Air Quality in the Comox Valley

Committee of the Whole

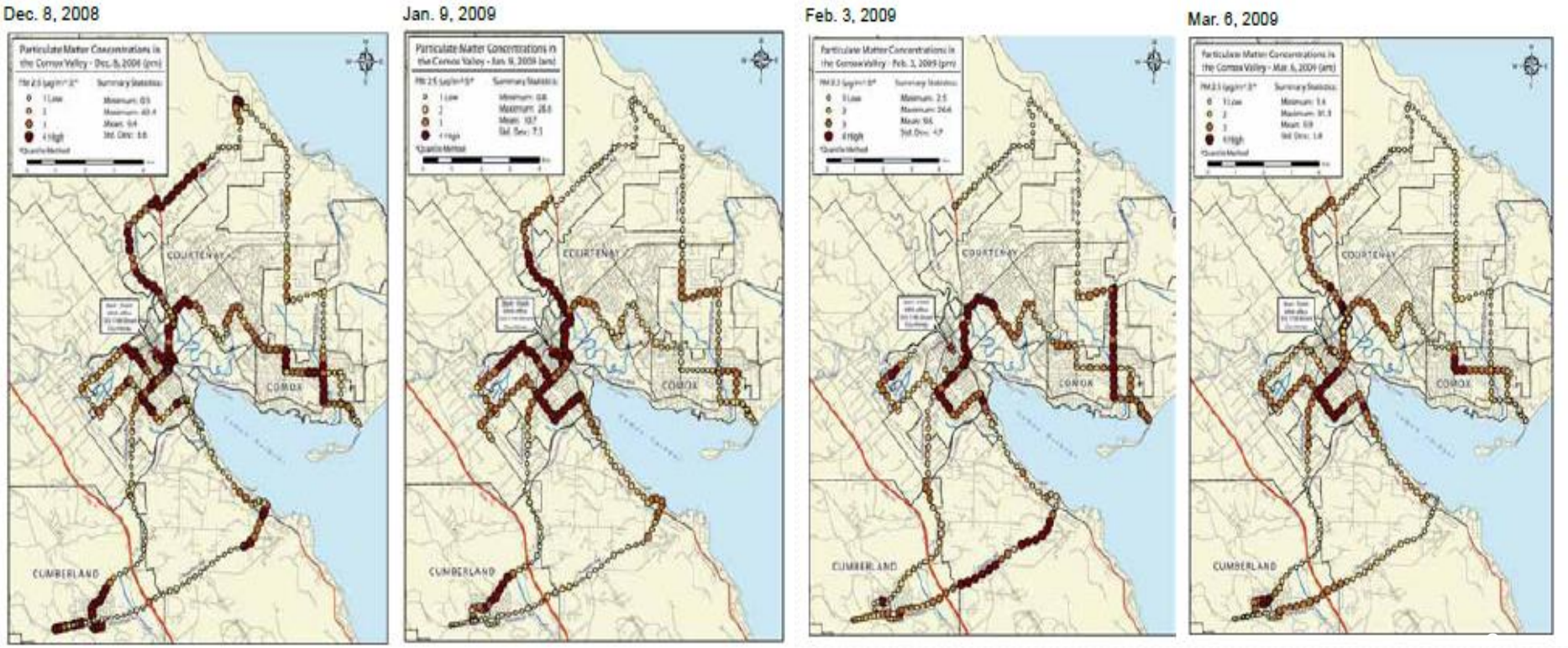
Jan 15, 2019

Earle Plain, Air Quality Meteorologist

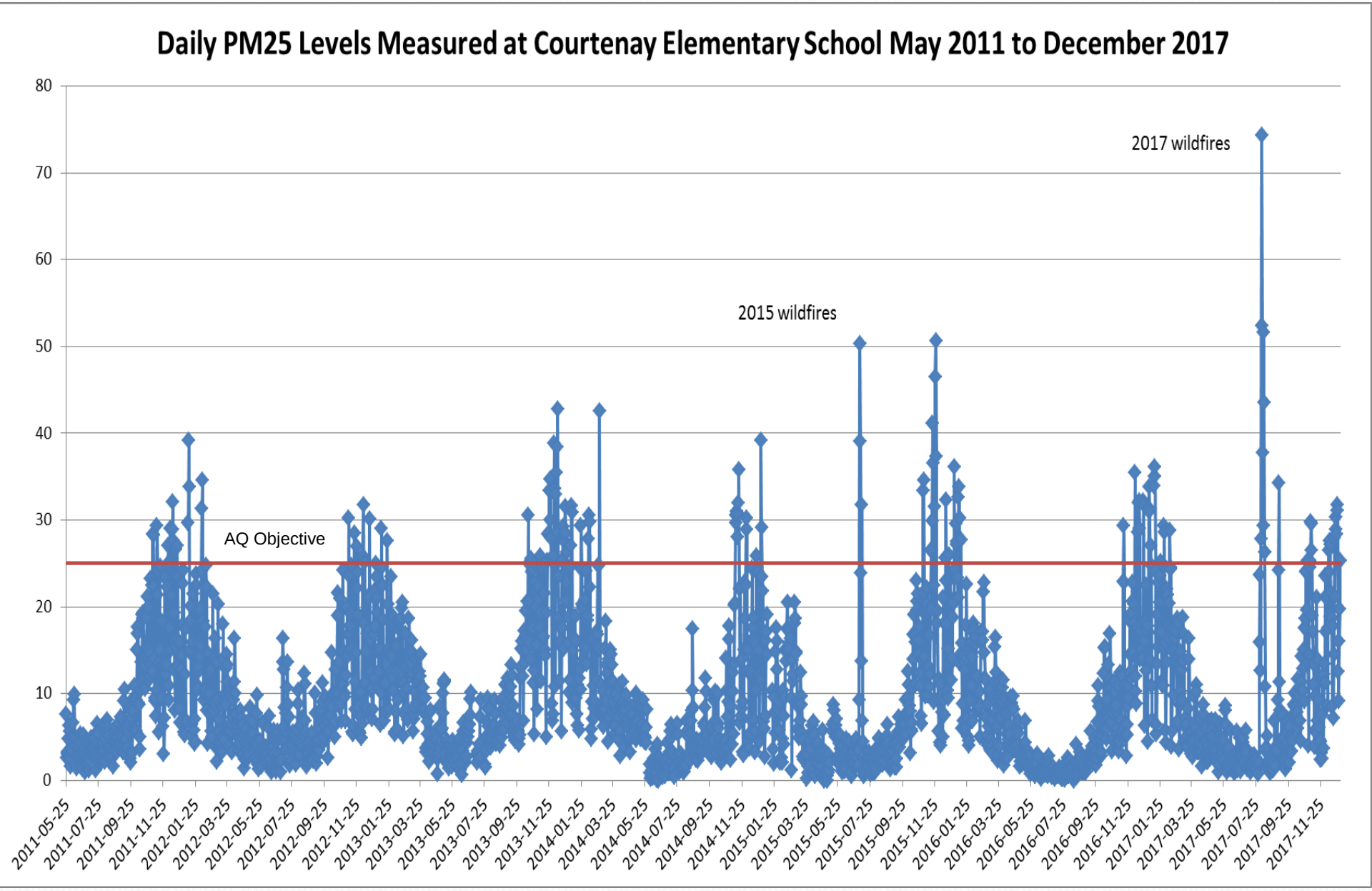
Environmental Protection Division

Mobile Monitoring

- UVIC/VIHA mobile monitoring study (2008-2009) highlights spatial variability of fine particulate concentrations across communities.
- http://web.uvic.ca/~ssrl01/SSRLtemp/CVRD%20Fine%20Particulates.pdf



What is Measured:
Fine Particulate Matter (PM2.5)
Ozone
Nitrogen Dioxide
Meteorology


Daily PM25 Levels Measured at Courtenay Elementary School May 2011 to December 2017
80
70
60
50
40
30
20
10
0
2017 wildfires
2015 wildfires
AQ Objective
2011-05-25
2011-07-25
2011-09-25
2011-11-25
2012-01-25
2012-03-25
2012-05-25
2012-07-25
2012-09-25
2012-11-25
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2017-01-25
2017-03-25
2017-05-25
2017-07-25
2017-09-25
2017-11-25

Courtenay $PM_{2.5}$ Annual Data Summary

Year	Annual Average	# of daily values	Annual 98th %ile of daily values	Max daily value	# of daily values > 25 ug/m3	% of time > 25 ug/m3
2011	8.9 ug/m3	217	28.4 ug/m3	32.1 ug/m3	10	4.6%
2012	9.2 ug/m3	360	29.7 ug/m3	39.2 ug/m3	11	3.1 %
2013	11.4 ug/m3	347	33.4 ug/m3	42.8 ug/m3	25	7.2%
2014	9.2 ug/m3	353	30.8 ug/m3	42.6 ug/m3	19	5.4%
*2015	8.3 ug/m3	349	32.5 ug/m3	50.6 ug/m3	17 (3 WF)	4.9%
2016	7.7 ug/m3	366	31.8 ug/m3	36.1 ug/m3	16	4.4%
*2017	9.3 ug/m3	361	31.0 ug/m3	74.3 ug/m3	31 (9 WF)	8.6%
*2018	7.9 ug/m3	322	24.9 ug/m3	116 ug/m3	14 (7 WF)	4.3%

Provincial Air Quality Objectives for $PM_{2.5}$:

- 8 ug/m3 – Annual
- 25 ug/m3 – Daily average and 98th percentile Daily average annually

