

5 URBAN DESIGN AND LANDSCAPE OBJECTIVES AND PRINCIPLES

5.1 VISION

The Vision for the Project is established in the RTA publication “Pacific Highway Urban Design Framework” (March 2005):

The upgrade should be a sweeping, green highway providing panoramic views to the Great Dividing Range and the forests, farmlands and coastline of the Pacific Ocean; sensitively designed to fit into the landscape, and be unobtrusive; and characterised by simple and refined road infrastructure.

This comprehensive vision statement remains valid for all Pacific Highway upgrades, including the OH2K Project.

5.2 OBJECTIVES

The Working Paper also adopts the six urban design objectives set out in the RTA “Pacific Highway Urban Design Framework” (The Framework) (March 2005) (these are also repeated in Table 17-4 of Vol. 1 of the EA) and these remain valid for the Project:

- Objective 1: Provide a flowing road alignment that is responsive to and integrated with the landscape.
- Objective 2: Provide a well vegetated, natural road reserve.
- Objective 3: Provide an enjoyable interesting highway with varied views and vistas of the landscape and pleasant restful places to stop.
- Objective 4: Value the communities and towns along the road.
- Objective 5: Provide consistency-with-variety in road elements.
- Objective 6: Provide a simplified and unobtrusive road design

5.3 PRINCIPLES

The following urban and landscape design principles are intended to guide the development of the Concept Design. They are drawn from the Environmental Assessment Working Paper and The Framework and tailored for use in the development of the OH2K Project:

5.3.1 Objective 1: Flowing and responsive

- A. The horizontal alignment should respond to the grain of the landscape, following the edges of valleys, skirting around hills and aiming for/using saddles where possible.
- B. Where possible, independent grading should be considered on hillsides and in narrow sections to minimise deep cuttings and provide an interesting road.
- C. Earthworks should be graded out where appropriate and space allows, with a varied gradient to help achieve a good fit with the topography.

5.3.2 Objective 2: Well vegetated and natural

- A. All landscape areas should be native seeded. Where planting is recommended in woodland areas (for screening purposes and headlight mitigation), local provenance trees and shrubs should be considered with a suitable spacing to help achieve an early result and a balanced range of species.
- B. The landscaping should be integrated into the local vegetation character and communities by continuing bands and groups of existing vegetation, avoiding linear planting along roadsides in areas where views are open. Linear strip planting of trees and shrubs, which accentuate rather than integrate the highway, should be avoided in all locations where appropriate, not just where views are available.

- C. Where space is available, median widths should allow for a self reliant, valuable landscape area to be retained in the median when additional lanes are required.
- D. Sedges and a neat two metre mown edge should be allowed for to the outside edges of any median planting
- E. Where space allows, vegetated noise mounds should be used in place of noise walls. Where there is insufficient room for a noise mound alone, use a lower mound and wall in preference to a taller wall alone if space permits. Where noise walls are used, a minimum two metre wide planting strip should be provided adjoining the wall if possible.
- F. Where space allows, planting/seeding should be provided at the base of cuttings to help integrate the cutting as well as help absorb cutting debris. Where possible a two metre planting strip should be provided at the base of cuttings and benches should be planted.
- G. Locate and design the highway and service roads to minimise loss of existing vegetation.
- H. The highway should be densely vegetated, except where desirable views from the road are available.

5.3.3 Objective 3: Enjoyable journey

- A. A varied sequence of views and spatial qualities should be provided along the highway. Views should be optimised where appropriate, particularly any views to the rivers, lakes over floodplains and towards other significant landmarks or landscape elements. The Hastings River is specifically cited in the Roads and Maritime Framework document as a key landmark to which views should be maximised.
- B. To assist in the achievement of this aim, consideration should be given to the use, where appropriate, of sedges or other suitable plants in view-scape areas, wire rope barriers and two rail bridge barriers.
- C. Design rest areas to include attractive landscaping, with grassed play areas, shade trees and planting to break up large expanses of parking.

5.3.4 Objective 4: Community benefit

- A. Visual impacts on communities should be minimised by the use of the topography and the design of the road alignment (both vertical and horizontal). Residual impacts should be mitigated where possible using landscaping, planting or mounds.
- B. Noise impacts on communities should be reduced consistent with relevant guidelines, using the topography and design of the road alignment (both vertical and horizontal). Mitigation of residual impacts above the relevant guidelines should then be undertaken using mounds or architectural treatments as appropriate.
- C. Where possible, advance glimpses of key landmarks or locations should be provided to help maintain the road user’s awareness of their presence.
- D. Access to local public space and community facilities should be maintained, or improved if possible and safety provisions should be prioritised.
- E. Distinctive vegetation should be provided at off ramps to help identify local communities to road users.
- F. Provide safe and attractive pedestrian and cyclist connectivity where appropriate.

5.3.5 Objective 5: Consistency with variety

- A. The highway overbridges should belong to the same design family to provide design consistency and unity. Wherever possible, consistency should also be achieved with other highway upgrades, particularly where they are in close proximity to this project.
- B. The style, design and colour of detail elements such as posts for wire rope barriers, noise walls, and bridge barriers should fulfil the requirements of safety, functionality and consistency, without being dominant or intrusive in the surrounding environment. Black mesh should be used on highly visible floppy top fencing.
- C. Distinctive stands of trees should be considered to highlight key locations along the route, such as interchanges, intersections, creek/road crossings and rest areas.
- D. Consider occasional unique bridges in appropriate locations

5.3.6 Objective 6: Simple, refined and unobtrusive

- A. Bridge parapets should be single plane, well proportioned and continuous elements with a generous overlap of the abutments. Spill through abutments and integrated piers (without headstocks) should be provided to allow open, light structures for bridges over the highway. Safety screens should be integrated with bridge barriers and extend the full length of the bridge, with the barrier end neatly connected to the road and safety barrier. Where pedestrian/cycleway access is proposed the screen will be a form of bridge barrier, with a vehicle barrier protecting cyclists/pedestrians from vehicles
- B. The use of shotcrete should be avoided wherever possible. The specification of shotcrete should be minimised in the design of the road geometry. Consideration should be given to the use of treatments other than shotcrete in sensitive areas around bridges, scenic areas and near towns. If necessary, it should be neatly applied to seams in a colour to match the adjacent rock.
- C. Earthworks should be as natural and informal as possible, with the tops, bottoms and ends rounded off and feathered into the adjacent landform. Wherever possible, steep embankments and cuttings should be avoided where they jar with corridor and context topography.
- D. The extent and location of all signage including road safety signage should be minimised. Where practical, signs and other types of road furniture should be kept clear of the skyline and placed so that important views are not blocked or impaired. Except for road names, keep signage off overbridges. Except for name plates and navigation markers, keep signage off bridges across major rivers.

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6 PROJECT STAGE DESCRIPTION

6.1 SANCROX TRAFFIC ARRANGEMENT DESIGN DESCRIPTION

The early upgrade works for the Sancrox Traffic Arrangement will provide temporary connections to the existing Pacific Highway (HW 10) carriageway. The interim connection provides left in and left out only access from/to HW 10 by utilising the existing acceleration and deceleration lanes. A road safety barrier will be provided through the median at the intersection of Sancrox Road and Fernbank Creek Road with the Pacific Highway. This will prevent cross highway movements and right turn movements in and out of side roads. These provisions will be in place as an interim measure; this arrangement will be modified as part of Stage 3.

A series of service roads have been provided off Sancrox Road and Fernbank Creek Road. These roads are a component of the ultimate design, and are to be designed as permanent works. These service roads are in place to accommodate the developments currently located in the vicinity of Sancrox Road. Provisions have been made for the future upgrade of the Sancrox service roads. These upgrades will occur either as a component of the Class M design, or as works undertaken by Port Macquarie Hastings Council as the Sancrox area undergoes further development.

6.1.1 General Design Description

The proposed traffic arrangement is located approximately 2.5 kilometres north of the existing intersection of the Pacific Highway and Oxley Highway (commonly referred to as 'the donut'). The proposed traffic arrangement includes modifications between Sancrox Road, Fernbank Creek Road and Pacific Highway.

The Pacific Highway runs in a south to north direction, intersecting with Sancrox Road on the west and Fernbank Creek Road on the east. The intersection includes right turn bays and non-conforming left turn auxiliary lanes in both directions, allowing vehicle movements in all directions in and out of Sancrox Road and Fernbank Creek Road. Acceleration lanes have not been provided in either direction, causing vehicles join a 100 kilometres /hour sign posted speed zone from a standing start.

The Sancrox area is undergoing development and expansion, with significant heavy vehicle traffic currently generated by this area, with the potential for more. With future industrial subdivisions identified for this area, the existing infrastructure will be insufficient to cater for these developments.

The Sancrox Traffic Arrangement package is comprised of:

- Three Service Roads.
- Modification of the existing Sancrox and Fernbank Creek Roads.
- Service road future connection points.
- The Sancrox Road Overpass Bridge.
- Three roundabouts.
- Widening of the interim ramps as required.
- A number of property access / adjustment works.
- Utility adjustments to suit.

Local road intersections with the main alignment have been designed to allow the future ramps as part of the Class M design to be implemented with minimum redundant works. The junctions of the local roads with the Pacific Highway have been configured as left in/ left out only. This is also the case for the Class M design. The ultimate design is not documented as part of this plan, but has been considered in the design of the Sancrox Traffic Arrangement package, and provisions made where required.

Direct property accesses onto the local Service Road network have been designed to allow movements in all directions. Cassegrain Winery Access Road will act as an entry and exit point as part of the Sancrox Traffic Arrangement. In the ultimate design this will be a light vehicle entry only, with the exit point located further to the north.

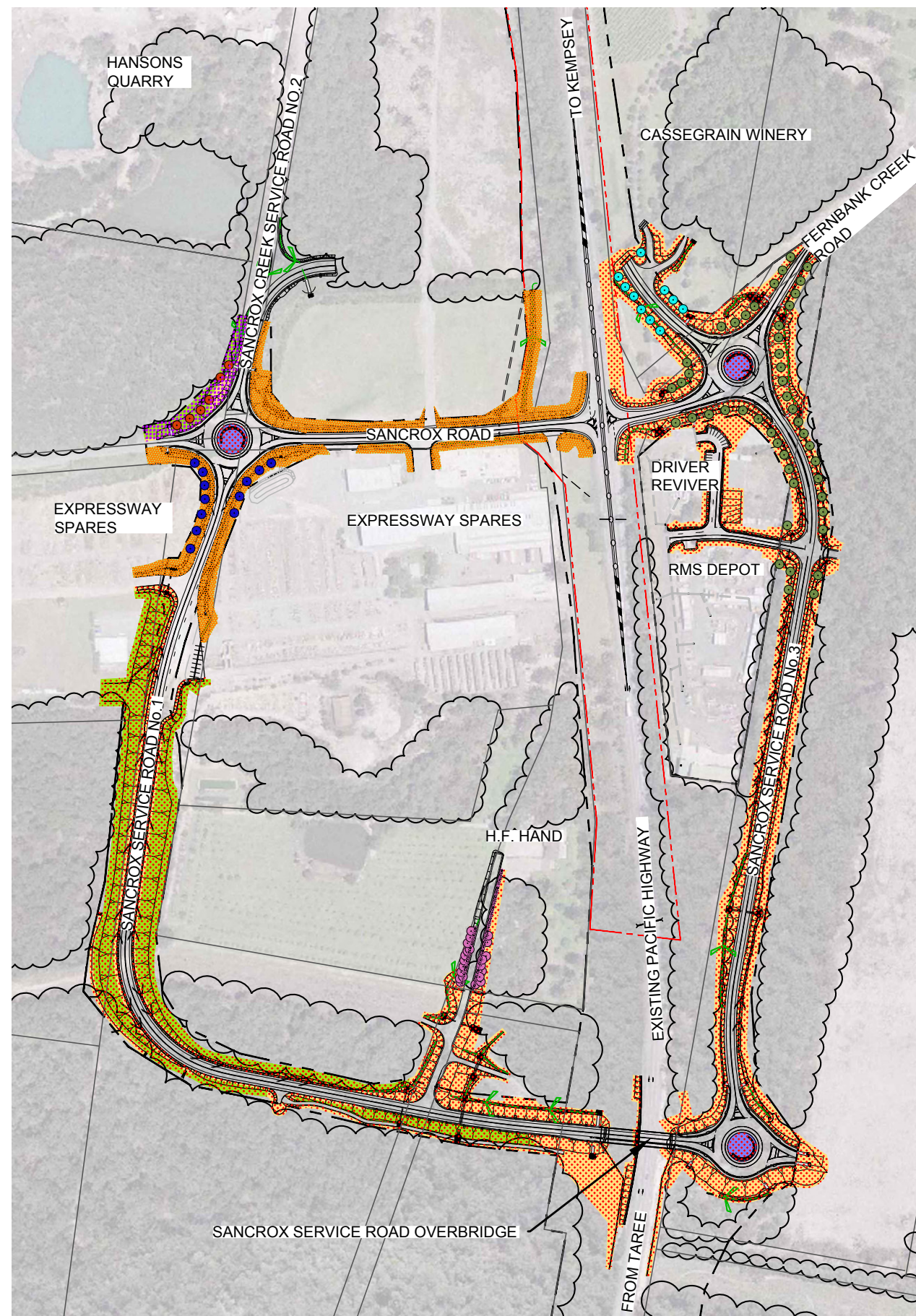


Figure 6.1.1 Sancrox Traffic Arrangement Features

6.2 LOCATIONS IMPACTED BY THE CONSTRUCTION OF THE SANCROX TRAFFIC ARRANGEMENT

Locations along the Sancrox Traffic Arrangement corridor directly or indirectly impacted by construction include locations where:

- Temporary ancillary facilities are sited.
- Access roads are required.
- Watercourses must be crossed to facilitate construction.
- Existing vegetation.

Temporary ancillary facilities including batch plants, compounds, stockpiles and other areas such as access tracks which are required for the construction of the Sancrox Traffic Arrangement, will require remediation. Following completion, the extent of landscape works will be adjusted on ancillary sites to suit. Some of these sites will remain in place during the maintenance period and may remain in use for Stage 3 works, after which they will be the subject of further landscape remediation.

As a minimum, these sites will be prepared as for other vegetated areas, topsoiled and seeded with native plants, native grasses or pasture grasses in order to restore the site to its former condition. The landscape plan and schedules nominate which species are to be used according to vegetation community type occurring in any given area. Refer to Section 8.6.2 for the procedures required to be followed to minimize the impacts of ancillary facilities on the environment.

Where temporary waterway crossings are required as part of the temporary works, the contractor must prepare and include in the Construction Environment Management Plan (CEMP) a Work Method Statement (WMS) detailing the control measures to avoid where possible, and minimise any adverse impact on water quality and riparian fauna and flora. The contractor must consult the Roads and Maritime Representative, Environmental Protection Agency (EPA), Department of Primary Industries (DPI) and NSW Office of Water and other relevant agencies in preparing the WMS and prior to undertaking any works near or in the waterways (refer section 8.5.2).

The contractor must undertake the following measures:

- Plan the physical work on site to avoid, where practicable, any activities in aquatic habitats and riparian zones.
- Properly protect and signpost as exclusion zones, all areas of aquatic habitats and riparian zones on or adjacent to the site which are excluded from the work areas.
- Minimise riparian vegetation removal where practicable, and restrict access to the waterways to the minimum amount of bank length required for the activity.
- Retain stumps in riparian zones and aquatic habitats, where practicable, to reduce the potential for bank erosion.
- Carry out any refuelling of plant and equipment, chemical storage and decanting at least 500 metres away from aquatic habitats.
- Operate boats or other watercraft in a manner that prevents boat wash which could cause erosion of the banks, and propeller damage to seagrass beds.

The greatest impact caused by the construction of the Sancrox Traffic Arrangement is the loss of existing vegetation. The landscape design addresses some of the loss of existing vegetation to be removed, but it is imperative to minimize the construction footprint in order to maximize the retention of existing vegetation and in addition, to provide a methodology which can be implemented by those carrying out the work in order to protect existing vegetation.

