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Proposed Expansion of Cemetery
on Erf 566 in Melkhoutfontein, and
on Erf 31/485 in Stilbaai



Preliminary Engineering Design
Report

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Proposed Expansion of Cemetery on Erf 566 in Melkhoutfontein, and on Erf 31/485 in Stilbaai.

Preliminary Engineering Design Report

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1 INTRODUCTION AND BACKGROUND

Element Consulting Engineers has been appointed by the Hessequa Municipality for the rendering of consulting engineering services for the proposed development of the cemetery expansions at Stilbaai and Melkhoutfontein.

Both the Stilbaai and Melkhoutfontein cemetery sites are located on municipal land and are indicated on the appended locality DRG 1702361/C/01.

Site investigations revealed that the existing in-town, Stilbaai cemetery currently only has approximately 220 vacant burial plots available. 220 burial plots will allow for approximately 3 years of cemetery life, at ± 60 funerals per year.

Site investigations also indicated that the existing Melkhoutfontein cemetery currently only has approximately 45 vacant burial plots available. 45 burial plots will allow for approximately 1.5 years of cemetery life, at ± 25 funerals per year.

Access to both sites are from existing surfaced streets with streetlighting. Existing off-street parking, along the entrances of both cemetery sites should still be utilized for parking. Both sites are completely walled / fenced in, although a bit dilapidated at some points. Existing water lines and taps in the cemeteries can be extended to serve the larger expanded areas. There are no toilets in either of the cemeteries.

The abovementioned investigations also indicated that the following cemetery expansions are possible:

- In Stilbaai an extension of the existing cemetery on Erf 31/485, extension area approximating 1,720.47m², part of existing Erf 31/485 of total area of 12,198.63 m², of which 10,482 m² is the existing walled cemetery; and
- In Melkhoutfontein an extension of the existing cemetery, to the east and south on vacant part B of Erf 141/480 (approximate area 5,843.5 m²) and to the south on an additional part A of Erf 566 (approximate area 2,495.5 m²). The existing walled cemetery approximate total area of 9,324 m², of which 5,162 m² is the existing cemetery part on Erf 566, and 4,162 m² is the existing cemetery part on Erf 141/480. The existing walled cemetery is overlapping part of Erf 566 and part of Erf 141/480. There also seem to be a discrepancy between erf cadastral boundaries and the real on-site cemetery boundaries; which are also incorrectly indicated on the Hessequa municipality's latest Spatial Development Framework (SDF) drawings (refer to appended DRG 1702361/C/02).

The following Environmental Impact requirements regarding the creation of new cemeteries or the expansion of existing cemeteries may be applicable to this project:

- A Basic Environmental Assessment will be required for the development of new cemeteries of 2 500 square metres or more in size OR the extension of an existing cemetery of 2 500 square metres or more in size (Listing Notice 1);
- A Basic Environmental Assessment will also be required for the clearance of an area of 1 hectare (10 000m²) or more, but less than 20 hectares of indigenous vegetation (Clause 27 in Listing Notice 1).

This report will detail and discuss the preliminary engineering design of the possible cemetery developments in terms of firstly the bulk engineering services and secondly the internal engineering designs in parallel with the engineering standards and technical design criteria applicable to the project.

2 LOCALITY AND ACCESS

Both the Stilbaai and Melkhoutfontein sites are located on municipal land and are indicated on the appended locality DRG 1702361/C/01. The Stilbaai cemetery site, Erf 31/485 is located in the Stilbaai town; and the Melkhoutfontein cemetery site, partly on Erf 566 and partly on Erf 141/480 is located east of Melkhoutfontein which is located approximately 5 kilometres north of Stilbaai.

Access to the **Stilbaai** cemetery site is currently obtained via an existing tarred road, the Jongensfontein road, turn-off from the R305 Main road in Stilbaai, indicated on the above-mentioned locality plan. Sight distances in both the eastern and western directions and in both the horizontal and vertical alignments are excellent at the existing access point to the cemetery. (refer to appended DRG 1702361/C/04).

Access to the **Melkhoutfontein** cemetery site is currently obtained via an existing tarred road, Rooipitjie road, turn-off from the Melkhoutfontein access road, turning off the R305 road about 5 kilometres from Stilbaai, indicated on the above-mentioned locality plan. Sight distances in both the eastern and western directions and in both the horizontal and vertical alignments are excellent at the existing access point to the cemetery. (refer to appended DRG 1702361/C/02).

There also is an existing gravel cemetery parking area, parallel to the main road passing the cemetery, on the northern boundary of the Melkhoutfontein site, and on the south western and eastern sides of the Stilbaai site. These parking areas will still be utilised as such and may only require minor renovation. Sight distances in all directions, and in both the horizontal and vertical alignments are excellent at the existing exit from these parking areas.

3 GEOTECHNICAL INVESTIGATION

Both Stilbaai cemeteries are located in an area consisting of calcareous sandstone, clastic limestone, conglomerate, coquinite; and mostly transported clayey sandy silt is encountered with a weathered mudstone present on the Melkhoutfontein site.

Due to the Stilbaai cemetery's location at approximately 1 000m from the nearest river, and the site being 30m higher than the elevation of the river, it is not necessary to present the 1:50 year flood line. Aerial photographs also indicate the cemetery location in an area altered and impacted by urban development.

Due to the Melkhoutfontein cemetery's location at approximately 2 800m from the nearest river, and the site being 30m higher than the elevation of the river, it is not necessary to present the 1:50 year flood line. Aerial photographs also indicate the cemetery location in an area altered and impacted by urban development.

No formal geotechnical investigation has been performed. A visual inspection of the site was conducted in order to assess conditions on site. No boreholes or groundwater users were identified, and no groundwater intersected in any of the trial pits. It is our professional opinion that conducting a geophysical survey at the site is unnecessary due to the geohydrological unfavourable geology and the absence of any geological structures on the geological map of the area.

A brief discussion of several relevant issues is presented hereunder for discussion purposes only.

Holistically, the conclusion reached is that the geological sands and limited transported materials found on the site are ideal for the construction of engineering services and cemetery plot development. Geotechnically, as evident in the existing cemeteries, there is nothing inhibiting the development of the proposed cemetery expansion, since the digging of graves will be easy and these will not fill up with loose sand and groundwater; also evident in the existing cemeteries.

General Soil Profile

General soil profile indicated relatively consistent soil horizons throughout with mostly transported clayey sandy silt, and with a highly weathered mudstone / sandstone conglomerate present on both cemetery sites. The materials appear slightly moist to dry and are fairly loose. No perched water table is evident and a low to moderate water retention rate is expected. Both the Stilbaai and Melkhoutfontein cemeteries are located

on very flat gentle slopes, with slope ranges between 1% and 3%. (Refer to the appended DRG. 1702361/C/05 and DRG. 1702361/C/03). A gradient of less than 10% (1:10) is required for the establishment of a cemetery, with 5% (1:20) recommended in general.

Ground water

No ground water and/or perched water are evident, and we expect a water table at a depth of approximately 10m. A low to moderate water retention rate is expected, nevertheless ponding should be discouraged. Due to the moderate to flat gradients on the site, lateral movement of storm water and transported topsoil will be slower, less liquification and less erosion may occur.

