Fraser Valley Regional District

STAFF REPORT

To: Regional and Corporate Services Committee **Date:** 2025-09-04

From: Lance Lilley, Manager of Environmental Services and Kim Nguyen, Environmental Services Technician

Subject: Monitoring of Air Quality in Small Communities using Low-Cost Sensors

Reviewed by: David Urban, Deputy Director of Regional Services
Stacey Barker, Director of Regional Services/Deputy CAO
Beth Klein, Controller/Deputy CFO
Jennifer Kinneman, Chief Administrative Officer

RECOMMENDATION

THAT the Fraser Valley Regional District Board support the continuation of the small community air quality monitoring program within the region.

BACKGROUND

The Fraser Valley Regional District (FVRD) operates a series of air quality monitoring stations within the region that collect long-term and continuous data on a broad suite of air pollutants. These stations, some of which have been collecting data for the past three decades, determine air quality conditions and trends and are critical for scientifically assessing airshed health as well as for issuing air quality warnings. The FVRD's six current air quality monitoring stations, located in areas to reflect ambient air quality conditions experienced by the greatest number of residents, are in Abbotsford (2), Mission, Chilliwack, Kent, and Hope. Due to the high costs associated with operating and maintaining these stations however, they cannot be housed in every community in the region.

While the FVRD's air quality monitoring stations measure ambient air quality experienced by most residents in the region, air quality conditions in smaller or more remote communities may have unique or local conditions that can potentially differ from measurements taken at the air quality stations. This could be due to the community's local topography or microclimate, local pollution sources, or just proximity to the nearest air quality station. In recognition of this potential information gap, and the emergence of affordable and reliable air quality monitoring equipment, the FVRD's Air Quality Management Plan included a recommendation to "*investigate and employ new evolving technologies for air quality testing, such as small and portable sensors, to amend and complement its existing air quality monitoring network*".

In 2023, to deliver on this action item, staff initiated a pilot project to assess the use of low-cost air quality sensors to improve understanding of local air pollution distribution patterns within the region. The primary type of sensor used was Purple Air (Figure 1). These sensors were chosen for their cost, the

accessibility of their data[1], and their ability to measure fine particulate matter (PM2.5) – one of the key pollutants of concern in the airshed due to its impact on human health, the environment, and visibility. PM2.5 is also the leading cause of air quality advisories issued within the region, largely due to the frequency and magnitude of smoke from wildfires often affecting the airshed.

Figure 1. A Purple Air sensor installed in Electoral Area E to measure local concentrations of fine particulate matter.

Sensor locations were selected based on several criteria, including:

- Geographic distribution within the region
- Sited in an area of residential development
- Public ownership of the facility or building
- Permission from site owner/manager
- Access to external electrical outlet, and
- Access to host Wi-Fi.

A total of 13 Purple Air sensors were installed as part of this pilot project (Figure 2). PM2.5 data from the sensors was then captured throughout 2024. Data was collected and compared to the nearest air quality monitoring station to observe local differences as well as consistency with regional ambient trends measured over the same period.

[1] Real-time measures of fine particulate matter from the sensors can be viewed at: https://aqmap.ca/aqmap/#11/49.1887/-121.8830/B31/L38/L40/L41