The construction footprint beyond the toe of batters or top of cuts will be restricted where feasible to four metres. At drainage structures the footprint will be limited where feasible to 2.5 metres. Existing vegetation to be retained and protected within the works with temporary fencing is marked in the landscape plans.

The following summarises the procedures to protect and maximise retention of existing vegetation:

- Pre clearing assessment is to be undertaken identifying the following: hollow bearing and /or habitat trees; threatened species or endangered ecological communities. Where identified, the use of fencing around all threatened species or EEC's (Riparian Forest) shall be undertaken to ensure construction activities do not encroach into threaten habitats or habitats containing threatened species where disturbance has not been approved;
- Collection of seed will be implemented prior to clearing.
- All vegetation to be retained will be appropriately protected for the duration of construction works. No severing of roots or branches from the trees or shrubs shown to be retained that have a diameter greater than 50 millimetres will be undertaken without written permission.
- Where significant stands of vegetation are to be retained, temporary exclusion fencing will be erected to the dripline before the commencement of construction. Similarly, parking areas, storage sites, turning circles and access points will be fenced off.
- Prior to demolition or construction work commencing, all trees to be retained will be marked with non-injurious, easily visible and removable means of identification. All such identification will be removed on completion of works. Individual trees to be retained will be tagged. Groups of trees or shrubs will be bounded or encircled by exclusion fencing.
- Storage of materials, mixing of materials, vehicle parking or stockpiling of materials will not be carried out within the drip line of existing trees to be retained. No bulk materials and / or harmful materials will be placed under or near trees. Spoil, chemicals or construction waste from excavations will not be placed against tree trunks, even for short periods. All measures will be undertaken to prevent windblown materials from harming trees and plants.
- Topsoil will not be added to or removed from within the drip line of existing trees without the approval of the Principal. Should it be necessary to excavate within the drip line, hand methods such that root systems are preserved intact and undamaged will be used.
- No encroachments into adjacent nominated bushland or vegetation will be permitted for access of machinery, for traffic control or for the stockpiling of material required for construction.

7 URBAN DESIGN DESCRIPTION

This section describes the urban design aspects for the Sancrox Traffic Arrangement Early Works project to show compliance with the urban design objectives and principles described in Section 5.

In essence this project comprises a service road “loop” with various connections to the existing Pacific Highway and local roads. Significant earthworks are limited to the embankments associated with the new bridge over HW10 on Sancrox Service Road No.1 and the adjacent roundabout, and a cutting at the southwest corner of the “loop” (refer Figure 9.1.6). These earthworks are landscaped as described in Chapters 8 and 9.

7.1 BRIDGE

The Sancrox Traffic Arrangement includes a new bridge over the highway connecting Sancrox Service Road No. 1 with Sancrox Road. Refer Figures 7.1.1 to 7.1.2.

This bridge will carry the two lanes of the Sancrox Service Road and a shared path over the upgraded Pacific Highway. It will have a high level of visibility particularly from the new highway and forms a visual landmark along the highway. The Sancrox Service Road Overbridge is one of a group of related bridges over the Pacific Highway. The design of the bridge has been carefully considered to purposefully relate it to the existing bridges of adjacent Pacific Highway upgrades.

The bridge consists of a two span simply supported PSC Super T structure. The overall length of the bridge is approximately 61.05m.

The abutments consist of reinforced concrete headstocks supported on four cast in place piles. Reinforced concrete wingwalls are used at both abutments. They act as a screen wall to conceal the girder bearings.

The central pier comprises a twin legged reinforced concrete portal supported on two cast in place piles. The portal pier is tapered in elevation from the Pacific Highway, with a minimum width of 1m at its base to suit Urban Design requirements. In elevation, perpendicular to the Pacific Highway, the legs are a constant width and inclined towards the centreline of the bridge at an angle



Figure 7.1.2 Bridge over HW10 on Sancrox Service Road No. 1: Section

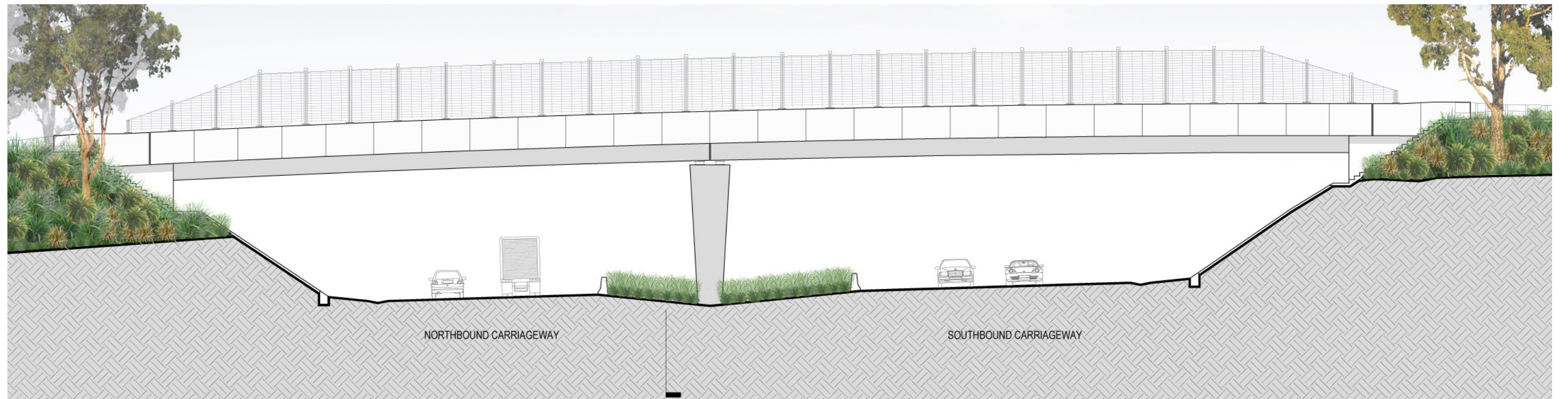


Figure 7.1.1 Bridge over HW10 on Sancrox Service Road No. 1: Elevation

of approximately seven degrees. The pier is located to allow for the potential future third lane widening of the Pacific Highway and to satisfy required sight distances.

The superstructure consists of seven 1500 millimetres deep PSC Super T Girders with an integral concrete deck.

Twin rail medium height traffic barriers are used to enhance views from the bridge and reduce the depth and visual weight of the parapets.

Safety screens are fully integrated with the traffic barriers, with vertical support posts aligned with and fixed to the barrier support brackets.

The traffic barriers adjacent to the carriageway are Roads and Maritime type MAO traffic barriers, which comprise truncated F type concrete parapets with twin steel rails. The southern concrete traffic barrier will be constructed using precast units to form the outer face of the barrier. The internal traffic barrier adjacent to the shared path will be cast insitu. The external pedestrian barrier along the northern edge of the bridge adjacent to the shared user path will comprise a concrete upstand with a vertical face adjacent to the path supporting a 900 millimetres high hand rail. A 1.3m high cycle rail is provided along both sides of the shared path. The outer face of the pedestrian barrier is formed from the typical pre-cast unit adopted for the MAO traffic barrier to maintain a consistent elevation from both the north and south along the Pacific Highway.

Safety screens are integrated with the external bridge barriers and extend a minimum of 6m beyond the traffic lanes of the Pacific Highway below. The design uses tapered steel T section posts to support the steel mesh of the screen. This T section fits neatly within the posts of the twin rail traffic barrier and the hand and cycle rail of the pedestrian barrier ensuring the safety screen is fully integrated into the bridge structure. The post of the safety screen is inclined outwards from the vertical by an angle of approximately 16 degrees to provide a feeling of openness on the bridge and a distinctive folded form. The top of the safety screen post is tapered to assist in creating a sense of visual lightness. The safety screens taper in elevation at each end to terminate in three evenly spaced panels.

Consideration of discolouration and colour match has been reviewed when applying anti-graffiti coatings only to partial areas of individual elements. It was decided that any applied coatings will extend to cover all of any one singular planar surface.

Urban Design Compliance Statement

The design of the bridge complies with the Minister's Conditions of Approval numbers B20(a) and B20(c) and the Statement of Commitments numbers VAD1 and VAD5.

7.2 CULVERTS

The typical culvert consists of precast crown units on an in-situ reinforced concrete (RC) base slab.

Headwalls are to be cast-in-place on top of the end precast culvert crown units. Headwalls and wingwalls have been designed as soil retaining structures. The height of the headwall and wing walls has been kept to a minimum, to address both safety issues and visual impact.

Non-sacrificial anti-graffiti protection will be provided to all exposed surfaces of the culvert headwall and wingwalls including the exposed end face of the precast crown units. The coating shall extend to cover all of any single planar surface.

Urban Design Compliance Statement

The design of culverts complies with the Minister's Conditions of Approval numbers B20(a) and B20(c) and the Statement of Commitments numbers VAD1 and VAD5.

7.3 CYCLISTS AND PEDESTRIANS

A shared path will be constructed in accordance with of the NSW Bicycle Guidelines (2005) at each Roundabout connected with kerb ramps at each corner of the roundabout providing safe access to cyclists and foot traffic via a two metres to three metres wide concrete path. On the Pacific Highway main alignment, a 2.5 metres wide sealed shoulder has been provided along the outside of the travel lanes to cater for cyclists. Signposting and crossing points will be provided in both the interim and ultimate arrangements at the entry and exit ramps. On the Sancrox Service Road network, a two meters wide sealed shoulder has been provided for utilisation by cyclists.

Additional provision has generally not been made for pedestrians along the main alignment or Sancrox Service Road network. However, it was decided in discussions with Port Macquarie Hastings Council and Roads and Maritime, to provide a formed footway along Sancrox Road between the Pacific Highway and the western roundabout to cater for potential future developments. In accordance with the OH2K Environmental Assessment, it is also a requirement that provision of a footway is made for pedestrians on the Sancrox Overbridge. The purpose of providing the pedestrian and cyclist facilities in the Sancrox area is to improve connectivity within the Sancrox Road employment zone. The proposed facilities are not associated with the Port Macquarie strategic bicycle network.

In consultation with Roads and Maritime, it has been decided that the path provided at the Sancrox Overbridge will be designated as a shared pedestrian and cyclist facility, with a minimum width of 2.5 meters. The main reason for making this a shared facility is that the footway is to service developments that have not yet been constructed. Making this path shared use allows cyclists to utilise the path, rather than reserving it for connection to a path that may never be deemed to be required by council. This arrangement also promotes safety by providing physical separation from the heavy vehicles that will frequent this area.

Urban Design Compliance Statement

The design of paths for cyclists and pedestrians complies with the Minister's Conditions of Approval number B20(g) and the Statement of Commitments number VAD1.

7.4 FENCING

Generally there are three different fence types that are required as part of the Sancrox Traffic Arrangement:

- Property / boundary fencing.
- Fauna fencing.
- Pedestrian / Cyclist fencing.

Where existing property boundary fencing has been impacted by Sancrox Traffic Arrangement works, it has been replaced either on a like for like basis, or as per individual agreements made between the landowner and Roads and Maritime. The property fencing will generally be "stockproof" type with prestressed concrete strainer and intermediate posts.

Fauna fencing is required along the existing highway south of Sancrox Overbridge on both sides of the alignment. This fauna fencing will be an interim measure, with more extensive measures applied in Stage 3.

Cyclist fencing is provided where there is a culvert headwall located in the vicinity of the cyclist path. These will be mounted on the culvert headwall and will be galvanised steel twin pipe – type handrail.

Urban Design Compliance Statement

The design of fencing complies with the Minister's Conditions of Approval number B20(g) and the Statement of Commitments VAD1.

7.5 STREET LIGHTING

Street lighting is provided at each of the roundabouts within the Sancrox Traffic Arrangement and is to be to council standards and it is likely that council will request lighting to be designed and constructed to Essential Energy (EE) technical requirements, which will also approve the design.

Urban Design Compliance Statement

The design of street lighting complies with the Minister's Conditions of Approval number B20(g) and the Statement of Commitments VAD1.

7.6 CUTTINGS AND EMBANKMENTS

Through the Sancrox Traffic Arrangement there are a number of cuts and fills along the service road network. Both the cut and fill batter slopes are 4H:1V except along Service Road No 1 travelling north to south, where the cut batter is 2:1 and along service Road No 1 on the eastern side of the alignment where the fill batter slope is 2H:1V.

All batter slopes will be topsoiled and revegetated as described above with indigenous grasses or native shrub mix consistent with clear zone and sight line requirements. At selected locations where shown on the landscape plans, topsoil depth will be increased to 100 millimetres-200 millimetres for tree plantings to ensure establishment of plantings. The generally shallow slopes of 4H:1V are ideal for landscape establishment because there is less chance of rilling and erosion and improved moisture-holding capacity than occurs on the usual 2H:1V slope used on roadside batters. Where 2H:1V slopes occur, a two-step hydraulic application of hydroseeding followed by strawmulching is applied for improved resistance to erosion.

The tops and bottoms of batters will be rounded and feathered into the adjacent landform and the ends of cuttings will be rounded off and feathered into the adjacent landform. Generally the rounding is a 2m radius but is increased to 3m radius at the top of low shallow fills and decreased to 1m at the top of high fills.

Shotcrete is not expected to be required to stabilize any of the cuttings in the Sancrox Traffic Arrangement

Urban Design Compliance Statement

The design of cuttings and embankments complies with the Minister's Conditions of Approval number B20(c) and the Statement of Commitments VAD1.

7.7 CONCLUSION

The design of urban design elements (structures) complies with the Minister's Conditions of Approval numbers B20(a) and B20(c) and the Statement of Commitments numbers VAD1 and VAD5.

8 LANDSCAPE DESIGN DESCRIPTION

8.1 APPLICATION OF THE PRINCIPLES

The Environmental Assessment “Urban and Regional Design/Landscaping Plan Working Paper” describes the treatments required to be implemented to meet the landscape and urban design objectives and principles which form the basis of the design. A key component of the landscape revegetation described is the recognition that:

“The potential exists for considerable natural regeneration, particularly in forested areas where trees and shrubs adjacent to the disturbed areas will disperse seed into the corridor and where seed banks will be present within the existing topsoil”.

This key component of the strategy has been adopted and developed in the preparation of the planting and seeding schedules proposed for the Sancrox Traffic Arrangement and is the key component in addressing Objective 2 and in matching the landscape context (and the following extant vegetation communities) through which the alignment passes.

8.2 VEGETATION COMMUNITIES

The landscape design for the Sancrox Traffic Arrangement is part temporary or interim works to allow for the modification when Stage 3 commences, and part permanent where local and service roads are a component of the ultimate design.

The main purpose of the temporary landscape works is to stabilise cut and fill batters with vegetation to prevent erosion until Stage 3 commences. Where permanent tree planting has been identified as being unaffected by the future works, they are proposed as part of the early works.

The vegetation communities that occur in the vicinity include:

- Community 1: Moist Gully Forest (Non-EEC).
- Community 2: Moist Slopes Forest (Non-EEC).
- Community 3: Riparian Forest (EEC).
- Community 4: Dry Ridgetop Forest (Non-EEC).
- Cleared areas (consisting of mainly pasture grasses with scattered trees) also occur in the locality. Refer Figure 8.2.1.

Hydroseed mixes have been developed which incorporate species from these communities and accommodate both permanent and temporary works. These are:

- Native Grass seed mix containing endemic native grass and sedge species where mowing/maintenance may be required for verges, channels and embankments where sightlines must be maintained and to allow views. The mix contains sedges which are able to withstand infrequent mowing and ensure that species will persist where moist patches occur in channels.
- Frangible shrubs seed mix containing endemic native grasses, sedges and frangible shrubs species for permanent embankment areas within the safety clearance zone (up to 11 metres from the edge of carriageway on the highway, and five metres on local roads).
- Tall shrubs seed mix for use on permanent embankments beyond the safety clearance zone.
- Pasture seeding mix is used on temporary embankments and for areas where grass cover is required, especially where adjacent to existing paddocks with exotic pasture cover. It includes both Couch Grass and Carpet Grass with cover crop. Couch establishes rapidly and forms a thick sward of rhizomes which will effectively resist erosion and is tolerant of saline and acidic soils. Couch is regarded as a native and is prevalent in the adjoining paddocks, although it also occurs outside Australia. Carpet Grass is a naturalised species in the area and found in the adjacent pasture which establishes easily but is not aggressive. The pasture seeding mix is used on temporary embankments.
- A cover crop mix is available for use on all disturbed areas for initial stabilization and erosion control where required prior to the application of the mixes above.

