Review of Hills of Gold Appendix N Soil and Water Addendum Report with Comments on Submission Report

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The findings and opinions in this report are based on research undertaken by Robert Banks (PhD, BSc Hons, Senior Adjunct Fellow UQ, Certified Professional Soil Scientist, Dip Bus) of SoilFutures Consulting Pty Ltd as independent consultants, and do not purport to be those of the clients.

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1. Introduction

This review has been made at the request of Hills of Gold Preservation Incorporated, a community interest group from the surrounds of Nundle. The request was to review introductory and material and sections 3, 16 of the Hills of Gold Wind Farm EIS (ERM, 2020), and associated Appendix O with respect to soil and landscape information provided in the EIS.

1.1 Suitability of Reviewer and Code of Conduct in Case of Court Proceedings

This review was conducted by soil scientist and geomorphologist Dr Robert Banks. Dr Robert Banks is a Certified Professional Soil Scientists (CPSS) as required for BSAL assessments/review and preferred for EIS work and review in NSW. Dr Vera Banks of SoilFutures Consulting Pty Ltd edited the review.

In preparing this review, I made all the inquiries I believed were necessary and appropriate and to my knowledge there have not been any relevant matters omitted from this review. I believe that the facts within my knowledge that have been stated in this review are true.

The opinions I have expressed in this review are independent and impartial, based on my training and abilities as a recognised soil scientist. I have read and understand *Schedule 7* to the *Uniform Civil Procedure Rules* and have used my best endeavors to comply with it.

In the case where I might appear in court regarding this review, I understand my duty to the Court and state that I have complied with it and will continue to do so. I believe I have the relevant expertise to be able to provide such information as requested for this review.

1.2 Suitability of Reviewer - Experience and Expertise of Dr Robert Banks

In my role as a researcher and soil survey scientist in the Soil Conservation Service and its descendant organisations, my undergraduate qualifications and Certified Professional Soil Scientist (CPSS) accreditation were accepted by the NSW Government and its agencies to perform and publish foundation assessments of soil materials.

In addition to the qualifications and experience outlined in my CV, I have published USCS class based foundation suitability, and road subgrade and untreated road suitability recommendations based on USCS class. Banks (1995), which has 199 USCS results and recommendations; Banks (1998) which has 224 USCS results and recommendations; Banks (2001) which has 459 USCS results and recommendations. These 882 tests and results cover soil samples from 332 soil profiles from the Liverpool Plains area of NW NSW and the upper Hunter Valley.

A further 438 USCS tests with recommendations have been made by me are held in the NSW soil data base and used by the NSW Government planning authorities for regional information on foundation hazard and its variance.

With respect to the soil landscapes (soil mapping units that the development footprint lies within) I have published 20 foundation recommendations based on USCS classes (Banks, 1998) and reviewed a further 18 foundation recommendations by McInnes-Clarke (2004).

2. Methodology of Assessment of Response to Review

The Hills of Gold Wind Farm Amendment Report - Soil and Water Addendum Report or Appendix N of the response to review was read in conjunction with sections of the Response to Submissions document.

A previous review of the EIS Soil and Water Section by SoilFutures Consulting raised questions about the validity of many statements made for the EIS that were in error or not justified with appropriate data. Most of these are summarised in tabular form in Appendix B of the Soil and Water Addendum Report.

Following is a consideration of whether the consultants have met the requirements for the EIS and a state significant development with regards to provision of clear and accurate, and site relevant data.

It should be noted that insertion of intentionally misleading information into an EIS is not only unethical, it has severe penalties under the relevant NSW planning legislation.

3. Assessment of Soil and Water Addendum Report

3.1 General Comments

Whilst it seems that some changes have been made to this section of the EIS supporting information, very little has been done to clearly change or improve the original work and address concerns raised. The qualifications and CPSS status of the authors are not given. However, it seems that the quality of the soil survey work suggests that the authors do not understand what is required in the provision of good soil information for the assessment of development purposes.

3.2 Description of what a soil survey should be

A site soil survey must at least comply with the following to be relevant in an EIS:

Be conducted at a suitable scale for the intensity of the development and with appropriate sampling density (with full soil profile descriptions) as per *Guidelines for Surveying Soil and Land Resources* (Gunn et al., 1988) to a level of detail by which a dominant soil types can be mapped for the area of interest.

