

Water Supply Code of Australia

Requirement	Clause
<p>PWC has adopted the 'Planning Guidelines for Water Supply and Sewerage' as issued by the Queensland Department of Environment and Resource Management. PWC has also adopted the WSAA codes and this supplement provides details of those modifications and additions that suit the particular requirements of PWC.</p> <p>This supplement only applies to those areas of the Northern Territory which are:</p> <ul style="list-style-type: none"> (i) Served by a public water supply system under the direct control of PWC (ii) New schemes or extensions to existing systems to be taken over by PWC (iii) Areas declared as Water Licence Areas under the Northern Territory <i>Water Supply and Sewerage Services Act</i> <p>The requirements of this supplement in respect of the WSAA codes take precedence over the requirements of the Queensland Planning Guidelines.</p>	1.1
<p>The Power and Water Corporation has adopted the 'Planning Guidelines for Water Supply and Sewerage' as issued by the Queensland Department of Environment and Resource Management. These guidelines provide a rigorous approach to the process of planning to ensure the comprehensive identification and evaluation of all options that meet defined service levels, and the needs of stakeholders.</p>	1.2
<p>At the end of the paragraph, add: ", and shall include the consideration of contingency supplies."</p>	1.2.4
<p>Delete (a) and insert the following:</p> <p>(a) Design drawings showing, inter alia and as appropriate, location of pipelines, valves, hydrants, pipe materials, size, pressure class, jointing methods and corrosion protection methods. Drawings are to be suitably scaled to allow ease of reading. Additional drawings may be required to avoid cluttering.</p> <p>Delete (d) and insert the following:</p> <p>(d) Documentation of design assumptions, constraints and issues relevant to the design and not otherwise noted in the Concept Plan or Design Drawings or Specifications. A Design Report is required. An electronic copy of spreadsheets (in MS Excel format) covering all calculations shall be submitted along with the Design Report.</p>	1.4
<p>After the final paragraph, insert:</p> <p>"Unless noted otherwise for a particular requirement, the term 'Planner' refers to the Designer."</p>	1.5.1
<p>PWC will not provide a Concept Plan and the Designer is required to develop the Concept plan for PWC approval.</p>	1.5.2
<p>Delete (b).</p> <p>PWC will not provide a Concept Plan and the Designer is required to develop the Concept plan for PWC approval.</p>	1.5.3
<p>The Designer shall undertake the necessary design and prepare a Concept Plan including design drawings.</p>	

Requirement	Clause												
<p>Replace the existing clause with the following:</p> <p>“Planners and Designers shall consult with stakeholders as necessary.</p> <p><i>Stakeholders may include, but are not limited to:</i></p> <ul style="list-style-type: none"> <i>a) Property Owners served (or affected) by the works, including absentee owners;</i> <i>b) Tenants</i> <i>c) Heritage groups;</i> <i>d) Indigenous people groups;</i> <i>e) AAPA</i> <i>f) Native Title holders;</i> <i>g) Municipal councils;</i> <i>h) Gas pipeline owners and/or operators;</i> <i>i) Road, rail and tram owners</i> <i>j) Planning authorities;</i> <i>k) Developers of adjacent works;</i> <i>l) Environmental and community groups; and</i> <i>m) Other utility agencies, including PWC power networks”</i> 	<p>1.6</p>												
<p>Demand forecasts for residential areas shall be based on the population served, and the nominal Peak Day Flow applicable to the region.</p> <p>Demand forecasts for Rural Areas shall be based on a flow rate per hectare, or, the equivalent population served and the nominal Peak Day Flow applicable to the region.</p> <p>Commercial and other non-residential demands shall be assessed on a case-by-case basis, but shall not be less than a PWC nominated flow rate per hectare, or, the equivalent population served and the nominal Peak Day Flow applicable to the region.</p> <p>Nominal Peak Day Flow shall be based on:</p> <ul style="list-style-type: none"> • Northern Region - 1100 L/capita/day (or equivalent to 0.0127 L/s/capita) • Southern Region - 1300 L/capita/day (or equivalent to 0.015 L/s/capita) 	<p>2.2</p>												
<p>Table 2.1 shall not be used.</p>	<p>2.2.1</p>												
<p>Where on-lot tanks are provided to allow the slow filling of the tanks over an extended time, the filling rate is subject to PWC approval.</p>													
<p>Refer to supplement Clause 2.2.2.2 and supplement Clause 2.2.3.3 below.</p>	<p>2.2.2.1</p>												
<p>Delete the fourth paragraph (“The actual demand value... by the Water Agency”).</p> <p>After the final paragraph, insert the following:</p> <p>“For developed areas or areas with defined future lot layouts, the population shall be estimated based on the following occupancy rates:</p> <table border="1"> <thead> <tr> <th>Zone</th> <th>Allowance (EP)</th> </tr> </thead> <tbody> <tr> <td>SD - Single Dwelling Residential (including rural dwellings)</td> <td>3.5 per dwelling unit</td> </tr> <tr> <td>MD – Multiple Dwelling Residential</td> <td>2.2 per dwelling unit</td> </tr> <tr> <td>MR – Medium Density Residential</td> <td>2.0 per dwelling unit</td> </tr> <tr> <td>HR – High Density Residential</td> <td>2.0 per dwelling unit</td> </tr> <tr> <td>CV - Caravan Park</td> <td>2.0 per site</td> </tr> </tbody> </table>	Zone	Allowance (EP)	SD - Single Dwelling Residential (including rural dwellings)	3.5 per dwelling unit	MD – Multiple Dwelling Residential	2.2 per dwelling unit	MR – Medium Density Residential	2.0 per dwelling unit	HR – High Density Residential	2.0 per dwelling unit	CV - Caravan Park	2.0 per site	<p>2.2.2.2</p>
Zone	Allowance (EP)												
SD - Single Dwelling Residential (including rural dwellings)	3.5 per dwelling unit												
MD – Multiple Dwelling Residential	2.2 per dwelling unit												
MR – Medium Density Residential	2.0 per dwelling unit												
HR – High Density Residential	2.0 per dwelling unit												
CV - Caravan Park	2.0 per site												



