South East Water

Technical Standard

Document Number AM2761

Facility Vehicle Access

Document Control

Revision History

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Revision Working Group (Rev 2)

Name	Position
Michael Lowe	Principal Mechanical Engineer
Scott Philips	Mechanical Engineer
Billy Weston	Graduate Mechanical Engineer
Sebastien Piquet	Principal Civil Engineer
Kristina Machena	Asset Integration Manager
Laurence Salley	Mechanical and Electrical Asset Services Manager
Jayson Street	Senior Technical Support Officer
Ascher Derwent	Manager Sewerage Network Operations
William Harris	WRP Technical Support Asset Engineer

Approved

Revision No.	Name	Position	Date
2.0	James McKimmie Digitally signed by James McKimmie Reason: Approved Date: 2025.12.22 14:49:34 +11'00'	Standards & Products Manager	22/12/2025

Authorised

Revision No.	Name	Position	Date
2.0	Ranga Gayan Fernando Digitally signed by Ranga Gayan Fernando Reason: Authorised Date: 2025.12.22 14:55:04 +11'00'	Engineering and Design Manager	22/12/2025

Table of Contents

List of Tables

List of Figures

1. Introduction

1.1 Purpose

This document provides information and requirements so facility designers can:

- Identify the vehicles that people working on behalf of SEW use to undertake operations and maintenance (O&M) at different types of SEW facilities (Section 2).
- Understand how people drive those vehicles to/from site, position them near water industry assets and then use them in a safe manner, in all weather conditions (Sections 2 and 3).
- Understand requirements for detail design of vehicular access (Section 4)
- Ensure that the impacts of both initial, and any planned or likely future development scenarios, are accounted for at both the planning and design stages for a facility. This is initiated through defining and communicating the functional interrelationships between;
  - water industry assets, i.e. protecting those assets and work vehicles from all other vehicles
  - provisions for the safe use of O&M vehicles servicing those assets
  - third-party infrastructure and traffic scenarios outside of SEW sites, particularly where related to the safe access to, into, out of, and from the SEW site. Consideration to be given to planned changes and natural variations (a road reaching maximum capacity, roads reaching there future maximum speed limit), in addition to emerging trends (reduction of space for public parking in new estates, etc)

Given the space required for vehicle use it is better to consider these provisions early in the design process when sites are being sized, located and arranged, leaving this late in the process generally creates rework, requiring comparatively more design time and effort.

This standard uses salient, rather than exhaustive, situations and scenarios to introduce the design criteria. Where the designer believes that a better solution exists which does not comply with this standard, the designer should contact South East Water to discuss.

1.2 Scope

This document applies to all SEW sewage and water facilities such as sewage / water pump stations, water pressure reducing stations, water storage tanks and sewage / water treatment plants, etc. It shall apply to the design of all potential trafficable areas such as roads and car parks.

1.3 Limitations & Exclusions

This standard is not intended to cover every conceivable project circumstance. The principles of good design are expected to be applied to ensure provisions are fit for purpose, including but not limited to, buildability, safety, sufficient access for maintenance, etc.

1.4 Reference documents

Table 1 - Reference Documents

Document Name
Austroads Guide to Road Design
[1]Supplement to Austroads Guide to Road Design (Department of Transport – Victoria)
Victorian Planning Authority (VPA) Standards
Erosion and Sediment Control on Unsealed Roads – NSW Government Office of Environment 2012
WSA04-2022 Sewage Pumping Station Code of Australia Ver 3.1
AM2961_WSA04-2022 Sewage Pump Station Code SEW Supplement

1.5 Terms and Definitions

Table 2 - Terms & Definitions

Terms	Definition
Erodibility	Ease and speed at which rain and weather will erode pavement
External Road	Road owned by an entity other than SEW (e.g. VicRoads, council, private company or private individual)
Facility	Collection of assets to achieve a function(s) at a particular location
Internal Road	Road owned by SEW
Parking area	Trafficable area designed for vehicles at rest
Pavement	Sealed or unsealed surface and underlying structural support of a trafficable area
Road	Trafficable area designed for vehicle travel
Trafficable area	Anywhere where vehicles are likely to travel or rest
Vehicle Movement Plan	Plan which indicates the motion and location of vehicles in trafficable areas required throughout the design area

[1] Replaced previous VicRoads Supplement to Austroads Guide to Road Design (AGRD)

1.5.1 Abbreviations

Table 3 - Abbreviations and Full Terms

Abbreviation (initialisations)	Full Term
AADT	Annual Average Daily Traffic
AGRD	Austroads Guide to Road Design
AS	Australian Standard
DTP	Department of Transport and Planning (Victoria)
GVM	Gross Vehicle Mass
NSW	New South Wales
NZS	New Zealand Standard
SD	Standard Drawing
SEW	South East Water Corporation
SPS	Sewer Pump Station
TMP	Traffic Management Plan
VMP	Vehicle Movement Plan
VPA	Victorian Planning Authority

2. Vehicle Information

South East Water's maintenance is generally undertaken by contractors who provide their own vehicles.

This gives them the best chance of a timely response to maintenance issues, rather than being beholden to the short-term rental market in times of crisis. SEW neither owns nor specifies the requirements of these vehicles.

This section categorises examples of the standard vehicles that are currently in use, i.e. there may be different models of each vehicle category working in SEW's area compared to what is described herein.

Whilst vehicles used by contractors will periodically change, SEW expects that future vehicles will be of a similar specification as they will service the same SEW sites.

This section only describes those vehicles that are more difficult to accommodate or are particularly critical to operations.

2.1 Loader Crane Trucks & Other Cranes

Contractors use rigid loader crane trucks (known colloquially as crane trucks) fitted with extendable-boom loader cranes and stabilising outriggers. Most of this fleet are small crane trucks **(Figure 1, Figure 2, Figure 3)** as maintainable items in SEW's network can generally be handled by this vehicle, hence the contractors prefer to use these more manoeuvrable vehicles whenever possible.

There is only one large crane truck to service each given area **(Figure 5, Figure 6 and Figure 7**Error! Reference source not found.**)**, which limits its timely availability, though the contractors require the flexibility to use it at any site as far as is practicable.

For activities that exceed the capacity of the large crane truck SEW strongly prefers to use a permanent on-site crane (given reliance on mobile crane rentals creates availability risks for urgent/emergency work, and cost and logistical risks for routine or recurring work). Hence a site layout may only be designed assuming a mobile crane, where such a crane is for infrequent pre-planned activities only, where the installation of a permanent on-site crane is not practicable, and with the approval of SEW's O&M teams.

SEW sites must be designed so small crane trucks can park close to maintainable items within that truck's lifting capacity, noting the lifting capacity of any crane trucks diminishes as the boom is extended (**Figure** 4**, Figure 8)**, and the cranes on small trucks are installed at the rear of the truck on the passenger side.

The total width required with outriggers deployed is typically between 3 to 4 metres for small crane trucks and between 5 to 8 meters for larger crane trucks, with pad dimensions of approximately 0.5m x 0.5m. Sites that require plant removal using a crane must have safe, level ground for outrigger deployment, and sufficient clearance to operate the crane safely.

The largest crane trucks currently in use across SEW sites **(Figure 5, Figure 6 and Figure 7)** are rigid-body trucks approximately 10m in length and 3m in width, which extend to 7.5m when outriggers are extended, fitted with mid or rear-mounted loader cranes. These vehicles are primarily used to remove submersible pumps or other mechanical assets from wet wells or chambers.

Key vehicle / access envelope parameters for the small and large crane trucks currently used under the SEW maintenance contract are summarised in **Table 4** with indicative lift versus reach capacities in **Table 5.**

South East Water

Table 4 - Small and Large Crane Trucks - Vehicle / Access Envelope

Parameter	Small Crane Truck[2]	Large Crane Truck[2]
Overall truck dimensions (Length x Width x Height)	$\leq 8.8m \times 2.9m \times 2.9m$	$\leq 12.5m \times 2.8m \times 4m$
Width with outriggers	$\leq 3.8m$	$\leq 8m$
Control layout	Fixed levers (passenger side) or basic radio remote	Radio remote + left hand manual levers
Rope length	$\sim 7m$	$\sim 34m$
Gross Vehicle Mass (GVM)	$\leq 8\ t$	$\leq 24\ t$
Minimum turning radius	$15m$	$20m$

Table 5 - Small and Large Crane Trucks - Indicative Lift Capacity Versus Reach

Crane's Horizontal Reach Radius	Small Crane Truck	Large Crane Truck
~2m	2t	6t
~5m	0.4t	2t
~10m	Nil	1t
~20m	Nil	0.8t

[2] Overall truck dimensions indicate worst case combination of width and length amongst vehicles of each type. Additional clearance required for door opening and access etc. Refer AS1657 for additional clearance requirements.

Operators require clear, unobstructed access to both the crane controls and tool cabinets, which are located on both sides of the truck.

