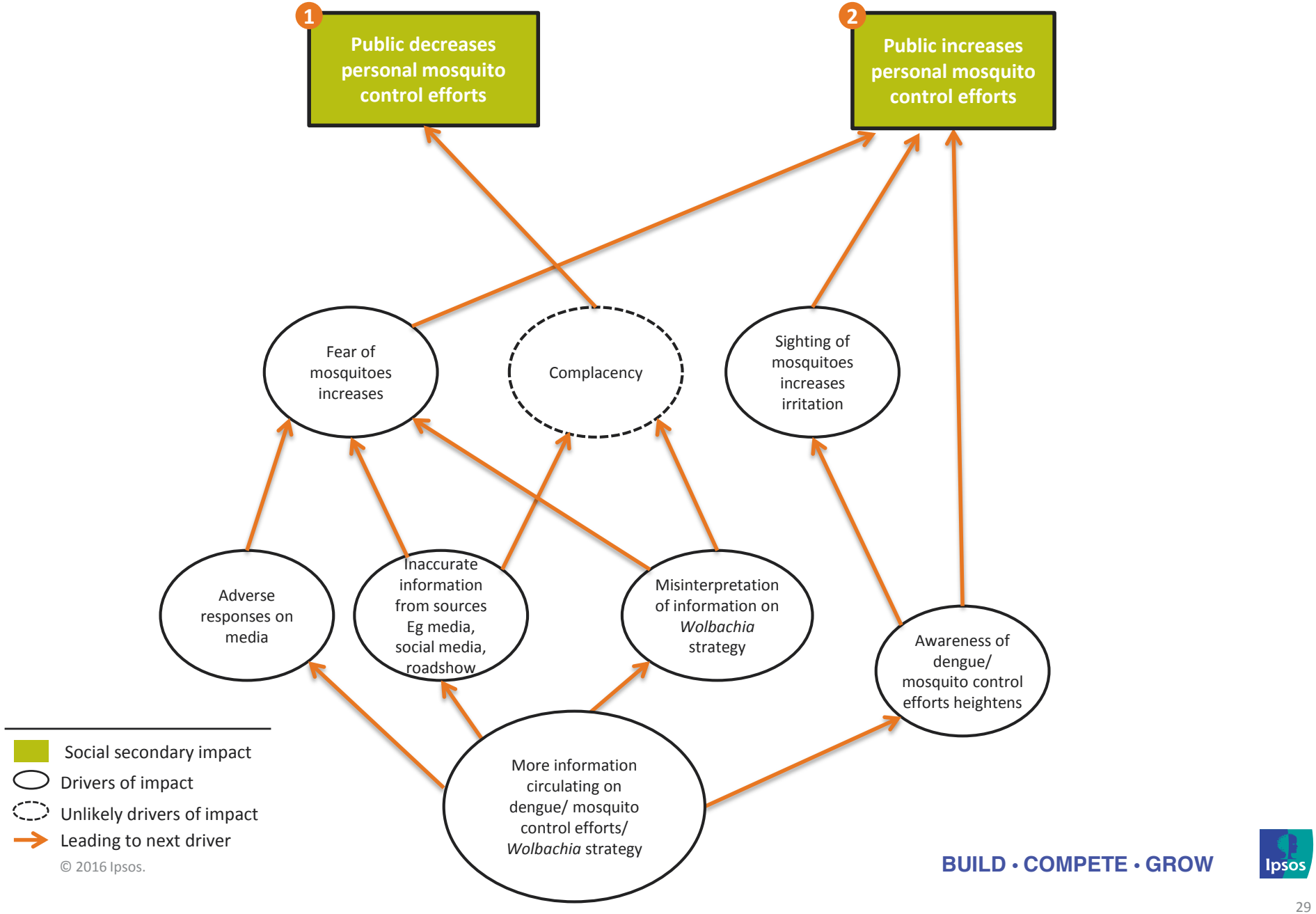
5

Social secondary impact analysis

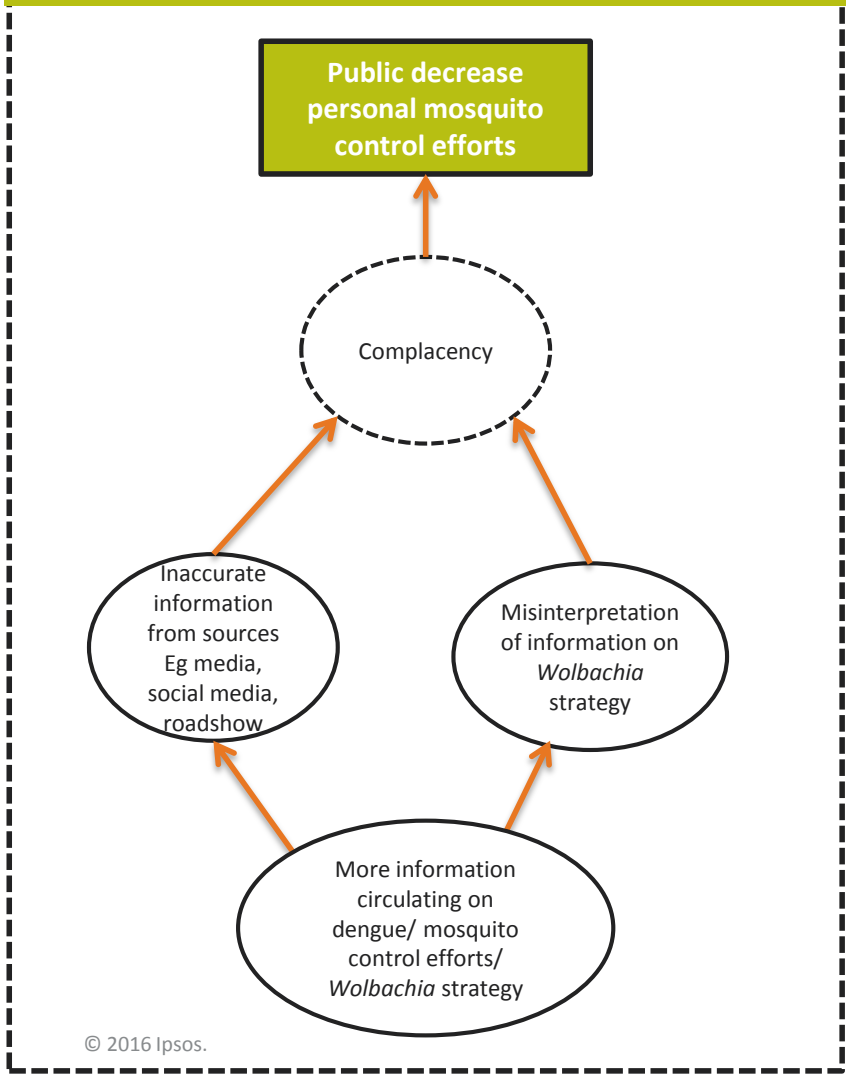
SOCIAL SECONDARY IMPACT (OVERVIEW)



