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REPORT

Hartebeespoort Housing Development – Roads and Stormwater Feasibility Study

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1. INTRODUCTION

The Housing Development Agency (HDA) intends to develop a site as an inner-city project for designated human settlement. Portion 237 of Farm Hartebeespoort 328 JR 772 JR was identified as the site for this development. The site is in the industrial area of Silverton and is bound by Stormvoël Road on the northern boundary, Derdepoort Road on the eastern boundary and railway line on the southern boundary. There is no defined feature on the western boundary, but the closest developed area is Lindopark.

This report covers the technical feasibility of the roads and stormwater for the development.

2. DEVELOPMENT OPTIONS

Four development options for assessment were proposed by the Town Planner from within the professional team undertaking the feasibility study.

The layout plans of the four options are included in the annexures to this study report (Options 1, 2, 2A and 2B). From a roads and stormwater prospective, the options differ very little from the one to the next. This is evident from the layout plans included. Essentially the options differ in respect to the suggested combination of CRU/Fully subsidised units, social housing and GAP (FLISP bonded) housing. Therefore in discussion of the roads and stormwater, the comments generally apply to all the options, unless an option is specifically referred to.

3. ROADS

3.1 Reference Documents/Guidelines

The following documents/guidelines were considered for assessment of the roads:

(i) City of Tshwane: Minimum Standards Applicable to Road Construction and Stormwater Drainage Systems – May 2013

(ii) City of Tshwane: General Content Requirements for Services Reports submitted in support of Land Use Applications;

(iii) Draft UTG5: Geometric Design of Urban Collector Roads – 1988

(iv) City of Tshwane: Minimum Standards Applicable to Road Construction and Stormwater Drainage Systems for all Low-Cost Housing Projects in Tshwane – April 2004

(v) Draft UTG7: Geometric Design of Urban Local Streets – 1989; and

(vi) TRH4: Structural Design of Flexible Pavements – 1996

3.2 Geometric Design

The proposed layout of the development essentially consists of an urban collector (classified as a Class 4 road) which runs through the development to connect into the existing Benton Street in the west and Derdepoort Road (M15) in the east, and approximately a third of the way into the development from west connects into Stormvoël Road (M8) via a short section of collector road (extension of Jan Coetzee Road). The remainder of the streets within the development are classified as Class 5 residential roads.

A 25m wide road reserve has been used for the Class 4 road, and a 16m wide reserve for the Class 5 internal roads. This is in alignment with the standards of Tshwane. These reserve widths will provide adequate room on the verges for walkways and services etc. The design speed used for all the roads within the development has been taken as 40km/h.

For maximum road gradients, the following shall apply:

- Class 4 roads: 1:10 (10%) for a maximum length of 100m; and
- Class 5 roads: 1:8 (12.5%) for a maximum length of 70m.

In addition, the maximum gradient for steep roads joining a crossroad will be 6% for a distance of at least 20m, each erf must have an access at 1:5 (20%) or better and the maximum cross gradient of sidewalks, excluding the erf access will be 1:3.

In terms of road cross section, the following has been used:

- Class 4 Roads: 7.4m surfaced width. Road markings will be used, and the lanes will be painted as 3.5m wide lanes, with a narrow 200mm shoulder to the kerb and channel or edge of road, and a 2.5m wide sidewalk to each side of the road.
- Class 5 Roads: 6.5m surfaced width with lanes of 3.05m wide, and a 200mm shoulder. Sidewalks will be 1.5m wide.

The intention with the narrow shoulder is to discourage vehicles from travelling too close to the kerb or edge of road and also to give some form of protection to the road verges. In the case of sharp curves local widening may need to be introduced.

The roads are intended to have a single crossfall of 3%, otherwise 2% crossfalls will apply in the case of camber roads. With the low internal design speed, super-elevation (if any) will be limited to 3%.

Figures 3.1 and 3.2 below reflect the typical cross sections for the Class 4 and Class 5 roads.

