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LEVEL CROSSING REMOVAL AUTHORITY

FRANKSTON PACKAGE

43 - Seaford Road, Seaford

Rail over Road Hybrid

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The topographically low lying level crossing sites at Edithvale Road, Edithvale (Edithvale), Bondi Street, Bonbeach (Bonbeach) and Seaford Road, Seaford (Seaford) present technical challenges in developing construction options for level crossing removal. To assist in the assessment of such challenges a comparison of key environmental considerations discussing groundwater, flooding and impact to the Edithvale – Seaford wetlands has been undertaken for the Edithvale, Bonbeach and Seaford sites. Where relevant, this report also offers a comparison to the northern sites of Charman Road, Cheltenham (Cheltenham) and Balcombe Road, Mentone (Mentone), located at elevated topographical levels.

Groundwater

Based on drilling conditions and preliminary monitoring, groundwater levels recorded at each of the sites are expected to range from 2 m to 4 m below the rail level at Seaford, and approximately 5 m below the rail level at Edithvale and Bonbeach.

A preliminary assessment of potential groundwater impacts, using regional hydrogeological datasets, found that the Seaford site presented higher risks compared to those at Edithvale and Bonbeach, for both short and long term groundwater impacts. Groundwater risks at each of the sites relate to potential adverse impacts to groundwater dependent ecosystems, specifically the Edithvale-Seaford Wetlands and potential acid sulfate soil activation.

The Cheltenham and Mentone sites are situated at higher topographic elevations comprise competent geology and show deep groundwater levels. Deeper groundwater levels suggest that the projects are less likely to intersect the groundwater table, implying that mounding impacts are less likely to affect sensitive receptors.

Flooding

The Edithvale and Bonbeach level crossings are both located along an elevated ridge of the existing rail corridor with no adjacent special building overlay (SBO) planning layers or Melbourne Water Corporation drainage infrastructure. Potential works associated with these locations are unlikely to have any significant effect on cross drainage flows and consequently flood risk within the surrounding area.

The Seaford Road level crossing is located within a large defined planning SBO, which is located immediately adjacent to the elevated track and rail corridor. A lowered rail trench at Seaford Road would require protection from flooding and existing overland flows, up to and including the 100-year ARI event, to prevent flood water from inundating the trench. The lowered section of rail would intersect an existing 1500 millimetre diameter Melbourne Water stormwater main drain pipe that will be required to be diverted to the north where it could feasibly cross the railway line and Seaford Reserve before discharging to Kananook Creek.

Therefore it is considered that from a flooding perspective, the Seaford site is more complex and difficult to manage in comparison as compared to Edithvale and Bonbeach.

Potential Impacts to the Edithvale-Seaford Wetlands Environment Area

The Seaford Level Crossing site is located approximately 700 m west from the Seaford Wetlands, with the Edithvale and Bonbeach sites located approximately 1,300 m and 2,500 m west respectively from the northern extent of the Edithvale Wetlands. The Edithvale-Seaford Wetlands Environment Area is a “Wetland of International Importance”, under the Ramsar Convention on Wetlands Treaty 1971.

Groundwater mounding potentially induced from a rail trench may alter current water levels and quality at the wetlands and therefore, may affect the vegetation and habitat provided for the threatened and migratory species that the wetlands are known to support. Currently, this presents an undefined risk to an environmental feature protected under the Australian Government *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), the *Water Act 2007* and state or territory based land and water planning legislation.

Preliminary groundwater modelling indicates that at Seaford, rail under road approach could potentially result in a greater impact at the southern extent of the Edithvale - Seaford Wetlands, with up to 0.2 metres of mounding. Modelling indicates that a similar construction approach at Edithvale and Bonbeach may potentially show less of an impact, up to 0.1 metres of local mounding and no mounding respectively at Edithvale Wetlands, compared to a similar approach at Seaford. The northern sites at Cheltenham and Mentone are not located in the vicinity of the Edithvale - Seaford Wetlands, and are therefore unlikely to have an adverse impact.

Potential Impacts to Kananook Creek

Kananook Creek flows parallel to the existing rail alignment, west of the Seaford project site. Preliminary modelling indicates that the area around Kananook Creek could potentially be impacted by groundwater drawdown of up to 0.3 metres, as a result of a rail under road approach.

Kananook Creek is understood to be flow deprived, and currently at only 10% of its historical flow. It is suggested tidal influences and local water diversions may support, and contribute to current levels. Based on numerical modelling using regional hydrogeological datasets, groundwater drawdown may have a significant effect on surface water levels and subsequently the ecosystem health at Kananook Creek.

The Edithvale and Bonbeach sites are not located in the vicinity of Kananook Creek. As a result, related level crossing removal works are not anticipated to have an impact on the groundwater conditions at Kananook Creek.

Seaford Rail over Road Hybrid Approach

A Hybrid approach has been conceived with the intent to reduce the visual impact which may result from raising the railway line over Seaford Road. The Hybrid approach would lower the road by approximately 1.5 m at Seaford Road. Further lowering of the rail structure by utilising an alterative structural form may also be realised.