SOCIAL SECONDARY IMPACT (1/2)

Assessing the possibility of the *Wolbachia* strategy causing the public to decrease their personal mosquito control efforts

FAULT TREE (SOC1)



SECONDARY IMPACT ASSESSMENT

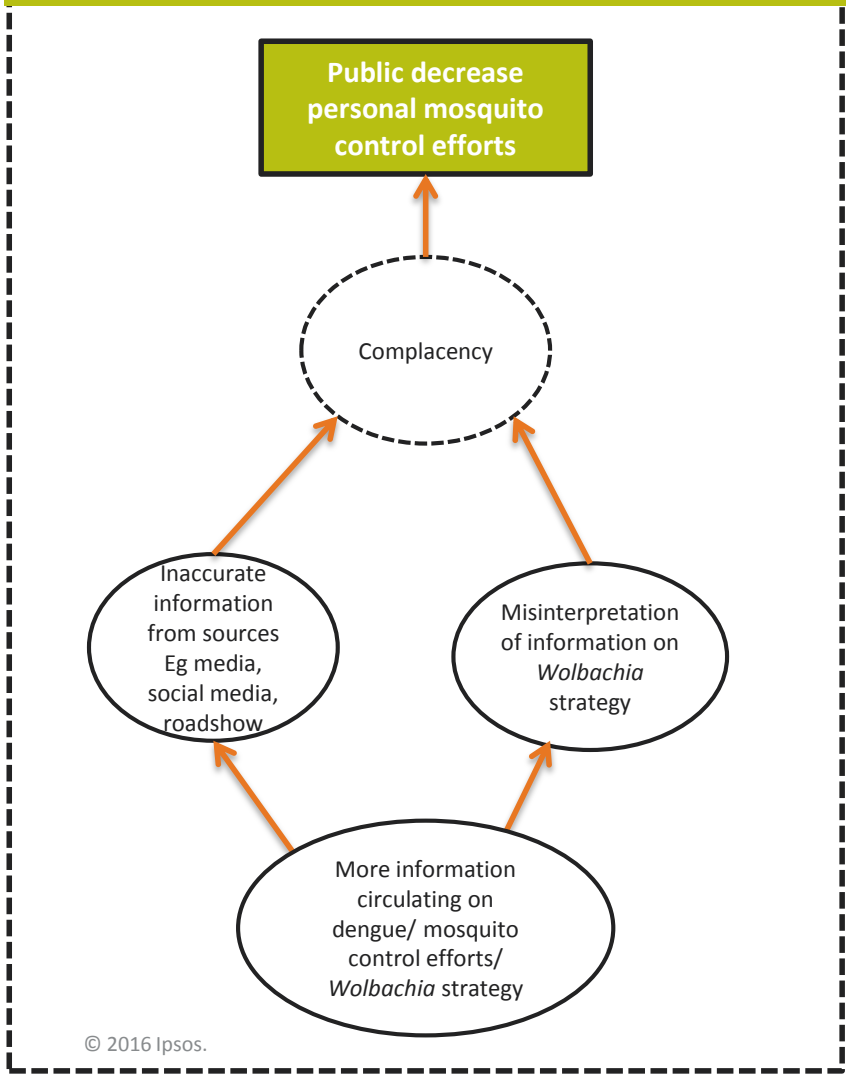
Assessment	
Likelihood	**Negligible**

- Based on the public perception survey, only **5% of the respondents showed complacency** when exposed to the *Wolbachia* strategy.
- Although only minority of the respondents showed signs of complacency, it is critical to ensure this does not spread to other parts of the population.

SOCIAL SECONDARY IMPACT (1/2)

Assessing the possibility of the *Wolbachia* strategy causing the public to decrease their personal mosquito control efforts

FAULT TREE (SOC1)



