

An Examination of Campfire Smoke Impacts Near Goldstream Provincial Park



Earle Plain
Ministry of Environment
Environmental Protection
Environmental Quality Section
Nanaimo, British Columbia

December, 2010



Acknowledgements

I would like to recognize the cooperative spirit shown by all parties involved in coordinating and completing this project. Special thanks go to Don Herriott of the Capital Regional District Water Services Branch, Heath Hilchey from MOE, Parks and Protected Areas, and MOE Environmental Protection staff members Ryan Wiederick and Ruth-Ann Devos.

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1.0 Introduction

Goldstream Provincial Park is located approximately 15 kilometres northeast of the city of Victoria on southern Vancouver Island, British Columbia (Figures 1 and 2). The southern boundary of the park is the interface area between the park and the residential area of Goldstream where roughly 500 people reside.

In the summer of 2008, the Ministry of Environment (MOE) received a complaint regarding the amount of wood smoke generated in the campground and its offsite impact on neighbouring residences. The complainant was concerned that the smoke from the campfires in Goldstream Provincial Park was affecting their health, lifestyle and that of their neighbours.

The Goldstream Park campground is comprised of 173 campsites (Appendix A) and is located near the southern boundary of the park (Figure 3). Due to its close proximity to the large urban center of Victoria, Goldstream Provincial Park receives very high day use and the overnight campground is completely booked for most of the season. Each campsite is equipped with a campfire ring and firewood is sold at the main park gatehouse.

B.C. Parks needed to make an informed decision on this issue and requested that the Ministry of Environment (Environmental Protection Branch) assist with ambient air monitoring in the area. The Ministry was able to provide an instrument capable of measuring continuous fine particulate matter and meteorology for the summer season of 2010. The objective of the sampling program was to quantify wood smoke impacts from the Goldstream campground in the neighbouring residential area during the summertime.

This report summarizes the findings of that monitoring project.

Figure 1. Location of Goldstream Provincial Park in British Columbia, Canada.

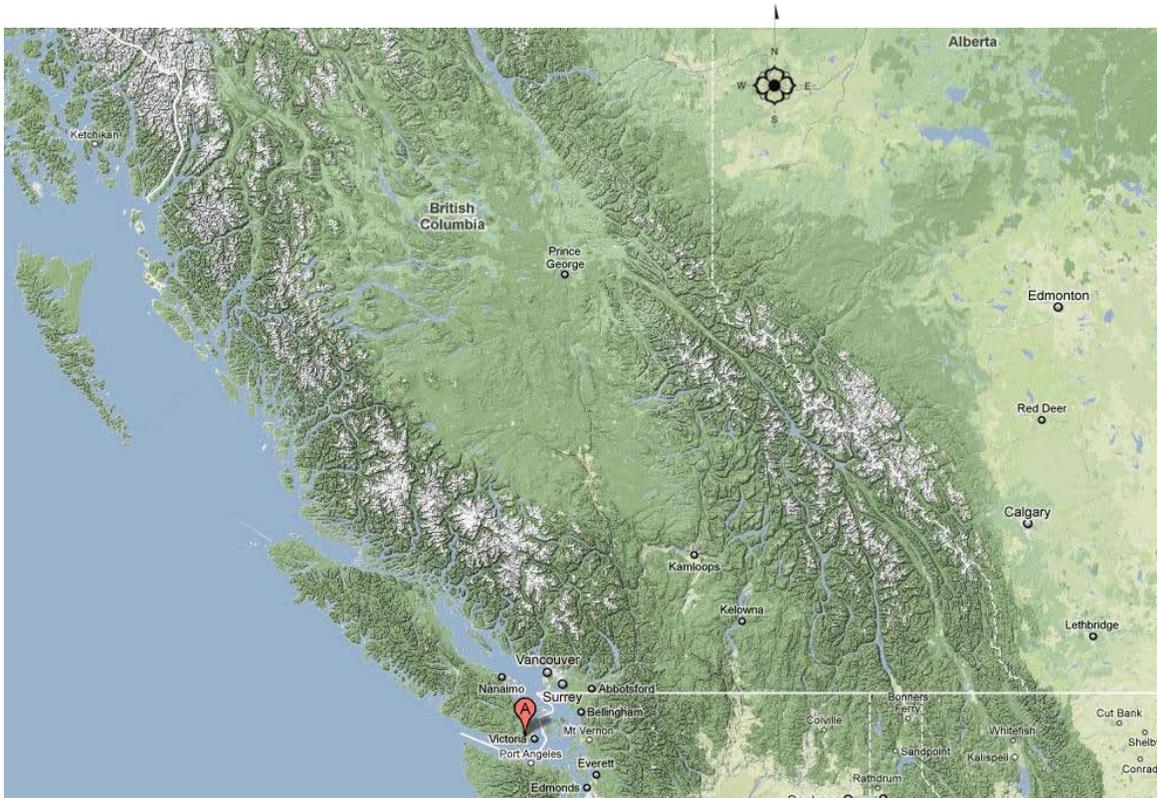


Figure 2. Location of Goldstream Provincial Park in relation to Victoria, British Columbia

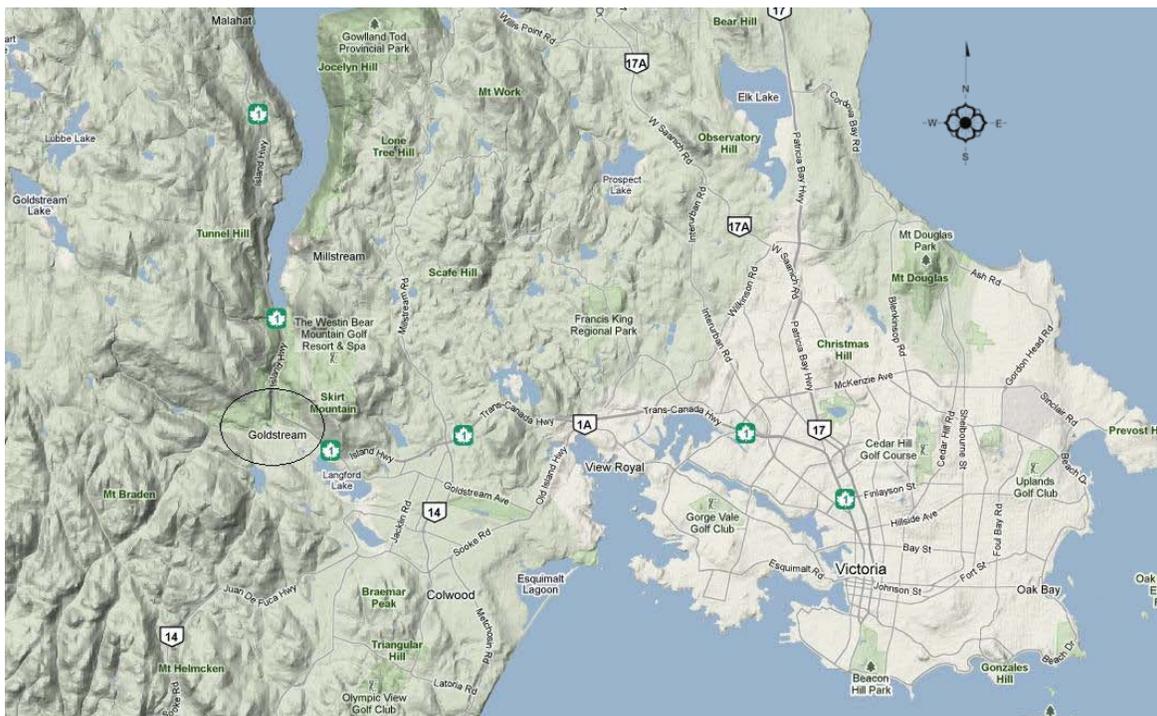
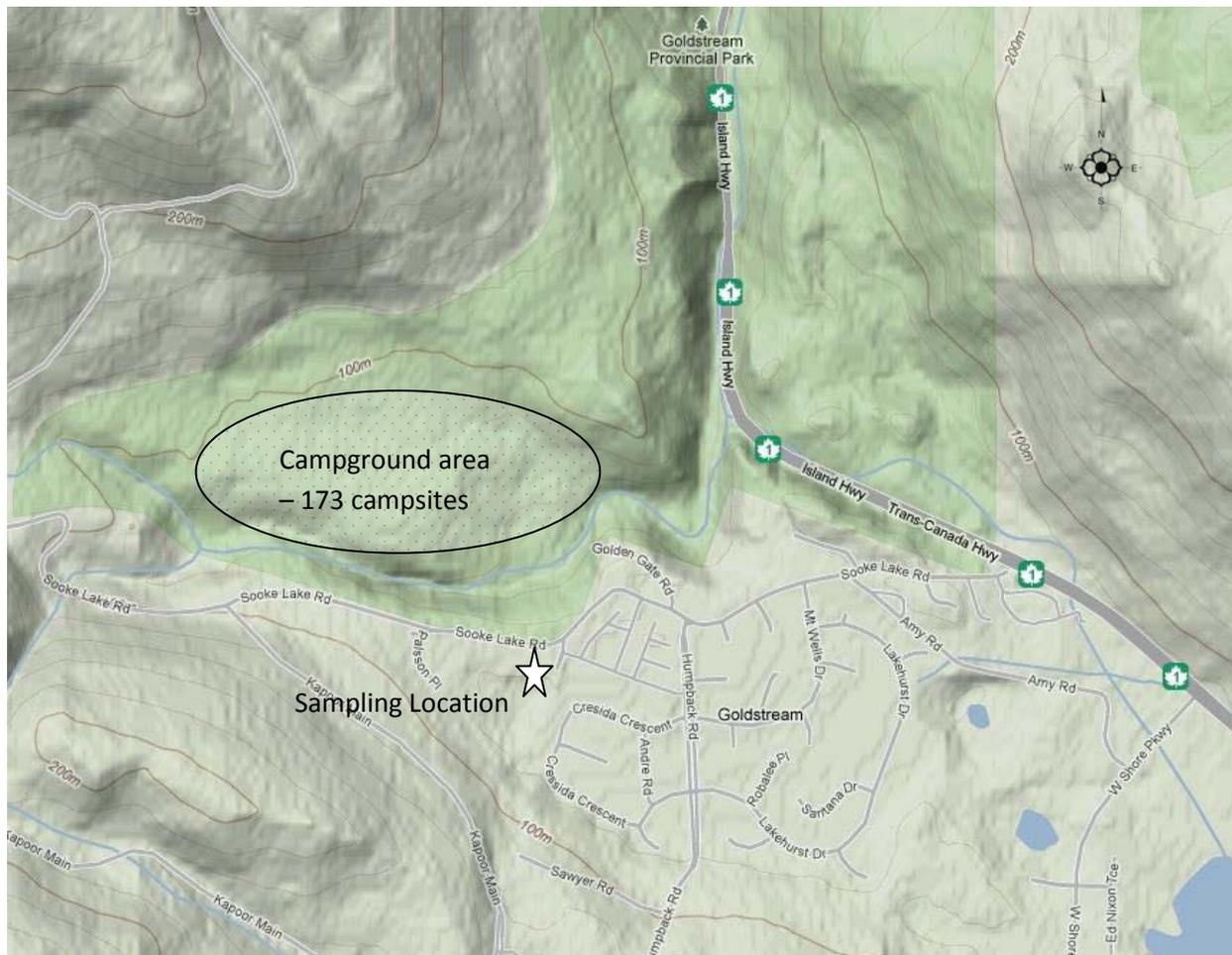


