

Horsham South Structure Plan – Water and Wastewater Services

Horsham South

Mesh

13 September 2024
Tonkin Ref: 221380

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Document History and Status

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1 Executive Summary

As the Horsham Staging Development Plan continues to be developed, Tonkin has been engaged to provide a high level assessment of the water and wastewater network requirements in the upcoming growth of Horsham South.

Noting the extension of the study area, Tonkin has identified the following key considerations to inform the final staging plan and the work planning for future network updates.

- Existing services are mainly located within the settled area of Horsham South (North of the study area), implying that economic factors might limit the extent of future works. This is particularly the case of the wastewater system.
- Although land use has been determined, there are still unknowns regarding the number of future allotments in the developing area, this directly impacts the way demands are calculated and recommendations tailored to the expansion of Horsham South.
- There needs to be agreement on serviced zones, as it has been identified that different constraints are evident for each one of the parties.
- Topography of Horsham South has been identified as mostly flat, this will have implications for the requirements of the proposed wastewater mains.

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2 Introduction

2.1 Project Overview

Mesh in conjunction with Horsham Rural City Council (Council) are developing a Structure Plan for the proposed Horsham South development. Tonkin has been engaged by Mesh to assist with the delivery of the services portion of the overall plan.

Horsham is 300km North-West of Melbourne comprising approximately 20,429 people; it is surrounded by large flat farmland areas situated on the banks of the Wimmera River and is approximately 50km North of the Grampians National Park. The Wimmera River divides Horsham into two areas: North and South.

The majority of the population and commercial district areas are located in Horsham North, while much of the farmland and industry is currently located south of the river with small pockets of residential zones.

As the region is growing, it is expected that Horsham South continues to develop in approximately 4144 Ha of commercial, industrial and residential zones. It is noted that most of the growth investigation area is located near already established water infrastructure assets, while the existing wastewater infrastructure assets are located mainly in the north of Horsham South, over 1 km of most of the future zones. Furthermore, it is aimed that existing assets will be utilised to serve the new development area where possible.

The new developments for the Horsham South area will be required to be serviced with a potable and wastewater connection and to aid in this planning a Servicing Strategy is required to inform the implementation of this development.

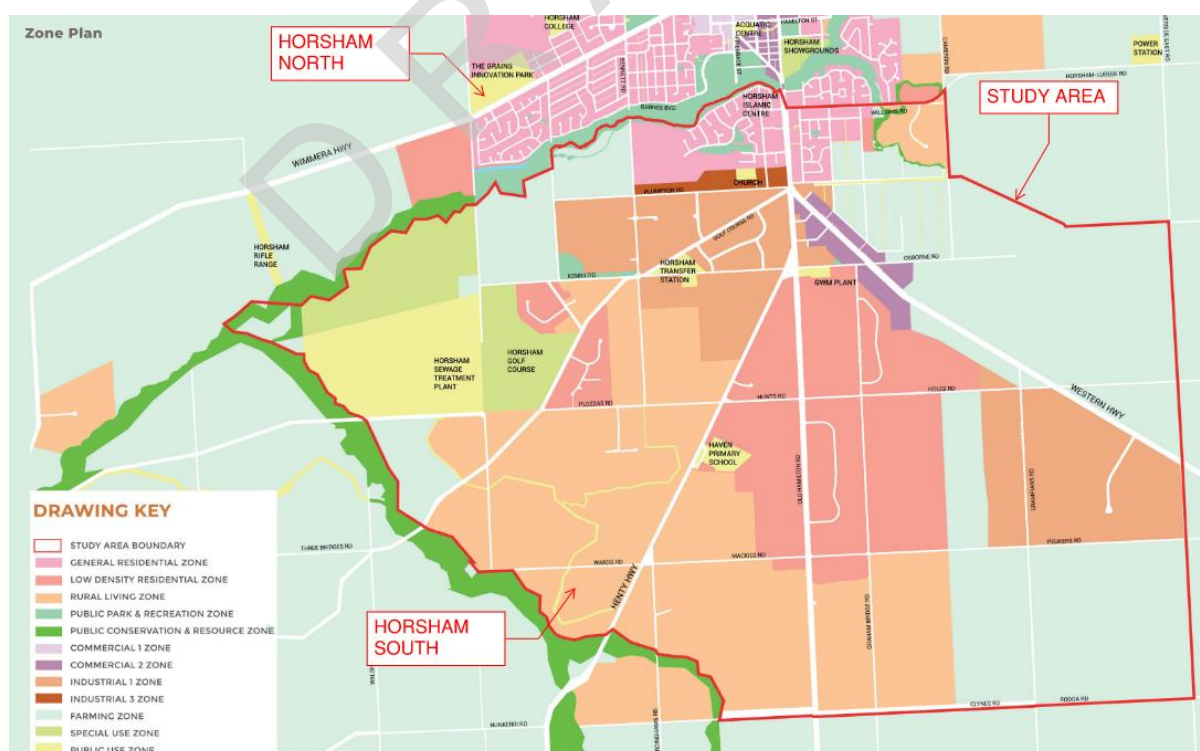


Figure 1 - Horsham Extent of Study Area¹

¹ Source: Horsham South – Issues and opportunities Background Report, October 2019



2.2 Project Scope of Assessment

The project scope includes the provision of a services strategy for the expansion of Horsham to the South of the Wimmera River as summarised in Figure 1 above.

The scope of the assessment follows the servicing strategy guidelines outlined in the Water Supply Code of Australia (WSA) 02 2014 and the WSA 03 – 2014 Planning and Design Codes.

As summarised in the WSA, the scope of assessment for the services structure plan comprises:

- Evaluation of the existing water and wastewater assets in Horsham South include the treatment plants, pump stations, storage facilities and main pipe trunk mains.
- Determination and evaluation of existing and new water and wastewater demands.
- Evaluation of the impact the new water and wastewater demands will have on the existing Grampians Wimmera Mallee Water Corporation (GMMWater) assets.
- Identify the required additional wastewater and water infrastructure to serve the proposed new lot developments and preliminary outline of the services configurations.
- Identify the required upgrade works for the existing GMMWater assets.

2.3 Purpose & Objectives of This Report

The purpose of this report is to provide Mesh and Council with a high level guide of infrastructure considerations as to the key services for the Horsham South Structure Plan. Specifically, the key objectives in this report comprise:

- Determine the overall wastewater and water demand for the expansion and its impact on the existing infrastructure.
- Determine the required infrastructure, its approximate location and potential size to ensure future lot developments will have a reliable water and wastewater supplies.
- Determine the required upgrades to the existing GMMWater assets.
- Determine any further investigations required as part of the overall Structure Plan.

2.4 Further Planning and Consideration

Not all elements outlined in the WSA have been captured in this report due to the limitations of scope and the detail known to date. These elements should be investigated further as more detail regarding the proposed expansions is understood. These elements comprise:

- Assessment regarding the existing water reservoirs and water/environmental management around water sources for Horsham and different parts of the area. Note our assessment is demand based only and does not take into consideration the potential for integrated water management, recycled water generation and potential reuse opportunities.
- Network analysis through hydraulic modelling to ascertain hydraulic loads and catchments as well as fire supply requirements.
- Network criticality assessment to understand level of redundancy required for each of the critical assets.
- Overflow locations for the wastewater systems.
- Odour and water quality control.
- System security.
- Climate change impacts.
- Environmental, cultural and heritage constraints.
- Network sizes and future system expansion.
- Geotechnical investigations and groundwater impacts.
- Flood plain impacts.



2.5 Assumptions and Limitations

The limitations for the services assessment include:

- Water and wastewater demand analysis is based on information provided by Council as well as demand estimation methods outlined in the WSA.
- No computational hydraulic or demand modelling has been completed as part of the review, this is a desktop analysis only.
- No water saving initiatives have been explored as part of this review.
- No modifications to the existing rural non-potable network were considered in this review.
- Pipework reticulation networks within the North Horsham (North of the Wimmera River) area are not included within the scope. Information provided by GMMWater comprise spatial info of water and wastewater assets within the study area, which excludes north area of Horsham.
- Information used for the assessment has been provided by Mesh, Council and GMMWater.

2.6 Reference and Briefing Documentation

The reference and briefing material for the project include:

Table 1 - Reference Documents

| Document | Revision / Date |
|---|-----------------|
| Horsham South – Issues and opportunities Background Report | October 2019 |
| TGM Horsham South - Drainage Water - Wastewater Infrastructure Assessment | May19 |
| Urban and Rural Water Strategy 2017 | July 2017 |
| Water Supply Demand Strategy 2012 | 2012 |
| 240806_HSSP_Draft Structure Plan_v9 | 2024 |
| Council’s preferences for future connections (Email from Mesh) | 29/08/24 |

2.7 Glossary

Table 2 - Glossary

| Abbreviation | Term |
|--------------|--|
| GMMWater | Grampians Wimmera Mallee Water Corporation |
| PS | Pumping Station |
| RC | Reinforced Concrete |
| WTP | Water Treatment Plant |
| WWTP | Wastewater Treatment Plant |



3 Design and Planning Criteria

The following design criteria has been established as a basis to assist in developing the services structure plan. Many of the design criteria extend from typical design principles and should be checked and modified accordingly to suit the limitations understood by GWM Water, Mesh and Council.

The assumptions made for the project include:

- New residential lots with areas less than 1Ha, as well as commercial and industrial lots will comprise a new wastewater connection.
- Each new lot will comprise a new potable water connection. This may change in the future once the Structure Plan is finalised; however, for the purpose of this assessment, a worst case scenario has been considered.
- The existing rural network will not be extended and therefore, new lot developments will not require a rural water network connection.
- Staging will be determined from others with a definitive version of zoning at the time. This project is based on the ultimate development only and the map/zoning provided to Tonkin (240806_HSSP_Draft Structure Plan_v9).

Table 3 - Design Criteria

| Design Element | Description |
|---------------------|--|
| General | Level of density of the proposed new development will be based on Horsham available census information. |
| Water demand | Water demand estimates for the proposed expansion area are based on existing demand values of the Horsham North Area. These values are compared with standard WSA estimation methods. |
| Water supply | Water supply shall be sourced from existing GWMWater treatment and pumping assets. No new sites for additional assets will be considered at this point. Each new lot development shall include a new potable water supply. Where possible, trunk mains shall reticulate through main roads. No easements to be incorporated at this stage of planning. Connection locations and number of connections will be estimated based on lot layouts provided. Fire supply demands have not been assessed in this review. |
| Water Pressures | It is assumed the existing assets will be upgraded in future to ensure suitable supply pressures throughout as required. System hydraulics have not been assessed in this review. |
| Rural water network | The rural water network shall continue to operate as it currently does and shall not be modified or expanded in future. The rural water network capacity and supply is not considered in the overall water demand and supply comparisons. |



| Design Element | Description |
|-----------------------|--|
| Wastewater Production | Wastewater volumes are estimated using current wastewater factors supplied by GMMWater. |
| Wastewater network | <p>New residential lots with areas less than 1Ha, as well as commercial and industrial lots will comprise a new wastewater connection</p> <p>Existing GMM Water treatment and pumping assets shall be utilised. A new site for a new wastewater treatment plant will not be considered.</p> <p>New pumping stations shall be located within the particular lots based on the site topography only. Capacity and demand on individual pumpstations will be estimated only.</p> <p>Trunk mains shall reticulate through main roads. It has been assumed that gravity mains shall extend as far as reasonably practical at a maximum depth of 4m invert before transitioning to a pumped system. It is understood that there might be some existing gravity mains at a depth of approximately 7m. This will need to be updated based on the final staging plan and the network's requirements by the time detailed design planning commences.</p> <p>Customer connection locations and number of connections will be estimated based on lot layouts provided.</p> |

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4 Site Layout

4.1 Proposed Expansion

The proposed study area comprises 4144 Ha; expansion within this area is broken down into the following main development zones:

Table 4 - Proposed Expansion

| Zone | Area (Ha) | General Description |
|--------------|-----------|--|
| Residential | 2076 | Housing to conventional to low density living |
| Commercial | 59 | Medium density and low density commercial |
| Industrial | 500 | Low and intermediate level range industrial including metal works, manufacturing etc |
| Farming | 1192 | Reliant on non-potable water for farming. |
| Public Space | 244 | Parks, gardens, reserves, and assembly buildings |
| Special Use | 84 | Golf Courses |

4.2 Topographical Summary and Challenges

The general topography of Horsham is relatively flat in most parts with the land grading towards the centrally located Wimmera River. Northern Horsham comprises elevations between 125 m to 131 m from the north sloping down to the south towards the river. Horsham South comprises elevations between 125 m to 141 m sloping south to north.