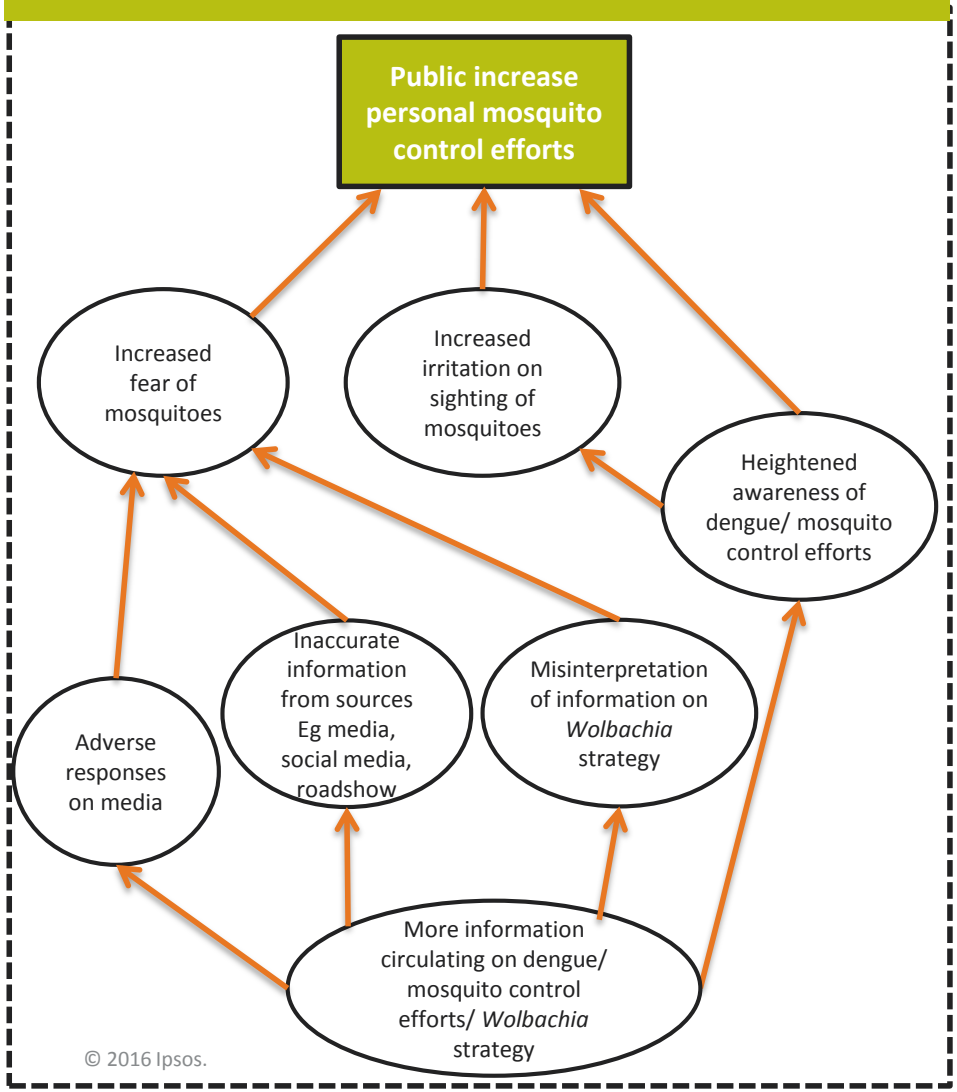
SECONDARY IMPACT ASSESSMENT

- Complacency poses a direct threat to the success of the suppression strategy as a reduction in personal control efforts would cause an increase in dengue cases
- NEA should ensure the message that the *Wolbachia* strategy is complementary to existing personal control efforts is strong
- NEA could also leverage on the announcement of the *Wolbachia* strategy to raise awareness about the seriousness of dengue situation in Singapore and importance of personal control efforts

SOCIAL SECONDARY IMPACT (2/2)

Assessing the possibility of the *Wolbachia* strategy causing the public to increase their personal mosquito control efforts

FAULT TREE (SOC2)