Figure 3. The southern border of Goldstream Provincial Park showing the campground area relative to the residential area of Goldstream and the sampling location.



2.0 Methods

Although there are many constituents of wood smoke that could act as a tracer, the focus for this study was on ambient levels of $PM_{2.5}$ (particulate matter less than 2.5 micrometers in diameter), coupled with meteorology. $PM_{2.5}$ is closely associated with combustion processes. Given the limited number of localized combustion sources in the Goldstream area during the summer months (e.g. no woodstoves or backyard burning during the summer months) $PM_{2.5}$ can be used to quantify campfire wood smoke impacts.

2.1 Ambient Monitoring

The ambient air monitor deployed for this project was a Met One Instruments Inc. E-BAM sampler. This sampler was selected due to availability, portability, and because it was capable of measuring PM_{2.5} (the main parameter of concern) and the meteorological parameters necessary to help determine source culpability (temperature, wind speed and wind direction). All parameters were measured continuously and stored in the instrument's internal data logger as 1-hour averages. The hourly data and diagnostics were downloaded from the E-BAM via laptop and HyperTerminal on a periodic basis by MOE technicians. More information on the operation of the E-BAM can be found on the Met One Instruments Inc. web site.

The E-BAM was installed at ground level in an open field to the south and southeast of the Goldstream Park campground (Figure 3). The Capital Regional District (CRD) Water Services Branch provided access to this secure sampling location (within their fenced compound) and also provided power. The fenced field is located behind the Water Services Branch office at 2955 Sooke Lake Road. This site is well exposed to all wind directions and is adjacent to the area where the residential complaints originated.

E-Bam deployed at ground-level in an open field near Goldstream Park.



The E-Bam was installed according to Ministry standards. All sensors were calibrated at the beginning of the sampling campaign and the E-BAM was leak checked and flow checked on a regular basis (Appendix C). Leak and flow checks were always within manufacturer specifications.

The E-BAM operated at the CRD Water Services branch location from June 28th to September 30th, 2010.

2.2 Data Analysis Considerations

During the summer 2010 ambient monitoring program, drought conditions forced the Ministry of Forests and Range to issue a campfire ban for much of Vancouver Island. This ban covered a geographical area that encompassed the study area (Appendix B). The campfire ban was put in place on July 23, 2010 and was lifted on September 1, 2010. In addition, during the campfire ban period there were two distinct periods where wildfire smoke had an impact on Vancouver Island. Between August 4-6th and August 15-17th, Wildfire Smoke Advisories were issued by the Ministry of Environment and the Vancouver Island Health Authority (Appendix B).

These events offer a unique opportunity to examine ambient PM_{2.5} concentrations under different scenarios. Therefore, PM_{2.5} concentrations under the “no-ban”, “ban”, and “wildfire” scenarios were compared.

3.0 Results and Discussion

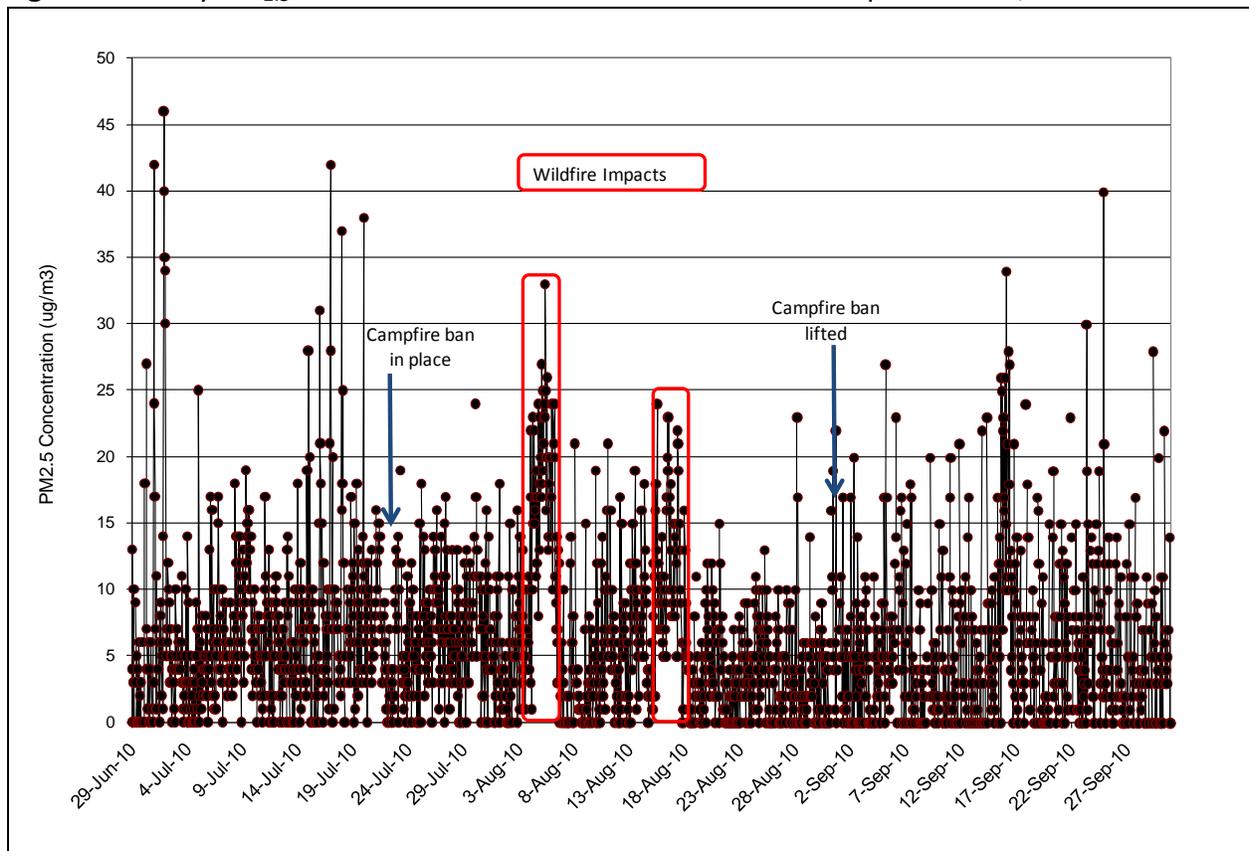
Woodsmoke contains very fine particles known as PM_{2.5} or particulate matter less than 2.5 micrometers in diameter. From a human health perspective, PM_{2.5} is of particular concern because it is respirable and penetrates deep into the lungs. PM_{2.5} is the air pollutant most strongly associated with increases in illness (cardiovascular and pulmonary disease) and death rates, even more so than pollutant gases (Baird, 2008).

