TORRENS LAKE PHOSLOCK® TRIAL

February 2008

REPORT OF WATER QUALITY RESULTS TO 23 APRIL 2008

Prepared by
Australian Water Quality Centre
for
Adelaide City Council
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Summary

Results are presented for water quality testing in Torrens Lake, for a period of eight weeks following treatment with the modified clay product Phoslock® on 25 February 2008. Phoslock® contains the rare earth element Lanthanum in a matrix of bentonite clays and has been developed for removing soluble phosphorus from the water column by binding it into an insoluble precipitate. An assessment is provided of the effectiveness of the 2008 Phoslock® treatment in controlling algal biomass and cyanobacterial growth in Torrens Lake. Results of macroinvertebrate surveys and Lanthanum analysis in water, soil and plants in Torrens Lake are also discussed in relation to possible environmental impacts of the 2007 and 2008 Phoslock® treatments.

The 2008 Phoslock® treatment provided evidence of a decrease in total algal biomass and cyanobacterial abundance in the water column soon after application. This observation may be explained by a direct flocculation and sedimentation effect of the bentonite clay on particulate matter, including algal cells, more so than an indirect response on algal growth from nutrient limitation; a process that can reasonably be expected to have a lag time of a few weeks. Unlike the 2007 trial, cyanobacterial populations did not redevelop in the month after treatment and this may be viewed as a successful outcome in 2008. However, bio-available phosphorus was detected in the treated section of the lake within a week of Phoslock® application in concentrations sufficient to sustain algal growth. The prolific growth of other algae in late March/April, including the dinoflagellate *Peridinium* and the diatom *Cyclotella*, supplemented by external nutrient input from a rain event, suggests that nutrient availability was not a limiting factor to algal growth at that time. It is also likely that the effectiveness of this product will be dependent on the timing and magnitude of inflows to the lake.

The capacity of Phoslock® to form a barrier layer at the sediment-water interface in Torrens Lake to prevent release of bio-available phosphorus to the water column over an extended period of time remains uncertain. While the results of sediment analysis suggest that Phoslock® treatment has reduced the release of bio-available Phosphorus, considerable redistribution of Lanthanum has occurred within the lake and immediately downstream of the Weir, possibly due to scouring and drift. Further investigation is required to determine the capacity of the barrier layer to adsorb additional inputs of soluble phosphorus to Torrens Lake from external sources and to quantify sediment deposition rates over the barrier layer. The occurrence of a cyanobacterial bloom during the 2008 summer, within 12 months of the 2007 treatment, suggests that applications of Phoslock® at critical times in each summer may be required for effective results.

There were no apparent adverse effects of the Phoslock® application on aquatic fauna, either by direct exposure to the active constituent or indirectly by a temporary decrease in dissolved oxygen concentration. Surveys of macroinvertebrate communities pre- and post-application of Phoslock® showed no substantial change in diversity and abundance. The implications of demonstrated uptake of Lanthanum in stands of *Typha* in Torrens Lake for health of the aquatic ecosystem are unknown.

Introduction

Torrens Lake was treated with the modified clay product Phoslock® on 25 February 2008. The purpose of the treatment was to reduce the potential for the development of cyanobacterial blooms that might have threatened scheduled events of the "Adelaide Festival" during February and March. Cyanobacterial blooms (composed of *Microcystis*, *Anabaena* or *Planktothrix*) have resulted in closure of the lake to recreational use in seven of the last ten years. Phoslock® has been trialled on one previous occasion in the Torrens Lake; in March 2007.

Phoslock® contains the rare earth element Lanthanum in a matrix of bentonite clays and has been developed for removing dissolved phosphate from the water column by binding it into an insoluble precipitate. Dissolved or Filterable Reactive Phosphorus (FRP) is directly available for biological uptake and is generally considered to be the limiting nutrient that controls cyanobacterial growth, particularly nitrogen fixing species such as the toxin producing *Anabaena circinalis*. There is also evidence of reduced phosphate release from the sediments as the modified clay precipitate forms a barrier layer on the sediment-water interface.

The Australian Water Quality Centre was contracted by the Adelaide City Council to analyse water quality and biological indicators in Torrens Lake over an intensive eight week period of monitoring from 22 February (three days prior to Phoslock® treatment) to 23 April 2008 and then at a reduced monthly frequency to September 2008. The water quality testing program met the monitoring requirements under the South Australian EPA Emergency Authorisation for applying a modified clay product to Torrens Lake.

This report contains the results of field surveys and analysis of samples collected during the first eight weeks after the 2008 treatment for water quality, algae, macroinvertebrates, and plant analysis. Results are provided from sampling locations within the treated area, between the City Weir and the King William Street Bridge, and other locations in the lake upstream and downstream of the treated area. Results of chemical analysis of sediment samples collected in November 2007, approximately eight months after the 2007 Phoslock® treatment of Torrens Lake, have been reported separately by AWQC, but are discussed herein, in relation to the 2008 monitoring program.

Monitoring Program

Results are presented in this report for the following parameters and sampling dates:

1. **Lanthanum in Water (total and soluble)**
   At City Weir, Elder Park and University Footbridge on 22 February (before dosing), 25-28 February (daily), 2 and 5 March and weekly from 11 March to 23 April*. At each site, samples were collected mid-channel at the surface, mid-depth and bottom, while another sample was collected at the surface near the river bank.

   * Only surface samples collected on 23 April.

2. **Phosphorus (total and soluble)**
   Sampling sites and dates as above.

3. **Turbidity**
   Sampling sites and dates as above.

4. **pH**
   Sampling sites and dates as above (mid-channel at surface only).

5. **Conductivity**
   Sampling sites and dates as above (mid-channel at surface only).

6. **Algal Counts and Chlorophyll Concentration**
   Algal counts at City Weir, Morphett St. Bridge, Elder Park, King William St. Bridge, University Footbridge, Frome Rd. Bridge and Hackney Rd. Bridge on 22, 26 and 28 February, 2 March and weekly from 5 March to 23 April. Chlorophyll-a at the City Weir, Elder Park and University footbridge only, on the same dates.

7. **In situ Profiles of Dissolved Oxygen and Oxidation Reduction Potential**
   At City Weir, Elder Park and University Footbridge four times daily on 22 February and from 25-28 February**. Then twice daily from 27 February to 7 March and once weekly from 11 March to 23 April.

   ** only two profiles were taken on 25 February due to dosing activities

8. **Aquatic Macroinvertebrate Diversity and Abundance**
   At St Peters Weir (upstream control), University Footbridge, Elder Park (opposite the Popeye boat launch), and 200m upstream from the weir at the eastern extent of the golf course carpark on War Memorial Drive. Samples were collected and analysed on 22 and 27 February and 3 March.

9. **Lanthanum Measurements in Aquatic Plants**
   Sampling sites at St Peters (upstream control), Elder Park (opposite the Popeye boat launch), 200m upstream from the City Weir and downstream of the Weir at Bonython Park Lake on 22 February.

For the purposes of this report, treatment locations are considered to be the City Weir, Morphett St. Bridge, Elder Park and King William St. Bridge. Control sites in the lake (upstream of treatment) are considered to be University Footbridge, Frome Rd. Bridge and Hackney Rd Bridge.

Results are also presented for samples collected on 22 February and 3 April from the River Torrens downstream of the Lake at Port Rd. Bridge, Holbrooks Rd. Bridge, Breakout Creek Wetland and Seaview Rd. Bridge. Parameters measured at these sites were Lanthanum and Phosphorus on both sampling dates and including Turbidity on 22 February.

Sediment cores and overlying water were collected by AWQC on 20 November 2007 at the City Weir, Elder Park, University footbridge, upstream of the Frome Road Bridge (behind the zoo) and downstream of the Weir at Bonython Park Lake. Samples were analysed for Lanthanum, Total P, FRP and Total Solids and the results were presented in a separate AWQC report. Discussion of some of these results is included in this report.

Results

1. Lanthanum in Water (Figures 1-3, 19; Table 2)

Concentration of total Lanthanum in Torrens Lake was detected at low levels (< 0.03 mg/L) prior to Phoslock® treatment (22 February) at the three monitoring sites. These background levels may be attributed to the previous treatment in March 2007. Soluble Lanthanum was not detected prior to treatment (<0.001 mg/L) at any site.

On the day of the 2008 treatment (25 February), maximum total Lanthanum concentrations of 1.12 mg/L and 0.80 mg/L were recorded at the City Weir and at Elder Pk respectively. At the University footbridge "control" site, total concentration was lower (maximum of 0.086 mg/L) on the day of treatment than the treated sites, but higher than detected at the same site prior to treatment, indicating possible wind drift upstream from the King William St. Bridge at the time of dosing. Maximum concentrations of soluble Lanthanum were recorded on the day of dosing at the City Weir (0.012 mg/L) and Elder Park (0.008 mg/L), while concentrations did not exceed 0.002 mg/L at the University footbridge. Overall, maximum concentrations of both total and soluble Lanthanum following the 2008 treatment were less than that following the 2007 trial.

Concentrations of Lanthanum then decreased significantly as the Phoslock® slurry settled over the next three days. By 2 March, total Lanthanum was less than 0.08 mg/L at the City Weir and Elder Park and less than 0.02 mg/L at University footbridge. Throughout March and April, concentrations remained relatively stable, except for a spike on 18 March, particularly at the bottom depth at the City Weir (0.184 mg/L), possibly due to resuspension of sediments. By 2 March and thereafter, soluble Lanthanum concentrations were below detection (<0.001 mg/L) at the University footbridge and ≤0.002 mg/L at the City Weir and Elder Park. A slight increase in soluble Lanthanum to 0.002 mg/L was recorded at the City Weir and Elder Park following the rain event of late March, but not as pronounced as that after rain events post treatment in 2007. No evidence of increases in soluble Lanthanum were recorded at the time of lowest dissolved oxygen concentration on 2 March.

Residual levels of total Lanthanum were detected at sites downstream of Torrens Lake before treatment (22 February), with the maximum concentration of 0.009 mg/L at Breakout Creek. After the first significant flow across the Weir following treatment, total Lanthanum increased at Port Rd to 0.015 mg/L and to 0.011 mg/L at Holbrooks Rd. No increase in concentration was recorded at Breakout Creek (0.002 mg/L) and Seaview Rd (<0.001 mg/L). Soluble Lanthanum was below detection prior to treatment and remained so after the first flow following treatment.

2. Phosphorus (Figures 4-6, 19; Table 2)

Soluble phosphorus concentrations (FRP) were below detection (<0.001 mg/L) at all three sites in Torrens Lake on 22 February prior to Phoslock® treatment, with the exception of a mid-depth result of 0.010 mg/L at the City Weir. FRP was also near or below detection at surface locations at the City Weir and Elder Park on two earlier sample dates (15 and 19 February). Concentrations of FRP were generally low ≤0.005-0.010 mg/L on the day of treatment and on the three days following (26-28 February).

Thereafter, FRP increased at each sampling site, with maxima on 5 March or 11 March of 0.015 mg/L (City Weir), 0.012 mg/L (Elder Park) and 0.019 mg/L (University footbridge). Another concentration spike occurred on 3 April at the University footbridge (0.029 mg/L) and Elder Park (0.025 mg/L), presumably as a result of inflows to the lake following a moderate rain event in late March (discharge of 175 ML at Holbrooks Weir over 5 days). FRP continued to be detected at the three sites at concentrations up to 0.016 mg/L for two weeks after the rain event.

Concentrations of total phosphorus before Phoslock® treatment (22 February) ranged from 0.095 to 0.155 mg/L at all sites. Decreases in total P occurred immediately following treatment, but were more pronounced at the treated sites. This was likely due to the flocculation effect of the bentonite clay on particulate matter (including algal cells), as only soluble phosphorus is reported to bind with Lanthanum. Concentrations declined slowly to minima of 0.045-0.061 mg/L on 5 or 11 March (at the time of increased FRP), then increased significantly to concentrations ranging from 0.165 mg/L at the City Weir (18 March), 0.405 mg/L at Elder Park (3 April) and 0.334 mg/L at the University footbridge (26 March). Some, but not all of these increases can be attributed to the rain event toward the end of March. Total P had decreased to levels below 0.100 mg/L by the end of April.

Following the first significant rain event (3 April), total phosphorus levels decreased at all downstream sites compared with those recorded on 22 February prior to Phoslock® treatment. FRP was not detected at any downstream sites both before and after the rain event, except at Seaview Rd, where the 'before treatment' concentration was 0.01 mg/L.

3. Turbidity (Figures 7-9; Table 2)

Unlike the 2007 Phoslock® treatment, there was no recorded increase in turbidity in the water column on the day of application, with values ranging from 19-35 NTU at all sites on the afternoon of 25 February. Secci Disc depth was slightly higher on 25-26 February (0.4-0.65m) than the pre-treatment recordings on 22 February (0.35-0.45m). However, an increase of 7-9 NTU was observed on 26 February at treated sites in samples collected near the bottom.

A significant decrease in turbidity occurred in the first three days after dosing with values dropping to 8-11 NTU at the surface of treated sites and 13-25 NTU at the surface of the untreated site. The clarity of the water at this time was probably due to flocculation of particulate matter by the Phoslock® product. Switching off the mixers at this time may also have reduced the resuspension of lake sediments. Turbidities had generally returned to pre-treatment levels by mid March.

4. pH (Figure 10; Table 4)

Problems were experienced with the field pH probe, resulting in unreliable pH readings on certain days (25-26 February and 2 March). However, a noticeable drop in surface pH levels occurred in the first 9 days after the Phoslock® treatment to minima of 7.2-7.4 on 5 March at both treated and non-treated sites.

A similar decrease was also observed directly after the 2007 treatment and is probably associated with a reduction in algal biomass and the resultant change in equilibrium of carbon dioxide and bicarbonate influenced by a lower photosynthetic rate. It could also be due to a direct effect of Lanthanum, which is very effective at removing bicarbonate from the water column. The rain event that occurred in late March had little effect on pH at any of the lake sites and values had stabilised between 7.7-8.2 by mid April.

5. Conductivity (Figure 10; Table 4)

Surface conductivity (EC) did not appear to be affected immediately following Phoslock® treatment, but pre-treatment values of 1143-1530 EC increased by 184-213 EC over the next three days at both treated and untreated sites. A similar increase in conductivity was also recorded after the 2007 dosing. Conductivity continued to increase during an extended period of hot weather, reaching maxima on 18 March of 1710 (City Weir), 1890 (Elder Park) and 2117 (University footbridge) before inflows to the lake from the rain event in late March produced a dilution effect and subsequent reduction to below 1500 EC at all sites.

6. Algal Biomass (Figures 11-12; Table 3)

Chlorophyll concentrations, representing total algal biomass in the water column, decreased at the treated sites (City Weir and Elder Park) from 41.2 ug/L and 51.8 ug/L respectively on 22 February to 22.5 ug/L and 27.3 ug/L on 25 February, within a few hours after Phoslock® treatment. It would appear that the initial decrease in chlorophyll was due to a flocculation effect of bentonite clay on algal cells, more so than phosphorus limitation, which would realistically take longer to influence cell growth.

Chlorophyll concentrations then declined further to minima of 8.8 ug/L and 15.2 ug/L at these sites on 11 March, 15 days after treatment. At the upstream untreated site (University footbridge), chlorophyll decreased from 61.4 ug/L to 49.1 ug/L immediately after treatment and then to 26.7 ug/L by 11 March. The percentage decrease in chlorophyll over the first 18 days was marginally greater (70.7-78.6%) at the treatment sites than at the untreated site (56.5%). Given the detection of Lanthanum at the untreated site soon after application, the decrease in chlorophyll may be attributed, at least in part, to the Phoslock® and the University footbridge therefore, cannot be regarded as a valid control site.

Increases in chlorophyll were observed at all three sites after 11 March, peaking at 38 ug/L on 25 March (City Weir), 120 ug/L on 3 April (Elder Park) and 380 ug/L on 15 April (University footbridge). The high chlorophyll results in can be attributed to prolific growth of the diatom *Cyclotella* and the dinoflagellate *Peridinium*, possibly triggered by external nutrient inputs to the lake from the rain event in late March. Thus, it can be assumed that nutrient availability was not a limiting factor to algal growth within six weeks of the Phoslock® treatment.

The dominant species of cyanobacteria in Torrens Lake during the 2008 summer were *Planktothrix mougeotii* (non-toxic), *Anabaena circinalis* (potentially toxic) and *Microcystis flos-aquae* (potentially toxic). *Anabaena* and *Microcystis* peaked in mid

to late January, with maxima of 39,300 cells/mL and 9,140 cells/mL respectively. Cell counts of *Anabaena* and *Microcystis* were less than 1,000 cells/mL at all sites immediately prior to the Phoslock treatment and did not increase in number thereafter. *Planktothrix* succeeded *Anabaena* as the dominant cyanobacterium in the lake, with maxima of 99,000 to 110,000 cells/mL recorded at the City Weir and Morphett Rd. Bridge on 5-8 February. Toxicity tests conducted on samples of *Planktothrix* collected on 21 February were negative.

After a temporary decline in *Planktothrix* numbers, a second peak was recorded on 19 February, with a maximum of 77,000 cells/mL at Elder Park. Evidence of another population decline was then observed at some, but not all locations three days prior to Phoslock® treatment. Further decreases in *Planktothrix* were recorded the day after treatment, possibly a combination of both natural population decline and flocculation by Phoslock®. Decreases of 20-64% were recorded at treated sites and 40-80% at untreated sites between 22 and 26 February, except at the Hackney Rd. Bridge, where numbers increased. Within 6 days of treatment, cells counts of *Planktothrix* at all sites had decreased below 5,000 cells/mL and numbers were generally less than 100 cells/mL at all sites by mid March, despite a period when weather conditions were conducive to cyanobacterial growth. Ambient temperatures exceeded 35^{o}C for 15 consecutive days from 3 March to 17 March.

7. Dissolved Oxygen and Oxidation-Reduction Potential Profiles (Figures 13-18; Table 4)

Dissolved oxygen concentrations generally decreased over the first week following the Phoslock® treatment at both treated and untreated sites. Minimum surface values were recorded in the morning of 2 March, six days after dosing and ranged from 2.2 mg/L at Elder Park to 3.5 mg/L at the City Weir (3.1 mg/L upstream at the University footbridge). Values near the bottom were less than 1.0 mg/L at Elder Park on the morning of 2 March, but had increased to greater than 4 mg/L throughout the water column by early afternoon.

As in 2007, the decrease in DO is most likely related to a simultaneous decrease in algal biomass which would have resulted in a decrease in oxygenation from photosynthesis, as well as a possible increase in BOD following any algal decomposition resulting from flocculation. Given that DO decreased similarly at both treated and untreated sites, there is insufficient evidence to suggest that the Phoslock® treatment was the only contributing cause. Overall, DO levels did not drop sufficiently to seriously threaten aquatic life and recovery to satisfactory levels (> 5 mg/L) were apparent by 3 March.

Technical problems were experienced with the redox field probe in the first few days following the Phoslock® treatment and very low values of 20 mV on 1 March are considered suspect. Notwithstanding, a general decrease in ORP was observed at all sites at the time of lowest dissolved oxygen concentrations. DO and ORP were at satisfactory levels on 11 March when elevated concentrations of FRP were recorded.

Overall, the lowest measurements of dissolved oxygen concentration in Torrens Lake over the 8 week monitoring period were recorded at the University footbridge on 26 March, immediately following a rain event and a likely increase in BOD associated

with inflows of organic material to the Lake. On 9 April, a maximum DO of 17.3 mg/L was recorded at the University footbridge and can be attributed to a bloom of the dinoflagellate *Peridinium*.

8. Aquatic Macroinvertebrate Diversity and Abundance (Figure 20; Table 1)

Macroinvertebrates were collected from three lake sites and one up-stream control site on three sampling events (22 & 27 February and 3 March). Samples were collected from ten metres of accessible edge habitat around stands of *Typha* sp. using a 250 µm mesh dip net. Processing involved a modified field-pick protocol where samples were emptied into large white trays and scanned for at least 30 minutes, recording the presence and abundance of all distinguishable taxa. Scanning was discontinued if no new taxa were detected in the last 5 minutes of the 30 minute scan; otherwise the process was continued until no new taxa were noted in additional 5 minute scans. At least one specimen of all taxa recorded was placed in a jar containing 75% ethanol. The whole sample was similarly preserved in a 1 Litre sludge pot for further processing if required.

There was no clear pattern of change in macroinvertebrate diversity and abundance over time as a result of the Phoslock® treatment. The variation in results discussed below is considered to be insignificant in terms of demonstrating possible ecosystem impacts using this indicator (Figure 20). Between-site variation is likely due to differences in the structure of macrophyte and substrate habitats at each site. Overall, a total of 32 taxa were recorded over all sites with four additional fish taxa also being collected.