The Hybrid solution provides the same opportunities as the Rail over Road solution for the reserve to be better connected to the north-east part of the community by providing improved pedestrian and cycling access to Johnstone Street.

Based on preliminary designs, it is likely that the surface of the lowered road would remain above the groundwater table and would therefore not result in any direct impact on regional groundwater levels or groundwater flow. As such, a hybrid option would likely not impact on Kananook Creek or the Edithvale-Seaford Wetlands.

1. Introduction

1.1 Purpose of this Report

This report focusses on the topographically lower lying sites along the Frankston line, at Edithvale, Bonbeach and Seaford, which are suggested to present the greatest technical challenges in developing construction options for level crossing removal.

This report outlines a comparison of the Edithvale, Bonbeach and Seaford sites and discusses the relevant technical challenges. Where applicable, this report also offers a comparison to the northern sites of Cheltenham and Mentone. This report addresses:

- Ground conditions
- Groundwater
- Flooding impacts
- Potential impacts to the wetlands
- Constraints/opportunities at each site.

1.2 Background

The Level Crossing Removal Authority (LXRA), an administrative office within the Victorian Government's Department of Economic Development, Jobs, Transport and Resources (DEDJTR), has engaged the AECOM-GHD Joint Venture (JV) to undertake the Technical Advisor role in relation to grade separation options for the removal of various level crossings within the metropolitan Melbourne area.

A number of grade separations are proposed along the Frankston rail line, from Cheltenham in the north to Frankston in the south, with a number of options being considered.

The northern most level crossings, yet to be removed, along the Frankston line, at Cheltenham and Mentone, are situated at higher topographical elevations, comprise differing geological profiles, situated some distance away from groundwater dependent ecosystems (GDEs) and show deeper groundwater levels when compared with the lower elevation sites of Edithvale, Bonbeach and Seaford. Nevertheless, each of the Frankston rail line sites are likely to show groundwater level depths of less than 5 metres below ground level, resulting in groundwater being likely intersected by shallow excavations relating to either construction approach.

The rail line south of Mentone including Edithvale, Bonbeach and Seaford, are situated at lower topographies, owing to their geomorphic setting being in historic swamplands. As such, these sites comprise unconsolidated geological materials, show comparative shallow groundwater levels and are situated in close proximity to identified GDEs, which include the Edithvale – Seaford Wetlands Environment Area.

The southernmost level crossing site at Skye Road, Frankston is situated in an area prone to flooding and, along with the identified shallow groundwater levels, renders this site limited in terms of potential construction options for level crossing removal.

A Hybrid approach has been developed for Seaford Road, with the intent to reduce the visual impact that results from raising the railway line. The Hybrid approach is suggested to lower the road invert by approximately 1.5m at Seaford Road. Further lowering of the rail structure by utilising an alterative structural form may also be realised.

2. Comparison of the Edithvale, Bonbeach and Seaford Sites

This section outlines a technical comparison of the Edithvale, Bonbeach and Seaford sites and discusses their relative challenges.

2.1 Ground Conditions

Borehole and Cone Penetrometer Test (CPT) investigations have been undertaken for various level crossing sites along the Frankston line including Edithvale, Bonbeach and Seaford. Geotechnical drilling and associated reporting is ongoing along the Frankston line at time of issue.

The following summary is provided, based on an overview of information which has been made available to date.

2.1.1 Seaford – Ground Conditions

The borehole investigations along the rail reserve at Seaford Road generally indicate:

- Permeable beach and dune sands to around 7 to 8 m depth below surface.
- Below the recent beach and dune sand deposits, Brighton Group sediments were encountered. The Brighton Group sediments at the Seaford Road site appear to comprise predominately lower permeability soils with high clay content, with only a limited thickness of sandy soil.
- The existing top of rail at the Seaford Road site is approximately RL 3.5 to 4.5 m AHD with the base of the beach / dune sands being at approximately RL -3 to -4 m AHD.
- For a rail trench approach, excavations and tanked retaining walls extending to around 9 m below surface at their deepest point, are likely to be required to fully extend to the base of the beach / dune sands.
- Based on borehole data, groundwater is anticipated to be encountered at around RL 0 to 1 m AHD, i.e. within 1 m of mean sea level.
- It is understood that the Seaford site may be subject to flooding. As near surface soils are permeable, groundwater levels could potentially rise up to ground level temporarily during large storm events. Rail under Road options may therefore need to be fully tanked up to ground level.

2.1.2 Edithvale and Bonbeach - Ground Conditions

The recently completed borehole investigations along the rail reserve at Edithvale and Bonbeach indicate:

- Permeable recent beach and dune sands from near ground level to a depth of around 10 to 15 m below surface.
- Below the recent sand deposits, Brighton Group sediments were encountered. The Brighton Group sediments are seen to predominately comprise interbedded clays and sands. The Brighton Group appear to have a higher proportion of soils described as sand in comparison to Seaford.

