

North Harbour Water Supply – Farry Road Capacity Assessment

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Prepared for:

North Harbour Holdings

Prepared by:

Liam White

Project/File: 300203789



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Checked and approved by RPEQ

Name: **Phillip Hall 23017**

Signature:



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Prepared by:

Liam White

Liam White

Reviewed by:

Phillip Hall

Phillip Hall

Approved by:

Phillip Hall

Phillip Hall



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1 Introduction

North Harbour is a progressing PDA development located within Moreton Bay. Water supply and sewerage infrastructure strategies to service the development have been approved by Unitywater and development is progressing in accordance with these plans. Development is currently endorsed by Unitywater to 15,741 EP.

The Marina Precinct and Residential East Footprint of North Harbour will be developed as one of the last North Harbour precincts. A section of the Residential East Footprint at the top of Farry Road has been identified as an option for early release. The masterplan strategy proposes a DN300 distribution main from Buckley Road to the service the Marina Precinct and Farry Road development. The purpose of this report is to establish the number of lots in the Farry Road development that can be supplied from the existing 100 mm diameter main before the proposed DN300 distribution main is required to service this precinct (as per the masterplan). This report will also establish the internal network sizing plan of the Farry Road development that is capable of servicing peak hour and fire flow demands.

1.1 Background

The existing and endorsed water supply master planning report for North Harbour is as follows:

- North Harbour Water Supply Master Plan Update – Final Updated (Stantec; June 2023)

Background related to the existing servicing strategies can be identified in the listed report.

2 Population and Demand Assessment

The demand in the Marina PDA has been calculated based on the SEQ Water and Sewerage Supply Design Codes, which is as follows:

- Water Average Day Demand (AD) = 230 L/EP/d
- Estimated Non-Revenue Water (NRW) = 30 L/EP/d
- PD/AD Peaking Factor = 2
- PH/AD Peaking Factor = 4

The Marina Precinct and Residential East development in the existing master planning consisted of 1,638 residential lots at a ratio of 2.6 EP/lot as well as two Marina Centres, one centre being 10.5 hectares (Ha) at 67 EP/Ha and the other centre being 15 hectares at 30 EP/Ha. This development is indicated in Figure 2-1 below which has been taken from the Water Supply Master Plan.

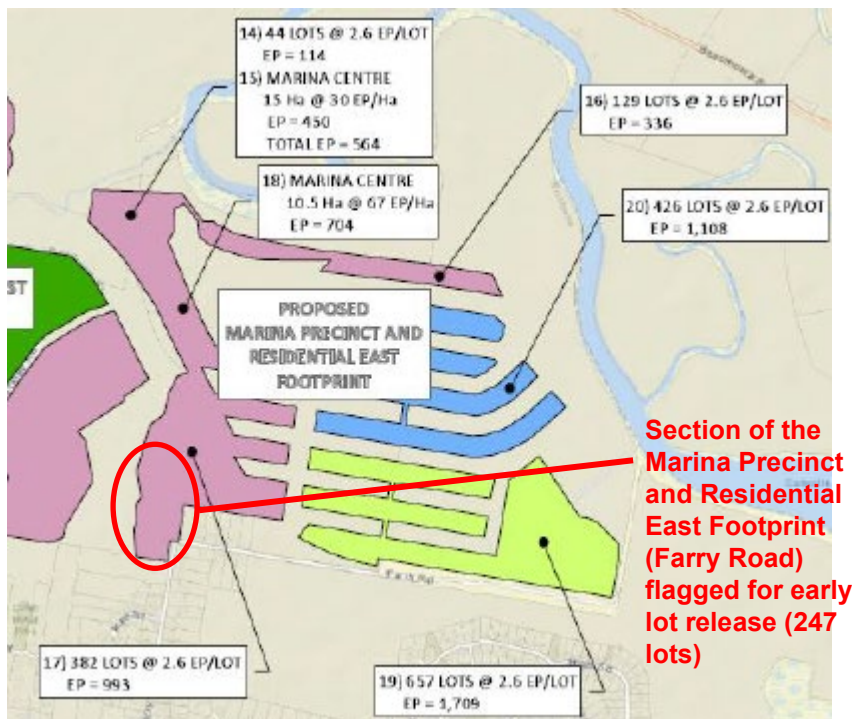


Figure 2-1: Marina Precinct and Residential East Footprint as per the masterplan

It has been advised by North Harbour Holdings that the area at the top of Farry Road has been flagged for an early release of lots, circled in red in Figure 2-1 above. There are 247 lots within this development area, with a concept layout presented below in Figure 2-2. All lots in this early release area are residential dwellings.

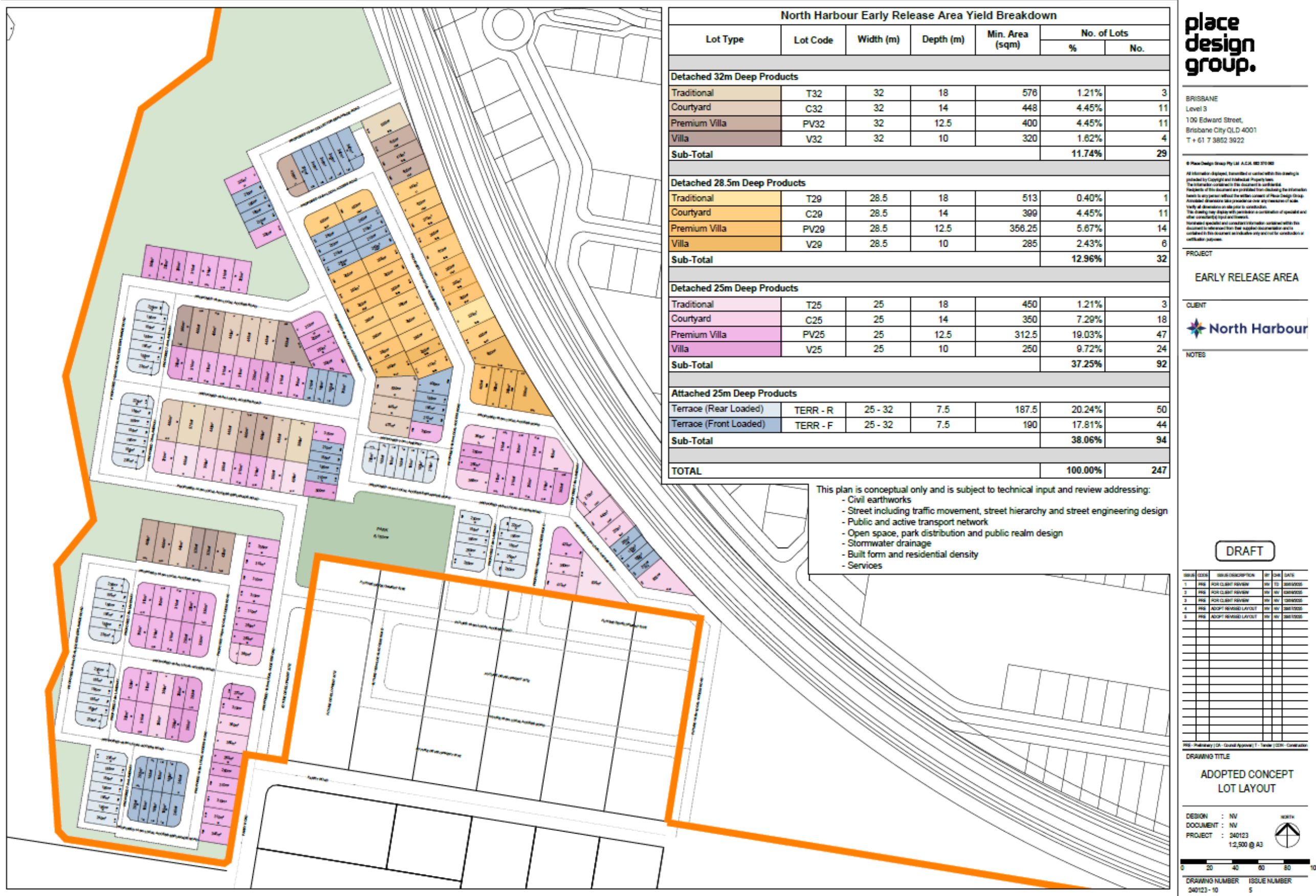


Figure 2-2: Concept lot layout of the early release area in the Marina Precinct and Residential East Footprint



North Harbour Water Supply and Sewerage Marina Expansion Assessment

2 Population and Demand Assessment

With all lots in the Farry Road development area being residential, and a residential lot ratio of 2.6 EP/lot being assumed for the master planning of the North Harbour network, the water demand of the early release area is presented below in Table 2-1.