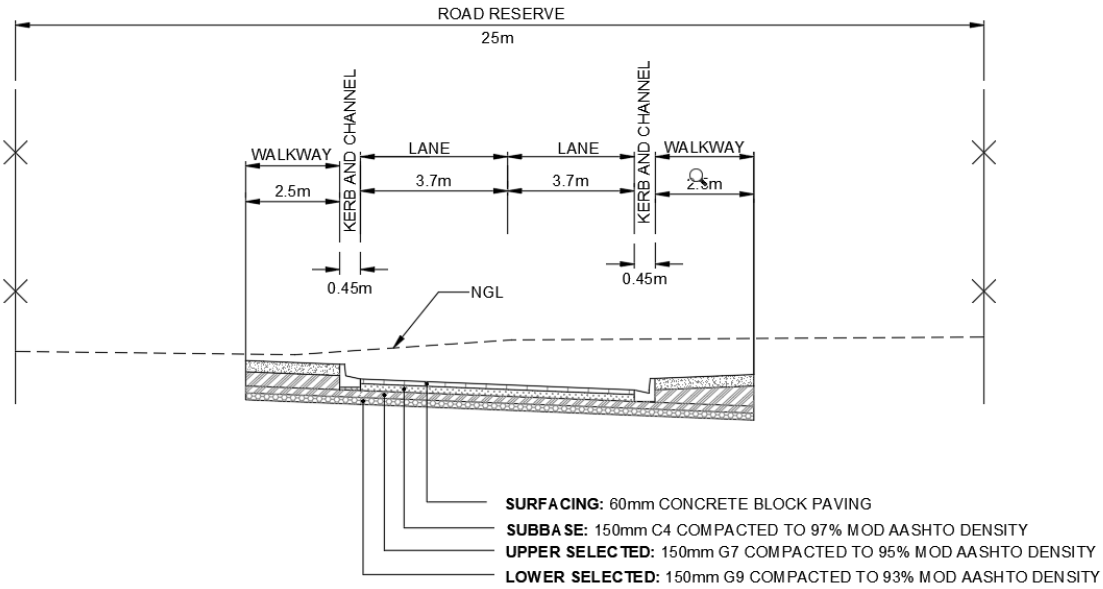


Figure 3.1: Typical Cross Section (Class 4 Road)

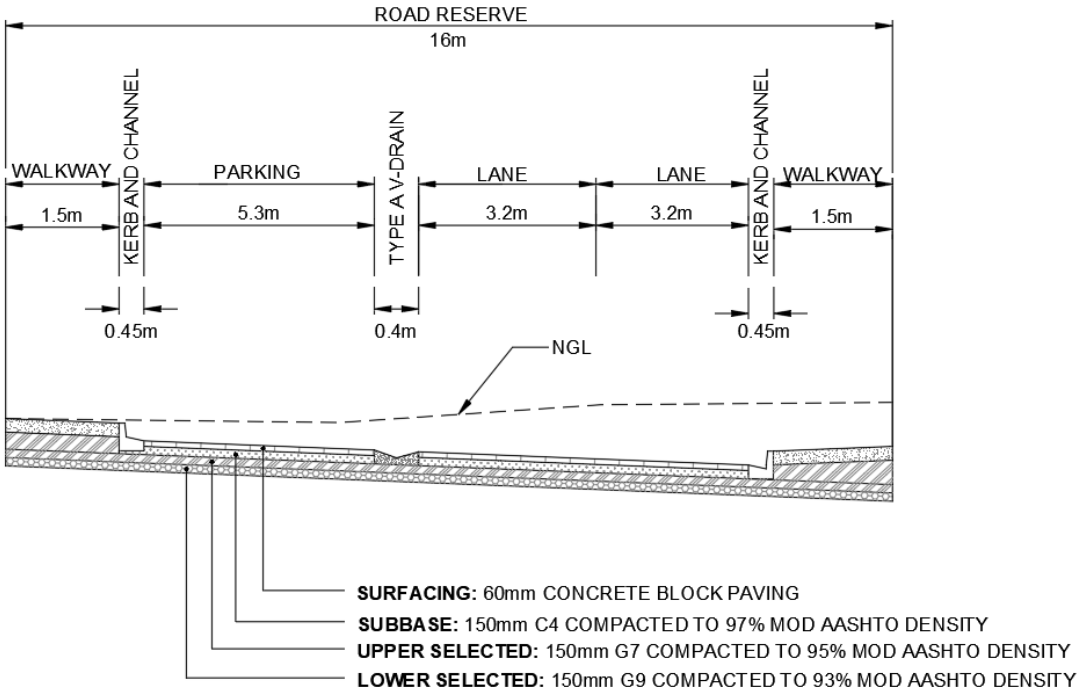


Figure 3.2: Typical Cross Section (Class 5 Road)

In the case of the Class 5 internal roads, some sections of road will have angular parking (5,3 m long) immediately adjacent to the road. The intention is to separate the roadway and parking area using a concrete edging or alternatively a narrow concrete V-drain (300 mm wide).

Furthermore in certain instances, essentially with the east-west and north-south mid-block roads, the parking areas alternate from one side of the road to the other between blocks. This is evident on the option layouts included in Annexures 1 to 4.

With reference to Figure 3.3, the development has three intersections with the external road network. The details of the intersections vary (with all options) as the status of the roads being tied into are different.

For example at Stormvoël Road (M8) which is a BRT/public transport route, it will not be ideal to have slip lanes as part of the upgrade of the intersection, due to difficulties in safely accommodating pedestrians crossing slip lanes. The intended upgrade of this intersection (subject to finalisation of the Traffic Impact Assessment) includes a fourth leg to the intersection followed by signalisation.

In the case of the Derdepoort Road (M15) intersection (Derdepoort/Mosaic), slip lanes will be considered as part of the upgrading of the intersection to include a fourth leg to the intersection followed by signalisation. Including a fourth leg to this intersection will however require re-alignment of a section (approximately 300m in length) of Derdepoort Road. Discussion is currently underway with the City of Tshwane (COT) in this regard. Should the COT not approve of the re-alignment of Derdepoort Road, access to and from the development at this location may need to revert to a left-in, left-out arrangement.