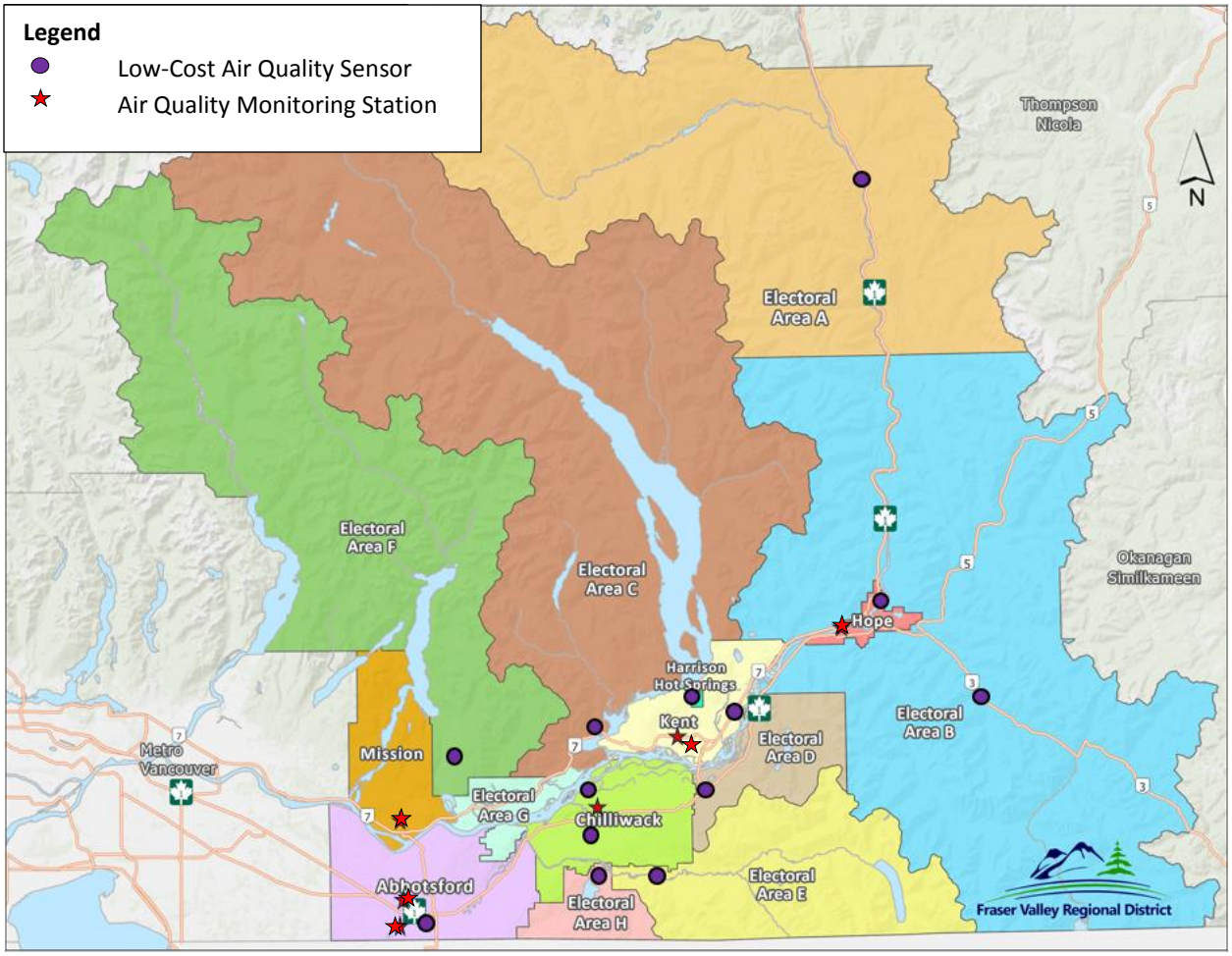

Figure 2. Locations of air quality monitoring stations within the FVRD as well as low-cost sensors installed for this study.

DISCUSSION

The low-cost air quality sensors were shown to provide effective real-time measures of fine particulate matter. While there were some site-specific challenges encountered with power sources and Wi-Fi connectivity, the sensors were shown to be dependable and stood up to quality control measures.

The PM2.5 data collected from these sensors showed that during this pilot project, localized conditions did not significantly differ from ambient conditions measured from the monitoring stations. They demonstrated similar peaks and drops throughout the year as was measured by the nearest monitoring station. Overall, there was strong alignment shown in air quality between communities tested and the air quality monitoring stations (e.g., Figures 3-5).