* Wildfire Effects removed for annual average and 98th Percentile

Air Zone Reports – Federal Air Quality Management System

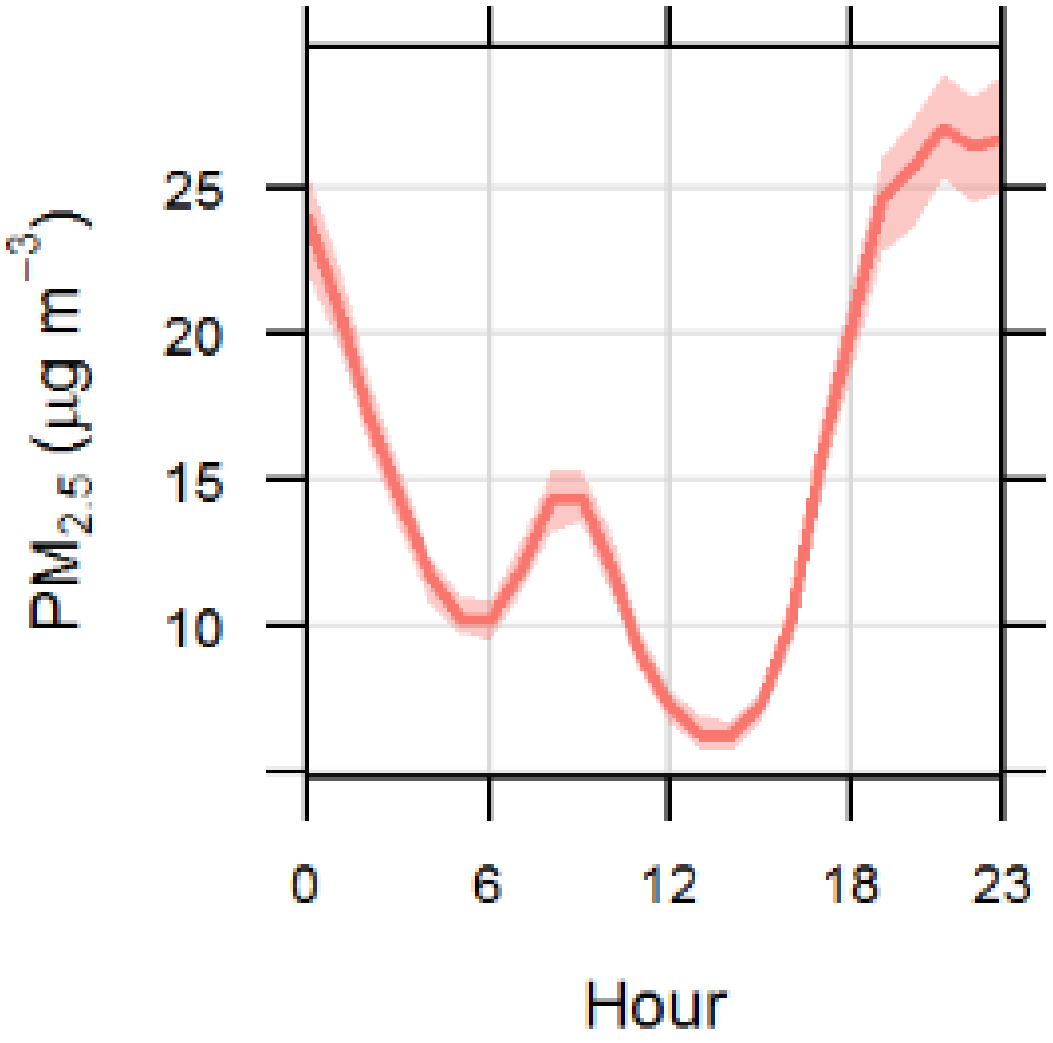
Table 3. Summary of $PM_{2.5}$ concentrations as measured and air zone management levels for the Georgia Strait Air Zone (based on 2015-2017 data). All concentrations in $\mu g/m^3$.

Location	Monitor Type	No. Valid Years	Daily Mean (98th Percentile)		Annual Mean		Air Zone Management Level
			As Measured	TF/EE Removed	As Measured	TF/EE Removed	
Colwood	FEM	3	19	16	5.8	5.5	Goal: CAAQS Achievement
Courtenay	FEM	3	34	32	8.8	8.4	
Crofton-Georgia Hts.	FEM	3	24	16	7.1	6.6	
Crofton-Substation	FEM	3	20	13	5.9	5.4	
Duncan-Cairnsmore	FEM	3	27	25	7.6	7.3	
Duncan-Deykin Ave.	FEM	3	26	20	6.4	6.0	
Campbell River	FEM	3	22	19	7.4	7.1	
Harmac	FEM	3	25	22	7.8	7.4	
Langdale	FEM	2	36	13	7.8	6.6	
Nanaimo	FEM	3	20	12	4.6	4.1	
Port Alberni	FEM	3	29	27	8.5	8.2	
Powell River-James Thomson School	TEOM	2	17	6	2.3	1.9	
Powell River-Wildwood	TEOM	2	21	7	3.1	2.3	
Squamish	FEM	3	34	12	6.2	5.2	
Victoria-Topaz	FEM	3	17	16	5.8	5.6	
Whistler	FEM	3	41	17	8.5	6.8	

We Have a Wood Smoke Issue

- **Weight of Evidence - wood smoke is the main contributor to $PM_{2.5}$ levels in the CVRD during the cold months (wood stoves, open burning).**
  - Wintertime mobile monitoring results (UVIC 2009 & UBC 2017)
    - Confirms that wood stove smoke issues are wide-spread in valley
  - PM Emissions Inventory (RWDI, 2016)
    - 81% of PM2.5 attributable to open burning and residential wood heat
  - BCCDC study (2016) – "Systematically identifying and prioritizing communities impacted by residential wood smoke in British Columbia, Canada" S. Henderson 2016.
    - Courtenay 2nd highest WS impacted community in province
  - Health Canada Study (wood smoke and heart attack) – 2016
    - High concentrations of wood smoke in Courtenay
    - Increased risk of heart attack during winter when high conc. of smoke
  - Ambient AQ data analysis (ENV report complete 2017) –
    - Analysis confirms that wood smoke sources are dominant during cold season
    - Exacerbated by POOR dispersion meteorology in the winter

Diurnal PM2.5 Patterns – Winter Months 2011-2016 -> Wood Stove Smoke Signature



- During the day, PM2.5 readings are low. Evening peaks followed by consistent morning spike.

- Wood Stove emissions; Mobile source contributions in AM; meteorology

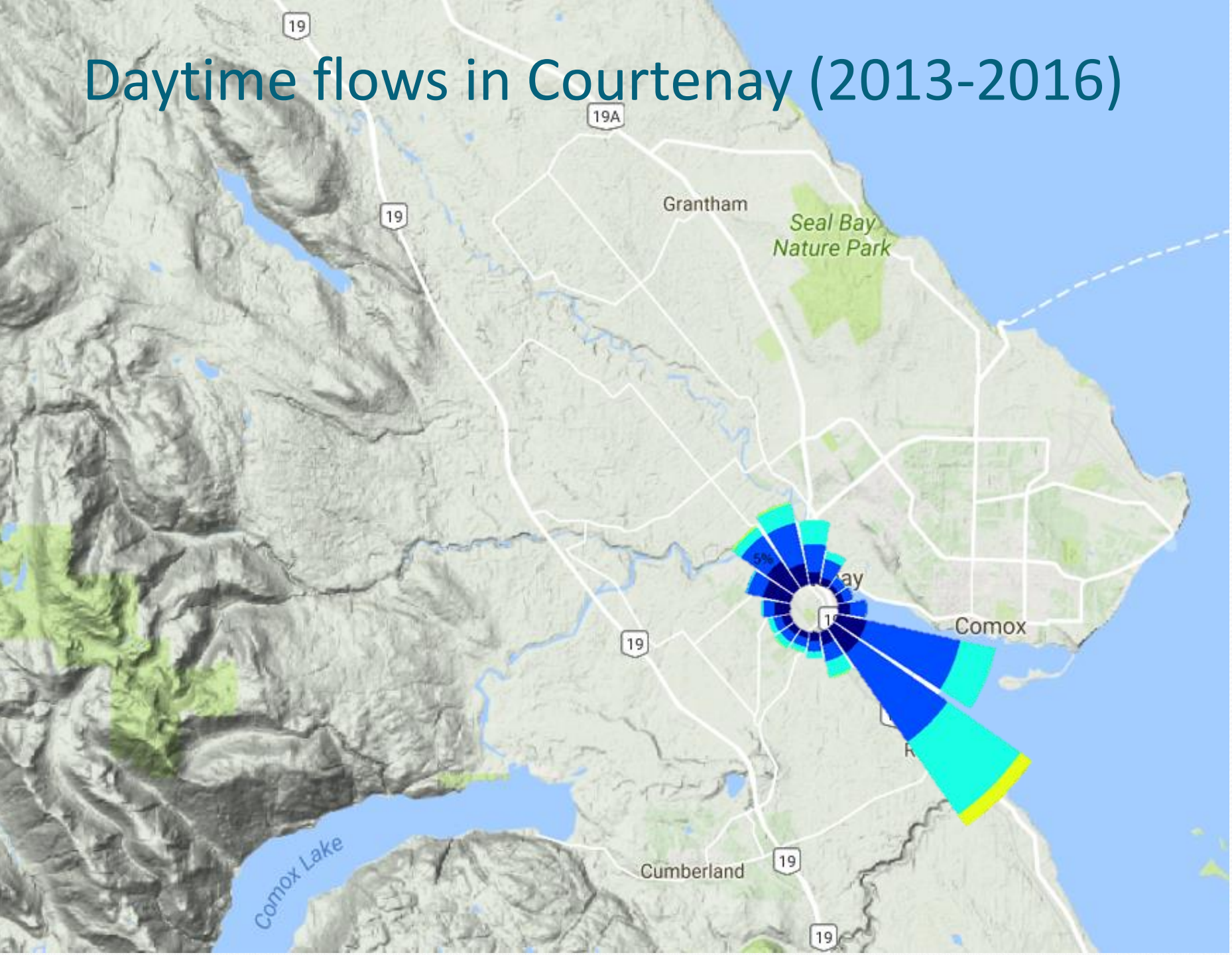
Next steps

- Support the formation of an Air Quality Advisory Group to help guide the development of a clean air action plan.

