RECOMMENDED EXEMPTION FROM FURTHER SPECIALIST PALAEONTOLOGICAL STUDIES OR MITIGATION:

Proposed Sato Energy Holdings (Pty) Ltd photovoltaic project on Portion 3 of Farm Zuurwater 62 near Aggeneys, Northern Cape Province

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1. Introduction

The company Sato Energy Holdings (Pty) Ltd is proposing to develop a photovoltaic (PV) energy generation facility of 500 MW capacity on Portion 3 of the Farm Zuurwater 62 (*c*. 5000 ha). The development site is situated to the north of the N14 tar road about 12 km southwest of the small mining community of Aggeneys and *c*. 75 km west-southwest of Pofadder, Northern Cape (Fig. 1). The PV development will comprise 26 units of 19.5 MW and cover a footprint of *c*. 884 hectares. An Environmental Impact Assessment for this project (SRK project number 435209) is being conducted on behalf of the developer by SRK Consulting (South Africa) (Pty) Ltd (Contact person: Senior Environmental Scientist Lyn Brown, SRK House 265 Oxford Road, Illovo 2196 Johannesburg, South Africa.).

The Zuurwater study area, currently used for low-density stock farming, lies at *c*. 800m amsl within a very arid desert region south of the River Orange. It is characterised by scattered Inselberge of resistent basement rocks surrounded by a sea of wind-blown Kalahari dune sands (orange on satellite images) and other superficial deposits such as braided stream sediments, sheet wash and colluvium (Fig. 2).

2. Geological context

The geology of the proposed development area is shown on 1: 250 000 geological map 2918 Pofadder (Council for Geoscience, Pretoria; Agenbacht 2007) (Fig. 3). Most of the study area comprises fairly flat-lying terrain between the scattered Inselberge to the southwest of the main Black Mountain Massif. These Inselberge, like the Black Mountain itself, are built of a variety of resistant-weathering igneous and high grade metamorphic rocks of Late Precambrian (Mokolian / Mid-Proterozoic) age. The various rock units - mainly gneisses, schists, quartzites and amphibolites - are listed in the legend to the geological map (Fig. 3). These basement rocks are assigned to the **Namaqua-Natal Province** and are approximately two to one billion years old (Cornell *et al.* 2006, Moen 2007, Almond & Pether 2008).

The flatter portions of the study area – including those that are likely to be directly affected by the proposed development - are underlain by a range of unconsolidated superficial sediments of Late Caenozoic age. These include **Quaternary to Recent sands and gravels** of probable fluvial or sheet wash origin (**Q-s2** in Fig. 3) that are locally overlain, and perhaps also underlain, by unconsolidated aeolian (*i.e.* wind-blown) sands of the Quaternary **Gordonia Formation** (**Kalahari Group**) (**Q-s1** in Fig. 3; orange dunes on satellite images, Fig. 2). All these sediments can be

subsumed into the Late Cretaceous to Recent **Kalahari Group**, the geology of which is reviewed by Partridge *et al.* (2006). The Gordonia dune sands are considered to range in age from the Late Pliocene / Early Pleistocene to Recent, dated in part from enclosed Middle to Later Stone Age stone tools. Note that the recent extension of the Pliocene - Pleistocene boundary from 1.8Ma back to 2.588 Ma would place the Gordonia Formation almost entirely within the Pleistocene Epoch.

3. Palaeontological context

The Mid Proterozoic basement rocks of the **Namaqua-Natal Province** are entirely unfossiliferous (Almond & Pether 2008).