In summary, an initial alignment of the road network has been carried out but to a low level of accuracy/detail due to the lack of erf/platform levels and a detail survey of the site. This level of design and assessment is however considered adequate for the feasibility study currently underway.

Figure 3.3 – Typical Intersection Points for the Development

3.3 Pavement Design

For the assessment of the pavement design, the east-west link Class 4 road, the heaviest trafficked road within the development was considered.

With reference to the traffic report (currently in progress) the east-west link is expected to carry in the order of 1023 vehicles/hr in the morning (AM) peak, and 1070 vehicles/hr in the afternoon (PM) peak. This link is therefore expected to carry in the order of 6000 vehicles per day. These traffic volumes apply to Development Option 2 which generated the most vehicle trips of the four options.

With reference to TRH4: 1996 the relevant pavement design data can be summarized as follows:

- Moderate climatic region;
- Road Category C: This is essentially a lightly trafficked road, mostly carrying private cars with very few heavy vehicles, and which needs to offer a moderate level of service;
- Risk: Low;
- Pavement Traffic Class: ES1 – ES10, and
- Structural Design Life: 20 years.

TRH 4 recommends a pavement structure with either a gravel subbase (G5) or cemented subbase (C4) below a crushed stone base (G4) and seal surfacing. Although the catalogue suggests the use of a bituminous seal, an asphalt surfacing and block surfacing were considered to more attractive following discussions with the project planner. A cost estimate was done for both asphalt and block paving options with the preference by HDA at this stage being the block paving option. In addition, the block paving surfacing is possibly better suited for a development of the kind being considered.

The vertical alignment of the roads are planned to be such that adjacent developments will drain towards the road, thus necessitating the roads to be approximately 250mm below the adjacent ground/erf level.

With reference to the geotechnical investigation carried out by others, the subgrade conditions to the site are “generally fair with the natural soil profile of the area generally being underlain to a depth of 2.5m by transported and residual clayey sands and clayey gravels”. From the laboratory test results, “the COLTO classification of the materials is generally poorer than G9”. It is therefore concluded that the insitu material excavated for the alignment of the roads will only be of such quality to be used as fill (G10), unless the quality is otherwise proved with subsequent investigations during the design development stage of the project.

The suggested pavement structure options (asphalt and block paving) at this stage reflect as follows:

(a) Option Block Paving:
- 65mm Block Paving
- 30mm Sand
- 150mm Cement Stabilised Sub-base (C4)
- 150mm Upper Selected Subgrade (G7)
- 150mm Lower Selected Subgrade (G9)
- Fill/Insitu (G10)

(b) Option Asphalt Surfacing:
- 35mm Asphalt Surfacing
- 125mm Crushed Stone Base (G2)
- 150mm Cement Stabilised Sub-base (C4)
- 150mm Upper Selected Subgrade (G7)
- 150mm Lower Selected Subgrade (G9)
- Fill/Insitu (G10)

4. STORMWATER

4.1 Referenced Documentation, Guidelines and Reports

This stormwater report should be read in conjunction with the Flood Line Study Report and the Environmental Screening Study Report.

In addition, the following Tshwane documentation/guidelines have been consulted:

(i) City of Tshwane: Minimum Standards to Road Construction and Stormwater Drainage Systems – May 2013;
(ii) City of Tshwane: Minimum Standards to Road Construction and Stormwater Drainage Systems for all low-cost Housing Projects in Tshwane;
(iii) City of Tshwane: General Content Requirements for Service Reports submitted in support of Land Use Applications; and
(iv) The SANRAL Drainage Manual 6th Edition

4.2 Description of the Site

The site is bound by Stormvoël Road on the northern boundary, Derdepoort Road on the eastern boundary and a railway line (emanating from the Koedoespoort Train Station) on the southern boundary. There is no defined feature on the western boundary other than a local small developed area.

The environmental screening study identified a wetland system(s) on the site, which has been interrupted by local developments (in particular on the northern boundary), which has led to drainage gullies/channels canalising stormwater into the wetlands and also further afar into a concrete-lined stormwater channel which starts in the south at the railway line, proceeds from the south to the north, and via a culvert structure underneath Stormvoël Road, flows into the Moretele River. Most of the gullies and channels running west-east over the site are hand-made furrows.

The overall ground surface of the site slopes gently towards the north east, with a slope in the order of 2%.

Figures 4.1 and 4.2 provide an overview of the Site.