PM_{2.5} data collected from the Goldstream ambient monitoring site were examined on different time scales (hourly, daily, and diurnal) and compared to standards where applicable. Note that the Ministry of Environment has ambient air quality objectives for PM_{2.5} based on daily (24-hour) and annual average values. PM_{2.5} data was also coupled with meteorology to help infer the source.

3.1 Hourly PM_{2.5} Concentrations

Hourly concentrations of PM_{2.5} collected at the Goldstream monitoring site from June 28-September 30th is presented in Figure 4.

Figure 4. Hourly PM_{2.5} concentrations from Goldstream June 28-September 30, 2010.



There are clear differences in the hourly data obtained at the monitoring site under the no campfire ban, wildfire, and campfire ban scenarios. The highest hourly values of PM_{2.5} occurred during the evenings of the no-ban period. These are higher than when wildfire smoke from the interior of the province was impacting Vancouver Island. Summary statistics for PM_{2.5} for the no-ban, ban, and wildfire periods are presented in Table 1 below.

The mean PM_{2.5} concentrations in Goldstream during the campfire ban and no-ban periods can be tested for statistical difference using Confidence Interval data for the two data sets. As shown in Table 1 below, the 95% Confidence Intervals of the two data sets do not overlap. There is therefore good evidence that the true mean PM_{2.5} concentrations are different. This can be interpreted as meaning that when campfires are permitted in the Park, the mean PM_{2.5} values are significantly higher than when campfires are not permitted.

Table 1. Summary statistics for PM_{2.5} data collected at Goldstream June 28-September 30, 2010

Summary Statistics for PM _{2.5} Data Collected at Goldstream			
	Campfire Ban	Campfires Allowed	Wildfire Impacts
# Hourly Values	727	1148	144
Average (over period)	5.2 ug/m ³	6.4 ug/m ³	13.2 ug/m ³
Maximum Hourly	24.0 ug/m ³	46.0 ug/m ³	33.0 ug/m ³
Minimum Hourly	0.0 ug/m ³	0.0 ug/m ³	0.0 ug/m ³
Median	5.0 ug/m ³	5.0 ug/m ³	13.0 ug/m ³
Std. Deviation	4.5 ug/m ³	6.4 ug/m ³	7.0 ug/m ³
95% CI Upper	5.5 ug/m ³	6.8 ug/m ³	14.4 ug/m ³
95% CI Lower	4.9 ug/m ³	6.0 ug/m ³	12.1 ug/m ³
# Hourly Values => 25 ug/m ³	0	24	4

A Welch Two Sample t-test using the R statistical program was also performed on the two data sets to verify the results of the Confidence Interval comparison test. The results of the t-test confirmed that average PM_{2.5} values are higher at Goldstream when campfires are permitted in Goldstream Provincial Park.

Results of the t-test are as follows:

t = 4.839, df = 1881.983, p-value = 1.411e-06
Alternative hypothesis: true difference in means is not equal to 0
95 percent confidence interval: 0.7153721 - 1.6904219

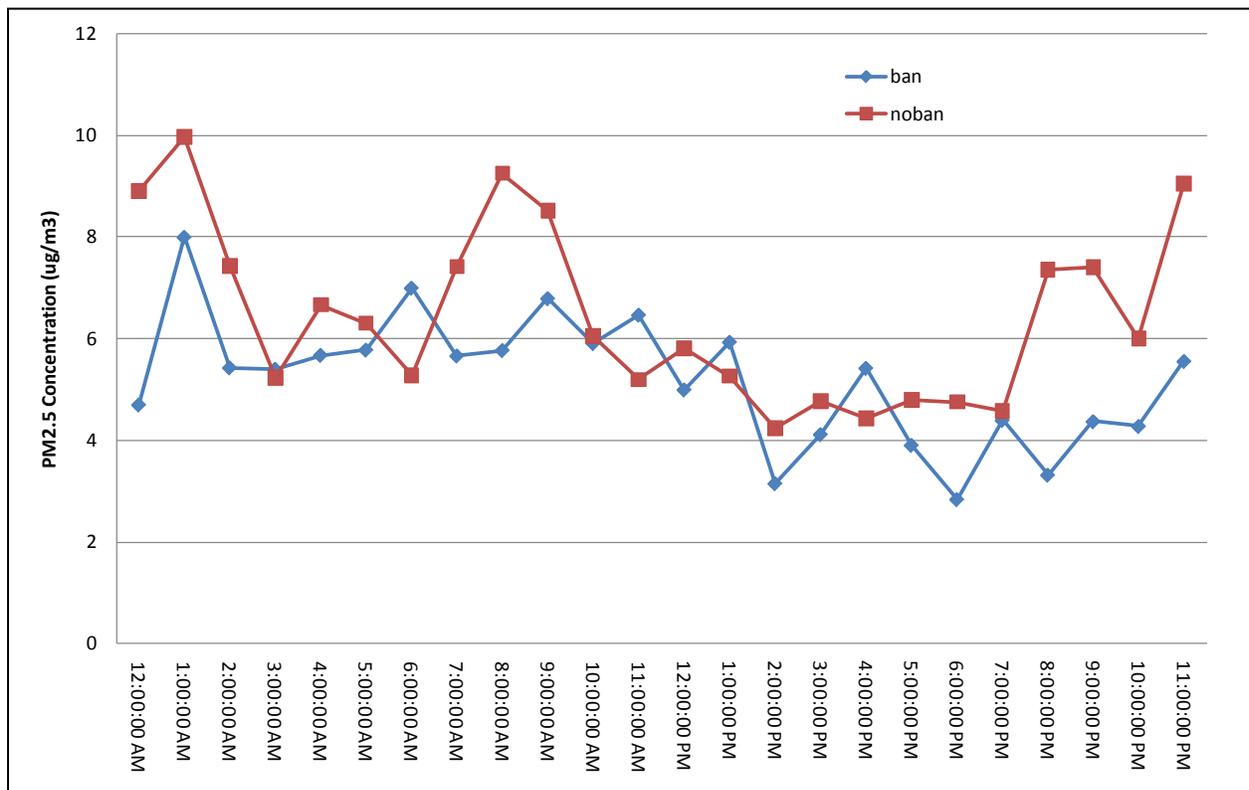
In examining the frequency of higher short-term values summarized in Table 1, it is notable that when campfires were allowed in the park, there were a total of twenty-four hourly values recorded that were equal to or greater than 25 ug/m³ while there were no values equal to or greater than 25 ug/m³ when the campfire ban was in place (outside of the wildfire impact periods).

The above analysis indicates that when campfires were allowed in Goldstream Provincial Park, hourly PM_{2.5} concentrations were, at times, elevated in the residential area of Goldstream. Statistical testing indicates that the mean PM_{2.5} concentration was higher in Goldstream when campfires were allowed in Goldstream Provincial Park.

3.2 Diurnal Patterns for PM_{2.5}

The average PM_{2.5} concentrations by hour of the day for the campfire ban and campfire permitted periods is presented in Figure 5. Differences are evident when we examine the hour of day PM_{2.5} averages during each period.

Figure 5. Hour of the day average PM_{2.5} at Goldstream for the campfire ban and no-ban periods.



Wood smoke effects were the highest at the Goldstream monitoring site during the no-ban period (campfires permitted), particularly between 8PM-2AM and then again from 7:00AM to 9:00AM. This is typically the time when people are most actively using their campfires. During the remainder of the daylight period, concentrations were similar between the two periods. It is interesting to note that there was still an early morning peak experienced during the campfire ban period at 1:00AM which may indicate some non-compliance issues at that time.

The above analysis supports the claim that campfire smoke from Goldstream Park was drifting into the residential area of Goldstream during the evening hours.