Table 2-1: Water and sewerage demands in the early release area of the Marina Precinct and Residential East Footprint

Area	No. of Lots	Equivalent Person (EP)	Water Demand	
			AD (L/s)	PD (L/s)
Early Release Area of the Residential East Footprint	247	642	1.93	3.64
TOTAL	247	642	1.93	3.64

In summary, the Farry Road development area has a peak day (PD) demand of 3.64 L/s. This technical memorandum will investigate whether the DN100 main from Farry Road (Pipe Asset ID = 2087717) can service this demand. If there are capacity constraints, then the number of lots that can be serviced off the DN100 main on Farry Road before service failures will be established.

3 Desired Standards of Service

Assessment has been undertaken against the design criteria in the SEQ WS&S D&C Code. The applicable desired standards of service for the North Harbour development are summarised as follows:

Water

- Minimum pressure under normal operating conditions = 22 metres
- Maximum service pressure = 55 metres
- Fire flow performance for detached residential dwellings = 15 L/s with a minimum residual pressure of 12 metres at 2/3 peak hour demand, 30 L/s for residential properties greater than three storeys and industrial and commercial properties.
- Desirable head loss = less than 5 m/km pipeline for mains $\leq$ DN150 and less than 3 m/km pipeline for mains $\geq$ DN200

4 Water Supply Servicing Strategy

4.1 Endorsed North Harbour Infrastructure System Capacity

The previously endorsed water supply strategy for the North Harbour development was the following:

- **Initial Phase:** The first 500 residential lots in North Harbour located in the southern residential precincts was supplied from the Burpengary North DMA. **(COMPLETED)**
- **Phase 1 (up to 2,500 EP):** Supply North Harbour from the Morayfield East DMA via connection to the existing 200 mm diameter main in Nolan Drive. **(COMPLETED)**
- **Phase 2 (2,501 – 4,600 EP):** Construct a 430 mm ID water trunk main in Buchanan Road through to Nolan Drive and under the Bruce Highway to connect North Harbour into Unitywater trunk mains upstream of Morayfield East DMA inlet. **(COMPLETED)**
- **Phase 3 (4,600 EP to Ultimate):** The temporary 200 mm diameter main built in Phase 1 to be replaced with a permanent 375 mm diameter main following the alignment of North Harbour Boulevard running from the Bruce Highway to the Residential West and Residential East precincts. **(COMPLETED)** Phase 3 infrastructure also includes the replacement of the temporary 300 mm diameter main in Nolan Drive with the continuation of the 430 mm ID main from Buchanan Road and crossing the Bruce Highway. **(DESIGN UNDERWAY)**

A summary of the ultimate water supply strategy for the North Harbour development is presented below in Figure 4-1.

North Harbour Water Supply and Sewerage Marina Expansion Assessment 4 Water Supply Servicing Strategy

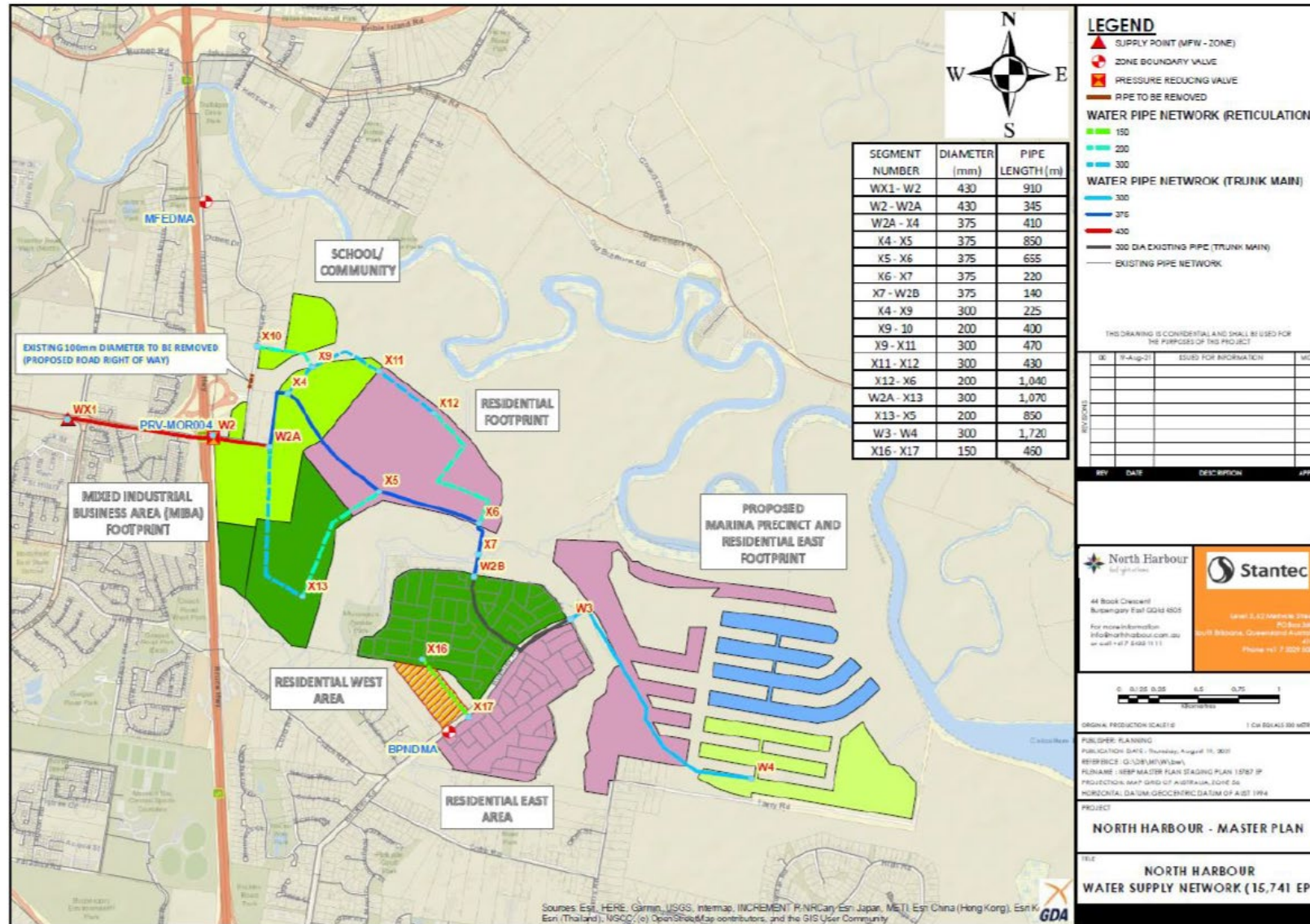


Figure 4-1: Existing Water Supply Strategy for the North Harbour Development



The strategy also includes the installation of a pressure reducing valve PRV-MOR004 at the North Harbour water supply inlet/connection point. The PRV sizing assessment specified the following requirements to service the North Harbour development:

- From 2,500 EP, PRV Size = 150 mm, Setting = HGL 49 m AHD, Flowmeter = 150 mm
- From 4,600 EP, PRV Size = 250 mm, Setting = HGL 40 m AHD, Flowmeter = 150 mm
- From 8,000 EP (for up to and including the 15,912 EP Ultimate Phase), PRV Size = 350 mm, Setting = HGL 44.5 m AHD, Flowmeter = 300 mm

4.2 Base Case Performance Scenario (No-Connection Performance)

The base case has been assessed by running 2026 planning horizon scenario in Unitywater's Caboolture Water Hydraulic Model without the demand from the Farry Road development applied to the Burpengary North PMA which contains the Farry Road 100 mm diameter main.

