributed in Africa, grassland areas	August flowering
19	*Helichrysum species*	Everlastings	Asteraceae	Aromatic perennial herbs or shrublets with densely hairy or woolly leaves and persistent flower heads. The smoke of which is a ritual incense, called 'imphepho'	Many ailments are treated with these popular medicinal plants, including coughs, colds, fever, infections, headache and menstrual pain. It is a popular ingredient for wound dressings.	Leaves and twigs are mainly used and sometimes the roots.	All over south africa	Differs for each specie
20	*Hypoxis hemerocallidea*	Star flower / Inkomfe (zulu)	Hypoxidaceae	Tuberous perennials with long, strap-shaped leaves and yellow, star-shaped flowers. Slightly hairy leaves which are arranged one above the other to form three distinct groups spreading outwards from the centre of the plant. Bright yellow, star-shaped flowers are borne on long, slender stalks.	Infusions of the corm are used as emetics to treat dizziness, bladder disorders and insanity. Decoctions have been given to weak children as a tonic and the juice is reported to be applied to burns. The stems and leaves are mixed with other ingredients to treat prostate problems. Traditional uses are also said to include testicular tumours, prostate hypertrophy and urinary infections.	The tuberous rootstock (corm), which is dark brown or black on the outside and yellow within when freshly cut, is used	Widely distributed in the grassland areas of South Africa	Flowering time: Sept - Jan
21	*Pelargonium luridum*	Ishaqa (zulu)	Geraniaceae	This herbaceous perennial has a tuberous rootstock from which a rosette of leaves develops in the growing season. The flower heads are borne on tall slender stalks of up to a metre in height. The flowers are usually pink but may occasionally be white or greenish-yellow.	Infusions of the tubes are used to treat diarrhoea and dysentery.	Tuberous, fleshy rootstock which is bright red inside, is harvested	Occurs over a large part of the interior of southern africa	

Num	Scientific name	Common names	Family	Botar	Medicinal use	Plant parts used	Distribution	Flower
The shrubs and groundcovers are locally indigenous, drought resistant and grows in the sun								
22	*Pallaea calomelanos*	Hard fern	Adiantaceae	Common fern, with underground rootstock of about 6mm in diameter, covered with small brown scales. The firm-textured leaves are composed of numerous blue-green leaflets which are broadly triangular in shape, with a distinct line of brown spore-producing bodies (sori) along the edges.	The leaves are smoked for head colds, chest colds and asthma. Decoctions of rhizomes are traditionally used to treat boils and abscesses, and for intestinal parasites. The leaves of several other species of ferns are also smoked to telieve head and chest colds.	The leaves and shizomes are used	Occurs over a large part of South Africa	
23	*Rhoicissus tridentata*	Bushmen's grape /Wild grape	Vitaceae	A shrubby creeper with the branches spreading outward from a thick woody base. The dark green, glossy leaves have three leaflets, each wedge-shaped, with a serrated margin. The inconspicuous greenish flowers are followed by small berries. 3m x 1.5m	The roots or tubers are used for stomache ailments, kidney and bladder complaints, infertility and dysmennorhoea. It is also administered as an enema for delayed menstruation and to facilitate childbirth.	The roots or tuberous rootstock are used. They have bright red pigments in the outer layer, resembling blood when fresh.	Occurs over a large part of south africa	Flowering time: Nov - Jan
24	*Vernonia oligocephala*	Sefafatse (Tswana)	Asteraceae	Herbaceous perennial with erect, flowering branches developing from a woody rootstock. Leaves are eliptic in shape, usually not more than twice as long as broad, with a sharp point and a very short stalk. Dark green and almost hairless on the uper side but densely hairy and silvery below. Bright violet flower heads are about 10mm in diameter and are borne in large groups towards the branch tips.	Infusions are taken as stomache bitters to treat abdominal pain and colic. Other ailments treated include rheumatism, dysentery and diabetes. The roots have been used to treat ulcerative colitis.	Leaves and twigs are ursed.rarely the roots	Plant is widespread in the grassland regions of South Africa.	Aug to Dec
25	*Withania somnifera*	Winter cherry	Solanaceae	An erect perennial shrublet with densely velvety stems and leaves. The leaves are oblong, pale green and covered with short, dense hairs, particularly when young. Small white or yellowish flowers are produced in short clusters, followed by small round berries 8mm in diameter. The berries are completely enclosed in brown papery and bladdery structures.	Leaf poultices are widely used in south africa for wound healing. It is applied externally to treat open cuts, wounds, abscesses, inflammation, haemorrhoids, rheumatism and syphilis. Root infusions are taken for asthma and tinctures as tonics. In Ayuvedic medicine, the plant is considered to be sedative and hypnotic, as well as adaptogenic.	Leaves or root bark are mainly used	Indigenous to south africa and has become a weed of disturbed places.	
26	*Aster bakerianus*	Undlutshana (zulu)	Asteraceae	Herbaceous perennial with one to several annual stems of up to 500mm high, developing from a perennial woody base. Leaves are 80mm long and vary in size and shape, with coarse hairs on the surface and sparse, minute teeth along the margins. Flowerheads are blue, mauve or rarely white.	Traditional headache remedy, the dried roots are powdered and used as snuff to induce sneezing.	The cluster of roots	Widely distributed in the grassland areas of South Africa	

Num	Scientific name	Common names	Family	Botani	Medicinal use	Plant parts used	Distribution	Flower
The shrubs and groundcovers are locally indigenous, drought resistant and grows in the sun								
27	*Bowiea volubilis*	Climbing potato	Hyaninthaceae	A greenish-white, fleshy tuberous bulb, without any papery or fibrous outer scales. Thin green leafless climbing and creeping flowering stems arise. Flowers are small greenish in colour and rather inconspicuous	Used to treat a wide variety of ailments, including headaches. A hot water extract of the roasted bulb is taken as a purgative. The fresh bulb is taken for oedema and infertility in women. The fresh juice may be rubbed into the skin of a sick person or a decoction applied as a lotion for sore eyes. A hot water extract of the fresh outer bulb scales is a Zulu remedy for ascites, sterility and bladder complaints.	The bulb or bulb scales	Widely distributed in the eastern part of SA	Spring and sometime will bloom twice in a year.
28	*Catharanthus roseus*	Madagascar periwinkle	Apocynaceae	Perennial herb, 1m high, with somewhat woody base. The leaves are dark green and glossy, with a prominent white midrib. Flower colour varies from pink to white, or white with a pink centre. This popular and attractive garden plant has become a weed in some parts of South Africa.	An infusion of the leaf has been used to treat diabetes, but even dilute mixtures can be extremely toxic. The two main alkaloids of the plant are used in combined chemotherapy and small doses are injected weekly or monthly	The roots or more commonly the leaves are used	Commonly grown in SA and has become a weed.	
29	*Pentanisia prunelloides*	Wild verbena	Rubiaceae	The plant is a perennial herb of about 300mm in height and 600mm wide, with leafy branches spreading from a thick, tuberous root. The leaves are oblong and usually somewhat hairy, and are borne in pairs. Small pale purple flowers occur in dense groups on the branch ends	Decoctions are often used for burns, swellings, sore joints and rheumatism. The plant is also used to treat heartburn, vomiting, fever, chest pain, toothache, tuberculosis, blood impurities, haemorrhoids and snakebite. It is taken regularly by pregnant women to ensure an easy childbirth. A leaf poultice is applied for a retained placenta.	The fleshy, tuberous root is mainly used, but sometimes also the leaves	The plant is an important component of grasslands in the eastern parts of South Africa	from August to January
30	*Scabiosa columbaria*	Wild scabious	Dipsacaceae	Perennial herb of up to 1m in height, with annual branches developing from persistent fleshy roots. Thin-textured, slightly hairy leaves form a rosette on the ground. Basal leaves have serrated margins, while those higher up have loped margins. Flowers are borne on several multi-branched stalks of up to 1m high. The attractive white flower heads have a daisy-like shape.	The plant is a remedy for colic and heartburn. Some other traditional uses have also been recorded. Dried roasted roots are made into a wound-healing ointment, and the powdered roots are also used as a pleasant-smelling baby powder.	Leaves or fleshy roots are used	Widely distributed in south africa, common in western cape	
31	*Senecio serratuloides*	Two day plant	Asteraceae	Herbaceous perennial with erect stems of up to 1m in height, sprouting from a woody rootstock. Serrated leave margins. Small yellow flowers are borne in sparse clusters towards the ends of the branches.	Leaves are applied externally to cuts, swellings, burns and sores to promote healing. Infusions are taken in small doses as blood purifiers for skin eruptions or for swollen gums and chest pains. The dried, powdered leaves are snuffed for treating headaches.	Leaves and stems are used rarely also the roots	Widely distributed in the summer rainfall area of South Africa	
32	*Anthericum saundersiae/ Clorophytum saundersiae*	Weeping anthericum/ St. Barnard's lily	Anchericaceae	Upright plant. The grey-green leaves are long and thin, resembling grass. The small, white flowers are trumpet-shaped and produced in long, spikes, in early summer. Up to 350mm, clump-forming, grass-like perennial. White flowers. Evergreen, water moderately. Excellent for mass planting. Frost resistant. 500mm x 250mm			To the east of Sout Africa near the coastal areas	Flowers early summer. Sept - March

Table 7: Shrubs and groundcovers plant list. (Author: 2011)

Veld grass list

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Existing grass species at Wonderboom Nature Reserve		
Num	**Scientific name**	**Common name**
1	Sourveld	Sourveld
2	Hyparrhenia hirta	Common thatching grass
3	Themeda triandra	Red grass
4	Cynodon dactylon	Couch grass
5	Digitaria eriantha	Common finger grass
6	Heteropogon contortus	Spear grass
7	Pennisetum sphacelatum	Bull grass
8	Melinis repens	Natal red top
9	Eragrostis curvula	Weeping love grass
10	Aristida congesta subsp. Barbicollis congesta	Tassel three-lawn

The veld grass species occuring on site will be harvested and the cuttings will be used between the medicinal plant species on the roof garden.

Cynodon dactylon will be used as lawn in the courtyard. It will be planted from wild type seeding.

See the existing grass species list to the left. These grass species were identified on site during site analysis.

Table 8: Above: Existing veld grass list. Left: The proposed veld grass species to be used in the design. (Author: 2011)

Wonderboom Fort - Plant species (proposed and existing on site)						
Num	**Scientific name**	**Common names**	**Botanical discription**	**Distribution**	**Flower**	**Area to be used**
			Locally indigenous grasses			
33	*Cynodon dactylon*	Couch grass	A short mat-forming grass which spreads by means of stolons and rhizomes. Inflorescence exclusively digitate. Spikelets are flat and without awns. Grows in disturbed places. Leaves point upwards. Flowers from Sept - May. Grows in all types of soil, especially sandy soil and fertile soil. Popular cultuvated pasture.	It occurs in all moderate parts of the world. Found in disturbed places		Used as lawn
34	*Eragrotis rigidior*	(Broad) curly leaf	Curly leaf usually grows in disturbed places. It is mostly found in sandy and loam soil. It is a hard perennial tufted grass with dry curly leaves. Inflorescence is a pinicle with the lower branches arranged in a whorl.	It occurs in southern Africa. It mostly occurs in warm regions	Oct to May	On roof garden mixed with the other medicinal plants
35	*Eragrotis curvula*	Weeping love grass	Weeping love grass usually grows in disturbed places. It is a robust, densely perennial tufted grass which produces many long, loose, hanging leaves. Inflorescences are mostly an open panicle. Spikelets are dark grey to dark olive green. Leaves are often concentrated at the base of the plant.	It originates from South Africa	August to June	On roof garden mixed with the other medicinal plants
36	*Themeda triandra*	Red grass	A varying perennial tufted grass. Inflorescence comprises groups of spiklets which are partiall enclosed by a spathe. Each spikelet pair has a long, dark, twisted awn. Leaf sheathes are compressed . Leaf blade has a prominent midrib. The nodes are dark-coloured. Ligule usually has a notch at the point. The entire plant has a red colour late in the season.		Flowers from oct - July.	On roof garden mixed with the other medicinal plants
37	*Digitaria smutsii*		Robust grass with stolons. It is a perennial tufted grass. The inflorescences are semi-digitate or digitate with long, thin fingers. Lower part of the plant is usually hairy.	Naturally in southern Africa	January to April	On roof garden mixed with the other medicinal plants
38	*Digitaria eriantha*	Common finger grass	A perennial rufted grass. Inflorescences semi-digitate or digitate with long, thin fingers. The lower part of the plant is usually hairy. It often has long, hairy stolons. Culms are usually unbranched. Populations vary considerably in terms of size, hairiness, shape of inflorescence and other charactersistics.	Occurs only in South Africa	Flowers from January to April	On roof garden mixed with the other medicinal plants

Plant sources diagram and table

All the medicinal planting on the roof garden are sourced locally from nurseries in a 40km radius. Refer to the diagram and table below which indicate the distance to the nursery from the Wonderboom Nature Reserve.

This method of sourcing plants locally is more ecologically sustainable and lowers the carbon footprint.

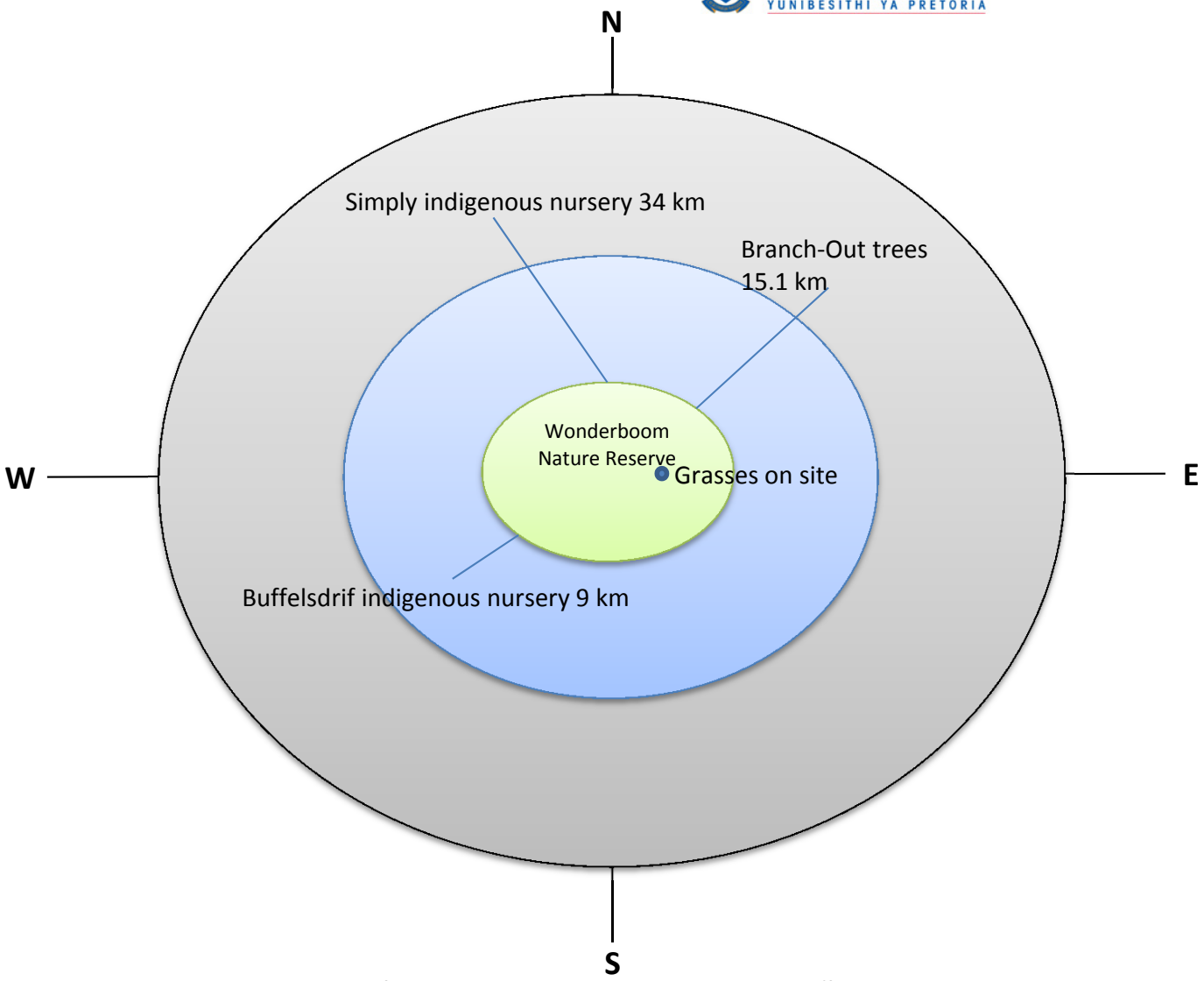

Fig. 22: Diagram indicating the distances from the Wonderboom Nature Reserve to the different nurseries. (Author, 2011)

Table 10: Nurseries, their location and distance from the Wonderboom Nature Reserve (Author: 2011)