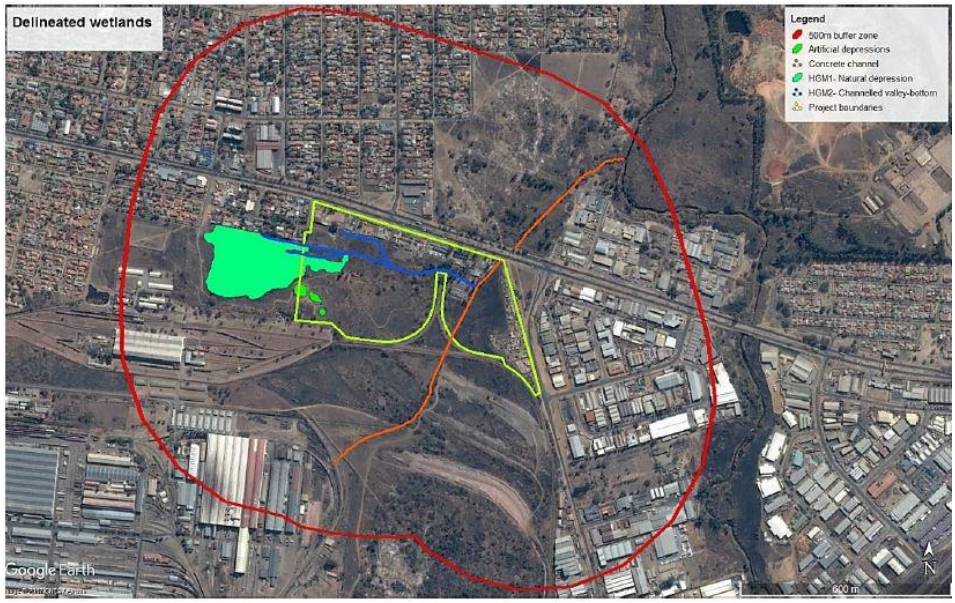


Figure 4.1: Location of Wetlands, Hand-made Furrows/ Channels and Open Lined Concrete Drain/Stream

Figure 4.2: Wetland Area within the Site

4.3 Proposed Development of the Site

The initial conceptual development as proposed by the Town/Urban Planner (refer to Figure 4.3) takes into account the wetland areas (which includes the areas covered by man-made furrows), and utilises these areas for green, open spaces within the development. The same applies to the area through which the concrete-lined channel runs, as well as the adjacent servitude area to the east of the concrete channel.

Subsequent to the initial development proposal, several options have been considered (refer to Annexures 1 to 4), but will all be utilising the site in a similar manner, only with the combination of housing categories being different.

Figure 4.3: Schematic of the Proposed Development (Initial Concept)

4.4 Drainage Design

4.4.1 Wetland Area/Green Open Spaces

At this stage it is envisaged (obviously subject to the final ground levels and planning of the green open spaces) that the above areas will be landscaped in such a manner to be self-draining towards and into the south-north running concrete lined open channel, resulting in minimal pipework to drain the open spaces.

It will be essential that the open plan areas accommodate at minimum a 1:20 year return period storm draining across them and with limited storm damage to the areas being crossed.

Significant stormwater run-off emanates from well beyond the western boundary to the development, and current planning accommodates this run-off onto and through the open space areas.

The extension of Jan Coetzee Road southwards into the development, and which also links the northern and southern parts of the development, necessitates the stormwater being catered for as it passes underneath this section of link road. The method of

accommodating this run-off beneath the section of link road will be finalised in due course, but at this stage a pipe crossing has been provided for.

4.4.2 Residential Areas

Drainage of the residential areas is by means of a stormwater pipe network, which includes manholes and inlet structures, as well as utilises the roadways in the case of larger storms. The following criteria applies to the network:

- The underground pipe network on its own accommodates a storm of a 1:2 year return period;
- The minimum pipe size is 450mm Ø, however 600mm Ø or larger is preferable, in particular when considering the need for ease of maintenance; and
- The underground pipe network, combined with the roadways, accommodates a storm of a 1:20 year return period.

For this particular development it will be permitted to discharge the pipe network directly into the concrete lined open drain/stream. Attenuation will not be required, and this has been confirmed by the City of Tshwane.

Depending on the network discharge points (emanating from the future survey), the capacity of the concrete lined open channel, will be further assessed, whilst also considering the additional discharge emanating from the proposed development.

Stormwater pipes will generally be positioned directly beyond the edge of the roadway, underneath the walkway area.

There are stormwater culverts passing stormwater beneath the railway tracks on southern boundary of the site between the concrete lined open drain and the south-west corner of the site. The run-off emanating from these culverts will be accommodated into the residential area stormwater pipe network, as it will not be possible to have this run-off bypass the residential area pipe network, and discharge directly into the concrete lined open drain/stream. These details will be finalised once a detail survey is available of the site.

4.4.3 Stormwater/Stream Structure on Stormvoël Road

The culvert structure that conveys stormwater under Stormvoël Road is a box culvert with triple barrels of 3,6m wide and 1,5m high. This structure carries all the stormwater from the site, the stormwater entering the site from beyond the western boundary, the stormwater emanating from south of the railway lines and the stormwater being carried by the concrete lined open drain.

Whilst the above culvert adequately accommodates the 1:50 year return period flood (as determined from the flood line study), the structure will be reassessed assuming post development conditions to ensure that the structure does not overtop with the 1:50 year flood. Should overtopping occur with a post development storm, the existing structure will need to be upgraded to accommodate 1:100 year flood. Whilst finalising these details are also subject to a detailed survey of the site, upgrading of this outlet structure is not envisaged, other than some possible maintenance.

