Waterloo Train Station

Reference Design Report Civil Services

Greater Wellington Regional Council

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1 Introduction

1.1 Overview

This report has been prepared for the Greater Wellington Regional Council (GWRC) to support the creation of a Reference Design for the new Waterloo Train Station, a pivotal element within the broader Waterloo Station Transit-Oriented Development (TOD) Project.

Serving as a central hub, this transportation hub is designed to efficiently integrate with the wider urban environment, fostering connectivity and accessibility.

Separate from the commercial developments that form part of the larger TOD, this report focuses specifically on the Civil Engineering Services reference design for the transportation hub itself. The design brief encapsulates the outcomes from three critical phases of the project—Define and Discover, Feasibility Study, and the Waterloo Station Reference Design.

By addressing the civil engineering services considerations within this reference design, the report aims to guide the delivery of a functional, sustainable, and user-friendly transport hub, aligned with the region's strategic goals for urban development and public transport enhancement.

1.2 Background

Waterloo Station is a key node in the Wellington Region's public transport network. Located on the Hutt Valley and Wairarapa Lines, it serves as the primary interchange for Naenae, Wainuiomata, Seaview, and Kelson, and connects into regional services linking Upper Hutt, Wellington City, and the Wairarapa. With over 14,000 rail boardings weekly and functioning as a key bus-rail transfer point, the station is strategically positioned to enable mode shift, reduce transport emissions, and unlock urban development within Lower Hutt City.

The current Waterloo Station Railway Station was constructed in 1988. In recent years the roof structure has suffered from ongoing maintenance issues and is past it end-of-life. This has provided the opportunity for the station infrastructure and surrounding urban catchment to be reconfigured in a way the supports transport orientated developments. Waterloo Station was selected by Wellington Regional Leadership as a potential TOD due to:

- A need to address major and end-of-life infrastructure issues in the Waterloo Station.
- The availability of prime commercially developable land in the wider precinct
- Waterloo station and the precinct's strategic location in the Hutt Valley and larger footprint (~18,865m2 of developable land).

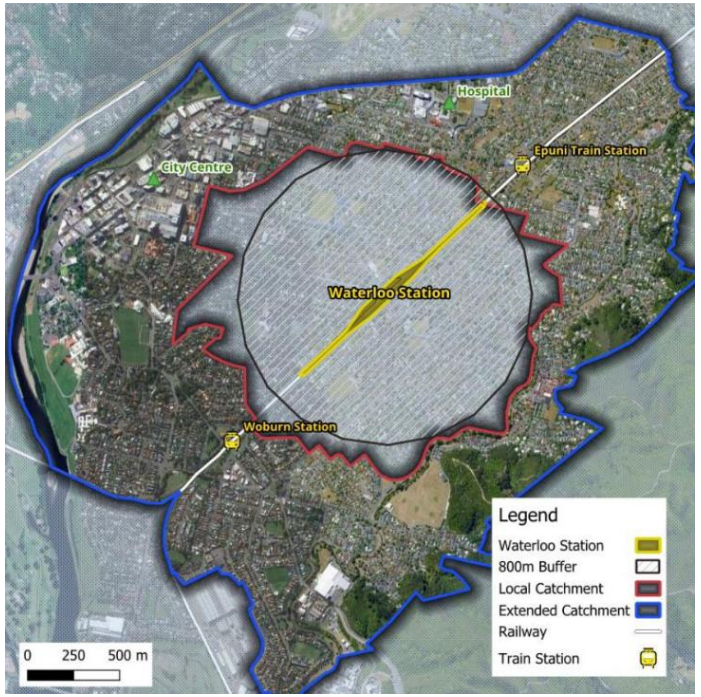


Figure 1 Waterloo Station and 800m radius

- The potential of the Waterloo Station precinct to facilitate urban intensification, contribute to realising the Wellington Regional Growth Framework, and contribute of other positive social and health outcomes.

The project constitutes a major redevelopment of the existing Waterloo Station. The design team has progressed to the creation of a reference station design (refer to Figure 2) to facilitate further development of the Waterloo Station precinct. The commercial area which is indicated as part of the station proposal has been documented for the purpose of the reference design as a 3 storey building (GF, L1, L2). The building has a footprint of 550sqm, with a total GFA of 1650 sqm over 3 floors. This building is subject to further development in the next phase once GWRC requirements are known.