Figure 2 – Indicative Topography of Horsham²

² Source: Google Earth



It is noted that due to the mostly flat topography, economic challenges are perceived for extending some services such as gravity wastewater mains. This will need to be considered for the final version of the staging plan.

5 Water Supply System

5.1 Existing Arrangement

Horsham is served by two independently operating centralised water systems. The water network, supplying potable water from Mt Zero reservoir to Morson Storage tank and Pump Station, which supplies to extensive section of Horsham South, is presented in sections 5.1.1 to 5.1.6; and the rural network pipeline, which delivers non-potable water to areas afar from the existing potable water network, presented in section 5.1.7.

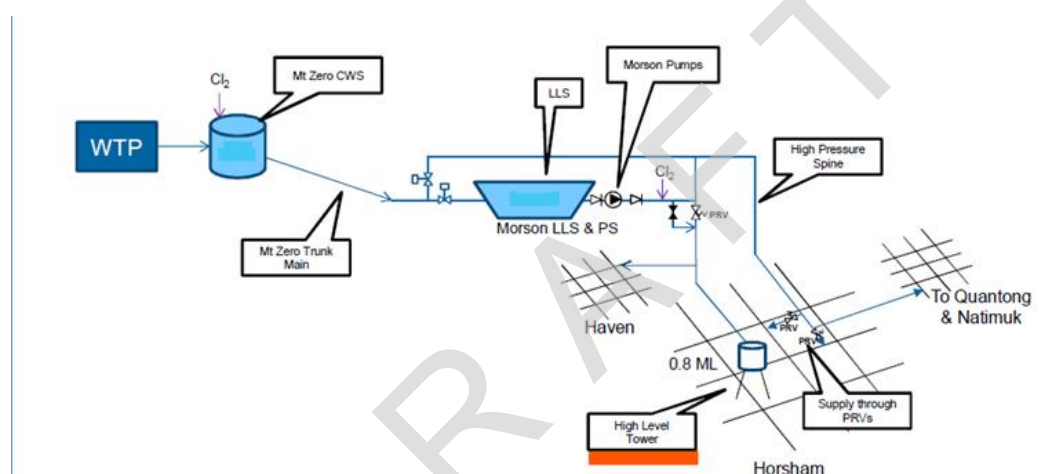


Figure 3 – Potable Water System Schematic

5.1.1 Water Network Source Water

The Grampians National Park is located to the southeast of Horsham; its tallest peak reaches about 1167mAHD. Wartook reservoir, is located at 441 mAHD and is utilised as the main source of water for Horsham; from here, water is continuously released and transferred by river and channel to the Mt Zero storage reservoir, located at approximately at 190 m AHD.

The availability of water in this region is currently stable as indicated by GWM Water, however consideration of the supply reliability following major expansions and increase in demand requires further investigation and consideration during the planning process.

Detailed review of the required actions around increasing water source reliability and sustainability is not covered in this review and should be considered based on current legislative and environmental requirements.

5.1.2 Mt Zero Water Treatment Plant

The Water Treatment Plant (WTP) serving Horsham also provides treated water for Haven, Quantong and the Natimuk townships. The Mt Zero WTP comprises the following characteristics:



Table 5 - Mt Zero WTP Summary

| Item | Description | Comment |
|---------------------------|---|---|
| Water Source | Rainfall runoff into the reservoirs | |
| Pre-Treatment Process | Powdered Activated Carbon (PAC) dosing system | Used during months with low river flows to remove the taste of the water. ³ Capacity: 30 ML/d |
| Treatment Process | <ul style="list-style-type: none">• Coagulation• Flocculation• Dissolved air• Flotation• Filtration• Disinfection• Fluoridation• pH correction⁴ | |
| Design Capacity | 30ML/day | The plant will require upgrade to increase the total design capacity as Horsham expands. |
| Maximum Operational Limit | 25ML/day | Maximum supply on peak day during summer This has been taken as the average daily flow. |
| Spare Capacity | 16% | |
| Areas Serving | Horsham, Natimuk Haven, Quantong | Multiple townships are reliant on Mt Zero WTP. |
| Commissioning Date | 1994 | |
| Condition and Operation | Good condition and no issues operationally | GWM Water have noted that the WTP is in good condition and operates well with no major concerns noted. Ongoing maintenance and system optimisation occurs as the system requirements shift. |

This project will assist GWM Water to consider the expansion of this existing plant as required to service the proposed new development expansion. It is understood from the 07/09/2022 meeting with GWM that there is no intent to decentralise the system and locate a new WTP in a separate location due to the limited availability of a reliable water source.

³ Trility Website: https://trility.com.au/wp-content/uploads/TRILITY-FS_Mount-Zero-Powdered-Activated-Carbon-PAC-2021_FINAL.pdf
GWM Water, Water Quality Annual Report 2021-2022

⁴ GWM Water Website: <https://www.gwmwater.org.au/our-water-supply/check-your-water-supply/horsham>



Figure 4 - Mt Zero Reservoir - Water Treatment Plant⁵

5.1.3 Mt Zero Trunk Main

The treated water from the Mt Zero WTP is transferred under gravity via the Mt Zero trunk main to the Morson Pump Station and low level storage. The characteristics of the Mt Zero Trunk Main comprise:

Table 6 – Mt Zero Trunk Main

| Item | Description | Comment |
|------------------------|--|--|
| Flows and Pressures | TBC L/s @ 60m head | Flows and pressures realised in the high pressure spine provide sufficient pressure to Horsham. It is understood low pressure issues are not a concern under current operations. |
| Material, Size and Age | 5.95 km of 525 mm RC (1962) 0.45 km of 600 mm Ductile Iron (2019) 4.75 km of 675 mm Mild Steel (1975) 2.75 km of 675 mm Mild Steel (1977) | Further hydraulic assessment is recommended once the staging development plan is finalised. |

⁵ Source: Google Earth



| Item | Description | Comment |
|----------|-------------------------------------|---------|
| | 5.42 km of 675 mm Mild Steel (1979) | |
| | 0.91 km of 675 mm Mild Steel (1978) | |
| Chainage | 20.23 km Approx. | |

The expected pipe pressure is approximately 60m head at the border of the Horsham township and delivers approximately 30-40m head pressure into the network through pressure reducing valve (PRV) assemblies at 5 strategic locations.

The high pressure spine passes through Horsham to maintain sufficient pressure to supply water under gravity to the town of Natimuk, and small rural properties in the Quantong area. Following advice from GWM Water it is understood the spine is in good operation and still within its expected design life.

5.1.4 Morson Water Storage and Pumping Station

The Morson Pump Station and water storage tank are located on Osborne Road in Horsham. The pump station duty point of 400L/s @ 40m Head, while the storage has 53 ML capacity which is enough to supply the town of Horsham and the other surrounding townships for approximately two peak days. It is a ground level storage with a floating cover. The water is periodically 'turned over' i.e. pumped out into the Horsham network using the Morson pumps and replenished out of the Mt Zero trunk main.

The pressure boosting pumping station boosts water from the storage tank back into the network which is also connected to the high pressure spine pipeline. The high level functional summary of the Morson pumping station is outlined in Table 7 below.

Table 7 - Morson Pumping Station Operation

| Scenario | Description |
|-----------------------------------|--|
| Normal Operation | In normal operation Horsham will rely on the water pressure within the high pressure spine pipeline with the pipeline connecting directly into the network. The Morson pumpstation is in standby at this time. |
| Reduction in System Pressure | In the event the system pressure drops below 37m head, or the instantaneous water demands exceed 250 L/s, the pumps will engage to provide the required additional pressure. |
| Water Treatment Plant Maintenance | The Morson pumping station will be turned on to supply all water demand to Horsham and the surrounding townships while the WTP is offline for maintenance. The peak use for Horsham and surrounding townships is around 20 ML/day. |

Previous assessments by GWM Water have concluded that it is likely the high pressure spine pipeline has sufficient capacity and pressure to connect to the new development in Horsham South without the requirement for additional pumping stations. Whether the existing system requires upgrade to provide additional pressure is not known at this point and is considered likely.

Following advice from GWM Water it is understood the Morson pumping station is in good operation and still within its expected design life.



Figure 5 - Storage Tank – Morson Pump Station

5.1.5 Horsham Water Tower

The Horsham water network also includes a water tower located in Horsham North. This water tower's primary use is for redundancy in water storage and supply. It has a capacity of 0.8 ML and is located at 47-51 Mill Street in North Horsham. It is understood this capacity is utilised in the event of a major supply interruption through both the Morson pump station and the High Pressure Spine.

According to GWM Water, it operates below the system pressure plane and therefore water fills during day and is emptied out at night into the system.

As this asset is for emergency purposes only, the storage capacity and reliability of the water tower will not be taken into consideration when calculating base demand requirements to service the new development.

5.1.6 Potable Water Network

The existing potable water network in Horsham supplies portions of Horsham South study area. As discussed in this report the pipeline is served by a single water supply from the Mt Zero WTP.

The network comprises a large number of standard water assets and are summarised below in Table 8.

Table 8 – Pipeline Asset Summary

| Asset | Description |
|--------------------------------|---|
| Pressure Reducing Valves (PRV) | Reduce pressure for reticulation to customer connections. Typically, above ground valve sets are within GWM Water land. PRV Settings at approximately 30-40m head |
| Isolation Valves | Inground isolation valves are at branches and junctions. It is assumed standard gate valves are used. |
| Fire Hydrants | Fire-fighting purposes along network pipeline |



| Asset | Description |
|----------------------|--|
| Scour Valves | None in urban potable water network |
| Magnetic Flow Meters | Measuring flow at major assets and at strategic locations and are connected to the GWM Water main SCADA network. |

The network model for Northern Horsham has not been provided to date for review and is expected to remain unchanged as part of the development works. No further review is required of the existing network in Horsham North.

As noted previously, there is no requirement for additional pumpstations to increase system pressure following advice from GWM Water in email from 13/09/2022 (See Appendix C) however there will be a requirement for the provision of additional pressure reducing valve assemblies in the network to ensure suitable pressures are realised at customer connections. The existing Horsham pipeline distribution is outlined in the figure below (note Horsham North excluded):

