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## Concerning – Peer Review of Coastal, Surface Water and Nutrient Pathway Modelling

Dear Tobias

This letter forms the final peer review report of a process conducted over approximately 18 months reviewing the coastal, surface water and nutrient pathway modelling for the Ashburton Salt Project.

Background

K+S Salt Australia (K+S) is proposing to construct and operate a solar salt facility 40km to the south-west of Onslow – the Ashburton Salt Project. The project will be constructed on existing salt flats and require marine infrastructure such as a seawater intake, offload jetty, bitterns discharge outfall as well as inland infrastructure such as pond walls, access roads, culverts and conveyor infrastructure.

A comprehensive programme has been undertaken to assess the feasibility of the project. Part of this programme was the development of a series of numerical models to assess impacts of the project on the marine and coastal environment, surface waters and nutrient pathways. These models were developed by Water Technology Pty Ltd (WaterTech).

K+S Salt Australia engaged DHI to perform a peer review function on the development and application of these models.

Peer review was conducted on the following final reports:

- Water Technology. Marine and Coastal Assessment and Modelling. Doc #: 5196-10_R04_v03_Coastal_&_Marine_Modelling_FINAL 3.5.21.pdf. Dated 3 May 2021.
- Water Technology. Nutrient Pathway Assessment and Modelling. Doc #: 5196-20_R02_v05_Nutrient_Pathway_Assessment_&_Modelling_FINAL_27.5.21.pdf. Dated 27 May 2021.
- Water Technology. Surface Water Assessment and Modelling. Doc #: 5196-20_R03_v05_Surface_Water_Modelling_FINAL_1.6.21.pdf. Dated 1 June 2021.

The peer review was specifically requested to provide commentary on whether the modelling conducted was suitable for the purpose of identifying potential environmental impacts.

The peer review had no role in providing impact assessment commentary.

This document describes the review process undertaken and presents a summary of the main conclusions and recommendations made under the peer review.

Structure of the Review Process

The peer review process was undertaken in a comprehensive, rigorous and iterative manner. It commenced in October 2019 with initial review of preliminary documentation produced by WaterTech. A series of meetings were conducted with K+S, WaterTech and DHI over the course of the review process to discuss progress and any identified issues. Preliminary versions of the above reports were provided in October 2020 with further updated versions provided in December 2020 and February /March 2021. Final versions of the reports were provided in May 2021.

Throughout the iterative review process K+S, WaterTech and DHI exchanged information and resolved issues through a well-structured process of report reviews, meetings and written communication. Technical issues raised were discussed and considered in detail which resulted in the modification and enhancement of the final reports. This iterative and interactive process resulted in a more robust set of models for the purposes of assessing potential environmental impacts.

K+S retains the extensive record of all commentary and correspondence of the detailed review process.

Peer Review – Marine and Coastal Assessment and Modelling Report

WaterTech used a series of numerical models to simulate potential impacts on the project of the marine and coastal environment. This included a hydrodynamic model MIKE 3 FM, CORMIX for the simulation of the bitterns discharge, MIKE ST for the simulation of sand transport and MIKE MT for the simulation of mud transport emanating from dredge plumes.

The hydrodynamic model was calibrated to measured water levels, tidal constituents, satellite imagery of inundation, temperature and salinity. A regional model was used to capture larger scale processes offshore of the site, with a high-resolution local model used to capture detail within the project area.

Coastal processes modelling focussed on issues associated with modifications to inundation patterns (critical for mangrove and algal mats), and hydrodynamics at Urala Creek South and the jetty location (Locker Point). It is the opinion of the peer reviewer that the models used can be considered suitable for the purpose of identifying potential environmental impacts at these locations for these processes.

Bitterns discharge modelling focussed on developing and assessing a bitterns diffuser concept design against derived environmental quality criteria. This assessment used both near-field and far-field modelling and included iterations and optimisation to reduce potential environmental impacts. It is the opinion of the peer reviewer that the models used to describe the bitterns discharge can be considered suitable for the purpose of identifying potential environmental impacts.

Dredge plume modelling focussed on consideration of the dredging concept, scale and schedule to inform potential impact zones. It is the opinion of the peer reviewer that the models used to describe the dredge plume can be considered suitable for the purpose of identifying potential environmental impacts.

Peer Review – Nutrient Pathway Assessment and Modelling Report

WaterTech used a series of models to simulate potential impacts of the project on nutrient pathways to the coastal environment. This included a conceptual model to determine a nitrogen budget for the project site and broader Exmouth Gulf, along with a hydrodynamic numerical model (MIKE 3 FM) coupled to a water quality model (MIKE ECO Lab) to determine potential impacts on nitrogen export at a spatially explicit scale.

The conceptual nitrogen budget uses data from a variety of independent sources for various processes responsible for nitrogen supply and uptake. This includes local measurements, relevant literature studies and the combination of the two to derive specific values for the project. It was encouraging to see that a sampling team was mobilised during the reasonably rare rainfall events in the project site to sample surface water quality to support these studies.

The MIKE ECO Lab model spatially accounted for the key habitat types identified in the conceptual model (mangroves, algal mats, salt flats, bare mudflats), coupled with the hydrodynamic model. Calibration of the hydrodynamic model was made against water level measurements (and is a similar model to that used in the Marine and Coastal Assessment and Modelling report). Calibration of the nitrogen component of the MIKE ECO Lab model focused on replicating diurnal ranges and spatial gradients in Total Nitrogen at 6 sites across Urala Creek. The model does sufficiently well in this regard for the purposes of this investigation.

A number of conservative assumptions were made in this report to ensure that project development effects were over-estimated rather than under-estimated. Consideration was made of data presented on an annual basis as well as a multi-year (50 year) basis to demonstrate the effects of less frequently occurring storm and cyclone events that can impact the project area. Results are presented both in the context of the project area and the broader Exmouth Gulf.

It is the opinion of the peer reviewer that the models used to describe the nutrient pathways can be considered suitable for the purpose of identifying potential environmental impacts.

Peer Review – Surface Water Assessment and Modelling Report

WaterTech used a series of models to simulate potential impacts of the project on surface waters. This included RORB for rainfall-runoff calculations, MIKE 21 FM for the regional flow conditions and a high resolution TUFLOW model for localised surface water flow effects within the project area.

The RORB models were unable to be calibrated due to a lack of data in the study area. A combination of literature surveys, local infiltration tests and sensitivity analysis was conducted to constrain flow estimates. These were also cross-checked against regional flood frequency estimates.

Ocean boundary conditions for the flooding models were consistently applied in this report based on those generated in the Marine and Coastal Assessment work described above. The high resolution TUFLOW model used inputs derived from the regional MIKE 21 FM model at the upstream boundary. Infiltration losses were applied consistently between both models.

The regional model was calibrated to satellite imagery available after the passage of Cyclone Vance, showing the extent of inland flooding. Regional model scenarios show the complex flow patterns that result from river breakouts and the highly variable local topography.

Impact assessment modelling was conducted with the high resolution TUFLOW model in the project area. Mitigation strategies were recommended based on the preliminary engineering designs available and will require update and assessment based on detailed engineering when available. These mitigation strategies indicate some localised ponding as expected, to be reviewed once further engineering is completed.

It is noted that the diversion channels produced only minor improvements relative to the unmitigated case and require further review. Borrow pit locations were not available at the time the report was completed.

The modelling was completed whilst engineering design was still preliminary, thus some modifications may be required once details of the site infrastructure are confirmed.

It is the opinion of the peer reviewer that the models used to describe the surface water can be considered suitable for the purpose of identifying potential environmental impacts.

Best regards

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