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STOCKLAND DEVELOPMENT PTY LTD

Paradise Waters Development, Deebing Heights

Water Supply Analysis

PLANS AND DOCUMENTS
referred to in the ULDA
APPROVAL dated 23/12/11

301001-01314 – 00-WW-REP-0001

25 May 2011

Infrastructure & Environment
Level 3, 60 Albert Street
Brisbane QLD 4000
Australia
Telephone: +61 7 3239 7400
Facsimile: +61 7 3221 7791
www.worleyparsons.com
ABN 61 001 279 812

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STOCKLAND DEVELOPMENT PTY LTD
PARADISE WATERS DEVELOPMENT, DEEBING HEIGHTS
WATER SUPPLY ANALYSIS

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PROJECT 301001-01314 - PARADISE WATERS DEVELOPMENT, DEEBING HEIGHTS

REV	DESCRIPTION	ORIG	REVIEW	WORLEY-PARSONS APPROVAL	DATE	CLIENT APPROVAL	DATE
0	Draft for Client Review	A Harris	K Page	K Page	6-Apr-2011	N/A	
1	Final	A Harris	K Page	K Page	14-Apr-2011		N/A
2	Final - Revised	A Harris	K Page	K Page	25-May-2011		N/A

CONTENTS

Appendices

1 INTRODUCTION

WorleyParsons were commissioned by Stockland Development Pty Ltd to undertake a water supply analysis for the proposed development at Paradise Waters, Ripley Valley. This development is part of the Ripley Valley Urban Development Area (UDA) Proposed Development Scheme.

The proposed Paradise Waters development is to be located adjacent to the existing Paradise Heights residential area at Deebing Heights, Ripley. The proposed layout for this development is shown in the RPS Drawing 104527-29 Rev E (contained in Appendix A). It is proposed that this new development's potable water services are to be connected to existing infrastructure owned and operated by Queensland Urban Utilities (QUU). This report considers the impact upon the existing water supply infrastructure within the Ripley area by this development.

This report confirms the required water infrastructure for Precinct A and identifies the potential servicing strategy for the full development. To ensure the Ipswich Planning Scheme Levels of Service (LOS) are maintained across all planning horizons, the proposed development has been analysed for the Existing (2011) and 2021 planning horizons for the QUU Water Supply Systems.

This report comprises of the following elements:

- The Equivalent Person (EP) calculation for the proposed development;
- Design Criteria for the proposed development;
- Assesses the water demand from the proposed development;
- Assesses Maximum Hour (MH) demand and desired fire-fighting flow within the development;
- Provisionally sizes and routing of the internal reticulation of the proposed development (further detailed design required prior to construction);
- Assesses the performance of the existing QUU water supply infrastructure in the Ripley area in relation to servicing the additional demand from the proposed development;
- Summarises the analysis carried out.

1.1 Existing Water Supply System

The majority of the Paradise Waters development is to be located within the Paradise Waters High-Level Zone (HLZ), a small sub-zone of the Ripley Water Supply District (WSD). Figure 1.1 displays the GIS information for the Ripley WSD, illustrating the key imports and exports from the zone and the position of the proposed development in relation to the water supply network. Network storage for the Ripley WSD is currently provided by two storage tanks, which have a combined volume of 26 Megalitres (ML). When the imports to the Ripley Zone are closed the reservoir provides the supply and determine the operating head (Bottom Water Level – BWL = 102.83m)

Figure 1.2 displays the position of the proposed development within the Paradise Waters HLZ. Water to the HLZ is supplied via a pump station located at the Ripley reservoir site. Storage for the HLZ is provided at Paradise Heights Reservoir (capacity of 0.12ML, BWL – 149.10m).

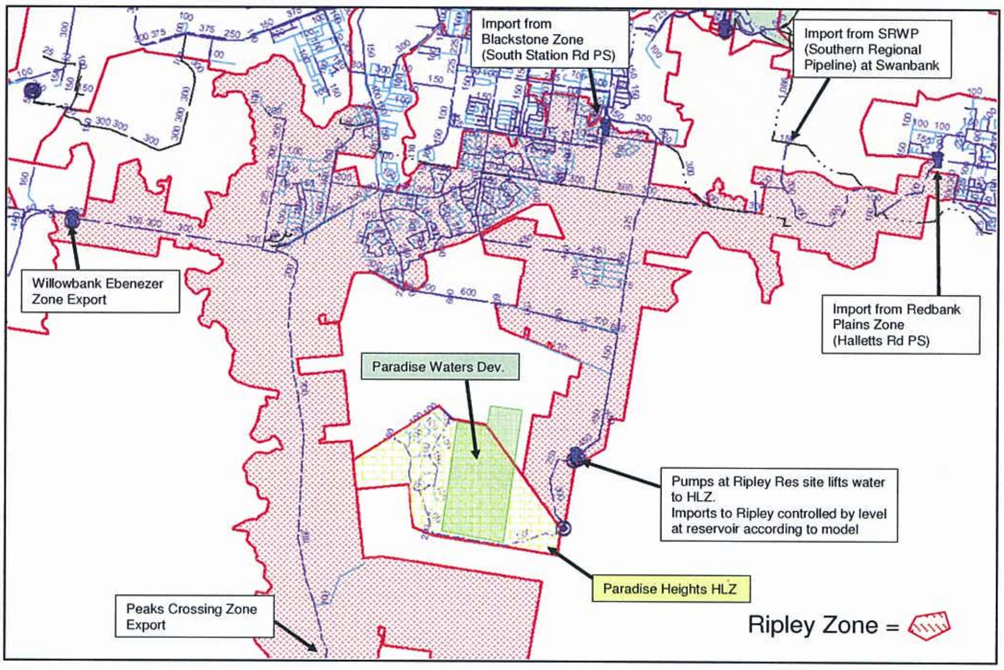


Figure 1.1: Ripley WSD

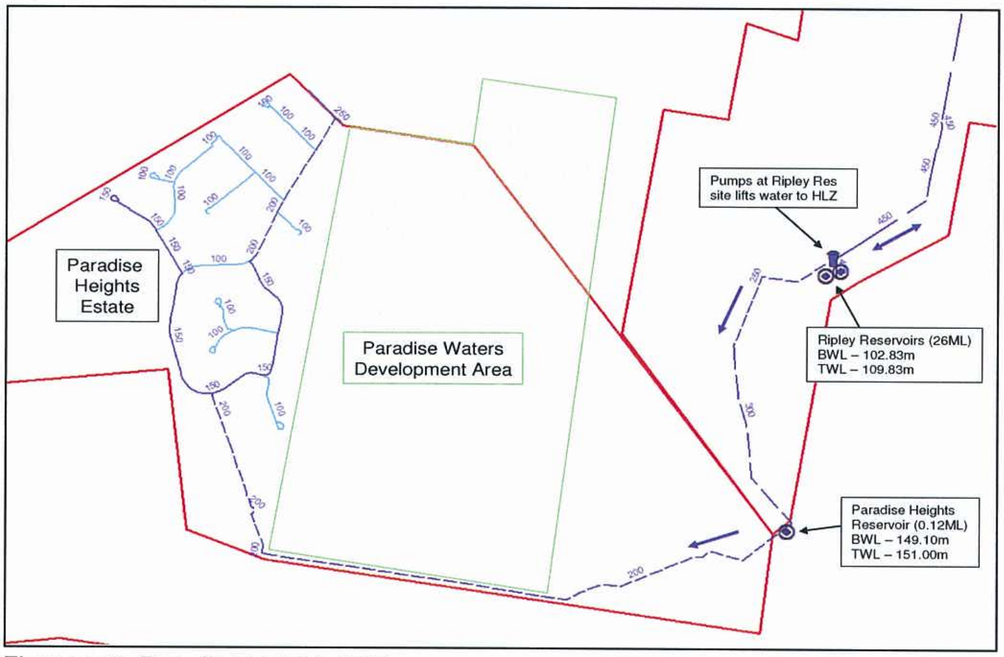


Figure 1.2: Paradise Heights HLZ

Interrogation of the hydraulic model provided by QUU for the Ipswich region provides the indicative current and development growth within the Ripley WSD and Paradise Heights HLZ (ref Table 1.1).

Table 1.1: Projected development growth in Equivalent Persons – EP (from hydraulic model)

Planning Horizon	Ripley Zone (EP) (incl Ebenezer zone but not including Paradise Heights & exports to Peaks Crossing)	Paradise Heights HLZ (EP)
2006	19160.1	466.5
2011	24520.1	616.5
2016	30088.8	1319.6
2021	37898.0	2160.5
2041	144710.9	5442.4
Ultimate	243745.4	6423.0

2 PROPOSED DEVELOPMENT

2.1 Scope of Analysis

The following analysis has been performed utilising H2OMap model provided by QUU for the Ipswich water supply network. It should be noted that this report concerns the water demand loadings from the proposed Paradise Waters Development, in isolation.

This assessment has addressed technical matters only. The servicing of the site by the water supply system will ultimately require Council Approval. Likewise any system augmentations proposed in this report will again require the approval of Council and should not be regarded as being representative of Council's position.

2.2 Development Loading

The predicted development yields are shown in the RPS Drawing 104527-29 Rev E (Appendix A) and for the purposes of this assessment the high end yield values (total development yield 2126 lots) have been applied. The exception to this is Precinct A for which a lot plan has been provided showing a total of 155 residential lots (7 of which identified as multi-dwelling – assumed 2 properties per lot), plus the neighbourhood centre.

Conversion from lots to Equivalent Persons (EP) for the hydraulic assessment has been carried out using factors sourced from the Ipswich Council document "Planning Scheme Policy 5 – Infrastructure, Appendix 1". Table 2.1 in Appendix B displays the calculated number of EP per precinct which will be applied for the hydraulic assessments.

2.3 Connection to Existing System

RPS Drawing 104527-29 Rev E (Appendix A) displays the contours across the Paradise Heights Development. The majority of the site is above an elevation of 70m and therefore will need to be supplied from the Paradise Heights HLZ system as the operating heads in the Ripley LLZ (approx 100m) will not be sufficient to maintain suitable levels of service.

Approximately 50% of the properties within Precinct A have a proposed slab level below 70m elevation; however the nearest connection point to the LLZ is 1.6km away at Ripley Reservoir. Therefore, it was assessed that it would be more economically viable to supply the entire Precinct A from the HLZ via a pressure control valve (PRV) to minimise excess pressure.

2.4 Load Staging

It has been identified that the initial construction will begin with Precinct A (estimated completion by end of 2012). It has been estimated that 145 lots are to be constructed per year for 5 years, followed by a rate of 250 lots per year until completion, at approximately 2021/2 (as shown in Table 2.2). It has been proposed that the initial stages of the development are to be connected to the existing water reticulation system of Paradise Heights (at the junction of South Deebing Road and Winland Drive). The ordering of the staging may be dependant on the capacity limitations of the existing potable water network, which could lead to significant new water infrastructure requirements.

Table 2.2: Potential staging for the Paradise Waters Development

Year	Development Rate (Lots)	Cumulative Development Size (Lots)
2012 (est. completion of Precinct A)	145	145
2013	145	290
2014	145	435
2015	145	580
2016	145	725
2017	250	975
2018	250	1225
2019	250	1475
2020	250	1725
2021	250	1975
2022 (development complete)	125	2100

3 WATER SUPPLY ANALYSIS

3.1 Design Criteria

The reticulation network has been assessed based on the Ipswich Council design criteria from the document "Planning Scheme Policy 3, Part 4 – Water Reticulation" June 2007. Table 3.1 provides a summary of the relevant standards which apply to this assessment.