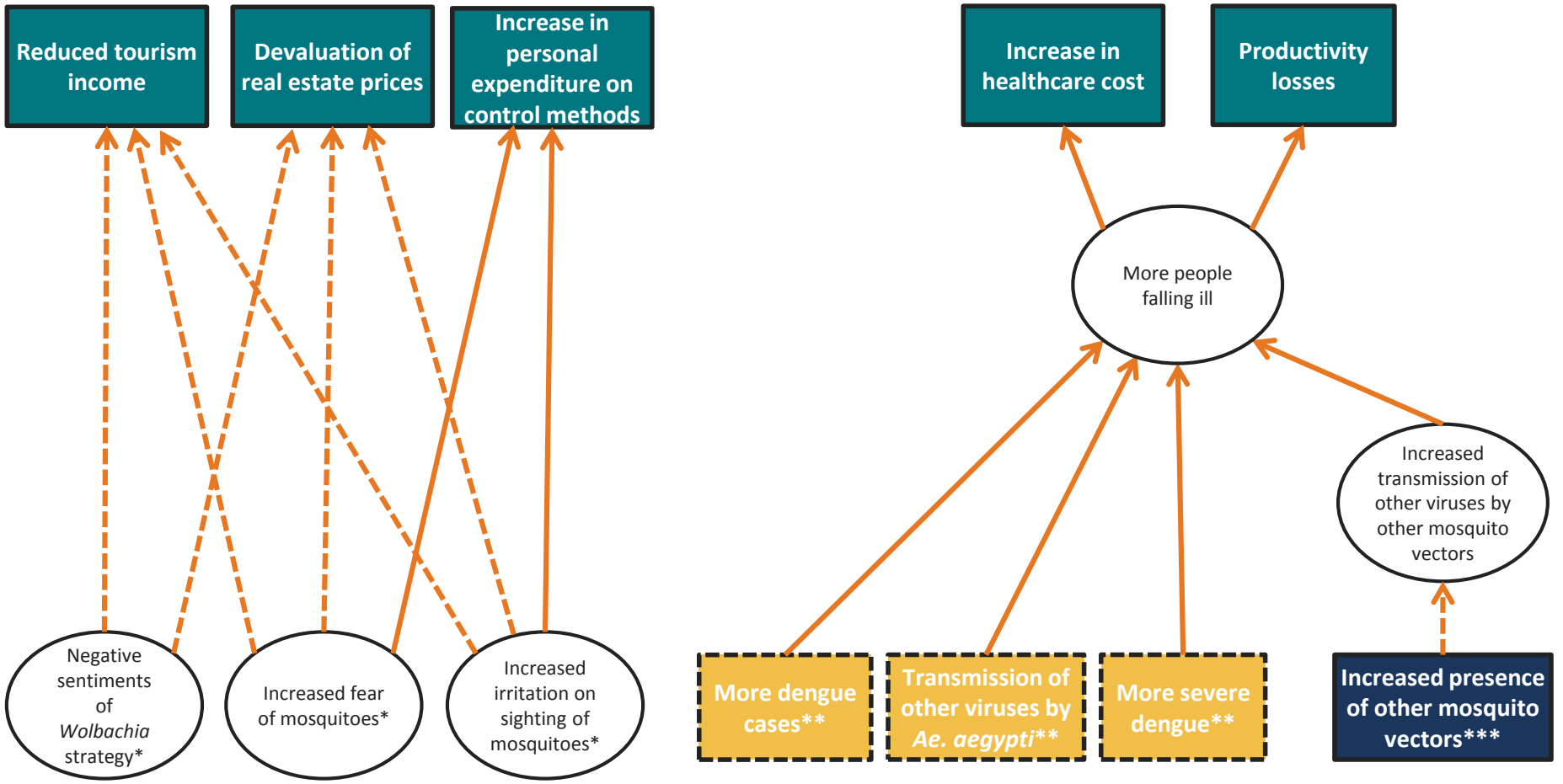
SECONDARY IMPACT ASSESSMENT

Assessment	
Likelihood	**Low**

- Based on the survey results, **10%** respondents indicated that they would **step up their personal control efforts** while **1%** indicated they would **start taking personal control efforts**
- NEA should aim to increase these percentages as the announcement of the *Wolbachia* strategy provides a good platform to do so

6 Economic secondary impact analysis

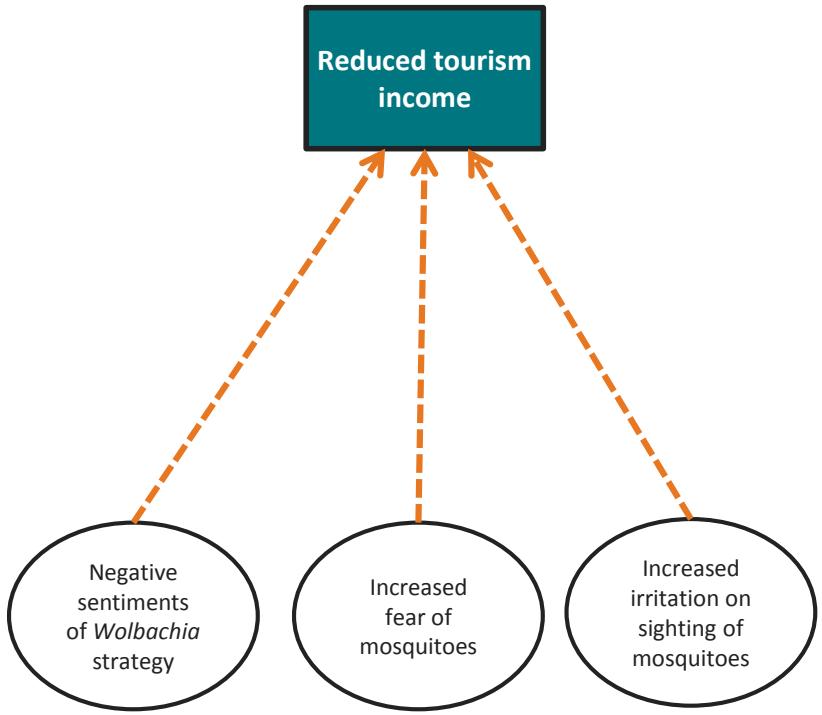
NEGATIVE ECONOMIC SECONDARY IMPACT (OVERVIEW)



NEGATIVE ECONOMIC SECONDARY IMPACT (1/5)

Assessing the possibility of *Wolbachia* strategy causing reduced tourism income

FAULT TREE (ECON1-NEG)



SECONDARY IMPACT ASSESSMENT

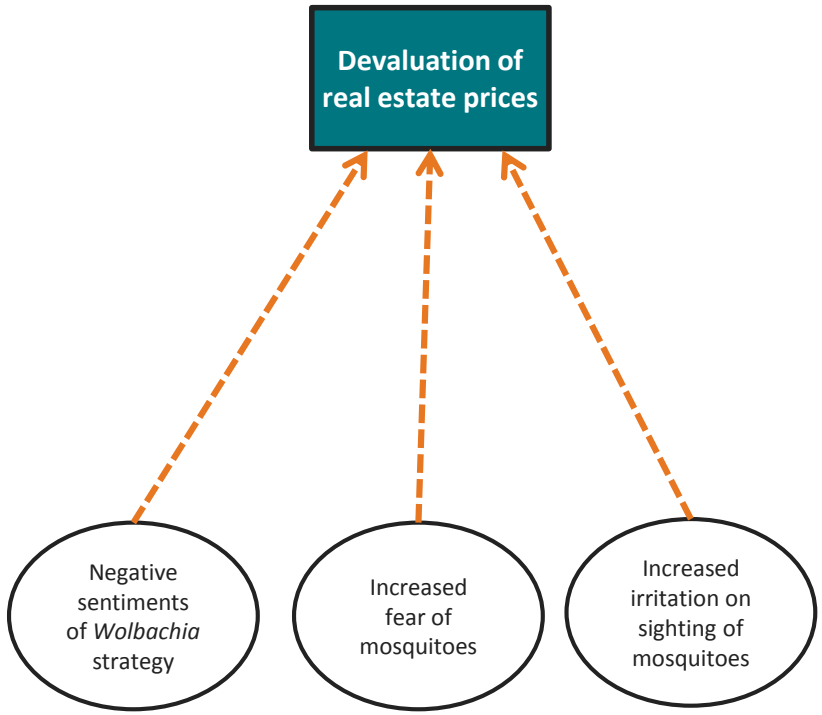
Ratings	
Likelihood	**Negligible**
Severity	**High**
Assessment	**Negligible risk**