- Based on available borehole information and in view of the proximity to the sea, groundwater is also expected to be typically between 0 to 1 m AHD i.e. within 1 m of mean sea level.
- The existing top of rail at the Edithvale and Bonbeach sites is approximately 6 m AHD.
- For a Rail under Road approach it is expected that the beach / dune sands will extend approximately 2 to 5 m below the invert of any excavation.

2.2 Groundwater

2.2.1 Background

Groundwater flow systems in the low-lying areas around the Edithvale - Seaford Wetlands can be described as localised, underlain by intermediate to regional flow systems. This implies that shallow groundwater within the aquifers are likely to interact or be influenced by local surficial features. Around the wetlands, local flow directions within the Quaternary Aquifer (QA) are likely to be topographically driven. For example, the coastal dunes are likely to represent a local area of higher recharge (and higher groundwater quality) due to coarser grained sediments. The wetlands are likely to represent local groundwater discharge features, owing to their lower topography. Local topographic and hydraulic low points, such as Port Phillip, Kananook Creek, Eel Race Drain and the Patterson Lakes / River complex, are also likely to influence flow systems.

The shallow surficial QA units are unconfined and form the water table. Where present, the underlying Upper Tertiary Aquifer (fluvial) (UTAF) is considered to have variable connection with the overlying QA. Shallower parts of the UTAF may be hydraulically connected, however deeper sandy lenses may be partly to wholly confine by overlying fine grained lenses within the sequence.

The regional flow system in the UTAF is generally from the east, where the unit outcrops and is recharged, towards the west and the coast where the groundwater discharges.

2.2.2 Studies Undertaken

A desktop technical assessment of potential groundwater impacts relating to the proposed level crossing removals has been undertaken at Edithvale, Bonbeach and Seaford. These studies assessed the potential groundwater impacts relating to lowered Rail under Road approaches, based on preliminary 'proof of concept' numerical groundwater modelling, and were undertaken concurrently with, and largely in isolation to, geotechnical and hydrogeological field investigations.

In order to develop an appreciation of such impacts, assumptions relating to thickness and extent of geological units, associated hydraulic properties of hydrogeological units, groundwater levels, hydraulic gradients, recharge and discharge mechanisms, saline intrusion and general head boundary elevations have been made.

These studies indicated that in the short term during construction, and over the longer term during operation, potential impacts to groundwater systems may become evident due to the trench structure required to facilitate Rail under Road approaches. Potential impacts to groundwater systems are likely to include mounding and/or drawdown of groundwater levels, which may subsequently introduce further impacts, i.e. interference with existing groundwater users nearby, soil water logging, and impact to stream base flows and adverse impacts to the greater Edithvale-Seaford Wetlands.

A risk assessment process was applied in the aforementioned studies, based on the findings of the preliminary desktop technical assessments. This process showed numerous 'low' and

moderate' risks, and identified some 'high' and 'significant' risks. With respect to the Seaford site, the main 'significant' risk relating to short term groundwater impacts was due to likely impacts to GDE's, namely the Edithvale-Seaford Wetlands. In terms of long term groundwater impacts, Edithvale and Bonbeach showed 'significant' risk as a result of impacts to the wetlands. Seaford showed an even higher risk of impact to a wetland, with a 'high' risk ranking. Furthermore, a 'significant' risk was also identified at each Edithvale, Bonbeach and Seaford as a result of potential acid sulfate soil activation.

Recently completed site investigations, have identified that the QA is thinner at Seaford, around 8 m thick, compared with Edithvale and Bonbeach where it was typically noted to be 10 to 15 m thick. The underlying UTAF (Brighton Group) is up to 30 m thick at Seaford with predominantly clayey or clayey sand lithology with a contrasting lower permeability material when compared to the overlying sandy QA.

The UTAF (Brighton Group) becomes thinner to the north at Bonbeach, typically less than 25 m thick and further still at Edithvale, typically less than 15 m thick, however at Bonbeach and Edithvale, the UTAF (Brighton Group) is sandier, and likely more permeable when compared to conditions in that unit at Seaford.

Based on drilling conditions and preliminary monitoring, groundwater levels are expected to be approximately 2 to 4 m below the rail level at Seaford and approximately 5 m below the rail level at Edithvale and Bonbeach.

2.2.3 Rail Trench Considerations – Groundwater

Preliminary modelling of groundwater flows for Rail under Road excavation at Seaford has been undertaken, based on available regional geological and hydrogeological datasets. These modelling studies assume ground conditions comprise relatively permeable soils extending to around 20 m depth overlying low permeability materials. Regional groundwater was modelled assuming a generalised groundwater flow direction towards the coast, with groundwater levels taken to be slightly above mean sea level.

For a full depth excavation, a tanking slab and impermeable retaining wall would be required to prevent groundwater inflow into the rail excavation. The tanking slab and impermeable retaining walls would be expected to extend to approximately 9 m below ground level at its deepest point. A result of such an excavation, could be to potentially inhibit regional groundwater movement over the length of the deepest section of cut, nominally a few hundred metres. In addition to the 9 m deep tanked slab, in order to support the excavations, piled retaining walls may need to extend to around 18 to 20 m depth. These piles would need to be impermeable as to prevent groundwater inflow into excavations during construction until the tank slab is in place.

