



iLifa leMveli leNtshona Koloni
Erfenis Wes-Kaap
Heritage Western Cape

NOTIFICATION OF INTENT TO DEVELOP

Completion of this form is required by Heritage Western Cape for the initiation of all impact assessment processes under Section 38(1) & (8) of the National Heritage Resources Act.

Whilst it is not a requirement, it may expedite processes and in particular avoid calls for additional information if certain of the information required in this form is provided by a heritage specialist/s with the necessary qualifications, skills and experience.

A. BASIC DETAILS

PROPERTY DETAILS:

Name of property:	
Street address or location (eg: off R44): DR 02404, DMA	
Erf or farm number/s:	Coordinates: 23.55'51.96S 31.50'19.68"E (A logical centre point. Format based on WGS84.)
Town or District: Central Karoo	Responsible Municipality: Central Karoo DMA
Extent of property:	Current use: Borrow pits
Predominant land use/s of surrounding properties: Farming	

REGISTERED OWNER OF PROPERTY:

Name 8.5: Road reserve c/o Central Karoo Municipality, 21.3: Marti Hesselink Farm Hartbeesfontein and 29.3 Magda van der Merwe Farm Zwavelkrans Road Reserve c/o Dept Transport and Public Works		
Address Dept. Transport & Public Works: WCPA: P O Box 2603, Cape Town, 8000		
Telephone 021 483 2020	Cell	E-mail quahnita@vidamemoria.co.za
By the submission of this form and all material submitted in support of this notification (ie: 'the material'), all applicant parties acknowledge that they are aware that the material and/or parts thereof will be put to the following uses and consent to such use being made: filing as a public record; presentations to committees, etc; inclusion in databases; inclusion on and downloading from websites; distribution to committee members and other stakeholders and any other use required in terms of powers, functions, duties and responsibilities allocated to Heritage Western Cape under the terms of the National Heritage Resources Act. Should restrictions on such use apply or if it is not possible to copy or lift information from any part of the digital version of the material, the material will be returned unprocessed.		
I confirm that I enclose with this form four hardcopies of all material submitted together with a CD ROM containing digital versions of all of the same.		

Signature of owner or authorised agent
(Agents must attach copy of power of attorney to this form.)

Date 21 / 09 / 2011

DEVELOPMENT DETAILS:

Please indicate below which of the following Sections of the National Heritage Resources Act, or other legislation has triggered the need for notification of intent to develop.

<input type="checkbox"/> S38(1)(a) Construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier over 300m in length.	S38(1)(c) Any development or activity that will change the character of a site -
<input type="checkbox"/> S38(1)(b) Construction of a bridge or similar structure exceeding 50m in length.	<input checked="" type="checkbox"/> (i) exceeding 5 000m ² in extent;
<input type="checkbox"/> S38(1)(d) Rezoning of a site exceeding 10 000m ² in extent.	<input type="checkbox"/> (ii) involving three or more existing erven or subdivisions thereof;
<input checked="" type="checkbox"/> Other triggers, eg: in terms of other legislation, (ie: National Environment Management Act, etc.) Please set out details: Environmental Management Programmes (EMProgs) as called for by the Mineral and Petroleum Resources Development Act (49 of 2008)	<input type="checkbox"/> (iii) involving three or more erven or divisions thereof which have been consolidated within the past five years. If you have checked any of the three boxes above, describe how the proposed development will change the character of the site: Borrow pits are used to obtain material for the maintenance of gravel roads

If an impact assessment process has also been / will be initiated in terms of other legislation please provide the following information:

Authority / government department (ie: consenting authority) to which information has been /will be submitted for final decision: Department of Mineral Resources

Present phase at which the process with that authority stands: Submission of EMProg pending comment from Heritage Western Cape

Provide a full description of the nature and extent of the proposed development or activity including its potential impacts (eg: changes in land use, envisaged timeframes, provision of additional bulk services, excavations, landscaping, total floor area, height of development, etc. etc.): As per the requirements of the Minerals and Petroleum Resources Development Act. all mining activities including extraction of material from borrow pits and quarries requires authorisation from the Department of Mineral Resources. Where the WCPA: Dept Transport and Public Works is undertaking the maintenance and / or upgrading of roads under its control, no application needs to be submitted for a mining right or permit, however, as per the provisions of Section 106(2) of the MPRDA, they are required to prepare and submit an EMProg to DMR for their approval, prior to the extraction of any material from a proposed borrow pit or quarry. According to the MPRDA, mineral resources are in the custodianship of the State, where the WCPA would temporarily acquire the right to mine the borrow pits, subject to approval by the DMR.

Material excavated from the borrow pits will be used for the re-gravelling to portions of road DR 02404 so as to benefit road users in terms of road safety and user economy as well as to minimise maintenance-related disruptions.

The existing borrow pit located in the road reserve at km 8.5 on divisional road DR02404 lies 13 km east-northeast of Murraysburg. Estimated Proven Reserves: ~28 000 m³ over an area of about 500 m

x 20 m wide to a maximum depth of about 2 m utilising 1v:3h cut face slopes. A discontinuous overburden layer consists of organic rich gravelly silty sand with a variable thickness up to about 0,1m in places.

This site is located at km21.3 on DR02404, approximately 20km northeast of Murraysburg. It is an existing borrow pit located on the left (west) of the road, on a gently to moderately southeast-facing slope. Estimated Proven Reserves: ~21 000 m³ over an irregular area of about 200m x 75 m wide to a maximum depth of 2,4 m utilising 1v:3h cut face slopes. An overburden layer consists of organic rich sandy silty gravel with a variable thickness up to about 0,1m in places.

This site is located 26km northeast of Murraysburg, at kilometre 29.3 on DR02404. It is an existing borrow pit which is currently used as a water storage facility due the landowner. The actions proposed herein (the mining of material for the maintenance of DR02404) will result in the enlargement of this feature. Water collected herein will likely be used for the irrigation of crops (e.g.: lucern) planted in fields to the north of the borrow pit. Estimated Proven Reserves: ~15 000 m³ over a triangular area of about 80m x 100 m wide to a maximum depth of about 3,5 m utilising 1v:3h cut face slopes. A topsoil overburden layer of highly organic slightly gravelly silty sand has a variable thickness up to about 0,5 m in places

No new roads would have to be constructed as borrow pits / quarries are accessed either directly off main road. The borrow pits and access tracks would be fenced for the duration of the mining activities. There will be no site buildings located at the borrow pits / quarry sites.

The Central Karoo District Municipality will be undertaking the work on behalf of the WCPA. Formal agreements will be entered into between the landowner and the WCPA and the municipality will manage the site until decommissioning and closure.

B. HERITAGE RESOURCES AND IMPACTS THEREUPON

Section 3 of the National Heritage Resources Act sets out the following categories of heritage resource as forming part of the national estate. Please indicate the known presence of any of these by checking the box alongside and then providing a description of each occurrence, including nature, location, size, type

Failure to provide sufficient detail or to anticipate the likely presence of heritage resources on the site may lead to a request for more detailed specialist information.

(The assistance of relevant heritage professionals is particularly relevant in completing this section.)

Provide a short history of the site and its environs (Include sources where available): Murraysburg was established as a 'kerkdorp' in 1855. The gravel road requiring regravelling forms access road to surrounding properties and does not form a component of the historic development of Murrasburg town

Please indicate which heritage resources exist on the site and in its environs, describe them and indicate the nature of any impact upon them:

<input type="checkbox"/>	<p>Places, buildings, structures and equipment of cultural significance</p> <p>Description of resource:</p> <p>Description of impact on heritage resource:</p>
<input type="checkbox"/>	<p>Places to which oral traditions are attached or which are associated with living heritage</p> <p>Description of resource:</p> <p>Description of impact on heritage resource:</p>

<input type="checkbox"/>	<p>Historical settlements and townscapes</p> <p>Description of resource:</p> <p>Description of impact on heritage resource:</p>
<input type="checkbox"/>	<p>Landscapes and natural features of cultural significance</p> <p>Description of resource:</p> <p>Description of impact on heritage resource:</p>
<input type="checkbox"/>	<p>Geological resources of scientific or cultural importance</p> <p>Description of resource: The geology consists of thickly bedded purple siltstone of the Beaufort Group and mudstone of the Abrahamskraal Formation, Beaufort Group, Karoo Supergroup, which is suitable for use as gravel wearing course used in road construction and maintenance. It is overlain by a thin unit of colluvial wash, which will be replaced during rehabilitation of the site post mining. (Aurecon geological strategic gravel pit summary report, Jan 2011)</p> <p>Description of impact on heritage resource: None</p>
<input type="checkbox"/>	<p>Archaeological resources (including archaeological sites and material, rock art, battlefields & wrecks):</p> <p>Description of resource: Although no sites known close by, sites in the general area suggest that MSA surface artefact scatters are extremely likely to occur. ESA & LSA sites are also a possibility. No studies are known from the immediate vicinity, however the general context is considered to be of high significance based on a desktop study (Manhire & Patrick September 2011) of sites known to exist in the general area.</p> <p>Description of impact on heritage resource:</p>
<input type="checkbox"/>	<p>Palaeontological resources (ie: fossils):</p> <p>Description of resource: Key Geological Units and age are Balfour Formation of Late Permian age with potential palaeontological resources of Diverse terrestrial and freshwater tetrapods of Dicynodon Assemblage Zone (amphibians, true reptiles, synapsids – especially therapsids), palaeoniscoid fish, freshwater bivalves, trace fossils (including tetrapod trackways), sparse vascular plants (Glossopteris Flora, including petrified wood) considered to be of high significance (desktop survey conducted by Dr John Almond, August 2011)</p> <p>Description of impact on heritage resource:</p>
<input type="checkbox"/>	<p>Graves and burial grounds (eg: ancestral graves, graves of victims of conflict, historical graves & cemeteries):</p> <p>Description of Resource:</p> <p>Description of Impact on Heritage Resource:</p>
<input type="checkbox"/>	<p>Other human remains:</p> <p>Description of resource:</p> <p>Description of impact on heritage resource:</p>
<input type="checkbox"/>	<p>Sites of significance relating to the history of slavery in South Africa:</p> <p>Description of resource:</p> <p>Description of impact on heritage resource:</p>
<input type="checkbox"/>	<p>Other heritage resources:</p> <p>Description of resource:</p> <p>Description of impact on heritage resource:</p>

Describe elements in the environs of the site that could be deemed to be heritage resources:
Description of impacts on heritage resources in the environs of the site: None

Summary of anticipated impacts on heritage resources: Sites have been identified as possessing low cultural significance and / or value and proposed expansion of existing borrow pits will result in no impact on heritage resources. Therefore no further studies are required in terms of Section 38. However, sites appear to be of archaeological and palaeontological sensitivity and should any archaeological and / or palaeontological material be discovered during earth moving activities, work should be stopped and HWC notified immediately.

An archaeological scoping fieldwork study and a palaeontological field assessment have been recommended by Patrick and Manhire and Dr John Almond respectively. It is proposed that such assessment be conducted prior to further excavation of Pit located at km 29.3

ILLUSTRATIVE MATERIAL (This form will not be processed unless the following are included):

Attach to this form a minimum A4 sized locality plan showing the boundaries of the area affected by the proposed development, its environs, property boundaries and a scale. The plan must be of a scale and size that is appropriate to creating a clear understanding of the development.

Attach also other relevant graphic material such as maps, site plans, satellite photographs and photographs of the site and the heritage resources on it and in its environs. These are essential to the processing of this notification.

Please provide all graphic material on paper of appropriate size and on CD ROM in JPEG format. It is essential that graphic material be annotated via titles on the photographs, map names and numbers, names of files and/or provision of a numbered list describing what is visible in each image.

C. RECOMMENDATION

In your opinion do you believe that a heritage impact assessment is required? Yes No

Recommendation made by:

Name Quahnita Samie

Capacity Town planner and heritage consultant at vidamemoria heritage consultants

PLEASE NOTE: No Heritage Impact Assessment should be submitted with this form or conducted until Heritage Western Cape has expressed its opinion on the need for such and the nature thereof.

D. INFORMATION TO BE PROVIDED AND STUDIES TO BE CONDUCTED AS PART OF THE HERITAGE IMPACT ASSESSMENT (HIA)

If it is recommended that an HIA is required please complete this section of the form.