- The likelihood of negative sentiments due to the *Wolbachia* strategy is very low as shown from the survey results (3% of the respondents disagreed with the implementation of *Wolbachia* strategy)
- The likelihood of increased fear of, or irritation caused by, mosquitoes can be significantly lowered by a carefully planned social engagement plan
- Based on past projects in Australia and Vietnam, no drop in tourists receipts was observed after the announcement of utilising *Wolbachia* as a vector control method
- Furthermore, as the releases are likely to be mainly in heartland areas and not in tourist attraction sites, it lowers the likelihood that the strategy will directly affect tourism income

NEGATIVE ECONOMIC SECONDARY IMPACT (2/5)

Assessing the possibility of *Wolbachia* strategy causing devaluation of real estate prices

FAULT TREE (ECON2-NEG)



SECONDARY IMPACT ASSESSMENT

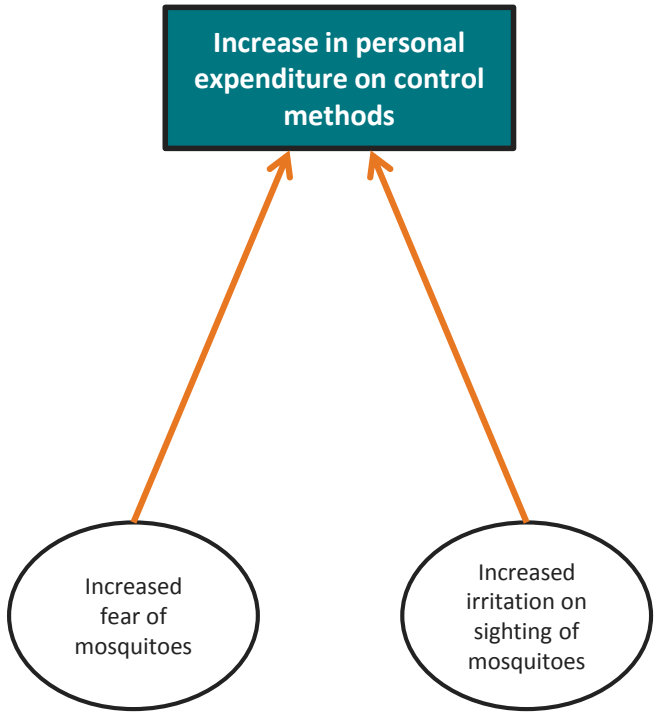
Ratings	
Likelihood	**Negligible**
Severity	**High**
Assessment	**Negligible risk**

- Based on the interviews conducted with property agents, it is unlikely the implementation of the *Wolbachia* strategy will cause a long term depreciation in real estate prices
- The effects, if any, are only likely to affect the rental prices in the areas of release for a short period of time
- The likelihood would be further reduced with a well planned social engagement plan that will significantly decrease the probability of the causes towards a devaluation of real estate prices

NEGATIVE ECONOMIC SECONDARY IMPACT (3/5)

Assessing the possibility of *Wolbachia* strategy causing increase in personal expenditure on mosquito control efforts

FAULT TREE (ECON3-NEG)



SECONDARY IMPACT ASSESSMENT

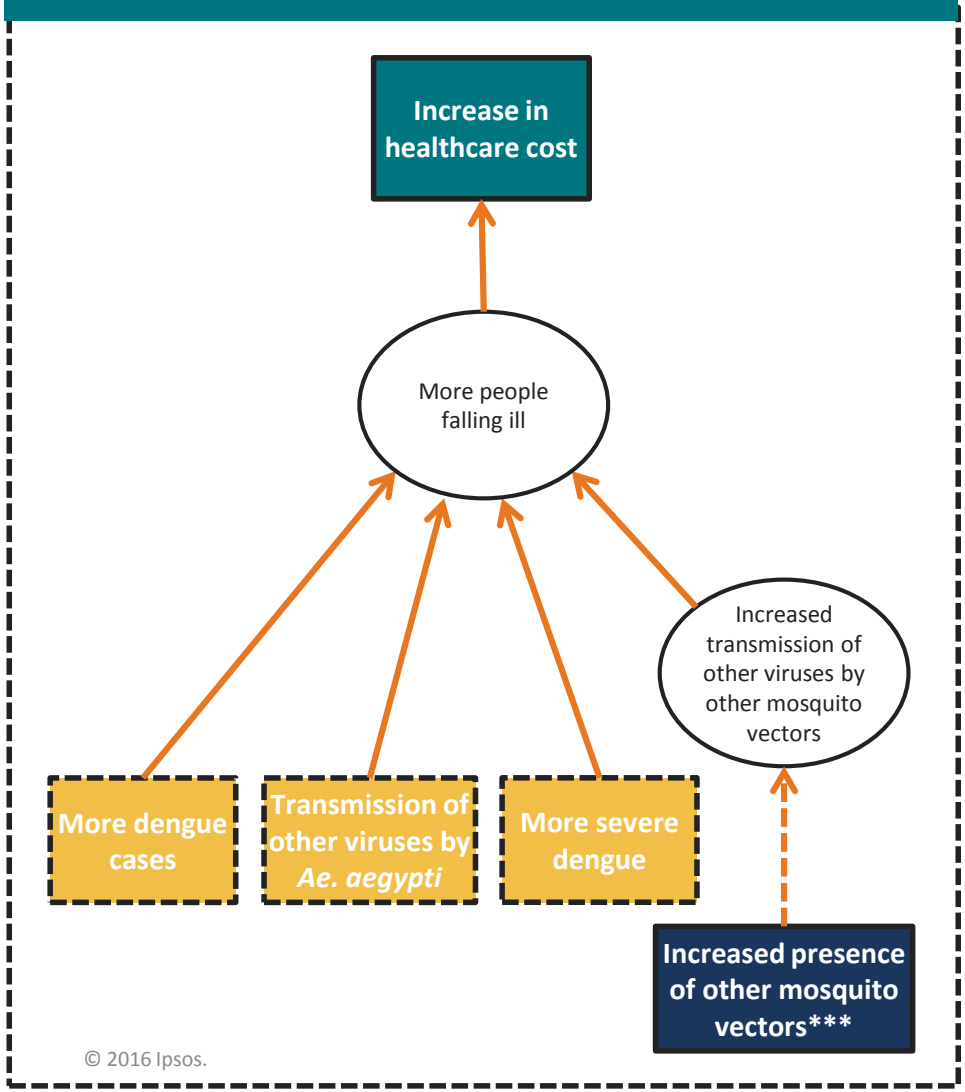
Ratings	
Likelihood	**Low**
Severity	**Low**
Assessment	**Negligible risk**