When positioning a crane truck:

- Ensure the truck is on flat, stable ground suitable for outrigger deployment.
- Park adjacent to hatches, pits, or equipment requiring lifting, ideally with the boom positioned above or directly beside the asset to reduce required reach.
- Avoid blocking routine site access, pedestrian paths, or critical infrastructure.
- Maintain enough clearance behind the vehicle for boom operation and safe landing of lifted items.
- Prevent overreach by ensuring the truck can park close to the lift point, as lifting capacity reduces significantly with boom extension **(Figure 4 and Figure 8).**

2.1.1 Small Crane Truck

Figure 1 - Small crane truck - light-duty unit - side view

Figure 2 - Small crane truck - light-duty unit - front view

Figure 3 - Small crane truck - light-duty unit - rear view

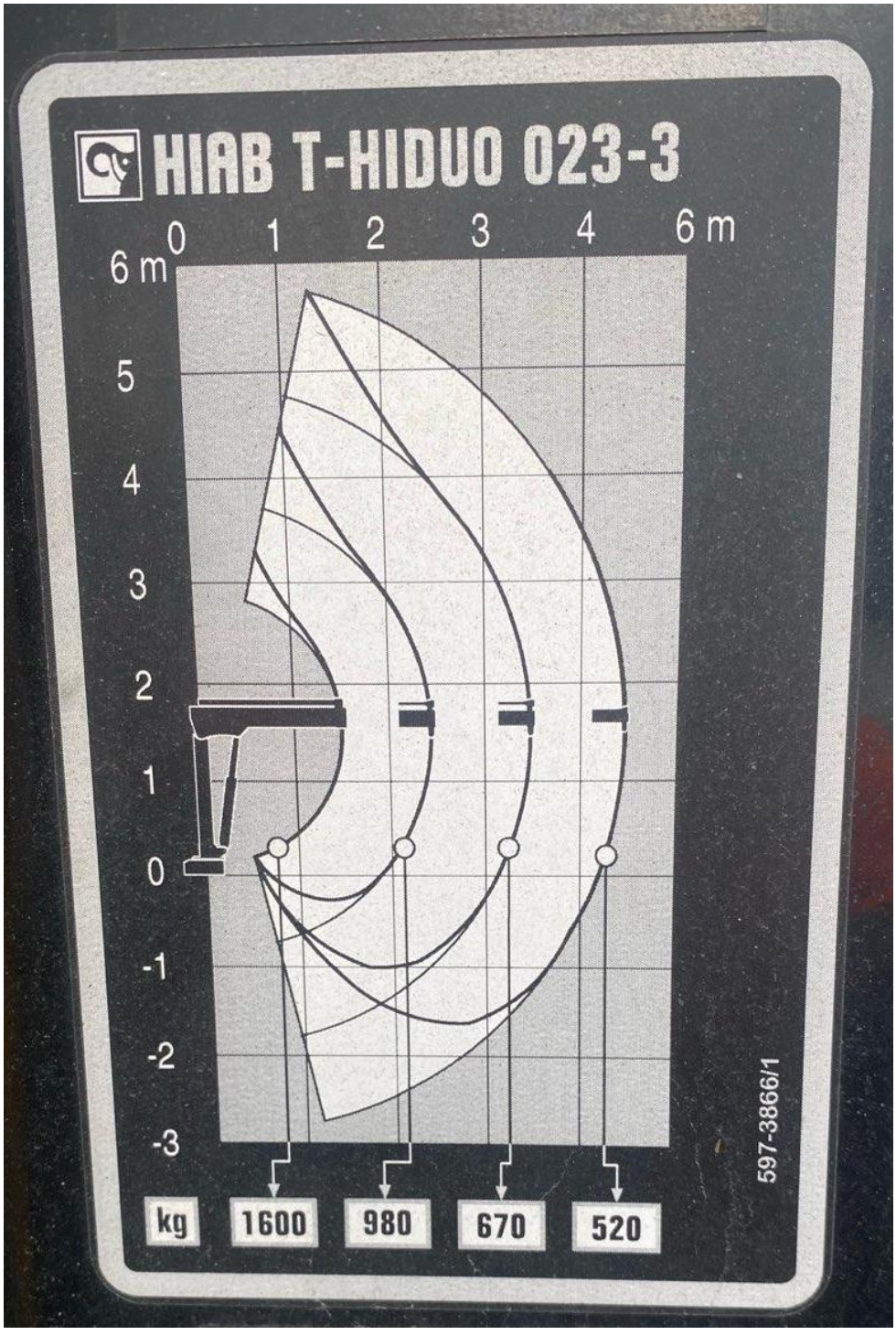

Figure 4 - Small crane truck - lifting capacity versus reach

2.1.2 Large Crane Truck

Figure 5 - Large crane truck - heavy-duty unit - side view

Figure 6 - Large crane truck - heavy-duty unit - side view during lift

Figure 7 - Large crane truck - heavy-duty unit - rear view

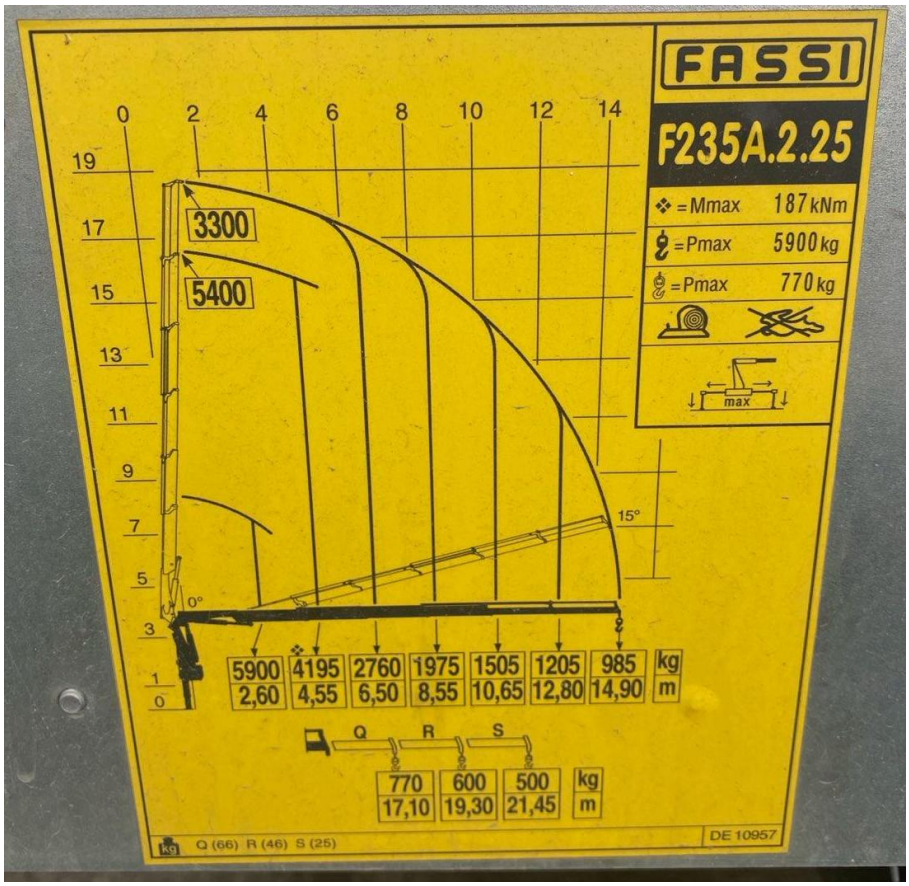

Figure 8 - Large crane truck - lifting capacity versus reach

2.2 Tanker Trucks

Tanker trucks, also known as eductors, eduction trucks, or vacuum trucks, are used to remove and store sewage, wastewater or recycled water **(Figure 12)**. Heavy vacuum trucks are used for hydro excavation as well as vacuuming sludge. Jetting trucks may be deployed for high-pressure cleaning of sewer infrastructure. Combination trucks (sometimes known as combo or combi trucks) are multitasking units with a jet hose for sewer cleaning and a vacuum hose for eduction **(Figure 9, Figure 10 and Figure 11)**.

These vehicles are deployed to facilities when built assets are unable to transfer flows due to failure, maintenance, or upgrade activities. They may be required to:

- Respond to emergency failures or breakdowns
- Empty or refill a storage vessel for cleaning or servicing
- Bypass an asset during a planned outage

As these vehicles convey liquid via large hoses, they must be parked close to the asset to minimise hose length and optimise suction or jetting performance. This is particularly critical for eduction trucks, which require short hose runs for efficient pumping.

The number and size of tanker trucks required to by-pass an asset is a function of[3]:

- The volume flow rate required to service SEW's network at that particular time
- The time required to fill the tanker, including site access and set-up of hoses
- The traffic conditions along the route between the pick-up and drop-off points. (Including the time to get into and out of SEW's site.)
- The time required to empty the tanker
- The size of the tankers available at the time

SEW will engage a small tanker(s) for a site that only has a small volume requirement, i.e. the layout of small sites need NOT cater for large tankers.

[3] A complete description of eduction truck logistics is in AM2973 SEW Sewer Scour Standard

Figure 9 - Combination truck - driver side

Figure 10 - Combination truck - passenger side

Figure 11 - Combination truck operating on site with safety barricades

Figure 12 - Eduction trucks, on site set-up example with safety barricades

2.3 Trailer-Mounted Equipment

Some assets such as back-up generators, small fuel delivery tanks, small chemical delivery tanks (**Figure 13**), etc. are trailer mounted. These trailers are towed to the site by a rigid truck, given trailers that don't feature lifting lugs or crane-compatible frames, they cannot be expected to be craned into place.

Generator trailers are positioned close to the equipment they support and parked so the towing vehicle can leave it securely on site. The site plan must include a clear, all-weather space (e.g. crushed rock or concrete pad) around trailer-mounted equipment to support its safe operation.

Table 6 - Trailer Mounted Equipment (Generator Related) Access Envelope

Trailer Type	Length (m)	Width (m)	Height (m)	Weight (kg)	Notes
250 kVA Generator Trailer	7.5	2.7	3.1	8000	No dedicated lift points; must be towable and parked securely on a level surface
100 kVA Generator Trailer	4.6	2.2	2.6	3500	
Fuel Trailer	3.9	2.1	1.6	2000	

2.4 Tray Trucks

Temporary plants, such as rented emergency generators can also be delivered via tray or tilt-tray trucks. These are often rigid trucks of similar dimensions to crane trucks. The equipment is usually landed immediately behind the vehicle and requires:

- An all-weather landing surface
- Clear access to the associated on-site equipment, e.g. generator connection point on the switchboard
- Space that does not obstruct regular movement around the site

These deliveries are often at short notice and are critical during outages, so appropriate turning circles, landing space, and unobstructed reversing paths are essential.

2.5 Chemical Delivery Vehicles

For sites using bulk chemical dosing (e.g. ferrous chloride, sodium hypochlorite, etc.), deliveries are conducted by external suppliers using tankers suited to the storage tank size. Two indicative vehicle types are shown in **Table 7**:

Table 7 - Chemical Delivery Vehicles Access Envelope

Vehicle Type	Example	Dimensions (LxW)	Tare Weight	Payload	Typical Use
Rigid Chemical Tanker	Kenworth T350	8.8m x 2.5m	10.14 t	12 t (~9,000 L)	Sites with smaller chemical storage
Chemical Tanker	Omni Tanker	19m x 2.5m	-	25 t (~18,500 L)	High-volume deliveries to large tanks

These vehicles require sufficient turning radius and flat parking close to tank fill points. Higher mass limits may apply depending on the vehicle route and load approvals. Where nutrient dosing is performed, tanks are currently filled manually onsite.