DETAILS OF HERITAGE PRACTITIONERS AND SPECIALISTS INTENDING TO CONDUCT THE HIA:

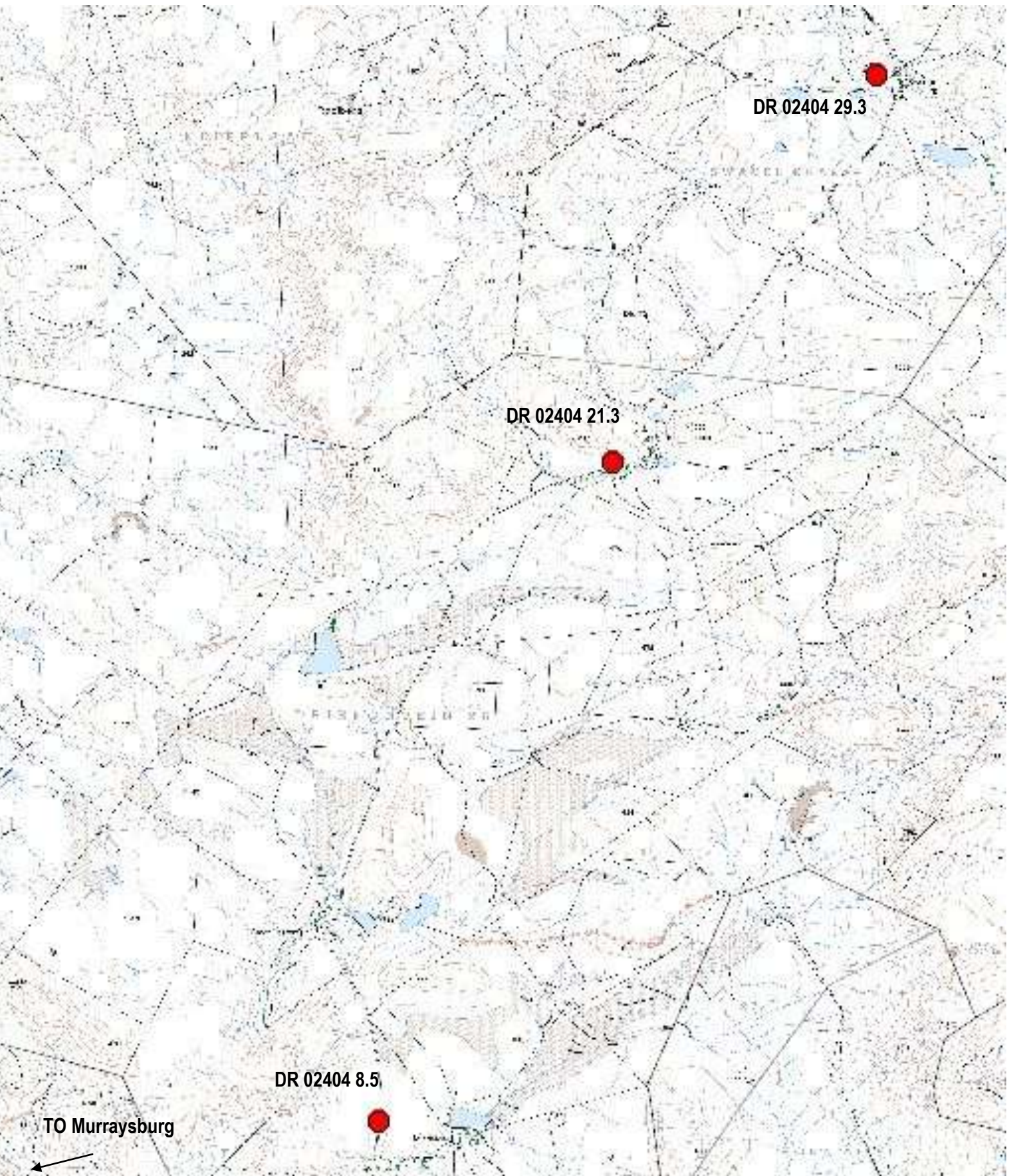
	Name of individual:	Name of Practice:	Area of specialisation:
1.	Qualifications:		
	Experience:		
	Standing in heritage resource management:		
	E-mail Address:	Telephone:	Cell:

2.	Name of individual:	Name of Practice:	Area of specialisation:
	Qualifications:		
	Experience:		
	Standing in heritage resource management:		
	E-mail Address:	Telephone:	Cell:
3.	Name of individual:	Name of Practice:	Area of specialisation:
	Qualifications:		
	Experience:		
	Standing in heritage resource management:		
	E-mail Address:	Telephone:	Cell:
4.	Name of individual:	Name of Practice:	Area of specialisation:
	Qualifications:		
	Experience:		
	Standing in heritage resource management:		
	E-mail Address:	Telephone:	Cell:
5.	Name of individual:	Name of Practice:	Area of specialisation:
	Qualifications:		
	Experience:		
	Standing in heritage resource management:		
	E-mail Address:	Telephone:	Cell:
If this submission is made in terms of Section 38(8) of the National Heritage Resources Act indicate below the particulars of the principle environmental consultant on the project.			
Name of individual:			
Name of Practice:			
Area of specialisation:			
E-mail Address:			
Telephone:			
Cell:			
Postal Address:			

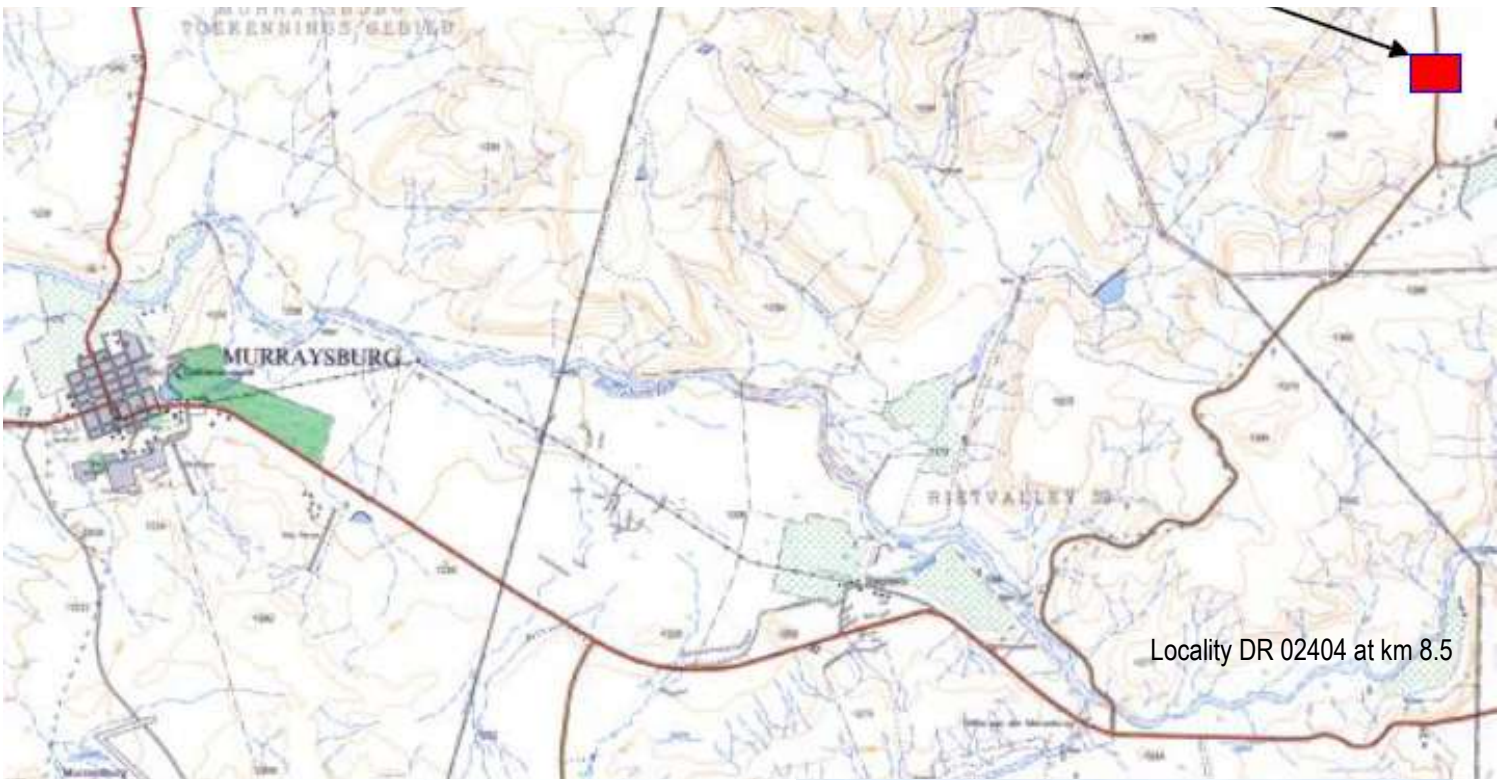
DETAILS OF STUDIES TO BE CONDUCTED IN THE INTENDED HIA

In addition to the requirements set out in Section 38(3) of the NHRA, indicate envisaged studies:	
<input type="checkbox"/>	Heritage resource-related guidelines and policies.
<input type="checkbox"/>	Local authority planning and other laws and policies.
<input type="checkbox"/>	Details of parties, communities, etc. to be consulted.

<input type="checkbox"/>	Specialist studies, eg: archaeology, palaeontology, architecture, townscape, visual impact, etc. Provide details:
<input type="checkbox"/>	Other. Provide details:
PLEASE NOTE: Any further studies which Heritage Western Cape may resolve should be submitted must be in the form of a single, consolidated report with a single set of recommendations. Specialist studies must be incorporated in full, either as chapters of the report, or as annexures thereto.	



Locality plan (1:50 3123 DD Murraysburg)



Locality DR 02404 at km 8.5



Looking east from the western edge of the existing borrow pit, located on either side of DR02404, situated where car is parked (April 2011).



Looking south from western side of existing borrow pit (road is to the left). Purple siltstone is to be mined (April 2011).



Looking southwest across existing borrow pit. Car is parked on DR02404 which runs through the centre of the pit (April 2011).



Ground cover on part of where the proposed pit will expand to. Vegetation consists of Karoo bushes, and there is evidence of small buck in the area (April 2011).

DR 02404 at km 21.3



Looking north from the access point to the existing borrow pit (April 2011). The area in the foreground will fall within the expanded pit.



Looking southeast from northern-western edge of proposed expansion to the pit (April 2011).



Looking southwest across existing pit illustrating the depth of suitable material present (April 2011).



Looking east from the western edge of the proposed expansion (April 2011). DR02404 is located immediately beyond the trees in the background.

DR 02404 at km 29.3



Looking north at existing pit to be expanded (April 2011). The pit holds water during the wet season and has promoted the establishment of bulrushes.



Looking northwest at existing pit to be expanded (April 2011). Cultivated lucerne fields are located to the north of the site.



Looking east at existing site (April 2011). The car in the background is on DR02404.



Looking west at upslope edge of existing pit (April 2011). Runoff water enters the existing pit before being fed to lucerne fields located downslope of the pit.

WESTERN CAPE BORROW PITS – INITIAL PALAEOONTOLOGICAL HERITAGE ASSESSMENT (August 2011 Second tranche)

Dr John E. Almond, *Natura Viva* cc, CAPE TOWN

Borrow pit	Location (DMS)		Key Geological Units & Age	Potential fossil heritage	Palaeontological sensitivity	Recommended mitigation
	East	South				
<p>26</p> <p>Central Karoo DMA DR02404/29.3/0.5L</p> <p>New</p>	23°58'11.28"	31°46'55.56"	<p>Balfour Formation</p> <p>(Lower Beaufort Group, Karoo Supergroup)</p> <p>Late Permian</p>	<p>Diverse terrestrial and freshwater tetrapods of <i>Dicynodon</i> Assemblage Zone (amphibians, true reptiles, synapsids – especially therapsids), palaeoniscoid fish, freshwater bivalves, trace fossils (including tetrapod trackways), sparse vascular plants (<i>Glossopteris</i> Flora, including petrified wood)</p>	HIGH	Palaeontological field assessment before further excavation commences
<p>29</p> <p>Central Karoo DMA DR02404/21.3/0.05L</p> <p>Existing</p>	23°55'51.96"	31°50'19.68"	<p>Balfour Formation</p> <p>(Lower Beaufort Group, Karoo Supergroup)</p> <p>Late Permian</p>	<p>Diverse terrestrial and freshwater tetrapods of <i>Dicynodon</i> Assemblage Zone (amphibians, true reptiles, synapsids – especially therapsids), palaeoniscoid fish, freshwater bivalves, trace fossils (including tetrapod trackways), sparse vascular plants (<i>Glossopteris</i> Flora, including petrified wood)</p>	HIGH	Palaeontological field assessment before further excavation commences
<p>30</p> <p>Central Karoo DMA DR02404/8.5/0LR</p> <p>Existing</p>	23°53'48.48"	31°56'7.80"	<p>Balfour Formation</p> <p>(Lower Beaufort Group, Karoo Supergroup)</p> <p>Late Permian</p>	<p>Diverse terrestrial and freshwater tetrapods of <i>Dicynodon</i> Assemblage Zone (amphibians, true reptiles, synapsids – especially therapsids), palaeoniscoid fish, freshwater bivalves, trace fossils (including tetrapod trackways), sparse vascular plants (<i>Glossopteris</i> Flora, including petrified wood)</p>	HIGH	Palaeontological field assessment before further excavation commences



Enquiries Justin Bradfield

Tel: 021 483 9543

Email: justin.bradfield@pgwc.gov.za

Date: 03/10/2011

Case No: 110928JB23

Auto IDs: 1548 - 1506

INTERIM COMMENT

**In terms of section 38(8) of the National Heritage Resources Act (Act 25 of 1999)
and the Western Cape Provincial Gazette 6061, Notice 298 of 2003**

Attention: Ms Quahnita Samie

Vidamemoria Consultants

P.O. Box 50605

Waterfront 8002

Cape Town

CASE NUMBER: 110928JB23

NID 3 PROPOSED BORROW PITS ALONG THE DR02404

The matter above has reference.

Your NID dated 28 September 2011 was tabled and the following was discussed:

Application is made for the expansion of two existing borrow pits (29.3 & 21.3) and the creation of one new borrow pit (8.5).

A desktop survey identified a high palaeontological and archaeological sensitivity in the area.

A HIA consisting of a palaeontological study and an archaeological study with integrated set of recommendations is required for pits 8.5. and 29.3. No further studies are required for the remaining gravel pit 21.3.

Terms and Conditions:

None

Should you have any further queries, please contact the official above and quote the case number above.