5. COST ESTIMATE (ROADS AND STORMWATER)

Cost estimates were prepared for two of the four development options considered. In the case of the cost estimates, separate estimates were prepared for the asphalt surfacing option and the concrete block paving option. These cost estimates (VAT exclusive) are summarised as follows:

Option	Option 2	Option 2A
Asphalt Surfacing Option	R 23 463 539.80	R 26 044 529.18
Concrete Block Paving Option	R 19 266 398.75	R 21 261 653.51

With the preparation of the above estimates rates of similar projects were used. In addition the estimates include for 15% contingencies, but excludes professional fees.

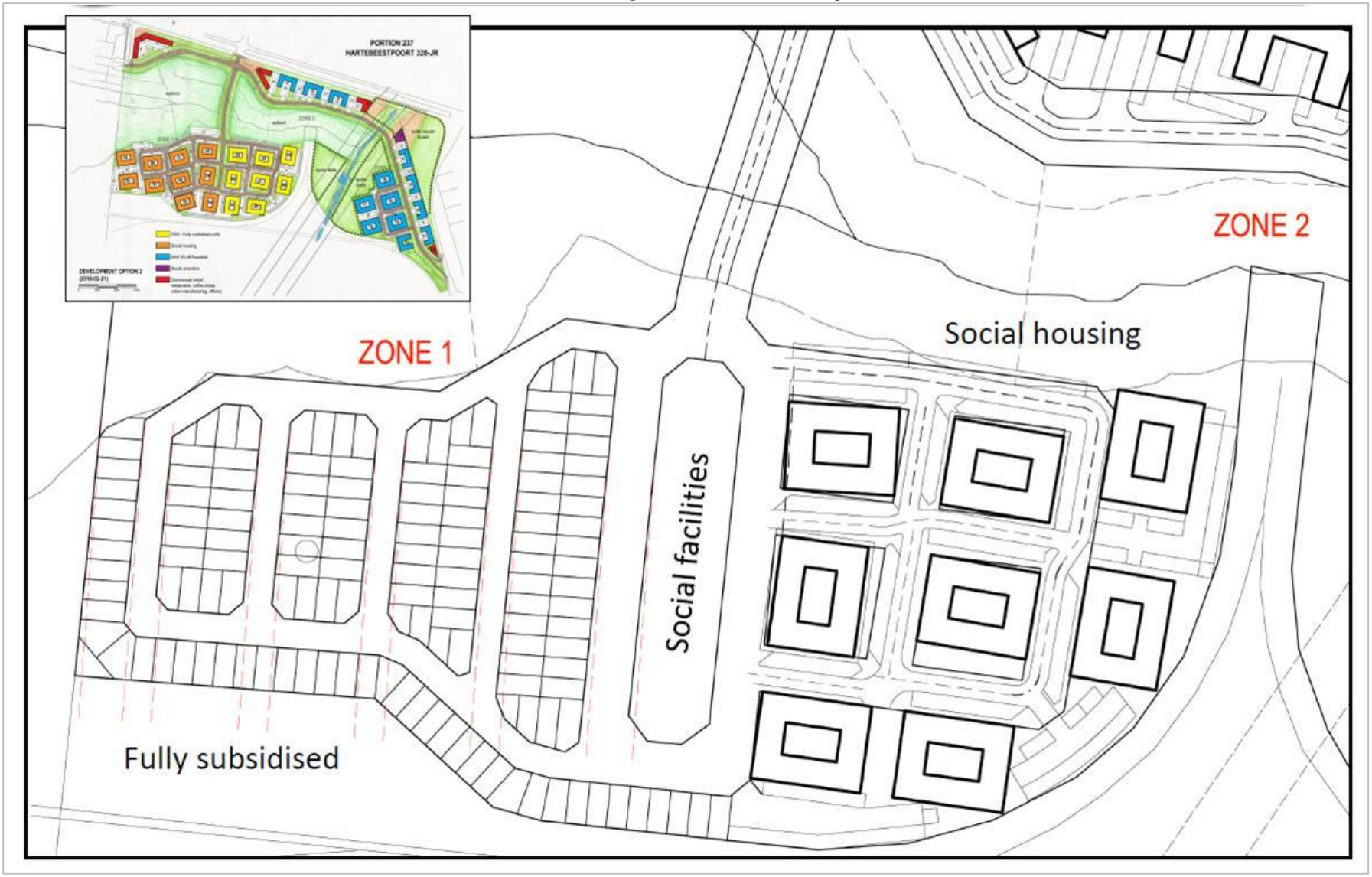
Refer to Annexure 5 for details of the cost estimates.