A small tank in a trailer with a built-in bund is used for top-up chlorination deliveries. Figure 13 shows this trailer open in use with doors, noting provision should be made for the trailer to be carried by a van or small truck as per **Figure 14**.

Figure 13 - Hypo delivery trailer in use

Figure 14 - Hypo delivery trailer towed by a van

3. Maintenance Information

3.1 Facility Set Out for Crane Truck Operation

SEW's first preference is to use truck mounted loader cranes to lift plant given that they are part of the maintenance fleet. Mobile cranes are hired, and as such they will only be considered after it has been demonstrated that a loader crane truck or permanent on-site crane is unsuitable.

SEW records the weight of each maintainable rotable, e.g. pump, mixer, etc. The maintenance crew adds a weight margin to any rotable that has been in raw sewage to provide for ancillaries such as the lifting chain and for any sewage debris that may be entangled inside the pump or wrapped around the outside.

As the lifting capacity of any crane depends on the reach of the crane's boom to the item, the site layout shall allow the truck to be positioned close to the item being lifted, such that:

- Neither the truck's wheels nor its outriggers rest on the cover slab of an underground structure
- Above ground structures such as a switchboard, light pole, vent stack, generator, tree, etc. don't obstruct the movement of the item being lifted between its normal position, any position where it is intended to be landed for maintenance activities, and the truck's tray
- It is preferred the site layout ensures the crane operator isn't required to operate the crane from directly underneath the load. It is preferred that the crane position doesn't impede the crane operator's line of sight of the item or the dogger/worker guiding the lift i.e. as occurs when the load is on the opposite side of the vehicle to the crane's controls. This is described in WorkSafe Australia's "General Guide For Cranes"

The most preferred set-up location for a crane truck, from most to least preferred, is:

a) On a vehicle road (i.e. off a cover slab) behind a permanent barrier, such as bollards, etc.

b) Just off a vehicle road after removable lockable bollards (that usually protect a cover slab), have been set aside by the maintenance crew

c) On a cover slab designed to suit the crane lift.

The load capacity table in **Figure 4 and Figure 8** is used to determine acceptable loader crane truck positions, noting that this load may be to the side or to the back of the loader truck. Section 3.4 describes the requirements associated with overhead electrical power lines.

By example **Figure 1515** shows a maintenance truck with a small loader crane attending to a mechanical issue at a pump station, e.g. a pump blockage, etc. The truck has a hoist on the back to lift a pump out of the wet well and has tool cabinets on both sides with doors hinged to swing upward. The ability to position the loader crane truck close to the item being lifted is essential. Both the wet well and electrical cabinet are open when a pump is lifted, so the facility layout requires sufficient space around these assets for the crew to move around safely. **Figure 16** shows two other smaller vehicles in attendance. Whilst this particular site provides space for these vehicles next to the loader crane truck, it is permissible for these vehicles to park on the street provided it is safe to do so.

Figure 1515 - Facility set out during pump removal works

Figure 16 - Facility set out during mechanical and electrical pump maintenance

3.2 Facility Set Out for Cleaning Operation

The example in **Figure 1717** shows a cleaning crew removing raw sewage from a pump station before they wash it down. The ability to position the eduction tanker truck close to the asset being emptied is essential, similar to crane trucks as described in Section 3.1.

After this has occurred the truck with the pressure washer needs to get close to the asset being cleaned. At this site it is possible to locate both the tanker truck and the jetting truck next to the wet well, but at other sites the tanker truck may need to move away so the jetting truck can get closer. The third truck holds supplies and other equipment.

Figure 1717 - Facility set out during wet well cleaning

3.3 Protecting the Public (Pedestrians & Traffic)

On occasion, inquisitive members of the public attempt to get close to works and in so doing put themselves, and therefore the crew, at risk. When a site has a perimeter fence to keep it secure the fence will also serve to keep the distance between the jobsite and the public.

As the site shown in **Figure 1515**Figure 1515 and **Figure 1717** is unfenced, the crew has set up barriers and signage to keep the public out of the path of danger.

Traffic management should not be required for normal maintenance activities. Traffic management can be complicated to organise and expensive to undertake, therefore is the least preferred alternative.

Where the work area overlaps a public thoroughfare, the site design needs to consider where the public will be safely redirected during work. If the public thoroughfare is expected to be busy and its foot and bicycle traffic cannot be readily redirected, this issue may render the location unsuitable for a SEW facility.

3.4 No Go Zones for Overhead Power Lines

Sites are to be designed so there are no restrictions with overhead power lines.

Where this cannot be achieved refer to Workcover Victoria and Energy Safe Victoria publications regarding “No Go Zones for Overhead Electrical Power Lines” available at the following link:

http://www.esv.vic.gov.au/technical-information/electrical-installations-and-infrastructure/no-go-zones/

For machinery operators and others working near powerlines, the safety requirements are:

Powerlines on poles:

- Do not work within 3 meters of overhead powerlines.
- Use a spotter when working between 3 metres and 6.4 metres from powerlines

Powerlines on towers:

- Do not work within 8 metres of powerline towers.
- Use a spotter when working between 8 metres and 10 metres from powerline towers

These rules form part of the “No Go Zone” safety approach, which sets minimum distances and controls to prevent contact with live overhead powerlines. Permission from the relevant network operator is required for work inside the 3-metre (poles) or 8-metre (towers) zones, and additional protective measures must be implemented.

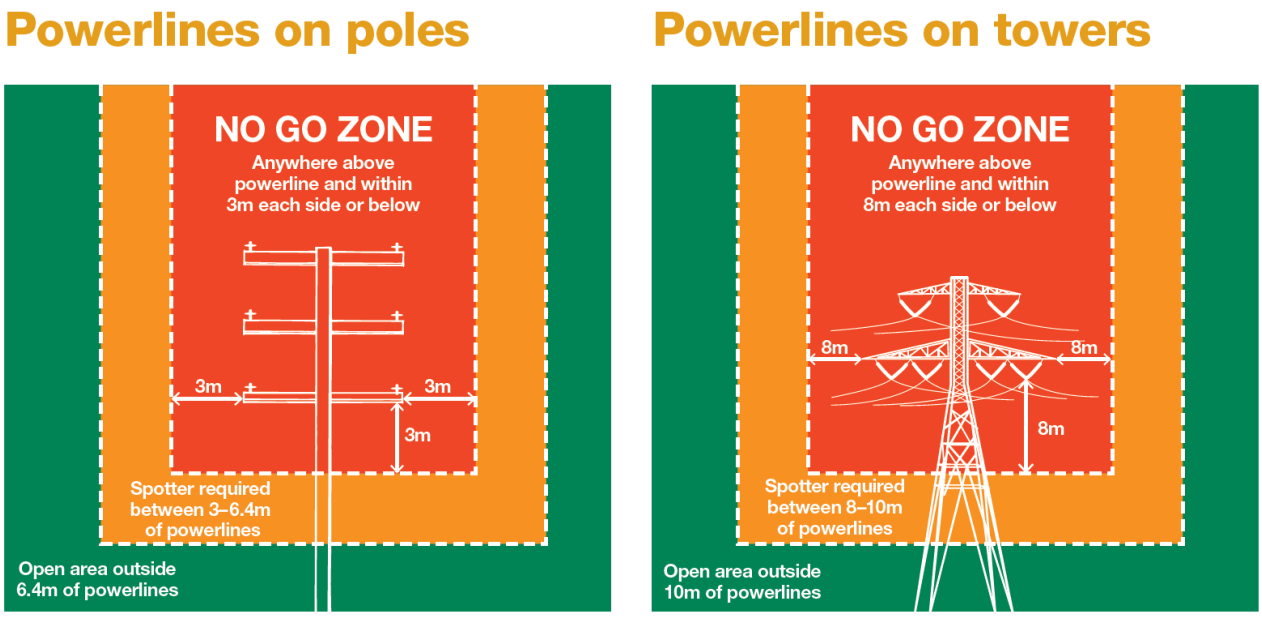

Figure 18 - Powerline No Go Zones (source: Energy Safe Victoria)

4. Design Requirements

4.1 Establish the Facility's Vehicle Access Requirements

Determine:

- What type and size of vehicles are required to support the various items of plant on site (refer **Table 8**)
- How those vehicles will be used, how the crews will set up the site and the space and clearances they will need (refer Section 30)
- The distance each vehicle type will need to park from the plant/ services and conversely where a vehicle should not go for load bearing, environmental, etc. reasons
- The areas in the facility where workers will typically work and the maximum likely number of workers that will work there concurrently. This will indicate the location and extent of the required vehicle parking area(s)

Areas that require vehicle access typically contain:

- Plant and equipment, workshops, offices, amenities such as meal rooms / toilets. Workers congregate in these areas and parking facilities are required for them
- Structures or equipment that will be installed or removed by a crane truck (e.g. pumps, permanent generators)
- Sewage that will need to be educted (removed by vacuum into a tanker truck)
- Structures or equipment that may need cleaning/unblocking using a "combination" or jet truck
- Water tanker connection points
- Structures that contain combustible materials may require fire truck access

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Table 8 - Facility Vehicle Requirements

Facility Type	Typical Vehicles Required	Vehicle Type & Configuration	Maximum Rear Axle Load (kg per wheel)	Maximum Truck Envelope (W x L, (m))	Typical Support Vehicles
***Small Sewage Pump Station** (Indicative flow rate < 40 L/s) **Water Pump Station** **Pressure Reducing Station**	- Small eductor or combination truck - Crane truck to lift plant - Service Vehicle with Trailer or Flatbed truck for generator	Rigid truck GVM up to 24,000kg	24,000 /4 = 6,000 kg	2.9 x 8.8	3
***Large Sewage Pump Station** Refer **AM2961** & **WSA04-2022** **Treatment Plants**	- Crane truck - Large JetVac or Eduction truck - Service Vehicle with Trailer or Flatbed truck for generator - Semi-trailer for by-pass or equipment delivery	Rigid or Semi-trailer GVM up to 32,000kg Towed trailers (no lift points)	32,000 / 4 = 8,000 kg	2.8 x 12.5 (truck & trailer = 2.5 x 19)	4 for sewage pump stations >10 for treatment plants
Water Reservoirs & Water Tanks **Metered Fill Points**	- Crane truck or mobile crane - Water tanker for fill station replenishment	Rigid truck GVM up to 32,000kg	32,000 / 4 = 8,000 kg	2.8 x 12.5	3
Sites with Chemical Dosing e.g. Water quality,Sewage odour control, treatment processes	- Crane truck - Rigid chemical tanker - Articulated chemical tanker for large tanks	Rigid and Semi Tanker GVM up to 46,000kg	46,000kg / 4 = 11,500 kg	2.5 x 19	3

Table 8 Notes:

- Turning Circle is diameter wall-to-wall (m) as per AP-G34-23 Austroads Design Vehicles and Turning Path Templates.
- W = Width is chassis width (m) including vehicle's side mirrors.
- L = Length is full length including chassis overhang (m).
- GVM is maximum loaded weight of the vehicle (excluding trailer).
- Wheel loading needs to be considered during pavement design.
- Quoted number of support vehicles are utility vehicles in addition to any trucks.
- A minimum height of 4m shall be allowed for all vehicles.
- *Flow rate indicated is a guide. Other factors may apply when selecting vehicle required such as how close vehicles may park near the asset and associated boom length. Bespoke conditions may also apply.