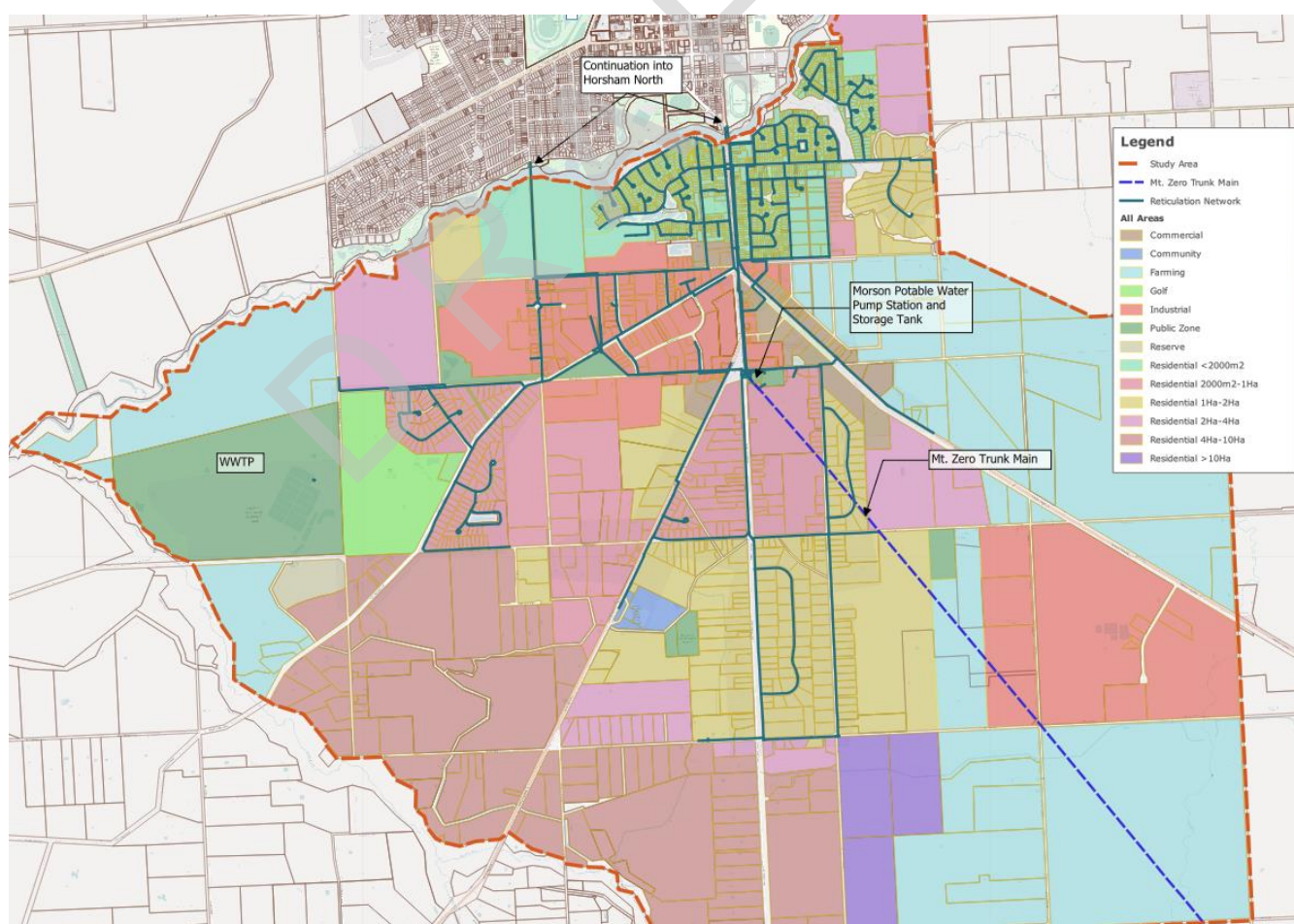


Figure 6 - Existing Potable Water Network



5.1.7 Rural Network Pipeline

The rural network pipeline is a raw water pipe network which is utilised to supply raw water to a small number of lot developments throughout Horsham. Primarily it is used by farmland areas where a primary potable water supply is not available; these areas utilise rainwater for drinking water purposes.

The water is sourced from Lake Bellfield and is piped via a trunk main to Taylors Lake Rural Pumping Station prior to being pumped out to the rural reticulation network. Due to this system delivering untreated water, and its location being of difficult access which interferes in any kind of proposed upgrades.

Important Note: As the rural water network is not considered under base water demand as a critical service, specifics of this network are excluded from this review and only considered an alternative supply for future use. The rural network will be an important asset in future reviews when considering water saving initiatives. No further review is required of the existing rural network in Horsham.

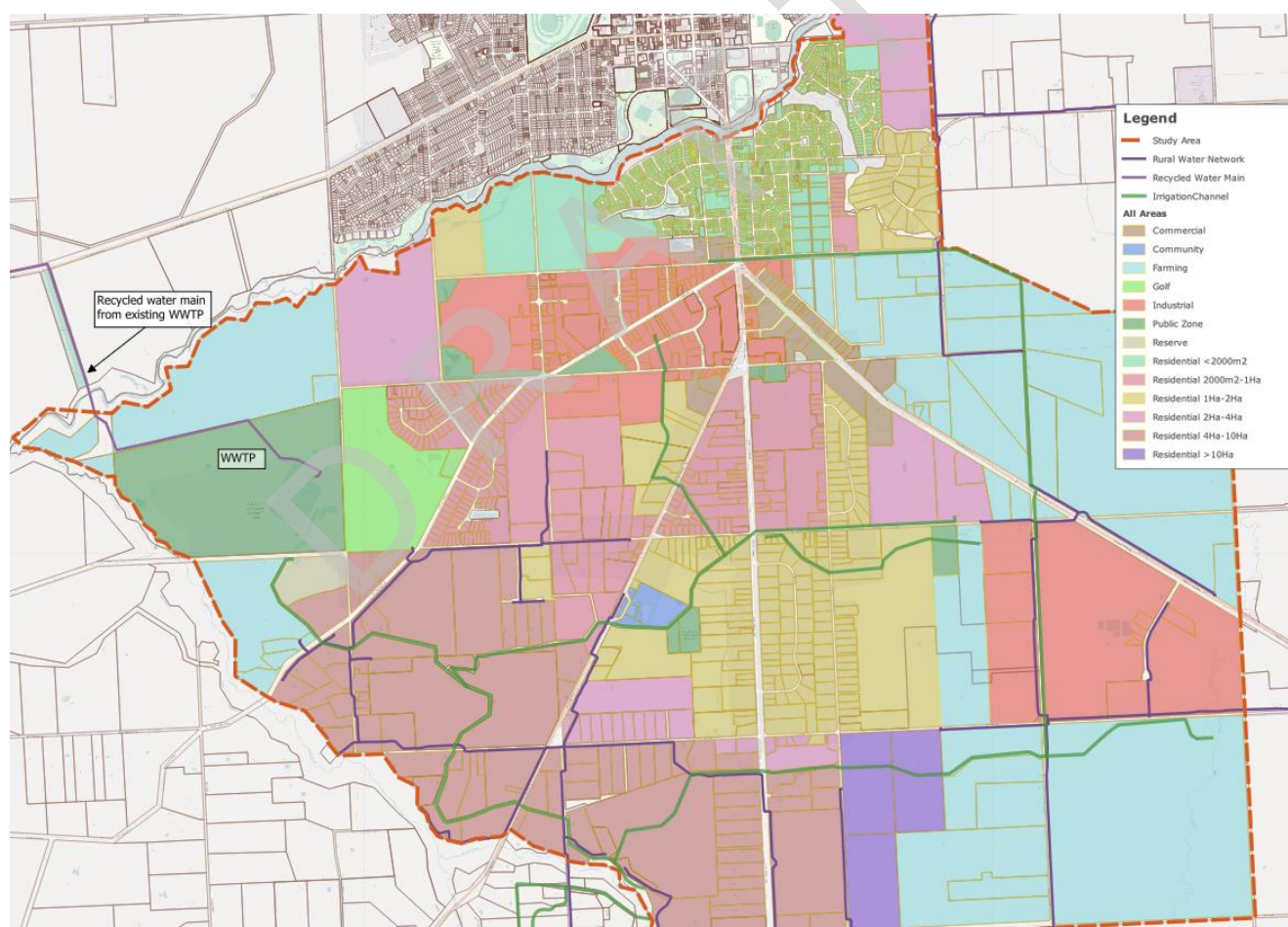


Figure 7 - Rural Supply Network

5.2 Current Water Network Issues and Concerns

There are no major issues or concerns noted by GWM Water regarding the water supply system. Some issues noted by GWM Water regarding the water network include:



- Previous community concerns include the firefighting pressure in Horsham North, which may be caused by low set points in PRVs.

5.3 Water Demands

5.3.1 Demand Estimate

Demand estimates were calculated based on WSA 02 Appendices B and C, in combination with typical water consumption values provided by GWMWater and available Census data for Horsham.

As provided GIS information contained parcels for Horsham South, it was possible to identify that most of the parcels have not been subdivided. The following minimum lot sizes were assumed to assist with the anticipated sub-allotments.

Table 9 – Assumed minimum Lot size (Ha)

| Land Use | Minimum Lot size (Ha) |
|-------------------------------------|-----------------------|
| Industrial | 1 |
| Residential <2000m ² | 0.2 |
| Residential 2000m ² -1Ha | 0.6 |
| Residential 1Ha-2Ha | 1.5 |
| Residential 2Ha-4Ha | 3 |
| Residential 4Ha-10Ha | 7 |
| Residential >10Ha | 10 |

Noting that network requirements vary from water to wastewater systems, calculations for each have been considered separately. Overall, it is noted that by providing each new allotment with a potable water connection, a total demand of 11ML/d is expected. Tonkin understands that supplying all allotments might not be the preferred option once the staging development plan is finalised; however, by considering the worst case scenario, there is a better understanding on the scale of possible future works, which can facilitate discussions regarding potable water coverage in Horsham South.

A full demand estimate breakdown is provided in Appendix B of this report.

Note these demand estimates should be reviewed as the project progresses until all parties are in agreement with the final values.

5.3.2 Horsham Growth and Demand Impacts

It is assumed that Horsham will grow at approximately 1% in population per annum at the current rate as expressed by GWM in their email from 13/09/2022 (See appendix C). Rates of growth during the development expansion process is not known and demand estimates will require extrapolation to allow for appropriate stage planning.



5.4 Proposed New Water Infrastructure

5.4.1 General

New water infrastructure and upgrades of the existing water assets will be required as part of the new development for Horsham South. As part of this review, we have identified the key infrastructure elements required to service each of the proposed property lots based on the estimated flow demands, geology and lot arrangements.

Note: we have not completed any hydraulic modelling as part of this review which will inform required water network pressure conditions and potential required upgrades. This will need to be completed to further inform the water network plan.

The infrastructure generally required to serve the new developments will include:

- Water reticulation pipework within residential streets up to each lot boundary
- Water branch pipework through connecting streets
- Water trunk main pipework transferring large flows through main roads.
- Associated maintenance equipment and structures including isolation valves, hydrants, scours, water meters and lot connections.

This review outlines the extent of the proposed service corridors and associated trunk mains required for the area.

Location and layouts of new street to street reticulation networks are not included in this report due to the level of detail of the lot developments known to date. Additionally, modelling and further system optimisation is required to refine the proposed layouts.

5.4.2 New Services Corridors to Transfer Water

When considering the transfer of water each of the lot developments the location of the lot connections and required flow and pressure will need to be taken into account.

It is proposed to develop three (3) new East-West services corridors to include new water trunk main. The East-West rising trunk mains should service all the proposed new residential and commercial developments in Horsham South.

The particular features of the water service corridors comprise:

- The mains should be located within the road reserve where possible and should include all associated assets as required by the WSA.

5.4.3 Upgrade and Expansion of the Existing Assets

As Horsham South Staging Plan continues to be developed, it is likely that the existing assets will require upgrade to account for the additional flow and pressure demands of the proposed new development. The extent of the upgrade works depends on the increase in peak potable water demands for the new development, noting that other areas of Horsham (outside of the Horsham South development area) also continue to grow.

5.5 Future Water Investigations Required

- As Mt Zero WTP expands it may be beneficial to investigate redundancy measures as Horsham develops.
- Source water review and investigation to ascertain the suitability of the current supply for future growth, noting the climate change impact in water production.
- Staging considerations and investigation to understand how the demand forecast will develop with time to help inform staging of assets.



- WTP decentralisation review to understand if a centralised or decentralised system is most beneficial.
- Hydraulic modelling to understand flow and pressure requirements for the system.

6 Wastewater System

6.1 Existing Arrangement

Horsham North and portions of Horsham South comprise a full wastewater network of combined gravity and pumping systems which collect and transfer wastewater to the centralised wastewater treatment plant located in the South-Western area of Horsham South on Pearsons Road.

Horsham South includes a similar wastewater system arrangement with a number of lots located to the South-East utilising onsite septic systems due to a lack of wastewater infrastructure in the area. Some of these properties are farms and industry.

6.1.1 Existing Wastewater Network –Horsham North

The wastewater network in North Horsham comprises a gravity network which discharge into a number of pump stations located throughout the area. These pump stations transfer wastewater from the catchments to a common rising main located in Kenny Road which discharges the majority of the Horsham wastewater into the treatment plant.

The network model for Northern Horsham has not been provided to date and it is not intended to be updated as part of the development works. No further review was undertaken or is proposed of the existing network in Horsham North as it is outside the study area.

6.1.2 Existing Wastewater Network –Horsham South

The network in Horsham South operates in the same fashion as North Horsham with gravity feed drainage connections to lot developments connecting downstream to a number of pump stations located throughout the Horsham South area.

Some pressure wastewater pipes and pump units have been added since 1989 where gravity sewer was deemed infeasible; these connect into the wastewater rising main network towards the WWTP.

