IN THE HIGH COURT OF SOUTH AFRICA
(WESTERN CAPE DIVISION, CAPE TOWN)

Case No.: 12994 / 2021

In the matter between:

OBSERVATORY CIVIC ASSOCIATION	First Applicant
GORINGHAICONA KHOI KHOIN INDIGENOUS TRADITIONAL COUNCIL	Second Applicant

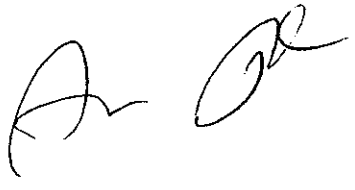
and

TRUSTEES FOR THE TIME BEING OF LIESBEEK LEISURE PROPERTIES TRUST	First Respondent
HERITAGE WESTERN CAPE	Second Respondent
CITY OF CAPE TOWN	Third Respondent
THE DIRECTOR: DEVELOPMENT MANAGEMENT (REGION 1), LOCAL GOVERNMENT, ENVIRONMENTAL AFFAIRS & DEVELOPMENT PLANNING, WESTERN CAPE PROVINCIAL GOVERNMENT	Fourth Respondent
THE MINISTER FOR LOCAL GOVERNMENT, ENVIRONMENTAL AFFAIRS & DEVELOPMENT PLANNING, WESTERN CAPE PROVINCIAL GOVERNMENT	Fifth Respondent
CHAIRPERSON OF THE MUNICIPAL PLANNING TRIBUNAL OF THE CITY OF CAPE TOWN	Sixth Respondent
EXECUTIVE MAYOR, CITY OF CAPE TOWN	Seventh Respondent
WESTERN CAPE FIRST NATIONS COLLECTIVE	Eight Respondent

EXPERT AFFIDAVIT

I, the undersigned,

DR MICHAEL THEODORE MENTIS



do hereby make oath and state as follows:

1. The facts contained in this affidavit are within my personal knowledge, except where the context indicates otherwise, and are to the best of my belief both true and correct.

2. Legal submissions contained herein are made on the advice of the applicants' legal advisors, which advice I believe to be correct. Where I rely upon information conveyed to me by others, I state the source, which information I likewise believe to be true and correct.

3. I am an adult male ecologist with address at 38 Aspen Villas. Kopje Road, Morning Side, Johannesburg, Gauteng Province.

   3.1. I gained experience as a wetland and a land rehabilitation specialist with more than 50 years of professional practice in these fields;

   3.2. I hold a doctoral degree in mathematical modelling in an agricultural context, which I obtained from the University of Natal during 1983; and

   3.3. I am also a registered environmental assessment practitioner ("EAP");

   4. My qualifications, training and experience are set out in my curriculum vitae, a copy of which is attached marked "**MM1**" and I submit that I am well qualified and have the necessary qualifications, training and experience to express expert opinions as to the matters raised and set out in this affidavit.

I. INTRODUCTION

5. The Applicants in this matter requested me to review and provide my expert opinion on the final basic assessment report ("FBAR") of June 2020, as submitted by the First Respondent ("Developer") to the relevant decision-makers in support of its applications for the various authorisations which enabled it to undertake the proposed development known colloquially as the River Club development ("the proposed development"). I considered the contents of the FBAR, including, but not limited to:

   5.1. the Biodiversity Impact Assessment prepared by Liz Day of Freshwater Consulting CC;

   5.2. the Surface Water Impact Assessment prepared by Aurecon (now Zutari);

   5.3. The Services Report prepared by Aurecon;

   5.4. The Stormwater Management Concept prepared by Aurecon; and

   5.5. The Environmental Management Programme ("EMPr") prepared by SRK Consulting.

6. I have also considered the environmental authorisation ("EA") granted by the Fourth Respondent ("the Director") to the Developer and the appeal decision of the Fifth Respondent ("the Minister"). (I refer to the Director and the Minister collectively as "the Province".). Although the water use licence ("WUL") granted to the Developer by the Department of Water and Sanitation ("DWS"),

in terms of the National Water Act ("NWA"), 1998 is not the subject of the review instituted by the Applicants, I confirm that I have also considered the WUL. Additionally, I have considered the applicable legal framework in terms of which the Province and the DWS granted the Developer its EA and WUL, and specifically the:

6.1. National Environmental Management Act, 1998, as amended ("NEMA");

6.2. Environmental Impact Assessment Regulations, 2014, as amended ("EIA Regulations"); and

6.3. National Water Act, 1998 ("NWA").

7. As part of my expert opinion, I provide an opinion on whether or not the impacts of the River Club Development on the Liesbeek River and receiving environment were adequately assessed in the FBAR, and also the implications for the decisions which was made on the basis of the FBAR.

8. In response to the Applicants' request, I have prepared the attached report titled "Proposed River Club development – exert review & opinion" (which is annexed hereto as "**MM2**"). The purpose of this affidavit is to summarise the key findings of my report, for the benefit of this Honourable Court.

II. KEY FINDINGS

9. In this section of the affidavit, I summarise the key findings of my expert review and opinion in respect of the EIA.

A. ***Inadequate modelling***

10. The hydrological impact assessment of Aurecon purported to assess the impact that the proposed development might have on flooding in the vicinity, downstream and upstream of the site. Important to this assessment of Aurecon is the surface water modelling. However, the modelling of Aurecon is flawed for various reasons, and consequently, the assessment of the flood risk posed by the proposed development was inadequate.

10.1. Firstly, the modelling was not testable, repeatable or reproducible by either decision makers or interested and affected parties ("I&APs"). This is so, because Aurecon does not report detailed input data they used for the modelling. It is not clear how the decision makers or I&APs were able to test or reproduce the results as contained in Aurecon's modelling, to satisfy themselves that there is not a material flood risk posed by this development.

10.2. Secondly, the modelling relied on subjective 'engineering judgements' of Aurecon, whereas a more objective approach was required and is widespread practice, and the modelling of Aurecon was conservative and deterministic. As a result of the modelling being conservative and deterministic, the results of modelling (as is the case with Aurecon's modelling) will invariably show that there is not a material flood risk.

10.3. Thirdly, there is no evidence available in the modelling which shows that the Aurecon considered that Cape Town, as with the rest of the world, will experience an increase of extreme weather events as a result of climate change. This is a relevant input which is needed to determine flood risk, since the risk of flooding can be increased by the co-occurrence of weather

extremes and events such as spring high tides, equinox, blocked river channels (as a result of bridges collapsing, tree stumps clogging the river canal, etc.). Any modelling to determine flood risks which is not attuned to the increase in frequency of extreme weather such events co-occuring, is not fit for purpose.

11. Without adequate modelling, the decision makers did not have access to all the relevant information to assess the flood risks posed by the proposed development and were not in a position to apply the precautionary principle.

B. Biodiversity impact assessment contingent of hydrological impact assessment, and limited in scope

12. The validity of the findings of the biodiversity assessment were explicitly conditional on the accuracy of the findings of the surface water modelling. Since the surface water modelling was defective, the biodiversity assessment was also compromised.

13. Furthermore, the biodiversity assessment considered only a fraction of the biota (plants and vertebrates among eukaryotes), and omitted to consider invertebrates, fungi, bacteria, protista and monera that are expected to have important environmental functional roles in watercourses, which will be impacted by the proposed development.

C. Important losses in watercourse functions remains unassessed

14. The FBAR does not include a consideration of the full breadth of watercourse (environmental) functions (conduit for waterflows, flood attenuation, aquifer recharge, water storage, water purification, carbon sequestration and

biodiversity support) impacted by the proposed development. With 65% of the proposed project area becoming occupied by development footprint, with developments raised on platforms to above flood levels, the proposed development possibly results in important losses in watercourse (environmental) functions, for example water purification and carbon sequestration.

15. The EIA does not attempt to assess the significance of the impacts of the proposed developments on these important environmental functions of the receiving environment.

D. Inadequate consideration of alternatives

16. There is no proper consideration of project alternatives that is logical and complies with the requirements of NEMA EIA regulations Appendix 1 in respect of:

16.1. explicitly addressing I&APs concerns;

16.2. defining criteria for comparing alternatives up front; and

16.3. designing a method of comparison also up front.

16.4. Though NEMA regulations explicitly mention 'location' as an alternative to be evaluated, this was not addressed in the FBAR.

E. Part of EMPr approved after EA was granted

17. The EA was granted before the stormwater management plan which forms part of the Environmental Management Program (EMPr) had been submitted,

considered or approved. NEMA sections 24N (1A) and (2), require that an EMPr must be submitted and considered before authorization is given.

18. Also, NEMA requires the Province to consider all relevant factors when granting an EA, and the EMPr contains impact control measures that constitutes such relevant factors. It follows therefore that the Province was not able to consider all relevant impact control measures before it granted the EA.

III. CONCLUSION

19. Pursuant to my key findings as explained above, in my expert opinion, the FBAR does not adequately assess the impacts of the Development on the Liesbeek River and the receiving environment.

20. The flawed modelling of Aurecon, the limited scope of the assessment of impacts on biodiversity and loss to important environmental functions, the inadequate considerations of alternatives and piecemeal approval of the EMPr, culminated in an inadequate and flawed FBAR and EA approval process. The inadequate and flawed nature of the FBAR resulted in the Province not being able to consider information relevant to their decisions in the first and second instances, and inversely considering inaccurate and consequently irrelevant information. This much is evident from the Director and Minister's respective reasons for their decisions.

DR MICHAEL THEODORE MENTIS

I hereby certify that the deponent has acknowledged that he:

(a) knows and understands the contents of this affidavit;

(b) has no objection to taking the oath;

(c) considers the oath to be binding on his conscience.

Thus signed and sworn to before me, at Sandton on 10 June 2022.

COMMISSIONER OF OATHS

NAME: Chisimati Leonard Mabasa

CAPACITY: Sergeant

ADDRESS: 02 Summit Rd

AREA: Sandton

SOUTH AFRICAN POLICE SERVICE
CLIENT SERVICE CENTRE
SANDTON
2022 -06- 10

CV Dr Mike Mentis

Name	Michael Theodore Mentis	
Date and place of birth	30 September 1945, Harrismith, South Africa	
Nationality	South African	
Address	Residential: 38 Aspen Villas, Kopje Road, Morningside 2057, Johannesburg, South Africa Postal: Postnet 540, Bag X9, Benmore 2010, South Africa Email: mmentis@saol.com Mobile: +27 82 372 1739	
Professional training / higher education	Education MBA University of Witwatersrand 1994 PhD (Agriculture) University Natal, Pietermaritzburg 1983 MSc (Nature Conservation) University of Stellenbosch 1973 BSc (Hons) University of Natal, Pietermaritzburg 1967 BSc (Botany & Zoology) University of Natal 1966 Training, qualifications & awards Environmental auditor 1995 Professional member of Institute for Environmental Management and Assessment (UK), currently Principal Environmental Auditor and Full Member (membership # 1820) Chartered Environmentalist with Society for the Environment (UK) (membership # 2000) Professional Scientist registered with South African Council for Natural Scientific Professions (membership # 117229) Registered Environmental Assessment Practitioner (EAPASA membership #2020/1275) Honorary member, Land Rehabilitation Society of Southern Africa Endowment for the Future Distinguished Visitor, University of Alberta, Edmonton, Alberta, Canada, 1984 Lifetime Achievement Award, Land Rehabilitation Society of Southern Africa – 12 November 2020	
Foreign language skills with an indication of the level (categories: native speaker, competent, basic, rudimentary),	English: native speaker Afrikaans: basic	
Professional experience specifying the employer, duration of employment, scope of duties and periods of employment abroad	*Employer* : Self employed *Dates* : 1991-02 - to date *Position* : Consultant in business & environment *Responsibilities* : Consultant on among the biggest infrastructure and resource exploitation projects in the subregion (Zambia, Zimbabwe, Botswana, Mozambique, Lesotho, South Africa). Some examples follow.	