6. ANNEXURES

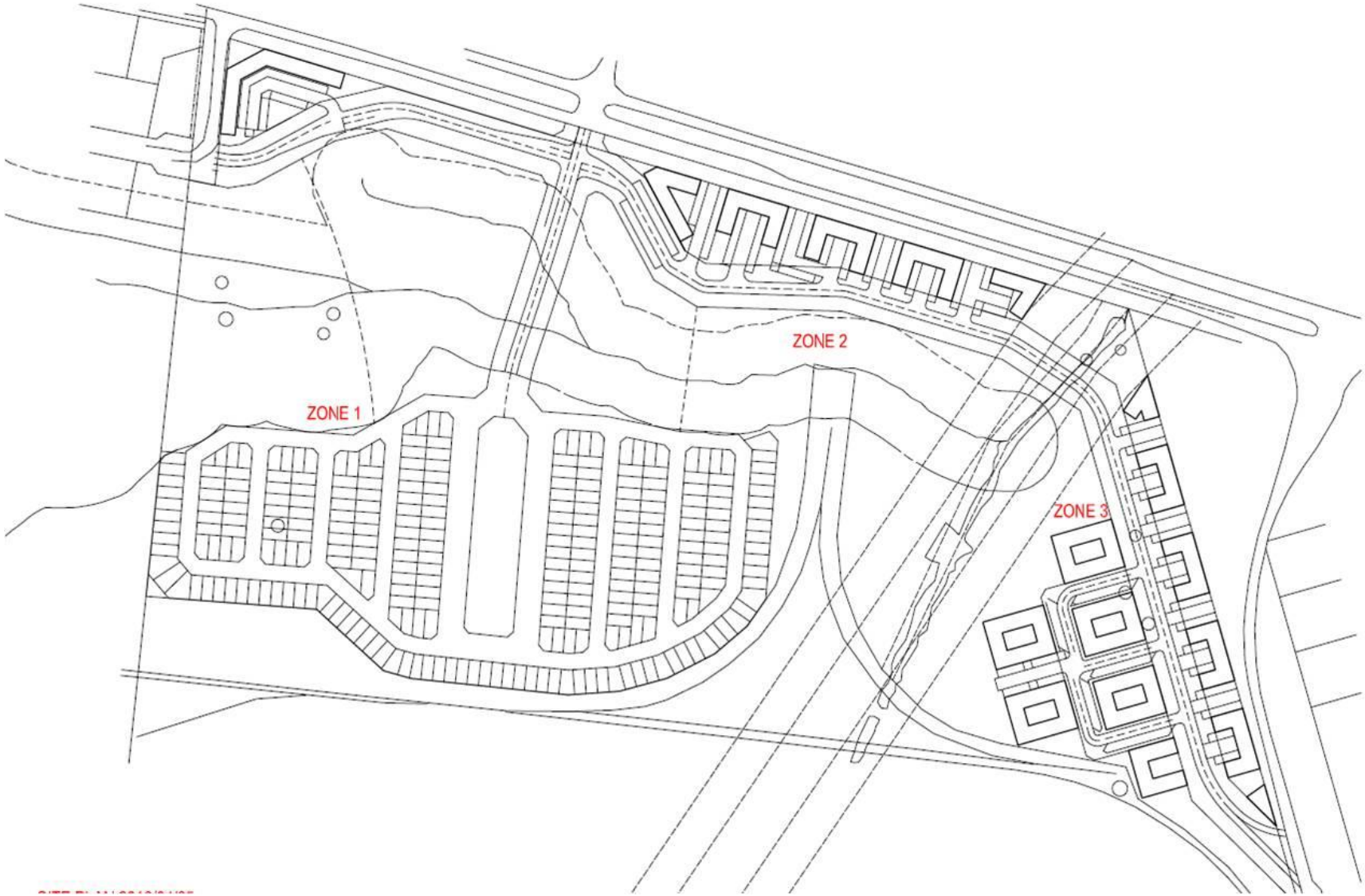
Annexure 1: Layout Plan for Option 1

Annexure 2: Layout Plan for Option 2

Annexure 3: Layout Plan for Option 2A



Annexure 4: Layout Plan for Option 2B



Annexure 5: Cost Estimates (Option 2 and Option 2A)