Soil sample points should always be described, photographed and mapped in accordance with the *Australian Soil and Land Survey Field Handbook (NCST, 2009),* and soil type classified according to *The Australian Soil Classification* (Isbell & NCST, 2021). Soil samples should be taken and analysed appropriately for the purpose at a NATA approved laboratory. Usually

within NSW, soil profiles are registered in E-Dirt and stored in SALIS for easy access and review and as a permanent record of each site.

Mapped soil units or soil landscape units should be described, and their associated soil variation given with relevant soil tests that show their suitability or otherwise for the proposed development along with what mitigation measures may be needed.

3.3 Stepwise review of Soil and Water Addendum Report

Table 1: Tabulated review of section

Page(s)	Comment
1	The introduction does not outline how the report improves or adds to information previously given in prior documentation. It should spell it out clearly instead of listing select sections in yet another appendix of what is already an appendix.
2	Is general information which would otherwise be scoping information for a site-specific survey along the footprint of the whole development.
3	Section 2.3.1 Soil and Geology. No soil type is mentioned in the soils section. No map based on soil profiles and fieldwork, nor any relevant soil laboratory data are presented. At best this is an introductory section to the report. No Australian standard mapping practice has been employed to provide risk or suitability information on the development.
3	Section 2.2.2 Erosion and Slips. There are no mapped landslips, they are simply mentioned as occurring. No attempt has been made to look for slips under the development footprint along the whole route of proposed roads some of which is under a canopy and cannot be remotely sensed etc.
4	Section 2.4.1 Encountered Surface Conditions. Purports to provide some soil information and soil profile information but gives a very general description of existing road surfaces. The intimation that a soil profile or more has been used is false.
5	Table 2-1 Soil Profile Summary Wind Farm Ridgeline. The claim that this is a soil profile description is false and does not meet any requirements for soil profile description at all. It is at best descriptive introductory material that offers no information that can be extended along the proposed development footprint. No engineering soil analyses are presented that may assist in understanding the relevance of this very broad description.
6	Table 2-2 Soil Profile Summary Switching Station Site. The claim that this is a soil profile description is false and does not meet any requirements for soil profile

	description at all. It is at best descriptive introductory material that offers no information that can be extended along the proposed development footprint. No engineering soil analyses are presented that may assist in understanding the relevance of this very broad description.
6	Sections 2.4.3 and 2.4.4 are general in nature and do not specify when or where they apply along the footprint of the proposed development.
7	No mention is made of which grass species may be used here. As the proposed development crosses a range of environments which feed seed into several catchments, this represents an invasive weed risk and needs to be very specific.
8-14	Section 3 and 4. The suggestion that slope along is used to determine Land and Soil Capability Classes is incorrect. Soil type needs to be considered within the context of slope. There are areas of NSW which have Class 7 or 8 which are flat, but classed so because of soil limitations. Despite this, I am pleased to see that an attempt has been made to map all slopes along the development footprint. The map has not been used correctly to correct LSC classes because there is no soil information given. Having said that, the slope map could have been used to identify soil profile and engineering test sites to make an adequate soil or soil and landscape map. Unfortunately, this did not happen so the conclusions from the slope mapping exercise are not necessarily adequate. The use of LSC in planning for a detailed and expensive development is not recommended except at a scoping stage. Soil landscapes (published ones available from OEH on request) would have been more helpful as a base. No soil type is mentioned in this page.
15	The comment that existing land use defies land capability is nonsense. There are many examples of poor farm management right across Australia, which is why the concept of 'no – go areas" has developed into protected land legislation and LSC classes etc. This statement is more about land use history than its capability.
16 - 22	Soil and Water Management. This section again is very general in nature and makes no attempt to place measures along the development footprint. No attempt has been made to assess the permanent runoff effects of the new interceptions surfaces of each catchment. Instead we are presented with irrelevancies such as how much of the development represents as a component of sub catchments. No numbers are given or calculated.

	The impact of snow melt on supercharging catchments has with runoff has not been mentioned at all. Considerable depths of snow can build within the crestline footprint in some years, and it tends to melt quickly, providing large surges of run-on to lower landscapes and creek lines.
23-24	These are great ideas, but most of them should have been included in plans within the EIS showing where these measures were to be employed. As such they are a list of what might be done. Once again, the way soil type (in absence of LSC class) has an impact on how these measures will work is not mentioned. No engineering or soil tests are provided to justify comments made.
25	No mention has been made of keeping soil pathogens separate from separate catchments. No mention has been made of a wash-down and sterilisation facility between catchments or sensitive areas.
26	Desktop review – has not provided additional information. Comment on current land use. This does not justify a land capability statement as much as say that poor land management may have been practiced in the area for a long time. The last sentence. No runoff values have been calculated or provided. This statement cannot be justified at all. Even the sudden modification of 2% of a smaller catchment with 100% runoff should significantly affect catchment flows, volume speed and duration.
27	It is suggested here that extra runoff will not impact on lower sloping areas. Presumably, water flows downhill into steeper sections of catchments and the inclusion of extra impermeable interception surfaces in a catchment will mean that those areas which are now covered or developed will have close to 100% runoff. The fate of the runoff has not been properly considered