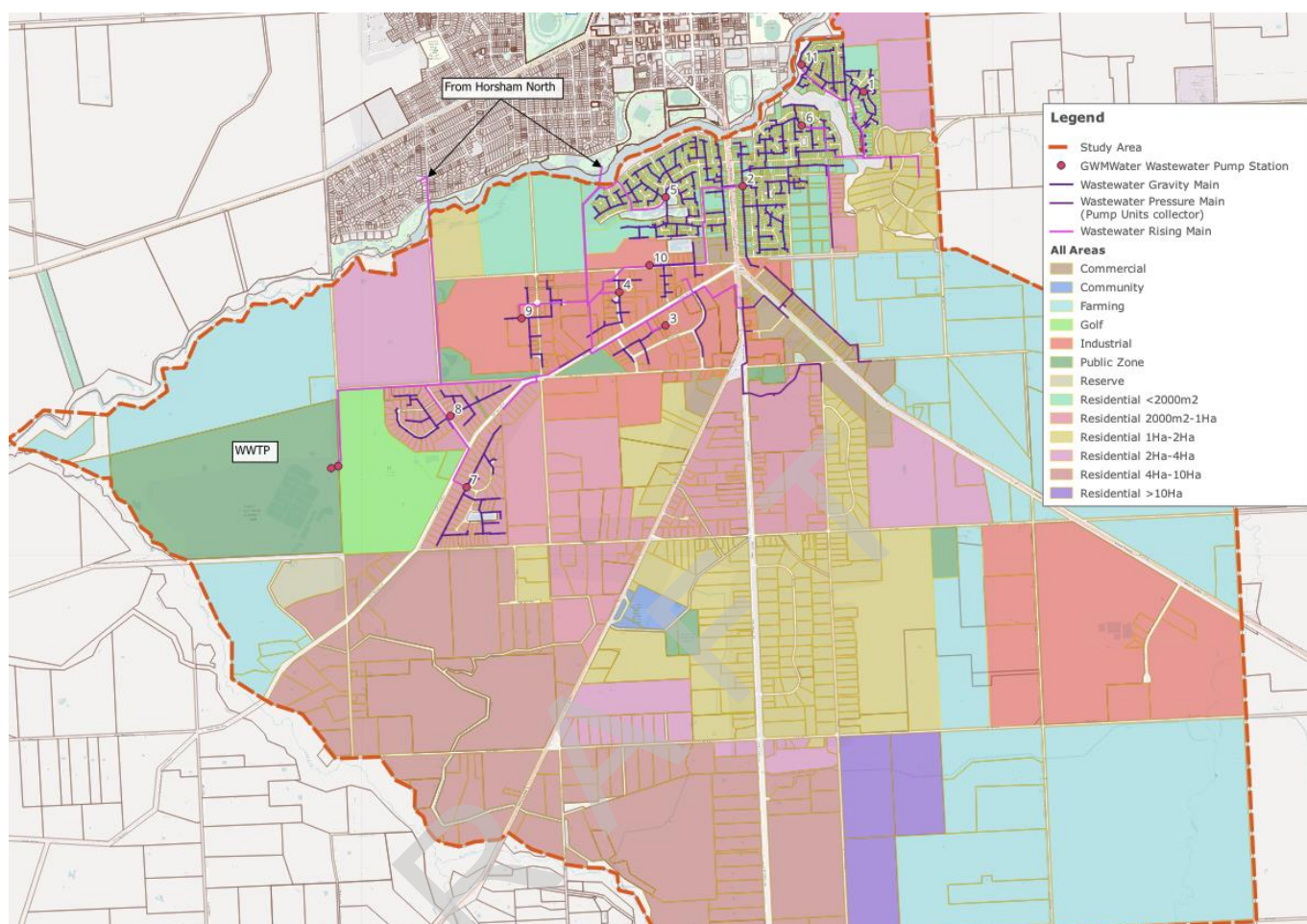


Figure 8 - Existing Wastewater Network

The general configuration of the Horsham South wastewater network can be summarised as follows:

- Gravity wastewater pipes reticulate within the residential streets and discharge at local pumpstations (indicated as pink circles in Fig 2).
- From the wastewater pumpstations, wastewater pressurised rising mains reticulate from the pumpstations into a common trunk rising main prior to discharging into the wastewater treatment plant.
- The rising main in Golf Course Road acts as the main trunk for the Horsham wastewater network and is the primary pipe transferring wastewater to the wastewater pumpstation.

The major pipeline network assets across Horsham South comprise the following:



Table 10 - Wastewater Asset Summary

| Asset | Location | Description | Age/Condition |
|--|---|---|--|
| Gravity reticulation network pipework | Throughout the residential areas in road reserves and easements | Much of the gravity feed pipework (purple line type) services the medium and high density residential areas and some industrial areas. See Figure 8 | <p>Existing infrastructure has been acquired through 1963 to 2022 as per GIS data provided by Horsham Council (See Appendix C – 12/09/2022).</p> <p>There are no records provided of any possible updates made to the reticulation network. GWM Water has not expressed the intention of upgrading or replacing the current network.</p> |
| Wastewater Manholes | Throughout the gravity network | Manholes are typically provided at gravity main junctions | No major issues have been noted by GWM Water. Manholes are regularly maintained |
| Rising Mains (Shown in purple) | Main roads and easements | Rising mains transfer wastewater from pumpstation to other main pumpstations | <p>Existing infrastructure has been acquired through 1963 to 2022 as per GIS data provided by Horsham Council (See Appendix C – 12/09/2022).</p> <p>There are no records provided of any possible updates made to the reticulation network. GWM Water has not expressed the intention of upgrading or replacing the current network.</p> |
| Trunk Rising Main | Golf Course Road / Kenny Road | The trunk rising main transfers all wastewater from Horsham to the wastewater treatment plant | Existing asset is understood to be within design life |
| Pressure Wastewater Mains | South of Stallwell Road and Old Hamilton Road | Some areas comprise private pumping and rising main systems which discharge into local GWM Water rising main | Installed 1989-2022 - some private pressure wastewater mains installed in 1989 are now GWMWater assets. All assets within design life |



6.1.3 Existing GWM Water Pumpstations

There are eleven (11) wastewater pump stations located across Horsham South which are owned and operated by GWM in open/public spaces as per network description by GWM Water in the meeting on 07/09/2022. The major pumpstations across Horsham South are summarised in Table 11:

Note: Finding all pump stations duty points and current operational data is a next step towards a more detailed design.

Table 11 – Major Pumpstation Layout

| No | Location | Description |
|----|---------------------|---|
| 1 | Sawyer Court | Serves residential, discharges into the gravity network |
| 2 | Citrus Avenue | Main pump station collection central and Eastern areas of Horsham South |
| 3 | Kendal Drive | Serves industrial area, discharges into the gravity network |
| 4 | King Drive | Serves industrial area, discharges into the gravity network |
| 5 | Mc Tavish Boulevard | Serves Suburban Residential Area. Main pump station collection central and Western areas of Horsham South |
| 6 | Watson Court | Serves residential, discharges into the gravity network |
| 7 | Colonial Drive | Serves to a small residential area, discharges into the gravity network |
| 8 | Velthuis Drive | Serves to a small residential area, discharges into the gravity network |
| 9 | Ballinger Street | Serves industrial area, discharges into the gravity network |
| 10 | Plumpton Road | Serves industrial area, located on the main trunk, acting as a boosting pump |
| 11 | Waterlink Esplanade | Serves residential, discharges into the gravity network |



6.1.4 Existing Pump Units

The Horsham South wastewater network comprises more than 40 pressure wastewater pump units that pump into the existing wastewater rising mains. These units are owned and operated by GWM Water for residential properties, whereas commercial/industrial properties own and operate their own units.

6.1.5 Wastewater Treatment Plant

The existing Wastewater Treatment Plant (WWTP) is a centralised system and is located on the South-Western side of Horsham South on Pearson Road, designed to treat an average daily flow of 7 ML/d; the WWTP relies on physical and biological treatment processes. Components include inlet screens, an oxidation ditch, two clarifiers, two maturation lagoons, three sludge lagoons, and a 30 ML storage. Recycled water is used off-site (adjacent golf course, or transferred to an agricultural research site), and on-site (irrigation of up to 40 Ha)



Figure 9 - Horsham WWTP Aerial view



6.2 Current Wastewater Issues and Concerns

Concerns and issues noted in existing documentation provided by Mesh (Horsham South – Background Report 2019 – Mesh) and raised by GWM Water during the development of this review are summarised below. GWM Water have advised that the existing wastewater system has been expanding in an “as needed” basis to maintain the service in the developing sectors of Horsham. This has resulted in many areas to the South and South-East of Horsham to be developed with no access to a wastewater connection. In this case onsite wastewater treatment has been adopted. GWM Water have noted that where practical, in future these lots should be provided with a new wastewater connection and the onsite treatment system decommissioned.

6.2.1 Pipeline Network

Issues raised regarding the wastewater pipeline network include:

- New lots which have been zoned a long distance away from the existing wastewater treatment plant have required the implementation of onsite septic tanks and treatment. These systems will require decommissioning and connection to the existing wastewater network as part of the re-development works.

6.2.2 Pumping Systems

Issues raised regarding the wastewater pumping systems include:

- The existing pump units across the South of Horsham are located on private property which makes access for maintenance and operation difficult. This has impacts on managing pressures and flows as required in the network. The new development should identify opportunities to modify these existing arrangements to allow for improved access and control, e.g. inclusion of easements.

Additionally, it may be useful to develop minimum access and control requirement standards for third party built and located pumpstations/pump units.

- It has been advised that currently, the existing common rising main is subject to compromised performance with high head loss and high flows when pumps are running simultaneously. Additionally, this results in pumps running below duty point and potentially outside their peak performance. It is understood the system is not currently subject to any outages or disruptions because of this; however, current conditions of the wastewater network assets can impact the feasibility of connecting developing areas to existing mains. Additional system hydraulic investigations will be required to understand the required upgrade works to rectify this concern.

6.2.3 Wastewater Treatment Plant

Issues raised regarding the wastewater treatment include:

- Community complaints have been reported regarding the WWTP odour, which has led to GWM Water to initiate a review of the processes and capacity of the assets within the WWTP area. A “high-level” assessment of the capacity has indicated that the plant may be approaching its peak capacity in approximately 5 to 10 years. It is GWM Water’s intention is to upgrade and/or renew the plant as needed, as well as implement new infrastructure to reduce odours and increase the buffer distance.



6.3 Wastewater Demands

6.3.1 Demand Estimate

As presented in section 5.3.1, considering the wastewater network requirements are different from the water system, wastewater production has been calculated to be 11.20ML/d. This considers servicing residential areas of less than 1 Ha, commercial and industrial sectors, as well as 60 lots with varying land of use: Residential 4Ha-10Ha (1 lot), Residential 2Ha-4Ha (19 lots), Residential 1Ha-2Ha (157 future lots), Public Zone (1 lot) and farming (5 lots). These additional have been included in the demand requirement due to their proximity to new connection locations.