The fossil record of the **Kalahari Group** as a whole is generally sparse and low in diversity; no fossils are recorded here in the recent Pofadder geology sheet explanation by Agenbacht (2007). The Gordonia Formation dune sands were mainly active during cold, drier intervals of the Pleistocene Epoch that were inimical to most forms of life, apart from hardy, desert-adapted species. Porous dune sands are not generally conducive to fossil preservation. However, mummification of soft tissues may play a role here and migrating lime-rich groundwaters derived from the underlying Dwyka Group may lead to the rapid calcretisation of organic structures such as burrows and root casts. Occasional terrestrial fossil remains that might be expected within this unit include calcretized rhizoliths (root casts) and termitaria (*e.g. Hodotermes*, the harvester termite), ostrich egg shells (*Struthio*) and shells of land snails (*e.g. Trigonephrus*) (Almond 2008, Almond & Pether 2008). Other fossil groups such as freshwater bivalves and gastropods (*e.g. Corbula, Unio*) and snails, ostracods (seed shrimps), charophytes (stonewort algae), diatoms (microscopic algae within siliceous shells) and stromatolites (laminated microbial limestones) are associated with local watercourses and pans. Microfossils such as diatoms may be blown by wind into nearby dune sands. These Kalahari fossils (or subfossils) can be expected to occur sporadically but widely, and the overall palaeontological sensitivity of the Gordonia Formation is therefore considered to be low. Underlying calcretes might also contain trace fossils such as rhizoliths, termite and other insect burrows, or even mammalian trackways. Mammalian bones, teeth and horn cores (also tortoise remains, and fish, amphibian or even crocodiles in wetter depositional settings) may be occasionally expected within Kalahari Group sediments and calcretes, notably those associated with ancient alluvial gravels. The younger **fluvial and alluvial sands and gravels** within the proposed development area are unlikely to contain any substantial fossil or subfossil remains.

4. Conclusions

The overall palaeontological sensitivity of the Precambrian basement rocks, as well as of the Kalahari Group and younger sediments mapped within the study region, ranges from zero to low. (Almond & Pether 2008). The proposed development has a small footprint and deep excavations are not envisaged for photovoltaic installations. **For these reasons, no further palaeontological specialist palaeontological studies or mitigation are recommended for this development.**

Should substantial fossil remains be exposed during construction, however, the ECO should safeguard these, preferably *in situ*, and alert SAHRA as soon as possible so that appropriate action (*e.g.* recording, sampling or collection) can be taken by a professional palaeontologist.

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Key references

AGENBACHT, A.L.D. 2007. The geology of the Pofadder area. Explanation of 1: 250 000 geology sheet 2918. 89 pp. Council for Geoscience, Pretoria.

ALMOND, J.E. 2008. Fossil record of the Loeriesfontein sheet area (1: 250 000 geological sheet 3018). Unpublished report for the Council for Geoscience, Pretoria, 32 pp.

ALMOND, J.E. & PETHER, J. 2008. Palaeontological heritage of the Northern Cape. Interim SAHRA technical report, 124 pp. Natura Viva cc., Cape Town.

CORNELL, D.H. *et al.* 2006. The Namaqua-Natal Province. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) The geology of South Africa, pp 325-379. Geological Society of South Africa, Johannesburg & Council for Geoscience, Pretoria.

MOEN, H.F.G. 2007. The geology of the Upington area. Explanation to 1: 250 000 geology Sheet 2820 Upington, 160 pp. Council for Geoscience, Pretoria.

PARTRIDGE, T.C., BOTHA, G.A. & HADDON, I.G. 2006. Cenozoic deposits of the interior. In: Johnson, M.R., Anhaeusser, C.R. & Thomas, R.J. (Eds.) The geology of South Africa, pp. 585-604. Geological Society of South Africa, Marshalltown.