Permanent tree planting is confined to street trees for Sancrox Road and the roundabout which connects to the Vineyard entry and Driver Reviver entry. The chosen species are:

- *Eucalyptus tereticornis* (Forest Red Gum) West of the alignment.
- *Cupaniopsis anacardioides* (Tuckeroo) to the southern side of the roundabout on Sancrox Road West.
- *Podocarpus elatus* (Plum Pine) surrounding the roundabout on Sancrox Road East and to the driver reviver entry.
- *Liquidamber styraciflua* (Liquidamber or Sweet Gum) at the entrance to the Cassegrain Winery.

Both Liquidamber and Podocarpus will be planted at 75 litre container size and Eucalyptus and Cupaniopsis will be planted at 35 Litre container sizes.

Swales and vegetated drainage channels

Extensive vegetated channels occur in the Sancrox Traffic Arrangement. Vegetated drainage channels are proposed to be seeded with the native grass seeding mix which contains endemic sedge species. The sedge species are expected to colonise the invert of the swales and channels while grasses are expected to colonise the drier side slopes.

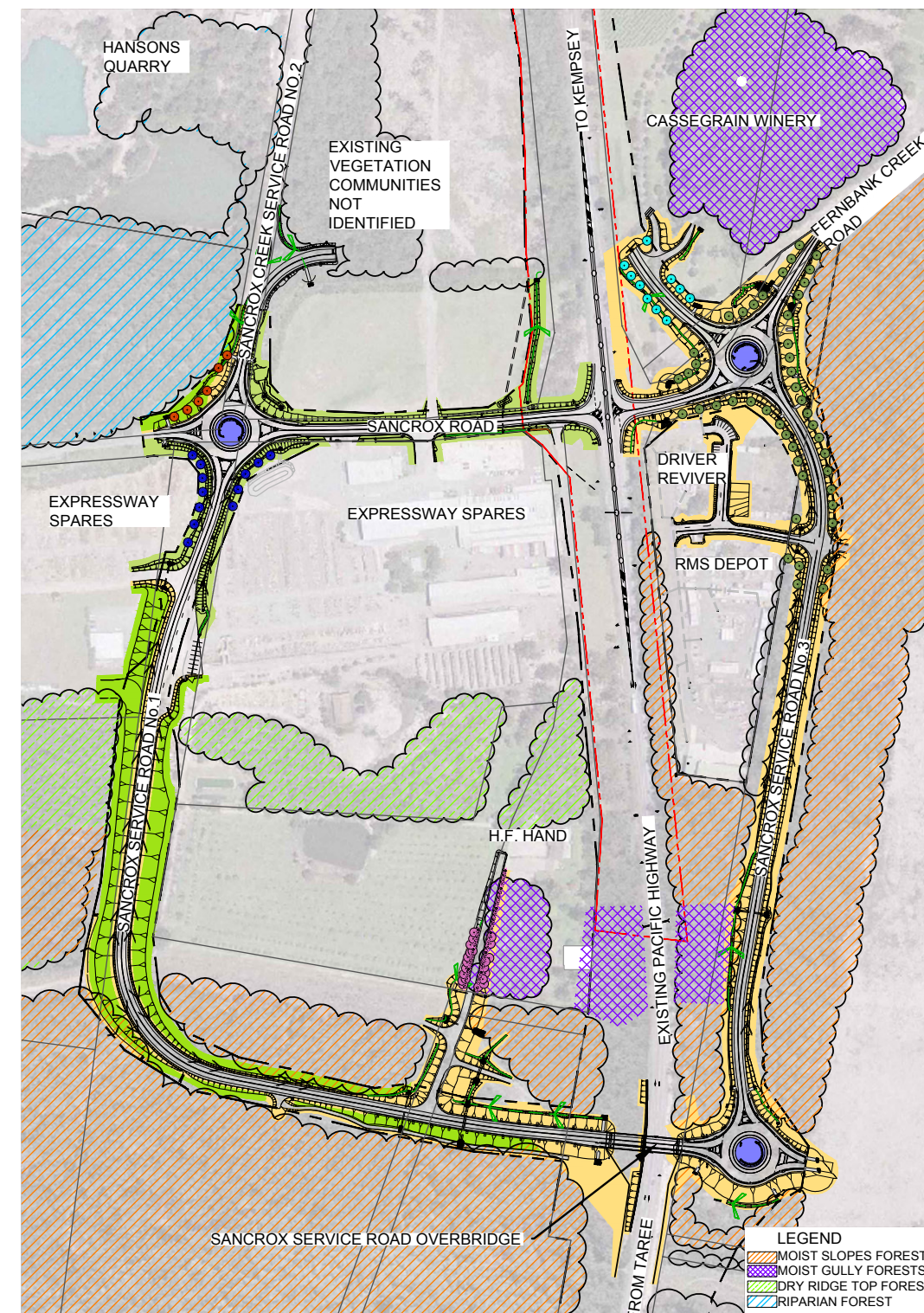


Figure 8.2.1 Sancrox Traffic Arrangement project area - Vegetation communities

8.3 TOPSOIL TREATMENTS

Proposed topsoil treatments must allow for various application methods dependent upon the existence of relatively undisturbed site topsoils, the complete removal of site topsoils or topsoils over new formation and the availability of site topsoils suitable for re-use. Steeper batters are to be revegetated with a two-step hydraulic application of hydroseeding followed by strawmulching, while flatter batters are revegetated via hydromulching only.

Topsoil Treatment 1: When site topsoils have been stripped or on new formation areas steeper than 3H:1V (For hydroseeding batters):

- Prepare batter slopes by ripping to a depth of 100 millimetres using the tynes on a swivelling head excavator bucket, or by some other means to form a loosened or roughened surface suitable for the application of topsoil and/or seed. During ripping, mix in gypsum at a rate of 500 grams/m².
- Provide 'cleatmarks', 'dimples' or horizontal scores to cut and fill batters prior to topsoil application. This is best achieved by track rolling with an excavator or bulldozer.
- Apply A1 horizon site topsoil mixed to a minimum depth of 100 millimetres, but not more than 150 millimetres.
- Spread out the topsoil to an even surface but do not otherwise smooth or compact the surface.
- Apply appropriate hydroseed seed mix.
- Apply (rice) strawmulching with binder over hydroseeding to a minimum thickness of 25 millimetres.
- For slopes steeper than 2H:1V and up to 1.5H:1V (eg; transitions from bridge abutments to 2:1 slopes) install Jute Mesh as per the specification over final topsoil preparation and prior to hydroseeding.

Topsoil Treatment 2: When site topsoils have been stripped or on new formation areas flatter than 3H:1V (For planting, turfing and seeding all areas other than batters):

- Rip the subsoil to a depth of 300 millimetres. Avoid all cultivation within the dripline of existing trees. Do not smooth or compact the roughened subsoil surface prior to the application of topsoil.
- Spread gypsum at a rate of 500 grams/m².
- Apply A1 horizon topsoil or soil mix as for Topsoil Treatment 1 to a minimum depth of:
 - » 100 millimetres but not more than 200 millimetres generally; and
 - » 50 millimetres for turf, pasture grass seed or native grass areas.
- Spread the topsoil but do not otherwise smooth or compact the surface (except where pasture/native grass is to be applied, level and trim the surface flush with adjacent surfaces and roll to lightly compact.)
- Apply appropriate hydromulch seed mix or plant.
- For tubestock: prepare 300x300x300 millimetres deep hole.
- For super advanced tree: prepare 600x600x600 millimetres deep hole.
- For semi mature tree: prepare 1000x1000x800 millimetres deep hole.
- Apply fertiliser at the recommended rates (to be specified in the relevant version of modified specifications R178 and R179).
- Install advanced trees/ tubestock and backfill with topsoil to finish flush with ground level.
- Apply 75 millimetres site won woodchip mulch or imported woodchip mulch where planted.

Topsoil Treatment 3: For vegetated swales and channels

- As for topsoil treatment 1 but with 50-100 millimetres and organic fibre mesh laid over the slope and berms following topsoil spreading and preceding hydroseeding and strawmulching to the extent of the topsoiling and/or to the top and bottom of the embankments.

8.3.1 Topsoil Management Zones

Stripped topsoil from pasture grass areas must be quarantined from forest soils so that the weed seed contained in these soils is not returned to forest areas. Topsoil must be stockpiled separately by vegetation community type and returned only to the location from where it was stripped or other locations mapped as the same community type.

Under no circumstances replace topsoil stripped from pasture areas in areas intended for native grasses or native shrubs seeding, however it is permissible to use it in areas intended for pasture grass seeding.

Topsoil management zones are as identified and mapped in the landscapes plans (refer section 9) and listed below:

- **Moist Gully Forest (Non-EEC)** - Moist, sheltered gullies in undulating terrain, typically at the base of steeper slopes. Generally associated with ephemeral drainage lines or minor creeklines.
- **Moist Slopes Forest (Non-EEC)** - Slopes or low ridges with a moist sheltered aspect and good drainage in undulating terrain.
- **Riparian Forest (EEC)** – A small patch of Riparian Forest community occurs north of the Sancrox Road roundabout.
- **Dry Ridgetop Forest (Non-EEC)** - Ridgetops and upper slopes in undulating terrain or more elevated and exposed areas above the floodplain in flatter terrain. A small section of this community occurs south of Hunter Expressway Spares on the northbound side of the existing highway. This area is not to be disturbed during early works and therefore no soil from this community will be stripped or stockpiled.
- **Pasture Grass Soils** – Hereafter referred to as landscape topsoils for use in areas mapped on the landscape plans intended for Pasture Grass seeding.

Note that due to the pre-dominance of Moist Slope Forest and its similarity in species makeup with Moist Gully Forest, that only Moist Slopes Forest is mapped on the final landscape plans.

Vegetation clearance distances used:

- Fauna Fencing - Native tree and shrub seeding and planting stock must not be used within three metres of fauna fences during the revegetation process.
- Where design speed of road is 60 kilometres /hour or less - frangible vegetation only within three metres from the edge of the travel lane.
- Where design speed of road is 80 kilometres /hour - frangible vegetation only within five metres from the edge of the travel lane.
- Where design speed of road is 100 kilometres /hour or less - frangible vegetation only within nine metres from the edge of the travel lane.
- Where design speed of road is 110 kilometres /hour or less - frangible vegetation only within 11 metres from the edge of the travel lane.
- Grasses only within 1.7metres behind Wire Rope Safety Barrier (Dynamic Deflection Zone).

8.3.2 Weed Control

Where listed weeds occur (refer to the Landscape Management Plan) within the Sancrox Traffic Arrangement boundary their removal will be approached using three strategies, as follows:

- Primary weeding, spraying weeds with herbicide - selective spraying of weeds with herbicides. Do not spray where herbicide could fall into a watercourse or when wind conditions could cause drift outside the area to be treated or onto desirable plants. Remove by hand any weeds which cannot be controlled by herbicide. Carry out grass and weed removal and where possible ensure that weeds do not flower to form seed heads.
- Major weeding, woody weed control - cutting/scraping and painting deep rooted woody weeds such as lantana and climbers with hand tools, chainsaws and brush cutters and painting cut stumps with herbicide, and selective hand removal of weeds.
- Targeted weeding - target drilling and injecting certain large exotic trees such as camphor laurel, large and small-leaf privet between December and April, whilst sap flow is at optimum levels for herbicide translocation, with herbicides such as glyphosate and a garlon/diesel mix.

Avoid disturbance to remnant native plants and to soil stored seed banks, which may contain dormant native plant propagules. All weeds are to be targeted during the primary weeding phase.

Follow-up weeding will be undertaken in areas that have received a primary weeding treatment, including selective removal or treatment of weeds, whilst allowing regenerating or planted native plants to increase in size, abundance and percentage cover. All weeds are to be targeted during the follow up weeding phase. Follow-up weeding work is to commence no longer than three months after the first exposure to primary weeding, and continue to a point where native plants occur at 95 per cent or higher cover levels.

Maintenance weeding is to be undertaken in areas where native plant regeneration has significantly progressed to the stage where native plants occur at high percentage cover levels (95 per cent or greater).

Weed control is to be undertaken by appropriately qualified personnel who have attained or be in the process of completing the TAFE certificate ii course in natural area restoration, or an equivalent qualification which has strong practical application of the principles of natural regeneration.

8.4 MANAGEMENT OF EXISTING TOPSOIL –DIRECT RETURN, TOPSOIL MANAGEMENT AND TOPSOIL MANAGEMENT ZONES

The management of site soil is an essential component of ensuring the long term viability of the landscaping for this project.

The direct return of topsoil, topsoil management and storage procedures and topsoil management zones will form an integral part of the revegetation strategy for the alignment in order to take full advantage of the existing seedbank contained in stripped topsoil.

The existing soil seedbank will contain close to the full complement of species from extant vegetation communities. Therefore the objective will be to return soil from different vegetation communities to the zone from which they were stripped.

The purpose of direct return and implementation of correct topsoil stockpile management procedures is to preserve the seedbank so that it remains viable until returned. This approach ensures that the highway landscape will most closely reflect the adjoining vegetation patterns and diversity identified in the environmental documents. With this approach seeding mixes become a stop gap measure and a back-up plan to be deployed where obvious failures in the topsoil strategy are observed.

For the purposes of this project, topsoil stripped from within existing pasture grass areas is known as “landscape topsoil” and topsoil stripped within mapped vegetation communities from which existing vegetation has been cleared is known as “bushland topsoil”. Bushland topsoil is to be managed to retain the environmental integrity of the material and preserve the soil seedbank. Stripped topsoil from pasture grass areas must be quarantined from bushland topsoils so that the weed seed contained in these soils is not returned to forest areas. Under no circumstances is landscape topsoil stripped from pasture areas to be replaced in areas intended for native grasses or native shrubs seeding, however it is permissible to use it in areas intended for pasture grass seeding.



Photo to the left illustrates the few species established via hydromulching, while the photo to the right illustrates the diversity achieved through direct return of topsoil containing a soil seedbank. *Glenugie Upgrade.*

Figure 8.4.1 describes the procedure for stripping and stockpiling of landscape topsoils.