Yours faithfully

Andrew B Hall

Chief Executive Officer

Heritage Western Cape



25 April 2012

Heritage Western Cape

Protea Assurance Building, Greenmarket Square

Cape Town, 8000

For Att: Heritage Resource Management Section c/o Jenna Lavin

Re: Borrow pits for the supply of materials for regravelling: C E N T R A L K A R O O, Western Cape

The subject of the attached heritage impact assessments are the expansion of existing borrow pits, and in certain cases proposed borrow pits, in order to obtain material for the maintenance of gravel roads. Heritage impact assessments have been compiled in response to interim comments as received from Heritage Western Cape. *vidamemoria* has compiled assessments focusing on specialist palaeontological and / or archaeological specialist assessments. Notification as previously submitted to Heritage Western Cape (dated 31 May 2011) and response (dated 20 June 2011) confirmed the approach to be undertaken in submitting borrow pit notifications to Heritage Western Cape.

Dr John Almond has provided specialist paleontological input and Madelon Tunesius in conjunction with Archaeology Contracts Office has provided specialist archaeological input.

Attached please find list of sites outlining specialist assessments conducted and associated recommendations.

Ref	Borrow pit road description	Specialist study conducted	Description	Recommendation
1	Central Karoo Laingsburg DR 01445 2 sites located at km: 13.9 and 17.15	Archaeological and palaeontological	Existing sites to be expanded	Buffer zone of 10m be applied between cemetery and western boundary of the proposed expansion at km 13.9 Fossil material from pit at km 17.15 be recorded and sampled during early stages of excavation
2	Central Karoo Prince Albert DR 01721 1 site located at km 8.4	Archaeological	Existing site to be expanded	No further archaeological studies or mitigation recommended
3	Central Karoo Beaufort West DR 02308 1 site located at km 36.6	Archaeological and palaeontological	Proposed new site	No further palaeontological studies or mitigation recommended Buffer zones of 10m archaeological recommendation with no further archaeological studies or mitigation recommended for this project.
10	Central Karoo DMA DR 02404 2 sites located at km 8.5 and 29.3	Archaeological and palaeontological	Existing sites to be expanded	No further palaeontological or archaeological studies or mitigation recommended

Trust the above is in order. Please do not hesitate to contact our office should you require any further information in this regard.

Yours faithfully

Quahnita Samie for *vidamemoria*



CHECKLIST FOR MATERIALS SUBMITTED IN TERMS OF SECTION 38 OF THE NATIONAL HERITAGE RESOURCES ACT

Completion of this form is required by Heritage Western Cape for submission of all materials associated with applications in terms of Section 38 of the National Heritage Resources Act other than initiation of the process via submission of the Notice of Intent to Develop (NID) form, form HWC 002.

A minimum of four hardcopies and a digital version is required of all material submitted together with checklist. This form should be attached on the outside of the front cover of such documentation.

Has this case previously been before Heritage Western Cape? Yes No

If 'Yes' provide the following information:

Case number stemming from Notification of Intent to Develop (NID) process: **110928JB23**
(Please continue to use this number in all correspondence with regard to this case.)

Date of most recent response: 3 October 2011

If 'No' provide an explanation as to why no NID form has been submitted and/or what the purpose of submission of the accompanying material is:

The material accompanying this form is submitted for the purpose of obtaining:

- Comment or advice on how to proceed in terms of heritage resource management.
- Section 38(3): Details required for a report as requested in terms of Section 38(2).
- Section 38(4): Record of Decision (A decision on a report submitted to HWC where HWC is the decision making Authority.)

- Section 38(8): Comment on Scoping Report in terms of NEMA.
- Section 38(8): Comment on Environmental Impact Report in terms of NEMA.
- Section 38(8): Comment on Environmental Management Plan in terms of MPA.
- Section 38(8): Comment in terms of other legislation. Provide details: Environmental Management Programmes (EMProgs) in terms of the Mineral and Petroleum Resources Development Act (49 of 2008)

The material is submitted for information purposes only with no action required on the part of Heritage Western Cape.

None of the above. Specify

By the submission of this material, clients and all consultants acknowledge that they are aware that the material and/or parts thereof will be put to the following uses and consent to such use being made: Filing as a public record; presentations to committees, etc; inclusion in databases; inclusion on and downloading from websites; distribution to committee members and other stakeholders and any other use required in terms of powers, functions, duties and responsibilities allocated to Heritage Western Cape under the terms of the National Heritage Resources Act. It is further understood that should such restrictions apply or should it not be possible to copy or lift material from any part of the digital version of this material, the material will be returned unprocessed.

I confirm that I enclose with this form four hardcopies of all material submitted together with a CD ROM containing digital versions of all of the same.

Name of person submitting: Quahnita Samie

SIGNATURE _____

DATE: 28 / March /20 12

Methodology for the preparation, operation and closure of borrow pit entails:

Basic methodology for preparation, operation and closure is detailed and should be read in conjunction with the mining plan reflecting final borrow pit layout.

1. Preparation/ Operation

The site preparation for the borrow pits/ quarry would entail the establishment of temporary site infrastructure (where required), including fencing. Wherever possible existing infrastructure or existing borrow pits / quarries and other disturbed areas would be utilised. Site preparation would also involve clearing and removal of topsoil and overburden from the area to be mined.

- Demarcation of mining / expropriated area demarcated with stone beacons
- The perimeter of mining area secured with stock-proof fencing as indicated on mining plan. Proposed new mining area to be secured with a gateway and suitable lock and a key supplied to the landowner upon completion of mining activities
- Access will be via the installed gateway as per the mining plan
- Signage to include heavy vehicle crossing signage, no unauthorised access signs at borrow-pit gate and caution signs erected at regulation distance from the heavy vehicle crossing signs
- All drainage outlets armoured using rock packings where they exit the site
- Clearance of alien vegetation by hand
- Indigenous vegetation and topsoil stockpiles to be created and located in areas indicated on mine plan. Vegetation should be mixed into topsoil stockpiles to provide organic material. Gaps shall be left between stockpiles to facilitate drainage
- Period between stockpiling of topsoil and its utilisation shall be as short as possible, and ideally topsoil should be transferred to its intended site of use immediately following site clearance and stockpiling. This would also avoid double handling
- Ablution and waste facilities will be provided at site entrance, screened with shade cloth. Waste is to be removed off of site to an approved landfill, on a weekly basis
- Dust is to be managed using a water tanker as necessary. No over-watering of the mining area or road surfaces should occur.
- No realignment of services is required
- No special noise management measures are required
- Protection of flora and fauna Indigenous vegetation within the site boundary shall be preserved and not damaged as far as is practical. No domestic animals shall be permitted on site. Fauna disturbed by the mining process on the site are to be carefully and safely removed from the site to an equivalent environment
- All mining activities shall be restricted to within the fenced boundaries of the mining area, and workers and equipment shall be prohibited from undertaking any activities outside of this area
- Should any archaeological and / or palaeontological remains / artefacts be discovered during the course of mining, work shall stop and the area cordoned off until the necessary remedial steps have been implemented as authorisation has been obtained to resume activities
- Special attention should be paid to the risk of veld fires , with standard fire management measures implemented.

2. Mining of material

The borrow pits / quarry would be mechanically mined using excavators and bulldozers to produce gravel suitable for wearing course material. Material from the quarry would be blasted from the work face and then transported to the on-site crusher for processing

before stockpiling. Stockpiled material would be loaded onto the haulage vehicles for transport. Should further processing of the material be required (e.g. breaking down oversize material or blending with plastic fines), it would take place at the mine face or on the road being rehabilitated.

- Material to be mined is gravel road wearing coarse. Material processing requirements are to be implemented as required and approved by an engineer
- Mining shall be undertaken utilising a dozer, and either a front-end loader or tracked excavator to load loosened material
- Mining shall take place by advancing the face away from the existing face towards the proposed limit of mining in order to mix material from the upper and lower portions of the mining face
- Temporary batter boards are to be erected as required as mining proceeds to indicate sideways and downwards limit of mining
- Each successive mined area shall be bound by a temporary vertical slope along its edge with unmined ground and a slope of 1v:3h along its edge (not to be mined)
- Topsoil should only be cleared when the underlying material is required for re-gravelling roads and is to be stockpiled only in the indicated areas, even if the topsoil is only partially cleared.

3. Rehabilitation

For most disturbed areas, landscaping and rehabilitation shall entail the clearing, shaping, trimming and scarification of the area and replacement of the stockpiled topsoil. Rehabilitation can commence as soon as the advancing face and sufficient working/loading area moves away from an area that has been mined out.

- During general site clean up, infrastructure, equipment, plant, fencing, temporary services, foreign materials, rubble and waste shall be removed from the site. Internal access tracks are to be obliterated by breaking the surface crust and scarifying the area to a depth of 250mm and covered with stockpiled topsoil
- Landscaping would entail slopes are to be cut to the final design profile as indicated on the mining plan. Any surplus material should be spread out in designated areas of the pit and used as fill, covering remaining oversize material. The excavation slopes and floor (including previously over-excavated areas) of the borrow pit shall be finished off to create a smooth surface and neat appearance.
- Topsoil stockpiled prior to mining is to be used as topsoil during rehabilitation process.
- Revegetation should focus on the slopes rather than level areas. Alien vegetation should be removed by hand or mechanical means and set aside for use as brush packing. Slopes should be stabilised. No traffic is to be allowed on revegetated areas. Should natural revegetation establishment not commence within 30 days, planting shall be undertaken in consultation with specialist guidance
- Runnels, erosion channels or wash always developing after rehabilitation to be backfilled and consolidated and the areas restored to a proper stable condition. Brush packing can be used in erosion runnels or at drainage outlets.

During decommissioning, the working area will be rehabilitated and revegetated, as per the approach outlined in the mining plan. It is important to recognise that the WCPA's liability for the site persists until such time as a Closure Certificate has been issued by the DMR. Accordingly, once the vegetation has established, a closure report will be submitted to DMR.

HERITAGE IMPACT ASSESSMENT

submitted in terms of section 38(8) of the National Heritage Resources Act

prepared for

AURECON South Africa (Pty) Ltd

25 April 2012

vidamemoria heritage consultants

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CK 2006/049087/23



DR 2404 Central Karoo

Murraysburg – Central Karoo District Municipality, Western Cape

Executive summary

Aurecon South Africa (Pty) Ltd appointed *vidamemoria* to conduct a heritage impact assessment for a expansion of existing borrow pits located along DR02404 at km 8.5 (13 km northeast of Murraysburg) and km 29.3 (28 km northeast of Middelburg) in Central Karoo District Municipality, Western Cape. *vidamemoria* appointed Dr John Almond (Natura Viva CC) to conduct necessary palaeontological specialist study and Madelon Tusenius (Natura Viva CC) to conduct necessary archaeological impact assessment. Heritage impact assessment is submitted for comment in terms of Section 38(8) of the NHRAct as a component of an Environmental Management Programme (EMProg in terms of Mineral and Petroleum Resources Development Act 49 of 2008) to be submitted to the Department of Mineral Resources (DMR).

Due to density of fossil vertebrate and plant material within a small area of bedrock within and around borrow pit site DR02404/8.5/0LR the palaeontological sensitivity is assessed as high. Lower Beaufort mudrocks at km 29.5 are also highly fossiliferous however, fossils here are likely to be very fragmented and dirt-covered following excavation, compared with naturally weathered-out material, reducing the value of scientific collecting. A palaeontologist should thus record and sample fossil material from pit at km 8.5 during the early stages of excavation. Archaeological investigation revealed impact of proposed borrow pit expansion should be very low in terms of archaeological resources. No further specialist palaeontological or archaeological studies are required and expansion should be allowed to proceed.

1. Introduction

Aurecon South Africa (Pty) Ltd on behalf of the WCPA: Department of Transport and Public Works appointed Quahnita Samie (*vidamemoria*) to conduct a Notification of Intent to Develop (NID) application in terms of Section 38(1) of the National Heritage Resources Act (Act 25 of 1999) **to expand existing borrow pits at km 8.5 and 29.3 along DR02404 near Murraysburg**, Central Karoo District Municipality. NID dated 21 September 2011 was submitted to Heritage Western Cape (HWC) for consideration. Response dated 3 October 2011 (**case ref 110928JB23**) requested 'a heritage impact assessment limited an archaeological scoping report and a palaeontological scoping report with an integrated set of recommendations is required' (Refer Annexure A). *vidamemoria* appointed Dr John Almond (Natura Viva CC) to conduct the necessary palaeontological specialist study (dated March 2012) and Madelon Tusenius (Natura Viva CC) to conduct necessary archaeological impact assessment (dated March 2012) under supervision of Dr Lita Webley (ACO Associates) as incorporated within this assessment.

The proposed action triggers Section 38(1) (c)(a) activity that will change the character of a site exceeding 5 000 m². This assessment report is submitted for comment in terms of Section 38(8) of the NHRAct as a component of an Environmental Management Programme (EMProg) in terms of the Mineral and Petroleum Resources Development Act (49 of 2008) to be submitted to the Department of Mineral Resources (DMR). Notification as previously submitted to HWC (dated 31 May 2011) and response (dated 20 June 2011) confirmed the approach to be undertaken in submitting borrow pit notifications to HWC.

