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Our Ref: PSM3739-021L Rev 1

31 March 2022

Development Manager
Mirvac
Level 28, 200 George Street
Sydney NSW 2000 Australia
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Attention: Alexandra Chung

Dear Alex

RE: MIRVAC ASPECT INDUSTRIAL ESTATE - 788-904 MAMRE ROAD, KEMPS CREEK SALINITY MANAGEMENT PLAN

1. Introduction

This letter presents salinity management advice for the proposed Aspect Industrial Estate (AIE) development located at 788-904 Mamre Road, Kemps Creek NSW (the Site). This work has been undertaken in accordance with our email proposal dated 27 January 2022. Further as requested by Mirvac on 30 March 2022, this letter is updated to specifically address the requirements of Section 2.9 of Mamre Road Precinct Development Control Plan (DCP) 2021.

This revision also incorporates PSM's response to E2Designlab's RFI (Ref: PSM3739-023L dated 15 March 2021) to allow E2D to address Clauses 6 and 7 of Section 2.4 *Integrated Water Cycle Management* in the DCP:

- *6) Development must not adversely impact soil salinity or sodic soils and shall balance the needs of groundwater dependent ecosystems.*
- *7) Infiltration of collected stormwater is generally not supported due to anticipated soil conditions in the catchment. All WSUD systems must incorporate an impervious liner unless a detailed Salinity and Sodicity Assessment demonstrates infiltration of stormwater will not adversely impact the water table and soil salinity (or other soil conditions).*

A copy of PSM3739-023L is attached in Appendix A.

Based on the estate masterplan (ref: 21250-MP2-02 Issue A, dated 14 January 2022) provided by Mirvac, we understand the proposed development will comprise:

- Warehouse facilities with hardstand areas, carparks, access roads, and retaining walls, etc.
- A 40 m wide creek riparian zone and a stormwater basin at the northern portion of the estate.

Inset 1 presents the site locality plan with approximate site boundaries in Blue.

Inset 1: Nearmap Aerial Photograph of the Site (dated 17 February 2022)

2. Section 2.9 – Salinity - Mamre Road Precinct DCP 2021

Table 1 below presents the controls described in Section 2.9 - Salinity of Mamre Road Precinct DCP 2021 and PSM responses.

Table 1 – Section 2.9 of DCP

Section 2.9 of DCP	PSM Response
1. Development applications shall include a detailed salinity analysis and Salinity Management Plan, noting the relatively low permeability and saline clay soils dominant in the area. The analysis is to consider the stormwater management measures proposed in accordance with Section 2.4 to limit the mobilisation of salts in the catchment	Salinity investigation / assessment was undertaken and reported in PSM report PSM3739-004L REV6, dated 29 May 2020. The results were summarised in Section 5 of this Salinity Management Plan. This Salinity Management Plan has been prepared to address the requirement of this item.
2. Salinity investigations are to be conducted in accordance with the Local Government Salinity Initiative series by the former Department of Natural Resources (2002)	The salinity investigation reported in PSM report PSM3739-004L REV6, dated 29 May 2020 was conducted in accordance with the document.
3. The author of the salinity analysis must sign off on the project on completion of works and submit this to Council prior to an occupation certificate being issued, if required	We note that the works for the development (incl. bulk earthworks and construction) have not commenced. Please refer to Section 7 of this plan regarding sign-off of the project.

4. Disturbance to the natural hydrological system shall be minimised by maintaining good surface drainage and reducing water logging on the site	This item is captured in the plan. We understand the drainage / civil designer has or will design the stormwater system, surface gradients and landscaping requirement to control surface flows. We understand when the development is completed, the facility will continue to be maintained.
5. Groundwater recharge is to be minimised to the extent it does not adversely impact groundwater dependent ecosystems downstream.	This item is captured in the plan. We note groundwater was not observed during the investigation. We note that the vast majority of the site will be sealed by the proposed development and appropriate surface runoff collection and disposal systems have been included in the design. We understand that appropriate erosion control will also be included during construction.
6. Construction techniques shall be employed that prevent structural damage to the development as a result of salinity (see Building in a Saline Environment).	This item is captured in the plan. We understand durability issues of structures have and will be considered by the structural designers in their design for the development.
7. All works are to conform with the Western Sydney Salinity Code of Practice June 2003.	This item is captured in the plan.