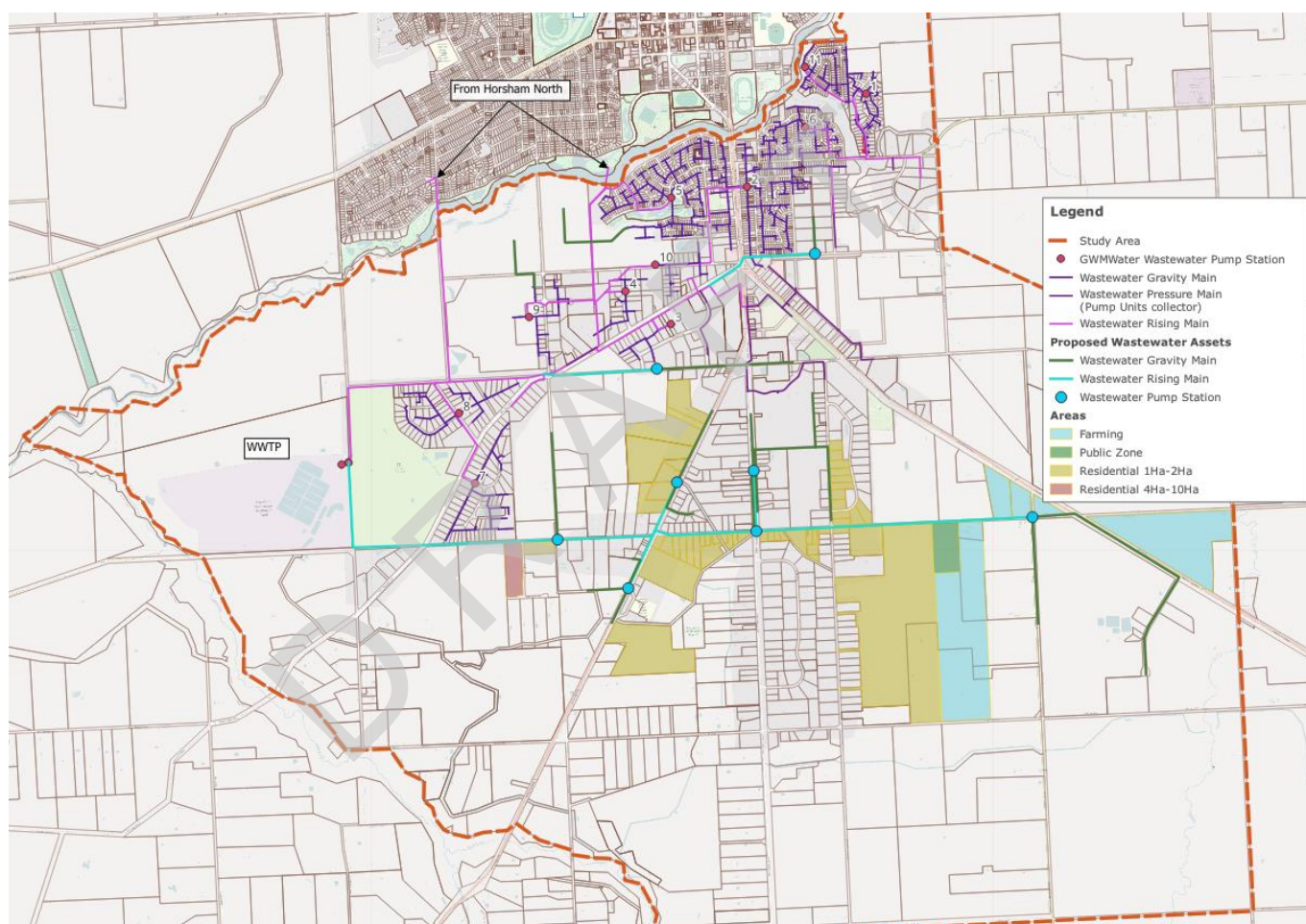


Figure 10 - Additional allotments in proximity to the proposed wastewater mains

A full demand estimate breakdown is provided in Appendix B of this report.

Note these demand estimates should be reviewed further as the project progresses until all parties are in agreement with the final values.



6.4 Proposed Wastewater Servicing Concept Plan

6.4.1 General

New wastewater infrastructure and upgrades of the existing wastewater assets will be required as part of the new development for Horsham South. The key infrastructure elements required to service each of the proposed property lots have been based on the estimated demands, site topography and lot arrangements.

The infrastructure generally required to serve the new developments will include:

- Wastewater reticulation gravity pipework within residential streets up to each lot boundary, where possible.
- Wastewater branch pipework through connecting streets.
- Wastewater trunk main pipework transferring large flows along main roads to the WWTP.
- Associated maintenance equipment and structures including manholes, inspection points and lot connections.
- Wastewater pumpstations and associated equipment and infrastructure where required.

This review outlines the extent of the proposed service corridors and associated trunk mains required for the area. Potential locations of the decentralised pumpstations have been identified to allow for the transfer of wastewater to the WWTP. As noted in previous sections of this report, this section assumes that the existing wastewater pumpstations will remain and that the system as a whole will continue to be a centralised wastewater system.

Location and layouts of new street to street reticulation networks are not included in this report due to the level of detail of the lot developments known to date. Additionally, modelling and further system optimisation is required to refine the proposed layouts.

6.4.2 New Services Corridors (Wastewater Rising/Gravity Main Trunk Mains) To Transfer Wastewater

Location of the lot connections predicted demands and site topography have been considered when selecting new services and wastewater corridors for the new development.

It is proposed to develop two (2) new East-West services corridors comprising a common wastewater rising main along, Holes/Plozzas Road and Osborne Road.

It is proposed that the new service corridors will comprise other critical services such as water, electrical as well as new wastewater rising mains, which will transfer bulk wastewater from the catchment areas to the existing WWTP.

The particular features of the wastewater service corridors comprise:

- The customer connections will gravity feed wastewater mains as far as reasonably practicable, which then will be pumped to a combined rising main.
- The mains shall run centrally within the road reserve where possible and shall include all required associated equipment such as manholes and inspections points at junctions as required by WSA.
- They shall interconnect strategically placed wastewater pumping stations along the alignments in a daisy chain style arrangement.

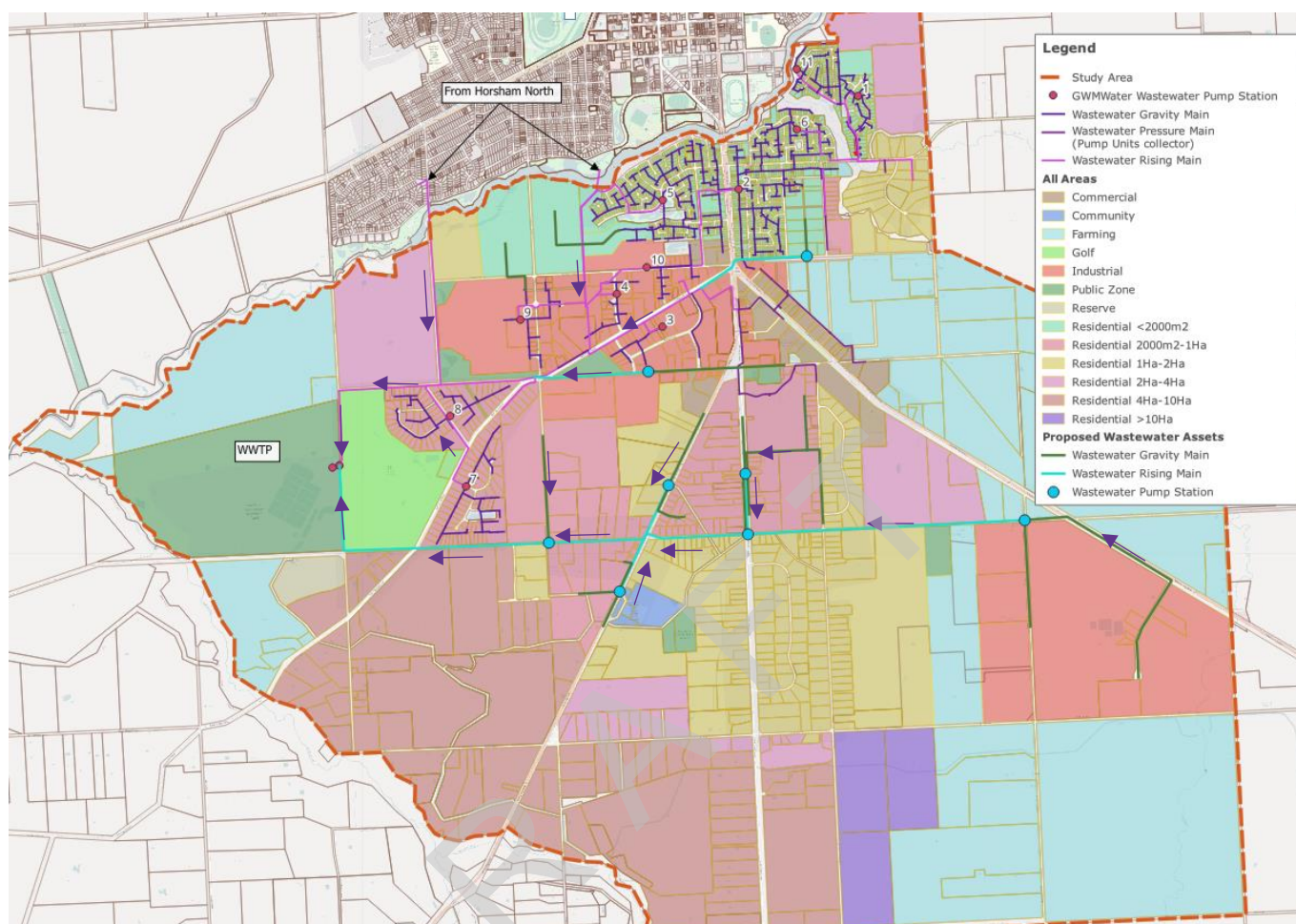


Figure 11 - Layout of Proposed Wastewater Network

Preliminary sizing of the rising main, as well as wastewater assets shall occur upon agreement of the serviced areas and final demand calculations.

6.4.3 New Wastewater Pumping Stations to Transfer Wastewater

New wastewater pumping stations will be provided in strategic locations ensuring new gravity pipework networks are extended as far as reasonably practicable and in locations to ensure maximum catchment coverage.

Pumping stations have been located primarily based on coverage efficiency and topographical limitations where a gravity drainage system is not feasible.

Importantly to note further design considerations are to be taken into account prior to finalising asset layouts and locations, these include but are not limited to:

- Location around flood prone areas
- Spare capacity allowances
- Provision for emergency storage
- Provision for connection and control to an existing or new SCADA system
- Overflow provisions and locations
- Equipment types and materials



6.4.4 Upgrade Works to Existing Pumpstations and Pipework Assets to Manage Increased Demands

The proposed new development of Horsham South includes new residential and commercial spaces adjacent to existing commercial areas South of the Wimmera River. These new lots will require new wastewater infrastructure connections to the existing gravity and pressure wastewater networks within the area. These additional demands will impact downstream pipework and pumping station assets. It is likely all downstream pumpstations of the new developments will require upgrade to allow for the additional demand. It is also likely the existing pipework will require upsizing or duplication to allow for the additional flows.

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6.4.5 Wastewater Treatment Plant Upgrade Works to Manage Increased Demands

The existing Horsham WWTP will require upgrades to increase the plant's capacity to allow for the future demand increases. As mentioned, at this stage it is assumed these upgrade works will occur at the existing site and that a decentralised system with new site locations will not be adopted.

Considerations regarding the required upgrade works will include:

- The upgrade works will likely have to rely on a fully mechanical system considering the magnitude of load expected from the development.
- The works will have to be appropriately staged to allow for consistent growth
- The asset area requirements will require assessment to ensure suitable clearances of the proposed new WWTP layout to existing and future assets and lot boundaries.
- Associated works such as electrical supply and communications supply will require consideration ensuring supply is available and appropriate.

6.5 Future Wastewater Investigations Required

Further consideration of the following points needs to be undertaken, in conjunction with GWM Water:

- Staging considerations and investigation to understand how the demand forecast will develop with time to help inform staging of assets.
- WTP decentralisation review to understand if a centralised or decentralised system is most beneficial.
- Hydraulic modelling to understand flow requirements for the system.
- Determination of pump station and rising main sizing and locations.



Appendix A – Services Layout Plans

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Notes:

- 1. This map presents the Horsham South land parcel zoning plan and the existing potable water and rural networks.
- 2. The presented zoning plan has been assumed from the most up-to-date Structure Plan provided by Mesh (240806_HSSP_Draft Structure Plan_v9).

Continuation into
Horsham North

Morson Potable Water
Pump Station and
Storage Tank

WWTP

Legend

- Study Area
- Reticulation Network
- Mt. Zero Trunk Main
- Rural Water Network
- All Areas**
- Commercial
- Community
- Farming
- Golf
- Industrial
- Public Zone
- Reserve
- Residential <2000m2
- Residential 2000m2-1Ha
- Residential 1Ha-2Ha
- Residential 2Ha-4Ha
- Residential 4Ha-10Ha
- Residential >10Ha



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**HORSHAM SOUTH STRUCTURE PLAN
General Layout
Zoning and Existing Water Services**

Figure 1

Notes:

This map identifies the land parcels in Horsham South which already comprise access to the potable water network and do not require additional water services infrastructure up to the lot boundary.

