Big Chetac Lake, Sawyer County (WBIC 2113300),
Endothall Herbicide Concentration Monitoring Summary, 2015

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John Skogerboe

Big Chetac Lake is listed as a eutrophic, drainage lake on the WI DNR web site. The lake has an area of 2400 acres, a maximum depth of 26 ft and a mean depth of 14 ft. On 4 May 2015, Big Chetac Lake was treated with a liquid formulation of dipotassium salt of endothall (endothall) applied as Aquathol K to control curly-leaf pondweed. The endothall was applied to a large area on the north end of the lake totaling 55.21 acres to achieve a target application rate of 1.00 mg/L active ingredient (Figure 1). Endothall application rates are specified by active ingredient (ai), but endothall concentrations in water are reported as acid equivalent (ae). An application rate of 1.0 mg/L ai is equal to 0.71 mg/L ae or 710 ug/L ae. The endothall treatment began at 1438 and was completed by 1610. The wind was 5 mph from the NW according to the Treatment Record. Water temperatures on the day of treatment were 14.4 ^{o}C (58 ^{o}F) which was within recommended treatment temperature ranges. An area (90 acres) in the same vicinity was treated with 1.5 mg/L ai in 2013 and 1.0 mg/L ai in 2014 (see Herbicide Concentration Summaries for 2013 and 2014).

Water sample sites were established at 2 sites (BC1 and BC3) within the treatment target area and 2 sites (BC2, and BC4) adjacent to the treatment target area to quantify endothall concentrations and exposure times. (Figure 2). Three additional sample sites (BC5, BC6, and BC10) were established in the norther basin to quantify dissipation of endothall throughout the basin. One sample site (BC8) was established in an untreated reference area in the southern basin, and one sample site (BC9) was established near wild rice beds in southern basin to quantify potential herbicide exposure. Water samples were collected at each sample site using an integrated water sampler which collects a water sample from the entire water column from 0 to 6 ft deep. Water samples from sites in or adjacent to the treatment target area were collected at time intervals of approximately 5, 8, 14, 27, 48, 72, 120, and 168 hours after treatment began (HAT). Water samples from other sample sites in in the northern and southern basin were collected at time intervals of approximately 24, 48, 72, 120, and 168 hours after treatment began (HAT). Water samples were taken to shore after completion of each sample interval, and 3 drops of sulfuric acid were added to each sample bottle to fix the herbicide and prevent degradation. Samples were then stored in a refrigerator, until shipped to the State Laboratory of Hygiene (SLOH), Madison, WI for analysis of endothall. Water samples had previously been collected from Big Chetac Lake following endothall applications in 2013 and 2014.

The maximum endothall concentrations in samples collected from the treatment target area ranged from 490 to 1500 ug/L ae compared to the target concentration of 710 ug/L ae (Figure 3). Endothall concentrations were greater than a baseline concentration of 100 ug/L ae through 12 to 24 HAT in the outer exposed area target site (BC3). The baseline concentration is the level at which endothall likely does not significantly impact plants and is used as a base for comparing exposure times of different herbicide treatments. Endothall concentrations were greater than 100 ug/L ae through 48 to 72 HAT in the inner, more protected target site (BC1). The maximum concentration in adjacent non-target areas ranged from 33 to 120 ug/L ae but were detectable at all sample intervals.

Endothall concentrations were detectable in northern basin sample sites between 48 and 72 HAT, but all samples were less than 100 ug/L ae. Endothall was above detection limits (1 ug/L ae) at the southern basin sample site near the wild rice beds at 24 HAT, and endothall was greater than the

detection limits at both the southern basin sample sites at 120 HAT. All samples were less than 100 ug/L ae throughout the monitoring period.

Mean endothall concentrations in 2013 water samples showed higher concentrations and longer exposure times in treatment target areas compared to samples collected in 2014 and 2015 (Figure 4). Endothall concentrations in samples from 2014 were similar to concentrations in samples from 2015. Part of the difference between 2013 compared to 2014 and 2015 is explained by the higher application rate of 1.06 ug/L ae in 2013 compared to 0.71 ug/L ae in 2014 and 2015. The mean endothall concentration at 72 HAT was 469 ug/L ae compared to 44 ug/L ae in 2014 and 64 ug/L ae in 2015. Winds were from the south, southeast in 2013 and may have helped to hold herbicide in the target area resulting in longer exposure times (Figure 5). Winds were from the north northeast in 2014 and north, northwest in 2015 and may have helped to push endothall out of the treatment target area (Figures 6 and 7).