3.2 PM_{2.5} Pollution Rose

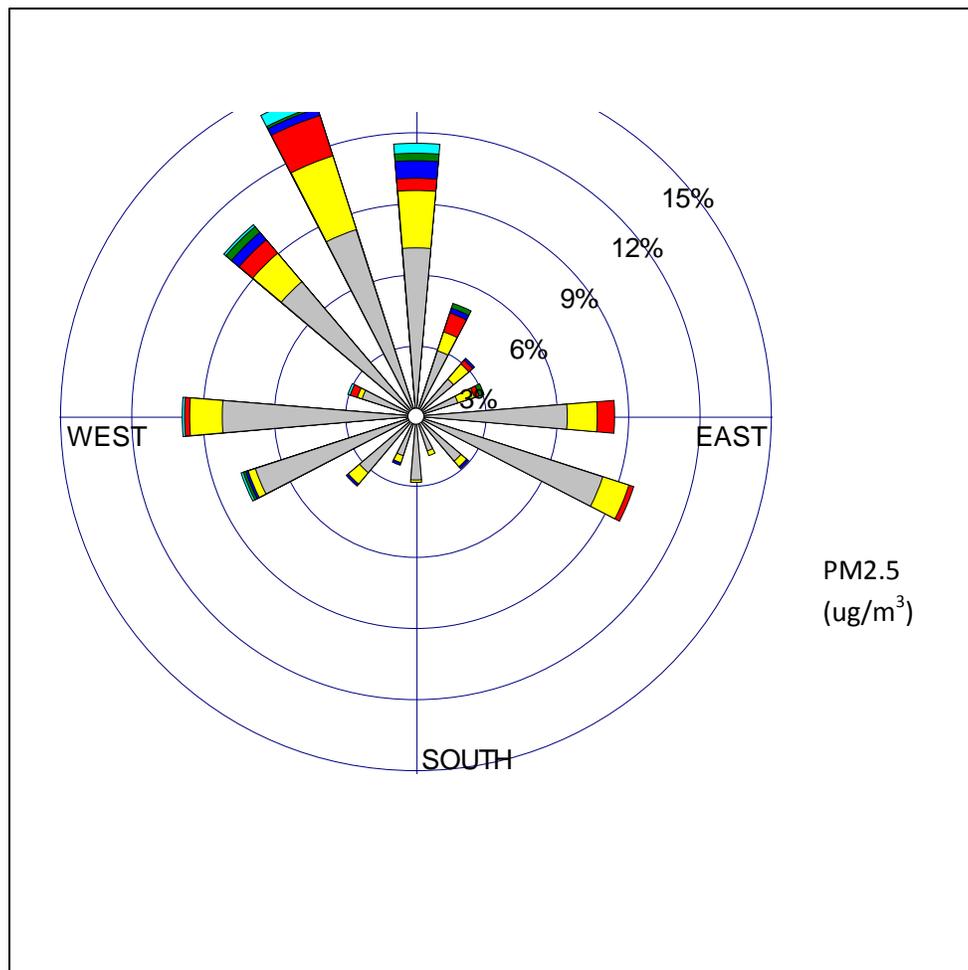
Figure 6 presents hourly PM_{2.5} data paired with wind direction data for the 2 periods when campfires were allowed in the park – June 29th-July 22nd & September 1st -30th. This analysis provides further insights into source contributions.

The dataset was processed as follows prior to charting with WRPLOT:

- All hourly data was removed if wind speeds were less than 0.4 m/s (anemometer threshold is 0.3 m/s).
- All hourly data was removed if the wind direction data was invalid.
- All hourly data was removed if the PM_{2.5} concentration was less than 1 ug/m³.

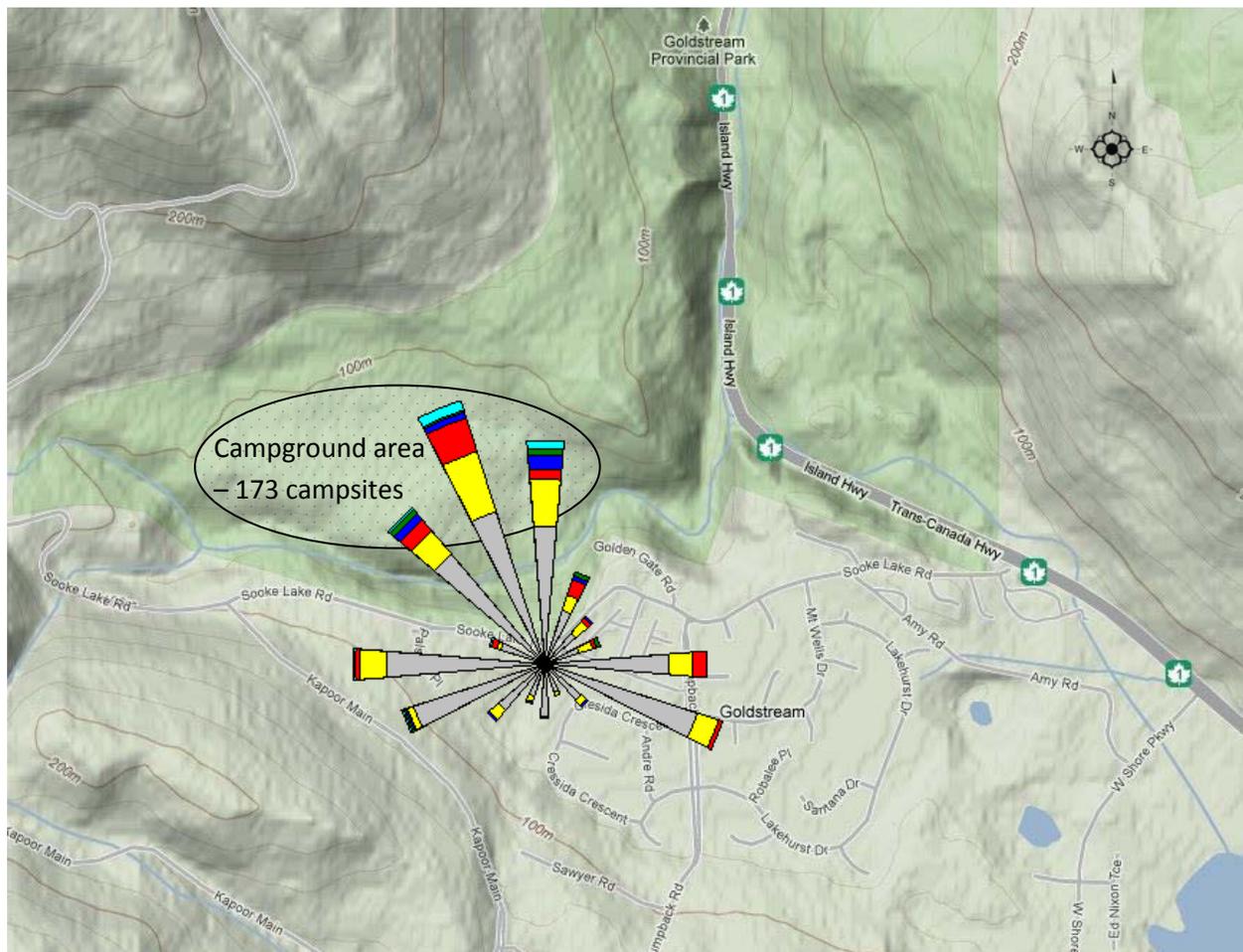
The pollution rose indicates which way the wind was blowing from at each PM_{2.5} concentration gradient recorded at the Goldstream monitoring site.

Figure 6. PM_{2.5} pollution rose for Goldstream for the period when campfires were permitted in Goldstream Provincial Park.



The pollution rose was placed on a map of the study area in Figure 7 below for ease of interpretation.

Figure 7. Goldstream PM_{2.5} pollution rose overlaid on the study area for period when campfires were permitted in Goldstream Provincial Park.