Engineering Services

The following aspects are relevant for engineering services:

- A slope analysis was performed for both the Stilbaai and Melkhoutfontein cemeteries and the following resulted:
 - The average slope of the complete site, for both sites, is approx. 2% or (1:50), for the Stilbaai site sloping from west to east and for the Melkhoutfontein site from north to south.
 - The maximum slopes on both sites are thus within the 5% Recommended gradient requirement and moderately flat.
 - No areas are un-developable due to slope restrictions
- Surface storm water management needs to be implemented for drainage in the area due to the moderately flat gradients which will not allow proper surface water runoff. This will require a semi-formal storm water reticulation system comprising of a combination of kerbing, lined and open v-channels, catchpits and perhaps storm water pipes.
- A TLB will suffice for excavations in all sands.
- Although the possibility of rock is deemed to be small, softer sandstone and limestone may be present at 2m and deeper depths. Hard rock may present a problem for the digging of graves, but since both the current cemeteries did not experience any problems we are confident that the proposed extension sites will be similar.

Foundations for single level service buildings

Although no buildings are proposed for the cemetery extensions, a visual investigation indicated that the residual and transported materials are adequate to support single level service buildings. The following may be considered:

- Reinforced strip footings where foundations are placed in cut faces only. The foundations must be placed on the residual materials only.
- Light raft foundations are envisaged on fill platforms. Platforms to be well compacted to an equivalent density, or better, to that of the surrounding insitu materials.

Minimum cutting and filling, to create terraces, is required at the site because of the moderate slopes across the site to be developed. Fill areas should be adequately compacted to a minimum specification to be determined from the formal geotechnical investigation.

Slope Stability

No natural slope instability is present at both the sites because of the flatter areas. However, care should still be taken against water ponding and an informal storm water v-channel system should be provided.

4 PROPOSED LAND USE

Both the Stilbaai and Melkhoutfontein sites are located on municipal land. The Stilbaai cemetery site, Erf 31/485 is located in the Stilbaai town; and the Melkhoutfontein cemetery site, partly on Erf 566 and partly on Erf 141/480 is located east of Melkhoutfontein, which is approximately 5 kilometres north of Stilbaai. (Refer appended locality DRG 1702361/C/01).

Current Expansion Proposal

The current expansion proposal hereafter will be a cheaper intermediate solution, sufficient for the next 5 years. It will not allow for the next ten years, specifically in the case of Stilbaai.

The proposed cemetery expansions, both sites located in the greater Stilbaai Municipal area, are:

- In **Stilbaai** an extension of the existing cemetery on Erf 31/485, extension area approximating 1,720.47m², part of existing Erf 31/485 of total area of 12,198.63 m², of which 10,482 m² is the existing walled cemetery; and
- In **Melkhoutfontein** an extension of the existing cemetery, to the east and south on vacant part **B** of Erf 141/480 (approximate area 5,843.5 m²) and to the south on an additional part **A** of Erf 566 (approximate area 2,495.5 m²). The existing walled cemetery approximate total area of 9,324 m², of which 5,162 m² is the existing cemetery part on Erf 566, and 4,162 m² is the existing cemetery part on Erf 141/480. The existing walled cemetery is overlapping part of Erf 566 and part of Erf 141/480. There also seem to be a discrepancy between erf cadastral boundaries and the real on-site cemetery boundaries; which are also incorrectly indicated on the Hessequa municipality's latest Spatial Development Framework (SDF) drawings (refer to appended DRG 1702361/C/02).

The proposed, existing in-town, **Stilbaai** cemetery expansion consists of demolishing of an existing boundary wall, and erection of a new boundary wall, on the south western side of the cemetery. The extension of 1,720.47m² will allow for an additional 110 standard 2.2m x 0.9m burial plots, and with 220 plots currently available in the existing cemetery, a total of 330 plots. At ± 60 funerals per year an additional 110 plots will extend the existing cemetery's life by approximately 2 years, and with the 220 plots currently available in the existing cemetery, the total of 330 plots will allow for approximately 4-5 years of cemetery life. If densified 'two per plot' the burial of 660 persons is possible, which will extend the existing cemetery's life by approximately 8 years at ± 60 funerals per year (refer to appended DRG 1702361/C/05). Because the

extension area is less than 2500m², no Environmental impact assessment (EIA) is required, only a survey, drawing and municipal approval.

The proposed **Mekhoutfontein** cemetery expansion consists of the demolishing of an existing boundary wall on the eastern and southern side of the cemetery, and erection of a new boundary wall further to the east and south of the property. Since, the existing cemetery is overlapping part of Erf 566 and part of Erf 141/480, the relocation of the boundary walls will fully utilize the complete Erf 141/480 space, as well as another part of Erf 566. The total extension of 8,339m² will allow for an additional 920 standard 2.2m x 0.9m burial plots, and with 45 plots currently available in the existing cemetery, a total of 965 plots. At ± 25 funerals per year an additional 965 plots will extend the existing cemetery's life by approximately 30 years. *If densified 'two per plot' the burial of 1,930 persons is possible, which will extend the existing cemetery's life by approximately 70 years at ± 25 funerals per year (refer to appended DRG 1702361/C/03).*

Since, both Mekhoutfontein erven are already partly impacted by development on Municipal property, and the proposed total extension area is 8,339m², a basic Environmental impact assessment (EIA) is required, with a survey, drawing and municipal approval. *The municipality will have to do an internally driven subdivision and possibly rezoning of the two erven in discussion, which will also necessitate an update of the municipal Spatial Development framework (SDF).*

Future Expansion Scenario

While the abovementioned current expansion proposal will be cheaper and sufficient for the next 5 years it will not allow for the next ten years, in the case of Stilbaai. Since there are no expansion opportunities for the 'in town' Stilbaai cemetery it is recommended that the Mekhoutfontein cemetery be utilised after Stilbaai cemetery's closure in 5 years' time.

The Melkhoutfontein cemetery will then, after 5 years, still have 965 minus 125 (5y x 25 burials/y) plots = 840 burial plots available which will allow for the next 9 years at 90 (25+60) burials per year.

Thus, this proposal will solve the Stilbaai area's cemetery problems for the next 14 years at least. Thereafter, further expansion eastwards on the vacant Erf 154/480 is possible, but the Hessequa municipality should earmark / reserve the proposed part of Erf 154/480 for the future extension after 14 years, by updating the Spatial development framework allowing for the future extension within the urban development boundary line (refer to appended DRG 1702361/C/02, and the SDF DRG 5.4). However, a rezoning and EIA process will then be a requirement if the extension is larger than 2500m².

5 PRELIMINARY DESIGN

This chapter will discuss the preliminary engineering design of the proposed development in terms of firstly the bulk engineering services and secondly the internal engineering designs in parallel with the engineering standards and technical design criteria applicable to the project.

A set of design drawings is also attached for reference and discussion purposes only, and should be consulted in parallel to the discussions below.

5.1 Water

Bulk Availability

The water needed for a cemetery are mostly for gardening purposes, with public toilets only intermittently using water at peak times during big funerals. In both cases the volume of municipal water can be decreased, supported with rainwater harvesting and tanks for storage.