The upstream control site at St Peters had the highest diversity of all surveys with 17 taxa being collected. Taxa only collected at this site include aquatic snails (*Physa acuta*), flat worms (Turbellaria), a species of water-boatmen (*Agraptocorixa* sp.), small water striders (*Microvelia* sp.) and soldier-fly larvae (Stratiomyidae spp.). The only Big headed gudgeon specimen (*Philypnodon grandiceps*) observed over the survey was also collected here on 27 February. Relatively good stream habitat most likely accounts for the slightly increased level of diversity compared with other sites.

At the University Footbridge diversity decreased from twelve taxa to ten on the second sampling event (post-treatment) before returning to pre treatment taxa diversity levels on the third sampling event. Taxa that were collected pre-treatment but not post-treatment include segmented worms (Oligochaeta spp.) and aquatic mites (Hydracarina spp.). All samples collected at this site were dominated by shrimp (*Paratya australiensis*), water-boatmen (*Micronecta* sp.) and backswimmers (*Anisops* sp.).

Samples from Elder Park (opposite the Popeye boat launch) showed the lowest diversity with nine taxa being recorded on the third sampling event. Highest diversity was observed on the second sampling event (post-treatment); the additional taxa collected being a scavenger beetle larva (Hydrophilidae sp.). All samples were again dominated by shrimp, water-boatmen and backswimmers. Almost all of the carp gudgeons (*Hypseleotris* sp.) collected over the survey were found at this site. Sediments here and at the previous site were strongly anoxic.

The furthest downstream site on the lake, 200m upstream of the weir, recorded slightly higher numbers of taxa than the previous two lake sites. Extensive stands of *Typha* sp. in this location may provide more structured macroinvertebrate habitat. However sediments still emit a strong anoxic odour. The pattern of taxa richness over time is similar to that of the University Footbridge in that numbers decrease between pre-treatment and post-treatment from 15 to 12 taxa and then increase again on the third sampling event to 13 taxa. Three taxa collected, and only found at this site, include may-fly larvae (Caenidae spp.), free-living caddis-fly larvae (*Ecnomus* sp.) and stick caddis-fly larvae (*Oecetis* sp.). Some Murray River rainbow fish (*Melanotaenia fluiatilis*) were also observed here.

The most common taxa found throughout the lake were zooplankton (Ostracoda), shrimp, water-boatmen, damselfly larva (*Coenagrionidae* sp.), stick caddis-fly larvae (*Leptoceridae* sp.) and mosquito fish (*Gambusia* sp.). Overall, no dead fauna (including fish and birds) were sighted; and no noticeable change in fauna behaviour was evident.

9. Lanthanum in Aquatic Plants (Fig 21; Table 5)

Root stock samples (in triplicate) were collected on 22 February from *Typha* reedbeds along the riverbank at two treated sites (Elder Park and Upstream of the City Weir), St. Peters Weir (upstream control) and downstream of the City Weir at Bonython Park Lake. Loose soil was washed from the roots prior to drying in a laboratory oven and analysis of homogenised material for Lanthanum content.

A large variability in results was recorded between sampling sites and between replicate samples at the Phoslock® treated sites. The lowest concentrations (mean 5.3 ppm) were recorded at the St. Peters control site, while the highest mean concentrations (172.1 and 172.5 ppm) were recorded at Elder Park (range 66.0-382.1 ppm) and the City Weir (range 32.2-298.3 ppm). A relatively high mean concentration of 98.9 ppm was recorded at the untreated downstream site at Bonython Park.

The results are generally consistent with analysis of Lanthanum in sediment cores collected in November 2007 (reported separately by AWQC) and confirm that uptake of Lanthanum by aquatic plants has occurred within 12 months of the 2007 Phoslock® treatment as a result of deposition in the lake sediments and those immediately downstream. The results from samples collected at St Peters are an indicator of background levels of Lanthanum in the Torrens system prior to Phoslock® treatment.

Conclusions

1. The 2008 Phoslock® treatment of Torrens Lake coincided with a noticeable decrease in algal biomass and in particular, a decline in abundance of the filamentous cyanobacterium *Planktothrix mougeotii*, which had reached cell numbers that threatened to close the lake for recreational use. A simultaneous decline in *Planktothrix* and chlorophyll at two of three untreated sites in the lake further upstream might suggest that a natural population decline was occurring at this time as it did prior to treatment in mid- February. The validity of the "control" sites must be questioned, however, given the detection of Lanthanum in water upstream of the treated zone soon after the application of Phoslock®.

2. Similar to the 2007 Phoslock® trial, the immediate decline in both *Planktothrix* and chlorophyll within the first few days after the Phoslock® treatment is most likely due to flocculation and sedimentation of algal cells, more so than a response to nutrient limitation resulting from the complexation of soluble phosphorus by Lanthanum. Depending on the nutrient status in the cells and in the water column prior to Phoslock® treatment, phosphorus starvation could reasonably be expected to take a few weeks before a noticeable decline in algal biomass is observed. The rapid growth phase of *Planktothrix* in mid-February and the negligible levels of soluble phosphorus in the water column prior to treatment suggests that rapid uptake of phosphorus by algal cells had occurred.

3. Unlike the 2007 Phoslock® trial, cyanobacterial populations did not redevelop in the month after treatment and this may be viewed as a successful outcome in 2008, particularly in view of the prevailing weather conditions that were conducive to cyanobacterial growth. A decrease in total phosphorus in the water column immediately following the treatment, presumably by flocculation of particulate matter, may also be viewed as a beneficial outcome, given that a proportion of particle bound phosphorus may become bio-available. However, bio-available phosphorus was detected in the treated section of the lake within a week of Phoslock® application and prolific growth of other harmless algae in late March/April, including the dinoflagellate *Peridinium* and the diatom *Cyclotella*, albeit with supplementation by external nutrient input, suggests that nutrient availability was not a limiting factor to algal growth at that time. The occurrence of this bloom and the cyanobacterial bloom in February 2008 demonstrates the difficulty in controlling algal growth in the Torrens Lake system in the mid to long term by suppression of internal nutrient release alone.

4. The capacity of Phoslock® to form a barrier layer at the sediment-water interface in Torrens Lake to prevent release of bio-available phosphorus to the water column over an extended period of time remains uncertain. The results of sediment analysis (reported separately by AWQC) indicate considerable redistribution of Lanthanum within the lake and immediately downstream, most likely due to scouring and drift. While sediment analysis may suggest that Phoslock® has decreased the bio-availability of phosphorus from sediment release, it is stated in the AWQC report that "the long term retention

of a barrier layer remains dependent on the internal water movements and sediment deposition rates". Annual applications of Phoslock® may be required to maintain a barrier layer and the timing of treatments during summer may be critical to suppress an upward trend in cyanobacterial growth. Further research under experimental conditions is required to fully investigate the effectiveness of the barrier layer in suppressing nutrient release and to determine its capacity to adsorb additional inputs of soluble phosphorus in the water column.

5. An observed decrease in dissolved oxygen concentration in the water column a few days after the Phoslock® application was most likely caused by rapid loss of algal cells by flocculation and decomposition. This cannot necessarily be attributed to the treatment as an equivalent decrease occurred at the upstream untreated site. The low DO was temporary and there was no evidence to suggest that aquatic life was seriously threatened. A survey of aquatic macro-invertebrates pre- and post-application of Phoslock® demonstrated relatively small variations in diversity and abundance of fauna and it can be concluded that there was no adverse effect that could be attributed to the treatment.

6. Lanthanum, the active constituent of Phoslock®, remained in the water column of Torrens Lake at levels up to 0.064 mg/L seven weeks after the 2008 treatment and was detected (max. of 0.015 mg/L) at some downstream sites after discharge across the City Weir from a rain event in late March. Analyses of Lanthanum in sediments and aquatic plants eight months and twelve months respectively after the 2007 treatment demonstrate the persistence and biological uptake of this element in the aquatic environment. The implications for health of the aquatic ecosystem are unknown.

References

Australian Water Quality Centre (2007). Torrens Lake Phoslock® Trial; March 2007. Report of Water Quality Results to 4 September 2007.

Australian Water Quality Centre (2008). Investigation into the effectiveness of Phoslock® in sequestering bio-available phosphorus in the Torrens River to prevent algal bloom formation.

Haghseresht, F. (2006). The availability of Lanthanum ions from Phoslock®: Residual concentrations following Phoslock® applications & implications for consumption. Phoslock Water Solutions Report No. PLT-06-2