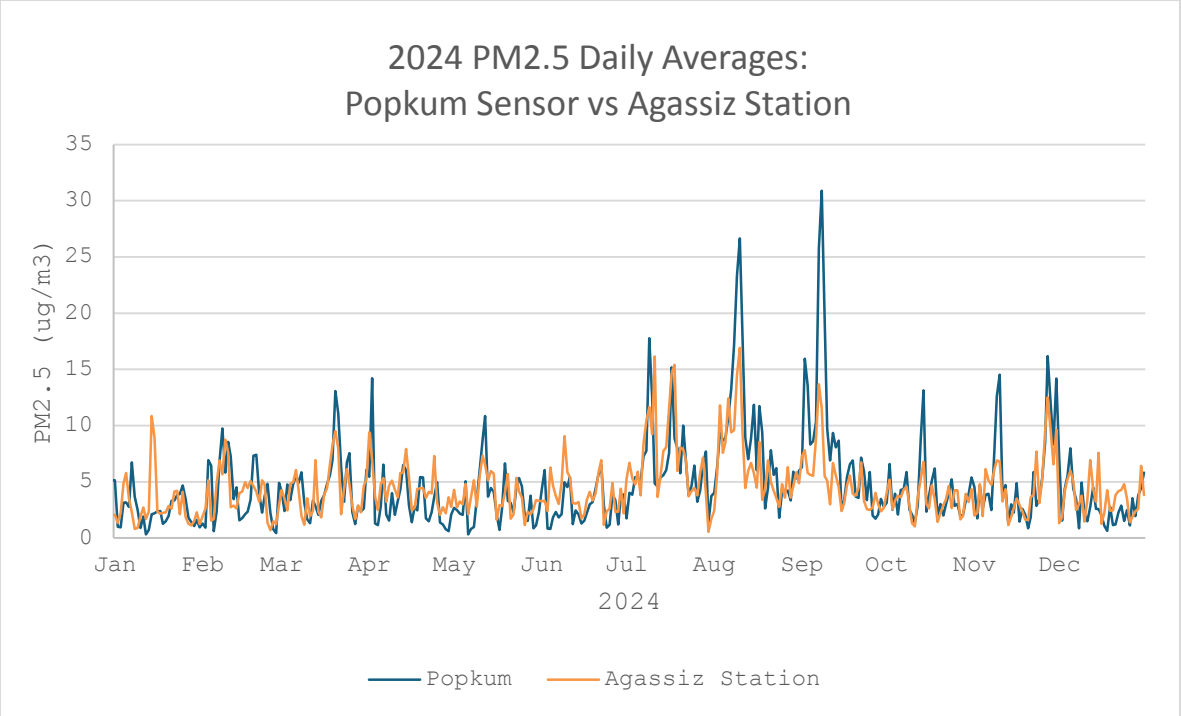

Figure 3. Daily average PM2.5 from the Popkum Purple Air sensor and from the Agassiz air quality monitoring station. The data showed very consistent air quality measurements from both sources over the same period. Note: the threshold for issuing an Air Quality Warning is based on a 24-hr average of PM2.5 exceeding 25 ug/m3 from more than one monitoring station.

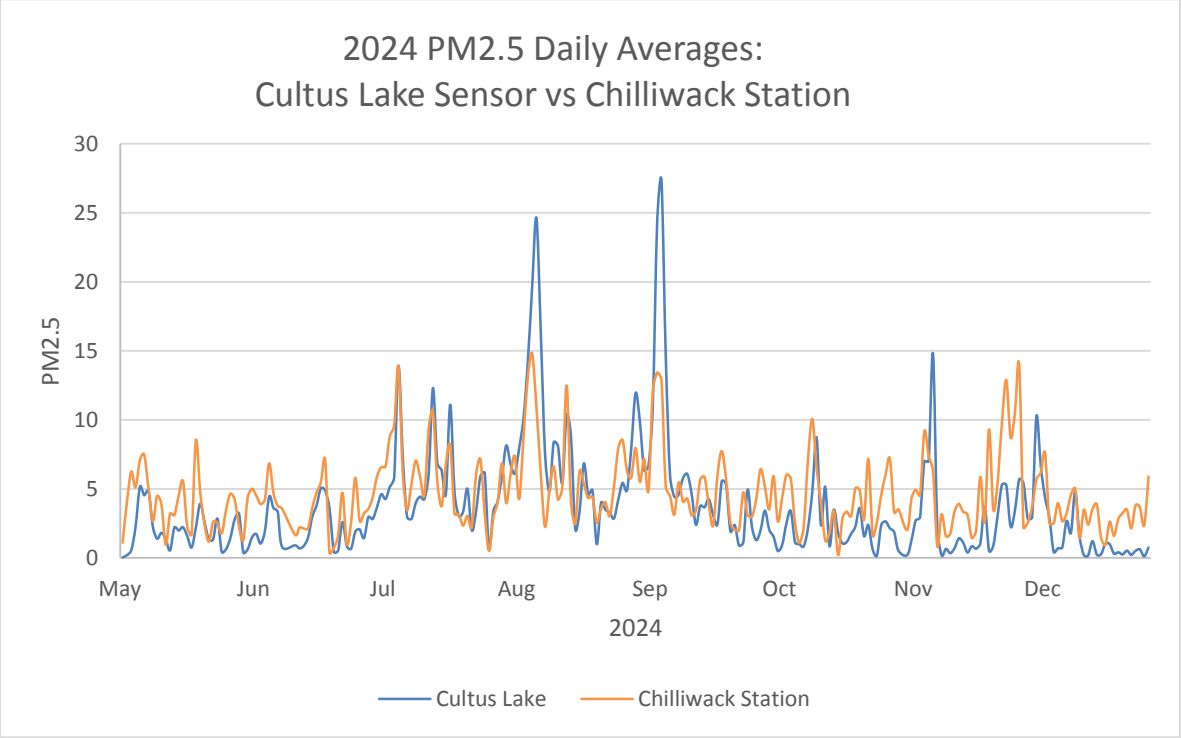

Figure 4. Daily average PM2.5 from the Cultus Lake Purple Air sensor and from the Chilliwack air quality monitoring station.