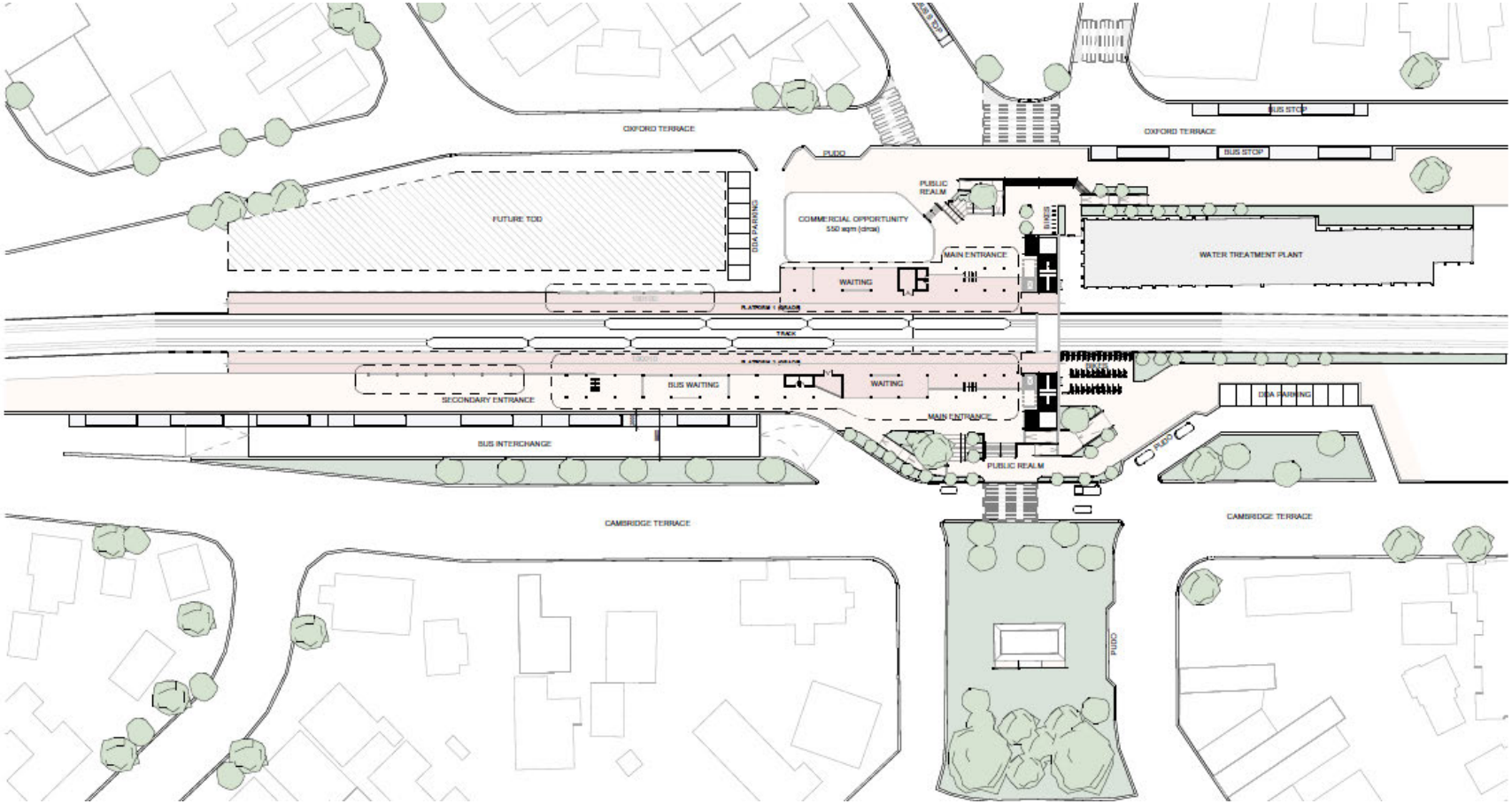


Figure 2 Reference Design (Drawing provided by Grimshaw Architects 20-08-25)

2 Existing Site

Waterloo Station is located within a largely existing residential housing area with some light commercial businesses on both the eastern and western side of the station with an established road network and car parking system. The railway line intersects the site into two separate catchments, from a civil services perspective.

The site is reasonably flat with the high point of the site contours located at the Waterloo station building and gently sloping to the north and the south. There is a small concrete crib retaining wall along the eastern edge of the car park on Cambridge Terrace.

The existing Station building is immediately adjacent to the Waterloo Water Treatment Plant (refer to Figure 3). The Plant is a critical piece of infrastructure, supplying the Wellington region with 40% of its annual water supply. Associated with the Water Treatment Plant is large diameter water transmission mains and associated valving work running parallel to Waterloo Station. This includes:

- 750mm diameter concrete lined steel transmission main, installed in 1981
- 525mm diameter concrete lined steel transmission main, installed in 1945

The treatment plant and associated infrastructure are constraints to the future development of Waterloo Station and need to be considered in all future design stages.

There are existing utilities located within the site extents. These are considered in further detail in the following sections.

Figure 3 Waterloo Water Treatment Plant (source: WWL)

3 Stormwater

3.1 Existing Network

The railway tracks split the site into two independent catchments to the east and the west. Stormwater runoff from the buildings is currently managed by downpipe collection which is directed to the public network located on Oxford Terrace and Cambridge Terrace. Overland flow from the hardstand areas in the surrounding carpark is directed to kerb and channel into a series of sumps around the perimeter of the site, which also drains to the public network. There are no known stormwater treatment devices i.e. raingardens, swales etc. on the site.

The stormwater drainage for the adjacent WWL Water Treatment Plant is also directed through Waterloo Station via a public 225 diameter concrete gravity pipe. The existing network can be seen in Figure 4 below.

Figure 4 Existing Stormwater Network

No consultation with Wellington Water has been undertaken to understand the condition or capacity of the existing network. The network on the western side of the station (Oxford Terrace) and the car park on the eastern side (Cambridge Terrace) consists of concrete pipe installed in the 1990's. The drain that runs along Cambridge Terrace is a concrete pipe installed in the 1940's. This pipe will be approaching the end of life over the next 10 - 20 years.