Company name	Location	Plant type	Distance (km)
Nature	Wonderboom nature reserve	Grasses	Harvested on site
Branch-Out Tree farm	Pretoria North	Trees	15.1
Simply indigenous nursery	Hartbeespoortdam	Bulps	34
Buffelsdrif indigenous nursery	Buffelsdrif	Shrubs	9.4

8.7 Hard Materials - Paving plan

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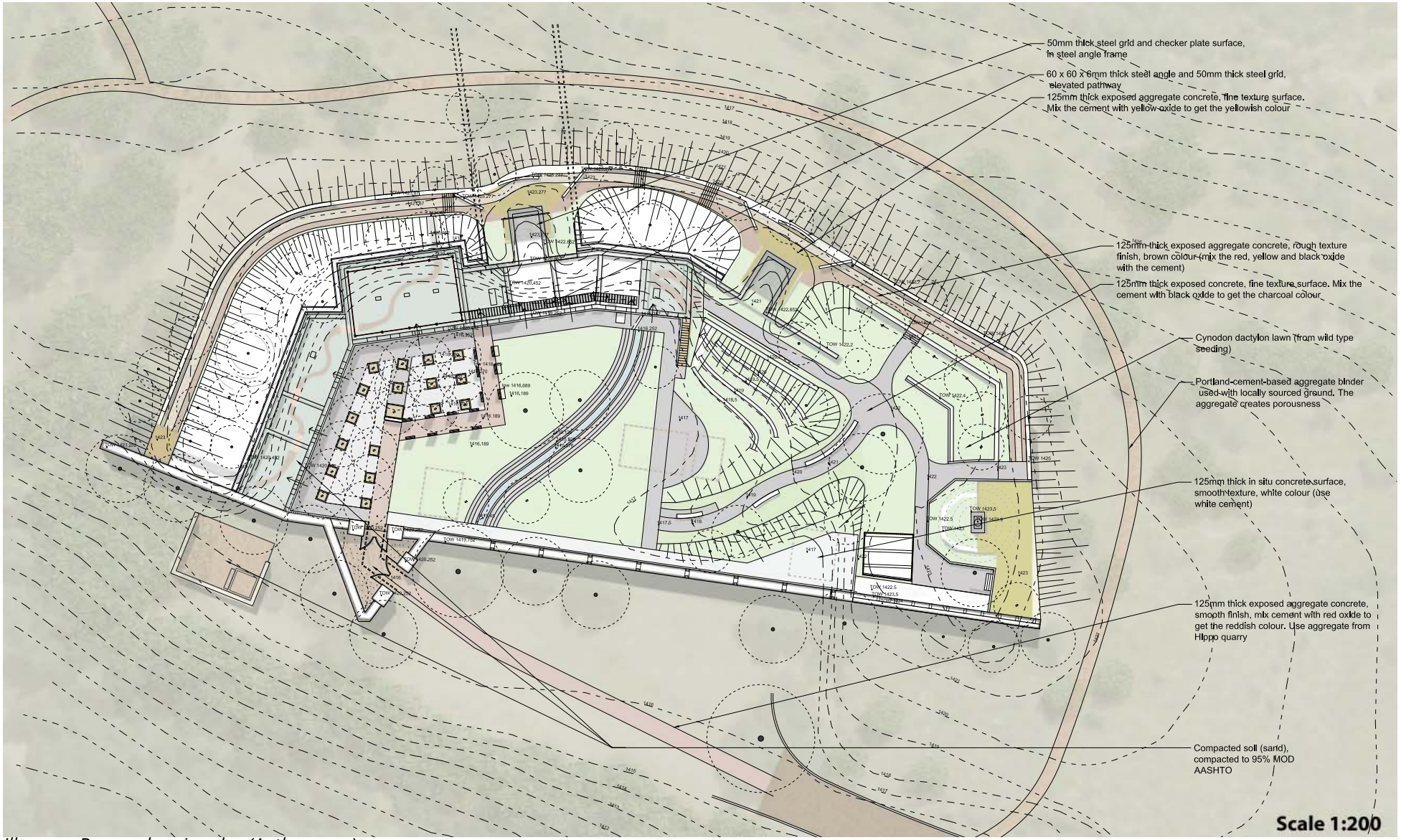
Different colour and texture concrete surfaces and pathways were chosen to keep the material pallet to a minimum and to ensure unity and coherence in the design. Exposed fine or rough textured concrete surfaces, smooth concrete surfaces, which are pigmented with red, yellow and black oxide (mixed with cement). Light cement was used to ensure a white colour on some surfaces. The three colours can be mixed to form brown. Aggregates from the quartzite and shale on site will be used as well as the aggregates from hippo quarry. Steel grids and checker plates are used in some instances to provide visibility of the artefact below or existing ground.



Illus. 301: Proposed paving plan (Author: 2011)

Material pallet, material source diagram and table

The design aims to use locally manufactured products/materials as far as possible within a radius of 50 km. It is more sustainable with a smaller carbon footprint.

Steel profiles are mainly used for new proposed structures to be clearly identifiable as such. Natural materials are used, such as eucalyptus lathes, soil and shale rocks (shale rocks from site).

The material pallet is kept to a minimum to ensure coherence and unity in the design as well as legibility. The details and different colours and textures enhance the complexity and diversity in the design.

The following materials were chosen (refer to paving plan, sections and details:

1. Exposed aggregate concrete (rough and fine textured; different colour pigmented concrete). Refer to paving plan.
2. Soil material:
    - Portland-cement-based aggregate binder used with locally sourced ground
    - Compacted soil (refer to paving plan).
3. Steel:
    - Steel grating
    - Steel profiles
    - Rectangular steel mesh
    - Steel checker plate
4. Eucalyptus lathes
5. Glass (laminated glass) for signage and information boards
6. Shale rocks (within the steel mesh baskets)

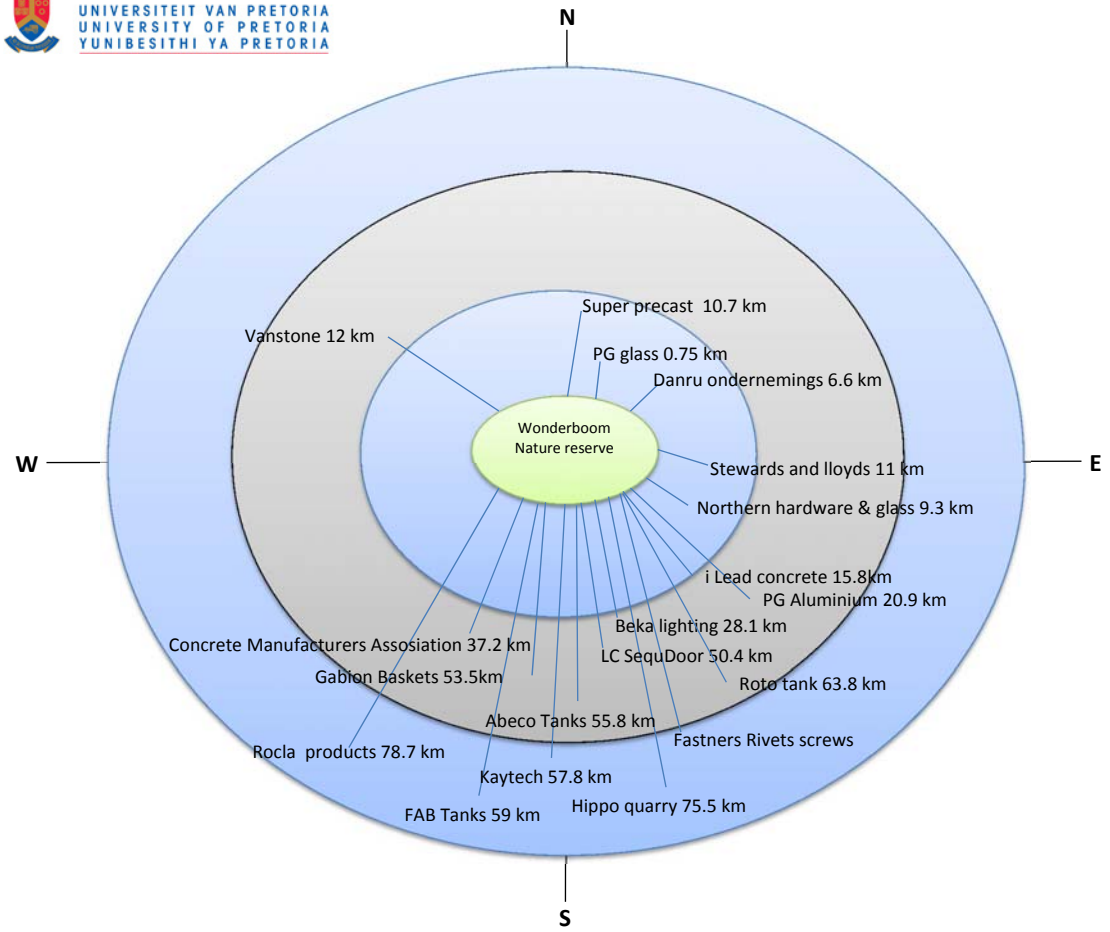
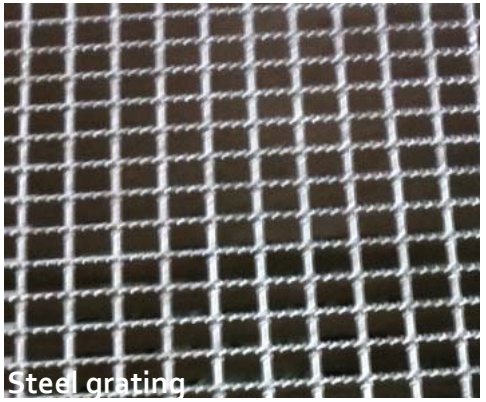


Fig. 23: Material sources diagram which indicates the different distances to the manufacturing companies. See table on the right for more information regarding the product, company and distances. (Author, 2011)


Exposed aggregate concrete


Fine, smooth or polished concrete surfaces

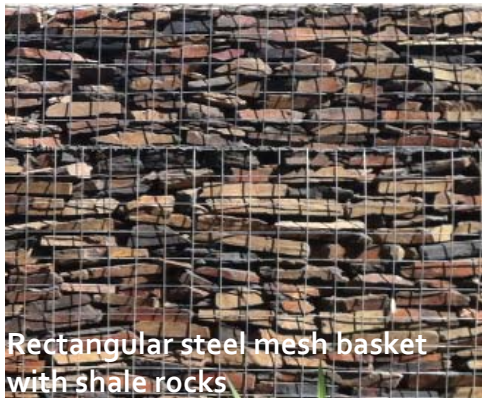
Glass - signage and information boards


Steel grating

Company Name	Location	Product	Distance (km) from WNR	Manufacturer/ Depot
Abeco tanks	6A Bedford road; Bedfordview; Johannesburg	Steel sectional water tanks	55.8	Manufacturer
African gabions	Central Johannesburg	Gabion	62	Manufacturer
Beka lighting	13 West View Road Olifantsfontein, Johannesburg	Lights	28.1	Manufacturer
Concrete Manufacturers Association	Block D, Lone Creek, Waterfall Office Park, Bekker Road, Midrand	Pre-stressed hollow core concrete slabs and in situ concrete	37.2	Manufacturer
Fastners Rivets Screws Bolts	Boksburg North Mushwelldate	Screws and bolts	57.9	Manufacturer
Gabion Baskets	Brighton Rd Lombardy west Jhb	Gabion Baskets	53.5	Manufacturer
Hippo quarry	Middle road, Anderbolt 1459, Boksburg	Quartzite aggregate	75.5	Manufacturer
i lead concrete	The innovation hub Pretoria	Concrete	15.8	Manufacturer
Kaytech	53 Harris Avenue, Isandovale, Edenvale	Bidim (geotextiles)	57.8	Depot: Jhb; Manufacturers: Cape town
LC SequDoor	Pilkington Industrial Park, Cnr. Johan le Roux & Morris str. Meyerton	Aluminium sliding folding door (stacking doors)	107	Manufacturer
Northern hardware & glass	Koedoespoort industrial Pretoria	Glass	9.3	Manufacturer
PG aluminium windows doors	Cnr Hans Strydom and Von Backstroom Street Silver lakes	Aluminium sliding folding door (stacking doors)	20.9	Manufacturer
PG glass	Pretoria north	Glass (Signage)	0.75	Depot
Rocla products	Cnr Main Reef Road and Houtkapper Street, Roodepoort	Culverts for storm water	78.7	Manufacturer
Roto tank	Kempton park	Septic tank	63.8	Manufacturer
Stewards and lloyds Structural steel products	Cnr stormvoel & Asetileen Pretoria	Steel angles, channels and grids, I beams and H sections	17.1	Depot: Pta; Manufacturer: Jhb
Super precast	Plot 55, Rentia Street, Onderstepoort	Concrete (pre-cast)	10.7	Manufacturer
Vanstone	Rosslyn Pretoria	Brown pink Quartzite / Concrete (different pigments)	12	Manufacturer


Steel checker plate


Steel profiles mainly used in new structures


Rectangular steel mesh basket with shale rocks


Eucalyptus lathes

8.8 Sustainability strategies

Storm water management

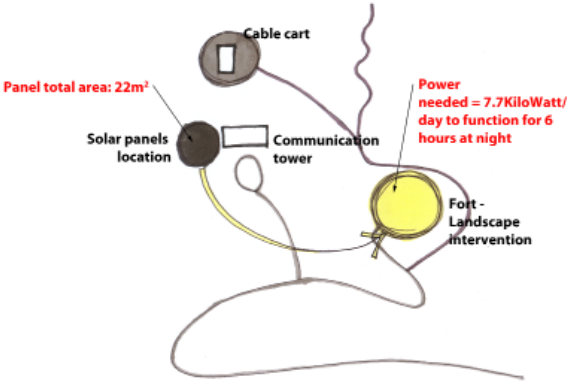
- A symbolic water feature channel (symbol of the old water furrows found on site) not only function as a semiotic resource but also serves as stormwater catchment. The channel operates with rainwater which is stored in a tank. Any excess water overflows into a second tank which is then channeled to a reservoir steel sectional tank.
- A concrete open channel is constructed behind the existing wall of the fort rooms to catch the storm water run-off from the steep gradient slope. The water is then channeled through the berm with concrete culverts into a steel sectional tank.
- The water yield from both systems are used for irrigation. See water budget tables and graphs on page 211. Their are enough water in the reservoir during the year to cater for the irrigation demand. Thus 100% of the irrigation water comes from rainwater harvesting.

Materials

- Locally sourced material within a 50 km radius as far as possible.
- Use material from site if possible (shale, soil, veld grass etc.)

Solar panels

Solar panels are used to power the restaurant and landscape lighting. The solar panels will be located at the existing communication tower. It is an already disturbed site and out of the visitor's sight, but easily accessible.



Solar panel diagram, indicating the location and operation requirements cycle (Author: 2011)

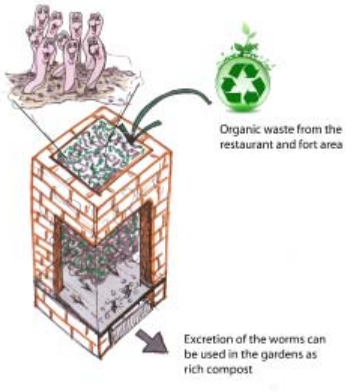
LED lights are used in the floodlights, spotlights, pathway and amenity lighting. It uses less energy and needs a lower wattage. This makes it easier to power by solar panels. The solar panels therefore cover a smaller area.

Plants

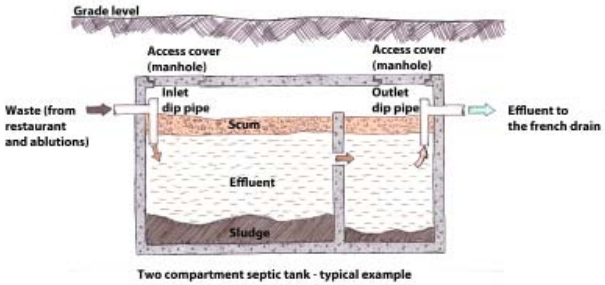
Locally indigenous plants and trees are used.

Waste

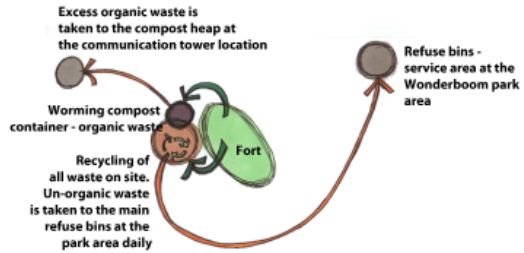
The organic waste of the restaurant and from on site recycle bins is collected and placed in a worming compost container. The excess waste is taken to a larger compost bin at the existing communication tower just of-site. The compost and worming compost can then be used in the gardens (vegetable and roof garden). Septic tanks are used as sanitary management. A septic tank is less of an intrusive system than normal sewage lines especially in a conservation area.