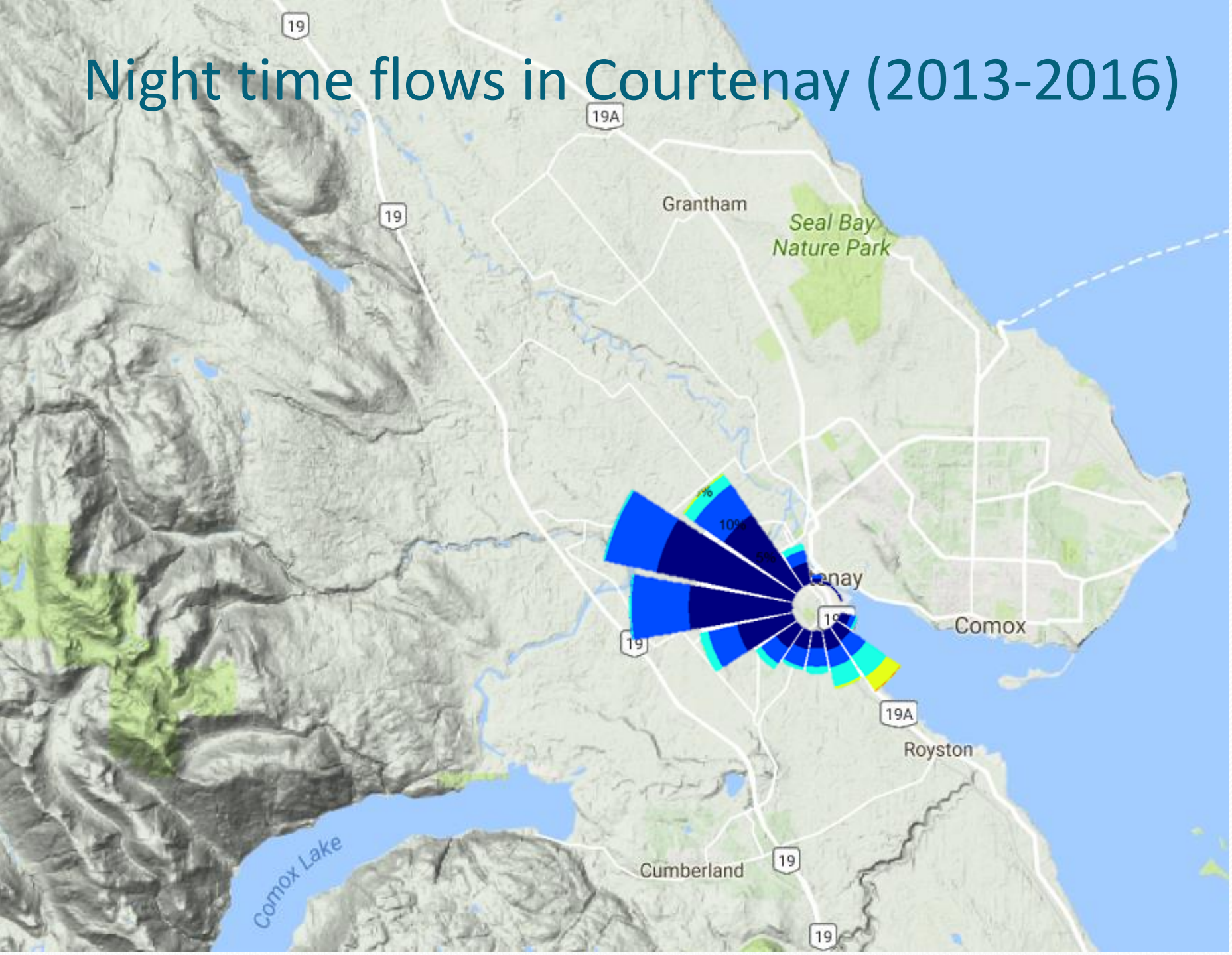
Thank You

Extra Slides

Daytime flows in Courtenay (2013-2016)

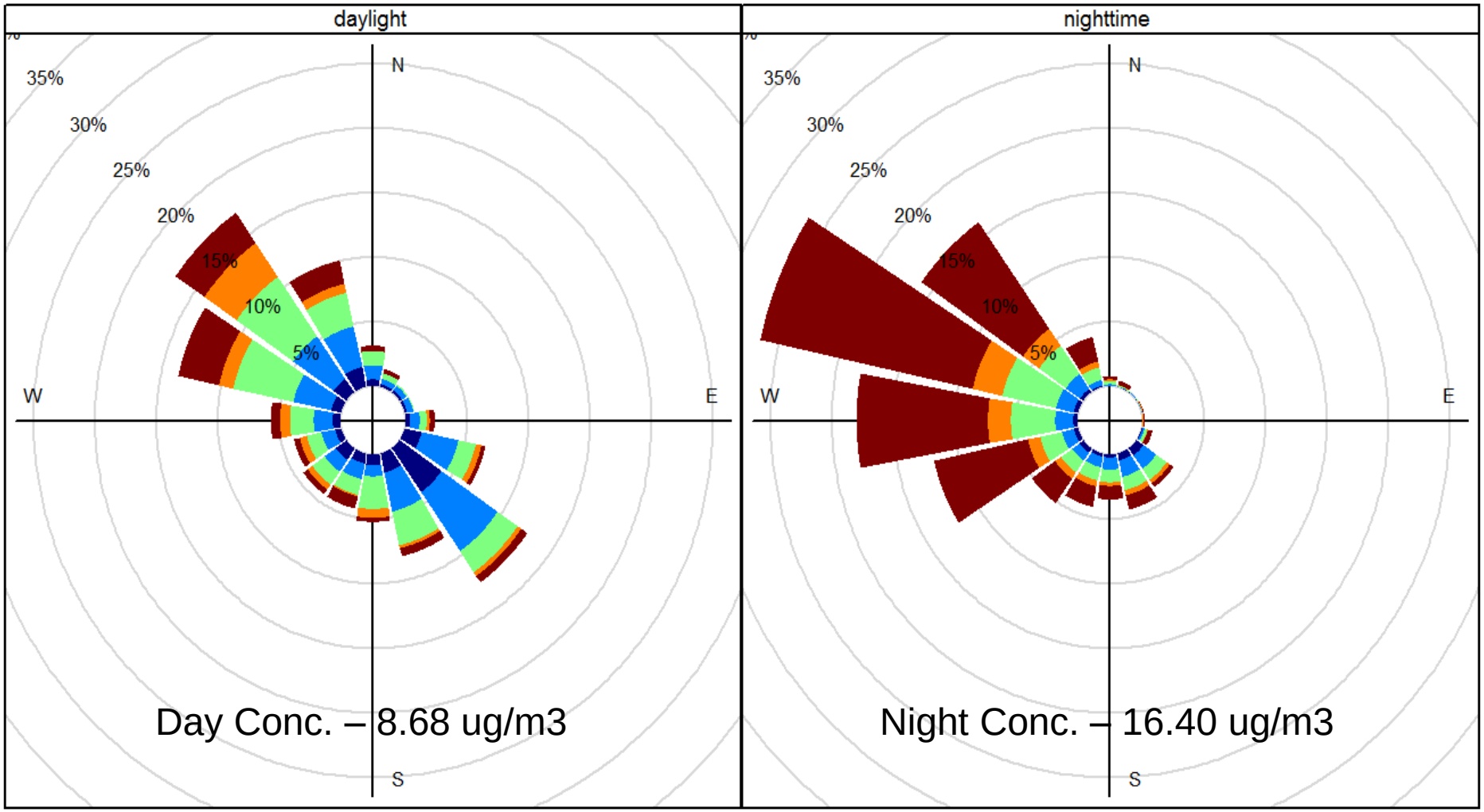


Night time flows in Courtenay (2013-2016)



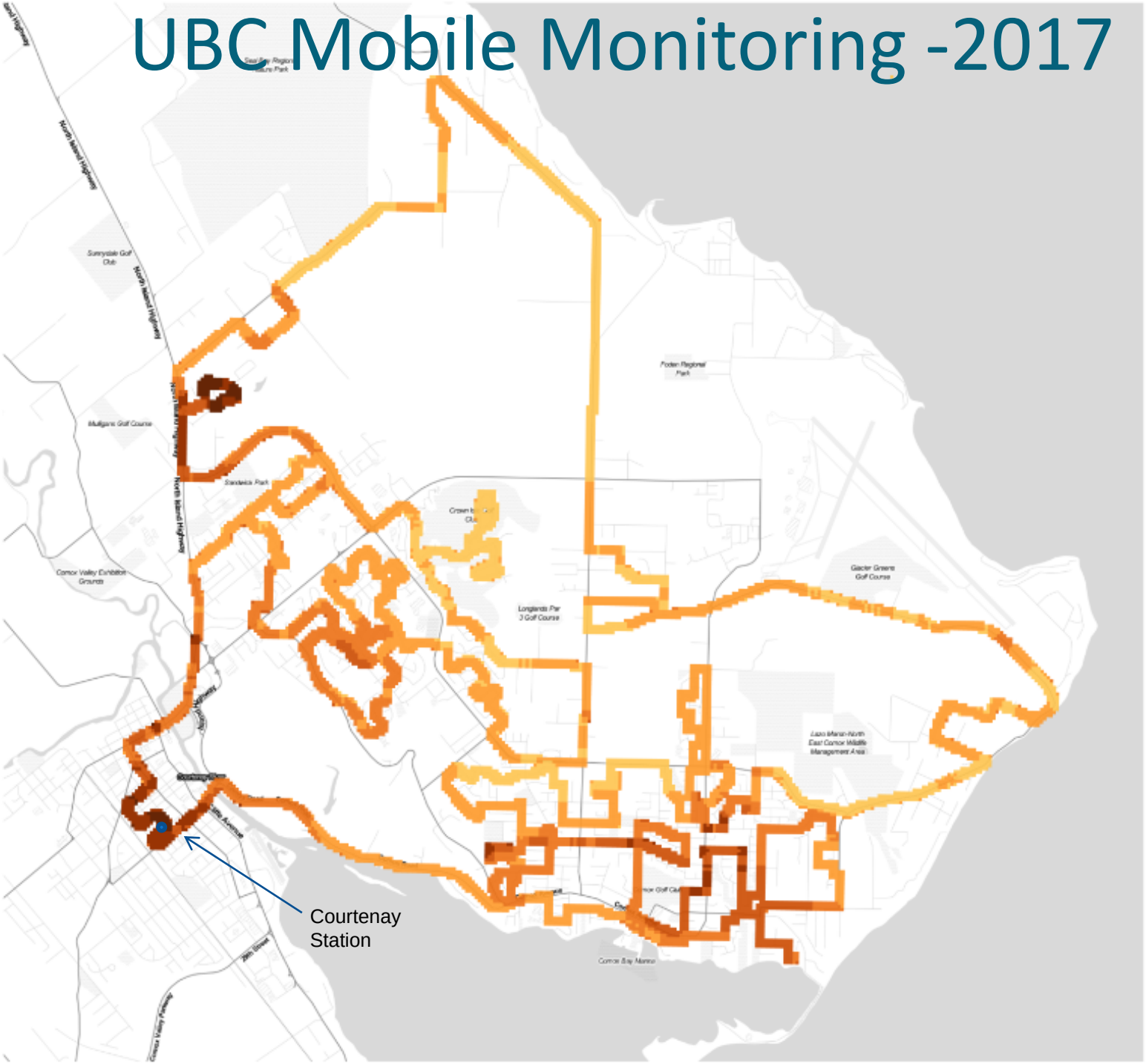
Diurnal Winter Pollution Rose - Courtenay Elementary