Table 3.1: Ipswich Region Water Reticulation design criteria

Criteria	Residential	Non - Residential
Average Day Demand (AD)	320L/EP/Day	383 L/EP/Day
Unaccounted for Water (UFW)	50 L/EP/Day	67 L/EP/Day
Mean Day Max Month (MDMM)* factor	1.5 x AD (480/EP/Day)	1.5 x AD (575/EP/Day)
Maximum Day (MD)* factor	2 x AD (640/EP/Day)	1.5 x AD (575/EP/Day)
Maximum Hour (MH) factor	53.3/EP/hour	47.9/EP/hour
Minimum Service pressure (@ MH)	22 metres	
Maximum Service pressure	80 metres	
Fire Fighting requirements (@ MH)	Flow rate 15L/s, residual pressure of 12m	Flow rate 30L/s, residual pressure of 12m
Reservoir storage capacity#	3 x (MD-MDMM)	
Pump Stations & associated pressure mains	Max 20 hours operation per day	
Hazen-Williams C values for reticulation mains	Mains ≤ 150mmØ = 100 Mains 200 to 300mmØ = 110 Mains ≥ 300mmØ = 120	

* factors do not include value for UFW, which is to be added.

"Where the distribution system is capable of supplying flows in excess of MDMM demand, smaller storages could be accepted subject to a risk analysis" – ref item 4.1.4 (2) Planning Scheme Policy 3.

3.2 Design Cases

The following analyses have been performed for the existing system and the proposed internal reticulation of the new development:

a) Max Hour (MH) and Fire Flow analysis and reservoir storage for the existing Paradise Heights HLZ system (according to the 2011 model conditions) to assess baseline system performance,

b) MH and Fire Flow analysis and reservoir storage for the existing Paradise Heights HLZ system (2011) + Precinct A of the Paradise Waters development,

c) Determination of the maximum demand that can be applied to the existing Paradise Heights HLZ system (at the connection point at South Deebing Road/Winland Drive – hydraulic model node J38044).

d) Provisional water supply servicing strategy for the total development (at 2021) incorporating significant new water infrastructure.

3.3 Internal Water Reticulation Sizing

The Precinct A reticulation network layout has been based on the GIS lot layout provided by Bradlees Civil Consulting, with the proposed 200mm, 150mm & 100mm diameter reticulation deemed adequate levels of service for Maximum Hour & Fire Flow conditions (Refer Figure 3.1 for pipe sizing and location – Appendix C). For the full Paradise Waters development a skeletal 200/300mm diameter network has been created (Ref Figure 3.2 – Appendix C) as the actual development layout may change, though this should demonstrate headloss issues across the development.

3.4 Network Analysis & Results

3.4.1 Existing System Analysis (2011)

The results for the existing Paradise Heights HLZ system water supply network at the 2011 planning horizon, during MH demand and under fire fighting conditions without the development for nodes are given in Tables 3.2 and 3.3 respectively in Appendix D. In summary, all nodes in the HLZ network satisfy the design criteria under these conditions.

Table 3.4 and Table 3.5 display the pressures at the proposed connection point to the existing network and critical point (CP) under MH and Fire flow demands without the proposed development.

Table 3.4: Results under maximum hour conditions – existing system

Node Identifier	HGL (m)	Pressure (m)	Acceptance Criteria	Result
J38044 – connection point	148.10	83.99	>22m	Excess pressure
J30187 - CP	148.46	32.55	>22m	Satisfactory

Table 3.5: Results under fire flow conditions – existing system

Node Identifier	Fire Flow (L/s)	Residual Pressure (m)	Acceptance Criteria	Result
J38044 – connection point	15	73.02	>12m	Satisfactory
J30187 - CP	15	24.31	>12m	Satisfactory

3.4.2 Existing System Analysis + Precinct A (2012)

The results for the existing Paradise Heights HLZ system, plus Precinct A demands (592.1EP) during MH demand and under fire fighting conditions are given in Tables 3.6 and 3.7 respectively in Appendix D. A pressure reducing valve (PRV) was added to the network where Precinct A connects to the existing network and set to maintain 50m on the outlet (approx 27m reduction) to prevent pressures at lower lying nodes exceeding 80m. In summary, all nodes in the HLZ network satisfy the design criteria under these conditions.

Table 3.8 and Table 3.9 display the pressures at the proposed connection point to the existing network and critical points (CP) under MH and Fire flow demands with the Precinct A development.

Table 3.8: Results under maximum hour conditions – existing system + Precinct A

Node Identifier	HGL (m)	Pressure (m)	Acceptance Criteria	Result
J38044 – connection point	141.70	77.59	>22m	Satisfactory
J30187 – CP Existing	144.97	29.07	>22m	Satisfactory
PW24 – CP Precinct A	113.87	35.37	>22m	Satisfactory

Table 3.9: Results under fire flow conditions – existing system + Precinct A

Node Identifier	Fire Flow (L/s)	Residual Pressure (m)	Acceptance Criteria	Result
J38044 – connection point	15	56.88	>12m	Satisfactory
J51 - CP	15	15.09	>12m	Satisfactory
PW38 – CP Precinct A	30	24.48	>12m	Satisfactory

3.4.3 Maximum loading that can be applied to existing system

Additional demand was added to the hydraulic model, assuming continued construction into Precinct B to assess the point at which the development could continue to grow from the connection point at node J38044, with no disadvantage experienced by existing customers in terms of level of service.

It was determined that only an additional 100EP (30 residential lots) could be added onto Precinct A, any advance of this would result in failure to provide minimum residual pressures under fire flow conditions at node J51. The results demands under MH and Fire flow conditions, with this additional loading are given in Tables 3.10 and 3.11 respectively in Appendix D.

Table 3.12 and Table 3.13 display the pressures at the proposed connection point to the existing network and critical points (CP) under MH and Fire flow demands with the increased development.

Table 3.12: Results under MH conditions – existing system + Precinct A + 30 lots Precinct B

Node Identifier	HGL (m)	Pressure (m)	Acceptance Criteria	Result
J38044 – connection point	140.1	75.90	>22m	Satisfactory
J30187 - CP	143.93	28.03	>22m	Satisfactory
PWB04 – CP Precinct B	113.81	34.31	>22m	Satisfactory

Table 3.13: Results under fire flow conditions – existing system + Precinct A + 30 lots Precinct B

Node Identifier	Fire Flow (L/s)	Residual Pressure (m)	Acceptance Criteria	Result
J38044 – connection point	15	54.03	>12m	Satisfactory
J51 - CP	15	12.34	>12m	Satisfactory
PW38 – CP Precinct A	30	20.38	>12m	Satisfactory

Figure 3.3 displays an option which would advance the construction of a 200mmØ main though Precincts B and C, to reduce headlosses experienced along the existing mains within the Paradise Heights residential area. Hydraulic modelling at fire-flow conditions, including this new connection revealed that only 60 Lots could be added within Precinct B until residual pressures at node J51 fell below 12m. Adding the demand of Precinct A to this new connection (closing the PRV connection at node J38044) would only allow a total of 90 Lots to be developed until residual pressures fall below 12m at fire-flow conditions.

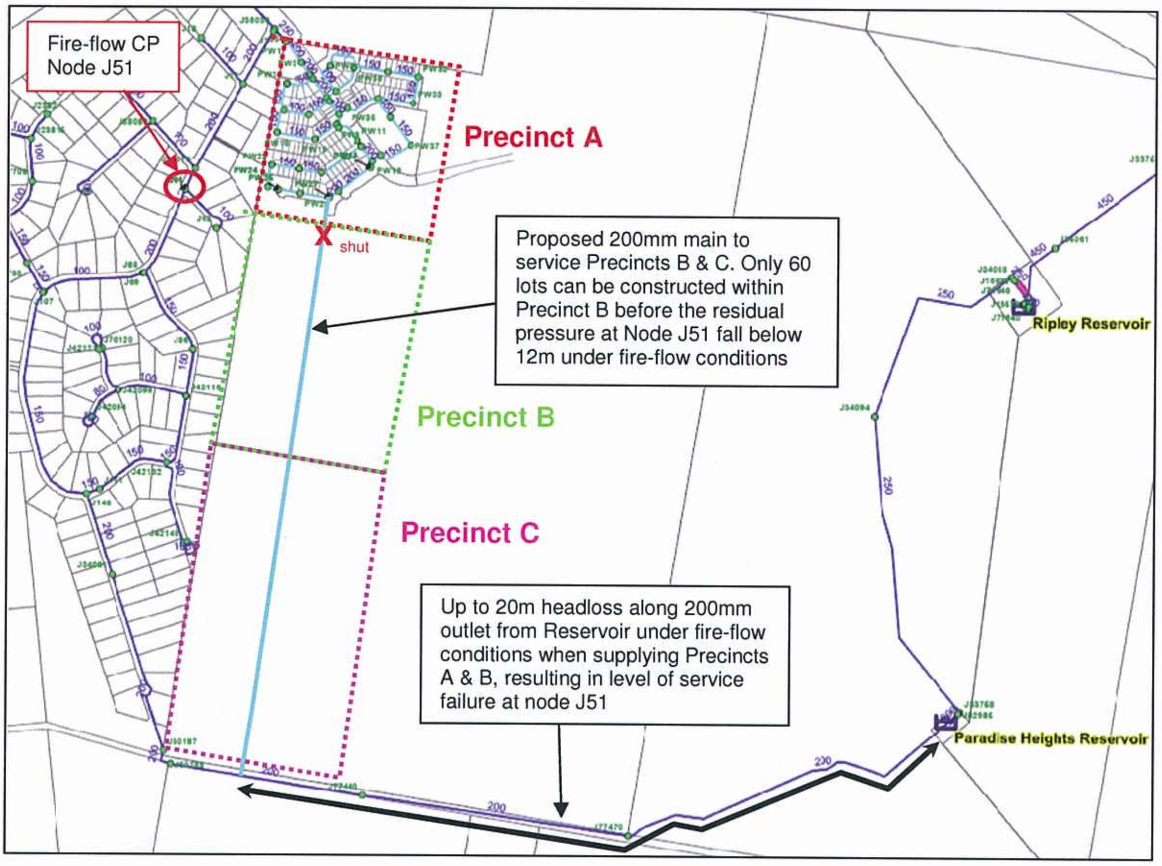


Figure 3.3: 200mmØ Precinct B & C main

Significant development within Precinct B is restricted by large headlosses generated along the 200mmØ outlet main from Paradise Heights Reservoir, under fire-flow conditions. The section from node J33758 to node J30188 experiences up to 20m headloss under these conditions over a total length of 2190m.

Therefore, the development demand of 692EP (Precinct A + 30 lots of Precinct B) becomes the trigger point at which this outlet main requires augmentation to increase capacity, or new mains installed from another source. Based on the current estimated staging as presented in Table 2.2, the timing for this upgrade would be 2013.

3.4.4 Provisional supply strategy for complete development

To resolve the capacity issues along the 200mmØ outlet main from Paradise Heights Reservoir a future water main connection has been identified, connecting to the existing system upstream of Paradise Heights Reservoir. The details of this proposed connection are shown in Figure 3.4 and

Table 3.14. Although this augmentation has been modelled for the 2021 planning horizon, installation will be required at 2013 to maintain DSOS within the HLZ.

