Potential Impacts from the Yannarie Solar Salt Project on the Exmouth Gulf

MG Kailis and WAFIC ERMP Response

Rev 0

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1 INTRODUCTION

Exmouth Gulf supports a long-standing sustainable prawn trawl fishery which provides Tiger Prawns, Exmouth King Prawns and Endeavour Prawns to the Perth market. The 16 licences in the fishery harvest on average 1000 tonnes of prawns every year whilst providing employment for over 100 people and producing in excess of $15 million in revenue.

The Yannarie mangrove system on the eastern side of Exmouth Gulf has been universally recognised as requiring high level protection. This is because it is a vital nursery for crustaceans and fish, including species utilised by significant commercial and recreational fisheries established in the region. In particular, both the well established prawning and pearling industry in the Gulf relies on this nursery for their future operation.

The prawn fishery is known to be dependent on juvenile recruitment from the shallow seagrass and algal beds on the eastern side of the gulf. Regular pulses of nutrients enrich these seagrass beds following outflows from the hinterland after cyclonic rainfall, or heavy winter rains. Studies of these seagrass beds following the impacts of cyclone Vance in March 1999, demonstrate the reliance of these nursery areas on terrestrial nutrient run-off (Kangas, M. et. al. 2007).

The fishery is closely monitored by WA Fisheries research staff and is managed cooperatively by the Fisheries Department and industry based on real-time information supplied by the world's leading technology. The fishery is often quoted as the "Best-Managed" Prawn Fishery in the world.

The Exmouth region is also home to a pearl oyster fishery and grow-out industry and an established recreational sports-fishery.

Both fishing and aquaculture are highly dependent on the maintenance of high water quality and the natural ecological processes which drive marine productivity. All these activities will be threatened by the proposed Yannarie Salt Project.

The production and transfer of juvenile pearl oyster to important pearl farm areas in the Kimberley is dependent on freedom from exotic disease and pests. The presence of large bulk carriers from high risk areas puts the disease-free status of stock from what the government has declared an 'icon' industry in WA at definite risk.

Both commercial and recreational fisheries will potentially see a reduction in recruitment as a consequence of changes to habitat structure and foodwebs resulting from the construction of the solar salt complex. Vast numbers of larvae and juveniles will also be directly removed from the nursery habitat by the intake pumps.

The presence of an industrial port and shipping operation may also result in the exclusion of both commercial and recreational fishers from important fishing areas.

2 SUMMARY OF MAJOR CONCERNS

The following topics have been identified as the major threats to the commercial prawning industry in the Exmouth Gulf due to the salt production proposal and are discussed in further detail in Section 1.3.

- Impacts from alteration of surface water flows (loss of productivity - ecosystem and fishery related by diversion of fresh-water runoff containing nutrients in heavy rainfall events);
- Impacts on groundwater and mangroves;
- Impacts from bitterns management (disposal of bitterns despite a commitment to use and accidental loss of bitterns);
- Impacts from water intake pumps (entrapment of juvenile prawns, loss of nursery area);
- Introduction of non-indigenous marine species through ballast water/hull fouling;
- Loss of mangroves/algal mats through sea-level rise;
- Impacts from barge harbour dredging / acid sulphate soils;
- Fisheries assessment based on inadequate information; and
- Scale and timeframe.

3 RESPONSE TO RELEVANT ERMP SECTIONS

3.1 Impacts from alteration of surface water flows

The project proposes the construction of rock retaining walls stretching more than 70 km along the east coast of the Exmouth Gulf and diverting the natural 'flood-out' drainage pattern and terrestrial run-off from storm surge events in the area. Although modelling indicated that no significant runoff occurs in the Yannarie and Rouse systems from the by-annual and annual recurrence interval (ARI) rainfall events, it was admitted that these watercourses are very complex systems and that the modelling was not completely accurate.

By constructing a diversion dam for flood protection from the Yannarie River system, retained water will deposit nutrients and sediments before reaching storm surge affected areas thereby depleting the mangrove, algal mat and nearshore habitats from nutrient influx.