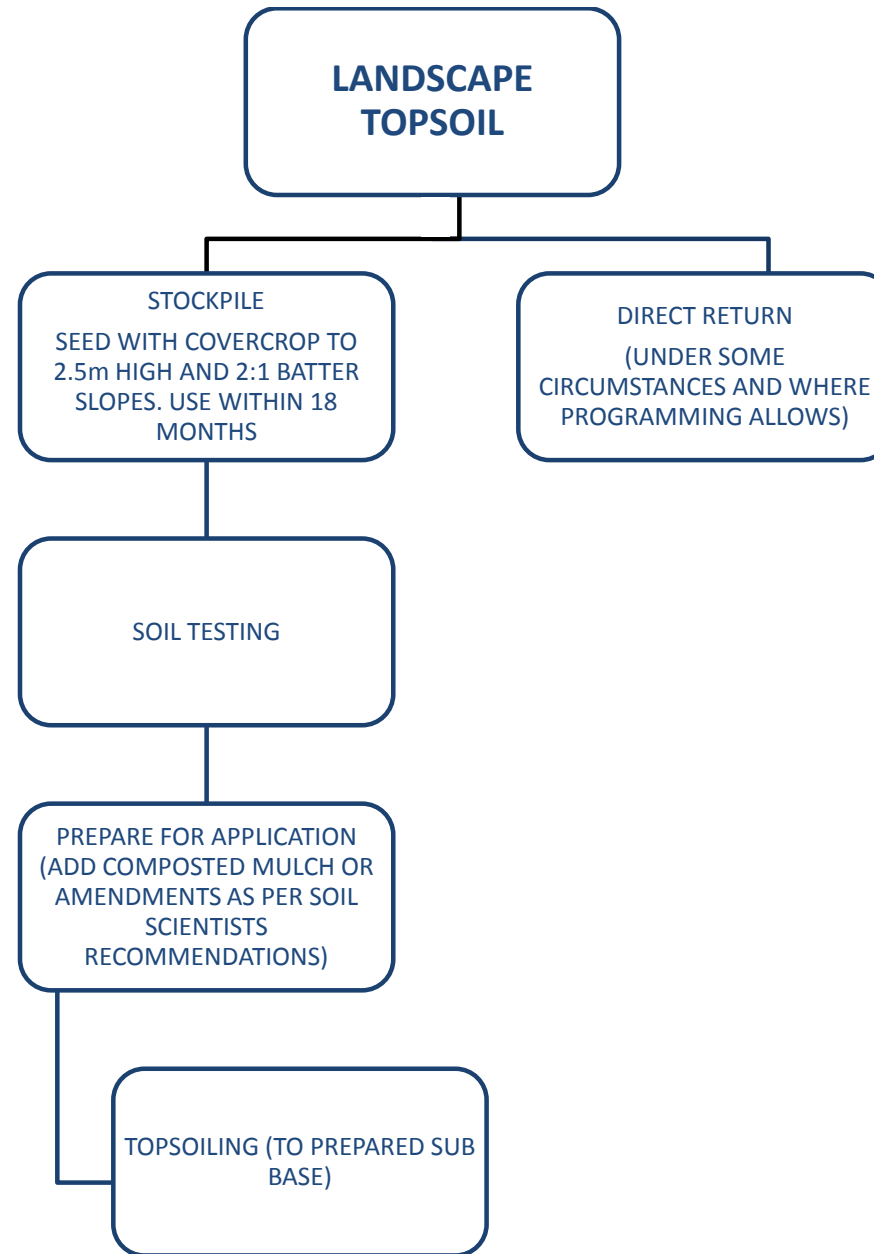


Figure 8.7.1 Landscape Topsoils

Figure 8.4.2 describes the procedure for stripping and stockpiling of Bushland Topsoils.

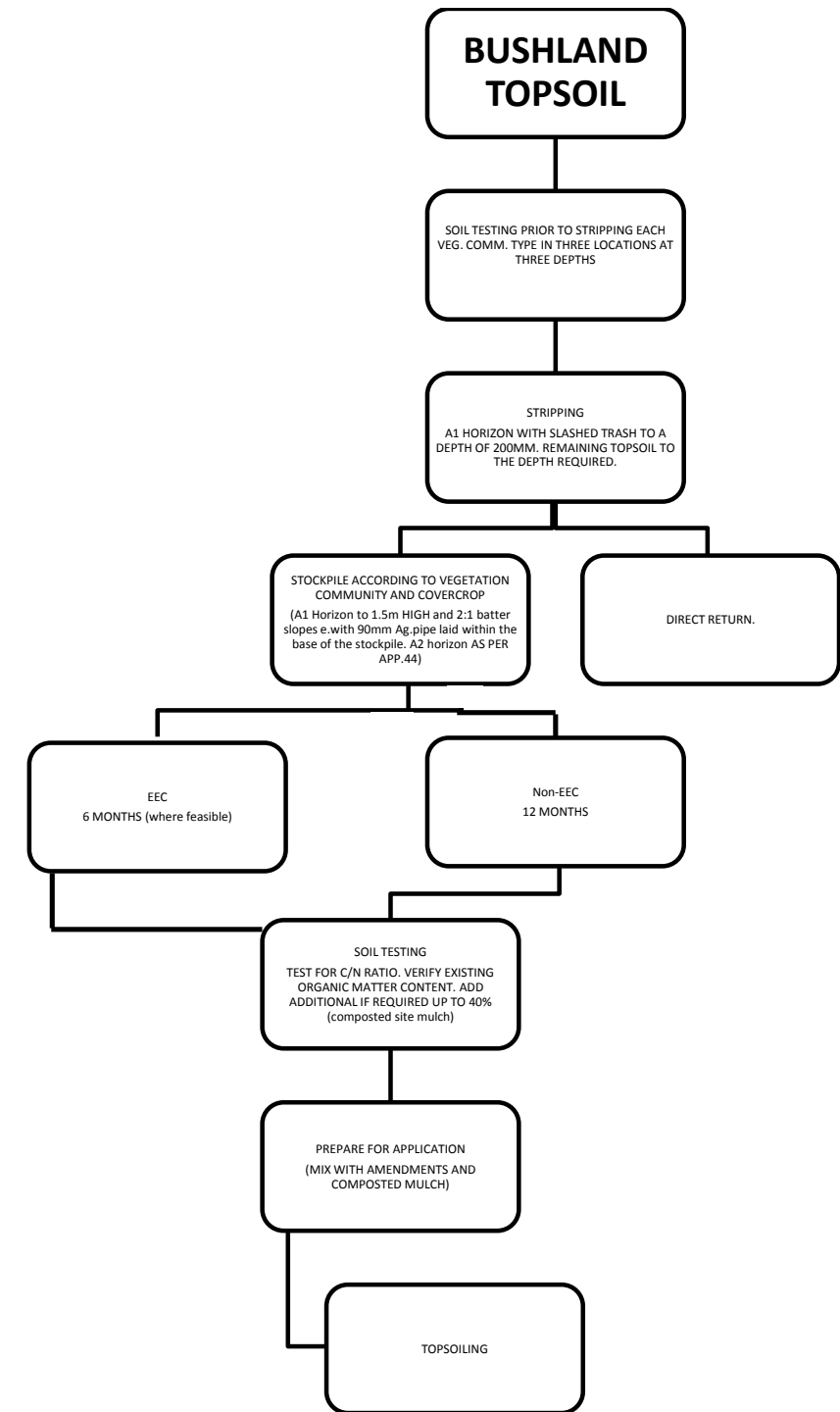


Figure 8.7.2 Bushland Topsoils

8.5 ANCILLARY FACILITIES

Ancillary facilities are all temporary site infrastructure required to construct the upgrade and can include site compounds for offices, car parks, toilets sheds, hardstand, batch plants and access (haul) roads.

It is proposed that ancillary facilities, including a site compound and stockpile site for storage and processing, will be available on the western side of the Pacific Highway, on land owned by Expressway Spares. This site can be divided into two sections. On the south-most half of the site, adjacent to Sancrox Road the area can be used as a potential site compound, and will provide good access to Sancrox Road. Refer to Figure 8.5.1 (outlined in red and noted as compound site 1). The north-most half of the site can be used as a stockpile site (outlined in orange and noted as stockpile site 2).

Where temporary ancillary facilities are located within private lands, the contractor will make arrangements/agreements with the landholder regarding the condition of the subject lands at handover. All subject lands have been through an environmental approvals process. Where ancillary facilities are located within Roads and Maritime owned land, the site is to be rehabilitated.

The following summarises the procedures to be followed to protect and minimise the impact of ancillary facilities on the environment:

- Be located more than 50 metres from a waterway.
- Have ready access to the road network or direct access to the construction corridor.
- Be located in areas of low ecological significance and require minimal clearing of native vegetation (not beyond that already required by the Project).
- Be located on relatively level land.
- Be separated from the nearest residences by at least 200 metres (or at least 300 metres for a temporary batching plant).
- Not unreasonably affect the land use of adjacent properties.
- Be above the 20 ARI flood level unless a contingency plan to manage flooding is prepared and implemented.
- Provide sufficient area for the storage of raw materials to minimise, to the greatest extent practical, the number of deliveries required outside standard construction hours.
- Be located in areas of low heritage conservation significance (including identified Aboriginal cultural value) and not impact on heritage sites beyond those already impacted by the Project.

Ancillary sites identified that do not meet the above criteria shall be assessed against this criteria to demonstrate how any impacts can be mitigated and managed to acceptable standards which includes demonstrating consistency with project impacts identified in the documents listed under condition A1, to the satisfaction of the Director General. Such assessment(s) can be submitted separately or as part of the Construction Environmental Management Plan required under condition B30.

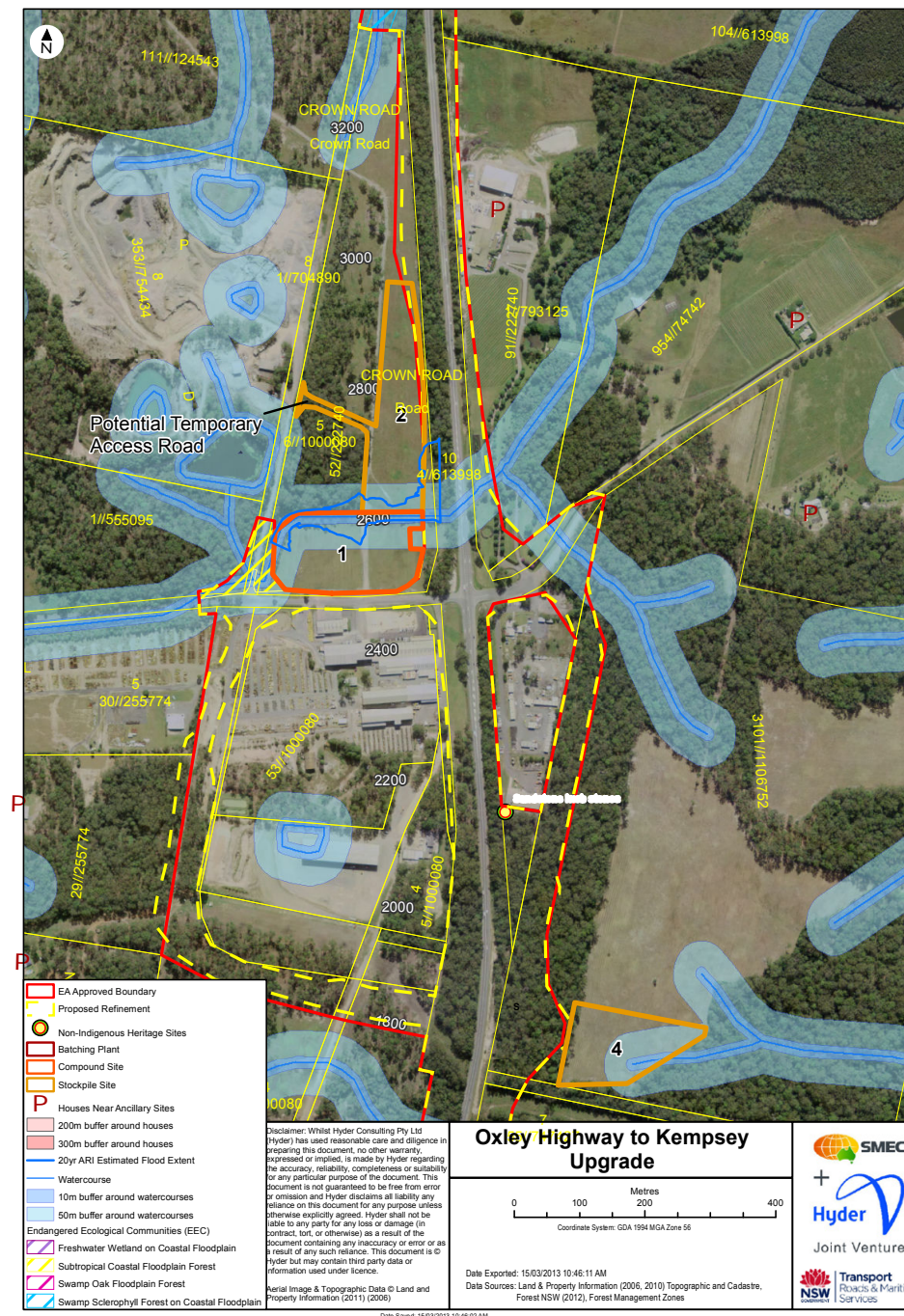


Figure 8.5.1 Proposed stockpile and site compound locations

8.5.1 Stockpile Sites

Stockpile sites may typically be required to store material including, but not limited to:

- Excavated material to be used in fill embankments and other design features.
- Acid Sulphate Soils subject to treatment prior to reuse.
- Excavated material unsuitable for reuse in the formation.
- Excess concrete, pavement, rock, steel and other material stored for either future use in the Project or prior to removal from site.
- Topsoil, mulch, excess timber for landscaping and revegetation works.

The criteria used to determine the location of stockpiles is as follows:

- The stockpile site must be located at least five metres clear of all areas of possible concentrated water flow.
- The stockpile site must be located at least 10 metres from a waterway.
- The stockpile site must be located on land with a slope less than 10 per cent.
- The stockpile site must have ready access to the road network or direct access to the construction corridor.
- The stockpile site must be on land that does not require the removal of threatened species, EECs or roosting habitat for listed threatened fauna species
- The stockpile site must be located in areas of low heritage conservation significance (including identified Aboriginal cultural value) and not impact on heritage sites beyond those already impacted by the Project.
- The temporary stockpile site must be rehabilitated at completion to the same standard it was in prior to its use and to the satisfaction of the landowner

Mitigation measures for each stockpile site include as a minimum:

- The perimeter of the stockpile (excluding vehicle access points) will be delineated with a bund (made out of earth/RAP or similar) or other type of fencing or barrier such as sediment fence.
- Materials will not be stockpiled under the drip lines trees or native vegetation to be retained, and never pushed up around the base of trees.
- Erosion and sedimentation controls will be erected between the site and any drainage lines or down-slope areas.
- A diversion bund will be installed on the uphill side of the stockpile to divert water around the site.
- Short-term stockpiles will be covered with plastic or kept damp to control dust where required. Long-term stockpiles (ie to remain for greater than 20 days) will be stabilised with cover crop.
- Potentially affected residents within 200 metres of stockpiles will be notified regarding the location of the stockpile areas, the potential impact from constructing the stockpile (including visual and odour impacts) and proposed mitigation measures.
- Where stockpiles are located within 200 metres of residences, these stockpile areas will be monitored for odour. If nuisance odours are generated and are impacting sensitive receivers, odour control measures will implemented, if feasible and reasonable. If this is not possible, material found to be emitting odours will be relocated to an alternative stockpile location away from residences.
- Acid Sulphate Soils (ASS) or mulch stockpile management, including leachate containment, will be in accordance with the Soil and Water Management Plan (SWMP). The Roads and Maritime publication *Environmental Direction - Management of Tannins from Vegetation Mulch (January 2012)* will be used as a reference document.

At the de-commissioning of stockpiles they are to be re-habilitated to a condition equal to the condition prior to disturbance.

In addition to the site identified west of the highway on land owned by Expressway Spares described above, two other potential stockpile sites have been identified for possible use for the Sancrox Traffic Arrangement works – on the eastern side of the Pacific Highway there is a large cleared area available near the proposed roundabout and Service Road No.3 which can be utilised as a stockpile and/or storage site. This site has the benefit of being close to the eastern bridge abutment and roundabout works, so can be used as a readily accessible storage sites for earthworks materials won from the eastern side of the Pacific Highway. Refer to Figure 8.5.1 (outlined in orange and noted as stockpile site 4).

The other is located on Roads and Maritime-owned land at Station 7000 which will be used as a stockpile site only for the Sancrox Traffic Arrangement works and will remain in place during Stage 3 construction works as both an ancillary site and as a stockpile site. The site would be established prior to the commencement of construction of Stage 3. Refer to Figure 8.5.1.1 (outlined in orange and noted as stockpile site 3).

It should be noted that a Contractor may decide to utilise the available sites in a different way to suit their specific program or construction sequencing. Approval of these sites will be the responsibility of the Contractor.