Recycling of organic waste to produce compost for the gardens - worming compost container. (Author: 2011)



Septic tank (sanitary waste management) (Author: 2011)



Waste cycle diagram. (Author: 2011)

8.9 Technical plans
Lighting plan (atmosphere)

Illus. 302: Lighting plan which indicates the atmosphere created at night and the location and type of lighting. (Author: 2011)

Lighting strategy:

LED lights will be used in the design, together with solar panels which will be located near the existing communication tower. LED technology is long lasting, durable, cool, mercury free, more efficient and cost effective.

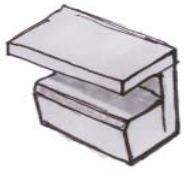
Beka LED lighting - This tube will be placed in a perforated steel post

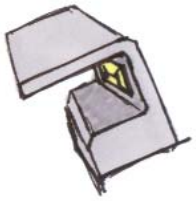
The light posts are placed at 2m intervals along the path

21 lights (low posts) x 13 W = 273 Watt, thus needs 2.184 kiloWatt/day to function for 8 hours. A solar panel of 6m² will have an output of 375 Watt/hr which will deliver 2.25 kiloWatt/day (6 hours)

Base type: 2 pin
Width: 26mm in diameter
Length: 900mm
Power consumption: 13 Watt
Voltage: 220 V
Lumens: 1200 LM
Beam angle: 120 deg
Light source: 217 SMD LEDs x 0.06W LED
Lumi factor: 8
Lumen flux: 760 LM
1m high illumination: 100 Lux
IP rating: 65

Beka series 51 light - This light will be used within a custom made low box casing

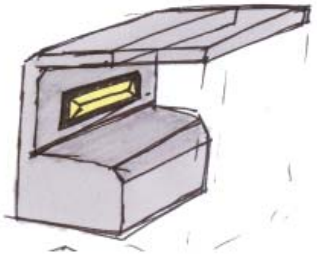




The light boxes are placed 1.5m intervals along the path

27 lights (boxes) x 15W = 405W, thus needs 3.24 kiloWatt/day
to function for 8 hours. A solar panel of 9m² will have an output of 562.5 Watt/hr which will deliver 3.375 kiloWatt/day (6 hours)

: high pressure die cast aluminium.
n head screws
Opaque: clear prismatic non-discolouring high impact acrylic injection moulded diffuser.
Ingress protection: IP66
Luminaire: power factor corrected to a min of 0.9
Bulkhead LED power consumption: 15W
Lamp: LED 12/1.2W
Lumen: 1270 LM



Bekadart LED spot light - This light will be used to light up trees & structures

20 lights x 9W = 180 W, thus needs 1.44 kiloWatt/day to function for 8 hours. A solar panel of 4m² will have an output of 250 Watt/hr which will deliver 1500 kiloWatt/day (6 hours)

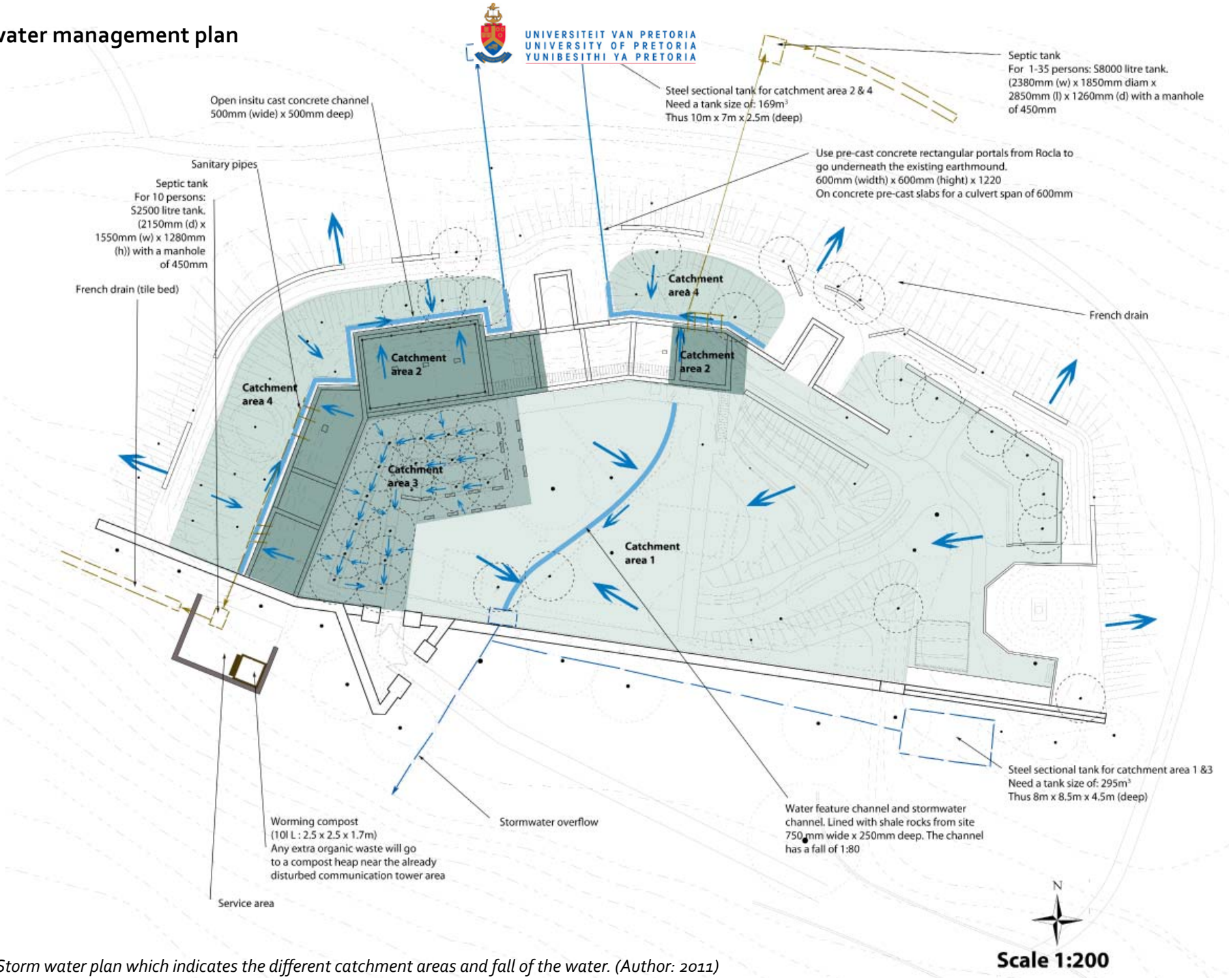
35 - 70 Watt (depending on the structure)
Ingress protection: IP66
Aluminium casing
Bekadart LED power consumption: 9W
LED 6/1.2W
Lumen: 642 LM

Beka Neos 1 LED floodlight - This light will be used if a large area needs to be lit up during functions and for facade lighting

3 lights x 36W = 108 W, thus needs 0.864 kiloWatt/day to function for 8 hours. A solar panel of 3m² will have an output of 187.5 Watt/hr which will deliver 1.125 kiloWatt/day (6 hours)

High-tightness floodlights with IP 66
30 LED's, of 1.2 W in red, 10 in green and
10 in blue
Cast aluminium alloy casing

Stormwater management plan



Illus. 303: Storm water plan which indicates the different catchment areas and fall of the water. (Author: 2011)

The table and graph below indicate the average monthly precipitation for Pretoria. Refer to the storm water management plan on page 209.

Average monthly precipitation, P (mm)

Month	Average Monthly Precipitation (mm)
January	136
February	75
March	82
April	51
May	13
June	7
July	3
August	6
September	22
October	71
November	98
December	110

Table 11: Average monthly precipitation of Pretoria (Author: 2011)

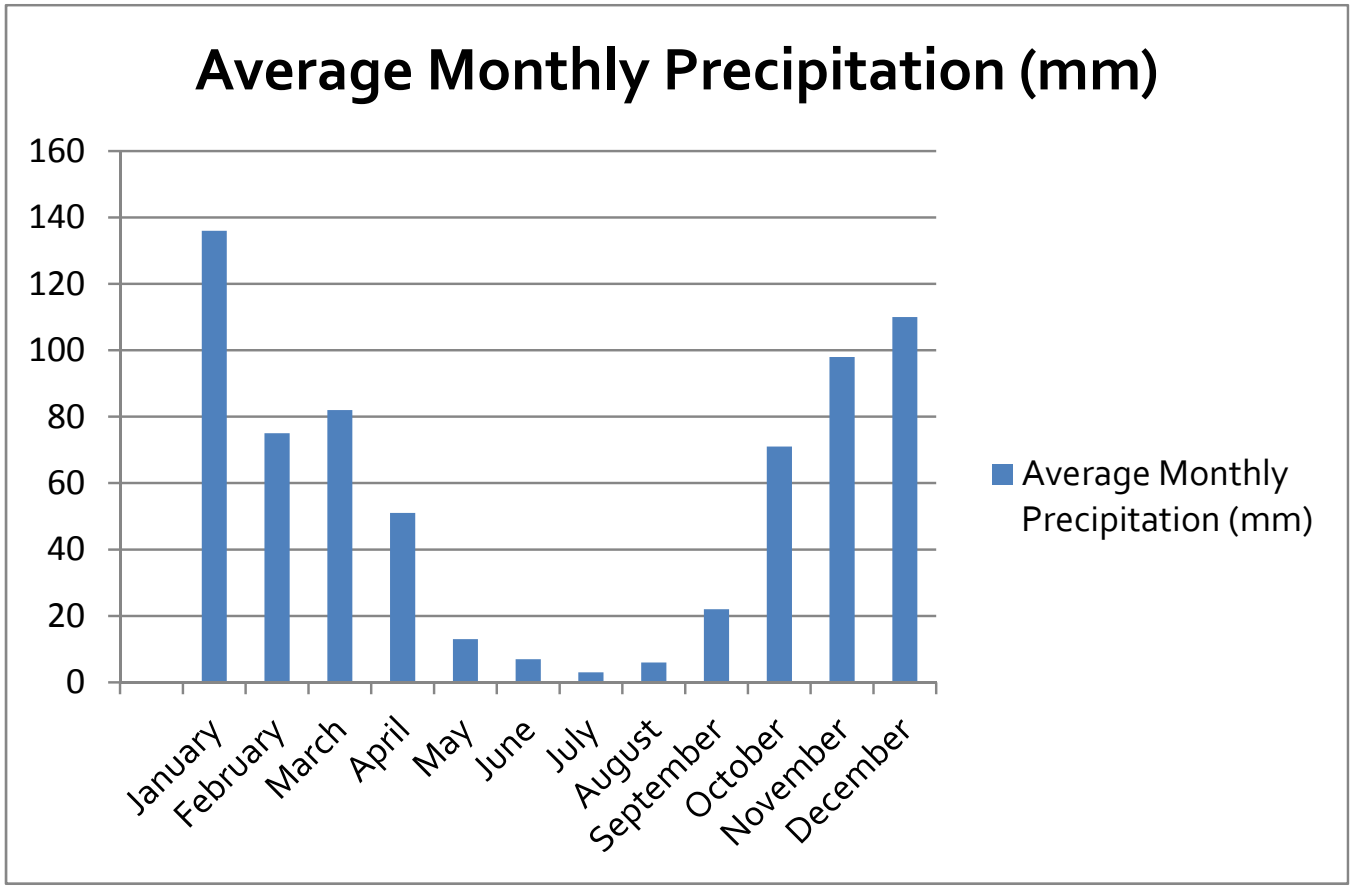


Fig. 24: Average monthly precipitation (Author, 2011)

The water budget for area 1, 2 and 4 was calculated. Area 3 is calculated tc and graphs indicate the irrigation demand per month, total yield of the area and the volume of water in the resesrvior.

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From the graphs one can deduce that their is enough water in the reservoir during the year to cater for the irrigation demand.

Water Budget: Catchment area 1

Month	Total Yield for area 1&3 (m³) (Yield = P x A x C)	Total Irrigation Demand (m³) (for veg garden (30m²) & water for water feature & 40 trees	Monthly Balance	Volume of water in Reservoir (m³)
January	69.8496	14.07	55.7796	140.6084
February	38.52	11	27.52	168.1284
March	42.1152	11	31.1152	199.2436
April	26.1936	11	15.1936	214.4372
May	6.6768	11	-4.3232	210.114
June	3.5952	11	-7.4048	202.7092
July	1.5408	11	-9.4592	193.25
August	3.0816	11	-7.9184	185.3316
September	11.2992	11	0.2992	185.6308
October	36.4656	11	25.4656	211.0964
November	50.3328	11	39.3328	250.4292
December	56.496	11	45.496	295.9252
Total	**346.1664**	**135.07**	**211.0964**	**2456.904**

Table 12: Water budget for catchment area 1 (Author: 2011)

Water Budget Catchment area 2 & 4

Month	Total Yield for area 1&3 (m³) (Yield = P x A x C)	Total Irrigation Demand (m³) (forplanting on gradient. 252m² and the excess water for roof garden)	Monthly Balance	Volume of water in Reservoir (m³)
January	100.8576	40	60.8576	135.1104
February	55.62	40	15.62	150.7304
March	60.8112	40	20.8112	171.5416
April	37.8216	40	-2.1784	169.3632
May	9.6408	40	-30.3592	139.004
June	5.1912	40	-34.8088	104.1952
July	2.2248	40	-37.7752	66.42
August	4.4496	40	-35.5504	30.8696
September	16.3152	40	-23.6848	7.1848
October	52.6536	40	12.6536	19.8384
November	72.6768	40	32.6768	52.5152
December	81.576	40	41.576	94.0912
Total	**499.8384**	**480**	**19.8384**	**1140.864**

Table 13: Water budget for catchment area 2 & 4 (Author: 2011)

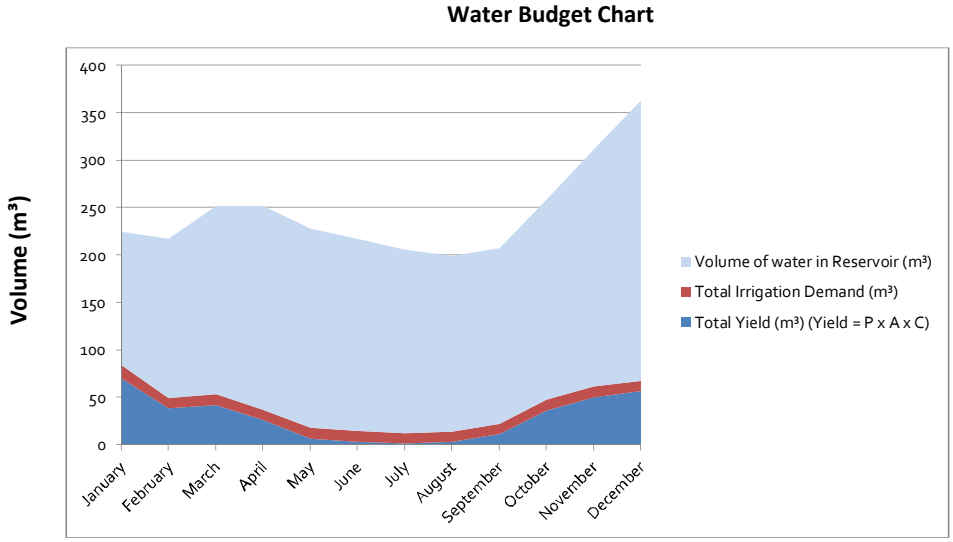


Fig. 25: Water budget chart for catchment area 1 (Author, 2011)