3.1.1 Site Flooding Risk

According to Hutt City Council GIS (see Figure 5 below), the Station and the associated carparks sit above the 100 year Average Recurrence Interval (ARI). flood zone. The exception is to car park north of the WWL Water Treatment Plant. There are no overland flow paths traversing Waterloo Station. It is noted that the adjacent road network and the car park to the north of the Treatment Plant is located within the flood zone.

Figure 5 100 year flooding zone, accounting for climate change

3.2 Design Criteria

The following section outlines the design criteria pertaining to the stormwater design.

3.2.1 Relevant Standards and Design Guidance

The following design criteria has been used for design of the proposed stormwater drainage system:

- Wellington Water– Water Sensitive Design for Stormwater: Treatment Device Design Guideline (2019).
- Acceptable Solutions and Verification Methods for New Zealand Building Code Clause E1 Surface Water (1st Edition, Amendment 10).
- Wellington Water – Regional Standard for Water Services (Dec 2024).
- Wellington Water – Regional Specification for Water Services (Dec 2024).
- AS/NZS 2890.1:2004 Parking Facilities - Part 1: Off-street car parking.

3.2.2 Design Flows

Stormwater flow calculations have been undertaken in accordance with the Regional Standard for Water Services (December 2024) using the rational method for hydrological design, suitable for catchments less than 100ha. The primary drainage system has been designed to convey a 10% AEP (1 in 10-year) rainfall event, which with an allowance for climate change increase (RCP 8.5; 2081-2100), resulting in 10-minute and 20-minute design rainfall intensities of 95.4 and 65.9 mm/hour, respectively (retrieved from HIRDS, accessed 08 August 2025)

The runoff coefficient (C) used for the design flows are in accordance with NZ Building Code E1and are summarised below:

- C = 0.95 for building rooves and hardstand pavement areas.
- C = 0.35 for landscape areas, green spaces and parks.

The total eastern catchment area is approximately 475 sqm, with 13.7% being pervious surfaces. The expected 10-year 10-minute flow for this catchment has been calculated at 10.87 L/s, while the 10-year 20-minute flow is estimated at 7.51 L/s. Similarly, the total western catchment covers approximately 540 sqm, of which about 3.4% is pervious. The expected 10-year 10-minute flow for the west catchment is 13.30 L/s, with the 10-year 20-minute flow calculated at 9.18 L/s.

Table 1 Stormwater design flows for Waterloo Station

Catchment Size	10% AEP 10 min	10% AEP 20 min
Eastern Catchment ~475	10.87 L/s	7.51 L/s
Western Catchment ~540	13.30 L/s	9.18 L/s

3.3 Proposed Stormwater Systems

The overall stormwater philosophy will largely remain unchanged for the site. Overland flow will continue to be directed to channel drains, kerb and channel and a series of sumps around the site. Where practicable, the reuse of existing infrastructure has been considered. In order to ensure compliance with Wellington Water and Greater Wellington Regional Council requirements, the use of water sensitive devices is proposed in the form of raingardens. This is further discussed in the sections below.

3.3.1 Stormwater Connections

New stormwater connections will be required for the Station buildings, commercial building, platform canopies and over bridge structure with 150mm and 225mm diameter uPVC pipes proposed to link into the existing stormwater network at the locations indicated in Figure 6 below. At this stage, consultation with Wellington Water has not been undertaken to confirm the suitability or capacity of these connections.

Figure 6 Stormwater Connection points (WWL GIS)

In addition to connections for the built structures, additional stormwater connections will be required for strip drains located at the top of stairs and ramps and repositioned or additional sumps in the carpark and entrance areas. Where practicable overland flow will be directed to a series of raingardens to treat the runoff prior to being discharged to the existing network The full extent of the stormwater infrastructure can be found in the drawing provided in Appendix A.

3.3.2 Rain Gardens

In addition to meeting compliance requirements in regard to stormwater quality, GWRC has expressed aspiration to improve sustainability outcomes for the project. The use of water sensitive devices has hence been reviewed for suitability, to improve the water quality outcomes and reduce adverse effects on the receiving environment through treatment of areas such as pavements. The suitability of water sensitive devices is dependent on-site constraints such as space availability and ground conditions. In general, space availability is limited to smaller devices given the transport requirements for the site.

On this basis, the following devices were considered but not deemed practical for the development:

- Permeable pavements – Permeable pavements are constructed hard surfaces that allow water to pass through to the underlying soil layers. This helps to reduce site run off and provide some water quality treatment. However, due to pavement requirements for buses, there were concerns around pavement longevity and maintenance, permeable pavements were not considered appropriate or effective for the site.
- Soakage – The option to return stormwater to the ground through soakage was not considered practical for this development.
- Vegetated swales, constructed wetlands and ponds – Swales, wetlands and ponds have been considered unsuitable due to space availability.

The one additional device that was considered appropriate for the site was the use of raingardens. Rain gardens slow down and capture stormwater at the source, reducing runoff velocity and volume, thereby minimizing flooding and erosion risks. These use plants and soil to naturally filter pollutants from stormwater, improving water quality. Rain gardens contribute visually appealing green spaces in urban areas.

