



Timber Harvest Program  
Standard Operating Procedures  
Continuous Temperature Monitoring

April 2006

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Timber Harvest Program

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## **Purpose**

This document provides standard operating procedures for continuous temperature monitoring on forest streams pursuant to the General Conditional Waiver of Waste Discharge Requirements – Timber Harvest Activities in the Central Coast Region (General Waiver). These procedures, when followed correctly, will support the collection of continuous temperature data. The data will be used for trend analysis and to determine compliance with Monitoring and Reporting Program R3-2005-0066.

## Monitoring Season

Monitoring shall begin at the onset of timber harvest operations (i.e. tree falling, yarding, and / or roadwork, etc.) and shall be consistent with the Monitoring and Reporting Program (MRP), any conditions set forth within the waiver or waste discharge requirements, and the procedures outlined in this document. Monitoring shall continue as specified in the MRP until it is revised or rescinded.

Continuous Temperature Monitoring occurs for the five and a half month period starting May 1 and ending October 15, at all temperature monitoring locations established in the MRP. If a site becomes dry at any point during the monitoring season, the logger shall be relocated further downstream where monitoring can continue. Relocation of the logger must be documented.

If timber harvest operations commence during the period of October 16 through April 30, temperature monitoring shall begin the subsequent May 1. If timber harvest operations commence during the period of May 1 through October 15, temperature monitoring shall begin and continue the day operations begin until October 15 of that same year. Temperature monitoring shall then continue in the subsequent years as prescribed in the MRP.

## Calibration Checks

Calibration checks shall be conducted on the data loggers at three separate times during the monitoring season: 1) prior to logger deployment 2) at mid-season data collection 3) at the end of the monitoring season. Calibration check One shall be conducted as described for the two bath tests (below). Calibration checks Two and Three will be conducted against a stream temperature thermometer<sup>1</sup> reading in the field, as described in the mid-season data collection and logger calibration section. Calibration checks are used to document logger performance and accuracy. This provides assurance of the quality of data being collected and reported. Calibration events Two and Three shall occur shortly after sampling results have been downloaded and backed up. Always download data according to the manufacture's instructions. Results of the calibrations must be documented on the calibration check form,<sup>2</sup> the form must be kept with your logbook.

The following bath tests shall be conducted at least once per year, prior to deployment of your logger for the monitoring season, to determine its accuracy. Each logger shall be assigned a unique temperature logger ID number. The calibration check form shall include fields to record the calibration check results for each data logger. The loggers, utilized for continuous temperature monitoring must be specified for full submersion, outdoor freshwater stream temperature monitoring. The logger must also be designed to withstand the environmental conditions it will be subjected to over the full duration of the monitoring season.

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<sup>1</sup> All references to a thermometer in this document call for the use of a Certified Reference Thermometer or one certified by the National Institute of Standards and Technology that is designed for total immersion.

<sup>2</sup> Available at the Water Board's website or upon request to Water Board staff.

## Data Logger Ice Bath

This test will allow you to determine the accuracy of your data logger at its lower range.

Place crushed ice in an insulated container that is large enough to hold the loggers that you are testing. It is important to crush the ice to maintain as consistent and uniform a temperature as possible. Fill the container with water to just below the level of the ice and stir the mixture around. Submerge the loggers that you are testing. Place the entire container in a refrigerator to minimize temperature gradients. Allow enough time for the logger to acclimate; at least ten minutes. The ice will melt slowly, so the actual temperature should settle around 0°C if the ice bath was prepared correctly. Place a thermometer in the bath to confirm the temperature against your logger's reading. Allow the logger to collect at least five readings before removing it from the bath. Check the reading of your logger to confirm that the five readings are within the acceptable accuracy range reported by the manufacturer at 0°C. Record the calibration check on your calibration check form.

## Room Temperature Bath

This test will allow you to determine the accuracy of your data logger at its higher range.

Fill an insulated container that is large enough to hold the loggers that you are testing with water. Place the open container in a room overnight that has constant air temperature at the higher end of the loggers temperature range. Submerge the loggers that you are testing. Allow enough time for the logger to acclimate; at least ten minutes. Place a thermometer in the bath to confirm the temperature against your logger's reading. Allow the logger to collect at least five readings before removing it from the bath. Check the reading of your logger to confirm that the five readings are within the acceptable accuracy range reported by the manufacturer at the upper end of the loggers temperature range. Record the calibration check on your calibration check form.