Endothall exposure times in large treatments such as Big Chetac were rapid (12 to 24 HAT) in exposed areas, but were longer in more protected areas of the target area (> 24 HAT). Concentration, exposure times in the treatment target area were likely sufficient to control curly-leaf pondweed in most of the area. Careful attention to wind speed and direction may significantly extend exposure times and control, and exposure time may become more critical in future long narrow, exposed treatment areas. I recommend treatment wind specifications of 0 to 5 mph applied on the windward side. Treatments applied to the leeward side of land (protected side) will significantly reduce exposure times.

Endothall applied to the bay on the north end of Big Chetac Lake is widely dissipated through much of the lake including the southern basin. Endothall dissipated as far as the wild rice beds in the southern basin in 2015, although the concentrations were less than 50 ug/L ae compared to the target concentration of 710 ug/L ae in the target area.

Figure 1. 2015 Big Chetac Lake Endothall Sample Sites

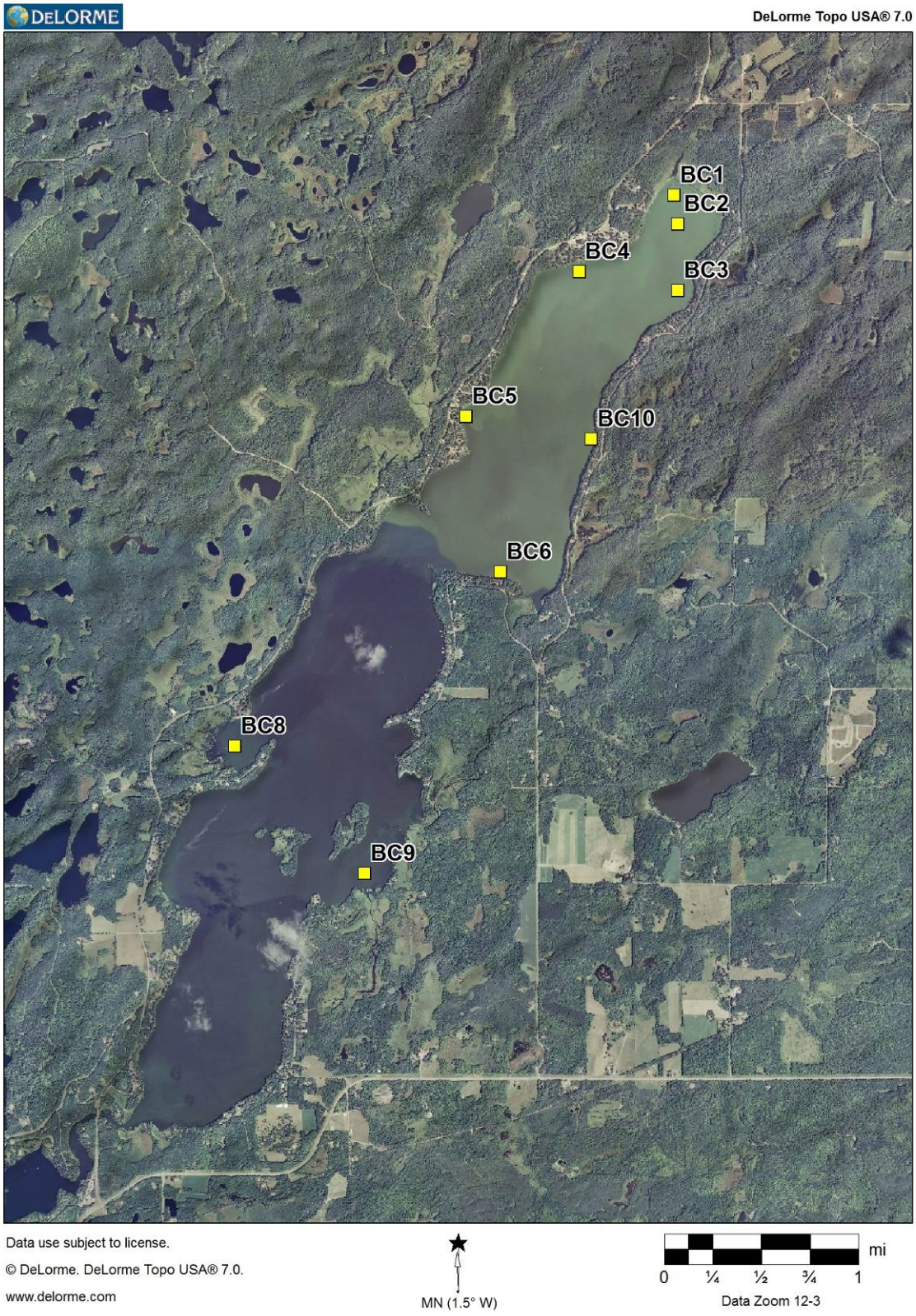


Figure 2. 2015 Big Chetac Lake Endothall Treatment Target Areas and Untreated Reference Areas

