Maine Medical Center
MaineHealth

December 4, 2020

Members of the Maine Medical Center Neighborhood Advisory Committee

Re: 2020 Sound Study Final Report Summary

To the Members of the NAC,

Enclosed is the report provided to Maine Medical Center by Russell Acoustics, LLC. The report provides details of the sound study and methods used to recalculate the annual average DNL (Day-Night Sound Level). Below is a summary of the report and its conclusion.

Representatives of the NAC (Alvah Davis, Peter Hall, Ed Suslovic, and Nell Donaldson), representatives from MMC, the principal of Russell Acoustics, LLC, Norman Dotti, met virtually on Monday November 23, 2020 to discuss the enclosed report in detail. MMC will share the findings presented in this report to the NAC at the next opportunity.

The Sound Study was required by the Sound Management Plan following a number of complaints related to the sound generated by LifeFlight trips to MMC's Helipad. The Sound Measurement Plan is a collaborative document approved by the City of Portland as part of MMC's site plan approval for the Coulombe Family Tower expansion. The plan looks to the annual average DNL as the measurement tool to require sound mitigation measures[1], should the level hit 65 or above.

During the period of the Sound Study, 9/16/20 to 9/21/20, an above average number of flights occurred – three flights[2] per day. The average number of flights at MMC's helipad during the previous eight months was 1.45 per day as illustrated in a report published by LifeFlight in August 2020. LifeFlight's August 2020 report also provided the actual distribution of flights between day-time and night-time. The annual average DNL is below 65 considering these factors and the actual sound level captured during the sound study.

The results of the recalculation completed with information collected from the sound study determined that the annual average DNL is below the DNL 65 threshold. Industry best practices do not support mitigation measures when the annual average DNL is below 65, nor are they called for in the Sound Measurement Plan approved by the city. If the annual average DNL was above 65, then mitigation measures would be supported by industry best practices.

Based on the results of this Sound Study and given the guidance in the Sound Measurement Plan and industry best practices, MMC will not be undertaking mitigation measures at this time. As laid out in the Sound Measurement plan, MMC will recalculate the annual average DNL and conduct a new sound study every three years following the opening of the helipad. The next sound study is scheduled for 2023.

Please contact the co-chairs of the NAC with questions about this report.

Thank you,

Maine Medical Center

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[1] Mitigation measures are defined in the Sound Measurement Plan in section 5.c. and could include acquisition of land or land interests, sound insulation, or construction of noise barriers.

[2] For the purposes of this letter, a flight is defined as one landing and one takeoff.

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22 October 2020

Mr. Dennis Morelli, AIA
Director, Design & Construction
MaineHealth
22 Bramhall Street
Portland, ME 04102

Re: Rooftop Helicopter Pads
Follow-up Sound Study

Dear Mr. Morelli:

The Sound Measurement Plan (revised October 10, 2019) you submitted addressed a condition of approval by the City of Portland Planning Board to assess sounds from the relocated rooftop helipads. It includes provisions for reassessing the sound exposures ("DNL," the Day-Night Sound Level, also called "Ldn") in the event the number of complaints over time exceeded a threshold. This report describes the reassessment we did in September.

The Sound Measurement Plan is a 28 page document so I'll not quote it all here. But the definition of the metric to be used – the DNL – bears repeating as it is important to remember what is – and is not – included in the assessment of aircraft/helicopter sound. From the Sound Measurement Plan:

> Aircraft sound in the U.S. is governed by the Federal Aviation Administration (FAA). The metric used for assessing sound by them is the Day-Night Average Sound Level, abbreviated Ldn or DNL (the two terms are used interchangeably). Ldn/DNL is used by major Federal agencies (U.S. Environmental Protection Agency (EPA), U.S. Department of Housing and Urban Development (HUD), the U.S. Department of Energy (DOE), The U.S. Department of Defense (DOD), and others) and internationally in the assessment of potential noise impacts as a result of aerial vehicle operation (planes and helicopters). Additionally, the FAA regulates sound levels produced by all aircraft manufactured and certified for use in the U.S. to reduce potential noise impact on people to an acceptable limit before they even take flight. These regulations have produced quieter modern aircraft like those that currently use MMC's helipad and are considered industry standard.
>
> A 2011 report for the Volpe National Transportation Systems Center (DOT/FAA/AEE/2011-03) stated "The Day-Night Average Sound Level, DNL, is the cornerstone of aviation noise impact analysis in the United States."
>
> MASSPORT, the Massachusetts Port Authority, which administers multiple airports and other transportation venues in the state, defines the Day-Night Sound Level as follows:
>
>> **Ldn:** *The Day-night Average Sound Level (Ldn) is the level of noise expressed (in decibels) as a 24-hour [logarithmic] average. Nighttime noise, between the hours of 10:00 p.m. and 7:00 a.m. is weighted; that is, given an additional 10 decibels to compensate for sleep interference and other disruptions caused by nighttime noise. An annual average of DNLs is used by the Federal Aviation Administration to describe airport noise exposure.*

> The aircraft-only DNL considers not only how loud a particular aircraft or helicopter event (landing or takeoff) is but also how long the sound is present, how many events occur over time, and whether the events occur during daytime or at night. The aircraft DNL is developed using computer modeling coupled with actual sound measurements of the various models of aircraft using a particular site and the facts of the pathways and frequency of aircraft flights.

Two important takeaways from the definition of DNL are 1) it is only the sound from the helicopter operations that is considered and 2) it is the long-term (annual) average level that is used when comparing to the threshold for mitigation. Other sounds in an area (e.g., motor vehicle traffic) and what occurs on a given day or even a single flight are not the basis for determining the sound from the helicopter (although it does add with all events over time to determine the annual average DNL).

Our recent study included setting up environmental sound monitors at nine locations around the hospital, the same locations used in previous studies. Figure 1 shows these monitoring points, labeled "CP-1" through "CP-9." These are the same points shown in Appendix 6 of the Sound Measurement Plan. A tenth instrument was placed on the rooftop helipad area to act as a reference for when helicopters landed and departed. The instruments measured and stored the overall A-weighted sound level (the metric used when determining DNL) over five continuous days, 24 hours a day, from noon on September 16 to noon of September 21, a Wednesday to Monday, covering actual real-world use of the helicopters. The instruments were calibrated before and after the testing. Their internal clocks were synchronized so all the measurements at all locations were made at the same time.

The instruments used for the long-term sound measurements are Larson-Davis Model 703 and 705+ digital time-history sound level meters equipped with instrumentation microphones and windscreens. They meet ANSI requirements for Type 2 sound level meters. They measure and store the overall A-weighted sound pressure level ("dBA"), at programmed intervals, for programmed measurement times. Each instrument has an internal clock. These were all set and synchronized using a common digital clock, which was set using time from a GPS receiver.

Each instrument was calibrated prior to the test, and the calibration checked after the tests, with a Bruel & Kjaer Type 4230 sound level calibrator. The calibrator's own calibration is done annually and is traceable to the National Institute of Standards and Technology (NIST), following good acoustical practice. Sound levels in this report are expressed in terms of decibels relative to the ANSI-preferred reference pressure of 20 uPa. The instrument detectors were set for "slow" response.

The dates and time of helicopter operation to and from the hospital were provided by LifeFlight of Maine from their records. During the test over 5 days there were 15 landings and 15 departures, 8 during the day (7 AM to 10 PM) and 22 at night, to and from the helipads.

Each of the nine instruments produced over 80,000 measurements. Out of those we needed to identify the helicopter sounds for calculating the DNL. We did this in three progressively more detailed steps to manage the amount of data.

Figures 2 through 10 show the basic sound level data, hour by hour, for the five days of testing. Each vertical red bar shows the high-low range for that hour and each blue square shows the energy-averaged level ("Leq") for the hour. The bars with green dots at the top show hours when one or more helicopters landed or departed from the hospital.