*Note: Water used to make the ice and fill the containers for the bath tests may be tap water or bottled water. Salt water may not be used.*

## **Deployment Procedure**

All loggers must be deployed at the temperature monitoring locations identified in your MRP. Only those loggers that pass the calibration check requirements may be programmed for deployment. Prior to deployment, follow the manufacture's instructions for programming the logger for a delayed start and set the logger to record point measurements every hour. All loggers and other monitoring equipment should be kept clean, stored in protective cases during transportation, and protected from extreme temperatures. Prior to programming the temperature logger, both the computer clock and the watch used to record deployment times shall be synchronized. You must also confirm that the date and time modes of the logger are functioning properly.

During the deployment process, all field data including station number, station name, temperature logger ID numbers, and calibration results must be recorded. All monitoring stations must have a unique site identification number and / or name. A sketch and description of the logger locations that notes a landmark reference point, such as a unique rock, log, root, or tree should also be recorded. In addition, a picture of the water temperate logger location including a landmark should be taken to help relocate the logger in the future.

The most important aspect of logger deployment is to find a location in the stream that is safe to get to and where representative stream temperature data may be obtained during lower flows. The logger should be placed to avoid direct sunlight. In small streams, loggers should be installed as close to the thalweg<sup>3</sup> as possible and six inches off the stream bottom. In large streams, areas of potential temperature stratification (resulting from eddies, groundwater, and tributaries) need to be avoided. In addition, placing the logger in a 2 -2 ½ foot deep location downstream or alongside a landmark rock or streambed feature improves the chance of it staying submerged during its deployment period and being located for retrieval.

When placing the logger at the sampling point, you must find a method to secure the logger in place for the duration of the monitoring season. Secure a waterproof business card to the logger in a manner that will not inhibit the collection of data. This provides an opportunity for the logger (and the data) to be returned in the event the logger is lost. If the logger will be placed in an area subject to vandalism, you must make accommodations to prevent vandalism. Most manufactures sell products that can camouflage the logger without disrupting its data collection.

### **Mid-season Data Collection and Logger Calibration**

For the safety of the data, data logger manufactures recommend that a logger never be deployed for longer than a three-month period. Mid-season data collection and logger calibration will decrease the chances of losing a full season of temperature data for any one monitoring point. Mid-season data collection and logger calibration shall occur within the last two weeks in July or first two weeks in August. This mid-season check can either be conducted in the field or the loggers may be taken back to the lab for data collection and analysis. Loggers removed from the field to perform the mid-season calibration check must be returned to their monitoring station within four days.

Upon inspection of the site, look for signs of physical disruption of channel conditions; inspect the logger for fouling, corrosion, or damage; perform a battery or power check; clean or service the sensor as needed; and calibrate the logger as described below.<sup>4</sup>

To conduct the mid-season data collection and logger calibration you must begin by checking the stream temperature with a thermometer. Place the thermometer next to the

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<sup>3</sup> The line defining the lowest points along the length of a riverbed or valley.

<sup>4</sup> This inspection regime must be repeated when the logger is removed from the field at the end of the monitoring season.

data loggers long enough for it to acclimate and then take the temperature reading. Record the thermometer's temperature reading on the calibration check form. After recording the temperature readings from the thermometer in the stream, remove the data loggers from the stream and download the data either onto a laptop in the field or on your computer in the lab. Check the reading of your logger to confirm that the reading is within the acceptable accuracy range presented by the manufacturer. Any loggers not reading within an acceptable range, found to be damaged, missing, or destroyed, must be replaced immediately with a logger that meets the specifications per these procedures. Spare loggers should be kept on hand for this purpose. Document all findings from the mid-season data collection and logger calibration on the calibration check form.

## Reporting Requirements

By November 15 of each year, you must submit an Annual Report to the Central Coast Water Board per the requirements in your MRP. When reporting the temperature data you must include:

- ❖ A summary of the water quality monitoring performed during the previous year.
- ❖ A detailed map with all monitoring locations clearly marked with unique site identification tags.<sup>5</sup>
- ❖ All data submitted electronically in excel format.
- ❖ Make and model of the data loggers being used at each monitoring location.
  - Copy of the manufacture's protocol / recommendation for proper use of the loggers.
- ❖ Calibration check form for each data logger.
- ❖ Description of any modifications or adjustments made based on the calibration checks and field observations.

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<sup>5</sup> The map needs to be submitted once unless monitoring station locations are modified. In the future a map with unique monitoring site tags shall be submitted with the Timber Harvest Information Form and Fact Sheet.

## Literature Consulted

Quick Accuracy Check Copyright © 1996-2004 Onset Computer Corporation  
<[http://www.onsetcomp.com/Support/HS\\_Support/5317\\_acc\\_test.html](http://www.onsetcomp.com/Support/HS_Support/5317_acc_test.html)>

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