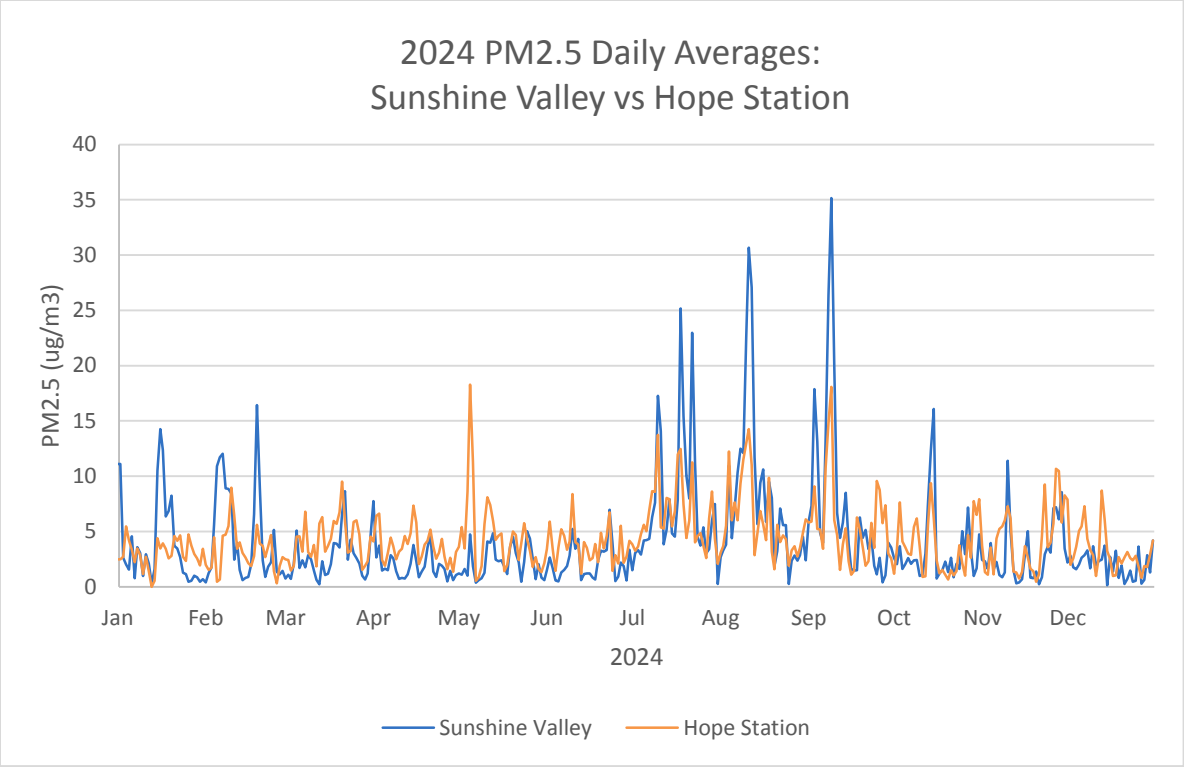

Figure 5. Daily average PM2.5 from the Sunshine Valley Purple Air sensor and from the Hope air quality monitoring station.

Although the Purple Air sensors measured similar air quality conditions for most of the year compared to the nearest monitoring station, there were preliminary seasonal differences that were also observed. For example, some of the Purple Air sensors measured higher short-term spikes in PM2.5 in the summer that were not picked up by the nearest monitoring station. These peaks were typically short in duration however and likely due to either wildfire smoke temporarily being distributed within portions of the airshed or to corrections made to the data from the monitoring stations.

A second preliminary difference showed that some communities (e.g., Boston Bar, Figure 6) may have higher particulate matter concentrations during the winter months compared to what is measured at the nearest monitoring station. While more data is needed, these winter levels are possibly attributed to an increased prevalence of residential wood burning for heating in these communities.