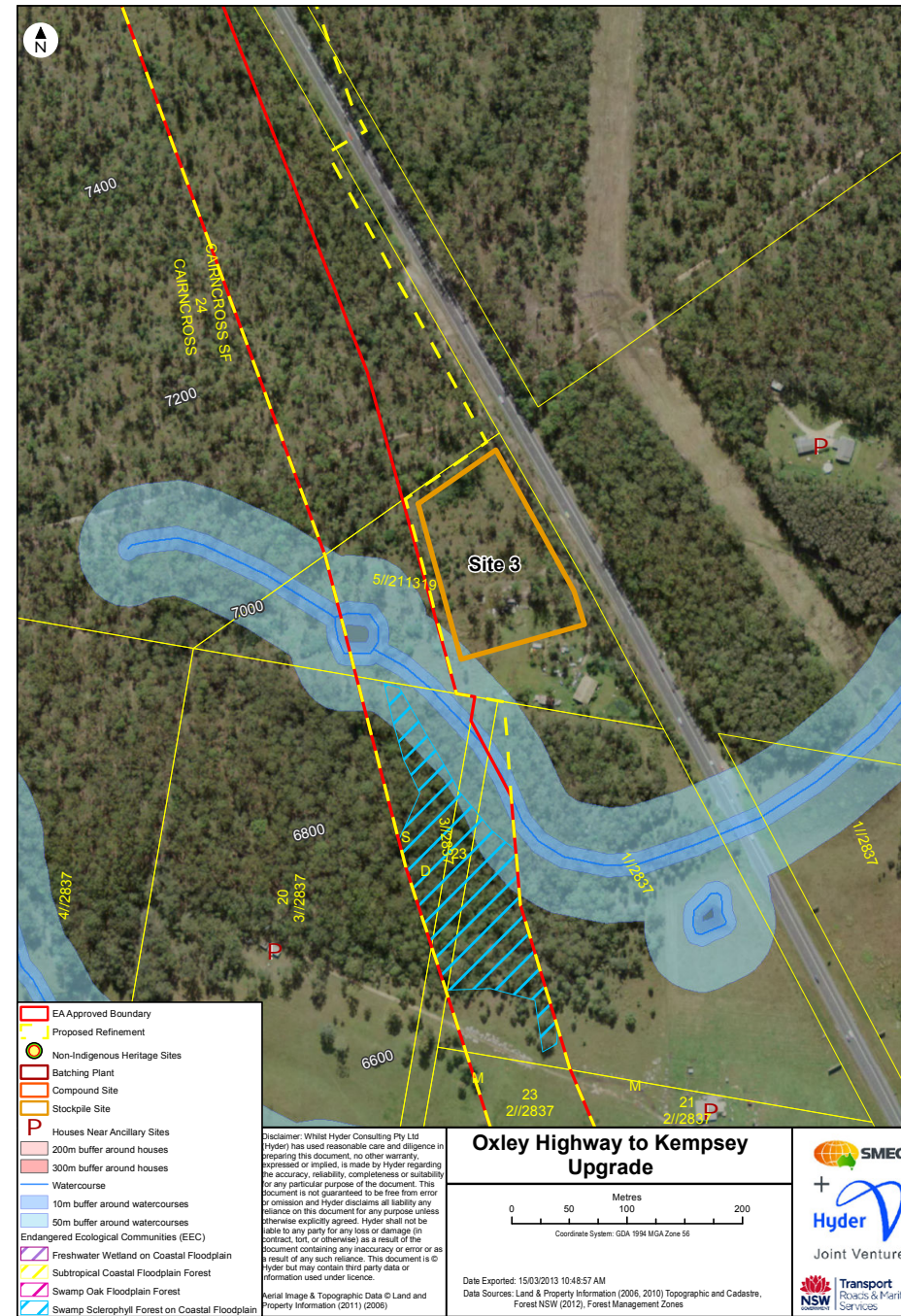


Figure 8.5.1.1 Roads and Maritime owned property at Station 7000

8.5.2 Access (haul) Roads

Where access roads are temporary, they will be restored at completion by removal of the road surface and ripped to the depth and extent of the select material zone. A2 Horizon topsoil (no compost) will be spread to a depth to restore the final surface to 100 millimetres below finished levels, and A1 horizon topsoil spread to a minimum depth of 100 millimetres. The appropriate hydromulch seed mix or planting will be applied in accordance with the landscape plans for the vegetation community in which the road occurs.

In some instances, haul roads may remain in place for use by Stage 3 works which is scheduled to follow soon after the Sancrox Traffic Arrangement works. There are no creeks required to be crossed during the construction of the early works.

Prior to use, the appropriate erosion and sedimentation control measures will be implemented to protect the watercourse.

8.6 VISUAL SCREENING

Several businesses and the Roads and Maritime depot are affected by the works. Both Expressway Spares and Cassegrain Winery are visually exposed to the existing highway. HF Hand is set back from the existing Highway and screened behind existing vegetation. The Roads and Maritime depot is partially screened. These conditions will remain unchanged. The following table describes the agreed treatments in regard to visual screening of the affected receptors:

Property	Adjustment works
Cassegrain Winery	Location of the property access and the access configuration has been modified to cater for required turning movements. This has resulted in the loss of avenue trees currently lining the winery entrance and other roadside trees. However no additional exposure to the highway from any residence or building from the winery has occurred as a result of these changes. In consultation with the owners, semi-mature trees have been selected for planting at the relocated entrance and roundabout. Further visual screening is not required as it is desirable to have views of the business to attract passing trade.
Roads and Maritime Depot	New access along Sancrox Road east to the Roads and Maritime depot and a Driver Reviver are proposed to be planted with semi-mature street trees. Native grasses below allow sightlines into the facility for passive surveillance and passing trade. On the highway side, existing vegetation is retained. Further visual screening is not required and it is desirable to have a view to the driver reviver facility from Fernbank Creek Road.
HF Hand	New access road off Sancrox Road west of the highway overbridge will be provided with feature tree and shrub planting selected in consultation with the owner within the subject property. Part of this access road is affected by overhead wires which affects the extent of planting. Further visual screening is not required.
Expressway Spares	New fencing and gate to be provided. The interface on Sancrox Road is affected by overhead power lines which precludes tree planting. Feature tree planting is used at the interface with the western Sancrox Road roundabout and leading to the second entry to the west. On the highway side, Expressway Spares enjoys exposure to the highway and passing trade which is to be maintained therefore no visual screening has been provided. Further works are proposed in Stage 3 at which time planting can be re-considered

There is no change to the visual impact and no residual visual impacts remain. In addition where visual exposure is desirable for businesses, no screening vegetation has been provided, in consultation with the landowners.

High visual impacts and residual impacts are not likely to remain at the end of the Sancrox Traffic Arrangement for any residences in the vicinity. Existing residences to the north-east off Fernbank Creek Road and west off Bushland Drive are more than 300 metres from the works and are separated visually from the works by existing vegetation to be retained.

8.7 PROGRESSIVE RE-VEGETATION

Several elements go together to make up the progressive establishment of re-vegetation across the proposal. These are:

- Staged implementation of the landscape installation. As sections of the earthworks are prepared, the section is prepared for topsoiling followed by seeding.
- In accordance with Roads and Maritime specifications all prepared areas flatter than 3:1 requiring vegetation must be vegetated within 14 days and steeper than 3:1 within seven days.
- All topsoiled areas are to be seeded within two days of completion of soil preparation or, if delayed by the weather conditions, as soon as weather conditions permit.
- Open drains are to be vegetated within seven days of excavation.
- Use of cover crops for rapid stabilisation of bare soils. Cover crop may be applied separately or in conjunction with all other hydromulch mixes.
- Planting is used where trees, shrubs and ground covers are required for early landscape and visual effect and for early landscape establishment in fauna movement corridors and adjacent to underpasses and below bridge structures.
- Super advanced and semi-mature trees are used at the intersections and property entrances for early visual effect.
- Maintenance inspection of plantings must be carried out at least monthly and missing or dead plants must be replaced within 14 days of detection.

In addition to the above, the topsoil management procedures which are devised to maximise the retention and germination from the soil seedbank, will ensure that native seed is already contained in any topsoiled areas. Since disturbance favours germination of colonising plants we can expect that fast growing pioneer species will germinate rapidly from topsoiled areas.

Areas which receive erosive pressures such as vegetated channels, water quality basins and slopes steeper than 2:1, will have organic fibre mesh installed in order to improve the establishment of the re-vegetation.

8.8 SEED COLLECTION

The seed schedules include endemic plants which are hardy and fast growing species for use in revegetation and are generally available commercially. However seed supply is subject to dramatic fluctuations in availability. If seed is not available commercially at the time required, the contractor may consider seed collection from site to complement commercially available seed. Collection will commence throughout the clearing footprint prior to clearing in the first instance. The optimum time for collecting most useful species is late spring.

Targeted species will be those listed in the seed schedules and to a lesser extent those in the planting schedules. These are all hardy and fast growing species for use in revegetation. No seed collection will be carried out of species protected under the NPW Act Schedule 13.

The collection program will include storage and treatment of seeds (refer to 8.8.1) to maximise germination rates. Collection sites will be identified through examination of aerial photographs and maps, local knowledge and verified by ground searches. Seed may be collected from other parts of Northern NSW with the concurrence of the Principal, and it is possible that other plant material may be salvaged from the proposed development area, as appropriate.

Seed collection, processing and storage should follow the Protocols contained in the Florabank Guidelines (Florabank Online). RTA has prepared its own Specifications for Seed Collection (DCM R176 Native Seed Collection August 2003) which are in basic agreement with the Florabank Guidelines and will be used for this project.

8.8.1 Seed Treatment and Storage Method Statement

The following procedures will be implemented during seed cleaning and storage:

- Seed will be separated from fruits (fleshy fruits or dry capsules, pods etc) and stored in sealed, labelled containers.
- Where there is evidence of insect attack, seed will be immersed in water for 12 hours, then re-dried.
- Seed will be stored at 5° C in a refrigerator (based on Floyd 1989 and Florence 2000) and checked for evidence of mould.
- Care will be taken not to expose seed to extremes of heat or cold or moisture.
- The seed of most sclerophyll species should retain viability for two years or more if stored under these conditions.
- Seeds of species that are unlikely to store well (many non-pioneer species) will be sent to a nursery for propagation within three months.
- Topsoil seed bank will be used for revegetation.

The following points are noted in relation to the use of topsoil seed banks in revegetation work:

- Use of the soil seed bank is expected to reduce the amount of planting necessary and the amount of seed required for plant propagation.
- Use of topsoil for rehabilitation work is a requirement of the Sancrox Traffic Arrangement.
- Only areas that are largely free of exotic species should be used for revegetation through soil seed bank regeneration.
- Topsoil stockpiles are to be managed to preserve the viability of seed banks in topsoil.

8.8.2 Seeding

Seeding mixes will not be specific to vegetation communities, however all seeding mixes will contain species which are common to vegetation communities comprising more than 80 per cent of the proposal footprint and are endemic to the proposal footprint. This is a valid approach for devising the seeding since many of the species from minority communities recorded along the proposal alignment (eg; Riparian Forest at 2.8 per cent of the proposal footprint) will not be suited for revegetation purposes on embankments where the microclimate for establishment is difficult.

The species selected for seeding mixes are those occurring along the proposal footprint, which are known to be hardy, drought tolerant and to establish quickly from seed. For example Acacia species are represented in the seed mix but are not included in planting mixes. Species which are more difficult to establish from seed, and all tree species are included in planting only.

Single seed mixes have been developed for:

- **Native Grass seed mix** containing native grass and sedge species where mowing/maintenance may be required for medians, verges and fauna fence access, where sightlines must be maintained and to allow views.
- **Frangible shrubs seed mix** containing native grasses, sedges and frangible shrub species for embankment areas within the safety clearance zone (up to 11 metres from the edge of carriageway), and where headlight glare screening is required in the median.
- **Tall shrubs seed mix** for use on embankments beyond the safety clearance
- **Cover crop seeding mix** (All disturbed areas identified to be hydromulched except pasture grass areas which already contains cover crop) cover crop may be applied separately or in conjunction with all other hydromulch mixes.

Refer to Appendix A for complete Seeding Schedules.

Tree seed is not included in any of the seeding mixes. Trees are to be introduced by planting only, by return of topsoil containing a soil seedbank, and through the opportunistic seeding from trees in the fringing forest vegetation of the alignment. Such seeding can be anticipated to occur at the top and bottom of embankments away from the road edge within the first two years following preparation of embankments.

9 OVERALL URBAN AND LANDSCAPE DESIGN

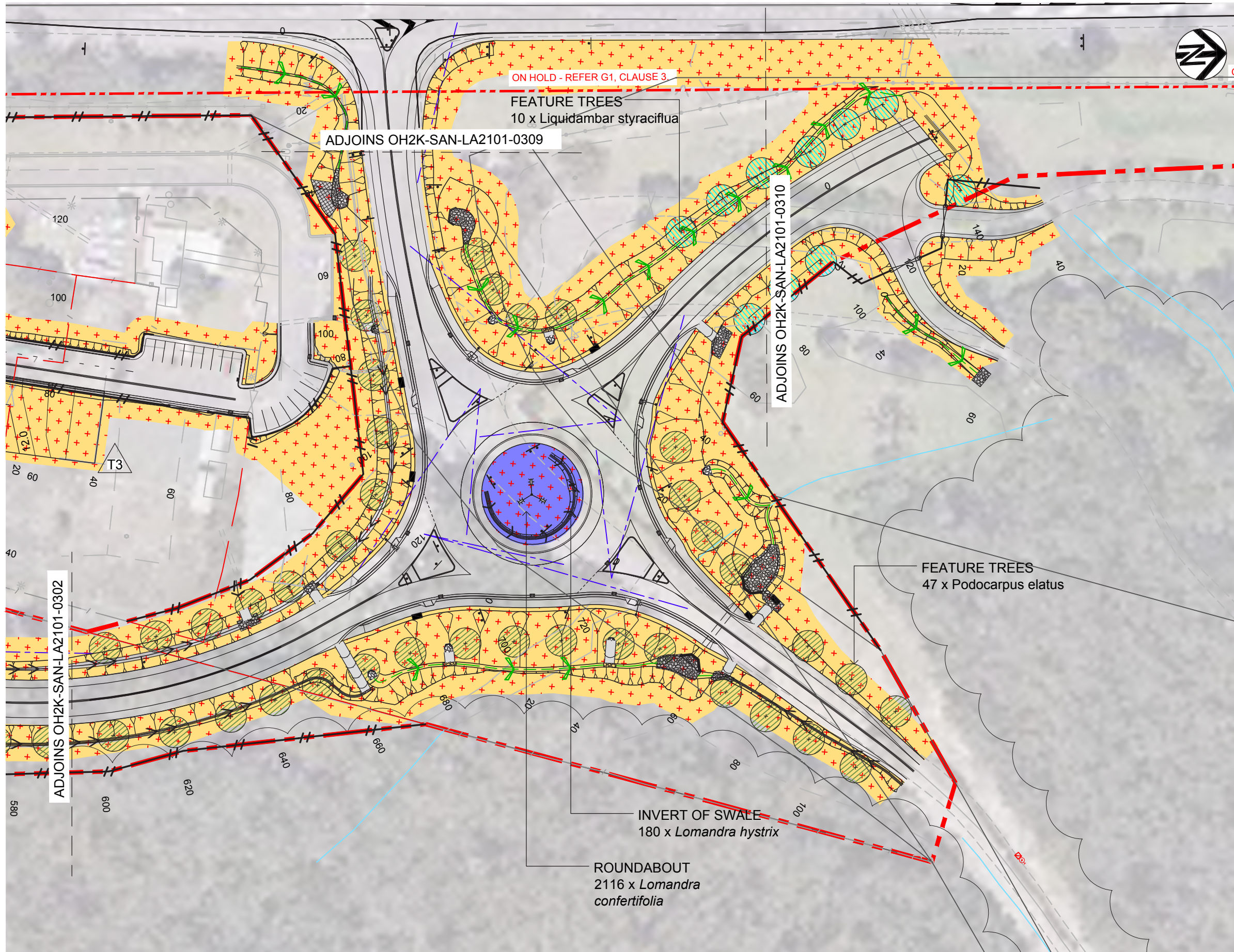
9.1 URBAN DESIGN AND LANDSCAPE PLANS

Refer to Figure 9.1.1 - 9.1.12.

The following urban and landscape plans, drawn at 1:1000 on an aerial photographic base are based upon the principles outlined in the urban and landscape design strategy and proposed treatments. They illustrate the integrated urban design and landscape outcome for the Sancrox Traffic Arrangement. The plans show:

- Existing adjacent context.
- Proposed landscape treatments.
- Landscape treatments of cuttings and embankments.
- Bridge.
- Planting and seeding schedules.