Requirement	Clause																																																																													
<p>The number of units per lot shall be the maximum allowable under the applicable zoning for each lot.</p> <p>Specific indigenous housing areas – subject to PWC approval, but use 9 persons per dwelling as an indicative value.</p> <p>For full developed rural areas primarily devoted to residential living purposes rather than commercial farming, and those less than 2 Ha, Peak Hour Flow (averaged over the hour) shall be taken as not less than 0.16 L/s/lot for the Northern Region and not less than 0.19 L/s/lot for Southern Region.</p> <p>For areas zoned for future urban residential development without a defined lot layout, the following population densities shall be applied:</p> <p>Residential – Single Occupancy Lots</p> <table border="1"> <thead> <tr> <th rowspan="2">Classification</th> <th colspan="2">Gross Area</th> <th colspan="2">Nett Area</th> <th rowspan="2">Remarks</th> </tr> <tr> <th>Unit</th> <th>EP per Unit</th> <th>Unit</th> <th>EP per Unit</th> </tr> </thead> <tbody> <tr> <td>Single lot 1000m²</td> <td>gross hectare</td> <td>25</td> <td>net hectare</td> <td>35</td> <td rowspan="4">Default lot size is 700m². Approx 30% of gross area considered to be used for roads, parks etc.</td> </tr> <tr> <td>Single lot 700m²</td> <td>gross hectare</td> <td>35</td> <td>net hectare</td> <td>50</td> </tr> <tr> <td>Single lot 500m²</td> <td>gross hectare</td> <td>50</td> <td>net hectare</td> <td>71</td> </tr> <tr> <td>Single lot 300m²</td> <td>gross hectare</td> <td>80</td> <td>net hectare</td> <td>114</td> </tr> </tbody> </table> <p>Residential – Multiple Occupancy Lots</p> <table border="1"> <thead> <tr> <th rowspan="2">Classification</th> <th colspan="2">Gross Area</th> <th colspan="2">Nett Area</th> <th rowspan="2">Remarks</th> </tr> <tr> <th>Unit</th> <th>EP per Unit</th> <th>Unit</th> <th>EP per Unit</th> </tr> </thead> <tbody> <tr> <td>MD (group housing)</td> <td>gross hectare</td> <td>45</td> <td>net hectare</td> <td>64</td> <td>Default - 20 dwellings per gross hectare</td> </tr> <tr> <td>MR (up to 4 storey)</td> <td>gross hectare</td> <td>96</td> <td>net hectare</td> <td>136</td> <td>Default - 48 dwellings per gross hectare</td> </tr> <tr> <td>HR (up to 5 storey)</td> <td>gross hectare</td> <td>120</td> <td>net hectare</td> <td>171</td> <td>Default - 60 dwellings per gross hectare</td> </tr> <tr> <td>HR (up to 8 storey)</td> <td>gross hectare</td> <td>190</td> <td>net hectare</td> <td>271</td> <td>Default - 96 dwellings per gross hectare</td> </tr> <tr> <td>HR (up to 12 storey)</td> <td>gross hectare</td> <td>280</td> <td>net hectare</td> <td>400</td> <td>Default - 144 dwellings per gross hectare</td> </tr> <tr> <td>CV (Caravan Park)</td> <td>gross hectare</td> <td>80</td> <td>net hectare</td> <td>114</td> <td>Default – 40 sites per gross hectare</td> </tr> </tbody> </table>	Classification	Gross Area		Nett Area		Remarks	Unit	EP per Unit	Unit	EP per Unit	Single lot 1000m ²	gross hectare	25	net hectare	35	Default lot size is 700m ² . Approx 30% of gross area considered to be used for roads, parks etc.	Single lot 700m ²	gross hectare	35	net hectare	50	Single lot 500m ²	gross hectare	50	net hectare	71	Single lot 300m ²	gross hectare	80	net hectare	114	Classification	Gross Area		Nett Area		Remarks	Unit	EP per Unit	Unit	EP per Unit	MD (group housing)	gross hectare	45	net hectare	64	Default - 20 dwellings per gross hectare	MR (up to 4 storey)	gross hectare	96	net hectare	136	Default - 48 dwellings per gross hectare	HR (up to 5 storey)	gross hectare	120	net hectare	171	Default - 60 dwellings per gross hectare	HR (up to 8 storey)	gross hectare	190	net hectare	271	Default - 96 dwellings per gross hectare	HR (up to 12 storey)	gross hectare	280	net hectare	400	Default - 144 dwellings per gross hectare	CV (Caravan Park)	gross hectare	80	net hectare	114	Default – 40 sites per gross hectare	2.2.2.2 (cont)
Classification		Gross Area		Nett Area			Remarks																																																																							
	Unit	EP per Unit	Unit	EP per Unit																																																																										
Single lot 1000m ²	gross hectare	25	net hectare	35	Default lot size is 700m ² . Approx 30% of gross area considered to be used for roads, parks etc.																																																																									
Single lot 700m ²	gross hectare	35	net hectare	50																																																																										
Single lot 500m ²	gross hectare	50	net hectare	71																																																																										
Single lot 300m ²	gross hectare	80	net hectare	114																																																																										
Classification	Gross Area		Nett Area		Remarks																																																																									
	Unit	EP per Unit	Unit	EP per Unit																																																																										
MD (group housing)	gross hectare	45	net hectare	64	Default - 20 dwellings per gross hectare																																																																									
MR (up to 4 storey)	gross hectare	96	net hectare	136	Default - 48 dwellings per gross hectare																																																																									
HR (up to 5 storey)	gross hectare	120	net hectare	171	Default - 60 dwellings per gross hectare																																																																									
HR (up to 8 storey)	gross hectare	190	net hectare	271	Default - 96 dwellings per gross hectare																																																																									
HR (up to 12 storey)	gross hectare	280	net hectare	400	Default - 144 dwellings per gross hectare																																																																									
CV (Caravan Park)	gross hectare	80	net hectare	114	Default – 40 sites per gross hectare																																																																									

Requirement			Clause
For areas not yet subdivided to the extent permitted by relevant zoning, the following minimum allowances shall be made:			2.2.2.2 (cont)
Minimum Rural Residential Demands			
Land Use	Population Density (persons/gross hectare)	Flow (L/s/gross hectare)	
Rural lot – less than 2 Ha	≥ 3.5	0.08	
Rural lot – 2 Ha Lot	4.5	0.08	
Rural lot – 3 Ha Lot	3.5	0.06	
Rural lot – 5 Ha Lot	2.4	0.04	
Rural lot – 8 Ha Lot or more	1.5	0.02	
Table 2.1 shall not be used.			2.2.2.3
Non-residential demands shall be assessed on a case-by-case basis where possible for existing developed lots but shall not be less than the values given below:			
MINIMUM NON-RESIDENTIAL DEMANDS⁴			
Land Use	Unit	Base Rate	% Non-Synchronous Flow
Retail, Business Office, Shopping Centre	L/s/gross ha ^{†n}	0.25	60
	EP/gross ha ⁿ	20	
	EP/Employee	0.2	
	EP/Visitors	0.05	
Commercial, Light Industry, Church ¹ , Sports Centre ¹ , Airport ¹ , Tavern ¹ , Pub ¹ , Club ¹ , Child Care Centre ¹ , Public Hall ¹ , Function Room ¹	L/s/gross ha ^{†n}	0.45	60
	EP/gross ha ⁿ	35	
	EP/Employee	0.3	
	EP/Visitors	0.05	
Hotel ¹ , Motel ¹ , Nursing Home ¹ , Institutional Accommodation ¹ , Boarding School ¹ , Hostel ¹ , Service Station, Take Away Food, Restaurant, Café, Prison, Defense Establishment	L/s/gross ha ^{†n}	0.52	100
	EP/gross ha ⁿ	40	
	EP/Employee	0.5	
	EP/Visitors	0.05	
School ¹	L/s/gross ha ^{†n}	0.60	60
	EP/gross ha ⁿ	45	
	EP/Employee	0.03	
	EP/Visitors	0.05	
Hospital ² , Health Care Centre	L/s/gross ha ^{†n}	2.23	60
	EP/gross ha ⁿ	175	
	EP/Employee	2.5	
	EP/Visitors	0.05	
General Industries (low water dependent)	L/s/gross ha [‡]	1.1	60
	EP/gross ha	60	
Future Unknown Industrial Area ³	L/s/gross ha [‡]	1.9	50
	EP/gross ha	150	
Playing Fields, Parks, Open Space, Outdoor Entertainment Centre	L/s/gross ha [‡]	1.05 ^a	50
	EP/gross ha	80	
[‡] Value applicable to Northern Region. For Southern Region, multiply by (1300/1100) ⁿ Where available, use employee or visitor numbers to calculate demand ^a 24 hour average ¹ . Use the maximum number of occupants for which the facility was licensed and/or designed			