	Observatory Civic Association (OCA), Cape Town: Dr Mentis acts as a specialist advisor to, and expert witness for, OCA in its appeal and High Court Action against proposed development by Liebeek Leisure Trust Properties below the 1 in 50-year floodline, 2021- Glencore Operations South Africa (Pty) Ltd and others: Dr Mentis assessed rehabilitation of mining-disturbed land. Dr Mentis developed standards for mine rehabilitation and system of rehabilitation assessment to measure against standards, identify shortcomings, devise corrective action and benchmark against industry performance – partly covered in recent book Environmental Rehabilitation Guide For South Africa and an article in international open access Springer Journal Forest Ecosystems https://doi.org/10.1186/s40663-020-00233-4. Clients included Glencore, BHPBilliton/South32/SAEC. Consulted to mining industry from 1985. Mission was to improve rehabilitation of mined land by objective assessment and provision of good advice on how to improve. Mining projects are on-going multi-billion Rand. Project has been challenging in knowledge of environmental function, developing simple powerful metrics, computer programming and AI using logical functions in Excel (very powerful), people skills (good rapport struck up with main client, Glencore), and teaching clients. The intellectual property of the rehabilitation assessment now sold to Agreenco which is continuing the assessments. Forest Ecosystems (FECS), Beijing, China: Dr Mentis is a Member of Editorial Board for this Springer open access journal (impact factor 3.645, rated 7th among 67 forestry journals). Dr Mentis was invited by FECS to workshops in Beijing in 2014 and 2019. His article *Managing project risks and uncertainties*, based on involvement in big infrastructure projects in southern Africa, is the second-most accessed article of the journal (>22 000 accessions) and can be downloaded free at https://doi.org/10.1186/s40663-014-0026-z. Another article *Environmental rehabilitation of damaged land* is the most accessed of articles published in Forest Ecosystems in 2020 (>6700 accessions) and can be downloaded free at https://doi.org/10.1186/s40663-020-00233-4. Costs of project met by donors – must run to Rand millions annually. Board members are honorary and earn no fee. Initiative led by a German, Prof Klaus von Gadow (2 honorary doctorates, much SA experience), who has appointed a multi-disciplinary team as sub-editors (Editorial Board). The demands of a sub-editor are being critical and constructive. The benefits are keeping up with the 'cutting edge' and learning from others. Transnet: Specialist to assess and advise on rehabilitation of 555 km fuel pipeline construction from Durban to Gauteng, 2011-2018. Previously participated in ESIA, mostly working with engineers in pipeline alignment. About R25 billion project, rehabilitation to order of R100 million. Straightforward application of my environmental rehabilitation expertise. Client took advice. Rehabilitation done to a high standard. With other pipeline projects Dr Mentis has gained 1000s km-years' experience on pipelines.

	Lesotho Highlands Water Project (LHWP): Coordinator of international environmental & social panel of experts, compliance with 'The Treaty' and loan covenants, compensation and resettlement, restoration of livelihoods, social development, protection of environmental amenity; review with an eminent engineer of feasibility of LHWP Phase 2; review of proposed Kobong Pumped Storage Scheme, 1996 to date. On-going highly complex financial/engineering, environmental/social multi-billion Rand project. Trans Caledon Tunnel Authority: Member of panel of environmental and social experts on bulk water supply projects – Mooi Mgeni Transfer Scheme, Olifants River Water Resources Development Project, Mokolo Crocodile Water Augmentation Project, 2010-2017. Collectively multi-billion Rand projects. Like LHWP, complex projects. Weakest project aspect was social, in particular involuntary relocation of land dwellers. Chobe-Zambesi Water Transfer: Member (environmentalist) of BIGEN Africa team in reconnaissance assessment to supply water to Gaborone, 2016-2017. High level. Fairly straightforward. Lesotho Highlands Botswana Water Transfer: Member (environmentalist) of BIGEN Africa team in reconnaissance assessment to supply water to Gaborone, 2015. High level. Fairly straightforward. South African National Roads Agency: Team member (wetland specialist) for ESIA for N3 Tugela Plaza to Warden, 2010-2016. This section of road was designed 50 years ago. It has not been built because of its cost, and now because of environmental impacts and stakeholder objection. ESIA cost estimated at tens of millions of Rand. Wetland work straightforward – easy to demonstrate greenfield road route across valley bottoms and over saddles would devastate wetlands. Most difficult aspect was the client who disregarded advice and avoided engaging with stakeholders – eventually client withdrew application for environmental authorization. Department of Water & Sanitation: De Hoop dam construction on Steelpoort river, lead reviewer on environmental and social review panel, 2008-2011. Multi-million Rand project. Less complex than LHWP. My lesson was the state can plan and orchestrate, but actual work should be contracted out under close supervision by client. Beit Bridge Bulawayo Railway Project, Zimbabwe: Prepared EIA and EMP, complimented by the Zimbabwean government for high standard, 1997-1999. Multi-million Rand project. This was a build-operate-transfer project. The operator had to fund it himself. It is the only project I've worked on that came in within budget, on time and fit-for-purpose. Beit Bridge Bulawayo Railway Project and Spoornet: Assessment of environmental liabilities (heavy metal contamination, land mines, *etc*) in railway concessions for Zambian and Mozambican railways, 2003. Potentially big projects, extent of implementation unknown, cost unknown. Had limited involvement. Seems respective governments were not committed. Metolong Dam and Water Supply Program, Lesotho: Coordinator of environmental and social panel of experts, 2010-2018. Multi-million Rand project. Like LHWP, a complex project. Involuntary relocation was limited.

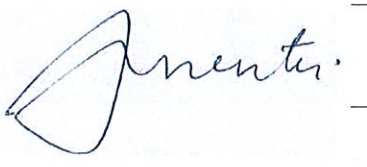
	Procurement was slow, and components such as environmental auditing and integrated catchment management did not start until project was near completion. Preparation of EMP was insufficient – too general and left contractors to devise detail after contracts (and budget) had been signed – generally contractors do not have will or capacity and it is not in their commercial interest to devise 'extra' environmental and social work. Eskom: Environmental consultant on Ingula Pumped Storage Scheme: assisted in gaining environmental authorization after it had been refused, supervised baseline study including hydrology, heritage, wetlands, vegetation, aquatic biota/endangered fish/interbasin transfer, undertook audits during final design, 2001-2006. Project cost escalated from R8 billion to R42 billion. Baseline study budget about R6 million. Baseline work straightforward. Involuntary relocation of land dwellers possibly worst of environmental/social legacies. Sasol: Mozambique-Secunda gas pipeline. Subconsultant to Mark Wood, participated in ESIA, construction monitoring, rehabilitation supervision, operations risk assessment, 2000-2010. Project cost multi-billion Rand. Insufficient supervision of environmental management and rehabilitation during construction. Impacts on farms severe. Farmers said 'if it were possible to give back Sasol compensation money, I'd do that and have them take their pipeline away'. Contractors don't care – want to complete construction, get paid and get out. Client had to appoint a special rehabilitation contractor at an additional cost of R50 million or so. Singita: Undertook ESIA for luxury lodge development in Nwanetsi Concession in Kruger National Park (top concession area in among world's most famous game parks), undertook audit during construction phase, invited by Egypt's Red Sea Sustainable Tourism Initiative to conference on lodge development in protected areas, 2000-2006. Lodge development cost about R70 million. Sensitive project because of its location. Owners of small businesses often not schooled in environmentalism and undue focus on bottom line can endanger the business. Water supply projects in Botswana: Team member in ESIAs for Letsibogo dam on Motloutse river (early 1990s) and Mosetsi river (2008). Letsibogo dam was built (multi-million Rand project), but not the Mosetsi – dam would mostly be empty, big downstream impacts on dirt-poor riparian people liable only to lose and gain no benefits. Eskom: ESIA for 400 kV powerline from Lephalale to Bulawayo, mid 1990s. Multi million Rand project. Straightforward except for remoteness. De Beers: ESIA reviewer for Venetia Diamond Mine. Early 1990s. Multi-billion Rand project. Water again an issue – die-off of riverine forest not because of water abstraction *per se*, but ingress of 'old' (saline) ground water from valley sides. De Beers: Assisted in application to gain environmental authorization for scanning kimberlite for diamonds with neutron beam, 2000-2002. Multi-million Rand research. Very technical project. Neutron beam radio-activated Kimberlite components that then had short half-lives. Had to identify worst-case: big seismic event coupled with hurricane that would rupture bunker and disperse radio-activity, probability of co-occurrence 1

in 100 million years. De Beers never implemented – they never say but suspect they were wary of 'pure' diamonds being perceived to be contaminated by radioactivity. Market perceptions are important.
University of Natal: Change management consultant in amalgamation of faculties of Agriculture and Science, late 1990s. Small project. Very challenging regarding people skills. Managed to allay the fears of the nay-sayers and amalgamation did happen.
Richards Bay Minerals: Consultant to chief public relations officer during the controversial application to mine the Kingsa Tojan lease near Lake St Lucia, assisted and advised on PR, undertook research on mining rehabilitation and economic and social effects of mining, gained first-hand experience of interface between green activists and big business, early to mid-1990s. Heavy minerals mining on NE coast is multi-billion Rand.

Employer : Faculty of Science, University of Witwatersrand
Dates : 1985-07 – 1991-01
Position : Professor and Director Resource Ecology Group
Responsibilities : Undergraduate courses in soils and quantitative methods in ecology, directed postgraduate school of some 20 MSc and PhD candidates, member of Foundation for Research Development (CSIR) committees on Grassland and Savanna Biomes and Nature Conservation, participated in International Union of Biological Sciences program on Response of Savannas to Stress and Disturbance (travelled to France, South America and US).

Employer : Faculty of Agriculture, University of Natal
Dates : 1979-04 – 1985-06
Position : Senior lecturer
Responsibilities : Undergraduate courses on veld and pasture management, ecology, and methods in quantitative ecology, supervised MSc and PhD students, undertook own PhD research (A simulation of the grazing of sour grassveld), member of Foundation for Research Development (CSIR) committee on Grassland Biome, undertook rangelands tour and attended rangelands conference in Australia, Endowment for the Future Distinguished Visitor at University of Alberta in Edmonton, 1984.

Employer : Natal Parks Board
Dates : 1969-04 – 1979-04
Position : Chief Professional Officer
Responsibilities : Primary responsibility was to develop and run a wildlife advisory service to Natal landowners. Managed a team of 3 professionals and 2 technicians. Undertook research into large herbivores, their impacts,

	management and productive capacity. Pioneered use of metabolic biomass as common currency for multi-species herbivore systems. Undertook gamebird research (MSc) and wildlife exploitation monitoring. For one year was Chief Conservator for southern Natal. *Employer* : International Biological Program *Dates* : 1968-01 – 1969-03 *Position* : Research fellow *Responsibilities* : Researched wild animal productivity. Studied historical natural biomasses in Umfolozi Game Reserve area. Undertook a review of life history features of the large herbivores of Africa.
Overview	Academic background: Dr Mentis has 5 degrees from Universities of Natal, Stellenbosch and Witwatersrand. He held fulltime undergraduate and postgraduate teaching responsibilities (include research group directorship) for a decade. He lectured part-time at the Wits Business School (business of the environment) and ran a course on environmental risk management at Rhodes University. Member of Editorial Board of Forest Ecosystems is international recognition of academic standing. Experience: teaching and practical application over 50 years across agriculture, business, ecology, economics, environmental and social risk management, nature conservation, research, wildlife biology, vegetation science. Published over 100 scientific and popular articles. Recent special focus on risk assessment. Deep experience with big infrastructure projects. Published book on *Environmental Risk Management in South Africa* http://www.publisher.co.za/product/environmental-risk-management-in-south-africa A summary and update of the book can be downloaded free at https://doi.org/10.1186/s40663-014-0026-z.The article *Managing project risks and uncertainties* is the second most accessed article in the journal *Forest Ecosystems* (>24 000 accessions from website). Learning is on-going and the science of risk management is still undergoing important if not fundamental change. Accomplished writer. Invited to write *Science writing in the real world* https://doi.org/10.1186/2197-5620-1-2. Authored book Environmental Rehabilitation Guide For South Africa (click to view) with summary and update at https://doi.org/10.1186/s40663-020-00233-4 (>9500 accessions from website). Local/regional conditions: Has practical work experience in all countries of sub-region except Namibia which has nevertheless visited for meetings and as tourist.
This CV was prepared by Dr Mike Mentis on 2021-11-16	

Report prepared for Observatory Civic Association & Goringhaicona Khoi Khoin Traditional Indigenous Council

Proposed River Club development – expert review & opinion

Prepared by
Dr Mike Mentis
mmentis@saol.com

31 May 2022

Summary *curriculum vitae*

I, **Michael Theodore Mentis**, have the following qualifications and experience

- BSc BSc(Hons) MSc PhD MBA
- More than 50 years' experience across agriculture, business, ecology, economics, environmental and social risk management, nature conservation, research and vegetation science, tertiary level teaching
- During 10 years as an academic rose from lecturer to professor at Wits and 'top dog' in ecology in South Africa
- In a consulting career of >30 years engaged often in leadership positions in among the biggest infrastructure and resource exploitation projects in southern Africa
- Principal Environmental Auditor registered with, and Full Member of, the Institute of Environmental Management & Assessment (UK) (member # 1820)
- Chartered Environmentalist with the Society for the Environment (UK) (member # 2000)
- Professional Natural Scientist registered with SACNASP (member # 117299)
- Environmental Assessment Practitioner registered with EAPASA (member # 2020/1275)
- Honorary member of Land Rehabilitation Society of Southern Africa
- Honorary member of Editorial Board for international open access journal *Forest Ecosystems* in Beijing (China)
- Endowment for the Future Distinguished Visitor, University of Alberta, Edmonton, Alberta, Canada, 1984
- Lifetime Achievement Award, Land Rehabilitation Society of Southern Africa – 12 November 2020
- Published >100 scientific and popular articles
- Acclaimed science writer (>4700 accessions) in *Forest Ecosystems* https://doi.org/10.1186/2197-5620-1-2
- Published book *Environmental Rehabilitation Guide for South Africa* (https://publisher.co.za/product/environmental-rehabilitation-guide/) with update and summary https://doi.org/10.1186/s40663-014-0026-z (>27000 accessions, second most accessed article in journal *Forest Ecosystems*
- Article on in *Forest Ecosystems* >15000 accessions https://doi.org/10.1186/s40663-020-00233-4

Conflict of interest statement

I certify that I have no conflict of interest in submitting this expert review.