The DN100 main on Farry Road is located within the Burpengary North DMA which is fed from PRV-BGY001 which has a pressure setting of 36 metres (total head = 50.14 m AHD). The Burpengary North DMA is a large pressure managed area which has a peak hour flow of **71** L/s. A summary of the minimum pressure performance for the base case is presented below in Table 4-1.

Table 4-1: Minimum pressure performance for the base case in Burpengary North DMA

Parameter	Value
PRV-BYG001 Pressure Setting	50.14 m AHD
Minimum Pressure in Burpengary North DMA – Junction G5024891	25.5 m
Minimum Pressure at Residential East Development Connection at Farry Road – Junction 2188738	41.2 m

The minimum pressure map of the Burpengary North DMA for peak hour in the 2026 planning horizon without the Farry Road development added is presented below in Figure 4-2. Pressures range from as low as 25.5 m to as high as 67.5 m as shown in the figure below. All pressures are above 22 metres in the Burpengary North DMA for the base case conditions of no additional demand from the Farry Road development, indicating no pressure constraints.

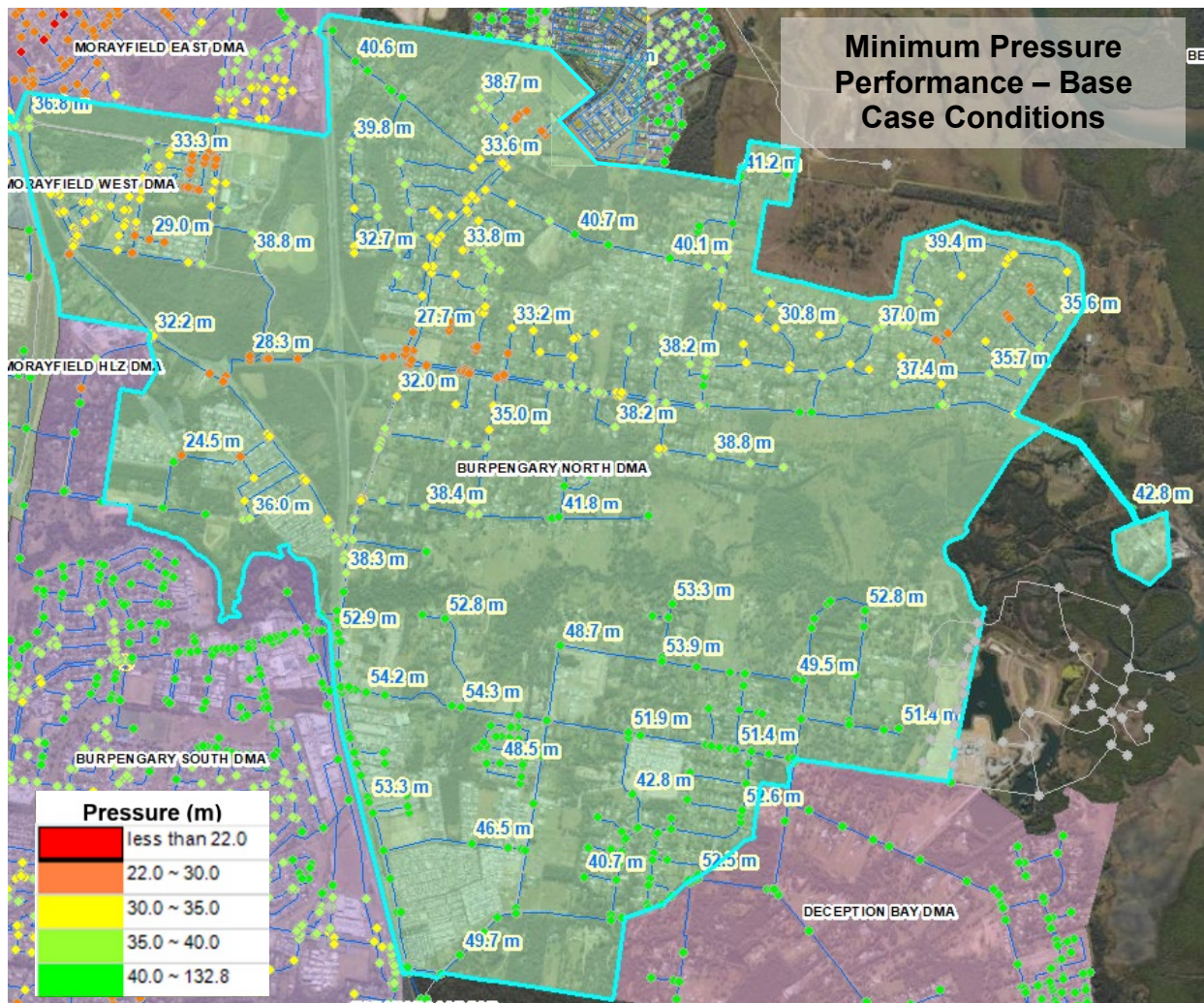


Figure 4-2: Minimum pressure performance for the base case conditions in the Burpengary North DMA (minimum pressure are labelled in blue)

The fire flow performance for the Burpengary North DMA for the base case scenario is summarised below in Table 4-2. There are 15 junctions that fail the fire flow requirements in the Burpengary North DMA which are listed in the table below. Looking at the visual overview of the fire flow performance in Figure 4-3, the junctions that fail the fire flow requirements are at the ends of small reticulation mains where constraints would be expected. Therefore, these junctions will also fail for the scenario where the additional demand from the Residential East footprint is added to the DMA and thus will be ignored for the fire flow assessment.

Junction 2188738 where the Farry Road development area could be supplied from in the interim currently passes the fire flow requirements, with a residual pressure of 14.2 m observed for a fire flow of 15 L/s. The available flow at this junction is 15.7 L/s for a residual pressure of 12 metres, which only marginally meets the fire flow requirements. Pipe Asset ID 2044649 is the primary concern for fire flow constraints, with this DN100 PVC-U main inducing significant head loss under a fire flow demand of 15 L/s. This main will limit the number of lots in the Farry Road development Area, which will be assessed in Section 4.3 below.

Table 4-2: Fire flow performance for the base case in Burpengary North DMA

Parameter	Value
PRV-BYG001 Pressure Setting	50.14 m AHD
Junctions that fails fire flow requirements	15 junctions fail. IDs are as follows: 2142076, 2126082, 2140058, 2128705, G5032723, 2133027, 2121204, G5038491, 2188738, 2122270, 2189258, 2131047, 2124133, G5027482 and G5029569
Residual Pressure at Residential East Development Connection at Farry Road – Junction 2188738	14.2 m
Available Flow at Residential East Development Connection at Farry Road – Junction 2188738	15.7 L/s (at 12 m residual pressure)
Residual Pressure upstream of the DN100 Farry Road Main – Junction 2187747	26.0 m

A visual overview of the fire flow performance for the Burpengary North DMA for the base case conditions is presented below in Figure 4-3.

