

NELSON MANDELA BAY MUNICIPALITY

EXTENTION OF WALKER DRIVE TO CAPE ROAD: REDHOUSE CHELSEA ARTERIAL (PHASE 1)

BRIEF TECHNICAL REPORT: PREPARED FOR REGISTRATION OF PROJECT WITH DEPARTMNET OF ECONOMIC DEVELOPMENT AND ENVIRONMENTAL AFFAIRS (DEDEA)

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1. INTRODUCTION

(Refer to Figure 1)

1.1. Terms of Reference

In terms of a Nelson Mandela Bay Municipal Council (NMBM) Resolution, The Executive Director: Infrastructure and Engineering informed BKS (Pty) Ltd on the 1 February 2008 that the previous appointment to design and construct the portions of Redhouse Chelsea Arterial from Walker Drive to Cape Road had been revised to include the link from extended Walker Drive to Cape Road traversing through the proposed Redhouse Chelsea Arterial reserve incorporating the provision of an overpass over N2 and its associated ramps. ***(Refer: NMBM reference B902)***

1.2. Extent of Assignment

The assignment incorporates route location and selection, geotechnical and environmental investigations, pavement design, and the route's stormwater drainage structures for the roadworks as described above.

The report was to be based on sections of the Traffic Impact Assessment (TIA) entitled ***"Revised Traffic Impact Assessment for Proposed Mixed Use Development on Erf 426 Hunters Retreat and Portion 131 Farm Little Chelsea No.10"*** dated October 2009 which was, conducted to assess the capacity of the relevant intersections and potential future traffic generated.

1.3. Background

The Integrated Transport Plan prepared for the NMBM made provision for the construction of the Redhouse Chelsea Arterial as a north/south arterial road on the western perimeters of the Metro urban area adjacent to the Sherwood Residential area. Although allowance was made in the initial town planning scheme for the road reserve required for various sections of this road, construction was delayed until there was sufficient development in the area to warrant the expenditure in view of traffic demand.

Provision was also made in the Integrated Transport Plan for the extension of Walker Drive to the west and to link up with an existing road bridge overpass of the N2 freeway. This existing bridge was constructed at the same time as the N2 Freeway and because there is no development in the immediate vicinity, the bridge was never connected to the road network and has thus never been used.

Various studies were undertaken from 2004 to investigate the feasibility of extending Walker Drive to the existing N2 overpass. The critical elements of these studies entailed the assessment of traffic flows and the design of a suitable interchange layout at the Walker Drive – N2 Existing Bridge to improve access to the western areas.

Parallel to this process, private developers who owned the land surrounding the proposed Redhouse Chelsea Arterial, Walker Drive extension and N2 advised of their intention to develop the area to the south-west of the proposed Redhouse Chelsea/N2 interchange. The nature of the design of the proposed subject interchanges influenced the access to these developments.

1.4. Purpose of this Report

The purpose of this report is to basically describe the location of and technical requirements of the proposed Redhouse Chelsea Arterial and Walker Drive extension in order that DEDEA may register the project for environmental purposes.

2. ROUTE LOCATION & DESCRIPTION

(Refer to Figure 2).

In terms of the assignment described above on 13 October 2008 BKS submitted a report to NMBM (*entitled "Extension of Walker Drive to Cape Road: Redhouse Chelsea Arterial (phase 1) Preliminary Design Report: Final Draft dated September 2008"*) on the proposed Redhouse Chelsea/Arterial Road. This design was based on locating the proposed road within the originally allocated road reserve provided for the facility. This reserve was situated immediately to the west of the Sherwood urban area passing through Rowallan Park to the Cape Road Bishops Road intersection. The construction of this road was to be Phase 1 of the road network implementation programme for the area which was approved by both NMBM and SANRAL.