Executive summary

The purpose of this report is to review the impact assessment documentation prepared and submitted to the relevant authorities, in support of the proposed development at River Club of the Liesbeek Leisure Property Trust (LLPT) in the Observatory area of Cape Town.

This review focuses on the key biophysical components (surface flooding and biodiversity) and the procedures for environmental impact assessment.

Environmental authorisation (EA) and a water use licence (WUL) have been granted, and the appeal by the Observatory Civic Association ('OCA), City of Cape Town (CoCT) and the Goringhaicona Khoi Khoin Traditional Indigenous Council (GKKTIC) against the EA were refused.

The LLPT impact assessment and design documents are reviewed here against:

a) applicable legislation
    a. National Water Act, 1998 (NWA);
    b. National Environmental Management Act (NEMA);
    c. Environmental Impact Assessment Regulations, 2017 (as amended) (EIA Regulations); and
b) standards of science

The main findings of this review are as follows.

1) Impact assessment, in particular the surface flooding modelling, was not testable, repeatable or reproducible, the modelling relied on subjective 'engineering judgements' about model inputs when a more objective approach was required and is widespread practice, and the modelling was conservative in that it did not consider sufficiently climate change and inevitable extreme weather events. In effect, the surface water modelling did not take into account relevant information and thereby materially influenced the decisions made by the EA and WUL decision-makers. Accordingly, the assessment and EA and WUL decisions do not comply with (a) NEMA sections 2 (4) (a) and 24O (b) to effect that for sustainability to be met all relevant factors must be considered; (b) NWA section 2 to effect that for water resources to be protected relevant factors must be taken into account, including protecting aquatic and associated ecosystems and their diversity, reducing and preventing pollution and degradation of water resources, managing floods and droughts.

2) The validity of the findings of the biodiversity assessment were explicitly conditional on the accuracy of the findings of the surface water modelling. Since this modelling was defective so the biodiversity assessment was invalid. This means that invalid/irrelevant information was considered by the decision-makers, and valid

and relevant information was not provided and therefore could not be considered by the decision-makers. All this conflicts with the legal requirements that relevant information must be considered by the decision-makers (NEMA sections 2 (4) (a) and 24O (b) and NWA section 2.

3) The biodiversity assessment considered only a fraction of the biota (plants and vertebrates among eukaryotes), and omitted to consider invertebrates, fungi, bacteria, protista and monera that are expected to have important environmental functional roles in watercourses, and therefore materially influenced the decisions made by the decision-makers. Therefore, the assessment and decisions do not meet the legal requirements that relevant considerations must be taken into account (NEMA section 2 (4) (a) and 24O (b) and NWA section 2.

4) Consideration of the full breadth of watercourse (environmental) functions (conduit for waterflows, flood attenuation, aquifer recharge, water storage, water purification, carbon sequestration and biodiversity support) is not found in the assessment documents, and materially influenced the decisions made by the decision-makers as explained above. Yet again there is non-compliance with the requirement to consider relevant factors, and not consider irrelevant factors, as set out in NEMA sections 2 (4) (a) and 24O (b) and the NWA.

5) With 65% of the proposed project area becoming occupied by development footprint, with developments raised on platforms to above flood levels, possibly important losses in watercourse (environmental) functions, for example water purification and carbon sequestration, are not considered in the assessment documents. Given this, EA and WUL decision-makers cannot have applied their minds to relevant factors in refusing the appeals, and the decision-makers yet again are not compliant with NEMA sections 2 (4) (a) and 24O (b) and the NWA.

6) There is no proper consideration of project alternatives that is logical and complies with the requirements of NEMA EIA regulations Appendix 1 in respect of explicitly addressing I&APs concerns, defining criteria for comparing alternatives up front, and designing a method of comparison also up front. Though NEMA regulations explicitly mention 'location' as an alternative to be evaluated, this was not addressed in the project documents. The defective evaluation of alternatives materially influenced the decisions made by the decision-makers. There is non-compliance with NEMA EIA Regulations Appendix 1 section 2 (b) and section 3 (1) (h). Because the assessment of alternatives was not properly done and reported the decision-makers could not have considered relevant factors and that they are required to do by NEMA sections 2 (4) (a) and 24O (b) and the NWA.

7) The EA was granted without conforming to the requirements of NEMA sections 24N (1A) and (2) that the Environmental Management Program (EMPr) be submitted and considered before authorization is concluded. This is a non-compliance by the EA decision-maker. It also represents a breach of the need to

consider all relevant factors (NEMA sections 2 (4) (a) and 24O (b) and the NWA, since the EMPr contains impact control measures that are relevant factors.

8) Project impact assessment (surface water modelling) and project design (stormwater management and services) have been done by one and the same organization, so that the requirement that the environmental assessment practitioner be independent and have no conflict of interest is not met. Hence there is non-compliance with NEMA EIA regulations section 13 that explicitly state the Environmental Assessment Practitioner must be independent and must undertake work in an objective manner.

9) Conditions of the EA and the EMPr do not separate project auditing/assessment and project execution functions, so that auditors/assessors will end up judging their own work, in which case I&APs are justified in being concerned that their rights might not be protected. This is a lapse in 'best professional practice' and it is also not compliant with the requirements that EAPs, any specialists who are co-opted, and environmental auditors are independent of, and have no conflict of interest in, the projects that they assess (NEMA, amendments to the Environmental Impact Assessment Regulations, 2014, sections 13 and 14, Appendices 6 and 7.

Contents

Introduction

1. The purpose of this report is to conduct an expert review of the impact assessment reports submitted in support of the proposed development at River Club of the Liesbeek Leisure Property Trust (LLPT) in the Observatory area of Cape Town. This report is prepared on behalf of the Observatory Civic Association (OCA) and the Goringhaicona Khoi Khoin Indigenous Traditional Council (GKKTIC) who contested environmental authorization (EA) for the proposed development, and issue of a water use licence (WUL), among other authorisations.

2. This review focuses on the key biophysical components (surface flooding and biodiversity) and the procedures for environmental impact assessment.

Background

Grounds for appeal

3. OCA, and the Spatial Planning and Environment section of the City of Cape Town (CoCT), contested the adequacy of the EA.

4. Grounds for appeal by OCA against the EA are as set out below, where the heritage issues are treated only summarily while the biophysical issues (the focus of the present review) are presented virtually verbatim.

   4.1 Heritage. There were multiple grounds, mostly concerning failure to address previously raised concerns. The objectors and appellants argue, among other things, that 'the statement that the sense of place has already been transformed iteratively over the past 80 years, does not make it acceptable to destroy what remains.'

   4.2 Hydrology (1). 'The OCA noted in its objection of 14 February 2020 that the hydrology report does not make explicit its assumptions and parameters. This is a comment that has not been dealt with. We believe that there are material differences in the flooding likelihood and severity should different assumptions and parameters be applied. But in the absence of such information, we cannot come to any conclusion regarding the veracity of the modelling. Moreover, the fact that 'new measurements' were mentioned to two Observatory homeowners whose houses were at risk of flooding, but there was no updating of the 2018 report, leaves us concerned that the lack of transparency in the modelling assumptions may belie very wide variability in the estimates of risk.'

   4.3 Hydrology (2). 'Sea level change data on which the hydrology study is based is derived from a previous study from 2010. Aurecon have not updated their 2018 study since first submission. Given the rapidity with which Climate Change data are evolving, it is in not appropriate that the estimation of flooding severity and

likelihood is based upon sea level rise data that are modelled from a 10-year old study. The fact that the City of Cape Town's Catchment Stormwater and River Management Branch may be using outdated climate change rainfall and sea-level rise assumptions should not justify this project using outdated data to model flooding. This objection was noted in an objection in February in my personal capacity and has not been addressed.'

4.4 Hydrology (3). 'The modelling ignored the joint occurrence of a Spring high tide and heavy downpours which could result in a push back of water. Spring highs occur twice a month for at least 4 days, high tide twice a day. The hydrology report fails to deal with a swollen stormy sea on a spring high in a heavy downpour, pushing back up the Salt River Canal, blocking the restricted outlet of the combined Black and Liesbeek Rivers, which should be adequately modelled with current Climate Change data on sea level, before an authorisation can be given which will alter the current drainage.'

4.5 Hydrology (4). 'The BAR provides no new studies on the effects of increases in storm intensity/sea rise/storm surges expected to result from climate change in the medium to long-term as part of planning for and designing this development. The hydrology studies should have taken more recent information and studies into account, including the 2018/19 City of Cape Town Climate Change Hazard, Vulnerability and Risk Assessment rather than rely on data from the 2010 study mentioned in the Aurecon report.'

4.6 Hydrology (5). 'Additionally, the question of the very deep foundations and extensive basements that are integral to the hard surface of the proposed mega-development on the River Club site interfere with the ability of the soil to absorb water during floods. This was an objection I raised in my personal capacity. This has not been addressed. The response listed in the project document Appendix F2c Draft_BA_Public_Issues_and_Responses_ Summary.pdf) answers a different question.'

4.7 Hydrology (6). 'Currently, every property owner is entitled in their deeds to have rainwater run-off not impeded by a neighbour. Ordinary residents are not allowed to renovate their properties in ways what will cause flooding of neighbours' properties. For the development at the River Club to proceed, a rezoning would have to be secured which will effectively relieve the River Club of its responsibility for flooding of neighbouring houses. Even a rise of 15cm, which is conceded in the report, will constitute a flooding risk. The decision-making authority has failed to apply his mind to this planning issue.'

4.8 Planning (1). 'The decision-maker states that "More than 60% of the proposed site will be retained as open space." This is incorrect. The Municipal Planning ByLaw defines Open Space as "'land ... used primarily as a site for outdoor sports, play, rest or recreation, or as a park or nature area ...". Of the 14.7 ha site, podiums comprising the buildings and their covered parking cover 8ha of

the site, and internal roads and bridges 1.5ha. That leave about 5.2ha, which is about 35% rather than 65% for potential open space. The figure of 60% open space is a claim made by the developers. It would seem the decision-maker ignored objections made about this figure and has simply taken at face value what the applicants have said. In this matter, the decision-maker has failed to apply his mind to the misrepresentation of fact in the proposal.'

4.9 Planning (2). 'The decision-maker states "Approximately 15.6 ha of open space will be provided in a number of open space areas throughout the site." We are puzzled at this statement which must be a typing error since the entire site is only 14.7 ha in size. If a decision-maker does not note an error of this magnitude, we have to ask how seriously the decision-maker considered all aspects of the development in writing up his decision.'