2.1 Integrated Water Cycle Management

We have provided the stormwater designer (E2Design) some information / discussion for them to assess and address some of the controls regarding Water Sensitive Urban Design (WSUD) system; i.e. Section 2.4 of DCP. Our letter to E2Design queries (Ref. PSM3739-023L) is attached to this SMP; Appendix A.

3. Background of Salinity Management Plan

This plan has been prepared to address the requirement of salinity analysis in Appendix B Lodgement Details of Mamre Road Precinct Development Control Plan 2021 prepared by DPIE (dated November 2021).

4. Objective

The objective of this salinity management plan (SMP) is to effectively manage site salinity, to minimise the effect of the proposed development on the salinity processes and to protect the proposed development from salinity damage. All works are to conform with the Western Sydney Salinity Code of Practice June 2003.

5. Salinity and Sodicity Assessment

PSM have previously undertaken a salinity and sodicity investigation at the Site in 2018 and 2019 (ref: PSM3739-004L REV6, dated 29 May 2020).

It is assessed that the soils on site are classified as “non-saline” to “moderately saline” (except for one sample from TP8 that is very saline, which is located in the proposed fill area). Salinity class of the soils includes:

- Ten (10) samples in “non-saline”
- Three (3) samples in “slightly saline”
- Six (6) samples in “moderately saline”.

It is assessed that the NATURAL SOIL on the site is classified as “Sodic” to “Highly sodic”.

The report also presented laboratory test results for soil aggressivity assessment as follows:

- pH of the soil samples analysed was in the range of 5.0 to 9.0, with an average of 6.5
- The 1:5 soil to water extraction and subsequent electrical conductivity ($EC_{1:5}$) of the soil samples analysed to be in the range of 27 µS/cm to 1400 µS/cm
- Concentrations of chlorides in samples analysed was in the range of 30 mg/kg to 2460 mg/kg
- Concentrations of soluble sulphate in samples analysed was in the range of less than 20 mg/kg to 930 mg/kg
- Cation Exchange Capacity (CEC) in samples analysed was in the range less than 0.2 meq/100g to 29.4 meq/100g
- Exchange Sodium Percentage (ESP) in samples analysed was in the range of 5.2% to 53.4%.

6. Discussion

6.1 Development Components

This SMP addresses the components of the proposed development at construction stage for the permanent works. Recommendations regarding the following development components are provided in the following sections:

- Earthworks
- Imported soils
- Gardens and landscaped areas
- Roads, footpaths and hardstand areas
- Surface water, stormwater and drainage
- Durability of concrete structures in contact with the ground
- Durability of steel structures in contact with the ground.

6.2 Earthworks

We understand the proposed earthworks will comprise up to approximately 15 m deep cut and 9 m deep fill in some areas. The design and construction of the earthworks should consider the following recommendations:

- Importation of soil as per Section 5.3 of this letter
- Vegetation cover should be estimated and maintained on permanent batters upon completion to control erosion
- The final surface of all areas of the development should be graded to prevent the ponding of surface water

- Erosion control of temporary batters, stockpiles and disturbed areas should be planned prior to undertaking the earthworks and implemented during the earthworks. Consideration should be given to:
  - Grading and sealing partially completed surfaces
  - Installation of clearly visible fencing and traffic control measures to prevent unnecessary trafficking of areas and ensuring site disturbance
  - Establishing set vehicular access points and roads
  - Protecting stockpiles (temporary vegetation or mulching) where these are to be left in place for long durations.
- Sediment control shall be implemented by means of sediment traps and silt fencing where considered necessary.

6.3 Importation of Soil

It may be required to import soil onto site. Materials to be imported to site should be assessed for suitability for the intended use. Highly saline or contaminated soils should not be imported to site.