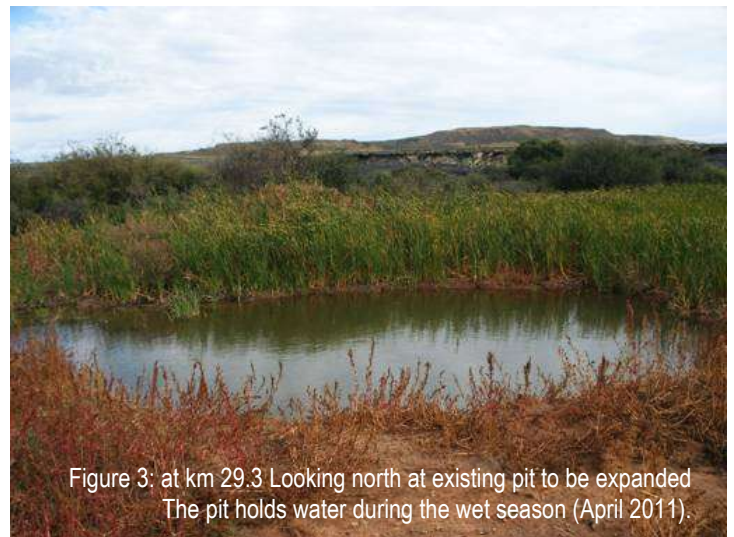
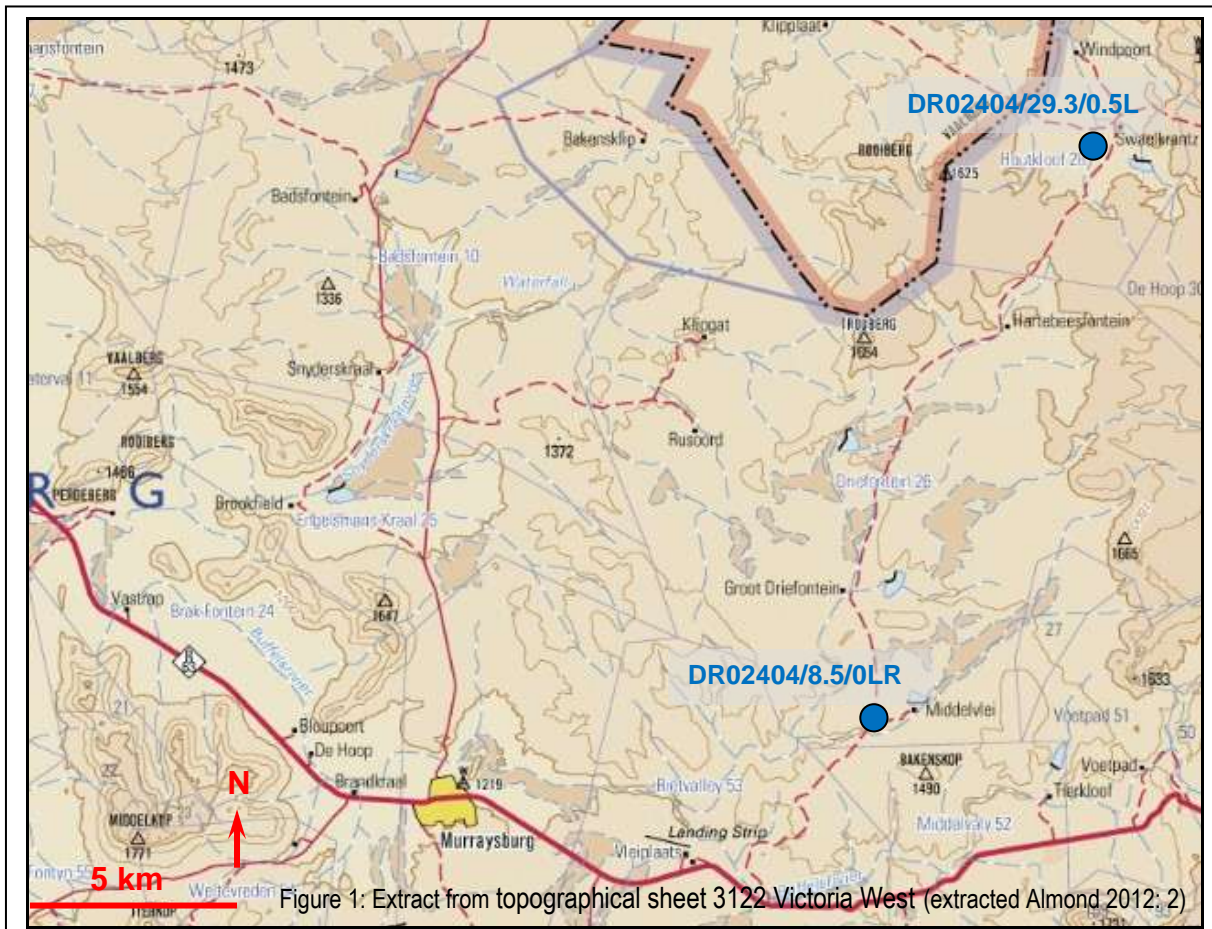
Structure of assessment

Section 1	Introduction provides background, site location, description of proposals and result of consultation	pg 2
Section 2	Identification of heritage resources, assessment of significance and heritage indicators	pg 6
Section 3	Assessment of impacts	pg 7
Section 4	Discussion and recommendations	pg 8
Annexure A	Interim comment from HWC	
Annexure B	Mine plan	
Annexure C	Methodology for the preparation, operation and closure of borrow pit	
Annexure D	Palaeontological specialist study conducted by Dr John Almond, Natura Viva CC (March 2012)	
Annexure E	Archaeological conducted by Madelon Tusenius, Natura Viva CC (March 2012)	

Site location and description

It is proposed to re-excavate and extend two existing borrow pits along DR 2404. The existing DR02404/8.5/0LR borrow pit site is situated on either side of the DR2404 dust road approximately 13 km north east of Murraysburg. The Middelvlei homestead lies about one kilometre to the east. A small stream gully cuts north to south through the pit area on the west side of the road. The site is located within the road reserve but expansion would extend to a portion of land owned by A Koopman and Kobus T. Site co-ordinates at km 8.5 are 31° 56' 7.80" S, 23° 53' 48.48" E. The potential pit is located in the road reserve of road DR2404 where it obliquely surmounts the valley side-slope of a shallow intermittent water course.

Pit DR02404/29.3/0.5L is currently a shallow farm dam located approximately 28 km northeast of Middelburg. Proposed expansion is located in the basin of an off-channel irrigation leidang that lies close to road DR2404. The dam has been filled with sediment from the floodwaters that have entered it via a diversion channel from the main stream that flows a short distance north of the leidang. Farm Zwavelkrans is owned by Mev M vd Merve and sie co-ordinates are 31° 46' 54.71" S, 23° 58' 2.46" E



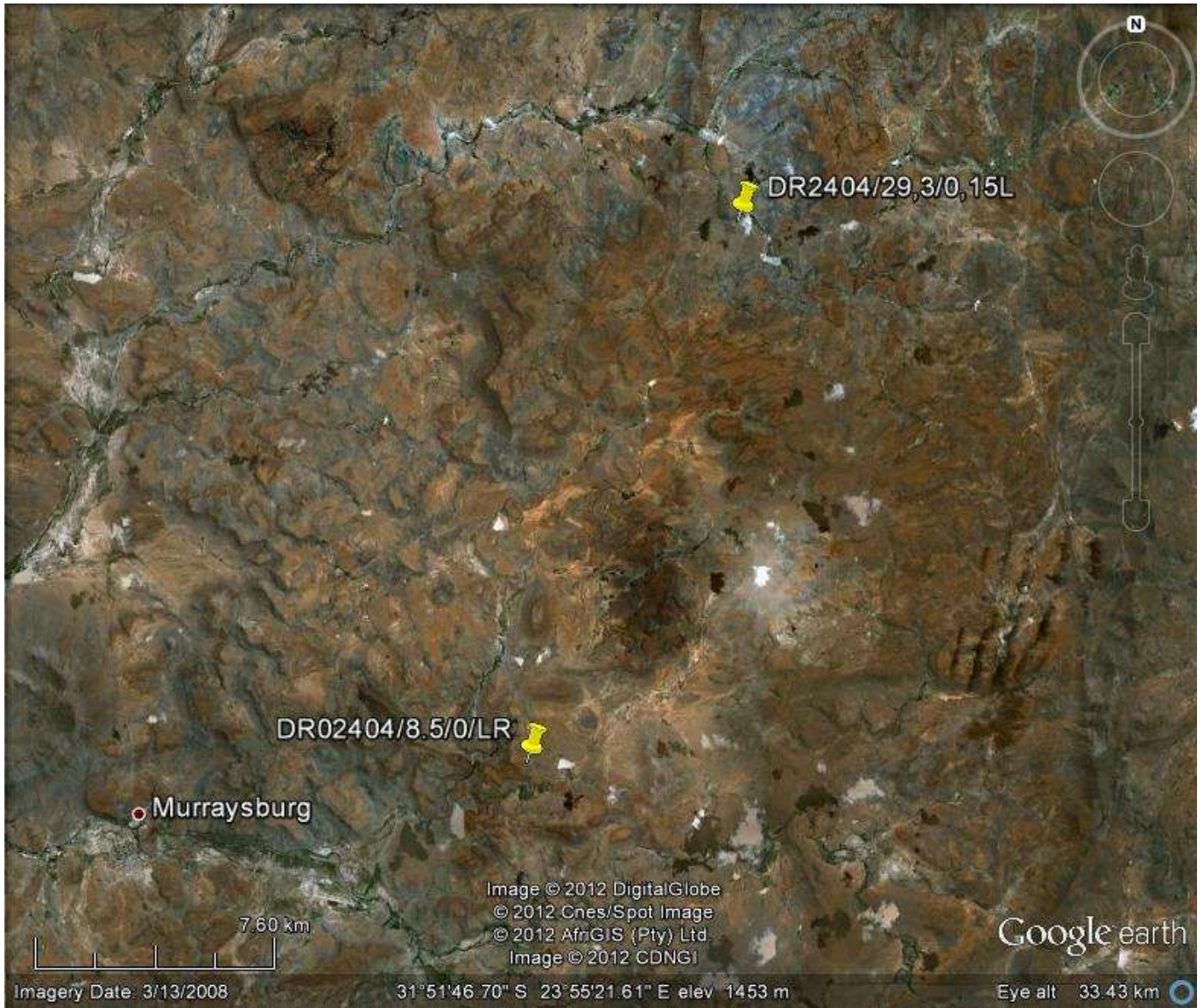


Figure 4: Aerial view of existing borrow pit location (Google earth image, April 2012)



Figure 5: Aerial view of existing borrow pit and expansion site at km 8.5 (Google earth image, April 2012)



Figure 6: Aerial view of existing borrow pit and expansion site at km 29.5 (Google earth image, April 2012)

Description of proposals

In terms of the Minerals and Petroleum Resources Development Act, all mining activities including extraction of material from borrow pits and quarries requires authorisation from the Department of Mineral Resources (DMR). Where the WCPA: Dept Transport and Public Works is undertaking the maintenance and / or upgrading of roads under its control, no application needs to be submitted for a mining right or permit, however, as per provisions of Section 106(2) of the MPRDAct, they are required to prepare and submit an EMProg to DMR for their approval prior to the extraction of any material from a proposed borrow pit or quarry. According to the MPRDAct, mineral resources are in the custodianship of the State, where WCPA would temporarily acquire the right to mine the borrow pits, subject to approval by the DMR.

For a gravel road to be able to carry traffic safely and effectively an upper layer of gravel known as a wearing course, which meets specific technical requirements, has to be placed on the prepared roadbed. With time, the wearing course is eroded away by both traffic and the elements. This wearing course needs to be replaced in order to continue to deliver a safe and functional surface to road users. Implementation of regravelling activities requires extraction of suitable materials from identified material sources. During decommissioning, working areas are rehabilitated and revegetated. Material excavated from borrow pit located at **km 8.5 and 29.3 along DR 2404** will be used for the re-gravelling so as to benefit road users in terms of road safety and user economy as well as to minimise maintenance-related disruptions. The end-use of this borrow pit would be re-vegetation.

Summary of borrow pit		
	at km 8.5	at km 29.3
Borrow pit / expropriation area	10 000 m ²	8 000 m ²
Maximum depth	2 m	3.5 m
Material description	Lower Beaufort mudrocks	Lower Beaufort mudrocks
Proposed usage after rehabilitation	Re-vegetation	Dam
Volume of material to be sourced	35 700 m ³	42 400 m ³

Trial pit investigations and sampling were conducted by Aurecon at four proposed borrow pits considered as potential sources of material. Two were however excluded from consideration due to environmental concerns and / or unsuitability of material for purpose of regravelling.

The mine plan outlining extent of borrow pit and mining is attached as Annexure B. Methodology for the preparation, operation and closure of borrow pit is outlined in Annexure C.

Central Karoo District Municipality is to undertake work on behalf of the WCPA. Formal agreements are to be entered into between the landowner and the WCPA, with the municipality managing the site until decommissioning and closure. During decommissioning, the working area will be rehabilitated and revegetated as per the approach outlined in the mining plan. WCPA's liability for the site persists until such time as a Closure Certificate has been issued by the DMR.

Results of consultation

DMR has outlined requirements for public participation in terms of the Minerals and Petroleum Resources Development Act (Act 28 of 2002) for exempted organs of state. This includes liaison with the landowner, notification of the immediate neighbours and either an on-site advertisement or advertisement in the local newspaper. The WCPA has indicated a commitment to developing and maintaining good relations with landowners and therefore landowners concerns are incorporated into the final agreement.

The public consultation process for this project has involved consultation with the landowners and neighbours, and the advertising of the proposed activity in the local newspaper.

No heritage related comments and / or concerns were received.