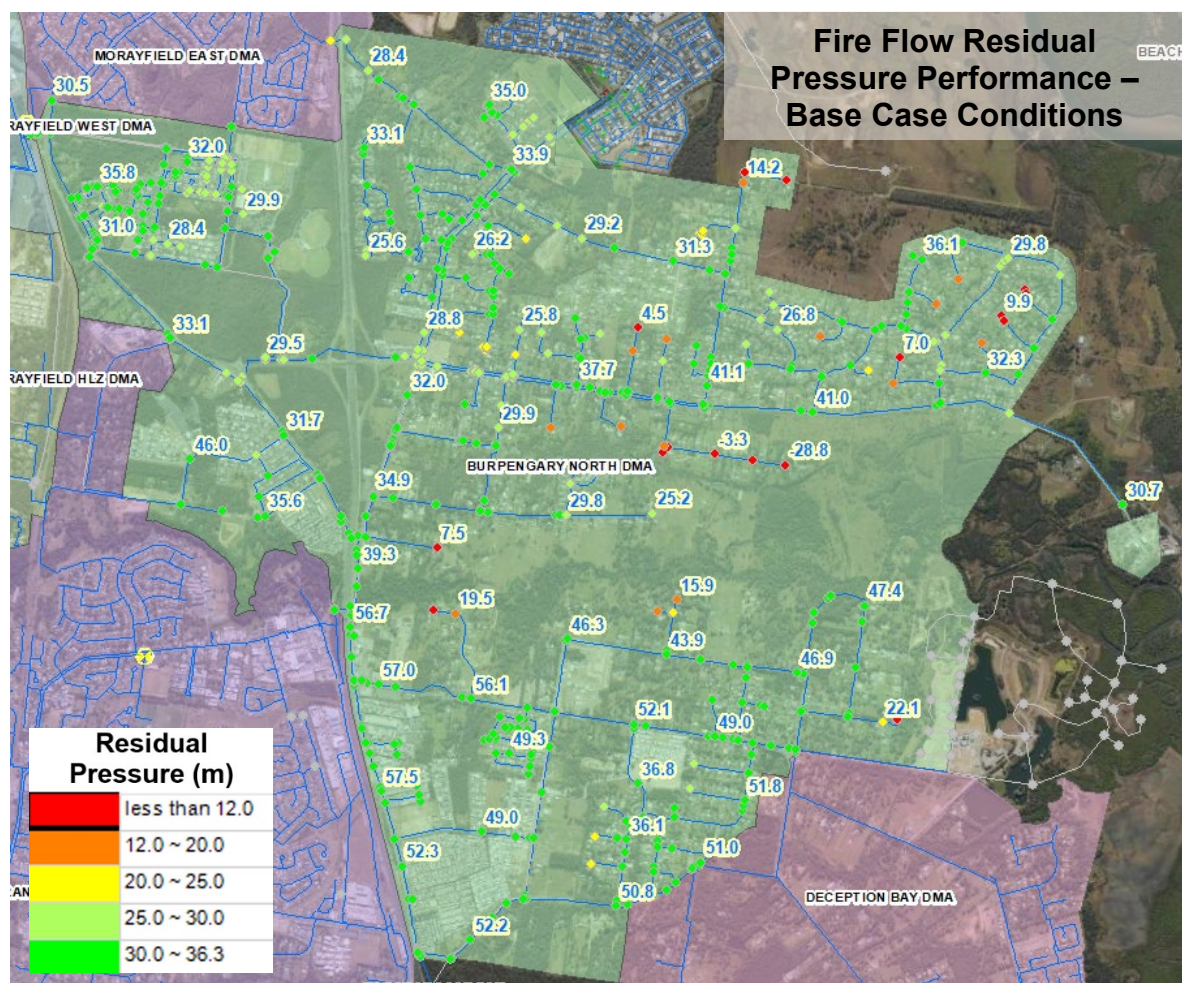


Figure 4-3: Fire flow residual pressure performance for the base case conditions in the Burpengary North DMA

4.3 Performance with Early Release Area Development Added

The ability of the DN100 main on Farry Road to supply the Farry Road development has been assessed by running the 2026 planning horizon scenario with the additional demand from the North Harbour development. As stated previously, the Burpengary North DMA is a large pressure managed area that has a peak hour flow of 71 L/s for the 2026 scenario. The additional demand from the full Farry Road development will increase this peak hour flow to 78.7 L/s. A summary of the minimum pressure performance for the Burpengary North DMA with the additional demand from the Farry Road Area is shown below in Table 4-3.

Table 4-3: Minimum Pressure Performance for the Burpengary North DMA with the Early Release Area Development added

Parameter	Value	Difference to Base Case
PRV-BYG001 Pressure Setting	50.14 m AHD	N/A
Minimum Pressure in Burpengary North DMA – Junction G5024891	24.8 m	- 0.7 m (decreased by 2.7%)
Minimum Pressure at Residential East Development Connection at Farry Road – Junction 2188738	33.2 m	- 8.0 m (decreased by 19.4%)

Minimum pressure at Junction 2188738, which will feed the Farry Road Area has dropped by 8 metres due to the additional demand from the development. However, pressures in the DMA are beyond 22 metres which indicates that the required standards of service can continue to be maintained under peak hour demand. The minimum pressure map of the Burpengary North DMA for peak hour in the 2026 planning horizon with the Residential East development added is presented below in Figure 4-4.