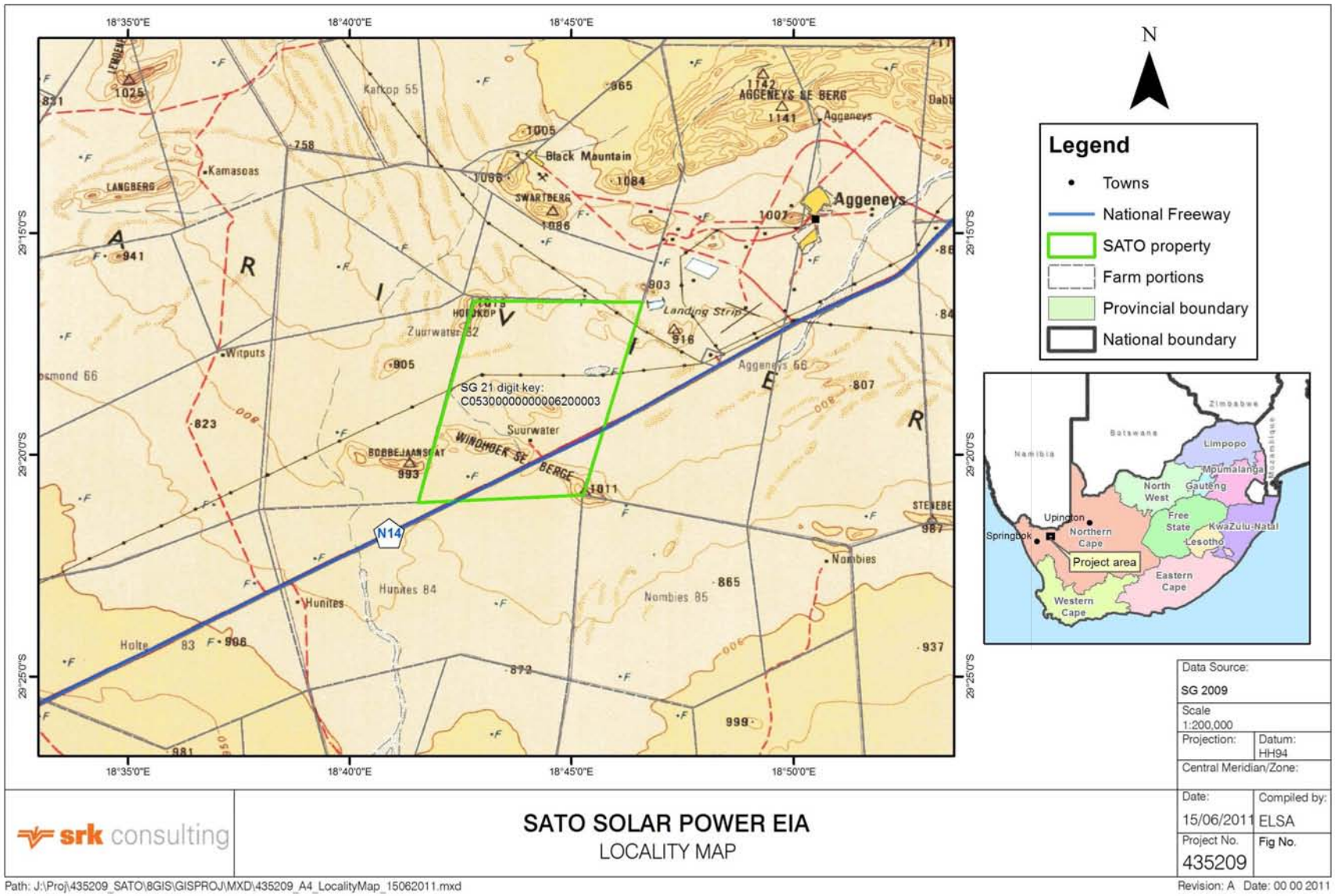

Fig. 1. Locality map for the proposed 500 MA PV solar energy facility study area (green polygon) on the farm Zuurwater 62, *c*. 12 km southwest of Aggeneys, Northern Cape (Image kindly provided by SRK Consulting, Johannesburg).