Subsequently Setplan were appointed by the NMBM to prepare a LSDF for the Greater Hunters Retreat Area and Engineering Advice and Services (EAS) were appointed as sub-consultants to Setplan to undertake the transportation planning for the greater area. This study indicated a new road network for the area with the proposed Redhouse/Chelsea Arterial and its interchange with the N2 in a new position. ***(Refer EAS report entitled "Transportation Study for the Western Suburbs Local Special Development plan dated 27 March 2009)***

On 8 April 2009 BKS were instructed by the NMBM to flag the new Redhouse/Chelsea route as proposed in the EAS March 2009 report. A section of this route passed through the property comprising the Bay West City development (formerly N2 Gateway). The developers agreed to make the land available for this section of the road reserve. The scope of the EAS report however did not encompass the optimization of the position of the Baakens River crossing nor does the required distances between off and on ramps between 2 interchange in terms of SANRAL requirements. The alignment of the Redhouse/Chelsea arterial was thus amended by BKS by moving the interchange eastwards but still crossing the Baakens River at the optimum position. The route was then flagged and verified for suitability by both the wetland and vegetation specialist consultants, Mr Jamie Pote and Dr Peter Illgner. These specialists were appointed as sub-consultants to Terratest who are the environmental consultants for Redhouse/Chelsea Arterial road. The road position chosen for the main Baakens River crossing is optimum with regard to both environmental and engineering aspects. The slight movement of the crossing position up or downstream will considerably increase the cost of the bridge and will also intercept numerous minor wetlands. This selected position of the proposed bridge should therefore be regarded as fixed.

At this juncture BKS were in a position to arrange for a new strip survey and geotechnical investigation on the revised alignment. However, during the submission process of the Environmental Impact Report for the Bay West City development it became apparent that the extent of the cyclopia endangered species along the watercourse immediately to the south and parallel to the N2 was more extensive than originally anticipated accordingly to the report of Dr Eileen Campbell dated 2008 commissioned by the Nelson Mandela Bay University. Although the cyclopia were not growing along the planned route at the time of the Terratest survey, the Campbell report showed that cyclopia had historically been present along the proposed alignment and that seeds could this be present in the ground.

A new alignment was therefore again selected in conjunction with the specialist environmentalists to avoid the most densely historically populated cyclopia area. This has been accomplished by moving the N2 crossing point 160m eastwards, but leaving the main Baakens crossing in the optimum position. The route was then re-flagged and verified for suitability by both the wetland and vegetation specialist consultants, Mr Jamie Pote and Dr Peter Illgner.

Certain rocky outcrops were also intercepted by the proposed road in the vicinity of the shopping mall. It is understood that as a result of other rocky outcrops in the vicinity of the shopping mall being preserved, agreement has been reached that the outcrops along the proposed roadway may be sacrificed.

It should be noted therefore that a section of the proposed new Redhouse/Chelsea alignment is now not in the position as determined by the EAS report i.e. the position of the Redhouse/Chelsea overpass bridge over the N2 has in total moved 230 m eastwards from the EAS selected position.

A more detailed description of the selected road routes follows:

2.1 Walker Drive Extension

- Firstly, Walker Drive commences from existing Walker Drive proceeding through to the west.
- Secondly, it then proceeds on the existing Utopia Road reserve between Erf. 441, 442 and 445.
- Thirdly, it curves to the left through Erf.443 towards Erf.426
- Lastly, it curves to the right to the existing Walker Drive Bridge.

The route will be approximately 2100m long from the existing Walker Drive end to the existing Walker Drive Bridge. It is made up of two (2 No.) horizontal curves, number of vertical curves and three (3 No.) of straight sections all of which comply to the required geometric design standards.

2.2 Redhouse Chelsea Arterial

- Firstly, It commences from the extended Walker Drive, on the west corner of Erf 443 proceeding northwards through Erf. 426.
- Secondly, it then proceeds through to the South African Roads Agency section where an overpass will be provided over the N2.
- Thirdly, it carries on through Erf 425. It then proceeds along the existing Redhouse Chelsea Arterial road reserve and terminates at Cape Road.

The route will be approximately **2220m** long from the extended Walker Drive to the to the intersection of Cape Road in the north. It is made up of three (3 No.) horizontal curves, ten (10 No.) vertical curves and four (4 No.) of straight sections all of which comply to the required geometric design standards.

The route will require two river crossings, viz the main Baakens River some 580m north of the N2 overpass and a tributary of the river approximately 260m south of the N2. The proximity of these two relatively deep valleys on both sides of the elevated roadway forming the N2 overpass results in fairly deep fills.