Figure 1. Lanthanum at the City Weir

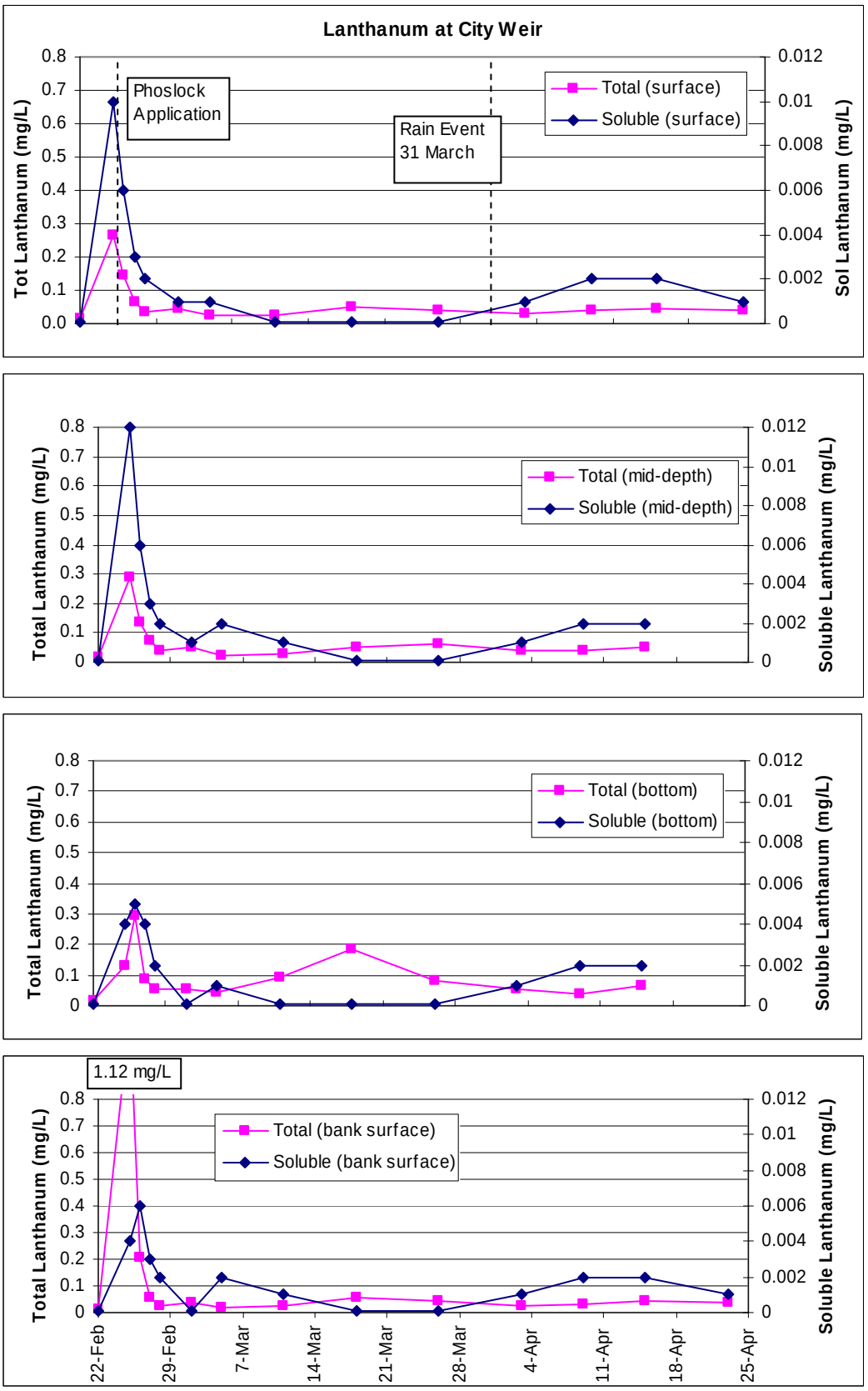


Figure 2. Lanthanum at Elder Park

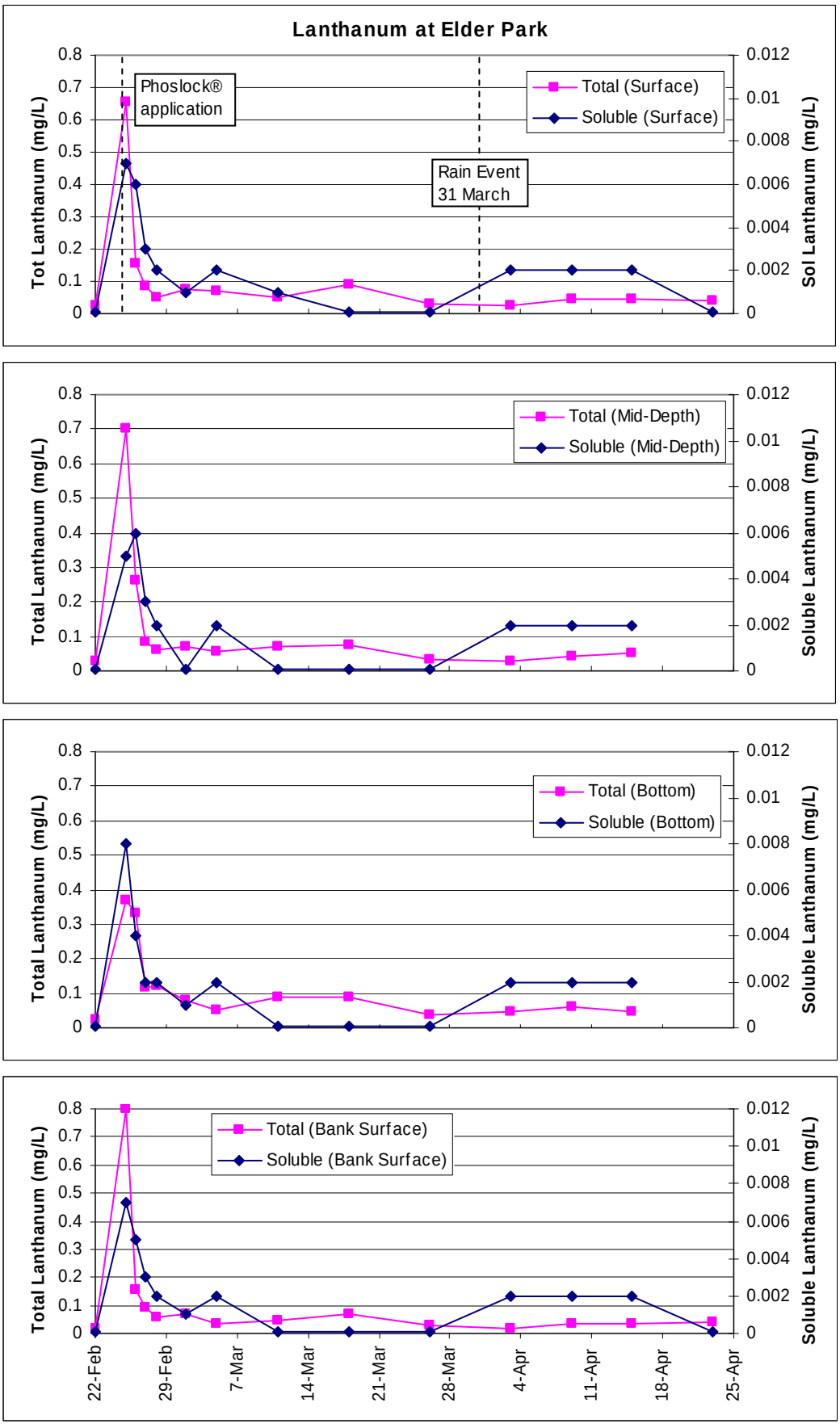


Figure 3. Lanthanum at University Footbridge

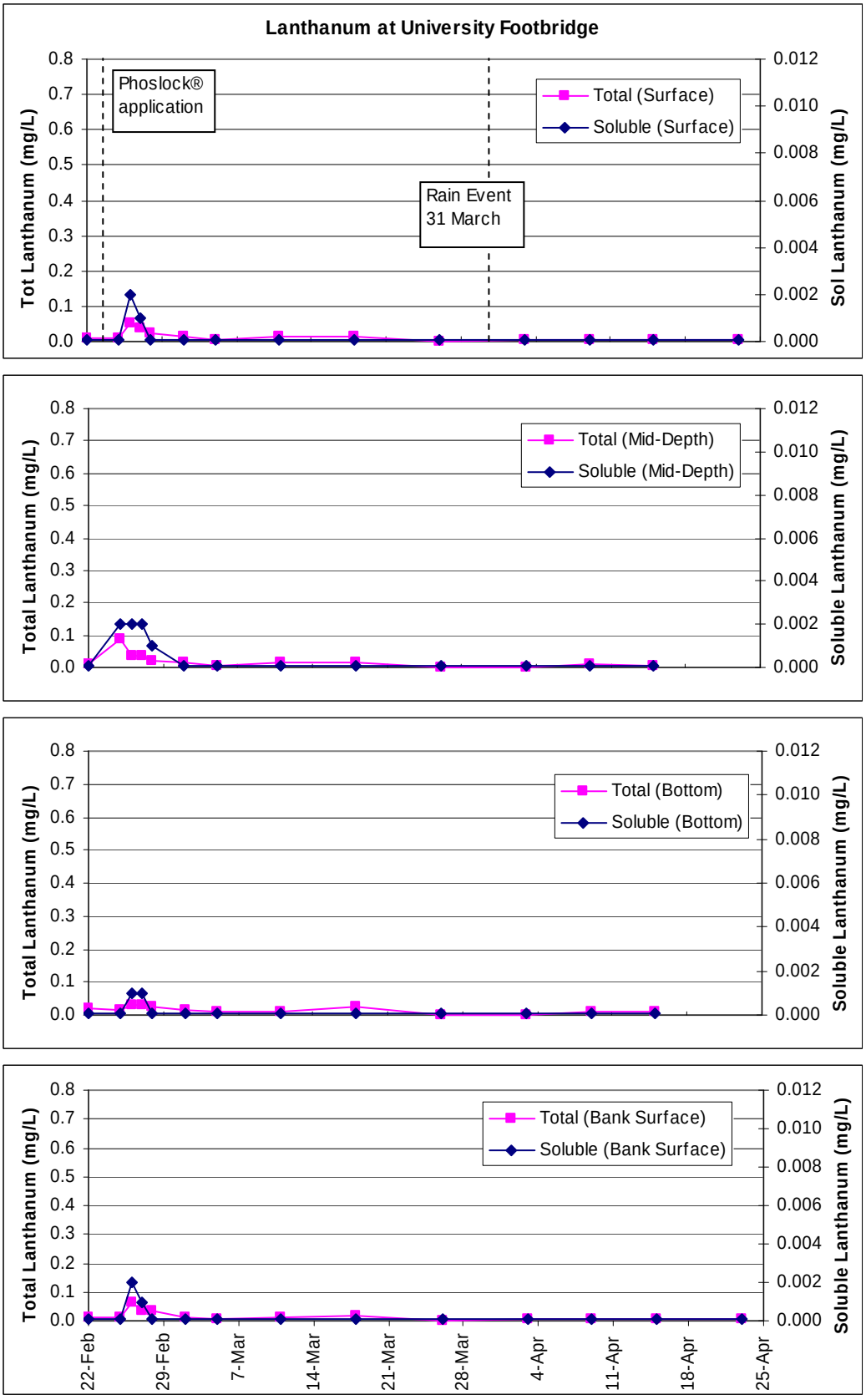


Figure 4. Phosphorus at the City Weir

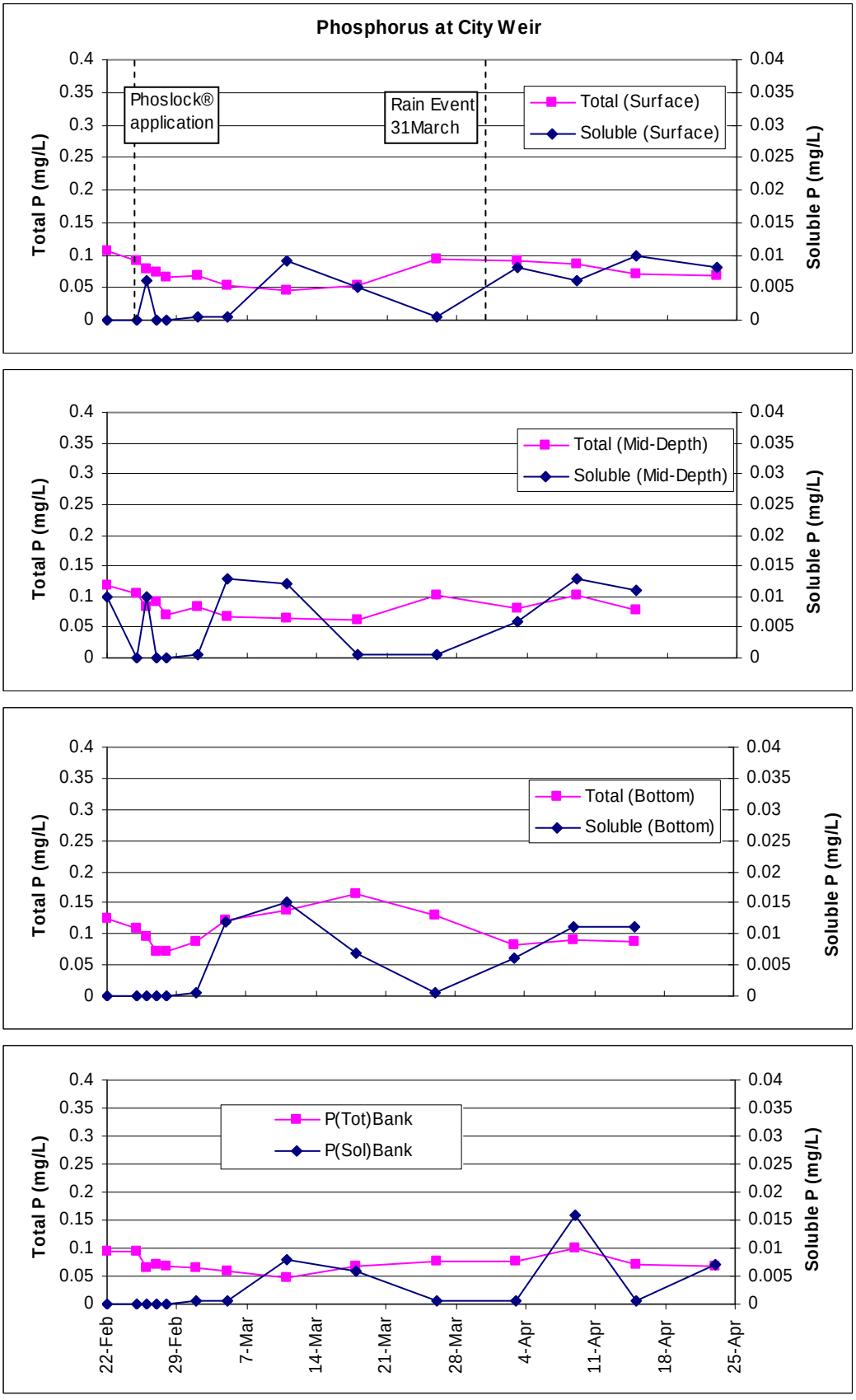


Figure 5. Phosphorus at Elder Park

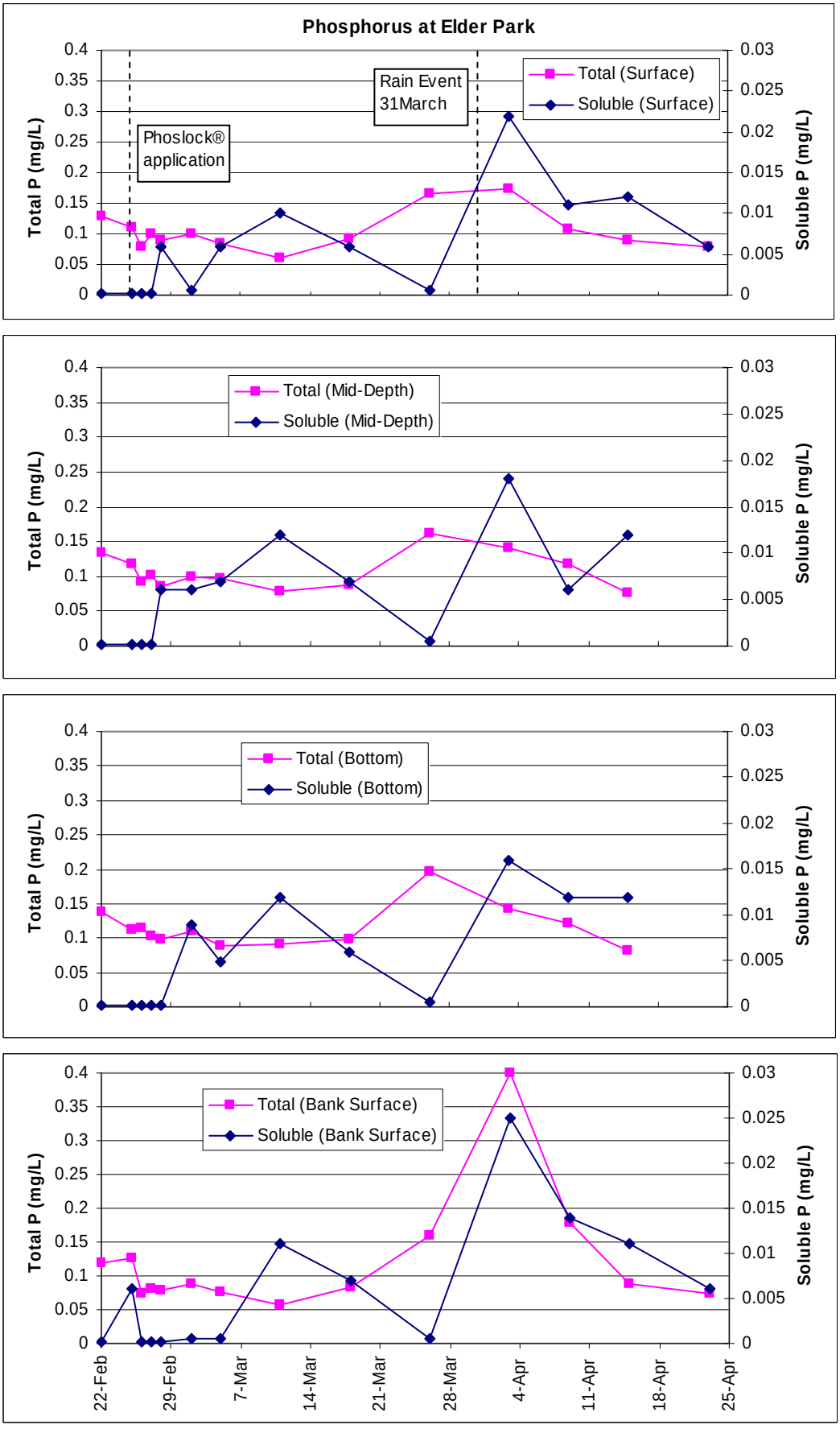


Figure 6 - Phosphorus at University Footbridge

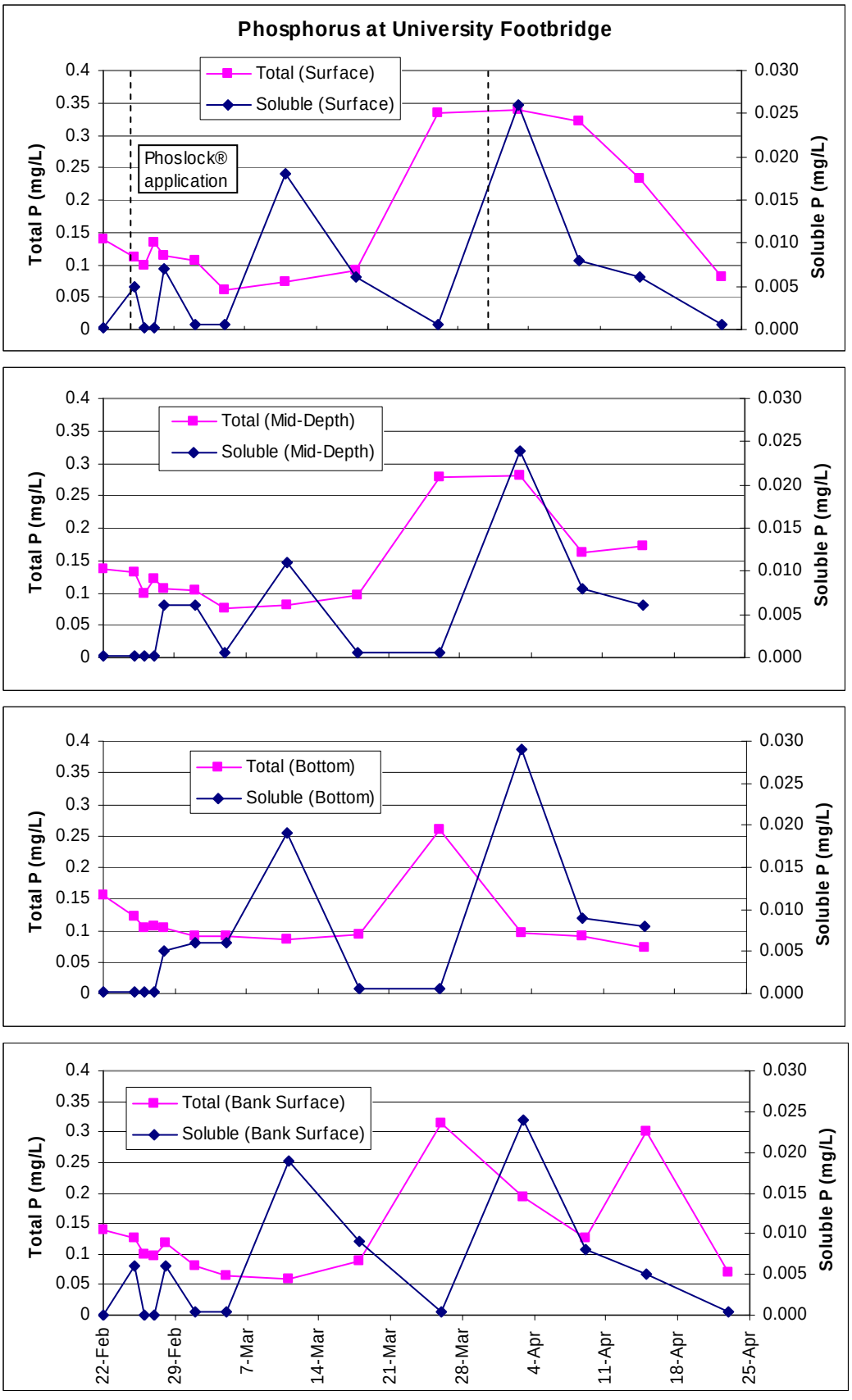


Figure 7 – Turbidity at the City Weir

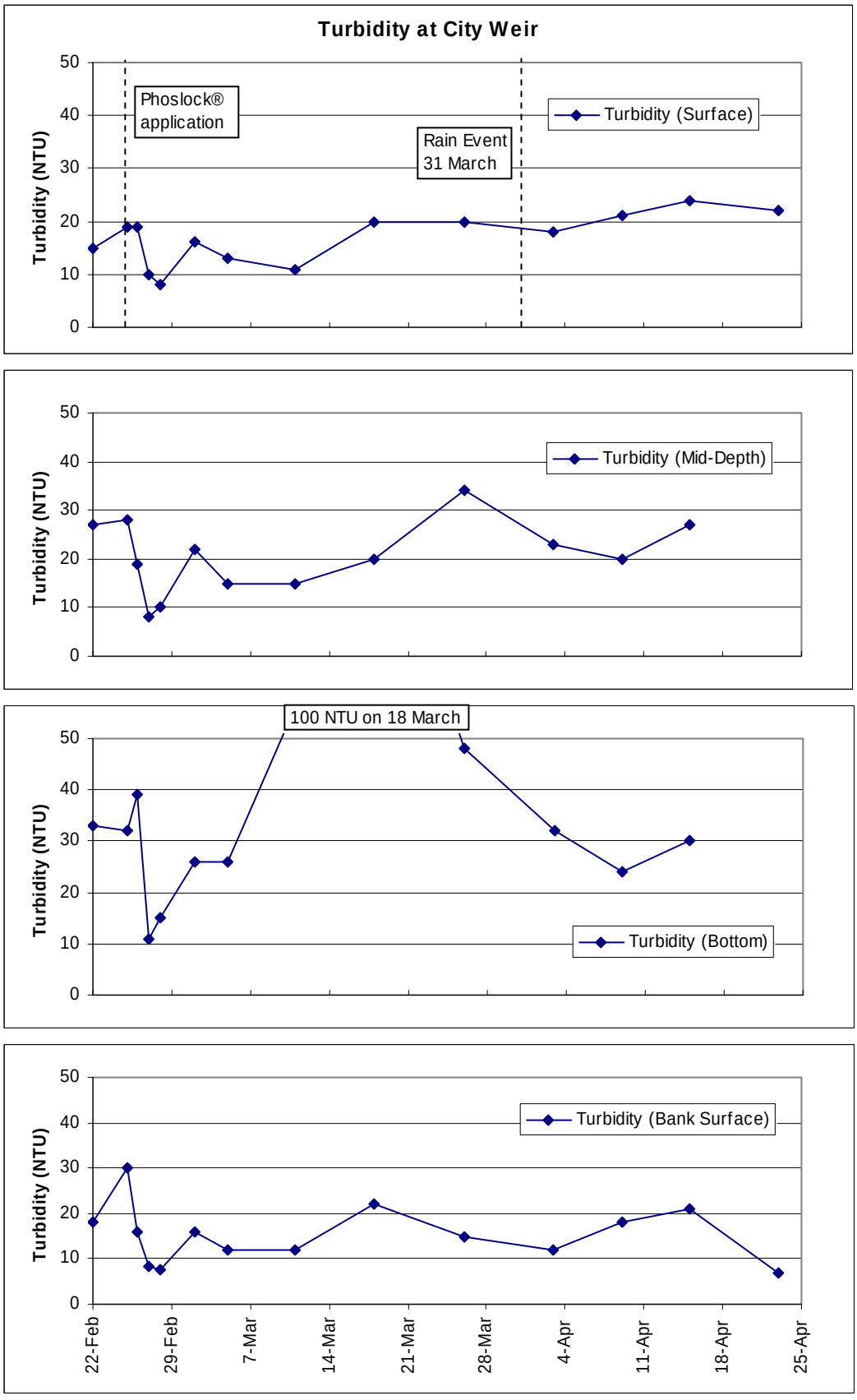


Figure 8 – Turbidity at Elder Park

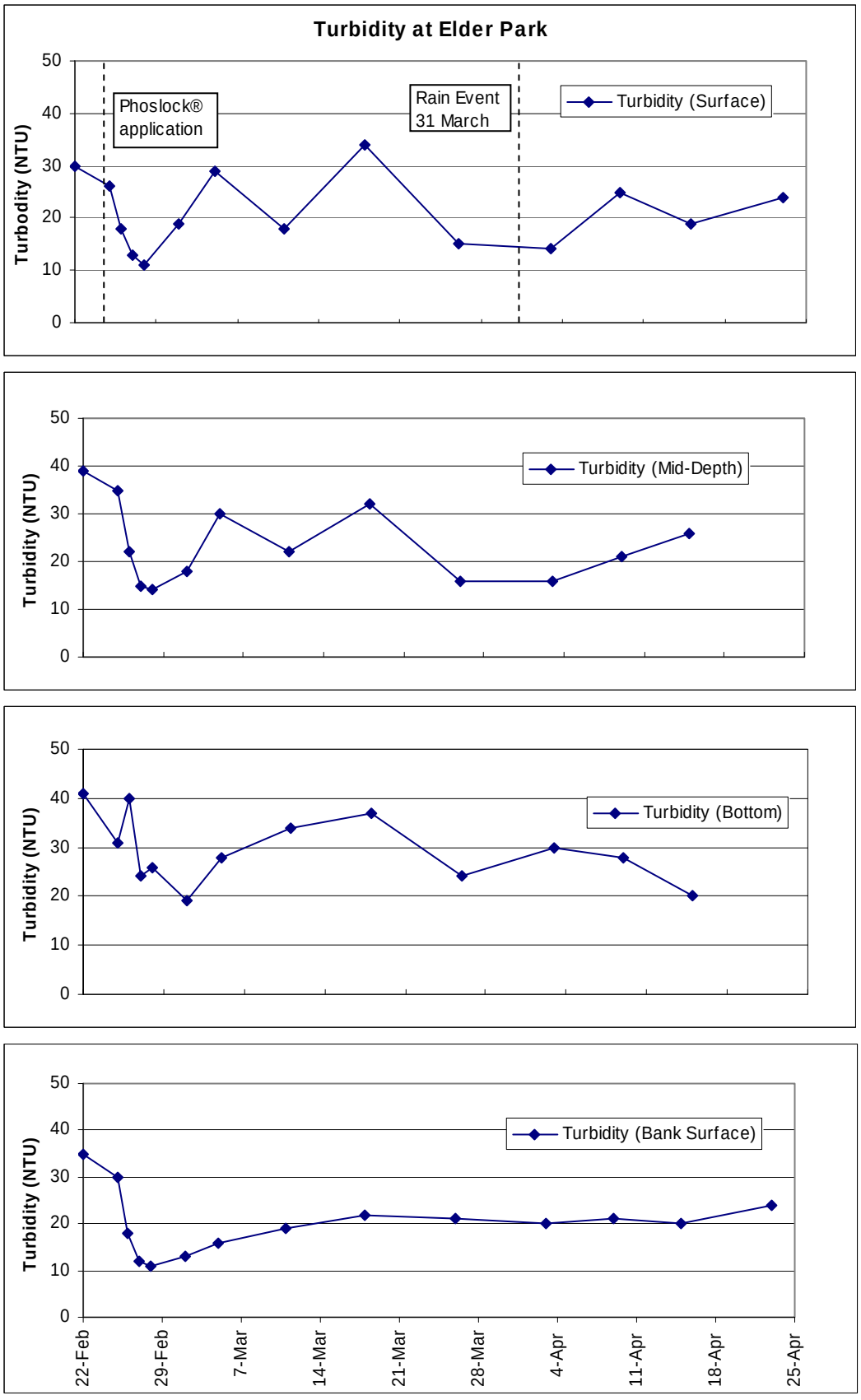


Figure 9 – Turbidity at University Footbridge