The source of potable water for both the Stilbaai and Melkhoutfontein cemeteries are from the existing municipal water mains supply. Water pipe lines and taps are present in both the existing cemeteries and it is proposed to just extend these with the addition of a few more taps. The demand from the proposed cemetery expansions will be insignificant.

The existing cemetery sites are serviced by a bulk water line of 50mm FC originating on the boundary of the properties and internal reticulation lines of 25mm uPVC line.

Standard of Engineering Services

- Pipe diameters varying between 25mm and 50mm depending on distances, pressure available and flow required.
- Pipe type and class to be uPVC class 9 or 12, depending on pressure.
- Each cemetery block to be serviced with a Ø25mm minimum, and preferably a Ø50mm connection.
- If provided, toilets are to be serviced with a 25mm connection.
- No Fire hydrants are required but fire hose reels are to be provided at the entry gate building (if provided), according to the "Guidelines for engineering services and amenities".

Design Criteria and Standards

- The following design consumption is used:

- Toilets – 20l/day/visitor (Assume 1.5 visitors/unit)
- Drinking water fountains – 5l/day/visitor (Assume 1.2 visitors/unit)
- Gardening – 50l/day/5 trees/ 50 burial plots
- Peak factors as prescribed.
- Minimum pressures for the network are calculated for a fire flow 20l/sec and peak demand at the point of lowest pressure under peak conditions.
- Maximum of 4 valves to isolate a pipe section.
- Maximum length of 600m of main pipe per isolated section.
- Air valves to be provided at T-pieces where applicable.
- Minimum cover to pipes of 600mm.
- Pipe material to be uPVC class 9 or 12 depending on pressures.
- Pipe diameters to be 25mm to 50mm depending on flow and pressure.
- Block connections to be polycop class 16.

Demand

The possible peak times demand for each of the cemetery site developments of approximately 500 burial plots, 50 trees, and 2 toilets, in line with the abovementioned design consumptions, assumptions, criteria and standards, is calculated at approximately 1 kl/day at peak times only. The volume of municipal water can easily be decreased, supplemented with rainwater harvesting and tanks for storage at the proposed main gate building/toilets. Only Rainwater should preferably be utilized for gardening.

Connection Points

Water pipe lines and taps are present in both the existing cemeteries and it is proposed to just extend these with the addition of a few more taps.

Design Drawing

As this is a preliminary report, a detail design drawing is not available yet.

5.2 Sewer

Background

Currently no toilets exist at both cemetery sites. There are existing sewer lines near both of the cemeteries, so the provision of a toilet/s at the main gates of both cemeteries should not present too much of a problem. Alternatively, the waterless 'Enviro Loo' type of toilets which require no water or sewer reticulation, can be utilized. While these toilets are slightly more expensive to install, there are big cost savings in water consumption, with minimum maintenance only required intermittently.

Standard of Engineering Services

- At least one, but preferably two, 'Enviro Loo' toilets should be provided for each site located at the main entrance to each cemetery.
- Pipe diameters of generally 110mm for all toilet connections and minor lines and 160mm and above for main lines, as required per the detailed designs.
- Pipe type and class to be uPVC class 34.
- Precast concrete rings manholes with concrete floor and pre-manufactured concrete lid where indicated.

Design Criteria and Standards

Note that the following criteria are not applicable to the 'Enviro Loo' toilet system, but only to the normal septic tank or municipal sewer system if this proof to be the final installation development.

- The following design flows will be utilized:
 - Toilets – 20l/day/visitor (Assume 1.5 visitors /unit)
 - Washbasins – 5l/day/visitor (Assume 1.2 visitors /unit)
- Specified peak factor of 3.0, only intermittent at peak times for large funerals
- Allowance for 10% extraneous flow
- Minimum flow velocities designed for as 0.7m/s.
- Minimum cover to all pipes to be 800mm.
- Pipe sizes varying between 110mm diameter minimum to 160mm diameter for main lines.
- Minimum design gradients to be as follows:

Toilet Units	Grade
1 (building connection)	1:60
1-5	1:80
6-10	1:100
11-80	1:120
81-110	1:150
>110	1:180

- Building connection depth to be minimum 1.0m and at least be able to drain 80% of the erf.
- Manhole covers and frames to be Polymer Concrete.
- Manholes to be central over main pipe on downstream side.
- Manhole spacing to be maximum 80m
- All concrete, mortar or screed used with manholes to be from dolomite aggregate and low alkali sulphate resistant cement to SABS 471.
- Pipelines to be uPVC class 34 and to be laid on Class C bedding.

Design Flow

The design average daily flow created by the possible provision of a toilet/s at the main gate, in line with the abovementioned criteria and standards, inclusive of allowance for extraneous flow, is calculated at approximately 1.0kl/day at peak times. The design peak flow, inclusive of a specified peak factor of 3.0, is calculated at approximately 3.5l/sec.

The existing internal gravel road will just be extended in Melkhoutfontein cemetery's case, and in Stilbaai cemetery's case it will be slightly relocated, with the following recommended design criteria:

- Access Road width to be 5.0m, with cemetery internal roads 4.0m MIN.
- Pavement structural materials to be imported from commercial sources if needed.
- All minimum radii at entry bell mouths to be 8m, and 5m for internal roads.
- Road design life of 20 years.
- Subgrade material CBR of 15-20.
- Subbase material CBR of minimum 45 – obtained from commercial sources.
- 50mm gravel surfacing, or alternatively 30mm Asphalt surfacing.
- Minimum road grade of 0.45% and crossfall of 2%.
- Design speed of 20km/h on all roads including main access road.

Design Drawing

As this is a preliminary report, a detail design drawing is not available yet.

Please refer to the attached preliminary design drawings (refer to appended DRG 1702361/C/03 and DRG 1702361/C/05 for reference purposes.

5.4 Storm water

Design

As discussed earlier in the report, storm water design for the proposed cemetery expansion developments is critical due to the flat gradients present. An informal stormwater reticulation system will as such be provided by a combination of surfaced roadways, v-channels and cut-off drains, limited inlet structures and concrete storm water pipes where needed.

The formal internal storm water reticulation system will naturally drain towards, and discharge into the existing open veld or into the existing cemetery storm water system if any.

Internal Standards and Design Criteria

An integrated storm water and road system forms an integral part of layout planning. The system rests on three legs, namely the minor system, the major system and the emergency system. Minor storms and normal flowoff are catered for in the normal road prism and piped system. Major storms are routed through a linked system of road prisms and public open spaces, using attenuation techniques. The emergency system recognizes failure of the minor and major systems and provides for emergency runoff by providing continuous overland flow routes to minimize flooding of gravesite areas.

The following standards and design criteria are normally envisaged:

- Minor system designed for 2 year return period and conveyed in a combination of maximum 200mm aboveground in the road prism and underground piped system.
- Major system designed for 50 year return period. Difference between the 50 year and 2 year flood to be conveyed in the road prism with depths not exceeding 150mm and into designated public open spaces.
- Minimum gradients for pipelines to allow minimum flow speeds of 0.7m/s at full flow.
- Maximum pipeline flow velocities to be 3.5m/s.
- Stormwater pipes to be 50D, 75D or 100D as required by specific loadings or installation conditions.
- Bedding to be Class C.
- Minimum cover on pipes to be 800mm.
- Minimum pipe diameter to be 375mm.