The Redhouse Chelsea Arterial also consists of three (3 No.) bridges which are as follows:

- a) "Cyclopa Bridge" is situated on the northern tributary at approximately at Chainage 630m
- b) Redhouse Chelsea/N2 Bridge Overpass is situated approximately at Chainage 820m
- c) "Baakens Bridge" is situated approximately at Chainage 1450m which will cross the main Baakens River.
- d) Culverts will be required to convey the N2 westbound off ramps over the northern tributary. (Refer to Figure 3)

2.3 On and Off Ramps

On and off Ramps have been provided on the eastern side of the interchange configuration. The on-ramp onto the N2 (north of N2) is 850m long with one horizontal curve. The loop ramp from the N2 (north of N2) is 650m long with single compound horizontal curve.

The off-ramp ramp (south of N2) is 1060m long and includes two horizontal curves. It will cross the tributary of the Baakens river by means of Bridge as recommended by the Wetlands Specialist. The loop ramp from the N2 (south of N2) is 1215m long with single compound horizontal curve. It will also cross the tributary of the Baakens river by means of Bridge / or culvert as recommended by the Wetlands Specialist.

3. TRANSPORTATION PLANNING

Various transportation reports were developed to motivate the Redhouse Chelsea/N2 interchange configurations and to assess the impact of the proposed land-use on the proposed and approved road layout. The following is a summary of Traffic Impact Assessment dated October 2009 and entitled "***Revised Traffic Impact Assessment for Proposed Mixed Use Development on Erf 426 Hunters Retreat and Portion 131 Farm Little Chelsea No.10***"

3.1 Surrounding Road Network

When the N2 freeway was constructed to the west of Port Elizabeth in the late nineteen sixties, an overpass was constructed over the N2 approximately 5km west of the Linton Interchange, in the vicinity of the present Hunters Retreat residential area. No interchange or link roads were constructed to the overpass with the consequence that it is still not in use after 40 years. Proposed developments in the area have created a need to complete an interchange at this location which would enable the future linking of Walker Drive and Cape Road with N2.

It was agreed with the Bay West City developer that the alignment of Walker Drive Extension west of the Redhouse Chelsea Arterial should be changed from that shown in the Western Suburbs LSDF by turning it northwards across the existing N2 bridge to connect to Van der Stel Street Extension, instead of linking directly to the Western Arterial south of the new N2 interchange.

The one major road is the Redhouse-Chelsea Arterial which will run from Cape Road to Kragga Kamma Road with a new bridge over the N2 that will have four ramps serving all interchange traffic movements, in the form of a partial cloverleaf (parclo) layout, facing eastwards.

Discussions between Nelson Mandela Bay Municipality, Eastern Cape Department of Roads and Transport and SANRAL, a Traffic Impact Assessment which incorporated a half diamond interchange between N2 and Redhouse Chelsea Arterial was agreed on. It was also proposed to connect the two interchanges i.e. Western Arterial – N2 Interchange (future phase) and Redhouse Chelsea - N2 interchange (phase 1) with service roads parallel to the N2 on both the northern and southern sides. The road network is illustrated in that drawing. This road network was approved by both SANRAL and ECDORT in 2010, although certain questions on detail aspects still needed to be solved. This solution provides excellent access to the proposed and future planned developments in the vicinity.

Furthermore this Redhouse Chelsea Arterial/N2 interchange configuration can be expected to alleviate present congestion at the Linton interchange. The implementation of the interchanges and roads will be phased in accordance with the short to medium term demand as illustrated. An Access Application Report was submitted to SANRAL in July 2007 in order to obtain approval for accesses to, from and over N2.

3.2 Background Traffic Volumes

Traffic counts were done by SSI in 2008 at the Cape Road/Friesland Street and Walker Drive/Wiehan Avenue intersections. They have been escalated at 3% per annum for 10 years to take into account background traffic growth resulting from other residential developments in the western suburbs, excluding the Bay West City development.

The rate of 3% per annum has been obtained from traffic counts on Cape Road and Walker Drive during the past 5 years.