3.4 Review of Appendix A

The only comment that can be made regarding this section is that it is poorly presented and does not present the data used. The soil landscape information referred to in this section is not referenced by page of the Landcom (2004) document. Therefore, we have no idea which data set was used.

The most appropriate data sets are given in the Landcom (2004) document on pages C57, C59, C63, and C66 and are derived directly from McInnes-Clarke (2004) and Banks (1998). As there has been no proper referencing from the document provided and no data presented except by vague range, this section remains of doubtful use.

3.5 Review of Appendix B

This section addresses each section of the table stepwise.

Table 2: Tabulated review of Appendix B

Comment	Comment on "Reference"
Redo Soil and Water Assessment based on correct Land and Soil Capability mapping, paying particular attention to Class 8 soil, high erosion and mass movement risk.	Unfortunately, as no soil data has been presented in this section, it is not possible to say that this has been done. The slope mapping constitutes a portion of the whole job.
Conduct on site soil survey and use results in modelling of erosion hazards.	There is no soil survey according to any available Australian standards. No soil survey has been undertaken along proposed access routes or pad sites. Geotechnical information is vague, misleading, poorly referenced, and poorly georeferenced. To say that this has been done is misleading and false.
Use Hanging Rock rainfall modelling (up to 50% higher than Nundle Post Office) and use figures to inform runoff and erosion mitigation.	OK – some attempt has been made. It needs to be clearly stated that the rainfall is up to 50% higher in the development footprint than at available stations such as Nundle PO.
Address potential for moving soil and waterbased pathogens between sites (including Ben Halls Gap Nature Reserve).	Pathogens are not mentioned in the document aside from this appendix. This is misleading and incorrect
Incorporate wash down facilities to avoid contamination or rare and endangered flora and fauna, weed spread and fungus movement affecting frogs.	Only discussed in terms of national park or forest areas in the RTS. Pathogens are not mentioned in the document aside from this appendix. This is misleading and incorrect
Address potential impacts of flooding, particularly on floodplain crossings needed for heavy transport vehicles.	No comment
Take into account the gradient of the site in engineering of road realignment, internal access roads, wind turbine and associated infrastructure construction.	Although a slope map has been presented, this has not been turned into a map along the length of the proposed development showing risk areas and what remedial measures will need to go where. No plan has been provided.
Modify wind turbine and site layout based on high erosion and mass movement risk.	Modifications do not appear to be clearly stated. Areas of mass movement risk based on soil

	testing as well as slope mapping are not provided. This statement is misleading.
Incorporate Class 8 soil high erosion and mass movement risk implications for road and wind turbine, and other infrastructure, into Capital Investment Value Report.	Not within scope of this review.
A thorough Hydrological and Geotechnical Analysis (on ground study) to determine the potential impact on groundwater flow.	Should have been provided within the soil and water addendum.
Determine potential impact on Tamworth water supply & Hunter / Manning catchments.	Should have been in this section, but aside from throw away comments about not extra runoff, it is not.
To insist on a thorough investigation into potential impacts on surface and groundwater flows into the Peel River, as people rely on springs for domestic and stock water.	Stock water not mentioned except in this appendix. Not addressed.
To insist on a thorough investigation into potential impacts on surface and groundwater flows into the Peel River, as people rely on springs for domestic and stock water.	Remote sensing used may be limited because of extreme depth penetration, not picking up shallow springs within the impact zone of the proposed development. If there were no shallow water in the area there would be no wells or windmills, therefore I am concerned that areas where groundwater is clearly used have not been picked up by the survey.
Include hardstands and compacted surfaces such as internal access roads in runoff modelling and mitigation.	Has not been undertaken in this document except by general discussion. Where is the data?

4. Concluding Remarks

Whilst some improvements have been made as to addressing issues of slope related hazards to the proposed development Appendix N, really provides no other information relevant to planning for the infrastructure and turbines needed for a wind farm. The slope information could have been used to clearly map out where different erosion control measures will need to be emplaced. I would have expected a proper survey showing this in particular.