4.2 Develop a Vehicle Movement Plan (VMP)

Produce a VMP that shows:

- Preferred pavement widths as outlined in **Section 4.5**
- The location of all existing or proposed:
  - above ground structures
  - trees including the extent of their canopy
  - plant and equipment
  - no go areas which have above ground hazards (e.g. suspended cables)
  - refer to Section 3.4 regarding Energy Safe Victoria's publication "No Go Zones for Overhead Electrical Power Lines"
  - below ground non trafficable structures
- The location of items that require crane truck access, the expected weight of these items plus the minimum and maximum distance the crane truck can be located from these items
- The location of parking areas which provide safe worker access to tools for the assets where work will more commonly occur.
- The Swept Path Envelope (vehicle's movement path outline) which:
  - Connects the external access road to internal paths within the facility
  - are of a width and radius of curvature appropriate to the largest vehicle that will access the relevant area of the facility
  - provide adequate proximity of the vehicle and/or trailer to the item it is accessing.
  - provide adequate visibility of all or the most likely pedestrian, worker or vehicle locations, considering trees and structures that may obstruct lines of sight
  - provide practical and safe entry and exit to/from each area requiring vehicle access in accordance with the preferences in **Table 9**
  - If required by operations & maintenance activities enables vehicles to overtake each other along any of the main access routes of the facility
  - enables a safe and effective set up of all required vehicles to facilitate maintenance. Examples of facility maintenance set up are provided in Section 3.1
  - avoids No Go Zones where practical. Should the available land be limited, underground structure cover slabs may need to be designed to allow for vehicles to drive over them
  - avoids vertical constraints such as overhanging trees, noting vehicles to a height of 4m shall be allowed for
- The extent (area) and boundary of the trafficable area(s) required to support the proposed vehicle movements path(s) and parking areas.
- Consider using AS 2890.2 Parking facilities - Off-street commercial vehicle facilities when determining site access and parking requirements.

Example VMPs are shown in Appendix A: Example Vehicle Movement Plans

Table 9 - Vehicle Swept Path Preferences

Preference	Description	Comments
1	One way travel with single entrance / exit (e.g.: via turning circle, parking bay)	One way travel reduces reversing and therefore risk of collision. One way travel preferred for larger vehicles.
2	One way travel via separate entry and exit points	Requires two gates and connections to access roads. One way travel preferred for larger vehicles.
3	3-point turn within the site	Requires drivers to reverse which increases collision risk
4	Perpendicular parking	Only feasible if it's safe enough that it doesn't, and won't, require a spotter or traffic management throughout asset's life (Evidence to be provided)

The VMP / trafficable area plan should be established concurrently with the layout design of structures, plant, and equipment at the facility.

This will ensure that the overall best solution for trafficable areas, plant and equipment, structures and landscaping is obtained in consideration of all the requirements for the facility.

4.3 Vehicle Access into and out of the Facility

The optimum point of access to and from the facility should be determined in consideration of the following.

Internal facility considerations:

- VMP options under consideration.
- The locations of trees and structures within the facility might render an access point impractical.
- The ability of a worker to safely exit a vehicle parked outside of the facility's fenced area and open or close any facility gate

Existing external road considerations:

- The ability of vehicles to safely enter and exit the facility, with all possible vehicles or pedestrians having full visibility of each other in all weather and lighting conditions. This will need to consider:
  - bends, dips or rises in the road
  - obstructions such as trees, poles, fences, buildings etc.
  - direction from which the sun will likely rise and set
  - angle of incidence of the facility's access road and the public road.
- The ability to enter the facility from any direction (or as many as possible north, south, east or west) and any obstructions or visibility problems or double lines.
- On high-speed roads, when turning left into the facility, whether the road owner may require an egress lane (slip lane) to be constructed adjacent to their road.
- Existing traffic levels.
- Existing speed limit.
- Continuous single or double white lines on the external access road at the turnoff to the facility.
- The near proximity of a round-about 180-degree turn which might enable safe vehicle entry to the facility from the other direction.
- Possible modifications that could be made to the external access road to enable safer access into or out of SEW's facility (e.g. road signage, road markings).

Future external road considerations:

This is particularly relevant where facilities will be initially constructed in areas which are not yet developed or are only partially developed.

- Proposed future intersections which may affect safe access to the facility.
- Proposed toad widening, median strip creation etc.
- Expected future traffic levels.
- Future maximum speed limit and any turning restrictions based on each road design stage.

Intersections of SEW facility access points with VicRoads roads shall be designed and constructed in accordance with VicRoads requirements by VicRoads approved consultants and contractors. Intersections of SEW facility access points with council roads shall be designed and constructed in accordance with council requirements.

Access barriers at the entrance to the facility shall be designed in accordance with the security requirements for the site (refer AM2759 Facility Resilience and Security Technical Standard upon request from South East Water).

4.4 Driveway Alignment

Where significant lengths of new access road (track or driveway) (i.e. > 50m) are required to reach a facility, the optimum alignment of the road shall be selected to:

- Provide optimum integration with the VMP and overall facility design.
- Minimise road length.
- Avoid road construction on steep slopes (especially > 60%) utilising full-bench construction where slopes over 60% cannot be avoided, with cut and fill roads on slopes flatter than 1 in 1.
- Minimise drainage issues and costs.
- Minimise cuts, fills and vegetation clearing.
- Stay away from streams, wetlands or gullies where possible.
- Take into consideration the properties of native soils available with each alignment.
- Consider the locations of trees and structures within the facility, which might affect visibility and therefore safety along the road. Trees and other vegetation may need to be removed to improve pedestrian and driver visibility. Alternatively, speed limits may need to be reduced.
- Maximise horizontal curve radius, noting the minimum preferred horizontal curve radius is 150m for any internal access road.
- Optimise vertical alignment grade, noting the maximum preferred grade is 10% and absolute maximum grade is 20%.
- Lengths of unsealed roads of different grades shall be limited as per Table 2 of NSW Government Office of Environment's 2012 publication, erosion and sediment control on unsealed roads. This limit shall also depend on the soil's erodibility as described in the subsequent table.
- Optimise slope (of the land at the driveway), noting maximum preferred land slope is 1 (rise) / 3 (run) where driveways are located.

This section is not relevant to pavement around facility assets (i.e. driveways only)

4.5 Driveway and Parking Area Pavement Type Selection

Less frequently accessed facilities (e.g. pump stations, pressure reducing stations, odour control stations etc.) shall be provided with an unsealed single lane access road, unsealed parking area(s) and open drainage. Roads shall be designed and constructed as per the:

- Department of Transport and Planning (DTP) Supplement to Austroads Guide to Road Design (AGRD) Part 3: Geometric Design (2021) - Figure V4.6: AADT 1-50, with 3m pavement with 2 x 1.5m shoulders.

Where space is limited, road shoulders may be narrowed to 1m, and SEW may consider having a road shoulder on one side only.

More frequently accessed facilities shall be provided with the vehicle access described in

Table 10.

Table 10 - Non-standard Access and Pavement Requirements

Regularity of access	Road Type Preferred	Relevant Standard
Facilities occupied regularly **(i.e. > once a month) and road length is not excessive (<50m))**	Sealed single lane access road, unsealed parking area(s) and open drainage	DTP Supplement to Austroads' "Guide to Road Design" (AGRD) Part 3: Geometric Design (2021) - Figure V4.6: AADT 51-150 (4m pavement with 2 x 1.5m shoulders)
Facilities mostly occupied during working hours **(e.g. larger treatment plants) and road length is not excessive (<50m))**	Sealed two lane access road(s). Concrete kerb, concrete footpaths, sealed parking area(s) and underground drainage required around active work areas	DTP Supplement to Austroads' "Guide to Road Design" (AGRD) Part 3: Geometric Design (2021) – Figure V4.6: AADT 151-1500 (6.2m pavement with 2 x 1.5m shoulders). Kerb, footpaths and vehicle crossings to Victorian Planning Authority (VPA) standards

Table 10 Notes:

- All trafficable surfaces shall have a cross-fall grade of 3 to 8 % (normal is 3.5%).
- All unsealed road shoulders shall have a cross-fall grade of 3 to 12% (normal is 5%).

Where decisions about the alignment, number of lanes and type of pavement are not straight forward, viable options shall be considered in consultation with South East Water.

Pavement type selection shall be based on:

- The pavement area requirements identified in the VMP
- The required design life of the pavement
- Cost of construction
- Cost of maintenance (higher for unsealed roads)
- Degree of traffic expected
- Collision risk of each access option (based on pavement width and ease of visibility)
- The minimum preferred sight distance is 100m (of oncoming traffic / pedestrians) for any internal access road.
- The amount of pavement below the 1 in 100-year flood level.
- All pavements shall be above the 1 in 5-year flood level, with a clearance of at least 0.5m between the flood level and the pavement's surface at its lowest point.
- Native soils available along the alignment.
- Criticality of the facility
- The potential risk of loss of access to the facility

4.6 Pavement Detailed Design

This section is relevant to driveways, parking areas and pavement adjacent to facility assets.