4.10 Planning (3). 'The decision-maker states that "According to the City of Cape Town's Municipal Spatial Development Framework ("MSDF") (2018), the proposed site is designated as 'Urban Inner Core'. The 'Urban Inner Core' represents the priority development and investment focus for the City at a metropolitan scale. The MSDF (2018) further maps the proposed site as a proposed heritage area. According to the "Consistency principles and post-2012 amendments, as contained in Technical Supplement D" of the MSDF (2018), lower order spatial plans and policies must be consistent with higher order spatial plans and policies. The MSDF identifies the land as 'Urban Inner Core" and therefore the lower order Table Bay District Plan is inconsistent with the higher order MSDF (which needs to be updated by the City of Cape Town)." This statement is a material misrepresentation of what the relationship is between different planning documents. The MSDF is a high-level plan which does not override specific zonings or provisions at local level. It provides a broad framework to encourage development in an area designated the 'Urban Inner Core'. However, this has been misrepresented by the Developers and some other government departments supporting the development to imply that any considerations which limit development can be discounted. This is far from the truth. As stated by Heritage Western Cape, the designation as an Urban Core provides for support in principle but "does not override heritage considerations, or indeed, mean that a mega project is appropriate on this particular site." It seems again that the decision-maker has simply absorbed the arguments of the developer without any critical review of these arguments and without applying his mind to the fact, nor taking account of objections that were lodged.'

4.11 Planning (4). 'The decision-maker states that "The proposed development is largely consistent with the draft Two Rivers Local Spatial Development Framework ("LSDF") (dated October 2019)." While this statement may be true, it is unclear why the decision-maker has accorded such importance to a draft LSDF that has not been completed and which has attracted many objections – including objections that the draft LSDF has been retrofitted to provide a post-hoc justification for the River Club development. Seemingly

unable to wait for the conclusion of the LSDF process, both the developers and the decision maker appear to think that the draft LSDF warrants consideration as the planning framework for the area. In that, they are wrong in law. The current planning document is the Table Bay Spatial District Plan (SDP) and Environmental Management Framework (EMP) both of which confirm that any development in the area should not 'negatively impact on the historical character of the area.' The decision-maker dismisses the legality of the Table Bay District Plan on the basis of the higher level MSDF. As pointed out above, there is no legal ground for such a claim. The updating of the Table Bay District Plan is still in process through the Two Rivers LSDF and until that process is finalised, the Table Bay District Plan remains the most relevant planning and policy framework available. The decision-maker appears to have erred in a matter of fact with regard to the planning framework.'

4.12 Climate change (1). 'The decision-maker has commented that the development is consistent with the City's policy on Climate Change. We do not agree that the construction of a mega project, requiring massive earthworks and displacing the flow of water, whilst permanently destroying a green lung for the City that is also a deeply important heritage site, can be interpreted as balancing a "triple bottom-line." There is no reasoning presenting in this decision that justifies this intrusive and destructive development.'

4.13 Climate change (2). 'We draw attention to the factors in the City of Cape Town's 2017 Climate Change Policy and which we raised in our previous objections but which have not been considered in granting this authorisation: (a) Climate change will likely increase mean sea level and "It is likely that the severity and impact of storm surges will be exacerbated by this factor." This is not accounted for in the hydrology report. (b) Cape Town's natural ecosystems should be "protected, managed and made resilient to enable these to act as effective buffers to climate change impacts and provide benefits of ecological infrastructure in support of current and future built infrastructure.'

4.14 Climate change (3). 'The above points are accentuated in the more recent 2020 City of Cape Town Draft Climate Change 2 the Strategy released 19 August 2020 as follows: (a) Note is made that there will be "increasing intensity, severity, and frequency" of adverse impacts including "Flooding and associated impact on people and infrastructure" and "Damage to infrastructure and property due to severe storms and strong winds." (b) The 2020 report warns that "the legacy of past planning decisions causes vulnerability due to the location of various infrastructure and the built environment in high-risk areas that are not suitable for development due to environmental factors that are exacerbated by climate change." (p7). This is a development in a site that is not suitable for development precisely because environmental factors that are exacerbated by climate change will increase risk of flooding.'

4.15 Climate change (4). 'Further, the recently released National Climate Change Adaptation Strategy notes that increasing physical infrastructure resilience and adaptive capacity will require encouragement of "the private sector to build in low climate risk areas" (p30). What we are seeing here is encouragement to build in a high climate risk area, contrary to national policy.'

4.16 Climate change (5). 'All three policy documents point to the importance of carefully accounting for the likely vulnerability to climate change caused by development decision. None of this careful thinking is present in the decision-maker's reasoning.'

4.17 Climate change (6). 'As indicated in our February 2020 objection, the court judgement on the rezoning decision to permit development in the Philippi Horticultural Area by Judge Savage confirmed the principle that the state must consider climate change and the impact of the development on the aquifer in the context of climate change in its decision-making processes. We argued in our February objection that the impacts on the aquifer as contained in this proposal were only superficially considered from the perspective of the impact of pollution but not from the point of view that the Liesbeek River, if managed differently, could contribute to better and more sustainable recharge of the aquifer, thereby rendering Cape Town more resilient to drought. We attached to that objection a report (Aziz and Winter (2019): Discharge and water quality of the Liesbeek River and implications for stormwater harvesting. Environmental & Geographical Science and Future Water, UCT), which has not been responded to.'

4.18 Climate change (7). 'We believe that the studies for the BAR are insufficient to address the requirement set out in Judge Savage's finding and the decision-maker's explanation does not provide reasons why the 'triple bottom line' approach leads necessarily to a conclusion to grant the authorisation. It would seem that the decision-maker's triple bottom line is a bottom line unduly influenced by the economic considerations at the expense of the social and environmental impacts. It is a preferencing of economic development at the expense of the other 'legs' of Sustainable Development.'

4.19 Irregular process to resolve the Heritage impasse. (The present review is focused on the Biophysical, not Heritage, aspects of LLPT's application, so Heritage is beyond the scope of this review.)

4.20 The evidence on irregular process shows that the decision-makers failed to apply its mind, the decision-makers erred in following required process, and the decision-maker was not impartial.

4.21 On the above grounds the environmental authorization is fatally flawed and should be rejected.

5. The OCA's grounds for appeal against the issue of a WUL were as follows.

   5.1 The decision-maker adopted a flawed approach from the outset by assuming that the rehabilitation of the water resources on the River Club Site is only possible if the proposed development is authorised

   5.2 The decision-maker failed to apply its mind independently or was under the mistaken impression that it must authorise the proposed development as previous authorisations had already been granted.

   5.3 The decision-maker failed to have the reports submitted in respect of the water use licence application independently reviewed, it failed to test the assumptions made by the specialists appointed by the developer in the EIA process, and it failed to provide interested and affected parties with an opportunity to comment on those reports or its findings in respect of those assumptions.

   5.4 The decision-maker failed to consider all relevant information including the design layout for the preferred alternative or to make that layout available for comment by interested and affected parties.

6. Grounds for appeal by CoCT Environmental Management Branch against the EA were as follows.

   6.1 The decision does not adequately take into account the City of Cape Town's previous professional and technical comments on the issues set out below.

   6.2 The decision does not align with relevant National and Provincial Legislation, Provincial and City Policy and Spatial Plans and the (Environmental Management Framework (EMF) approved by the Western Cape Government (WCG) MEC for Environmental Affairs & Development Planning (EA&DP).

   6.3 Insufficient consideration was given to the City's comments regarding context, role of the site and desirability of the proposed development.

   6.4 Insufficient consideration was given to heritage informants and the relevant heritage resources authority's comments and there was non-compliance with S38(8) and S38(3) of the National Heritage Resources Act, 25 of 1999 (NHRA).

   6.5 The stormwater impacts, including flooding, are not sufficiently mitigated against, the decision-maker relied on outdated information and the City's Floodplain and River Corridor Management Policy appears to not have been considered.

   6.6 The decision does not give due consideration to climate change impacts and resilience.

   6.7 The decision does not appropriately describe, or mitigate, the loss of open space on site.

6.8 The decision does not appropriately describe, or mitigate the high negative biodiversity impact or habitat loss of a high faunal sensitivity proclaimed Protected Area and assumes a willingness on the City's part to relinquish such Protected Area.

6.9 There was a failure to consider appropriate alternatives including the no-go alternative.

6.10 The decision-maker failed to conduct a site inspection on receipt of the City's comments to ascertain their veracity, and the decision refers to features that are not present on the site.

6.11 There is lack of clarity regarding the boundaries of 'the site.'

6.12 Technical Errors, Discrepancies and Omissions in the EA Resulting in Vagueness.

6.13 Impractical and Inadequate Conditions in the EA.

Method

7. The review undertaken here is founded on two sets of criteria. The first concerns compliance with legal requirements regarding environmental authorization and issue of a water use licence. The second relates to standards for science, which standards are explained below. Individual impact assessment reports (surface water modelling and biodiversity), and the procedures of impact assessment followed for the River Club application are tested against these two sets of criteria.

8. The main provisions in legislation, setting out the requirements for EAs and WULs to be granted, and used in the present review, are set out in Exhibit 2.

Exhibit 1 Articles of law relevant to granting EAs and WULs

Act/regulation	Section
National Water Act No 36 of 1998	Sections 2, 27
National Environmental Management Act No 107 of 1998	Section 2, 24
National Environmental Management Act No 107 of 1998 Amendments to Environmental Impact Assessment Regulations, Government Gazette No 40772 7 April 2017	Section 13, Appendix 1

9. The second set of criteria, concerning standards for science, applied in this report, is given in Exhibit 2. The nature of science is a popular subject and there are many recent books on the matter. Possibly no two people share exactly the same views, but there is consensus that there are several considerations, as explained for example by McIntyre (2019) and paraphrased as follows. The reason why standards for science, rather than for arts or astrology or other, are chosen is that science offers the most reliable basis for knowledge. Like the law, science is reasoned, 'evidence-based' and, among other things, requires testable facts. It is

not pretended that science offers infallible knowledge or certainty. Quite the contrary, science admits fallibility. The findings of any individual piece of science could be mistaken. This is a strength of science. An open and critical mind is retained. No finding or theory is sacrosanct. Nothing is ever proved valid to the extent that it is beyond question. Over the long haul, mistakes – be they unintended error or deliberate fabrication – are likely to be found out on account of the openness and transparency of science and by relentless peer review that pits theory against observation.

Exhibit 2 Standards for science

#	Criterion	Explanation
1	Falsifiable	The issue must be amenable to testing that could show the issue to be mistaken. Alternatively, consequences, implications or predictions of the issue must be amenable to such testing.
2	Repeatable, reproducible and transparent	A method must be stated, it must be capable of implementation, and it must yield consistent results. Method and results must be in the public domain so that they can be reviewed and evaluated.
3	Error elimination	Tests aim to refute and discard flawed ideas, not prove theories correct. Supposed tests of a theory using the data on which the theory is built are circular logic, and independent data are needed for testing. There must be a preparedness to modify or replace a theory if it is found to fail.
4	Frequent iterative theorizing, testing and correcting	The issue is capable of being thought about, the theories critically tested by observation or by physical or thought experiment, the issue re-thought, revised, and re-tested.
5	Positive not normative	Focus on how the world (universe) *is*, on its structure and process, not on how the world *should be.*
6	Strong inference	Results of observations and tests enable firm conclusions to be drawn.
7	Parsimony	Theories, and tests of them, are no more elaborate than need be to meet their purpose.

Results

Surface water modelling

10. Aurecon produced a report, dated 12 March 2018, titled 'Proposed River Club Development: Investigation into the impact of the proposed redevelopment of the River Club on flooding and flood abatement in the Salt River Catchment'. Study was commissioned by LLPT to investigate the impact that the proposed development might have on flooding in the vicinity, downstream and upstream of their property. The modelling report indicated little impact on flood levels, though potential flooding could occur in case of big events (1 in 50- and 1 in 100-year floods) and which would happen whether or not the proposed development took place. Interested and affected parties (OCA and CoCT) rejected the model findings (see above) and, as explained below, this reviewer finds the modelling wanting and the conclusions scientifically unacceptable.

11. Aurecon qualified its modelling with the following statements: '...hydrology and hydraulic modelling should be considered as a tool for analysing potential impacts and scenarios and as this is not an 'exact science', engineering judgement and experience in interpreting the results are important. As such the findings based on the complete analysis are presented and interpreted using Aurecon's knowledge of the site. For these reasons, Aurecon involved three of its staff who have extensive experience of this site in order to ensure the analyses were undertaken and interpreted in the most appropriate manner.'