As discussed elsewhere in this report, modelling has indicated that installation of tanked excavations with deep piled retaining walls could adversely impact on groundwater levels in the vicinity of adjacent wetlands as regional groundwater flows may likely be impeded.

If it is confirmed by detailed groundwater modelling studies of trench options, that negative impacts on groundwater levels/ flows could occur, then one possible mitigation option could be the use of temporary cut-off walls to prevent inflows during construction. Following construction of the tanked slab the cut-off walls could be removed to leave behind "hit and miss" retaining wall piles below the tanking slab.

At Edithvale and Bonbeach, where soils below the tanks slab are more permeable in nature, using "hit and miss" piles may help to maintain flows of groundwater around and beneath the trench. This would act to reduce the regional impact to groundwater levels. However at Seaford, in view of the reduced thickness of upper permeable QA and the presence of lower permeability clayey UTAF (Brighton Group), the use of "hit and miss" piles may not be feasible.

2.3 Flooding

The Edithvale and Bonbeach level crossings are both located along an elevated ridge of the existing rail corridor and adjacent hydrological catchments. Surface flows generally discharge away from the rail corridor under existing conditions. These sites are not located within, or adjacent to, any special building overlay (SBO) planning layers or Melbourne Water Corporation drainage infrastructure. Works associated with level crossing removal works are unlikely to have any significant effect on cross drainage flows and consequently flood risk within the surrounding area. Smaller local drainage networks would likely be required to be diverted around any excavated trench as necessary, with new drainage systems required to support any new track infrastructure. Lowered trenches would be protected from any surface overland flow by minor flood barriers, forming part of the retaining structure arrangement.

Conversely, Seaford is located within a large defined planning SBO which is located immediately adjacent to the elevated track and rail corridor. A review and assessment of public flood overlays and Melbourne Water's existing 100-year average recurrence interval (ARI) flood extent indicates that the 100-year ARI event does not overtop the existing rail formation and is impounded on the eastern side by the existing track elevation. Two large diameter Melbourne Water main drain pipes also cross the rail corridor in the proximity of Seaford Road and Railway Parade, and Bardia Avenue, to the south, which convey stormwater flow beneath the rail corridor to Kananook Creek. However, only one of these pipes is within the project area.

A lowered rail trench at Seaford Road will require protection from existing overland flows, up to and including the 100-year ARI event. This would require flood barriers with appropriate freeboard to be provided along the top of the trench for the lowered section of rail. The barriers would prevent flow from crossing the rail corridor that is currently contained by the existing rail embankment and would also be required to prevent existing flood levels from being changed both upstream and downstream over the wider floodplain. The lowered section of rail would intersect an existing 1500 millimetre diameter Melbourne Water stormwater main drain pipe. This would be required to be diverted to the north where it could feasibly cross the railway line and Seaford Reserve before discharging to Kananook Creek. Alternatively the use of a large siphon could be investigated subject to Melbourne Water approval as the asset owner. The extent of flooding in the proximity of the Seaford project is illustrated in Figure 2-1 overleaf.