- Based on the survey results (refer to appendix slide 79), **20%** respondents indicated that they might have to **spend more on personal mosquito prevention measures.**
- However, the announcement of the *Wolbachia* strategy provides a good opportunity for NEA to:
  - Stress the relative importance of cost-free source control methods (e.g. clearing of stagnant water) in preventing dengue over methods that incur monetary expenses (e.g. purchase of insect repellent)
  - Emphasize that only male *Ae. aegypti* mosquitoes that do not bite will be released
- This helps to minimise the likelihood of the public overspending on personal control methods.

NEGATIVE ECONOMIC SECONDARY IMPACT (4/5)

Assessing the possibility of *Wolbachia* strategy causing increase in healthcare costs

FAULT TREE (ECON4-NEG)



SECONDARY IMPACT ASSESSMENT

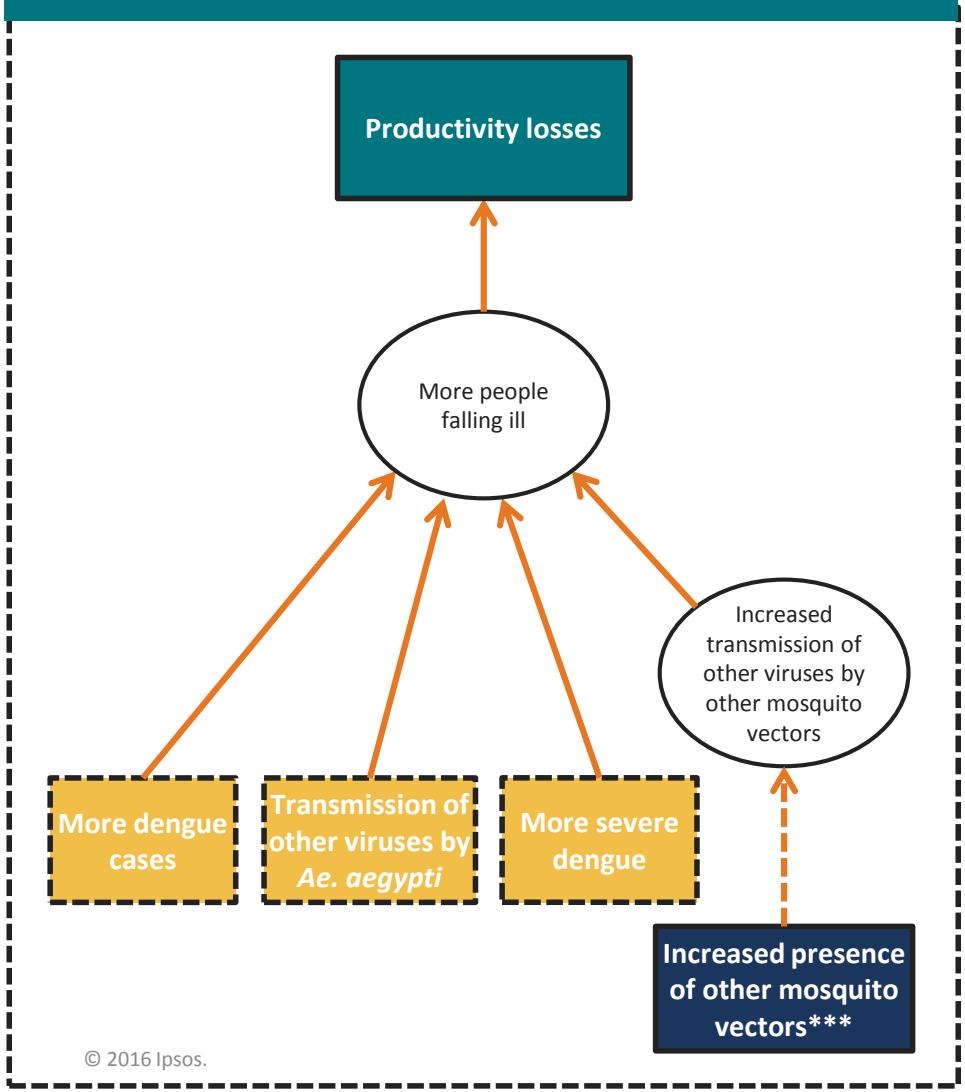
Ratings	
Likelihood	**Negligible**
Severity	**High**
Assessment	**Negligible risk**

- Based on the biological secondary impact assessment, the listed biological causes of an increase in healthcare cost are extremely unlikely to happen
- Although the increase in other mosquito vectors has a high likelihood of occurrence, NEA already has monitoring measures (i.e. use of Gravitraps) in place
- This significantly lowers the probability of it leading to an increase in number of vector-borne diseases
- The extremely low likelihood of the events at the base of the fault tree causes the likelihood of an increase in healthcare costs to be negligible

NEGATIVE ECONOMIC SECONDARY IMPACT (5/5)

Assessing the possibility of *Wolbachia* strategy causing productivity losses

FAULT TREE (ECON5-NEG)