12. This reviewer's reading of Aurecon's report revealed several shortcomings as described below.

    12.1 The method, data inputs and assumptions of Aurecon's modelling are not reported sufficiently for the modelling to be repeated to assess the reproducibility of Aurecon's results as explained below.

    12.2 To be sure, the Aurecon report states that PCSWMM and HEC-RAS (hydrologic/hydraulic models) were applied to assess flood levels under current conditions and with the proposed development done. There is some discussion of the model inputs. But there is not sufficient information given in the Aurecon report for I&APs, including EA or WUL decision-makers, to upload the data, run the models, and assess reproducibility.

    12.3 For example '...it was assumed that the currently accepted hydrological and hydraulic data for the greater Salt River catchment...are correct' (Aurecon report section 3.1). What are 'the currently accepted data'? Where are they to be found? Accepted by who? Further '...inconsistencies and/or inaccuracies were identified these were rectified based on the available data...' Aurecon report section 3.1). What exactly were the inconsistencies and inaccuracies? How were they determined to be inconsistent or inaccurate? Just how were they 'rectified'? The I&APs do not have access to the digital terrain model and underwater profiles (Aurecon report section 3.1.1). If there are variations in which are the accepted data, the identity of inconsistencies and inaccuracies of data and how they were remedied, in the digital terrain model and in the underwater profiles, how critically might these variations affect model outputs? Answers to these questions are, for the I&APs, untestable. Further, as explained below (para 14), it is not known to what extent, and even whether, Aurecon explored the implications of which are accepted data, what the inconsistencies and inaccuracies were, how they were corrected, the shape of the terrain, the underwater profile, and how variations in these factors might affect model output.

    12.4 There are still further questions not addressed in the Aurecon report. For example, how long is the rainfall record that was used? If it is a long record then, in the face of climate change, are data from long ago relevant? Might rainfall records of long ago be misleading about the current and future climate? If only recent rainfall records were used, then, in the face of high rainfall variability, might the data be insufficient for modelling purposes? The Aurecon report does not address these questions. Aurecon's 'acceptable data' as input for the modelling might be so selected as to make a favourable case for the

applicant. Further, how were 1 in 50- and 1 in 100-year events estimated? Was the Normal Distribution assumed (bell curve)? Or was one or other Extreme Value Distribution adopted? How well did the data fit alternative types of statistical distributions? Evidently many hydrologists, dam designers and other water resource managers have used the Normal Distribution, but extreme event rainfall data fit Extreme Value Distributions well (Agbonaye and Izinyon 2017). Underestimating the frequency of big flood events (*eg* by assuming the Normal Distribution when an Extreme Event Distribution is appropriate) could lead to underestimation of flooding, insufficient provision of drainage, development on land liable to be inundated, dam failures and the like. The Aurecon report gives no indication about how, or even whether, these such issues were addressed.

12.5 On this basis, the decision-makers did not have access to relevant and material information to their decisions to grant the authorisation, and results in relevant information not being considered. If the decision-makers were not able to upload the data, run and test the models which Aurecon was presenting, the question begs as to how the decision-makers were able to assess the flood risk presented by the development. Furthermore, how were the decision-makers able to establish that the precautionary principle was adhered to, and how could the decision-makers decide whether any of the alternatives for the proposed development constituted the best practicable environmental option, as prescribed by section 2 of NEMA?

12.6 The above results in a fatal flaw of the decision-makers approving the EA, as they were not able to assess the environmental impacts associated with the flood risks if they approved the development, and therefore they were not able to take into account all relevant factors as required by section 24O(1)(b)(i), nor were the decision-makers able to adequately determine what measures could be taken to protect the receiving environment relative to the flood risk, which is required by section 24O(1)(b)(ii) of NEMA.

12.7 To emphasize this point, I have studied Minister Bredell's appeal decision and its accompanying reasons,[1] and it is clear that where he assesses the hydrological impact report and the grounds of appeal in relation thereto, he was uncritical and disregarded any shortcomings of the modelling presented by the Aurecon report, and that this impacted his ability to make a decision compliant with the principles of NEMA and the requirements of section 24O of NEMA.

12.8 The Aurecon report does not meet the requirements of testability, repeatability and reproducibility and accessibility to iterative theorizing-testing-review-revision (principles 1, 2 and 4 in Exhibit 2). The Aurecon report is not science and consequently the conclusions in the report are not fit for purposes of assessing flood levels under current conditions and with the proposed

[1] Inter alia, appeal ground 2, as per paragraph 5.11; appeal ground 3, in relation to need and desirability, as per paragraph 5.18.14 to 5.18.16; appeal ground 6, climate change impacts, as per paragraphs 5.93 to 5.97.

development done. The conclusions of the Aurecon report are unreliable and therefore not relevant to the EA and WUL decision-makers.

12.9 However onerous it might be to provide I&APs, including the decision-making authorities, with the necessary information, the modelling in the present case is not immediately repeatable, so that Aurecon's results are not readily testable. Even though the decision-makers uncritically accepted the modelling of the Aurecon hydrology report, I&APs cannot be expected to as a matter of faith rather than on the basis of testability, repeatability and reproducibility, that Aurecon's conclusions are legitimate.

12.10 Given that Aurecon's surface water modelling is not more than poorly qualified opinion, the Aurecon report does not provide a secure basis for the relevant factors of sustainable environmental management to be considered, as required by the NEMA section 2 subsection (4). It is therefore not possible for decision-makers to consider whether the flood risk associated with the site and to the surrounding properties is impacted by the presence of the development, and to take fair and reasoned decisions to grant EA and WUL.

12.11 Further, given 'not more than poorly qualified opinion', the requirements for granting a WUL are not met. NWA section 2 that stipulates that relevant factors be taken into account, for example
(g) protecting aquatic and associated ecosystems and their biological diversity
(h) reducing and preventing pollution and degradation of water resources
(k) managing floods and droughts.
It is not possible to take these factors into account if the flooding has not been properly modelled (see also section below on biodiversity assessment, which explicitly relies on the modelling).

13. In addition to the defects in modelling explained above, the modelling was overly conservative.

13.1 Modelling was conservative, since it focused on the effects of common events or 'business-as-usual'. The old adage about computers applies: nonsense in, nonsense out. Similarly, input common events and the model will yield common outputs.

13.2 While the Aurecon report claims to have considered 1 in 100-year events, storm surges, sea level rises, *etc*, the inputs are indeed conservative in the context of Black Swans. Black Swan is a metaphor that describes an event that comes as a surprise, has a major effect, and is often inappropriately rationalized after the fact with the benefit of hindsight. The term is based on an ancient saying that presumed black swans did not exist – a saying that became reinterpreted to teach a different lesson after the first European encounter with them. Black Swan theory was developed by NN Taleb (see bestseller Taleb NN 2007 *The Black Swan: The Impact of the Highly Improbable*, and his monograph *Silent Risk* (Taleb 2015).

13.3 Aurecon modelling omits to consider Black Swan events which, though occasional and unexpected, have disproportionate impact, as Taleb explains.

13.4 Often Black Swans arise as co-occurrence of unfavourable events – a big rainfall event, storm surge, spring high tide, equinox, blocked river outflows, impeded escape routes for people, power black-outs, communications failures, and so on.

13.5 The frequency distributions for these extreme events are difficult to derive empirically because of the scarcity of data (typically they have 'fat tails' (they are more common than the Normal Distribution would predict) (*eg* based on assumed Normal Distribution of daily market share fluctuations, the 2008 global financial collapse was so rare as to be unlikely since the Big Bang (13 billion years ago), yet market collapses have happened repeatedly). Plainly the Normal Distribution does not apply universally, and resort must be made to extreme event theory that invokes probability distributions which have higher probability of extreme events than the Normal Distribution predicts.

13.6 Given the climatic change now being experienced, including the rising frequency, and greater intensity or severity, of extreme events described by Scholes and Engelbrecht (2021), and illustrated by April and May 2022 floods in Kwazulu Natal (KZN), and that are graphically reported on TV almost daily, Taleb's words ring true: 'the future will have fatter tails'. What this means is that what are now rare extreme events will become commoner, and that still more extreme events are likely. One reads of reports of increasing storm intensity and increasing daily precipitation (EPA 2021). Climate change authorities say 'The risk of severe storms, including intense tropical cyclones and very intense thunderstorms, increases with climate change in southern Africa. As a result, loss of life, injury and damage to infrastructure also increases' (Scholes and Engelbrecht 2021). The World Weather Attribution Centre considers that KZN floods like that of April 2022 now have a 20-year return period compared to 40-year return period before recent climate change (WWAC 2022). So-called extreme event theory (characterized by probability distributions different from the Normal Distribution, and with 'fat tails') is nowadays not just an arcane issue, but is of practical import and needs to be considered if property, the environment and people's lives are to be protected. No evidence could be found in the assessment and design documents for the proposed LLPT development that Cape Town will not experience the climatic extremes that are happening around the globe. Both OCA and CoCT submit, in their appeals, that updated data on climate change have not been considered by the modellers and the decision-makers. Quite simply, the assessment and design documents are defective, and decision-makers deficient, since neither modellers nor the decision-makers considered relevant information and impacts of extreme or Black Swan events, and the predicted increase in frequency with which they will occur.

13.7 To further explain extreme events and Black Swans, risk experts, such as Taleb, advise that in case of highly consequential events, the conventional R = L x C (risk equals the likelihood of the event happening multiplied by its consequence) should not be applied. Rather, ignore the 'chance' and focus on the consequence. There are some common examples of this. One example is the airline industry. By diligent review of accidents, incidents and near misses, the modern airliner has become the safest means of travel – from Kittyhawk to Boeing Dreamliner in little more than a century. The chance of an accident is very low. Yet flying airliners disregards the low chance. Pilot and crew focus on accident-prevention regardless of the vanishingly small chance of a crash. Another common example is travelling by motor vehicle. The chance of an accident on an individual road journey is extremely remote. But we are exhorted, even legally required, to wear the safety belt for every journey. One does not know if and when a crash, with possibly severe even fatal consequences, might happen. If you are prudent (risk averse and cautious, NEMA section 2 (4) (a) (vii)) you always buckle-up regardless of the vanishingly small chance of an accident, because of the potentially catastrophic consequences. And so it is that this reviewer considers justified, in compliance with the 'risk averse and cautious approach' (NEMA section 2 (4) (a) (vii)), that development in and near a low-lying watercourse should not be approved, yet the EA and WUL decision-makers recklessly approved development because they did not take into account relevant flooding, pollution and environmental factors that NEMA section 2 and NWA section 2 require them to consider.

13.8 The concern expressed by OCA and CoCT about the inadequacy of Aurecon's surface water modelling is, in my expert review, justified.

13.9 It may be that Black Swans will have big impacts regardless of LLPT's Alternative 1, Alternative 2 or 'no go'. However, the effects of the different alternatives in the face of Black Swans have not been explored and demonstrated, and are therefore unknown. Under these circumstances of uncertainty, why not adopt the precautionary approach (risk averse and cautious approach, NEMA section 2 (4) (vii)) and simply stay out of the watercourse instead of investing more 'development' in the watercourse?

13.10 Aurecon's modelling flouts principle 6 in Exhibit 2. Aurecon's overly conservative model inputs do not permit strong inference to be drawn about future flooding, and therefore omits relevant information which was required to be assessed by the respective decision-makers. In explanation, NEMA section 24O (b) requires the decision-maker to take into account all relevant factors, which may include any pollution, environmental impacts or environmental degradation likely to be caused if the application is approved or refused; further, to consider measures that may be taken to protect the environment from harm as a result of the activity which is the subject of the application, measures to protect, control, abate or mitigate any pollution, substantially detrimental environmental impacts or environmental degradation. Similarly, NWA section 2

requires the nation's water resources to be protected by considering relevant factors including protecting aquatic and associated ecosystems and their biological diversity, reducing and preventing pollution and degradation of water resources, and managing floods and droughts. The EA and WUL decision-makers could not have taken these factors into account when the base information supplied to them via the Aurecon report was deficient.

13.11 Both OCA and CoCT, in their appeals against granting the EA and WUL respectively, state that the decision-makers failed to take into account climate change and extreme climatic events. Also reflected is an unwillingness to change mindsets in the face of new or broader or realistic information (conflict with principle 3 in Exhibit 2).