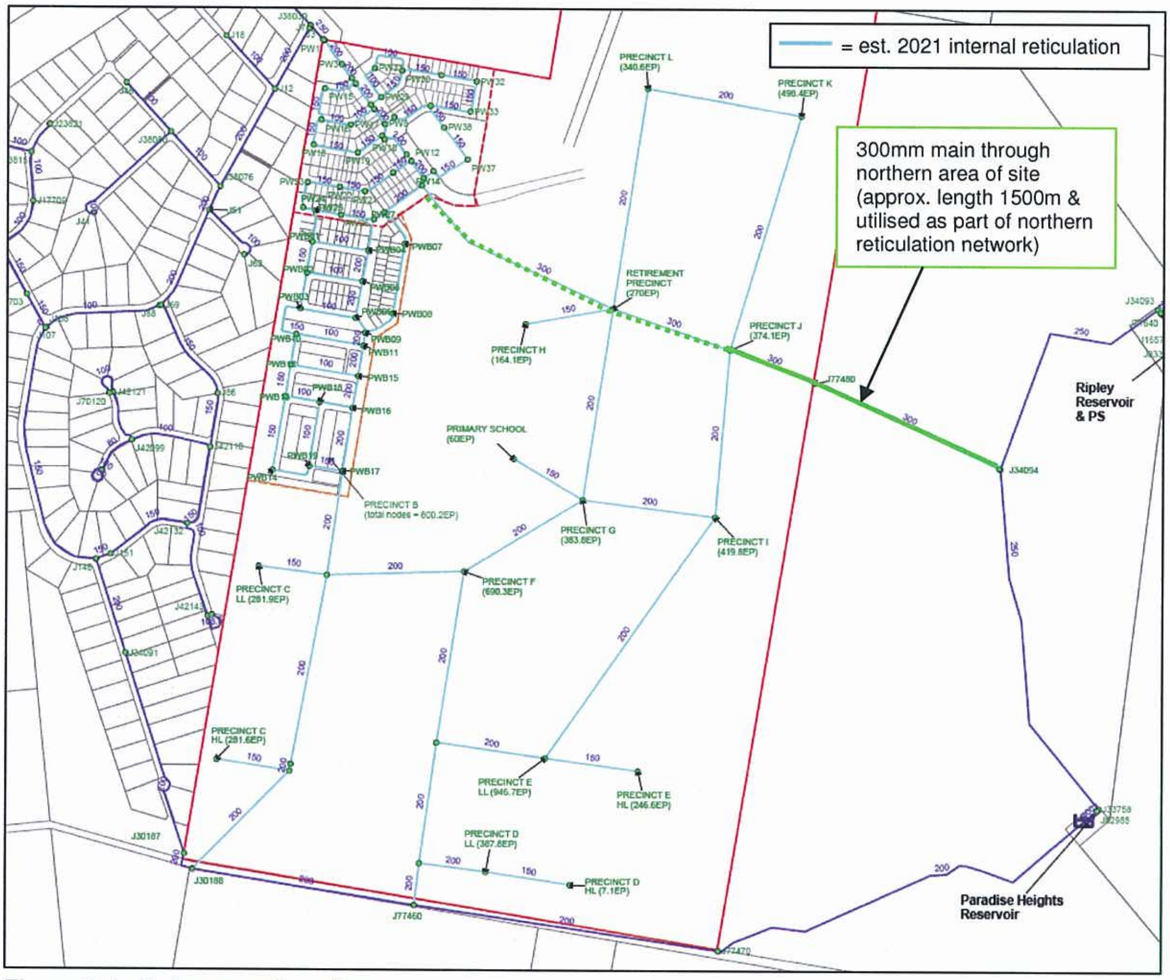


Figure 3.4: Future supply option

Table 3.13: Future supply option details

Diameter (mm)	Length (m)	Comments
300	1500	Connects to pumping main from Ripley PS. Length from Precinct J to A (800m) will form the spine main for the northern area of the development & support pressures in the north-west of the existing HLZ

This future connection require a more detailed route planning assessment, as the alignment passes through open ground that will eventually be developed for Precinct J and the Retirement Precinct, plus adjacent land owned by others. A skeletal 200/300mm diameter network has been created (Ref Figure 3.2 – Appendix C) to illustrate how the system could be configured incorporating this strategy. This new source of supply could allow development to progress initially in the northern area of the site, around the Retirement Precinct and Precinct J.

The results for the existing Paradise Heights HLZ system at the 2021 planning horizon, including the complete Paradise waters Development during MH demand and under fire fighting conditions are given in Tables 3.15 and 3.16 respectively in Appendix D. There are a number of nodes that may receive pressures in excess of 80m due to their relative ground elevation, though these would need to be resolved through pressure management schemes, following the development of the actual lot plans.

Table 3.17 and Table 3.18 display the critical point pressures under MH and Fire flow demands for the complete Paradise Waters development at the 2021 planning horizon.

Table 3.17: Results under MH conditions – existing system (2021) + Paradise Waters development

Node Identifier	HGL (m)	Pressure (m)	Acceptance Criteria	Result
CP existing – J30187	144.01	28.10	>22m	Satisfactory
CP Paradise Waters – PCTE8	143.94	28.94	>22m	Satisfactory

Table 3.18: Results under fire flow conditions – existing system (2021) + Paradise Waters development

Node Identifier	Fire Flow (L/s)	Residual Pressure (m)	Acceptance Criteria	Result
CP existing – J30187	15	25.21	>12m	Satisfactory
CP Paradise Waters – PCTE8	15	23.32	>12m	Satisfactory

3.5 Reservoir Storage

Storage for the HLZ is provided at Paradise Heights Reservoir, which has a capacity of 0.12ML. Table 3.19 shows the storage capacity requirements of the HLZ based on the Ipswich Planning Scheme design criteria

Table 3.19: Paradise Heights HLZ potable water storage requirements

Horizon	Demand (EP)	Storage Requirement (ML) = 3 x (MDMM-MD)	Result compared to current volume
Existing system (2011)	616.5	0.30	Unsatisfactory
Existing + Precinct A (2012)	1208.6	0.58	Unsatisfactory
Existing + Precinct A + 30 lots Precinct B	1308.6	0.63	Unsatisfactory
Projected 2016 + est. 700 lots completed for Paradise water Development (2016)	3700	1.78	Unsatisfactory
Projected 2021 + complete Paradise Waters Development (2021)	8900	4.27	Unsatisfactory
Projected 2041 + complete Paradise Waters Development (2041)	12200	5.86	Unsatisfactory
Projected Ultimate + complete Paradise Waters Development (Ultimate)	13200	6.34	Unsatisfactory

As can be seen from Table 3.19, the existing reservoir does not satisfy the Ipswich Planning scheme design criteria for current and future demand levels. In the short term, it may be possible that surplus storage contained within Ripley Reservoir for the LLZ could be utilized for the HLZ. The Paradise Heights HLZ is supplied directly from the pump station located at the Ripley Reservoir site, which has a total capacity of 26ML. Table 3.20 displays the storage requirement for the Ripley Water Supply Zone, calculated using demands as indicated by the hydraulic model.

Table 3.20: Ripley LLZ potable water storage requirements (current total storage = 26ML)

Horizon	LLZ Demand (EP) (Incl Ebenezer Zone)	Storage Requirement (ML) = 3 x (MDMM-MD)	Result compared to current volume
Existing system (2011)	17321 (Res), 7199 (non-Res)	8.31	Satisfactory
2016	20819 (Res), 9270 (non-Res)	9.99	Satisfactory
2021	26345 (Res), 11553 (non-Res)	12.65	Satisfactory

Based on the assumption that Ripley Reservoir can be included as available storage capacity for the HLZ, Table 3.20 shows that the current available storage can meet the demands of the whole LLZ, plus the HLZ. According to the model, the pump station to the HLZ appears to be capable of supplying flows in excess of the MDMM demand for the HLZ (approx 7.5L/s for 2011) and so potentially no additional storage is required at Paradise Heights for Precinct A. However, as the required storage utilised from the existing Ripley Reservoir is dependant on the pumps at this site, a review of the current power supply and any back-up should be undertaken prior to the acceptance of this option.

Should the utilization of the available capacity at Ripley Reservoir not deemed to be acceptable, the design of a new 5ML storage reservoir should proceed in the near future.

4 SUMMARY

The water supply analysis is summarized below:

- Existing system analysis at the 2011 planning horizon shows that the standards of service are met by the current system configuration, with the exception of the reservoir storage for the Paradise Heights HLZ, for which there is a 0.18ML deficit;
- The addition of the Precinct A demand of 592.1EP to the existing system results in no disadvantage to existing customers in the Paradise Heights HLZ in terms of levels of service received;
- An additional demand of 100EP (30 lots) of Precinct B can be added to Precinct A without existing customers receiving a disadvantaged standard of service. Based on current estimated staging, this is likely to occur in 2013. Further development past this will require augmentation to increase the supply capacity into the HLZ to maintain levels of service (advancing augmentations identified for the 2021 Planning Horizon);
- An investigation will need to be carried out to determine if the total storage available at Ripley Reservoir can be included as available storage for the Paradise Heights HLZ, for the Precinct A stage of the development;
- Based on the inclusion of Ripley Reservoir as available storage capacity for the HLZ, no additional reservoir storage is required to service the Paradise Waters Development for Precinct A. Further development past Precinct A is likely to require augmentations to increase storage capacity at the Paradise Heights Reservoir to maintain pumping efficiency at the supply pump station at Ripley Reservoir. A storage upgrade for the HLZ to 5ML is likely to be required to maintain operational efficiency at the pumps at Ripley Reservoir and satisfy the Ipswich Planning Scheme design criteria up to and including the 2021 Planning Horizon;
- Should the utilization of the available capacity at Ripley Reservoir not deemed to be acceptable for Precinct A, the design of a new 5ML storage reservoir should proceed in the near future.
- A provisional supply strategy has been investigated for the complete Paradise Waters development against the 2021 planning horizon. This has included the connection of the proposed development to the pumping main upstream of the Paradise Heights Reservoir site. This new source of supply could allow development to progress initially in the northern area of the site, around the Retirement Precinct/Precinct J.

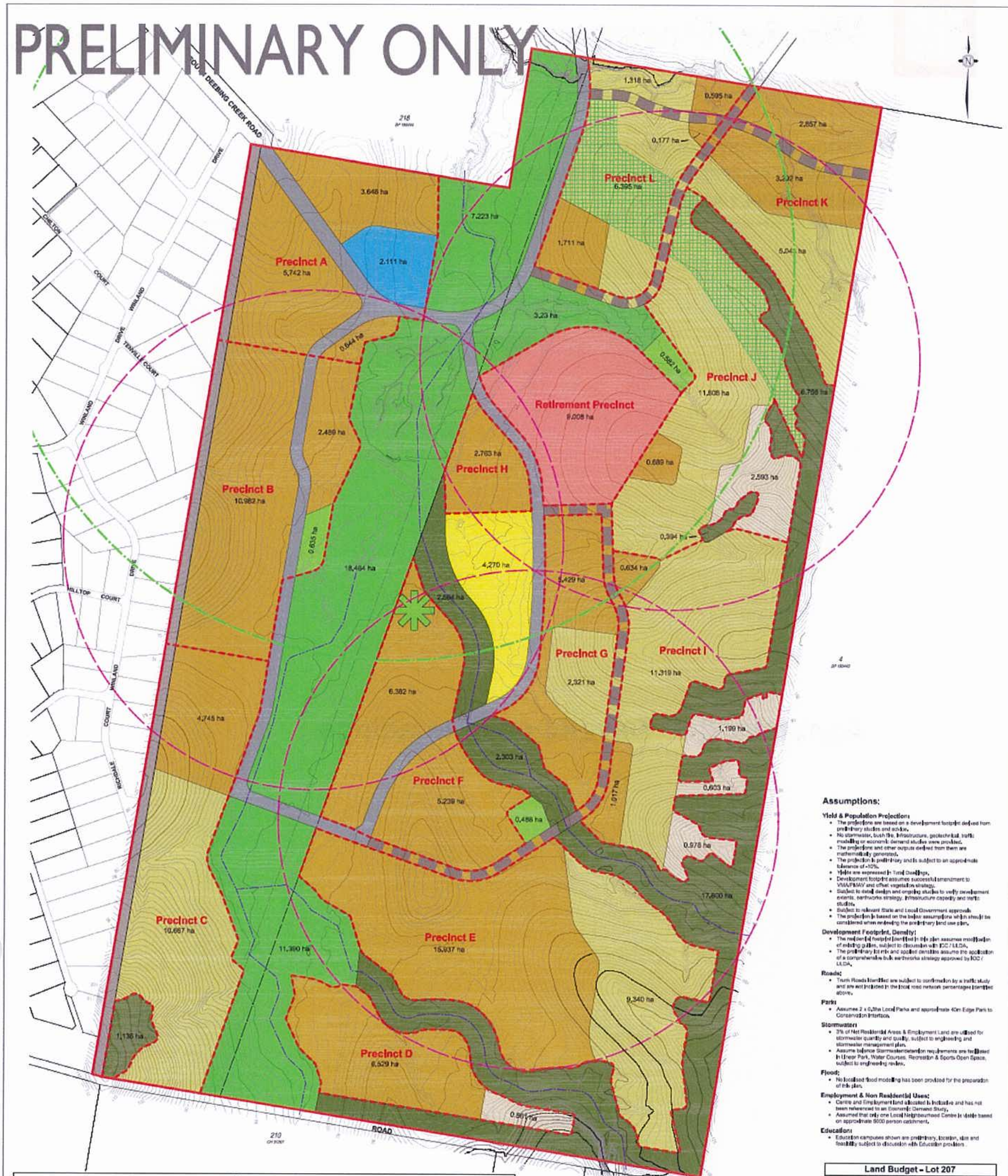
  This connection is required to maintain levels of service, not only within the proposed development boundary, but also within the existing system to the west. Further pressure management analysis will be required at the detail design stage to ensure maximum pressure limits are not exceeded.