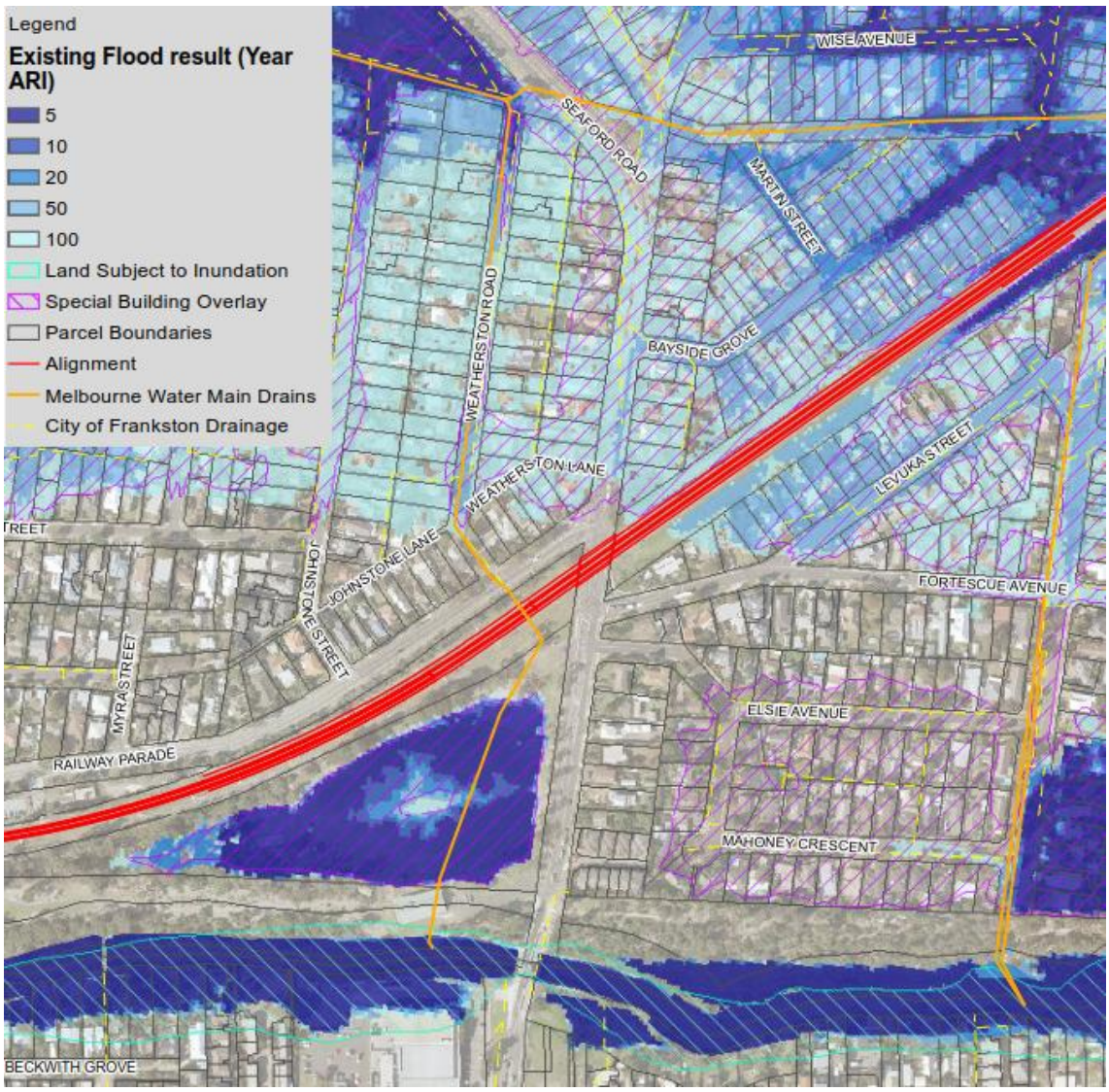

Figure 2-1 Anticipated Seaford Road Flooding Extents

2.4 Potential Impacts to the Edithvale-Seaford Wetlands Environment Area

Any proposed tanked structure associated with a Seaford Road Rail under Road approach, would likely create a hydrogeological barrier impeding groundwater flow towards the coast. As a result, these approaches may affect local and regional groundwater availability, quality during construction and operation of the infrastructure, which may result in a potential long-term change to water level and water quality in the Edithvale-Seaford Wetlands.

2.4.1 The Edithvale-Seaford Environment Wetlands

The Edithvale-Seaford Wetlands is a "Wetland of International Importance", listed under the Ramsar Convention on Wetlands Treaty 1971. The Ramsar listed site comprises two hydrologically and hydrogeologically separate features, the Edithvale Wetland and Seaford Wetland, which are hydraulically separated by the Patterson River.

The Edithvale-Seaford Wetlands provide habitat for:

- Sharp-tailed Sandpipers (EPBC-Act listed migratory species)
- Australasian Bittern and Curlew Sandpiper (EPBC-Act listed species)
- High diversity of significant avifauna, including 20 species of waterbirds listed under international migratory agreements.

2.4.2 Potential effects of works at Seaford on the Edithvale-Seaford Wetlands

The Edithvale-Seaford Wetlands Environment Area is located approximately 700 metres northeast of the Seaford Road level crossing. Although the project does not intersect this Ramsar listed wetland, it is connected hydrologically and hydrogeologically with the Seaford component of the wetlands.

The preliminary groundwater impact assessment indicates that groundwater mounding in the order of 0.2 metres may result at the Seaford component of the wetlands from a Rail under Road approach. If groundwater mounding were to occur at the wetlands (i.e. intersected the wetlands), it could change the groundwater level regime at the Edithvale-Seaford Wetlands and consequently, could possibly result in longer inundation periods at the wetland mud flats.

The Seaford Wetland is a GDE and changes to water level or quality could affect the vegetation and habitat provided for the threatened and migratory species and may impact on the ecological character of the Edithvale-Seaford Wetlands.

Modification of this watering regime may have impact on vegetation that requires a 'drier' period and may impact reliant fauna.

2.4.3 Comparison to Edithvale and Bonbeach level crossing removals

A comparison of distance from the Edithvale-Seaford Wetlands and potential impacts is shown in Table 2-1.