Storm surges leading to higher sea levels transgressing onto the supratidal salt flat will return accumulated sediment and nutrients to the coastal areas. Since this is an infrequent occurrence, small flushes of storm surges which occur more frequently are potentially an important event for maintaining/replenishing the nutrient health status for the nursery habitat and sediment status of the estuaries extending along the eastern coast of the Gulf. The ERMP catchment modelling however did not continue close enough to the coast to show flows from sub-catchments near the shore in smaller events. The proposed barrier and in fact the whole project could drastically alter heavy rain and both small and large storm surge effects in Exmouth Gulf, potentially degrading much of the Gulf's east shore ecosystem through alteration of storm frequency run-off, cyclone impact area and local rainfall events. Impacts from bitterns management.

The proposal will involve the impoundment of vast quantities of toxic bitterns. The proponent claims that it will store the bitterns until such time as new technology becomes available to prohibit discharge from occurring. However, the proponent fails to mention the volume of bitterns to be stored, the location of the storage and the management of potential environmental impacts from storage. If not stored properly, this material could enter the Gulf ecosystem through seepage, wall failure or natural disaster events, potentially affecting mangrove and algal mat systems as well as marine creatures. And at which time will be decided that the storage capacity is full and discharge is required? Moreover, other equipment/machinery will be required for processing the bitterns which could lead to additional environmental impacts or water requirements and therefore this project is not proven to be an environmentally sustainable solution so that we challenge the notion of "beneficial outcomes for the environment" as stated in Chapter 2, Section 1 of the ERMP.

3.2 Impacts on groundwater and mangroves

Large scale mangrove mortalities have been shown to be associated with the formation of concentrator ponds in Port Hedland. The ponds were constructed in mid 1990s and significant mangrove mortalities (many hectares) were still found to be occurring in 2005, some more than 1km from the bund wall. The cause of the mangrove impacts has been found to be as follows:

a. The hydrostatic head formed by the impoundment of water on top of the naturally occurring hypersaline groundwater of the supratidal salt flats to migrate towards the coast. Due to the low hydraulic conductivities of the mud underlying the salt flats, the plume migrates at a slow rate;

b. The salinity in the plume is too high to support mangroves and mortalities occur at the landward edge of the mangrove zone and the terminal portions of tidal creeks where groundwater is less influenced by tidal variations; and

c. Bore logs kept over more than 10 years provide a clear record of this process.

The proponent fails to take the learnings from other saltfields such as Port Hedland into consideration, and downplays the potential for seepage due to the underlying clays and distance of the ponds from the mangroves.

Given the scale of the project the geotechnical investigations were inadequate and assumptions of uniformity along the entire 75 km are unfounded.

The potential for groundwater salinity impacts on algal mats were not addressed.

3.3 Impacts from bitterns management

The proposed operation will involve the impoundment of vast quantities of toxic bitterns. The proponent claims that it will store the bitterns until such time as new technology becomes available to prohibit discharge from occurring. However, the proponent fails to give adequate information on the following:

- The volume of bitterns to be stored;
- The location of the storage; and
- The management of potential environmental impacts from storage.

If not stored properly, this material could enter the Gulf ecosystem through seepage, wall failure or natural disaster events, potentially affecting mangrove and algal mat systems as well as marine fauna. Furthermore, at what time will it be decided that the storage capacity is full and discharge of bitterns is required?