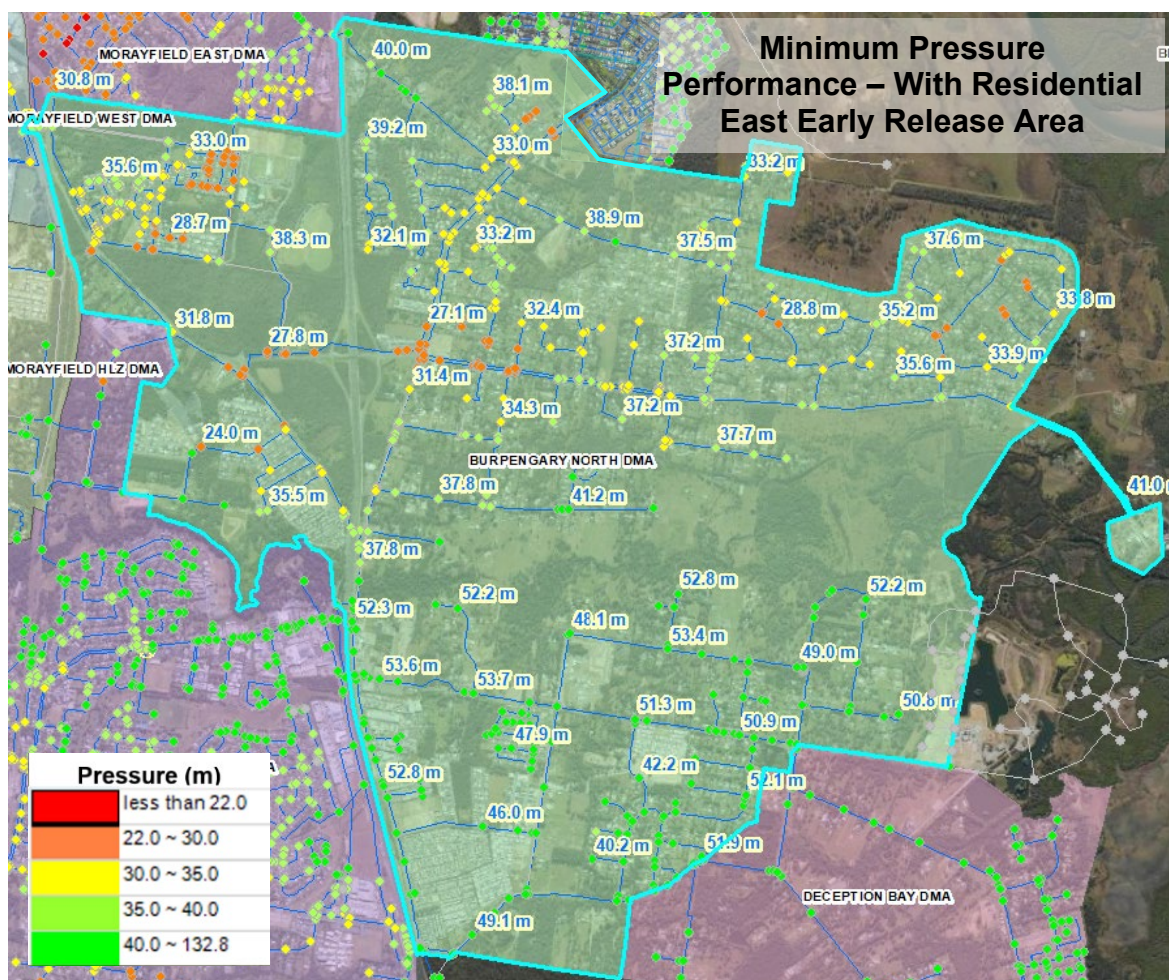


Figure 4-4: Minimum Pressure Performance of the Burpengary North DMA with the addition of the Residential East Early Release Area Demand

The fire flow performance for the Burpengary North DMA with the addition of the Full Farry Road Area demand is summarised below in Table 4-4 and presented visually in Figure 4-5. The additional demand from the Full Farry Road Area impacts the fire flow performance, particularly along the DN100-150 main on Farry Road that services the development.

Junction 2188738 where the Farry Road Area will be extended from fails the fire flow requirements when the demand from this development is added to the model, with a residual pressure of 3 m observed for a fire flow of 15 L/s. The available fire flow at Junction 2188738 is 12.8 L/s at a residual pressure of 12 metres. Pipe Asset ID 2044649 is the primary concern for fire flow constraints, with this DN100 PVC-U main inducing significant head loss under a fire flow demand of 15 L/s, resulting in the failure of the fire flow requirements.

Table 4-4: Fire Flow Performance for the Burpengary North DMA with all the Early Release Area Development demand added

Parameter	Value	Difference to Base Case
PRV-BYG001 Pressure Setting	50.14 m AHD	N/A

Parameter	Value	Difference to Base Case
Residual Pressure at Residential East Development Connection at Farry Road – Junction 2188738	3.0 m	-11.2 m (decreased by 80%)
Available Flow at Residential East Development Connection at Farry Road – Junction 2188738	12.8 L/s (at 12 m residual pressure)	- 3.1 L/s (decreased by 19.6%)
Residual Pressure upstream of the DN100 Farry Road Main – Junction 2187747	19.4 m	- 6.6 m (decreased by 25.4%)

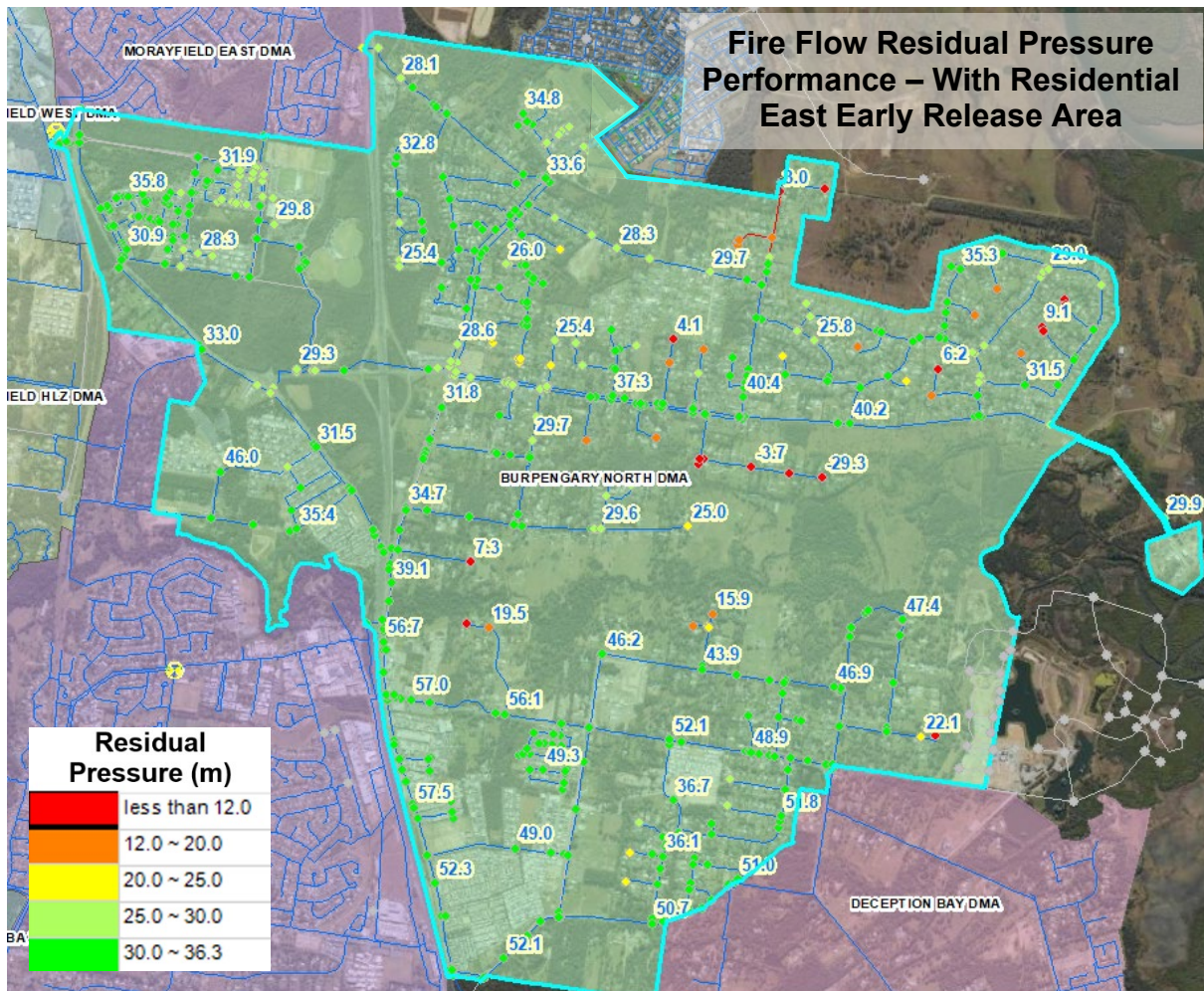


Figure 4-5: Fire flow residual pressure performance for the Burpengary North DMA with the additional demand from the Residential East Early Release Area

Due to the failure of fire flow requirements at the connection point to the Farry Road Area, investigations need to be completed to determine the number of lots (i.e. additional demand) that can be serviced from the DN100 Farry Road main before fire flow requirements are not met. These investigations have been completed below in Section 4.3.1.

4.3.1 Number of Lots that can be fed from the DN100 main on Farry Road

To determine the number of lots that can be fed from the DN100 main on Farry Road before fire flow failures occur, sensitivity of the number of EP inputted into the model has been completed. The influence of the number of lots developed in the Farry Road Area on the fire flow performance at Junction 2188738 where the development will be connected is presented below in Table 4-5.