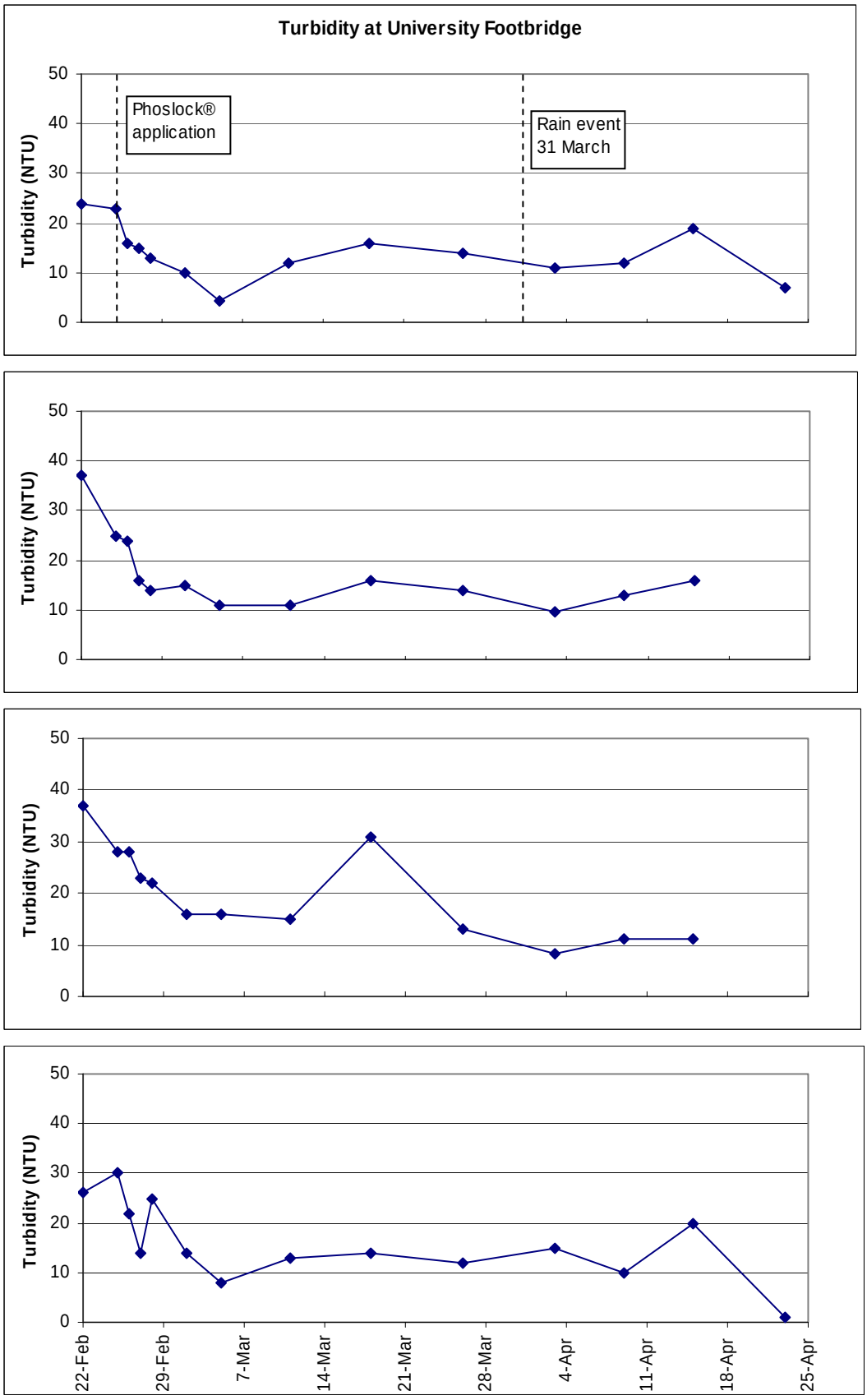


Figure 10 – Conductivity and pH

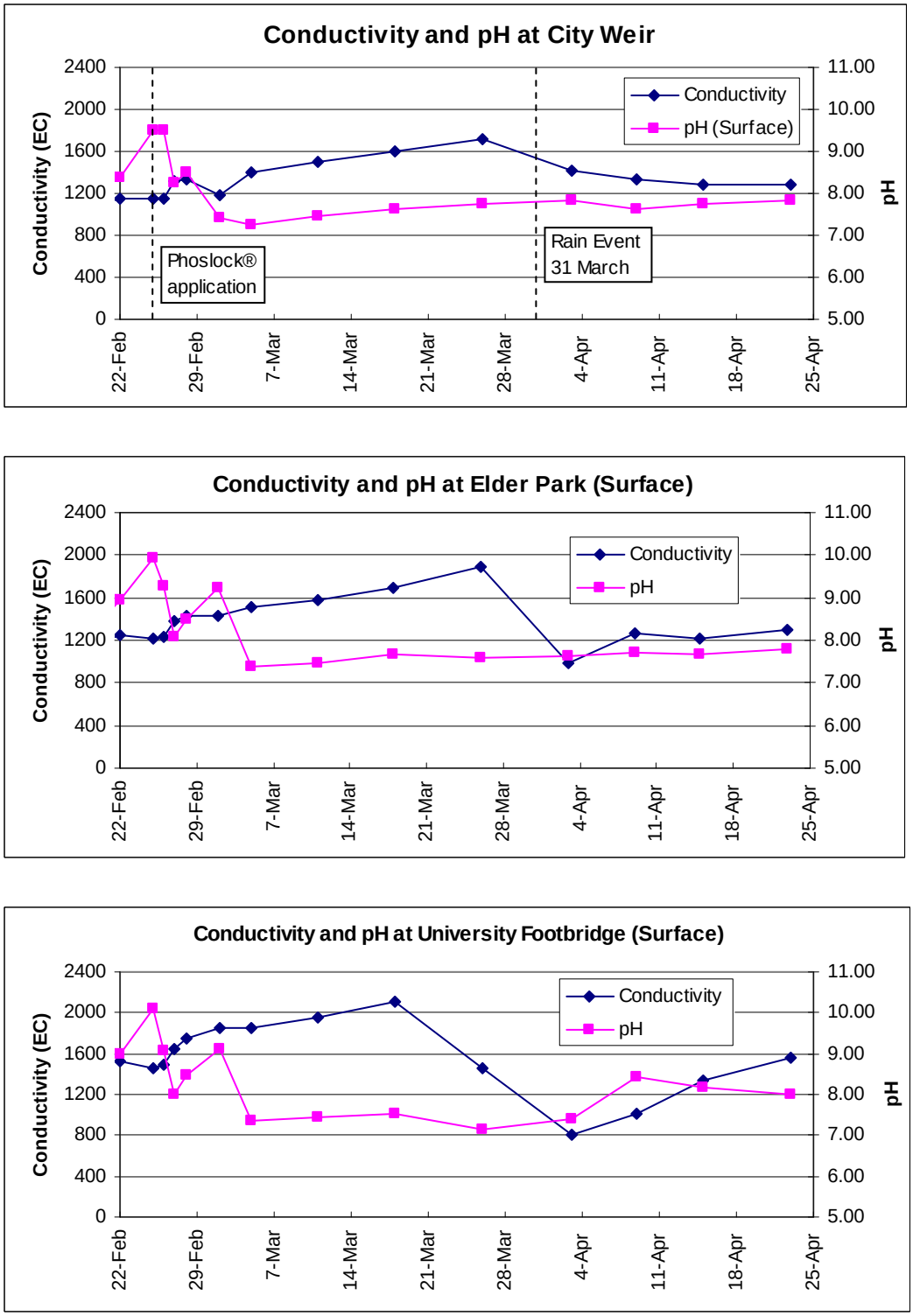
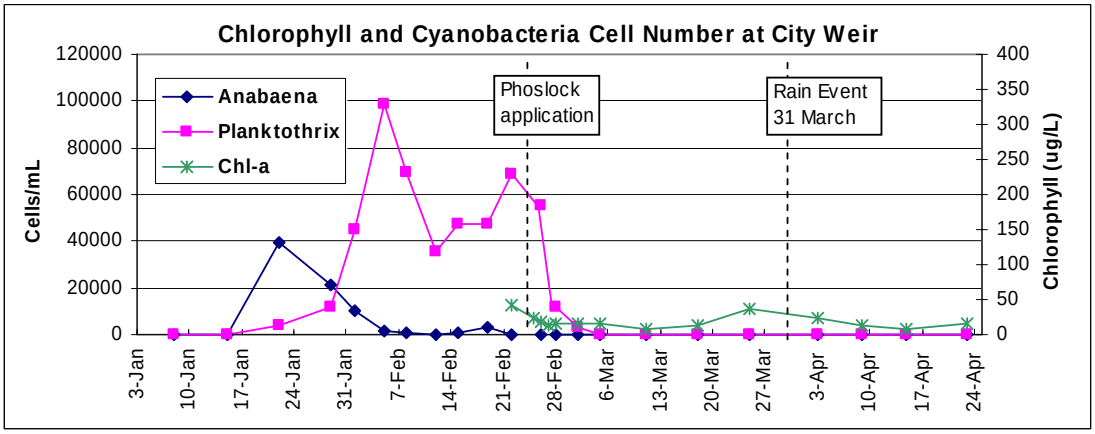
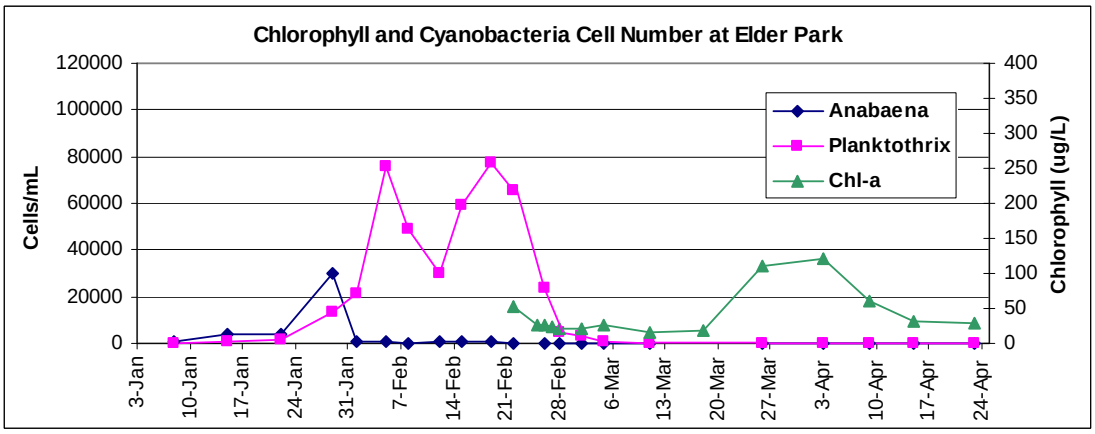


Figure 11 – Algal Counts and Chlorophyll at City Weir, Elder Park and University Footbridge





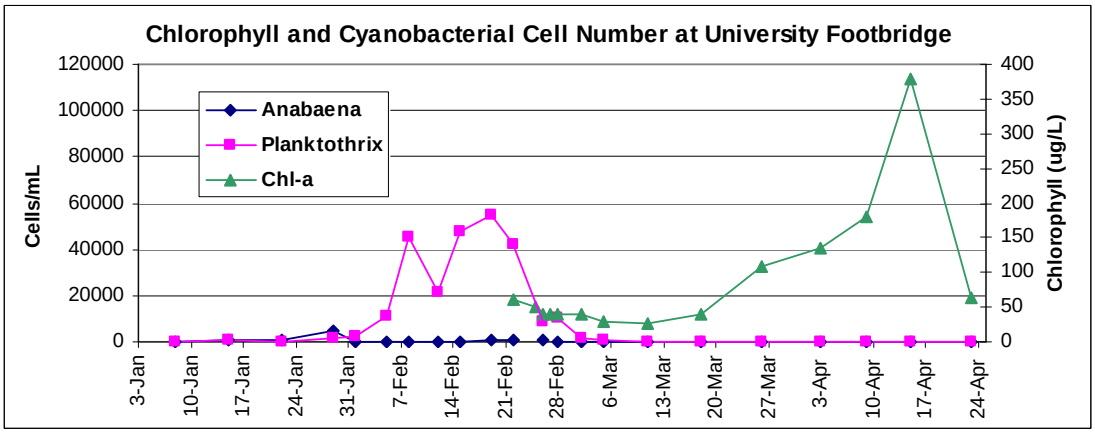


Figure 12 – Algal Counts at Morphett St. Bridge, King William St. Bridge, Frome Rd. Bridge and Hackney Rd. Bridge

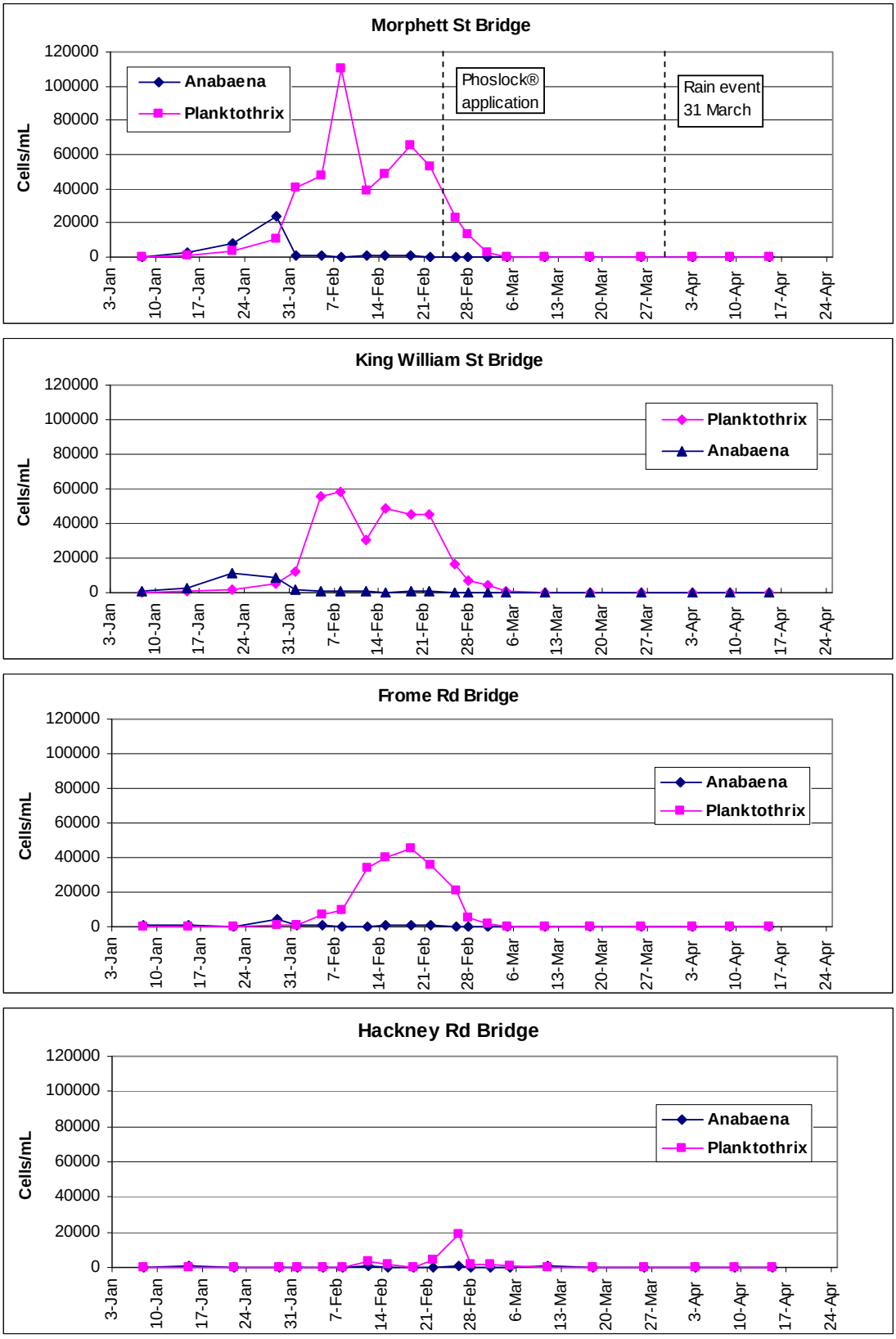
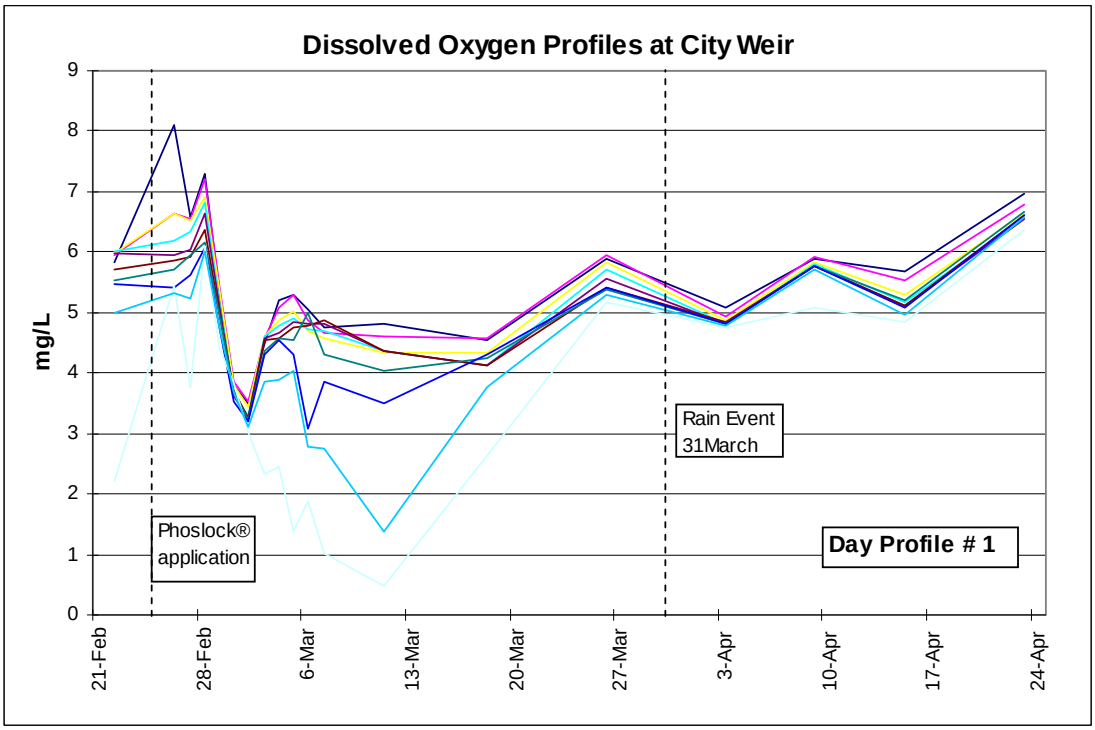


Figure 13 – Dissolved Oxygen profiles at the City Weir



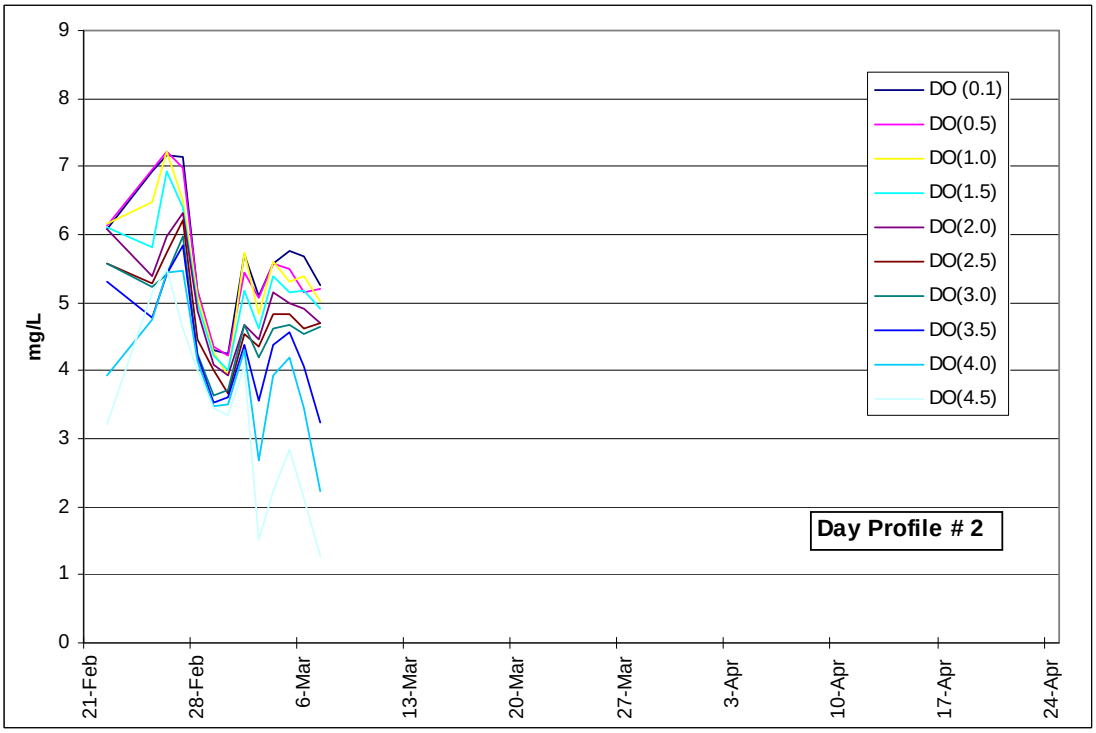
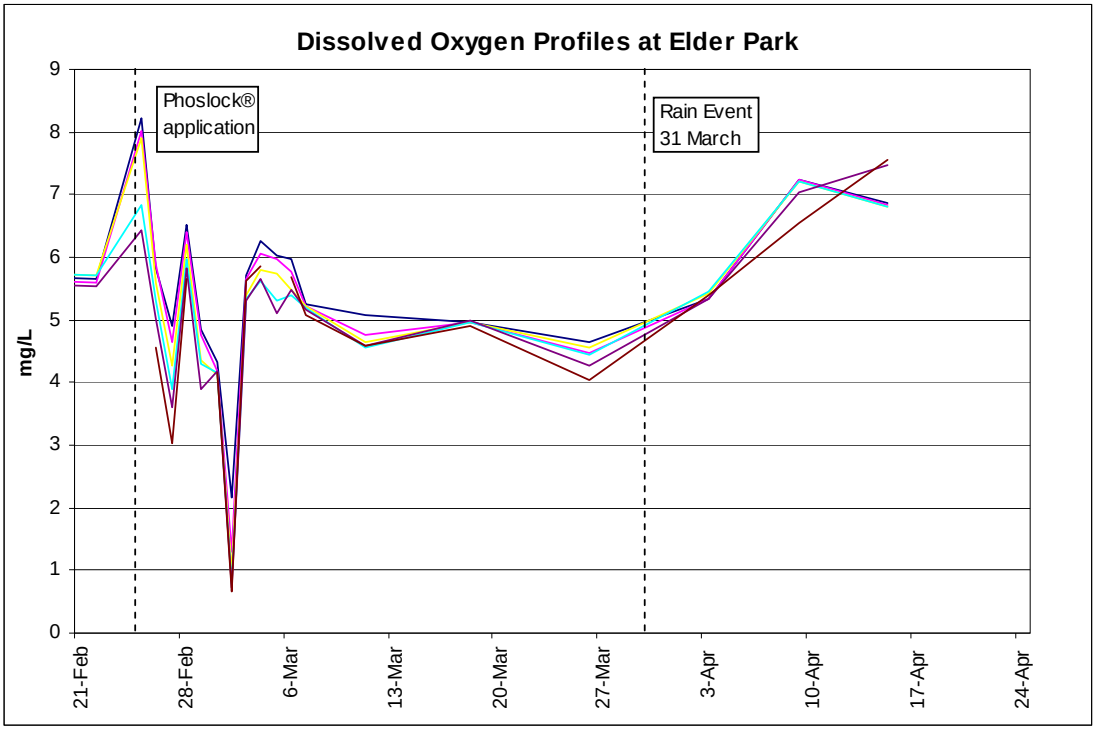