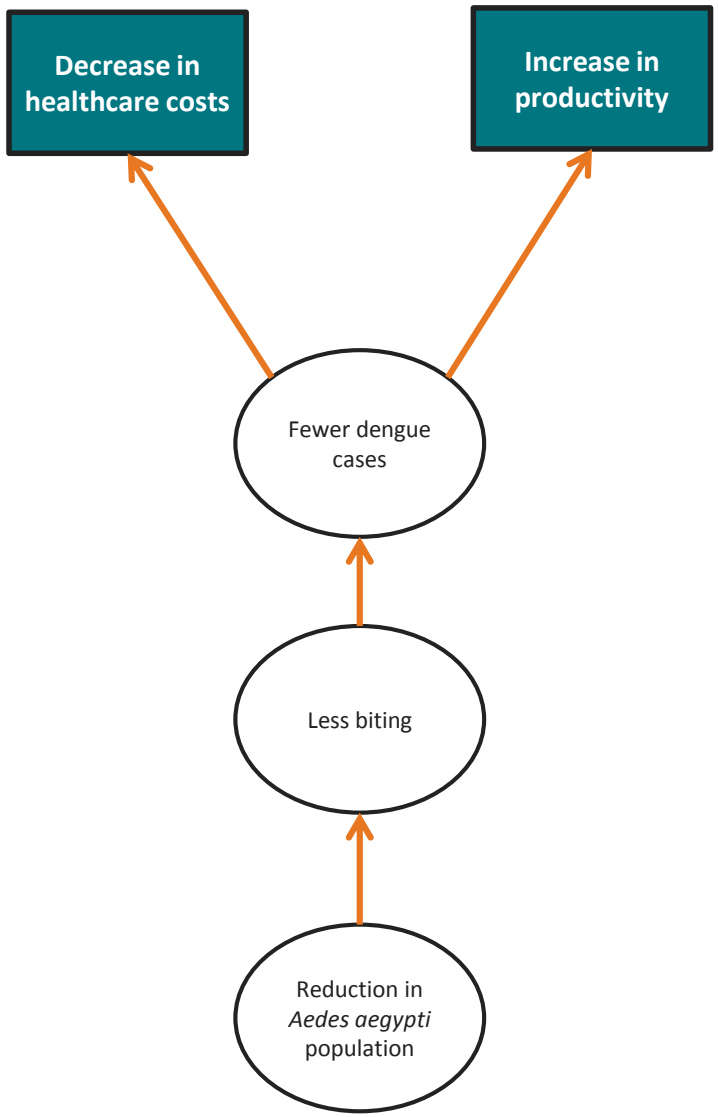


SECONDARY IMPACT ASSESSMENT

Ratings	
Likelihood	**Negligible**
Severity	**High**
Assessment	**Negligible risk**

- Based on the biological secondary impact assessment, the listed biological causes of productivity losses are extremely unlikely to happen
- Although the increase in other mosquito vectors has a high likelihood of occurrence, NEA already has monitoring measures (i.e. use of Gravitraps) in place
- This significantly lowers the probability of it leading to an increase in number of vector-borne diseases
- The extremely low likelihood of the events at the base of the fault tree causes the likelihood of productivity losses to be negligible

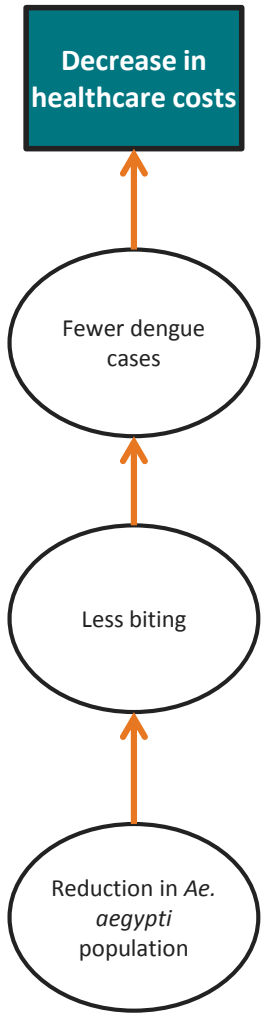
POSITIVE ECONOMIC SECONDARY IMPACT (OVERVIEW)



POSITIVE ECONOMIC SECONDARY IMPACT (1/2)

Assessing the possibility of *Wolbachia* strategy causing a decrease in healthcare costs

FAULT TREE (ECON1-POS)



SECONDARY IMPACT ASSESSMENT

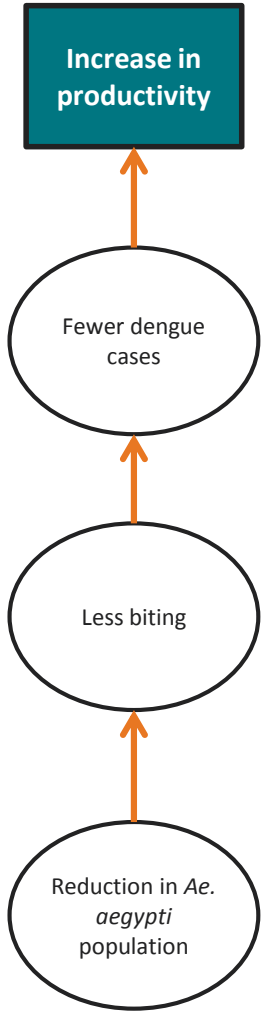
Ratings	
Likelihood	**Very high**
Positive impact	**High**
Assessment	**High impact**

- Based on the interviews with experts, cytoplasmic incompatibility (CI) is highly likely to work well in the field and this presents an extremely good probability of the suppression strategy helping to reduce the *Ae. aegypti* population in Singapore
- The success in reducing *Ae. aegypti* population is likely to cause a drop in dengue cases due to the decrease in dengue vectors in the environment
- This would help to reduce the amount of resources expended in dengue-related issues
- However, complacency (which has already been assessed to be unlikely in the social secondary assessment) must not set in to ensure the success of the strategy

POSITIVE ECONOMIC SECONDARY IMPACT (2/2)

Assessing the possibility of *Wolbachia* strategy causing an increase in productivity

FAULT TREE (ECON2-POS)