The landscape installation will be carried out progressively with topsoiling and seeding followed by planting of disturbed areas installed as work site becomes available. The implementation of topsoil management to preserve the soil seedbank will also aid in the progressive revegetation.



- LEGEND**
- PROJECT BOUNDARY
 - FEATURE TREES (*Podocarpus elatus*)
 - FEATURE TREES (*Cupaniopsis anacardioides*)
 - FEATURE TREES (*Eucalyptus tereticornis*)
 - FEATURE TREES (*Liquidambar styraciflua*)
 - FEATURE TREES (*Eucalyptus microcorys* and *Eucalyptus pilularis* - Mixed Planting)
 - FEATURE PLANTING TO HF HANDS ENTRY (*Syzygium luehmannii* 'Royal Flame')
- TOPSOILS**
- MOIST SLOPES FOREST SOILS
 - RIPARIAN FOREST SOILS
 - PASTURE GRASS SOILS
- SEEDMIXES**
- NATIVE GRASSES SEED MIX
 - TALL SHRUBS SEED MIX
 - PASTURE GRASS SEED MIX (COUCH)
 - TUBESTOCK PLANTING
- EXISTING VEGETATION CANOPY
 - VEGETATION COMMUNITY BOUNDARY
 - WIRE ROPE SAFETY BARRIER
 - SIGHTLINES
 - NEW FENCE
 - FAUNA FENCE
 - EXISTING FENCE
 - EXISTING FENCE TO BE REMOVED
 - SIGNPOST
 - TABLE DRAIN - LINED
 - CHANNEL - ROCK LINED
 - CHANNEL - VEGETATED
 - CATCH DRAIN - VEGETATED
 - SPREADER
- NOTES:**
- FOR GENERAL NOTES REFER TO DRAWING OH2K-SAN-LA2101-0041
 - FOR PLANTING AND SEEDING SCHEDULES REFER DRAWINGS OH2K-SAN-LA2101-0601



Figure 9.1.1 Landscape Concept Plan 1

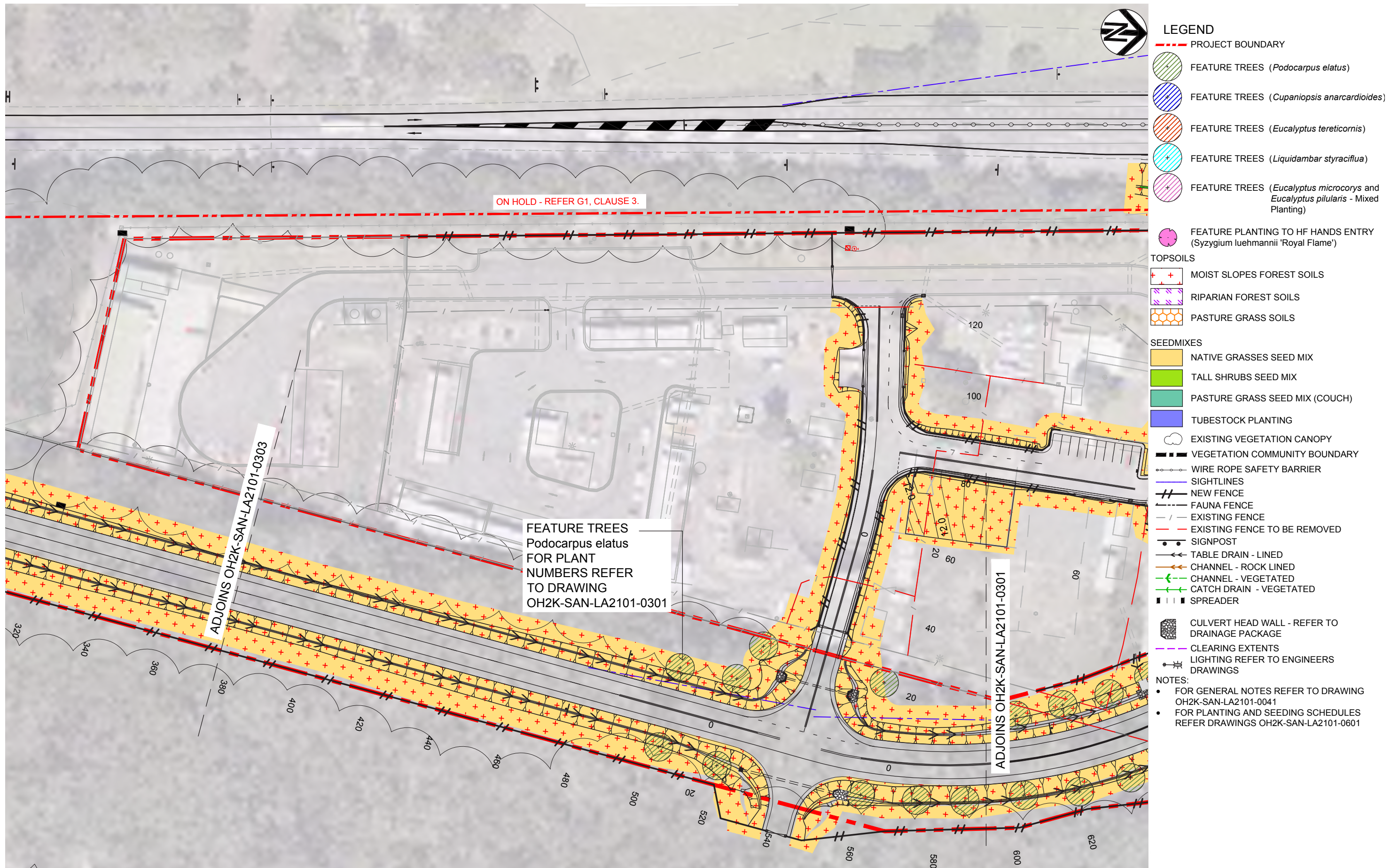


Figure 9.1.2 Landscape Concept Plan 2

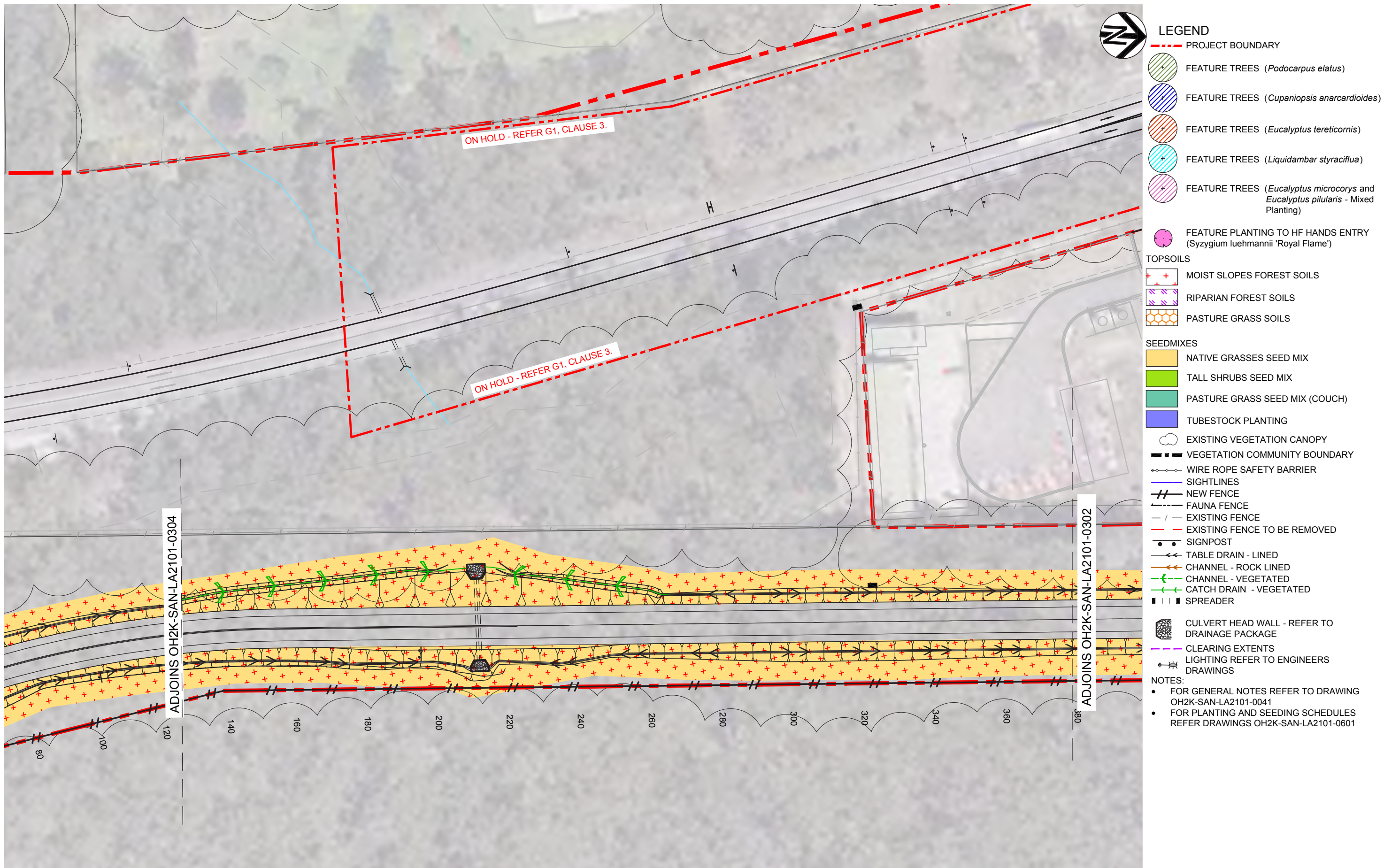


Figure 9.1.3 Landscape Concept Plan 3



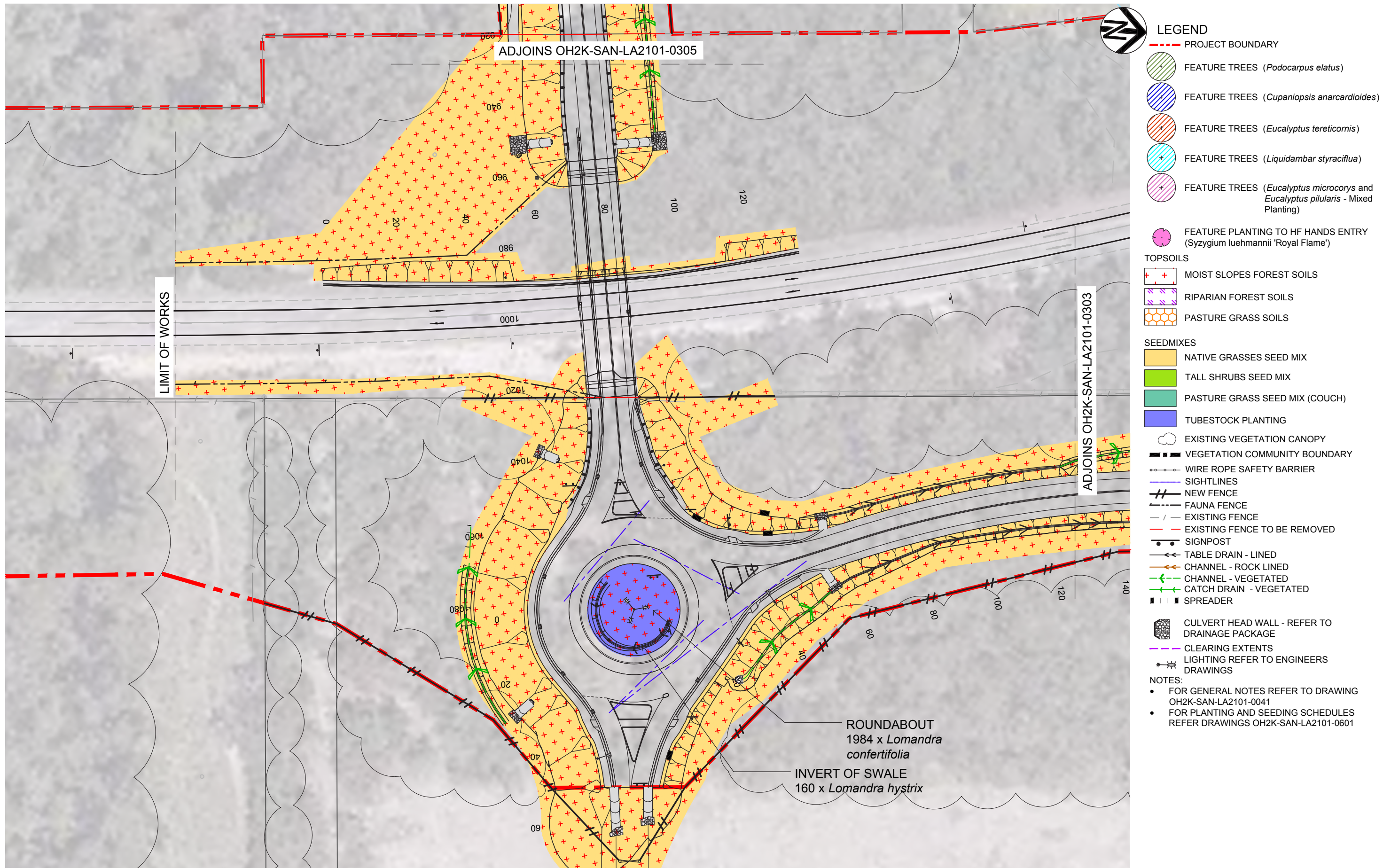
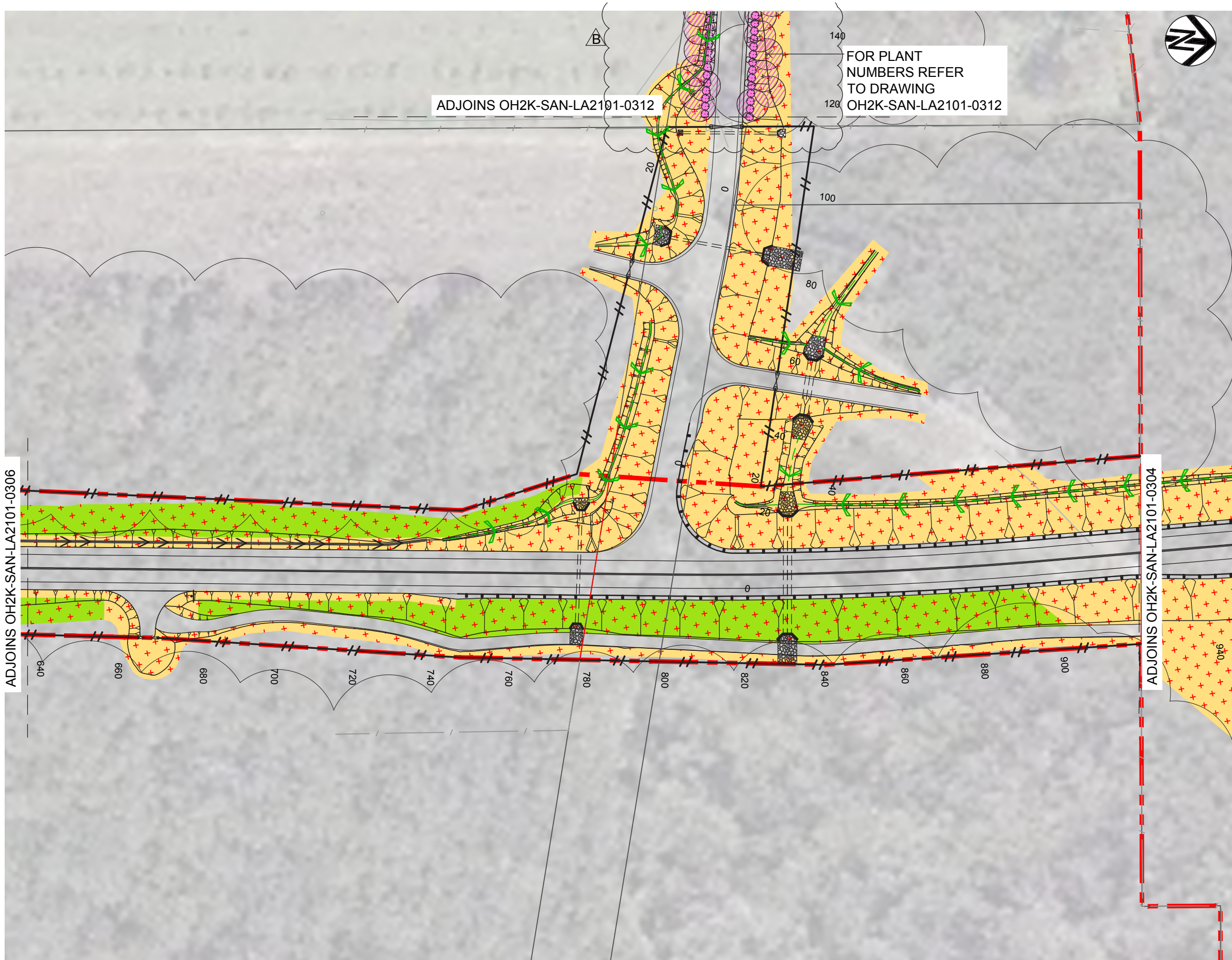