Requests / concerns of owner:

- At km 8.5: Road reserve – proposed activities are not anticipated to affect adjacent land owners
- At km 29.3: re-create a working 'leidam' and consideration to be given to environmental and mining regulations

2. Heritage resources

Identification of heritage resources

Proposed site and immediate context do not fall within conservation or protected heritage areas. The site does not fall within a historical settlement or townscape and does not contribute towards rural or natural landscape of cultural significance. The site is therefore not considered as an integral component of the cultural landscape.

Dr John Almond conducted a palaeontological field assessment and provided a report outlining geological context, palaeontological heritage and palaeontological sensitivity. Refer to Annexure D report dated March 2012. Both sites are excavated into mudrocks within the lower part of the Balfour Formation (Lower Beaufort Group / Adelaide Subgroup) of Late Permian age. The fluvial sediments of the Balfour Formation in the Murraysburg area are highly fossiliferous, containing a range of reptiles, therapsids, plants and trace assigned to the *Cistecephalus* Assemblage Zone. During field assessment a substantial number of vertebrate and plant fossil sites were recorded both within and around the margins of the two borrow pit sites.

Madelon Tusenius conducted archaeological field assessment and provided report identifying and assessing archaeological resources, associated impact, assessment of significance and recommendations regarding any mitigation required. Dr L Webley of ACO Associates acted as the Principal Investigator supervising the study done by M Tusenius. No archaeological remains were observed on the ground or in the heaps of stone in the affected area of pit at km 8.5. Sparse surface scatters of LSA artefacts and a few isolated MSA blade fragments were observed in the area of proposed pit at km 29.3. Resources of historical interest were noted close to the affected area - a stone kraal and stone farm buildings which are probably over sixty years old, as well as a cemetery of unmarked farm workers' graves. Cemetery is located beyond fields to the north of proposed extension.

Heritage significance

The context within which the site lies is identified as possessing heritage value. Given the density of fossil vertebrate and plant material within a small area of bedrock within and around borrow pit site DR02404/8.5/0LR, the palaeontological sensitivity of this area is assessed as high. The Lower Beaufort mudrocks in the DR02404/29.3/0.5L borrow pit study area are also highly fossiliferous however, fossils here are likely to be very fragmented and dirt-covered following excavation, compared with naturally weathered-out material, reducing the value of scientific collecting. Further specialist studies or mitigation are not considered warranted at km 29.5 (Almond 2012: 6).

No archaeological remains were observed on the ground or in the heaps of stone in the affected area of pit at km 8.5 and is thus of low archaeological significance. Sparse surface scatters of LSA artefacts and a few isolated MSA blade fragments were observed in the area of proposed pit at km 29.3, however, as material is not in a primary context it is considered to be of low archaeological significance.

Heritage indicators

Landscaping and rehabilitation of the site should commence as soon as advancing face and sufficient working/loading area moves away from an area that has been mined out. Archaeological investigation revealed impact of proposed borrow pit expansion should be very low (Tusenius 2012: 2). Fossil material from pit 8.5 should be recorded and sampled during early stages of excavation (Almond 2012: 14).

3. Assessment of impacts

An assessment of the potential development impacts on significance is undertaken using relevant assessment criteria as well as response to indicators. Assessment of impacts on palaeontological significance has been provided as well as consideration of the cultural landscape and assessment of cumulative impacts.

Cultural landscape: Expansion of existing borrow pit would not result in a negative impact on the cultural landscape. The landscape within which the site lies possesses low intrinsic heritage value and no heritage resources were identified within the immediate context. The site and its immediate context are considered as being of low heritage significance. No heritage resources will be impacted and the overall status of the impact is considered as low.

Archaeological and palaeontological impact: Fossil material from pit at km 8.5 should be recorded and sampled during early stages of excavation. No mitigation measures are to be put in place prior to expansion to protect archaeological resources.

Visual impact: Low intensity visual impact is limited to the immediate surroundings and will be limited to operational phase.

Cumulative impact: The proposed moderate intensity intervention lies within a disturbed context with degraded conditions. No new roads would have to be constructed as the borrow pit is accessed directly off main / divisional roads or via existing access tracks. The borrow pit and access tracks would be fenced for the duration of the mining activities. There will be no site buildings located at the borrow pit site. No long-term traffic increase will be experienced. Low impact is associated with impact of increased personnel and cumulative impacts on borrow pit footprint and surroundings.

Site rehabilitation: It is expected that there should be an acceptable seed bank in the topsoil and this would be kept aside for rehabilitation. Slope changes would be finished off so that flowing curves that blend with the surrounding landscape are formed in preference to sharp angles. Topsoil and vegetation stripped during site clearance would be spread evenly across the borrow pit area. The area excavated as part of previous borrow pit activities would be ripped and also covered with a layer of topsoil. At km 29.5 highly organic topsoil from the leidam should be utilised in places away from the leidam that require topsoil.

Impact relative to sustainable social and economic benefits: The project will result in social and economic benefits for the local community in terms of service provision and employment opportunities.

Overall status of the impact is considered as low.

4. Discussion

During the course of borrow pit excavations, operations should be planned in such a way that the amount of work that will be necessary for the finishing off of the borrow pit is reduced as far as possible. Indiscriminate excavation without due regard for the desired final shape of the borrow pit should not be permitted and should be rectified immediately. Timing of rehabilitation is important as rehabilitation of disturbed areas should ideally be programmed to occur as soon as practically possible following cessation of work in a specific area. The period between cessation of activities associated with mining of materials and the onset of rehabilitation for that area should ideally not exceed 1 month. Rehabilitation operations should ideally be conducted in parallel with extraction. Accordingly, progressive rehabilitation, in which depleted sections of a borrow pit are reclaimed while extraction is ongoing in other sections of the same pit is encouraged.

Site development, operation, mining and closure guidelines outlined with the Environmental Management Programme provides detailed guidance for the preparation, operation and decommissioning of the site. Rehabilitation of old and current working faces has been undertaken to mitigate visual impact to road users. Measures outlined should be adhered to in order to minimise potential negative impacts. It is recommended within the EMProg that an environmental control officer or suitably experienced engineer monitors the preparation, operational and decommissioning of the borrow pit so as to ensure that mitigation and rehabilitation measures are adhered to.

Due to the low significance of the Stone Age archaeological heritage of both study areas, no further archaeological studies or mitigation are recommended. If any human remains are found during the development of the proposed pits, work in that area must cease and the South African Heritage Resources Agency (SAHRA) must be notified immediately (Tusenius (2012: 14). Archaeological investigation revealed impact of proposed borrow pit expansion should be very low (Tusenius 2012: 2).

The context within which the site lies is identified as possessing heritage value. Given the density of fossil vertebrate and plant material within a small area of bedrock within and around borrow pit site DR02404/8.5/0LR, the palaeontological sensitivity of this area is assessed as high and fossil material from pit 8.5 should be recorded and sampled during early stages of excavation (Almond 2012: 14).

Landscaping and rehabilitation of the site should commence as soon as advancing face and sufficient working/loading area moves away from an area that has been mined out. Overall status of the impact is considered as low.

Recommendations

It is therefore recommended that:

1. expansion of exiting borrow pits be supported
2. comment be issued that proposed activity may proceed in terms of Section 38(8) of the NHRAct

References:

- Almond John E PhD (March 2012): *Palaeontological specialist study: field assessment & recommendation for exemption from further studies & mitigation*
- ASAPA Aggregate and Sand Producers Association of Southern Africa (30 September 2009): *The issue of borrow pits being used in the aggregate and sand industry* accessed online
- Aurecon / Nadeson JV (July 2011): *Draft environmental management programme, summary report and mine plan*
- Galliers R M (July 2011): *Geotechnical investigations and geological strategic gravel pit summary report* for Aurecon South Africa
- Heritage Western Cape (July 2007): *Minimum Standards For Phase 1 Archaeological Impact Assessment (Aia) Reports*
- Tusenius M (March 2012): *Archaeological impact assessment*
- vidamemoria (September 2011): *Notification of Intent to Develop*

**ARCHAEOLOGICAL IMPACT ASSESSMENT
OF TWO PROPOSED BORROW PITS
NEAR MURRAYSBURG, CENTRAL KAROO DMA,
WESTERN CAPE**

(Assessment conducted under Section 38 (8) of the National Heritage Resources Act as part
of a Heritage Impact Assessment)

Prepared for:

Vidamemoria Heritage Consultants
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E-mail: quahnita@vidamemoria.co.za

On behalf of:

Aurecon South Africa (Pty) Ltd

Prepared by:
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Under the supervision of: Dr Lita Webley, ACO Associates

MARCH 2012

EXECUTIVE SUMMARY

Natura Viva cc was appointed by Vidamemoria Heritage Consultants on behalf of Aurecon South Africa (Pty) Ltd to undertake an Archaeological Impact Assessment (AIA) for the proposed extension of an existing borrow pit, DR2404/8.5/0LR (Vidamemoria pit no. 30), and the development of a new one, DR2404/29.3/0.05L (Vidamemoria pit no. 26), in the Murraysburg region of the Central Karoo DMA. Material excavated from the pits will be used for re-gravelling portions of the DR02404. The worked-out area of pit 30 will be rehabilitated whereas that of pit 26 will be added to the existing irrigation dam.

This study forms part of the Heritage Impact Assessment triggered by the development. The brief for the study was a field visit and short report identifying and assessing archaeological resources and any impact on them, an assessment of significance and recommendations regarding any mitigation required. Dr L Webley of ACO Associates acted as the Principal Investigator supervising the study done by M Tusenius of Natura Viva cc. The field assessment was conducted on foot on 16 February 2012.

No archaeological remains were observed on the ground or in the heaps of stone in the affected area of pit 30 and no impact on archaeological heritage resources is expected if expansion of the existing pit proceeds. Pit 30 is thus of low archaeological significance.

No dolerite boulders suitable for rock engravings were found in or near the affected areas of both pits 30 and 26.

Sparse surface scatters of LSA artefacts and a few isolated MSA blade fragments were observed in the area of proposed pit 26. As the material is not in a primary context it is considered to be of low archaeological significance. The main scatter of stone artefacts in fact lies outside the study area so no direct impact is expected.

Resources of historical interest were noted close to the affected area - a stone kraal and stone farm buildings which are probably over sixty years old, as well as a cemetery of unmarked farm workers' graves. The cemetery is located beyond cultivated fields to the north of the proposed extension and will not be affected by the development. The probable heavy vehicle traffic along the DR 2404 may however have an impact on the stone kraal and old farm buildings.

Due to the low significance of the Stone Age archaeological heritage of both study areas, no further archaeological studies or mitigation are recommended.

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1. INTRODUCTION

Natura Viva cc was appointed by Vidamemoria Heritage Consultants on behalf of Aurecon South Africa (Pty) Ltd to undertake an Archaeological Impact Assessment (AIA) for the proposed extension of an existing borrow pit DR2404/8.5/0LR (Vidamemoria pit no. 30), and the development of a new pit, DR2404/29.3/0.05L (Vidamemoria pit no. 26), in the Murraysburg region of the Central Karoo DMA (Figure 1). Pit 30 lies 13 km east-northeast of Murraysburg and Pit 26 is located approximately 27 km to the northeast of the town. Material excavated from the pits will be used for re-gravelling portions of the DR02404. The worked-out area of pit 30 will be rehabilitated whereas that of pit 26 will be added to the existing irrigation dam.



Figure 1: Google earth image showing the location of the proposed extensions of two existing borrow pits DR2404/8.5/0LR (Vidamemoria pit no. 30) and DR2404/29.3/0.05L (Vidamemoria pit no. 26). The distance between the pits and Murraysburg is approximately 13 and 27 km respectively. The relevant 1:50 000 topographical map is 3123DD Murraysburg.

2. LEGAL FRAMEWORK

Section 38 of the National Heritage Resources Act (Act 25 of 1999) is triggered by certain types of development, including changes of character to an area exceeding 5 000m², and makes provision for compulsory Heritage Impact Assessments to assess the potential impacts of such proposed developments on heritage resources. In terms of Section 38(1), a Notification of Intent to Develop (NID) form was submitted to Heritage Western Cape (HWC) by Vidamemoria. Following comment from HWC (case number 110928JB23) an AIA was included amongst the requirements according to Section 38(8) of the Act.

3. TERMS OF REFERENCE

The terms of reference for the AIA stipulated a field visit to locate and map archaeological resources, a short report dealing with the field observations, an assessment regarding the significance of the resources (in the context of other studies in the area) and any impacts on them, as well as recommendations regarding any mitigation required. The report was to be overseen by Dr Lita Webley of ACO Associates as the Principal Investigator.

4. STUDY APPROACH

4.1 Methods

Fieldwork for both pits was undertaken by the author on 16 February 2012. Site plans indicating the affected areas were provided by Aurecon for the Phase 1 survey. Each area was covered on foot and archaeological occurrences and tracks were recorded by a Garmin GPSMAP 60CSx set on the WGS84 datum (Figures 2 & 9). Both sites were extensively photographed.

4.2 Limiting factors

Visibility of archaeological remains on the ground was variable in both cases, with conditions ranging from good, where the vegetation was sparse, to poor where it was more dense. Apparently the Murraysburg region had recently had good rain so the vegetation was generally green and more abundant than usual. Where visibility was a problem, specific mention is made of it.