Figure 14 – Dissolved Oxygen Profiles at Elder Park



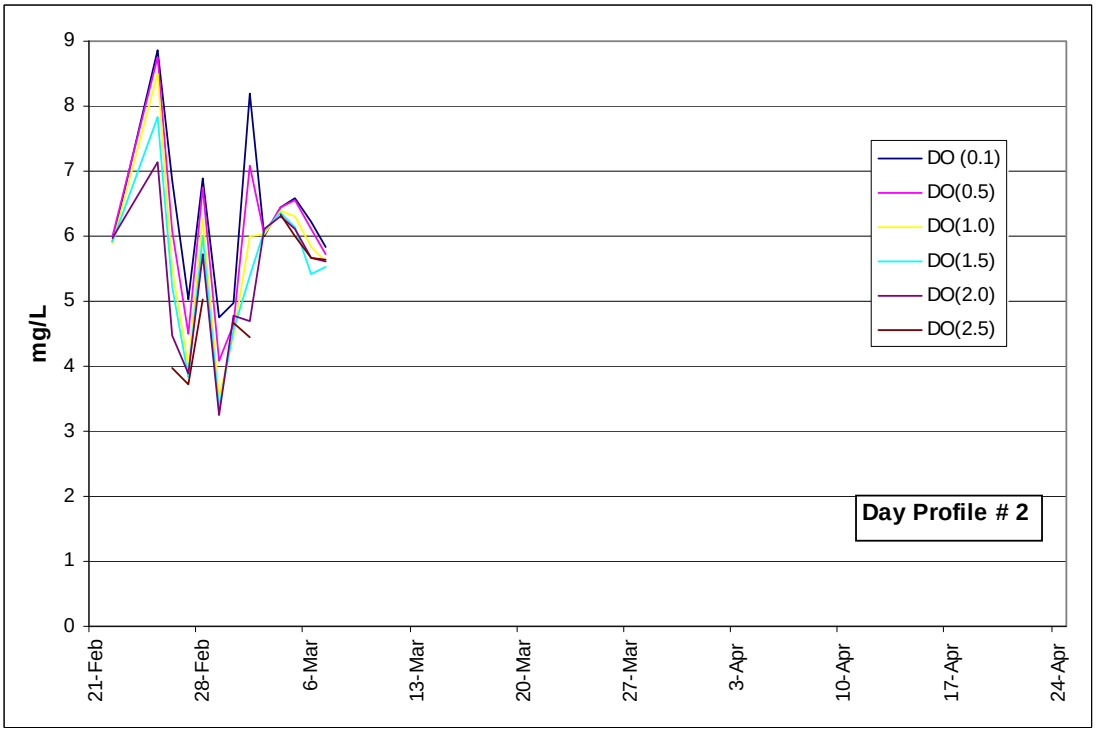
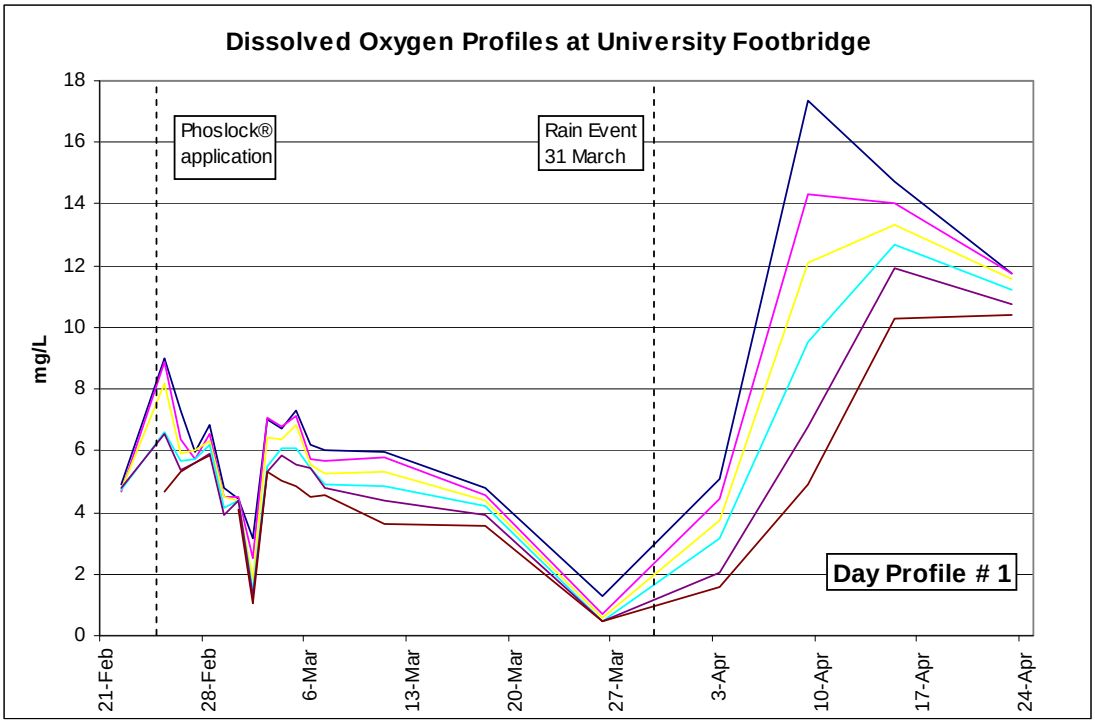


Figure 15 – Dissolved Oxygen profiles at the University Footbridge



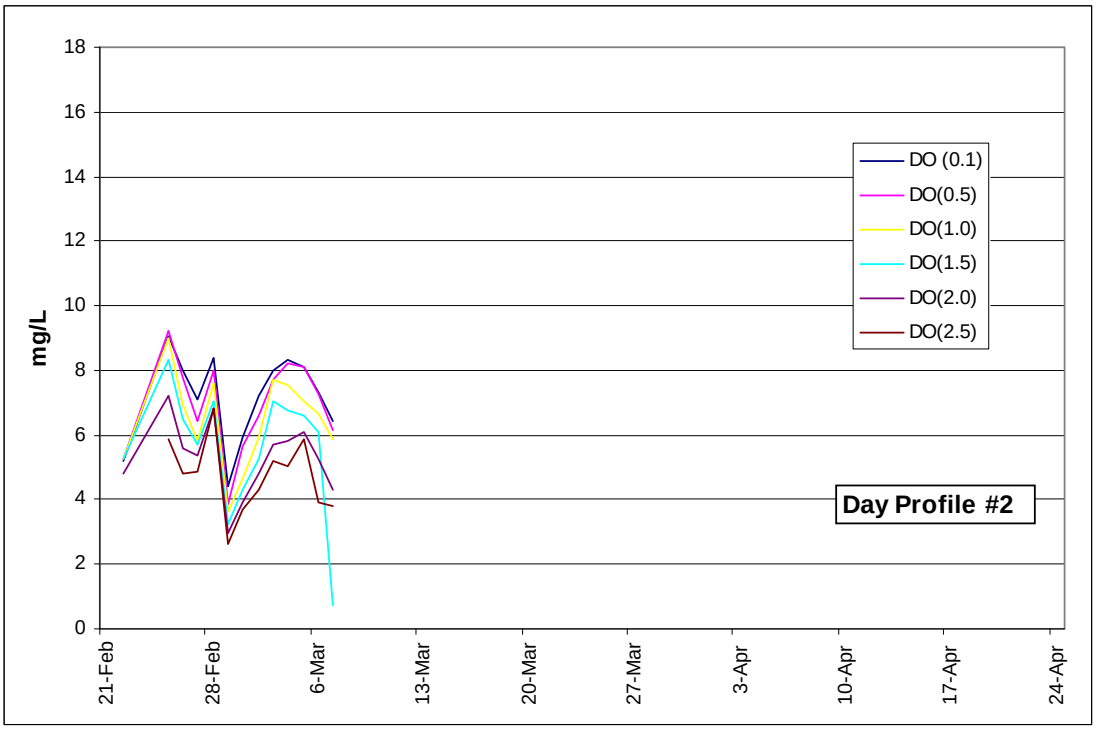


Figure 16 – Oxidation-Reduction Potential profiles at the City Weir

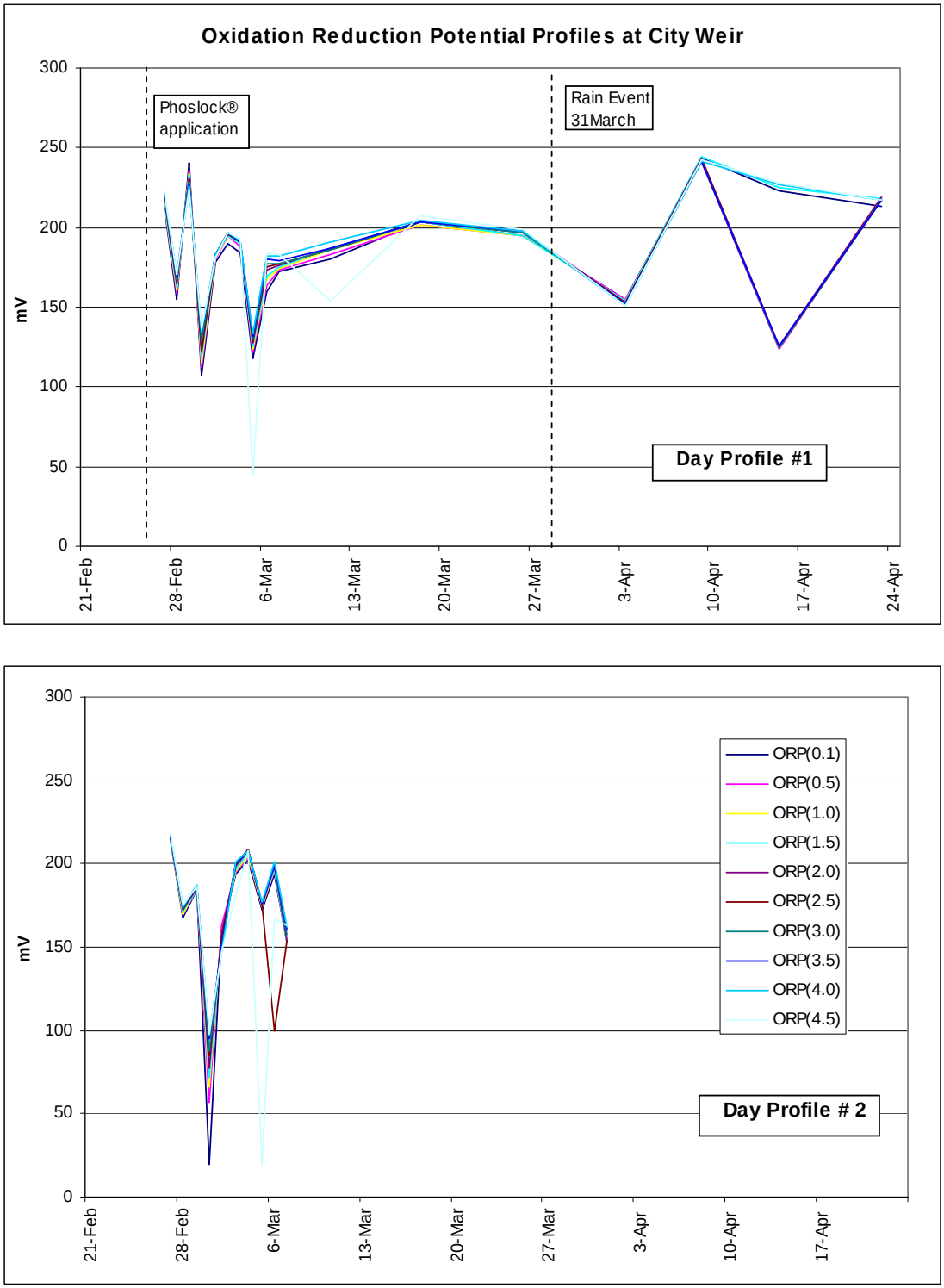
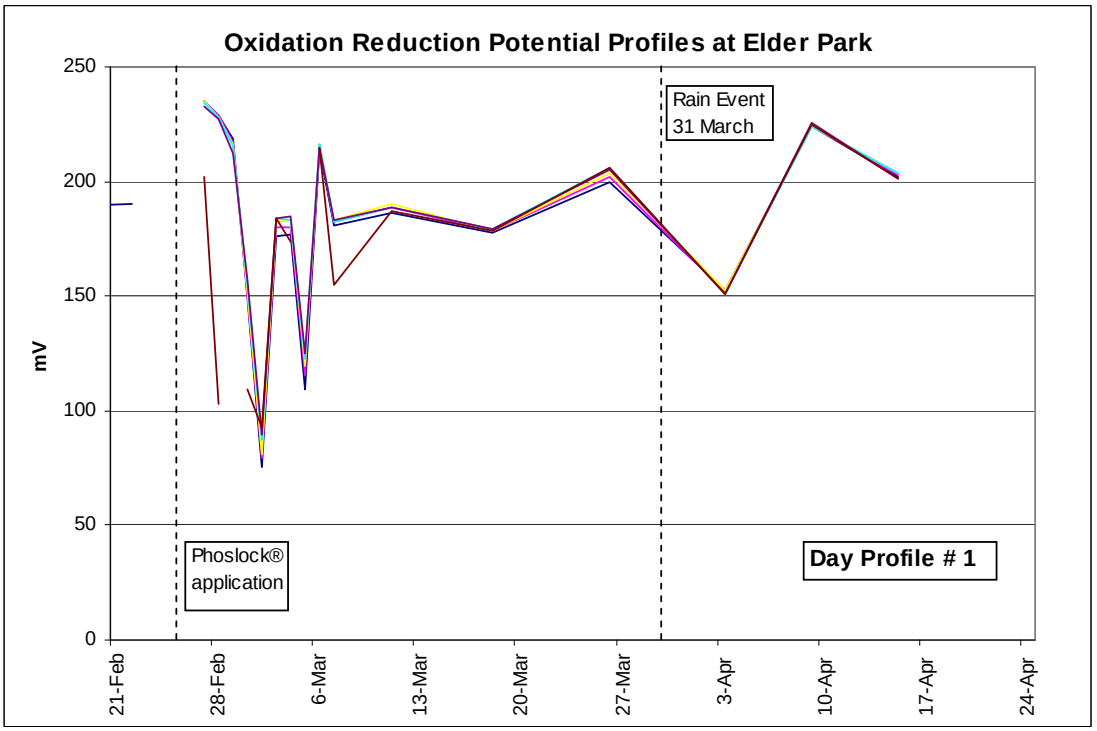