Raingardens have been incorporated into the urban form and have been designed in accordance with Water Sensitive Design for Stormwater: Treatment Design Guideline (Wellington Water, 2019). They have been sized to capture 2% of the impervious are in a 1% AEP 20-min storm event.

3.3.3 Attenuation

There are no significant changes to the impervious area post development, therefore, attenuation is likely not required for the station redevelopment. However, the TOD development will likely trigger some more onerous requirements such as attenuation and water reuse. This has not been considered as part of this reference design.

4 Wastewater

4.1 Existing Network

The existing wastewater network surrounding the project site is illustrated in Figure 7 below. The existing wastewater network is to be maintained and protected, unless mentioned to be abandoned or relocated on the civil drawings found in Appendix A. There is an existing 900mm trunk main, that runs parallel to the site on Cambridge Terrace. This is a critical asset within the network however, it will not be directly affected by the construction works. It is to be protected and maintained during proposed construction works. There is no known wastewater treatment or attenuation on site.

No consultation with Wellington Water has been undertaken to understand the condition or capacity of the existing network.

Figure 7 Existing Wastewater network (WWL GIS)

4.2 Design Criteria

The wastewater network will be designed to comply with the following standards and codes:

- Acceptable Solutions and Verification Methods for New Zealand Building Code Clause G13 Foul Water (2nd Edition, Amendment 9).
- Wellington Water – Regional Standard for Water Services (Dec 2024).
- Wellington Water – Regional Specification for Water Services (Dec 2024).

The following design criteria shall be used for design of the proposed wastewater drainage system:

- Minimum pipe gradients to comply with Wellington Water Standards.
- Minimum self-cleansing velocity of 0.75m/s in Average Dry Weather Flow (ADWF).
- Peak velocity of 3m/s in Peak Wet Weather Flow (PWWF).

4.3 Proposed Wastewater Network

The wastewater system will collect sanitary sewer from the station buildings and commercial area via proposed 150mm diameter uPVC wastewater connections to the existing network via existing manholes.

No consultation has been undertaken with Wellington Water to confirm connection points or network capacity. With the addition of a significant commercial area on the site, there is a possibility that wastewater attenuation may be required if there is inadequate capacity in the downstream network.

While not considered as part of this reference design, it is likely that the TOD will likely trigger downstream capacity upgrades or onsite wastewater attenuation requirements.

