1.0 Introduction
The Ilparpa swamp, a 130 hectare area near Alice Springs, has long been a public health concern as an extensive breeding habitat for the common banded mosquito *Culex annulirostris* during summer to autumn. This mosquito is a major vector for Murray Valley encephalitis virus (MVE) and Kunjin virus (KUN), as well as Ross River virus (RRV). The most recent cases of MVE and KUN occurred in Alice Springs in 2001 when there were 2 cases of MVE and 2 cases of KUN. There have been cases of RRV disease reported from Alice Springs every year from at least 2001 to the present.

To reduce the potential for arbovirus borne disease in Alice Springs, a drainage system was established in Ilparpa swamp in 2002 by the Department of Lands and Planning (DLP) in liaison with Power Water Corporation (PWC), Department of Health and Families (DHF), Alice Springs Town Council (ASTC) and the traditional owners, to drain Ilparpa swamp via an open unlined drain (OUD) into St Mary’s Creek near the racecourse to the south east.

Since the main OUD from Ilparpa and the finger drains in the swamp that feed the OUD were established, mosquito numbers have generally remained very low.

This report details the heavy rainfall in the Alice Springs area in January to April 2010, its effect on mosquito numbers, and measures taken to reduce the potential for mosquito borne disease.

2.0 Background
Adult mosquito numbers in Alice Springs are monitored weekly by six traps in a combined program with Environmental Health (EH) and Medical Entomology (ME) of DHF. Traps are set and collected by EH in Alice Springs and sent to ME in Darwin for identification, interpretation and recommendations.

Between 6th and 11th January 2010 the Alice Springs airport received a total rainfall of 136 mm but no sewage effluent from the nearby Alice Springs sewage treatment ponds was released into Ilparpa swamp. Adult mosquito traps baited with dry ice (EVS traps) are run overnight once a week at five locations near Ilparpa swamp. These locations include Ilparpa swamp A (east end), Ilparpa swamp B (west end), Greatorex Rd and Lilliecrapp Rd (rural area to the west) and Old Timers to the east of the swamp. While no *Culex annulirostris* were recorded in the mosquito traps on 6th January 2010, *Cx. annulirostris* numbers started to increase the following week, with 5, 13 and 47 specimens recorded in the Ilparpa swamp B, Greatorex Rd and Ilparpa swamp A traps respectively. On 17th February 2010 numbers peaked at Swamp B, with 660 *Cx. annulirostris* recorded (Fig. 5). On 24th February *Cx. annulirostris* numbers peaked at Swamp A with 392 specimens (Fig. 6), and at Greatorex Rd *Cx. annulirostris* numbers peaked on 3rd March with 1071 specimens recorded (Fig. 7).
During a ME inspection of the swamp area on 17th February, it was noticed that large areas in the sprinkler irrigation area near Ilparpa ponds B were pooling water.

Between 24th February and 2nd March 2010 Alice Springs received a further 213 mm of rainfall, with reports of the Ilparpa Road being flooded. Due to the appreciable rainfall, the PWC in Alice Springs carried out an authorised (Environmental Protection Agency) wet weather discharge of excess effluent from the Alice Springs sewage ponds, with an estimated 452 ML of effluent discharged out of the final evaporation pond (EP10) into the Ilparpa swamp A area between 24th February and 2nd March 2010 (Appendix 1, Figs 1-3).

The combination of rain and effluent release flooded an appreciable area in the Ilparpa swamp (Appendix 1, Figs 5 & 6). The already high numbers of Cx. annulirostris meant that the new flooding was likely to lead to an explosive increase of Cx. annulirostris by a new egg laying round. Previous analyses of summer rain in Alice Springs indicated that this rain and flooding posed a high potential for an MVE outbreak (Whelan et al. 2003, Kurucz et al. 2005). ME of DHF contacted Allan Whyte of PWC to discuss a possible aerial mosquito control operation in Ilparpa swamp to reduce the potential for arbovirus borne disease. PWC agreed to fund the insecticide (methoprene pellets) and helicopter costs for a once off aerial control operation. However, PWC stated they did not take responsibility for future mosquito control operations or Ilparpa drain maintenance, and advised that to their understanding DLP was responsible for drain maintenance in Ilparpa swamp, as the drain was located on Crown Land. PWC contacted DLP, who then contributed $20,000 towards the aerial control operation.

Based on an aerial control operation carried out in Ilparpa swamp in 2001 (Kurucz et al. 2002), ME estimated the flooded area to be controlled in Ilparpa swamp and decided to use methoprene pellets that give 30 days control to allow for longer term control in residual flooded areas that may remain after drainage and evaporation. Methoprene pellets were directly delivered to PWC in Alice Springs, and Jayrow Helicopters were contacted to do the application. Jayrow advised that they had a helicopter based in Alice Springs, and would only need to transport the control equipment from Darwin to Alice Springs. The control operation was planned for 12th March 2010 to allow for some drainage of Ilparpa and before mosquito breeding could reach the adult stages.