Hartebeesport Proposed Housing Development, City of Tshwane Option 2

Month			1	2	3	4	5	6	7	8	9	10	11	12
Civil Engineering using Asphalt Surfacing	**Contr_Est**		R586 477.59	R241 477.59										
	Contr_Requirements		R50 266.67	R50 266.67	R50 266.67	R50 266.67	R50 266.67	R50 266.67	R50 266.67	R50 266.67	R50 266.67	R50 266.67	R50 266.67	R50 266.67
	Stormwater				R883 749.83	R883 749.83	R883 749.83	R883 749.83						
	Roads													
	Clearing			R194 068.95										
	Accodation of Traffic			R197 108.36										
	Box cutting					R72 079.33	R72 079.33	R72 079.33	R72 079.33					
	Layer Works						R956 347.25	R956 347.25	R956 347.25	R956 347.25				
	Base							R236 800.00	R236 800.00	R236 800.00	R236 800.00			
	Surfacing								R1 143 775.00	R1 143 775.00	R1 143 775.00	R1 143 775.00		
	Kerbing									R480 869.76	R480 869.76	R480 869.76	R480 869.76	
	Road signs and marking												R30 456.87	R30 456.87
	Erosion													R15 542.60
	Drains												R192 522.59	R192 522.59
	Parking			R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00			
	Traffic Signals												R200 000.00	R450 000.00
	Tesing of material			R20 000.00	R20 000.00	R20 000.00	R20 000.00	R20 000.00	R20 000.00	R20 000.00	R20 000.00	R20 000.00	R20 000.00	R20 000.00
	Surveyor		R23 322.00	R23 322.00	R23 322.00	R23 322.00	R23 322.00	R23 322.00	R23 322.00	R23 322.00	R23 322.00	R23 322.00	R23 322.00	R23 322.00
Sub-Total			R660 066.26	R726 243.57	R977 338.50	R1 049 417.82	R2 005 765.07	R2 242 565.07	R2 502 590.24	R2 911 380.67	R1 955 033.42	R1 718 233.42	R997 437.87	R782 110.72
Sub-total including P&G's		1.10	R726 072.88	R798 867.92	R1 075 072.35	R1 154 359.61	R2 306 629.84	R2 466 821.58	R2 752 849.27	R3 202 518.74	R2 150 536.76	R1 890 056.76	R1 097 181.66	R860 321.79
Total Including Contingencies		1.15	R834 983.81	R918 698.11	R1 236 333.20	R1 327 513.55	R2 652 624.31	R2 836 844.82	R3 165 776.66	R3 682 896.55	R2 473 117.28	R2 173 565.28	R1 261 758.91	R899 427.32
			R834 983.81	R1 753 681.93	R2 990 015.13	R4 317 528.68	R6 970 152.99	R9 806 997.80	R12 972 774.46	R16 655 671.01	R19 128 788.29	R21 302 353.57	R22 564 112.47	**R23 463 539.80**
Civil Engineering using Block Paver	**Contr_Est**		R586 477.59	R241 477.59										
	Contr_Requirements		R50 266.67	R50 266.67	R50 266.67	R50 266.67	R50 266.67	R50 266.67	R50 266.67	R50 266.67	R50 266.67	R50 266.67	R50 266.67	R50 266.67
	Stormwater				R883 749.83	R883 749.83	R883 749.83	R883 749.83						
	Roads					R144 158.65	R144 158.65							
	Clearing			R194 068.95										
	Accodation of Traffic			R197 108.36										
	Box cutting					R72 079.33	R72 079.33	R72 079.33	R72 079.33					
	Layer Works						R956 347.25	R956 347.25	R956 347.25	R956 347.25				
	Sand Seal							R93 420.25	R93 420.25	R93 420.25	R93 420.25			
	Concrete Block Paving								R366 187.50	R366 187.50	R366 187.50	R366 187.50		
	Kerbing									R480 869.76	R480 869.76	R480 869.76	R480 869.76	
	Road signs and marking												R30 456.87	R30 456.87
	Erosion													R15 542.60
	Drains												R192 522.59	R192 522.59
	Parking			R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00			
	Traffic Signals												R200 000.00	R450 000.00
	Tesing of material			R20 000.00	R20 000.00	R20 000.00	R20 000.00	R20 000.00	R20 000.00	R20 000.00	R20 000.00	R20 000.00	R20 000.00	R20 000.00
	Surveyor		R23 322.00	R23 322.00	R23 322.00	R23 322.00	R23 322.00	R23 322.00	R23 322.00	R23 322.00	R23 322.00	R23 322.00	R23 322.00	R23 322.00
Sub-Total			R660 066.26	R726 243.57	R977 338.50	R1 193 576.47	R2 149 923.72	R2 099 185.32	R1 581 622.99	R1 990 413.42	R1 034 066.17	R940 645.92	R997 437.87	R782 110.72
Sub-total including P&G's		1.10	R726 072.88	R798 867.92	R1 075 072.35	R1 312 934.12	R2 472 412.28	R2 309 103.86	R1 739 785.29	R2 189 454.76	R1 137 472.79	R1 034 710.51	R1 097 181.66	R860 321.79
Total Including Contingencies		1.15	R834 983.81	R918 698.11	R1 236 333.20	R1 509 874.24	R2 843 274.13	R2 655 469.44	R2 000 753.08	R2 517 872.98	R1 308 093.71	R1 189 917.09	R1 261 758.91	R989 370.06
			R834 983.81	R1 753 681.93	R2 990 015.13	R4 499 889.37	R7 343 163.49	R9 998 632.93	R11 999 386.01	R14 517 258.99	R15 825 352.70	R17 015 269.79	R18 277 028.70	**R19 266 398.75**

