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Ms Megan Trousdale
Secretary
Hills of Gold Preservation Inc
Nundle
NSW

Dear Megan

Thank you for providing the supporting links and supplementary technical documents associated with the proposed Hills of Gold Wind Farm Development near Nundle, NSW. I base the following comments on these documents.

In summary:

1. The Environmental Impact Statement (EIS) and supporting technical documents for the proposed development provide scant information on the potential multiple environmental impacts of this development. There are gaps in the environmental information presented and as such there remains significant risk associated with the proposed development. Overall, the environmental materials sighted are not fit for purpose or represent industry standards.
2. There is no detailed analysis of potential changes to rainfall/runoff processes associated with this development.
3. Methods employed to show the potential environment impact of the proposed development do not represent best available science or meet industry standards.
4. The compounding effect of climate change on the environmental impact of the development is not considered. The best available science from the Commonwealth Scientific, Industrial Research Organisation (CSIRO) on climate change for this region of NSW show rainfall events to increase in intensity. This has significant implications for potential changes to rainfall/runoff ratios, soil erosion and therefore added stress to aquatic ecosystems connected to or influenced by this development.
5. Material provided on potential environmental impacts is limited to the immediate area of the development with no consideration to wider regional impacts. Moreover, there is little on the medium- or long-term impacts of the future operation of this development.

In the following I provide detail on some of these summary comments.

DETAILED BACKGROUND COMMENTS.

1. The area of development is within a region of NSW that contains sensitive and endangered ecosystems. There has been scant recognition of this fact and the implications of the construction and on-going operation of the Hills of Gold Wind Farm on these ecosystems.

   The upland region where this proposed development is planned contains an array of sensitive Upland Aquatic Ecosystems – some of which the NSW Government has classified as endangered ecosystems. These ecosystems are sensitive to both natural and human disturbances.

   These sensitive and endangered aquatic ecosystems have not been documented or considered in the environmental documents associated with this development.

   Typical Upland Aquatic Ecosystems, including headwater streams, wetlands, swamps, and bogs, are important for several reasons:

   - Water generation: Headwater streams are the significant source of much of the water in larger streams and rivers. In the Murray Darling Basin, typically headwater regions generate up to 80% of the runoff to downstream areas.
   - Water quality: These ecosystems play a critical role in maintaining the quality of downstream water resources by filtering sediments, excess nutrients, and other pollutants.
   - Habitat: Upland aquatic ecosystems provide important and unique habitat for many aquatic and terrestrial species, including fish, amphibians, insects, and migratory birds. They represent important breeding and spawning grounds for many species and are key refugia for migratory birds. The Upland Aquatic Ecosystems of the region, in which the proposed development will occur, form an important habitat node of the Eastern Australian migratory bird pathway – that route taken by migratory birds that travel from breeding grounds in the Northern Hemisphere to their non-breeding grounds in Australia and the Pacific Islands. Many species of migratory birds use the Eastern Australian migratory pathway, including shorebirds such as sandpipers and plovers, as well as songbirds such as flycatchers and thrushes. These birds typically breed in the Arctic regions of North America and Asia during the Northern Hemisphere summer, and then make a long journey to their non-breeding grounds in Australia and the Pacific Islands for the winter. The Eastern Australian migratory pathway is important for these birds because it provides them with suitable habitats for resting, feeding, and breeding during their migration. However, the Eastern Australian migratory pathway is also threatened by human activities such as habitat loss that will happen with this development. This development has the potential to reduce the availability and quality of the habitats that the migratory birds rely on and affect the timing and success of their breeding and migration.

     In addition, wind farms, such as that proposed, can have additional negative effects on bird populations.

Wind farms pose a significant threat to bird populations by causing direct mortality through collisions with wind turbines. This is particularly true for birds that fly at low altitudes, such as water birds and migratory birds that use the Eastern Australian migratory pathway. However, the extent of this threat can depend on a variety of factors, such as the size, design, and location of the wind turbines, as well as the behavior and flight patterns of the birds in the area.

- Carbon storage: These ecosystems sequester large amounts of carbon, which helps mitigate climate change. Upland wetlands, for example, can store carbon in their soils for thousands of years.
- Flood control: Upland aquatic ecosystems can help control flooding by absorbing and storing water during high-flow events, reducing the volume and velocity of water downstream.
- Cultural significance: These ecosystems are often valued by local communities for their cultural, recreational, and aesthetic significance. They may also have important spiritual and historical significance.