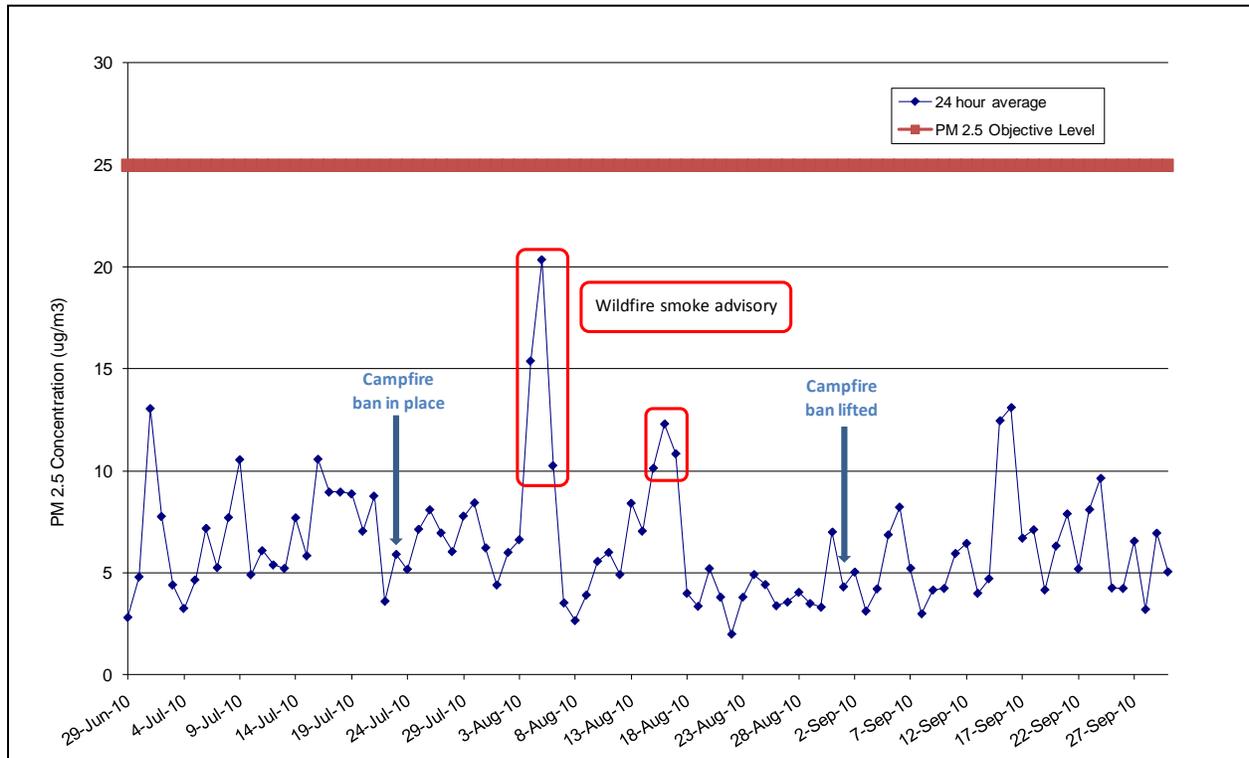


The Goldstream Provincial Park campground is to the north and northwest of the sampling location. The pollution rose demonstrates that during the period when campfires were permitted in the Park, the majority of the elevated PM_{2.5} hourly concentrations occurred when winds were directed from the campground towards the monitoring location. Other high values were experienced when winds were out of the west and west-southwest. This is likely not indicative of other sources in the area. Instead it is more feasible that smoke from the campground was directed across the valley on a light northerly wind where it built up against the hillside to the west of the monitoring location. When the winds changed to a westerly flow, these emissions would be brought into the residential area of Goldstream.

3.3 Daily PM_{2.5} Concentrations

Daily average (midnight to midnight) PM_{2.5} concentrations from the Goldstream ambient monitoring site are presented in Figure 8.

Figure 8. 24-Hour PM_{2.5} concentrations at Goldstream June 29-September 30, 2010.



All 24-hour concentrations recorded during the sampling campaign were below the Provincial Ambient Objective for PM_{2.5} of 25 ug/m³. It is notable that there were five days during the period when campfires were permitted where daily levels were greater than 10 ug/m³ while daily levels during the campfire ban were all below 10 ug/m³. It is also interesting that while higher hourly PM_{2.5} values were experienced during the period when campfires were permitted in the park, the highest 24-hour levels occurred when there were wildfire smoke impacts in the area. Meteorology would also have an effect on the results.

4.0 Conclusions

1. Wood smoke generated from the use of campfires in Goldstream Provincial Park can drift into the residential area of Goldstream. Analysis of the PM_{2.5} data collected at the Goldstream monitoring site indicates the following:
 - The highest hourly PM_{2.5} concentrations recorded at the Goldstream ambient monitoring site were recorded when campfires were permitted at Goldstream Provincial Park. Maximum hourly values were roughly twice those recorded during the campfire ban period.
 - When the campfire Ban and No-Ban periods were examined, mean PM_{2.5} concentrations were higher in Goldstream when campfires were permitted in Goldstream Provincial Park.
 - Diurnal patterns in PM_{2.5} concentrations recorded at the Goldstream monitoring site indicate that wood smoke from campfires in the Park is drifting into the residential area of Goldstream in the evening and early morning hours.
 - Pollution rose indicate that when the majority of elevated hourly PM_{2.5} concentrations occur, the wind is blowing from the campground area towards the monitoring location and the residential area of Goldstream.
2. Daily (midnight to midnight) PM_{2.5} values did not exceed Provincial Ambient Air Quality Objectives.

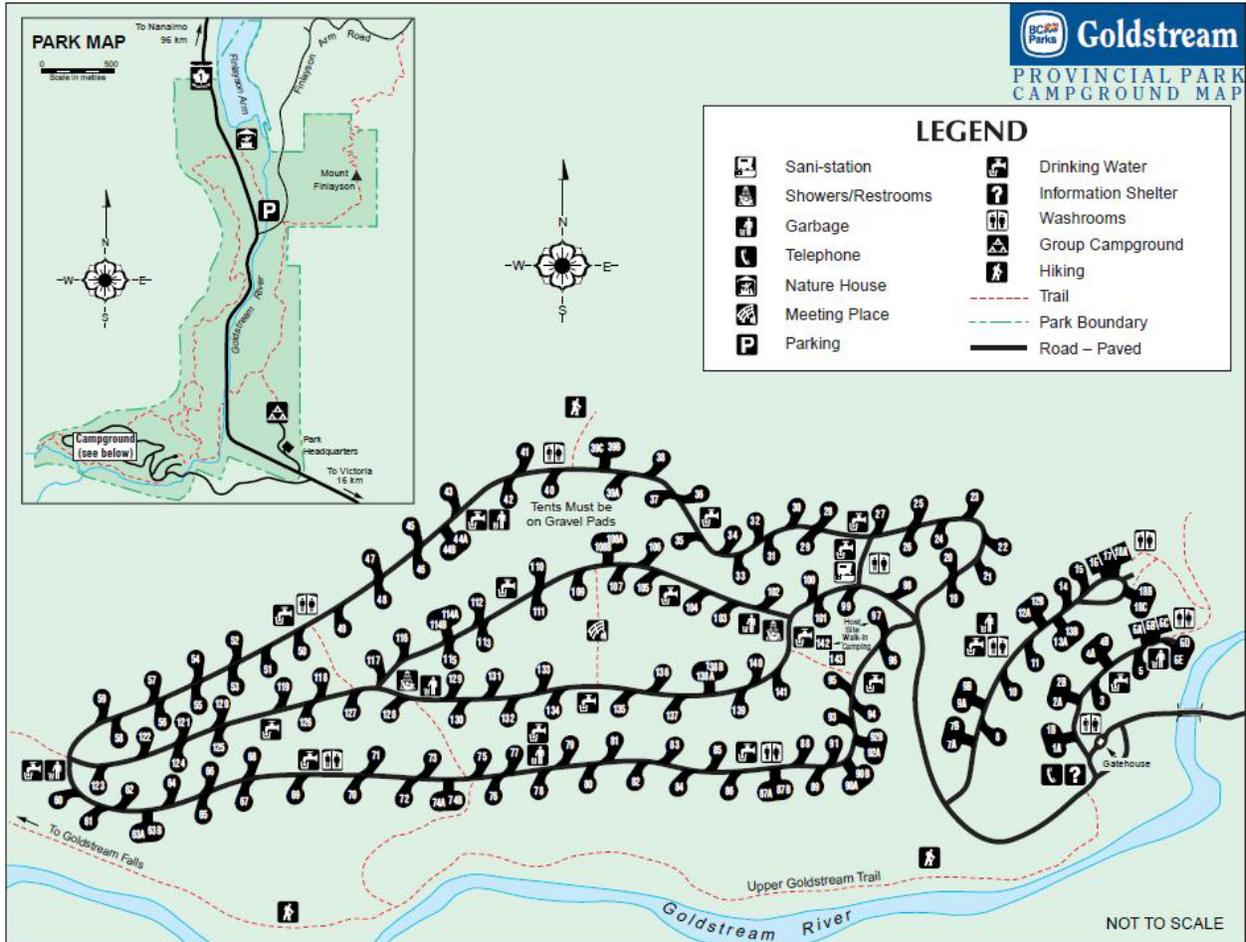
5.0 Recommendations

Although the daily Provincial Ambient Air Quality Objective was not exceeded during the study period, it is recommended that BC Parks direct the results of this study to the Vancouver Island Health Authority for an opinion on health effects of short-term exposure to hourly PM_{2.5} concentrations greater than 25 ug/m³. A smoke management strategy for the Park may be warranted.