Figure 9.1.4 Landscape Concept Plan 4





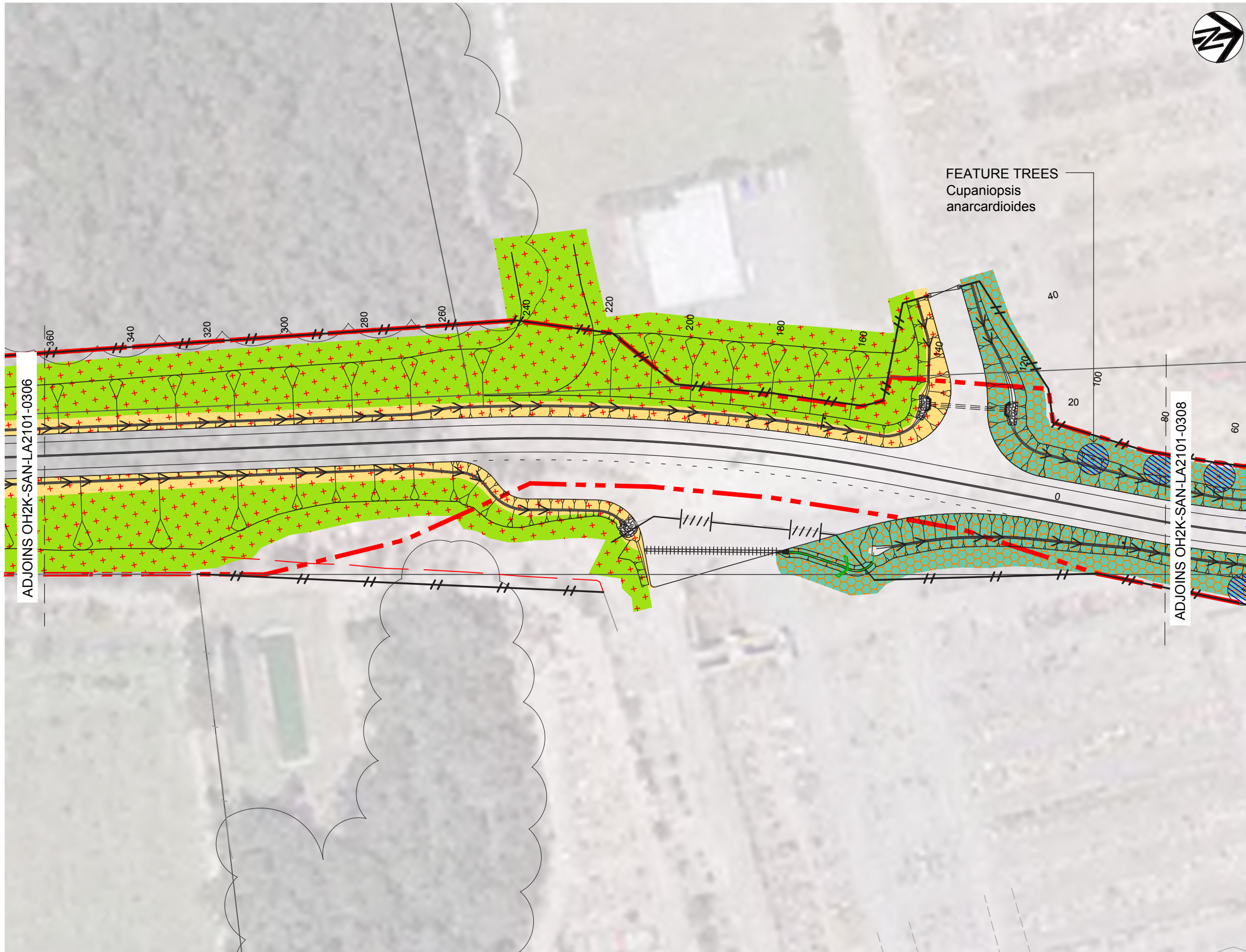
- LEGEND**
- PROJECT BOUNDARY
 - FEATURE TREES (*Podocarpus elatus*)
 - FEATURE TREES (*Cupaniopsis anarcardioides*)
 - FEATURE TREES (*Eucalyptus tereticornis*)
 - FEATURE TREES (*Liquidambar styraciflua*)
 - FEATURE TREES (*Eucalyptus microcorys* and *Eucalyptus pilularis* - Mixed Planting)
 - FEATURE PLANTING TO HF HANDS ENTRY (*Syzygium luehmannii* 'Royal Flame')
- TOPSOILS**
- MOIST SLOPES FOREST SOILS
 - RIPARIAN FOREST SOILS
 - PASTURE GRASS SOILS
- SEEDMIXES**
- NATIVE GRASSES SEED MIX
 - TALL SHRUBS SEED MIX
 - PASTURE GRASS SEED MIX (COUCH)
 - TUBESTOCK PLANTING
- OTHER SYMBOLS**
- EXISTING VEGETATION CANOPY
 - VEGETATION COMMUNITY BOUNDARY
 - WIRE ROPE SAFETY BARRIER
 - SIGHTLINES
 - NEW FENCE
 - FAUNA FENCE
 - EXISTING FENCE
 - EXISTING FENCE TO BE REMOVED
 - SIGNPOST
 - TABLE DRAIN - LINED
 - CHANNEL - ROCK LINED
 - CHANNEL - VEGETATED
 - CATCH DRAIN - VEGETATED
 - SPREADER
 - CULVERT HEAD WALL - REFER TO DRAINAGE PACKAGE
 - CLEARING EXTENTS
 - LIGHTING REFER TO ENGINEERS DRAWINGS
- NOTES:**
- FOR GENERAL NOTES REFER TO DRAWING OH2K-SAN-LA2101-0041
 - FOR PLANTING AND SEEDING SCHEDULES REFER DRAWINGS OH2K-SAN-LA2101-0601

Figure 9.1.5 Landscape Concept Plan 5



Figure 9.1.6 Landscape Concept Plan 6





- LEGEND**
- PROJECT BOUNDARY
 - FEATURE TREES (*Podocarpus elatus*)
 - FEATURE TREES (*Cupaniopsis anarcardioides*)
 - FEATURE TREES (*Eucalyptus tereticornis*)
 - FEATURE TREES (*Liquidambar styraciflua*)
 - FEATURE TREES (*Eucalyptus microcorys* and *Eucalyptus pilularis* - Mixed Planting)
 - FEATURE PLANTING TO HF HANDS ENTRY (*Syzygium luehmannii* 'Royal Flame')
 - TOPSOILS**
 - MOIST SLOPES FOREST SOILS
 - RIPARIAN FOREST SOILS
 - PASTURE GRASS SOILS
 - SEEDMIXES**
 - NATIVE GRASSES SEED MIX
 - TALL SHRUBS SEED MIX
 - PASTURE GRASS SEED MIX (COUCH)
 - TUBESTOCK PLANTING
 - ☁ EXISTING VEGETATION CANOPY
 - VEGETATION COMMUNITY BOUNDARY
 - WIRE ROPE SAFETY BARRIER
 - SIGHTLINES
 - NEW FENCE
 - FAUNA FENCE
 - EXISTING FENCE
 - EXISTING FENCE TO BE REMOVED
 - SIGNPOST
 - TABLE DRAIN - LINED
 - CHANNEL - ROCK LINED
 - CHANNEL - VEGETATED
 - CATCH DRAIN - VEGETATED
 - SPREADER
 - CULVERT HEAD WALL - REFER TO DRAINAGE PACKAGE
 - CLEARING EXTENTS
 - LIGHTING REFER TO ENGINEERS DRAWINGS
- NOTES:**
- FOR GENERAL NOTES REFER TO DRAWING OH2K-SAN-LA2101-0041
 - FOR PLANTING AND SEEDING SCHEDULES REFER DRAWINGS OH2K-SAN-LA2101-0601

Figure 9.1.7 Landscape Concept Plan 7



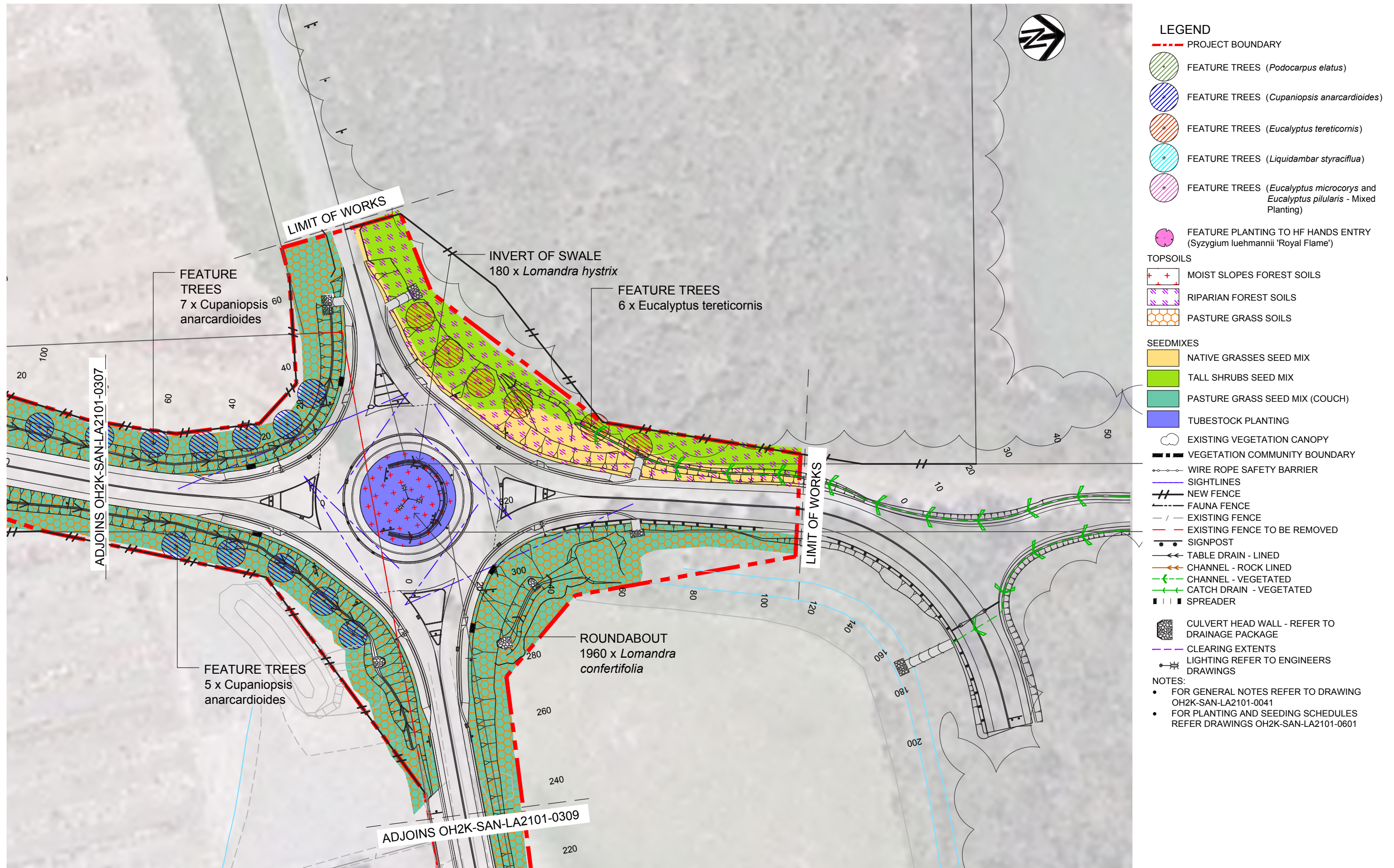
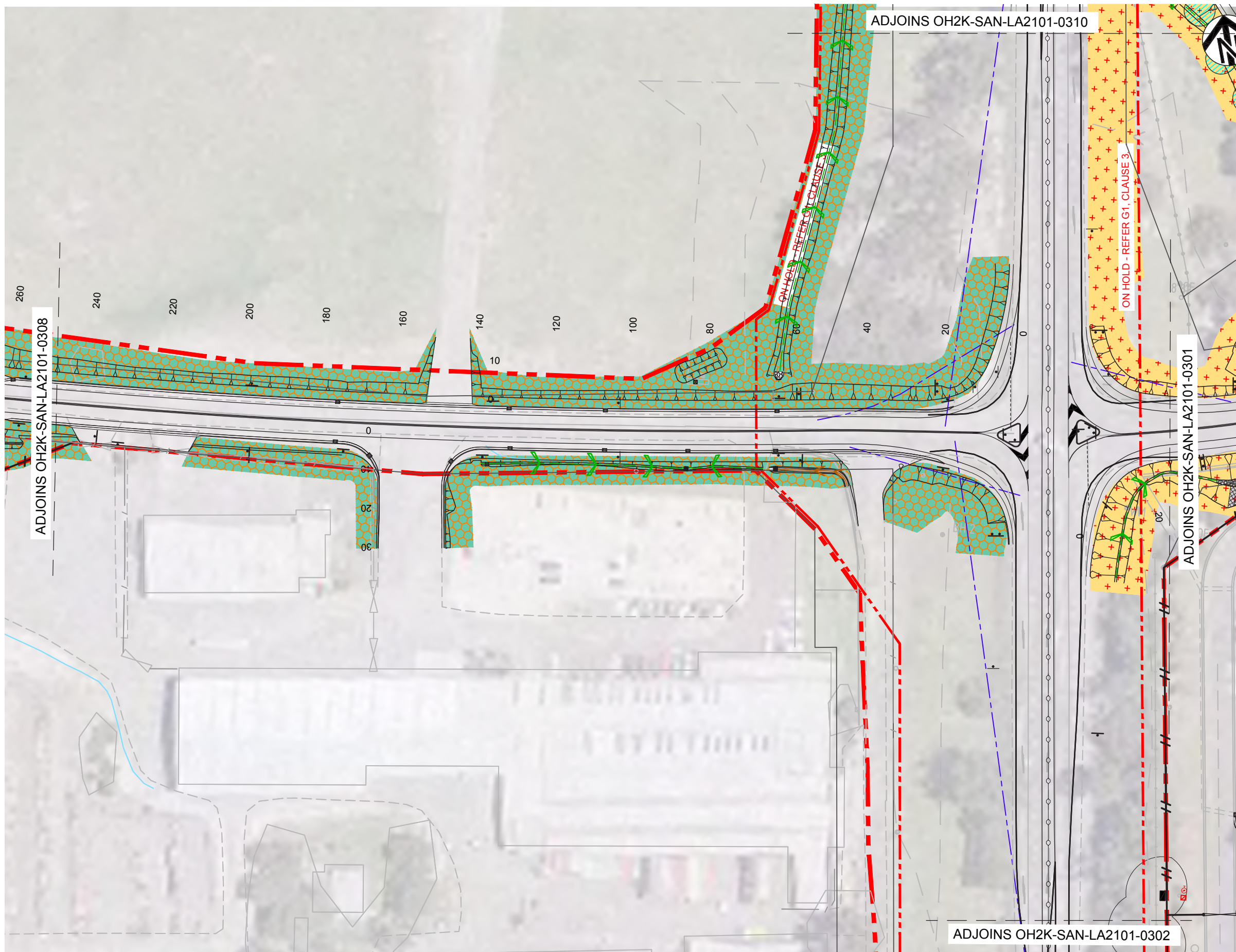