Table 4-5: Sensitivity analysis of the number of lots developed in the Residential East Early Release Area on the Fire Flow Performance at the connecting Junction 2188738

Number of lots developed in Residential East Early Release Area	Associated EP	Residual Pressure for a Fire Flow of 15 L/s at Junction 2188738
0	0	14.2 m
25	65	13.2 m
50	130	12.1 m
55	143	11.9 m
75	195	11.0 m
100	260	9.9 m
150	390	7.6 m
200	520	5.2 m
247	642	3.0 m

Based on the residual pressure observed for a fire flow of 15 L/s, the fire flow performance marginally fails when 55 lots are connected from the DN100 main on Farry Road, with a residual pressure of 11.9 metres observed for a fire flow of 15 L/s at Junction 2188738. Therefore, North Harbour can connect 55 lots from the DN100 main on Farry Road before an upgrade is required to service the development.

4.3.2 Proposed Upgrades to Service the Residential East Early Release Area Development

To service the 247 lots in the Residential East Early Release Area from the Burpengary North DMA, an upgrade to the DN100 main on Farry Road is required so that fire flow requirements can be satisfied. There are couple of different options available for servicing the development through the Farry Road main, which are listed below.

- **Option 1:** Build approximately 480 metres of dual DN100 main along Farry Road from Junction 2182461 to Junction 2188738 to increase the fire flow capacity to the Residential East development.

The extent of works is presented below in Figure 4-6. Completing the construction of a dual DN100 main on Farry Road results in satisfactory fire flow and minimum pressure performance at the connection point (Junction 2188738) for the Residential East Early Release Area, with the results presented below in Table 4-6.

Table 4-6: Minimum pressure and fire flow performance with the Option 1 upgrades

Parameter	Value
Minimum Pressure at Residential East Development Connection at Farry Road – Junction 2188738	36.9 m
Residual Pressure at Residential East Development Connection at Farry Road – Junction 2188738 (for a fire flow of 15 L/s)	26.4 m



Figure 4-6: Option 1 – Build approximately 320 metres of dual DN100 main as shown in red

- **Option 2:** Upsize the DN100 main along Farry Road to a DN150 main from Junction 2182461 to Junction 2188738 so that a consistent DN150 main is supplying the Residential East Early Release Area.

The extent of works is presented below in Figure 4-7. Completing this upsize to the DN100 main on Farry Road results in satisfactory fire flow and minimum pressure performance at the connection point (Junction 2188738) for the Residential East Early Release Area, with the results presented below in Table 4-7.

Table 4-7: Minimum pressure and fire flow performance with the Option 2 upgrades

Parameter	Value
Minimum Pressure at Residential East Development Connection at Farry Road – Junction 2188738	37.2 m
Residual Pressure at Residential East Development Connection at Farry Road – Junction 2188738 (for a fire flow of 15 L/s)	28.4 m



Figure 4-7: Option 2 – Upsize the DN100 main coloured in red on Farry Road to a DN150 main

- **Option 3:** Construct the DN300 main from Buckley Road as part of the North Harbour Masterplan and connect the Residential East Early Release Area development (disconnect the Farry Road DN100 main connection).

The scope of works with this option is presented below in Figure 4-8. The DN300 main from Buckley Road has been found to be sufficiently sized to service the entire Marina Precinct and Residential East development as documented in the North Harbour Marina Expansion Water Supply Assessment Report (Stantec, July 2023).

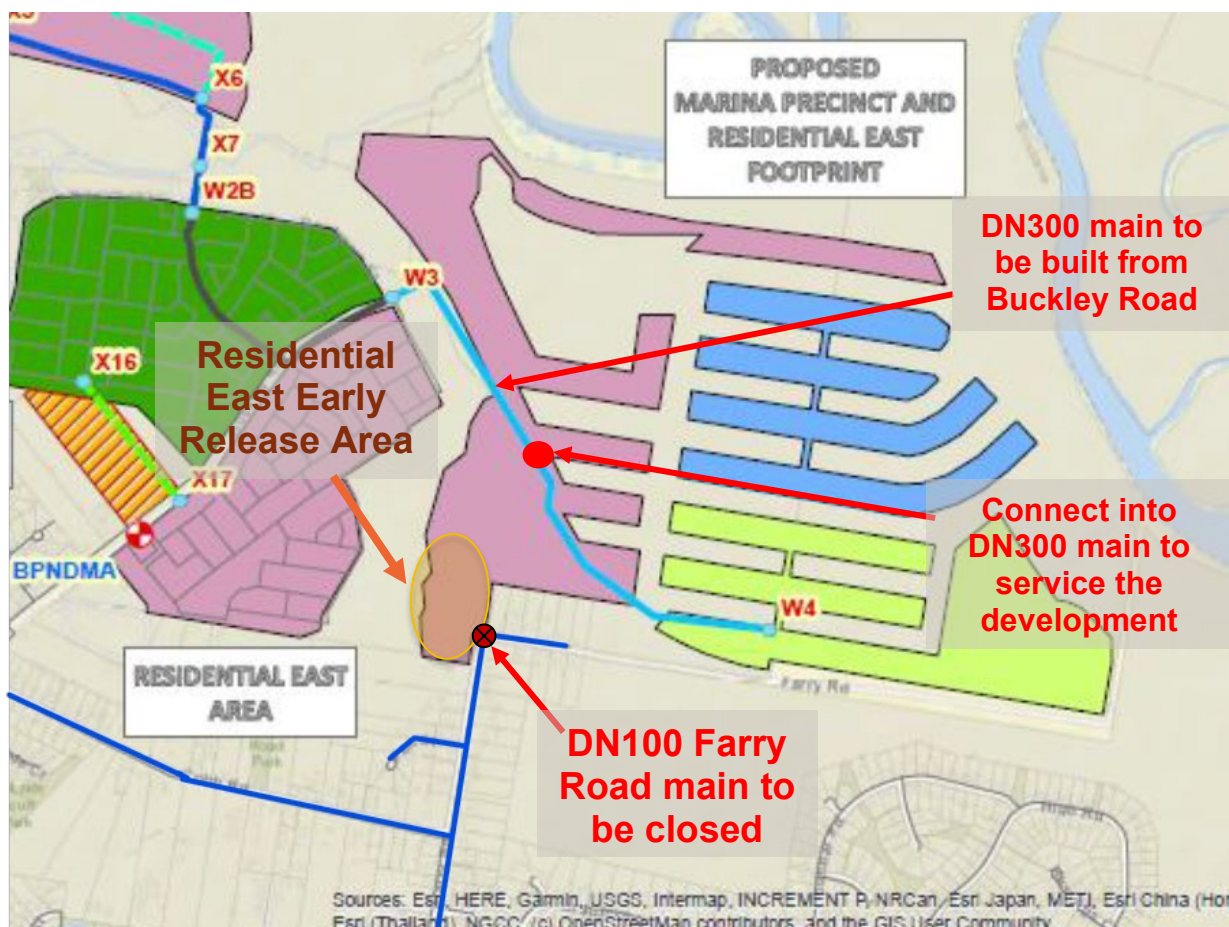


Figure 4-8: Option 3 – Construct the DN300 main from Buckley Road as per the masterplan

All options above can service the Farry Road Development Area, with North Harbour to select a preferred option based on timelines, constructability, cost and any other factors.

Beyond the servicing strategy to supply the Farry Road Area development, the internal network sizing arrangement has also been investigated with the findings detailed in Section 4.4 below.