5. DESCRIPTION OF AFFECTED ENVIRONMENT AND SITES

5.1 Archaeological background:

With the notable exception of the research done by Sampson in the Seacow Valley (1985), the rich archaeological heritage of the Karoo has not been systematically studied. Almost no Archaeological Impact Assessments have been carried out in the vicinity of Murraysburg but

data from work done near Beaufort West and Three Sisters, approximately 120 km to the southwest and 65 km to the west respectively, is relevant. This includes studies undertaken by Deacon (2007), Kaplan (2002, 2006), Nilssen (2011), Orton (2010) and PGS (2012). Sites and scatters of Early, Middle and Late Stone Age (ESA, MSA and LSA) material have been recorded, as well as pastoralist occurrences, historical sites, rock paintings and engravings. A well-known concentration of rock engravings is that of the Nelspoort area, approximately 73 km to the southwest of Murraysburg.

The only archaeological impact assessment that I am aware of in the immediate vicinity of the pits under consideration is Kaplan's 2007 assessment of borrow pits to the south and west of Murraysburg. In his study he identified archaeological remains of varying density. Of the 21 pits surveyed, only two (BP20 and 31) had archaeological remains of any significance. Relatively large numbers of LSA and some MSA tools were recorded and, in the case of BP31, also rock engravings and one (or possibly three) graves. Isolated flaked material was found at 11 of the other sites and no archaeological remains were found at the remaining 8 pits. The survey done by Van Schalkwyk & Wahl (2007) along the Gamma Grassridge powerline, located in a strip approximately 26 km to the west of Murraysburg, failed to reveal any archaeological material on this stretch of the line.

5.2 Borrow pit DR2404/8.5/0LR (Vidamemoria pit no. 30)

Approximate area: 500 m x 20 m

Location: S 31° 56' 7.8" E 23° 53' 48"

Farm name and number: Road reserve on Driefontein 26

Environment: This potential borrow pit extension is located in the unusually wide road reserve on either side of the DR02404 which runs in a north-south direction along this stretch of the road (Figure 2). Existing fences form the boundaries to the east and west of the road; the site plan was used to determine the northern and southern boundaries of the affected area. The existing pit lies on the eastern side of the road (Figures 3 and 4) and the western side contains a large erosion gully /donga (Figures 5 and 6). The terrain on both sides slopes gently to the south and has been disturbed by erosion and water run-off. There are signs of digging of various sorts – the geotechnical test pits, animal burrows (west side) and possibly for a pipeline (east side). The terrain is generally rocky with a surface of gravelly silty sand of variable thickness overlying the weathered Beaufort Group siltstone which is clearly visible in the existing quarry. The Beaufort Group rocks are overlain by dolerite from which the surrounding red soils have been derived. Slabs of sandstone and dolerite scree are scattered over the surface (Figure 7) and some larger sandstone boulders occur (Figure 8). Archaeological visibility varied across the study area -it was good in the areas between low karoo bushes, e.g. ankerkarroo (*Pentzia incana*,) and a light covering of grass, but not in depressions where water collects and taller shrubs and grass grow (Figures 4 and 8).



Figure 2: Google earth image showing the proposed extension of the existing borrow pit 30 and tracks of the field survey. The existing quarry lies to the east of the road and the donga is located on the western side.



Figures 3 and 4: Pit 30 – view of the eastern side of the study area showing the existing quarry with exposed Beaufort Group siltstone (view towards the south) and disturbance caused by water erosion (view towards the north). The existing quarry lies towards the top of the slope in the photo to the right.



Figures 5 and 6: Pit 30 – views of the erosion gully on the western side of the road, looking towards the west and the northeast respectively.



Figures 7 and 8: Pit 30 – views towards the north showing differing archaeological visibility across the study area: sparse vegetation and blocks of sandstone and dolerite scree; dense vegetation and large boulders.

Results of survey: Both sides of the road were surveyed and no archaeological remains were observed. Several heaps of stone used for anti-erosion purposes were examined and no artefacts were found. Due to the very disturbed nature of the terrain, any artefacts found would not have been in a primary context. One would expect to see the occasional flaked piece of stone washed into the study area if there were archaeological remains in the immediate vicinity. No dolerite boulders suitable for rock engravings were found in or near the affected area.

5.3 Borrow pit DR2404/29.3/0.05L (Vidamemoria pit no. 26)

Approximate area: 80 m x 100 m

Location: S 31° 46' 54.71" E 23° 58' 2.46"

Farm name and number: Zwavelkrans (Swavel Kranse 28)

Environment: The proposed pit is located in the basin of an irrigation dam that lies close to cultivated land to the west of the DR02404 and the Zwavelkrans farm buildings (Figures 9 and 10). According to the site plan, the pit could be extended towards an adjoining dam to the east (Figure 12). The generally flat-lying proposed area is bounded by a fence to the north and east, the access track on the south and by the dam wall to the west. The area of the dam, empty of water at present, is obviously disturbed but the raised area to the west of it appears to be relatively undisturbed as it is vegetated by a variety of karoo bushes. Archaeological visibility was generally good in this western part of the affected area, but poor in the eastern part where the full dam is surrounded by dense vegetation. Not much of this latter area could be surveyed.



Figure 9: Google earth image showing the affected area of the proposed borrow pit 26, the tracks of the field survey and the cemetery of farm workers' graves approximately 200 m to the north at waypoint 338/9.



Figure 10: Historical Google earth image which provides a better view of the affected area of pit 26 and the location of the farm buildings to the east.



Figure 11: Pit 26 – view towards the east of the proposed pit which would be located in the basin of the existing irrigation dam. The farm buildings and stone kraal are located behind the tall trees and ridge in the back right corner of the photo.



Figures 12 and 13: Pit 26 – view towards the east of the eastern part of the affected area which mainly consists of a dam filled with water and dense vegetation surrounding it; view towards the north taken from the undisturbed terrain beyond the western extent of pit 26. The windpump close to the cemetery lies approximately 200 m to the north of the pit.

Results of survey: The affected area and some of the surrounding ground was surveyed. Sparse surface scatters of LSA artefacts and a few isolated MSA blade fragments were observed, mainly outside the affected area of the proposed pit (See Table 1 in the Appendix and Figures 16 - 21). It is probable that these are not in a primary context as there is evidence of sheet wash throughout the area. The MSA material was very weathered and patinated in comparison with the fresher-looking hornfels of the LSA artefacts. A few quartzite flakes of indeterminate age were also found (Figure 19). No dolerite boulders suitable for rock engravings were found in or near the affected area.

Various relatively modern structures concerned with the management of water were observed. These ranged from lines, several meters in length, of heaped-up stones to prevent erosion outside of and within the basin of the western dam (Figure 22), to brick structures to the west of it. A possible foundation wall of a building was observed in a dense patch of *Diospyros* sp. just northwest of the dam wall and close to the northern fence (Figure 23).

Some historical background to the farm was provided by Mr Martin Hesselink of Hartbeesfontein, the neighbouring farm. This included the information that several upright stones observed (Figure 15) were fence posts which had marked one of the earlier roads to the northern Cape, and that some of the farm buildings were in existence at the time of the Anglo-Boer war. The heap of bricks noted (Figures 15, 24 and 25) was probably the remains of brick-making activities of 50 to 80 years ago.

Resources of historical interest were noted outside the affected area, namely: a stone kraal and stone farm buildings which are over sixty years old (Figures 26 and 27). Mr Martin Hesselink of the neighbouring farm informed us about a cemetery of unmarked farm workers' graves beyond the agricultural fields to the north of the proposed pit site. An inspection of the cemetery, located close to the water pump approximately 200 m north of the dam, revealed at least 17 graves marked by heaps of stone with or without headstones (Figure 29).



Figures 14 and 15: Pit 26 – view to the west showing typical scatters of flaked and unflaked stone to the west of the affected area; view to the east showing part of the heap of abandoned bricks in the foreground and two of several stone fence posts to the right.



Figures 16, 17 and 18: Pit 26 – selection of hornfels LSA artefacts including a bladelet core and chunk from waypoint 331 and a circular, retouched piece from the scatter of material to the west of the study area. The scale is in cm.



Figures 19, 20 and 21: Pit 26 – hornfels and quartzite flakes from the scatter to the west of the dam; one of the snapped MSA blades to the left in the middle photo; snapped, weathered MSA blade found at waypoint 337. The scale is in c



Figures 22 and 23: Pit 26 – view to the north of a typical line of heaped stone to prevent erosion; possible stone foundation wall to the northwest of the dam wall.



Figures 24 and 25: Pit 26 – the remains of brick-making 50 to 80 years ago. The ruler is 15 cm in length.



Figures 26 and 27: A couple of the stone farm buildings at Zwavelkrans at least 130 m to the east of the proposed pit.



Figures 28 and 29: View of the stone kraal to the east of the DR02404; a few of the unmarked farm workers' graves at the cemetery to the north of the affected area.

6. SIGNIFICANCE AND RECOMMENDATIONS

No archaeological or historical remains were observed in the affected area of pit 30 and no impact on archaeological heritage resources is expected if expansion of the existing pit proceeds.

No dolerite boulders suitable for rock engravings were found in or near the affected areas of both pits 30 and 26.

The LSA and MSA material observed in the affected area of pit 26 is of low archaeological significance as it is not in a primary context – it has been washed into the low-lying area to the west of the dam wall. The main scatter is in fact outside the area which will be excavated for gravel so no direct impact is expected.

The cemetery with unmarked graves is located beyond cultivated fields to the north of the proposed extension of pit 26 and will not be affected by the development. The probable heavy vehicle traffic along the DR 2404 may however have an impact on the stone kraal and old farm buildings.

Due to the low significance of the Stone Age archaeological heritage of both study areas, no further archaeological studies or mitigation are recommended.

If any human remains are found during the development of the proposed pits, work in that area must cease and the South African Heritage Resources Agency (SAHRA) must be notified immediately.

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8. ACKNOWLEDGEMENTS

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9. APPENDIX

Table 1: Pit 26 waypoints

Waypoint (MT)	South	East	Description of material found
331	31 46 55.0	23 58 00.9	Isolated hornfels core and chunk (Figure 16)
332	31 46 54.2	23 57 58.8	Scatter of artefacts including mainly hornfels LSA flakes & chunks, quartzite flakes, weathered MSA flakes/snapped blades, (Figures 14, 17, 18, 19, 20)
333	31 46 55.4	23 57 55.8	Approximate western extent of artefact scatter
334	31 46 54.7	23 57 59.3	Approximate southeastern extent of artefact scatter
335	31 46 53.6	23 58 00.6	Possible stone foundation wall (Figure 23)
336	31 46 55.8	23 58 04.5	Heap of bricks, probably dating 50 to 80 years ago (Figures 15, 24, 25)
337	31 46 51.2	23 50 11.7	Single snapped MSA blade
338=339	31 46 47.3	23 57 57.6	Cemetery of unmarked workers' graves (Figure 29)

PALAEONTOLOGICAL SPECIALIST STUDY: FIELD ASSESSMENT

TWO BORROW PIT SITES NEAR MURRAYSBURG, CENTRAL KAROO DISTRICT MUNICIPALITY, WESTERN CAPE

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1. EXECUTIVE SUMMARY

It is proposed to develop two borrow pit situated to the northeast of Murraysburg, Central Karoo District Municipality, Western Cape, for road material. Borrow pit sites DR02404/8.5/0LR near Middelvlei and DR02404/29.3/0.5L near Swaelkranz to the northeast of Murraysburg are both excavated into mudrocks within the lower part of the Balfour Formation (Lower Beaufort Group / Adelaide Subgroup) of Late Permian age. The fluvial sediments of the Balfour Formation in the Murraysburg area are highly fossiliferous, containing a range of reptiles, therapsids ("mammal-like reptiles"), plants and trace fossils (including large vertebrate burrows) that are assigned to the *Cistecephalus* Assemblage Zone. During field assessment a substantial number of vertebrate and plant fossil sites were recorded both within and around the margins of the two borrow pit sites.

Given the density of fossil vertebrate and plant material (including therapsid skull material) within a small area of bedrock within and around borrow pit site DR02404/8.5/0LR, the palaeontological sensitivity of this area is assessed as HIGH. It is recommended that the more scientifically valuable fossils already exposed in the pit area (e.g. cranial material) are fully recorded and collected by a professional palaeontologist *before* further excavation takes place.

The Lower Beaufort mudrocks in the DR02404/29.3/0.5L borrow pit study area are also highly fossiliferous (*i.e.* HIGH palaeontological sensitivity) but the fossil sites currently exposed lie outside the area proposed for exploitation. Fossil remains will undoubtedly be exposed, damaged and destroyed by excavation within the proposed pit area. However, the fossils here are likely to be very fragmented and dirt-covered following excavation, compared with naturally weathered-out material, reducing the value of scientific collecting. Further specialist studies or mitigation are not considered warranted in this case.

2. INTRODUCTION

The Department of Transport, Western Cape, is applying to the Department of Mineral Resources for approval to exploit road material from two borrow pit sites situated along the DR2404 to the northeast of Murraysburg, Central Karoo District Municipality, Western Cape. The existing pit DR02404/8.5/0LR (31° 56' 7.80" S, 23° 53' 48.48" E) lies either side of the road one kilometre east of Middelvlei farmstead and 13 km ENE of Murraysburg. Pit locality DR02404/29.3/0.5L (31° 46' 54.71" S, 23° 58' 2.46" E), currently a shallow farm dam, is located about half a kilometre west of the historical Swaelkranz homestead and 28 km northeast of Middelburg (Fig. 1).