6.4 Gardens and Landscaped Areas

The proposed development will result in the majority of the site comprising roads, footpaths, and hardstand areas. Garden and landscaped areas are likely to be of limited extent. The design and construction of the gardens and landscaped areas should consider the following recommendations:

- Selection of plant species should consider the soil conditions, including moderate salinity, relatively poor fertility and clayey low permeability soil profiles. Promotion of successful revegetation is likely to require use of nutrient rich topsoil. Saline topsoils should not be imported to site.
- Potential for water logging should be minimised by:
  - Adopting plant species with minimal watering requirements
  - Adopting ‘waterwise’ gardening principles
  - Minimising use of potable water in landscaped areas
  - Properly designed and implemented irrigation systems
  - Establishment of perennial species and deep rooted trees.

6.5 Roads, Footpaths and Hardstand Areas

As stated, the proposed development will result in the majority of the site comprising roads, footpaths, and hardstand areas. The design and construction of roads, footpaths and hardstand areas should consider the following recommendations:

- Roads, footpath and hardstand surfaces should be graded, and the grades maintained at all times to prevent ponding of surface water at locations where this can result in infiltration into the underlying soils (e.g. pavement joints)
- Connections between the roads, footpath and hardstand surfaces and the surface water and stormwater drainage infrastructure should be designed, constructed and maintained to restrict infiltration into underlying soils
- Services that are to be located below the roads, footpath and hardstand surfaces should be installed, where practical, at the time of construction
- Provision for a damp-proof course or membrane beneath slabs should be considered by the slab designer.

6.6 Surface Water, Stormwater and Drainage

Surface water, stormwater and drainage design should aim at restricting infiltration into the ground resulting in groundwater recharge. The design and construction of surface water, stormwater and drainage measures should thus consider the following recommendations:

- Disturbance of natural drainage patterns should be reduced. Where these are disturbed or altered appropriate artificial drainage should be installed
- Stormwater and surface water should be managed to restrict infiltration
- Temporary water retaining structures used during construction should be managed to restrict infiltration
- Stormwater and surface water infrastructure should be designed and constructed to minimise the likelihood of leakage
- Guttering and down pipes should be connected and maintained
- Surface water runoff should be directed around all exposed surfaces, temporary stockpiles and landscaped areas
- Disturbance to the natural hydrological system shall be minimised by maintaining good surface drainage and reducing water logging on the site
- Groundwater recharge is to be minimised to the extent it does not adversely impact groundwater dependent ecosystems downstream.

6.7 Durability of Concrete Structures in Contact with The Ground

In designing structural concrete elements in contact with the ground the design should consider the results of the salinity assessment and the durability requirements in AS2159:2009 Piling “Design and Installation” and AS3600:2018 “Concrete Structures”.

Both these standards provide guidance on minimum concrete grade/strength and minimum cover requirements.

Based on the salinity and aggressivity test results (ref. PSM3739-004L REV6, dated 29 May 2020), it is recommended that:

- The design of structural concrete members in contact with the ground (excluding piles) adopt a “B1” exposure classification as defined in AS3600:2009
- The design of concrete cast in situ piles adopt a “mild” classification as defined in AS2159:2009.

6.8 Durability of Steel Structures in Contact with The Ground

Table 6.5.2(C) of Australian Standard AS2159:2009, Piling – Design and Installation provides criteria for exposure classification for steel piles based on resistivity, soil and groundwater pH, and chlorides in soil and groundwater. On the basis of soil chlorides, resistivity and pH testing completed we assess the exposure classification for steel piles in the soil to be “Non-aggressive”.

7. Sign off

We recommend the following:

- The designer(s) and contractor(s) responsible for construction of the various development components be required to sign-off their design and the as built, certifying that:

  “The works have been designed/constructed having given appropriate consideration to the recommendations in the SMP (Ref. PSM3739-021L)”.

The designer and contractors should contact PSM during the works if they have any queries with regards to the requirements in the SMP or if conditions significantly differ from those described in this SMP.

Yours Sincerely

TONY OU
GEOTECHNICAL ENGINEER

AGUSTRIA SALIM
PRINCIPAL

EXCL.