One of the pavements in

Table 11 should be selected for each distinct trafficable area. The designer shall refrain from swapping between one type of pavement and another more than once or twice.

Table 11 - Pavement Specifications

Road Type	Surface Course (40mm thick)	Base Course	Sub-base Course	Subgrade (foundation)
Unsealed pavement (gravel surface)	As per Austroads Guide to Pavement Technology Part 6: Unsealed Pavements Table 3.5, noting at least 80% gravels 0.075 to 20mm in size. No surface course required if Class 4 base.	> 150mm thick graded high-density material free of voids, with low fines (i.e. < 10% particles < 0.075mm) and a reasonable fraction (i.e. >20%) of angular large particles (20 to 70mm), **or** > 100mm of 20mm Class 4 crushed rock		All top soil, vegetation and tree roots shall be removed prior to construction of pavement. Found roads on native soils with adequate strength and low plasticity. Thicker base courses shall be provided over a subgrade which is of low strength and/or high plasticity (e.g. silty sands and clays).
Spray Seal surfaced sealed pavement	2 layers of Class 170 bitumen & aggregate	> 100mm thick 20mm Class 2 crushed rock	> 100mm thick 20mm Class 4 crushed rock or crushed concrete	
Asphalt Bitumen surfaced sealed pavement **(only for the treatment plants with regular traffic)**	2 layers of Class 320 bitumen asphalt	> 100mm thick 20mm Class 2 crushed rock	> 100mm thick 20mm Class 3 crushed rock, & > 100mm thick 20mm Class 4 crushed rock or crushed concrete	

4.7 Unsealed Pavement Native Soil Assessment

Where pavement areas are to be small, specialist geotechnical advice may not be warranted, and pavement soils may be selected where they clearly meet the base course / surface course specification.

Where native soils are proposed to be used in any significant way (i.e. > 100m2 of pavement) to form the sub-base or surface course of unsealed trafficable areas, road specialist geotechnical advice should be obtained to determine the following characteristics of the native soil(s) at the facility:

- the strength (load bearing capacity) at different moisture contents
- the plasticity (change of shape with load) at different moisture contents
- the suitability of the material for use as a subgrade (foundation)
- the erodibility and suitability of the material for use as a sub-base course
- the erodibility and suitability of the material for use as a surface course

Only base course soils with suitable strength, durability and plasticity (at all likely moisture contents) to support the vehicles likely to attend the facility (refer section 3) shall be used in pavement construction.

4.8 Drainage Design for Paved Area

Future land surface level shall be indicated on design plans which clearly show how surface waters will drain away from paved areas. Access covers and electrical switchboards shall be located at high points, so surface water drains away from these areas. Surfaces shall be profiled to ensure that work areas and paved areas do not pond or pool. This is usually achieved by draining surface waters across surfaces of a suitable grade, rather than by installing closed or open drainage systems.

Drainage of paved areas shall be designed in consideration of the following:

- Keep the road base and sub-base as dry as practical. Drainage shall be designed to maintain the water level below the sub-base.
- Open and closed channel drainage systems shall be designed to 1 in 100-year Average Recurrence Interval rain events.
- Kerb and closed drainage systems (typically required in conjunction with sealed asphalt roads) shall be designed and constructed to Victorian Planning Authority (VPA) standards with semi-mountable kerbs.
- Open drainage (spoon drains / table drains / culverts) shall be designed and constructed in accordance with Austroads Guide Part 5B: Drainage - Opens Channels, Culverts and Floodways and the NSW Government Office of Environment's 2012 publication, Erosion and Sediment Control on Unsealed Roads.
- Open drains shall not be constructed of highly erodible soils such as dispersive clays (which "dissolve" in water) or silty sand. Where such native soils are present, open drains shall be lined to a depth of 100mm with the materials described for unsealed road base course in
- **Table** 11

- All open channels > 1 in 10 grade in native soils and any drops into structures shall be stabilised with rock beaching, cement, sandbag or concrete stabilised surfaces.
- Unsealed roads shall slope with the fall of the land (out-slope) where practical.
- Install unsealed road with rolling dips on out-slope roads whenever practical. Dips should be spaced at 30-150m separation. At the lowest section of dips, rock beaching shall be installed between the road shoulder and the road drain to prevent erosion of the shoulder.
- Where out-sloped unsealed areas are not practical, install catch drains on the inside drainage system and culverts to cross the pavement.
- Line the collection and discharge points of the culvert with rock beaching to prevent erosion at the culvert ends. Construct as per VicRoads standard SD 1700 and SD 1811.

4.9 Contaminated Storm Water Discharge

Designers should consider which areas of the facility and pavement should drain to the stormwater system and which areas should drain to the sewerage system.

Typically, water contaminated with sewage or biosolids (e.g. washdown areas and biosolids truck standing areas) shall be provided with separated drainage catchments which shall then normally drain to the sewerage system. All pavements which may drain to the sewerage system shall be sealed and all drains in such areas shall be buried.

Collection points for this water shall have the option of being configured to discharge to the stormwater or sewerage system via the operation of a single Knife gate valve which is safely operable from surface. Where this drainage water cannot practically gravitate to the sewerage system, a pump station compliant with SEW Sewage Pump Station standards shall be constructed to transfer this water the sewerage system.

4.10 Anytime Facility Access

SEW requires access to its facilities at all times and external entrances to facilities shall always be kept clear. Parking restrictions may need to be applied to external roads as indicated in **Figure 19**. Note that the No Standing area corresponds to the amount of space required to undertake maintenance activities (refer to **Sections 3.1** and **3.2**).

Figure 19 - Example of No Standing Area and associated signage

4.11 Protecting Assets from Vehicular Damage

The designer shall identify areas of the facility where vehicles must not enter (No Go areas). This may be due to the presence of one of the following in or near to a trafficable area:

- Above ground cables.
- Below ground structures that cannot support vehicle weight.
- Smaller less visible or collision susceptible structures, plant or equipment.

Threats to such structures may come from one of the following sources:

- SEW authorised vehicles.
- Neighbouring land owners, such as councils, who may use ride-on mowers and other maintenance equipment to maintain their land immediately adjacent to the SEW facility.
- Members of the public who may either intentionally or unintentionally drive a vehicle at a facility. This is more likely in unfenced facilities which are open to the public.

Protection may take the form of:

- Locating less vulnerable items such as fences and kerbs between trafficable areas and vulnerable assets. Note that non mountable kerbs may prevent vehicle access, but they can also affect the movement of surface water and can present a trip hazard.
- Installing dedicated traffic barriers such as bollards and guard-railing (e.g.Armco) between trafficable areas and vulnerable assets. Barriers have the advantage of also stopping vehicles from parking on structures and they can (if designed well) protect operations and maintenance personnel from an open hole when working at the site. Barriers can look unsightly in publicly visible facilities and care shall be taken to ensure they do not hinder the movement of people around assets that require access.
- Locating traffic vulnerable structures such as buildings, poles and electrical cubicles distant to trafficable areas.
- Ensuring that underground structures in trafficable areas are strong enough to support trafficable loads (refer AM2757_Specification for Covers for Underground Chambers).. Limited land availability sometimes means that the only way to get to the further asset is to drive over an underground structure. Barriers may not be suitable in such instances.
- A facility perimeter fence. This control may be visually obtrusive, restrict movement and hinder other party's from accessing their land. Council approval may also be required and not forthcoming.

Bollards and barriers shall:

- Be selected, designed, constructed and installed as per AS/NZS 3845.
- Be located in such a way that they do not cause a significant traffic hazard. Bollards are only for low-speed areas. Barriers are required for high-speed areas.
- Where bollards or barriers would present an unacceptable traffic hazard, consider locating at risk assets underground in a chamber covered by trafficable covers.
- It is preferred that bollards are direct buried and concreted into the surface where practical and where the bollard is to be located in native soil or crushed rock.
- Bollards fixed to concrete slabs are not preferred because the concrete slab is damaged when the bollard is hit. Where this cannot practically be avoided, bollards in concrete slabs shall be readily replaceable.
- Not interfere with the operation of the asset (i.e. opening of doors or covers or regular O&M activities).
- Locate bollards far enough away from assets being protected so that if the bollard is hit, it does not damage the asset it is protecting.
- Refrain from distancing bollards from plant which will require crane truck removal. Crane loads are reduced whenever the crane cannot be located close to the asset being lifted.
- Satisfy all conditions of the land owner where they will be located in reserves. Wooden or recycled plastic bollards may be specified by the land owner.
- Bollards in SEW owned land shall be constructed of galvanized or zinc coated mild steel or 304 stainless steel. Bollards shall be powder coated Canary Yellow to AS2700, colour Y11 where this would not have a negative visual impact on the local

environment. Polished 304 stainless steel construction or powder coated Eucalyptus Green to AS2700, colour G52 should be used where a brighter colour would have negative visual impact on the local environment.

- Installed in compliance with the manufacturer's installation instructions.
- Installed at 1.5m separation.
- Be > 1000mm high.

"Standard" bollards and barriers on SEW owned land shall:

- Prevent vehicle access to all sensitive assets from any likely direction of travel
- Be > 110mm outside diameter with > 5mm wall thickness, or

"Heavy duty" bollards and barriers on SEW owned land shall:

- Prevent vehicle access to all sensitive assets from all possible directions of travel.
- Be > 160mm outside diameter with > 5mm wall thickness, or
- Be > 140mm outside diameter with > 6mm wall thickness

Fences and gates shall be designed and installed to meet the requirements listed in SEW's AM2759 Facility Resilience and Security Technical Standard.

4.12 Road Signage, Markings and Devices

Once the pavement alignment and boundaries have been determined and the preferred location of all buildings, plant and equipment has been finalised, the designer shall prepare a Traffic Management Plan (TMP). The TMP shall be produced in consultation with the SEW Service Delivery Group and shall comply with the methodology and principles outlined in:

- the Victorian Road Management Act Code of Practice for Worksite Safety – Traffic Management.
- AS 1742.3 Manual of Uniform Traffic Control Devices (Part 3).