Design Drawing

As this is a preliminary report, a detail design drawing is not available yet.

Please refer to the attached design drawing (refer to appended DRG 1702361/C/03 and DRG 1702361/C/05 for reference purposes.

5.5 Solid Waste

A formal solid waste collection point with rubbish bins should be provided at the main gate of each cemetery. Solid waste will have to be regularly removed by the municipality.

5.6 Electricity

Electrical Supply

Investigations on site and discussions with the Hessequa Municipality indicated that municipal electrical services in both cases ends at the cemeteries' boundaries, and are located on the access roads passing the property. It was however indicated by municipal officials that spare capacity for small consumption exists in the area.

Cemeteries, not being used at night except by ghosts, will need very little electricity. The only possible electricity requirements will be for the main gate which may require a streetlight, and lighting at toilet facilities. However, it is envisaged that all electricity needs of a cemetery can be provided by solar panels with LED lighting. This should be sufficient for the intermittent utilization of buildings at the cemetery.

6 ESTIMATED COSTS (AS AT 30 SEPTEMBER 2018)

The following tables provide the estimated project cost breakdown, based on actual recent tender amounts, as at 30 September 2018. The indicated costs cover the planning and construction for both Stilbaai and Melkhoutfontein cemeteries together, and with a construction duration of 1 month. The indicated Preliminary & General cost includes the Environmental Control Officer's site supervision costs of R30,000 (excluding VAT) for the Melkhoutfontein cemetery construction – as previously indicated the extension of the Melkhoutfontein cemetery requires an EIA.

ITEM	COST
Preliminary & General	R 320 912.24
Site clearance	R 69 289.52
Earthworks	R 63 985.51
Stormwater drainage	R 24 087.73
Roadworks	R 118 564.00
Ancillary roadworks	R 143 348.87
Gabions and Pitching	R 5 493.30
Sub Total A	R 745 681.17
Contingencies at 5%	R 37 284.06
Sub Total B (excluding VAT)	R 782 965.23
VAT 15%	R 117 444.78
TOTAL CONSTRUCTION COST (Stilbaai and Melkhoutfontein together)	R 900 410.01

NOTE that the indicated costs are only estimates and may increase or reduce, eventually, subject to the final scope of works and time of tender.

ESTIMATED Professional Fees & Recoverable Costs	
Professional Fees @ 12% (ECSA Rates) MINUS 5% discount	R 89,258.04
Site Supervision (1 month)	R 30,000.00
Land and Topography Surveying & Pegging	R 10,000.00
Environmental Impact Assessment (EIA)- (Melkhoutfontein cemetery)	R 300,000.00
Health & Safety Agent (1 month)	R 4,000.00
Geotechnical Tests	R 5,000.00
Sub Total (excluding VAT)	R 438,258.04
VAT (15%)	R 65,738.71
TOTAL FEES AND RECOVERABLE COSTS (Stilbaal and Melkhoutfontein together)	R503,996.75

The indicated Fees and recoverable costs cover the planning and construction for both Stilbaai and Melkhoutfontein cemeteries together. However, the Environmental Impact Assessment (EIA) costs are only applicable to the Melkhoutfontein cemetery. A month's construction period is expected to cover both cemetery sites together.

NOTE that the indicated costs are only estimates and may increase or reduce, eventually, subject to the final scope of works and time of tender.

7 CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

The following conclusions can be reached from the Engineering Design Report on the proposed cemetery expansion developments on the existing sites in Stilbaai and Melkhoutfontein:

1. The Stilbaai cemetery site, Erf 31/485 is located in the Stilbaai town; and the Melkhoutfontein cemetery site, partly on Erf 566 and partly on Erf 141/480 is located east of Melkhoutfontein which is located approximately 5 kilometres north of Stilbaai.
2. Site investigations revealed that the existing in-town, **Stilbaai** cemetery currently only has approximately 220 vacant burial plots available. 220 burial plots will allow for approximately 3 years of cemetery life, at ± 60 funerals per year.
3. Site investigations also indicated that the existing **Melkhoutfontein** cemetery currently only has approximately 45 vacant burial plots available. 45 burial plots will allow for approximately 1.5 years of cemetery life, at ± 25 funerals per year.
4. In **Stilbaai** an extension of the existing cemetery on Erf 31/485 is possible, extension area approximating 1,720.47m², part of existing Erf 31/485 of total area of 12,198.63 m², of which 10,482 m² is the existing walled cemetery.
5. In **Melkhoutfontein** an extension of the existing cemetery is possible, to the east and south on vacant part **B** of Erf 141/480 (approximate area 5,843.5 m²) and to the south on an additional part **A** of Erf 566 (approximate area 2,495.5 m²). The existing walled cemetery approximate total area of 9,324 m², of which 5,162 m² is the existing cemetery part on Erf 566, and 4,162 m² is the existing cemetery part on Erf 141/480. The existing walled cemetery is overlapping part of Erf 566 and part of Erf 141/480.
6. No formal Land and Topography Survey has been performed, only a visual inspection. There seem to be a discrepancy between erf cadastral boundaries and the real on-site Melkhoutfontein cemetery boundaries; which are also incorrectly indicated on the Hessequa municipality's latest Spatial Development Framework (SDF) drawings (refer to appended DRG 1702361/C/02).
7. While this land is on undeveloped municipal property a rezoning and EIA process will still be a requirement for the Melkhoutfontein cemetery because the extension of 8,339m² is larger than 2500m².
8. No EIA process is required for the Stilbaai cemetery extension of 1,720.47m², since it is smaller than 2500m².
9. There are no access or parking problems at both the Melkhoutfontein and Stilbaai cemetery sites.
10. No Traffic Impact Study has been performed, and is not needed for both sites, because the trips generated from these small cemetery extensions will have an