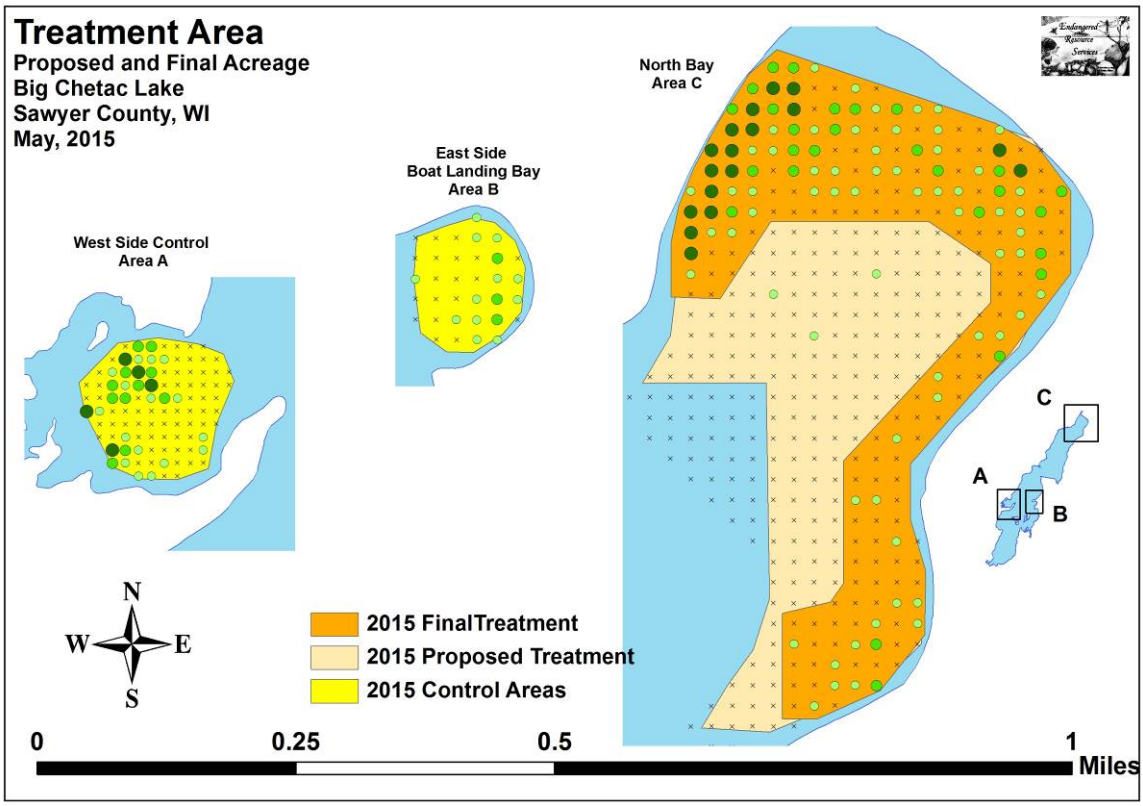


Figure 3. 2015 Big Chetac Endothall Concentrations