While this code of practice and Australian Standard has been produced with temporary works at public roads in mind, they still form a sound foundation on which to produce a TMP for a permanent facility.

The designer and contractor shall undertake the hazard management process described in the Victorian Road Management Act Code of Practice for Worksite Safety – Traffic Management, namely:

1) Determine Worksite Hazard Rating
2) Determine Required Level of Planning
3) Determine Hazards at the Worksite
4) Consider Hazard Control Measures that Could be Used – Hierarchy of Safety Controls
5) Determine the Hazard Control Measures to be Implemented
6) Prepare and Implement Traffic Management Plan
7) Review the Traffic Management Plan in Practice

The TMP shall identify, assess and control risks in consideration of the following:

<u>High and/or regularly active site locations</u>

- The areas of the facility where pedestrian / worker movement is more likely to occur on a regular basis. These areas, high activity areas, would normally be present where plant, equipment or facilities are located.

<u>Speed limits within different areas of a facility</u>.

- Speed limits within SEW facilities shall be indicated. Speed limits in high activity areas would normally be lower (i.e. 15 km/hr.), especially where blind spots may be present or workers / pedestrians will be working near roads.

Placement and specification of signs.

- Give way signs, stop signs, pedestrian crossing signs and speed signs etc shall be installed as required to control risks at intersections and at the entry and exit points of high activity areas.
- Signs shall comply with AS 1743 Road Sign Specifications and the VicRoads Supplement to AS 1743.

Placement and specification of road humps.

- Road humps shall be implemented at or prior to reductions in speed limits or to aid in imposing speed limits in high activity areas.
- Where road humps area required, they shall be Type 2 road humps as per AS2890.1 Parking Facilities and they shall be adopted at spacings between 10 and 50m.

Placement and specification of pedestrian crossings.

- Where high activity areas are located adjacent to each other on both sides of a road, consideration should be given to installing a signed and marked pedestrian crossing (i.e. "zebra crossing").

Placement and specification of barricades.

- Road barricades may be required to separate work areas from roads where they are close to each other.
- They shall comply with AS 1742.3.

Road markings.

- Road markings such as parking bay lines, centre lines, intersection lines and pedestrian crossings shall be used to help safely direct and separate vehicles and pedestrians.
- All road pavement markings shall comply with AS/NZS 4049.3 Paints and related materials, Road Marking Materials.

Requirements for visibility.

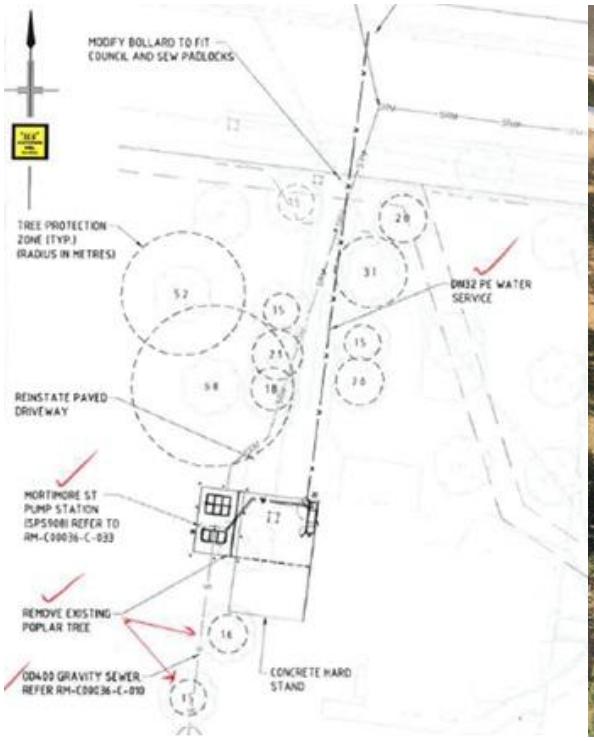
- As much as practical, sight distance shall be maximised.
- Blind corners (corners which have a reduced line of site to other vehicles or pedestrians) shall be avoided, visual obstructions minimised, and road radius optimised.

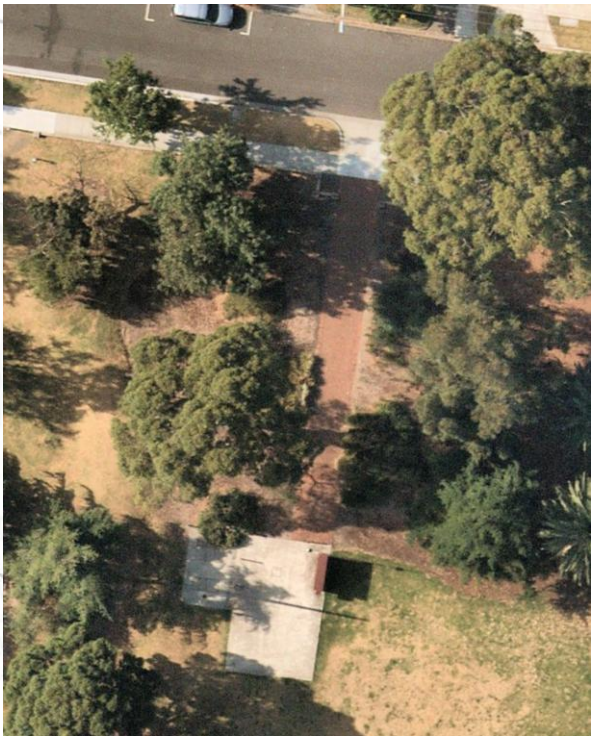
Management of blind corners.

- Where blind corners cannot be avoided, specific risk controls should be adopted which may include the placement of convex mirrors and reduced speed limits.
- Where buildings or plant and equipment exacerbate the risk of blind corners, the designer shall reconsider the location of these assets and/or size of land provided to reduce the traffic risk.

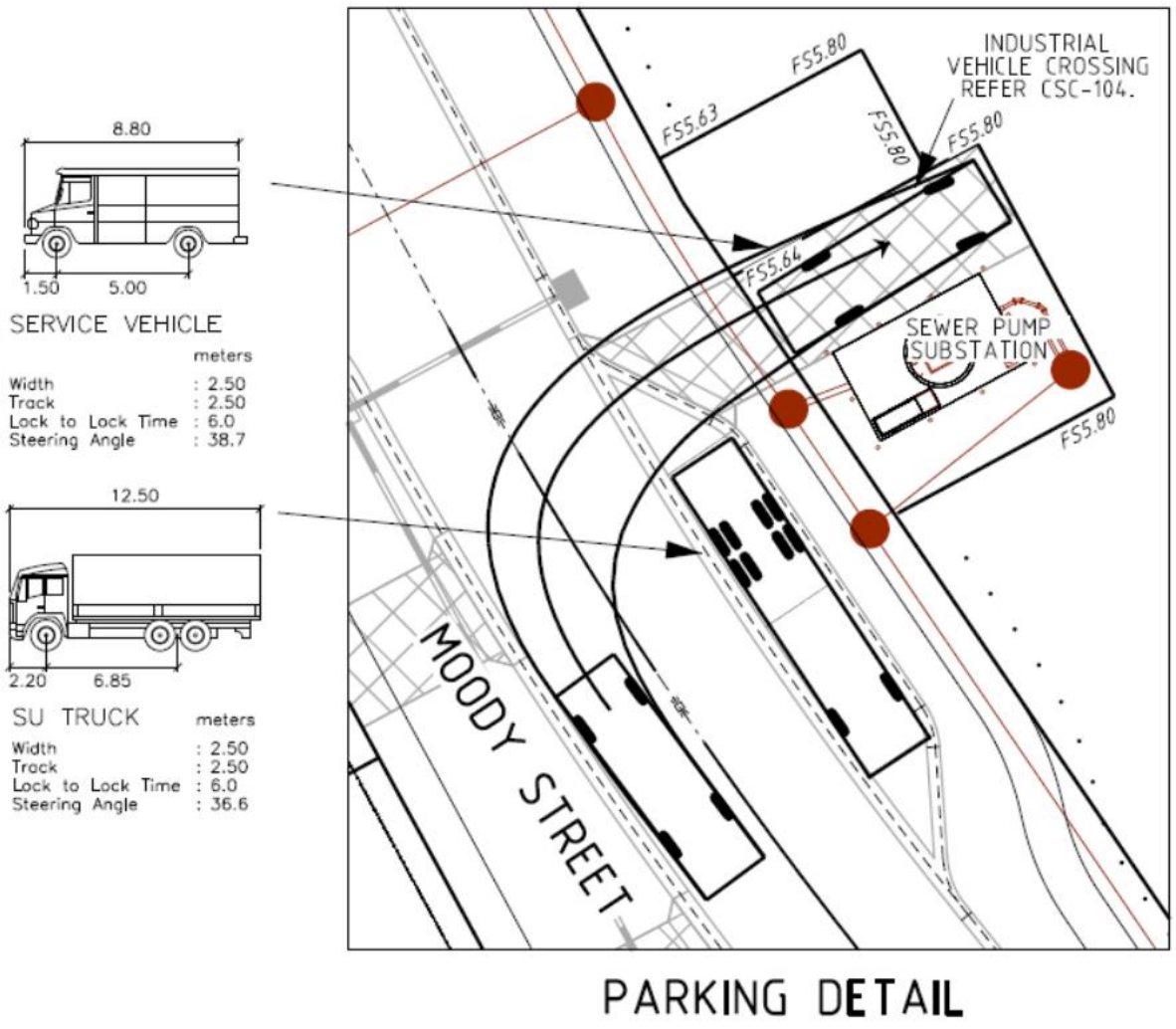
Appendix A: Example Vehicle Movement Plans

Mortimore St SP908 was built in a pre-existing unfenced public recreation park that had protected fauna. Vehicles can only access the driveway entrance by removing a locked bollard using a council or SEW key.