NB

- extremely low to insignificant impact on capacity and level of service on the access roads.
11. No formal geotechnical investigation has been performed, only a visual inspection. The conclusion reached is that the geological sands and limited transported materials found on the site are ideal for the construction of engineering services and cemetery plot development. Geotechnically, as evident in the existing cemeteries, there is nothing inhibiting the development of the proposed cemetery expansion, since the digging of graves will be easy and these will not fill up with loose sand and groundwater; also evident in the existing cemeteries.
 12. No ground water and/or perched water are evident, and we expect a water table at a depth of approximately 10m. A low to moderate water retention rate is expected, nevertheless ponding should be discouraged. Due to the moderate to flat gradients on the site, lateral movement of storm water and transported topsoil will be slower, less liquification and less erosion may occur.
 13. The proposed, existing in-town, Stilbaai cemetery expansion consists of demolishing of an existing boundary wall, and erection of a new boundary wall, on the south western side of the cemetery. The extension of 1,720.47m² will allow for an additional 110 standard 2.2m x 0.9m burial plots, and with 220 plots currently available in the existing cemetery, a total of 330 plots. At \pm 60 funerals per year an additional 110 plots will extend the existing cemetery's life by approximately 2 years, and with the 220 plots currently available in the existing cemetery, the total of 330 plots will allow for approximately 4-5 years of cemetery life (refer to appended DRG 1702361/C/05). Because the extension area is less than 2500m², no Environmental impact assessment (EIA) is required, only a survey, drawing and municipal approval.
 14. The proposed **Mekhoutfontein** cemetery expansion consists of the demolishing of an existing boundary wall on the eastern and southern side of the cemetery, and erection of a new boundary wall further to the east and south of the property. Since, the existing cemetery is overlapping part of Erf 566 and part of Erf 141/480, the relocation of the boundary walls will fully utilize the complete Erf 141/480 space, as well as another part of Erf 566. The total extension of 8,339m² will allow for an additional 920 standard 2.2m x 0.9m burial plots, and with 45 plots currently available in the existing cemetery, a total of 965 plots. At \pm 25 funerals per year an additional 965 plots will extend the existing cemetery's life by approximately 30 years (refer to appended DRG 1702361/C/03).
 15. Since, both Mekhoutfontein erven are already partly impacted by development on Municipal property, and the proposed total extension area is 8,339m², a basic Environmental impact assessment (EIA) is required, with a survey, drawing and municipal approval. *The municipality will have to do an internally driven subdivision and possibly rezoning of the two erven in discussion, which will also necessitate an update of the municipal Spatial Development framework (SDF).*

16. While the abovementioned current expansion proposal will be cheaper and sufficient for the next 5 years it will not allow for the next ten years, in the case of Stilbaai. Since there are no expansion opportunities for the 'in town' Stilbaai cemetery it is recommended that the Melkhoutfontein cemetery be utilised after Stilbaai cemetery's closure in 5 years' time.
17. The Melkhoutfontein cemetery will then, after 5 years, still have $965 \text{ minus } 125 (5y \times 25 \text{ burials/y})$ plots = 840 burial plots available which will allow for the next 9 years at 90 (25+60) burials per year.
18. The source of potable water for both the Stilbaai and Melkhoutfontein cemeteries are from the existing municipal water mains supply. Water pipe lines and taps are present in both the existing cemeteries and it is proposed to just extend these with the addition of a few more taps. The demand from the proposed cemetery expansions will be insignificant.
19. Currently no toilets exist at both cemetery sites. There are existing sewer lines near both of the cemeteries, so the provision of a toilet/s at the main gates of both cemeteries should not present too much of a problem. Alternatively, the waterless 'Enviro Loo' type of toilets which require no water or sewer reticulation, can be utilized. While these toilets are slightly more expensive to install, there are big cost savings in water consumption, with minimum maintenance only required intermittently.
20. The existing internal gravel road will just be extended in Melkhoutfontein cemetery's case, and in Stilbaai cemetery's case it will be slightly relocated.
21. Storm water design for the proposed cemetery expansion developments is critical due to the flat gradients present. An informal stormwater reticulation system will as such be provided by a combination of v-channels and cut-off drains, limited inlet structures and concrete storm water pipes where needed.
22. A formal solid waste collection point with rubbish bins should be provided at the main gate of each cemetery. Solid waste will have to be regularly removed by the municipality.
23. Cemeteries, not being used at night, will need very little electricity. The only possible electricity requirements will be for the main gate which may require a streetlight, and lighting at toilet facilities. However, it is envisaged that all electricity needs of a cemetery can be provided by solar panels with LED lighting. This should be sufficient for the intermittent utilization of buildings at the cemetery.
24. The estimated costs cover the planning and construction for both Stilbaai and Melkhoutfontein cemeteries together, and with a construction duration of 1 month. The estimated construction cost for the extensions at Stilbaai and Melkhoutfontein cemeteries together is R900,410.01 (VAT Inclusive). The estimated professional fees and recoverable cost for the extensions at Stilbaai and Melkhoutfontein cemeteries together is R503,996.75 (VAT Inclusive). NOTE that the indicated costs are only estimates and may increase or reduce, eventually, subject to the final scope of works and time of tender.

25. Due to both cemetery's location at more than 1,000m from the nearest river, and the sites being 30m higher than the elevation of the river, it is not necessary to present the 1:50 year flood line. Aerial photographs also indicate the cemeteries' location in an area altered and impacted by urban development.
26. As this is a preliminary report, detail design drawings are not available yet.

With reference to all of the conclusions above, it can holistically be concluded that the proposed cemetery expansion developments can be designed and constructed to acceptable specifications and standards from an engineering design perspective, inclusive of water, sewer, roads, stormwater and electrical reticulation.

7.2 Recommendations

With reference to the conclusions above, the following is recommended:

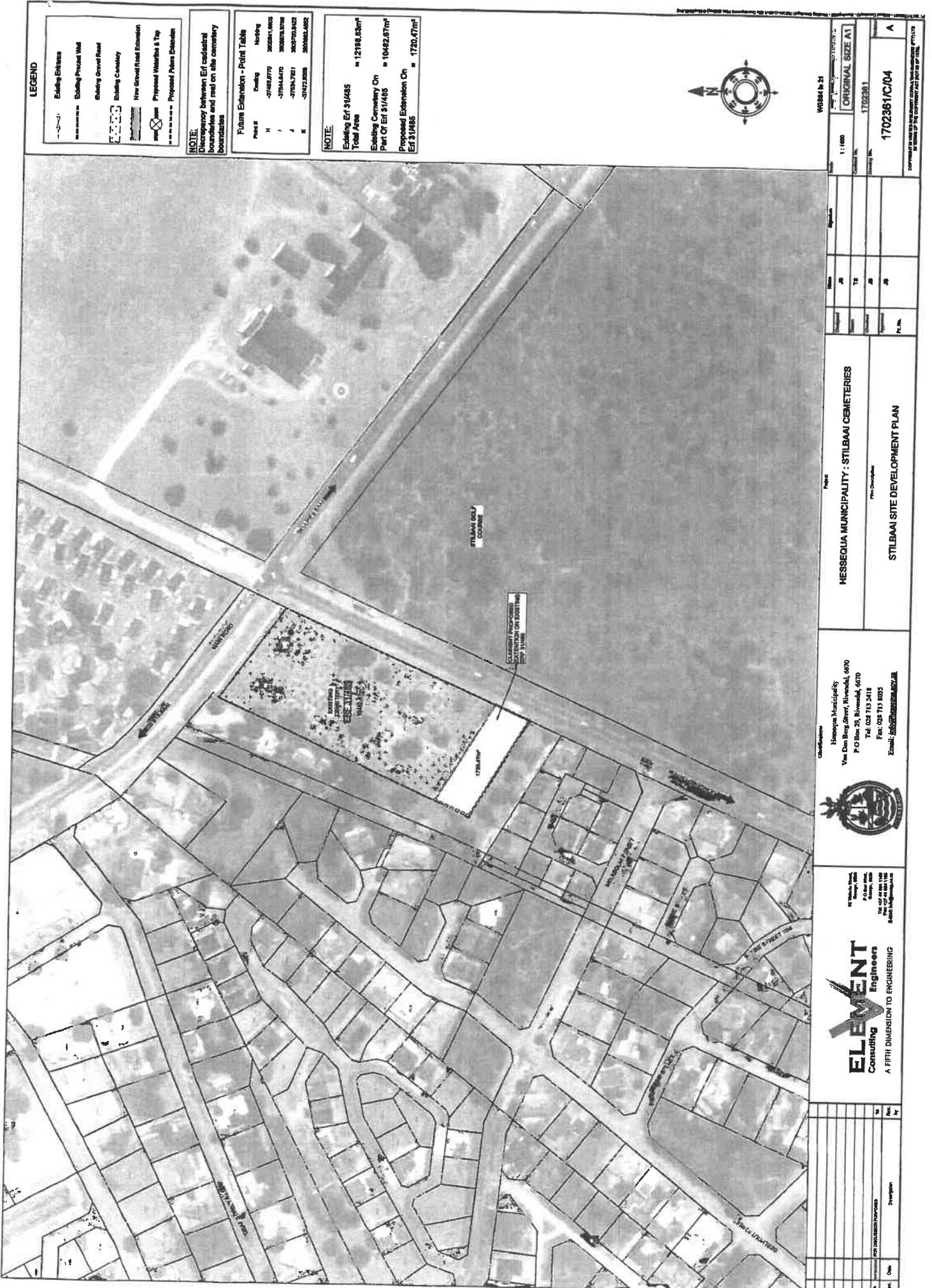
1. That the planning and construction of the extension to the Stilbaai cemetery be implemented immediately. Existing access, parking and services can be utilized. Since, the extension area is less than 2500m², no Environmental impact assessment (EIA) is required, only a survey, drawing and municipal approval.
2. That the extension to the existing Melkhoutfontein cemetery be done in two phases:
 - a. As an intermediate emergency Phase1, the municipality can firstly extend the Melkhoutfontein cemetery to the south on an additional part A of Erf 566 (approximate area 2,495.5 m²) without an Environmental impact assessment (EIA) since the extension area is less than 2500m²; and
 - b. the further Phase 2 Melkhoutfontein cemetery extension to the east and south on vacant part B of Erf 141/480 (approximate area 5,843.5 m²) a bit later because this requires an EIA process.
3. That the municipality will have to do an internally driven subdivision and possibly rezoning of the two Melkhoutfontein erven in discussion, which will also necessitate an update of the municipal Spatial Development framework (SDF).
4. That all the preliminary design specifications and standards in this report be accepted and approved and that the proposed water, sewer, roads, stormwater and electrical reticulation be designed accordingly for each of the cemetery sites.
5. That a Wall of Remembrance area be provided at the Melkhoutfontein cemetery, for the disposal of Cremation remains, for placing of ash containers in wall niches. Such a Wall of Remembrance area already exists in the Stilbaai cemetery.
6. That waterless 'Enviro Loo' type toilet/s be provided at the entrance gate to each cemetery site.

It is the recommendation of Element Consulting Engineers that the proposed cemetery expansion developments, at the existing cemeteries, be approved from an engineering design perspective.

8 APPENDIXES

- 8.1 Appendix 1 – Preliminary Design Drawings**
 - 8.2 Appendix 2 – Preliminary Site Development Plan**
-

Attachment A



LEGEND

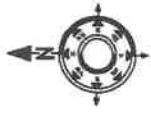
- Existing Entrance
- Existing Private Wall
- Existing Gravel Road
- Existing Cemetery
- New Gravel Road Extension
- Proposed Markers & Top
- Proposed Fence Extension

NOTE:
Discrepancy between ERF cadastral boundaries and real on site cemetery boundaries

Future Extension - Point Table

Point #	Reading	Northing
H	-07482.8770	3020261.8005
I	-07484.6170	3020266.0706
J	-07484.7261	3020270.8428
K	-07482.8088	3020263.4482

NOTE:
Existing ERF 31485 Total Area = 12188.63m²
Existing Cemetery On Part Of ERF 31485 = 10482.67m²
Proposed Extension On ERF 31485 = 1720.47m²



WR884 Is 24

Scale: 1 : 1000

Original Size A1

Drawing No. 1702361

Client Ref. 1702361/C/04

Sheet No. A

HESSEQUIA MUNICIPALITY - STILBAAI CEMETERIES

Site Description: STILBAAI SITE DEVELOPMENT PLAN

Project: HESSEQUIA MUNICIPALITY - STILBAAI CEMETERIES

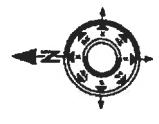
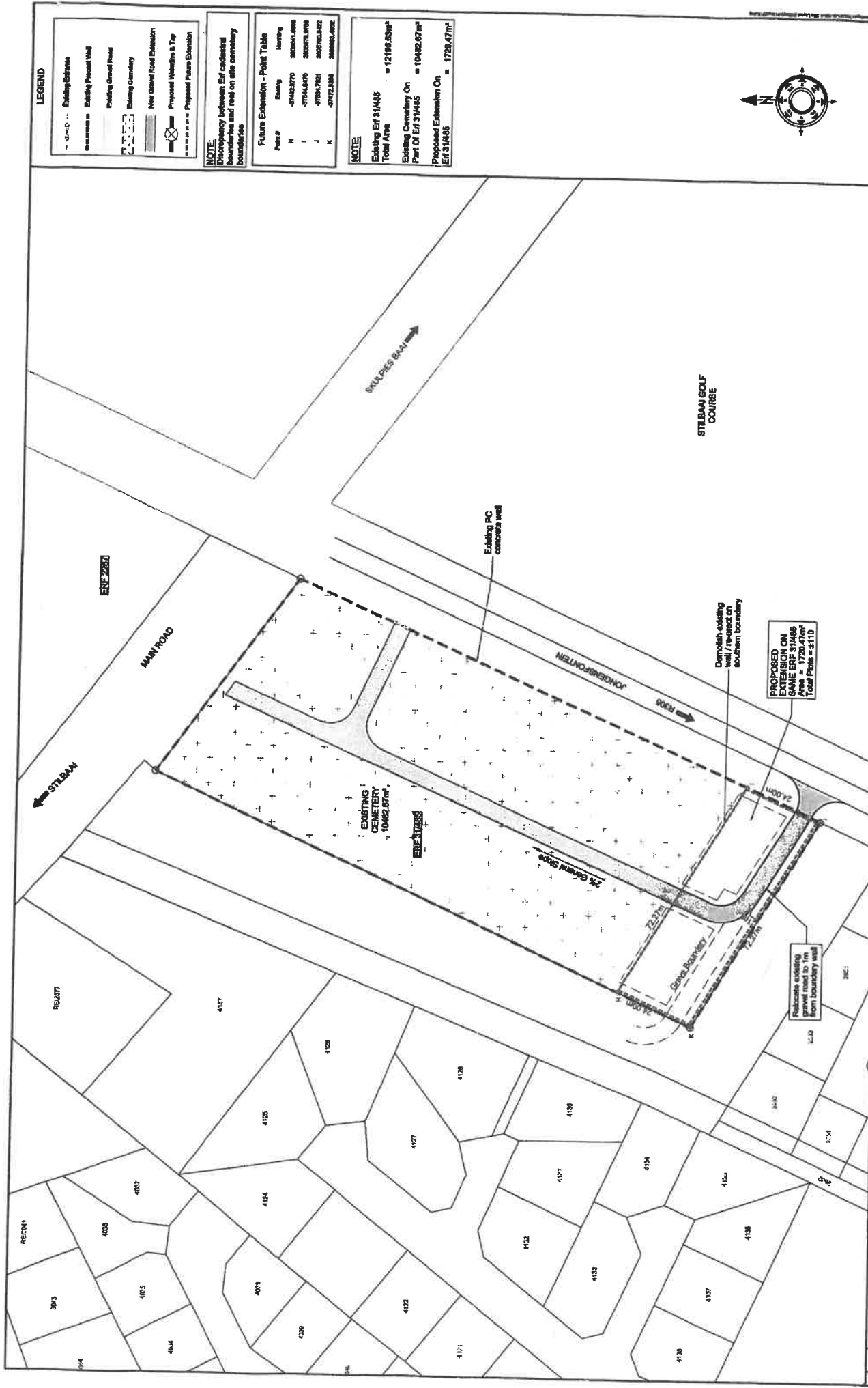
Hessequia Municipality:
Van Der Bang Street, Hessequia, 6670
P.O. Box 25, Hessequia, 6670
Tel: 031 713 2418
Fax: 031 713 8005
Email: info@hessequia.gov.za



