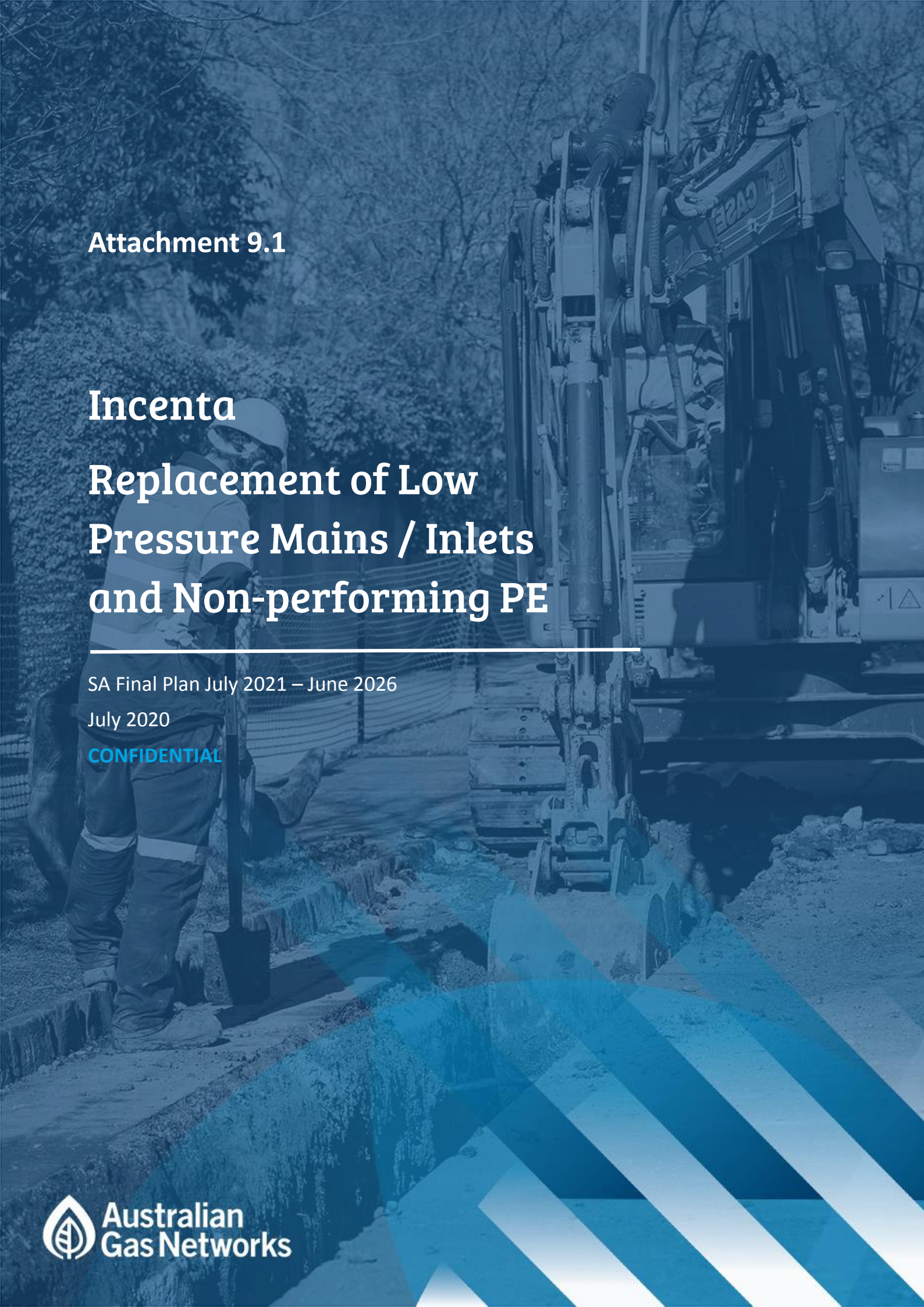


Attachment 9.1

Incenta Replacement of Low Pressure Mains / Inlets and Non-performing PE

SA Final Plan July 2021 – June 2026

July 2020

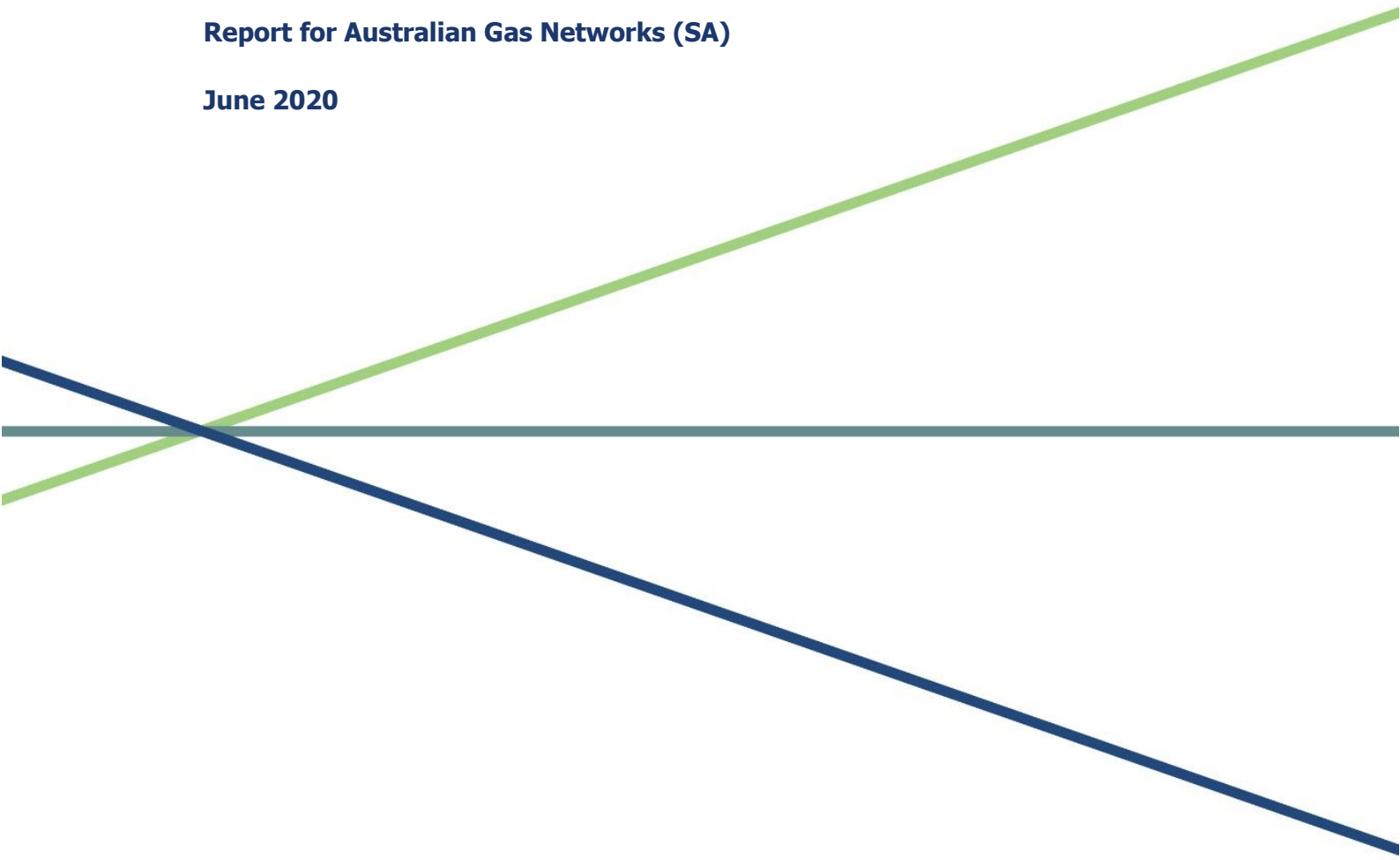
CONFIDENTIAL

Australian Gas Networks

Replacement of Low Pressure Mains / Inlets and Non-performing PE

Report for Australian Gas Networks (SA)

June 2020



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Tables and figures

1. Introduction and summary of conclusions

1.1 Scope

1. Incenta Economic Consulting ("Incenta", "we" or "us") has been engaged by Australian Gas Networks (AGN) to assist in calculating the adjustment to regulatory depreciation that is appropriate to reflect the replacement of low pressure pipelines and its non-performing polyethylene (PE). The relevant background to this request is that, as a consequence of AGN's replacement programs, there will be:

   a. assets that have a value in AGN's opening capital base for the next access arrangement period that will have already been replaced by that date, and

   b. there will be a further set of assets that have a value in the opening capital base that will be replaced over the next access arrangement period.

2. AGN is proposing to depreciate the undepreciated value of both sets of assets (i.e., the already replaced and to-be-replaced) evenly over the next access arrangement period. As both sets of assets are to be treated in a like manner, the focus of this report is to establish, as at the start of the next access arrangement period (i.e., 1 July 2021), the sum of:

   a. the assets that would have been replaced by the commencement of the access arrangement period, and

   b. the assets that are planned to be replaced over the course of the next access arrangement period.

3. We provided a report to AGN in 2016 to support a similar proposal in relation to its Victorian gas distribution network, where we set out the merits of that proposal against the requirements of the relevant elements of the gas regulatory regime. The AER's decision in that matter accepted AGN's proposal. Accordingly, we have not repeated our views here about the merits of the proposal – save to note here that the issues are materially the same – and instead we focus on how we have derived our estimates.

1.2 Summary of advice

1.2.1 Method applied

4. The focus of this report is to estimate the projected capital base value of the assets that, under its plans, AGN will have replaced by to the end of the next access arrangement period. Our analysis suggests that the majority of the replaced assets relate to those that would have been in place at the date that the initial regulatory asset base was determined, and hence we restrict attention to those assets, which we refer to the initial capital base (ICB) assets.

5. The steps of our analysis were as follows.

a. *Step 1*, we establish the capital base associated with the relevant ICB assets as at the commencement of the next access arrangement period. For this purpose, we:

   i. commenced with the capital base value as at June 2011 for mains and inlets that was calculated within the 2011 roll-forward model, with the model delivering a separate value for the aggregated ICB mains and the aggregated ICB inlets,[1] and

   ii. then updated the capital values for those two sets of ICB assets on the assumption that those assets continued to be depreciated separately, applying the revised remaining lives that were determined to apply from 2011.

b. *Step 2*, we have allocated the capital base values for the ICB mains and ICB inlets into subgroups that reflect the material type and pressure grade, applying information AGN had retained about the assumptions underpinning the setting of the initial capital base.[2] Specifically we:

   i. calculated the capital base value that each of the subgroups would have had as at 30 June 2021 if "individual tracking" depreciation had applied to each of the subgroups,[3] applying each subgroup's remaining life, and

   ii. then pro-rated the aggregated ICB capital base values for mains and inlets into each subgroup according to the relative shares of each of the subgroups in the "individual tracking" capital base as at 30 June 2021.[4]

   This method means that the weight assigned to each of the subgroups will be sensitive to both the initial capital base and the initial remaining life of the subgroups.

c. *Step 3*, we applied information from AGN about the past and planned replacement activities by material type and pressure grade to calculate the proportion of each of the subgroups that are to be replaced by 30 June 2026. The kilometres of mains replaced in the respective subgroups was used as the scaling factor for both mains and inlets.

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1 One minor issue that we encountered was that the 2011 roll-forward model included errors in the naming of the categories of assets. The class that comprised only "mains" had been incorrectly labelled as "mains and inlets", and the category that comprised "regulators and inlets" (albeit with regulators accounting for approximately 1.3 per cent of the total) was incorrectly labelled "regulators / odorising" and has since been aggregated into "other distribution system equipment". In this report, we have focussed on the underlying substance of the relevant decisions, and hence have ignored this labelling error.

2 Specifically, AGN has information underpinning its DORC proposal, although not about the precise adjustments that were made by the regulator to the DORC proposal to derive the final DORC estimate (which was applied as the initial capital base). Accordingly, we assume that all of subgroups within an asset class were adjusted by the proportion that applied to the class overall (e.g., the DORC for medium pressure PE mains was assumed to be adjusted by the same amount as applied to the aggregated mains asset class), which we consider to be a reasonable assumption.

3 For example, assuming that "low pressure cast iron" assets were depreciated as a separate class.

4 The sum of the individually depreciated assets was lower than the depreciated aggregated values; however, this is a common outcome of aggregating assets for depreciation purposes.

1.2.2 Results

6. Table 1 sets out our estimate of the capital base value at the start of the next access arrangement period of the assets that will have been replaced under the two replacement programs by the end of the next access arrangement period (i.e., 30 June 2026), which is **$251.52 million**.

Table 1 – RAB value of assets replaced by 30 June 2026

	Km in ICB for asset type	Km replaced by:			Assets in opening RAB replaced by:		
		30/06/2019	*30/06/2021*	*30/06/2026*	*30/06/2019*	*30/06/2021*	*30/06/2026*
Low pressure and iron / steel replacement							
Cast iron (low pressure)	2,194	1,821	1,894	2,194	109.19	113.57	131.55
Unprotected steel (low pressure)	216	180	184	216	0.00	0.00	0.00
Protected steel (low pressure)	121	106	104	115	7.41	7.27	8.04
PE (low pressure)	723	520	569	723	42.80	46.83	59.49
Cast iron (medium pressure)	125	108	118	125	0.29	0.31	0.33
Unprotected steel (medium pressure)	20	16	19	20	0.38	0.45	0.48
Total	**3,400**	**2,752**	**2,889**	**3,394**	**160.07**	**168.44**	**199.90**
Non-performing PE replacement							
Medium pressure	712	25	157	261	1.75	11.04	18.41
High pressure	939	90	251	449	6.63	18.60	33.22
Total	**1651**	**114**	**408**	**710**	**8.37**	**29.64**	**51.63**
Combined programs							
Grand total	**5,052**	**2,867**	**3,297**	**4,104**	**168.44**	**198.08**	**251.52**

7. We agree with AGN that the most practicable method of addressing the replaced assets is to deduct the value of the assets projected to be replaced by the end of the access arrangement period ($251.52 million in total) from the categories in the capital base in which these assets appear, and then spread the aggregate amount evenly over the access arrangement period.

1.3 Structure of the remainder of this report

8. The remainder of this report provides further elaboration upon:

   a. the method that we have applied

   b. the sources of information that we have used, and

   c. our results.

9. This report is intended to be read in conjunction with a spreadsheet model that we have produced to show our calculations,[5] and references are included to that model where relevant.

[5] *AGN SA - Replaced assets final.xlsx*, 181 kb.

2. Method, data sources and results

2.1 Method

10. The basic method that we have applied to estimate the current RAB value of the replaced assets is similar to the method we employed for AGN's Victorian business, namely to:

    a. derive the current capital base value for the aggregated class or classes in which the relevant ICB assets were placed when the ICB was set and subsequently depreciated, and

    b. derive the portion of the aggregated class or classes that relates to the replaced assets according to the most reasonable method that is practicable in the circumstances, and most notably the information that is available that may be used for that apportionment.

11. Similar to the AGN Victoria network, all of the materials types and pressure grades for mains and inlets were aggregated into a single class, although unlike in Victoria separate asset classes were created for mains and inlets.[6] However, unlike in Victoria, AGN retains information about how the ICB value associated with each of the asset classes broke down by materials type and pressure grade, and the average age and remaining life of each of these classes. This information is in the form of the DORC estimate that was proposed by the service provider.[7]

12. Accordingly, we have used this additional information to derive the portion of the current capital base that is associated with the relevant ICB asset classes that has been replaced. Specifically, the method that we have applied involves three steps.

    a. First, we have established the RAB associated with the aggregated ICB mains and aggregated ICB inlets as at the commencement of the next access arrangement period, which we have done by:

        i. commencing with the capital base value for the ICB mains and inlets assets that was calculated in the 2011 roll-forward model, and

        ii. then rolling-forward those values by applying straight-line depreciation to 30 June 2021, using the remaining lives determined for the ICB assets as at 2011 and the inflation assumptions consistent with the 2011, 2016 and 2021 roll-forward models.

    b. Secondly, we have allocated the aggregate capital base values for the ICB mains and ICB inlets at 30 June 2021 to the different materials types and pressure grades according to the relativities in the written down values that would have resulted between these sub-categories if the ICB mains and inlets had instead been depreciated

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6 The inlets class also included a small amount (in value terms) of regulators.

7 The same information in relation to the final DORC estimate – which was applied as the ICB – is unavailable.

on an "individual tracking" basis for each material type and pressure grade.[8] This method therefore results in an allocation between the sub-categories of mains and inlets that reflects both the relative value of the different sub-categories in the ICB, as well as the relative remaining lives.

c. Thirdly, we have applied information from AGN about the past and planned replacement activities to calculate the proportion of each of the sub-groups that would be replaced by 30 June 2026. Where relevant, this adjustment used the kilometres of mains in the respective sub-groups as the scaling factor for both mains and inlets.

13. We explain in further detail the calculations required for these three steps in the following two sections.

2.2 Derivation of the capital base associated with the ICB mains and services

14. As noted above, the 2011 roll-forward method identified the following rolled-forward values for the ICB mains and inlets as at 30 June 2011, in December 2005-dollar terms.

Table 2 – RAB value for the ICB mains and inlets and regulators in the 2011 roll-forward model

Asset class	ICB assets at 30 June 2011 ($m Dec 2005)	Remaining lives as at 30 June 2011
Mains	370.4	47.00
Inlets and regulators	173.1	27.00
Total mains, inlets and regulators	**543.6**	

15. One issue that we encountered in the 2011 roll-forward model was that the "mains" asset class had been incorrectly labelled as "mains and inlets", and the category that comprised "inlets and regulators" had been incorrectly labelled as "regulators / odorising", which was then aggregated with other assets into the "other distribution system equipment" class. This labelling error can be confirmed simply by comparing the values recorded in the 2011 roll forward model with the access arrangement information for the first access arrangement period.[9] In this report we have applied the substance of the relevant decisions and so have remedied this error in the table above.

16. We then rolled-forward these values to the start of the next access arrangement period by applying straight line depreciation for a further 10 years, and using the measures of actual inflation that were applied in the relevant roll-forward models. In addition, as part of this calculation, we reduced the value of the class within which the inlets reside to remove our estimate of the value associated with regulators. We assumed that the proportion of regulators in the inlets and regulators class was the same as in the proposed DORC value (which is discussed further below), which was approximately 1.3 per cent. The steps of this calculation and results are set out in turn below.

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8 This results in 16 sub-categories for mains and 12 sub-categories for inlets.

9 Final AAI, 1999, p.12. As discussed further below, in the proposed DORC the regulators comprised approximately 1.3 per cent of the total for this class.

Table 3 – Capital base value for the ICB mains and inlets as at 30 June 2021

Item	Inflation date basis	Mains	Comment	Inlets	Comment
[1] 2011 Capital base value for ICB assets	$Dec 2005	370.40	2011 RFM	170.95	2011 RFM reduced by 1.3%
[2] Depreciation from 2011 to 2021	$Dec 2005	78.81	= [1] x 10 / 47	63.31	= [1] x 10 / 27
[3] 2021 Capital base value for ICB assets	$Dec 2005	291.59	= [1] - [2]	107.64	= [1] - [2]
[4] 2021 Capital base value for ICB assets	$June 2021	**414.15**	**= [3] x 1.42**	**152.87**	**= [3] x 1.42**

2.3 Allocating the mains and inlets into materials types and pressure grades

17. As noted above, we have apportioned the aggregate values for mains and inlets into the different materials types and pressure grades according to the proportion that each of those subclasses would have if the ICB mains and inlets sub-classes had been depreciated on an "individual tracking" basis. Whilst we do not have the final ICB broken down by materials type and pressure grade, we have the estimate of the DORC value that the service provider proposed when the ICB was set, and we assume that the relativities of these sub-classes in the proposed DORC and ICB (which reflected the regulator's estimate of DORC) are the same, which we think is reasonable.

18. The steps that we have applied in this calculation are as follows.

    a. First, as noted above, we extracted the service provider's estimate of the DORC values for each of the mains and inlets sub-categories, which comprised 28 sub-categories across both asset classes.

    b. Secondly, we scaled the proposed DORC values so that the totals for mains and inlets respectively sum to the approved ICB values (this step was not necessary, however, to derive the relativities).[10]

    c. Thirdly, we obtained the average lives for each of the sub-categories from the proposed DORC, which we assume to be correct, and we obtained the total lives of each of the materials types from the final access arrangement information.[11] From this, we calculated the remaining lives for each sub-category as at 30 June 1998.[12]

    d. Fourthly, we observed that there was a slight reduction to the remaining lives for mains and inlets aggregate classes after 2011. In particular, the average remaining lives for the mains class as at June 1998 were revised down from 65 to 60 years and from 41 to 40 years for the inlets, which was then used to calculate the remaining lives for these assets from June 2011.[13] We applied the proportionate reduction in the 1998 remaining lives for the aggregated classes to the 1998 remaining lives for each of the sub-classes – which then flowed into the remaining lives for each of the sub-classes – when depreciating the assets after 2011.

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10 These values were obtained from: Final AAI, 1999, p.12, and where the inlets and regulators asset class has been reduced by 1.3 per cent to remove the estimated contribution of regulators.

11 Final AAI, 1999, p.14.

12 The weighted average remaining lives that I calculate for the total mains and inlets asset classes are very close to those that were applied to depreciate the assets (66 vs. 65 applied for mains and 44 vs. 41 applied for inlets and regulators).

13 That is, the average remaining life for ICB mains at June 2011 was revised down from 52 years (= 65 – 13) to 47 years (= 60 – 13) and from 28 years (= 41 – 13) to 27 years (= 40 – 13) for inlets.

e. Fifthly, we applied actual inflation consistent with what was used in the roll-forward models (this step also was not necessary, however, to derive the relativities in the different sub-classes).

f. Sixthly, the aggregate capital base value for ICB mains and services derived in the previous section was then apportioned into the different materials types and pressure grades according to the relative magnitude of the final written down values that were derived through this "individual tracking" depreciation.

19. The steps in this calculation, and the resulting allocated capital base for ICB mains and inlets as at 30 June 2021, is shown in Table 4.

Table 4 – Use of individual tracking WDVs to allocate the ICB mains and inlets capital base

	DORC proposal	ICB scaled according to DORC	Units (km of mains, number of inlets)	Average age of class	Total life from 1998	Remaining life June 1998	Depreciation to 2011 (13 years)	Individual tracking WDVs at June 2011 ($June 1998)	Remaining life at June 2011 - before adjustment	Remaining life at June 2011 - after adjustment	Depreciation to 2021 (10 years)	Individual tracking WDVs at June 2021 ($June 1998)	Individual tracking WDVs at June 2021 ($June 2021)	ICB mains and inlets capital base allocated according to "individual tracking" WDVs
Mains														
Protected steel - Low pressure	7.78	5.77	121	24.71	120	95.29	0.79	4.99	82.29	74.96	0.67	4.32	7.36	8.46
Protected steel - Medium pressure	48.88	36.28	462	17.42	120	102.58	4.60	31.68	89.58	81.69	3.88	27.80	47.35	54.46
Protected steel - High pressure	94.12	69.86	1,049	21.95	120	98.05	9.26	60.59	85.05	77.50	7.82	52.78	89.89	103.38
Protected steel - Transmission	53.44	39.66	173	23.22	120	96.78	5.33	34.33	83.78	76.33	4.50	29.84	50.82	58.44
Unprotected steel - Low pressure	11.12	8.25	216	47.23	60	12.77	8.25	0.00	-0.23	0.00	0.00	0.00	0.00	0.00
Unprotected steel - Medium pressure	1.67	1.24	20	45.00	60	15.00	1.08	0.17	2.00	0.85	0.17	0.00	0.00	0.00
Unprotected steel - High pressure	7.01	5.20	104	48.13	60	11.87	5.20	0.00	-1.13	0.00	0.00	0.00	0.00	0.00
PE - Low pressure	59.09	43.86	723	14.70	60	45.30	12.58	31.27	32.30	28.82	10.85	20.42	34.78	40.00
PE - Medium pressure	43.66	32.41	712	12.15	60	47.85	8.80	23.60	34.85	31.17	7.57	16.03	27.30	31.40
PE - High pressure	56.22	41.73	939	8.89	60	51.11	10.61	31.11	38.11	34.18	9.10	22.01	37.49	43.11
Cast iron - direct buried - Low pressure	8.06	5.98	127	41.09	85	43.91	1.77	4.21	30.91	27.53	1.53	2.68	4.57	5.25
Cast iron - direct buried - Medium pressure	1.76	1.30	25	61.46	85	23.54	0.72	0.58	10.54	8.73	0.58	0.00	0.00	0.00
Cast iron - direct buried - High pressure	0.06	0.04	0	20.35	85	64.65	0.01	0.03	51.65	46.67	0.01	0.03	0.05	0.05
Cast iron - insertion - Low pressure	106.37	78.95	2,068	40.98	85	44.02	23.31	55.64	31.02	27.64	20.13	35.51	60.47	69.55
Cast iron - insertion - Medium pressure	4.11	3.05	100	61.40	85	23.60	1.68	1.37	10.60	8.79	1.37	0.00	0.00	0.00
Cast iron - insertion - High pressure	0.03	0.02	0	20.35	85	64.65	0.00	0.02	51.65	46.67	0.00	0.01	0.02	0.02
Total mains	**503.36**	**373.60**	**6,841**				**94.00**	**279.60**			**68.18**	**211.42**	**360.09**	**414.15**
Inlets														
Steel - Low pressure	12.24	9.51	17,447	37.05	60	22.95	5.39	4.13	9.95	9.39	4.13	0.00	0.00	0.00
Steel - Medium pressure	19.75	15.35	22,462	17.58	60	42.42	4.70	10.65	29.42	28.39	3.75	6.90	11.74	11.32
Steel - High pressure	41.78	32.46	49,781	22.98	60	37.02	11.40	21.06	24.02	23.12	9.11	11.95	20.36	19.62
Steel - Transmission	0.22	0.17	9	23.03	60	36.97	0.06	0.11	23.97	23.07	0.05	0.06	0.11	0.10
Cast iron - Low pressure	92.05	71.53	117,650	39.80	85	45.20	20.57	50.96	32.20	31.10	16.39	34.57	58.88	56.75
Cast iron - Medium pressure	3.98	3.09	5,777	59.82	85	25.18	1.60	1.50	12.18	11.57	1.29	0.20	0.35	0.33
Cast iron - High pressure	0.03	0.02	36	24.96	85	60.04	0.01	0.02	47.04	45.57	0.00	0.01	0.03	0.02
Cast iron - Transmission	0.00	0.00	0	0.00	85	85.00	0.00	0.00	72.00	69.93	0.00	0.00	0.00	0.00
PE - Low pressure	30.83	23.96	38,595	13.71	60	46.29	6.73	17.23	33.29	32.16	5.36	11.87	20.22	19.49
PE - Medium pressure	28.31	22.00	32,978	11.22	60	48.78	5.86	16.14	35.78	34.59	4.66	11.47	19.54	18.83
PE - High pressure	37.50	29.14	41,071	7.94	60	52.06	7.28	21.86	39.06	37.79	5.79	16.08	27.38	26.40
PE - Transmission	0.00	0.00	0	0.00	60	60.00	0.00	0.00	47.00	45.54	0.00	0.00	0.00	0.00
Total inlets	**266.70**	**207.23**	**325,806**				**63.59**	**143.64**			**50.53**	**93.12**	**158.60**	**152.87**
Grand total - mains and inlets	**770.05**	**580.83**					**157.60**	**423.24**			**118.70**	**304.54**	**518.69**	**567.02**

2.4 Proportion of the initial assets to be replaced

20. We were provided with the following actual and forecast inventories of mains assets for the financial years ending with 30 June 2019, 30 June 2021 (the commencement of the next access arrangement period) and 30 June 2026 (the end of the next access arrangement period).

Table 5 – Actual and projected mains inventories[14]

AGN - SA Networks (excl Mildura) - km - projected 1 July 2026												
	Cast Iron	Copper	UPS	Steel (Protected)	PVC	Nylon	HDPE PE 250	HDPE PE 500/575	MDPE PE 80	HDPE PE 100	PE (Unknown Class)	Total
Low	0	0	0	6	0	0	0	0	0	21	0	**27**
Medium	0	1	0	480	0	0	0	380	1,387	658	0	**2,906**
High	0	0	0	1,140	0	0	0	406	1,926	2,225	0	**5,697**
Transmission	0	0	0	214	0	0	0	0	0	0	0	**214**
Total	**0**	**1**	**0**	**1,840**	**0**	**0**	**0**	**786**	**3,313**	**2,904**	**0**	**8,843**
AGN - SA Networks (excl Mildura) - km - projected 1 July 2021												
	Cast Iron	Copper	UPS	Steel (Protected)	PVC	Nylon	HDPE PE 250	HDPE PE 500/575	MDPE PE 80	HDPE PE 100	PE (Unknown Class)	Total
Low	300	0	32	17	0	0	118	36	44	30	0	**577**
Medium	7	1	1	480	0	0	14	470	1,387	539	0	**2,899**
High	0	0	0	1,140	0	0	0	603	1,926	1,134	0	**4,804**
Transmission	0	0	0	214	0	0	0	0	0	0	0	**214**
Total	**307**	**1**	**33**	**1,851**	**0**	**0**	**132**	**1,109**	**3,357**	**1,703**	**0**	**8,493**
AGN - SA Networks (excl Mildura) - km - actual 1/7/2019												
	Cast Iron	Copper	UPS	Steel (Protected)	PVC	Nylon	HDPE PE 250	HDPE PE 500/575	MDPE PE 80	HDPE PE 100	PE (Unknown Class)	Total
Low	373	0	36	15	0	0	155	48	58	12	0	**697**
Medium	17	1	4	480	0	0	125	491	1,387	396	0	**2,901**
High	0	0	0	1,140	0	0	0	765	1,926	711	0	**4,542**
Transmission	0	0	0	214	0	0	0	0	0	0	0	**214**
Total	**390**	**1**	**40**	**1,850**	**0**	**0**	**279**	**1,304**	**3,372**	**1,118**	**0**	**8,354**

21. The DORC proposal that we discussed above also provided information on the length of mains by pressure grade and materials type that were assumed in the initial capital base, and which are reproduced for the sub-components of interest in Table 8 below. We cross-checked these mains lengths against the information in the final access arrangement information for the first access arrangement period, and found them to reconcile closely.

22. We then investigated how much of the current assets in each of the materials types and pressure grades are likely to have been in place at the time that the initial capital base was determined, versus the assets that are likely to have been installed since then. We were provided with the following mains inventory as at 30 June 2018, which also identified the range of the lives of assets currently in service. From this information, we were able to identify which of the materials types were likely to predate the determination of the initial capital base and those that are likely post-date that exercise. This is set out in Table 6.

Table 6 – Age ranges for assets as at 30 June 2018

	Age (max)	Age (min)	First used	Last used	Proportion of current assets in initial capital base
Cast Iron	70	50	30/06/1948	30/06/1968	All in the ICB
Unprotected steel	63	49	30/06/1955	30/06/1969	All in the ICB
Protected steel	49	0	30/06/1969	30/06/2018	Some in the ICB, some installled after
Copper	15	10	30/06/2003	30/06/2008	None in the ICB
HDPE 250	45	40	30/06/1973	30/06/1978	All in the ICB
HDPE 575	37	23	30/06/1981	30/06/1995	All in the ICB
PE 80	23	4	30/06/1995	30/06/2014	Some in the ICB, some installled after
PE 100	4	0	30/06/2014	30/06/2018	None in the ICB

14 The mains inventory for 2026 excludes certain augmentation projects; however, this does not affect the calculations undertaken for this report.

23. From this information, we observe that:

    a. There has been fairly clear separation of the materials types into vintages, from which it is possible to separate most of the current-day mains into those that pre-date the setting of the ICB and those that post-date, and in particular that:

        i. All of the cast iron and unprotected steel assets, as well as HDPE 250 and HDPE 575, pre-date the setting of the ICB, and so any amount of these materials that remain in place must correspond to assets in the ICB.

        ii. All of the PE 100 post-dates the setting of the ICB, and so none of these materials that remain in place correspond to assets in the ICB.

    b. The only categories of materials whose use both pre-dated and post-dated the setting of the ICB were the protected steel and PE80 categories. Accordingly, additional information was required to ascertain the extent of these assets that will remain in service that relate to ICB assets. These are addressed in turn.

Protected steel

24. The age range for assets summarised above reflect the range across all pressure grades; however, for protected steel, it is only low-pressure assets that are being replaced. We were informed that, whilst the use of protected steel continues to be a standard technology in relation to high-pressure applications, only small amounts has been applied for low pressure applications in the period since 1998. We have therefore adopted the conservative assumption that all of the current low-pressure protected steel was installed prior to 1998.[15]

PE 80

25. According to the information presented above, the use of PE 80 commenced several years prior to the ICB being set and then continued to be used for many years subsequently. We obtained further information about the quantity of PE80 that existed around the time of the setting of the ICB, specifically the inventory of these assets at 30 June 1999 (the inventory from the year earlier was unavailable). We used this information to infer an approximate length of PE80 mains that were present at the time the ICB was set. Specifically, we:

    a. commenced with the observation that the use of PE80 started after 30 June 1995

    b. assumed a constant annual rate of construction over the four years to 30 June 1999, which

    c. implies that three-quarters of the inventory as at 30 June 1999 would have been installed by 30 June 1998.

[15] This is conservative (i.e., likely to understate the value of replaced assets) because any low pressure protected steel that has been installed since 1998 and replaced under the current replacement program will not be included in the value of the replaced assets that I have calculated.

26. This calculation is shown in Table 7.

Table 7 – Further information on PE80 mains

PE80 pressure grade	PE80 (km) at 30 June 1999	Pro-rating factor	Pro-rated PE80 (km) at 30 June 1998
Low pressure	20.1	0.75	15.08
Medium pressure	95.1	0.75	71.33
High pressure	112.9	0.75	84.68
Total	228.1		171.1

27. Table 8 combines the information above, summarising the mains by material types and pressure grade that were in place at the time of the ICB, and the extent of those mains that remain or are expected to remain after 30 June 2019, 30 June 2021 and 30 June 2026. I have blanked out the sub-categories of mains that are not part of the two replacement programs. This table required two additional assumptions about PE80 assets, which were as follows:

a. In relation to the low pressure PE80 assets, we assumed that all of the low pressure PE80 that was in the ICB would have been replaced by 30 June 2019 (i.e., that it would have been replaced first), although as all of the low pressure PE80 will be gone by the end of the access arrangement period this assumption is immaterial.

b. In relation to the medium and high pressure PE80, we assumed that none of the assets in the ICB will be replaced under the non-performing PE program and so will remain in service.

Table 8 – ICB Mains remining in service

Main inventory (km) as at:		Initial capital base			30 June 2019			30 June 2021			30 June 2026		
Material type / pressure grade		*Low*	*Medium*	*High*	*Low*	*Medium*	*High*	*Low*	*Medium*	*High*	*Low*	*Medium*	*High*
Cast iron		2,194	125		373	17		300	7		0	0	
Unprotected steel		216	20		36	4		32	1		0	0	
Protected steel		121			15			17			6		
	HDPE 250				*155*	*125*	*0*	*118*	*14*	*0*	*0*	*0*	*0*
	HDPE 575				*48*	*491*	*765*	*36*	*470*	*603*	*0*	*380*	*406*
Polyethylene	*PE 80*				*0*	*71*	*85*	*0*	*71*	*85*	*0*	*71*	*85*
	PE 100				*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
	Total PE	723	712	939	203	687	850	154	556	688	0	451	490

28. We then used these original and remaining length-of-main figures to calculate the proportion of the ICB assets in each sub-category of mains that will be replaced under AGN's two replacement programs. The proportions of the sub-categories of the ICB mains assets would have been replaced by the date indicated is set out in Table 9.

Table 9– Proportions of assets replaced by the date indicated

Material type / pressure grade	Proportion replaced by:		
	30 June 2019	*30 June 2021*	*30 June 2026*
Cast iron (low pressure)	83.0%	86.3%	100.0%
Unprotected steel (low pressure)	83.4%	85.2%	100.0%
Protected steel (low pressure)	87.6%	86.0%	95.0%
Cast iron (medium pressure)	86.4%	94.4%	100.0%
Unprotected steel (medium pressure)	80.3%	95.1%	100.0%
PE - low pressure	71.9%	78.7%	100.0%
PE - medium pressure	3.5%	22.0%	36.6%
PE - high pressure	9.5%	26.8%	47.8%

29. We used these percentages of the mains to be replaced to estimate the current capital base value of both the replaced mains and the inlets. Applying the mains replacement proportions also to inlets assumes that the inlets (which are being replaced along with the mains) are approximately evenly spread along the mains of the associated material type and pressure grade, which we consider to be a reasonable assumption.

30. However, one further assumption is required to estimate the proportion of certain inlets that will be replaced. Applying the proportion of mains replaced to the associated type of inlets straightforward for most materials types as the inlets are broken down into most of the same materials types; however, the exception is the inlets associated with steel mains, where there was no distinction made between the inlets attached to protected and unprotected steel. For this, we simply pro-rated the capital base values for steel inlets in each pressure grade between unprotected steel and protected steel according to the relative length of the associated mains. This assumes that inlets are approximately evenly distributed across the different steel mains within each pressure grade, which we also consider to be a reasonable assumption.

2.5 Results

31. The following table combines:

    a. the current capital base for the ICB mains and inlets, that has been

    b. allocated into materials types and pressure grade, with

    c. the estimated proportion of assets that will be replaced in each material type and pressure grade.

Table 10 – Estimate of the RAB value of replaced ICB mains and inlets

	Capital base value of ICB assets - apportioned by individual tracking	Proportion replaced by:			Capital base value of assets replaced by:		
		30 June 2019	*30 June 2021*	*30 June 2026*	*30 June 2019*	*30 June 2021*	*30 June 2026*
Mains							
Protected steel - Low pressure	8.46	87.6%	86.0%	95.0%	7.41	7.27	8.04
Protected steel - Medium pressure	54.46	n/a	n/a	n/a	n/a	n/a	n/a
Protected steel - High pressure	103.38	n/a	n/a	n/a	n/a	n/a	n/a
Protected steel - Transmission	58.44	n/a	n/a	n/a	n/a	n/a	n/a
Unprotected steel - Low pressure	0.00	83.4%	85.2%	100.0%	0.00	0.00	0.00
Unprotected steel - Medium pressure	0.00	80.3%	95.1%	100.0%	0.00	0.00	0.00
Unprotected steel - High pressure	0.00	n/a	n/a	n/a	n/a	n/a	n/a
PE - Low pressure	40.00	71.9%	78.7%	100.0%	28.78	31.49	40.00
PE - Medium pressure	31.40	3.5%	22.0%	36.6%	1.09	6.90	11.51
PE - High pressure	43.11	9.5%	26.8%	47.8%	4.11	11.54	20.60
Cast iron - direct buried - Low pressure	5.25	83.0%	86.3%	100.0%	4.36	4.53	5.25
Cast iron - direct buried - Medium pressure	0.00	86.4%	94.4%	100.0%	0.00	0.00	0.00
Cast iron - direct buried - High pressure	0.05	n/a	n/a	n/a	n/a	n/a	n/a
Cast iron - insertion - Low pressure	69.55	83.0%	86.3%	100.0%	57.73	60.04	69.55
Cast iron - insertion - Medium pressure	0.00	86.4%	94.4%	100.0%	0.00	0.00	0.00
Cast iron - insertion - High pressure	0.02	n/a	n/a	n/a	n/a	n/a	n/a
Total mains	**414.15**				**103.48**	**121.78**	**154.96**
Inlets	**0**						
Steel - Low pressure	0.00	84.9%	85.5%	98.2%	0.00	0.00	0.00
Steel - Medium pressure	11.32	3.4%	4.0%	4.2%	0.38	0.45	0.48
Steel - High pressure	19.62	n/a	n/a	n/a	n/a	n/a	n/a
Steel - Transmission	0.10	n/a	n/a	n/a	n/a	n/a	n/a
Cast iron - Low pressure	56.75	83.0%	86.3%	100.0%	47.11	48.99	56.75
Cast iron - Medium pressure	0.33	86.4%	94.4%	100.0%	0.29	0.31	0.33
Cast iron - High pressure	0.02	n/a	n/a	n/a	n/a	n/a	n/a
Cast iron - Transmission	0.00	n/a	n/a	n/a	n/a	n/a	n/a
PE - Low pressure	19.49	71.9%	78.7%	100.0%	14.02	15.34	19.49
PE - Medium pressure	18.83	3.5%	22.0%	36.6%	0.65	4.14	6.90
PE - High pressure	26.40	9.5%	26.8%	47.8%	2.52	7.06	12.61
PE - Transmission	0.00	n/a	n/a	n/a	n/a	n/a	n/a
Total inlets	**152.87**				**64.97**	**76.30**	**96.57**
Grand total - mains and inlets	**567.02**				**168.44**	**198.08**	**251.52**

32. The resulting estimate of the current capital base associated with the ICB mains and inlets that has been – or is projected to be – replaced is provided in the last three columns, and in total amounts to:

    a. **$168.44** million that has already been replaced (i.e., to 30 June 2019)

    b. **$198.08** that is projected to be replaced by the commencement of the next access arrangement period (i.e., 30 June 2021), and

    c. **$251.52 million** that is projected to be replaced by the end of the next access arrangement period (i.e., 30 June 2026).

33. We agree with AGN that the most practicable method of addressing the replaced assets is to deduct the value of the assets projected to be replaced by the end of the access arrangement period (i.e., $154.96 million in mains and $96.57 million in inlets, being $251.52 million in total) from the categories in the capital base in which these assets appear, and then spread the aggregate amount evenly over the access arrangement period.