Discharge of bitterns into Exmouth Gulf would pose a highly significant environmental stress on the ecosystem for the following reasons (from confidential source):

a. Preliminary ecotoxicity testing of bitterns suggests ecological effects at dilutions of more than 100 fold, even when diluted with surrounding water;

b. Toxic effects are likely related to difference in ionic composition of bitterns to seawater, with concentrations of magnesium in bitterns of around 70,000 mg/L in contrast to background concentrations of around 1,400 mg/L;

c. Field studies in Nickol Bay and Port Hedland have shown that bitterns will flow away from discharge points as a poorly mixed hypersaline layer unless mixing is achieved by strong spring tidal currents associated with tidal variations of more than 2m;

d. During neap tides poor dilution results in pooling of toxic concentrations of bitterns in nearshore waters and spring tides move the partially diluted plume kilometres away from the discharge point;

e. Exmouth tidal variation (<2m during spring tides) is less than that of the more northerly salt field locations and so mixing can be expected to be less;

f. Poorly mixed discharge from Yannarie salt fields would flow down the bathymetric gradient to the deeper areas of Exmouth Gulf which currently support the prawning industry; and

g. Mixing close to shore would result in shallow seagrass nursery areas being subject to potentially toxic concentrations of bitterns.

In addition, other equipment/machinery will be required for processing the bitterns which could lead to supplementary environmental impacts. This only adds further doubt and speculation that this idea is not proven to be an environmentally sustainable solution.

We therefore challenge the notion of “beneficial outcomes for the environment” as stated in Chapter 2, Section 1 of the ERMP.

3.4 Impacts from water intake pumps

Straits' proposal involves the extraction of significant quantities of seawater via two or more massive intake pump stations in two creeks which will be pumping for an average of 14 hours a day. The water intake chambers will be designed with screens to avoid intake of floating debris and mega fauna. The ERMP states that there is a reasonable risk of siltation in Naughton Creek and that the combination of high pumping rates and the existing tidal fluxes will result in a significant change of the creek water flows. Furthermore, excavation of the seabed is required and the soils are potentially acid sulphate generating.

The design of these pumps and the pumping rates do not take into consideration that juvenile prawns, fish larvae and post-larval fishes use these creeks and coastal areas up to a depth of 5 to 8 m. The banana and greasyback prawns especially, move substantial distances inshore with the tides (Vance et. al. 2002) and will therefore be substantially affected by the shallow water intake in the creek areas. Not only will juvenile fauna entering the intakes be damaged and resulting in significant mortality rates, but the changes in hydrodynamics will substantially alter the salinity gradients within the creeks thereby altering the suitability and availability of habitats to the prawns. The proponent has not demonstrated that these concerns are adequately addressed in the design through comprehensive intake modelling. In addition, the level of mortality must be quantified, and measures be put in place to reduce these to within adequate levels.

The nursery area is of vital importance to the Gulf ecosystem and to the commercial fisheries. The area is presently completely closed to trawling and has been proposed as a marine conservation reserve under the Conservation and Land Management Act, 1984 as well as a fish habitat protection area under the Fish Resources Management Act, 1994. Straits' proposal fails to quantify the impact that the massive water intake of 506 million m^3/year will have on the prawn and fish nursery areas in the creeks and wider surrounding area. The draw-down of water is likely to create a large area where nursery stock is being continuously depleted and saline gradients are altered, which will impact upon the vitality of the ecosystem, the commercial fisheries and Exmouth economy.

The management of entrapment of marine life when pumping seawater (as stated in Chapter 6, Section 3.4.5 of the ERMP) contradicts principles of good practice. The Marine Management Plan (Volume 2, Chapter 3) states that biota baseline surveys will be undertaken to determine impacts of seawater pumps. The ERMP states that Straits will assess the extent and rate of entrapment once production has commenced. It is not acceptable to carry out baseline surveys and assess impacts after the ERMP has been submitted nor is it acceptable to only manage the seawater intake effects upon fish species. The banana prawn species in Exmouth Gulf are likely to be most affected by the water intake pumps since they use small tidal creeks and gutters that drain mangrove forests at low tides and the mangrove forests at high tides (Kenyon R.A. & Loneragan, N.R. 2004).

Prawn larvae are able to survive in hyper saline water (50-60 ppt) where some of their predators can not. Drawing water flows into the creeks from the deeper gulf area will change salinity levels and thereby allow prawn larvae predators to enter formerly uninhabitable areas, essentially eradicating the nursery grounds.