13.12 An example of a Black Swan and the need to provide for high-consequence rare events in planning, assessment and design is that of Fukushima Dai-ichi nuclear power plant (NPP) in Japan that was flooded and suffered meltdown and release of radioactive material following an offshore earthquake and tsunami in March 2011. According to a review by Synolakis and Kânoglu (2015), the design, construction and operation of the NPP underestimated the magnitude of possible seismic events, the size of tsunamis created, and the effects of nearshore topography on tsunami wave height. It is notable that the nuclear safety community advocates design for 'worst case' which near tectonic plate subduction zones is an earthquake of M~9.5 and tsunamis 30-40 m high. The NPP was designed for an M~7.5 seismic event and 6.1 m high tsunami. The earthquake of 11 March 2011 was M = 8.9-9.1 and the tsunami was 10-13 m high. Synolakis and Kânoglu (2015) are damning in their evaluation, saying that knowledge at the time required 'higher' safety measures in design and in later improvements in recognition of recent seismic events and tsunamis, and they cite the assessment of the National Diet of Japan that the nuclear power industry in Japan had become 'immune to the scrutiny of civil society' (*cf* our I&APs) and 'its regulation was entrusted to the same government bureaucracy responsible for its promotion'. The disaster at Fukushima Dai-ichi was preventable, and might have been prevented had there been independent review during design, construction and operation. The costs of independent reviews and corrective measures would have been much less than the loss of the NPP, the radioactive contamination of land and sea, immediate loss of life, evacuation of the area, loss of livelihoods and production, increased risk of radiation to local people, *etc.*

13.13 In the project under review, design and assessment plainly did not entertain worst-case scenarios (Black Swans) that the prudent risk manager would adopt for high-consequence risks, precautions that are demanded by 'risk-averse and cautious approach' (NEMA section 2 (4) (a) (vii)), and 'relevant factors' that impact assessors and EA and WUL decision-makers must observe (NEMA sections 2 and 24O, NWA section 2).

14. Still further on the inadequacies of Aurecon's surface water modelling, in addition to inputs and assumptions for the modelling being insufficiently stated and tested, Aurecon placed undue and unnecessary reliance on 'engineering judgement'.

14.1. Modelling depends on several to many input variables. There is inherent uncertainty about the values that the inputs should take.

14.2. The uncertainties of input variables need to be taken into account in modelling. This can be done by Monte Carlo modelling, *ie* by entering an appropriate frequency distribution of values for each input, iterating calculation of model output by selecting input values drawn randomly from each input variable distribution, and producing an output with a frequency distribution (mean/expected value, upper and lower confidence limits, *etc*).

14.3. In this way, uncertainties and variability inherent in the real world can be included in modelling. As stated earlier, 'nonsense in, nonsense out'; 'deterministic input, deterministic output' – much of our world is not deterministic. Aurecon is quite right in asserting that surface water modelling is not an 'exact science' (deterministic). In reality, much depends on chance and contingency, but Aurecon nevertheless models only deterministically. This is a fatal flaw in the modelling of Aurecon and has resulted in decision-makers not being presented with all the relevant information material to their decision, as the data provided by the deterministic modelling of Aurecon does not enable the decision-makers to base their decisions on reliable and/or complete data to assess the flood risk to a degree which would satisfy the requirements of section 24O(1)(b) of NEMA (*ie* take into account all relevant factors).

14.4. The inadequacy of Aurecon's deterministic modelling can be illustrated by analogy. Suppose a drunk man walking along the centre-isle of a dual carriageway road. In his drunken state he wanders off the isle into the one carriageway, and then wanders back across the isle into the other carriageway. If the model of his walk inputs his average position (the isle) the man might live to become sober. If the model input includes his variable position, he probably gets hit by a vehicle and dies.

14.5. Applying the drunk man analogy, Aurecon's surface water modelling, and flooding considers average and business-as-usual conditions, equivalent to the drunk man walking down the centre of the centre isle and wandering only to edges of the isle but not into the carriageways. Such a mental modelling does not test the extreme but quite realistic consequences of the drunk man on a dual carriage-way. Aurecon's modelling has not tested the extreme consequences of surface flooding.

14.6. Software has long-since been designed to aid modelling, showing the effects of uncertain and variable inputs. An example is @RISK which is a Microsoft Excel add-in that has been on the market for more than 30 years. Any numerical modelling can be embedded into Excel, and therefore have @RISK (or other Monte Carlo method) applied.

14.7. Aurecon's failure to explicitly consider and explain the effects of uncertainty in input variables is a deficiency in method and it flouts principle 6 in Exhibit 2 (strong inference). The simplistic model will predict that the drunk survives, whereas realistic input of the variable position of the drunk will predict he is in mortal danger. How can a model with limited input variability possibly be expected to reflect a real world of growing climatic and other variability? Simply put, it won't be able to.

14.8. Both OCA and CoCT appealed granting of the EA on grounds that Aurecon modelling was not explicit on assumptions and parameters. The Aurecon report explicitly says 'engineering judgement' was used. Reasoned judgments are not presented by Aurecon and consequently by the relevant decision-makers in so far they considered these models. It was therefore not demonstrable that the relevant factors were considered by the modellers and the decision-makers, as required by NEMA section 2 and section 24O(1) of NEMA and NWA sections 2 and 27. The failure of the EA and WUL decision-makers to address impact assessment shortcomings after they were pointed out by OCA and CoCT in their appeals suggests bias as well as an unwillingness to change mindset (principle 3 in Exhibit 2.

15. In yet more explanation of the defects of the surface water modelling, Aurecon does not explore the effects of different inputs on the model output.

15.1 Aurecon interprets 'sensitivity analysis' as identifying what aspects of the environment are sensitive to surface flooding. This is not wrong. However, another meaning of 'sensitivity analysis' is identification of the model inputs that most sensitively affect model output.

15.2 This second type of 'sensitivity analysis' is an aid to modelling because it displays for which inputs accurate information is required. It may be recalled that Aurecon mentioned model inputs such as rainfall records, terrain models, corrections, *etc* (para 12 above). How sensitively do 'adjustments' to these inputs affect model output? That is what this second type of 'sensitivity analysis' is intended to answer.

15.3 This second type of 'sensitivity analysis' is included in @RISK.

15.4 The surface water modelling did not do the second type of 'sensitivity analysis' but rather the importance of particular inputs, and the values assumed for them, were evidently based on 'engineering judgement'. If the model input for rainfall intensity, rainfall duration, infiltration and runoff coefficients, terrain model, *etc* are altered, how much does this affect the model output? What is the effect on model output of varying each one of the model inputs? The answers to these such questions do not have to be by 'engineering judgement' but can be executed in @RISK and demonstrated transparently to I&APs and decision-makers.

15.5 Nobel laureate Daniel Kahneman and coworkers consider that professional judgements are inconsistent, much more so than most of us would like to believe (Kahneman et al 2016, Kahneman et al 2021). They

advocate measures be adopted to reduce or eliminate professional judgement. In the present case, the 'decisions' about input variables could have been explored and taken objectively, giving reasons, and thereby reducing questionable and untestable professional judgements.

15.6 Aurecon's 'engineering judgements' about the values for input variables were avoidable, and Aurecon's failure to be objective and transparent and to include the second type of sensitivity analysis flout principles 2 and 6 in Exhibit 2 – professional judgements are poorly repeatable, and little or no inference might be drawn where model input is questionable. This again reflects a failure, by both modellers and EA and WUL decision-makers, to consider the relevant factors, as required by NEMA sections 2 and 24O and NWA section 2.

16. Aurecon's surface water modelling focusses on hazard zone identification (where infrastructure and human life are at risk) but omits to consider possible effects of development-altered flooding regimes on the environmental functioning of the watercourse/wetland. It may be that impacts on environmental function are beyond the scope of 'surface water modelling' and should be included in the biodiversity or other assessment. But the potential impacts on environmental functioning were not found in the biodiversity assessment (see below), nor anywhere else in the project documents.

16.1 In the context of environmental impact assessment of the development proposed by LLPT, identifying hazard zone is necessary but not sufficient. Watercourses, including wetlands, perform environmental functions (or deliver environmental services) including conducting flows across the landscape, flood attenuation, water storage, water infiltration to recharge groundwater/aquifer, water purification, carbon sequestration and biodiversity support.

16.2 While LLPT contends that 60% of the 14.7 ha of site will be open space, OCA identifies 9.5 ha (8 ha buildings and 1.5 ha roads and bridges) so that only 35% of the site will be left as open space.

16.3 What might be the impact of reducing, for example, aquifer recharge, carbon sequestration, or water purification (see later), across 9.5 ha (or even only 5.2 ha) of the proposed development site? The impact assessment does not permit strong inferences here, so principle 6 in Exhibit 2 is not met, simply because of failure to assess relevant issues. This also falls foul of the requirements of section 24O(1) of NEMA, as the decision makers were not able to assess all relevant factors pertaining to the development. The onus surely lies on the proponent and his/her impact assessors to demonstrate 'no harm', or where there is harm advise on appropriate mitigation measures, but such demonstration or advice was not found in the Aurecon surface water flooding report. It is also evident from Minister Bredell's decision that they did not consider the importance of the impact of reducing aquifer recharge, carbon sequestration or water purification of the receiving environment, as a result of the development. There is no reference to these impacts in the Minister's decision.

16.4 The failure of impact assessment, and therefore also of EA and WUL decision-makers, to consider relevant factors (all watercourse environmental functions, including aquifer recharge, carbon sequestration and water purification) conflicts with the requirements set out in NEMA sections 2 and 24O (1), and NWA sections 2 and 27. NEMA section 24O is quite explicit that decision-makers must take 'environmental degradation' into account, and yet in the present case an EA is granted despite 65% of the watercourse being lost.

17. The Aurecon surface water flooding report admits that the proposed development in the watercourse conflicts with Cape Town's 'Floodplain and River Corridor Management Policy' which excludes development below the 1 in 50-year floodline (CoCT appeal pages 7-9). According to the CoCT appeal against the EA, there is no appropriate description or mitigation of the high negative biodiversity impact or habitat loss of a high faunal sensitivity proclaimed Protected Area, and the permissions assume a willingness on the City's part to relinquish such Protected Area (CoCT appeal pages 14-17).

17.1 The Aurecon report recommends that, to avoid conflict with CoCT policy, the developments be raised on platforms to above the 1 in 50-year floodline. This might reduce flooding risk for the developments themselves, but would not avoid the loss of 9.5 ha of watercourse that would be sterilized by the development footprint. As explained in para 16 above and para 18 below, the consequences in terms of environmental function loss (all functions including carbon sequestration and water purification), were not identified and not investigated in the impact assessment.

17.2 Under the circumstances, the loss of environmental function cannot be mitigated. The only effective control measure is to avoid, and that is by not permitting any development footprint to extend into the watercourse.

17.3 If LLPT is permitted to destroy 65% of a watercourse then, by precedent, every developer must be permitted to do the same, and widespread loss of watercourse environmental function would occur. With serial developments, watercourse environmental function – with 65% loss on each occasion – would soon be run down to near zero. Even where watercourses are not protected by city policy or by protected area proclamation, watercourses need to be 'no go' areas for development if biospheric function is to be preserved and the wellbeing of present and future generations assured.

17.4 The Aurecon surface water flooding report, inadequate as it is, does not go beyond hazard zone identification (the integrity of infrastructure and lives of people), and does not address environmental protection, as required by NEMA sections 24O and 28. According to the Constitution Section 24 (b) everyone has the right to have the environment protected. Simply, the LLPT environmental impact assessment and the decision-makers' deliberation does not fulfil the Constitutional obligation to approve only those developments which protect the environment to the benefit, health and wellbeing of present and future affected communities.