(Jan. 1, 2013 - Dec. 31, 2016)



Percent Calms (<0.5 m/s): Daylight= 16.8 %, Nighttime= 21.4 %

UBC Mobile Monitoring -2017

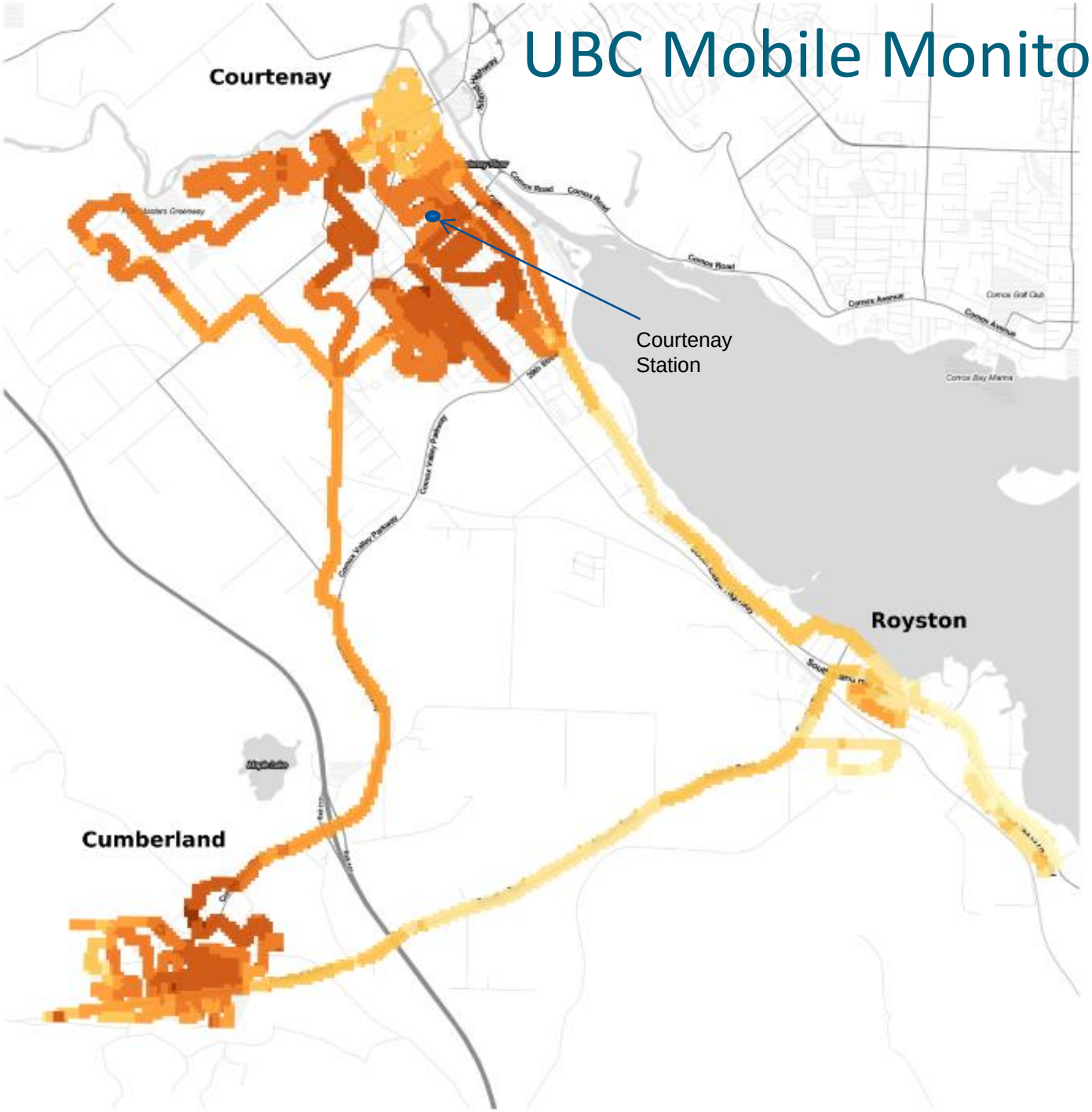


Mean Z Score	$PM_{2.5}$ ($\mu g/m^3$)
-1.5	2.5
-1	3.3
-0.5	4.6
0	6.7
0.5	10
1	15
1.5	24

This map shows the average night conditions measured during seven mobile monitoring runs conducted between January 24th and February 6th 2017.

UBC Woodsmoke Monitoring Project
Created by Matthew Wagstaff
Funding from Health Canada and The BC Lung Association

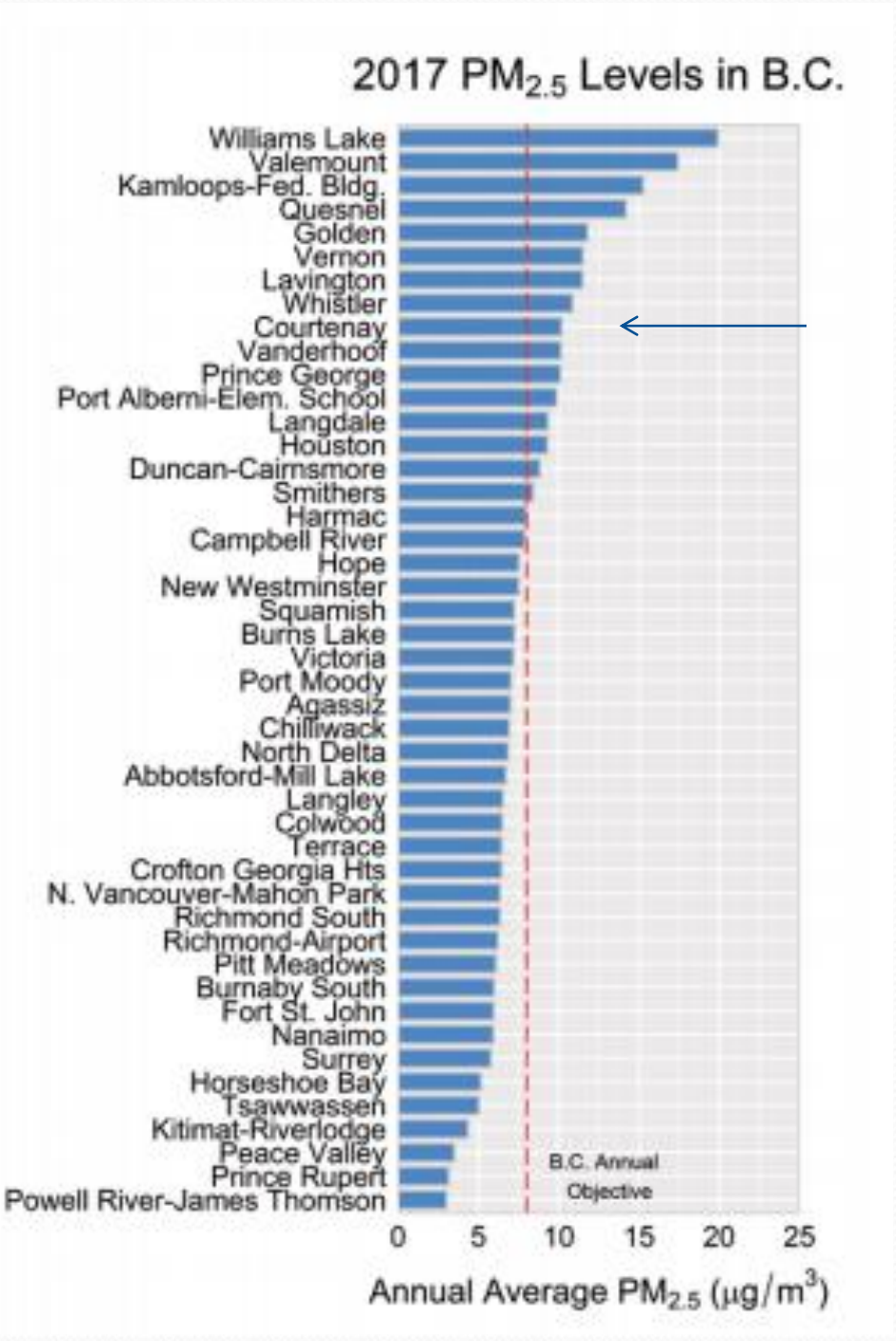
UBC Mobile Monitoring -2017



Mean Z Score	$PM_{2.5}$ ($\mu g/m^3$)
-1.5	5.7
-1	8.3
-0.5	12
0	18
0.5	28
1	43
1.5	66