The proposed 'management' will address impacts after they have occurred instead of trying to anticipate and prevent adverse impacts. The 'management' will be too late for the nursery and ecosystem as a large area would be depleted of juvenile fauna and salinity levels will be altered, rendering a large area unsuitable as nursery habitat. It is not a sustainable management strategy to wait until damage has been done in order to 'fix' the problem, if this is possible at all. No initiative has been included in the ERMP with possible solutions for minimising or resolving the issue of entrapment of vital juvenile

fauna. This issue should have been addressed prior through modelling and from experiences with other salt fields with regards to impact on areas of water intake points.

3.5 Introduction of non-indigenous marine species (NIMS) through ballast water / hull fouling

The ERMP states that allowance is made for multiple anchorage / loading locations. The proponent estimates that with 3,000,000 tonnes of salt production, 40-50 ships up to 65,000 tonnes will be loaded annually This is predicted to increase to 120-150 ships at 10,000,000 tonnes salt production. The ERMP states that there will be up to three Panamax class container ships anchored in the Gulf at any one time, 19 barge loads will be required on average every week to fill these ships and 1 dredge vessel will be working at Hope Point for approximately 4 months.

This level of shipping activity within the Gulf will inevitably result in major impacts on the local ecosystems, as well as other activities including commercial and recreational fishing, tourism, whale watching, diving etc. In addition, marine pests have been introduced to Australia and moved around Australia (or translocated) by a variety of human and natural means. Transport opportunities for marine pests are, amongst others, through biofouling (hull growth of non-indigenous marine species (NIMS), anchor chains, and internal compartments of boats). Pests can also be transported in seawater systems of boats, including inside pipes and in bilge and ballast water or simply by drifting with ocean current movements. Risks are two-fold and include direct transfer from international shipping activity, as well as secondary transfer through local shipping activity between local ports, anchorages and other locations.

Once introduced to an area, the potential exists for marine pests to thrive, particularly where their origin has similar environmental conditions, and they do not face predators or competitors in their new environment. They can spread rapidly and may prey on, or compete with, native species, therefore affecting food chains. Marine pests can severely affect biodiversity, marine habitats and rare and endangered species.

Once established, introduced pests may have a significant impact on the local fisheries by potential impact on recruitment, competition for food and quarantine requirements resulting from outbreaks. This has been observed in numerous locations in Australia and elsewhere. The financial consequences potentially are devastating.

The substantial increase in the number of international ships anchoring and moving in the Gulf area poses a significant risk to the commercial fisheries and to the nursery area. The ERMP proposes to select multiple anchorage areas thus further increasing the risk by facilitating a more rapid spread of potential pest species. It is not sufficient to state that all ships will adhere to the International Maritime Organisation (IMO) guidelines, the Commonwealth Quarantine Act 2000 and Australian Quarantine and Inspection Service (AQIS) Ballast Water Management Requirements since the area is of high natural value and importance for the commercial fishery industry.

Moreover, unlike Australian Ballast Water regulations, the risk of introduced marine pests from hull fouling currently is not formally regulated under AQIS Requirements, so that this risk is even more difficult to manage and control.

The prawn fishery depends heavily upon the continuation of vegetation mosaics in the shallower waters on the east coast of Exmouth Gulf. Any changes in type and extend of vegetation have a direct impact upon the juvenile prawn population and thus the prawn fishery, as was shown by Cyclone Vance. Marine pests such as seaweeds and macro algae may change the nursery vegetation to the detriment of the dependent fauna.

The proponent should, as a minimum, have assessed which pest species have the greatest potential of becoming established and which have the ability to disrupt the

nursery ecosystem and the commercial fisheries. The proponent should have detailed management plans and emergency response plans to the introduction of these marine pests and as well as described safeguards against these incursions.