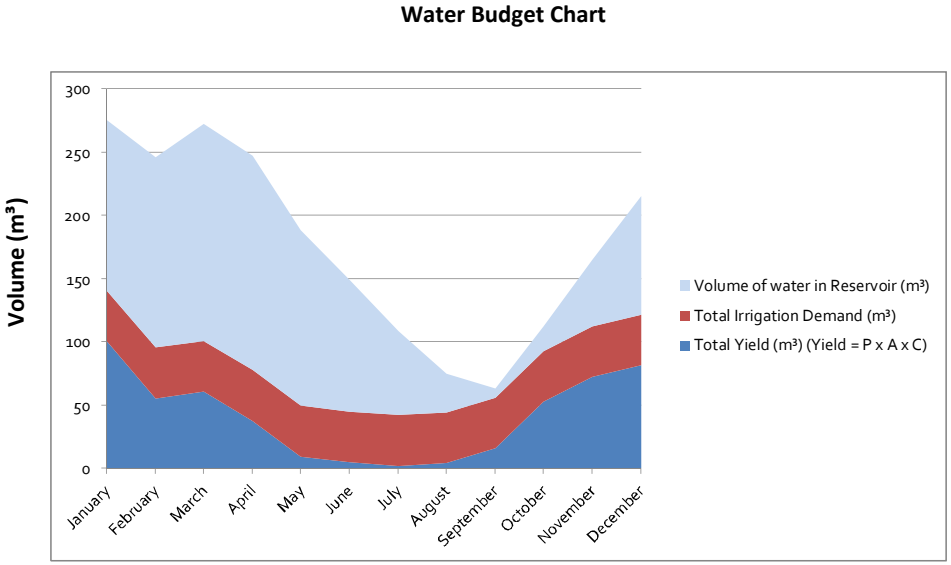
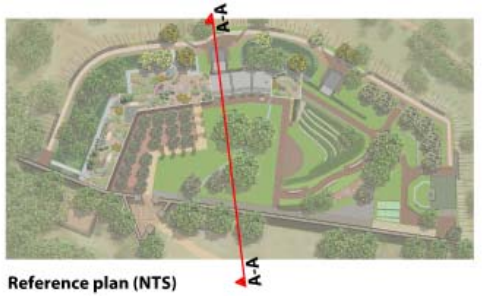
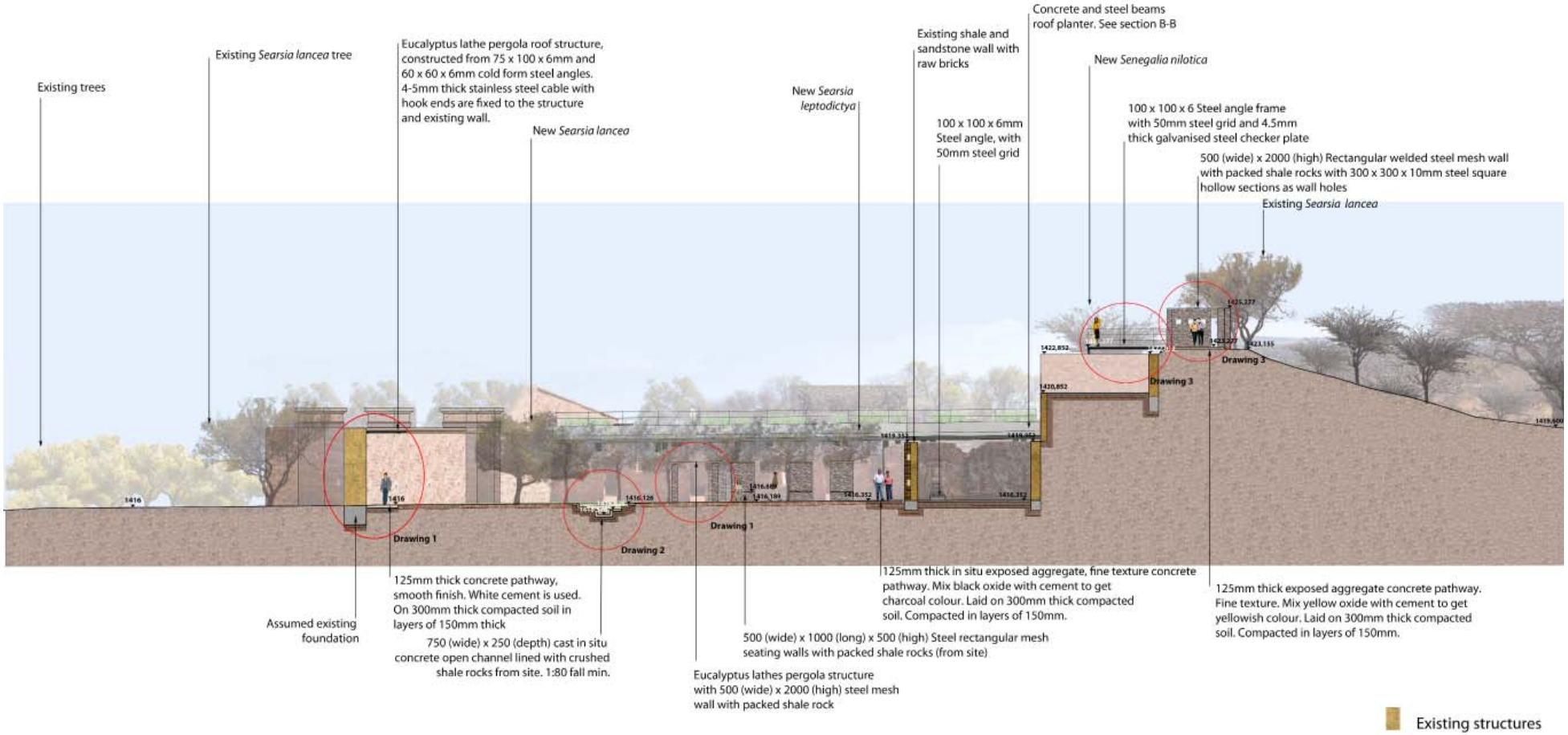
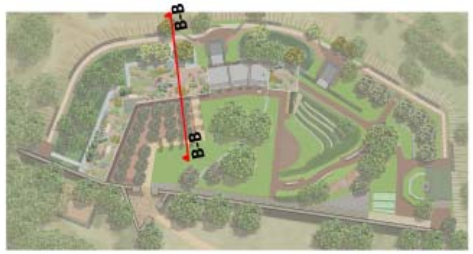


Fig. 26: Water budget chart for catchment area 2 & 4 (Author, 2011)

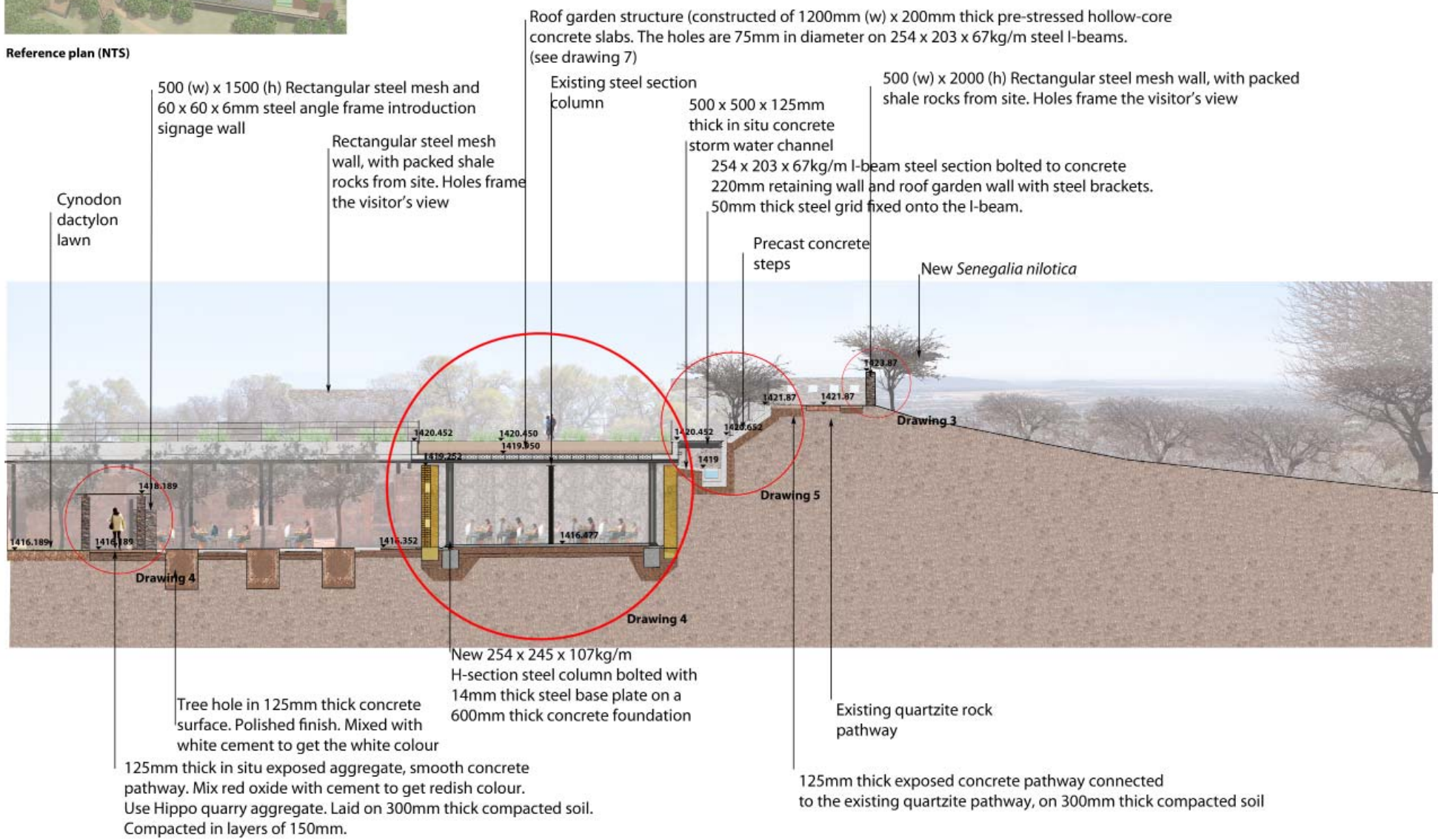




Illus. 304: Section A-A through the fort courtyard, room, cannon store and lookout 2 (Author: 2011)

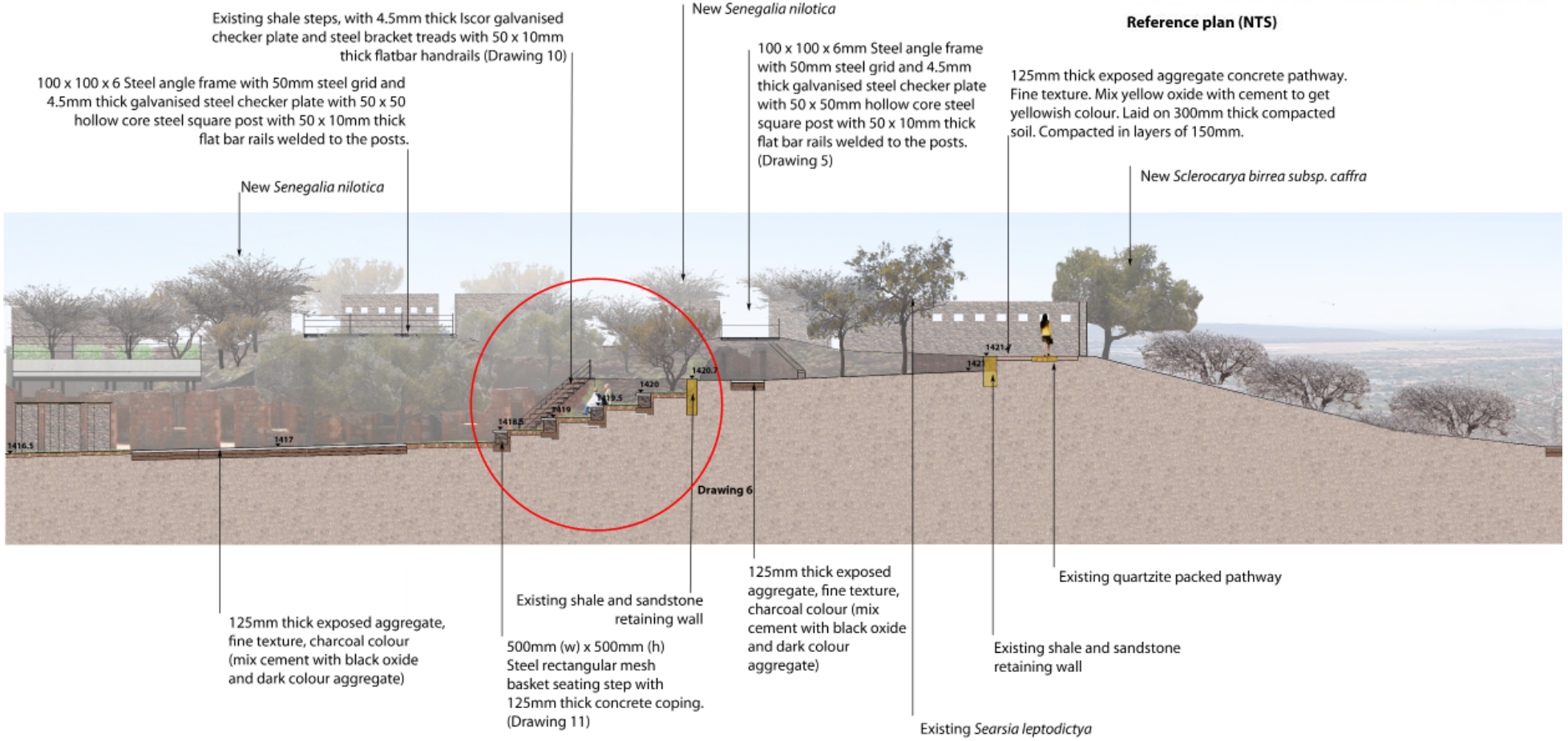


Reference plan (NTS)



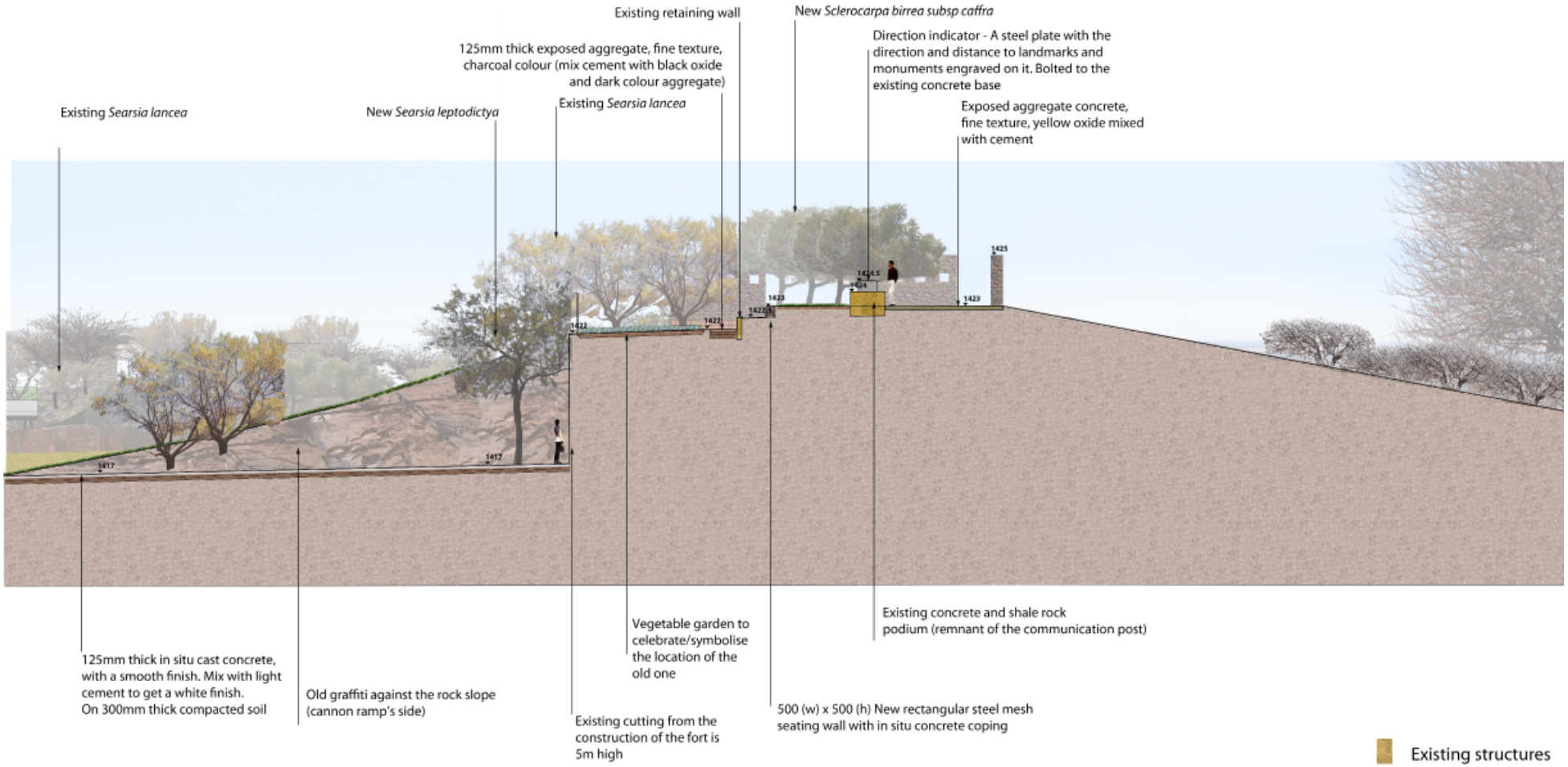
Illus. 307: Section B-B through the restaurant spill-out area, service area and open storm water channel (Author: 2011)

Reference plan (NTS)