The table below also summarizes the A-weighted sound pressure levels over the same five days covered in the graphs:

CP #	Lmin	L90	Leq	L10	Lmax
1	46.7	49	58.2	58	94.8
2	46.7	50	66.1	68	100
3	47	50	64.6	59.5	103.7
4	51.6	53.5	58.3	57.5	92.7
5	40	43	53	53	85
6	41.2	46	55.5	56	97
7	43.2	47	57.5	57	86.8
8	35.2	41	55.8	53.5	94.4
9	39.9	44.5	56.2	58	92.3

Lmin and Lmax are, respectively, the minimum and maximum sound levels measured over the entire period at a test location. Leq is the energy-averaged ("average") sound level. L90 and L10 are the sound levels exceeded 90% and 10% of the time; 80% of the time the sound levels were between the L90 and L10 levels.

We first evaluated the total sound over all five days at each test location. We calculated the DNL for all the sounds, assuming it was all from the helicopter operations. If the DNL from all the sounds was under the DNL 65 threshold then the sounds from just the helicopter would be under 65. Having identified those locations where it was possible the helicopter-only sounds could exceed DNL 65 we then calculated the DNL for those locations using just the hours when there were helicopter operations but again assuming all the sound in those hours came from the helicopter flights. The table below shows the results of these distillations:

CP#	5-day DNL*	Affected hours DNL**
1	64.2	
2	70.2	66.8
3	72.2	71.5
4	66.0	64.4
5	56.6	
6	60.4	
7	64.6	
8	57.5	
9	60.4	

*Note: This is EVERYTHING, not just helicopters

** Hours when helicopter operated

Of the nine locations three have DNL levels, based on all the sounds, over 65. The other six locations are excluded. Of those three two have potential sound exposures over DNL 65 based on only the hours when one or more helicopter operations occurred. We then looked at the detailed sound level measurements for CP-3 (the location with highest DNL calculated with the above method) to pick out the sounds when the helicopter was approaching or departing the rooftop. We took all the sounds during each event, added 10 dBA to those occurring at "night," then added up the sounds over the five days so all 30 landings and takeoffs were accounted for.

As was previously stated it is the "annual average DNL" that is the criterion. During the five days of testing there was a total of 15 flights in and out of the rooftop; three a day on average. Of the 30 flights 8 occurred during the day, 22 at night.

In the August 12, 2020 report to the Neighborhood Advisory Committee approximately eight months of helicopter activities were presented. In these 244 days 355 approaches and departures (each) occurred; that equates to 1.45 per day. Of these 70.5% were during the day, 29.5% at night. (The report used 4-hour time slices; we proportioned the flights in the 4:00-7:59 and 20:00-23:99 intervals to correspond to the DNL "day" of 7:00 to 22:00 and "night" of 22:00-7:00). Finally, used the sound data from the five test days in combination with the number of flights over the 244 days and the proportion taking place "day" and "night" to calculate the long-term DNL for CP-2 and CP-3.

At CP-2 the DNL, based on the eight months of flight information, is 59 dBA. At CP-3 it is 64.2. As the DNL levels do not exceed 65 there is no necessity for mitigation.

We were asked how the sounds from the helicopter flights compare to other sounds in the community. As previously mentioned, Figures 2 through 10 show the sound levels over the five days of around-the-clock sound level testing. As previous sound studies for this project have shown, the helicopter sounds are not the loudest in any of the areas monitored. Close to the hospital the helicopter sound are more significant than far away, but even there the sound from the helicopter is not the highest; there are still instances where other sounds are louder. The contribution to the total sound in an area from a helicopter approach or departure lasts 30 to 60 seconds. A helicopter flight to and from the rooftop pads, based on eight months of actual use, shows there are just under one-and-a-half flights a day.