Table 2-1 Distance from Wetlands to level crossings

Level crossing removal site	Approximate distance from Edithvale Wetlands* (metres)	Approximate distance from Seaford Wetlands* (metres)	Potential groundwater mounding at the nearest component of the Edithvale-Seaford Wetlands** (metres)
Edithvale	1,300	6,200	0.1
Bonbeach	2,500	2,700	None
Seaford	7,600	700	0.2

Notes:
** Distances measured from the level crossing intersections to the nearest point at the wetland features, as defined by the Ramsar boundary.*
*** A regional groundwater model is being developed to confirm the impacts and determine if cumulative impacts may occur.*

Based on preliminary groundwater modelling, the Seaford Rail under Road approach is likely to result in a similar level of groundwater mounding at the level crossings as to those proposed at Edithvale and Bonbeach, that is, up to one metre of drawdown/mounding at the level crossings. However, the Seaford Rail under Road approach will result in a greater impact at the nearest component of the Edithvale-Seaford Wetlands, up to 0.2 metres of mounding at the Seaford Wetlands compared to Edithvale and Bonbeach where up to 0.1 metres of mounding and no mounding respectively at Edithvale Wetlands is anticipated.

2.5 Potential Impacts to Kananook Creek

Kananook Creek flows parallel to the west of the Seaford project site. The modelling undertaken to date, considers the project area as a homogeneous hydrogeological profile across the site, defined by the Victorian Aquifer Framework (VAF).

The preliminary modelling shows that areas around Kananook Creek may be impacted by groundwater drawdown of up to 0.3 metres by a Rail under Road approach, however it should be noted, this does not necessarily imply that surface water levels would be drawn down to the same extent. If a reduction in groundwater through flow occurs, this may result in an overall reduction in groundwater recharge to Kananook Creek.

Kananook Creek is understood to be flow deprived, and currently at only 10% of its historical flow. It is suggested tidal influences and local water diversions may support, and contribute to current levels. Groundwater drawdown may have a significant effect on surface water levels and subsequently ecosystem health at Kananook Creek.

2.6 Proximity of Adjacent Constraints and Opportunities

The R.F Miles Reserve contains a cricket oval, cricket nets and some ancillary buildings, as well as accommodating a shared use path along the rail corridor and bounded by Kananook Creek along its western boundary.

A Hybrid solution in this location provides the opportunity for the reserve to be better connected to the north-east part of the community by providing improved pedestrian and cycling access to Johnstone Street. This would provide more direct pedestrian access from Seaford Primary School, as well as provide more direct and safer pedestrian and cycling routes through to Edithvale-Seaford Wetlands and East Seaford Reserve.

Within R.F. Miles Reserve and its immediate surrounds, the Rail over Road Hybrid solution provides opportunity to ‘extend’ the space visually through to the Railway Avenue frontage. There are also opportunities to integrate access to bus stops and provide for a wider array of improvements to recreation facilities in an integrated way as part of the level crossing removal project, without interface issues between the rail infrastructure and landscape provision or recreational interference, such as stray balls etc.

In comparison, the Edithvale and Bonbeach sites are constrained by the adjacent roads, leaving limited space under a rail over solution, which cannot provide for landscape with any longevity due to shading and lack of rainfall, leaving expanded car parking as the likely only benefit that can be provided as part of an elevated solution.

3. Summary of Environmental Considerations

3.1 Groundwater and Ground Conditions

Based on drilling conditions and monitoring, groundwater levels at each of these sites is expected to range from 2 to 4 m below the rail level at Seaford and approximately 5 m below the rail level at Edithvale and Bonbeach.

A preliminary impact assessment of potential groundwater impacts relating to the proposed level crossing removals indicated that the Seaford site showed higher risks compared to Edithvale and Bonbeach for both short and long term groundwater impacts. The Cheltenham and Mentone level crossing sites show lower risks by comparison, owing to their higher elevations, differing geological profiles and their distant location to GDEs.

The recently completed borehole investigations at Seaford generally indicate that the permeable beach and dune sands extend to a depth of around 7 to 8 m below the ground. At Edithvale and Bonbeach the permeable beach and dune sands extend to a depth of around 10 to 15 m below the ground. Below this level it was found that the material at Seaford was predominantly clayey materials, while at Edithvale and Bonbeach the material is sandier, and typically more permeable.

Based on groundwater modelling studies undertaken considering trenched options, adverse impacts on groundwater levels/ flows could occur with a Rail under Road approach. One possible mitigation option could be to use temporary cut-off walls to prevent inflows during construction that are extracted once tanked slabs are in place to leave behind “hit and miss” retaining wall piles below the tanking slab. At Edithvale and Bonbeach where soils below the tank slab are permeable, using “hit and miss” piles may help to maintain flows of groundwater around and beneath the trench. This would act to reduce the regional impact to groundwater levels. However, at Seaford, in view of the reduced thickness of upper permeable QA and the presence of lower permeability clayey UTAF (Brighton Group), the use of “hit and miss” piles may not be feasible. It is noted that a detailed technical assessment of “hit and miss” piles has not been undertaken to date.

The Cheltenham and Mentone sites are situated at higher elevations comprising differing geological profiles. As a result of these variations, the sites are less likely to impact sensitive receptors.

The flooding adjacent to the rail corridor means that the height of the tanked structure at the lowest point of the trench would be approximately 7 m. This is significantly more challenging to construct compared to the tanked structure at Edithvale or Bonbeach which will require a tanked structure with a height of approximately 3 m.