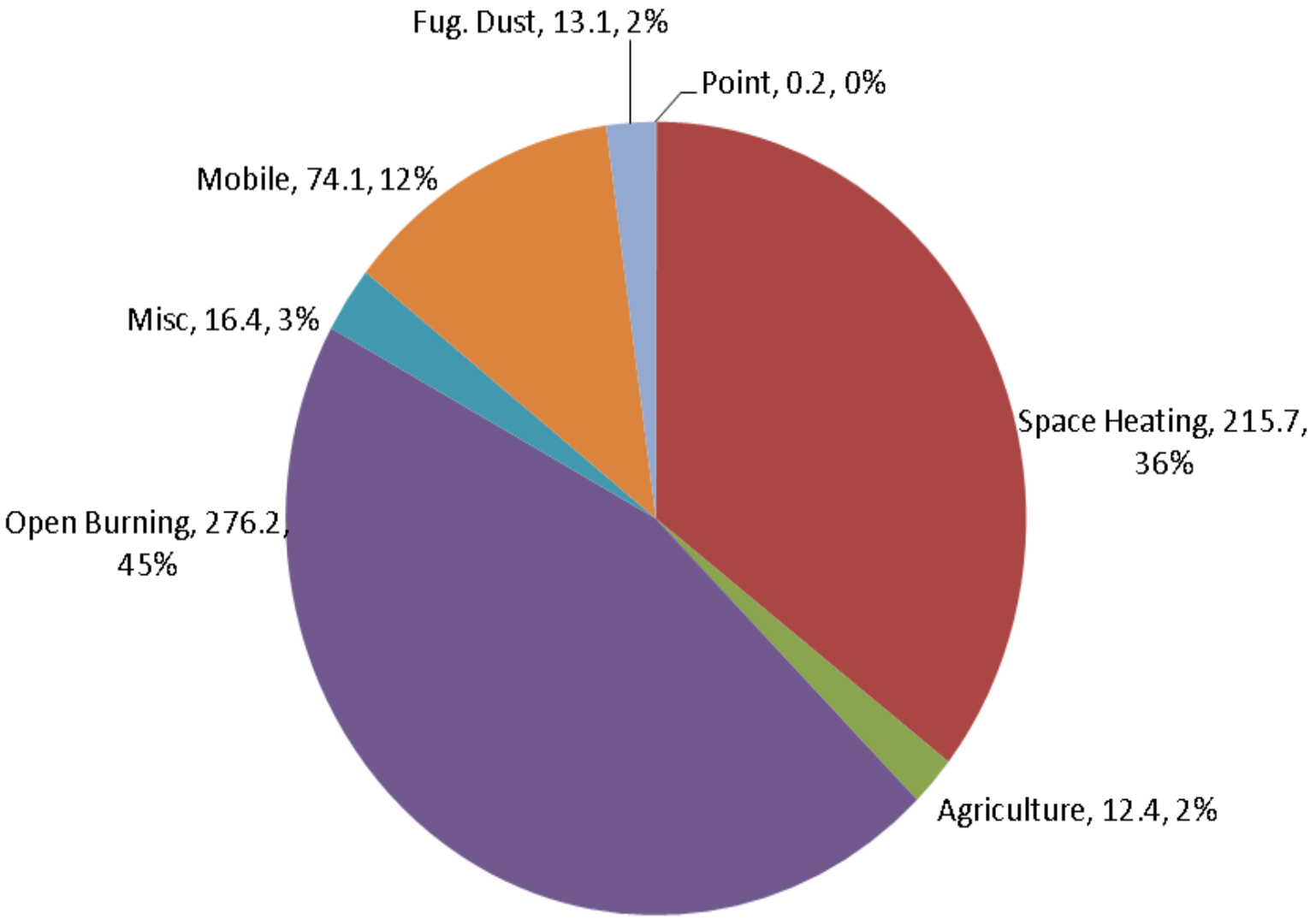
This map shows the average night conditions measured during seven mobile monitoring runs conducted between January 24th and February 6th 2017.

UBC Woodsmoke Monitoring Project
Created by Matthew Wagstaff
Funding from Health Canada and The BC Lung Association



BC Lung State of Air report 2018 https://bc.lung.ca/protect-your-lungs/air-quality-lung-health/bc-state-air-report

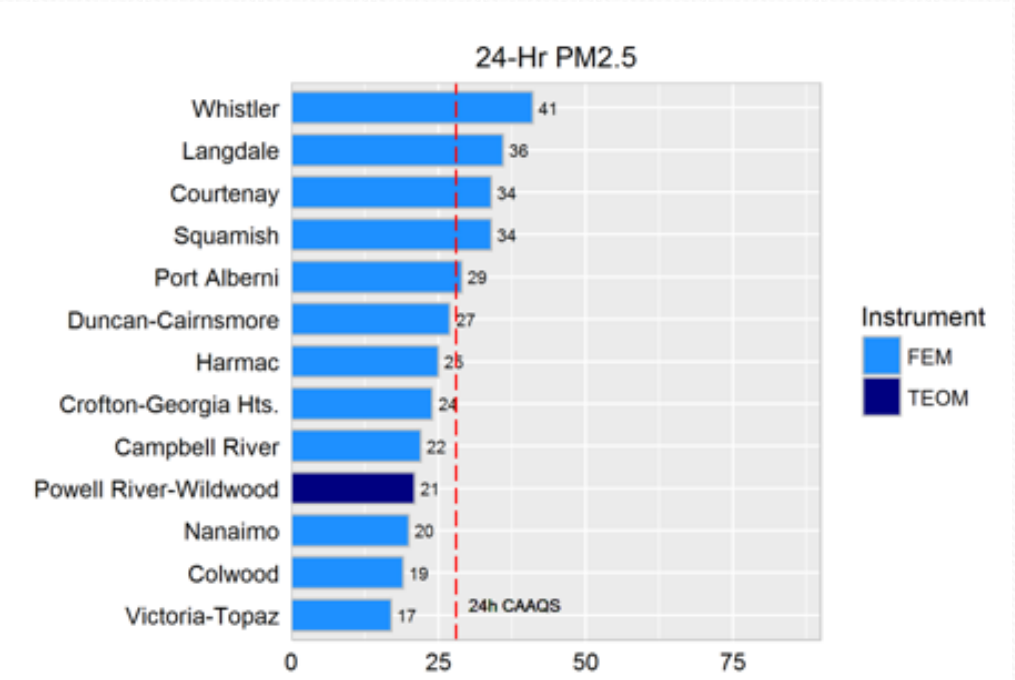
Comox Valley Emissions Inventory For PM2.5 (TPY)
Base Year 2015

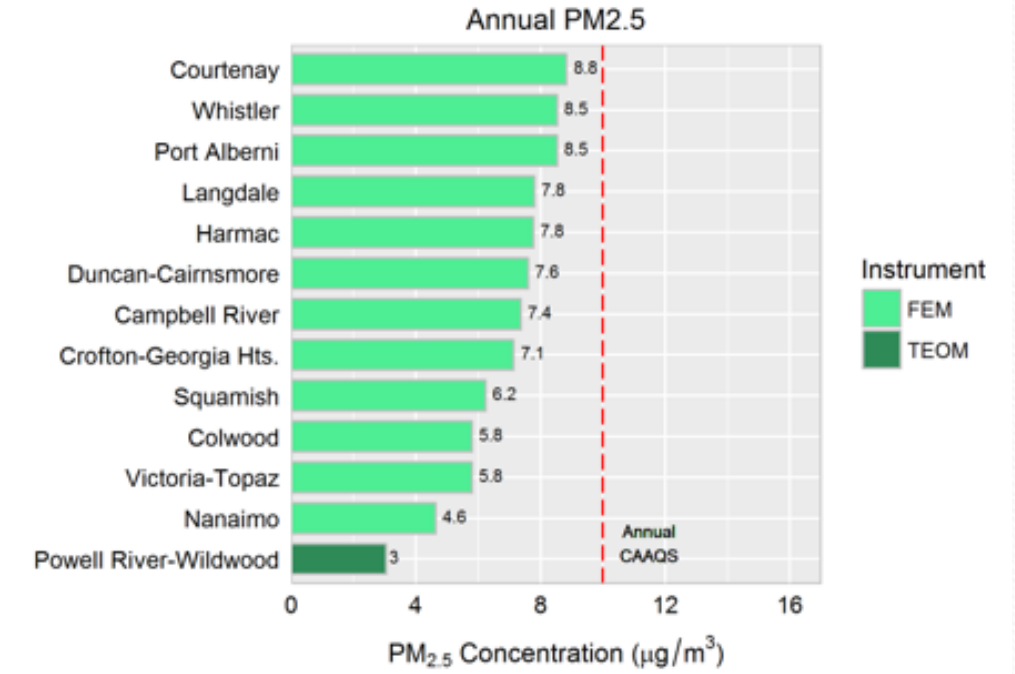


Source Location and Timing Matters

- Source location relative to people is an important consideration. Smoke from back-yard burning, land-clearing, and wood stoves is released right where people live and play.
- Pollutants from these sources are more likely to be <u>inhaled</u> by people.
- Burning under GOOD vs. POOR ventilation allows for dispersion of smoke. <u>Nighttime = POOR VI</u>