It is assumed that access via a single facing of the land parcel is sufficient for this planning stage.

Note a capacity assessment of the existing potable water mains to serve the proposed land parcels is yet to be completed.

Continuation into Horsham North

Morson Potable Water Pump Station and Storage Tank

WWTP

Legend

- Study Area
- Ex. Reticulation Water Network
- Mt. Zero Trunk Main

All Areas

- Commercial
- Community
- Farming
- Golf
- Industrial
- Public Zone
- Residential <2000m2
- Residential 2000m2-1Ha
- Residential 1Ha-2Ha
- Residential 2Ha-4Ha
- Residential 4Ha-10Ha



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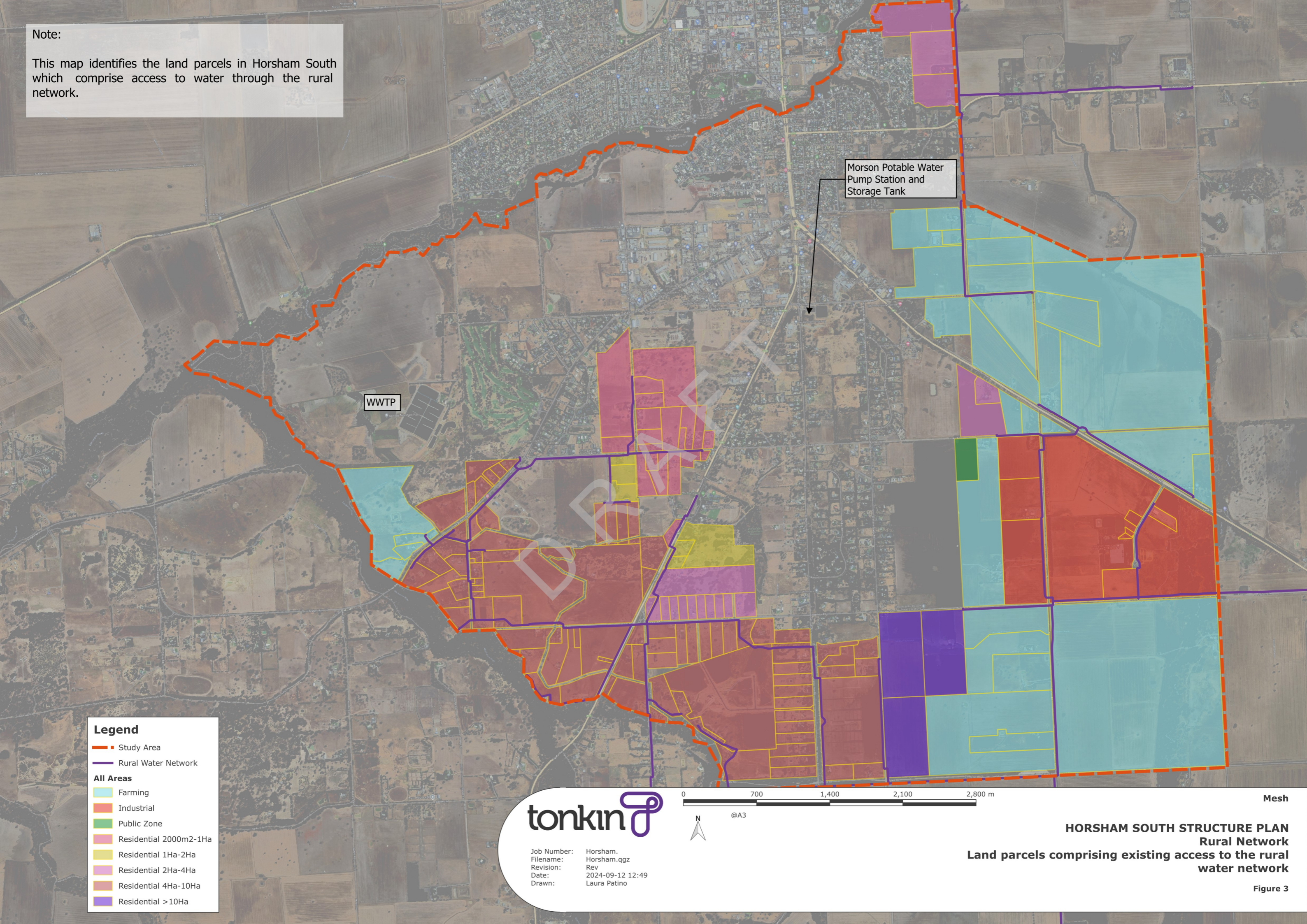
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**HORSHAM SOUTH STRUCTURE PLAN
Potable Water Network
Land parcels comprising existing access to the potable
water network**

Figure 2

Note:
 This map identifies the land parcels in Horsham South which comprise access to water through the rural network.



Morson Potable Water Pump Station and Storage Tank

WWTP

Legend

- - - Study Area
- Rural Water Network

All Areas

- Farming
- Industrial
- Public Zone
- Residential 2000m²-1Ha
- Residential 1Ha-2Ha
- Residential 2Ha-4Ha
- Residential 4Ha-10Ha
- Residential >10Ha

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HORSHAM SOUTH STRUCTURE PLAN
Rural Network
Land parcels comprising existing access to the rural water network

Figure 3

Notes:

This map identifies the potable water network extensions required to provide the new land parcels with access to the potable water network.

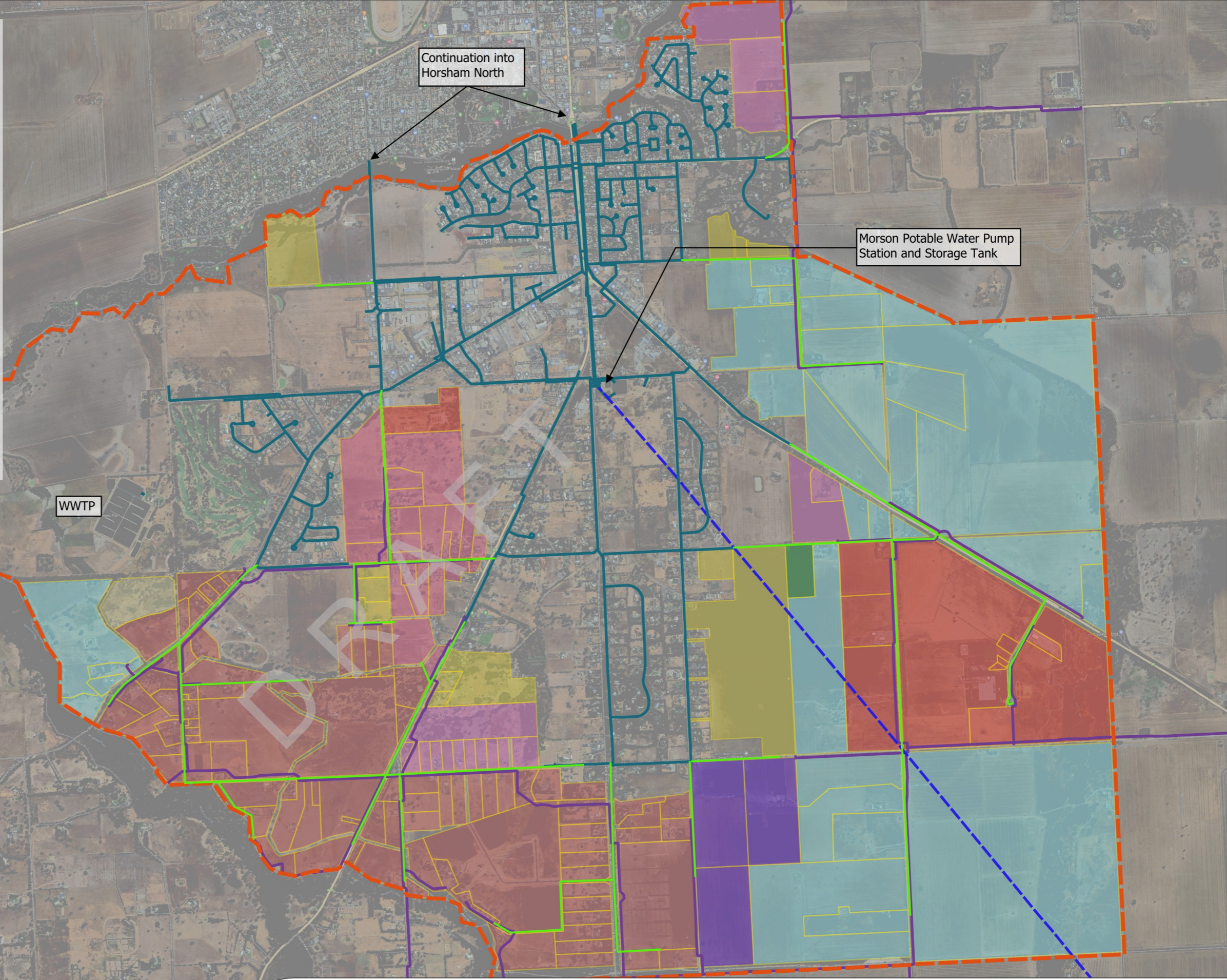
It is assumed that access via a single facing of the land parcel is sufficient for this planning stage.

It is noted that this map assumes that a potable water connection will be available to all new allotments. This will need to be reviewed once the Structure Plan has been finalised, including the proposed road network and drainage corridors/assets

Should further sub-division of the indicated land parcels occur, the network will require extension into those sub-developments.

Land parcels which already comprise access to the potable water network are not shown on this map and are shown in Figures 2 and 3.

This map does not consider existing mains which may require upgrade.



Legend

- - - Study Area
- Proposed Potable Water Network
- Ex. Potable Water Reticulation Network
- - - Mt. Zero Trunk Main
- Ex. Rural Water Network

All Areas

- Farming
- Industrial
- Public Zone
- Reserve
- Residential 2000m²-1Ha
- Residential 1Ha-2Ha
- Residential 2Ha-4Ha
- Residential 4Ha-10Ha
- Residential >10Ha



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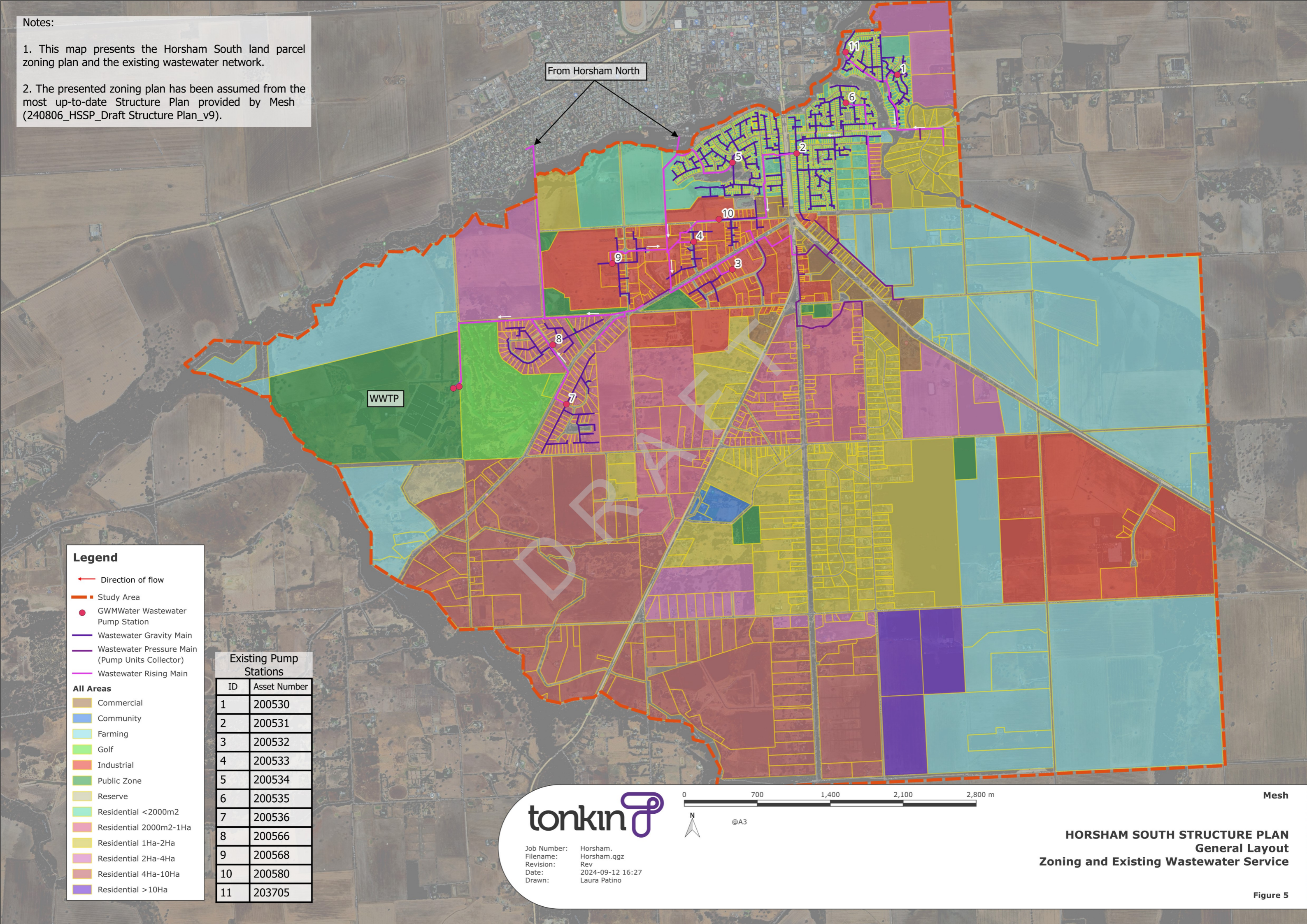
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HORSHAM SOUTH STRUCTURE PLAN
Water and Rural Networks
Extension of the potable water network