Biodiversity assessment

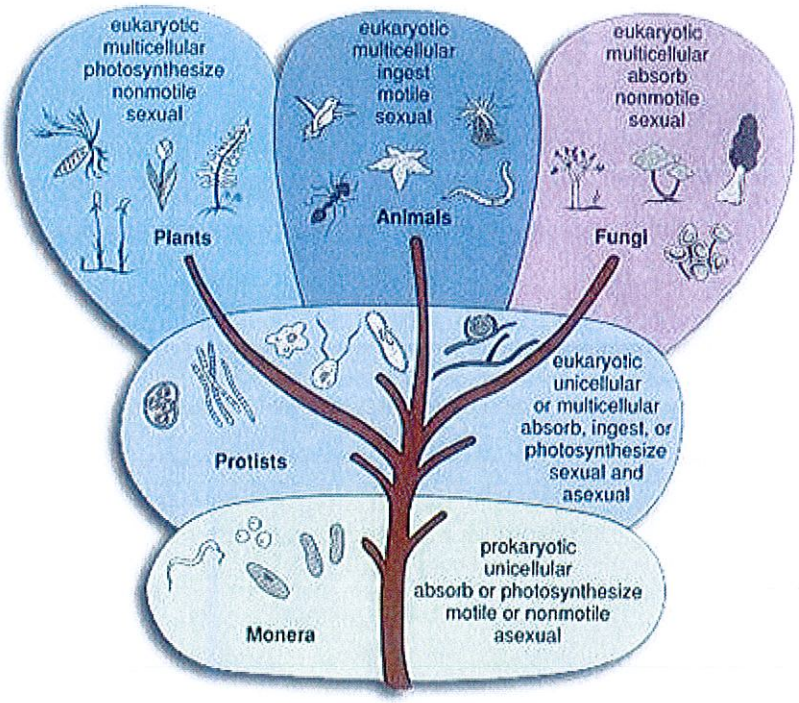
18. The biodiversity impact assessment report was titled 'Assessment of potential biodiversity impacts – incorporating the findings of the aquatic ecosystems (rivers and wetlands), botanical, faunal, avifaunal and groundwater specialists' prepared by Dr Liz Day and dated December 2019. The report considers the aquatic ecosystem (including aspects of water quality), plants, vertebrates and some groundwater issues. The report identified some sensitivities including (a) wetland sensitivity to drainage, diversion, and increased flood velocity, frequency, duration or magnitude, (b) possible contribution to rhenosterveld conservation, and (c) clawless otter, dwarf chameleon, and the endangered western leopard toad. The validity of the findings of the biodiversity assessment were explicitly conditional on the accuracy of the findings of the hydrological study (by Aurecon which is shown above to have failed to consider relevant factors (as required by NEMA sections 2 and 24 and NWA sections 2 and 27) and to fall short of the standard for science). The biodiversity study is therefore invalid. Review of the biodiversity report led to identification of further shortcomings as follows.

    18.1 The scope of the biodiversity study was only partial in the context of proposed development in a watercourse.

    18.2 The consideration of biodiversity omits eukaryotes other than plants and vertebrates (not invertebrates), and omits fungi, bacteria, protista and monera. See Exhibit 3 that displays the diversity of living organisms. There are indeed several different classifications of living things, but Exhibit 3 is sufficient to make the point that the biodiversity assessment by Dr Day considers only a fraction of actual biodiversity. Despite the limited scope of biodiversity consideration, the biodiversity report concludes that biodiversity and wetlands have limited sensitivity to the proposed development.

    18.3 In the present case in a watercourse 9.5 ha (65%) of the development site will be occupied by building, road and bridge footprint. Normal soil (environmental) function will be curtailed under the footprint. The environmental functions of a watercourse (conduit for water flows, flood attenuation, aquifer recharge, water storage, water purification, carbon sequestration, biodiversity support) will be curtailed. In reality the biodiversity that would be impacted includes micro-organisms such as bacteria, fungi and invertebrates, none of which the biodiversity study considered. The soil microbes contribute significantly to the soil component called soil organic matter which is regarded to make up the 'life' of soil and to distinguish soil capable of supporting life from fragmented rock. The loss of environmental services in the development footprint (65% of site) might be considered to be near total in respect of some functions (flood attenuation, water purification, carbon sequestration).

Exhibit 3 Types of living organisms



18.4 If the footprint extends into the watercourse, it is the obligation of impact assessment to determine and make known the nature and extent of curtailment of soil (environmental) function. The proposed development does extend into the watercourse, and the impact on soil (environmental) function was not studied and disclosed.

18.5 If development in 65% of the watercourse is to be permitted in the present case, then this creates a precedent (via the Constitutional 'equality before the law') for other developments to be granted similar permissions, so that soon most watercourse function everywhere is lost.

18.6 Because the Aurecon surface flood modelling was unrealistically conservative and did not consider likely Black Swan storms and floods, one of the assumptions of the biodiversity study (the surface flooding modelling is accurate) is not met. The findings of the biodiversity study are therefore unjustified and even invalid. It is noted too that the biodiversity study identified wetland sensitivity to '…increased flood velocity, frequency, duration or magnitude…' in respect only of a limited array of the biota, the part of the biota that is mostly a symptom of environmental conditions rather than a driver of these conditions. If the flooding were bigger than the biodiversity

study considered (bigger because of climate extremes and Black Swans that the Aurecon study to not entertain), and a wider array of biota studied, how much more sensitive might the system have emerged to be? Fungi and bacteria strongly determine soil (environmental) function and condition on which plants and vertebrates depend.

18.7 Because of the invalidity (relied on the Aurecon modelling report which was deficient because it, among other things, failed to consider extreme events – see above) and narrow scope of the biodiversity assessment (only some classes of biota considered, overlooked extent of loss of environmental function) strong inference cannot be drawn from the biodiversity study, and principle 6 in Exhibit 2 is not met. The Final EA, in its stated reasons for granting authorization, (a) does not consider effects of impacts of the proposed development on fungi, bacteria, invertebrates and soil (environmental) function (EA pages 22-24), (b) does not address the loss of 65% of the watercourse (EA pages 24-26), and (c) does not mention Black Swan/extreme flooding events (EA pages 26-27). These shortcomings mean that both the biodiversity study and the EA and WUL decisions cannot meet NEMA sections 2 and 24 and NWA sections 2 and 27 requirements to consider all relevant factors.

Alternatives

19. There are alternatives to just about any project – alternatives to the objective, and alternatives in terms of issues such as activity, location and technology. NEMA EIA regulations require alternatives to be identified, and methods to be described for evaluation and selection among alternatives (Amendments to the Environmental Impact Assessment Regulations, 2014, Government Gazette 40772, 7 April 2017, see especially Appendices 1 and 2). In the impact assessment of the proposed LLPT, limited development alternatives are considered and treatment of them is perfunctory.

19.1 In terms of NEMA (EIA regulations referred to immediately above), and for comparison of alternatives to be rational, certain conditions must be met: (a) alternatives must be identified, (b) relevant criteria of comparison must be defined up front, (c) the relevance of the criteria must be explained, (d) the method of scoring or rating each alternative on each criterion must be devised before any comparison is attempted, (e) the reasons why each alternative was scored the way it was against each criterion must be explained, and (f) the method of using the scores to reject, accept or order alternatives must also be decided, again before the comparison is attempted. An example of how alternatives should be evaluated is given in Mentis (2010, pages 139-149).

19.2 Condition (a) in the above paragraph is nominally met since project alternatives were stated as follows.

Alternative 1 (preferred alternative): This entails rehabilitation of the canal into a more natural, un-lined channel, and the infilling of the natural channel to create a landscaped open space and stormwater swale system.

Alternative 2: This allows for retention of the canal, with minor landscaping and softening of its edges, and the protection and rehabilitation of the natural channel into an (albeit disconnected and rendered unnatural but still functional) wetland.

Alternative 3: No go (project does not proceed).

19.3 A serious defect in identifying alternatives is that an option to develop outside the watercourse was not included. The law explicitly mentions 'location' as an alternative to be considered in EIA (Amendments to the Environmental Impact Assessment Regulations, 2014, Government Gazette 40772, 7 April 2017, Appendix 1 section 2 (b)). The proponent might of course discard such an alternative from the outset, but I&APs and decision-makers would want to know the reasons for rejection of such an option. If there were good reasons the proponent would not be shy to have the 'somewhere else' option considered. For any big development, the land cost is minor, and investor capital is mobile and could easily be at this or that location.

19.4 The other conditions (b) to (f) above are not found in the River Club documents. The surface water modelling and biodiversity reports do no more than, *post hoc*, indicate preference for this or that alternative (in fact preference for Alternative 1).

19.5 The assessment documents do not, as legally required by NEMA regulations, summarize all the issues raised by I&APs (NEMA EIA Regulations Appendix 1 3 (1) (h) (ii) and (iv)) and do not describe the environmental attributes associated with the alternatives including the geographical, physical, biological, social, economic, heritage and cultural aspects (NEMA EIA Regulations Appendix 1 3 (1) (h) (ii) and (iv)). For example, the climate extremes and big weather events (including Black Swans) that I&APs want considered (see their grounds for appeal above) are not addressed. Similarly, the assessment documents do not specify a method of evaluating and choosing among alternatives, as required by (NEMA EIA Regulations Appendix 1 3 (1) (h) (vi)).

19.6 The way in which alternatives are considered in the impact assessment documents is by deciding on criteria of comparison (*eg* impacts on plants and vertebrates), and method of selecting among alternatives (*eg* impacts on plants and vertebrates differ between alternatives), after study of limited scope was undertaken. This is a weak test of alternatives, for four main reasons. The first concerns WYSIATI ('what you see is all there is'

(Kahneman D 2011 *Thinking, Fast and Slow,* Penguin). If the study is narrow then what you can see is limited. A broad study, designed to compare impacts of alternatives under day-to-day and extreme events on a wide array of organism types (plants, vertebrate and invertebrate animals, bacteria, fungi, *etc*) and on relevant environmental functioning (flood attenuation, water storage, aquifer recharge, water purification, carbon sequestration, *etc*)[2] would allow 'more to be seen' and therefore permit stronger inference to be drawn (item 6 in Exhibit 2), as explained under the bullet point above. Second, criteria to discriminate between alternatives need to be predefined so that study can be designed to address relevant issues. If the criteria are not predefined the chances are that not all relevant data will be collected in the study (item 3 in Exhibit 2). Third, study design must deliberately stress-test, and seek fault in, the alternatives rather than collect data only in support. Just about any theory can be validated if only supporting evidence is collected. Fourth, collecting data by a narrow study, using the data to identify criteria, then using the selfsame data to evaluate the criteria commits circular logic – the conclusion is contained in the premise (*eg* unlawful hunting is wrong because it is illegal) (principle 3 in Exhibit 2). The procedure used in the impact assessment is not scientific and not logically sound.

19.7 In the absence of climate change and big events being included in the hydrological modelling, as requested by I&APs, there is no knowing which alternative is preferable, especially on the point of flooding. It is quite plausible that, for example, under climate change and big weather events, huge flooding will occur irrespective of the alternative (1, 2 or no go), in which case the preferable option, on grounds of 'minimum regret', a risk-averse and cautious approach (NEMA section 2 (4) (a) (vii)) and the best practicable environmental option (NEMA section 1 Definitions), would be to stay out of watercourse (even withdraw from it) and ensure natural environmental systems are kept intact to mitigate the impacts of climate change and extreme weather events. 'Staying out of the watercourse' is the development alternative that was omitted in the impact assessment documents and in the decision-makers' deliberations.

19.8 In explanation, 'minimum regret' complies with NEMA section 2 (4) (vii). NEMA requires that a risk-averse and cautious approach is applied. Unlike the popularly stated 'precautionary principle', there is an exact algorithm for performing 'minimum regret'. It equates with the economist's mini-max strategy whereby the option with the least damaging worst scenario is adopted. The opposite to mini-max is maxi-max where the option with the biggest possible payoff, if all goes right, is selected. It is improbable in any

[2] The biodiversity study results suggest that water quality is better in the channel/canal than surrounding environment. This reviewer's experience is that this is the case in semi-arid and arid environments. If water is abstracted from the channel, or flow down the channel is hastened, then recharge of the 'riparian' zone is limited, and ingress of poor quality/saline water from neighbourhood can happen. This ingressed poor quality water can have severe impact on the channel and nearby biota.

project, which has countless aspects, that everything does indeed 'go right'. Some things are bound, by chance alone, to 'go wrong'. Often the option with the biggest payoff is also the option with the worst, or at least a very bad, worst case when things don't go 'all right'. Maxi-max is gambling and it is expressly prohibited by NEMA section 2 (4) (a) (vii). In effect, the appeals by OCA and CoCT are saying that climate change and the increase of extreme weather events due to climate change have not been considered, that if these extremes occurred (inevitable) flooding in the future would be unacceptable, and that accepting the narrow approach adopted in Aurecon flood modelling amounts to LLPT opting for maxi-max (gambling with the environment) that is prohibited by NEMA. The EA and WUL decision-makers are at fault too for not having applied their minds to these issues (especially after I&APs raised them). The decision-makers cannot have considered all the relevant factors, as required by NEMA section 2 and NWA section 2, and the decision-makers have therefore taken decisions unfairly, without considered reason.