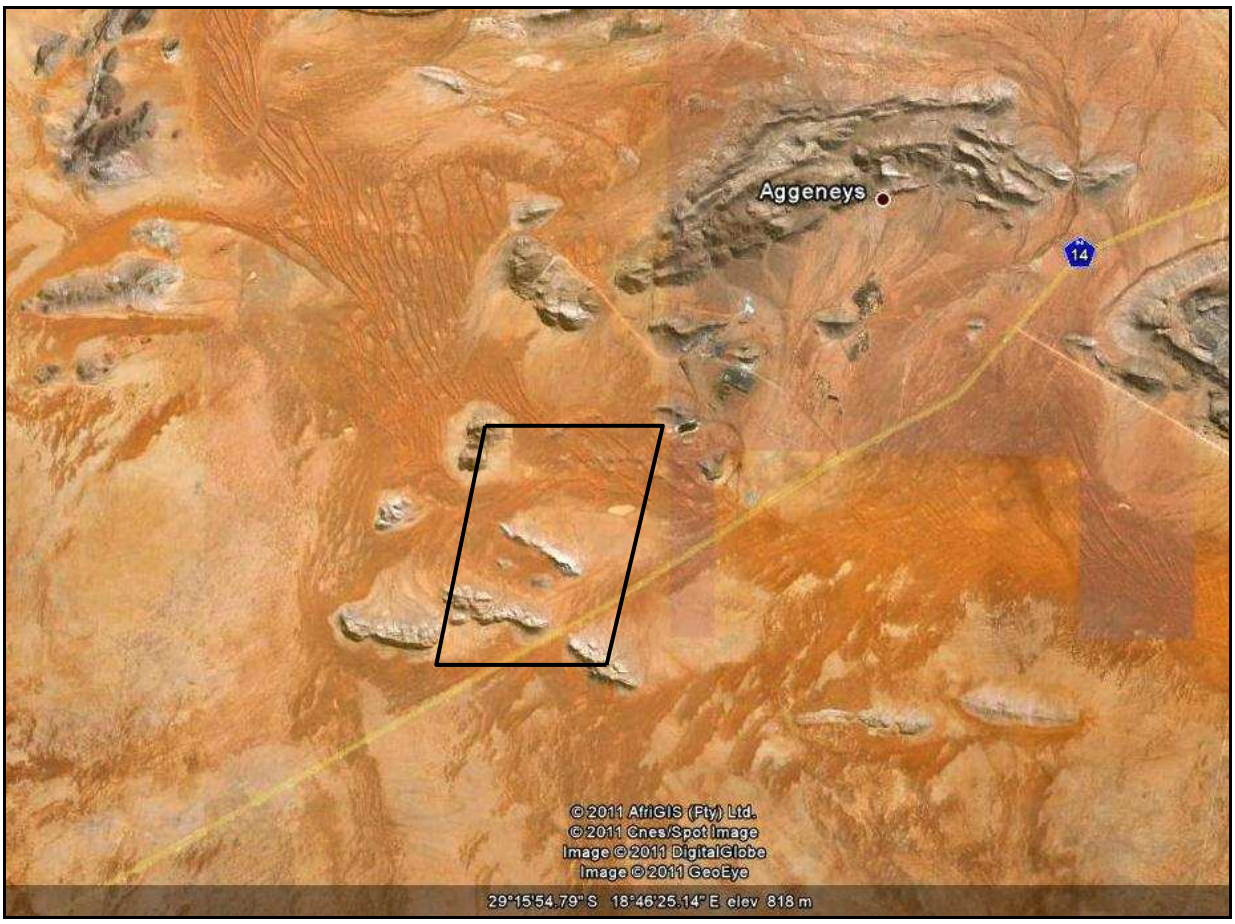

Fig. 2. Google Earth® satellite image of the Zuurwater 62 study area (black polygon) *c.* 12 km southwest of Aggeneys, Northern Cape Province showing scattered small Inselberge of Precambrian basement rocks to the southwest of the Black Mountain surrounded by a sea of wind-blown Kalahari sands (orange) and paler alluvial, colluvial and sheet wash deposits.