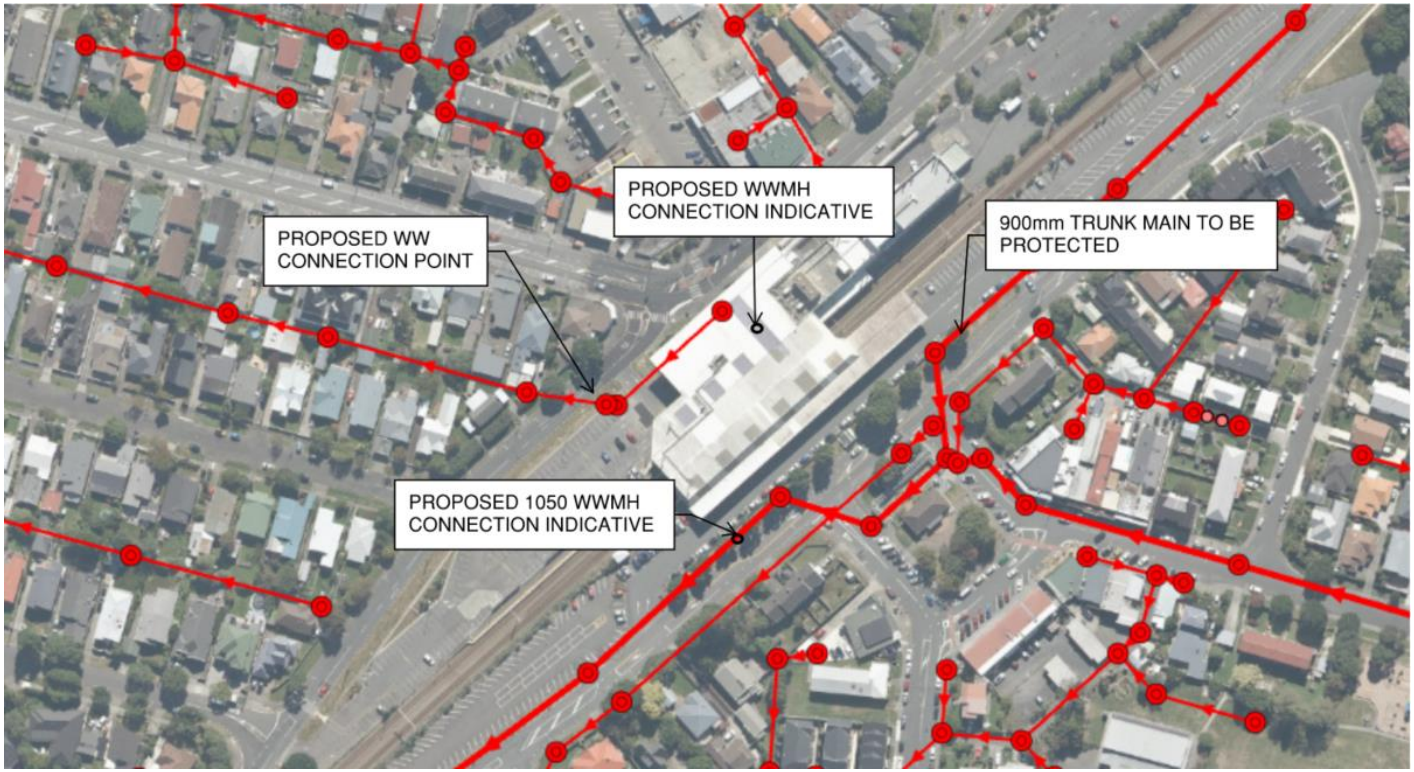


Figure 8 Proposed Wastewater connection points (WWL GIS)

5 Proposed Water Supply

5.1 Existing Network

As previously mentioned, the site is adjacent to Waterloo water treatment plant and the associated underground infrastructure. Within Oxford Street there is a 525mm diameter transmission main installed in the 1940's and a 750mm diameter transmission main, installed in the 1980s. In addition, there is potable water infrastructure located to the east and the west which provide connection opportunities. All existing infrastructure to be maintained and protected during construction works.

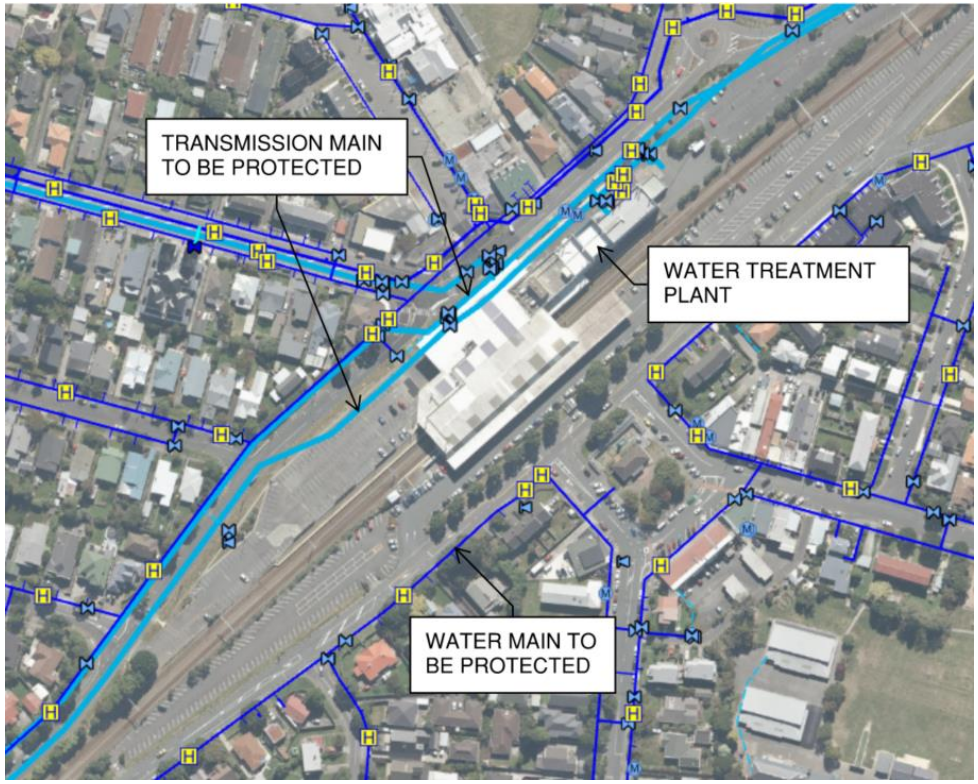


Figure 9 Existing bulk and potable water network (WWL GIS)

5.2 Design Criteria

The potable water network has been designed to comply with the following standards and codes:

- Acceptable Solutions and Verification Methods for New Zealand Building Code Clause G12 Water Supplies (3rd Edition, Amendment 12).
- Wellington Water – Regional Standard for Water Services (Dec 2024).
- Wellington Water – Regional Specification for Water Services (Dec 2024).

The following design criteria shall be used for the design of the proposed potable water supply and fire sprinkler mains:

- Fire services to be concrete lined steel (STCL) pipe in accordance with acceptable materials for fire services as per Wellington Water Regional Specification.
- Allowable pipeline losses on principal mains. ≤ 5 m/km for 110OD PE100 SDR11 potable water pipe (Wellington Water Regional Standard, 6.3.1.5 Allowable pipeline losses).
  - Darcy Weisbach method outlined in Wellington Water Regional Standard for calculating pipeline losses.
- As per SNZ PAS 4509:2010, all structures with a sprinkler system installed to an approved standard are classified by FW2 with minimum of two fire hydrants to provide flow.
- Sprinkler requirements for water supply as per NZS 4541:2020.

5.3 Proposed Water Supply Network

A proposed 50mm diameter potable water connection from the existing network on the eastern side and a proposed 100mm diameter potable water connection from the existing network on the western side will supply water to the buildings. These proposed connections are indicated in Figure 10 below. No consultation has been undertaken with Wellington Water to confirm connection points or network capacity.

