NOTE: 1. This Technical Note has been prepared to respond to issues raised by the Inquiry and Advisory Committee (IAC) in the Preliminary Matters and Further Information Request dated 20 June 2019.

2. For ease of reference, this Technical Note sets out the relevant requests made by the IAC followed by a response from NELP.

REQUEST: 3. The IAC has made the following requests at paragraph #50 and #51 of the Further Information Request, to provide:

50. Has the Proponent undertaken a thorough review of feasible alternatives that would alleviate the requirement to remove this 300 year old tree as it is unclear that this has been undertaken in the EES?

51. It would assist the IAC if the Proponent could point out the tree identification number of the River Red Gum located on the corner of Bridge Street and Manningham Road, Bulleen (known as the Caltex Tree) in Technical Appendix G Arboriculture to obtain an appreciation of its arboriculture value).

RESPONSE: 1. As part of EES Technical Report Q - Ecology, the River Red Gum was assessed as a large scattered tree (as shown in Figure 11-12 of Technical Report Q). As the tree is classified as a scattered tree, it was not assessed as part of EES Technical report D - Arboriculture. An arboricultural assessment is provided as Attachment A.

2. A review of design alternatives was undertaken by NELP and a summary of that assessment is provided as Attachment B. In summary, the assessment indicated that none of the alternative options considered were feasible having regard to all relevant competing objectives.

ATTACHMENTS: Attachment A - Arboricultural assessment
Attachment B - Summary of options assessment
Attachment A - Arboricultural assessment

TREE: *Eucalyptus camaldulensis* (River Red Gum)
ORIGIN: Indigenous
HEALTH: Good
STRUCTURE: Fair-Good
FORM: Symmetrical (Crown of regrowth)
ULE: 20+
AGE: Mature
HEIGHT (m): 15-20
WIDTH (m): 24
DBH (cm): >125cm
TPZ (m): 15.0
ARBORICULTURAL RATING: Very High
NOTES: Regionally significant tree. Hollow bearing. Previously lopped with crown of mature regrowth. Located in raised bed with heavy steel possum band at base.
Attachment B - Summary of options assessment

1. Purpose

The purpose of this document is to summarise the assessment of design alternatives undertaken by NELP in respect of the 300 years' old River Red Gum tree (Tree) situated adjacent to the Caltex Service Station in Bulleen.

2. Methodology

An assessment was made of the Tree’s ‘Tree Protection Zone’ (TPZ) (radial distance set aside for the protection of a tree’s roots and crown to ensure its viability) and ‘Structural Root Zone’ (SRZ) (a smaller, radial area around the base of a tree required for the tree’s stability in the ground).

Minimum depths below the Tree’s roots have also been investigated, to define a ‘construction envelope’ and determine the minimum horizontal and vertical setbacks that would be required to be provided from project infrastructure.

![Diagram from AS4970-2009 Protection of trees on development sites](image)

**Figure 1 - Diagram from AS4970-2009 Protection of trees on development sites**

The SRZ is determined following the formula provided in AS 4970-2009 Protection of trees on development sites (Council of Australian Standards, 2009) where:

\[
\text{SRZ radius} = (D \times 50)^{0.42} \times 0.64
\]

\[D = \text{trunk diameter, in m, measured above the root buttress.}\]

In the case of the Tree, which is a large River Red Gum *Eucalyptus camaldulensis* with a DBH of 190cm and a diameter at root buttress of approximately 200cm, the following applies:

- TPZ = 15 metre radius (30 metre diameter)
- SRZ = 4.43 metre radius
In considering the standards of AS 4970-2009, the age of the Tree and its potential sensitivity to modification of its growing conditions, the following criteria are recommended to provide a reasonable level of confidence that the Tree could be retained as a viable specimen in the landscape:

(a) Works should not encroach within the 15 metre radius TPZ from the centre of the trunk;
(b) If encroachment is unavoidable it should not exceed more than 10% of the TPZ, or be closer than 10 metres on one side of the tree;
(c) Where tunnelling or subsurface activities are required, a minimum depth of 10 metres must be maintained for the Tree to have a reasonable chance of survival during and after construction of the project.1

The further project infrastructure is away from the tree, the increased likelihood of the continued viability of the tree.

3. Options assessment

3.1 Reference design

The extent of works associated with the reference design is shown in Figure 2 below. The Tree would be directly impacted by the reference design in the following ways:

(a) Directly impacted by construction of the cut and cover tunnel and south-exit ramp.
(b) Impacted horizontally by surface roads works (and retaining walls) within the TPZ to raise Manningham Road, and the left-turn deceleration lane to Bridge Street. Manningham Road is to be raised approximately five metres in this area to achieve 1 in 200 ARI (Average Recurrence Interval) flood mitigation requirements and protect the excavated ramps from flooding impacts.
(c) Impacts from excavation works (and retaining walls) to construct the south-bound on-ramp.

![Figure 2 - The reference design](image)

1 Note: this depth is based on available literature and actual rooting depth of the tree is unknown.
3.2 Alternative design

The alternative design for the Manningham Interchange as shown in the EES Map Book has a similar impact on the Tree when compared to the reference design. The Tree will be directly impacted by construction of the cut and cover tunnel and south-bound exit ramp, excavation for the south-bound on-ramp, as well as by surface road works and retaining walls.

![Figure 3 - The alternative design](image)

3.3 Move the south bound tunnel away from the tree

It may be possible for the cut and cover tunnel sections to be located closer together. However, a minimum of approximately 16 metres' spacing is required between the TBM tunnels immediately to the north to maintain ground stability during construction. It is therefore not possible to avoid the Tree by moving the south bound tunnel to the west.