The qualifications of the authors are not given, and in terms of soil they should be clearly stated to ascertain if they are suitable people to conduct a soil survey or to review soil survey information with regards to the development. Ideally, they should be at least CPSS accredited. The author(s) have shown no understanding of what is required with respect to adequate soil survey and use of available soil information.

No attempt has been made at all to do a soil survey. The supposed soil profiles are not soil profiles as per the relevant Australian standards for soil survey. There are no soil profiles along the proposed development footprint, and no corresponding soil tests outlining the hazards associated with each soil profile. It would have been helpful if the soil section referred to published soil erosion and engineering hazards specifically as given in the oft referred text Landcom (2004). At least these are located within the same soil landscapes as the proposed development, although coming from slightly to the west where the rainfall and rainfall intensity is lower. The supposed soil profile data given is misleading and not acceptable in terms of Australian Standards. I would have expected at least reference data with K factors, USCS classes, road suitability foundation suitability and untreated (dirt) road suitability in such a document. For example Banks (1998) (pages 180 and 182) have a total of 20 soil tests published for these landscapes the results are summarised below.

Table 3: Published soil test Results from Banks (1998).

Soil Landscape	Test	VL2	VL	L1	L	M	H
Coober-Bulga (South side of range). 13 soil test results with USCS Class	Building Foundation Suitability	7	3	2		1	
	Road Subgrade Suitability		7		3	3	
	Untreated Road Suitability		12		1		
Langs Neck (North Side of range). 7 soil test results with USCS Class	Building Foundation Suitability	7					
	Road Subgrade Suitability		3		2	2	
	Untreated Road Suitability		5	2			
Ranking	**VL2**	**VL**	**L1**	**L**	**M**	**H**	**VH**
Suitability for Purpose	Very Low	Very Low	Low	Low	Moderate	High	Very High

In addition to these results which are reported from a drier area of the range, McInnes-Clarke (2004) reported a further 18 USCS classes for these landscapes, from which the same rankings can be derived. The above results indicate that there are likely to be serious issues with road stability and foundation suitability of soil materials within the footprint of the development.

No soil distribution is discussed except for broad comments. It appears that the footprint is considered by the author(s) to be one soil type. However, a review of McInnes-Clarke (2004) and Banks (1998) shows that there are likely to be at least 8 very different soil types within the development footprint, each with their own engineering and erosion characteristics. These need to be clearly mapped for such a development to detail the developments soil related engineering and environmental risks. They are not.

The use of a conservative k-factor is good; however, this does not accommodate the variation in soil types and slopes within the development footprint. Again, no maps have been provided.

The document does not clearly show a calculation of increased runoff from new impermeable interception surfaces.

Soil hygiene related to transfer of soil pathogens and weds seeds is not mentioned adequately. No wash down stations for sterilizing implements are provided on maps.

Rapid and large volume snow melt, which is an occasional feature in the area is not assessed as part of erosion hazard or runoff assessments provided.

In short the revised Soil and Water study does not demonstrate that the proposed disturbance footprint includes an appropriate allowance for constructability, implementation of erosion and sediment controls, and is informed by geotechnical data collected on site or from published soil landscapes which include the footprint of the development. The information provided is somewhat misleading and has, for the most part, not addressed issues raised in the prior review of the original documentation.

5. References

Banks, R. G. (1995). *Soil Landscapes of the Curlewis 1:100 000 Sheet. Map and Report*. Sydney: NSW Dept. of Conservation and Land Management.

Banks, R. G. (1998). *Soil Landscapes of the Blackville 1:100 000 Sheet. Map and Report*. Sydney: NSW Dept of Land and Water Conservation.

Gunn, R., Beattie, J., Reid, R., & Van de Graaff, R. (1988). Australian soil and land survey handbook: guidelines for conducting surveys.

Isbell, R., & NCST. (2021). *The Australian Soil Classification. 3rd Edition.* (3 ed.). Melbourne: CSIRO Publishing.

Landcom, N. (2004). Managing Urban Stormwater: Soils and Construction. In: Volume.

McInnes-Clarke, S. K. (2004). *Soil Landscapes of the Murrurundi 1: 100 000 Sheet:(Parkville, Kars Springs, Murrurundi, Quirindi, Wallbadah)*: Department of Infrastructure, Planning and Natural Resources.

NCST. (2009). *Australian Soil and Land Survey Field Handbook. Third Edition* (3rd Ed.). Collingwood, VIC, Australia: CSIRO PUBLISHING.