5 QUALIFICATION

1. In preparing the report WorleyParsons has exercised the degree of skill and care and diligence normally exercised by members of the engineering profession and has acted in accordance with accepted practices of engineering design principles.
2. WorleyParsons has used all reasonable endeavours to inform itself of the parameters and requirements of the project and has taken all reasonable steps to ensure that the report is as accurate and comprehensive as possible given the information upon which it is based.
3. It is not intended that this report represent a final assessment of the feasibility of the project.
4. WorleyParsons reserves the right to review and amend all calculations and/or opinions included or referred to in the report if additional sources of information not presently available (for whatever reason) are provided or become known to WorleyParsons.
5. The report is restricted in that certain information is obtained from external sources and has not been independently verified.
6. This report is for the use of the party to whom it is addressed and for no other persons. No responsibility is accepted to any third party for the whole or part of the contents of this report.
7. If any claim or demand is made by any person against WorleyParsons on the basis of detriment sustained or alleged to have been sustained as a result of reliance upon the report or information therein, WorleyParsons will rely upon this provision as a defence to any such claim or demand.

Appendix A RPS Drawing 104527-29 Rev E

PRELIMINARY ONLY



Assumptions:

Yield & Population Projection:

- The projections are based on a development footprint derived from preliminary studies and advice.
- No stormwater, bush fire, infrastructure, geotechnical, traffic modelling or economic demand studies were provided.
- The projections and other outputs derived from them are mathematically generated.
- The projection is preliminary and is subject to an approximate tolerance of -10%.
- Yields are expressed in Total Dwellings.
- Development footprint assumes successful amendment to VMA/PMAV and offset vegetation strategy.
- Subject to detail design and ongoing studies to verify development extents, earthworks strategy, infrastructure capacity and traffic studies.
- Subject to relevant State and Local Government approvals.
- The projection is based on the below assumptions which should be considered when reviewing the preliminary land use plan.

Development Footprint, Density:

- The residential footprint identified in this plan assumes modification of existing gullies, subject to discussion with ICC / ULDA.
- The preliminary lot mix and applied densities assume the application of a comprehensive bulk earthworks strategy approved by ICC / ULDA.

Roads:

- Trunk Roads identified are subject to confirmation by a traffic study and are not included in the local road network percentages identified above.

Park:

- Assumes 2 x 0.5ha Local Parks and approximate 40m Edge Park to Conservation Interface.

Stormwater:

- 3% of Net Residential Areas & Employment Land are utilised for stormwater quantity and quality, subject to engineering and stormwater management plan.
- Assume balance Stormwater/detention requirements are facilitated in Linear Park, Water Courses, Recreation & Sports Open Space, subject to engineering review.

Flood:

- No localised flood modelling has been provided for the preparation of this plan.

Employment & Non Residential Uses:

- Centre and Employment land allocated is indicative and has not been referenced to an Economic Demand Study.
- Assumed that only one Local Neighbourhood Centre is viable based on approximate 6000 person catchment.

Education:

- Education campuses shown are preliminary, location, size and feasibility subject to discussion with Education providers.

Yield Assessment

Sub-Urban T3 Zone

	Neighbourhood <12.5% slope			Neighbourhood 12.6-15.9% slope			Neighbourhood 16% + slope			Retirement Village		Total		
	Area	Dwelling Yield		Area	Dwelling Yield		Area	Dwelling Yield		Area	Dwellings	Area	Dwelling Yield	
Precinct	ha	@ 16 dw/ha	@ 18 dw/ha	ha	@ 6 dw/ha	@ 8 dw/ha	ha	@ 1.6 dw/ha	@ 2.5 dw/ha	ha	dw	ha	Low	High
Precinct A	10,034	160	180	0	0	0	0	0	0	0	0	10,034	160	180
Precinct B	13,471	215	242	0	0	0	0	0	0	0	0	13,471	215	242
Precinct C	4,745	75	85	10,667	64	85	0	0	0	0	0	15,412	139	170
Precinct D	8,529	104	117	0	0	0	0,861	1	2	0	0	7,39	105	119
Precinct E	15,937	254	286	9,34	56	74	0	0	0	0	0	25,277	310	360
Precinct F	11,621	185	209	0	0	0	0	0	0	0	0	11,621	185	209
Precinct G	5,429	86	97	2,321	13	18	0	0	0	0	0	7,75	99	115
Precinct H	2,763	44	49	0	0	0	0	0	0	0	0	2,763	44	49
Precinct I	1,651	26	29	11,319	67	90	2,76	5	6	0	0	15,75	98	125
Precinct J	0,689	11	12	11,808	70	94	2,593	4	6	0	0	15,09	85	112
Precinct K	6,149	98	110	5,043	30	40	0	0	0	0	0	11,192	128	150
Precinct L	2,483	39	44	7,713	46	61	0	0	0	0	0	10,196	85	105
Retirement	0	0	0	0	0	0	0	0	0	9,008	180	9,008	180	180
Total	**81,501**	**1297**	**1460**	**58,211**	**346**	**462**	**6,234**	**10**	**14**	**9,008**	**180**	**154,954**	**1833**	**2116**

Structure Plan elements subject to further design:

1. Given the topography characteristics resulting in irregular urban layouts, and the typical forms of house construction required to meet affordability targets, yield will likely be reduced by 10-15%. The table below applies this to the High and low density calculations.

	Total Neighbourhood Dwellings		Retirement Village	Total	
	Low	High		Low	High
-10%	1487	1742	180	1667	1922
-15%	1405	1645	180	1585	1825

2. An area has not been allowed for the Ripley Valley Structure Plan requirements of a major sportsground of 10ha. If required this would need to be spatially tested in the Structure Plan and assessed against stormwater requirements of achieving Q10 for ovals.

3. The location of the retirement village is situated on a 1:10 slope gradient, which will require additional building and earthworks costs compared to a flat site, to achieve access and movement requirements suited to this land use.

Legend

- Site Boundary
- Precinct Boundary
- 500m Walking Catchment
- 800m Walking Catchment
- Area Subject to further Ecological Review
- Waterways to be Retained
- Sports Park / Recreation Park

Land Budget - Lot 207		
Land Type	**ha**	**%**
Open Space		
Linear Park	40,307	15,9%
Local Park	1,705	0,7%
Waterway/Edge Park/Habitat Conservation	31,053	12,3%
Sub total	73,065	28,9%
Non Residential		
Neighbourhood Centre	2,111	0,8%
School (primary)	4,270	1,7%
Trunk Roads	8,486	3,5%
Local Collector Roads	6,176	2,4%
Existing Rural Residential Road	3,793	1,5%
Sub Total	24,846	9,8%
Residential		
Neighbourhood <12,5% slope	81,501	32,2%
Neighbourhood 12,6 - 15,9% slope	58,211	23,0%
Neighbourhood 16% + slope	6,234	2,5%
Retirement Living	9,008	3,6%
Sub total	154,954	61,3%
TOTAL	252,865	100,0%

Note
All dimensions and areas are approximate only and are subject to survey and Council approval.

Dimensions have been rounded to the nearest 0,1 metres.

The boundaries shown on this plan should not be used for final detailed engineers design.

REVISION	Level Datum	Date: 26 OCTOBER 2010
	Origin	Comp By.: WNW
		DWG Name.: 104527_Structure
		Local Authority: IPSWICH CITY COUNCIL
	Scale 1 : 2500 / Sheet A0	Locality: DEEBING HEIGHTS
		Job Reference: 104527

CLIENT
STOCKLAND

STRUCTURE PLAN OVERALL OVER LOT 207 ON CH 31135

PROJECT
PARADISE WATERS

Plan Ref: **104527 - 29** Rev: **E**

RPS

Appendix B Development Loadings

Appendix B: Table 2.1 - Paradise Waters Development Loading by Precinct (in EP)