19.9 The proponent's preferred alternative (development go-ahead with rehabilitation of the canal into a more natural, un-lined channel, and the infilling of the natural channel to create a landscaped open space and stormwater swale system) includes occupation by development of 65% of the rivercourse (below the 50-year floodline). Proposing infilling of any natural channel raises red flags and is liable to cause problems. Natural channels exist because of flows, and flow regime interacting with the substrate determines channel dimensions. This reviewer cannot find explanation for why a natural channel should be infilled. The loss of watercourse environmental function (amount of loss not assessed in the EIA documents) over 65% of the development site is environmental degradation which, according to the Constitution (section 24 (b) (i)) and NEMA (section 2 (4) (a) (ii), section 28 (1) ('must take reasonable measures to prevent such pollution or degradation from occurring') should be avoided as far as possible. This reviewer cannot find reason in the documents to justify this loss. The proponent's preferred alternative does not conform to 'best practicable environmental option' (NEMA section 1 Definitions), since the development could have been 'somewhere else' and thereby avoided the impacts on heritage and watercourse.

19.10 The proponent's selection of Alternative 1 to go ahead with development, infill the natural channel, rehabilitate the canal, create of a swale system rather than either Alternative 2 (go ahead with development, no channel infill but undertake some rehabilitation, retain canal with minor rehabilitation) or Alternative 3 (no development, no rehabilitation) defies logic and the provisions of NEMA section 28 'duty of care'. If the environment is degraded then it should be rehabilitated by the party responsible for the degradation. So why should there not be rehabilitation regardless of whether the development goes ahead? The answer to that question was not found in the project documents. And why might there be variation in the nature of

rehabilitation (Alternatives 1 and 2) when by NEMA's duty of care the requirement is to remedy the degradation. Rehabilitation must always be to the 'high standard' (so we pass on to future generations an unimpaired environment that requires not more maintenance than the unimpacted environment), and anything less than 'to the high standard' is not rehabilitation (Mentis 2019, 2020). If sub-standard or no rehabilitation is permitted then the Constitutional principle of equality before the law is flouted, then precedent for not always rehabilitating properly is created, and we are on a slippery slope to biospheric ruin.

19.11 It is this reviewer's experience in working on land rehabilitation projects for more than 35 years that swale systems, and other such artefacts on the landscape, should be avoided (Mentis 2019, 2020). Though these interventions might serve a purpose in the short-term, they often cause more damage/erosion than they prevent, they require on-going maintenance and they thereby conflict with the sustainability principle of not passing costs (cost to maintain, cost to repair, cost to suffer a degraded environment) on to posterity. The landscape must be restored to its natural form ('The flow pattern of run-off water, the topography and the slope shall, depending on the volume of material exploited or removed, be restored as closely as possible to the original condition.' Conservation of Agricultural Resources Act 43 of 1983 Regulations section 14 (1) (c) (iv)). In short, the proposed swale system conflicts with this reviewer's experience about what is sustainable, and it conflicts with the law.

19.12 The EA gives reasons for authorisation and does consider 'alternatives' (EA page 15). However, the EA reasons on alternatives have critical defects. First, the obvious alternative of 'somewhere else', outside the watercourse is not considered. The proponent and the decision-makers might have good reasons why 'somewhere else' was not considered. But this reviewer cannot find mention of the 'somewhere else' option in any of the documents. This reviewer also makes the point that cost benefit analysis (CBA), as might be contemplated to develop in the watercourse, is invalid. The reasons for this are set out in an article published in the international open access journal *Forest Ecosystems* (Mentis 2020 https://doi.org/10.1186/s40663-020-00233-4). This is a widely read article with over 16 000 accessions from the website in just over 2 years since publication. The reasons for CBA being invalid in these circumstances are (a) long time spans are involved and discounting is supposedly warranted but there is no definitive answer to what discount rate to use, (b) the nature of the assets (natural capital such as weather, nutrient cycling, succession) are unlike labour and machinery which are exchangeable in the common CBA, but are indispensable and irreplaceable, (c) natural capital does not change hands in the market place, and prices have to be imputed (guessed). The upshot is that CBA is too easily adjustable and so can support any preconceptions. Science and technology, including CBA, are silent on the desirability of, say, short-erm employment and

economic development at the cost of, say, future environmental function and livability of our planet. The choice between such alternatives rests on a value judgement. This value judgement is written into The Constitution of South Africa. The environment must be protected for present and future generations. If there is good reason for the present proponent not to develop 'somewhere else' such reason is not presented, but this does not validate development in the watercourse to the destruction of environmental function for 65% of the development footprint. The watercourse natural capital, in a water-scarce South Africa, is indispensable and irreplaceable.

Incomplete EMPr

20. Environmental authorization for LLPT's proposed development was granted on 20 August 2020. Among the conditions of EA were formulation and submission of a Stormwater Management Plan and a Rehabilitation/Restoration Plan. However, the law requires that management planning be completed and submitted before authorization is granted.

20.1 Environmental authorization was granted subject to, among other things, two management plans be compiled and submitted (EA section 9, page 7).

20.2 EA section 9.1 states: 'The Stormwater Management Plan, to be compiled, must be included in the EMPr. A copy of the Stormwater Management Plan must be submitted to this Department prior to the commencement of construction for record purposes'.

20.3 EA section 9.2 states: 'A rehabilitation/restoration plan for the rehabilitation of the Liesbeek Canal must be compiled in consultation with CapeNature prior to the commencement of rehabilitation work to be undertaken. A copy of the final rehabilitation/restoration plan must be submitted to this Directorate prior to the commencement of the rehabilitation work for record purposes'.

20.4 No statement was found in the EA to effect that these two plans were required to be approved (following critical evaluation) by 'this Department' or by CapeNature or by both. Nor was any statement found in the EA that required the plans to be shown to I&APs. There is therefore no prescribed control over the standards for stormwater management and rehabilitation. In effect, this commits the same incestuous operation practiced by the Japanese nuclear industry and which lead to the catastrophe of the Fukushima Dai-ichi nuclear power plant (para 13.12 above).

20.5 The law requires that where authorization requires environmental impact assessment as a basis for decision, an environmental management program (EMPr) must be submitted before deciding on an application for authorization (NEMA section 24N (1A)).

20.6 The EMPr must contain information on any proposed management, mitigation, protection or remedial measures that will be undertake to address the environmental impacts that have been identified in a report contemplated in section 24 (1A), including environmental impacts or objectives in respect of (i) planning and design, (ii) pre construction and construction activities, (iii) the operation or undertaking of the activity in question, (iv) the rehabilitation of the environment, and (v) closure, if applicable (NEMA 24N (2)).

20.7 The EA has therefore been granted without conforming to the requirements of NEMA sections 24N (1A) and (2).

Conflicting interests

21. Review of project documents, in particular the assessment (surface water modelling) and design (stormwater and services) reports, the EA and the EMPr reveal conflicting interests or lack of independence between assessment, projection execution and compliance-checking, as explained below.

21.1 Assessment work (the surface water modeling) and planning work (service reports, storm water management) have been done by one and the same organization, Aurecon/Zutari.

21.2 If impact assessment and design are not done independently then there is a risk that the one might influence the other. For example, impacts are downplayed by the assessors to avoid the design-work being cancelled. Alternatively, the impacts are embellished to make the design components bigger, and then supervision of construction that much more lucrative.

21.3 Independence of the environmental assessment practitioner is required (NEMA, Amendments to Environmental Impact Assessment Regulations, Government Gazette No 40772 7 April 2017, Section 13). See also Buthelezi (2020 *Critical Analysis of the Independence of Environmental Assessment Practitioners in South Africa*).

21.4 In the final EA for LLPT there is a shortcoming where condition 4 states that 'The holder shall be responsible for compliance with the conditions…' and condition 11 that states that the holder must appoint an ECO 'to ensure compliance with the provisions of the EMPr and the conditions contained in this Environmental Authorization'.

21.5 If the ECO is 'to ensure' he/she must be given executive authority (this reviewer knows of no case of such executive authority being granted to an ECO) in which case he/she becomes part of the project and he/she must judge his/her own work, and thereby compromise independence in judgement of whether or not compliance is met.

21.6 If the ECO is not granted executive authority then he/she CANNOT 'ensure compliance', though the ECO might assess and report whether or not there is compliance.

21.7 Alternatively or in addition, if the ECO is 'to ensure compliance' then there are two bodies responsible for compliance (the holder and the ECO), so that if non-compliances arise the holder can blame the ECO, and the ECO can blame the holder. 'If three people are made responsible to feed the dog, the animal will starve' according to General Stanley McChrystal (McChrystal and Butrico 2021).

21.8 In the ideal, it is the holder who must be solely accountable to ensure compliance, and the ECO must be independent (avoid involvement in the project beyond mere assessment of compliance) and report compliance/non-compliance to the holder, the competent authority and the stakeholders.

21.9 In the EMPr the Environmental Control Officer (ECO) is indicated to report to, among others, the Contractor, and to approve proposed corrective measures in the case of non-compliance. If the Contractor implements the corrective measures, the ECO's assessment of 'correction' involves judging the success or otherwise of his/her own approvals and therefore lacks independence. If the corrective measures fail, the Contractor can excuse himself by saying 'I did what you told me to do'. Involving the ECO in approving corrective measures absolves the Contractor from accountability. These kinds of problems are identified by Mentis (Mentis M 2015 Managing project risks and uncertainties *Forest Ecosystems* 2:2 https://doi.org/10.1186/s40663-014-0026-z. This is a widely read article with more than 27 000 accessions from the website.)

21.10 '...independent expertise whose affiliations lie outside those of the experts officially involved in project development should be used for peer review of environmental impact assessment, monitoring and auditing.' (Flyvbjerg B, Bruzelius N, Rothengatter W 2003 *Megaprojects and Risk: An Anatomy of Ambition* Cambridge University Press, Cambridge).

21.11 One famous/notorious case of the 'referee and player' combination is that of the Enron/Arthur Andersen scandal. Arthur Andersen was Enron auditor, and also advised on business management. 'The Enron scandal was an accounting scandal involving Enron Corporation, an American energy company based in Houston, Texas. Upon being publicized in October 2001, the company [share value fell from >US$90 to >US$1 and it] declared bankruptcy and its accounting firm, Arthur Andersen – then one of the five largest audit and accountancy partnerships in the world – was effectively dissolved. In addition to being the largest bankruptcy reorganization in U.S.

history at that time, Enron was cited as the biggest audit failure' (Enron scandal - Wikipedia).

21.12 Another case of 'doer and reviewer' not being independent is that of the Fukushima Dai-ichi nuclear power plant in Japan. In their review of the earthquake/tsunami disaster and overwhelming of the plant in March 2011, Synolakis and Kânoglu (2015) cite the assessment of the National Diet of Japan: the nuclear power industry in Japan had become 'immune to the scrutiny of civil society' and 'its regulation was entrusted to the same government bureaucracy responsible for its promotion'. Independent review of Japan's nuclear industry might have identified the shortfalls and avoided catastrophic loss of the nuclear power plant, release of radioactive material to land and sea, evacuation of the area, loss of livelihoods and loss of land and business productivity, all worth US$ billions.

21.13 While appeal was made in respect of conflict of interest, and while the Minister did address this appeal, the matter related to decision-maker independence (Minister's Appeal Decision REFERENCE NO: 14/3/1/A7/17/0478/20, page 122, Appeal Ground 13) and not to the above-described objection that relates to conflicting interests in assessment of the project, planning its infrastructure and monitoring and auditing.

21.14 It is not only 'best professional practice' for impact and risk assessors, any specialists appointed to help them, and auditors to be independent of, and have no conflicting interests in, the projects that they work on, but the law requires independence and absence of conflict of interest, as set out in NEMA, amendments to the Environmental Impact Assessment Regulations, 2014, sections 13 and 14, Appendices 6 and 7. The project is therefore yet again non-compliant.

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