Figure 4

Notes:

1. This map presents the Horsham South land parcel zoning plan and the existing wastewater network.
2. The presented zoning plan has been assumed from the most up-to-date Structure Plan provided by Mesh (240806_HSSP_Draft Structure Plan_v9).



Legend

- Direction of flow
- Study Area
- GWMWater Wastewater Pump Station
- Wastewater Gravity Main
- Wastewater Pressure Main (Pump Units Collector)
- Wastewater Rising Main

- All Areas**
- Commercial
 - Community
 - Farming
 - Golf
 - Industrial
 - Public Zone
 - Reserve
 - Residential <2000m2
 - Residential 2000m2-1Ha
 - Residential 1Ha-2Ha
 - Residential 2Ha-4Ha
 - Residential 4Ha-10Ha
 - Residential >10Ha

| Existing Pump Stations | |
|------------------------|--------------|
| ID | Asset Number |
| 1 | 200530 |
| 2 | 200531 |
| 3 | 200532 |
| 4 | 200533 |
| 5 | 200534 |
| 6 | 200535 |
| 7 | 200536 |
| 8 | 200566 |
| 9 | 200568 |
| 10 | 200580 |
| 11 | 203705 |



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**HORSHAM SOUTH STRUCTURE PLAN
 General Layout
 Zoning and Existing Wastewater Service**

Figure 5

Notes:

This map identifies the land parcels in Horsham South which already comprise access to the wastewater network and have not been excluded in figure 7.

It is assumed that access via a single facing of the land parcel is sufficient for this planning stage.

Note a capacity of the existing wastewater pumpstations and rising mains to serve the proposed land parcels is yet to be completed.

From Horsham North

Legend

- ← Direction of flow
- Study Area
- Gravity Wastewater Mains
- Pressure Wastewater Mains (Pressure Units Collector)
- Rising Wastewater Main
- GWMWater Wastewater Pump Station

All Areas

- Commercial
- Farming
- Golf
- Industrial
- Public Zone
- Residential <2000m2
- Residential 2000m2-1Ha
- Residential 1Ha-2Ha

| Existing Pump Stations | |
|------------------------|--------------|
| ID | Asset Number |
| 1 | 200530 |
| 2 | 200531 |
| 3 | 200532 |
| 4 | 200533 |
| 5 | 200534 |
| 6 | 200535 |
| 7 | 200536 |
| 8 | 200566 |
| 9 | 200568 |
| 10 | 200580 |
| 11 | 203705 |



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**HORSHAM SOUTH STRUCTURE PLAN
 Wastewater Network
 Land parcels comprising existing access to the
 wastewater network**

Figure 6

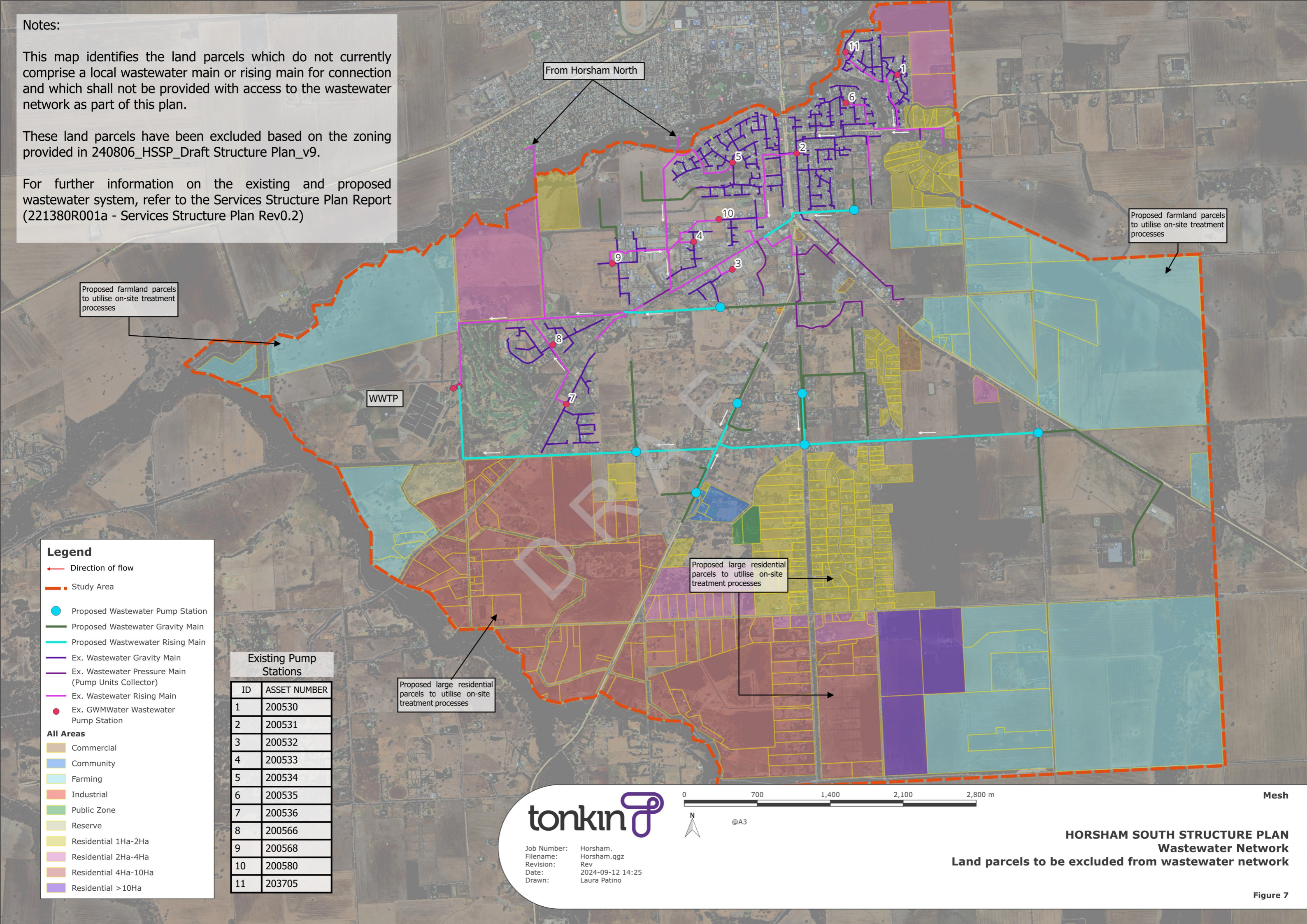
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Notes:

This map identifies the land parcels which do not currently comprise a local wastewater main or rising main for connection and which shall not be provided with access to the wastewater network as part of this plan.

These land parcels have been excluded based on the zoning provided in 240806_HSSP_Draft Structure Plan_v9.

For further information on the existing and proposed wastewater system, refer to the Services Structure Plan Report (221380R001a - Services Structure Plan Rev0.2)



Legend

- Direction of flow
- Study Area
- Proposed Wastewater Pump Station
- Proposed Wastewater Gravity Main
- Proposed Wastewater Rising Main
- Ex. Wastewater Gravity Main
- Ex. Wastewater Pressure Main (Pump Units Collector)
- Ex. Wastewater Rising Main
- Ex. GWMWater Wastewater Pump Station

All Areas

- Commercial
- Community
- Farming
- Industrial
- Public Zone
- Reserve
- Residential 1Ha-2Ha
- Residential 2Ha-4Ha
- Residential 4Ha-10Ha
- Residential >10Ha

| Existing Pump Stations | |
|------------------------|--------------|
| ID | ASSET NUMBER |
| 1 | 200530 |
| 2 | 200531 |
| 3 | 200532 |
| 4 | 200533 |
| 5 | 200534 |
| 6 | 200535 |
| 7 | 200536 |
| 8 | 200566 |
| 9 | 200568 |
| 10 | 200580 |
| 11 | 203705 |

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**HORSHAM SOUTH STRUCTURE PLAN
 Wastewater Network
 Land parcels to be excluded from wastewater network**

Figure 7

Notes:

This map identifies the wastewater network extensions required to provide the new land parcels with access to the wastewater network.

It is assumed that access via a single facing of the land parcel is sufficient for this planning stage.

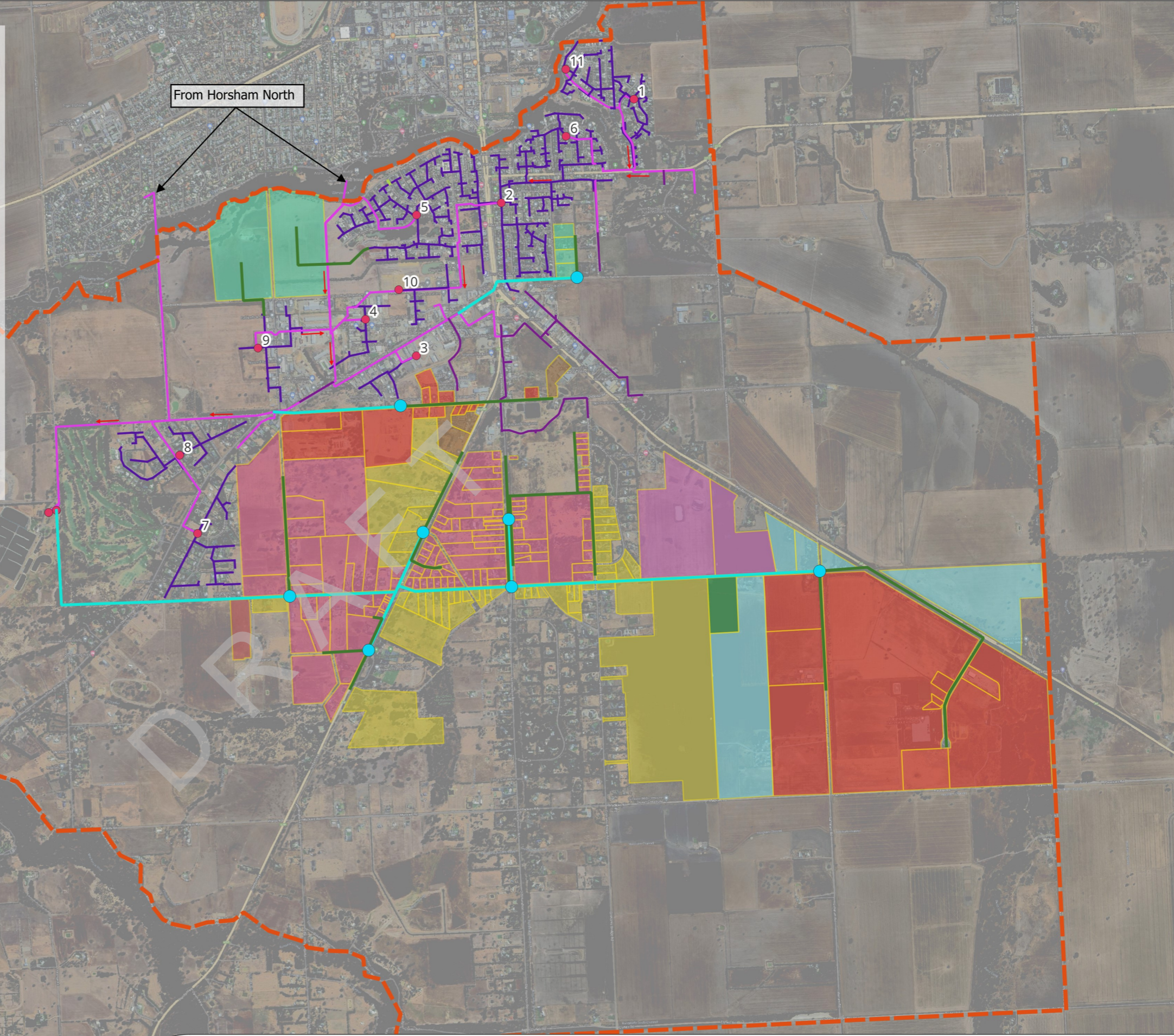
These land parcels have been included based on the zoning provided in 240806_HSSP_Draft Structure Plan_v9. The information here contained will need to be reviewed once the Structure Plan has been finalised, including the proposed road network and drainage corridors/assets

Should further sub-division of the indicated land parcels occur, the network will require extension into those sub-developments

Land parcels which already comprise access to the wastewater network are not shown on this map

This map does not consider existing pumpstations which may require upgrade

Proposed location of new pumpstations is indicative and shown for information only. It is proposed some parcels will have access to a street rising main and others will comprise a gravity connection.