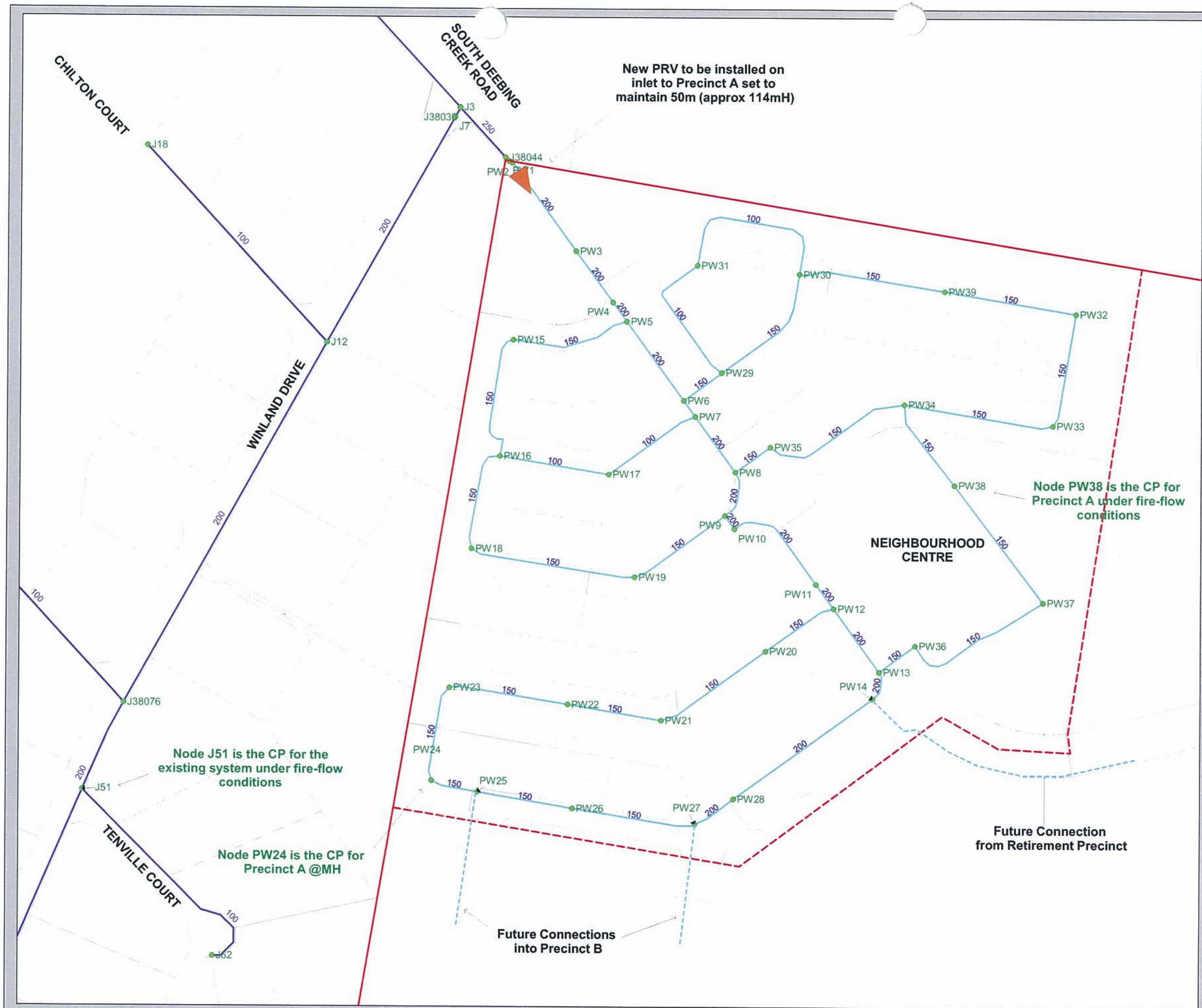
WorleyParsons
resources & energy

Development Type	Dwelling per Ha	Area (Ha)	Total Number of dwellings	Equivalent Persons (EP) (Water)	Total Nr of dwellings per Precinct	EP per Precinct	Precinct
Precinct A - Res as per lot layout (148 single lots, 7 double lots)	-	10.034	155	512.9	155	592.1	**Precinct A**
Precinct A - Neighbourhood Centre	-	2.111	-	79.2			
Precinct B - Res 18	18	13.471	242	800.2	242	800.2	**Precinct B**
Precinct C - Res 8	8	10.667	85	281.6	171	563.5	**Precinct C**
Precinct C - Res 18	18	4.745	85	281.9			
Precinct D - Res 2.5	2.5	0.861	2	7.1	120	394.9	**Precinct D**
Precinct D - Res 18	18	6.529	118	387.8			
Precinct E - Res 8	8	9.340	75	246.6	362	1193.2	**Precinct E**
Precinct E - Res 18	18	15.937	287	946.7			
Precinct F - Res 18	18	11.621	209	690.3	209	690.3	**Precinct F**
Precinct G - Res 8	8	2.321	19	61.3	116	383.8	**Precinct G**
Precinct G - Res 18	18	5.429	98	322.5			
Precinct H - Res 18	18	2.763	50	164.1	50	164.1	**Precinct H**
Precinct I - Res 2.5	2.5	2.780	7	22.9	127	419.8	**Precinct I**
Precinct I - Res 8	8	11.319	91	298.8			
Precinct I - Res 18	18	1.651	30	98.1			
Precinct J - Res 2.5	2.5	2.593	6	21.4	113	374.1	**Precinct J**
Precinct J - Res 8	8	11.808	94	311.7			
Precinct J - Res 18	18	0.689	12	40.9			
Precinct K - Res 8	8	5.043	40	133.1	151	498.4	**Precinct K**
Precinct K - Res 18	18	6.149	111	365.3			
Precinct L - Res 8	8	7.713	62	203.6	103	340.6	**Precinct L**
Precinct L - Res 18	18	2.306	42	137.0			
Retirement Precinct 180 lots	-	9.008	180	270.0	180	270.0	**Retirement Precinct**
Primary School 400 enrolment	-	4.270	-	60.0		60.0	**Primary School**
Total		**161.158**	**2099**	**6745**	**2099**	**6745**	

Development Densities - *Ipswich Planning Scheme Policy 5 - Appendix 1*

Res 2.5/8/18 (dw/ha) Lots>450m²	3.3	EP/lot
Multiple Residential (3 bed)	1.75	per dwelling
Non-Res (Local Retail)	37.5	EP/ha
Retirement Precinct (2bed)	1.5	EP/unit
Primary School (est 400 enrolment)	0.15	EP/enrolment

Appendix C Figures 3.1 & 3.2 – Proposed Reticulation System



N W E S

150	Paradise Waters Site Boundary
	Precinct A Boundary
150	Existing Potable Water Main (nom dia)
150	Proposed Potable Water Main (nom dia)
	Proposed Future Connections
PW1	Node Identifier from Model
	Pressure Reducing Valve

Not to Scale

STOCKLAND DEVELOPMENT PTY LTD

FIGURE 3.1:

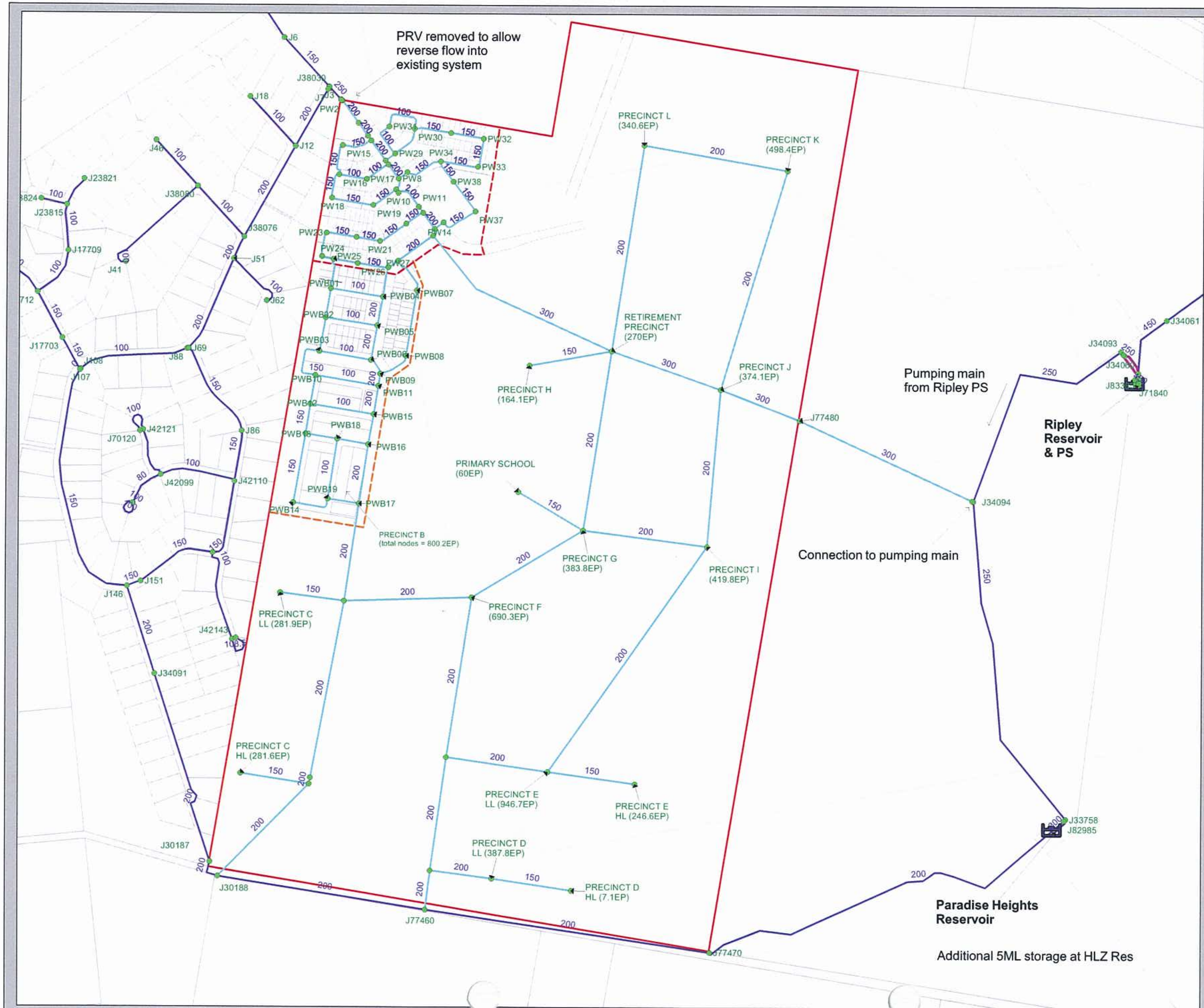
PRECINCT A - PROPOSED POTABLE WATER RETICULATION

PARADISE WATERS DEVELOPMENT

DEEBING HEIGHTS

WorleyParsons
resources & energy

Worley Parsons Services Pty. Ltd.
ABN 61 001 279 812
60 Albert St, Brisbane QLD 4006
Ph. 32449600 Fax. 32449699



N W E S

	Paradise Waters Site Boundary
	Precinct A Boundary
	Precinct B Boundary
150	Existing Potable Water Main (nom dia)
150	Proposed Potable Water Main (nom dia)
PW1	Node Identifier from Model

Not to Scale

STOCKLAND DEVELOPMENT PTY LTD

FIGURE 3.2:

PROVISIONAL POTABLE WATER RETICULATION FOR FULL DEVELOPMENT

PARADISE WATERS DEVELOPMENT

DEEBING HEIGHTS

WorleyParsons
resources & energy

Worley Parsons Services Pty. Ltd.
ABN 61 001 279 812
60 Albert St, Brisbane QLD 4006
Ph. 32449600 Fax. 32449699

Appendix D Model Results

Existing 2011 Hydraulic Model Results (616.5EP)

Existing HLZ System Nodes

Table 3.2: Existing MH Min pressures @ 19:30hrs

ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (m)
J107	0.14	101.31	148.1	46.79
J108	0.36	101.22	148.1	46.88
J12	0.31	73.77	148.1	74.32
J146	0.31	98.46	148.25	49.79
J151	0.17	96.48	148.24	51.76
J17703	0.14	99.46	148.09	48.63
J17707	0.18	82.18	148.07	65.89
J17709	0.13	87.73	148.07	60.34
J17712	0.2	93.26	148.07	54.82
J18	0.16	66.69	148.09	81.41
J23798	0.04	81.12	148.07	66.95
J23815	0.09	78.42	148.06	69.64
J23821	0.11	72.13	148.06	75.93
J23824	0.12	77.32	148.06	70.74
J3	0	64.23	148.1	83.87
J30187	0.12	115.9	148.46	32.55
J30188	0	114.38	148.49	34.1
J34091	0.67	100	148.31	48.31
J38030	0	64.25	148.1	83.84
J38044	0.13	64.11	148.1	83.99
J38076	0.27	103.93	148.1	44.17
J38080	0.44	95.06	148.06	53
J41	0.31	81.5	148.05	66.55
J42094	0.05	82.68	148.08	65.4
J42099	0.22	76.5	148.1	71.6
J42110	0.05	76.15	148.13	71.97
J42121	0.03	82.5	148.1	65.6
J42132	0.22	77.54	148.17	70.63
J42143	0.16	90.51	148.16	57.65
J46	0.13	79.36	148.06	68.69
J51	0.15	106.71	148.1	41.39
J6	0.01	58.59	148.09	89.5
J62	0.14	98.5	148.09	49.59
J69	0.14	94.02	148.1	54.07
J7	0.05	64.88	148.1	83.22
J70110	0.35	82.66	148.08	65.43
J70120	0.05	82.42	148.1	65.68
J70130	0.04	89.38	148.16	58.78
J77200	0.29	82.99	148.07	65.08
J77260	0.09	78.19	148.08	69.89
J77270	0.04	78.5	148.08	69.59
J77280	0	76.33	148.08	71.75
J77290	0.09	80.57	148.08	67.52
J77300	0.04	66.86	148.09	81.23
J77310	0	75.51	148.09	72.58
J77320	0	65.83	148.09	82.26
J77330	1.2	81.5	148.07	66.57
J77460	0	84.41	148.82	64.41
J77470	0.17	102.71	149.28	46.57
J86	0.32	89.16	148.11	58.95
J88	0.22	94.31	148.1	53.79

Table 3.3: Fire-Flow (@ Max Hour)