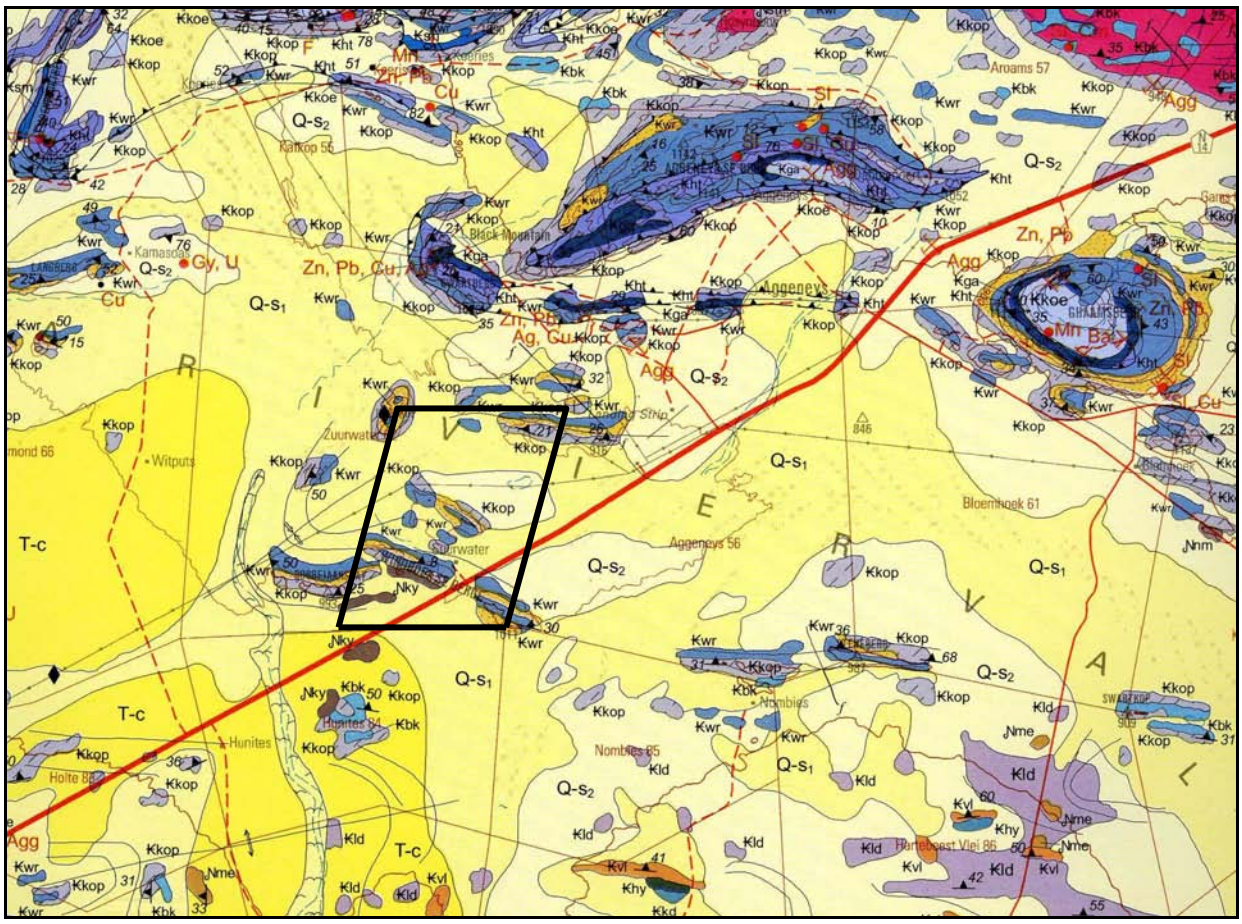

Fig. 3. Extract from 1: 250 000 geological map 2918 Pofadder (Council for Geoscience, Pretoria) showing outline (black polygon) of the study area for the proposed photovoltaic energy facility southwest of the Black Mountain near Aggeneys. Geological units mapped in the study area include:

(a) Mid Proterozoic (Mokolian) igneous and metamorphic basement rocks

Kwr (blue-grey & buff) = Wortel Formation (Bushmanland Group)
Kkop (grey) = Koeipoort Gneiss (Gladkop Metamorphic Suite)
Nky (brown) = Konkyp Gneiss (Little Namaqualand Suite)

(b) Late Caenozoic superficial sediments

Q-s1 (medium yellow) = red aeolian sands of the Gordonia Formation (Kalahari Group) and Q-s2 (pale yellow) = sand, scree, rubble and sandy soil.

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 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 development 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.

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