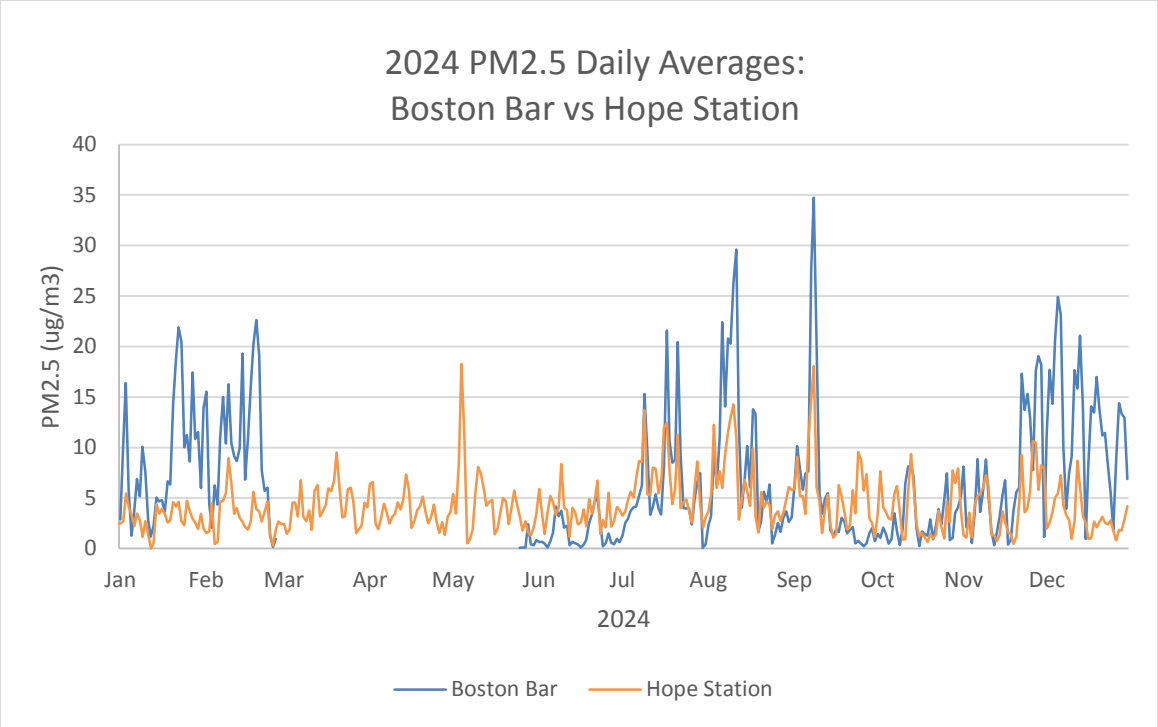

Figure 6. Daily average PM2.5 from the Boston Bar Purple Air sensor and from the Hope air quality monitoring station. Note that data was not recorded in April and May in Boston Bar due to equipment malfunction. Boston Bar is approximately 55 km from the Hope station, the largest distance in this study between a sensor and a station.

While Air Quality Warnings are issued for the airshed out to Hope, the Fraser Canyon and areas around Sunshine Valley receive Smoky Skies Bulletins (SSBs) instead. SSBs, which are issued by the Province, are used to inform the public of deteriorating air quality in regions lacking nearby air quality monitoring stations. These bulletins are based on a combination of satellite imagery, air quality forecasts, and information available from sensors in the area, including Purple Air sensors. The presence of low-cost sensors in those areas not only helps to monitor air quality trends or local issues that could be present but also ensures that real-time air quality from those communities is helping to inform the issuing of timely and accurate Smoky Skies Bulletins.

Despite some seasonal variations, all communities tested showed a strong correlation to ambient conditions and trends as measured by the air quality monitoring stations. This suggests that the air quality monitoring stations in the region are providing an effective service at monitoring ambient conditions throughout the airshed, even for communities that do not host a station. Local air quality conditions can occur however, and the use of low-cost sensors offers the ability and flexibility to observe community-specific trends or issues. Continued and expanded use of the low-cost air quality sensors, particularly in locations furthest from a monitoring station such as the Fraser Canyon or Sunshine Valley, will allow for ongoing monitoring of local air quality that supplements data from the main air quality stations.

COST

The cost for the two-year pilot project, for monitoring equipment and supplies, was approximately $23,000, and was budgeted for within the 2023 and 2024 Air Quality budgets. The cost for maintaining the equipment, including replacement of sensors and adding new host locations as opportunities arise, is estimated to be $3,000 per year, which is budgeted for in the annual Air Quality budget.

CONCLUSION

A network of low-cost PM2.5 sensors were installed within the FVRD as part of a pilot project to assess their use and to identify if there were differences noted in fine particulate matter in smaller or more remote communities compared to data from the region's air quality monitoring stations. From a PM2.5 perspective, all communities included in this project experienced conditions comparable to their nearest air quality monitoring station. Seasonal variations do suggest that more rural communities may experience higher levels of PM2.5 during certain times of year, but additional monitoring is needed to verify. Overall, the sensors were shown to be useful tools can supplement the region's network of air quality monitoring stations and promote public engagement.