6.0 Works Cited

Baird, Colin and Michael Cann. *Environmental Chemistry*. 4th ed. Gordonsville, Virginia: W.H. Freeman & Co, 2008.

Appendix A – Campground map for Goldstream Provincial Park



**Appendix B – Backyard Burning Ban Notices, Campfire Ban Notices and
Wildfire Smoke Advisories**



INFORMATION BULLETIN

2010FOR0068-000570
May 12, 2010

Ministry of Forests and Range
Coastal Fire Centre

BACKYARD BURNS RESTRICTED ACROSS COASTAL FIRE CENTRE

PARKSVILLE – Effective noon May 15, medium-sized backyard burns will be prohibited within the Coastal Fire Centre’s jurisdiction to help prevent human-caused wildfires and limit the impact of smoke.

Specifically the restriction refers to:

- Waste, slash or other material, piled or unpiled, that is larger than 0.5 metres in height and 0.5 metres in width, but smaller than two metres in height and three metres in width.
- Stubble or grass that is being burned over an area greater than 2,000 square metres.

The ban does not apply to cooking stoves that use gas, propane or briquettes, or to open fires, including campfires, that are a half-metre by a half-metre or smaller. People lighting fires larger than two metres by three metres must comply with burning regulations and obtain a burn registration number by calling 1-888 797-1717.

Approved open fires used for resource management, such as eco-system restoration, are not included in the prohibition.

The ban covers all BC Parks, Crown and private lands, but does not apply to the City of Vancouver or within the boundaries of local governments that have forest fire-prevention bylaws and are serviced by a fire department. Please check with civic authorities for any restrictions before lighting a fire.

Anyone found in contravention of the ban could be fined up to \$345 or be held responsible for suppression costs if their negligence causes a wildfire. The ban will be in place until Oct. 15, 2010 or until otherwise lifted.

The Coastal Fire Centre covers the area west of the height of land on the Coast Mountain range from the U.S./Canada border at Manning Park to the western border of Tweedsmuir Park in the north, and includes the Sunshine Coast, the Lower Mainland, Vancouver Island and the Gulf Islands.

To report a wildfire or unattended campfire call 1-800 663-5555 or *5555 on most cellular networks.

For more information on open fire prohibitions, area restrictions or for updates on current wildfire activity, visit www.bcwildfire.ca.

-30-

Media Contact: Donna MacPherson
Fire Information Officer
Coastal Fire Centre

250 951-4209 (office)

250 927-1446 (cell)

More information on wildfires in British Columbia is available on Twitter at <http://twitter.com/BCGovFireInfo> and on Facebook at <http://facebook.com/BCForestFireInfo>.

For more information on government services or to subscribe to the Province's news feeds using RSS, visit the Province's website at www.gov.bc.ca.



Ministry of Forests and Range



Wildfire Management

Legal Notice

Order Identification #: CoFC-002

OPEN FIRE PROHIBITION ORDER FIRE BAN

Under section 10(1) of the *Wildfire Act*, and pursuant to the authority delegated to me by the Minister of Forests and Range, in order to reduce the risk of wildfire and to protect public safety, I, Tim Ewart, Acting Fire Centre Manager, hereby **PROHIBIT** within the restricted area described below, the lighting, fueling or use of the following types of open fires:

- Campfires of any size or description, burning woody material;
- All waste, slash or other burning, whether piled or unpled, of any size; and
- Stubble or grass burning over any area.

Furthermore, I order all persons lighting, fuelling or using any of the open fires listed above within the restricted area to cease doing so and to **extinguish all such fires**.

The ban does not apply to cooking stoves that use gas, propane or briquettes, or to portable campfire apparatus with a CSA or ULC rating using briquettes, liquid or gaseous fuel if the operator maintains a flame length of no longer than 15 centimeters.

This Order takes effect at noon on July 23, 2010 and remains in force until the Order is lifted.

This Order applies within the regional district boundaries described below that fall within the jurisdictional boundaries of the Coastal Fire Centre, and includes all public and private land except land situated within the boundaries of a local government with an open fire bylaw that provides for fire prevention and forest protection and is serviced by a fire department:

- Alberni– Clayoquot Regional District
- Capital Regional District
- Central Coast Regional District west of Tweedsmuir Provincial Park
- Comox Regional District
- Cowichan Valley Regional District
- Fraser Valley Regional District
- Greater Vancouver Regional District
- Mount Waddington Regional District south of Tweedsmuir Provincial Park
- Nanaimo Regional District
- Powell River Regional District
- Squamish– Lillooet Regional District, ONLY electoral areas C & D
- Sunshine Coast Regional District
- Strathcona Regional District

This Order does not apply within the West Vancouver Island Fog Zone, as described below, and indicated on the attached map.

The West Coast Fog Zone includes all land running inland 2 kilometers from:

- Owen Point near Port Renfrew and continuing north past Cape Beale to Hissin Point, then;
- across Alberni Inlet to Chup Point to exclude the headwaters of Alberni Inlet, then;
- following the shoreline around Toquart Bay to Ucluelet and Tofino, then;
- north to Opitsat IR, Robert Point and Kraan Head to exclude the inner waters of Clayoquot Sound, then;
- along Catface Mountain to Clifford Point then across Millar Channel to McNeill Peninsula to exclude the inner waters of Hebert Inlet, then along the west coast of Flores Island to the northern boundary of Flores Island Provincial Park, then
- across Sydney Inlet to the northern end of Hot Springs Cove to exclude the inner waters of Shelter and Sidney Inlets, then along the shoreline through Boat Basin Harbour and Estevan Point to Burdwood Point, then;
- across the entrance to Nootka Sound to Friendly Cove to exclude the inner waters of Nootka Sound including Tahsis and Gold River then north along the shoreline of Nootka Island to Garden Point, then;
- across Esperanza Inlet to Leading Hill to exclude the inner waters of Zeballos, Espinosa and Port Eliza Inlets, then north to Rugged Point, then;
- across Kyuquot Channel to Union Island then north to the narrows of Crowther Channel and across to Surprise Island and to Guillod Point to exclude the inner waters of Kyuquot Sound, then;
- west through McKay Cove to Malksope and Ououkinsh Inlet to Brooks Peninsula Provincial Park, then;
- around Brooks Peninsula Provincial Park to Klashkish Inlet and along the shoreline north to Cliffe Point, then;
- north across Quatsino Sound to Nordstrom Cove to exclude Holberg and Neroutsos Inlets, then west to Winter Harbour and San Josef Bay to Cape Scott Provincial Park, then;
- around Cape Scott Provincial Park and the northern end of Vancouver Island to Shushartie Bay then east along Goletas Channel ending at the boundary of the District of Port Hardy.

Failure to comply with this Order can result in a fine of up to \$100,000 and imprisonment of up to one year

_____ Date : July 20, 2010

Tim Ewart
Acting Fire Centre Manager
Coastal Fire Centre

Attachment – West Vancouver Island Fog Zone map



Ministry of Forests and Range



Wildfire Management

Legal Notice

Order Identification #: CoFC-006

OPEN FIRE PROHIBITION ORDER RESCIND

Under section 10(1) of the *Wildfire Act*, and pursuant to the authority delegated to me by the Minister of Forests and Range, I, Tim Ewart, Acting Fire Centre Manager, hereby **RESCIND the campfire prohibition order** throughout the Coastal Fire Centre. The lighting, fueling or use of the following type of open fire is now permitted:

- Campfires burning woody material;

This Order takes effect at noon on September 1, 2010.

This Order applies within the jurisdictional boundaries of the Coastal Fire Centre, and includes all public and private land except land situated within the boundaries of a local government with an open fire bylaw that provides for fire prevention and forest protection and is serviced by a fire department.

_____ Date : September 1, 2010

Tim Ewart
Acting Fire Centre Manager
Coastal Fire Centre

WILDFIRE SMOKE Advisory

MEDIA RELEASE

WILDFIRE SMOKE ADVISORY ISSUED FOR East Coast of Vancouver Island

(Aug 4, 2010) The Ministry of Environment in collaboration with the Vancouver Island Health Authority has issued a Smoke Advisory for the east coast of Vancouver Island from Cowichan Valley to Campbell River, including the communities of Duncan, Parksville, Port Alberni, Courtenay and Comox, because of forest fire smoke that is affecting some areas. Smoke concentrations will vary widely as winds, fire behaviour and temperatures change. This situation is expected to persist for the next 24 hours.

Avoid strenuous outdoor activities. If you are experiencing any of the following symptoms, contact your health care provider: difficulty in breathing, chest pain or discomfort, and sudden onset of cough or irritation of airways. Exposure is particularly a concern for infants, the elderly and those who have underlying medical conditions such as diabetes, and lung or heart disease.