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100 Water Street
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Email: info@element.co.za

Rev.	Date	Description



WGS84 to 31

Scale	1 : 1000
Original Size	A1
Contract No.	1702381
Drawing No.	1702381/C/05
Sheet No.	A

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LEGEND

- - - - - Existing Eriente
- ===== Existing Proposed Wall
- Existing Gravel Road
- Existing Cemetery
- New Gravel Road Extension
- Proposed Walls & Top
- Proposed Future Extension

NOTE:

Discrepancy between Erf cadastral boundaries and need on site cemetery boundaries

Future Extension - Point Table

Point #	Bearing	Distance
H	S202.270°	20004.000
I	S714.640°	20070.878
J	S708.170°	20070.852
K	S712.608°	20000.000

NOTE:

Existing Erf 31485 Total Area = 12188.53m²
 Existing Cemetery On Part Of Erf 31485 = 10482.87m²
 Proposed Extension On Erf 31485 = 1720.47m²

HESSEQUIA MUNICIPALITY : STILBAAI CEMETERIES

STILBAAI SITE LAYOUT PLAN

Client: Hessequia Municipality
 Van Der Berg Drive, Bovenburg, 6070
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 F: 028 713 8015
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 Checked by: [Name]
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 Bovenburg, 6070
 Tel: 028 713 2418
 Fax: 028 713 8015
 Email: info@hessequia.gov.za

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Rev.	Date	Description

LEGEND

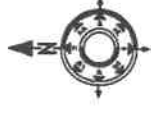
- Existing Entrance
- Existing Process Wall
- Existing Gravel Road
- Existing Cemetery
- New Gravel Road Extension
- Proposed Windows & Top
- Proposed Plaza Extension

NOTE:
 Boundary between Erf residential boundaries and rest of site cemetery boundaries

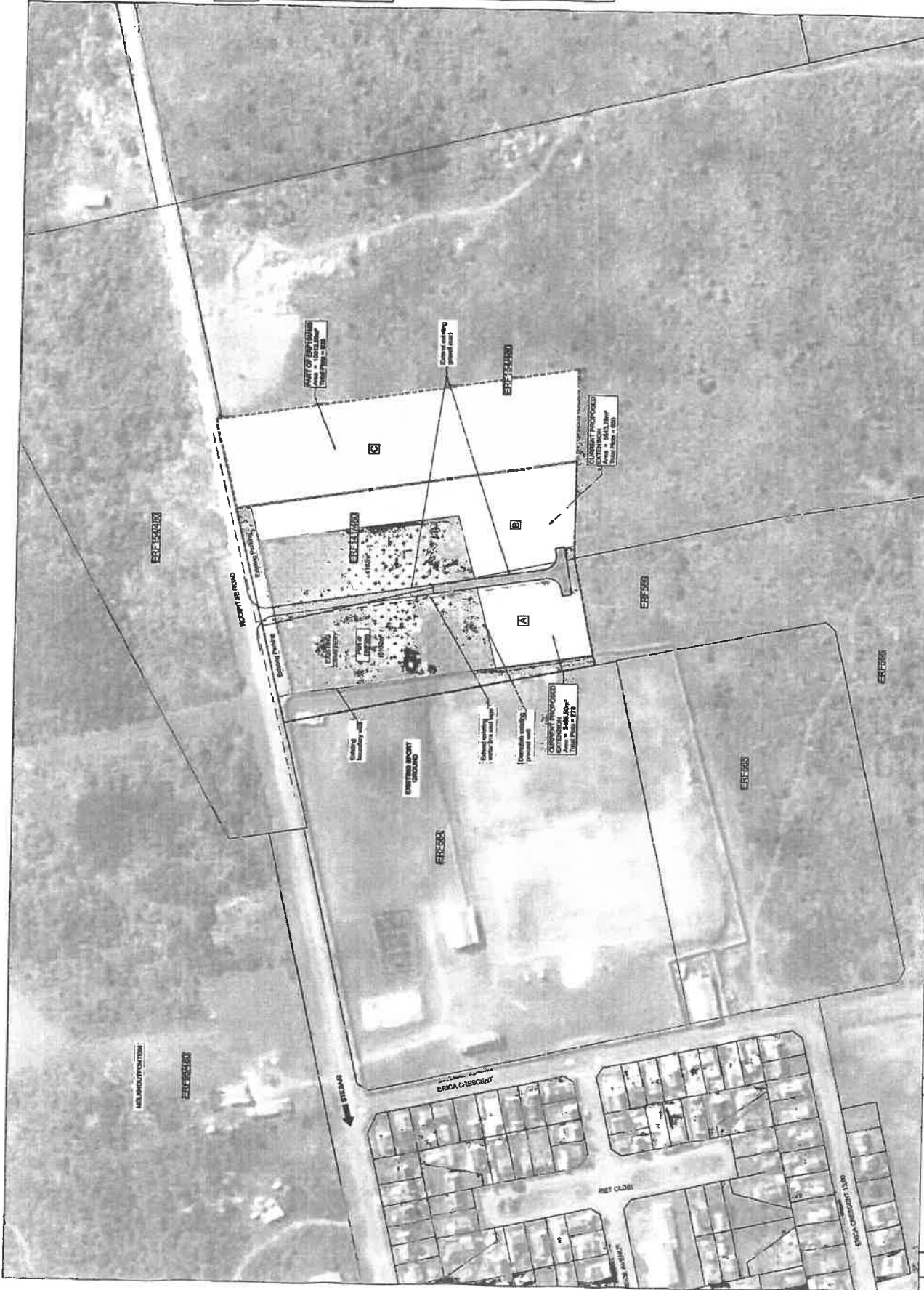
Future Extension - Point Table

Point #	Existing	Existing	Existing
A	-2507.2364	379970.8802	
B	-2522.2368	379954.1000	
C	-2525.4724	379944.1700	
D	-2520.7060	379946.4528	
E	-2514.4276	379949.7441	
F	-2513.8229	379953.0280	
G	-2522.1818	379978.1191	