3.6 Loss of mangroves / algal mats through sea-level rise

In Chapter 4 the proponent states that "*long-term sea-level rise in the Exmouth Gulf will not necessarily result in an inland migration of the mangrove system from its current position.*" This was based upon evidence from mangrove elevations in muddy coastal environments in south-west Florida which had kept pace with 10-20 cm sea-level rises from 1930 to 1990. Then, in Chapter 6 the proponent states that one of the key sediment study results was that "*sediment accumulations rates are extremely small (<1 m for the Holocene) and some of the intertidal mangroves and salt flat regions appear to be zones of erosion rather than deposition.*" When the proponent applied the Bruun Rule to locate their infrastructure on the supratidal salt flat, catering for a shoreline retreat of 38 m, it conveniently disregarded the sediment study results. Clearly the key sediment studies indicate that areas of mangroves are unlikely to elevate themselves through sediment deposition and therefore they likely get permanently flooded as sea levels rise and will die as a result. The possibility of Mangroves retreating further up the coast has been effectively cut off with the construction of the retaining wall (500-600 m between the wall and the mangroves). In addition, it is likely that the existing creek system will vanish as well due to alteration of the surface water flows. The project could therefore result in localised depletion of mangrove and algal mat systems with a consequent impact upon the nursery habitat. The ERMP fails to model the effect of mangrove death combined with storm surge / cyclone effects upon the salt fields. It is a likely outcome of the project that mangroves growing locally will die due to either acid sulphate soils (ASS), sea level rise, alteration of sediment deposition, salinity changes, fuel spills or a combination of these factors.

3.7 Impacts from barge harbour dredging / acid sulphate soils

All infrastructure proposed in the subsea and intertidal area of the Gulf will modify existing marine faunal habitats, again, to the detriment of prawns and other species using the area as a nursery and seagrass habitat which may also lead to loss of dugong feeding areas.

The silty bottom of the eastern side of the Exmouth Gulf is likely to be mobilised by repeated dredging operations, hence smothering marine benthic primary producer habitats.

The proponent states that the material to be excavated may be potentially acid generating and this is major cause for concern. The migration of acidity in soils moves metal elements, adversely affecting marine organisms and hence causing serious impacts on the prawn industry in the Exmouth Gulf (Walker, C. 2007).

The proponent also states that the volume of ASS is small compared with the total volume of material proposed to be removed. The amount of material to be excavated is in the order of 8 million m^3 and the "small" amount of potential moderate to high risk acid generating excavation material is in the order of 1 million m^3 (as per the ASS Management Plan in Volume 2, Chapter 6), which could have severe impacts upon the local environment if not handled properly.

The Department of Environment (DoE) guideline on ASS (DoE. 2006) states that it "*has recent experience with a number of projects in Western Australia where the level of ASS management undertaken was reduced, because laboratory soil analyses indicated that the ASS materials in question had sufficient acid neutralising capacity (ANC) to render*

them self-neutralising. However, it was found that under real field conditions, disturbance of the soil profile did in fact result in the generation of significant acidity, with resultant environmental damage including release of heavy metals into groundwater and surface waters. Once this mobilisation of acidity and metals has occurred, it is very difficult, if not impossible, to reverse."

The soil testing by the proponent for the presence or absence of acid sulphate soils has to date concentrated on the water intake areas in the two creeks and the excavation area for the barge harbour. The results indicate that "*all samples were potential acid sulphate soils but their acidic neutralising capacity was in excess of their acid forming potential.*" The proponent also states that Parsons Brinkerhoff determined that the geomorphic zones of supratidal-intertidal boundary and the supratidal salt plain have moderate to high acid generating capacity potential and that an ASS Management Plan will undertake further sampling and address sediment handling and treatment.

The DoE guideline (DoE. 2006) states further that "*DoE considers that utilisation of ANC values without confirmatory field kinetic testing or modified laboratory methods cannot be used as an argument to reduce the level of management required for the disturbance of ASS*" and "*an ASS Dewatering Management Plan should still be developed for sites with potential sulfidic acidity in excess of Texture-Based Action Criteria, regardless of the outcome of the ANC testing*"*.*

Since the barge harbour and excavation areas for the water intake pumps are found to be potentially acid sulphate generating and the DoE's guideline states that a dewatering management plan should be developed, the proponent's assessment and management proposal is totally inadequate with regards to identification of dredge material disposal impacts upon the mangrove, algal mat and marine nursery areas. Furthermore, other infrastructural works such as the building of the dams, wash plant and road areas on the supratidal salt flat are also likely to disturb soils which have been identified as having a moderate to high potential for generating ASS and for which no data is available in the ERMP.