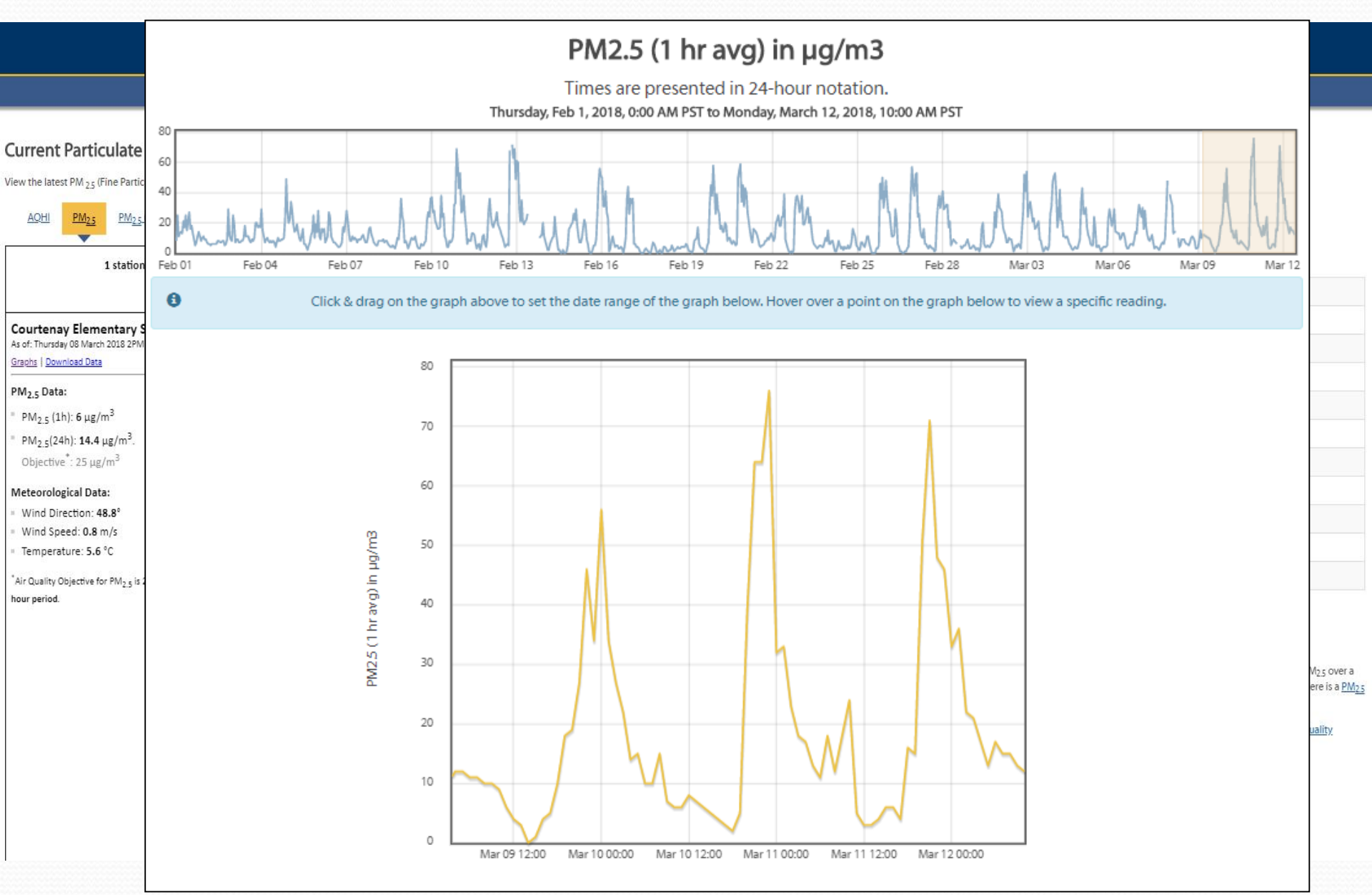
Georgia Strait Air Zone Report 2015-2017



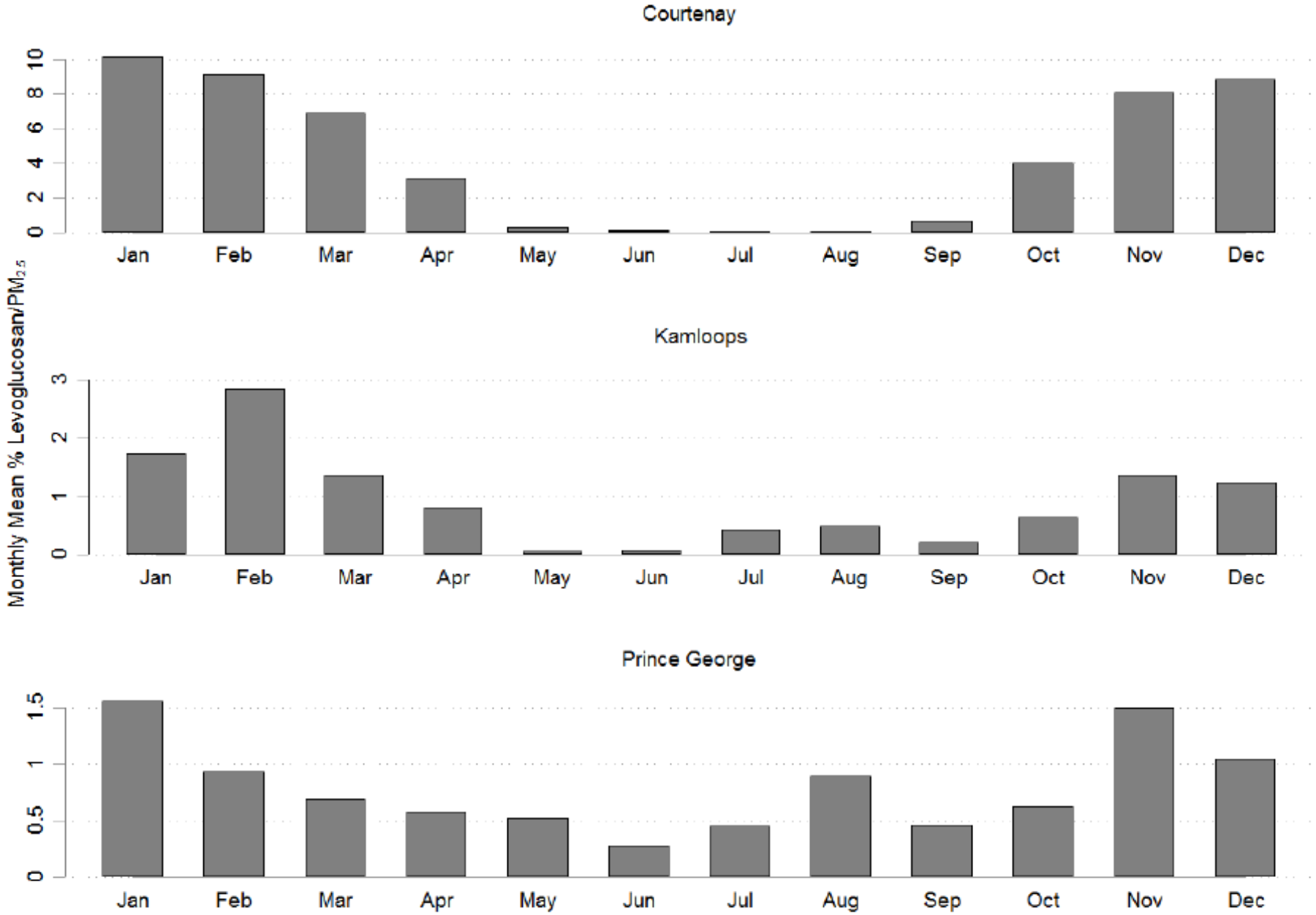


Managing the Issue

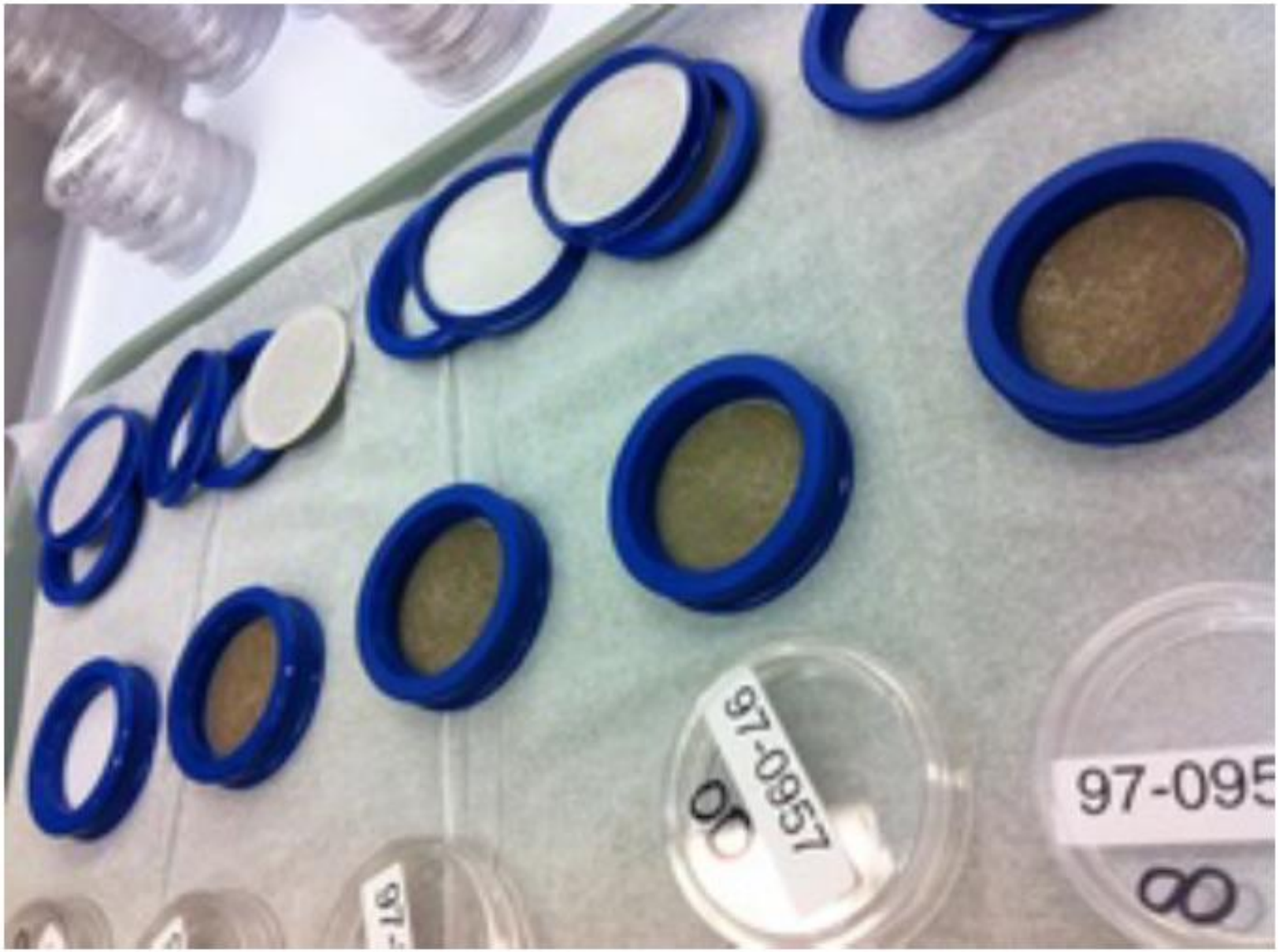
- Provincial Regulation updates –
  - Solid Fuel Burning Domestic Appliance Regulation
  - Open Burning Smoke Control Regulation
- Local government- bylaw development/harmonization
  - Solid waste management; alternatives for organics
- WS Exchange & Public Education –best practices; clean energy upgrades; CBSM
- OCP development with Air Quality impacts in mind
- Airshed Management Planning
  - Process that recognizes multi-jurisdictional management of sources across the airshed
- Continued monitoring and reporting