ID	Static Demand (L/s)	Static Pressure (m)	Static Head (m)	Fire-Flow Demand (L/s)	Residual Pressure (m)
J107	0.14	46.79	148.1	15	35.58
J108	0.36	46.88	148.1	15	35.68
J12	0.31	74.32	148.1	15	63.34
J146	0.31	49.79	148.25	15	40.18
J151	0.17	51.76	148.24	15	41.94
J17703	0.14	48.63	148.09	15	37.04
J17707	0.18	65.89	148.07	15	53.53
J17709	0.13	60.34	148.07	15	42.24
J17712	0.2	54.82	148.07	15	42.79
J18	0.16	81.41	148.09	15	63.09
J23798	0.04	66.95	148.07	15	53.97
J23815	0.09	69.64	148.06	15	46.43
J23821	0.11	75.93	148.06	15	49.27
J23824	0.12	70.74	148.06	15	40.33
J3	0	83.87	148.1	15	72.9
J30187	0.12	32.55	148.46	15	24.31
J30188	0	34.1	148.49	15	26.02
J34091	0.67	48.31	148.31	15	39.04
J38030	0	83.84	148.1	15	72.87
J38044	0.13	83.99	148.1	15	73.02
J38076	0.27	44.17	148.1	15	33.18
J38080	0.44	53	148.06	15	33.88
J41	0.31	66.55	148.05	15	34.31
J42094	0.05	65.4	148.08	15	33.04
J42099	0.22	71.6	148.1	15	51.64
J42110	0.05	71.97	148.13	15	61.01
J42121	0.03	65.6	148.1	15	39.91
J42132	0.22	70.63	148.17	15	59.98
J42143	0.16	57.65	148.16	15	36.54
J46	0.13	68.69	148.06	15	42.82
J51	0.15	41.39	148.1	15	30.41
J6	0.01	89.5	148.09	15	77.93
J62	0.14	49.59	148.09	15	31.74
J69	0.14	54.07	148.1	15	43.15
J7	0.05	83.22	148.1	15	72.25
J70110	0.35	65.43	148.08	15	33
J70120	0.05	65.68	148.1	15	39.73
J70130	0.04	58.78	148.16	15	37.41
J77200	0.29	65.08	148.07	15	52.38
J77260	0.09	69.89	148.08	15	57.78
J77270	0.04	69.59	148.08	15	57.67
J77280	0	71.75	148.08	15	59.05
J77290	0.09	67.52	148.08	15	54.21
J77300	0.04	81.23	148.09	15	67.78
J77310	0	72.58	148.09	15	59.84
J77320	0	82.26	148.09	15	70.56
J77330	1.2	66.57	148.07	15	54.03
J77460	0	64.41	148.82	15	58.2
J77470	0.17	46.57	149.28	15	42.93
J86	0.32	58.95	148.11	15	47.93
J88	0.22	53.79	148.1	15	42.87

2012 Hydraulic Model Results = Existing 2011 (616.5EP) + Precinct A (155 Residential Lots + Neighbourhood Centre = 592.1EP)

Table 3.6: Existing MH Min pressures @ 19:00hrs

	ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (m)
Existing HLZ System Nodes	J107	0.14	101.31	142.38	41.07
	J108	0.36	101.22	142.38	41.16
	J12	0.32	73.77	141.76	67.99
	J146	0.32	98.46	143.65	45.19
	J151	0.17	96.48	143.57	47.09
	J17703	0.14	99.46	142.3	42.84
	J17707	0.18	82.18	142.1	59.92
	J17709	0.13	87.73	142.18	54.45
	J17712	0.2	93.26	142.19	48.93
	J18	0.16	66.69	141.76	75.07
	J23798	0.05	81.12	142.04	60.92
	J23815	0.09	78.42	142.18	63.76
	J23821	0.11	72.13	142.18	70.05
	J23824	0.12	77.32	142.18	64.86
	J3	0	64.23	141.71	77.48
	J30187	0.12	115.9	144.97	29.07
	J30188	0	114.38	145.08	30.69
	J34091	0.68	100	144.05	44.05
	J38030	0	64.25	141.71	77.46
	J38044	0.14	64.11	141.7	77.59
	J38076	0.28	103.93	141.85	37.93
	J38080	0.45	95.06	141.82	46.76
	J41	0.32	81.5	141.81	60.31
	J42094	0.05	82.68	142.55	59.87
	J42099	0.22	76.5	142.57	66.07
	J42110	0.05	76.15	142.59	66.44
	J42121	0.03	82.5	142.56	60.06
	J42132	0.23	77.54	142.99	65.45
	J42143	0.17	90.51	142.99	52.47
	J46	0.13	79.36	141.81	62.45
	J51	0.15	106.71	141.88	35.17
	J6	0.01	58.59	141.74	83.15
	J62	0.15	98.5	141.88	43.38
	J69	0.14	94.02	142.01	47.99
	J7	0.05	64.88	141.71	76.83
	J70110	0.35	82.66	142.55	59.89
	J70120	0.05	82.42	142.56	60.14
	J70130	0.05	89.38	142.99	53.6
	J77200	0.3	82.99	141.89	58.89
	J77260	0.09	78.19	141.78	63.59
	J77270	0.04	78.5	141.76	63.27
	J77280	0	76.33	141.76	65.43
	J77290	0.09	80.57	141.75	61.19
	J77300	0.04	66.86	141.75	74.9
	J77310	0	75.51	141.75	66.25
	J77320	0	65.83	141.75	75.92
	J77330	1.22	81.5	142.04	60.54
	J77460	0	84.41	146.3	61.89
	J77470	0.18	102.71	147.97	45.26
	J86	0.33	89.16	142.39	53.22
	J88	0.23	94.31	142.01	47.7
Precinct A Nodes (Pressure controlled to 114mH at inlet)	PW1	0	64	141.7	77.7
	PW10	0.15	73	113.88	40.88
	PW11	0.05	69.5	113.88	44.38
	PW12	0.05	69	113.88	44.88
	PW13	0	65	113.88	48.88
	PW14	0.2	65	113.87	48.87
	PW15	0.16	68.5	113.91	45.41
	PW16	0.26	69.5	113.9	44.4
	PW17	0.36	69	113.89	44.89
	PW18	0.31	73.5	113.89	40.39
	PW19	0.66	72.5	113.88	41.38
	PW2	0	64	114	50
	PW20	0.51	71	113.87	42.87
	PW21	0.36	69.5	113.87	44.37
	PW22	0.61	71.5	113.87	42.37
	PW23	0.21	77	113.87	36.87
	PW24	0.05	78.5	113.87	35.37
	PW25	0.1	75.5	113.87	38.37
	PW26	0.3	71.5	113.87	42.37
	PW27	0.1	68	113.87	45.87
	PW28	0.25	66.5	113.87	47.37
	PW29	0.25	70	113.89	43.89
	PW3	0	63	113.96	50.96
	PW30	0.51	70	113.88	43.88
	PW31	0.2	66.5	113.88	47.38
	PW32	0.41	55	113.88	58.88
	PW33	0.2	55.5	113.88	58.38
	PW34	0.36	65	113.88	48.88
	PW35	0.21	71.5	113.88	42.38
	PW36	0	63	113.88	50.88
	PW37	0.3	58	113.88	55.88
	PW38	0.3	61	113.88	52.88
	PW39	0.61	63	113.88	50.88
	PW4	0	66.5	113.93	47.43
	PW5	0.1	67.5	113.92	46.42
	PW6	0.1	71	113.9	42.9
	PW7	0.1	72	113.89	41.89
	PW8	0	73	113.89	40.89
	PW9	0.15	73	113.88	40.88

Table 3.7: Fire-Flow (@ Max Hour)

ID	Static Demand (L/s)	Static Pressure (m)	Static Head (m)	Fire-Flow Demand (L/s)	Residual Pressure (m)
J107	0.14	41.07	142.38	15	22.18
J108	0.36	41.16	142.38	15	22.29
J12	0.32	67.99	141.76	15	47.5
J146	0.32	45.19	143.65	15	30.29
J151	0.17	47.09	143.57	15	31.72
J17703	0.14	42.84	142.3	15	23.44
J17707	0.18	59.92	142.1	15	39.64
J17709	0.13	54.45	142.18	15	28.5
J17712	0.2	48.93	142.19	15	29.06
J18	0.16	75.07	141.76	15	47.24
J23798	0.05	60.92	142.04	15	39.94
J23815	0.09	63.76	142.18	15	32.68
J23821	0.11	70.05	142.18	15	35.52
J23824	0.12	64.86	142.18	15	26.58
J3	0	77.48	141.71	15	56.82
J30187	0.12	29.07	144.97	15	17.15
J30188	0	30.69	145.08	15	19.01
J34091	0.68	44.05	144.05	15	30.06
J38030	0	77.46	141.71	15	56.79
J38044	0.14	77.59	141.7	15	56.88
J38076	0.28	37.93	141.85	15	17.76
J38080	0.45	46.76	141.82	15	18.44
J41	0.32	60.31	141.81	15	18.86
J42094	0.05	59.87	142.55	15	19.8
J42099	0.22	66.07	142.57	15	38.41
J42110	0.05	66.44	142.59	15	47.8
J42121	0.03	60.06	142.56	15	26.68
J42132	0.23	65.45	142.99	15	47.79
J42143	0.17	52.47	142.99	15	24.35
J46	0.13	62.45	141.81	15	27.38
J51	0.15	35.17	141.88	15	15.09
J6	0.01	83.15	141.74	15	62.25
J62	0.15	43.38	141.88	15	16.42
J69	0.14	47.99	142.01	15	28.28
J7	0.05	76.83	141.71	15	56.16
J70110	0.35	59.89	142.55	15	19.76
J70120	0.05	60.14	142.56	15	26.5
J70130	0.05	53.6	142.99	15	25.22
J77200	0.3	58.89	141.89	15	37.75
J77260	0.09	63.59	141.78	15	42.5
J77270	0.04	63.27	141.76	15	42.24
J77280	0	65.43	141.76	15	43.54
J77290	0.09	61.19	141.75	15	38.51
J77300	0.04	74.9	141.75	15	52.23
J77310	0	66.25	141.75	15	44.31
J77320	0	75.92	141.75	15	54.97
J77330	1.22	60.54	142.04	15	40
J77460	0	61.89	146.3	15	52.91
J77470	0.18	45.26	147.97	15	40
J86	0.33	53.22	142.39	15	34.14
J88	0.23	47.7	142.01	15	27.99
PW1	0	77.7	141.7	15	56.98
PW10	0.15	40.88	113.88	15	40.15
PW11	0.05	44.38	113.88	15	43.53
PW12	0.05	44.88	113.88	15	44.01
PW13	0	48.88	113.88	15	47.96
PW14	0.2	48.87	113.87	15	47.93
PW15	0.16	45.41	113.91	15	44.63
PW16	0.26	44.4	113.9	15	43.52
PW17	0.36	44.89	113.89	15	43.02
PW18	0.31	40.39	113.89	15	39.41
PW19	0.66	41.38	113.88	15	40.45
PW2	0	50	114	15	50
PW20	0.51	42.87	113.87	15	41.67
PW21	0.36	44.37	113.87	15	42.9
PW22	0.61	42.37	113.87	15	40.79
PW23	0.21	36.87	113.87	15	35.25
PW24	0.05	35.37	113.87	15	33.79
PW25	0.1	38.37	113.87	15	36.83
PW26	0.3	42.37	113.87	15	40.96
PW27	0.1	45.87	113.87	15	44.76
PW28	0.25	47.37	113.87	15	46.29
PW29	0.25	43.89	113.89	15	43.08
PW3	0	50.96	113.96	15	50.81
PW30	0.51	43.88	113.88	15	42.81
PW31	0.2	47.38	113.88	15	44.7
PW32	0.41	58.88	113.88	15	57.58
PW33	0.2	58.38	113.88	15	57.15
PW34	0.36	48.88	113.88	15	47.91
PW35	0.21	42.38	113.88	15	41.56
PW36	0	50.88	113.88	15	49.87
PW37	0.3	55.88	113.88	30	27.31
PW38	0.3	52.88	113.88	30	24.48
PW39	0.61	50.88	113.88	15	49.61
PW4	0	47.43	113.93	15	47.04
PW5	0.1	46.42	113.92	15	45.98
PW6	0.1	42.9	113.9	15	42.3
PW7	0.1	41.89	113.89	15	41.28
PW8	0	40.89	113.89	15	40.21
PW9	0.15	40.88	113.88	15	40.17