4. SERVICES INVESTIGATIONS

All engineering services information has been sourced from the Nelson Mandela Bay Municipality database. Telkom indicated that there are existing services both underground and overhead which will be affected by the construction of Redhouse Chelsea Arterial and Walker Drive Extension. These services will be relocated by various service departments or the contractor prior to commencement or during the implementation of this project.

5. SITE SURVEY

Surplan Engineering Surveying was appointed in March 2010 and they anticipate to submit the work on the 16 April 2010. A detailed survey was conducted to pick-up existing road details in the area, erf boundaries, invert and cover levels of existing services together with the necessary spot heights. The survey commences at the western boundary of Erf 443 and terminates at Cape Road intersection.

6. DESIGN PARAMETERS

The design standards have been adopted from the *“Geometric Design of Urban Collector Roads”*. *Draft UTG 5*

A design speed of 80km/h has been specified for the arterial roads and 60km/h for the on and off ramps. Table 1 and 2 below set out the minimum curve requirements for these design speeds.

Table 1: Horizontal Alignment

Road Name	Design Speed	Minimum Requirement
Redhouse Chelsea Arterial	60km/h	110m
Walker Drive Extension	60km/h	110m
South Off-Ramp	60km/h	110m
South Loop Ramp	60km/h	110m
North Off-Ramp	60km/h	110m
North Loop Ramp	60km/h	110m

Table 2: Vertical Alignment

Road Name	Design Speed	Minimum Required K value (Crest)
Redhouse Chelsea Arterial	60km/h	16
Walker Drive Extension	60km/h	16
South Off-Ramp	60km/h	16
South Loop Ramp	60km/h	16
North Off-Ramp	60km/h	16
North Loop Ramp	60km/h	16

From **Table 1 and 2** it is evident that the maximum allowable side friction was taken into account. The horizontal curve deflection angles are small as the physical conditions permit, so that the roads are as directional as possible.

7. TRAFFIC GENERATED

7.1 Traffic Analysis

As described previously, comprehensive traffic studies have been undertaken to determine the future traffic flow patterns and operational efficiency of the road system, together with providing information required for road classification and pavement design purposes.

Inspection of the 2018 traffic forecasts for the peak hours indicates that the number of lanes which must be provided per direction on each of the roads to accommodate the 2018 traffic forecasts for Phase 1 of the Bay West City development, including escalated background traffic, is as follows:

Road Name	No. Lanes	Proposed Road Reserve
Redhouse-Chelsea Arterial (Cape Road to Walker Drive)	2 lanes per direction	40m
Walker Drive Extension (Walker Drive – South CD Road)	1 lane per direction	40m
Cape Road (Lategan to Bishops Way)	2 lanes per direction	Existing

The road lane requirements for the ultimate development scenario have been determined by Aurecon/EAS using the updated NMBM Transport Demand Model with the land use information that was contained in the December 2008 rezoning and subdivision application.

This has also resulted in the following summarised recommendations regarding the intersections:

- The Redhouse Chelsea Arterial – Walker Drive intersection be signalised
- The Redhouse Chelsea – South Ramp intersection be signalised
- The Redhouse Chelsea – North Ramp intersection be signalised
- The Redhouse Chelsea – Cape Road intersection be signalised

8. GEOTECHNICAL INVESTIGATION

Terratest Geotechnical and Environmental Consultant were appointed in March 2010 and they anticipate submitting the work on the 23 April 2010. The Trial holes commence at the western boundary of Erf 443 and terminate at Cape Road intersection.

9. PAVEMENT DESIGN

The Geotechnical Investigation will be utilised to determine the pavement design of the road.

10. CROSS SECTION AND ROAD RESERVES

The road reserves proposed in the traffic report for various sections of the project are as follows:

- For Redhouse Chelsea Arterial ranges between 40m and 60m
- For Walker Drive and Redhouse Chelsea Arterial 40m

The ultimate cross section for Redhouse Chelsea Arterial and Walker Drive is a class 2E urban arterial, generally it is a two-lane bi-directional facility separated by a median with an outer shoulder and sidewalks/cycle tracks.

Cross sections for the project roads are attached.