Figure 17 – Oxidation-Reduction Potential profiles at Elder Park



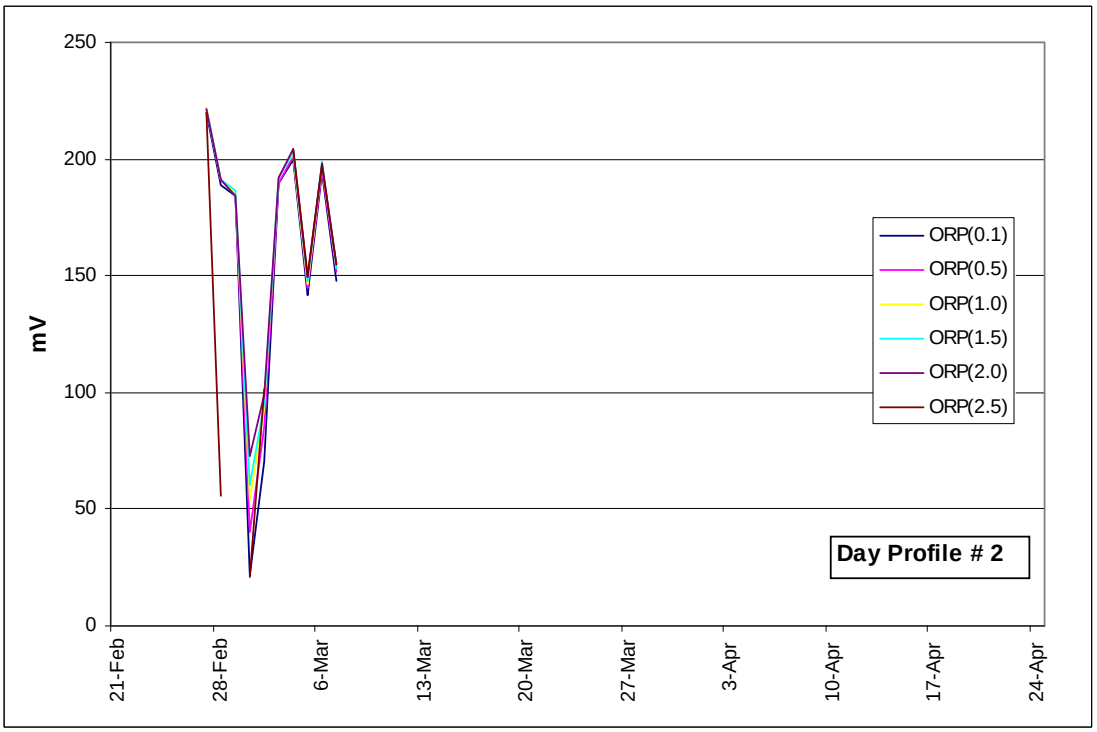


Figure 18 – Oxidation-Reduction Potential profiles at the University Footbridge

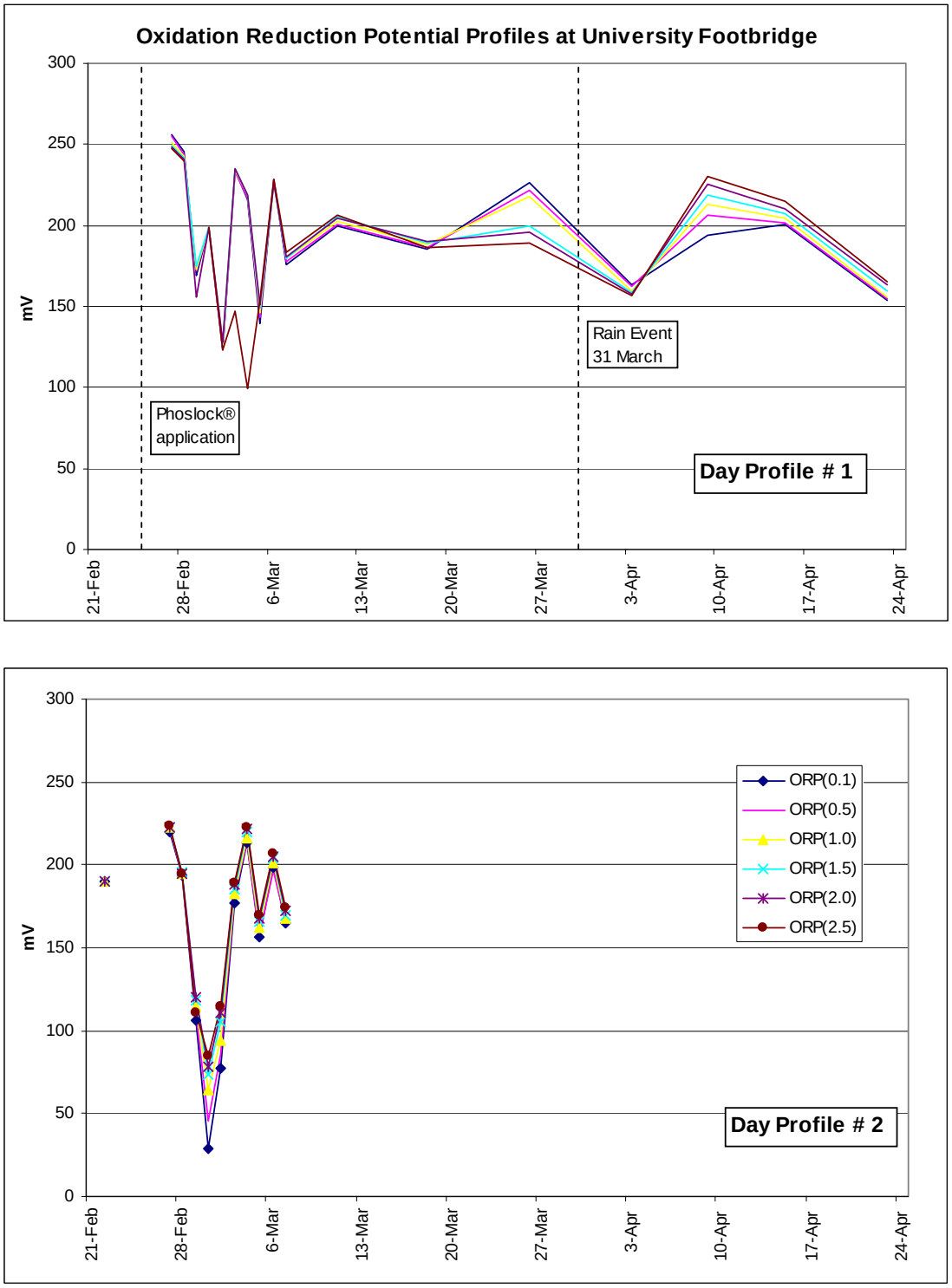
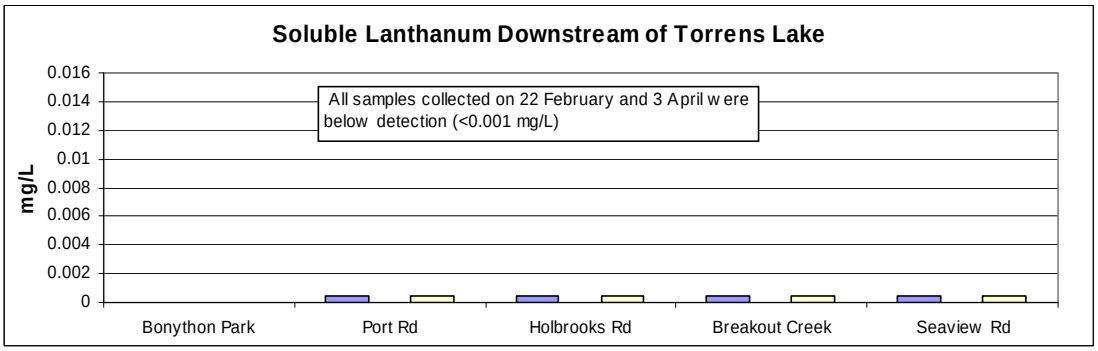
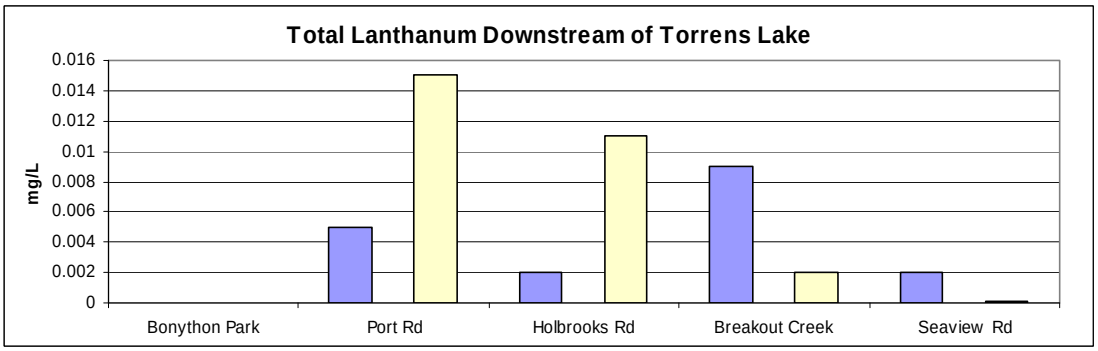
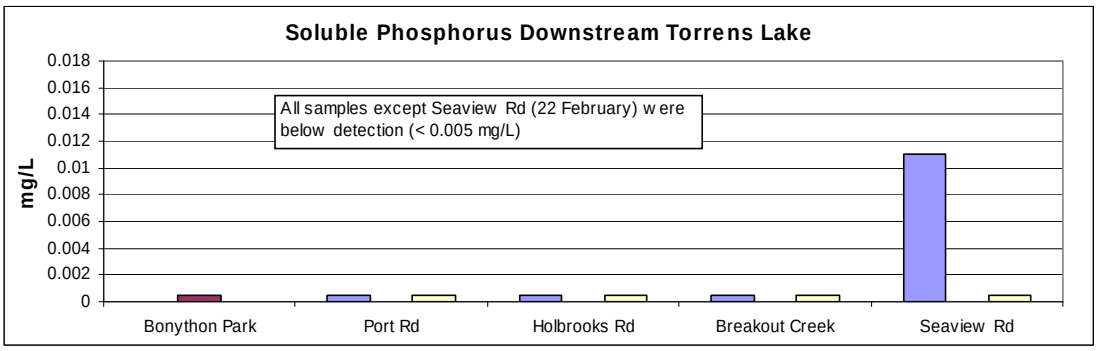


Figure 19 – Lanthanum and Phosphorus Concentrations at River sites downstream of Torrens Lake







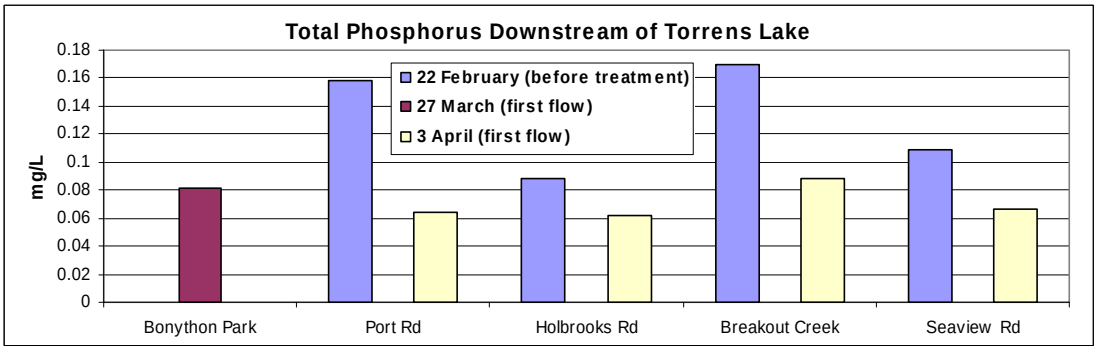


Figure 20 – Macroinvertebrate and zooplankton taxa richness from St Peters (upstream control site), University Footbridge (lake site untreated in 2008) and two treated lake sites, Elder Park and 200m upstream of the City Weir. Sampling dates represent one 'before treatment' and two 'after treatment' surveys.

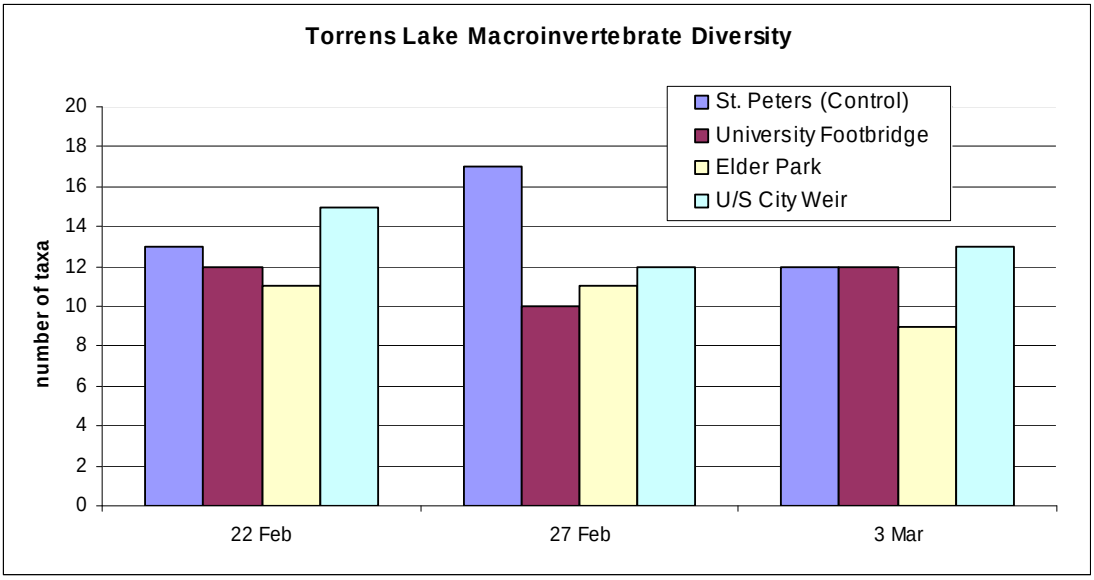


Figure 21 – Lanthanum concentrations in plants (*Typha* sp.) at one upstream site and three lake sites.

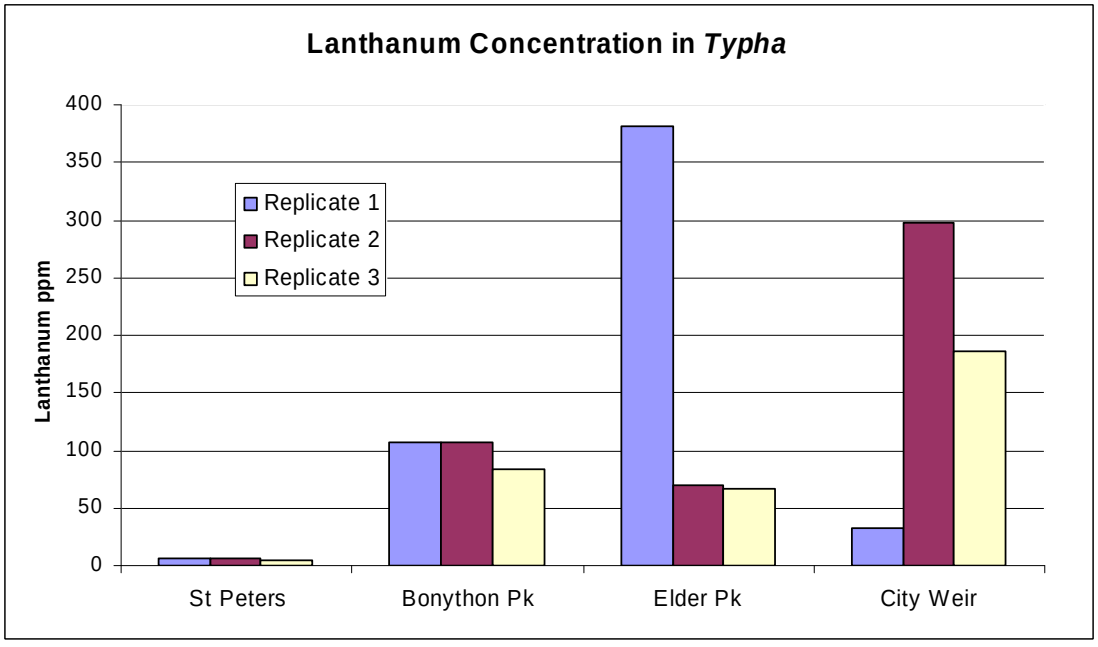


Table 1. Macroinvertebrate and zooplankton (*italics*) communities from upstream control site, lake site untreated in 2008 (UF) and two other Torrens lake sites. Surveys were conducted before and during phoslock application, and also one week post application. Also included are incidental fish collected from each site.

		22/2/08 survey				**27/2/08 survey**				**4/3/08 survey**			
Family	**Species**	Control	UF	PL	Golf	Control	UF	PL	Golf	Control	UF	PL	Golf
Turbellaria		<10											
Glossiphoniidae					<10	<5							
Oligochaeta			<10		<10								
Hydracarina			<10										
Hydrobiidae										<10			
Ancylidae	Ferrissia sp.		<10	<10			<5	<10	<10			<10	<10
Physidae	Physa acuta*					<5							
Ostracoda		<100	<100	<50	<50	<100	<50	<200	<50	<200	<100	<100	<100
Copepoda: Cyclopoida						<20	<10						<100
Cirolanidae	Austroargathona picta				<10								
Aytidae	Paratya australiensis	<100	<50	<100	<100	<20	<100	<300	<100	<20	<100	<100	<200
Parastacidae	Cherax destructor				<10								<10
Hydrophilidae	Hydrophilid larvae	<10						1					
Scirtidae		<10			<10						<10		
Culicidae	Culicine larvae												
Ceratopogonidae					<10	<5							
Stratiomyidae										<10			
Chironomidae	Chironomus sp	<10	<10	<20		<10	<5	<10	<10	<10	<10		<10
Chironomidae	non Chironomus sp	<10	<10	<20	<20	<5		<10	<10		<10	<10	<10

		22/2/08 survey				27/2/08 survey				4/3/08 survey			
Family	**Species**	Control	UF	PL	**Family**	**Species**	Control	UF	PL	**Family**	**Species**	Control	UF
Chironomidae	Chiromonid pupae												
Baetidae	Cloeon sp.	<10	<10	<10				<5	<10	<20	<10	<10	<20
Caenidae									<5				
Hydrometridae	Hydrometra sp.					1							<10
Veliidae	Microvelia sp.					<5				<10			
Corixidae	Agraptocorixa sp.	<10				<20				<10			
Corixidae	Micronecta sp.	<200	<150	<150	<10	<200	<200	<100	<100	<100	<200	<200	<200
Nepidae	Ranatra sp.	<10				1					<10		
Notonectidae	Enithares sp.					<5	<10			<10	<10		
Notonectidae	Anisops sp.		<10	<10	<10		<20	<20	<10		<100	<10	<10
Notonectidae						<5							
Coenagrionidae		<10	<10	<20	<10	<20	<20	<20	<10	<10	<10	<10	<10
Anisoptera													
Ecnomidae	Ecnomus sp.				<10								
Leptoceridae	Oecetis sp.				<10				<5				
Leptoceridae	Triplectides sp.	<10	<10	<10	<10	<20	<20	<10	<10	<20	<10	<10	<20
TOTAL TAXA		**13**	**12**	**10**	**15**	**17**	**10**	**11**	**12**	**12**	**12**	**9**	**13**
Fish													
Poeciliidae	Gambusia sp. *	<10	<10	<20	<20	<10	<50	<20	<10	<10	<100	<20	<100
Eleotridae	Philypnodon grandiceps					1							
Eleotridae	Hypseleotris sp.			<10			1	<5					<10
Pseudomugilidae	Melanotaenia fluviatilis				<10								

* denotes introduced species.

Table 2. Chemical and Physical Data

Date	Parameter	City Weir (surface)	City Weir (middle)	City Weir (bottom)	City Weir (bank)	Elder Pk (surface)	Elder Pk middle	Elder Pk bottom	Elder Pk (bank)	University F/B (surface)	University F/B (middle)	University F/B (bottom)	University F/B (bank)
15/02/08	Soluble Lanthanum (mg/L)												
	Total Lanthanum (mg/L)												
	Filterable Reactive Phosphorus (mg/L)	<0.005				0.006							
	Total Phosphorus (mg/L)	0.11				0.14							
	Turbidity (NTU)												
19/02/08	Soluble Lanthanum (mg/L)												
	Total Lanthanum (mg/L)												
	Filterable Reactive Phosphorus (mg/L)	<0.005				<0.005							
	Total Phosphorus (mg/L)	0.09				0.125							
	Turbidity (NTU)												
22/02/08	Soluble Lanthanum (mg/L)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	Total Lanthanum (mg/L)	0.014	0.015	0.017	0.01	0.025	0.028	0./024	0.02	0.01	0.012	0.02	0.013
	Filterable Reactive Phosphorus (mg/L)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	Total Phosphorus	0.106	0.118	0.125	0.095	0.128	0.135	0.137	0.12	0.138	0.137	0.155	0.14

	(mg/L)												
	Turbidity (NTU)	15	27	33	18	30	39	41	35	24	37	37	26
Date	**Parameter**	**City Weir (surface)**	**City Weir (middle)**	**City Weir (bottom)**	**City Weir (bank)**	**Elder Pk (surface)**	**Elder Pk middle**	**Elder Pk bottom**	**Elder Pk (bank)**	**University F/B (surface)**	**University F/B (middle)**	**University F/B (bottom)**	**University F/B (bank)**
25/02/08	Soluble Lanthanum (mg/L)	0.01	0.012	0.004	0.004	0.007	0.005	0.008	0.007	<0.001	0.002	<0.001	<0.001
	Total Lanthanum (mg/L)	0.267	0.287	0.133	1.12	0.654	0.7	0.37	0.8	0.011	0.086	0.015	0.012
	Filterable Reactive Phosphorus (mg/L)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.006	0.005	<0.005	<0.005	0.006
	Total Phosphorus (mg/L)	0.09	0.106	0.108	0.094	0.11	0.117	0.113	0.127	0.111	0.132	0.121	0.126
	Turbidity (NTU)	19	28	32	30	26	35	31	30	23	25	28	30
26/02/08	Soluble Lanthanum (mg/L)	0.006	0.006	0.005	0.006	0.006	0.006	0.004	0.005	0.002	0.002	0.001	0.002
	Total Lanthanum (mg/L)	0.147	0.139	0.293	0.206	0.154	0.263	0.331	0.158	0.052	0.037	0.028	0.061
	Filterable Reactive Phosphorus (mg/L)	0.006	0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	Total Phosphorus (mg/L)	0.079	0.082	0.096	0.066	0.08	0.092	0.114	0.075	0.099	0.100	0.105	0.098
	Turbidity (NTU)	19	19	39	16	18	22	40	18	16	24	28	22
27/02/08	Soluble Lanthanum (mg/L)	0.003	0.003	0.004	0.003	0.003	0.003	0.002	0.003	0.001	0.002	0.001	0.001
	Total Lanthanum (mg/L)	0.064	0.073	0.089	0.059	0.087	0.086	0.115	0.09	0.036	0.036	0.032	0.034
	Filterable Reactive Phosphorus (mg/L)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	Total Phosphorus (mg/L)	0.073	0.092	0.072	0.071	0.101	0.102	0.102	0.082	0.133	0.122	0.106	0.097
	Turbidity (NTU)	10	8.2	11	8.2	13	15	24	12	15	16	23	14
28/02/08	Soluble Lanthanum (mg/L)	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	<0.001	0.001	<0.001	<0.001

	Total Lanthanum (mg/L)	0.036	0.038	0.055	0.028	0.048	0.062	0.123	0.056	0.022	0.023	0.024	0.032
Date	**Parameter**	**City Weir (surface)**	**City Weir (middle)**	**City Weir (bottom)**	**City Weir (bank)**	**Elder Pk (surface)**	**Elder Pk middle**	**Elder Pk bottom**	**Elder Pk (bank)**	**University F/B (surface)**	**University F/B (middle)**	**University F/B (bottom)**	**University F/B (bank)**
	Filterable Reactive Phosphorus (mg/L)	<0.005	<0.005	<0.005	<0.005	0.006	0.006	<0.005	<0.005	0.007	0.006	0.005	0.006
	Total Phosphorus (mg/L)	0.065	0.07	0.071	0.069	0.09	0.086	0.099	0.079	0.113	0.106	0.105	0.117
	Turbidity (NTU)	8.1	10	15	7.7	11	14	26	11	13	14	22	25
2/03/08	Soluble Lanthanum (mg/L)	0.001	0.001	<0.001	<0.001	0.001	<0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001
	Total Lanthanum (mg/L)	0.047	0.052	0.054	0.04	0.074	0.069	0.078	0.067	0.014	0.0168	0.016	0.011
	Filterable Reactive Phosphorus (mg/L)	<0.005	<0.005	<0.005	<0.005	<0.005	0.006	0.009	<0.005	<0.005	0.006	0.006	<0.005
	Total Phosphorus (mg/L)	0.069	0.084	0.087	0.066	0.099	0.099	0.11	0.088	0.107	0.103	0.091	0.081
	Turbidity (NTU)	16	22	26	16	19	18	19	13	9.8	15	16	14
5/03/08	Soluble Lanthanum (mg/L)	0.001	0.002	0.001	0.002	0.002	0.002	0.002	0.002	<0.001	<0.001	<0.001	<0.001
	Total Lanthanum (mg/L)	0.023	0.023	0.042	0.019	0.07	0.055	0.053	0.034	0.007	0.005	0.01	0.005
	Filterable Reactive Phosphorus (mg/L)	<0.005	0.013	0.012	<0.005	0.006	0.007	0.005	<0.005	<0.005	<0.005	0.0060.061	0.076
	Total Phosphorus (mg/L)	0.054	0.068	0.123	0.06	0.084	0.097	0.088	0.077	0.061	0.076	0.091	0.064
	Turbidity (NTU)	13	15	26	12	29	30	28	16	4.3	11	16	8
11/03/08	Soluble Lanthanum (mg/L)	<0.001	0.001	<0.001	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	Total Lanthanum (mg/L)	0.024	0.029	0.092	0.027	0.048	0.071	0.091	0.044	0.012	0.013	0.012	0.009
	Filterable Reactive Phosphorus (mg/L)	0.009	0.012	0.015	0.008	0.01	0.012	0.012	0.011	0.018	0.011	0.019	0.019