Given their ecological importance, I would have expected the EIS to address the issue of how this development will mitigate any potential impacts on Upland Aquatic Ecosystems. This represents a significant environmental risk from this development.

2. Information on potential hydrological changes because of the proposed development is limited. The development will occur in important hydrological – headwater - regions.

The proposed construction and ongoing operation of the proposed wind farm represents a significant land use change. Land use change can have a significant impact on rainfall / runoff processes. When natural vegetation is either disturbed and or replaced with relatively impervious surfaces, such as construction sites, access roads and concrete emplacements for wind towers and associated infrastructure the amount of water that infiltrates into the soil is reduced, and the amount of runoff that flows over the land surface and into streams and rivers is increased. This can lead to more frequent and more severe flooding events. Additionally, land use change can alter the timing and magnitude of runoff. For example, deforestation and the construction of wind farms and its associated infrastructure can lead to increased peak flows and reduced base flows, which can have significant impacts on water availability downstream.

The proposed Hills of Gold Wind Farm will occur in a hydrologically important region of the landscape. Headwater regions are the significant source of water generation to downstream streams, rivers, and floodplains. In the Murray Darling Basin, typically, headwater regions generate up to 80% of the runoff to downstream areas. Disturbance to these headwater source areas, such as that proposed by the Hills of Gold Wind Farm, represent a major risk to natural rainfall / runoff processes and their ability to provide a reliable and sustainable water resource in the long term.

Water security is an issue for regions downstream of the Hills of Gold Wind Farm. During the last drought period Tamworth enacted severe water restrictions. The implications of the Hills of Gold Wind Farm on future water security, especially during drought periods has not been addressed in the EIS or technical documents provided to me.

Land use change can also impact the quality of runoff. With developments like that proposed significant increases in soil erosion will occur and eventually be washed into streams and rivers, leading to water quality degradation and freshwater habitat deterioration.

Overall, the effect of land use change that will occur because of the proposed development on rainfall / runoff processes is complex and depends on factors such as the type and intensity of land use change, soil characteristics, climate, and topography. Understanding these factors is important for developing effective strategies to manage land use and minimize negative impacts on hydrological systems.

Changes in rainfall / runoff processes because of this development represent a significant risk to the hydrology of the region and to the water security of downstream riparian communities and municipal areas. However, they have not been dealt with in any sufficient detail within the EIS documentation sighted.

3. The construction and on-going operation of the wind farm represent a significant risk to soil erosion and increased sediment delivery to freshwater ecosystems.

   The EIS and technical documents do address the issue of potential increases in soil erosion and soil loss from the area of the development via the Universal Soil Loss Equation (USLE). The USLE is a widely used empirical model for predicting soil erosion. However, there are several issues with the use of the USLE that should be considered that result in it not representing best available science nor being recognised as an industry standard.

   - Limited applicability in Australia: The USLE was developed for use in the United States and has primarily been tested in agricultural fields. Its applicability to other regions like the proposed wind farm and land uses is limited.
   - Simplistic assumptions: The USLE assumes that erosion is driven solely by rainfall and surface runoff and does not account for other important factors such as wind erosion and sediment transport by rivers. This can lead to inaccuracies in predictions.
   - Limited input data: The USLE requires input data such as soil erodibility, slope length and steepness, vegetation character and cover, and rainfall intensity and duration. Obtaining accurate and up-to-date data for these variables is challenging, particularly in areas with limited data availability. The area of the wind farm development is an area of poor data availability that can provide reasonably accurate soil loss information.

- Limited consideration of the temporal dynamics of soil erosion: The USLE assumes that erosion rates are constant over time, which is not always the case. For example, erosion rates are higher during extreme rainfall events, lower during dry periods and significantly greater following the breaking of drought periods.

The USLE can be a useful tool for predicting soil erosion and informing land management decisions. However, it must be used with caution and its results should be validated with field measurements. No field data on soil loss were provided with the EIS or associated technical documents.