Figure 9.1.8 Landscape Concept Plan 8





- LEGEND**
- PROJECT BOUNDARY
 - FEATURE TREES (*Podocarpus elatus*)
 - FEATURE TREES (*Cupaniopsis anacardioides*)
 - FEATURE TREES (*Eucalyptus tereticornis*)
 - FEATURE TREES (*Liquidambar styraciflua*)
 - FEATURE TREES (*Eucalyptus microcorys* and *Eucalyptus pilularis* - Mixed Planting)
 - FEATURE PLANTING TO HF HANDS ENTRY (*Syzygium luehmannii* 'Royal Flame')
 - TOPSOILS**
 - MOIST SLOPES FOREST SOILS
 - RIPARIAN FOREST SOILS
 - PASTURE GRASS SOILS
 - SEEDMIXES**
 - NATIVE GRASSES SEED MIX
 - TALL SHRUBS SEED MIX
 - PASTURE GRASS SEED MIX (COUCH)
 - TUBESTOCK PLANTING
 - EXISTING VEGETATION CANOPY
 - VEGETATION COMMUNITY BOUNDARY
 - WIRE ROPE SAFETY BARRIER
 - SIGHTLINES
 - NEW FENCE
 - FAUNA FENCE
 - EXISTING FENCE
 - EXISTING FENCE TO BE REMOVED
 - SIGNPOST
 - TABLE DRAIN - LINED
 - CHANNEL - ROCK LINED
 - CHANNEL - VEGETATED
 - CATCH DRAIN - VEGETATED
 - SPREADER
 - CULVERT HEAD WALL - REFER TO DRAINAGE PACKAGE
 - CLEARING EXTENTS
 - LIGHTING REFER TO ENGINEERS DRAWINGS
- NOTES:**
- FOR GENERAL NOTES REFER TO DRAWING OH2K-SAN-LA2101-0041
 - FOR PLANTING AND SEEDING SCHEDULES REFER DRAWINGS OH2K-SAN-LA2101-0601

Figure 9.1.9 Landscape Concept Plan 9



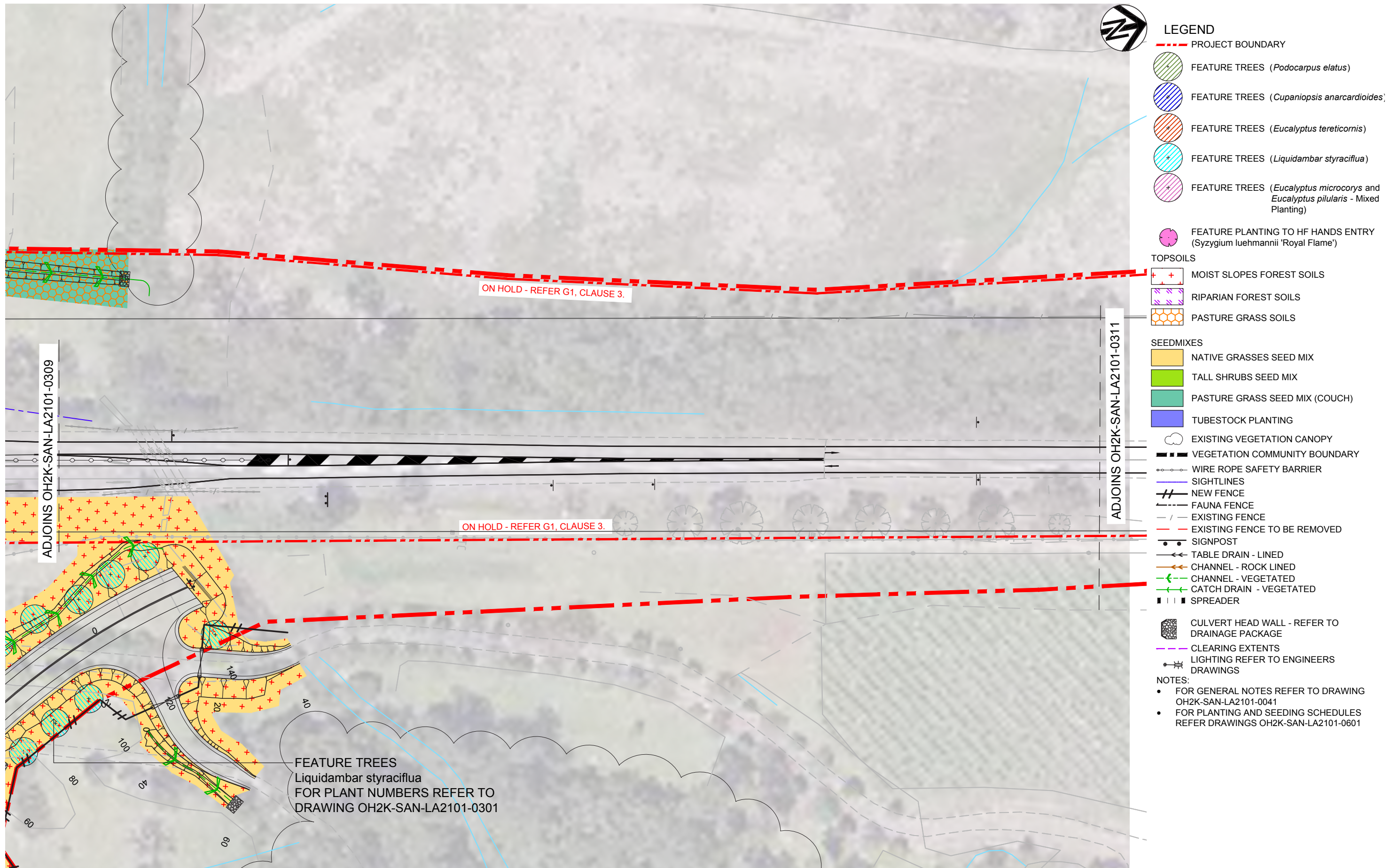
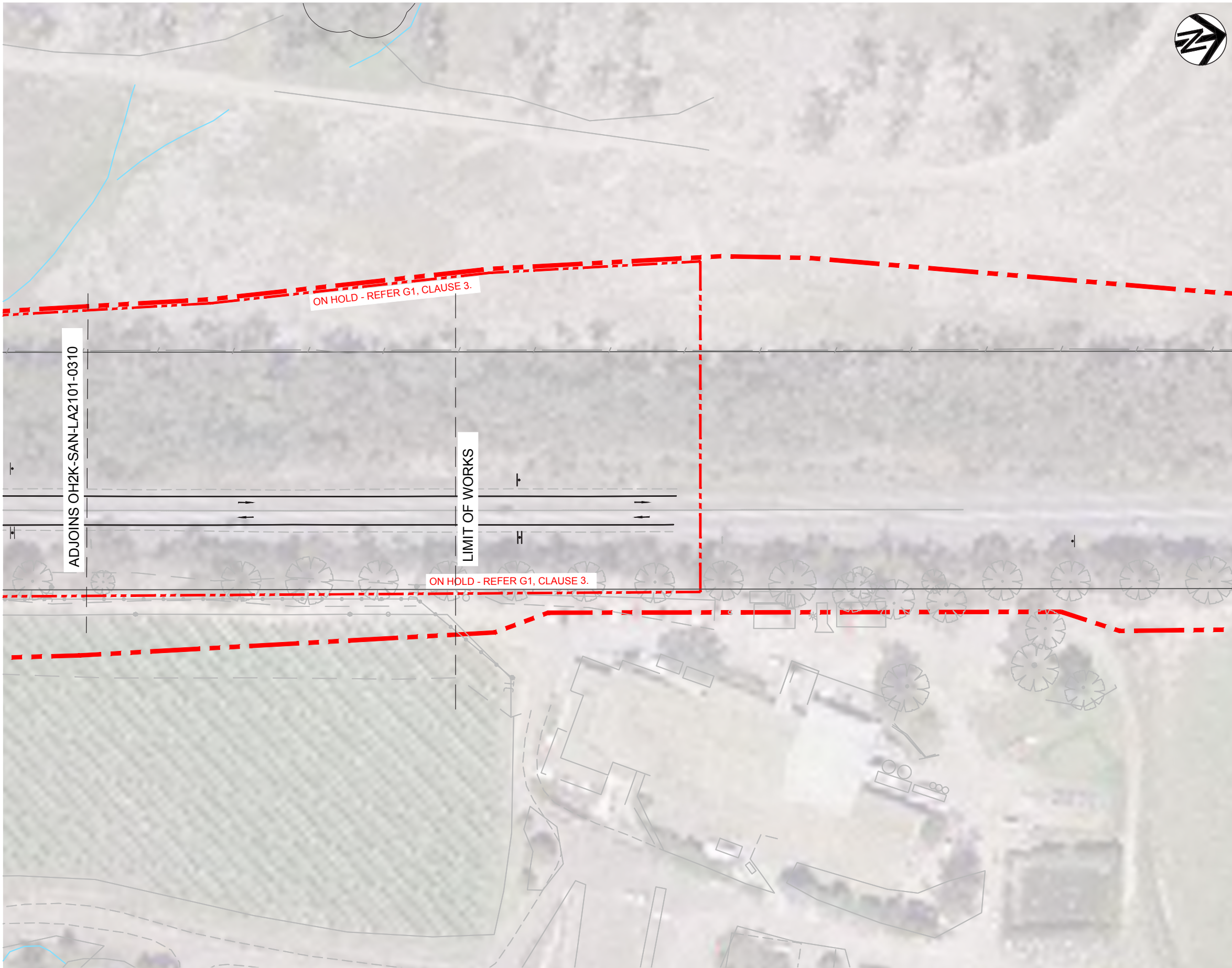


Figure 9.1.10 Landscape Concept Plan 10





- LEGEND**
- PROJECT BOUNDARY
 - FEATURE TREES (*Podocarpus elatus*)
 - FEATURE TREES (*Cupaniopsis anarcardioides*)
 - FEATURE TREES (*Eucalyptus tereticornis*)
 - FEATURE TREES (*Liquidambar styraciflua*)
 - FEATURE TREES (*Eucalyptus microcorys* and *Eucalyptus pilularis* - Mixed Planting)
 - FEATURE PLANTING TO HF HANDS ENTRY (*Syzygium luehmannii* 'Royal Flame')
 - TOPSOILS**
 - MOIST SLOPES FOREST SOILS
 - RIPARIAN FOREST SOILS
 - PASTURE GRASS SOILS
 - SEEDMIXES**
 - NATIVE GRASSES SEED MIX
 - TALL SHRUBS SEED MIX
 - PASTURE GRASS SEED MIX (COUCH)
 - TUBESTOCK PLANTING
 - EXISTING VEGETATION CANOPY
 - VEGETATION COMMUNITY BOUNDARY
 - WIRE ROPE SAFETY BARRIER
 - SIGHTLINES
 - NEW FENCE
 - FAUNA FENCE
 - EXISTING FENCE
 - EXISTING FENCE TO BE REMOVED
 - SIGNPOST
 - TABLE DRAIN - LINED
 - CHANNEL - ROCK LINED
 - CHANNEL - VEGETATED
 - CATCH DRAIN - VEGETATED
 - SPREADER
 - CULVERT HEAD WALL - REFER TO DRAINAGE PACKAGE
 - CLEARING EXTENTS
 - LIGHTING REFER TO ENGINEERS DRAWINGS
- NOTES:**
- FOR GENERAL NOTES REFER TO DRAWING OH2K-SAN-LA2101-0041
 - FOR PLANTING AND SEEDING SCHEDULES REFER DRAWINGS OH2K-SAN-LA2101-0601

Figure 9.1.11 Landscape Concept Plan 11



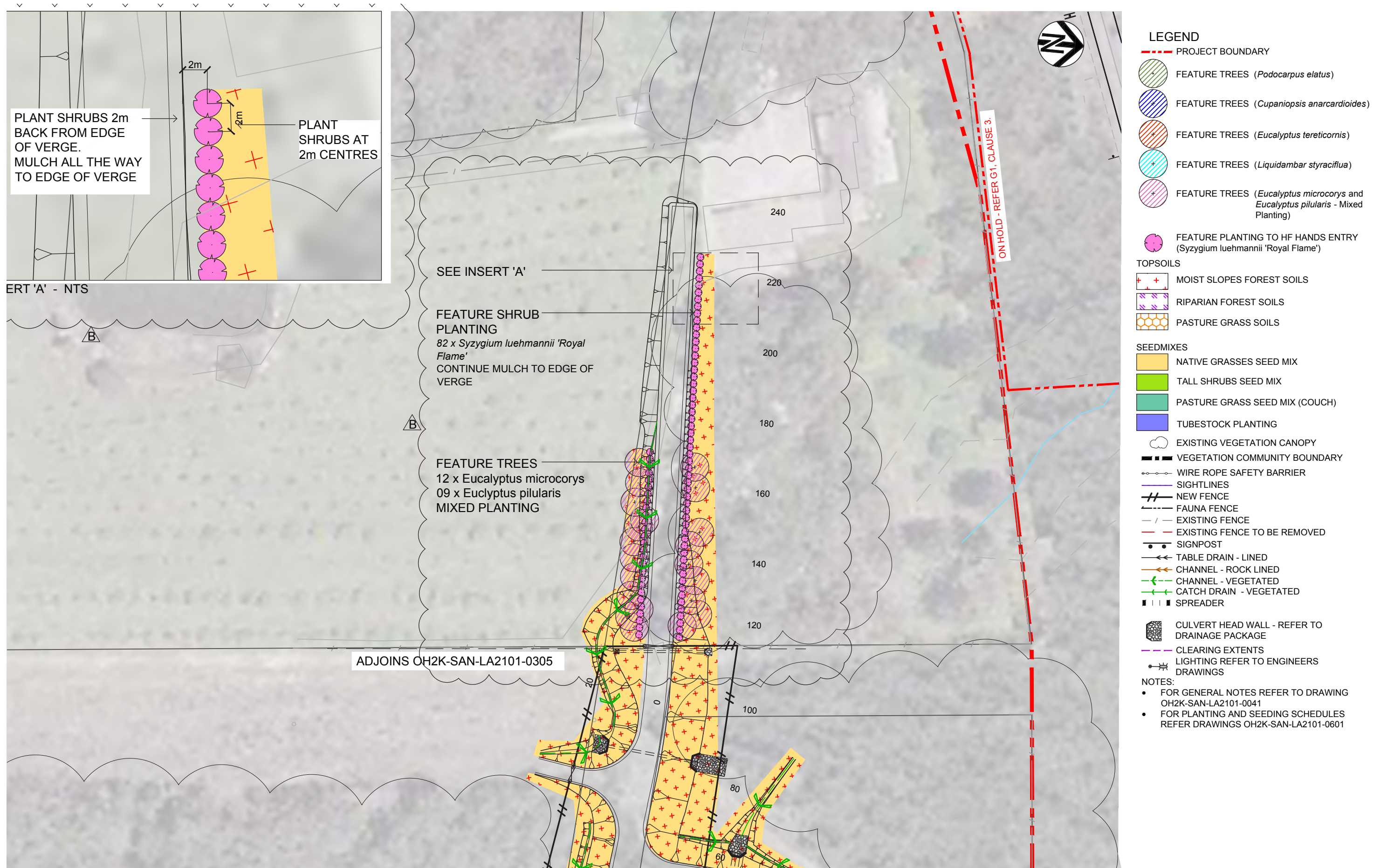


Figure 9.1.12 Landscape Concept Plan 12



9.2 LANDSCAPE MANAGEMENT

A Landscape Management Plan (LMP) has been prepared and is attached as Appendix B. The LMP details all landscape maintenance actions for the upgrade. The landscape maintenance works will be monitored and maintained by a suitably qualified landscape specialist for a period of two years.

Any required remediation measure(s) will be implemented to maintain landscaping works as required by the design documents.

The landscaping will be cost effective, minimise ongoing maintenance requirements and utilise native species, dense planting, bold simple planting designs and rapid planting establishment.