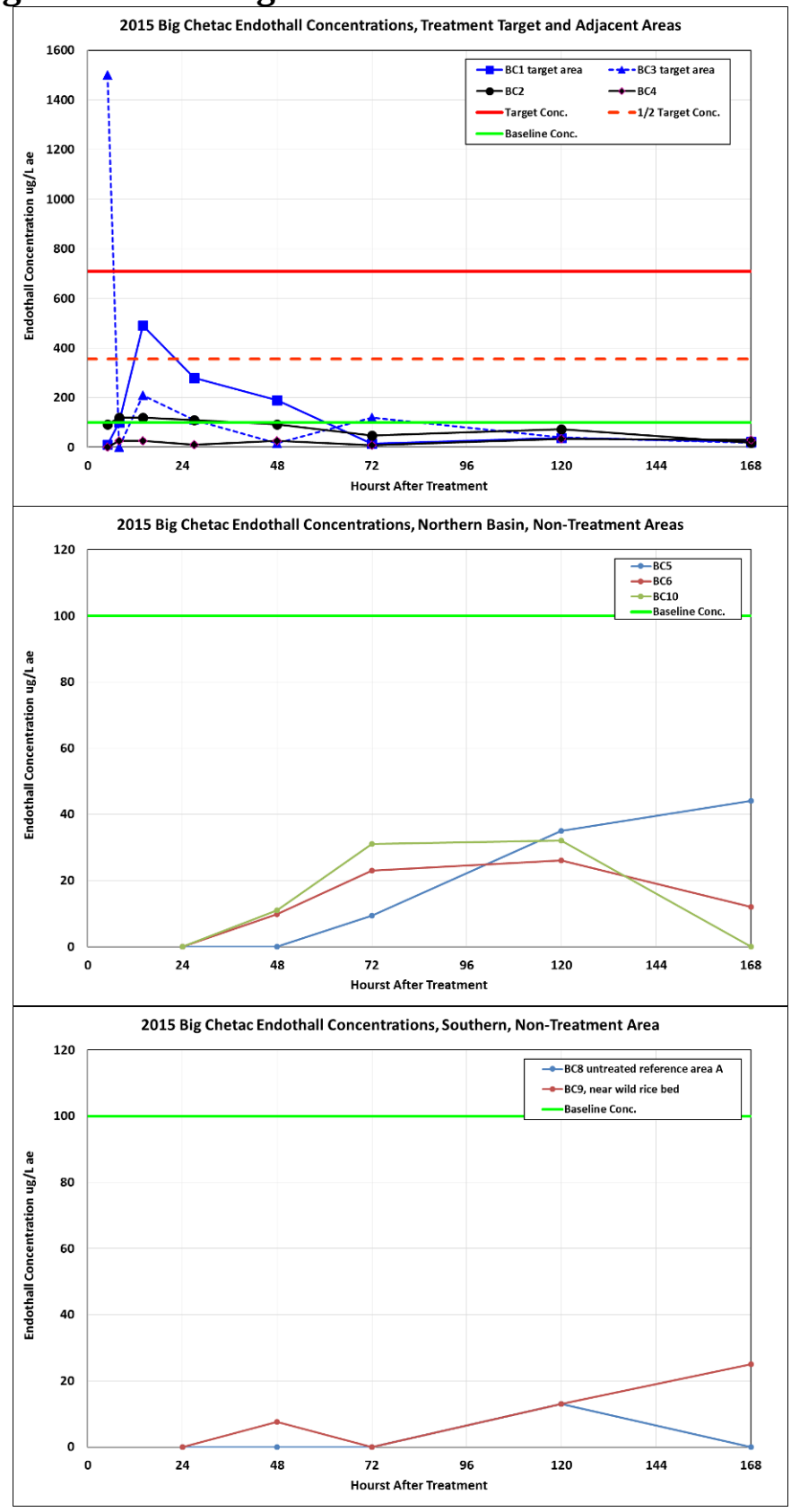


Figure 4. 2013 to 2015 Mean Endothall Concentrations in Treatment Target Area