Figure 10 Proposed Water connection points (WWL GIS)

6 Utilities

6.1.1 Communication

According to resources sent via beforeUdig by EonFibre, 2degrees and Chorus there is existing communication infrastructure adjacent to or are existing cable connection in the project site, all of which must be protected during works. Of particular note is a Chorus duct bank consisting of 6 x 100 diameter duct within a 450 diameter concrete pipe that runs under the railway, as shown in Figure 11 below. With the extension of the platforms and the proposed commercial areas on site, this duct bank will likely require relocation. This will need to be determined in consultation with the NUO.

There is a communications cable that runs through the station from east to west that may require relocation as it currently runs under the proposed stairs. Any relocation will need to be undertaken with Chorus.

Additional communication connections are likely to be required for the redevelopment. As mentioned above, there is existing infrastructure in both Oxford and Cambridge Terraces to enable these connections.

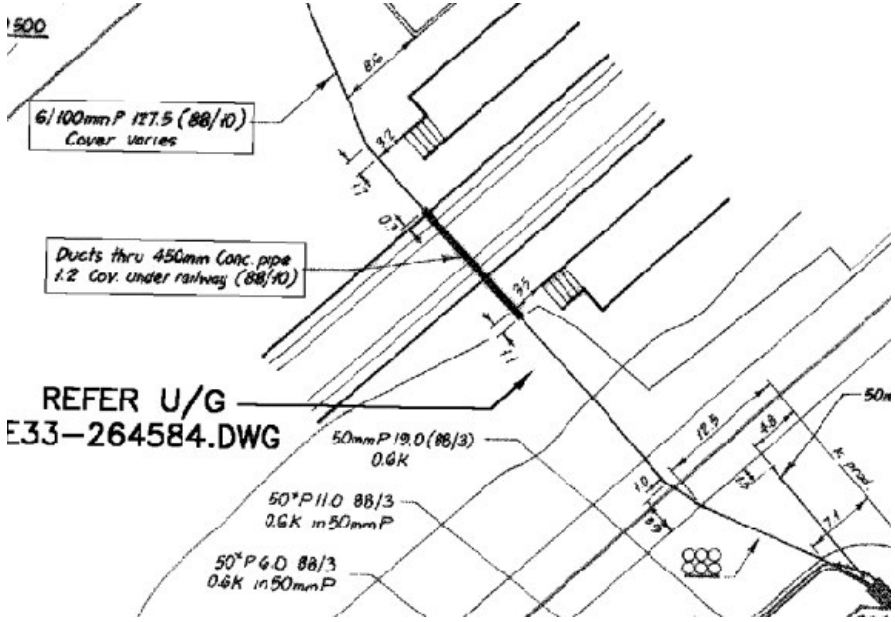


Figure 11 Existing Chorus duct bank

6.1.2 Power

Based on the Wellington Electricity plans have indicated that there is 33kV cables, 11kV cables,400V cables, Auxiliary cables, public light, distribution station in and around the site (see Figure 12). It is recommended that the power cables within the platform of the station are precisely located, prior to commencement of works and protected as necessary. There is an electrical cable that runs through the station from east to west that may require relocation as it currently runs under the proposed stairs. Any relocation will need to be undertaken with the relevant Network Utility Operator.

The installation of new lifts will require the provision of new power and data supplies to support their operation. Additionally, new lighting and emergency lighting will be installed for the stair. Services for the public toilets will be located in an adjacent utility room for easy access and maintenance. The new overpass bridge will necessitate the installation of lighting. The electrical infrastructure installation will require careful staging to transition from the old system to the new one seamlessly. This process must be managed in phases to ensure that full operational capacity is maintained throughout construction. Proper planning and execution will be essential to avoid service interruptions while upgrading the electrical systems.