4.4 Internal Network Sizing Arrangement

The internal network sizing arrangement for the early release area of the Residential East development has been assessed using the ultimate (planning horizon scenario and the proposed DN300 distribution main to be built from Buckley Road as part of the servicing strategy for the Marina Precinct and Residential East Footprint development.

The approximate internal network arrangement for the early release area has been inputted into the model based on the provided concept lot layout, as shown below in Figure 4-9. Based on the predicted peak hour demand of the area, a DN150 main has been proposed to run from the offtake of the DN300 main through to the DN100 Farry Road main. DN100 reticulation mains will feed off this proposed DN150 main.

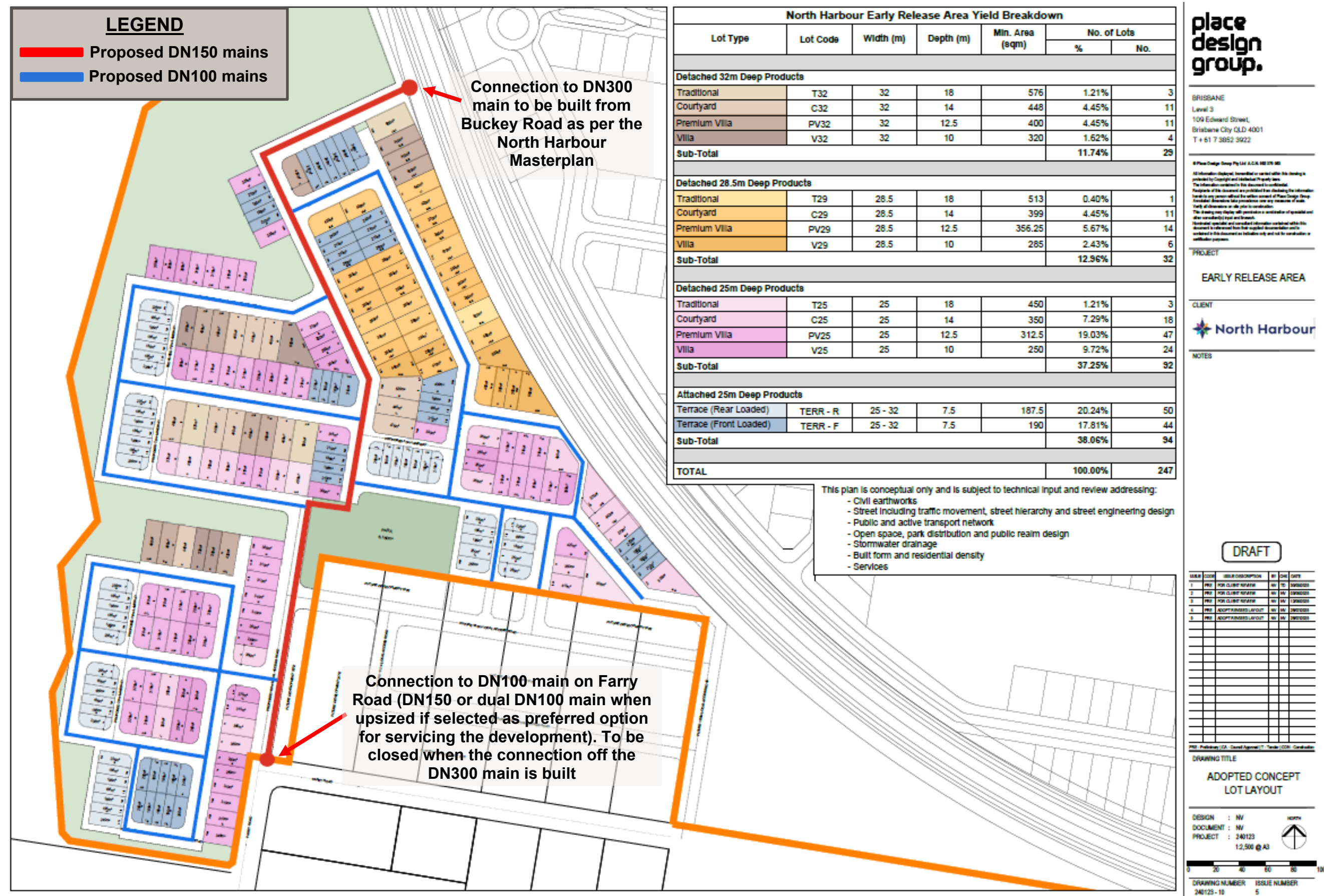


Figure 4-9: Proposed internal network arrangement and sizing for the early release area of the Residential East footprint

Based on this concept internal sizing arrangement, the EP of the Farry Road Area has then been evenly distributed in the network and a standard hydraulic run has been used to assess the minimum pressure performance. The results of the minimum pressure performance within the Farry Road development area are presented below in Table 4-8 and visually in Figure 4-10. The pressures in this region are beyond 22 metres, indicating that the proposed sizing in Figure 4-9 above is sufficient for minimum pressure requirements (for ultimate growth).

Table 4-8: Summary of the minimum pressure performance for the Residential East Early Release Area

Parameter	Value
PRV-MOR004 Pressure Setting	49.5 m AHD
Minimum Pressure in Residential East Early Lot Release Area	30.3 m (ranges from 30.3 m to 32 m)

