5.0 Conclusions and Recommendations

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From the results on ammonia volatilisation from facultative and maturation ponds obtained in this study, the following conclusions can be made:

1. In the facultative pond, the ammonia volatilisation is very small. The conditions of the pond (ie. pH level) are also found to be less than ideal which suggests that volatilisation is not a major mechanism or nitrogen removal.

2. The nitrate/nitrite findings in the investigation does not rule out the chance that nitrification and denitrification are responsible for nitrogen removal. The low levels of DO in the pond, particularly at night, reinforce this possibility that anoxic conditions would be available for denitrification to take place. Similarly, sufficiently high DO contents seen during the day in the facultative pond would provide suitable conditions for nitrification to take place.

3. In the maturation pond, the ammonia volatilisation levels are greater than the facultative pond. This shows that, as predicted, the volatilisation from the maturation pond is greater as the conditions are more ideal for it (ie. higher pH). However the values are still small which does not confirm that volatilisation is a major mechanism of removal.

4. The conditions in the maturation pond are ideal for nitrification as the pond has high amount of dissolved oxygen, however the high levels of DO and depth of the pond may rule out the possibility of an anoxic layer forming. Although from the nitrate and nitrite findings this mechanism can obviously not be ruled out.

5. The ammonia volatilisation results of both the facultative and the maturation pond do not correlate with the results of the ammonia stripping model (Pano & Middlebrooks, 1982). In the majority of weeks investigated, both ponds

experienced less actual ammonia volatilisation than the theoretical model predicts.

6. The volatilisation results from the stabilisation ponds suggest that the ponds are more environmentally friendly than the ammonia stripping model would suggest. The low ammonia levels being released from the ponds would cause less negative impacts on the environment.

7. From this investigation it is important to remember that there is no definitive answer as to where the nitrogen is going. There are a number of significant pathways, namely; ammonia volatilisation, algal sedimentation and nitrification/denitrification. Through the methods I have employed to research this, there is no way of telling for sure how the different forms of nitrogen have been converted and how they were removed. With this research we are only able to speculate.

5.2 Improvements and areas for further study

There are a number of recommendations for future investigations in this area that may provide more conclusive evidence, these include:

1. This investigation was limited as there was no accurate way of detecting the occurrence nitrification, denitrification or sedimentation. As a result I was unable to come to any firm conclusions about where exactly the nitrogen is going. For future areas or study this aspect of the investigation would be recommended. The future work should aim to identify nitrogen pathways in ponds so that an accurate mass balance can be produced. An example of this would be to use isotopic tracers to follow the N species around the pond.

2. Future work on trapping ammonia volatilising from the surface of the pond should also include testing the box apparatus. This should be done in a laboratory, using a range of pH’s, to check that the box apparatus is successful in trapping the increasing amount of ammonia volatilising as the pH get higher.

3. Ideally, daphnia would not be present when this investigation is being conducted. As we have seen from the results, daphnia has a profound effect on the conditions of the pond. By consuming the algae, there is a trail of repercussions including lowering the pH, to which the nitrogen pathways are very sensitive.

4. After the box apparatus was initially installed, I noticed that there was a lot of condensation building up on the inside on the box. Ammonia dissolves easily into liquid so the presence of condensation could provide an alternative source of ammonia collection. This was why the box apparatus was set on a slant and a gutter installed to collect the condensation for testing. Although the majority of the condensation was collected, there was no way of knowing if it was 100% efficient. There is also no guarantee that the ammonia did not dissolve back into the pond water itself.

5. The maturation pond used for this investigation was recently reconstructed. The size of the pond had been reduced and so cycles in the wastewater pond were just establishing themselves when I started my investigation. The relatively new age of the pond may have been some limitation in term of algal population establishment and development.

6. The ammonia levels in the samples were measured using the ammonia probe. The ammonia volatilising was trapped in flasks of boric acid. In most cases the results were below 1mg/l. When using this ammonia probe, the results can sometimes become inaccurate below the 1mg/l mark.

7. The equipment analysing the nitrate and nitrite results is very sensitive. Therefore, especially considering the low levels of nitrate and nitrite detected in the samples, some of the nitrate or nitrite detected may have been cause by an anomaly in the investigation process.