11. STORMWATER MANAGEMENT

11.1 Scope

The scope of this section of the report is to evaluate the impact of the proposed road on the run-off from the various catchment areas which the road crosses and to determine the optimum methods to accommodate these stormwater flows. Drainage from the road surface and within the road prism is also discussed.

It is understood that a condition of development of all future upstream developers will be that they will be required to attenuate post-development peak flows to the pre-development flows. Whilst it might be the intention of the upstream owners to

attenuate the stormwater run-off from their properties, the effectiveness of these attenuation systems cannot be guaranteed, and the bridges / culverts as described hereunder will therefore have sufficient capacity to approximately accommodate an un-attenuated post-development flows in order to provide a reasonable factor of safety for the structures and their training works.

The township master-planning for the “greater western area” is presently being undertaken and more information as to how the upstream catchments will be developed should be available by the time that the final design stage of the Redhouse Chelsea Arterial is commenced. At this stage the 1:100 yr flood lines will also be accurately determined.

11.2 Design Parameters

- Method utilized for flow calculations: Rational Method
- MAP value 624mm/year
- IDF obtained by Midgley & Pitman Formula
- Impermeability coefficients determined from National Transport Commission: Road Drainage Manual
- Storm frequency for main watercourses and rivers 1:100yr
- Storm frequency for road drainage on Redhouse Chelsea Arterial 1:5 year or increased where applicable
- Culvert design from methods set out in National Transport Commission:
- Road Drainage Manual

11.3 Bridge Descriptions for Main Drainage System

11.3.1 General

There are two options which can be utilized to effect the stream and river crossings, viz bridge crossings or the provision of precast or cast-in-situ box culverts. From a cost benefit evaluation it was found that the use of reinforced concrete culverts would result in significant savings in cost and time. In the case of both precast and in-situ culverts, multi-span configurations would be used. The final arrangement of the bridges and / or culverts is dependant on the environmental considerations and in particular the impact on wetlands if they are present at the crossing positions. The environmental studies are presently underway. The proposed bridges and / or culverts will accommodate the 1:100yr, post-development flow.

A more detailed description of the anticipated bridge / culvert structures is contained in Section 14 hereunder.

11.4 Road Surface and Road Prism Drainage

Stormwater which will flow via a sheet flow pattern up to the road prism will be intercepted by a system of lined side drains on the high side of the road which will eventually discharge into the main natural watercourses under controlled conditions.

Stormwater run-off from the road surface will be by means of a system of grids, side inlets, pipes and concrete chutes.

The design standards adopted will be in accordance with the SANRAL Drainage Manual and SABS 1200. Minimum pipe sizes will be 450mm diameter.

12. ENVIRONMENTAL IMPACT ASSESSMENT (EIA) PROCESS

The Executive Director: Infrastructure and Engineering authorised BKS (Pty) Ltd on the 23 March 2010 to appoint Terratest Geotechnical, Environmental and Earth Science Consultants as sub-consultant to undertake the Environmental Impact Assessment (EIA) process for Extension of Walker Drive, Redhouse Chelsea and associated ramps and liaise with NMBM's Environmental and Health Directorate.

Subsequent to that Terratest appointed wetlands and vegetation specialists as permitted by Nelson Mandela Bay Municipality on the 23 March 2010.

This process is on-going

13. LAND MATTERS

The present reserve for Redhouse Chelsea Arterial varies from 42m west of Sherwood and south of N2 and 63m west of Rowallen Park and north of N2.

However, there is a requirement for land expropriation on land to be set aside on the following Erven for both Walker Drive Extension and Redhouse Chelsea Arterial:

- Erf 425 currently owned by Engen and it's affected by Redhouse Chelsea, North Off-Ramp and North Loop Ramp. The required expropriation is 6.40 Ha.
- Erf 426 currently owned by Bay West City and it's affected by Redhouse Chelsea, Walker Drive Extension and South Ramp. The required expropriation is 12.29 Ha.
- Erf 442 currently held by Anathi Property Investments who hold the rights through a Service Level and Land Availability Agreement with the Department of Housing, Local Government and Traditional Affairs. It is affected by Walker Drive Extension. The required expropriation is 0.20 Ha.
- Erf 443 currently held by Anathi Property Investments who hold the rights through a Service Level and Land Availability Agreement with the Department of Housing, Local Government and Traditional Affairs. It is affected by Walker Drive Extension. The required expropriation is 1.47 Ha.