A previous desktop basic assessment of the pit sites by the author assessed their palaeontological heritage sensitivity as high due to the presence here of potentially fossiliferous sediments of the Lower Beaufort Group. A palaeontological field assessment of the two pits as part of an HIA was requested by Heritage Western Cape (HWC case ref. no. 110928JB27, Interim comment 3

October 2011) in accordance with the requirements of the National Heritage Resources Act, 1999 (Section 38).

The present palaeontological heritage field assessment and short report were accordingly commissioned by Vidamemoria Heritage Consultants, Cape Town (Address: 3rd Floor, Guarantee House, 37 Burg Street, Greenmarket Square, Cape Town; tel: 021-424 8432; e-mail: Quahnita@vidamemoria.co.za). These are Vidamemoria pit nos. 26 and 30 and NID ref. no. 10. Fieldwork for this project was carried out on 16 February 2012.



Fig. 1. Extract from topographical sheet 3122 Victoria West (Courtesy of the Chief Directorate: National Geo-spatial Information, Mowbray) showing the location of the two borrow pits DR02404/8.5/0LR near Middelvlei and DR02404/29.3/0.5L near Swaelkranz to the northeast of Murraysburg, Central Karoo District Municipality, Western Cape (blue dots).

3. GEOLOGICAL CONTEXT

The geology of the study area near Murraysburg is outlined on the 1: 250 000 geology sheet 3122 Victoria West (Le Roux & Keyser 1988) (Fig. 2). The area is largely underlain by Late Permian continental sediments of the **Lower Beaufort Group** (Adelaide Subgroup, Karoo Supergroup). A useful overview of this internationally famous rock succession has been given by Johnson *et al.* (2006). The bedrocks in the study area are assigned to the **Balfour Formation (Pb)** of Late Permian age, and in particular to the c. 70 m-thick sandstone-rich basal subunit known as the **Oudeberg Member** (= “Richmond Sandstone” of Le Roux and Keyser 1988). This member is characterised by pale yellow to greyish, medium-grained multi-storey channel sandstones, often with basal mud clast conglomerates, that are interbedded with grey-green to purple-brown overbank mudrocks. The sandstone component decreases in importance towards the north,

grading laterally into thinly-interbedded mudrock and sandstone horizons. Bedding dips are not indicated on the Victoria West sheet, suggesting that the Beaufort Group succession is largely flat-lying and undeformed. However, these Permian sediments are extensively intruded and thermally metamorphosed (baked) by sills and dykes of the Early Jurassic **Karoo Dolerite Suite (Jd)**.

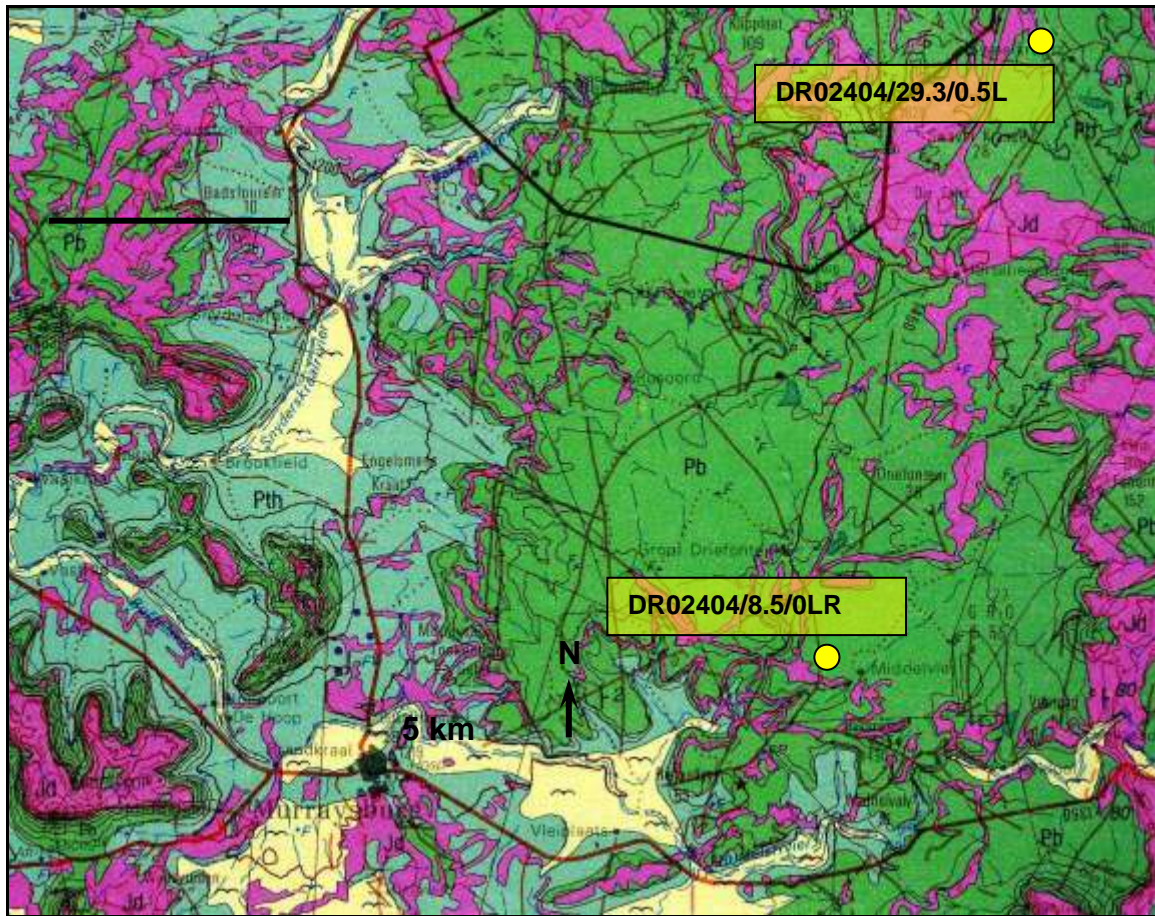


Fig. 2. Extract from 1: 250 000 geology sheet 3122 Victoria West (Council for Geoscience, Pretoria) showing the locations of the two borrow pits DR02404/8.5/0LR near Middelvlei and DR02404/29.3/0.5L near Swaelkranz to the northeast of Murraysburg, Central Karoo District Municipality, Western Cape (yellow dots). Both pit sites are underlain by mudrocks in the lower part of the Balfour Formation (Adelaide Subgroup, Lower Beaufort Group) (Pb, green). The Beaufort Group rocks in this area are extensively intruded by Early Jurassic dolerites of the Karoo Dolerite Suite (Jd, pink).

3.1. DR02404/8.5/0LR borrow pit site

The existing DR02404/8.5/0LR borrow pit site is situated on either side of the DR2404 dust road at c. 1360 m amsl and 13 km ENE of Murraysburg. The Middelvlei homestead lies about one kilometre to the east. A small stream gully cuts north to south through the pit area on the west side of the road.

The Lower Beaufort succession exposed on the pit floor east of the road mainly comprises purple-brown, well-consolidated siltstones with horizons of rusty-weathering pedogenic calcrete nodules associated with scattered fossil bones (Fig. 4; Section 4.1). The siltstones are overlain by purplish, hackly-weathering mudrocks capped by a multi-storey channel sandstones (Fig. 3). The latter are variously flaggy to cross-bedded and ripple cross-laminated, and contain concentrations of transported plant material. On the west side of the road the Beaufort Group sediments are mantled by a thick layer of gravelly alluvium and soils, incised by the modern stream gully here (Fig. 5). The edge of a dolerite intrusion and adjacent baked Beaufort rocks are exposed in the stream bed on the south-western side of the study area.



Fig. 3. Purplish-brown mudrocks and overlying channel sandstones (on the horizon) exposed on the south-eastern side of borrow pit site DR02404/8.5/0LR.



Fig. 4. Purplish siltstones exposed on the floor of borrow pit site DR02404/8.5/0LR, looking towards the northwest. A partially-exposed fossil specimen is arrowed.



Fig. 5. Contact between a dolerite intrusion (rusty brown) and adjacent baked Beaufort Group sediments (grey-green) in the south-western portion of the study area. The bedrocks are mantled with well-bedded, fine gravelly alluvium here.

3.2. DR02404/29.3/0.5L borrow pit site

The DR02404/29.3/0.5L borrow pit site is located about half a kilometre west of the historical Swaelkranz homestead and 28 km northeast of Middelburg. The site is an extensive shallow dam lying at c. 1450 m amsl on the southern side of a channel bend in a NW-flowing tributary of the Bakenskliprivier. Exposure of Beaufort Group sediments within the dam area is generally poor, since they are covered with fine alluvium and a sparse veneer of sheetwash gravels (dolerite, hornfels, sandstone) (Fig. 6). However, there are excellent Beaufort Group sandstone and mudrock exposures along a low, sandstone-capped ridge running south of an irrigation furrow along the southern side of the study area, as well as on the north side of the river. Both these areas were inspected for fossil remains in order to assess the palaeontological sensitivity of the proposed borrow pit site. A densely vegetated area just east of dam site may also be exploited for road material but here the Beaufort bedrocks are deeply buried beneath muddy alluvium and spring sediments (Mr M. Hesselink, pers. comm.).

The low ridge to the south of the study area is capped by a c. 1.5 m thick channel sandstone showing cross-bedding, subordinate channels, ripple cross-lamination and other sedimentary features (Figs. 7, 8). The sole of the sandstone body often features a well-developed ferruginous basal conglomerate dominated by reworked calcrete glaebules with occasional fragments of fossil bone. The underlying grey-green mudrocks contain several horizons of pedogenic calcrete nodules, some of which are richly fossiliferous (Fig. 15).



Fig. 6. View south-eastwards across borrow pit site DR02404/29.3/0.5L showing mantle of fine-grained alluvium and sheetwash gravels in the dam area in the foreground and the low sandstone-capped ridge towards the south where several fossil sites are located.



Fig. 7. View along the sandstone-capped ridge showing good exposure of fossiliferous Lower Beaufort mudrocks just south of the DR02404/29.3/0.5L borrow pit study area.



Fig. 8. Pinkish-brown, speckled lens of calcrete conglomerate at the base of the channel sandstone shown in the previous photograph (Hammer = 32 cm). These basal conglomerates often contain rolled fossil bone fragments.

4. PALAEOLOGICAL HERITAGE

The sandstone-rich Oudeberg Member of the Balfour Formation is characterised by fossil tetrapods of the *Cistecephalus* Assemblage Zone (= upper *Cistecephalus* Biozone or *Aulacephalodon-Cistecephalus* Assemblage Zone of earlier authors). The following major categories of fossils might be expected within *Cistecephalus* AZ sediments in the study area (Kitching 1977, Keyser & Smith 1977-78, Anderson & Anderson 1985, Smith & Keyser 1995, MacRae 1999, Cole *et al.*, 2004, Rubidge *et. al.* 1995, 2005):

- isolated petrified bones as well as rare articulated skeletons of terrestrial vertebrates such as true reptiles (e.g. large herbivorous pareiasaurs like *Pareiasaurus*, small insectivorous owenettids) and therapsids or “mammal-like reptiles” (e.g. diverse herbivorous dicynodonts, notably *Cistecephalus*, *Oudenodon* and *Aulacephalodon*, a wide range of flesh-eating gorgonopsians such as *Lycaenops*, and insectivorous therocephalians like *Ictidosuchoides*);
- aquatic vertebrates such as large temnospondyl amphibians (*Rhinesuchus*, usually disarticulated), and palaeoniscoid bony fish (*Atherstonia*, *Namaichthys*); these are often represented by scattered scales rather than intact fish;
- freshwater bivalves (*Palaeomutela*);
- trace fossils such as worm, arthropod and tetrapod burrows and trackways (e.g. of the large dicynodont *Aulacephalodon*), coprolites (fossil droppings), plant roots;
- vascular plant remains including leaves, twigs, roots and silicified woods (“*Dadoxylon*”) of the *Glossopteris* Flora, especially glossopterid trees and arthropytes (horsetails). Plant remains are usually sparse and fragmentary.

Authoritative lists of vertebrate genera and species recorded so far from the *Cistecephalus* Assemblage Zone are given by Smith and Keyser (1995). Faunal lists for fossil sites in the Victoria West map area are given by Kitching (1977). The marked increase in fossils of the small dicynodont *Cistecephalus* at the top of the AZ in the Victoria West area and elsewhere is noted by these authors. Vertebrate fossils recorded in the Oudeberg Member in particular include the dicynodont genera *Cistecephalus* (the commonest form), *Aulacephalodon* and *Oudenodon* (Le Roux & Keyser 1988).

As far as the biostratigraphically important tetrapod remains are concerned, the best fossil material is generally found within overbank mudrocks. In contrast, fossils preserved within channel sandstones (e.g. channel lag breccio-conglomerates of reworked mudflakes and calcrete nodules) tend to be fragmentary and water-worn (Smith & Keyser 1995, Smith 1993). Many fossils are found in association with ancient soils (palaeosol horizons) that can usually be recognised by bedding-parallel concentrations of calcrete nodules. The fossil bones are isolated and disarticulated for the most part, and are typically permineralised and encrusted in a mantle of calcrete (often brown-weathering). Fossil bone embedded in mudrocks adjacent to major dolerite intrusions may be modified by thermal metamorphism; for example, bones in the Graaff-Reinet District may acquire a smooth, white “porcellanite” pallor, while bones recorded near Bedford may be black (Smith & Keyser 1995).