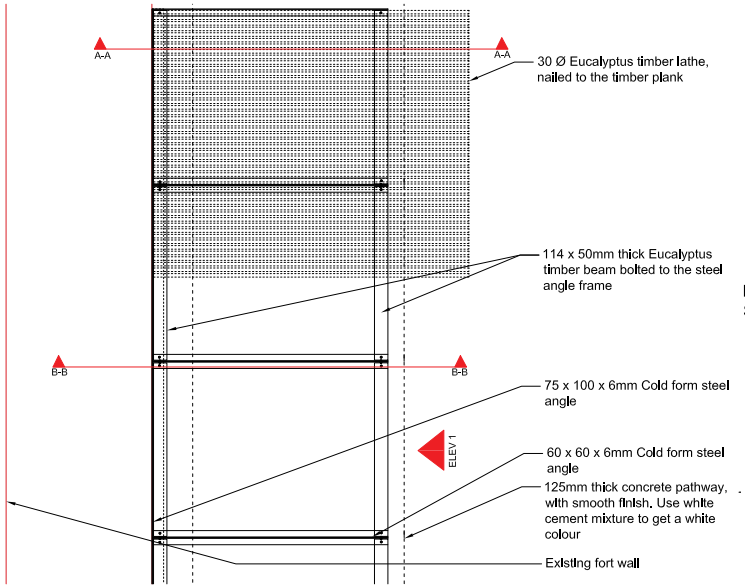


Illus. 311: Section C-C through the amphitheatre (Author: 2011)

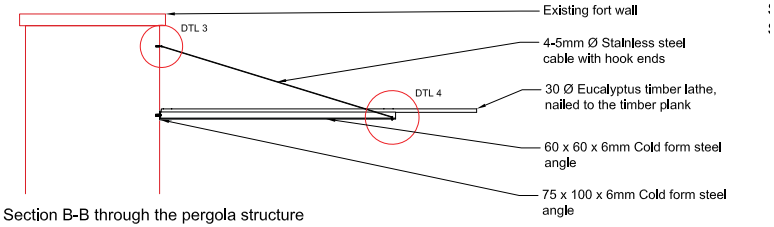
Reference plan (NTS)



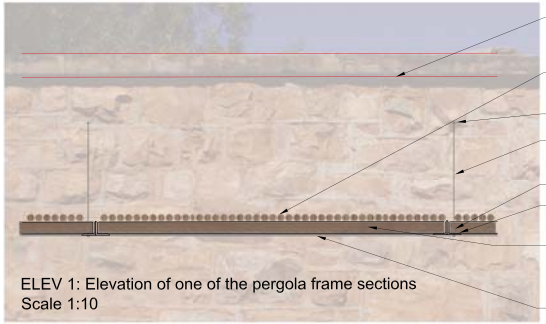
Illus. 313: Section D-D through the geology, materiality and spirit op place space as well as lookout point 4 (Author: 2011)



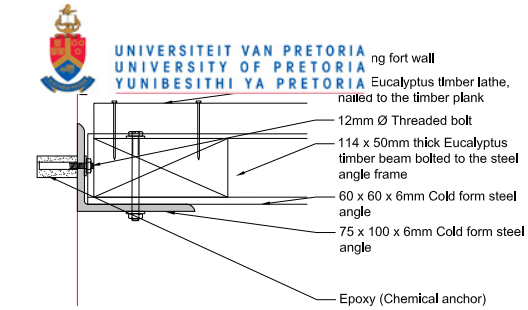
Plan of the steel and timber pergola against the existing wall
Scale 1:20



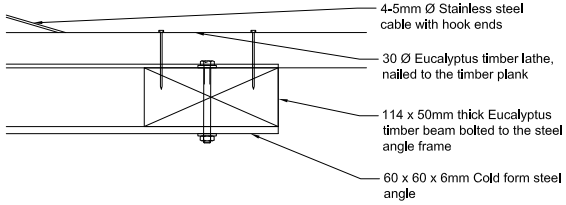
Section B-B through the pergola structure
Scale 1:20



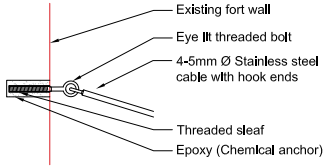
ELEV 1: Elevation of one of the pergola frame sections
Scale 1:10



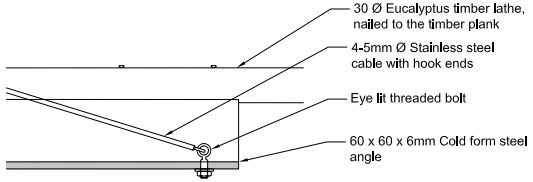
DTL1: Detail steel angle frame to existing wall
Scale 1:2



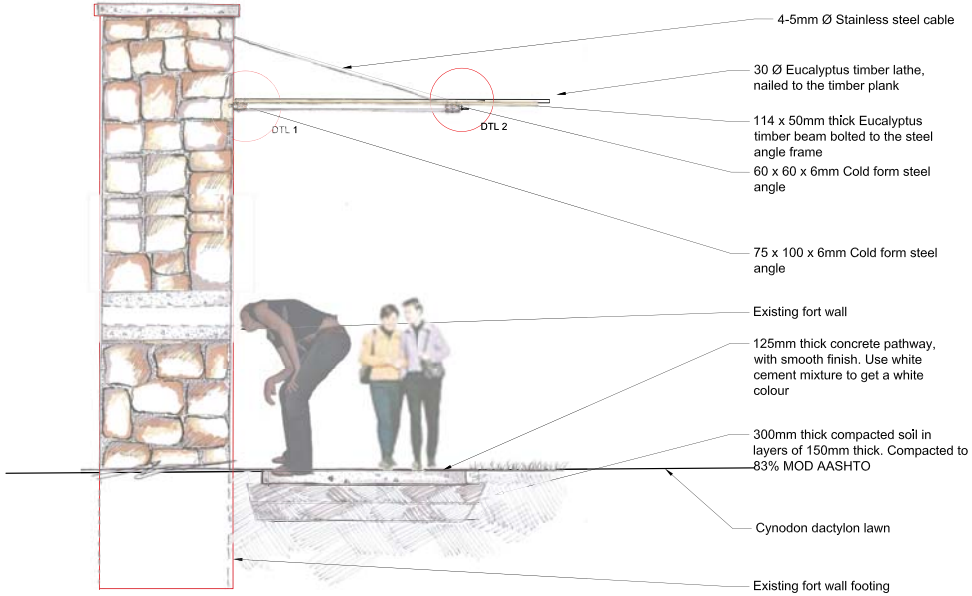
DTL 2: Detail of timber beam fixed to steel angle
Scale 1:2



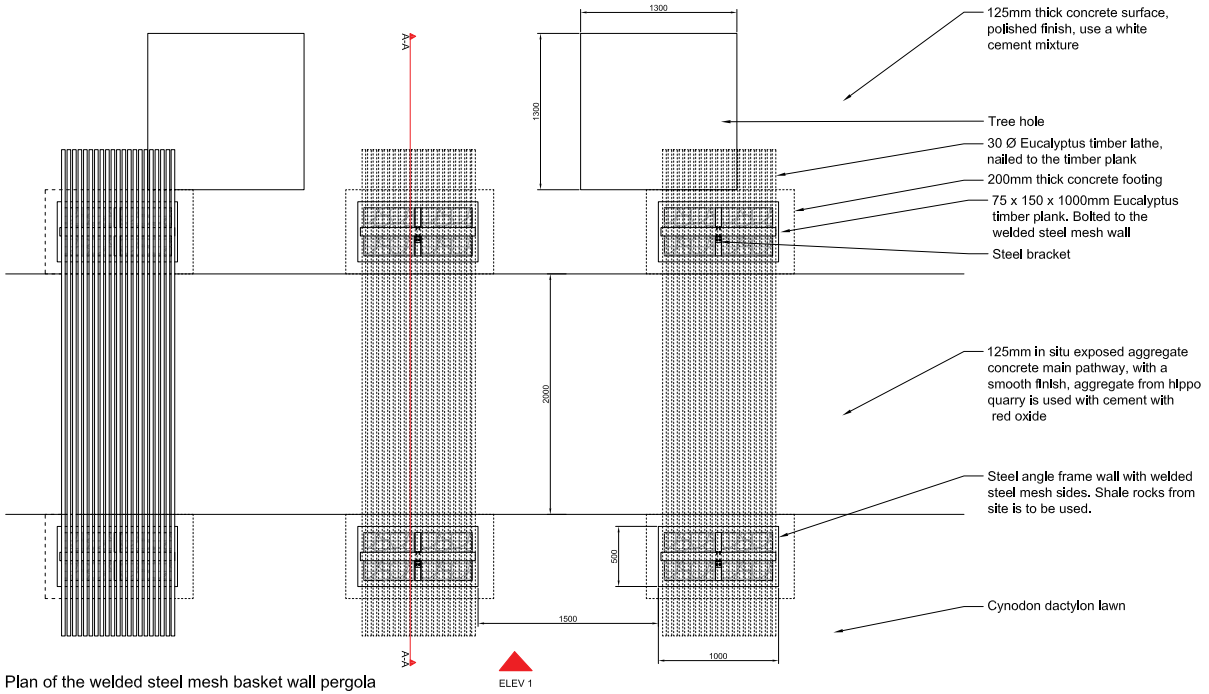
DTL 3: Detail of cable fixture to the existing wall
Scale 1:2



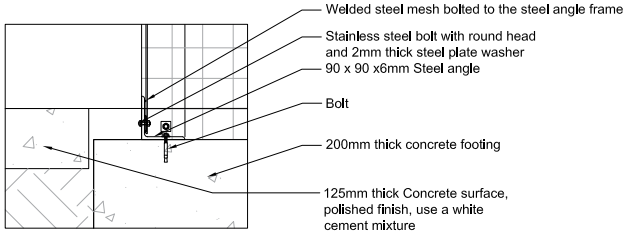
DTL 4: Detail of cable fixture to the steel angle
Scale 1:2



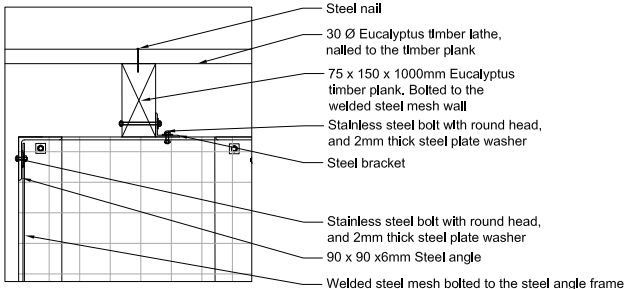
Section A-A through the pergola structure
Scale 1:20



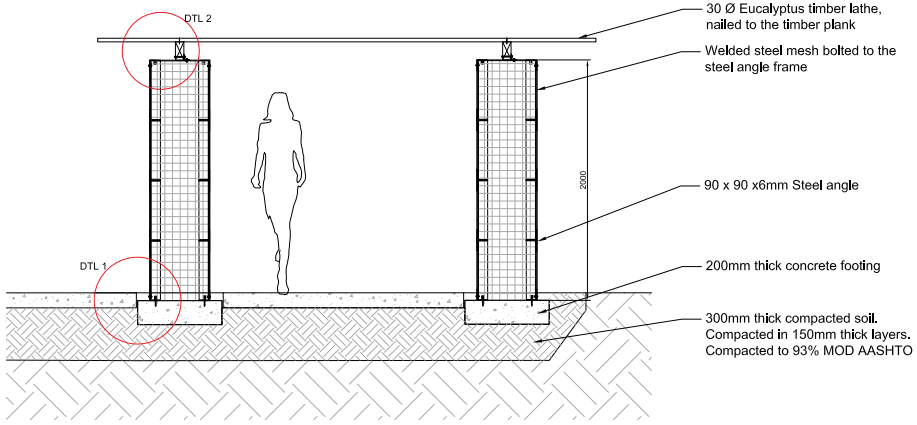
Plan of the welded steel mesh basket wall pergola
Scale 1:20



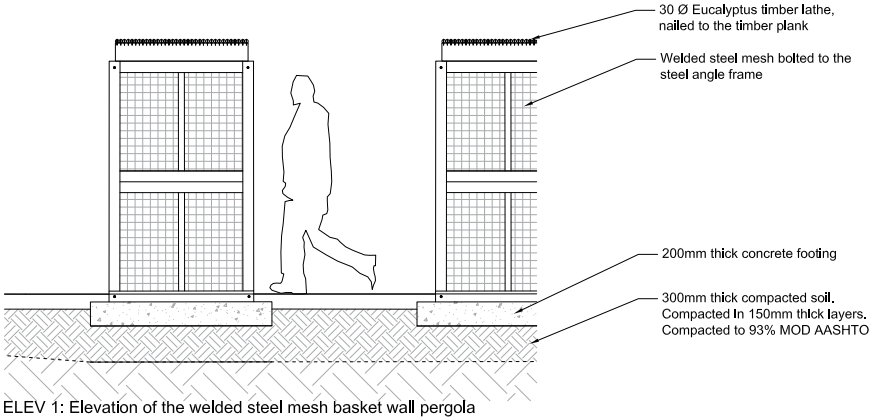
DTL 1: Detail of fixing to concrete footing
Scale 1:5



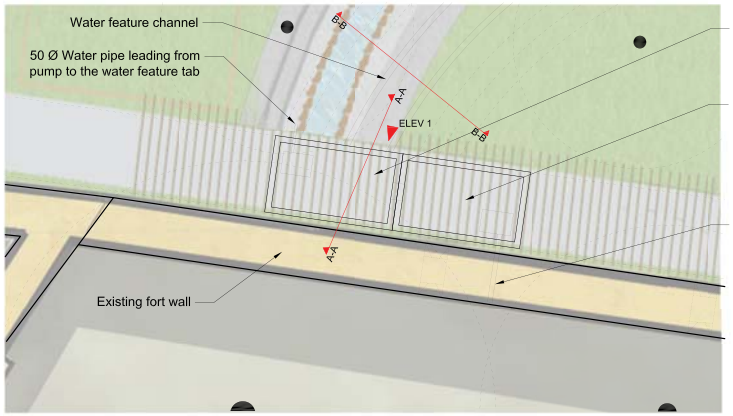
DTL 2: Detail fixing of timber plank to welded steel mesh wall
Scale 1:5



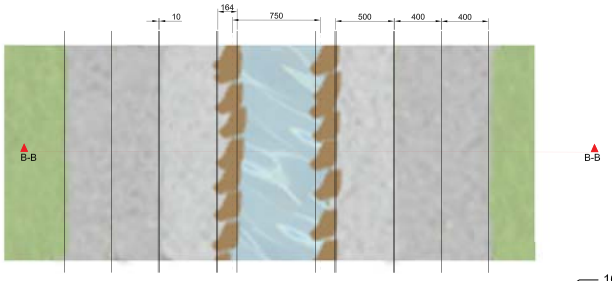
Section A-A through the welded steel mesh basket wall pergola
Scale 1:20



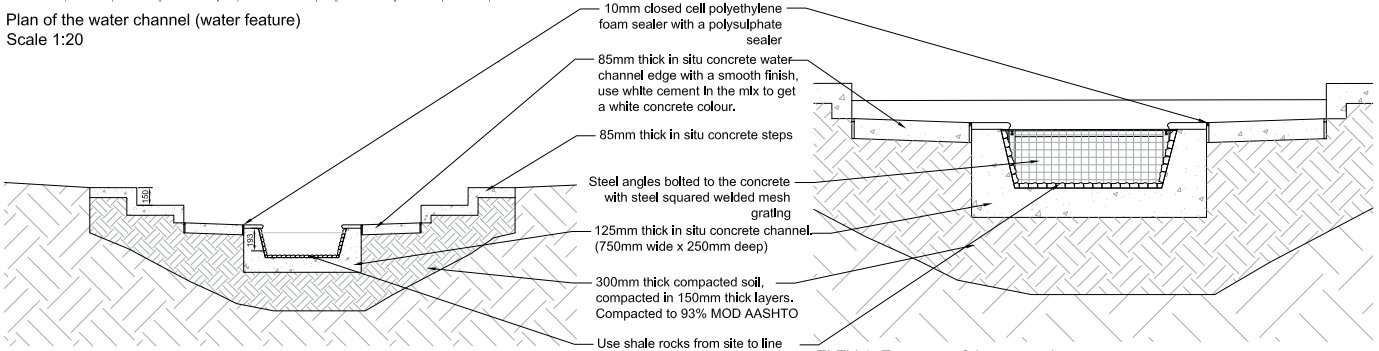
ELEV 1: Elevation of the welded steel mesh basket wall pergola
Scale 1:20