It is certainly not good practice to say that investigation will take place, and the impacts will be dealt with after permission for the project has been granted by the government. It is highly probable that mobilisation of acidity and metals will occur during construction works. This would be detrimental to mangrove and algal mats and have an impact upon the marine nursery area and dependent fauna, in addition to reducing the values of the proposed marine conservation reserve, and fish habitat protection areas.

The ERMP states in Chapter 6 that the "implementation of the proposal poses only a minor risk to water and sediment quality in Exmouth Gulf". However, the proponent has not carried out an appropriate and thorough assessment of the impacts of ASS.

3.8 Fisheries assessment based on inadequate Information

The ERMP information provided in relation to fisheries productivity has been based on largely unsupported initial assessments thereby failing to provide an adequate basis for assessing the environment impacts of the proposal (Penn, J.W. 2007). In particular the ERMP lacks:

- A sophisticated spatial model of the hydrology and local water movement patterns throughout the Gulf;
- The mapping of the benthic primary producers (including both algal mats and seagrass) along the east coast, and the relation of their distribution to juvenile prawn abundance; and
- A prediction of the effects of cyclone events and the related tidal surges on the intertidal and supra tidal zones of the Eastern Gulf.

3.9 Scale and timeframe

The EPA is requested to take into consideration that the scale proposal is unprecedentedly large and will form an unacceptable barrier between the coast and the hinterland for over 70 km. The only other solar salt field of comparable dimensions (by ESSA in Baja California, Mexico) to be proposed was not permitted to go ahead because of environmental concerns (Profepa, 1998).

Furthermore, the proposal fails to mention the expected timeline of operation and has no clear commitment during decommissioning of the facility to rehabilitate the area to its pristine state.

4 CONCLUSION

MG Kailis Group is extremely concerned with the Yannarie Solar proposal as outlined in the ERMP, and any large scale development along the eastern side of Exmouth Gulf. The proposed project is not a sustainable long term development as it will alter and have long term detrimental effects upon the coastal area and inland waters, including the vitally important nursery area.

The proponent has not given enough consideration to the impacts of the following:

- Introduced marine pest species;
- Generation of acid sulphate soils;
- Sediment and nutrient management of the area;
- Hydrological changes; and
- Impacts of the water intake pumps upon the juvenile prawn and fish species.

Furthermore, in the long term, the proposed facility will certainly lead to alteration of the creek, algal mat and mangrove systems due to the 70 km long retaining wall being built a mere 600 m inshore of this regionally significant ecosystem.

MG Kailis and other fisheries are totally dependent upon the nursery area and the clean waters of Exmouth Gulf. The prawn fishery is known to be dependent on juvenile recruitment from the shallow seagrass and algal beds on the eastern side of the gulf. The proposal to address bitterns handling/recovery and impacts until after the project has been assessed by the EPA is unacceptable since this likely constitutes the biggest environmental consequence of the project upon the nursery areas and clean waters of Exmouth Gulf.

Both commercial and recreational fisheries will potentially see a reduction in recruitment as a consequence of changes to habitat structure and foodwebs resulting from the construction of the 70 km long solar salt complex.

The proponent has tried to give falls impressions of its project through diverging media releases implying that prominent scientific institutions back the project.

5 ABBREVIATIONS

ANC	Acid Neutralising Capacity
ARI	Annual Recurrence Interval
ASS	Acid Sulphate Soils
AQIS	Australian Quarantine and Inspection Service
DoE	Department of Environment
IMO	International Maritime Organisation
NIMS	Non-Indigenous Marine Species
WAFIC	Western Australian Fishing Industry Council inc

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