	Total Phosphorus (mg/L)	0.045	0.065	0.138	0.047	0.061	0.079	0.092	0.058	0.074	0.081	0.087	0.058
	Turbidity (NTU)	11	15	56	12	18	22	34	19	12	11	15	13
Date	**Parameter**	**City Weir (surface)**	**City Weir (middle)**	**City Weir (bottom)**	**City Weir (bank)**	**Elder Pk (surface)**	**Elder Pk middle**	**Elder Pk bottom**	**Elder Pk (bank)**	**University F/B (surface)**	**University F/B (middle)**	**University F/B (bottom)**	**University F/B (bank)**
18/03/08	Soluble Lanthanum (mg/L)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	Total Lanthanum (mg/L)	0.05	0.051	0.184	0.054	0.088	0.077	0.09	0.068	0.016	0.013	0.027	0.017
	Filterable Reactive Phosphorus (mg/L)	0.005	<0.005	0.007	0.006	0.006	0.007	0.006	0.007	0.006	<0.005	<0.005	0.009
	Total Phosphorus (mg/L)	0.053	0.062	0.165	0.068	0.092	0.087	0.099	0.083	0.09	0.096	0.093	0.089
	Turbidity (NTU)	20	20	100	22	34	32	37	22	16	16	31	14
26/03/08	Soluble Lanthanum (mg/L)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	Total Lanthanum (mg/L)	0.042	0.06	0.079	0.041	0.03	0.034	0.037	0.03	<0.001	<0.001	0.001	<0.001
	Filterable Reactive Phosphorus (mg/L)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
	Total Phosphorus (mg/L)	0.093	0.101	0.13	0.077	0.166	90.161	0.196	0.159	0.334	0.278	0.259	0.313
	Turbidity (NTU)	20	34	48	15	15	16	24	21	14	14	13	12
3/04/08	Soluble Lanthanum (mg/L)	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	<0.001	<0.001	<0.001	<0.001
	Total Lanthanum (mg/L)	0.031	0.042	0.056	0.022	0.023	0.028	0.045	0.018	0.003	0.002	0.001	0.006
	Filterable Reactive Phosphorus (mg/L)	0.008	0.006	0.006	<0.005	0.022	0.01`8	0.016	0.025	0.026	0.024	0.029	0.024
	Total Phosphorus (mg/L)	0.091	0.08	0.083	0.076	0.173	0.142	0.143	0.4	0.34	0.28	0.096	0.194
	Turbidity (NTU)	18	23	32	12	14	16	30	20	11	10	8.3	15
9/04/08	Soluble Lanthanum (mg/L)	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	<0.001	<0.001	<0.001	<0.001

	Total Lanthanum (mg/L)	0.039	0.04	0.038	0.034	0.047	0.044	0.06	0.034	0.004	0.008	0.009	0.005
Date	**Parameter**	**City Weir (surface)**	**City Weir (middle)**	**City Weir (bottom)**	**City Weir (bank)**	**Elder Pk (surface)**	**Elder Pk middle**	**Elder Pk bottom**	**Elder Pk (bank)**	**University F/B (surface)**	**University F/B (middle)**	**University F/B (bottom)**	**University F/B (bank)**
	Filterable Reactive Phosphorus (mg/L)	0.006	0.013	0.011	0.016	0.011	0.006	0.012	0.014	0.008	0.008	0.009	0.008
	Total Phosphorus (mg/L)	0.085	0.102	0.09	0.099	0.108	0.119	0.121	0.179	0.322	0.163	0.092	0.127
	Turbidity (NTU)	21	20	24	18	25	21	28	21	12	13	11	10
15/04/08	Soluble Lanthanum (mg/L)	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	<0.001	<0.001	<0.001	<0.001
	Total Lanthanum (mg/L)	0.045	0.05	0.064	0.045	0.046	0.052	0.049	0.035	0.007	0.007	0.009	0.007
	Filterable Reactive Phosphorus (mg/L)	0.01	0.011	0.011	<0.005	0.012	0.012	0.012	0.011	0.006	0.006	0.008	0.005
	Total Phosphorus (mg/L)	0.072	0.077	0.088	0.07	0.089	0.076	0.082	0.087	0.234	0.173	0.073	0.300
	Turbidity (NTU)	24	27	30	21	19	26	20	20	19	16	11	20
23/04/08	Soluble Lanthanum (mg/L)	0.001			0.001	<0.001			<0.001	<0.001			<0.001
	Total Lanthanum (mg/L)	0.038			0.038	0.042			0.041	0.007			0.006
	Filterable Reactive Phosphorus (mg/L)	0.008			0.007	0.006			0.006	<0.005			<0.005
	Total Phosphorus (mg/L)	0.068			0.069	0.079			0.075	0.082			0.070
	Turbidity (NTU)	22			6.8	24			24	6.9			0.9

Table 3. Algal Counts and Chlorophyll Data

Date	Parameter	City Weir	Morphett St Bridge	Elder Park	King William St Bridge	University footbridge	Frome Rd Bridge	Hackney Rd Bridge
8/01/08	*Anabaena circinalis*	125	242	402	805	250	625	259
	Microcystis aeruginosa	13	0	0	0	125	90	0
	Microcystis flos-aquae	44	275	630	155	170	540	33
	Planktothrix mougeotia	35	41	31	32	38	13	14
15/01/08	*Anabaena circinalis*	266	2600	3670	2350	1010	525	595
	Microcystis aeruginosa	0	0	160	92	60	580	530
	Microcystis flos-aquae	80	236	460	332	434	1350	350
	Planktothrix mougeotia	81	1270	929	640	540	320	36
22/01/08	*Anabaena circinalis*	39300	7680	4170	11200	874	110	0
	Microcystis aeruginosa	741	400	550	360	267	30	0
	Microcystis flos-aquae	1750	960	970	440	233	70	0
	Planktothrix mougeotia	3680	3190	1590	1490	92	28	28
29/01/08	*Anabaena circinalis*	21600	23400	30000	8900	5040	4150	104
	Microcystis aeruginosa	0	480	0	0	440	1600	0
	Microcystis flos-aquae	482	9140	2490	7920	700	2200	0
	Planktothrix mougeotia	11500	11000	13600	5490	1750	1040	0
1/02/08	*Anabaena circinalis*	10000	1080	1000	1380	153	572	0
	Microcystis aeruginosa	0	0	0	0	0	0	0
	Microcystis flos-aquae	5150	1080	59800	8280	5550	1130	0
	Planktothrix mougeotia	45100	40700	21400	11800	2480	652	0
5/02/08	*Anabaena circinalis*	1360	928	1010	1230	318	840	297
	Microcystis aeruginosa	0	800	0	0	0	0	0
	Microcystis flos-aquae	1120	4600	1410	467	700	925	81
	Planktothrix mougeotia	98900	47900	75700	55900	10900	6750	0

Date	Parameter	City Weir	Morphett St Bridge	Elder Park	King William St Bridge	University footbridge	Frome Rd Bridge	Hackney Rd Bridge
8/02/08	*Anabaena circinalis*	600	170	388	584	103	237	156
	Microcystis aeruginosa	0	0	0	0	0	380	0
	Microcystis flos-aquae	400	230	400	300	470	1420	1150
	Planktothrix mougeotia	69800	110000	49000	58000	45300	9900	60
12/02/08	*Anabaena circinalis*	114	596	688	964	108	194	880
	Microcystis aeruginosa	0	0	1800	0	0	0	1200
	Microcystis flos-aquae	94	840	0	600	800	600	2800
	Planktothrix mougeotia	35200	38500	29900	30100	21200	33600	3640
15/02/08	*Anabaena circinalis*	952	642	832	300	330	706	172
	Microcystis aeruginosa	0	0	400	0	0	0	0
	Microcystis flos-aquae	300	300	700	1100	400	1500	600
	Planktothrix mougeotia	47000	48900	59400	48400	4800	39600	1930
19/02/08	*Anabaena circinalis*	3260	952	552	1260	864	900	0
	Microcystis aeruginosa	0	0	0	0	1400	2700	0
	Microcystis flos-aquae	400	86	0	800	800	0	0
	Planktothrix mougeotia	47600	65600	77000	45600	55000	44800	213
22/02/08	*Anabaena circinalis*	330	92	254	540	810	726	341
	Microcystis aeruginosa	0	0	0	0	0	0	0
	Microcystis flos-aquae	0	0	1200	56	500	2200	67
	Planktothrix mougeotia	69000	52700	65600	45400	42000	35500	4460
	Chlorophyll (ug/L)	41.2	-	51.8	-	61.4	-	-
26/02/08	*Anabaena circinalis*	46	124	22	112	444	74	875
	Microcystis aeruginosa	0	0	0	1000	400	324	0
	Microcystis flos-aquae	0	400	600	0	1000	0	1750
	Planktothrix mougeotia	55100	23000	23300	16800	8270	21200	19200
	Chlorophyll (ug/L)	18.6	-	25.1	-	38.7	-	-

Date	Parameter	City Weir	Morphett St Bridge	Elder Park	King William St Bridge	University footbridge	Frome Rd Bridge	Hackney Rd Bridge
28/02/08	*Anabaena circinalis*	0	0	0	0	0	37	284
	Microcystis aeruginosa	150	40	400	0	885	149	0
	Microcystis flos-aquae	0	0	500	0	0	0	0
	Planktothrix mougeotia	12200	13600	4960	6860	10200	5310	1660
	Chlorophyll (ug/L)	16.0	-	21.1	-	38.8	-	-
2/03/08	*Anabaena circinalis*	0	114	0	131	0	0	50
	Microcystis aeruginosa	0	250	550	0	250	0	0
	Microcystis flos-aquae	0	0	0	50	0	400	400
	Planktothrix mougeotia	3260	3000	3160	4180	1880	1560	1380
	Chlorophyll (ug/L)	16.0	-	21.9	-	39.1	-	-
5/03/08	*Anabaena circinalis*	8	15	76	62	182	87	52
	Microcystis aeruginosa	340	150	180	60	140	160	0
	Microcystis flos-aquae	0	30	40	140	500	660	550
	Planktothrix mougeotia	14	259	693	1300	472	429	667
	Chlorophyll (ug/L)	15.2	-	27.2	-	29.6	-	-
11/03/08	*Anabaena circinalis*	0	0	0	31	172	169	466
	Microcystis aeruginosa	140	80	0	0	120	0	300
	Microcystis flos-aquae	0	0	60	360	760	830	900
	Planktothrix mougeotia	0	0	31	91	343	277	138
	Chlorophyll (ug/L)	8.8	-	15.2	-	26.7	-	-
18/03/08	*Anabaena circinalis*	0	0		1	12	180	125
	Microcystis aeruginosa	0	0		0	0	0	0
	Microcystis flos-aquae	500	473		695	460	290	566
	Planktothrix mougeotia	3	0		46	142	216	292
	Chlorophyll (ug/L)	12.6	-	18.7	-	40.1	-	-

Date	Parameter	City Weir	Morphett St Bridge	Elder Park	King William St Bridge	University footbridge	Frome Rd Bridge	Hackney Rd Bridge
26/03/08	*Anabaena circinalis*	0	3	8	7	0	0	0
	Microcystis aeruginosa	620	1060	440	0	0	0	0
	Microcystis flos-aquae	60	180	380	214	70	170	100
	Planktothrix mougeotia	47	96	27	139	10	9	10
	Peridinium				Present	575		
	Cyclotella	675	1050	1530	-	-	687	333
	Chlorophyll (ug/L)	38.0	-	110	-	108	-	-
3/04/08	*Anabaena circinalis*	0	0	0	0	0	0	0
	Microcystis aeruginosa	140	180	40	0	0	100	22
	Microcystis flos-aquae	60	60	80	40	24	60	0
	Planktothrix mougeotia	212	256	38	0	0	27	28
	Peridinium		395	850	610	1060	-	-
	Cyclotella	250	-	-	-	-	600	255
	Chlorophyll (ug/L)	24.5	-	120	-	134	-	-
9/04/08	*Anabaena circinalis*	7	0	23	0	0	0	0
	Microcystis aeruginosa	660	38	221	369	22	70	0
	Microcystis flos-aquae	120	62	210	318	0	120	84
	Planktothrix mougeotia	16	16	66	55	24	0	0
	Peridinium	30	262	875	715	2180	4830	-
	Chlorophyll (ug/L)	11.9	-	60.6	-	180	-	-
15/04/08	*Anabaena circinalis*	4	0	0	0	0	0	0
	Microcystis aeruginosa	310	834	350	310	407	0	0
	Microcystis flos-aquae	150	489	70	0	5	30	9
	Planktothrix mougeotia	0	0	8	0	14	0	11
	Peridinium	-	190	595	1100	2340	1900	-
	Chlorophyll (ug/L)	7.8	-	31.6	-	380	-	-

Date	Parameter	City Weir	Morphett St Bridge	Elder Park	King William St Bridge	University footbridge	Frome Rd Bridge	Hackney Rd Bridge
23/04/08	*Anabaena circinalis*	3	0	0	0	0	0	0
	Microcystis aeruginosa	783	470	247	144	186	44	60
	Microcystis flos-aquae	60	110	0	90	282	0	0
	Planktothrix mougeotia	11	0	24	0	0	0	29
	Peridinium							
	Chlorophyll (ug/L)	15.8	-	27.8	-	63.9	-	-

Table 4. Torrens Lake Profile Data

Date	Profile #	Depth	City Weir				Elder Park				University Footbridge			
			Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)
22/02/08	1	Surface	5.84	184	8.37	1143	5.65	190	8.93	1247	4.9	190	8.97	1530
		0.5m	5.96	-			5.6	-			4.68	-		
		1.0m	5.99	-			5.72	-			4.72	-		
		1.5m	6.01	-			5.7	-			4.74	-		
		2.0m	5.98	-			5.53	-			4.78	-		
		2.5m	5.71	-										
		3.0m	5.52	-										
		3.5m	5.46	-										
		4.0m	4.99	-										
		4.5m	2.2	-										
22/02/08	2	Surface	6.07	190	9.45	1145	5.92	190	9.43	1250	5.2	190	9.23	1525
		0.5m	6.14				6.01	190			5.23	190		
		1.0m	6.15				5.9	190			5.27	190		
		1.5m	6.11				5.92	190			5.27	190		
		2.0m	6.07				5.97	190			4.83	190		
		2.5m	5.57				6	190						
		3.0m	5.58											
		3.5m	5.3											
		4.0m	3.92											
		4.5m	3.22											
22/02/08	3	Surface	6.32	190	9.45	1150	6.33	190	9.49	1245	5.8	190	9.51	1520
		0.5m	6.38	190			6.22	190			5.81	90		
		1.0m	6.34	190			6.27	190			5.75	190		
		1.5m	6.22	190			6.35	190			5.12	190		
		2.0m	6.1	190			5.97	190			4.86	190		
		2.5m	5.33	190										

Date	Profile #	Depth	City Weir				Elder Park				University Footbridge			
			Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)
		3.0m	5.21	190										
		3.5m	4.59	190										
		4.0m	3.61	190										
		4.5m	2.83	190										
22/02/08	4	Surface	15.30	190	10.21	1150	6.6	190	10.06	1275	6.85	190	9.53	1520
		0.5m	6.25	190			6.63	190			5.93	190		
		1.0m	6.27	190			6.68	190			5.88	190		
		1.5m	6.22	190			6.62	190			5.79	190		
		2.0m	6.04	190			6.78	190			5.73	190		
		2.5m	5.82	190							5.8	190		
		3.0m	5.67	190										
		3.5m	5.67	190										
		4.0m	4.58	190										
		4.5m	4.49	190										
25/02/08	1	Surface	-	-	-	-	8.23	-	9.92	1215	9	-	10.11	1460
		0.5m	-	-			8.03	-			8.86	-		
		1.0m	-	-			7.9	-			8.16	-		
		1.5m	-	-			6.84	-			6.62	-		
		2.0m	-	-			6.44	-			6.52	-		
		2.5m	-	-							4.67	-		
		3.0m	-	-										
		3.5m	-	-										
		4.0m	-	-										
		4.5m	-	-										
25/02/08	2	Surface	6.92	-	9.48	1150	8.86	-	9.92	1215	9.06	-	10.11	1460
		0.5m	6.96	-			8.76	-			9.25	-		
		1.0m	6.49	-			8.51	-			8.98	-		

Date	Profile #	Depth	City Weir				Elder Park				University Footbridge			
				Redox (mV)	pH	Conductivity (EC)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)
		1.5m	5.81	-			7.82	-			8.33	-		
		2.0m	5.4	-			7.13	-			7.2	-		
		2.5m	5.28	-							5.86	-		
		3.0m	5.24	-										
		3.5m	4.77	-										
		4.0m	4.75	-										
		4.5m	5.16	-										
26/02/08	1	Surface	8.1	-	9.50	1145	5.84	-	9.26	1233	7.29	-	9.06	1484
		0.5m	6.65	-			5.88	-			6.38	-		
		1.0m	6.63	-			5.61	-			5.9	-		
		1.5m	6.18	-			5.31	-			5.68	-		
		2.0m	5.94	-			5.02	-			5.36	-		
		2.5m	5.87	-			4.55	-			5.29	-		
		3.0m	5.72	-										
		3.5m	5.4	-										
		4.0m	5.31	-										
		4.5m	5.44	-										
26/02/08	2	Surface	7.16	-	9.62	1185	6.85	-	9.89	1307	7.98	-	9.99	1523
		0.5m	7.21	-			6.07	-			7.76	-		
		1.0m	7.22	-			5.49	-			6.91	-		
		1.5m	6.94	-			5.22	-			6.49	-		
		2.0m	5.98	-			4.47	-			5.57	-		
		2.5m	5.74	-			3.98	-			4.81	-		
		3.0m	5.41	-										
		3.5m	5.41	-										
		4.0m	5.45	-										
		4.5m	5.49	-										

Date	Profile #	Depth	City Weir				Elder Park				University Footbridge			
			Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)
26/02/08	3	Surface	13.00	-	9.16	1182	7.2	-	8.86	1235	8.55	-	8.70	1474
		0.5m	8.21	-			7.11	-			8.43	-		
		1.0m	7.93	-			7.03	-			8.06	-		
		1.5m	7.97	-			5.07	-			7.06	-		
		2.0m	6.42	-			4.65	-			6.5	-		
		2.5m	6.01	-			4.1	-			5.05	-		
		3.0m	5.75	-										
		3.5m	5.67	-										
		4.0m	5.49	-										
		4.5m	5.29	-										
26/02/08	4	Surface	15.25	156.7	8.23	1305	8.49	186.7	8.14	1354	8.76	187.4	8.10	1587
		0.5m	8.99	158.7			8.48	185.8			8.76	185.6		
		1.0m	8.97	161			8.31	186.9			8.75	187.1		
		1.5m	8.66	162			7.82	189.8			7.76	191		
		2.0m	8.03	164.4			5.46	101.3			6.68	193.5		
		2.5m	7.29	166.6			5.19	107.4			5.73	192.2		
		3.0m	6.27	168										
		3.5m	6.05	171										
		4.0m	5.66	175.6										
		4.5m	5.46	173.8										
27/02/08	1	Surface	10.10	213	8.25	1320	4.89	235	8.08	1375	5.94	256	8.0	1645
		0.5m	6.58	215			4.64	235			5.72	255		
		1.0m	6.55	215			4.27	235			6.02	251		
		1.5m	6.53	216			3.9	234			5.75	249		
		2.0m	6.34	218			3.6	233			5.62	248		
		2.5m	6.03	219			3.02	202			5.59	247		
		3.0m	5.92	220										
		3.5m	5.95	221										