Appendix A PSM3739-023L

Appendix A
PSM3739-023L

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Our Ref: PSM3739-023L

15 March 2022

Development Manager
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Level 28, 200 George Street
Sydney NSW 2000 Australia
alexandra.chung@mirvac.com

Attention: Alexandra Chung

Dear Alex

RE: MIRVAC ASPECT INDUSTRIAL ESTATE - PSM RESPONSE TO E2D QUERIES

1. Introduction

PSM have reviewed E2Designlab (E2D)'s queries regarding the site conditions on 788 – 904 Mamre Road, Kemps Creek for the proposed Aspect Industrial Estate development (the Site).

This letter has been prepared to address E2D queries so that E2D could address the requirements to satisfy the Waterway Health objectives with reference to the AIE's post-developed Soil Salinity and Sodicity impact in the Mamre Road Development control plan.

We understand that the following PSM factual reports were issued and had been reviewed by E2D:

- PSM3739-004L Rev 6 dated 13 October 2020 – Results of Geotechnical Investigations
- PSM3739-020L dated 9 December 2021 – Results of Additional Geotechnical Investigations (Southern pads, RW21 and RW22).

Appendix A presents E2D's queries and the interpretation on PSM factual reports abovementioned (dated 4 March 2022).

2. PSM response to E2D queries

2.1 *Comment on whether the existing dams have influenced the results*

PSM response: We assume the query is regarding water seepage and the salinity in the ground. We consider the existing dams would have influence on the water seepage and salinity levels for samples collected in excavations near the dams.

However, there were only limited number of soil samples for salinity testing that were collected in 2018 (Ref. PSM3739-004L Rev 6) that were in the vicinity of the existing dams. These samples include TP31 and TP33.

2.2 *Estimate a defensible saturated infiltration rate of the sub-soil at 1.5 to 2.0m depth at a selection of representative sites (including locations 3, 30, 31, 34)*

PSM response: We note that the soil at depth 1.5 m and 2 m comprises Natural Soil unit that is medium to high plasticity clay, at least stiff consistency (eg. typical western Sydney natural clay).

We consider the permeability of insitu Natural Soil which comprises stiff clay could be between 1x 10^{-8} m/s and 1 x 10^{-11} m/s (Ref: Fell et al (2017) and Domenico and Schwartz (1990)).

2.3 *Estimate the likely depth to groundwater at locations 3, 30, 31, 34*

PSM response: We did not encounter groundwater or observe water seepage in the full extent of excavation of test pit TP3, TP30, TP31 and TP34 in 2018. The test pits were excavated to a depth of 3 m below the surface. Groundwater would be well below the test pit excavation level.

2.4 *Determine if the sub-soils are sodic or dispersive and if the proposed infiltration is likely to have detrimental impact on soil structure and continued infiltration*

PSM response: Sodicity of the soil was discussed in Section 6 of PSM3739-004L Rev 6 (dated 13 October 2020) which states the following.

> *Sodicity provides a measure of the likely dispersion on wetting and to shrink/swell properties of a soil. Soil sodicity is classified based on the Exchangeable Sodium Percentage (ESP) which is the amount of exchangeable sodium as a percentage of the Cation Exchange Capacity (DLWC, 2002).*
>
> *The Exchangeable Sodium Percentages calculated from these laboratory results, ranging from 5.6% to 53.4%, indicates that the soils on site range from sodic to highly sodic when compared to criteria listed in "Site Investigations for Urban Salinity", DLWC (2002).*