2013 Hydraulic Model Results = Existing + Precinct A + 30 Lots of Precinct B (592.1 + 100 = 692.1EP)

Max loading possible from Existing System

Table 3.10: Existing MH Min pressures @ 19:00hrs

	ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (m)
Existing HLZ System Nodes	J107	0.14	101.31	140.87	39.56
	J108	0.36	101.22	140.87	39.66
	J12	0.32	73.77	140.09	66.32
	J146	0.32	98.46	142.39	43.92
	J151	0.17	96.48	142.29	45.8
	J17703	0.14	99.46	140.78	41.32
	J17707	0.18	82.18	140.55	58.36
	J17709	0.13	87.73	140.64	52.92
	J17712	0.2	93.26	140.65	47.4
	J18	0.16	66.69	140.09	73.4
	J23798	0.05	81.12	140.47	59.35
	J23815	0.09	78.42	140.64	62.22
	J23821	0.11	72.13	140.64	68.51
	J23824	0.12	77.32	140.64	63.32
	J3	0	64.23	140.02	75.8
	J30187	0.12	115.9	143.93	28.03
	J30188	0	114.38	144.05	29.67
	J34091	0.68	100	142.85	42.85
	J38030	0	64.25	140.02	75.77
	J38044	0.14	64.11	140.01	75.9
	J38076	0.28	103.93	140.21	36.29
	J38080	0.45	95.06	140.17	45.12
	J41	0.32	81.5	140.16	58.66
	J42094	0.05	82.68	141.08	58.4
	J42099	0.22	76.5	141.1	64.6
	J42110	0.05	76.15	141.12	64.97
	J42121	0.03	82.5	141.1	58.6
	J42132	0.23	77.54	141.6	64.06
	J42143	0.17	90.51	141.59	51.08
	J46	0.13	79.36	140.17	60.81
	J51	0.15	106.71	140.25	33.54
	J6	0.01	58.59	140.07	81.47
	J62	0.15	98.5	140.25	41.75
	J69	0.14	94.02	140.41	46.39
	J7	0.05	64.88	140.02	75.14
	J86	0.33	89.16	140.87	51.71
	J88	0.23	94.31	140.41	46.1
	J70110	0.35	82.66	141.08	58.42
	J70120	0.05	82.42	141.1	58.67
	J70130	0.05	89.38	141.59	52.21
	J77200	0.3	82.99	140.27	57.27
	J77260	0.09	78.19	140.12	61.93
	J77270	0.04	78.5	140.1	61.6
	J77280	0	76.33	140.09	63.76
	J77290	0.09	80.57	140.09	59.52
	J77300	0.04	66.86	140.09	73.23
	J77310	0	75.51	140.08	64.58
	J77320	0	65.83	140.08	74.25
	J77330	1.22	81.5	140.47	58.97
	J77460	0	84.41	145.49	61.08
	J77470	0.18	102.71	147.45	44.74
Precinct A Nodes (Pressure controlled to 114mH at inlet)	PW1	0	64	140.01	76.01
	PW2	0	64	114	50
	PW3	0	63	113.94	50.94
	PW4	0	66.5	113.91	47.41
	PW5	0.1	67.5	113.89	46.39
	PW6	0.1	71	113.86	42.86
	PW7	0.1	72	113.86	41.86
	PW8	0	73	113.84	40.84
	PW9	0.15	73	113.84	40.84
	PW10	0.15	73	113.84	40.84
	PW11	0.05	69.5	113.83	44.33
	PW12	0.05	69	113.83	44.83
	PW13	0	65	113.82	48.82
	PW14	0.2	65	113.82	48.82
	PW15	0.16	68.5	113.88	45.38
	PW16	0.26	69.5	113.86	44.36
	PW17	0.36	69	113.86	44.86
	PW18	0.31	73.5	113.85	40.35
	PW19	0.66	72.5	113.84	41.34
	PW20	0.51	71	113.82	42.82
	PW21	0.36	69.5	113.81	44.31
	PW22	0.61	71.5	113.81	42.31
	PW23	0.21	77	113.81	36.81
	PW24	0.05	78.5	113.81	35.31
	PW25	0.1	75.5	113.81	38.31
	PW26	0.3	71.5	113.81	42.31
	PW27	0.1	68	113.81	45.81
	PW28	0.25	66.5	113.82	47.32
	PW29	0.25	70	113.85	43.85
	PW30	0.51	70	113.84	43.84
	PW31	0.2	66.5	113.84	47.34
	PW32	0.41	55	113.83	58.83
	PW33	0.2	55.5	113.83	58.33
	PW34	0.36	65	113.83	48.83
	PW35	0.21	71.5	113.84	42.34
	PW36	0	63	113.82	50.82
	PW37	0.3	58	113.82	55.82
	PW38	0.3	61	113.83	52.83
	PW39	0.61	63	113.83	50.83
Precinct B Nodes	PWB01	0.77	79.5	113.81	34.31
	PWB04	0.77	70	113.81	43.81

Table 3.11: Fire-Flow (@ Max Hour)

ID	Static Demand (L/s)	Static Pressure (m)	Static Head (m)	Fire-Flow Demand (L/s)	Residual Pressure (m)
J107	0.14	39.56	140.87	15	19.66
J108	0.36	39.66	140.87	15	19.77
J12	0.32	66.32	140.09	15	44.69
J146	0.32	43.92	142.39	15	28.23
J151	0.17	45.8	142.29	15	29.63
J17703	0.14	41.32	140.78	15	20.83
J17707	0.18	58.36	140.55	15	37.05
J17709	0.13	52.92	140.64	15	25.92
J17712	0.2	47.4	140.65	15	26.47
J18	0.16	73.4	140.09	15	44.43
J23798	0.05	59.35	140.47	15	37.34
J23815	0.09	62.22	140.64	15	30.1
J23821	0.11	68.51	140.64	15	32.93
J23824	0.12	63.32	140.64	15	23.99
J3	0	75.8	140.02	15	53.97
J30187	0.12	28.03	143.93	15	15.49
J30188	0	29.67	144.05	15	17.38
J34091	0.68	42.85	142.85	15	28.12
J38030	0	75.77	140.02	15	53.94
J38044	0.14	75.9	140.01	15	54.03
J38076	0.28	36.29	140.21	15	14.99
J38080	0.45	45.12	140.17	15	15.67
J41	0.32	58.66	140.16	15	16.09
J42094	0.05	58.4	141.08	15	17.3
J42099	0.22	64.6	141.1	15	35.91
J42110	0.05	64.97	141.12	15	45.29
J42121	0.03	58.6	141.1	15	24.18
J42132	0.23	64.06	141.6	15	45.44
J42143	0.17	51.08	141.59	15	22
J46	0.13	60.81	140.17	15	24.61
J51	0.15	33.54	140.25	15	12.34
J6	0.01	81.47	140.07	15	59.44
J62	0.15	41.75	140.25	15	13.67
J69	0.14	46.39	140.41	15	25.59
J7	0.05	75.14	140.02	15	53.32
J70110	0.35	58.42	141.08	15	17.26
J70120	0.05	58.67	141.1	15	24
J70130	0.05	52.21	141.59	15	22.87
J77200	0.3	57.27	140.27	15	35.06
J77260	0.09	61.93	140.12	15	39.73
J77270	0.04	61.6	140.1	15	39.45
J77280	0	63.76	140.09	15	40.74
J77290	0.09	59.52	140.09	15	35.71
J77300	0.04	73.23	140.09	15	49.42
J77310	0	64.58	140.08	15	41.51
J77320	0	74.25	140.08	15	52.17
J77330	1.22	58.97	140.47	15	37.4
J77460	0	61.08	145.49	15	51.63
J77470	0.18	44.74	147.45	15	39.21
J86	0.33	51.71	140.87	15	31.56
J88	0.23	46.1	140.41	15	25.3
PW1	0	76.01	140.01	15	54.12
PW10	0.15	40.84	113.84	15	40.04
PW11	0.05	44.33	113.83	15	43.4
PW12	0.05	44.83	113.83	15	43.87
PW13	0	48.82	113.82	15	47.82
PW14	0.2	48.82	113.82	15	47.79
PW15	0.16	45.38	113.88	15	44.55
PW16	0.26	44.36	113.86	15	43.43
PW17	0.36	44.86	113.86	15	42.94
PW18	0.31	40.35	113.85	15	39.32
PW19	0.66	41.34	113.84	15	40.35
PW2	0	50	114	15	50
PW20	0.51	42.82	113.82	15	41.54
PW21	0.36	44.31	113.81	15	42.78
PW22	0.61	42.31	113.81	15	40.68
PW23	0.21	36.81	113.81	15	35.17
PW24	0.05	35.31	113.81	15	33.73
PW25	0.1	38.31	113.81	15	36.78
PW26	0.3	42.31	113.81	15	40.83
PW27	0.1	45.81	113.81	15	44.58
PW28	0.25	47.32	113.82	15	46.12
PW29	0.25	43.85	113.85	15	42.99
PW3	0	50.94	113.94	15	50.78
PW30	0.51	43.84	113.84	15	42.72
PW31	0.2	47.34	113.84	15	44.61
PW32	0.41	58.83	113.83	15	57.48
PW33	0.2	58.33	113.83	15	57.05
PW34	0.36	48.83	113.83	15	47.8
PW35	0.21	42.34	113.84	15	41.46
PW36	0	50.82	113.82	15	49.73
PW37	0.3	55.82	113.82	30	23.2
PW38	0.3	52.83	113.83	30	20.38
PW39	0.61	50.83	113.83	15	49.52
PW4	0	47.41	113.91	15	47.15
PW5	0.1	46.39	113.89	15	45.92
PW6	0.1	42.86	113.86	15	42.22
PW7	0.1	41.86	113.86	15	41.19
PW8	0	40.84	113.84	15	40.11
PW9	0.15	40.84	113.84	15	40.06
PWB01	0.77	34.31	113.81	15	32.41
PWB04	0.77	43.81	113.81	15	42.46

2021 Hydraulic Model Results = 2021 existing model loading (2160.5EP) + Full Paradise Waters development loading (6745EP)

Table 3.15: Existing MH Min pressures @ 19:00hrs

	ID	Demand (L/s)	Elevation (m)	Head (m)	Pressure (m)
Existing HLZ System Nodes	J107	0.15	101.31	142.92	41.61
	J108	0.37	101.22	142.91	41.7
	J12	0.32	73.77	143.59	69.81
	J146	0.33	98.46	143.6	45.14
	J151	0.18	96.48	143.6	47.11
	J17703	0.15	99.46	142.72	43.26
	J17707	0.19	82.18	142.2	60.01
	J17709	0.14	87.73	142.43	54.71
	J17712	0.21	93.26	142.45	49.19
	J18	0.21	66.69	143.58	76.9
	J23798	0.05	81.12	142.02	60.91
	J23815	0.09	78.42	142.43	64.01
	J23821	0.15	72.13	142.43	70.3
	J23824	0.13	77.32	142.43	65.11
	J3	0	64.23	143.62	79.39
	J30187	0.15	115.9	144.01	28.1
	J30188	0	114.38	144.04	29.66
	J34091	0.95	100	143.71	43.71
	J38030	0	64.25	143.62	79.37
	J38044	0.05	64.11	143.63	79.53
	J38076	0.3	103.93	143.54	39.62
	J38080	0.47	95.06	143.49	48.44
	J41	0.35	81.5	143.48	61.98
	J42094	0.06	82.68	143.47	60.79
	J42099	0.22	76.5	143.49	66.99
	J42110	0.08	76.15	143.52	67.37
	J42121	0.05	82.5	143.49	60.99
	J42132	0.26	77.54	143.55	66.01
	J42143	0.19	90.51	143.54	53.03
	J46	0.19	79.36	143.49	64.13
	J51	0.17	106.71	143.54	36.83
	J6	0.02	58.59	143.4	84.81
	J62	0.17	98.5	143.54	45.04
	J69	0.16	94.02	143.52	49.49
	J7	0.06	64.88	143.62	78.74
	J70110	0.39	82.66	143.47	60.81
	J70120	0.09	82.42	143.49	61.06
	J70130	0.05	89.38	143.54	54.16
	J77200	1.48	82.99	141.96	58.97
	J77210	0.09	72.27	141.61	69.34
	J77220	5.79	70.55	140.93	70.38
	J77230	0	78.01	140.93	62.92
	J77240	0	70.5	140.93	70.43
	J77250	5.53	76.33	140.07	63.73
	J77260	0	78.19	141.96	63.77
	J77270	3.66	78.5	142.31	63.81
	J77280	0	76.33	142.4	66.07
	J77290	2.61	80.57	142.4	61.83
	J77300	0	66.86	142.48	75.62
	J77310	0	75.51	142.54	67.04
	J77320	0	65.83	143	77.17
	J77330	5.34	81.5	142.02	60.52
	J77460	0	84.41	144.56	60.15
	J77470	0	102.71	148.23	45.52
	J77480	0	101.46	149.02	47.56
	J86	0.36	89.16	143.52	54.36
	J88	0.24	94.31	143.52	49.21
Precinct A Nodes	PW1	0	64	143.65	79.65
	PW10	0.12	73	144.55	71.55
	PW11	0.04	69.5	144.79	75.29
	PW12	0.04	69	144.85	75.85
	PW13	0	65	145.07	80.07
	PW14	0.17	65	145.21	80.21
	PW15	0.14	68.5	144.22	75.72
	PW16	0.23	69.5	144.3	74.8
	PW17	0.29	69	144.32	75.32
	PW18	0.26	73.5	144.35	70.85
	PW19	0.54	72.5	144.44	71.94
	PW2	0	64	143.66	79.66
	PW20	0.42	71	144.83	73.83
	PW21	0.29	69.5	144.8	75.3
	PW22	0.5	71.5	144.78	73.28
	PW23	0.18	77	144.76	67.76
	PW24	0.04	78.5	144.75	66.25
	PW25	0.08	75.5	144.74	69.24
	PW26	0.25	71.5	144.77	73.27
	PW27	0.08	68	144.81	76.81
	PW28	0.21	66.5	144.88	78.38
	PW29	0.21	70	144.32	74.32
	PW3	0	63	143.93	80.93
	PW30	0.43	70	144.34	74.34
	PW31	0.17	66.5	144.33	77.83
	PW32	0.33	55	144.4	89.4
	PW33	0.17	55.5	144.44	88.94
	PW34	0.29	65	144.5	79.5
	PW35	0.18	71.5	144.47	72.97
	PW36	0	63	145.01	82.01
	PW37	0.3	58	144.8	86.8
	PW38	0.3	61	144.61	83.61
	PW39	0.5	63	144.37	81.37
	PW4	0	66.5	144.09	77.59
	PW5	0.08	67.5	144.15	76.65
	PW6	0.08	71	144.32	73.32
	PW7	0.08	72	144.35	72.35
	PW8	0	73	144.46	71.46
	PW9	0.12	73	144.52	71.52