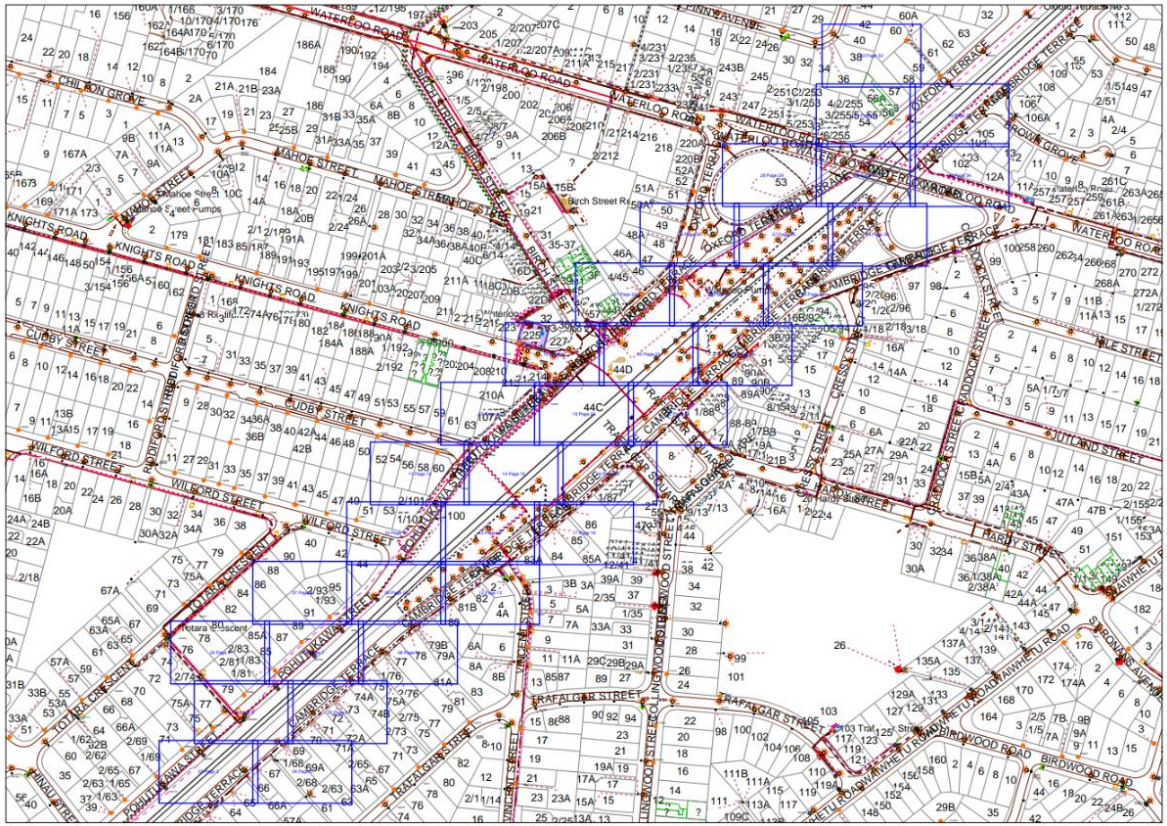


Figure 12 Wellington Electricity infrastructure

6.1.3 LINZ Survey

There are several survey markers within or adjacent to the site that will require protection and / or removal and replacement after construction. Refer to Figure 13 below.