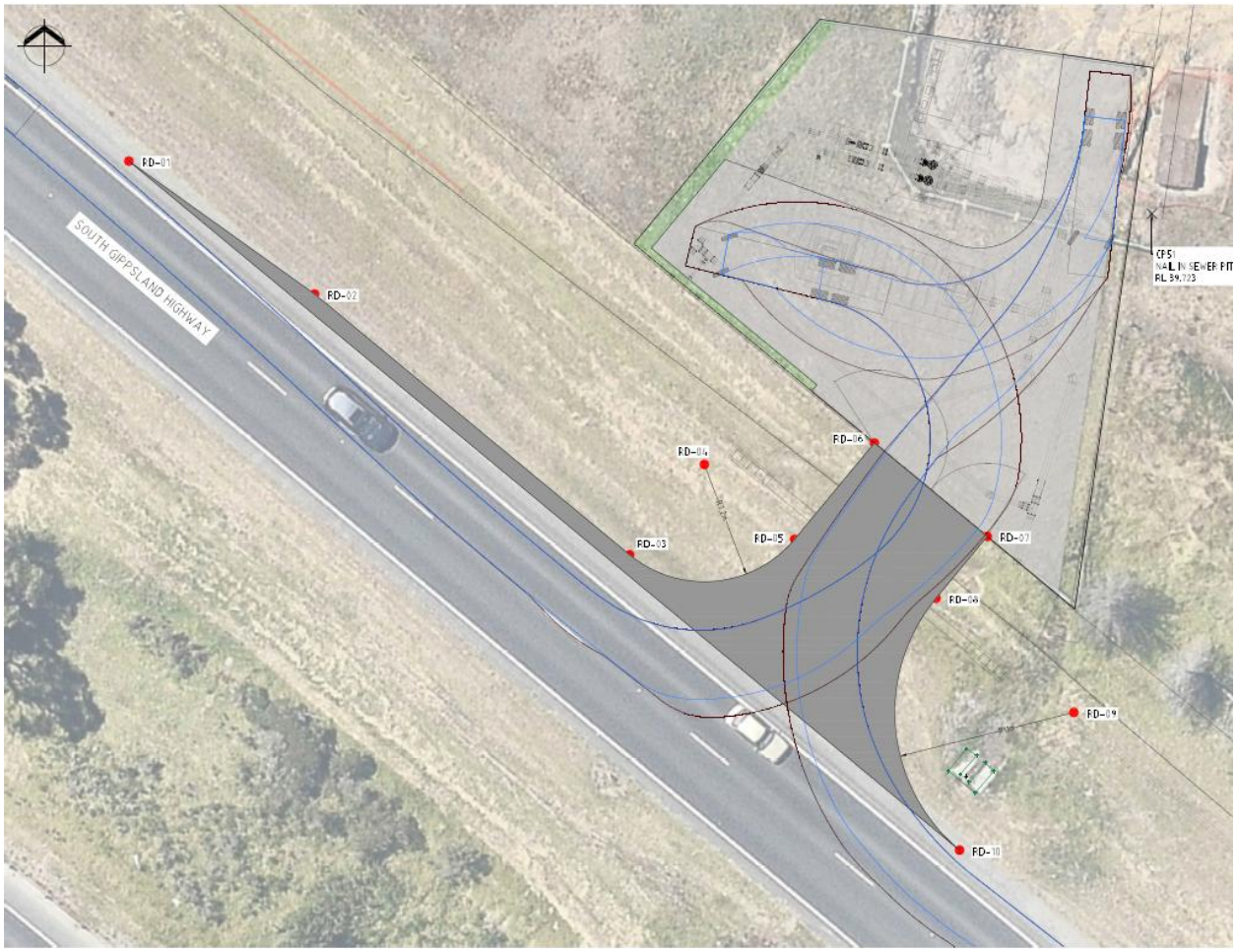
Moody St East SP914 (shown below) is an example of a small asset located on a low-speed side street. A rigid heavy vehicle is able to reverse in from the street to lift pumps, clean the wet well, etc. A longer vehicle is able to park in separate bay (similar to a bus-stop) so that it doesn't obstruct this narrow street or its footpath. SEW has 24/7 access to this bay as per Section 4.10.



Example from South Gippsland Hwy SP936 below illustrates:

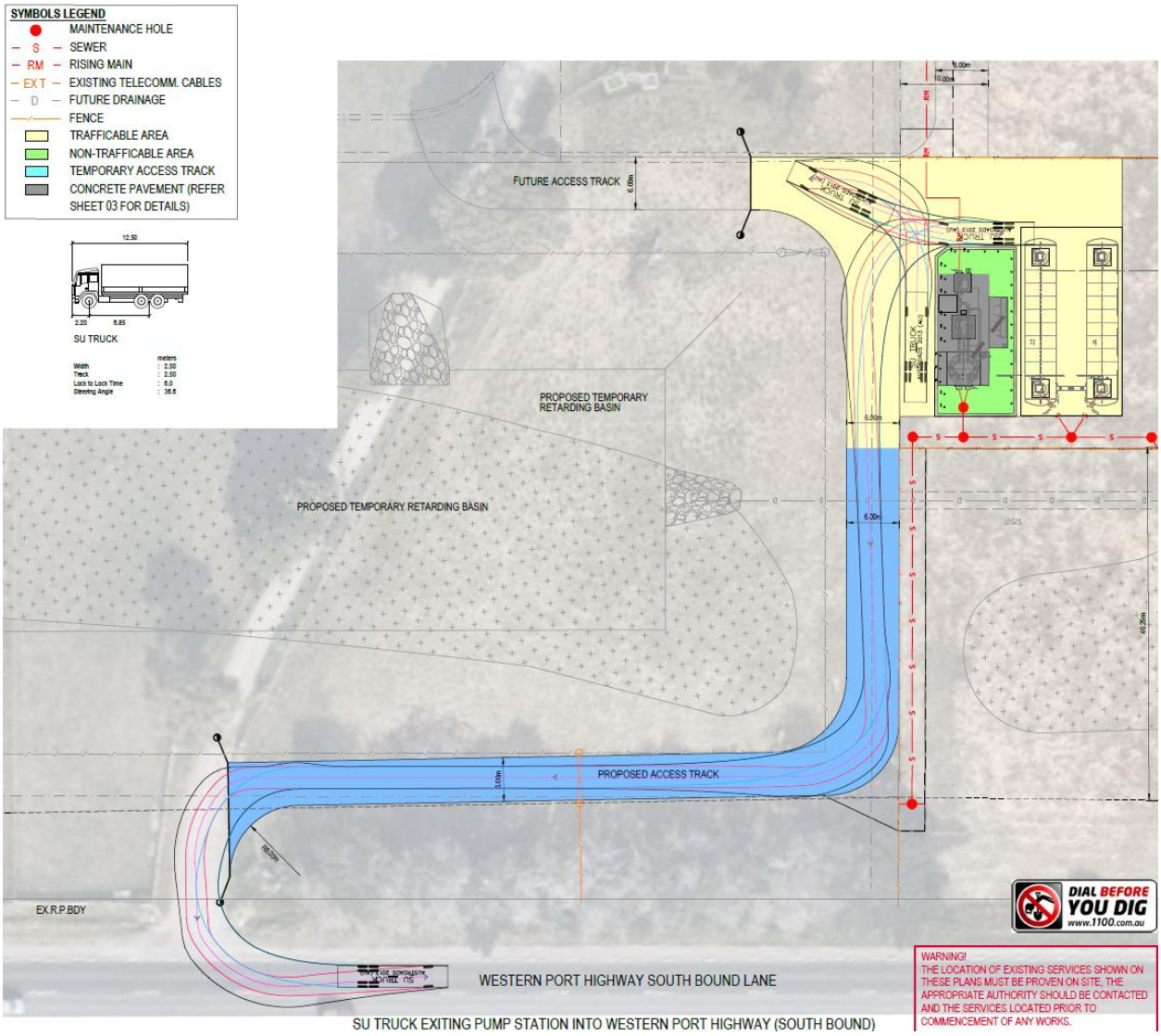
- Egress lane from 100kph South Gippsland Highway southbound lanes
- Space for vehicles to pull over whilst a worker unlocks / locks the access gate
- Three-point turn within site for dual drive axle heavy vehicle
- Arc to exit
- Access gate width to provide for entry and exit, with sufficient room to swing gates clear

Note that site will eventually have a northern or western entry from a future property development that is currently undefined.



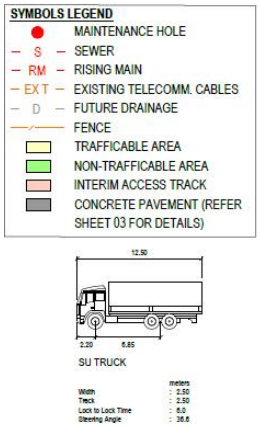
Hereunder is an example from Westernport Hwy SP940 that illustrates a multi-stage land development.

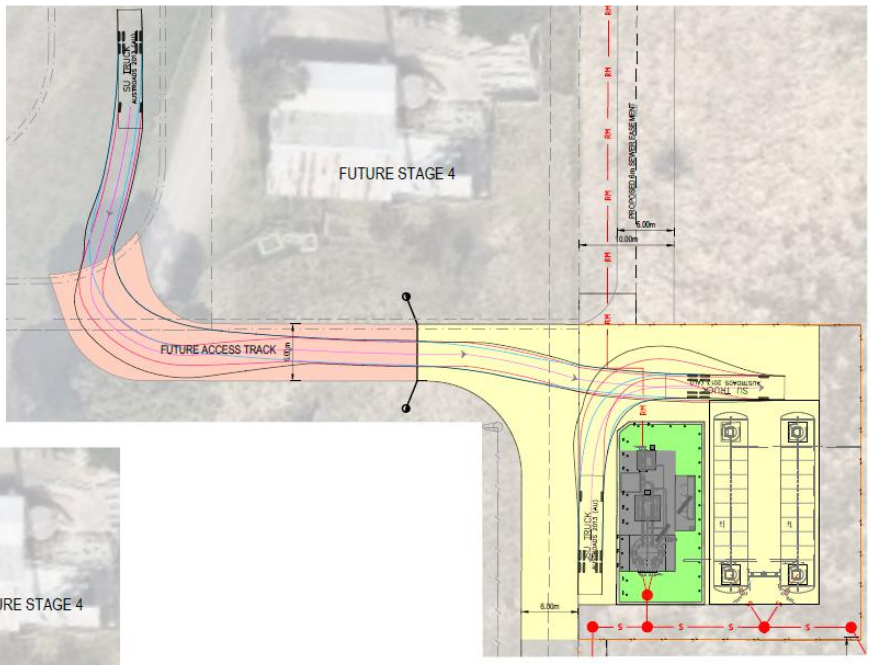
The diagram below shows Stage 1 temporary access from Westernport Highway south bound lane before land development works occurred.