Cheltenham and Mentone are likely to require a similar tanked structure to Edithvale and Bonbeach.

3.2 Potential Impacts to the Edithvale-Seaford Wetlands Environment Area

Groundwater mounding may alter water levels and quality at the wetlands and therefore, may affect the vegetation and habitat provided for the threatened and migratory species that the wetland is known to support.

The Seaford level crossing is located approximately 700 metres from the southern portion of the Edithvale-Seaford Wetlands. The Edithvale and Bonbeach level crossings are located approximately 1,300 metres and 2,500 metres respectively from the northern portion of the Edithvale – Seaford Wetlands.

Preliminary modelling indicates that a Seaford Rail under Road approach may potentially result in a greater impact at the southern portion of Edithvale - Seaford Wetlands, leading to a potential mounding of up to 0.2 metres. Preliminary modelling indicates that Rail under Road approaches at Edithvale and Bonbeach, potentially show less impacts, up to 0.1 metres of mounding and no mounding respectively at Edithvale Wetlands, compared to a similar approach at Seaford.

3.3 Potential Impacts to Kananook Creek

Kananook Creek is understood to be flow deprived, and currently at only 10% of its historical flow. It is suggested tidal influences and local water diversions may support, and contribute to current levels. Groundwater drawdown may have a significant effect on surface water levels and subsequently ecosystem health at Kananook Creek.

No other project sites are located in the vicinity of Kananook Creek and therefore do not impact Kananook Creek.

3.4 Flooding

The Edithvale and Bonbeach level crossings are both located along an elevated ridge of the existing rail corridor with no adjacent special building overlay (SBO) planning layers or Melbourne Water Corporation drainage infrastructure. These project locations would not have any significant effect on cross drainage flows and consequently flood risk within the surrounding area.

Seaford is located within a large defined planning SBO which is located immediately adjacent to the elevated track and rail corridor. A lowered rail trench at Seaford Road will require protection from existing flood impacted areas and overland flows up to and including the 100-year ARI event. The use of suitable flood protection barriers that could provide an appropriate freeboard and protection from extreme event flooding would also be required to avoid flood water entering and flooding the trench. The lowered section of rail would directly intersect an existing large diameter, 1,500 millimetre Melbourne Water stormwater main drain pipe, which will be required to be diverted to the north where it could feasibly cross the railway line and Seaford Reserve before discharging to Kananook Creek.

4. Seaford Hybrid Solution

A Hybrid approach has been developed to reduce the visual impact that results from raising the railway line over Seaford Road. The Hybrid option lowers the road by approximately 1.5 m at Seaford Road and has the potental to incorporate an alternative structural form to further reduce the overall height.

4.1 Road Alignment

The Hybrid approach proposes to lower Seaford Road at the existing level crossing by approximately 1.5 m where the rail tracks intersect the road, thereby reducing the required length and height of the rail construction.

The hybrid design is based on the existing grade of Seaford Road to the east of the level crossing. This grade is proposed to be extended west of the elevated track, lowering Seaford Road by 1.5 m at the elevated structure.

4.1.1 Horizontal Alignment

The road arrangement has maintained the existing intersection configuration with minor modifications to simplify the connection between Seaford Road, Railway Parade and Fortescue Avenue. Some driveway reconfiguration would be necessary, given the vertical alignment of Seaford Road and subsequently the connecting local access roads would be lowered.

The plan of the proposed road alignment is shown below in Figure 4-1.

Figure 4-1 Proposed Road Alignment

The existing kerb lines require minor modifications for the swept paths for the turning movements into Railway Parade and Fortescue Avenue, given the vertical alignment of Seaford Road and the subsequent lowered local access roads.

4.1.2 Vertical Alignment

The elevation along the centreline of the proposed lowered Seaford Road is approximately RL +2.28 metres AHD at the existing level crossing. The Seaford Road alignment matches into existing levels to the west of Fortescue Avenue and to the east of Railway Parade. Railway Parade and Fortescue Avenue are lowered to tie into Seaford Road.

There are three existing private driveways impacted by the lowering of Seaford Road, Railway Parade and Fortescue Avenue. These driveways are suggested to require regrading within private property to tie into the lowered roads.

4.2 Impact of Flooding

Flood model results obtained from Melbourne Water, indicate that for the existing conditions, flooding overtops Seaford Road during a 1 in 100 year storm event and Levuka Street during a 1 in 50 and 1 in 100 year storm event. The Melbourne Water results for flood hazard and safety risk classification for a 1 in 100 year event on Seaford Road is low, meaning that the road remains trafficable to cars and emergency vehicles.

The proposed works would partly occur directly adjacent to the defined SBO which overlays Seaford Road and the broader project boundary.

The Hybrid approach would require a combination of retained and minor earth fill sections, to provide the elevation required to tie into the bridge sections crossing Seaford Road. Filling and/or surface modifications that occur within the existing floodplain storage or overland flow areas along the southern extent of the existing rail corridor may potentially have an adverse impact to the existing floodplain; however these are expected to be minor.