### 3.0 Larval survey operation

On 11th March 2010, the Operations Manager and the Advice & Control Officer of ME travelled to Alice Springs to carry out a larval survey by foot in Ilparpa swamp. On arrival, Julie Driver from EH Alice Springs provided ME with a car. Areas surveyed on 11th March included the sewage ponds, the sewage pond emergency outlet area (EP10), Swamp A, Swamp B, the Ilparpa tree plantation and the nearby effluent sprinkler dispersal area, the OUD which leads into St Mary’s Creek (Appendix, Figs 3 & 4), St Mary’s Creek itself and the ‘White Gums’ area along Ilparpa Rd (Figs 1 & 2). The sprinkler irrigation and the Swamp B area were dry, while low to high numbers of Cx. annulirostris and Anopheles amictus larvae were found breeding in the remaining areas as indicated in Figs 1 & 2. It was observed that the finger drains draining water out of the Swamp A area into the OUD and the OUD worked well, draining large volumes of water out of the swamp into St Mary’s Creek.
In the morning of the 12th March 2010, ME surveyed the ‘clay pans’ along Ilparpa Rd and the Shooter’s Range swamp with the assistance of a helicopter. Small areas of mosquito breeding were found, as indicted in Fig. 2.

Fig. 1: Alice Springs Ilparpa Swamp survey 11th March 2010

Fig. 2: Alice Springs Shooter’s Range Swamp & clay pan survey 11th & 12th March 2010
4.0 Aerial control operation

Aerial mosquito control in Ilparpa swamp, the Shooter’s Range swamp and the clay pans was carried out on 12th March 2010, with a total of 58ha controlled by applying methoprene pellets (30 day residual hormone growth pellets) as indicated in Figs 3 & 4.

A Bell 206 III Jet Ranger with an Easton bucket was used to distribute the methoprene pellets at a rate of 3.3kg/ha. Prior to the control operation, an aerial survey was conducted by landing in various sites to confirm the location and extent of mosquito breeding and to brief the pilot on the areas to control. The open grassy area east of the sewage Ponds A was used to load and service the helicopter. A total of 191kg of methoprene pellets were used during the operation.

Fig. 3: Alice Springs Ilparpa swamp aerial control 12th March 2010
5.0 Results

5.1 Greatorex Road
The adult mosquito monitoring results show that in the Greatorex Road trap *Cx. annulirostris* numbers peaked on 3rd March. This was probably a result of the rainfall occurring 24th Feb to 4th March (total: 213 mm) (Fig. 5). The most likely breeding sources resulting in this peak include the clay pans, the shooter’s range swamp, the white gums area and could include some dispersal of *Cx. annulirostris* adults from the swamp B area, as well as some contribution from effluent dispersal areas around swamp B.

Aerial mosquito control carried out on 12th March in parts of the Shooter’s Range swamp, the clay pans, the sprinkler irrigation area and the Ilparpa swamp A area was successful, with *Cx. annulirostris* numbers reduced in the Greatorex Rd trap to levels less than the rain peak in March and well below the ME pest number evaluation of 600 per trap/night. Slight increases in *Cx. annulirostris* numbers in the Greatorex Rd trap since 31st March are probably due to continuing effluent dispersal in the Ilparpa swamp B area sprinkler and tree plantation area, and a possible breeding site associated with the Ilparpa rural subdivision drain.

5.2 Ilparpa swamp B
In the Ilparpa swamp B area *Cx. annulirostris* numbers first increased after the initial January rain, with a peak on 17th February (Fig. 6). This peak was most likely due to pooling of water as a result of sprinkler irrigation, and also due to pooling in the tree plantation and Ilparpa swamp B itself. A second *Cx. annulirostris* peak occurred on 3rd
March, as a result of rain starting 24th February (Fig. 5). However, numbers decreased following the aerial control, with only slightly elevated numbers collected in the swamp B trap following the control operation.

5.3 Ilparpa swamp A
The Ilparpa swamp A area received most of the released effluent and was extensively flooded (Appendix 1, Figs 5 & 6). However, numbers of *Cx. annulirostris* remained well below pest levels of 600 per trap/night in the Ilparpa swamp A area between January and April 2010 (Fig. 7). Adult numbers reached a peak on 24th February, most likely due to dispersal from the Swamp B area, as well as probable breeding in the Swamp A area itself. *Culex annulirostris* numbers remaining low after the aerial control carried out on 12th March indicate the success of the control program.