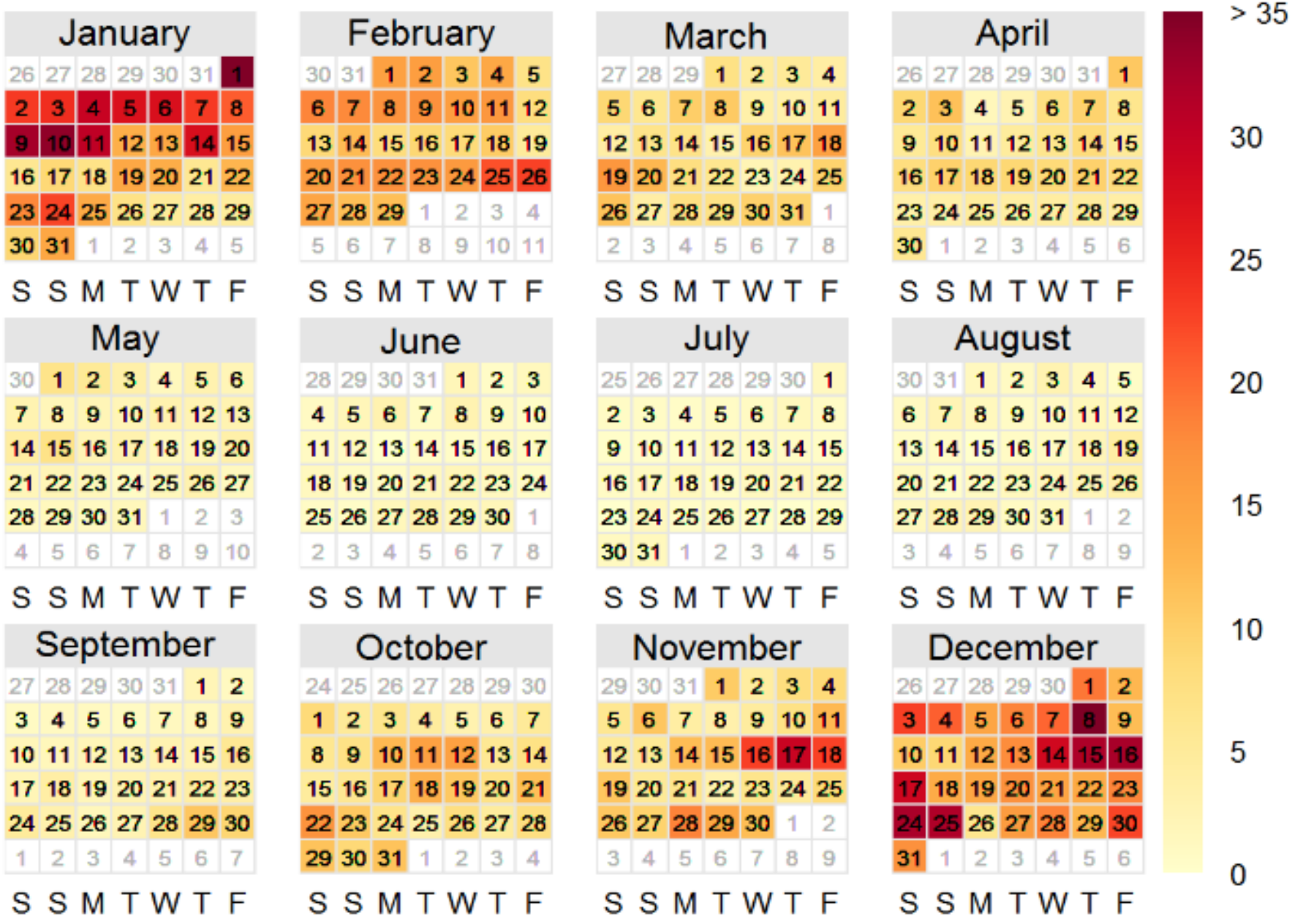


Website:
bcairquality.ca


Courtenay
0
2
4
6
8
10
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Monthly Mean % Levoglucosan/PM2.5
Kamloops
0
1
2
3
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Prince George
0
0.5
1
1.5
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

24-hour $PM_{2.5}$ Winter Filters in Courtenay




PM2.5 concentrations (µg m−3) in Courtenay (2016)
January
26 27 28 29 30 31 1
2 3 4 5 6 7 8
9 10 11 12 13 14 15
16 17 18 19 20 21 22
23 24 25 26 27 28 29
30 31 1 2 3 4 5
S S M T W T F
February
30 31 1 2 3 4 5
6 7 8 9 10 11 12
13 14 15 16 17 18 19
20 21 22 23 24 25 26
27 28 29 1 2 3 4
5 6 7 8 9 10 11
S S M T W T F
March
27 28 29 1 2 3 4
5 6 7 8 9 10 11
12 13 14 15 16 17 18
19 20 21 22 23 24 25
26 27 28 29 30 31 1
2 3 4 5 6 7 8
S S M T W T F
April
26 27 28 29 30 31 1
2 3 4 5 6 7 8
9 10 11 12 13 14 15
16 17 18 19 20 21 22
23 24 25 26 27 28 29
30 1 2 3 4 5 6
S S M T W T F
May
30 1 2 3 4 5 6
7 8 9 10 11 12 13
14 15 16 17 18 19 20
21 22 23 24 25 26 27
28 29 30 31 1 2 3
4 5 6 7 8 9 10
S S M T W T F
June
28 29 30 31 1 2 3
4 5 6 7 8 9 10
11 12 13 14 15 16 17
18 19 20 21 22 23 24
25 26 27 28 29 30 1
2 3 4 5 6 7 8
S S M T W T F
July
25 26 27 28 29 30 1
2 3 4 5 6 7 8
9 10 11 12 13 14 15
16 17 18 19 20 21 22
23 24 25 26 27 28 29
30 31 1 2 3 4 5
S S M T W T F
August
30 31 1 2 3 4 5
6 7 8 9 10 11 12
13 14 15 16 17 18 19
20 21 22 23 24 25 26
27 28 29 30 31 1 2
3 4 5 6 7 8 9
S S M T W T F
September
27 28 29 30 31 1 2
3 4 5 6 7 8 9
10 11 12 13 14 15 16
17 18 19 20 21 22 23
24 25 26 27 28 29 30
1 2 3 4 5 6 7
S S M T W T F
October
24 25 26 27 28 29 30
1 2 3 4 5 6 7
8 9 10 11 12 13 14
15 16 17 18 19 20 21
22 23 24 25 26 27 28
29 30 31 1 2 3 4
S S M T W T F
November
29 30 31 1 2 3 4
5 6 7 8 9 10 11
12 13 14 15 16 17 18
19 20 21 22 23 24 25
26 27 28 29 30 1 2
3 4 5 6 7 8 9
S S M T W T F
December
26 27 28 29 30 1 2
3 4 5 6 7 8 9
10 11 12 13 14 15 16
17 18 19 20 21 22 23
24 25 26 27 28 29 30
31 1 2 3 4 5 6
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25
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15
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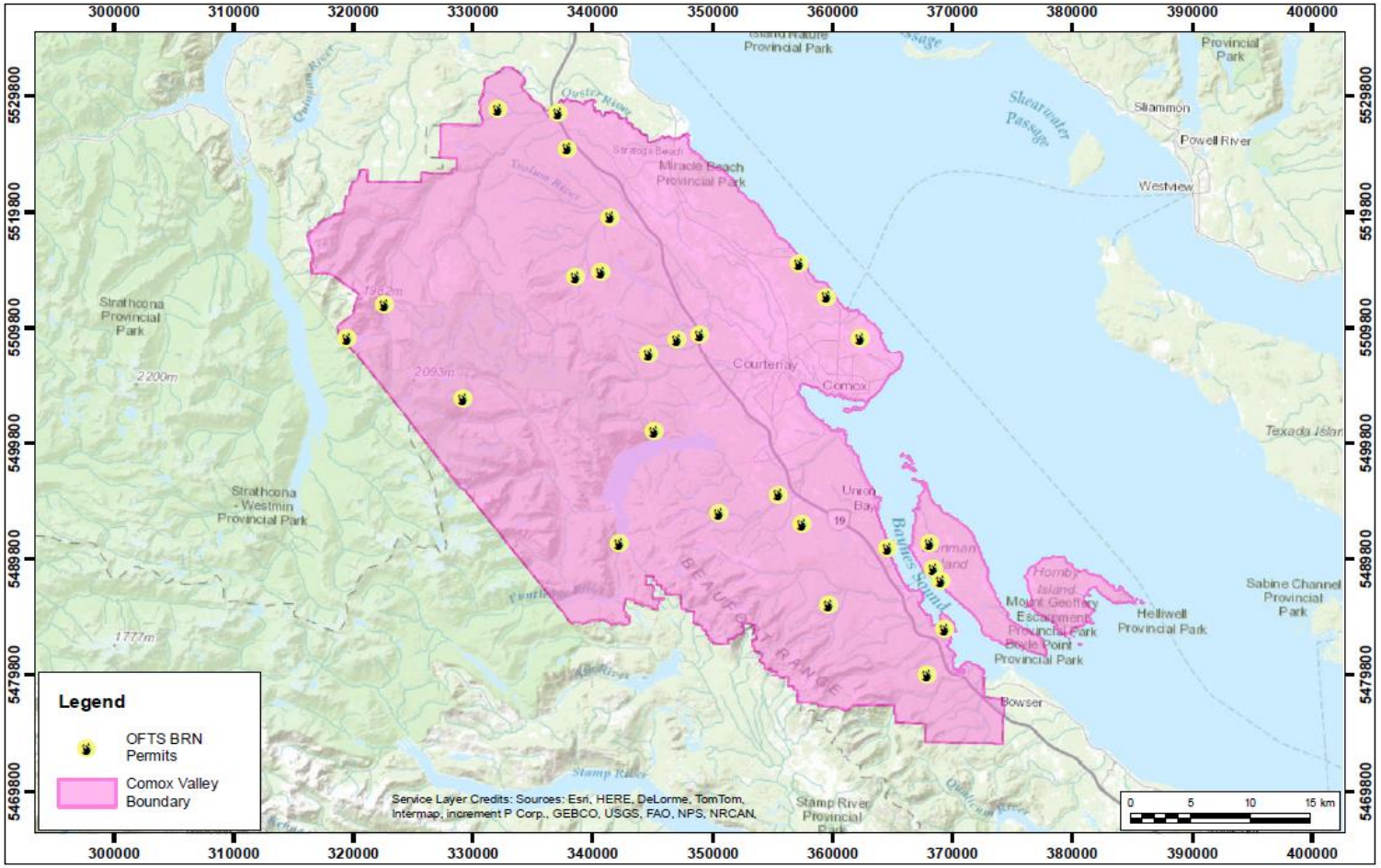
0