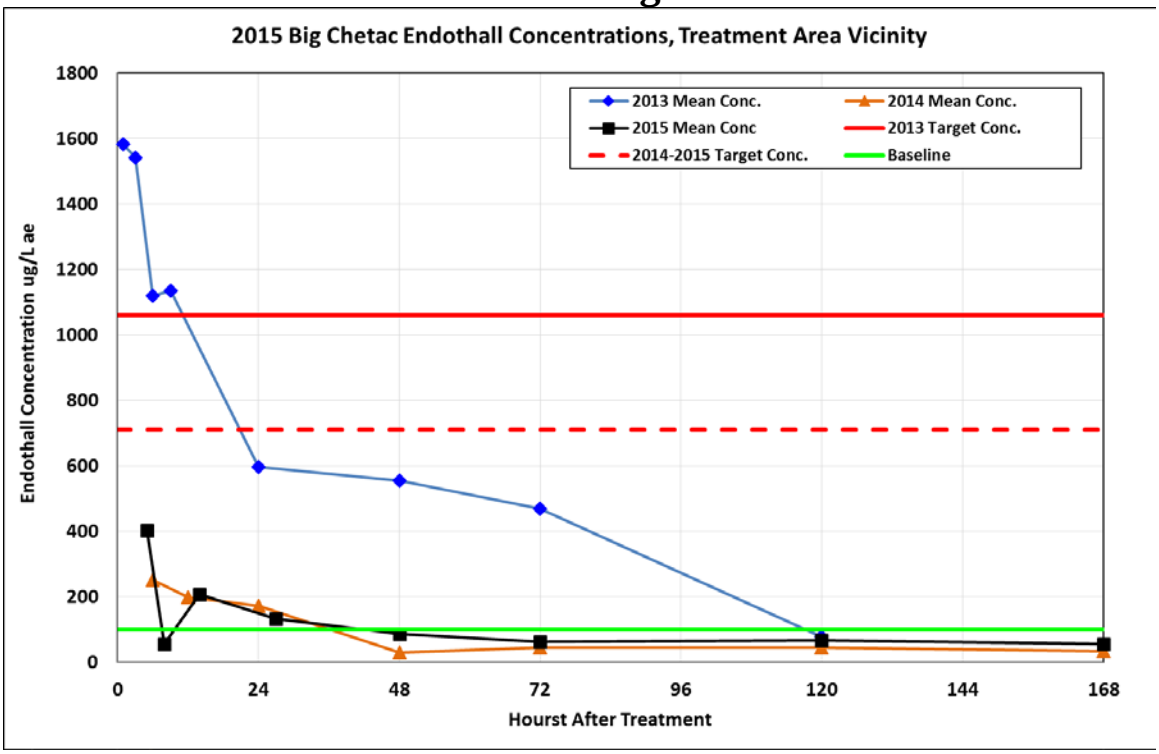


Figure 5. Spooner Weather Data
28 May 2013