- Erf 445 currently held by Anathi Property Investments who hold the rights through a Service Level and Land Availability Agreement with the Department of Housing, Local Government and Traditional Affairs. It is affected by Walker Drive Extension. The required expropriation is 0.80 Ha.
- Erf 447 currently held by Anathi Property Investments who hold the rights through a Service Level and Land Availability Agreement with the Department of Housing, Local Government and Traditional Affairs. It is affected by South off Ramp and South Loop Ramp. The required expropriation is 3.12 Ha.
- Erf 448 currently held by Anathi Property Investments who hold the rights through a Service Level and Land Availability Agreement with the Department of Housing, Local Government and Traditional Affairs. It is affected by South off Ramp. The required expropriation is 0.53 Ha.
- Erf 449 currently owned by Nelson Mandela Bay Municipality. It is affected by North off Ramp. The required expropriation is 1.00 Ha
- Erf 456 currently owned by Nelson Mandela Bay Municipality. It is affected by South Loop Ramp and Redhouse Chelsea Arterial. The required expropriation is 3.97 Ha
- Erf 668 currently owned by Nelson Mandela Bay Municipality and/or Department of Health. It is affected by Redhouse Chelsea Arterial. The required expropriation is 0.97 Ha

Generally many sections could not be accommodated within the current reserves. i.e. Within the South African National Road Agency and the Nelson Mandela Bay Municipality reserves. (Refer to Figure 3A)

14. BRIDGE STRUCTURES

(Refer to Figure 3).

14.1 Cyclpia Bridge / S Culverts (CH 620m)

The project includes the construction of a new bridge crossing the upper main tributary of the Baakens River. The bridge is on two vertical curves with radii ranging between 180 and 220m, and crosses the subject tributary at an angle of 64.2°. The roadway to be accommodated on the proposed bridge has a total width of **35m**, consisting of two 4.0m wide lanes per direction, a 2.8m shoulder lane, a 3.5m wide Non-Motorised Facility Lane in each direction and a 5m median. The bridge span will be determined at the design report stage.

14.2 Redhouse Chelsea Bridge Overpass (CH 880m)

The project includes the construction of a new overpass bridge crossing National Route 2 (N2). The bridge is on a vertical curve of radius 140m, and crosses the N2 at an angle of 64°. The roadway to be accommodated on the proposed bridge has a total width of **35m**, consisting of two 4.0m wide lanes per direction, a 2.8m shoulder lane, a 3.5m wide Non-Motorised Facility Lane in each direction and a 5m median.

The N2 consists of two 3.4m lanes in each direction, with wide shoulders. The proposed Redhouse Chelsea arterial crosses the N2 on a straight, with a longitudinal grade of 1:400. (Refer to Figure 4)

14.3 Baakens Bridge (CH 1450m)

The project includes the construction of a new bridge crossing the main Baakens River. The bridge is on a vertical curve of radius 220m, and crosses the Baakens River at an angle of **57°**. The roadway to be accommodated on the proposed bridge has a total width of **35m**, consisting of two 4.0m wide lanes per direction, a 2.8m shoulder lane, a 3.5m wide Non-Motorised Facility Lane in each direction and a 5m median.

The proposed Redhouse Chelsea arterial is on a straight and horizontal curve of 300m.

A Multiplan bridge is envisaged with spill through embankments. The central span will be of sufficient width to encompass the full width of the 1:100 year post development flow. (Refer to Figure 4)

14.4 Southern Offramps and the Southern Loop Ramps – Culverts

The project includes the construction of two Multiplan culverts crossing the northern watercourse (immediate to the south of the N2) to accommodate the southern off-ramps and southern loop ramps.

15. CONCLUSION AND RECOMMENDATIONS

It is recommended that the contents of this brief report be accepted for the purpose of registering the proposed Redhouse / Chelsea Arterial Road Project as a project at the Department of Economic Development and Environmental Affairs.