Provincial Open Burning Permits (forestry and land clearing) – 2015



Locations of OFTS BRN Permits in 2015

True North

Drawn by: DJH | Fig: 3

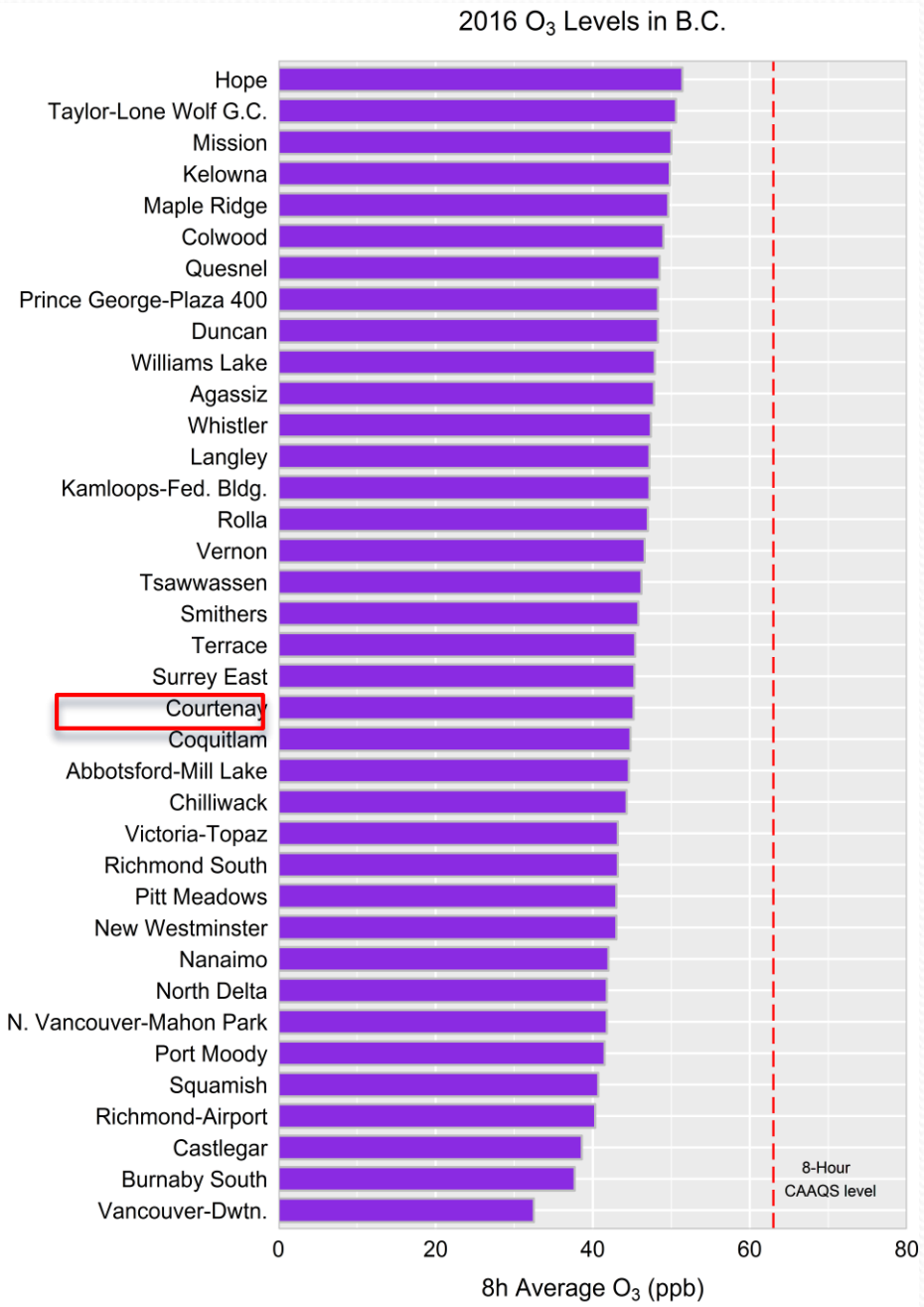
Approx. Scale: 1:450,000

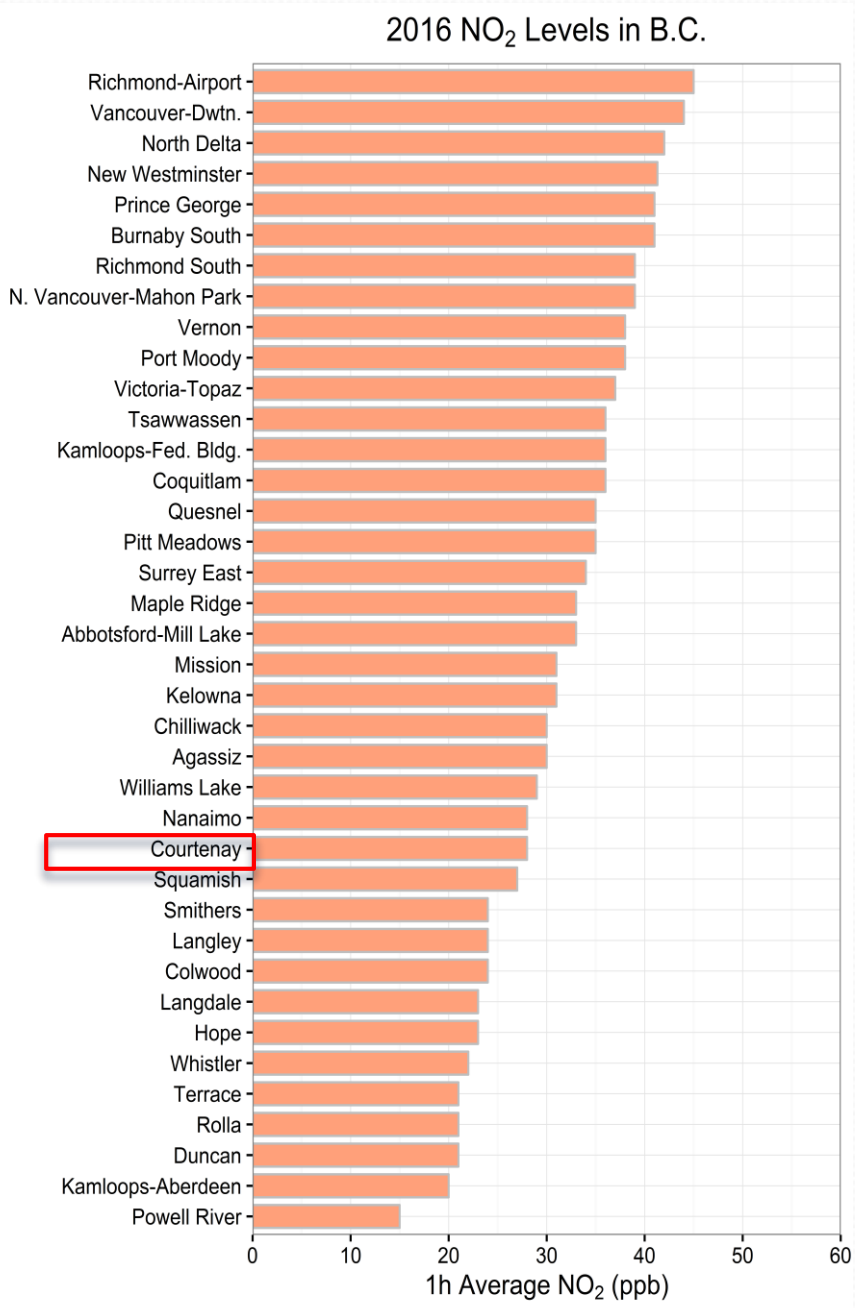
Date Revised: Dec. 21, 2016

Particulate Matter Emissions Inventory for the Comox Valley, 2015 - Comox Valley, BC

Project #1700243

RWDI





N. Suzuki, BC MOE