People with heart or lung conditions should reduce their levels of activity while air quality is poor. These individuals should watch for worsening of their symptoms. If this happens, they should reduce their exposure to the smoke and contact their health care provider, walk-in clinic or emergency department for advice. To speak to someone immediately about your health concerns, contact HealthLink BC, available toll free, 24 hours a day, 7 days a week at 8-1-1, or via the web at: <http://www.healthlinkbc.ca/kbaltindex.asp>

Tips to reduce your personal health risk:

- People with heart or lung conditions may be more sensitive to the effects of smoke and should watch for any change in symptoms that may be due to smoke exposure. If any symptoms are noted, affected individuals should **take steps to reduce their exposure to**

smoke and if necessary see their physician. People with symptoms should go to their health care provider, walk in clinic or emergency department depending on severity of symptoms.

- Use common sense regarding outdoor physical activity – if your breathing becomes difficult or uncomfortable, stop or reduce the activity.
- Stay cool and drink plenty of fluids.
- Smoke levels may be lower indoors, however levels of smoke particles will still be increased. If you stay indoors, be aware of your symptoms.
- Consider visiting a location like a shopping mall with cooler filtered air. Keep in mind that staying indoors may help you stay cool and provide some relief from the smoke, however many air conditioning systems do not filter the air or improve indoor air quality.
- Reduce indoor pollution sources such as smoking or burning other materials.
- You may be able to reduce your exposure to smoke by moving to cleaner air. Conditions can vary dramatically by area and elevation.
- Residents with asthma or other chronic illness should activate their asthma or personal care plan.
- Pay attention to local air quality reports, air quality may be poor even though smoke may not be visible.
- Commercially available HEPA (high efficiency particulate air) filters can further reduce poor indoor air quality near the device.
- Maintaining good overall health is a good way to prevent health effects resulting from short-term exposure to air pollution.
- For general information about smoke and your health, contact HealthLink BC available toll free, 24 hours a day, 7 days a week at 8-1-1, or via the web at: <http://www.healthlinkbc.ca/kbaltindex.asp>.
- Real-time air quality information in B.C. is available at <http://www.bcairquality.ca>.

Food safety and water quality tips:

- During a forest fire, it's also important to be aware of health risks associated with **food safety in power outages** and **water quality**.
- Interior Health's website contains helpful information and other resources related to forest fire smoke exposure / air quality, as well as food safety when the power is out and ensuring your drinking water is safe.
- Visit <http://www.interiorhealth.ca>, click on the Health & Safety tab at the top of the page, then follow the links for Emergency Information > Forest Fires.

Contact: Earle Plain, Air Quality Meteorologist, Ministry of Environment (250) 751-3171

Contact: Charmaine Enns, Vancouver Island Health Authority (250) 334-5461



Ministry of
Environment



WILDFIRE SMOKE ADVISORY ENDED

MEDIA RELEASE

WILDFIRE SMOKE ADVISORY ENDED FOR EAST COAST OF VANCOUVER ISLAND

(Aug 6, 2010 – Nanaimo) The Ministry of Environment in collaboration with the Vancouver Island Health Authority has ended the Wildfire Smoke Advisory for the east coast of Vancouver Island from Cowichan Valley to Campbell River, including the communities of Duncan, Parksville, Port Alberni, Courtenay and Comox, due to improving air quality that has resulted from a change in the weather.

For more information on current air quality, see: www.bcairquality.ca.

Pollutant concentrations and the associated health risk are now lower due to changing weather conditions.

Contact: Earle Plain, Air Quality Meteorologist, Ministry of Environment

Phone: (250)751-3171

Contact: Charmaine Enns, Vancouver Island Health Authority

Phone: (250) 331-8592



Ministry of
Environment



WILDFIRE SMOKE Advisory

MEDIA RELEASE

WILDFIRE SMOKE ADVISORY ISSUED FOR NORTHERN, CENTRAL AND EAST COAST VANCOUVER ISLAND

(Aug 15, 2010 – Nanaimo) The Ministry of Environment in collaboration with the Vancouver Island Health Authority has issued a Wildfire Smoke Advisory for the northern, central and east coast Vancouver Island because of forest fire smoke that is affecting some areas. Communities affected include the Cowichan Valley, Nanaimo, Parksville, Port Alberni, Comox Valley, Campbell River, Port McNeill, Port Hardy and Port Alice. Weather conditions are forcing smoke from wildfires in the interior of British Columbia to the coast, producing smoky skies throughout the South Coast Region. Smoke concentrations will vary widely as winds, fire behaviour and temperatures change. This situation is expected to persist until weather conditions change.

Avoid strenuous outdoor activities. If you are experiencing any of the following symptoms, contact your health care provider: difficulty in breathing, chest pain or discomfort, and sudden onset of cough or irritation of airways. Exposure is particularly a concern for infants, the elderly and those who have underlying medical conditions such as diabetes, and lung or heart disease.

People with heart or lung conditions should reduce their levels of activity while air quality is poor. These individuals should watch for worsening of their symptoms. If this happens, they should reduce their exposure to the smoke and contact their health care provider, walk-in clinic or emergency department for advice. To speak to someone immediately about your health concerns, contact HealthLink BC, available toll free, 24 hours a day, 7 days a week at 8-1-1, or via the web at: <http://www.healthlinkbc.ca/kbaltindex.asp>

Tips to reduce your personal health risk:

- People with heart or lung conditions may be more sensitive to the effects of smoke and should watch for any change in symptoms that may be due to smoke exposure. If any symptoms are noted, affected individuals should **take steps to reduce their exposure to smoke** and if necessary see their physician. People with symptoms should go to their health care provider, walk in clinic or emergency department depending on severity of symptoms.
- Use common sense regarding outdoor physical activity – if your breathing becomes difficult or uncomfortable, stop or reduce the activity.
- Stay cool and drink plenty of fluids.
- Smoke levels may be lower indoors, however levels of smoke particles will still be increased. If you stay indoors, be aware of your symptoms.
- Consider visiting a location like a shopping mall with cooler filtered air. Keep in mind that staying indoors may help you stay cool and provide some relief from the smoke, however many air conditioning systems do not filter the air or improve indoor air quality.
- Reduce indoor pollution sources such as smoking or burning other materials.
- You may be able to reduce your exposure to smoke by moving to cleaner air. Conditions can vary dramatically by area and elevation.
- Residents with asthma or other chronic illness should activate their asthma or personal care plan.
- Pay attention to local air quality reports, air quality may be poor even though smoke may not be visible.
- Commercially available HEPA (high efficiency particulate air) filters can further reduce poor indoor air quality near the device.
- Maintaining good overall health is a good way to prevent health effects resulting from short-term exposure to air pollution.
- For general information about smoke and your health, contact HealthLink BC available toll free, 24 hours a day, 7 days a week at 8-1-1, or via the web at: <http://www.healthlinkbc.ca/kbaltindex.asp>.
- Real-time air quality information in B.C. is available at <http://www.bcairquality.ca>.

Food safety and water quality tips:

- During a forest fire, it's also important to be aware of health risks associated with **food safety in power outages** and **water quality**.
- Interior Health's website contains helpful information and other resources related to forest fire smoke exposure / air quality, as well as food safety when the power is out and ensuring your drinking water is safe.
- Visit <http://www.interiorhealth.ca>, click on the Health & Safety tab at the top of the page, then follow the links for Emergency Information > Forest Fires.

Contact: Earle Plain, Air Quality Meteorologist, Ministry of Environment (250) 751-3171

Contact: Charmaine Enns, Vancouver Island Health Authority (250) 331-8592



Ministry of
Environment



WILDFIRE SMOKE ADVISORY ENDED

MEDIA RELEASE

WILDFIRE SMOKE ADVISORY ENDED FOR NORTHERN, CENTRAL AND EAST COAST VANCOUVER ISLAND

(Aug 17, 2010 – Nanaimo) The Ministry of Environment in collaboration with the Vancouver Island Health Authority has ended the Wildfire Smoke Advisory for northern, central and east coast Vancouver Island due to improving air quality that has resulted from a change in the weather patterns.

Fine particulate levels have dropped below the Provincial Ambient Air Quality Objective at all monitoring locations on Vancouver Island.

For more information on current air quality, see: www.bcairquality.ca.

Pollutant concentrations and the associated health risk are now lower due to changing weather conditions.