The CSIRO has undertaken major soil erosion research programs across Australia. This research shows that soil erosion is a major environmental issue in Australia. It reduces land productivity and has off-site effects of decreased water quality. CSIRO has calculated broad-scale spatially distributed soil erosion loss using a variety of spatial modelling methods that predict soil erosion over the Australian continent using revised soil loss equations and have developed spatial data layers for each of the contributing environmental factors. These models have been compared and validated using Australian erosion plot data and reveal an acceptable consistency between predictions and observations. The modelling results for the region of the wind farm development show:

- High erosion potentials compared to many other regions in Australia. They are also significantly higher than that predicted by the standard USLE, as suggested by the technical documents presented for this development.
- Soil erosion potential differs significantly between summer and winter. The technical documents provide only an average.
- Average erosion rate of the region is 5-10 t/ha yr^{-1}, which is greater than the continental average.
- Erosion rates will increase substantially if catchment surfaces are disturbed, as proposed by this development.

Increased soil erosion represents a significant environmental risk as result of this development. It is a risk that has been substantially underestimated in the EIS and technical documents.

4. Increased soil erosion because the wind farm represents a significant risk to water quality and habitat conditions of receiving freshwater ecosystems.

Increased soil erosion can have a significant impact on downstream water quality. As soil is eroded, it can carry sediment, nutrients, and other pollutants into rivers and other water bodies. These pollutants can cause a range of problems, including:

- Reduced water clarity: As soil and sediment is carried downstream, it clouds the water (measured as turbidity), reducing light penetration and affecting aquatic plant growth.
- Altered aquatic habitat: Increased sediment fills stream channels and reduce water depth, altering aquatic habitats and affecting fish and other aquatic life.

- Nutrient loading: Soil erosion can transport nutrients such as nitrogen and phosphorus, which can lead to increased algal growth and decreased oxygen levels in the water.
- Contamination: Soil erosion can also transport pollutants such as pesticides, heavy metals, and pathogens, which can be harmful to human health and aquatic life.
- Increased turbidity increases water treatment costs: As sediment and other pollutants enter water supplies, they can increase the costs of water treatment for municipal and industrial uses. For the Hills of Gold Wind Farm development this may have implications for downstream municipal areas like Tamworth.

The effects of increased soil erosion on downstream water quality can be exacerbated by land use practices that increase erosion rates, such as deforestation, urbanization, and intensive agriculture.

The risk of increased sediment loads as result of the Hills of Gold Wind Farm development has not been addressed in the EIS or associated technical documents available to me.

5. There is no consideration of the compounding effect of climate change.

The EIS and associated technical documents do not address the issue of climate change for the region and its impact on rainfall / runoff processes and soil erosion for the development site. Climate change modelling by the CSIRO show significant impacts on rainfall / runoff processes in eastern Australia, with the potential for increased flooding, drought, and water scarcity. Some of the potential impacts are:

- Changes in precipitation patterns: Climate change is expected to result in more extreme weather events, including heavier rainfall in some areas. This can increase the likelihood of flash flooding and runoff, particularly in urban areas with impervious surfaces. Increased rainfall intensity will occur with climate change for the region, and this has significant implications for both rainfall / runoff processes and soil erosion.
- Increased evapotranspiration: As temperatures rise, evapotranspiration rates are likely to increase, leading to decreased soil moisture and reduced runoff.
- Changes in vegetation patterns: Climate change is expected to alter the distribution of vegetation types, with potential impacts on runoff processes. For example, if drought-tolerant vegetation replaces water-intensive vegetation, runoff rates may decrease.
- Water availability: Climate change is expected to reduce the amount of water available in some areas due to decreased rainfall and increased evapotranspiration. This can have significant impacts on water supply for agriculture, urban areas, and ecosystems.
- Changes in groundwater recharge: Climate change may alter the timing and amount of groundwater recharge, leading to changes in water availability and quality.

In addition to these impacts, climate change interacts with other stressors such as land use change, further exacerbating the effects on rainfall / runoff processes.

Overall, I find the technical documentation and the EIS provided to significantly underestimate the environmental risk of the proposed wind farm. EIS's are important tools used to assess the potential environmental impacts of large-scale development projects, including wind farm developments.

I am happy to discuss any aspect of my observations on this development.

Yours faithfully

Martin Thoms