Table 3.16: Fire-Flow (@ Max Hour)

ID	Static Demand (L/s)	Static Pressure (m)	Static Head (m)	Fire-Flow Demand (L/s)	Residual Pressure (m)
J107	0.15	41.61	142.92	15	36.31
J108	0.37	41.7	142.91	15	36.4
J12	0.32	69.81	143.59	15	66.36
J146	0.33	45.14	143.6	15	41.61
J151	0.18	47.11	143.6	15	43.47
J17703	0.15	43.26	142.72	15	37.58
J17707	0.19	60.01	142.2	15	53.6
J17709	0.14	54.71	142.43	15	42.5
J17712	0.21	49.19	142.45	15	43.1
J18	0.21	76.9	143.58	15	66.06
J23798	0.05	60.91	142.02	15	53.86
J23815	0.09	64.01	142.43	15	46.65
J23821	0.15	70.3	142.43	15	49.47
J23824	0.13	65.11	142.43	15	40.53
J3	0	79.39	143.62	15	76.1
J30187	0.15	28.1	144.01	15	25.21
J30188	0	29.66	144.04	15	26.84
J34091	0.95	43.71	143.71	15	40.33
J38030	0	79.37	143.62	15	76.08
J38044	0.05	79.53	143.63	15	76.26
J38076	0.3	39.62	143.54	15	35.98
J38080	0.47	48.44	143.49	15	36.55
J41	0.35	61.98	143.48	15	36.92
J42094	0.06	60.79	143.47	15	34.93
J42099	0.22	66.99	143.49	15	53.61
J42110	0.08	67.37	143.52	15	63.1
J42121	0.05	60.99	143.49	15	41.84
J42132	0.26	66.01	143.55	15	61.85
J42143	0.19	53.03	143.54	15	38.38
J46	0.19	64.13	143.49	15	45.44
J51	0.17	36.83	143.54	15	33.16
J6	0.02	84.81	143.4	15	81.12
J62	0.17	45.04	143.54	15	34.47
J69	0.16	49.49	143.52	15	45.7
J7	0.06	78.74	143.62	15	75.45
J70110	0.39	60.81	143.47	15	34.89
J70120	0.09	61.06	143.49	15	41.65
J70130	0.05	54.16	143.54	15	39.25
J77200	1.48	58.97	141.96	15	52.34
J77210	0.09	69.34	141.61	15	62.19
J77220	5.79	70.38	140.93	15	60.64
J77230	0	62.92	140.93	15	50
J77240	0	70.43	140.93	15	54.53
J77250	5.53	63.73	140.07	15	45.09
J77260	0	63.77	141.96	15	57.93
J77270	3.66	63.81	142.31	15	58.57
J77280	0	66.07	142.4	15	60.27
J77290	2.61	61.83	142.4	15	55.08
J77300	0	75.62	142.48	15	68.93
J77310	0	67.04	142.54	15	61.29
J77320	0	77.17	143	15	72.86
J77330	5.34	60.52	142.02	15	53.92
J77460	0	60.15	144.56	15	57.58
J77470	0	45.52	148.23	15	42.26
J77480	0	47.56	149.02	15	46.62
J86	0.36	54.36	143.52	15	50.16
J88	0.24	49.21	143.52	15	45.41
PW1	0	79.65	143.65	15	76.38
PW10	0.12	71.55	144.55	15	68.97
PW11	0.04	75.29	144.79	15	72.93
PW12	0.04	75.85	144.85	15	73.57
PW13	0	80.07	145.07	15	77.9
PW14	0.17	80.21	145.21	15	78.13
PW15	0.14	75.72	144.22	15	72.67
PW16	0.23	74.8	144.3	15	71.79
PW17	0.29	75.32	144.32	15	71.31
PW18	0.26	70.85	144.35	15	67.8
PW19	0.54	71.94	144.44	15	68.94
PW2	0	79.66	143.66	15	76.4
PW20	0.42	73.83	144.83	15	71.33
PW21	0.29	75.3	144.8	15	72.61
PW22	0.5	73.28	144.78	15	70.53
PW23	0.18	67.76	144.76	15	65.04
PW24	0.04	66.25	144.75	15	63.62
PW25	0.08	69.24	144.74	15	66.69
PW26	0.25	73.27	144.77	15	70.71
PW27	0.08	76.81	144.81	15	74.48
PW28	0.21	78.38	144.88	15	76.07
PW29	0.21	74.32	144.32	15	71.41
PW3	0	80.93	143.93	15	77.86
PW30	0.43	74.34	144.34	15	71.23
PW31	0.17	77.83	144.33	15	73.18
PW32	0.33	89.4	144.4	15	86.19
PW33	0.17	88.94	144.44	15	85.86
PW34	0.29	79.5	144.5	15	76.7
PW35	0.18	72.97	144.47	15	70.22
PW36	0	82.01	145.01	15	79.5
PW37	0.3	86.8	144.8	30	80.49
PW38	0.3	83.61	144.61	30	77.16
PW39	0.5	81.37	144.37	15	78.12
PW4	0	77.59	144.09	15	74.64
PW5	0.08	76.65	144.15	15	73.75
PW6	0.08	73.32	144.32	15	70.54
PW7	0.08	72.35	144.35	15	69.6
PW8	0	71.46	144.46	15	68.8
PW9	0.12	71.52	144.52	15	68.92

2021 Hydraulic Model Results = 2021 existing model loading (2160.5EP) + Full Paradise Waters development loading (6745EP) - Continued

Table 3.15: Existing MH Min pressures @ 19:00hrs

Precinct B Nodes	PWB01	0.77	79.5	144.66	65.16
	PWB02	0.77	79	144.58	65.58
	PWB03	0.77	75	144.5	69.5
	PWB04	0.77	70	144.69	74.69
	PWB05	0.77	70	144.6	74.6
	PWB06	0.77	67	144.5	77.5
	PWB07	0.38	63.5	144.72	81.22
	PWB08	0.38	64	144.53	80.53
	PWB09	0	64	144.46	80.46
	PWB10	0.77	72.5	144.4	71.9
	PWB11	0.77	65.5	144.43	78.93
	PWB12	0.77	79	144.35	65.35
	PWB13	0.77	85	144.3	59.3
	PWB14	0.77	68	144.26	76.26
	PWB15	0.77	65	144.37	79.37
	PWB16	0.77	64	144.31	80.31
	PWB17	0.77	66	144.24	78.24
	PWB18	0.77	71.5	144.29	72.79
	PWB19	0.77	66	144.25	78.25
Remainder of Paradise Waters Nodes	PRECINCT C LL	4.33	87	143.96	56.96
	PRECINCT C HL	4.33	110	143.88	33.88
	PRECINCT D LL	5.96	88	144.12	56.12
	PRECINCT D HL	0.11	100	144.12	44.12
	PRECINCT E LL	14.55	105	144.09	39.09
	PRECINCT E HL	3.79	115	143.94	28.94
	PRECINCT F	10.61	87	144.11	57.11
	PRECINCT G	5.9	90	144.22	54.22
	PRECINCT H	2.52	70	146.27	76.27
	PRECINCT I	6.45	112	145.06	33.06
	PRECINCT J	5.75	110	147.24	37.24
	PRECINCT K	7.66	70	146.59	76.59
	PRECINCT L	5.24	88	146.33	58.33
	RETIREMENT PRECINCT	4.15	91	146.34	55.34
	PRIMARY SCHOOL	0.45	70	144.21	74.21

Table 3.16: Fire-Flow (@ Max Hour)

Precinct B Nodes	PWB01	0.77	65.16	144.66	15	62.55
	PWB02	0.77	65.58	144.58	15	62.94
	PWB03	0.77	69.5	144.5	15	66.87
	PWB04	0.77	74.69	144.69	15	72.29
	PWB05	0.77	74.6	144.6	15	72.15
	PWB06	0.77	77.5	144.5	15	75.04
	PWB07	0.38	81.22	144.72	15	76.46
	PWB08	0.38	80.53	144.53	15	75.77
	PWB09	0	80.46	144.46	15	78
	PWB10	0.77	71.9	144.4	15	69.25
	PWB11	0.77	78.93	144.43	15	76.46
	PWB12	0.77	65.35	144.35	15	62.64
	PWB13	0.77	59.3	144.3	15	56.5
	PWB14	0.77	76.26	144.26	15	73.3
	PWB15	0.77	79.37	144.37	15	76.89
	PWB16	0.77	80.31	144.31	15	77.84
	PWB17	0.77	78.24	144.24	15	75.78
	PWB18	0.77	72.79	144.29	15	69.46
	PWB19	0.77	78.25	144.25	15	75.52
Remainder of Paradise Waters Nodes	PRECINCT C LL	4.33	56.96	143.96	15	52.38
	PRECINCT C HL	4.33	33.88	143.88	15	28.65
	PRECINCT D LL	5.96	56.12	144.12	15	51.21
	PRECINCT D HL	0.11	44.12	144.12	15	37.42
	PRECINCT E LL	14.55	39.09	144.09	15	36.27
	PRECINCT E HL	3.79	28.94	143.94	15	23.32
	PRECINCT F	10.61	57.11	144.11	15	54.6
	PRECINCT G	5.9	54.22	144.22	15	51.6
	PRECINCT H	2.52	76.27	146.27	15	72.21
	PRECINCT I	6.45	33.06	145.06	15	30.49
	PRECINCT J	5.75	37.24	147.24	15	35.94
	PRECINCT K	7.66	76.59	146.59	15	74.37
	PRECINCT L	5.24	58.33	146.33	15	56.58
	RETIREMENT PRECINCT	4.15	55.34	146.34	15	53.76
	PRIMARY SCHOOL	0.45	74.21	144.21	30	62.18