Requirement	Clause								
<p>2. Use only number of available beds – allowance for staff, visitors and staff accommodation included in EP/available bed rate.</p> <p>3. Only used when the future types of industry are unknown – otherwise use Table A2 and Table A3</p> <p>4. Where both employee and visitor numbers are available, use the higher calculated demand</p>	2.2.2.3 (cont)								
<p>Delete the third paragraph ("Unless specified otherwise...") and insert the following:</p> <p>"For Darwin and Alice Springs, indicative values for peak day factor can be obtained from the NT supplement to the Queensland Planning Guidelines for Water Supply and Sewerage.</p> <p>For other centres, peak day factors are to be sourced from PWC."</p>	2.2.3.2								
<p>Delete the third paragraph ("Unless specified otherwise...") and insert the following:</p> <p>"The peak hour demand (L/s) shall be calculated by multiplying the peak day demand (L/s) by the peak hour factor.</p>	2.2.3.3								
<p>PEAK HOUR FACTORS</p> <table border="1"> <thead> <tr> <th>Population Range</th> <th>Peak Hour Factor (F_p)</th> </tr> </thead> <tbody> <tr> <td>Less than 499</td> <td>3.0</td> </tr> <tr> <td>500 to 999</td> <td>2.5</td> </tr> <tr> <td>≥ 5000</td> <td>1.9 (Darwin) 1.8 (Other Centres)</td> </tr> </tbody> </table>		Population Range	Peak Hour Factor (F _p)	Less than 499	3.0	500 to 999	2.5	≥ 5000	1.9 (Darwin) 1.8 (Other Centres)
Population Range	Peak Hour Factor (F _p)								
Less than 499	3.0								
500 to 999	2.5								
≥ 5000	1.9 (Darwin) 1.8 (Other Centres)								
<p>Dead end mains in cul-de-sacs are not permitted.</p>	2.3								
<p>Staged pipework is not permitted without approval.</p> <p>Delete the existing wording and insert:</p> <p>"All PWC systems shall be modelled by PWC and connection point pressures shall be supplied to the designer. The Designer is responsible for the design and on lot modelling of his development.</p> <p>Modelling of development load must demonstrate that the system fully recovers over 24 hours."</p>	2.4.2								
<p>Table 2.2 shall not be used.</p> <p>Peak hour Non-Fire: 20m over the highest point in any serviced lot</p> <p>OR</p> <p>20m plus 5m per 1000m distance from the main above the most hydraulically disadvantaged site on the block where the lot extends more that 250m from the main.</p> <p>Fire Flows: 10m at any hydrant location under fire fighting conditions.</p>	2.4.3.1								
<p>Table 2.2 shall not be used.</p> <p>The maximum allowable pressure is 60 m.</p>	2.4.3.2								

Requirement	Clause
Table 2.2 shall not be used.	2.4.3.3
Delete this clause.	
Refer to PWC Customer charter for minimum allowable service pressure.	
Where tanks are used on-lot, pressure transients from inlet valve closure/opening shall be eliminated.	2.4.4
Refer also to PWC Backflow Prevention Manual	2.5.2
Delete (b).	2.5.3
Delete (c).	
Delete reference to WAT-1104.	
Dead end mains in cul-de-sacs are not permitted.	
Staging of the size of mains is not permitted.	
Delete (c) and insert the following:	2.6
(c) A Standby pump shall be provided. For Pump Stations with 3-6 pumps provide a minimum of 2 standby pumps. Where a pump station contains more than 6 pumps then refer to PWC.	
Delete (e) and insert the following:	
(e) In-line booster pumping without high-level storage shall only be used when a minimum residual of 15m is provided by gravity alone. Where this cannot be achieved installation of an elevated tank or alternative methods shall be considered. Reduced carbon footprint options shall be considered.	
After the final paragraph, add:	
"Inline booster pumping will not be permitted without written approval from PWC.	
For larger developments PWC may require elevated storage."	
Delete the third paragraph ("Typically, reserve storage...").	2.7
Delete the fourth paragraph ("Typically, storage capacities...").	
Delete the fifth paragraph ("Surface reservoir - ...").	
Delete the sixth paragraph ("Elevated and standpipe reservoirs - ...")	
Refer to Chapter 7 of the 'Planning Guidelines for Water Supply and Sewerage' as issued by the Queensland Department of Environment and Resource Management and Table 5.8(NT) of the related NT supplement for storage capacity requirements.	
Storage shall be provided in not less than two hydraulically separate tanks.	
Where no ground level storage is provided at the site or within the same zone, then two elevated tanks shall be provided.	

Requirement	Clause
In (a), delete "DN 100" and insert "DN 150". In (b), delete "DN 150" and insert "DN 225". Delete reference to WAT-1104. Dead end mains in cul-de-sacs are not permitted.	3.2.2
Where approved by PWC, the following table may be adopted for sizing mains for concept or preliminary designs and investigations.	3.2.3

Delete Table 3.1 and insert the following:

**TABLE 3.1(NT)
EMPIRICAL GUIDE FOR PIPE SIZING**

Nominal Size of Main (DN)		Capacity of Main (Dual Feed)					
PVC Series 1 Class 12	PVC Series 2 Class 16	Urban SD Residential (Number of Lots) - 25 l/s -Fire flows	Urban MD Residential (Number of Units) - 25 l/s -Fire flows	Urban MR Residential (Number of Units) - 45 l/s -Fire flows	Urban HR Residential (Number of Units) (maximum 4 storied) - 45 l/s Fire Flow	Rural residential (gross Ha) 25 L/s Fire Flow (4.5 EP/Ha)	Commercial - Light Industrial - (gross Ha) - 45 L/s Fire Flow (35 EP/Ha)
100	NP	NP	NP	NP	NP	NP	NP
150	NP	120	167	183	88	13	NP
NP	200	280	324	356	142	21	13
NP	225	400	552	607	193	28	18
NP	250	480	728	801	255	37	24
NP	300	650	728	801	255	37	24
NP	375	900	728	801	255	37	24