3.4 Move both tunnels west of the tree

Moving the tunnels west would see both the cut and cover and the TBM tunnels located closer to the Yarra River. This has the potential to have different and potentially increased impacts on the Yarra River and its environs.

Moving the tunnels to the west may also mean that it's difficult to achieve sufficient cover above tunnels north of Bridge Street under the Yarra River. This is due to the ground level and subsurface rock dropping to the west. The ground conditions to the west are expected to require the depth of the tunnels increased to avoid unreasonable ground settlement and collapse. This would require longer and steeper connecting ramps to Manningham and Bulleen Roads, which is expected to require additional land for the project.

Ramp gradients are predominantly based on safety considerations and steeper ramp gradients would result in an interchange design that does not meet acceptable standards.

Further investigations would be required to establish the geotechnical conditions to the west where the tunnels would need to pass adjacent to and under the Yarra River floodplain to fully understand the construction constraints and assess any potential adverse impacts on the Yarra River and its environs.

Construction of the interchange would be complex and result in the tree being located near the following significant features of the interchange:
(a) cut and cover section for the south-bound tunnel and south bound entry and exit ramps;
(b) surface road works to reinstate Manningham Road at a level raised by approximately five metres (to mitigate against flooding impacts);
(c) left-turn deceleration lane to Bridge Street (and consequential retaining walls); and
(d) works to demolish the Caltex Service Station and decommission and remove the underground fuel tanks.

Even if the Tree could be potentially be protected during construction of the Project under this option, the ongoing survival of the tree cannot be ensured due to the significant alterations to the immediate environment of the tree, especially the nearby surface and filling works to Manningham Road.

3.5 Move both tunnels east of the tree

Moving both tunnels to the east would consequently shift the retrieval of the TBM's (assuming a launch from the north) from Banksia Park, into privately owned properties on Bridge Street and adjacent to an existing childcare centre.

This would require the acquisition of two residential properties at the southern end of the bored tunnel alignment, one of which is of heritage significance. Retrieving the TBM's further south, to avoid the additional acquisition, was considered. However, the Bulleen Industrial area may not be available in time to make this a viable option, also extending the construction period and associate impacts on the local community.

Moving the alignment east would locate the tunnels very close to Heide Museum of Modern Art which contains significant vegetation, and the buildings are of local and State significance (and included on the Victorian Heritage Register). Therefore, technical assessments would be required to determine the extent of any adverse environmental impacts (i.e. vibration, ground movement, ground water drawdown etc.) of this tunnel alignment.

Construction of this option would result in the tree being located in close proximity to the following significant features of the interchange:

(a) cut and cover section for the north-bound tunnel and north bound on ramp;
(b) surface road works to reinstate Manningham Road at a level raised by approximately five metres;
(c) works to demolish the Caltex Service Station and decommission and remove the underground fuel tanks; and
(d) left-turn deceleration lane to Bridge Street and associated retaining walls.

With this scenario, excavation and retaining walls to construct the south-bound exit-ramp would still be required, however the works could commence further east, and therefore further from the TPZ of the Tree. While potentially protected during construction of the Project, the ongoing survival of the Tree cannot be ensured due to the significant alterations to the immediate environment of the tree.

3.6 Split the tunnels either side of the tree

Splitting the tunnels either side of the Tree would position the south-bound tunnel alignment to the east, much closer to Heide Museum of Modern Art which contains significant vegetation, and the buildings are of local and State significance (and included on the Victorian Heritage Register). Technical assessments would be required to determine the extent of any adverse environmental impacts (i.e. vibration, ground movement, ground water drawdown etc.) of this tunnel alignment.
Moving the south-bound tunnel alignment east would shift the retrieval of the TBM for that tunnel (assuming a launch from the north), from Banksia Park, into privately owned property on Bridge Street. This would require the acquisition of at least one and possibly two residential properties at the southern end of the bored tunnel alignment, one of which is of heritage significance.

With this scenario, construction of the interchange would be the most complex of the options and result in the Tree being located between two cut and cover tunnel sections that would be independently constructed (compared to the reference design which constructs these as a consolidated section), surface road works to raise Manningham Road, and the left-turn deceleration lane to Bridge Street (and consequential retaining walls), and excavation works to construct the south-bound on-ramp (and consequential retaining walls).

Retrieving the TBM further south, to avoid the additional acquisition, was considered. However, the Bulleen Industrial area would not be available in time to make this a viable option, also extending the construction period for the local community. The construction of this option would still be complex and result in the Tree located amongst significant tunnel and ramp excavation works. An interchange option which splits the tunnels would require longer cross passages, compounding the issue associated with the Tree being located adjacent to major excavations works.

4. Conclusion

In 2020, following primary planning and environmental approvals, NELP will receive tenders from contractors bidding for the main works package that includes their design and construction solution for the Manningham interchange. NELP confirms it would favourably assess any tender proposal that retains the Tree while maintaining function, program and cost imperatives.

The project’s draft Planning Scheme Amendment and Incorporated document require an Urban Design Strategy (UDS) to be prepared prior to works commencing. A draft UDS has been developed which encourages innovative designs to avoid the loss of the Tree. Project contractors will be required to comply with the following UDS requirement:

*Demonstrate efforts to retain the existing significant River Red Gum tree near the Caltex site (section 5.3, requirement 1B).*