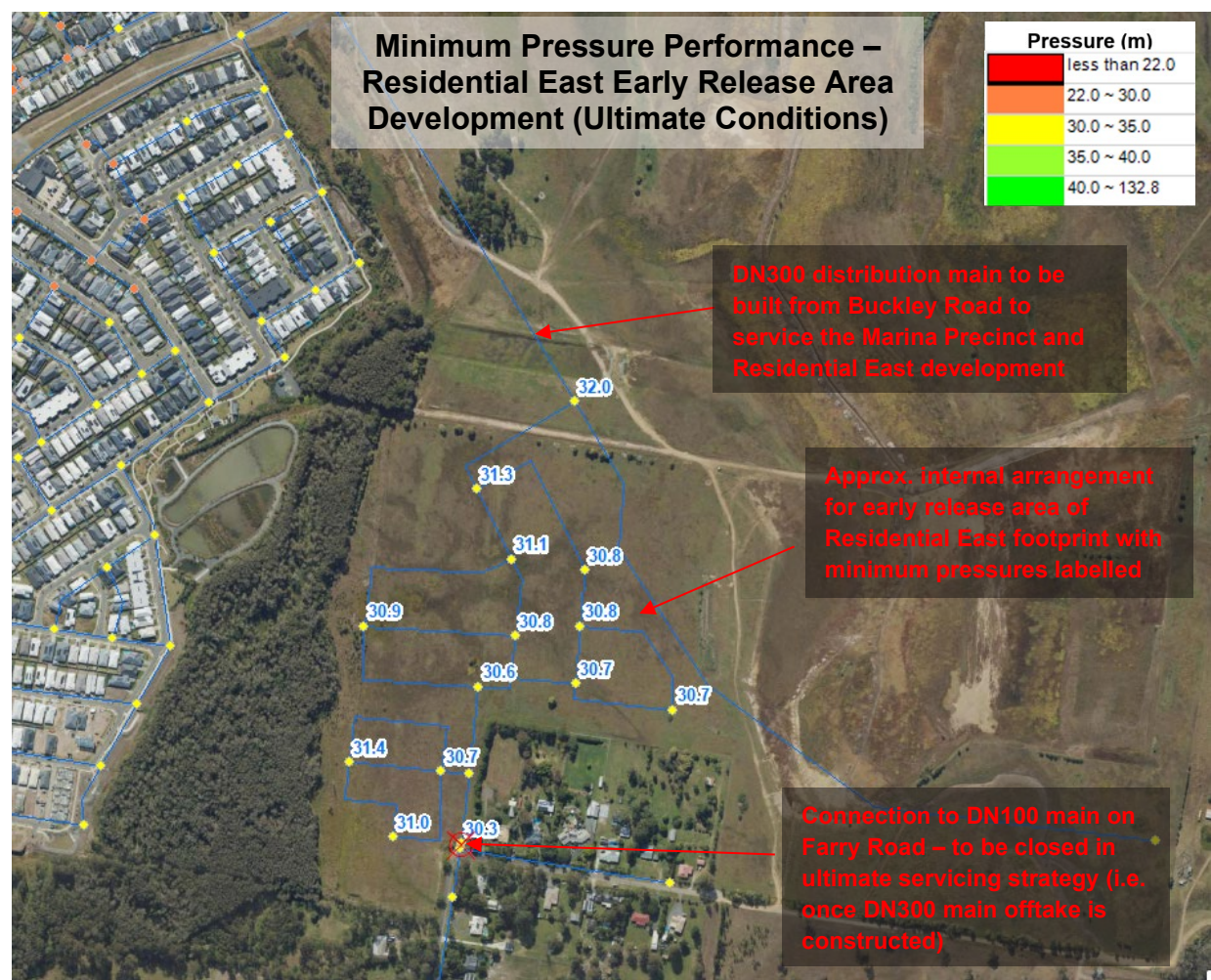


Figure 4-10: Visual overview of the minimum pressure performance for the Residential East Early Release Area in ultimate growth conditions

A fire flow hydraulic run has also been completed to establish whether the internal network sizing is sufficiently sized for fire flow. For residential connections, a fire flow of 15 L/s is required at 2/3 peak hour demand and a residual pressure of 12 metres. All junctions in the Farry Road Area comfortably passes the required residual pressure of 12 metres, with the critical junction in the eastern corner of the

development which has a residual pressure of 27.2 metres. The fire flow performance results within the Farry Road area are presented below in Table 4-9 and visually in Figure 4-11.

Table 4-9: Summary of the fire flow performance for the Residential East Early Release Area

Parameter	Value
PRV-MOR004 Pressure Setting	49.5 m AHD
Fire Flow Demand Required in Residential East Development	15 L/s
Residual Pressure at Critical Fire Flow Node in the Residential East Early Release Area	27.2m

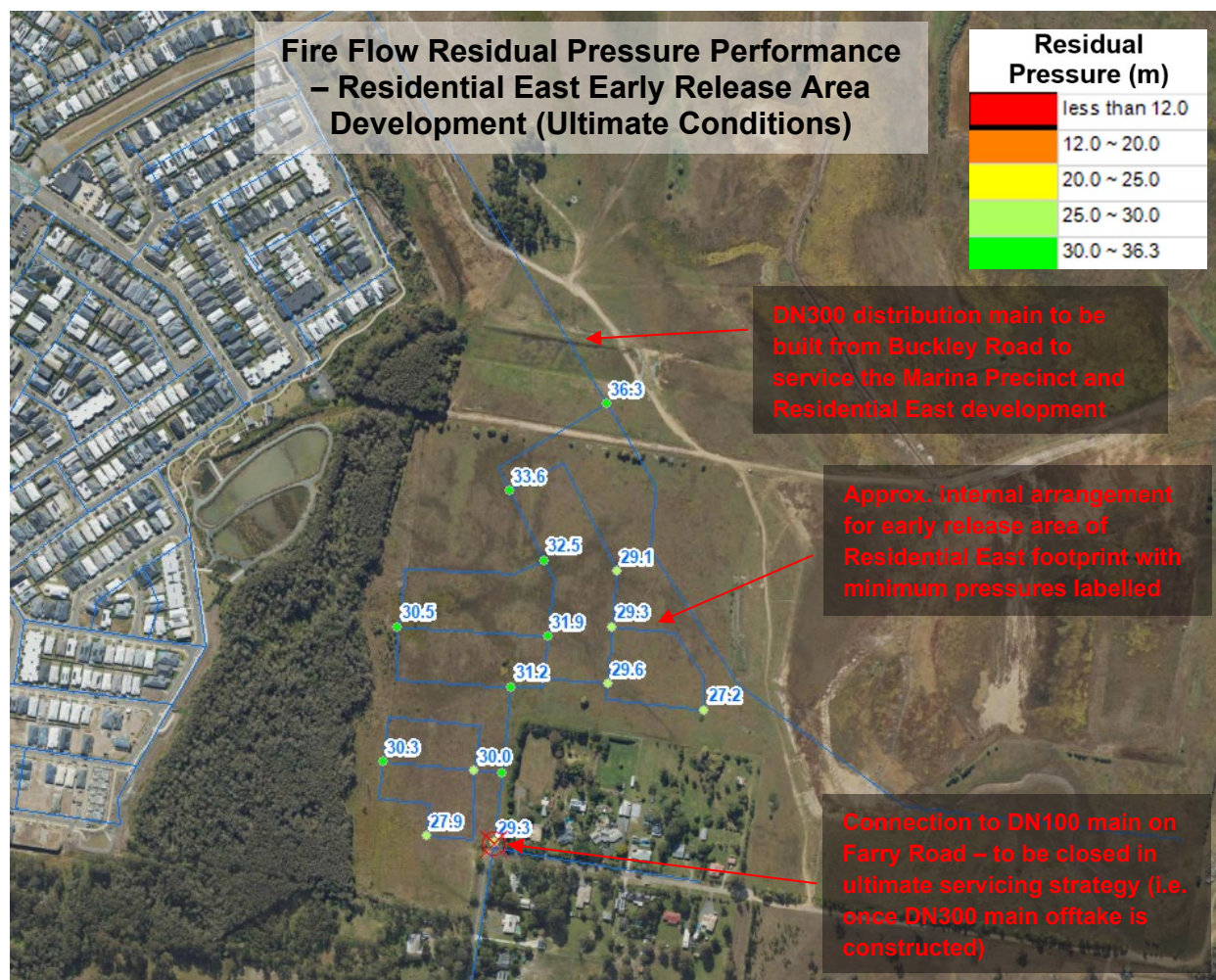


Figure 4-11: Visual overview of the fire flow performance for the Residential East Early Release Area in ultimate growth conditions

Both the minimum pressure and fire flow performance in Farry Road meets standards for the Ultimate demand conditions once connected to the permanent 300 mm diameter main North Harbour main, therefore, the proposed internal network arrangement and sizing in Figure 4-9 is sufficiently sized.

5 Conclusions and Outcomes

The following outcomes and recommendations are proposed for service the Farry Road development area with water supply:

- The DN100 Farry Road main can service 55 lots in the Farry Road Area development before fire flow failures occur, which is short of the 247 lots proposed to be developed.
- To service the entire 247 lots within the Farry Road Area, an upgrade to the water supply network is required. Three feasible options for supplying this development have been presented in this report:
 1. Build approximately 480 metres of dual DN100 main along Farry Road from Junction 2182461 to Junction 2188738.
 2. Upsize the DN100 main along Farry Road to a DN150 main from Junction 2182461 to Junction 2188738.
 3. Construct the DN300 main from Buckley Road as part of the North Harbour Masterplan and connect the Farry Road Area development from this main.
- All options allow the supply to the Farry Road Area whilst meeting minimum pressure and fire flow requirements. North Harbour is to determine the best servicing strategy for this development based on timelines, constructability, cost and any other factors.
- An internal sizing of the Farry Road Area development has been provided in this report. A DN150 main is proposed to run from the DN100 Farry Road offtake to the offtake from the DN300 North Harbour trunk main. DN100 reticulations mains will feed off this DN150 main to service the residential connections in the Residential East Early Release Area. Refer to Figure 4-9 for the proposed internal sizing arrangement.