2.5 *Estimate the potential risk of capillary rise of salt*

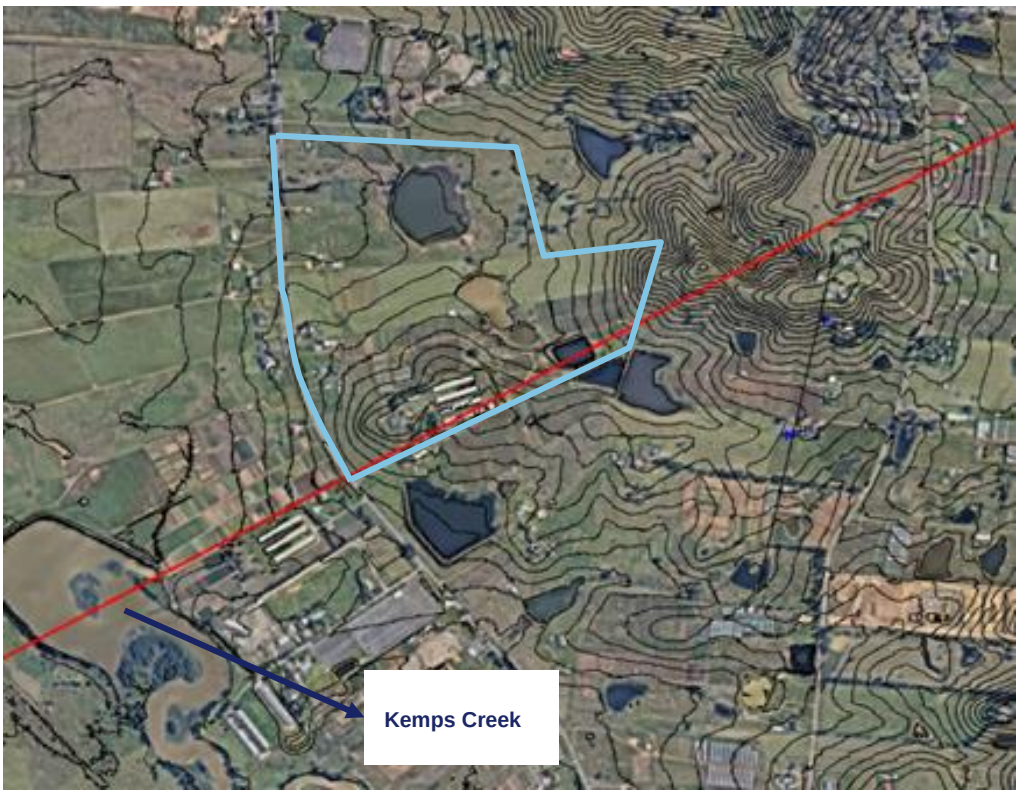
PSM response: We note that the rise of salt is typically due to the permanent rise of groundwater. As discussed previously we did not observe groundwater within our test locations. We also consider that the proposed developments will not affect groundwater level, in particular to rise the groundwater level, within the site. On this basis we consider the potential risk of capillary rise of salt is unlikely.

Further, we did not sight any evidence of accumulation of salts in the soil surface on the site.

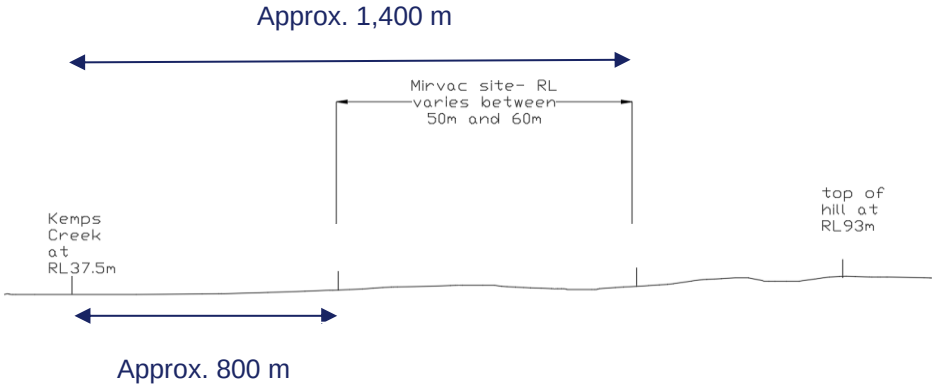
2.6 *Comment on the regional groundwater flow characteristics of the broader Mamre Road Precinct*

PSM response: The Site is located at the east of Kemps Creek. Based on the surface elevation (from Geoscience Australia), we note that the elevation of the Site ranging between RL 50 m and 60 m is significantly higher than that of Kemps Creek at RL 30 m. Inset 1 and Inset 2 present a cross section between Kemps Creek and the Site. We did not observe groundwater in the investigation holes that we had completed.