As this option proposes to lower the road by 1.5 m at the level crossing, it creates an extension of the eastern Seaford Road grade to pass below the elevated track. This design does not require flood barrier protection and can be designed with minor impacts to the existing 1 in 100-year flood extent estimate which could be mitigated or avoided. The impacts do not reduce the ability of Seaford Road to be used during a 1 in 100 year ARI event. The proposed hybrid design is potentially beneficial in managing road runoff and rainfall that falls within the lowered section of Seaford Road, as it allows for a gravity drainage system and avoids the need for a pump system.

Lowering the road significantly beyond 1.5 m at the level crossing may result in the formation of a dip (or land locked sag) below the railway line which may fill from overland flow during large storm events. Further hydrological assessments are required to assess potential drainage and functional requirements

4.3 Interaction of Hybrid Option with Groundwater

Based on preliminary groundwater level monitoring data outlined in Section 2.2.2, the following key considerations with respect to potential interaction between the hybrid option grade separation and groundwater can generally be summarised as follows:

- As the anticipated groundwater elevation is likely to range from +0.3 m to at around RL +1 m, it is believed that amending the level of Seaford Road from RL +3.8 m to around RL +2.1 m is possible and that the surface of the lowered road would remain above the groundwater table, and therefore is unlikely to result in any direct impact on regional groundwater levels or groundwater flow.
- It is expected that low retaining walls would be required to support the ground adjacent to the lowered road. The type or form of such walls (where required) would be determined during detailed design, however options would include reinforced soil or concrete walls supported on shallow foundations, or post and panel walls with relatively widely spaced piles. It is expected that foundations for a low retaining wall would not alter groundwater conditions.
- The structure over Seaford Road would be founded on piles. Driven or bored concrete piles installed into the underlying Brighton Group sediments would be suitable options. Preliminary numerical modelling undertaken by the JV to assess groundwater flow for the Seaford Road level crossing removal (Ref LXRA-LX31-43-GE-RPT-0003) indicated that foundation piles supporting an elevated rail bridge structure would have no discernible impact on groundwater levels or movement.
- It is also understood that the area around Seaford Road is subject to flooding following large storm events. As permeable sands are present at the site it is expected that groundwater levels may temporarily rise to ground surface at times of flooding. The level crossing removal design would need to consider such events including the provision for adequate surface and subsurface water drainage, in particular for the lowered section of the road. Since flooding is a short term transient event, it is not expected that the proposed rail over road hybrid option where the road is lowered by 1.5 metres would impact long term groundwater flow patterns.

In conclusion, it is not expected that earthworks or foundations associated with the rail over road hybrid option would have an impact on the existing groundwater regime.

4.4 Impact on Edithvale-Seaford Wetland Environment Area and Kananook Creek

Based on preliminary designs, it is likely that the surface of the lowered road would remain above the groundwater table and would therefore not result in any direct impact on regional groundwater levels or groundwater flow. As such, a hybrid option would likely not impact on Kananook Creek or the Edithvale-Seaford Wetlands.

5. Conclusion

An assessment of potential groundwater impacts relating to the proposed level crossing removals found that the Seaford site shows higher risks compared to Edithvale and Bonbeach, for both short and long term groundwater impacts. At Seaford, a Rail under Road approach is inferred to result in a greater impact at the nearest component of the Edithvale-Seaford Wetlands, in the order of 0.2 metres of mounding at the Seaford Wetlands, compared to Edithvale and Bonbeach, in the order of 0.1 metres of mounding and no mounding respectively at Edithvale Wetlands.

Groundwater mounding, if experienced at the wetlands, may change water levels and quality of the Edithvale-Seaford Wetlands. Changes to the hydrology of the wetlands may affect the vegetation and therefore habitat provided for the threatened and migratory species that the wetland is known to support.

The Seaford site is adjacent to, and parallel with, Kananook Creek, where preliminary modelling indicates that the area around the Creek could potentially be impacted by groundwater drawdown of up to 0.3 metres, as a result of a rail under road approach.

As Kananook Creek is already flow deprived and at only 10% of its historic flow, groundwater drawdown is likely to have an adverse effect on surface water levels and thus ecosystem health at Kananook Creek.

The hybrid option provides for a reduced overall project footprint within the existing SBO, and also allows for conventional gravity pipe drainage, avoiding the need for a pump system and subsequent modifications to the Melbourne Water main drain pipe systems. Progression of the design would require modification and management of the local drainage network and sub-catchments. These elements should be incorporated into the design and further analysis of major overland flow paths and flood impacts confirmed.

The Hybrid option for Seaford was developed to reduce the visual impact that results from raising the railway line over Seaford Road and will also ameliorate impacts on:

- Groundwater – It is not expected that earthworks or foundations would have an adverse impact on existing groundwater systems.
- Edithvale-Seaford Wetlands and Kananook Creek – The hybrid option is unlikely to result in direct impact on regional groundwater levels or groundwater flow.