Hartebeesport Proposed Housing Development, City of Tshwane			Option 2A										
Month			1	2	3	4	5	6	7	8	9	10	11	12
Civil Engineering using Asphalt Surfacing	**Contr_Est**		R650 990.12	R268 040.12										
	Contr_Requirements		R55 796.00	R55 796.00	R55 796.00	R55 796.00	R55 796.00	R55 796.00	R55 796.00	R55 796.00	R55 796.00	R55 796.00	R55 796.00	R55 796.00
	Stormwater				R980 962.31	R980 962.31	R980 962.31	R980 962.31						
	Roads													
	Clearing			R215 416.53										
	Accodation of Traffic			R218 790.28										
	Box cutting					R80 008.05	R80 008.05	R80 008.05	R80 008.05					
	Layer Works						R1 061 545.45	R1 061 545.45	R1 061 545.45	R1 061 545.45				
	Base							R262 848.00	R262 848.00	R262 848.00	R262 848.00			
	Surfacing								R1 269 590.25	R1 269 590.25	R1 269 590.25	R1 269 590.25		
	Kerbing									R533 765.43	R533 765.43	R533 765.43	R533 765.43	
	Road signs and marking												R33 807.12	R33 807.12
	Erosion													R17 252.29
	Drains												R213 700.07	R213 700.07
	Parking			R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00			
	Traffic Signals												R222 000.00	R499 500.00
	Tesing of material			R22 200.00	R22 200.00	R22 200.00	R22 200.00	R22 200.00	R22 200.00	R22 200.00	R22 200.00	R22 200.00	R22 200.00	R22 200.00
	Surveyor		R25 887.42	R25 887.42	R25 887.42	R25 887.42	R25 887.42	R25 887.42	R25 887.42	R25 887.42	R25 887.42	R25 887.42	R25 887.42	R25 887.42
Sub-Total			R732 673.54	R806 130.36	R1 084 845.73	R1 164 853.78	R2 226 399.23	R2 489 247.23	R2 777 875.17	R3 231 632.55	R2 170 087.10	R1 907 239.10	R1 107 156.04	R868 142.90
Sub-total including P&G's	1.10		R805 940.90	R886 743.39	R1 193 330.31	R1 281 339.16	R2 560 359.12	R2 738 171.96	R3 055 662.69	R3 554 795.80	R2 387 095.81	R2 097 963.01	R1 217 871.64	R954 957.19
Total Including Contingencies	1.15		R926 832.03	R1 019 754.90	R1 372 329.85	R1 473 540.04	R2 944 412.98	R3 148 897.75	R3 514 012.09	R4 088 015.17	R2 745 160.18	R2 412 657.46	R1 400 552.39	R998 364.33
			R926 832.03	R1 946 586.94	R3 318 916.79	R4 792 456.83	R7 736 869.81	R10 885 767.56	R14 399 779.65	R18 487 794.82	R21 232 955.00	R23 645 612.46	R25 046 164.85	**R26 044 529.18**
Civil Engineering using Block Paver	**Contr_Est**		R624 427.59	R268 040.12										
	Contr_Requirements		R55 796.00	R55 796.00	R55 796.00	R55 796.00	R55 796.00	R55 796.00	R55 796.00	R55 796.00	R55 796.00	R55 796.00	R55 796.00	R55 796.00
	Stormwater				R980 962.31	R980 962.31	R980 962.31	R980 962.31						
	Roads					R160 016.10	R160 016.10							
	Clearing			R215 416.53										
	Accodation of Traffic			R218 790.28										
	Box cutting					R80 008.05	R80 008.05	R80 008.05	R80 008.05					
	Layer Works						R1 061 545.45	R1 061 545.45	R1 061 545.45	R1 061 545.45				
	Sand Seal							R103 696.48	R103 696.48	R103 696.48	R103 696.48			
	Concrete Block Paving								R406 468.13	R406 468.13	R406 468.13	R406 468.13		
	Kerbing									R533 765.43	R533 765.43	R533 765.43	R533 765.43	
	Road signs and marking												R33 807.12	R33 807.12
	Erosion													R17 252.29
	Drains												R213 700.07	R213 700.07
	Parking			R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00	R0.00			
	Traffic Signals												R200 000.00	R450 000.00
	Tesing of material			R22 200.00	R22 200.00	R22 200.00	R22 200.00	R22 200.00	R22 200.00	R22 200.00	R22 200.00	R22 200.00	R22 200.00	R22 200.00
	Surveyor		R25 887.42	R25 887.42	R25 887.42	R25 887.42	R25 887.42	R25 887.42	R25 887.42	R25 887.42	R25 887.42	R25 887.42	R25 887.42	R25 887.42
Sub-Total			R706 111.01	R806 130.36	R1 084 845.73	R1 324 869.89	R2 386 415.33	R2 330 095.71	R1 755 601.52	R2 209 358.90	R1 147 813.45	R1 044 116.97	R1 085 156.04	R818 642.90
Sub-total including P&G's	1.10		R776 722.11	R886 743.39	R1 193 330.31	R1 457 356.87	R2 744 377.63	R2 563 105.28	R1 931 161.67	R2 430 294.79	R1 262 594.80	R1 148 528.67	R1 193 671.64	R900 507.19
Total Including Contingencies	1.15		R893 230.43	R1 019 754.90	R1 372 329.85	R1 675 960.41	R3 156 034.28	R2 947 571.07	R2 220 835.92	R2 794 839.01	R1 451 984.01	R1 320 807.97	R1 372 722.39	R1 035 583.26
			R893 230.43	R1 912 985.33	R3 285 315.19	R4 961 275.59	R8 117 309.87	R11 064 880.94	R13 285 716.87	R16 080 555.87	R17 532 539.89	R18 853 347.86	R20 226 070.25	**R21 261 653.51**