Detail section plan of the water channel and catchment tanks
Scale 1:50

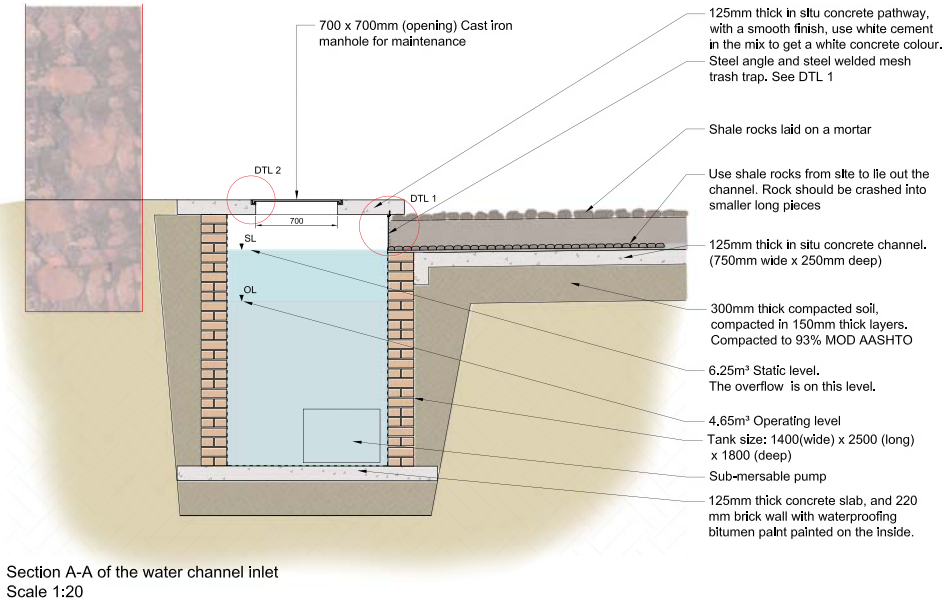


Plan of the water channel (water feature)
Scale 1:20

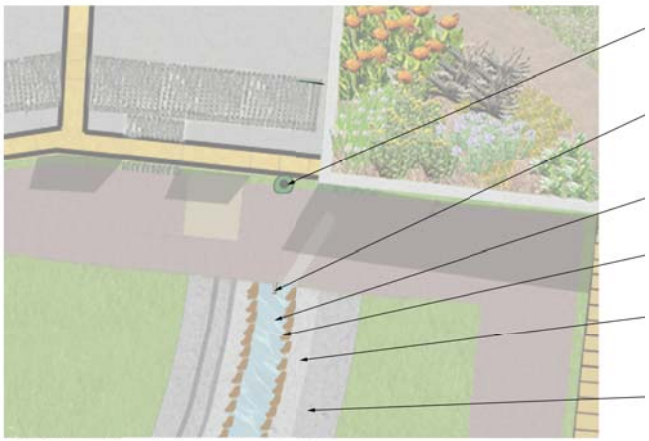


Section B-B through the water channel (water feature)
Scale 1:20

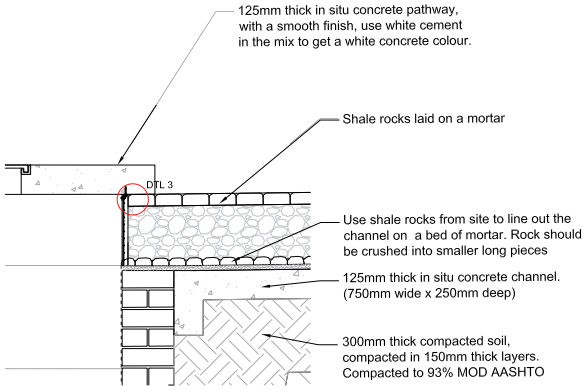
ELEV 1: Elevation of the water channel inlet
Scale 1:20



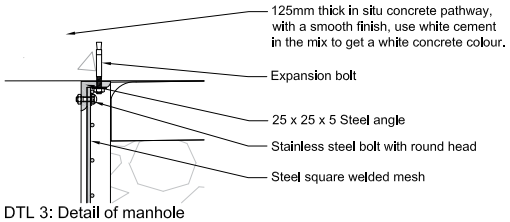
Section A-A of the water channel inlet
Scale 1:20



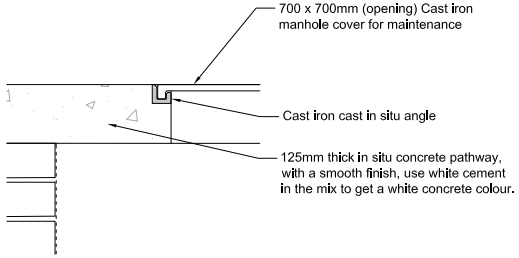
Detail plan og the water feature channel outlet
Scale 1:50



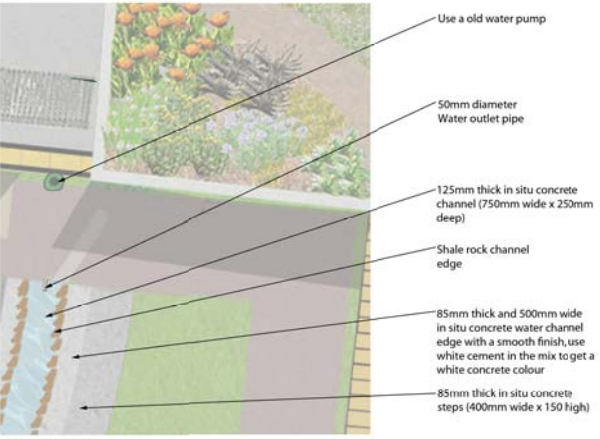
DTL 1: Section through water channel inlet
Scale 1:10



DTL 3: Detail of manhole
Scale 1:2



DTL 2: Detail of manhole
Scale 1:5



A example of a old water pump used during the fort's operation. This will be used as a water outlet for the water feature channel
NTS

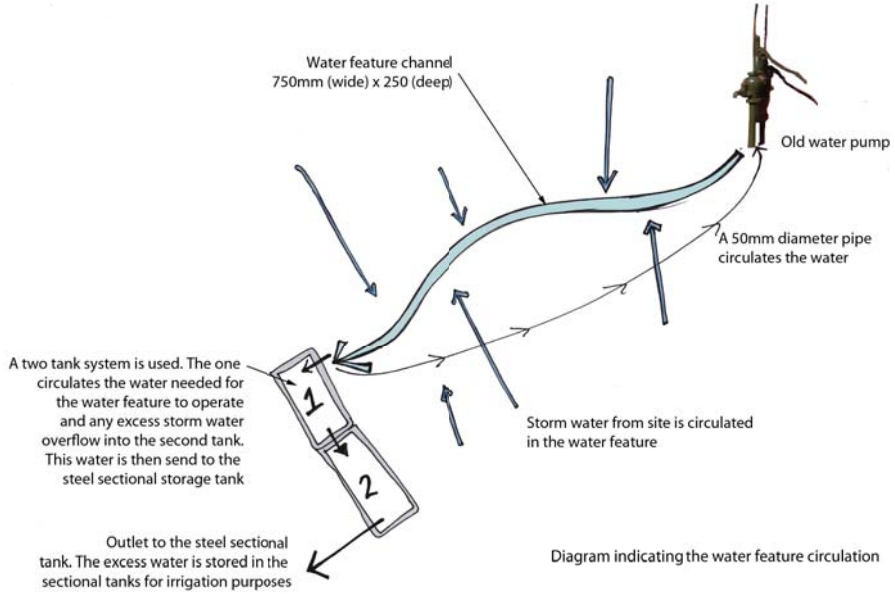


Diagram indicating the water feature circulation

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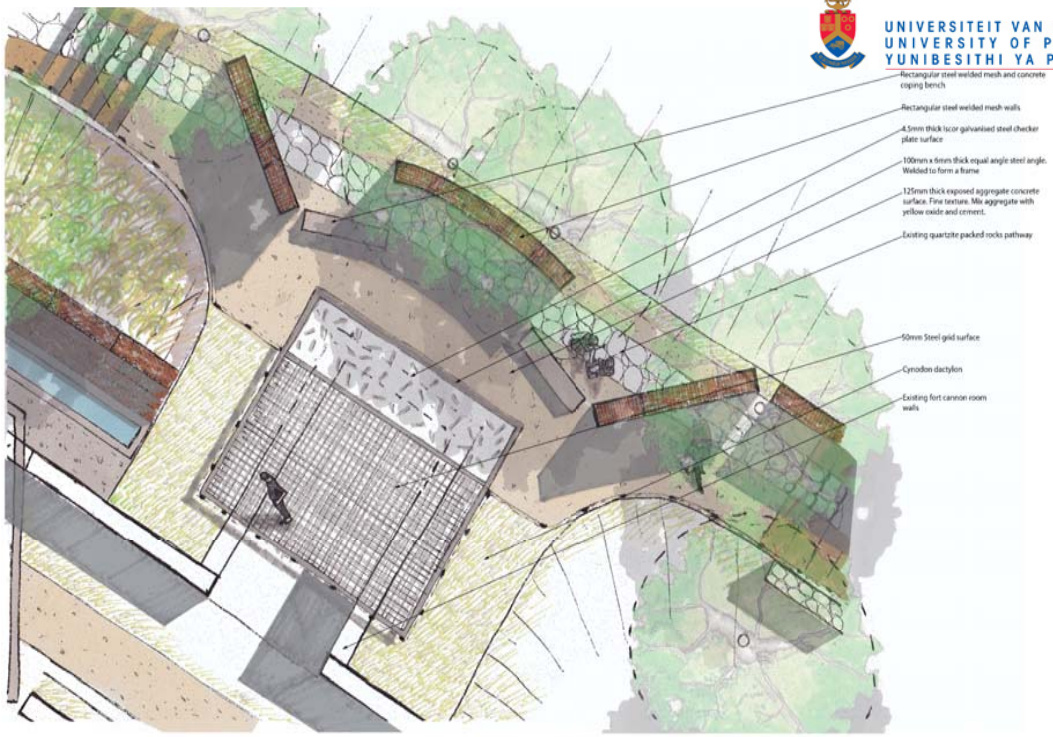
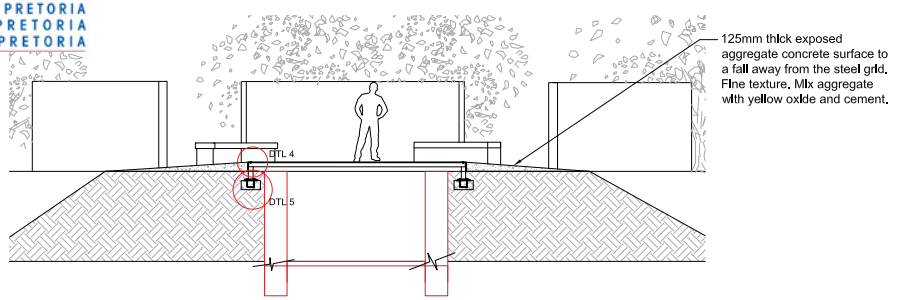
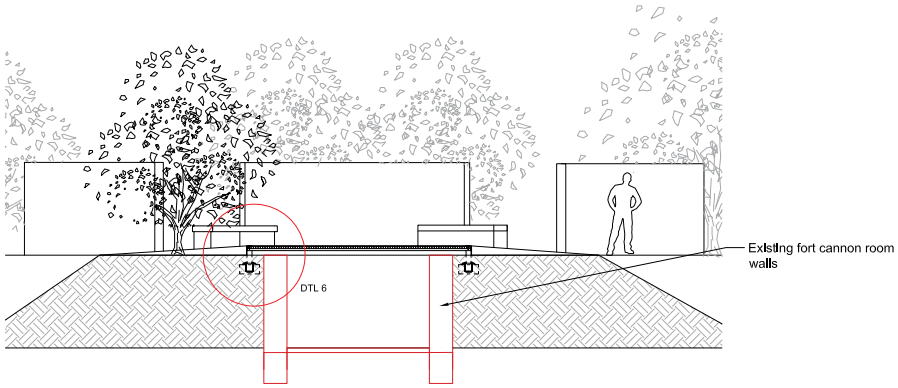


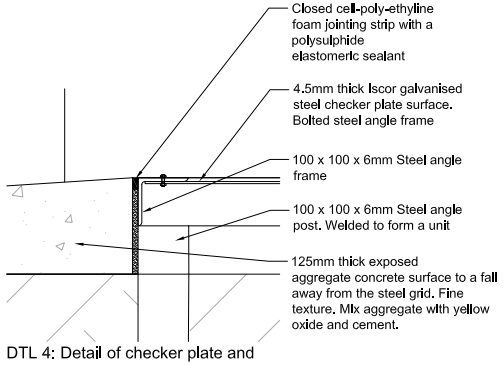
Plan of one of the four lookouts (lookout 3)
Scale 1:50



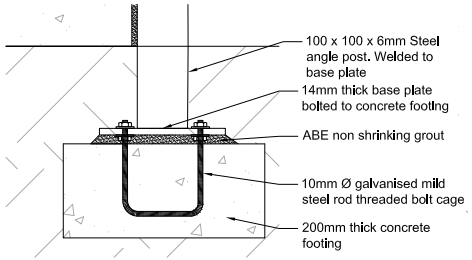
Section A-A through lookout point 3 - checker plate surface
Scale 1:50



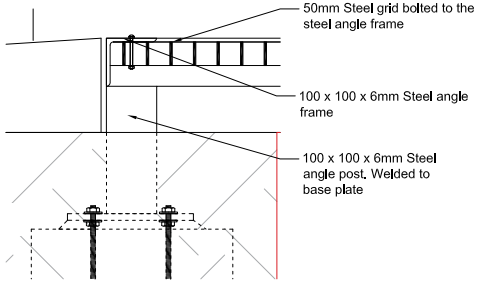
Section B-B through lookout point 3 - galvanised steel grid surface
Scale 1:50



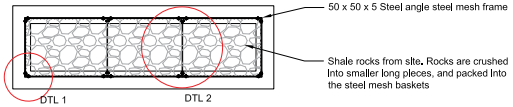
DTL 4: Detail of checker plate and concrete edge
Scale 1:5



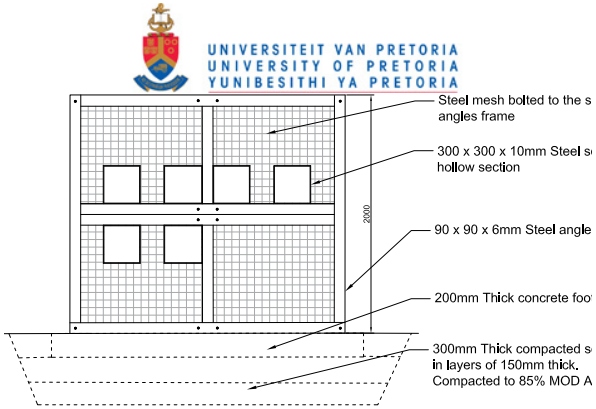
DTL 5: Detail of steel angle frame lookout footing
Scale 1:5



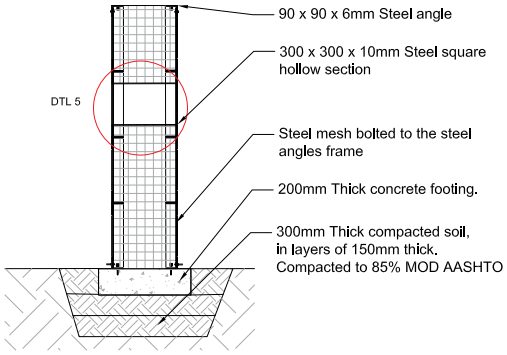
DTL 6: Detail of steel grid and angle frame
Scale 1:5



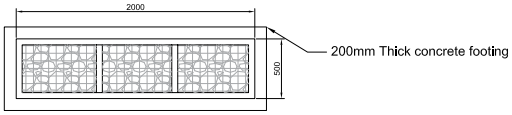
Section plan of the steel mesh basket wall with signage
Scale 1:20



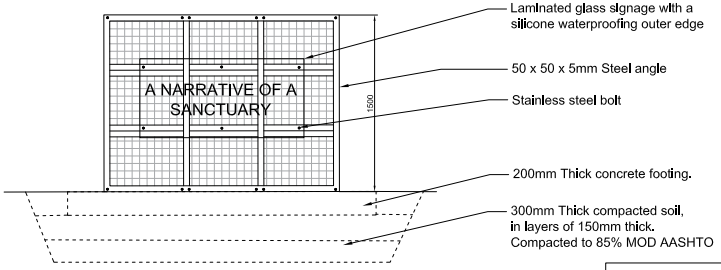
Elevation of the steel mesh basket wall with holes



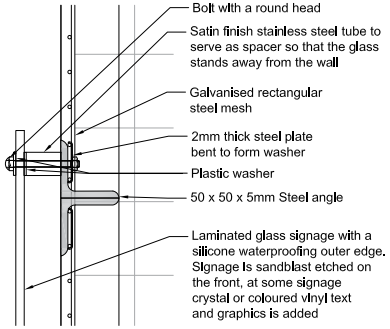
Detail section of the steel mesh basket wall with holes
Scale 1:20



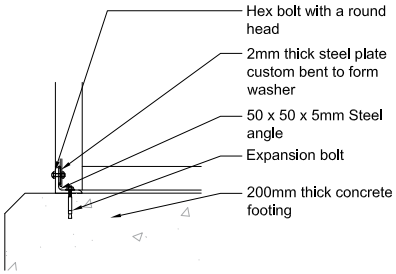
Plan of the steel mesh basket wall with signage
Scale 1:20



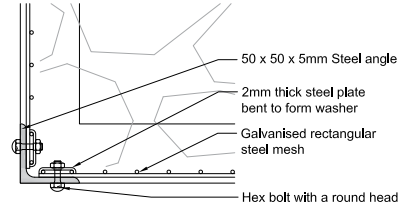
Elevation of the steel mesh basket wall with signage
Scale 1:20