5.4 Old Timers & Bloomfield Street
Only very low numbers of *Cx. annulirostris* were recorded in the Old Timers trap, indicating that this species did not disperse far from the Swamp A area. Trapping results from Bloomfield St north of the McDonnell Ranges and the Gap, with only a few *Cx. annulirostris* trapped also indicate that this species did not disperse far from Ilparpa swamp, and did not impact on the main residential areas of Alice Springs.

5.5 Sentinel chickens
None of the sentinel chickens of the Ilparpa rural or the Arid Zone Research Station flocks in Alice Springs seroconverted to MVE or KUN up until 7th April 2010, despite the high summer rainfall.

Fig. 5: Ilparpa Swamp B adult mosquito monitoring results
6.0 Discussion and follow up
6.1 Aerial control operation in March
Due to the Ilparpa drainage system draining large volumes of water out of the swamp to St Mary’s Creek, the Ilparpa swamp B area had largely dried up within 3 to 4 weeks after the cease of the February/March rain and the associated effluent discharge to St Mary’s Creek. Despite the enhanced drainage of the swamp, pooling still occurred in the Swamp
A area, providing suitable mosquito breeding areas. However, the adult mosquito monitoring results following the aerial control operation in Swamp A on 12th March showed low numbers of *Cx. annulirostris*, indicating the success of the control operation. As a result, the potential for arbovirus borne disease was kept low, with no seroconversions to MVE or KUN detected in the sentinel chickens until 7th April 2010.

### 6.2 OUD Drain maintenance

During a ME OUD drain inspection on 17th February 2010, it was noted that no drain maintenance had been regularly carried out, and vegetation has started to grow in the main OUD, as well as in the finger drains, which will decrease the effectiveness of this drainage system in the future.

To address the drain maintenance and ownership issue, DHF forwarded a letter to DLP in March 2010, asking DLP for their plans for future OUD drain maintenance, and possible drainage enhancements in Ilparpa swamp. As a result, a meeting between DHF and DLP took place in Darwin on 7th April 2010. Contrary to the previous discussion with PWC, DLP was of the understanding that PWC has ownership of the Ilparpa drainage system. In a later discussion with PWC on 14th April, PWC acknowledged ownership of the drain, but advised that the asset is unwanted and might be removed. Further discussions will be held between PWC and DHF in regards to the future of the drainage system.

### 6.3 April rain and associated effluent release

After the aerial control operation, Alice Springs experienced more rain with a total of 40.8 mm between 6th and 12th April. ME discussed possible effluent discharge into Ilparapa swamp with PWC, and it was decided that immediate discharge would be the best option, to avoid prolonged inundation of the Swamp A area. Discharge took place between 12th and 14th April, with a total of 117ML of effluent released into Ilparpa swamp A area via EP10 and some was also released out of Ponds C as advised by PWC. The April rain and effluent discharge into Ilparpa swamp did not lead to increased mosquito numbers, and *Cx. annulirostris* numbers decreased to very low numbers in Ilparpa swamp by 27th April 2010. Uncertainty in regard to the discharge licence remained, and the issue was discussed during a teleconference between DHF, PWC and EPA on 14th April. EPA advised that PWC could lodge an application for effluent discharge during summer when required, and that a risk analysis should be carried out prior to applying for a new discharge licence, so that issues regarding the timing of effluent release and the potential for mosquito breeding and disease risk could be incorporated into the discharge licence.

### 7.0 Summary

Alice Springs experienced high summer rainfall between January and March 2010, resulting in PWC discharging large volumes of effluent into the Ilparpa swamp A area. ME carried out an aerial mosquito larval control operation in Ilparpa swamp in March, and adult mosquito numbers remained relatively low as a result of this control operation. This control operation was assisted by the efficient drainage of rainwater and effluent out of the swamp via the Ilparpa OUD into St Mary’s Creek. However, the lack of drain maintenance is of great concern, as vegetation growth and silt deposits might hinder the efficient operation of the drainage system in the future. Thus, it is very important to resolve the issue of drain maintenance, and potentially enhance the drainage system to ensure efficient drainage of the swamp in the future to minimise the potential for arbovirus borne disease. Additional rain and effluent release in April did not lead to
increased mosquito numbers. *Culex annulirostris* numbers decreased to very low numbers in Ilparpa swamp by 28th April 2010.

### 8.0 References


### Appendix 1

*Fig. 1: Drain running parallel to old EP10 outlet pipe into Ilparpa swamp A, 11/3/2010*

*Fig. 2: EP10 outlet area into Ilparpa swamp A. Flow from sewage ponds A, LHS, 11/3/2010*
Fig. 3: Start of OUD in the northern part of Ilparpa swamp A, 11/3/2010

Fig. 4: OUD south of Ilparpa Rd leading to St Mary’s Creek 11/3/2010

Fig. 5: Mosquito breeding area at the southern side of Ilparpa swamp A near east end looking north 11/3/2010

Fig. 6: Aerial view of Ilparpa swamp A looking east 12/3/2010