Legend

- Direction of flow
- Study Area
- Proposed Wastewater Pump Station
- Proposed Wastewater Gravity Main
- Proposed Wastewater Rising Main
- Ex. Wastewater Gravity Main
- Ex. Wastewater Pressure Main (Pump Units Collector)
- Ex. Wastewater Rising Main
- GWMWater Wastewater Pump Station

- All Areas**
- Commercial
 - Farming
 - Industrial
 - Public Zone
 - Residential <2000m2
 - Residential 2000m2-1Ha
 - Residential 1Ha-2Ha
 - Residential 2Ha-4Ha
 - Residential 4Ha-10Ha

| Existing Pump Stations | |
|------------------------|--------------|
| ID | Asset Number |
| 1 | 200530 |
| 2 | 200531 |
| 3 | 200532 |
| 4 | 200533 |
| 5 | 200534 |
| 6 | 200535 |
| 7 | 200536 |
| 8 | 200566 |
| 9 | 200568 |
| 10 | 200580 |
| 11 | 203705 |



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**HORSHAM SOUTH STRUCTURE PLAN
 Wastewater Network
 Extension of the wastewater network**

Figure 8



Appendix B – Demand Estimates

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Water Demand Calculations

Notes:

1. Demand calculations cover new development of the Horsham South Strategic Plan. Existing connections have not been included.
2. Demand calculations are based on the Gravity Sewerage Code of Australia (WSA 02). Section 3, Appendices B and C.
2. EP values are based on 2021 Census (Density 2.3 ppl/household)

| EQUIVALENT PERSON - BASED ON WSA 02 | From GIS | | (EP per Unit)* # Lots | |
|-------------------------------------|-------------|-------------|-----------------------|--------------|
| | Residential | EP per Unit | Number of Lots | Total |
| <2000m2 | | 1.73 | 0 | 0 |
| 2000m2-1Ha | | 0.49 | 215 | 106 |
| 1Ha-2Ha | | 0.17 | 113 | 19 |
| 2Ha-4Ha | | 0.08 | 45 | 4 |
| 4Ha-10Ha | | 0.04 | 118 | 4 |
| >10Ha | | 0.02 | 9 | 0 |
| Total Residential | | - | 500 | 134 |
| Commercial/Special Cases | | | | |
| Commercial | | 30 | 0 | 0 |
| Community | | 2.3 | 0 | 0 |
| Farming | | 2.3 | 28 | 64 |
| Special Use/Golf courses | | 10 | 0 | 0 |
| Industrial | | 20 | 238 | 4,760 |
| Public Zone | | 2.3 | 1 | 2 |
| Reserve | | 2.3 | 1 | 2 |
| Total | - | | 768 | 4,962 |

| Water Demand | kL/EP/d | kL/d | Notes |
|---------------------------|-------------|------------------|---|
| Residential | 1.09 | 145.23 | Based on typical water consumption provided by GWM Water |
| Commercial | 0.52 | 0.00 | Based on typical water consumption provided by GWM Water |
| Community | 1.2 | 0.00 | Assumed based on one water connection per building for normal use only. Assume irrigation from alternative source |
| Farming | 1.09 | 70.20 | Assumed based on one water connection for residential purposes |
| Special Use/Golf courses | 0.52 | 0.00 | Assumed based on one water connection per building for normal use only. Assume irrigation from alternative source |
| Industrial | 2.17 | 10347.83 | Based on typical water consumption provided by GWM Water |
| Public Zone | 1.2 | 2.76 | Assumed based on one water connection per building for normal use only. Assume irrigation from alternative source |
| Reserve | 0.52 | 1.20 | Assumed based on one water connection per building for normal use only. Assume irrigation from alternative source |
| Total Water Demand | kL/d | 10,567.20 | |
| | ML/d | 10.57 | |

Wastewater Demand Calculations

Notes:

1. Demand calculations cover new development of the Horsham South Strategic Plan. Existing connections have not been included.
2. Demand calculations are based on the Gravity Sewerage Code of Australia (WSA 02). Section 3, Appendices B and C.
2. EP values are based on 2021 Census (Density 2.3 pp/household) and the use of alternatives sources of water in areas as public space and special use

| EQUIVALENT PERSON - BASED ON WSA 02 | | | (EP per Unit)* # Lots |
|-------------------------------------|-------------|----------------|-----------------------|
| Residential | EP per Unit | Number of Lots | Total |
| <2000m2 | 1.73 | 326 | 562 |
| 2000m2-1Ha | 0.49 | 401 | 198 |
| 1Ha-2Ha | 0.17 | 157 | 27 |
| 2Ha-4Ha | 0.08 | 19 | 2 |
| 4Ha-10Ha | 0.04 | 1 | 0 |
| >10Ha | 0.02 | 0 | 0 |
| Total Residential | - | 904 | 789 |
| Commercial/Special Cases | | | |
| Commercial | 20 | 9 | 180 |
| Community | 2.3 | 0 | 0 |
| Farming | 2.3 | 5 | 12 |
| Special Use/Golf courses | 10 | 0 | 0 |
| Industrial | 20 | 270 | 5400 |
| Public Zone | 2.3 | 1 | 2 |
| Reserve | 2.3 | 0 | 0 |
| Total | - | 1189 | 6383 |

| Water Demand | kl/EP/d | kl/d | Notes |
|---------------------------|-------------|------------------|---|
| Residential | 1.09 | 857.31 | Based on typical water consumption provided by GWM Water |
| Commercial | 0.52 | 93.93 | Based on typical water consumption provided by GWM Water |
| Community | 1.2 | 0.00 | Assumed based on one water connection per building for normal use only. Assume irrigation from alternative source |
| Farming | 1.09 | 12.54 | Assumed based on one water connection for residential purposes |
| Special Use/Golf courses | 0.52 | 0.00 | Assumed based on one water connection per |
| Industrial | 2.17 | 11739.13 | Based on typical water consumption provided by GWM Water |
| Public Zone | 1.2 | 2.76 | Assumed based on one water connection per building for normal use only. Assume |
| Reserve | 0.52 | 0.00 | irrigation from alternative source |
| Total Water Demand | kl/d | 12,705.65 | |
| | ML/d | 12.71 | |

| FLOW ESTIMATION FOR UNDEVELOPED AREAS - BASED ON WSA 02 | | | Notes |
|---|-------------|--------------|---|
| Design flow (ADWF+GWI+RDI) | ML/d | 11.20 | Design flow based on ADWF for a more representative performance of the system |
| Design flow (PDWF+GWI+RDI) | ML/d | 8.25 | Design flow based on PDWF for peak dry weather |

| Average Wastewater contributions (ADWF) | Factor | KL/d | |
|---|--------|-----------------|---|
| Residential | 0.60 | 514.38 | Based on typical wastewater contribution info |
| Commercial | 0.60 | 56.35 | Based on typical wastewater contribution info |
| Community | 0.50 | 0.00 | Assumed based on one water connection per |
| Farming | 0.60 | 7.52 | Assumed based on one water connection for |
| Special Use/Golf courses | 0.50 | 0.00 | Assumed based on one water connection per |
| Industrial | 0.80 | 9,391.30 | Based on typical wastewater contribution info |
| Public Zone | 0.50 | 1.38 | Assumed based on one water connection per |
| Reserve | 0.50 | 0.00 | building for normal use only. Assume |
| Total | - | 9,970.94 | |

| Peak Dry Weather Flow (PDWF) | ML/d | KL/d | |
|------------------------------|----------------|-----------------|---|
| | KL/EP/d | 7,060.96 | |
| Residential | 0.18 | 152.82 | Based on typical wastewater contribution info |
| Commercial | 0.13 | 11.84 | Based on typical wastewater contribution info |
| Community | 0.29 | 0.00 | Assumed based on one water connection per |
| Farming | 0.41 | 5.14 | Assumed based on one water connection for |
| Special Use/Golf courses | 0.29 | 0.00 | Assumed based on one water connection per |
| Industrial | 0.59 | 6,890.36 | Based on typical wastewater contribution info |
| Public Zone | 0.29 | 0.80 | Assumed based on one water connection per |
| Reserve | 0.29 | 0.00 | building for normal use only. Assume |

| Average daily sanitary flow (ADWF) | ML/d | KL/d | Notes |
|------------------------------------|------|-------------|-------------------------------|
| | | 7.00 | Based on ADWF provided by GWM |

| Peak Wet Weather Flow (PWWF) | ML/d | KL/d | |
|------------------------------|---------------|-------------|------------------------------------|
| PWWF=PDWF*Factor | Factor | KL/d | |
| Residential | 3 | 458.47 | Factor 3 assumed based on GWM data |
| Commercial | 3 | 35.52 | |
| Community | 3 | 0.00 | |
| Farming | 3 | 15.42 | |
| Special Use/Golf courses | 3 | 0.00 | |
| Industrial | 3 | 20671.08 | |
| Public Zone | 3 | 2.40 | |
| Reserve | 3 | 0.00 | |

| | | | |
|-------------------|----|----------|--|
| Equivalent Person | EP | 6,382.52 | |
| Area | Ha | 699.42 | As per WSA02, 30% assumed to be public space |

| Groundwater Ingress (GWI) - | ML/d | KL/d | |
|---|---------------|-----------------|---|
| GWI = 0.025 * Area (Ha) * PortionWet | Factor | 1,057.52 | |
| | L/s | 12.240 | |
| Portion Wet | Factor | 0.700 | PortionWet is the portion of the planned pipe |

| Peak (rainfall dependent) inflow and infiltration (RDI) | RDI = | ML/d | KL/d | L/s | |
|---|---------|-------------|---------------|-------------|---|
| 0.028 * Aeff * C * I | | 0.17 | 171.39 | 1.98 | |
| Total Effective area (Aeff) | Ha | 21.48 | | | |
| Effective area Residential (AeffR) | Ha | 13.00 | | | |
| Density | (EP/Ha) | 0.08 | | | |
| Effective area Commercial (AeffC) | Ha | 8.49 | | | |
| Portion Impervious | - | 0.20 | | | |
| III leakage severity coefficient (C) | - | 0.40 | | | C will lie in the range from 0.4 to 1.6 |
| Rainfall intensity (I) | - | 8.24 | | | |
| 1 hour duration rainfall intensity at the location, for an average recurrence interval of 2 years. (I1,2) | - | 19.1 | | | Taking Ballarat as reference |
| FactorSize | - | 0.71 | | | |
| FactorContainment | - | 0.61 | | | |