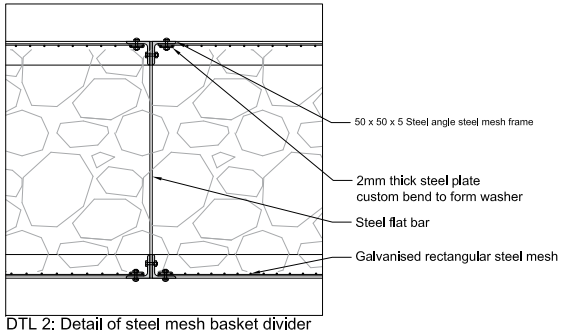
DTL 3: Detail of glass signage fixing to the steel mesh wall
Scale 1:2



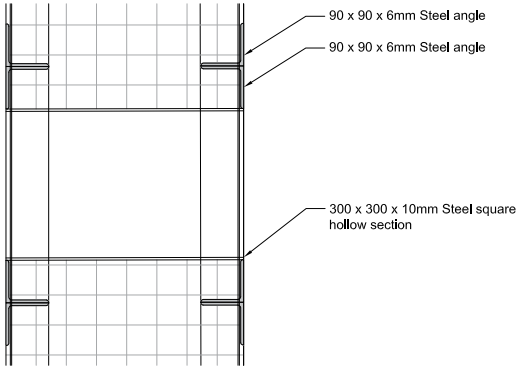
DTL 4: Detail section of the steel mesh basket wall to the concrete footing
Scale 1:5



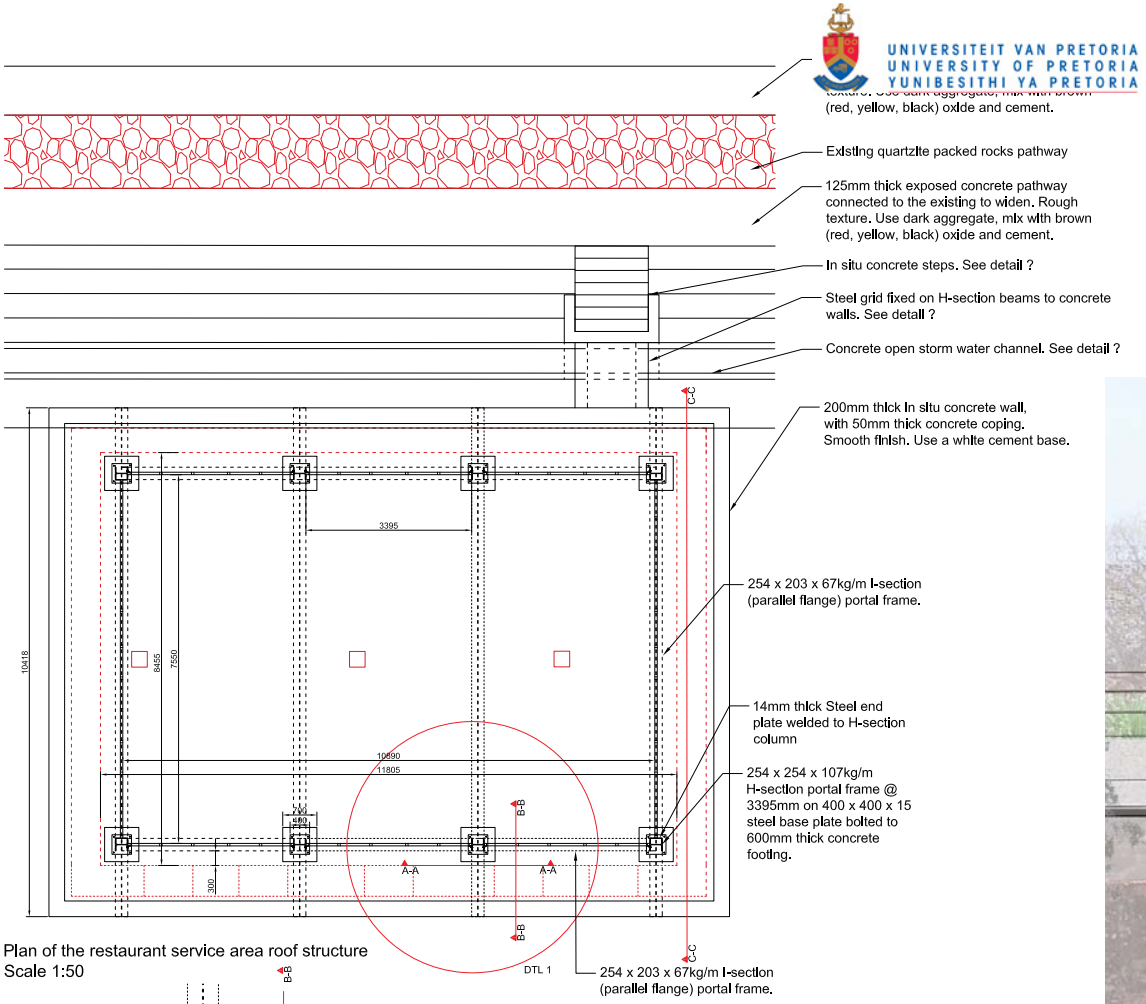
DTL 1: Detail of the steel mesh basket wall corner Scale 1:2



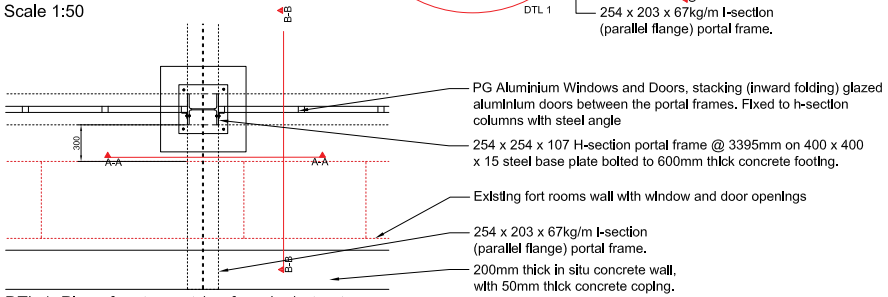
DTL 2: Detail of steel mesh basket divider
Scale 1:5



DTL 5: Detail of steel square hollow tube
Scale 1:5

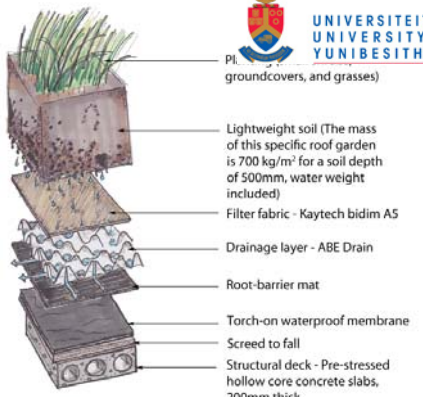


Plan of the restaurant service area roof structure
Scale 1:50

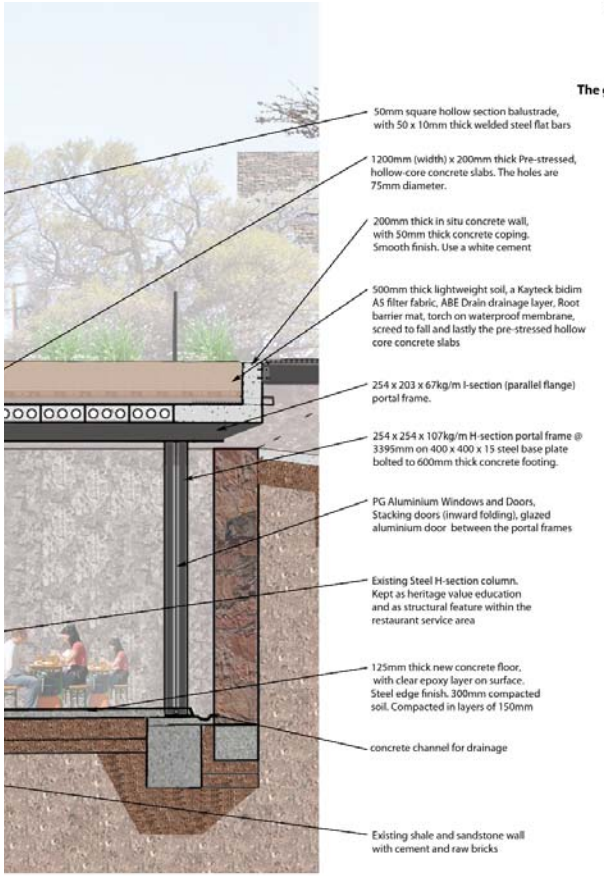


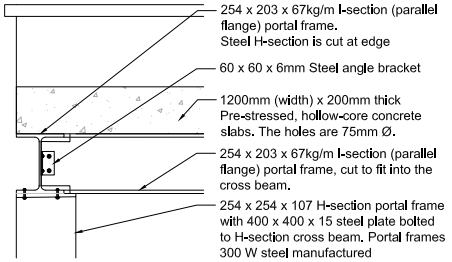
DTL 1: Plan of restaurant (roof garden) structure
Scale 1:20

ction C-C: Detail section through the restaurant service area
ale 1:25

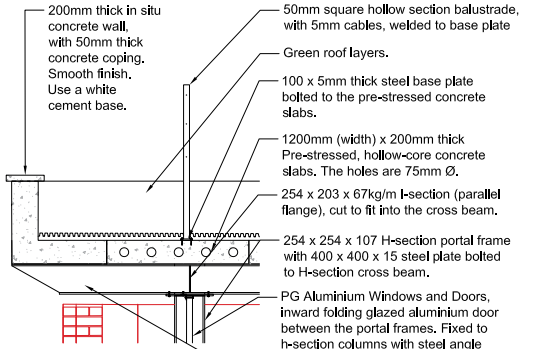


The green roof layers (NTS)

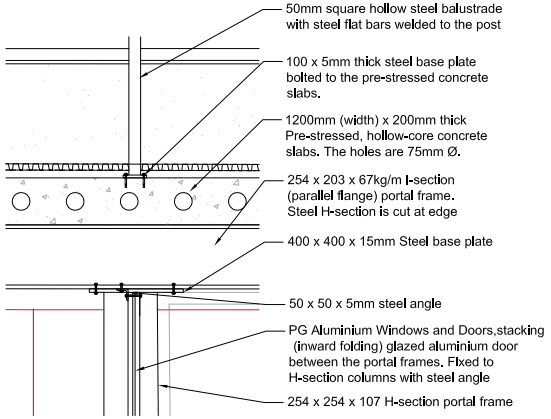




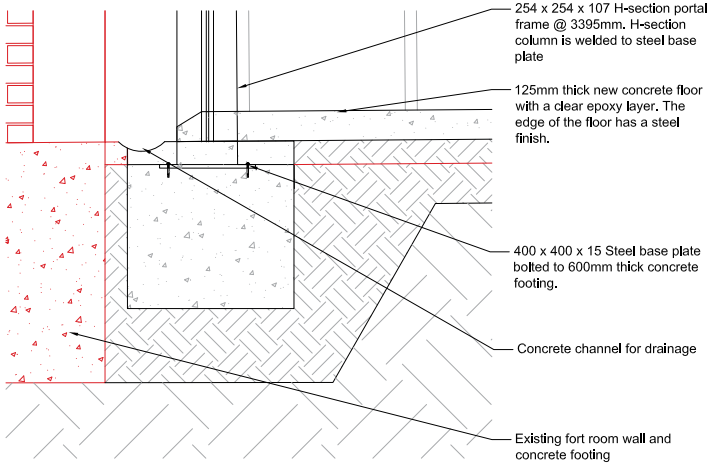
Detail section A-A steel H-section fixing
Scale 1:10



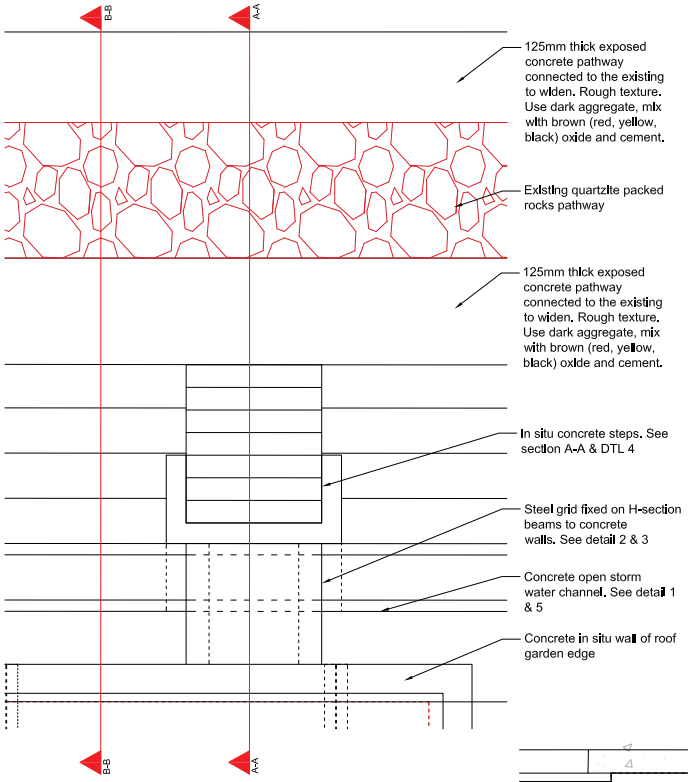
Detail section B-B of the steel H- section and roof slab fixing
Scale 1:20



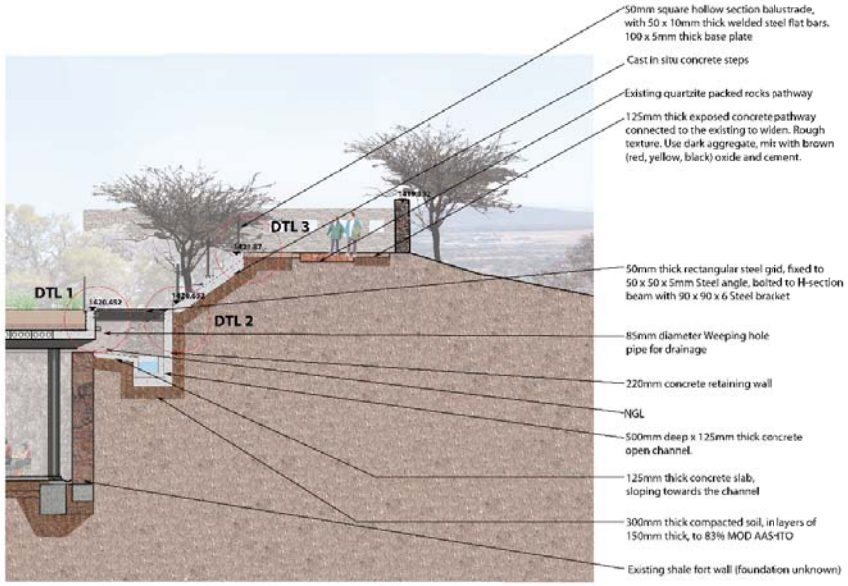
DTL 3: Detail of H-section to roof and aluminium glazing fixing
Scale 1:10



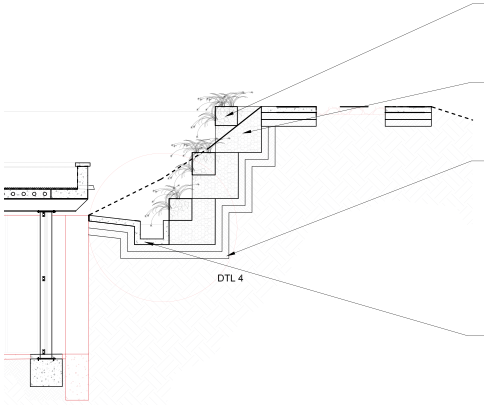
DTL 2: Detail of the steel H- section fixed to concrete footing
Scale 1:10



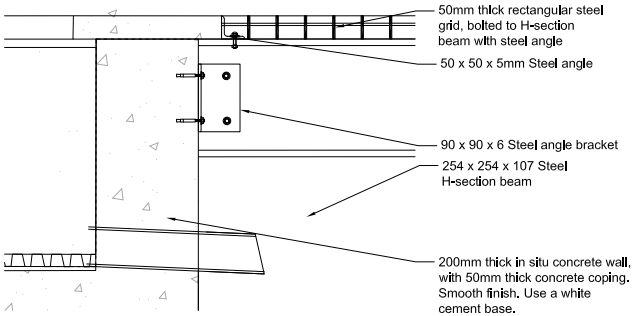
Plan of the concrete open storm water channel and steps
Scale 1:25



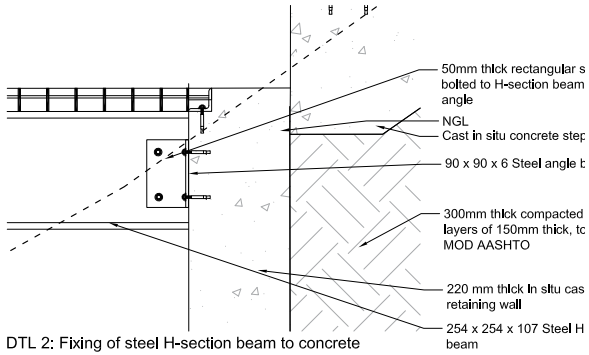
Section A-A: Detail section through the concrete open storm water channel and steps
Scale 1:50