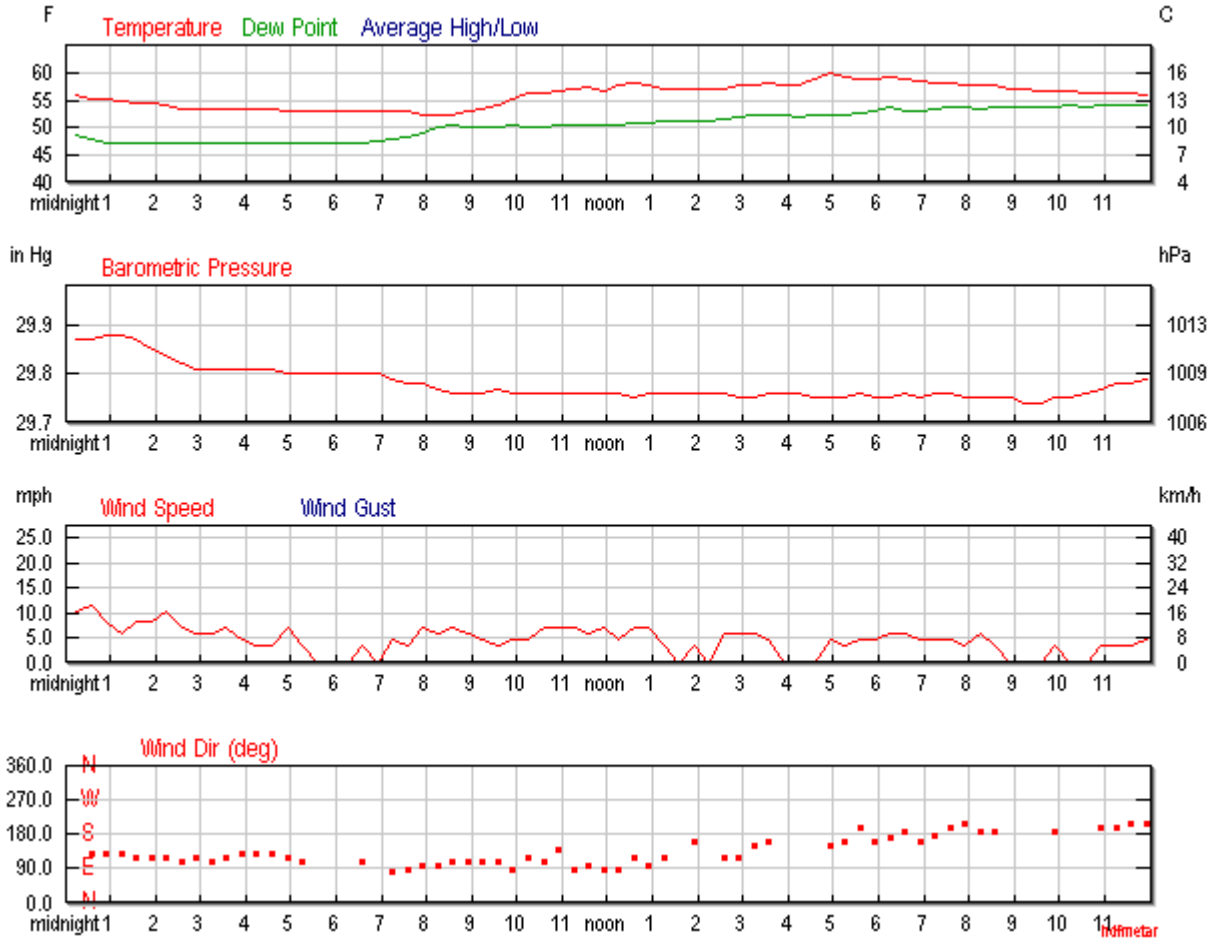


Figure 6. Spooner Weather Data
21 May 2014

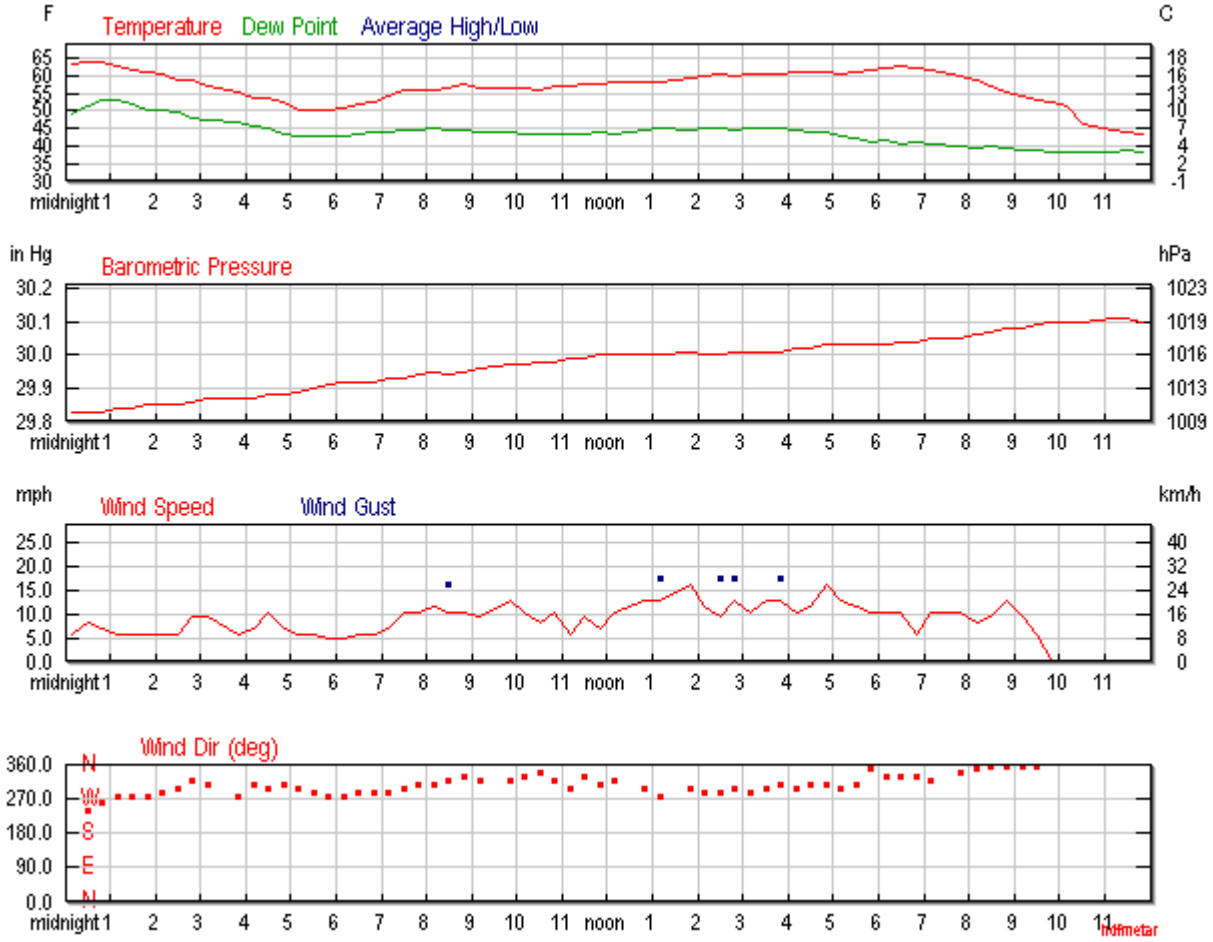