Date	Profile #	Depth	City Weir				Elder Park				University Footbridge			
			Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)
		4.0m	5.63	213										
		4.5m	5.22	215										
27/02/08	2	Surface	11.30	214	8.33	1320	5.02	220	8.14	1409	7.11	220	8.19	1580
		0.5m	7.15	215			4.5	221			6.43	222		
		1.0m	6.98	215			3.99	222			5.82	223		
		1.5m	6.51	215			3.84	221			5.69	223		
		2.0m	6.4	215			3.88	221			5.34	223		
		2.5m	6.33	216			3.73	220			4.85	224		
		3.0m	6.21	216										
		3.5m	5.97	216										
		4.0m	5.83	217										
		4.5m	5.48	218										
27/02/08	3	Surface	13.15	183	8.43	1310	5.57	213	8.27	1390	6.66	216	8.28	1605
		0.5m	6.8	184			5.37	213			6.22	217		
		1.0m	6.67	185			4.92	214			6.09	217		
		1.5m	6.58	187			4.22	216			5.09	220		
		2.0m	6.31	188			3.59	215			4.83	220		
		2.5m	5.93	188			3.32	133			4.55	220		
		3.0m	5.84	189										
		3.5m	5.63	190										
		4.0m	5.43	192										
		4.5m	4.56	193										
27/02/08	4	Surface	15.20	157	8.40	1299	15.00	186	8.29	1395	6.22	212	8.12	1650
		0.5m	4.75	162			5.22	187			5.94	209		
		1.0m	4.72	164			5	187			5.35	209		
		1.5m	4.53	168			4.64	189			5.12	207		
		2.0m	4.28	169			4.22	189			4.44	208		

Date	Profile #	Depth	City Weir				Elder Park				University Footbridge			
			Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)
		2.5m	4.09	171			3.31				3.58	164		
		3.0m	3.98	175										
		3.5m	3.64	179										
		4.0m	3.5	180										
		4.5m	3.17	1280										
28/02/08	1	Surface	10.15	155	8.49	1329	6.53	229	8.49	1431	6.86	246	8.49	1743
		0.5m	7.31	159			6.4	229			6.53	244		
		1.0m	7.2	161			6.21	228			6.29	243		
		1.5m	6.9	163			5.96	228			6.19	242		
		2.0m	6.81	165			5.82	227			5.88	241		
		2.5m	6.63	167			5.66	103			5.85	240		
		3.0m	6.38	168										
		3.5m	6.17	169										
		4.0m	6.08	170										
		4.5m	6	170										
28/02/08	2	Surface	11.50	168	8.63	1334	5.02	189	8.56	1438	8.41	194	8.53	1720
		0.5m	5.18	170			4.5	191			7.97	195		
		1.0m	5.17	170			3.99	191			7.58	195		
		1.5m	5.11	171			3.84	191			7.03	196		
		2.0m	4.99	172			3.88	191			6.82	195		
		2.5m	4.89	173			3.73	56			6.8	195		
		3.0m	4.46	173										
		3.5m	4.26	174										
		4.0m	4.21	174										
		4.5m	4.13	175										
28/02/08	3	Surface	14.00	184	8.7	1356	4.08	192	8.63	1432	4.84	197	8.66	1710
		0.5m	4.24	184			3.79	194			4.69	197		

Date	Profile #	Depth	City Weir				Elder Park				University Footbridge			
			Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)
		1.0m	4.17	184			3.47	194			4.21	199		
		1.5m	4.03	186			3.19	194			3.91	199		
		2.0m	3.87	187			3.07	193			3.7	199		
		2.5m	3.71	187			2.84	177			3.33	199		
		3.0m	3.61	187										
		3.5m	3.38	189										
		4.0m	3.05	189										
		4.5m	2.91	140										
28/02/08	4	Surface	15.30	179	8.7	1326	5.5	180	8.68	1416	3.26	187	8.73	1696
		0.5m	6.52	179			5.25	179			2.88	188		
		1.0m	6.16	180			4.59	181			2.64	188		
		1.5m	5.87	181			4.09	183			2.43	188		
		2.0m	5.4	183			3.7	183			2.18	187		
		2.5m	5.13	184			3.3	181			1.98	187		
		3.0m	4.8	185										
		3.5m	4.43	185										
		4.0m	4.03	184										
		4.5m	3.82	183										
29/02/08	1	Surface	10.30	240.9	8.78	1367	4.86	218.4	8.80	1437	4.82	169.2	8.78	1793
		0.5m	5.33	235.9			4.76	216.8			4.52	172		
		1.0m	5.44	234.1			4.36	216.5			4.51	173.1		
		1.5m	5.38	232.9			4.31	215.8			4.16	175.2		
		2.0m	5.16	231.3			3.88	212.6			3.91	156.1		
		2.5m	5.1	230										
		3.0m	4.98	228.9										
		3.5m	4.97	227.4										
		4.0m	4.76	226.2										
		4.5m	4.76	224.3										

Date	Profile #	Depth	City Weir				Elder Park				University Footbridge			
			Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)
29/02/08	2	Surface	12.35	184.8	8.85	1365	4.75	184.5	8.93	1479	4.39	106.5	8.89	1768
		0.5m	4.31	184.5			4.09	184.4			3.84	110.7		
		1.0m	4.36	185			3.53	185.5			3.64	114.7		
		1.5m	4.28	184.8			3.36	186.4			3.24	118.5		
		2.0m	4.23	185			3.24	184.1			2.98	120		
		2.5m	4.08	185.4							2.63	110.7		
		3.0m	4.02	186.6										
		3.5m	3.65	186.4										
		4.0m	3.53	187.2										
		4.5m	3.48	186.3										
1/03/08	1	Surface	9.50	107.0	6.63	1177	4.34	218.4	6.13	1205	4.45	199.0	6.54	1487
		0.5m	3.80	112.0			4.19	216.8			4.52	198.0		
		1.0m	3.85	115.0			4.13	216.5			4.36	199.0		
		1.5m	3.80	119.0			4.16	215.8			4.36	199.0		
		2.0m	3.65	122.0			4.17	212.6			4.36	199.0		
		2.5m	3.63	124.0			4.14	109.0			4.09	199.0		
		3.0m	3.70	129.0										
		3.5m	3.67	133.0										
		4.0m	3.53	134.0										
		4.5m	3.68	136.0										
1/03/08	2	Surface	12.30	20.0	7.74	1204	4.96	22.0	7.36	1234	5.95	29.0	7.44	1498
		0.5m	4.26	57.0			4.65	40.0			5.65	46.0		
		1.0m	4.21	66.0			4.46	54.0			4.62	64.0		
		1.5m	3.92	72.0			4.55	60.0			4.29	74.0		
		2.0m	4.00	77.0			4.77	73.0			3.89	78.0		
		2.5m	3.94	85.0			4.68	21.0			3.70	85.0		
		3.0m	3.67	88.0										
		3.5m	3.73	95.0										

Date	Profile #	Depth	City Weir				Elder Park				University Footbridge			
			Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)
		4.0m	3.60	97.0										
		4.5m	3.51	98.0										
2/03/08	1	Surface	9.40	177.8	7.02	1183	2.16	75.7	9.23	1435	3.14	122.8	9.13	1846
		0.5m	3.50	180.2			1.3	79.5			2.5	123.1		
		1.0m	3.54	181.4			0.98	81.3			1.84	125.6		
		1.5m	3.44	182.4			0.78	87.4			1.48	127.1		
		2.0m	3.28	182.8			0.72	89.8			1.31	128.5		
		2.5m	3.25	183.3			0.66	92.8			1.08	123.7		
		3.0m	3.25	183.3										
		3.5m	3.24	183.6										
		4.0m	3.21	183.3										
		4.5m	3.12	181.2										
2/03/08	2	Surface	12.30	160.5	7.41	1386	8.2	70.5	7.67	1432	7.22	77	7.17	1821
		0.5m	5.72	162.8			7.08	85.4			6.58	85.9		
		1.0m	5.43	158.2			6.01	92.6			5.94	94.1		
		1.5m	5.73	156.3			5.38	95			5.24	105.2		
		2.0m	5.18	158.1			4.7	99.2			4.81	111		
		2.5m	4.67	155.6			4.45	101.4			4.32	114.2		
		3.0m	4.53	151.3										
		3.5m	4.68	150.5										
		4.0m	4.37	147.5										
		4.5m	4.30	146.8										
3/03/08	1	Surface	10.55	190.0	7.12	1385	5.71	176.0	7.26	1440	7.03	234.0	7.23	1785
		0.5m	4.49	195.0			5.65	180.0			7.06	233.0		
		1.0m	4.58	195.0			5.40	182.0			6.41	234.0		
		1.5m	4.61	195.0			5.35	184.0			5.51	235.0		
		2.0m	4.59	196.0			5.32	184.0			5.34	235.0		

Date	Profile #	Depth	City Weir				Elder Park				University Footbridge			
			Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)
		2.5m	4.58	190.0			5.62	184.0			5.32	147.0		
		3.0m	4.53	195.0										
		3.5m	4.36	195.0										
		4.0m	4.31	195.0										
		4.5m	3.85	196.0										
3/03/08	2	Surface	13.55	194.0	7.13	1385	6.00	190.0	7.19	1455	8.00	177.0	7.08	1860
		0.5m	5.09	195.0			6.02	190.0			7.72	181.0		
		1.0m	5.06	196.0			6.04	193.0			7.69	183.0		
		1.5m	4.84	197.0			6.07	192.0			7.02	185.0		
		2.0m	4.63	198.0			6.10	192.0			5.71	188.0		
		2.5m	4.47	199.0							5.18	189.0		
		3.0m	4.35	200.0										
		3.5m	4.19	200.0										
		4.0m	3.57	201.0										
		4.5m	2.69	182.0										
4/03/08	1	Surface	11.00	162.6	7.17	1394	6.25	177.0	7.28	1463	6.75	216.0	7.23	1820
		0.5m	5.20	166.8			6.06	180.0			6.78	217.0		
		1.0m	5.08	167.8			5.80	183.0			6.36	219.0		
		1.5m	4.88	168.6			5.62	183.0			6.10	219.0		
		2.0m	4.79	169.3			5.64	185.0			5.87	219.0		
		2.5m	4.67	169.3			5.87	174.0			5.03	99.0		
		3.0m	4.58	170.8										
		3.5m	4.58	191.0										
		4.0m	4.55	192.0										
		4.5m	3.90	193.0										
4/03/08	2	Surface	14.00	202.0	7.14	1382	6.45	200.0	7.27	1477	8.31	213.0	7.03	1779
		0.5m	5.57	204.0			6.44	201.0			8.24	214.0		

Date	Profile #	Depth	City Weir				Elder Park				University Footbridge			
			Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)
		1.0m	5.57	205.0			6.39	202.0			7.54	216.0		
		1.5m	5.60	207.0			6.35	203.0			6.74	220.0		
		2.0m	5.40	208.0			6.31	204.0			5.83	222.0		
		2.5m	5.16	209.0			6.34	204.0			5.02	223.0		
		3.0m	4.82	208.0										
		3.5m	4.61	208.0										
		4.0m	4.37	208.0										
5/03/08	1	Surface	10.15	157.4	7.25	1402	6.04	109.0	7.37	1509	7.32	139.1	7.34	1846
		0.5m	5.29	162.2			5.97	115.3			7.11	143.2		
		1.0m	5.30	163.3			5.73	119.2			6.82	145.9		
		1.5m	5.03	164.1			5.30	122.6			6.05	149.2		
		2.0m	4.89	164.5			5.11	125.3			5.55	150.9		
		2.5m	4.85	164.4							4.87	153.9		
		3.0m	4.75	166.0										
		3.5m	4.55	131.9										
		4.0m	4.30	133.0										
		4.5m	4.05	44.8										
5/03/08	2	Surface	13.05	172.6	7.12	1397	6.58	142.0	7.33	1469	8.09	156.2	7.50	1788
		0.5m	5.75	174.2			6.55	144.6			8.12	157.4		
		1.0m	5.49	174.4			6.30	146.6			7.02	162.3		
		1.5m	5.32	175.8			6.14	147.6			6.61	166.3		
		2.0m	5.15	175.3			6.12	149.0			6.12	167.4		
		2.5m	5.00	175.4			6.00	150.2			5.89	169.2		
		3.0m	4.82	176.0										
		3.5m	4.68	176.4										
		4.0m	4.56	177.3										
		4.5m	4.19	20.0										

Date	Profile #	Depth	City Weir				Elder Park				University Footbridge			
			Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)
6/03/08	1	Surface	10.20	160.0	7.31	1416	5.97	214.0	7.38	1500	6.19	228.0	7.28	1866
		0.5m	5.06	164.0			5.77	216.0			5.72	228.0		
		1.0m	4.88	168.0			5.49	216.0			5.57	227.0		
		1.5m	4.69	169.0			5.40	216.0			5.44	226.0		
		2.0m	4.73	173.0			5.48	215.0			5.41	226.0		
		2.5m	4.82	175.0			5.67	215.0			4.52	228.0		
		3.0m	4.79	177.0										
		3.5m	4.99	180.0										
		4.0m	3.09	182.0										
		4.5m	2.78	184.0										
6/03/08	2	Surface	13.30	194.0	7.25	1419	6.21	194.0	7.36	1516	7.34	198.0	7.30	1843
		0.5m	5.67	196.0			6.10	195.0			7.28	197.0		
		1.0m	5.16	197.0			5.82	197.0			6.66	201.0		
		1.5m	5.38	197.0			5.43	199.0			6.10	204.0		
		2.0m	5.19	198.0			5.68	198.0			5.28	205.0		
		2.5m	4.90	100.0			5.66	197.0			3.94	207.0		
		3.0m	4.62	199.0										
		3.5m	4.54	199.0										
		4.0m	4.05	201.0										
		4.5m	3.44	167.0										
7/03/08	1	Surface	10.30	172.0	7.34	1430	5.24	181.0	7.41	1520	6.01	176.0	7.41	1880
		0.5m	4.75	173.0			5.23	182.0			5.66	178.0		
		1.0m	4.65	174.0			5.22	183.0			5.26	180.0		
		1.5m	4.58	175.0			5.18	182.0			4.91	180.0		
		2.0m	4.69	176.0			5.17	183.0			4.80	181.0		
		2.5m	4.82	177.0			5.07	155.0			4.55	183.0		
		3.0m	4.86	177.0										
		3.5m	4.30	179.0										

Date	Profile #	Depth	City Weir				Elder Park				University Footbridge			
			Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)
		4.0m	3.86	172.0										
		4.5m	2.76	173.0										
7/03/08	2	Surface	13.10	153.0	7.35	1415	5.83	148.0	7.42	1510	6.41	165.0	7.27	1888
		0.5m	5.25	154.0			5.72	152.0			6.16	167.0		
		1.0m	5.20	153.0			5.60	153.0			5.85	168.0		
		1.5m	5.01	153.0			5.52	153.0			0.71	170.0		
		2.0m	4.92	154.0			5.61	155.0			4.29	172.0		
		2.5m	4.71	154.0			5.63	155.0			3.82	174.0		
		3.0m	4.69	157.0										
		3.5m	4.64	160.0										
		4.0m	3.25	162.0										
		4.5m	2.23	163.0										
11/03/08	1	Surface	12.40	180.0	7.44	1500	5.09	186.0	7.45	1580	5.98	200.0	7.44	1950
		0.5m	4.81	183.0			4.75	189.0			5.81	201.0		
		1.0m	4.61	186.0			4.63	190.0			5.30	203.0		
		1.5m	4.35	187.0			4.57	189.0			4.87	205.0		
		2.0m	4.36	187.0			4.59	189.0			4.38	204.0		
		2.5m	4.37	186.0			4.60	187.0			3.65	206.0		
		3.0m	4.36	186.0										
		3.5m	4.04	187.0										
		4.0m	3.51	191.0										
		4.5m	1.39	154.0										
18/03/08	1	Surface	10.40	203.1	7.61	1601	4.95	177.6	7.67	1700	4.78	185.3	7.54	2117
		0.5m	4.55	201.2			4.96	178.7			4.58	186.4		
		1.0m	4.56	201.6			4.97	178.7			4.37	188.1		
		1.5m	4.35	203.2			4.96	179.0			4.20	189.2		
		2.0m	4.13	203.3			4.99	179.5			3.93	190.4		

Date	Profile #	Depth	City Weir				Elder Park				University Footbridge			
			Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)
		2.5m	4.13	203.1			4.90	178.7			3.58	186.6		
		3.0m	4.14	201.2										
		3.5m	4.24	201.6										
		4.0m	4.31	203.2										
		4.5m	3.76	203.3										
26/03/08	1	Surface	12.45	195.0	7.76	1710	4.64	200.0	7.60	1890	1.30	226.0	7.13	1450
		0.5m	5.90	195.0			4.48	202.0			0.73	222.0		
		1.0m	5.96	195.0			4.55	204.0			0.56	218.0		
		1.5m	5.82	195.0			4.45	206.0			0.45	200.0		
		2.0m	5.70	198.0			4.26	205.0			0.46	196.0		
		2.5m	5.55	197.0			4.05	206.0			0.48	189.0		
		3.0m	5.42	197.0										
		3.5m	5.38	198.0										
		4.0m	5.40	198.0										
		4.5m	5.29	199.0										
3/04/08	1	Surface	13.45	155.3	7.85	1420	5.34	152.4	7.63	985	5.09	163.8	7.40	807
		0.5m	5.07	155.0			5.33	152.0			4.47	162.3		
		1.0m	4.93	154.3			5.41	152.2			3.76	159.6		
		1.5m	4.88	153.8			5.46	150.7			3.18	159.0		
		2.0m	4.82	153.3			5.34	150.8			2.07	157.6		
		2.5m	4.81	152.5			5.38	150.6			1.59	156.6		
		3.0m	4.84	151.8										
		3.5m	4.82	151.7										
		4.0m	4.80	151.3										
		4.5m	4.79	150.9										
9/04/08	1	Surface	10.20	243.1	7.63	1338	7.25	224.0	7.73	1262	17.35	193.5	8.45	1013
		0.5m	5.90	241.5			7.24	224.0			14.29	206.5		

Date	Profile #	Depth	City Weir				Elder Park				University Footbridge			
			Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)	Dissolved Oxygen (mg/L)	Redox (mV)	pH	Conductivity (EC)
		1.0m	5.93	243.1			7.22	224.2			12.12	212.6		
		1.5m	5.82	241.5			7.21	224.1			9.52	218.6		
		2.0m	5.79	243.9			7.03	225.3			6.79	225.2		
		2.5m	5.77	244.0			6.55	225.2			4.93	229.9		
		3.0m	5.76	243.6										
		3.5m	5.76	242.7										
		4.0m	5.77	242.0										
		4.5m	5.70	241.5										
15/04/08	1	Surface	12.30	223.0	7.73	1284	6.87	202.0	7.68	1218	14.71	201.0	8.19	1343
		0.5m	5.67	124.0			6.85	203.0			14.03	202.0		
		1.0m	5.52	125.0			6.80	204.0			13.32	204.0		
		1.5m	5.28	225.0			6.82	204.0			12.67	207.0		
		2.0m	5.17	126.0			7.47	201.0			11.91	210.0		
		2.5m	5.12	125.0			7.55	201.0			10.31	215.0		
		3.0m	5.12	125.0										
		3.5m	5.19	126.0										
		4.0m	5.08	227.0										
		4.5m	4.95	228.0										
23/04/08	1	Surface	10.15	213.0	7.84	1291	8.20	121.0	7.81	1306	11.76	154.0	7.98	1557
		0.5m	6.98	218.0			8.16	123.0			11.73	155.0		
		1.0m	6.80	219.0			8.07	125.0			11.59	156.0		
		1.5m	6.64	218.0			8.02	139.0			11.20	160.0		
		2.0m	6.55	219.0			8.02	140.0			10.77	163.0		
		2.5m	6.56	217.0			8.02	140.0			10.38	165.0		
		3.0m	6.60	217.0										
		3.5m	6.67	217.0										
		4.0m	6.61	217.0										
		4.5m	6.58	217.0										

Table 5. Lanthanum in Aquatic Plants (22/2/08)

Location	Replicate 1 (ppm)	Replicate 2 (ppm)	Replicate 3	Mean
St. Peters	5.47	6.09	4.25	5.27
Elder Park	382.11	69.36	66.02	172.5
U/S City Weir	32.19	298.31	185.93	172.14
Bonython Park	106.75	106.69	83.24	98.89