4.1. Fossils at the DR02404/8.5/0LR borrow pit site

A scatter of nine fossil vertebrate sites was recorded *within* the DR02404/8.5/0LR borrow pit site on the east side of the road (Fig. 4). The fossil bones are exposed in the quarry floor and are mostly disarticulated, although they include some articulated lower limb bones (Figs. 9 to 12). They are largely embedded in grey-green to purplish siltstone and are associated with a palaeosol (fossil soil) horizon, as indicated by abundant pedogenic calcrete nodules at this level. A few bone fragments were also noted within the overlying purple-brown mudrocks. Most of the remains observed are postcranial, but at least one lower jaw (Fig. 7) and skull (Fig. 9) are present. The fossils have not yet been firmly identified, but at least some of them probably belong to a medium-sized dicynodont therapsid such as *Aulacephalodon*. It is possible that several of the fossils are parts of the same animal whose skeletal remains were dispersed on the floodplain surface after death. However, floods may also have concentrated the bones of several different animals here.

In situ channel sandstones on the south-eastern edge of the pit site, and even more so displaced blocks of sandstone on the west side of the road, contain compressions and moulds of reworked plant material, possibly stems or large branches (Fig. 10). Mudflake conglomerates on the soles of these sandstones contain further fossil plant material as well as scattered bone fragments and moulds of small intact bones.



Fig. 9. Lower jaw (mandible) of a medium-sized dicynodont therapsid exposed on the floor of borrow pit site DR02404/8.5/0LR.



Fig. 10. Unidentified fossil bone exposed on the floor of borrow pit site DR02404/8.5/0LR.



Fig. 11. Articulated lower limb bones of a medium-sized therapsid exposed on the floor of borrow pit site DR02404/8.5/0LR.



Fig. 12. Palatal (ventral) view of the skull of a medium-sized dicynodont, possibly *Aulacephalodon*, exposed on the floor of borrow pit site DR02404/8.5/0LR.



Fig. 13. Large displaced slab of channel sandstone showing current-orientated plant material associated with mudflakes and reworked bone fragments on the sole surface (Hammer = 32 cm).

4.1. Fossils at the DR02404/29.3/0.5L borrow pit site

Few fossils were noted within the DR02404/29.3/0.5L borrow pit study area itself due to low exposure of bedrock here. However, mudrocks excavated from a test pit towards the western end of the dam contain several bone fragments (Fig. 14), suggesting that the bedrock here may well be highly fossiliferous. Exposures of Beaufort Group mudrocks north of the river also yielded several fossil bone fragments.

The mudrocks underlying the low sandstone ridge along the southern side of, but outside, the borrow pit study area proved to be richly fossiliferous. Several fossil sites with well-preserved bone were noted during a survey of this portion of the broader study region lasting some two hours in total, and undoubtedly a more thorough search would reveal many more fossil occurrences. Fossils recorded here were usually associated with, or entirely enclosed by, pedogenic calcrite nodules reflecting ancient soil horizons (Figs. 15-17). They include the fairly intact skull of a medium-sized, large-tusked dicynodont (Fig. 18, possibly *Aulacephalodon*) as well as several isolated or semi-articulated vertebrae, ribs and limb bones of therapsids and / or reptiles. Rolled bone fragments were also recorded within the well-developed ferruginous basal conglomerate of the overlying channel sandstone (Fig. 8).

No fossils were observed in the densely vegetated area to the east of the dam. Since this is apparently the site of a spring, it is quite possible that skeletal remains (e.g. bones, teeth) of Quaternary to Recent mammals and other wildlife attracted to the spring in the past, especially during times of drought, might be buried here.



Fig. 14. Bone fragments embedded in grey-green Beaufort mudrocks excavated from a test pit in the western part of the dam area.



Fig. 15. Ancient soil horizon marked by pinkish calcrete nodules. Note concentration of disarticulated fossil bone a few cm above the calcrete zone.



Fig. 16. Freshly broken calcrete nodule showing white fossil bones embedded inside (Scale in cm).



Fig. 17. Disarticulated or semi-articulated vertebrae of a medium-sized reptile or therapsid that have eroded out of the Beaufort mudrocks and been concentrated in gullies (Scale in cm).

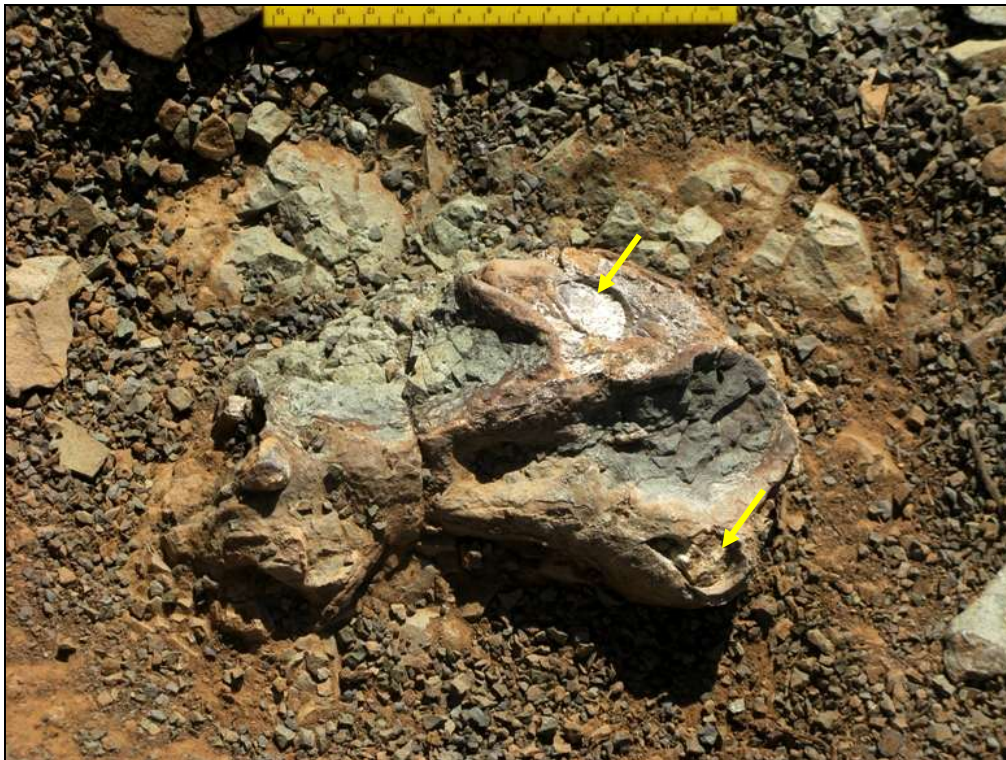


Fig. 18. Skull of a medium-sized, large-tusked dicynodont therapsid, possibly *Aulacephalodon*, seen in palatal (ventral) view (tusks arrowed). The snout of the animal is facing to the right. Scale in cm.

5. CONCLUSIONS & RECOMMENDATIONS

Borrow pits sites DR02404/8.5/0LR near Middelviei and DR02404/29.3/0.5L near Swaelkranz to the northeast of Murraysburg are excavated into mudrocks within the lower part of the Balfour Formation (Lower Beaufort Group / Adelaide Subgroup) of Late Permian age. The fluvial sediments of the Balfour Formation in the Murraysburg area are high fossiliferous, containing range of reptiles, therapsids (“mammal-like reptiles”), plants and trace fossils (including large vertebrate burrows) that are assigned to the *Cistecephalus* Assemblage Zone. During field assessment substantial number of vertebrate and plant fossil sites were recorded both within and around the margins of the two borrow pits sites under consideration.

Given the density of fossil vertebrate and plant material (including therapsid skull material) within a small area of bedrock within and around borrow pit site DR02404/8.5/0LR, the palaeontological sensitivity of this area is assessed as HIGH. It is recommended that the more scientifically valuable fossils already exposed in the pit (e.g. cranial material) are fully recorded and collected by a professional palaeontologist *before* further excavation takes place.

The Lower Beaufort mudrocks in the DR02404/29.3/0.5L borrow pit study area are also highly fossiliferous (*i.e.* HIGH palaeontological sensitivity) but the sites currently exposed lie outside the area proposed for exploitation. Fossil remains will undoubtedly be exposed, damaged and destroyed by excavation within the proposed pit area. However, the fossils here are likely to be very fragmented and dirt-covered following excavation, compared with naturally weathered-out material, reducing the value of scientific collecting. Further studies or mitigation are not considered warranted in this case.

6. ACKNOWLEDGEMENTS

Ms Quahnita Samie of Vidamemoria Heritage Consultants, Cape Town, is thanked for commissioning this specialist study and for kindly providing the necessary background information.

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APPENDIX: GPS LOCALITY DATA FOR FOSSIL SITES

All GPS readings were taken in the field using a hand-held Garmin GPSmap 60CSx instrument. The datum used is WGS 84.

LOC	GPS	COMMENT
040	S32 53.447 E28 03.699	Fossil bone occurrences on floor of pit DR02404/8.5/0LR
041	S32 53.369 E28 03.659	
042	S32 53.212 E28 03.521	
043	S32 53.222 E28 03.570	
044	S32 53.220 E28 03.588	
045	S32 53.255 E28 03.731	Series of large vertebrate burrows along river bank between borrow pit sites
046	S32 53.257 E28 03.734	Rare rolled bone fragments among sheetwash gravels, & within mudrocks from test pit at site DR02404/29.3/0.5L
048	S32 53.231 E28 03.715	Large tusked dicynodont skull
049	S32 53.300 E28 03.818	Ribs within calcrete nodule
050	S32 53.404 E28 03.865	Fossil bones weathering out of ferruginous calcrete horizon
051	S32 53.345 E28 03.812	Bone fragments within mudrock slopes north of river

8. QUALIFICATIONS & EXPERIENCE OF THE AUTHOR

Dr John Almond has an Honours Degree in Natural Sciences (Zoology) as well as a PhD in Palaeontology from the University of Cambridge, UK. He has been awarded post-doctoral research fellowships at Cambridge University and in Germany, and has carried out palaeontological research in Europe, North America, the Middle East as well as North and South Africa. For eight years he was a scientific officer (palaeontologist) for the Geological Survey / Council for Geoscience in the RSA. His current palaeontological research focuses on fossil record of the Precambrian - Cambrian boundary and the Cape Supergroup of South Africa. He has recently written palaeontological reviews for several 1: 250 000 geological maps published by the Council for Geoscience and has contributed educational material on fossils and evolution for new school textbooks in the RSA.

Since 2002 Dr Almond has also carried out palaeontological impact assessments for developments and conservation areas in the Western, Eastern and Northern Cape under the aegis of his Cape Town-based company *Natura Viva* cc. He is a long-standing member of the Archaeology, Palaeontology and Meteorites Committee for Heritage Western Cape (HWC) and an advisor on palaeontological conservation and management issues for the Palaeontological Society of South Africa (PSSA), HWC and SAHRA. He is currently compiling technical reports on the provincial palaeontological heritage of Western, Northern and Eastern Cape, Gauteng, Limpopo and Free State for SAHRA and HWC. Dr Almond is an accredited member of PSSA and APHP (Association of Professional Heritage Assessment Practitioners – Western Cape).

Declaration of Independence

I, John E. Almond, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed borrow pit project, application or appeal in respect of which I was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.



Dr John E. Almond (Palaeontologist, *Natura Viva* cc)

WESTERN CAPE BORROW PITS – INITIAL PALAEOONTOLOGICAL HERITAGE ASSESSMENT (August 2011 Second tranche)

Dr John E. Almond, *Natura Viva* cc, CAPE TOWN

Borrow pit	Location (DMS)		Key Geological Units & Age	Potential fossil heritage	Palaeontological sensitivity	Recommended mitigation
	East	South				
<p>26</p> <p>Central Karoo DMA DR02404/29.3/0.5L</p> <p>New</p>	23°58'11.28"	31°46'55.56"	<p>Balfour Formation</p> <p>(Lower Beaufort Group, Karoo Supergroup)</p> <p>Late Permian</p>	<p>Diverse terrestrial and freshwater tetrapods of <i>Dicynodon</i> Assemblage Zone (amphibians, true reptiles, synapsids – especially therapsids), palaeoniscoid fish, freshwater bivalves, trace fossils (including tetrapod trackways), sparse vascular plants (<i>Glossopteris</i> Flora, including petrified wood)</p>	HIGH	Palaeontological field assessment before further excavation commences
<p>29</p> <p>Central Karoo DMA DR02404/21.3/0.05L</p> <p>Existing</p>	23°55'51.96"	31°50'19.68"	<p>Balfour Formation</p> <p>(Lower Beaufort Group, Karoo Supergroup)</p> <p>Late Permian</p>	<p>Diverse terrestrial and freshwater tetrapods of <i>Dicynodon</i> Assemblage Zone (amphibians, true reptiles, synapsids – especially therapsids), palaeoniscoid fish, freshwater bivalves, trace fossils (including tetrapod trackways), sparse vascular plants (<i>Glossopteris</i> Flora, including petrified wood)</p>	HIGH	Palaeontological field assessment before further excavation commences
<p>30</p> <p>Central Karoo DMA DR02404/8.5/0LR</p> <p>Existing</p>	23°53'48.48"	31°56'7.80"	<p>Balfour Formation</p> <p>(Lower Beaufort Group, Karoo Supergroup)</p> <p>Late Permian</p>	<p>Diverse terrestrial and freshwater tetrapods of <i>Dicynodon</i> Assemblage Zone (amphibians, true reptiles, synapsids – especially therapsids), palaeoniscoid fish, freshwater bivalves, trace fossils (including tetrapod trackways), sparse vascular plants (<i>Glossopteris</i> Flora, including petrified wood)</p>	HIGH	Palaeontological field assessment before further excavation commences