Contact: Earle Plain, Air Quality Meteorologist, Ministry of Environment

Phone: (250)751-3171

Contact: Charmaine Enns, Vancouver Island Health Authority

Phone: (250) 331-8592

Appendix C - E-BAM Calibration Certificates

Ambient Monitor Audit Certificate

Date: March 24 2010 Location: Goldstream E-BAM Initial check @ : Nanaimo Site Code: Technician Wiederick Method: Beta-Attenuation Make: Met One Model: E-BAM Serial Number: D8565 Parameter: PM2.5 Start: n/a Finish: n/a		Barometric Pressure: 751 mmHg Ambient Temperature: 23.4 °C Relative Humidity: n/a % K-Factor: 0.993 Flowmeter: Streamline Streamline Data Total Main m: 0.4145 b: -0.2436					
Sample Flow:	Target	(1)	(2)	(3)	(Avg)	Actual	%Error
	L/Min.	In. H2O	In. H2O	In. H2O	In. H2O	L/Min.	
	16.700	5.53	5.52	5.53	5.53	16.61	-0.5%
Target flow is read from calibration screen							
<u>Temperature:</u> Ambient Temperature (Audit) 23.4 °C Ambient Temperature (BAM) 23.2 °C		<u>Pressure:</u> Ambient Pressure (Audit) 751 mmHg Ambient Pressure (BAM) 752 mmHg					
<u>Relative Humidity:</u> Relative Humidity (Audit) n/a % Relative Humidity (BAM)		<u>Leak Check:</u> Leak Flow: 0.3 l/min Leak Offset: 0					
<u>Audit Criteria:</u> Sample Flow Error: -0.5% Pass Temperature Error: 0.2 Pass Pressure Error: 0.90 Pass Humidity Error: 0 Pass Leak Test: 0.04 Pass Self-test: Pass Pass Head Condition: Clean Pass				<u>Operational Parameters:</u> C _v : n/a ABS: n/a K: n/a Q _o : n/a m _{sw} : n/a BKGD: n/a Flow Mode: Actual RH Control ON: RH Set Point:			

Comments: Modified BAM calibration sheet, not all parameters applicable.
Temp probe changed to unit on loan while repairs are done to MoE probe
Pump changed prior to deployment
Pump test completed, indicated slightly worse than marginal pump operation
Initial flow check flow = 16.32lpm @ 16.7 set point.
Inlet heater cable poorly installed on multiple previous pump changes.
Wire was under tension and chafing against instrument chassis. Bare wire exposed.
Looked to be shorted out across wires, and both bare wires also shorted to ground.
Taped over each individual chafed spot with electrical tape. Permanent repairs need to take place at a later date.

Manufacturer recommends not adjusting internal temp or RH

Membrane test passed

Audit
Results: PASS

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Ambient Monitor Audit Certificate

Date: July 21st, 2010 Location: Langford (goldstream) : Site Code: Technician: Wiederick Method: Beta-Attenuation Make: Met One Model: E-BAM Serial Number: Parameter: PM2.5 Start: Finish: 	Barometric Pressure: 752 mmHg Ambient Temperature: 28.8 °C Relative Humidity: 26 % K-Factor: 0.977 Flowmeter: Streamline Streamline Data <table style="width: 100%; border-collapse: collapse;"> <tr> <td></td> <td align="right">Total</td> <td align="right">Main</td> </tr> <tr> <td>m:</td> <td align="right">0.4145</td> <td></td> </tr> <tr> <td>b:</td> <td align="right">-0.2436</td> <td></td> </tr> </table>		Total	Main	m:	0.4145		b:	-0.2436	
	Total	Main								
m:	0.4145									
b:	-0.2436									

Sample Flow:	Target	(1)	(2)	(3)	(Avg)	Actual	%Error
	L/Min.	In. H2O	In. H2O	In. H2O	In. H2O		
	16.700	5.68	5.60	5.69	5.66	16.95	1.5%

<u>Temperature:</u>	<u>°C</u>	<u>Pressure:</u>	<u>mmHg</u>
Ambient Temperature (Audit)	28.8	Ambient Pressure (Audit)	752
Ambient Temperature (BAM)	30.0	Ambient Pressure (BAM)	752

<u>Relative Humidity:</u>	<u>%</u>	<u>Leak Check:</u>	<u>l/min</u>
Relative Humidity (Audit)	26	Leak Flow:	0.2
Relative Humidity (BAM)	33	Leak Offset:	0

<u>Audit Criteria:</u>			<u>Operational Parameters:</u>			
Sample Flow Error:	1.5%	Pass	C _v :		Q _o :	
Temperature Error:	1.2	Pass	ABS:		m _{sw} :	
Pressure Error:	0.00	Pass	K:		BKGD:	
Humidity Error:	7	Pass	Flow Mode:	Actual		
Leak Test:	0.04	Pass	RH Control ON:			
Self-test:	Pass	Pass	RH Set Point:			
Head Condition:	Clean	Pass				

Comments: Instrument has been deployed for 1 month, field check.
 June 28th deployment calibration certificate accidentally over written with this document.

Audit **PASS** Environmental

Ambient Monitor Audit Certificate

Date: Sept 2, 2010 Location: Langford (goldstream) : Site Code: Technician: Wiederick Method: Beta-Attenuation Make: Met One Model: E-BAM Serial Number:				Barometric Pressure: 756 mmHg Ambient Temperature: 23.6 °C Relative Humidity: n/a % K-Factor: 0.999 Flowmeter: Streamline												
Parameter: PM2.5 Start: Finish:				Streamline Data <table border="1"> <thead> <tr> <th></th> <th>Total</th> <th>Main</th> </tr> </thead> <tbody> <tr> <td>m:</td> <td>0.4145</td> <td></td> </tr> <tr> <td>b:</td> <td>-0.2436</td> <td></td> </tr> </tbody> </table>					Total	Main	m:	0.4145		b:	-0.2436	
	Total	Main														
m:	0.4145															
b:	-0.2436															
Sample Flow:	Target	(1)	(2)	(3)	(Avg)	Actual	%Error									
	L/Min.	In. H2O	In. H2O	In. H2O	In. H2O			L/Min.								
	16.700	5.68	5.68	5.68	5.68	16.79	0.5%									
Temperature: °C Ambient Temperature (Audit) 23.6 Ambient Temperature (BAM) 23.9				Pressure: mmHg Ambient Pressure (Audit) 756 Ambient Pressure (BAM) 756												
Relative Humidity: % Relative Humidity (Audit) n/a Relative Humidity (BAM) n/a				Leak Check: l/min Leak Flow: 0.2 Leak Offset: 0												
Audit Criteria: Sample Flow Error: 0.5% Pass Temperature Error: 0.3 Pass Pressure Error: 0.00 Pass Humidity Error: 0 Pass Leak Test: 0.04 Pass Self-test: Pass Pass Head Condition: Clean Pass				Operational Parameters: C _v : ABS: K: Q _o : m _{sw} : BKGD: Flow Mode: Actual RH Control ON: RH Set Point:												

Comments:

Audit PASS

Environmental

Ambient Monitor Audit Certificate

Date: Oct 6, 2010 Location: Langford (goldstream) : Site Code: Technician: Wiederick Method: Beta-Attenuation Make: Met One Model: E-BAM Serial Number: Parameter: PM2.5 Start: Finish:				Barometric Pressure: 757 mmHg Ambient Temperature: 14.9 °C Relative Humidity: n/a % K-Factor: 1.031 Flowmeter: Streamline Streamline Data <table border="1"> <thead> <tr> <th></th> <th>Total</th> <th>Main</th> </tr> </thead> <tbody> <tr> <td>m:</td> <td>0.4145</td> <td></td> </tr> <tr> <td>b:</td> <td>-0.2436</td> <td></td> </tr> </tbody> </table>					Total	Main	m:	0.4145		b:	-0.2436	
	Total	Main														
m:	0.4145															
b:	-0.2436															
Sample Flow:	Target	(1)	(2)	(3)	(Avg)	Actual	%Error									
	L/Min.	In. H2O	In. H2O	In. H2O	In. H2O	L/Min.										
	16.700	5.91	5.90	5.89	5.90	16.85	0.9%									
Temperature: °C Ambient Temperature (Audit) 14.9 Ambient Temperature (BAM) 14.9				Pressure: mmHg Ambient Pressure (Audit) 757 Ambient Pressure (BAM) 757												
Relative Humidity: % Relative Humidity (Audit) 62 Relative Humidity (BAM) 58				Leak Check: l/min Leak Flow: 0.2 Leak Offset: 0												
Audit Criteria: Sample Flow Error: 0.9% Pass Temperature Error: 0.0 Pass Pressure Error: 0.00 Pass Humidity Error: 4 Pass Leak Test: 0.04 Pass Self-test: Pass Pass Head Clean Pass				Operational Parameters: C _v : ABS: K: Q _o : m _{sw} : BKGD: Flow Mode: Actual RH Control ON: RH Set Point:												

Condition:



Comments: Final verification check before instrument removal.

**Audit
Results: PASS**

**Environmental
Quality Branch**