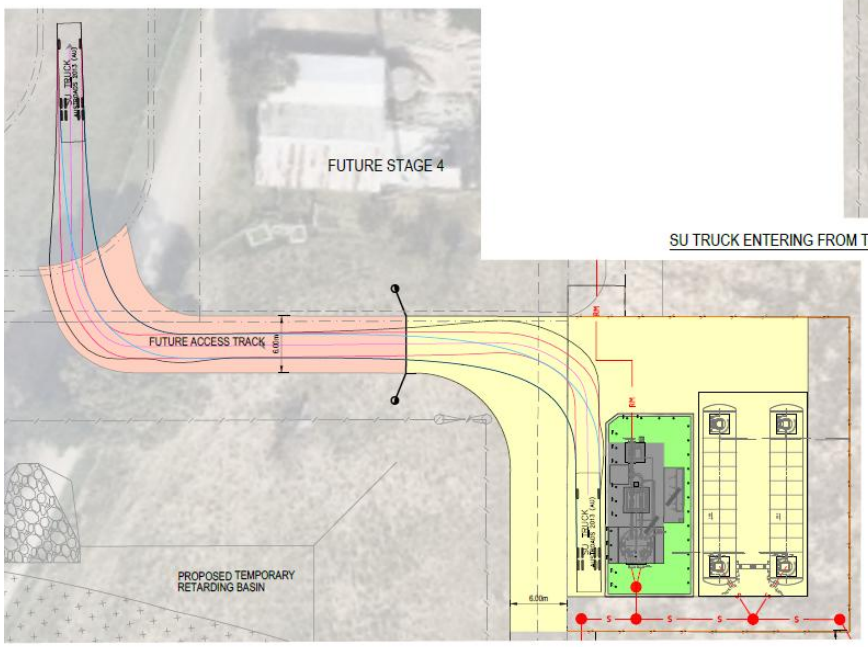
SU TRUCK EXITING PUMP STATION INTO WESTERN PORT HIGHWAY (SOUTH BOUND)

The diagram below shows Stage 2 access from new road within land development for works that occurred in the near term. Interim Stage 1 access from highway was then abandoned so that area could be redeveloped into a storm water retarding basin.



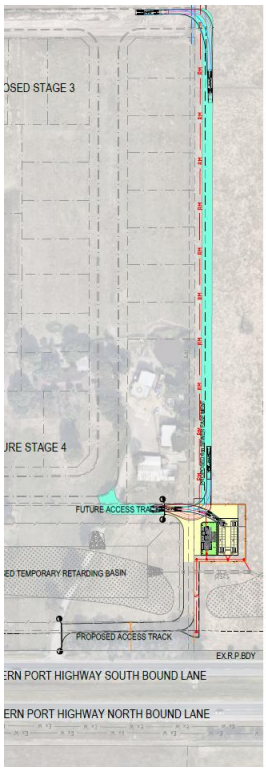


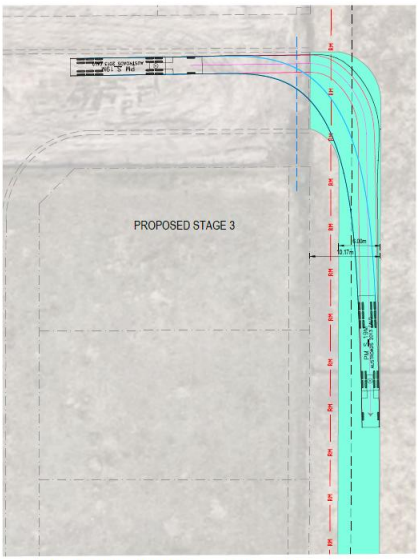
SU TRUCK ENTERING FROM THOMPSONS BASE - STAGE 4 INTO PUMP STATION



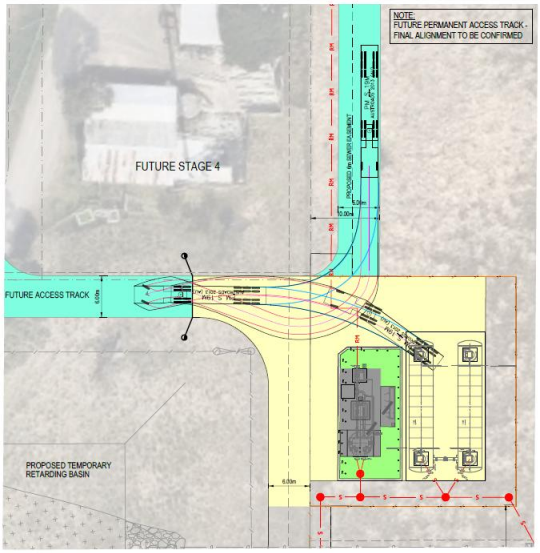
SU TRUCK EXITING PUMP STATION

The diagram below shows final stage 3 access when all roads in future land development are available.

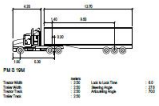


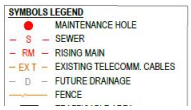


PM S 19m ENTERING FROM THOMPSONS BASE - STAGE 3
INTO PERMANENT ACCESS TRACK



PM S 19m ENTERING FROM PERMANENT ACCESS TRACK
INTO PUMP STATION

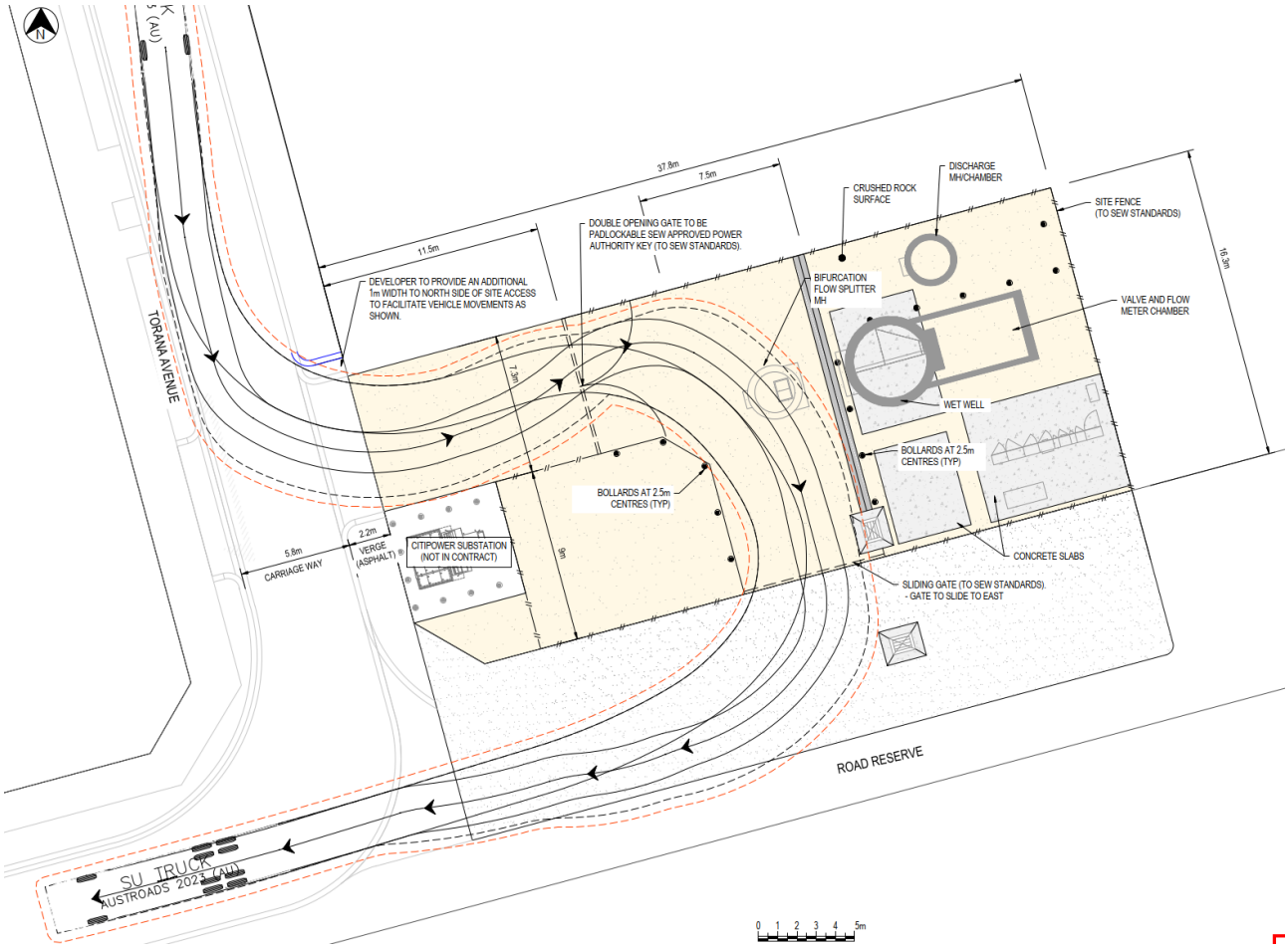




Melbourne Rd Sth SP925 was built in an area that was already mostly developed. The sole available site could only be accessed from the northbound land of Melbourne Rd; it isn't possible to drive in from the southbound lane. The diagram below shows how the site layout design provides for a drive through access track. The second diagram below shows that space is provided before the entry gate so that the truck can safely park whilst the worker unlocks and opens the entry gate. It also shows how the truck can park after exiting the fenced area, whilst the worker closes and locks the exit gate.

The below examples are for information purposes only and do not stipulate the maximum requirements that may be required by South East Water.

Example of greenfield site that has been negotiated:



Example of repurposing existing clearing: