



**AER Access Arrangement 2017  
Multinet**

**Stage 2 Report**

**Prepared for**



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*Zincara P/L*

*11 Alexandra Street*

*St Kilda East 3183*

*Telephone 03 9527 4921*

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Report prepared by :  
Reviewed by:

Brian Fitzgerald, Ed Teoh  
Suzanne Jones

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## 1. EXECUTIVE SUMMARY

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### 1.1 INTRODUCTION

In August, 2017, Multinet provided a response to the AER's draft decision. The AER has engaged Zincara P/L (Zincara) to advise on the revised mains replacement program in Multinet's submission.

In its revised mains replacement program submission Multinet states:

- Low pressure mains have a High risk rating and therefore must be replaced as soon as practicable.
- Medium pressure cast iron mains and early first generation HDPE mains have a High risk rating, higher than the low pressure and therefore must be replaced as a priority.
- All medium pressure projects should be undertaken as they are High risk and are all critical supply mains in inner urban areas.
- Replacing the mains is the only way to minimise the risks from High to Low.
- The basis of the revised mains replacement program volumes for 2018-2022, is the volume of mains replaced during the first six months of 2017, ie. an annual average around 119 kilometres. Once provision is made for the four medium pressure projects (24 kilometres), the early first generation HDPE mains (31 kilometres), and "other" mains (9 kilometres) then that leaves 531 kilometres of low pressure for the 2018-2022 period. Note: "other" refers to other mains replaced as part of the block replacement of the HDPE.
- Early first generation HDPE. A further 31 kilometres will need to be replaced in the subsequent period (there are 62 kilometres of early first generation HDPE mains).
- Low pressure mains replacement program aims to be complete by target year of 2033, meaning that it will need to increase the annual average mains replacement rate from its revised program average of 119 kilometres per year to around 146 kilometres per year in subsequent periods.

**Risk assessment.** The high risk rating for medium pressure and HDPE relates to the consequence of failure. Zincara does not disagree with these ratings, however, on the basis of the risk assessment methodology, these mains have had such a rating for a very long period of time, i.e. it is not a new situation. Zincara believes that Multinet has had many mitigation strategies in place as part of its asset management capabilities to manage the residual risks to a low as practicable during this time, and will continue to do so until prudent delivery capacity and efficient cost enable the mains to be replaced.

**Delivery capability.** Multinet submitted a report by Advisian that was engaged to conduct an independent review of Multinet's 2013-2017 program and expectation for 2017. The report suggests that Multinet can complete its 527 kilometres for the access arrangement period, including 60 kilometres completed in the first half of 2017 and a remaining 100 kilometres in the second half of 2017. Multinet has used its delivery in the first six months

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as the basis for proposing its revised program averaging 119 kilometres per year for 2018-2022. Multinet says that it has revised its field delivery arrangements, increasing resources and enabling it to tender work for multiple years in advance. Zincara notes these changes and agrees that they should help to increase Multinet's delivery capabilities. However, the mains replacement program will continue to get more complex with lower productivity rates as they progress into the inner urban areas (as demonstrated by the increasing unit rates being proposed), meaning that planning and field resourcing will become increasingly complex.

Given Multinet's current mains replacement program progress, particularly during 2017, Zincara estimates that Multinet will complete approximately 500 kilometres for the 2013-2017 period. This estimate suggests Multinet will complete around 135 kilometres during 2017, the highest annual rate for the period.

Multinet's revised planning and delivery processes over the last few years suggest that it can increase its annual mains replacement rate. In contrast, the program will become increasingly complex as they progress into inner urban areas, requiring increased levels of planning, project management and field resources. While acknowledging the High risk rating associated with the mains covered by the mains replacement program, Zincara considers that the 2033 target date may no longer be practically achievable, nor may it still be prudent and cost efficient. Considering the potential options for completion dates Zincara suggests that it may be appropriate to consider 2036 or 2037 as more realistic. These dates show that low pressure mains replacement would need to achieve an average of around 112 kilometres or 102 kilometres per year respectively from 2023 and subject to kilometres replaced during the 2018 – 2022 period. Such dates would also be subject to Multinet's progress over the future periods and ongoing asset condition.

**Medium pressure mains projects.** Multinet has provided additional fracture and leak information specific to each of the 4 medium pressure projects which shows around 2 fractures per year, across the four projects. Zincara concludes that the number of fractures is consistent with Multinet's Distribution Mains Strategy information, which also showed around 2 fractures per year for the last ten years. Based on the information provided, Zincara considers that the Medium pressure asset condition seems to be stable in terms of leaks and fractures. On this basis, Zincara does not propose any change to recommendations made in its earlier report.

**Early first generation HDPE mains.** Multinet's additional information includes leak and fracture data for the two suburbs of Glen Waverley and Vermont since 2005. Following a review of the information Zincara concludes that the condition of the early first generation HDPE mains does not show a level of deterioration (using leak and fracture data) that warrants an increased priority for replacement during the 2018 -2022 period. Zincara also notes that Multinet is scheduling this work for 2021 and 2022, following completion of the medium pressure mains replacement. It could be inferred from this that Multinet does not consider these high risk mains as an immediate priority compared to its ongoing low pressure cast iron / UPS mains replacement program. Zincara therefore, does not propose any change to its recommendations made in its first report which is not to recommend the replacement of these mains in the forecast period.

**Low pressure mains replacement program.** Zincara agrees with ESV's comments (refer this paper section 3.6.1), and considers that the program be based on replacing pipe at a

prudent rate that seeks to deliver reduced risk over time, balanced by cost and ability to manage resources to deliver the program. In particular, Zincara notes:

- Multinet has assessed the low pressure cast iron mains as high risk and this rating implies that these mains must be replaced as soon as practicable.
- Delivery capability during 2013 – 2017 has been subject to a number of changes by Multinet in order to increase their volume of mains replacement and recent performance indicates that Multinet does now have increased capability. Zincara estimates that Multinet will complete around 500 kilometres for the period and around 135 kilometres during 2017.
- Approximately 1,950 kilometres of low pressure mains are still to be replaced from the end of 2017.
- There will be increasing complexity as the low pressure program progresses in to inner urban areas, which will slow productivity and increase unit rates.

On the basis of the high risk rating, large outstanding program and increased delivery capability, Zincara considers that it is reasonable to increase Multinet’s low pressure mains replacement program to 500 kilometres for the 2018 – 2022 period (which is in line with continuation of Multinet’s performance during the current period, based on Zincara’s assessment, while offsetting for increasing complexity). Zincara also considers that it is more realistic to revise Multinet’s target completion date to around 2036 or 2037, on the basis that it is more achievable than the high annual replacement rates (146 kilometres) required to achieve the 2033 target, particularly as the program becomes increasingly complex. The above program is also expected to enable efficient costs to be achieved.

Using a simple pro-rata estimate of cost, Zincara calculates capex as \$166.3 million (excluding overheads and escalation).

The following tables show the forecast capex and kilometres for the 2018 – 2022 AA period proposed by Multinet’s revised mains replacement program information and as compared with the AER’s draft decision and Zincara’s recommendations, based on outcomes of this review.

**Table 1: Mains Replacement Revised Forecast 2018 - 2022 (\$M, nominal)**

	Draft Decision	Multinet	Zincara
Low pressure mains	142.4	176.6	166.3
Medium pressure cast iron	10.4	18.1	10.4
Early first generation HDPE	-	15.9	-
Reactive mains replacement	1.0	1.0	1.0
Reactive service replacements	5.7	5.7	5.7
<b>Total Direct (excluding escalations)</b>	<b>159.5</b>	<b>217.3</b>	<b>183.4</b>
Overheads	8.5	11.7	9.7
Escalation	1.3	1.8	1.5
<b>Total (incl. o’heads and escalations)</b>	<b>169.2</b>	<b>230.8</b>	<b>194.6</b>

(Source: Revised Access Arrangement Information: Table 6.4; Zincara calculation)

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The revised mains replacement volumes compared with the initial proposal and the AER's draft decision are provided in the following table. The table excludes reactive mains replacement and unplanned service renewals as these were accepted in the draft decision.

**Table 2: Mains Replacement Revised Program 2018 - 2022 (kilometres)**

	<b>Draft Decision</b>	<b>Multinet</b>	<b>Zincara</b>
LP mains replacement	425	531	500
MP mains replacement	12	24	12
HDPE (early generation)	-	40	-
<b>Total</b>	<b>437</b>	<b>595</b>	<b>512</b>

(Source: Revised Access Arrangement Information: Table 6.5; Zincara data)



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## **2. INTRODUCTION**

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### **2.1 BACKGROUND**

In July 2017, the Australian Energy Regulator (AER) published its draft decision on Multinet's revision to its Access Arrangement for the period 2018-2022. In August, 2017, Multinet provided a response to the draft decision. The AER has engaged Zincara P/L (Zincara) to advise on the revised mains replacement program in Multinet's submission.

For information on Zincara's recommendations to the AER prior to the draft decision refer to "Report to the AER –Review of Capex Forecast Multinet 25 June 2017".

### **2.2 APPROACH**

In carrying out the review, Zincara has adopted a similar approach that it had used in assessing Multinet's initial information provided in December 2016:

- Analyse the information provided in Multinet's response on its Mains replacement;
- Confirm the conclusions reached by the AER in its draft decision;
- Sought clarifications on Multinet's response; and
- Review the risk analysis provided by Multinet;
- Conclude on the prudence and efficiency of the main replacement program.

### 3. MAINS REPLACEMENT

#### 3.1 INTRODUCTION

In response to the AER's Draft Decision issued in July 2017, Multinet submitted a "revised mains replacement program" that includes:

- revised unit rates based on latest tender costs;
- reduced volume of low pressure mains replacement;
- retained its proposed medium pressure replacement program;
- retained its proposed early first generation HDPE program.

The following table summarises Multinet's initial and revised mains replacement program, compared with the AER draft decision.

**Table 3: Mains Replacement Revised Forecast (\$M, nominal)**

	Original	Draft Decision	Revised	Diff
Low pressure mains	209.0	142.4	176.6	(34.2)
Medium pressure cast iron	18.1	10.4	18.1	(7.8)
Early first generation HDPE	15.9	-	15.9	(15.9)
Reactive mains replacement	1.0	1.0	1.0	-
Reactive service replacements	5.7	5.7	5.7	-
<b>Total Direct (excluding escalations)</b>	<b>249.7</b>	<b>159.5</b>	<b>217.3</b>	<b>(57.9)</b>
Overheads	15.0	8.5	11.7	(3.3)
Escalation	2.2	1.3	1.8	(0.5)
<b>Total (incl. o'heads and escalations)</b>	<b>266.9</b>	<b>169.2</b>	<b>230.8</b>	<b>(61.6)</b>

(Source: Revised Access Arrangement Information: Table 6.4)

The revised mains replacement volumes compared with the initial proposal and the AER's draft decision are provided in the following table. The table excludes reactive mains replacement and unplanned service renewals as these were accepted in the draft decision.

**Table 4: Mains Replacement Revised Program (kilometres)**

	Original	Draft Decision	Revised	2022
LP mains replacement	624	425	531	(106)
MP mains replacement	24	12	24	(12)
HDPE (early generation)	40	-	40	(40)
<b>Total</b>	<b>688</b>	<b>437</b>	<b>595</b>	<b>(158)</b>

(Source: Revised Access Arrangement Information: Table 6.5)

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The above table shows that Multinet propose a revised low pressure mains replacement volume of 531 kilometres (average 106 kilometres per year), which it says<sup>1</sup> *“reflects a reasonable rate of replacement that we will deliver during the 2018-2022 period. It also represents an amount that will set a platform for achieving our Energy Safe Victoria (ESV) endorsed target of removing all low pressure, high risk material from the network by 2033, while maintaining the overall level of network risk associated with these assets to as low as reasonably practical.”*

With respect to the revised unit rates for the low pressure replacement program, Multinet advise that by using the latest tender costs and applying them to the revised volumes and locations the average direct unit rate reduces from \$334.50 per metre to \$332.60 per metre.

Multinet does not propose any change to its initial mains replacement program in relation to medium pressure cast iron and early first generation HDPE, as it considers<sup>2</sup> that *“not replacing specified medium pressure cast iron and early first generation HDPE during the 2018-22 access arrangement period would not reflect the actions of a prudent network operator managing risk to as low as reasonably practicable.”*

Multinet says that its “Revised Mains Replacement Program” document provides the following additional information to demonstrate the prudence and efficiency of the modified program:

- risk assessment that applies the framework specified under AS/NZS 4645
- additional information on its 2017 delivery performance
- Fracture and Leak rates for the medium pressure mains
- Break and leak rates for the early first generation HDPE mains

Multinet’s response considers the impact of the AER’s proposed mains replacement program (refer section 1.1.1), stating that 1242km of high risk mains would remain at the end of 2018-2022 period (comprising 1164 kilometres low pressure CI/UPS mains, 16 kilometres medium pressure CI mains, and 62 kilometres HDPE mains), compared with 1123 kilometres of high risk mains if applying Multinet’s revised program (comprising 1092 kilometres low pressure CI/UPS mains and 31 kilometres HDPE mains). It estimates that there would be an additional 182 leaks of which 60 could potentially be fractures in the low pressure networks. The capex variation is approximately \$61 million.

Multinet also provides a scenario of risk, leaks and fractures if the same mains replacement rate continues to 2033, along with no replacement of medium pressure and HDPE. However, Zincara considers this to be speculative, as future access arrangement reviews, will be subject to the AER’s assessment of proposals submitted at those times.

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<sup>1</sup> Attachment 2 – Revised Mains Replacement Program: section 1.1

<sup>2</sup> Attachment 2 – Revised Mains Replacement Program: section 1.1

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### 3.2 RISK MANAGEMENT

Multinet has provided a section “risk assessment of Multinet’s revised proposal” (section 1.2) outlining an assessment of the risk associated with different categories of mains. The overall risk rating<sup>3</sup> shows medium pressure cast iron and early first generation HDPE have a “High” risk rating, higher than low pressure unprotected steel and low pressure cast iron which also have “High” risk ratings.

Multinet emphasises that its “High” risk assessment for the low pressure cast iron mains implies that these mains must be replaced as soon as practicable. Further its medium pressure cast iron mains and early first generation HDPE mains are assessed as a higher risk than the low pressure cast iron mains and hence should be replaced as a priority. Multinet notes<sup>4</sup> that *“replacing these mains is the only way to minimise the risks from high to low”*. It also note that the medium pressure mains are *“all critical supply mains in inner urban areas.”*

Zincara notes these risk ratings and also the fact that on the basis of the risk assessment methodology, they have had such a rating for a very long period of time. There are many mitigation actions that Multinet have in place that have managed the residual risks to as low as reasonably practicable during this time. Their ongoing condition and performance, resource capability to maintain or replace the mains and cost all play a key role in determining the prudent and efficient rate of mains replacement. This is recognised by the fact that the mains replacement program, because of its sheer size, is being managed over an extended period of time.

In its risk mitigation (section 1.2.5), Multinet says that *“the AER accepted Zincara’s view that the medium pressure cast iron replacement program is based on the technical life of these assets, and if this is the case, a watching brief would be sufficient to manage the risk associated with these mains.”* In fact, Zincara was making the point that End of Technical Life (EOTL) is only an indicator and *“not a criterion for replacing mains”* and further *“the mains replacement program should therefore be based on the condition of the mains and not the age of the mains”*.

Multinet concludes its risk mitigation section by emphasising that monitoring and maintenance do not reduce the risk. *“The only effective method for reducing the high risk .....is to replace the mains with latest generation PE”*.

### 3.3 DELIVERY CAPACITY

Multinet states that by the end of 2017 there will be 1,953 kilometres of low pressure mains still to be replaced (refer section 1.3). Multinet has identified a further 90 kilometres of main (28 kilometres of Medium pressure cast iron and 62 kilometres of early first generation HDPE), which it assess as higher risk than the low pressure cast iron and propose that these mains be replaced in parallel with the low pressure mains replacement program so that synergies between the programs can be achieved.

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<sup>3</sup> Attachment 2 – Revised Mains Replacement Program: Figure 1-4

<sup>4</sup> Attachment 2 – Revised Mains Replacement Program: section 1.2.4, page 12

During the 2013-2017 period Multinet have replaced a total of 365 kilometres during the first four years (average of 91 kilometres per year). It has completed a further 62.4 kilometres for the six months ending June 2017 (average of 10 kilometres per month). In response to a question from the AER, Multinet advised that it has completed 85 kilometres from 1 January to 31 August 2017 (i.e. 23 kilometres during July-August, an average of 11.5 kilometres per month) and propose to complete a further 87 kilometres between 1 September and 31 December (an average of 22 kilometres per month).

Multinet has provided a report by Advisian, who it engaged to independently review the replacement completion program. The report confirms the volume of mains replacement completed up to June 2017, and advises that *“the management processes and strategies adopted by Multinet Gas should enable additional 100kms of mains to be delivered between 1 July 2017 and 31 December 2017, thereby achieving the Multinet target of 527kms”*.

Multinet had earlier indicated that it would complete 100 kilometres during 1 July to 31 December 2017. With 23 kilometres completed in the first two months of this period and assuming the monthly completion rate is still increasing then Zincara estimates that a further 50 kilometres may be more likely, giving a total 2013 – 2017 period completion of approximately 500 kilometres (compared with 527 kilometres approved by the AER).

Multinet explains that its inconsistency in delivery times across the 2013-2017 period was the result of “commercial” changes, rather than insufficient capacity to deliver or increased complexity. These changes included the transition from one to a two service provider arrangement in 2013, and then in 2015 Multinet introduced a two party tender process to replace the direct issue of projects. The two party tender process also included arrangements to enable Multinet to tender work out for multiple years, giving greater clarity to the service providers so it could resource appropriately. This has been time consuming and impacted the volume of mains replaced during that period. In May 2017, Multinet introduced a competitive works panel to further increase capacity, effectively introducing new players.

In proposing a revised volume of low pressure mains replacement for the 2018-2022 access arrangement period, Multinet state<sup>5</sup> that they *“have used the 2017 half-year replacement rate as the basis for ongoing replacement during 2018-2022 access arrangement period. Our revised proposal is consistent with delivering 119 kilometres of mains on average per year, consistent with our demonstrated delivery capacity”*. The following table shows the proposed annual volumes forecast.

**Table 5: Mains replacement revised annual forecast volumes (kilometres)**

	2018	2019	2020	2021	2022	Total
LP mains replacement	111.7	112.4	111.1	99.0	96.8	531.0
MP mains replacement	10.2	5.5	8.1	-	-	23.8
HDPE (early first generation)	-	-	-	20.4	11.0	31.4
Other	-	-	-	1.9	6.6	8.5
Total	121.8	117.9	119.2	121.2	114.5	595.0

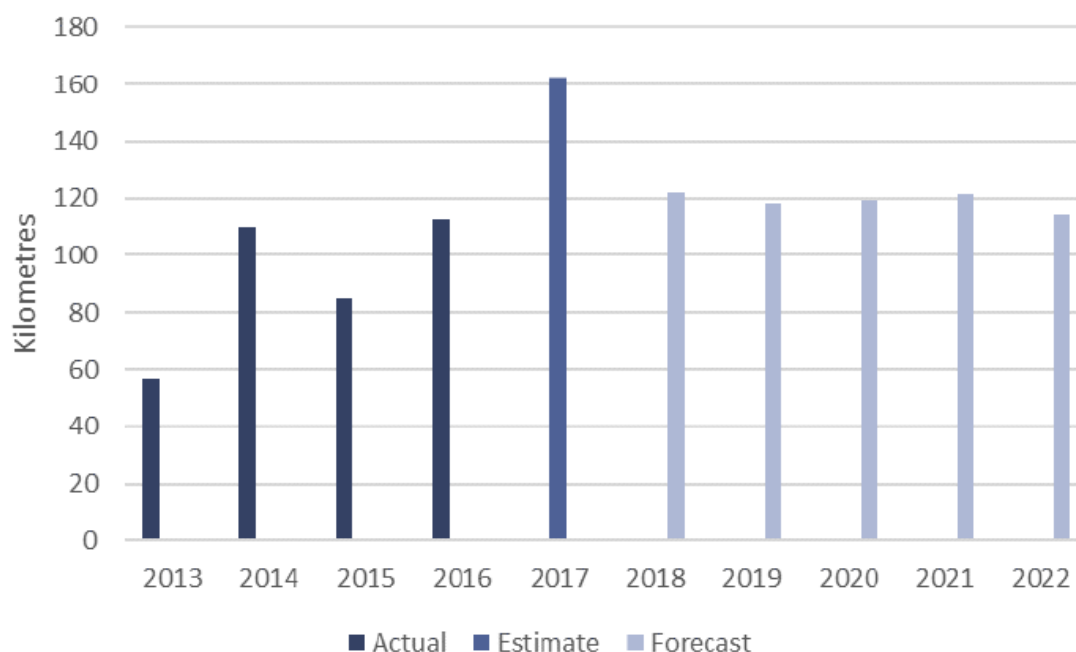
(Source: Attachment 2 - Revised Mains Replacement Program: Table 1.12)

<sup>5</sup> Attachment 2 – Revised Mains Replacement Program: section 1.3, page 15

In the above table, “Other” refers to sections of other PE that would be replaced as part of the early first generation HDPE block replacement. Multinet says that “The block replacement method is standard industry practice and is a lower cost solution than piecemeal or reactive replacement”. It is also noted that in addition to the 24 kilometres of medium pressure cast iron mains proposed to be replaced, a further 4 kilometres will be abandoned.

Multinet says that “The volumes of mains forecast to be replaced in our revised proposal are in line with our current delivery capacity”, with the view to increasing capacity in the future to enable Multinet to achieve the 2033 target completion date.

**Figure 1: Annual volumes of mains replaced and forecast 2013 - 2022**



(Source: Attachment 2 - Revised Mains Replacement Program: Figure 1-5)

With respect to future access arrangement periods, Multinet say<sup>6</sup> that it “will need to increase replacement rates from 119 kilometres per year to 146 kilometres per year for the remaining ten years of the program from 2023 to 2033”. It anticipates that some of the capacity will become available as the other gas distribution networks complete their respective mains replacement programs.

Zincara acknowledges the steps taken by Multinet and agrees that they should enable increased delivery capability. However, the mains replacement program will continue to get more challenging as it progresses into the inner urban areas (as reflected by the increasing unit rates), meaning that planning and field resourcing will become increasingly complex and labour intensive. Based on a review of delivery performance to date, Multinet have not yet demonstrated that it will be able to sustain and increase the mains replacement program to achieve its 2033 target date, particularly allowing for the increasing complexities as the program progresses.

<sup>6</sup> Attachment 2 – Revised Mains Replacement Program: section 1.3.4, page 18

While Zincara agrees that these high risk mains “need to be replaced as soon as practicable”, given the above delivery challenges, we question whether the target date of 2033 is still prudent and cost efficient. Notwithstanding the AER’s final decision with respect to Multinet’s mains replacement program for 2018 – 2022, and considering Multinet’s estimate of 146 kilometres per year for 10 years, then the following table shows potential completion dates.

**Table 6: Mains replacement program completion estimates**

Program Duration from end 2022	Annual rate (kms)	Completion Year
10 years	146	2033
11 years	133	2034
12 years	122	2035
13 years	112	2036
14 years	104	2037

(Assuming 1460 kilometres to be completed from end 2022; Zincara analysis)

In its response to questions from the AER, Multinet provided information relating to its planning and tendering process preparations for the 2018 – 2022 period:

- Low pressure mains replacement. 95 kilometres of low pressure mains replacement is currently “out to market” for competitive tender to facilitate awarding projects prior to 1 January 2018. A further 16 kilometres is nearing completion of detailed design with construction scheduled for 3<sup>rd</sup> quarter of 2018.
- Medium pressure mains replacement. The Clayton South project is out to market for competitive tender ready for construction to commence in early 2018. Note the AER did not approve this project in its draft decision. Graham St Port Melbourne project is currently in detailed design. The Aughtie Drive, St Kilda project is currently in detailed design. The Like for Like projects remain at the conceptual planning phase.
- HDPE projects have completed conceptual design.

### 3.3.1 Conclusion

Given Multinet’s current mains replacement program progress, particularly during 2017, Zincara estimates that Multinet will complete approximately 500 kilometres for the 2013-2017 period. This estimate suggests Multinet will complete around 135 kilometres during 2017, the highest annual rate for the period.

Multinet’s revised planning and delivery processes over the last few years suggest that it can increase its annual mains replacement rate. In contrast, the program will become increasingly complex as it progresses into inner urban areas, requiring increased levels of planning, project management and field resources. While acknowledging the High risk rating associated with the mains covered by the mains replacement program, Zincara considers that the 2033 target date may no longer be practically achievable, nor may it still be prudent and cost efficient. Considering the potential options for completion dates shown in table 4 above, it may be appropriate to consider 2036 or 2037 as more realistic. Such

dates would be subject to Multinet’s progress over the future periods and also subject to asset condition.

### 3.4 MEDIUM PRESSURE CAST IRON

In its revised mains replacement program, Multinet reaffirms that the high risk rating relating to its medium pressure mains require that all four of its medium pressure cast iron replacement projects be completed as a priority, and is supported by ESV.

**Table 7: Medium Pressure cast iron replacement capex (\$M, real 2017)**

	2018	2019	2020	2021	2022	Total
Clayton South (MP CI Block Renewal)	1.49	-	-	-	-	1.49
Like for Like Replacement	-	-	6.27	-	-	6.27
Graham St, Port Melbourne**	5.76	-	-	-	-	5.76
Aughtie Drive, Albert Park**	-	4.61	-	-	-	4.61
<b>Total direct expenditure</b>	<b>7.24</b>	<b>4.61</b>	<b>6.27</b>	<b>-</b>	<b>-</b>	<b>18.13</b>
Overheads & Escalation	0.43	0.27	0.39	-	-	1.10
<b>Total Expenditure</b>	<b>7.68</b>	<b>4.88</b>	<b>6.66</b>	<b>-</b>	<b>-</b>	<b>19.22</b>

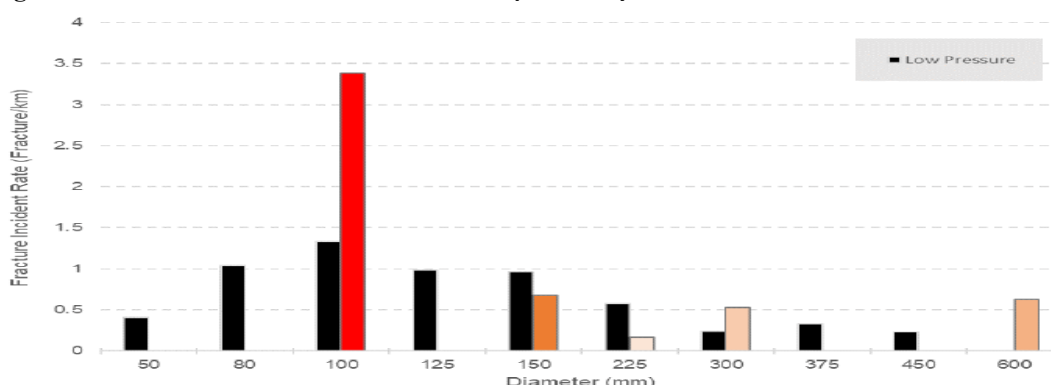
(Source: Attachment 2 - Revised Mains Replacement Program: Table 1.14)

\*\* Projects approved by the AER in its Draft Decision

#### 3.4.1 Failure Analysis

Multinet’s risk assessment, as discussed above, assesses the medium pressure mains as High risk, and higher than the risks associated with the low pressure cast iron mains. Multinet has provided further information showing fracture and leak rates for each project. The following figures show cast iron fracture rates for various diameters and the composition of diameters included in each of the four medium pressure projects.

**Figure 2: Cast Iron Fracture Incident Rate Comparison by Pressure**



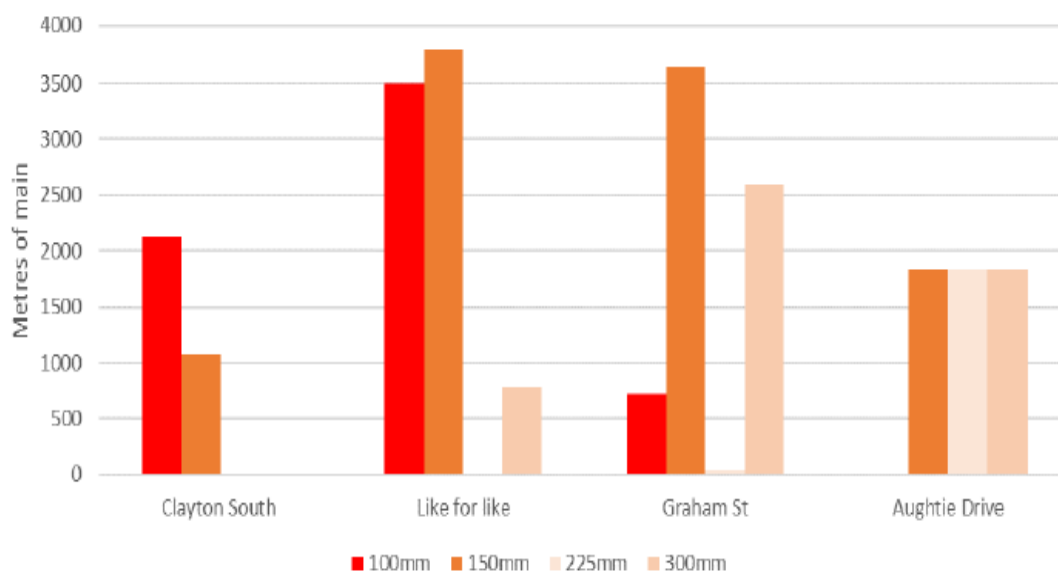
(Source: Attachment 2 - Revised Mains Replacement Program: Figure 1-7)

In response to questions from the AER, Multinet clarified that the time horizon for the information provided in the above figure is over a 15 year period (2001 to 2015). This means that for medium pressure 100mm cast iron there were 3.4 fractures per kilometre over 15



years and not per year as is the usual definition of these incident rates. Multinet says that the figure highlights the fracture rate of 100mm cast iron operating at medium pressure relative to other diameters and pressure tiers.

**Figure 3: Composition of medium pressure cast iron mains by project**



(Source: Attachment 2 - Revised Mains Replacement Program: Figure 1-8)

In response to questions from the AER, Multinet provided the following table which shows the history of leaks and fractures from 2005 for each of the four medium pressure projects.

**Table 8: Medium Pressure projects – Leak and Fracture History**

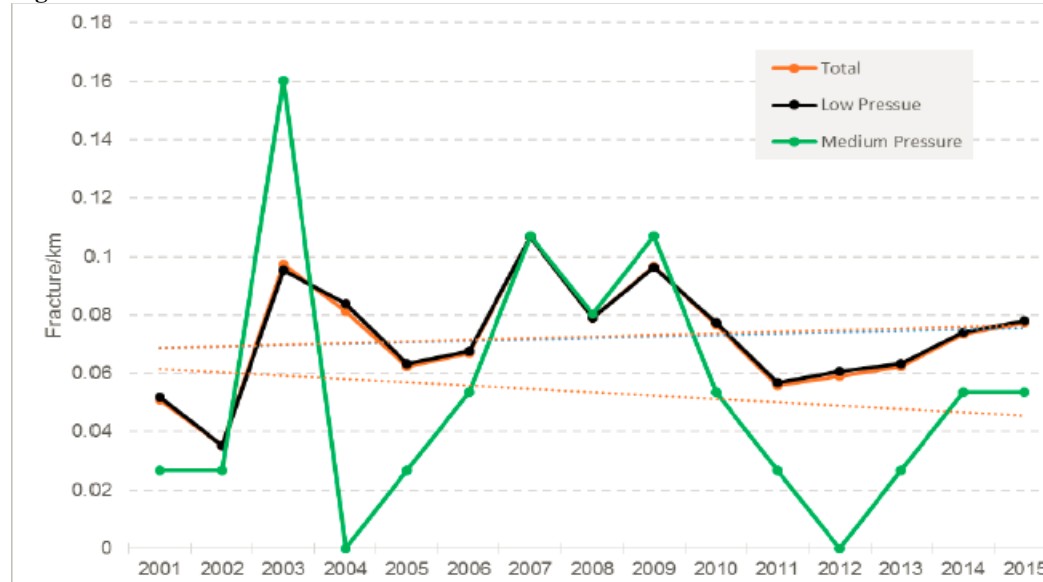
Project	Failure Type	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Like for Like	Leaks	-	1	2	1	3	6	4	3	1	-	-	-
	Fractures	1	2	4	3	1	1	1	-	1	-	-	-
Aughtie Dr	Leaks	-	1	-	1	-	1	2	-	1	-	1	-
	Fractures	-	-	-	-	-	-	-	-	-	-	1	-
Clayton South	Leaks	-	1	-	-	1	-	-	1	-	-	-	-
	Fractures	-	-	-	1	2	1	-	-	-	1	-	1
Graham St	Leaks	1	2	1	2	1	7	1	11	2	2	-	-
	Fractures	-	-	-	-	-	-	-	-	-	1	-	-

(Source: AER Multinet Gas Information Request #31 – Capex – mains replacement, table 3, page 5)

The table shows that the medium pressure cast iron mains are experiencing an average of around 2 fractures per year and around 5 leaks per year. Multinet’s Distribution Mains Strategy Figure 2.8, reproduced below, shows the medium pressure fracture rates from 2001 to 2015. The figure and underlying data show that the number of fracture incidents have been one to two incidents per year for the last ten years, apart from the years 2007 to 2009 when there are 3–4 fractures per year. In its review Zincara (section 5.3.3.1) “acknowledges the greater consequence of a MP fracture incident, but the number of incidents has been very low and these have been managed by operations and maintenance”.

The information indicates that there does not appear to be deterioration in asset condition with respect to leaks and fractures. Zincara does acknowledge Multinet’s comments<sup>7</sup> that “a reduction in fractures over time is not indicative of a reduction in risk. Fractures are often caused by ground movement which in turn is driven by changes in ground moisture.”

**Figure 4: Distribution Mains Cast Iron Fracture Incidents**



(Source: Distribution Mains Strategy: Figure 2-8)

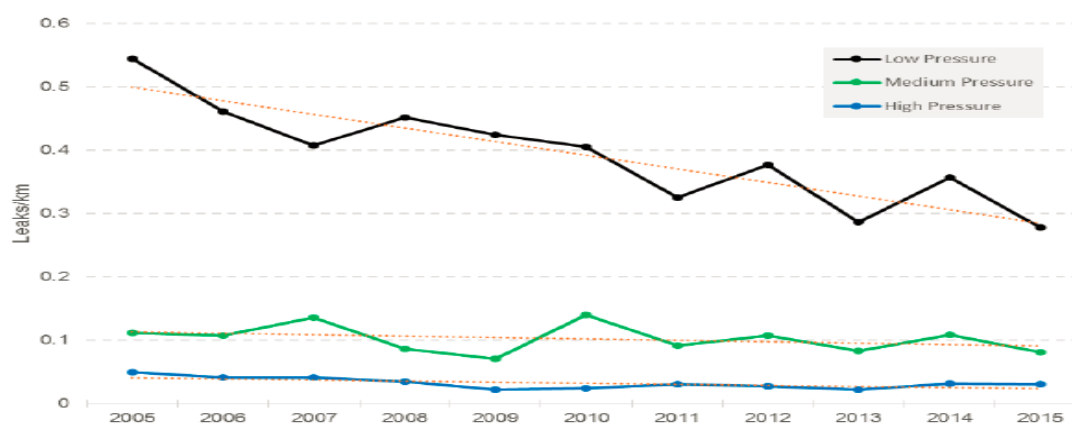
The medium pressure networks have a higher proportion of larger diameter mains greater than 150mm diameter (55% in MP v 14% in LP). Multinet says<sup>8</sup> that “while these larger diameter medium pressure cast iron mains have a lower probability of failure from fracture, in the case of Multinet they are all deemed critical supply mains and are all located within the inner urban areas of metropolitan Melbourne. This combination of higher operating pressures, critical supply and high density geographic location places these assets as “high risk” from a consequence perspective in comparison to that of the overall low pressure cast iron network.”

The following figure, reproduced from Multinet’s Distribution Mains Strategy, shows leak incidents for the various network pressures. In its earlier review Zincara made the following comments with respect to medium pressure leaks “The MP leak incident rate (LIR) has been relatively steady since 2005 and at 2015, the LIR for MP was 0.08 (down from 0.11 in 2005). The LIR for MP networks is significantly lower than for LP”. Leak history data in table 8 above shows that apart from 2010 (14 leaks) and 2012 (15 leaks), the number of leaks over the last 12 years have been relatively low. As with fractures, leaks also vary dependent on ground movement, changes in ground moisture and leak survey (if applicable).

<sup>7</sup> AER Multinet Gas Information Request #31 – Capex – mains replacement, page 5

<sup>8</sup> Distribution mains strategy 4.3.2

**Figure 5: Distribution Mains Leak Incident Rate by Pressure**



(Source: Distribution Mains Strategy: Figure 2-5)

The four medium pressure projects are further reviewed below, incorporating information provided during the initial review and further information now provided by Multinet.

### 3.4.2 Clayton South

The Distribution Mains Strategy (section 5.5.1) shows that this project consists of the replacement of 4.1 kilometres of medium pressure, which has 3.2 kilometres of cast iron (comprising 2,123 metres of 100mm diameter and 1,078 metres of 150mm diameter). This project also includes the decommissioning of the associated field regulator. Unit rate is \$364/m giving capex of \$1.491 million.

In the initial submission there was no specific information relating to fracture and leak incidents. The revised mains replacement program and additional data in response to questions, shows that there have been 6 fractures and 3 leaks over the last 12 years, as shown in table 8 above. While the additional information helps to quantify the asset condition for these areas, the number of fractures and leaks don't appear to demonstrate a deteriorating asset condition warranting priority replacement during 2018 – 2022 period.

### 3.4.3 Graham St, Port Melbourne

The Distribution Mains Strategy (section 5.5.3) shows that this project consists of 7 kilometres of cast iron in the Port Melbourne and Albert Park area, with 3 kilometres to be replaced as HP grid main to support the LP to HP replacement projects in Port Melbourne.

**Table 9: Graham St, Port Melbourne – Length Decommissioned Cast Iron**

Diameter (mm)	Length (m)
100	716
150	3,648
225	42
300	2,597
<b>Total length (m)</b>	<b>7,003</b>

(Source: Distribution Mains Strategy: Table 5-14)

In order to upgrade the area to high pressure a new field regulator is required. In addition, 17,789m of medium pressure mains will be upgraded to HP along with 1,552 supply points. Total capex is \$5.755 million. Multinet’s additional information, as shown in table 8 above, shows that there has been 1 fracture and 30 leaks over the last 12 years.

Zincara previously noted that Multinet advised that this project is required to provide high pressure to the supply grid for the LP to HP mains replacement in Port Melbourne, which is scheduled for 2018-22. The AER has approved this project in its draft decision.

#### 3.4.4 Aughtie Drive, St Kilda

The Distribution Mains Strategy (section 5.5.4) shows that this project consists of 5.5 kilometres of large diameter cast iron, with 4 kilometres to be replaced as grid main to support LP mains replacements in Elwood and St Kilda. The project also includes modifications to four existing district regulators (ref: Distribution Strategy: Appendix 5.5.4). Capex is \$4.606 million.

**Table 10: Aughtie Drive, St Kilda – Length Decommissioned Cast Iron**

Diameter (mm)	Length (m)
150	477
225	26
450	3,647
600	1,321
<b>Total length (m)</b>	<b>5,471</b>

(Source: Distribution Mains Strategy: Table 5-17)

In the initial submission there was no specific information relating to fracture and leak incidents. Multinet’s additional information, as shown in table 8 above, shows that there has been 1 fracture and 7 leaks over the last 12 years.

Zincara previously noted that Multinet advised that this project will provide high pressure supply grid for the LP to HP mains replacement in Elwood and St Kilda which is scheduled for 2018-22. The AER has approved this project in its draft decision.

#### 3.4.5 Like for Like (various).

The Distribution Mains Strategy (section 5.5.2) shows that this project consists of 8.1 kilometres of MP, size for size replacement, of dispersed lengths of cast iron mains, totalling 30 minor projects. Capex is \$6.275 million.

**Table 11: Like for Like – Length Decommissioned Cast Iron**

<b>Diameter (mm)</b>	<b>Length (m)</b>
Less 100	1,018
100	2,480
150	3,807
300	777
<b>Total length (m)</b>	<b>8,082</b>

(Source: Distribution Mains Strategy: Table 5-12)

Multinet’s Mains Distribution Strategy, Table 5-13, lists the projects along with details such as diameter of cast iron to be replaced any PE or steel that would be included within the projects, resulting in a total of 8 kilometres.

In the initial submission there was no specific information relating to fracture and leak incidents. Multinet’s additional information, as shown in table 8 above, shows that there have been 14 fractures and 21 leaks over the last 12 years. The additional information has not enabled assessment of the 30 individual projects, however, Zincara believes that Multinet will continue to review these projects and take appropriate action if asset condition deteriorates in specific mains.

While the additional information provided by Multinet helps to quantify the asset condition for this region, the recent fracture and leak history over the last few years does not appear to demonstrate a priority replacement during 2018 – 2022 period.

### **3.4.6 Conclusion**

In its revised mains replacement program submission Multinet has provided additional information relating to fractures and leaks for the four specific medium pressure projects. Since 2005 there has been an average of around 2 fractures per year and 5 leaks per year across the medium pressure mains projects.

On the basis of the information provided by Multinet for its specific projects, previous information provided during the initial review, and recent response to questions from the AER, Zincara concludes that the medium pressure mains do not show any increased level of deterioration in asset condition (leaks and fractures) that warrants priority for replacement during the 2018 -2022 period.

Multinet’s risk assessment shows the medium pressure mains as having a High risk, and higher than that for low pressure given the consequences of a fracture with the higher pressure mains. Multinet also notes<sup>9</sup> that its medium pressure cast iron mains “... are all deemed critical supply mains and are all located within the inner urban areas of metropolitan Melbourne. This combination of higher operating pressures, critical supply and high density geographic location places these assets as “high risk” from a consequence perspective in comparison to that of the overall low pressure cast iron network.”

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<sup>9</sup> Distribution mains strategy 4.3.2

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Energy Safe Victoria (ESV) notes<sup>10</sup> that “Cast iron medium pressure mains are generally larger diameter and operate at significantly higher pressures than low-pressure cast iron. The failure modes are similar but a medium-pressure failure will result in a higher volume of gas escaping with a higher risk due to the larger size of the pipe and the higher pressure. In addition the larger diameter cast iron medium-pressure mains at higher pressures are much more difficult to stop off potentially resulting in large gas escapes that can continue for many hours whilst tapping and bagging operations are carried out potentially increasing risk”.

In support of Multinet’s LP to HP mains replacement program the AER’s draft decision approved the following specific medium pressure mains replacement projects:

- Graham St, Port Melbourne, 3207. Capex is \$5.755 million.
- Aughtie Drive, St Kilda, 3182. Capex is \$4.606 million.

With respect to the remaining two specific medium pressure mains projects:

- Clayton South. 3.2 kilometres and Capex is \$1.49 million
- Like for Like. 8.1 kilometres and Capex is \$6.27 million

Zincara agrees with Multinet’s comment that risks aren’t reduced if the number of fractures reduce. This is because the “consequence” remains the same. However, this risk rating has been evident for many years. While a change in ground conditions can result in an increase in fractures / leaks, recent data doesn’t suggest deterioration in asset condition in recent years. As a result of analysis of the recent additional information, Zincara remains of the view that the asset condition has not shown signs of further deterioration (through leaks and fractures) and does not believe that it is necessary to change the AER’s draft decision.

### **3.5 EARLY GENERATION HDPE REPLACEMENT**

Multinet’s revised mains replacement program reaffirms that the high risk rating relating to its early first generation HDPE require that these mains be replaced as a priority and proposes 31 kilometres be replaced during 2018 – 2022, of a total 62 kilometres.

Multinet says<sup>11</sup> that “The block replacement program will target these mains located in areas of high concentration of failures within each postcode (Glen Waverley and Vermont) and will include 9 kilometres of other mains as a result of the block replacement approach. This results in a total of 40 kilometres on main to be replaced”.

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<sup>10</sup> Email from ESV to AER dated 3 May 2017

<sup>11</sup> Attachment 2 – Revised Mains Replacement Program: section 1.4.2, page 25

**Table 12: Early first generation HDPE mains replacement capex (\$M, real 2017)**

	2018	2019	2020	2021	2022	Total
Glen Waverley	-	-	-	8.65		8.65
Vermont	-	-	-		7.22	7.22
<b>Total direct expenditure</b>	-	-	-	<b>8.65</b>	<b>7.82</b>	<b>15.87</b>
Overheads & Escalation	-	-	-	0.56	0.48	1.04
<b>Total Expenditure</b>	-	-	-	<b>9.21</b>	<b>7.70</b>	<b>16.92</b>

(Source: Attachment 2 - Revised Mains Replacement Program: Table 1.16)

The above Table shows that these mains would be replaced during 2021 and 2022, following completion of the medium pressure mains replacement projects and the further 31 kilometres will be replaced in the subsequent period.

### 3.5.1 Failure Analysis

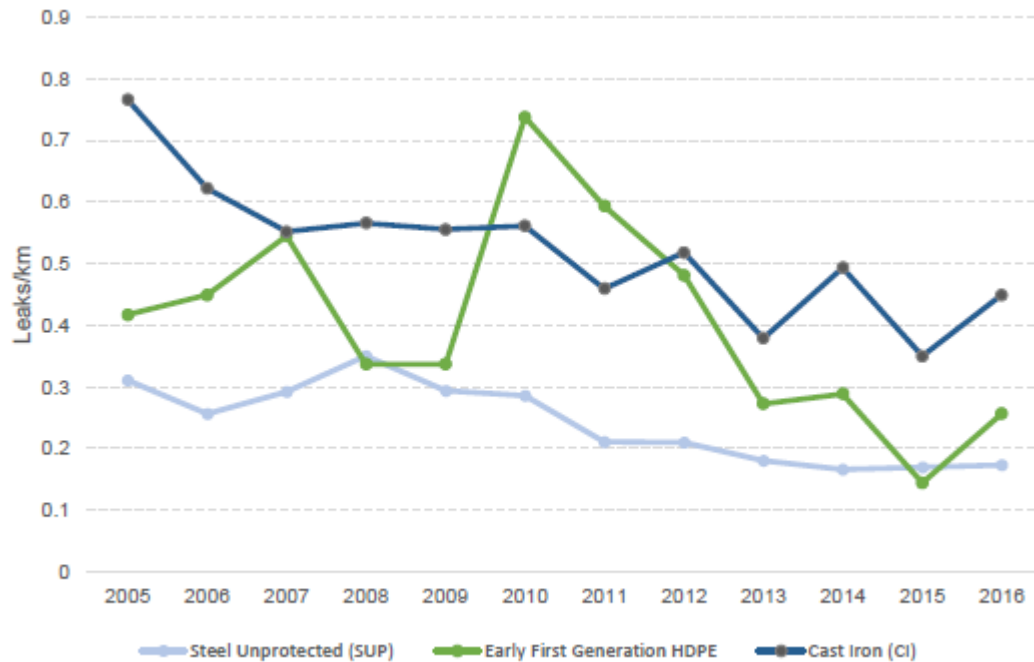
Early (first) generation PE mains<sup>12</sup> were installed between 1970 and 1980, with properties which offer limited resistance against severe environmental and operating conditions. They are classified as class 250 (P2) and class 575 (P7) for operation at medium and high pressure respectively.

The general mode of field failure for polyethylene is brittle, slow crack growth through the pipe wall. These cracks can initiate at microscopic stress-raising flaws, inherent in the basic pipe product, or more likely from defects. Failure can also occur prematurely with mains damaged in squeeze-off operations where very high localised plastic deformations occurred from over-squeezing. These squeeze-off failures are referred to as polyethylene fractures or breaks. Multinet has provided further information showing break and leak rates.

The following figure compares the leak incident rates for early first generation HDPE between 2005 and 2016 compared with leak incident rates of cast iron and unprotected steel mains. Multinet notes that leaks during 2016 increased compared to 2015, although they are similar to 2013 and 2014. Apart from a spike during 2010 – 2012 there has been a general downward trend.

<sup>12</sup> Distribution Strategy: section 4.4

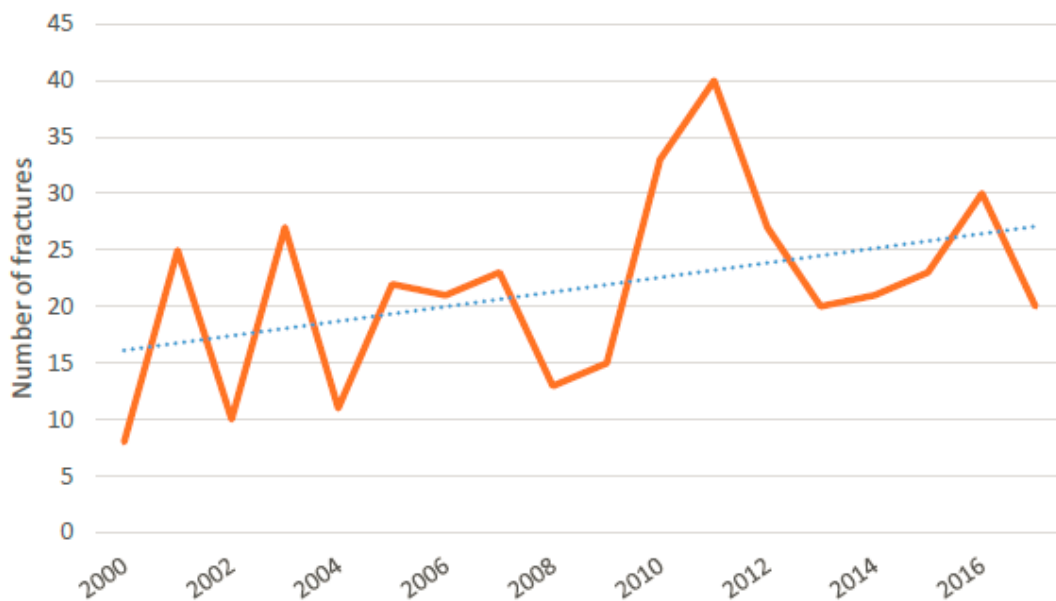
**Figure 6: Leak Incident Rates**



(Source: Attachment 2 - Revised Mains Replacement Program: Figure 1-10)

Multinet says that it has been monitoring “squeeze off” failures as a sub-set of broken mains since 2007. The following figure outlines the volume of brittle fractures (broken mains and squeeze-off) of all class 575 polyethylene mains (ie. first generation polyethylene) on the network. Again the figure shows a spike during 2010 – 2012.

**Figure 7: Distribution Mains Polyethylene Fracture Volumes**

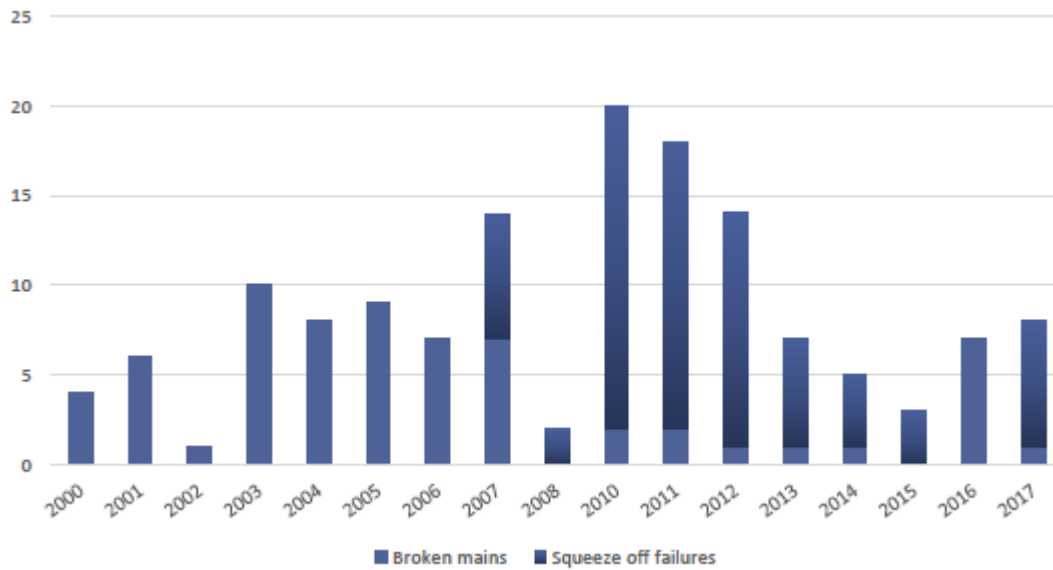


(Source: MG Response to AER information requests – Figure 2-10, page 6)

The following figure further refines the data set used above to only consider early generation polyethylene mains commissioned prior to 1976, and hence the subject of the current replacement program proposed for 2018-2022.



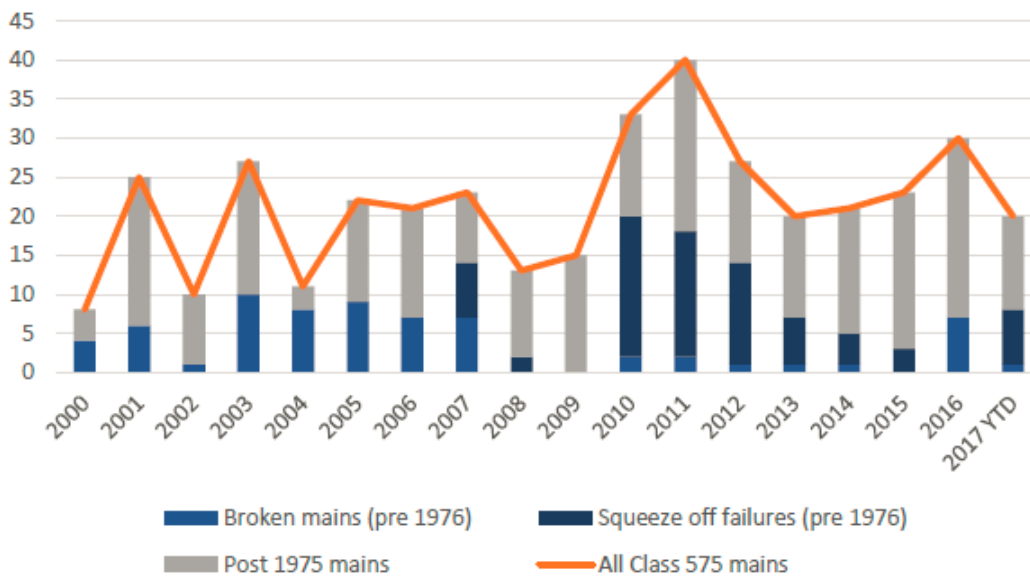
**Figure 8: Polyethylene broken mains**



(Source: Attachment 2 - Revised Mains Replacement Program: Figure 1-11)

The relationship between the above two figures is further clarified in the following figure.

**Figure 9: Relationship between pre- and post- 1976 HDPE mains**



(Source: MG Response to AER information requests – Figure 1, page 7)

These figures show that the broken / squeeze-off failures for class 575 (first generation) HDPE have been generally in a band of 20 – 25 per year, with a spike during 2010 – 2012. The pre-1976 mains reflect a similar trend albeit with lower volumes of failures.

Multinet has provided a spatial dataset to identify the location of the early generation PE mains and fault history (leak and break rates), refer Distribution Strategy figure 4.9 and figure 4-10 and also in its revised mains replacement program document (figure 1-12). Pre-

1976 mains account for around 60km of the total PE network, with 48km (80%) being concentrated within Glen Waverley and Vermont.

Multinet’s proposed prioritisation is based on:

- Breakage incident rates, and
- Leak incident rates

In its response to questions from the AER, Multinet have provided leak and fracture history specific to the locations proposed for replacement. This data is reproduced below.

**Table 13: Leak & Fracture History – HDPE replacement - Glen Waverly**

	Mains Type	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Fractures	Early HDPE	3	2	6	3	7	5	3	4	1	2	1	-
	Other PE	3	2	5	1	-	3	5	-	-	2	-	2
Leaks	Early HDPE	3	6	-	8	1	5	2	2	2	1	2	-
	Other PE	-	-	-	-	-	-	-	-	-	-	-	-

(Source: MG Response to AER information requests – Table 4, page 8)

**Table 14: Leak & Fracture History – HDPE replacement - Vermont**

	Mains Type	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Fractures	Early HDPE	2	-	1	-	-	2	4	2	2	1	1	1
	Other PE	-	1	-	-	-	1	2	-	-	1	-	-
Leaks	Early HDPE	-	1	1	1	-	-	2	1	1	1	-	-
	Other PE	1	1	4	-	1	1	3	-	-	-	-	-

(Source: MG Response to AER information requests – Table 5, page 8)

As part of its response, Multinet emphasises that *“a reduction in fractures over time is not indicative of a reduction in risk for those same reasons as described”* (for cast iron). However, the data does show that asset condition does not appear to have further deteriorated over recent years, which Zincara acknowledges may also be related to ground conditions.

Multinet has scheduled<sup>13</sup> the HDPE replacement for 2021 and 2022 *“to coincide with completion of the medium pressure cast iron replacement program. The remaining 31 kilometres early generation HDPE mains will be replaced in the subsequent regulatory period.”*

Multinet’s risk assessment, as discussed above, assesses the early first generation HDPE mains as High risk, and higher than the risks associated with the low pressure cast iron mains and as such requires higher priority for replacement.

<sup>13</sup> Attachment 2 – Revised Mains Replacement Program: section 1.4.2, page 24

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### 3.5.2 Conclusion

In its revised mains replacement program submission Multinet has provided additional information relating to fractures (break and squeeze off) and leaks for its early first generation HDPE mains.

Multinet's risk assessment shows the early first generation HDPE mains as having a High risk, and higher than that for low pressure given the consequences of a fracture with the higher pressure mains.

Energy Safe Victoria (ESV) notes<sup>14</sup> that *"The high density PE replacement is driven by squeeze off failures. The early generation high-density PE has low crack growth resistance. Locations on the pipe that have been damaged by squeeze off are believed to be prone to time-dependent failure. Unfortunately the location of squeeze off sites is not known and as such organisations can only react to failures as they occur"*.

Using the information provided by Multinet for its specific suburb projects, Zincara concludes that the condition of the early first generation HDPE mains does not show a level of deterioration that warrants increased priority for replacement during the 2018 -2022 period. Zincara also notes that Multinet is scheduling this work for 2021 and 2022, following completion of the medium pressure mains replacement. This does not appear to suggest that Multinet considers these high risk mains as an immediate priority compared to its ongoing low pressure cast iron / UPS mains replacement program. On this basis Zincara does not propose any change to recommendations made in its earlier report.

### 3.6 LOW PRESSURE MAINS

The AER draft decision approved continuation of the historical average (85 kilometres per year) during the 2018-2022 period. In Zincara's report to the AER we stated<sup>15</sup> *"In summary, Zincara agrees that mains replacement of cast iron and unprotected steel is essentially for safety and reliability issues. Zincara also agrees with Multinet's approach to target the high fracture areas and believes that Multinet will do this regardless of the length of mains replaced. From the failure analysis and given the current FIR and LIR trends, Zincara considers that if Multinet were to continue its historical mains replacement rate for the 2018 – 2022 period, there is no reason why it could not effectively manage at least the same level of fractures and as such maintain the same level of risk as experienced of the 2013-2017 period"*. In its response to the draft decision Multinet says<sup>16</sup> *"we do not agree that replacing only 85 kilometres of low pressure mains per year is sufficient to efficiently and effectively address the high risk of these mains"*.

In particular, Multinet's response<sup>17</sup> has emphasised that *"Multinet is obliged to reduce the risk to low or ALARP. Maintaining the current level of risk and extending the program beyond 2033 is inconsistent with prudent and efficient management of the risk and would be non-compliant with our obligations"*.

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<sup>14</sup> Email from ESV to AER dated 3 May 2017

<sup>15</sup> Zincara – AER Access Arrangement 2107 – Multinet: section 5.3.2.1, page 40)

<sup>16</sup> Attachment 2 – Revised Mains Replacement Program: section 1.2, page 5

<sup>17</sup> Attachment 2 – Revised Mains Replacement Program: section 1.4.3, page 26

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Multinet’s revised mains replacement program proposes to replace 531 kilometres during 2018 – 2022, compared with 425 kilometres approved by the AER in its draft decision and the 624 kilometres initially submitted. The revised program relates to delivery capability where Multinet have used the 2017 half year replacement rate as the basis for ongoing replacement during 2018 – 2022 access arrangement period<sup>18</sup>, *“Our revised proposal is consistent with delivering 119 kilometres of mains on average per year, consistent with our demonstrated delivery capacity. We consider this is a reasonable and conservative starting point for the forward-looking mains replacement program”*.

A key driver for the volume of low pressure mains replacement program is to achieve its *“Energy Safe Victoria (ESV) endorsed target of removing all low pressure, high risk material from the network by 2033, while maintaining the overall level of network risk associated with these assets to as low as reasonably practicable”*<sup>19</sup>.

In support of the revised program Multinet has provided further information relating to its risk assessment and its delivery capacity, which Zincara has reviewed in above sections 1.2 and 1.3 respectively.

Multinet has not provided any additional information relating to condition / failure analysis.

Multinet notes that the revised volumes forecast has resulted in some minor adjustments to the proposed profiling of mains replacement per postcode, including deferment of some postcodes based on lower fracture and leak incident rates relative to prioritised postcodes.

### **3.6.1 Conclusion**

Multinet’s revised mains replacement program emphasises its target completion for the low pressure mains replacement remains as 2033. The ESV email noted above makes the comments *“Multinet set out a 30 year replacement program in 2003 based on replacing pipe at a prudent rate that sought to deliver reduced risk over time, balanced by cost and ability to manage resources to deliver the program”*.

While Multinet has not provided any further information that relates to the condition of its low pressure network, it emphasises the High risk assessment and impact of extending the replacement program beyond 2033. It has made changes to delivery capability, with the volume of the revised program based on delivery during the first six months of 2017.

As with the other mains replacement programs, the “high” risk rating becomes a key driver for replacement of the mains. Multinet’s delivery capability and achieving an efficient cost, while maintaining the overall level of network risk associated with these assets to as low as reasonably possible are also key drivers. Given these drivers and on the basis of Multinet’s efforts to improve its delivery processes, Zincara concludes that there is some capacity to increase the volume of low pressure mains replacement during 2018 - 2022.

As noted in section 3.3 (Delivery Capacity) above, Zincara estimates that Multinet will complete approximately 500 kilometres during 2013 - 2017, with around 135 kilometres being completed during 2017. While Zincara’s estimate is below that proposed by Multinet

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<sup>18</sup> Attachment 2 – Revised Mains Replacement Program: section 1.3, page 15

<sup>19</sup> Attachment 2 – Revised Mains Replacement Program: section 1.1, page 1

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and also below its target of 527 kilometres, Zincara agrees that changes to Multinet's delivery processes should enable it to increase its mains replacement program rate in future periods. However, this needs to be moderated by the increasing complexity that will be experienced as the program progresses into the inner urban areas and as demonstrated by increasing unit rates.

Zincara agrees with ESV's comments, quoted above and considers that the program be based on replacing pipe at a prudent rate that seeks to deliver reduced risk over time, balanced by cost and ability to manage resources to deliver the program. With Multinet's improved delivery processes in place Zincara proposes a low pressure mains replacement program of 500 kilometres for 2018 – 2022. This continues the estimated program delivery for the current period. Zincara considers that this along with an extended completion date around 2036 would meet the above criteria. Using a simple pro-rata estimate of cost Zincara calculates capex as \$166.3 million (excluding overheads and escalation).

### **3.7 UNIT RATES**

In its revised mains replacement program, Multinet advises that it has applied the methodology, endorsed in the AER's draft decision, to the revised project locations and volumes, resulting in a decrease in the average direct unit rate from \$334.50 per metre to \$332.60 per metre and detailed in its Table 1.17.

Multinet confirms that there are no changes to the unit rates for medium pressure cast iron and early first generation HDPE.

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## Appendix A

### References

Revised Access Arrangement Information – August 2017
Attachment 2 – Revised Mains Replacement Program – August 2017
Multinet Pipe Works Projects – Advisian – August 2017
Draft Response Capex Model
Notes from ESV – May, 2017
Response to questions from the AER – email dated 15 September 2017
Access Arrangement Information
Capital Expenditure Overview: Mains Replacement
Distribution Mains Strategy