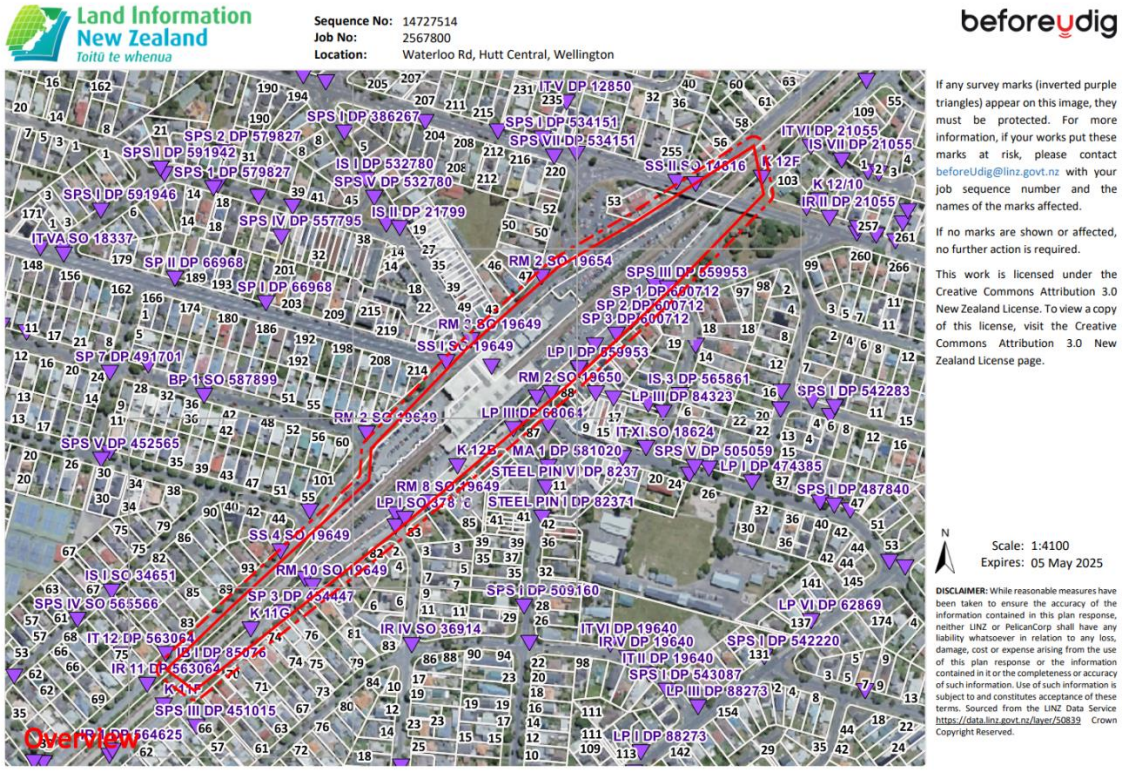
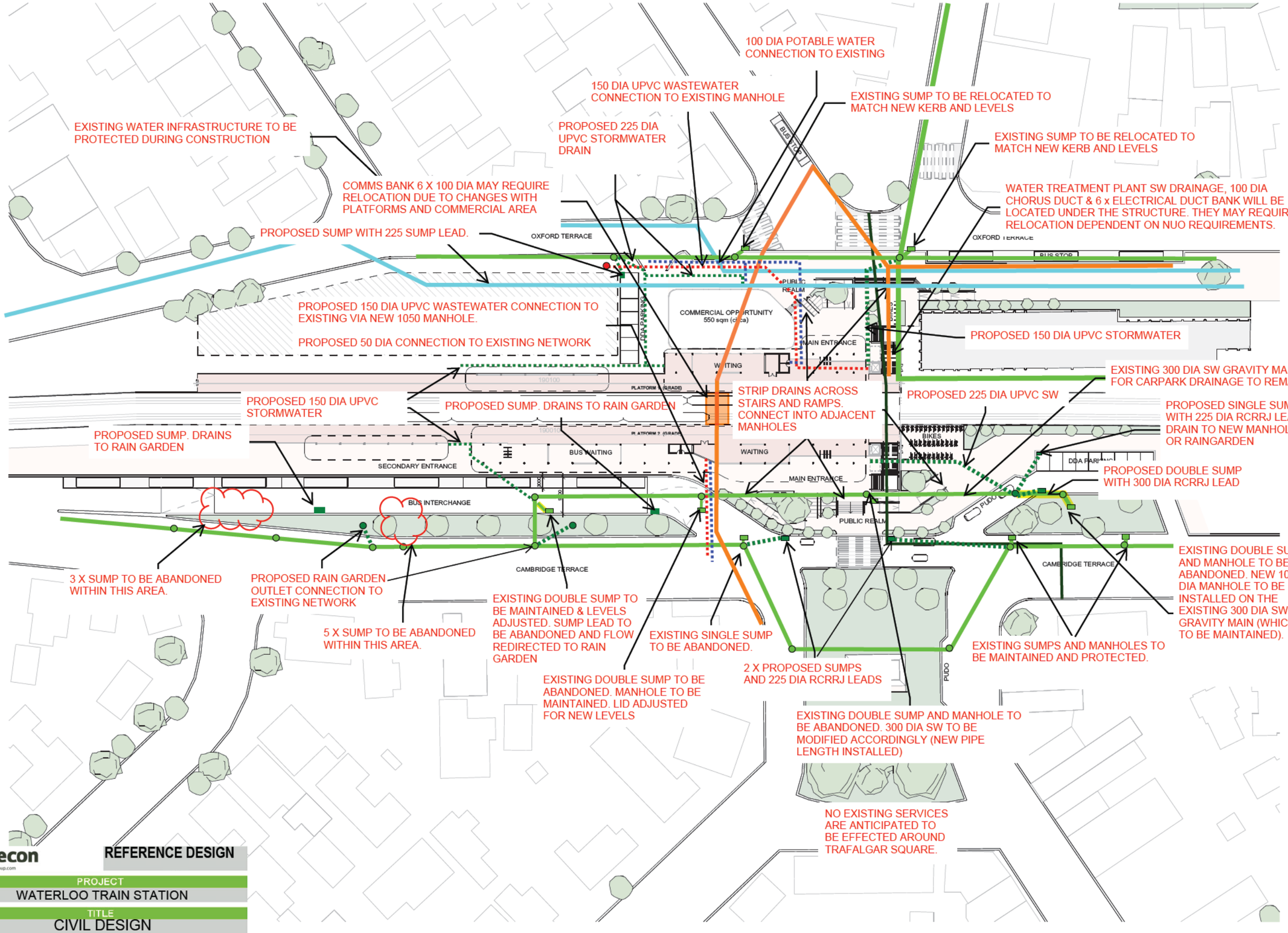


Figure 13 Linz survey marks

Appendix A
Civil Drawing

Civil Drawing



LEGEND

EXISTING SERVICES

- WATER SUPPLY
- SANITARY SEWER
- STORMWATER
- CHORUS DUCTING
- ELECTRICAL DUCTING

PROPOSED SERVICES

- STORMWATER
- WASTEWATER
- POTABLE WATER

GENERAL NOTES

1. PROVISION FOR RAINGARDENS ARE REQUIRED. ALLOWANCE SHALL BE CALCULATED AS 2% OF PROJECT AREA.
2. EXISTING OFF SITE 3 X WATER INFRASTRUCTURE WILL BE UNDERSIZED FOR THE ADDITIONAL TOD & COMMERCIAL DEMANDS. PARTICULARLY WASTEWATER FLOWS. PROVISION FOR ATTENUATION & PUMPING SYSTEM SHOULD BE ALLOWED.
3. WITH THE USE OF RAINGARDENS THERE SHOULD BE MINIMAL / NO INCREASE IN IMPERVIOUS AREA. HOWEVER TO BE CONSERVATIVE, ALL ALLOWANCE FOR RAIN WATER HARVESTING OR ATTENUATION SHOULD BE MADE.
4. NO ALLOWANCE HAS BEEN MADE FOR THE FUTURE TOD SPACE.

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REFERENCE DESIGN

PROJECT	
WATERLOO TRAIN STATION	
TITLE	
CIVIL DESIGN	

DESIGNED	DRAWN	PROJECT No.	SIZE
AM	AM	528886	A1
SCALE	DATE	SKETCH No.	REV
NTS	21/08/2025	SK- CC-0001	B

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