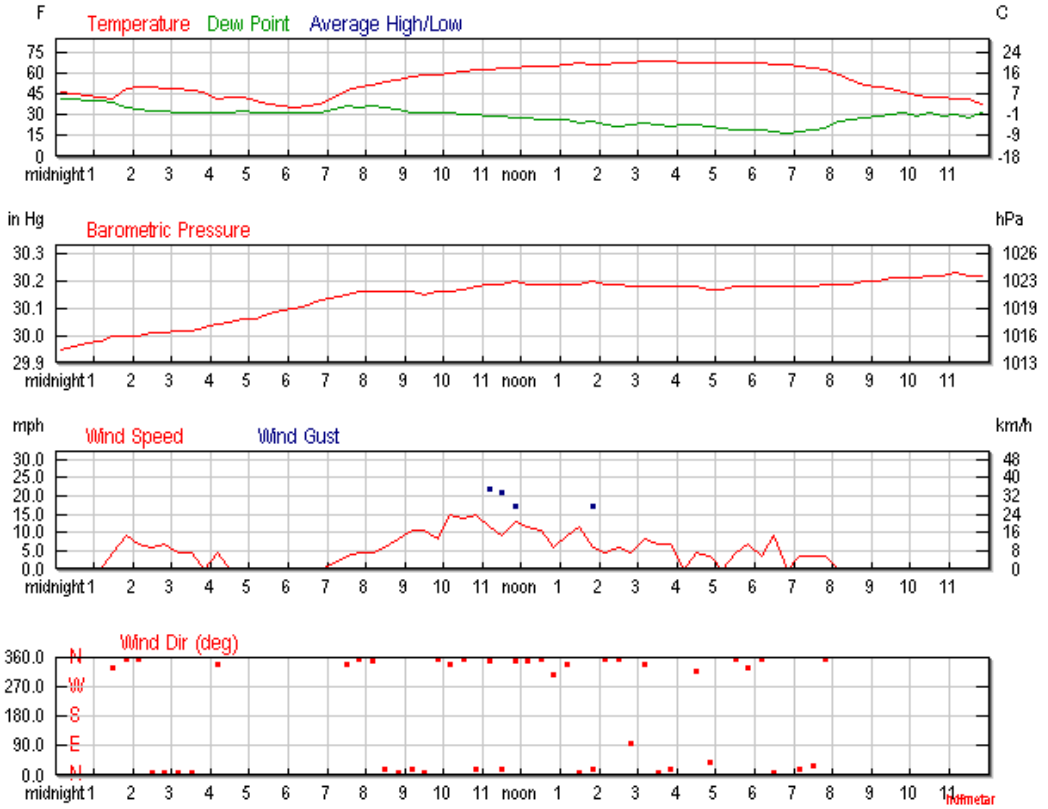


Figure 7. Spooner Weather Data
4 May 2015



5 May 2015