NOTES: NP ≡ Not Permitted, PE pipe not permitted for water mains

Add the following table:

Maximum Length of Mains Criteria

Water Main Size (DN)	Maximum Length of Main - Single Feed [‡] (m)
100**	40
150	500
200	800
225	1000
250	1200
300	1500
375	2300

** DN100 is not permitted for new construction

‡ In urban areas, single feeds are only permitted for DN100 and DN150 mains

Requirement	Clause																		
<p>Delete the existing wording and insert the following:</p> <p>"The system shall be designed for minimum fire flow requirements as specified below:</p> <table border="1"> <thead> <tr> <th style="text-align: center;">Risk Category</th> <th style="text-align: center;">Land Use</th> <th style="text-align: center;">Minimum Fire Flow (L/s)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td>SD Residential and MD Residential</td> <td style="text-align: center;">25</td> </tr> <tr> <td style="text-align: center;">2</td> <td>MR Residential (up to 4 storey), minor commercial areas, small institutions and places of public assembly</td> <td style="text-align: center;">45</td> </tr> <tr> <td style="text-align: center;">3</td> <td>HR Residential, Light Industry, large institutions & places of public assembly</td> <td style="text-align: center;">60</td> </tr> <tr> <td style="text-align: center;">4</td> <td>Major Industries</td> <td style="text-align: center;">150</td> </tr> <tr> <td style="text-align: center;">5</td> <td>Large Shopping Centres & Special Risks</td> <td style="text-align: center;">200</td> </tr> </tbody> </table> <p>The supply shall sustain the flows above for not less than 4 hours with minimum residual pressure of 10m at ground level.</p> <p>Where the requirements of the BCA and AS2419.1 for any single development exceed the flows given above, the higher values shall prevail.</p> <p>If there is uncertainty, seek advice from PWC."</p>	Risk Category	Land Use	Minimum Fire Flow (L/s)	1	SD Residential and MD Residential	25	2	MR Residential (up to 4 storey), minor commercial areas, small institutions and places of public assembly	45	3	HR Residential, Light Industry, large institutions & places of public assembly	60	4	Major Industries	150	5	Large Shopping Centres & Special Risks	200	3.2.4
Risk Category	Land Use	Minimum Fire Flow (L/s)																	
1	SD Residential and MD Residential	25																	
2	MR Residential (up to 4 storey), minor commercial areas, small institutions and places of public assembly	45																	
3	HR Residential, Light Industry, large institutions & places of public assembly	60																	
4	Major Industries	150																	
5	Large Shopping Centres & Special Risks	200																	
Delete reference to Table 3.1.	3.2.5.1																		
Delete the first paragraph and insert:	3.2.5.2																		
<p>"To facilitate economic designs, design analysis shall be conducted to maintain maximum losses within the following limits:</p> <p>Maximum permissible losses are:</p> <table> <tbody> <tr> <td style="padding-left: 20px;">(i) ≤ DN 300</td> <td style="text-align: right;">6.0 m/1000m</td> </tr> <tr> <td style="padding-left: 20px;">(ii) DN 375 and DN450</td> <td style="text-align: right;">4.0 m/1000m</td> </tr> <tr> <td style="padding-left: 20px;">(iii) DN525 to DN 675 (inclusive)</td> <td style="text-align: right;">3.0 m/1000m</td> </tr> <tr> <td style="padding-left: 20px;">(iv) DN 750 and above</td> <td style="text-align: right;">2.0 m/1000m"</td> </tr> </tbody> </table>	(i) ≤ DN 300	6.0 m/1000m	(ii) DN 375 and DN450	4.0 m/1000m	(iii) DN525 to DN 675 (inclusive)	3.0 m/1000m	(iv) DN 750 and above	2.0 m/1000m"											
(i) ≤ DN 300	6.0 m/1000m																		
(ii) DN 375 and DN450	4.0 m/1000m																		
(iii) DN525 to DN 675 (inclusive)	3.0 m/1000m																		
(iv) DN 750 and above	2.0 m/1000m"																		
Delete the existing wording and insert:	3.2.5.3																		
<p>"Final pipe sizing for the construction of all water mains shall be determined by analysis using reputable network analysis methods and formulae, appropriate demand flows and roughness values as tabled below. The values given include allowance for losses from typical fittings and services.</p> <table border="1"> <thead> <tr> <th colspan="3" style="text-align: center;">Roughness Values</th> </tr> <tr> <th style="text-align: center;">Pipe Type</th> <th style="text-align: center;">Hazen Williams C</th> <th style="text-align: center;">Colebrook White k (mm)</th> </tr> </thead> <tbody> <tr> <td>PVC, GRP, PE, ABS</td> <td style="text-align: center;">130</td> <td style="text-align: center;">0.17</td> </tr> <tr> <td>DICL, MSCL, Copper</td> <td style="text-align: center;">120</td> <td style="text-align: center;">0.33</td> </tr> </tbody> </table>	Roughness Values			Pipe Type	Hazen Williams C	Colebrook White k (mm)	PVC, GRP, PE, ABS	130	0.17	DICL, MSCL, Copper	120	0.33							
Roughness Values																			
Pipe Type	Hazen Williams C	Colebrook White k (mm)																	
PVC, GRP, PE, ABS	130	0.17																	
DICL, MSCL, Copper	120	0.33																	
Generally, flow velocities should not exceed 1.4 m/s during peak hour demand.	3.2.5.4																		

Requirement	Clause
For all reticulation mains and fittings the minimum hydrostatic test pressure shall be 1000 kPa.	Add 3.4.3
For distribution mains and fittings, the minimum hydrostatic test pressure shall be 1200 kPa.	
PVC distribution mains, where permitted by PWC, shall have a minimum pressure rating of PN16.	
Refer to WSA Technical Note 4 (WSA-TN4 – Guidelines for design of pressure pipeline systems for water supply using PVC-M and PVC-O pipes).	3.5.3.1
Note that Table 3.2 and Table 3.3 have been modified and updated in TN4. Use the tables from TN4.	
Where the fatigue life of pressure mains is less than the nominal asset design life given at Table 1.1 (ie. 100years), replacement costs will be included in whole-of-life cost analysis.	
For pumped mains, a minimum of 14 cycles/day shall be used.	
PVC fittings not permitted.	3.5.3.2
Use 30°C for all centres.	3.6
For water mains <DN 200, the minimum pressure class shall be PN12.	3.7.2
For water mains ≥DN 200, the minimum pressure class shall be PN16.	
The minimum pressure class for fittings shall be PN16.	
For steel mains, refer to Clause 4.13.1 below.	
Refer also to Water and Sewage Infrastructure Products Manual	3.8
Reliability and/or redundancy of main delivery pipes, pumps, supply metering and storages shall be incorporated into the design to the satisfaction of PWC.	4.0
Coordinates to be specified to MGA. Pine Creek and west of Pine Creek falls within Zone 52. East of Pine Creek falls within Zone 53.	4.1.1
This clause applies to proposed and existing services, structures and obstacles.	4.1.2
Long sections shall be provided for all mains >DN 250.	
Before the first paragraph, insert the following: "Before construction commences, Aboriginal Areas Protection Authority (AAPA) clearances shall be obtained, including a set of clearances in the name of the Power and Water Corporation." Delete the second paragraph ("Wherever practicable, environmentally ...") After the final paragraph, add: "(xii) Seeds and weed transportation/importation through fill and bedding materials	4.1.4.1

Requirement	Clause
<p>Delete the third paragraph ("Some typical areas that ...") and insert: The following sensitive areas shall be avoided wherever practicable:</p> <ul style="list-style-type: none"> (a) National parks, nature reserves, proclaimed reserves, state forests, stands of native vegetation etc. (b) Habitats of threatened species (c) Steep slopes (d) Waterways and floodways (e) Wetlands, swamps, estuaries, sand dunes, foreshore areas (f) Bushland and vegetation communities and/or fauna (g) Heritage items and precincts (h) Aboriginal relics and sacred sites (i) Unstable areas subject to rock falls, slips and flows including areas steeper than 33% grade (j) Aggressive ground conditions eg. mining areas, acid sulphate soils and contaminated land, including suspected contaminated land (k) Land fill sites and mine subsidence areas (l) Areas under control of an aboriginal land council (m) Areas where Native Title has been granted 	4.1.4.1 (cont)
<p>After the final paragraph, add:</p> <p>"Where water mains are in road reserves, the alignment shall conform to that nominated on the service allocation plan and by gaining approval from PWC and the relevant road authority or Council. Refer also 'Service Allocations in Road Reserves' in Section 4 of Volume 2 of the Power Supply Volumes of PWC's Standard Drawings (drawing numbers SO2-4-1-XX).</p> <p>Where water mains are in road reserves, the alignment shall generally 2.4m from the property boundary.</p> <p>Preference shall be given to locating the water main on the opposite side of the road to the sewer.</p> <p>Where water mains are less than 2.0m from the property boundary, easements in favour of PWC shall be provided over the adjacent portion of the property.</p> <p>Where water mains cross roadways they shall be at right angles to the roadway.</p> <p>Where a water main is required to cross multi lane carriageway or a major road, including all roads controlled by DCI, or an intersection or roundabout, PWC may specify extra protection methods or different pipe materials to minimise the requirement for future maintenance.</p> <p>Such requirements may include enclosing the water main in a bored or jack sleeved pipe or culvert."</p>	4.3.2

Requirement	Clause								
<p>Delete the first paragraph.</p> <p>Delete the second paragraph</p> <p>Delete the third paragraph ("For some Water Agencies, an easement over private property...") and insert:</p> <p>"An easement over private property is not the preferred location for a pipeline and may only be used as temporary solution pending future permanent pipeline within a road reserve".</p> <p>Delete the fourth paragraph "<i>Typical situations where the Water Agency may approve mains in easements ...</i>".</p> <p>After the final paragraph, insert the following:</p> <p>"Where a water main must be located within a residential lot, it shall be in accordance with the PWC Policy for Minimum Easement Dimensions, Conditions and Restrictions for Water and Sewerage Infrastructure.</p> <p>All easements in favour of PWC shall be inline with the Power and Water Corporation Easement Policy 'Minimum Easement Dimensions for Power and Water Corporation'.</p> <table border="1"> <thead> <tr> <th>Pressure Mains</th> <th>Minimum Easement Width (m)</th> </tr> </thead> <tbody> <tr> <td>≤ DN 150</td> <td>3</td> </tr> <tr> <td>>DN 150 to ≤DN 450</td> <td>6</td> </tr> <tr> <td>DN 450 and greater</td> <td>8</td> </tr> </tbody> </table> <p>The easement is generally to be centrally located over the water main.</p> <p>Water mains located within private land may be subject to increased easement requirements to the satisfaction of PWC, where:</p> <ul style="list-style-type: none"> • the water main is not parallel to the property boundary • there is a shared alignment for services approved by the relevant authorities • there more than one PWC asset within the easement" 	Pressure Mains	Minimum Easement Width (m)	≤ DN 150	3	>DN 150 to ≤DN 450	6	DN 450 and greater	8	4.3.3
Pressure Mains	Minimum Easement Width (m)								
≤ DN 150	3								
>DN 150 to ≤DN 450	6								
DN 450 and greater	8								
<p>Add the following after final paragraph:</p> <p>"Note that trees and some landforms, particularly in desert areas, can form part of an aboriginal sacred site. If there is any doubt, then the advice of the Aboriginal Areas Protection Authority should be sought, and if necessary, an AAPA certificate obtained and paid for by the developer.</p> <p>Developers should be aware that significant delays may occur should AAPA certificates not be obtained in time to commence construction. Power and Water will not accept any site that has been the subject of destruction of sacred sites until all outstanding issues resulting from that destruction have been finalised and final AAPA certification issued.</p> <p>Severe penalties apply under NT law for destruction of sacred sites."</p>	4.3.4								

Requirement	Clause
<p>Add the following after final paragraph:</p> <p>"Note that trees and some landforms, particularly in desert areas, can form part of an aboriginal sacred site. If there is any doubt, then the advice of the Aboriginal Areas Protection Authority should be sought, and if necessary, an AAPA certificate obtained and paid for by the developer.</p> <p>Developers should be aware that significant delays may occur should AAPA certificates not be obtained in time to commence construction. Power and Water will not accept any site that has been the subject of destruction of sacred sites until all outstanding issues resulting from that destruction have been finalised and final AAPA certification issued.</p> <p>Severe penalties apply under NT law for destruction of sacred sites."</p>	4.3.5
<p>Concrete encasement is not permitted. Grouting in casing is not permitted. Mechanical protection in the form of structural concrete slabs may be considered with the approval of PWC in some cases where depth cannot be achieved.</p> <p>For open trench construction, restrained joint ductile iron pipes shall be used under roadways in central business districts. Type 2 or Type 4 embedment or 2% cement stabilised backfill shall be used in these situations.</p>	4.3.8
Delete the third paragraph ("Typical methods to reduce the ...")	4.3.10
Common trenching is not permitted	4.4
<p>After the final paragraph, add:</p> <p>"Unless otherwise approved by PWC, rider mains shall be provided where service connection would otherwise be required on distribution mains.</p> <p>Typically rider mains shall be installed on the same side of the roadway as the distribution main, except where wider than normal road reserves are provided, in which case the rider main shall be installed on the opposite of the roadway to the distribution main."</p>	4.6
<p>After the first paragraph, add:</p> <p>"The developer is responsible for all works up to and including the connection to existing mains except that the actual connection must be carried out by PWC.</p> <p>In minor centres and subject to the specific written approval of PWC, PWC may permit the Developer to carry out the connection in accordance with conditions set down by PWC."</p>	4.7
<p>Delete final paragraph including reference to WAT-1102, WAT-1103 and WAT-1105.</p> <p>Dead ends in cul-de-sacs are not permitted.</p>	4.8.1
<p>Delete reference to WAT-1104.</p> <p>Delete reference to WAT-1104.</p>	4.8.2
<p>Refer to PWC Standard Drawing W1-2-19, which can also be applied to permanent ends of water mains.</p> <p>Refer to PWC Standard Drawing W1-2-19.</p>	4.8.3

Requirement	Clause																				
<p>Delete reference to WAT-1106, WAT-1107, WAT-1108 and WAT-1109.</p> <p>Delete the existing wording and insert the following:</p> <p>"For multi-dwelling residential unit blocks, the following table applies:</p> <table border="1"> <thead> <tr> <th>Number of Dwelling Units</th> <th>Minimum Service Connection Size for Single Water Meter Serving Multiple Units</th> <th>Minimum Meter Size for Single Water Meter Serving Multiple Units</th> <th>Minimum Service Connection Size for Multi-Metering</th> <th>Applicable Drawing for Multi-Metering</th> </tr> </thead> <tbody> <tr> <td>1 – 2</td> <td>DN25</td> <td>DN20</td> <td>DN25</td> <td>W1-1-29</td> </tr> <tr> <td>3 - 6</td> <td>DN50</td> <td>DN25**</td> <td>DN50</td> <td>W1-1-18A</td> </tr> <tr> <td>7 - 12</td> <td>DN50</td> <td>DN40**</td> <td>DN50</td> <td>W1-1-18A</td> </tr> </tbody> </table> <p>** water meter size to be dependent on number of fixtures installed – consult with PWC</p> <p>The above table does not include fire service requirements, which are assumed to be separately metered.</p> <p>For unit blocks with more than 12 units, consult with PWC.</p> <p>In major centres, no service connections are permitted to distribution mains DN 300 or larger.</p> <p>In minor centres, no service connections are permitted to distribution mains DN 225 or larger.</p> <p>For commercial lots, service connections shall be DN25 or greater.</p> <p>For industrial lots, service connections shall be DN50 or greater."</p>	Number of Dwelling Units	Minimum Service Connection Size for Single Water Meter Serving Multiple Units	Minimum Meter Size for Single Water Meter Serving Multiple Units	Minimum Service Connection Size for Multi-Metering	Applicable Drawing for Multi-Metering	1 – 2	DN25	DN20	DN25	W1-1-29	3 - 6	DN50	DN25**	DN50	W1-1-18A	7 - 12	DN50	DN40**	DN50	W1-1-18A	4.9
Number of Dwelling Units	Minimum Service Connection Size for Single Water Meter Serving Multiple Units	Minimum Meter Size for Single Water Meter Serving Multiple Units	Minimum Service Connection Size for Multi-Metering	Applicable Drawing for Multi-Metering																	
1 – 2	DN25	DN20	DN25	W1-1-29																	
3 - 6	DN50	DN25**	DN50	W1-1-18A																	
7 - 12	DN50	DN40**	DN50	W1-1-18A																	
<p>After the final paragraph, add:</p> <p>"Location of services will be required in the field prior to commencement of construction.</p> <p>Information on depths and separation distances from proposed water mains will be required for submission to PWC.</p> <p>Prior to cut-in, check the existing water main details (diameter / material / level / alignment) at site at the proposed connection point."</p>	4.10.5.1																				
<p>Delete the existing wording, including Table 4.1, and insert the following:</p> <p>"The Designer shall consult with service owners to confirm requirement for crossing gas, oil or fuel lines and comply with all requirements imposed.</p> <p>Separation distances between water mains and sewers shall be as great as practical. Preferably locate sewers on the opposite side of the road to water mains.</p> <p>For normal trenching and trenchless technology installation, clearance from other service utility assets shall not be less than (and preferably exceed) the minimum vertical and horizontal clearances shown in Table 4.1(NT).</p>	4.10.5.2																				

Requirement				Clause
TABLE 4.1(NT)				4.10.5.2
CLEARANCES BETWEEN WATER MAINS AND UNDERGROUND SERVICES				
Utility (Existing Service)	Minimum Horizontal Clearance (mm)		Minimum Vertical Clearance ¹ (mm)	
	New Main Size			
	≤DN 200	>DN 200		
Water mains >DN 375	600	600	500	
Water mains ≤DN 375	600	600	300	
Gas Mains	600	600	300	
Telecommunication conduits and cables	600	600	300	
Electricity conduits and cables	600	1000	300 ²	
Drains	600	600	300	
Sewers	1000 ³ /600	1000 ³ /600	500 ⁴	
Kerbs	150	600 ⁵	150	
NOTES:				
1. Vertical clearances apply when water mains cross one another and other utility services, except in the case of sewers when a vertical separation shall always be maintained, even when the water main and sewer are parallel. <i>The water main should always be located above the sewer to minimise the possibility of backflow contamination in the event of a water main break.</i>				
2. For minimum vertical clearances for electrical services refer to PWC Power Networks requirements.				
3. When the sewer is at the minimum vertical clearance below the water main (500mm), maintain a minimum horizontal clearance of 1000mm. <i>This minimum horizontal clearance can be progressively reduced to 600mm as the vertical clearance is increased to 750mm.</i>				
4. <i>Water mains should always cross over sewers and stormwater drains.</i> For cases where there is no alternative and the main must cross under the sewer, construction shall be in accordance with Standard Drawing WAT-1211.				
5. Clearance from kerbs shall be measured from the nearest point of the kerb. For water mains ≤DN 375, clearances from kerbs can be progressively reduced until the minimum of 150mm is reached for water mains ≤DN 200."				
After the first paragraph, insert the following:				4.10.7
<p>"Bending of PVC pipe is not permitted.</p> <p>For design, no deflection shall be permitted at spigot-socket joints on PVC pipeline. For construction, the maximum individual joint deflection angle permitted at a flexible joint shall be in accordance with the manufacturer's recommendation.</p> <p>For design, deflection of a PVC pipeline within a socket of a DI fitting shall be two degrees or less (ie. for a socket-socket DI connector, a maximum of four degrees deflection is permitted across the connector).</p> <p>Figure 4.4(a) – Only applies only for small vertical deflections.</p> <p>Figure 4.4(b) - Deflections must be fully restrained</p> <p>Figure 4.4(c) – Only applies only for small horizontal deflections. Deflections must be fully restrained where allowable horizontal bearing pressure of the soil, when saturated, is less than 100 kPa.</p> <p>Water mains shall be laid above stormwater, gravity and pressure sewers wherever possible."</p>				

Requirement	Clause										
<p>Add the final paragraph, insert the following:</p> <p>“Standard steel pipe outside diameters are to conform to PWC Water and Sewage Infrastructure Products Manual.</p> <p>Unless otherwise approved by PWC, the minimum design pressure for steel mains shall be 2100 kPa.”</p>	4.13.1										
<p>In the first paragraph, delete the words “≤DN 375 shall be 1.2m and for pipe >DN 375”.</p> <p>Delete reference to WAT-1201.</p> <p>After the final paragraph, insert the following:</p> <p>“Standard minimum cover for water mains shall be:</p> <table> <tr> <td>(i) Road reserves</td> <td>750 mm</td> </tr> <tr> <td>(ii) In thrust bored situations</td> <td>1500 mm</td> </tr> <tr> <td>(iii) NT Road Network roads</td> <td>1500 mm</td> </tr> <tr> <td>(iv) Elsewhere</td> <td>600 mm</td> </tr> <tr> <td>(v) OUD</td> <td>750 mm</td> </tr> </table> <p>Maximum cover can be increased with the approval of PWC.</p> <p>Consideration to be given to height of gate valves in determining cover.</p> <p>Additional depth may be required for OUD crossings if mechanical protection is not provided. 5% cement stabilised gravel backfill shall be used at OUD crossings.”</p>	(i) Road reserves	750 mm	(ii) In thrust bored situations	1500 mm	(iii) NT Road Network roads	1500 mm	(iv) Elsewhere	600 mm	(v) OUD	750 mm	5.4.2
(i) Road reserves	750 mm										
(ii) In thrust bored situations	1500 mm										
(iii) NT Road Network roads	1500 mm										
(iv) Elsewhere	600 mm										
(v) OUD	750 mm										
<p>Delete reference to WAT-1201.</p> <p>Delete the existing wording and insert the following:</p> <p>“Pipe trench width design requirements and embedment types are set out in the PWC Water Supply and Sewerage Construction Master Specification.</p> <p>Unless geotechnical investigations have been completed and the resultant report supports the use of lower quality bedding, a minimum of Type 2 embedment shall be used for pipe bedding.”</p> <p>Where embedment type changes in a trench, a vertical geotextile barrier shall be inserted between Type 1 and Type 2 embedment or Type 2 and Type 4 embedment to prevent material migration.</p> <p>Minimum trench widths shall be based on the following table:</p>	5.4.3										

Requirement			Clause
APPLCIATION	MINIMUM PERMISSIBLE EMBEDMENT TYPE	COMMENTS	
			5.4.3 (cont)
Under roadways (open cut)	4	Use cement stabilised sand for trench fill (backfill)	
Under drains	4	Use 5% cement stabilised gravel for trench fill (backfill)	
Areas with high water table	2A / 2B	Consider use in conjunction with geotextile	
Areas subject to tidal inundation	2A / 2B	Consider use in conjunction with geotextile	
Areas where water table is influenced by tides	2A / 2B	Consider use in conjunction with geotextile	
Poor native soils	2A / 2B		
High subsoil drainage flows	2B	Use in conjunction with geotextile	
Grades > 5%	1 / 2	Use trenchstops or bulkheads in accordance with Clause 8.10	
Normal	1		
Delete reference to WAT-1203 and WAT-1204			5.4.4
In the first paragraph, delete "DN 450" and insert "DN 375".			5.5
<p>At the end of the second paragraph, delete "talus slope, land fill or refuse dumping, mine subsidence" and insert "soils with low horizontal bearing capacity when waterlogged, talus slope, mine subsidence, land fill or refuse dumping".</p> <p>"Where geotechnical assessment is undertaken, test points shall be no more than 150 metres apart and shall be completed to a depth at least 1.5 metres deeper than the design trench depth.</p> <p>For each test point, soil classifications, actual groundwater level and maximum seasonal groundwater level shall be identified</p> <p>For each test point, vertical and horizontal bearing capacity shall be determined for waterlogged conditions.</p> <p>A copy of the geotechnical report shall be provided to PWC before approval of design designs is sought."</p>			
Delete reference to WAT-1203 and WAT-1204.			
Delete the second sentence of the first paragraph ("Guidance on selection ...").			5.6
Delete the third sentence of the first paragraph ("Specifications referenced in Part ...").			
Materials to comply with PWC Water and Sewage Infrastructure Products Manual			

Requirement	Clause
After the final paragraph, insert the following: "Trenchless technology may be required by the road authority under roads and railways. Consideration of the types of structures and existing vegetation shall be taken into account when specifying trenchless technology. Maintenance of the mains must be allowed for in the design."	5.8
Delete the first paragraph and insert the following: "Anchorage shall be provided at all changes in direction, in-line valves, tees, changes in pipe size and termination points."	5.9.1
After the second paragraph, insert the following: "For mains \leq DN250, design must take into account fully submerged conditions and horizontal bearing capacity. Thrust blocks shall be provided on socket-socket valves."	5.9.2
After the first paragraph, insert the following: "Use of short lengths of welded pipe at bends or junctions to restrain axial thrusts is permitted provided restraint length is determined to suit conditions. Note: AWA M11 calculation method is considered unacceptable. "	5.9.5.2
After the first paragraph, insert the following: "In the Northern Region, consideration shall be given to the installation of concrete bulkheads on each side of road crossings where soil groundwater may drain from one side of the road to the other via the pipe trench." Delete the third paragraph (" <i>Trenchstops are not generally ...</i> ").	5.10
Delete the words in brackets "(Refer to WSA 03, Part 3)"	5.11
Delete reference to WAT-1301, WAT-1302, WAT-1303, WAT-1304 and WAT-1308	6.1.4
Delete the first sentence of the first paragraph ("Valves shall have anti-clockwise rotation ...") and insert the following: "Gate valves shall be clockwise closing." Delete the final paragraph (" <i>Full size or reduced size ...</i> ").	6.2.1.2
After the final paragraph, insert the following: "Butterfly valves shall be installed with the shaft horizontal and the disc opening in the direction of flow from the bottom. Design of the butterfly shall be suitable for installation with the shaft horizontal. Where a by-pass is fitted around the butterfly valve to facilitate filling of the main, the by-pass shall be installed on the opposite side to the gearbox."	6.2.1.3