We therefore consider the proposed development is unlikely to affect the regional groundwater.



Inset 1: **Aerial image of the broader Mamre Road Precinct and a cross-section line across the Site (approximate boundary in Blue) and Kemps Creek (indicated above)**



Inset 2: **Cross Section to compare the elevation of the Site to the elevation of Kemps Creek**

We trust the discussion provided in this letter is sufficient to address E2D queries.

Yours Sincerely

TONY OU
GEOTECHNICAL ENGINEER

AGUSTRIA SALIM
PRINCIPAL

Excl.

Appendix A E2D review of Geotechnical Information

REF:

- Fell, R., MacGregor, P., Stapledon, D., Bell, G. and Foster M. Geotechnical Engineering of Dams – 2nd edition, 2017.
- Domenico, P.A. and F.W. Schwartz, 1990. Physical and Chemical Hydrogeology, John Wiley & Sons, New York, 824 p

E2DESIGNLAB

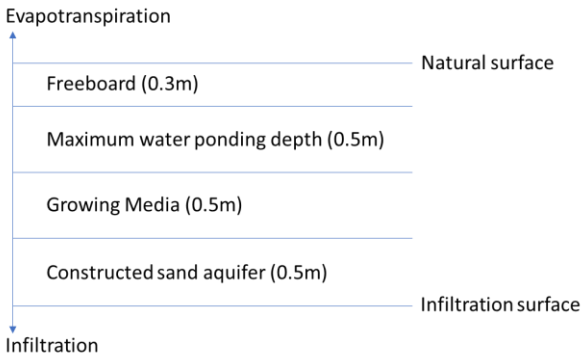
MIRVAC AIE Review of existing Geotechnical Information **04/03/2022**

Review documents include:

1. PSM 3739-004L Rev 6 788-904 Mamre Road, Kemps Creek (lots 54-58 – DP 259135) Results of Geotechnical Investigations.
2. PSM 3739-0221 MIRVAC AIE Results of Additional Geotechnical Investigation – Southern Pad and RW21 and RW22.

From our review of the above documents we make the following comments:

1. It appears most swamp forest (evapotranspiration/infiltration) systems will be located in areas that will remain as existing natural surface.
2. The surrounding development pads will be filled (or cut) to allow gravity drainage to the E2 corridor.
3. Swamp forest general profile.



4. Test pits 1, 3, 30, 31, 33, 34, & 35 are spatially relevant to the swamp forest locations. The infiltration surface of the swamp forest will be at least 1.8m below natural surface. Test pit logs suggest the following conditions are likely at the infiltration surface of the swamp forest:

   Pit 1. Red clay, medium to high plasticity, becomes mottled grey and orange at 2.0m.

   Pit 3. Orange clay, medium to high plasticity.

   Pit 30. Orange to brown clay, medium plasticity.

   Pit 31. Orange to brown clay, medium plasticity, becomes mottled red and grey at 0.5m.

   Pit 33. Dark brown to black gravelly clay, low to medium plasticity.

   Pit 34. Orange brown clay, medium plasticity.

   Pit 35. Dark brown and black sandy clay, low to medium plasticity, becomes wet at 2.2m.

5. We note from the reports that, these soils do not appear to be saline or sodic.

Proposed Action for PSM:

1. Comment on whether the existing dams have influenced the results.
2. Estimate a defensible saturated infiltration rate of the sub-soil at 1.5 to 2.0m depth at a selection of representative sites (including locations 3, 30, 31, 34).
3. Estimate the likely depth to groundwater at locations 3, 30, 31, 34.
4. Determine if the sub-soils are sodic or dispersive and if the proposed infiltration is likely to have detrimental impact on soil structure and continued infiltration
5. Estimate the potential risk of capillary rise of salt
6. Comment on the regional groundwater flow characteristics of the broader Mamre Road precinct.