SECONDARY IMPACT ASSESSMENT

Ratings	
Likelihood	**Unknown**
Positive impact	**High**
Assessment	**Moderate impact**

- Based on the interviews with experts, cytoplasmic incompatibility (CI) is highly likely to work well in the field and this presents an extremely good probability of the suppression strategy helping to reduce the *Ae. aegypti* population in Singapore
- The success in reducing *Ae. aegypti* population is likely to cause a drop in dengue cases due to the decrease in dengue vectors in the environment
- This would help to reduce the likelihood of people falling sick due to the dengue virus and missing work
- However, it is only moderately likely to observe a significant increase in productivity as currently the dengue virus has not yet been established as a main contributor to people missing work among other diseases

7 Recommendations

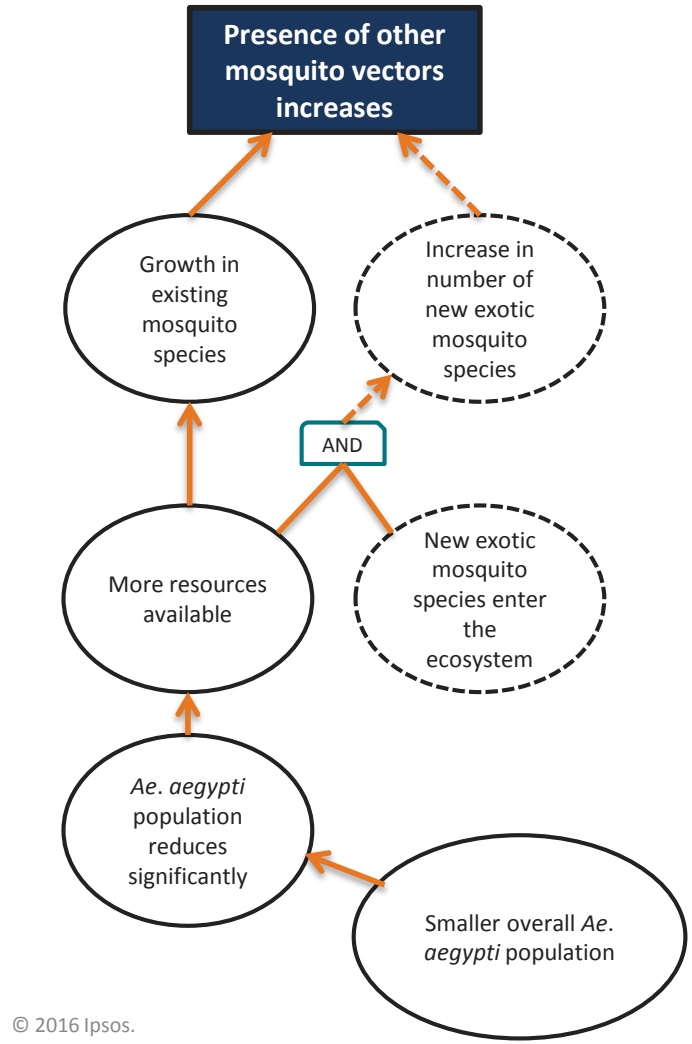
RECOMMENDATIONS

- The critical secondary impacts (based on likelihood and severity) that may have a negative effect on the *Wolbachia* strategy have been identified as the following:
  - Increase in presence of other mosquito vectors (ECO 4)
  - Unexpected dengue cases (BIO 2)

MITIGATION MEASURES (ECOLOGICAL)

Secondary impacts with a rating of low risk and above are identified. Possible mitigation measures are developed in consultation with NEA.

FAULT TREE (ECO4)



MITIGATION MEASURE

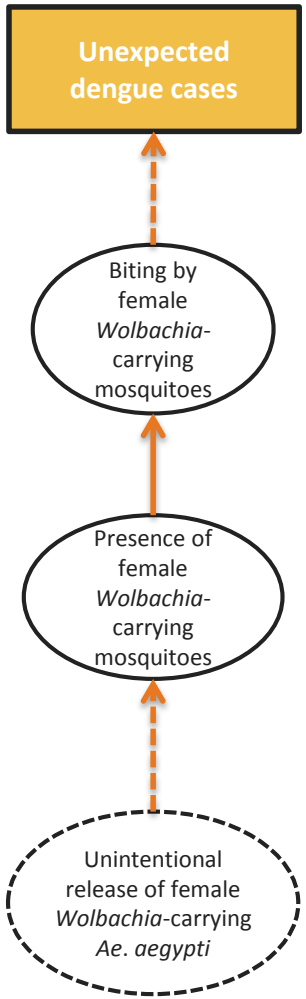
Ratings	
Likelihood	**High**
Severity	**Unknown**
Assessment	**Moderate risk**

- It is recommended to closely observe the above secondary impact through the monitoring of *Aedes albopictus* levels and any other consequences in areas of release
- NEA has already deployed Gravitraps in most dengue cluster areas in Singapore that enables the agency to monitor the number and species of mosquitoes
- Gravitraps will be a useful and effective tool that Singapore can utilise to monitor the number of *Aedes albopictus* and other container-breeding mosquito species in the areas of release after the implementation of the suppression strategy

MITIGATION MEASURES (BIOLOGICAL)

Secondary impacts with a rating of low risk and above are identified. Possible mitigation measures are developed in consultation with NEA.

FAULT TREE (BIO2)



MITIGATION MEASURE

Ratings	
Likelihood	**Low**
Severity	**High**
Assessment	**Low risk**

- The probability of an unintentional release could be greatly reduced by a robust sorting method.
- Utilisation of radiation, that would sterilise any females but would have no fitness effects on males, is a further measure that could be explored.
- If by chance, female *Wolbachia*-carrying *Aedes aegypti* mosquitoes are released, the likelihood that this will contribute to dengue incidence will be greatly reduced by the virus blocking potential of *Wolbachia* (*Moreira et al. 2009; Walker et al. 2011; van den Hurk et al. 2012*).

Appendix

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