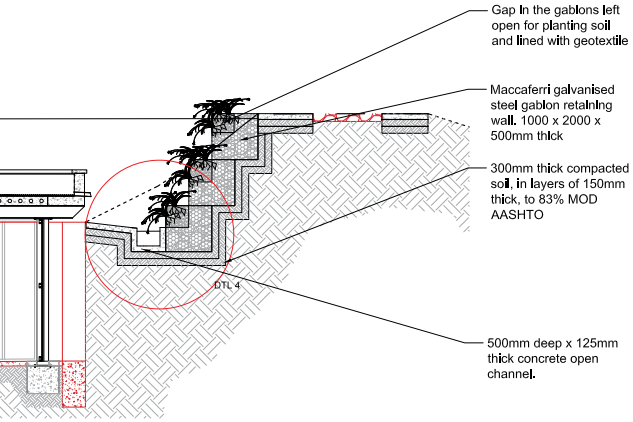
Section B-B: Detail section through the concrete open storm water channel and gabion retaining wall
Scale 1:50



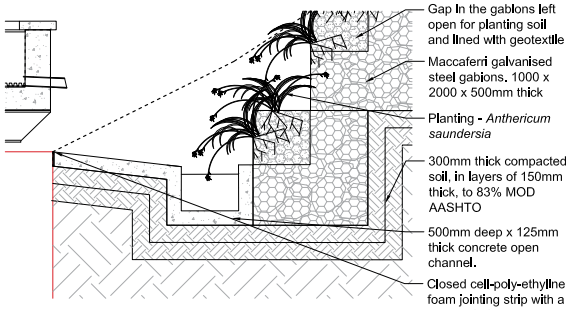
DTL 1: Fixing of steel H-section beam to concrete wall and steel grid
Scale 1:5



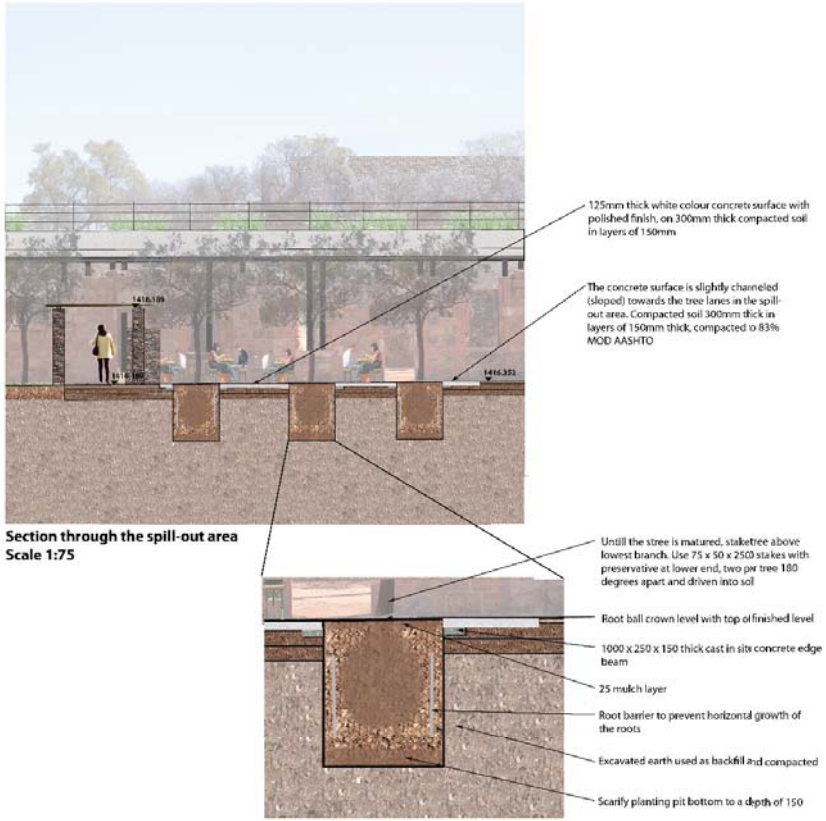
DTL 2: Fixing of steel H-section beam to concrete retaining wall and steel grid
Scale 1:5



Section B-B: Detail section through the concrete open storm water channel and gabion retaining wall
Scale 1:50

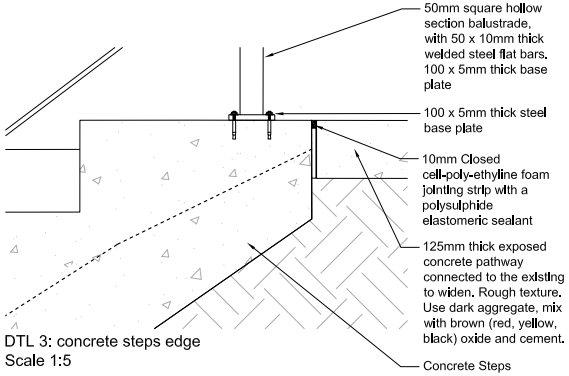


DTL 4: Detail section through the concrete open storm water channel and gabion retaining wall
Scale 1:20

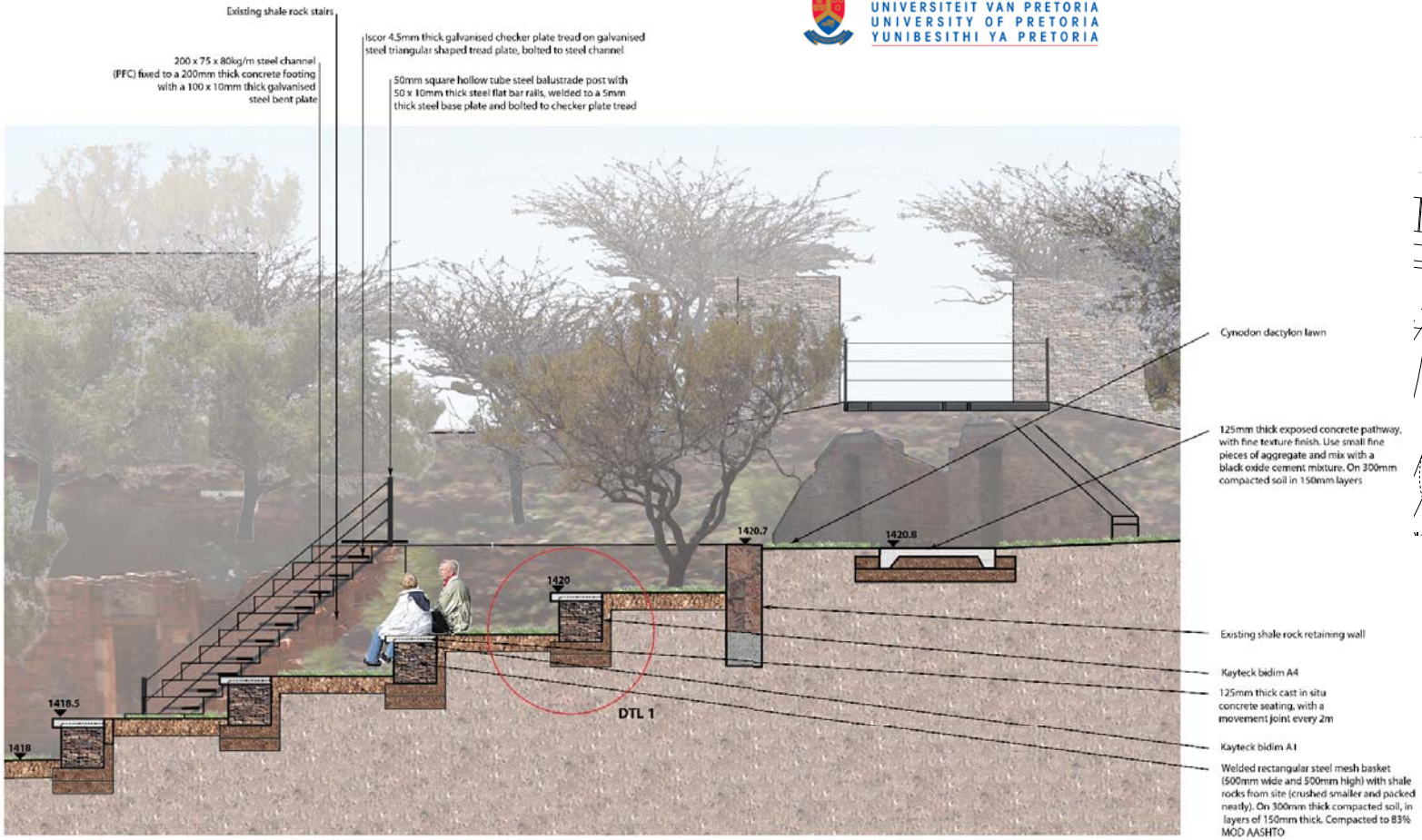


Section through the spill-out area
Scale 1:75

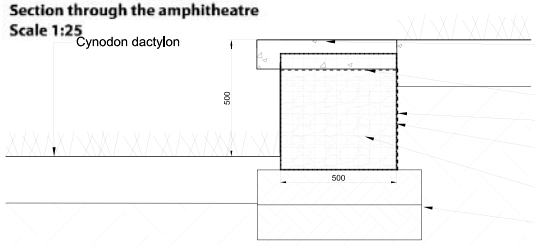
Detail of the tree planter



DTL 3: concrete steps edge
Scale 1:5

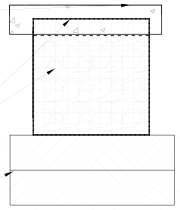


Section through the amphitheatre
Scale 1:25

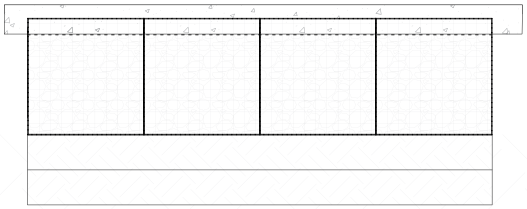


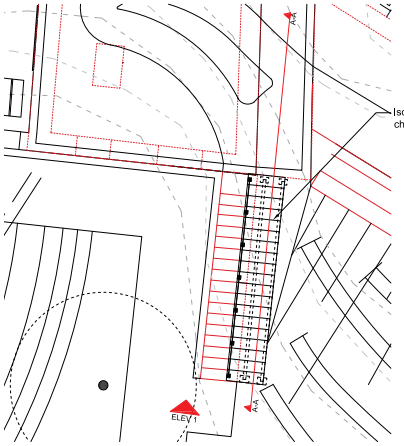
125mm thick cast in situ concrete seating, with a movement joint every 2m
Kayteck bidim A1
Kayteck bidim A4
Welded rectangular steel mesh basket (500 wide and 500 high)
Shale rocks from site
300mm thick compacted soil, in layers of 150mm thick. Compacted to 83% MOD AASHTO

DTL 1: Section through amphitheatre seating steps
Scale 1:10

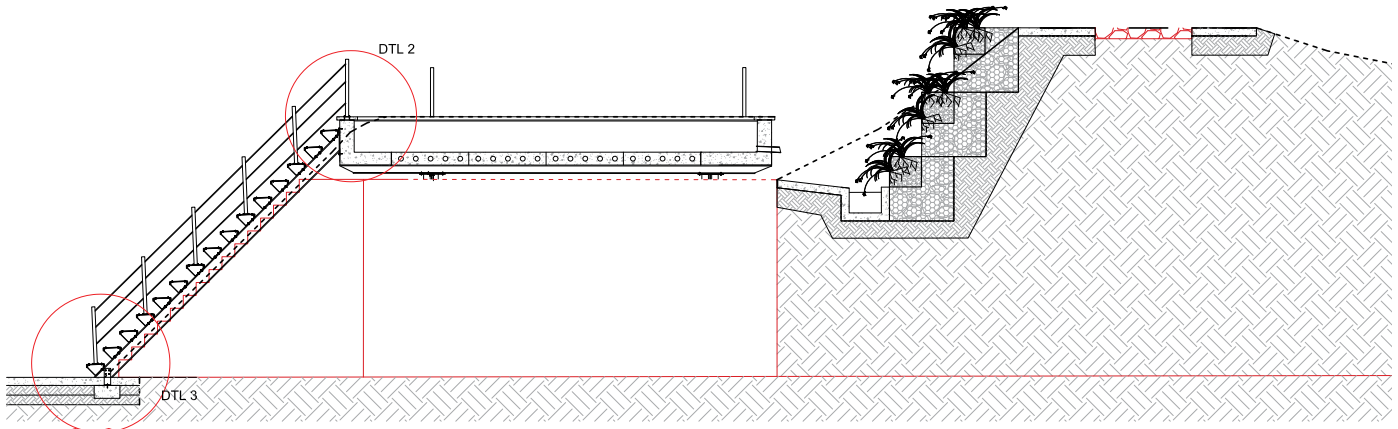


Section through bench
Scale 1:10

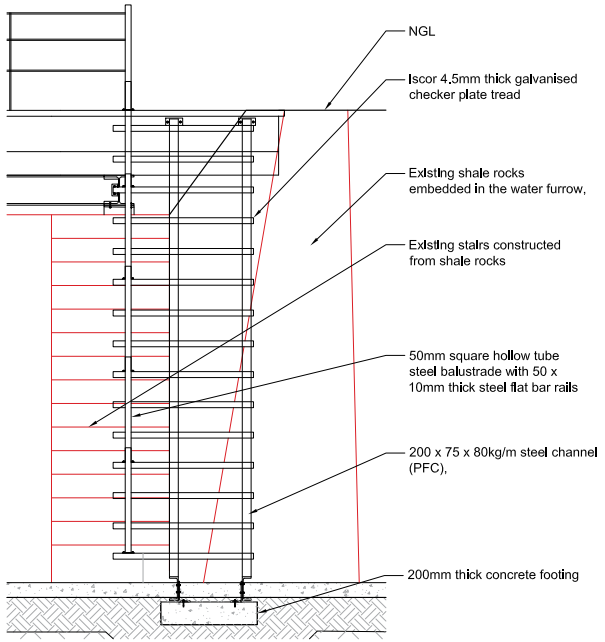




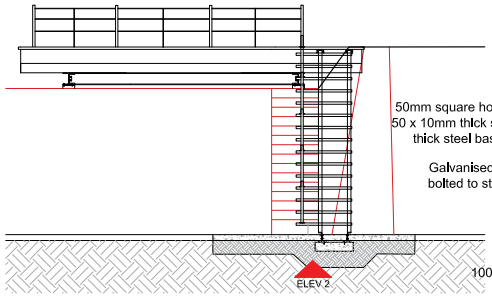
Plan of the existing stair and new proposed steel stairs to the roof garden
Scale 1:50



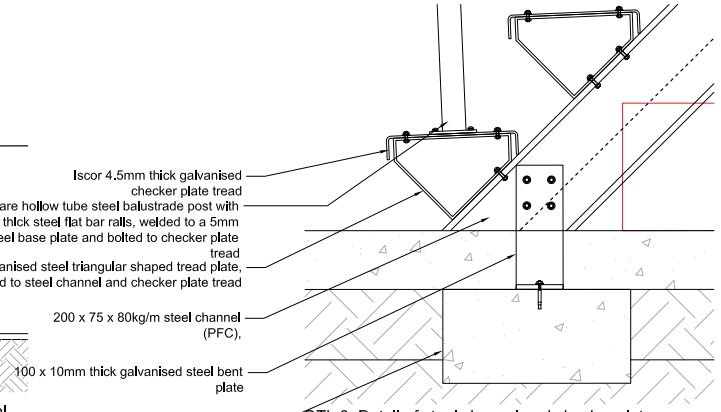
Section A-A of the existing stair and new proposed steel stairs to the roof garden
Scale 1:50



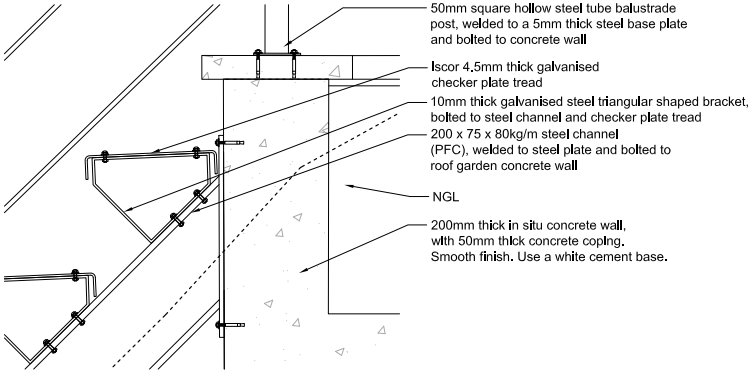
ELEV 2: Detail elevation of the existing stairs and new proposed steel stairs to the roof garden
Scale 1:20



ELEV 1: Elevation of the existing stairs and new proposed steel stairs to the roof garden
Scale 1:50



DTL 3: Detail of steel channel and checker plate staircase and footing
Scale 1:5



DTL 2: Detail of balustrade footing and checker plate treads
Scale 1:5