Requirement	Clause								
Gearboxes shall be waterproofed to the satisfaction of PWC and where specified, installed in a chamber to facilitate maintenance of the gear box."	6.2.1.3 (cont)								
Delete the third paragraph (" <i>Stop valve sizes should be as dictated by the hydraulic ...</i> ") and insert the following: "Subject to PWC approval, the size of the stop valve may be reduced to the next smallest size for water mains >DN 600."	6.2.2								
Before the first paragraph, insert the following; "Resilient seated gate valves up to and including DN600 may be used on reticulation mains." Delete the third paragraph (" <i>Stop valves in mains <DN 80 ...</i> "). Delete the fourth paragraph ("The number of property service connections ...") and insert the following: "The overriding maximum spacing between in-line valves shall be in accordance with Table 6.1(NT).	6.2.3								
<p style="text-align: center;">TABLE 6.1(NT) MAXIMUM STOP VALVE SPACING</p> <table border="1"> <thead> <tr> <th>Water main size (DN)</th> <th>Maximum spacing (m)</th> </tr> </thead> <tbody> <tr> <td>≤150</td> <td>300*</td> </tr> <tr> <td>200 to 300</td> <td>750</td> </tr> <tr> <td>375</td> <td>1000</td> </tr> </tbody> </table>	Water main size (DN)	Maximum spacing (m)	≤150	300*	200 to 300	750	375	1000	
Water main size (DN)	Maximum spacing (m)								
≤150	300*								
200 to 300	750								
375	1000								
In urban areas, stop valves shall be provided so that no more than 25 property service connections need to be isolated during maintenance. In rural areas, stop valves shall be provided at road intersections and so that no more than 20 property service connection services need to be isolated during maintenance. When assessing property service numbers in a 'shut-off' area, community title and strata title properties such as apartment buildings and multi-unit developments shall be counted as multiple connections." Delete the last paragraph (" <i>Normally one valve is adequate for most bypass applications ...</i> "). In the second paragraph, delete "The size of the by-pass for the stop valve shall be:" and insert: "The minimum size of the by-pass for the stop valve shall be:" In (a), delete "DN 100" and insert "DN 80".	6.2.4								

Requirement	Clause
Delete reference to WAT-1104. After the final paragraph, insert the following: "Valves will be required at each side of crossing where crossing rivers, stormwater OUD's, creeks, locks, estuaries etc."	6.2.5.1
Delete the existing wording and insert the following: "Stop valves shall be located on branch mains adjacent to the through water main. A flanged branch and flanged valve shall be used for all main sizes (Refer to Figure 6.1 and Standard Drawings WAT-1102 and WAT-1103)."	6.2.5.2
Delete the last sentence and insert the following: "Restrained joints must be used from the tee to the valve (refer to Figure 6.2 and Standard Drawings WAT-1102, WAT-1103 and WAT-1208 must be used in these situations."	6.2.5.3
After the first paragraph, add the following: "Written approval for example (c) must be obtained from PWC".	6.2.6
Delete reference to WAT-1302. After the final paragraph, insert the following: "Due to the solubility of air in water under constant pressure, and the presence of service connections, accumulation of air does not generally occur in distribution and reticulation mains however a means to admit and expel air during maintenance may necessitate installation of air valves for mains without alternative vent points such as hydrants or service connections. Consideration will be given to the installation of air valves in rural areas where there are few services to release air from the system."	6.4.1
Delete the second paragraph	6.4.2
After the final paragraph, insert the following: "Design and sizing of air valves shall be in accordance with specific manufacturer's recommendations. Consideration shall be given to rate of closure of air valves and related surge effects."	6.4.3
Add: (h) Where necessary to enable drainage of main (i) A minimum of 150mm aboveground (j) A minimum of 150mm above the 1:100 year flood level (k) Not in pits Delete the last paragraph	6.4.4

Requirement	Clause
<p>After the final paragraph, insert the following:</p> <p>"Reflux valves shall be installed in a pit or above ground for ease of maintenance.</p> <p>Isolation valves shall be provided each side of the reflux valve.</p> <p>Spring loaded check valves shall be installed at the bore head for submersible bore pumps.</p> <p>Thrust consideration shall be taken into account in the design."</p>	6.5
<p>After the final paragraph, insert the following:</p> <p>"Where scour pipework extends under a road valves shall be provided at both sides of the road."</p>	6.6.5
<p>Swabbing points are not generally required in PWC mains but may be specified for systems with high suspended solids load.</p>	6.7
<p>After the first paragraph, insert the following:</p> <p>"Hydrants are to be located so that a 90m radius circle around the hydrant covers the whole of lot/s.</p> <p>Where a lot is deeper than 70m, hydrant coverage of the rear of the lot is not required, however in these circumstances, consideration shall be given to the provision of service connections suitable for later installation of on-lot hydrant systems."</p>	6.8.2
<p>After the final paragraph, insert the following:</p> <p>"Spring hydrants are not used in PWC systems.</p> <p>Unless otherwise approved, all hydrants on PWC mains shall be below ground BS750 screw down type."</p>	6.8.3
<p>After the final paragraph, insert the following:</p> <p>"Spring hydrants are not used in PWC systems.</p> <p>Unless otherwise approved, all hydrants on PWC mains shall be below ground BS750 screw down type."</p>	6.8.4
<p>After the first paragraph, insert the following:</p> <p>"Hydrants are to be located so that a 90m radius circle around the hydrant covers the whole of lot/s.</p> <p>Where a lot is deeper than 70m, hydrant coverage of the rear of the lot is not required, however in these circumstances, consideration shall be given to the provision of service connections suitable for later installation of on-lot hydrant systems."</p>	6.8.7
<p>Delete reference to WAT-1300, WAT-1301 and WAT-1302.</p> <p>After the final paragraph, insert the following:</p> <p>"Hydrant installation shall be below ground.</p> <p>In rural areas steel marker posts shall be used."</p>	6.8.8

Requirement	Clause
Refer also to PWC Standard Drawing W1-2-19	6.8.10
Refer to PWC customer handouts 1, 2 and 3 for design checklists.	7.1
Refer to PWC's Drawing Procedures Volume available on the PWC website (www.powerwater.com.au)	7.2.1
At (d), delete ">DN 300" and insert ">DN 250"	7.2.2(d)
After the final paragraph, add the following: "MGA coordinates shall be provided on the drawings for all fittings including hydrants, bulk meters, valves, service tapping points, tees and bends. Confirmation of all existing services locations shall be undertaken and documented in the design drawings prior to submission to PWC for approval. Provide an electronic copy of the specification to PWC."	7.2.4
Delete the existing wording and insert the following: "All drawings to be provided in CAD format .DGN or .DWG. Where a hard copy of 'as constructed' information is required it shall be provided on Milar (film) and to the approved page size. All 'as constructed' drawings shall be provided at least 1 week prior to scheduled handover inspection. All 'as constructed' drawings shall be signed by the Constructor. All 'as constructed' survey information shall be collected by surveyors. Cadastral surveys to be undertaken by registered surveyor. Certification of all 'as constructed' information shall be undertaken by the certifying consulting engineer. Manufacturer details of any specific infrastructure shall be included in the 'as constructed' information. MGA Coordinates for fittings including hydrants, bulk meters, valves, service tapping points, tees and bends shall be provided. Provide Final Design report to PWC prior to handover inspection. Operations and Maintenance manuals for rotating mechanical infrastructure shall be provided prior to handover. This shall include, but not be limited to, pumps, pump controls, valve controls, valve actuators and PRV's."	7.3