



# Oregon Department of Environmental Quality Memorandum

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To: Barbara Burton  
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From: Steve Schnurbusch

State of Oregon  
Department of  
Environmental  
Quality

Subject: Gypsy Moth Spray WQ Analysis

Harold Thistle, Ph.D. from the US Forest Service in West Virginia provided ultra conservative modeling results estimating the amount of spray that would reach the water surface. The modeling assumes no tree cover so that 100% of the spray reached the water surface. This is very conservative considering many of the streams in the spray area have significant amounts of tree cover.

The model simulation resulted in a maximum volumetric deposition prediction of 0.4 ml/m<sup>2</sup> (0.00004 cm<sup>3</sup>/cm<sup>2</sup>). The average predicted diameter of each droplet is 0.0132 cm. The spray material will fall on the surface of the water and immediately mix within a very small depth of the surface. If we allow the material to mix within the first 0.25 cm (0.1 inch), a simple volumetric dilution calculation results in a dilution of 6350. This demonstrates that a dilution of 6350 would be reached within 0.25 cm from the water surface. This dilution will be used to determine the impact of the spray deposition on pH and temperature. In addition, a dissolved oxygen analysis will be performed to determine the impact of the discharge on dissolved oxygen.

## **pH**

The pH of the spray material will range from 4.1-4.3. There is no water quality data for any of the streams this spray will impact. There is water quality data for Cascade Creek which is a nearby in the same basin and is likely representative of the water quality in other streams in the area. This data was used to perform a "pH balance" to determine if the discharge would meet the pH criterion of 6.5 at the edge of the proposed mixing zone. A dilution of 6350 was assumed at the edge of the mixing zone as discussed above. The pH of the stream was assumed to be 7.0 based on pH data collected on Cascade Creek during April and May. The exercise demonstrates no reasonable potential to violate the lower pH criterion beyond the edge of the mixing zone. A copy of the spreadsheet used to perform the analysis is attached.

## **Temperature**

None of the streams in the spray zone are water quality limited for temperature during the months the spray is being applied. The Department's temperature standard does not allow for a measurable increase in temperature if the increase would impair the biological integrity of any threatened and endangered (T&E) species. Coho are present in the basin and are listed as threatened.

The temperature analysis consisted of a simple temperature balance exercise. The most conservative analysis is when the largest difference between ambient air temperature and surface water temperature occurs. The temperature of the spray material is assumed to be the same as ambient air temperature. The material is being sprayed in the early mornings when the ambient air temperature is the lowest. The assumed worst-case air temperature was 55°F. The assumed minimum surface water temperature was 50°F. Assuming a dilution of 6350 as discussed above, the temperature increase at the edge of the mixing zone is less than 0.001°F. This assumes the edge of the mixing zone is at a depth of 0.25 cm.

## **Dissolved Oxygen**

A dissolved oxygen analysis was performed to determine if there is any potential for the spray material to cause a significant dissolved oxygen depression downstream. The Alsea River is water quality limited for dissolved oxygen during the spray period. The Alsea River is about 8 miles downstream from the edge of the spray area. Based on this listing, the Department must demonstrate there is no impact on dissolved oxygen within the spray area and downstream in the Alsea River.

The area being sprayed consists of a network of streams ranging from very small headwater streams up to the size of Five Rivers. Performing a dissolved analysis on each stream in the spray zone would require collecting a large amount of field data and practically would not be possible. Therefore, a representative worst-case scenario has been modeled based on conservative assumptions. The Streeter-Phelps dissolved oxygen model was used to simulate instream dissolved oxygen.

Many of the streams within the spray area were visited on February 25, 2003. All of the very small streams (3-5 ft wide) cascaded down fairly steep terrain and had a dense vegetative cover. These streams offered the least amount of dilution but prevented much of the spray material from entering the creek because of the vegetative cover. These streams would also have high reaeration rates due to the exposure to the air as they cascaded down the steep hillside. This type of stream was considered the worst-case scenario to be modeled because the other streams provided such a greater degree of dilution.

Based on field observations, the simulated worst-case stream was assumed to be 3 feet wide with a depth of 3 inches, a flow rate of 0.5 ft<sup>3</sup>/s, and a velocity of 0.67 ft/s. Based on the dense vegetative cover, only 25 percent of the spray material was assumed to enter the stream. A lower percentage is likely to enter the stream. The BOD<sub>5</sub> of the spray material was measured by the DEQ lab to be 260,000 mg/L.

The longest stream in the spray area with similar characteristics to those described above is Cherry Creek. It travels about 6000 feet (1.1 miles) before flowing into Five Rivers. After traveling 1.1 miles the predicted dissolved oxygen reduction is about 0.05 mg/L. Upon entering Five Rivers, there is no additional detectable dissolved oxygen reduction because of the large amount of dilution available in Five Rivers.

Based on these modeling efforts, the predicted minor reduction in dissolved oxygen would not adversely impact water quality within the spray area. The actual dissolved oxygen reduction is

likely to be much less than that predicted due to the conservative assumptions. In addition this modeling exercise assumes a continuous discharge. Because this is not a continuous discharge and the model does not consider lateral dispersion, the dilution within the stream will be much greater than predicted and any predicted reduction in dissolved oxygen would occur for only a very short period of time.