NOTE:
 Existing Erf 141480 = 10054.43m²
 Total Area = 10054.43m²
 Existing Cemetery On Part Of Erf 141480 = 4182.43m²
 Proposed Extension On Erf 141480 = 5843.79m²
 Existing Cemetery On Part Of Erf 696 = 5182.00m²
 Proposed Extension On Part Of Erf 696 = 2594.80m²
 Proposed Total Extension Of Cemetery = 8347.79m²



WGS84 to Z1



Scale	1:1000
Original Size A1	1702381
Drawing No.	1702381/C/02
Client	HESSEQUIA MUNICIPALITY - STILBAAI CEMETERIES
Project	MELKHOUTFONTEIN SITE DEVELOPMENT PLAN

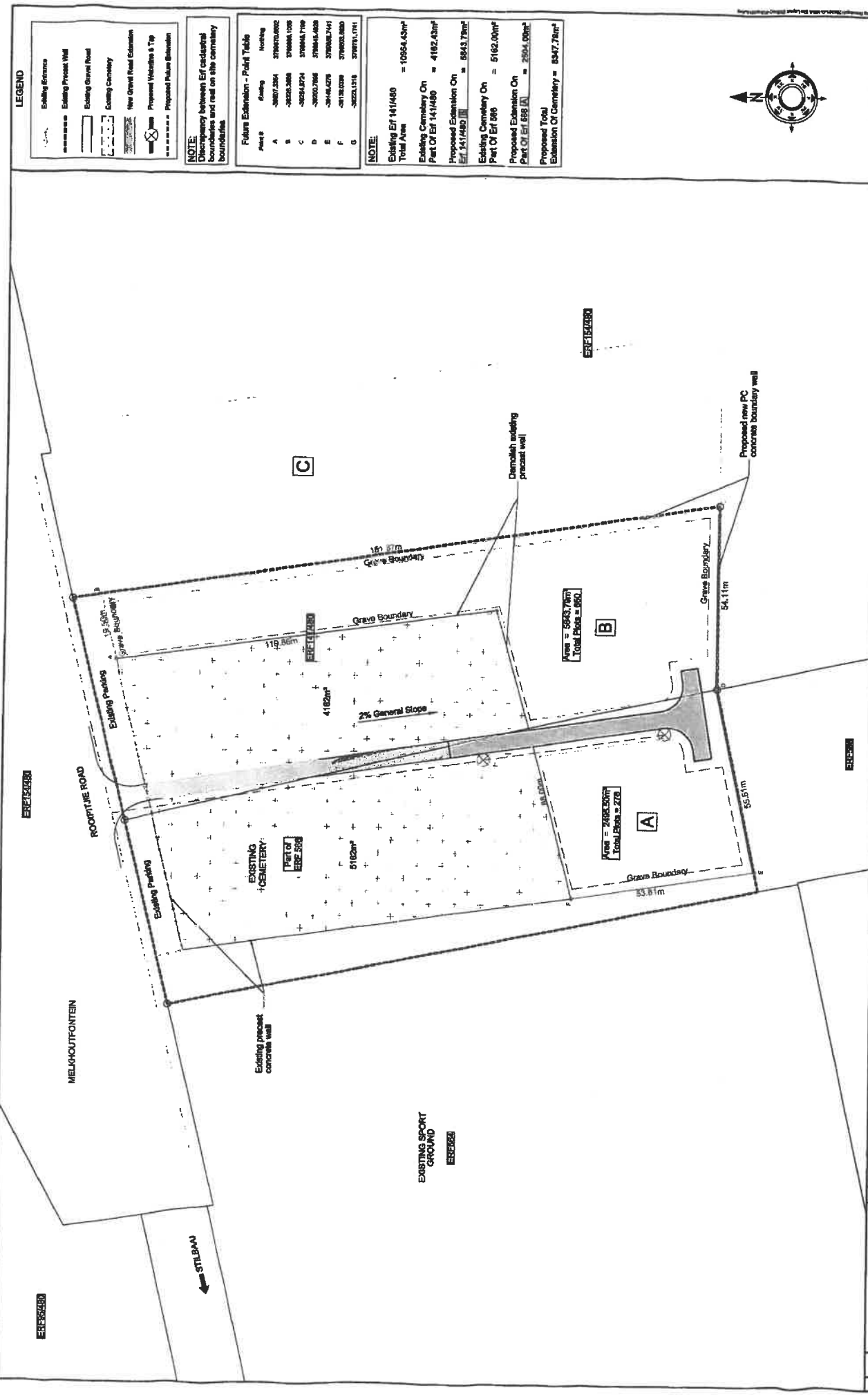
Rev.	Date	Description
1	15/08/2024	Issue for Tender
2	15/08/2024	Issue for Tender
3	15/08/2024	Issue for Tender

HESSEQUIA MUNICIPALITY - STILBAAI CEMETERIES
 Melkhoutfontein Site Development Plan

Client: Hessequia Municipality
 Van Der Berg Street, Bovenburg, 6070
 P.O. Box 29, Bovenburg, 6070
 Tel: 052 712 3418
 Fax: 052 712 8035
 Email: info@hessequia.gov.za

Consultant:
ELEMENT
 Consulting Engineers
 A FIFTH DIMENSION TO ENGINEERING

Rev.	Date	Description
1	15/08/2024	Issue for Tender
2	15/08/2024	Issue for Tender
3	15/08/2024	Issue for Tender



LEGEND

- Existing Entrance
- Existing Precast Wall
- Existing Grave Road
- Existing Cemetery
- New Grave Road Extension
- Proposed Wall/Grave & Top
- Proposed Future Extension

NOTE:
 Discrepancy between Erf cadastral boundaries and real on site cemetery boundaries.

Future Extension - Plot Table

Plot #	Existing	Existing	Existing
A	2486.20	272	272
B	5643.74	650	650
C	4182.43	4182.43	4182.43
D	2000.79	2000.79	2000.79
E	2014.07	2014.07	2014.07
F	2014.07	2014.07	2014.07
G	2014.07	2014.07	2014.07

NOTE:

- Existing Erf 141480 = 10954.43m²
- Total Area = 10954.43m²
- Existing Cemetery On Part Of Erf 141480 = 4182.43m²
- Proposed Extension On Erf 141480 = 5943.74m²
- Existing Cemetery On Part Of Erf 688 = 5162.00m²
- Proposed Extension On Part Of Erf 688 = 2594.00m²
- Proposed Total Extension Of Cemetery = 8547.74m²

Worksheet: 21

Scale	1:1000
Original Size At	1702361
Current No.	1702361
Project No.	1702361/C/03

Project	Client
HESSECUA MUNICIPALITY : STILBAAI CEMETERIES	MELKHOUTFONTEIN SITE LAYOUT PLAN

Client: Hessequa Municipality
 Van Der Berg Street, Riversdal, 6670
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 Tel: 028 713 2418
 Fax: 028 713 6075
 Email: info@hessequa.gov.za



Consultant: ELEMENT Consulting Engineers
 A FIFTH DIMENSION TO ENGINEERING

No.	Date	Description
1		
2		
3		
4		