Yours truly,

Norman R. Dotti, PE, PP, INCE
Principal

NRD/me

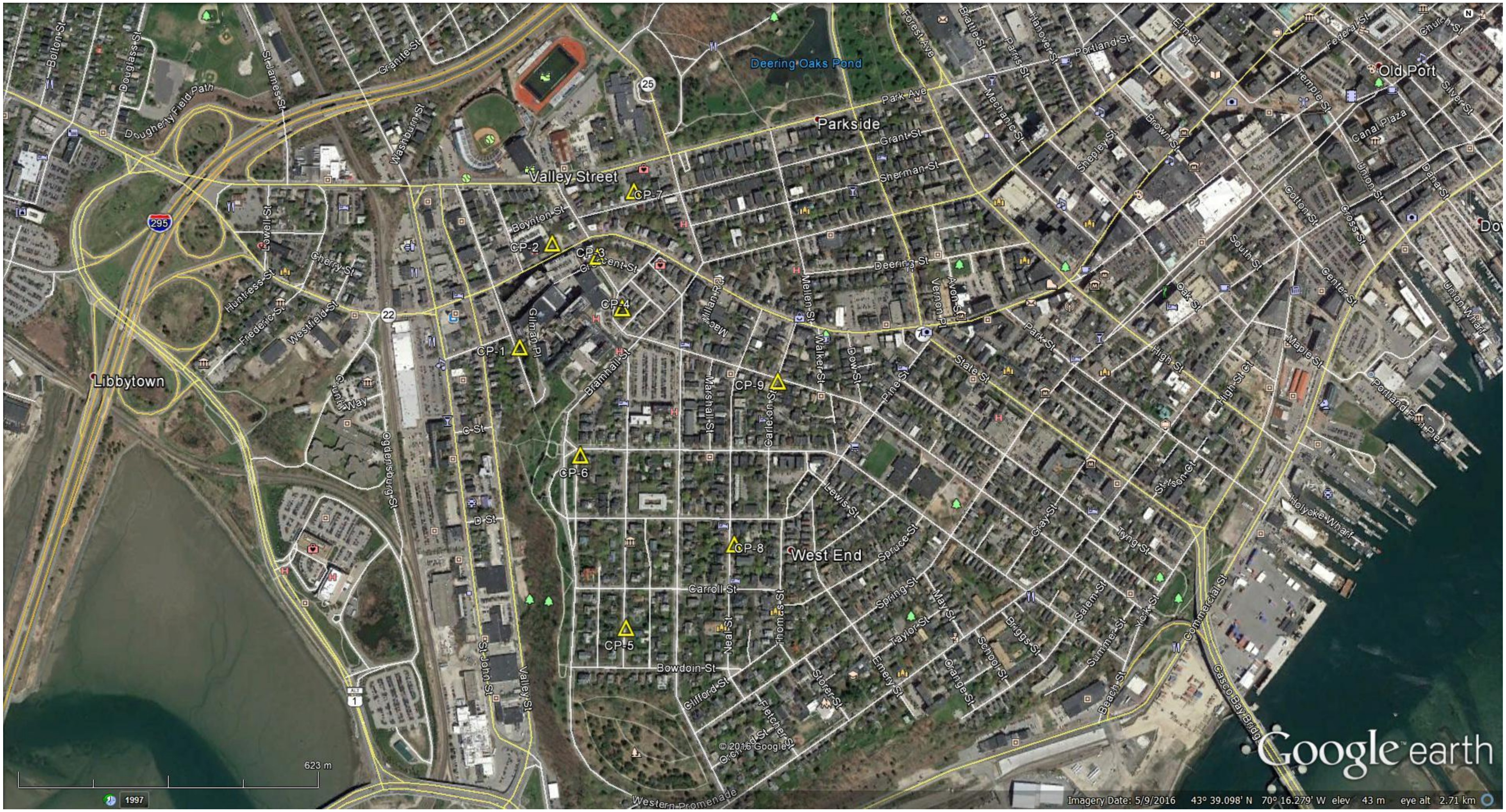


Figure 1 – Sound Measurement Locations

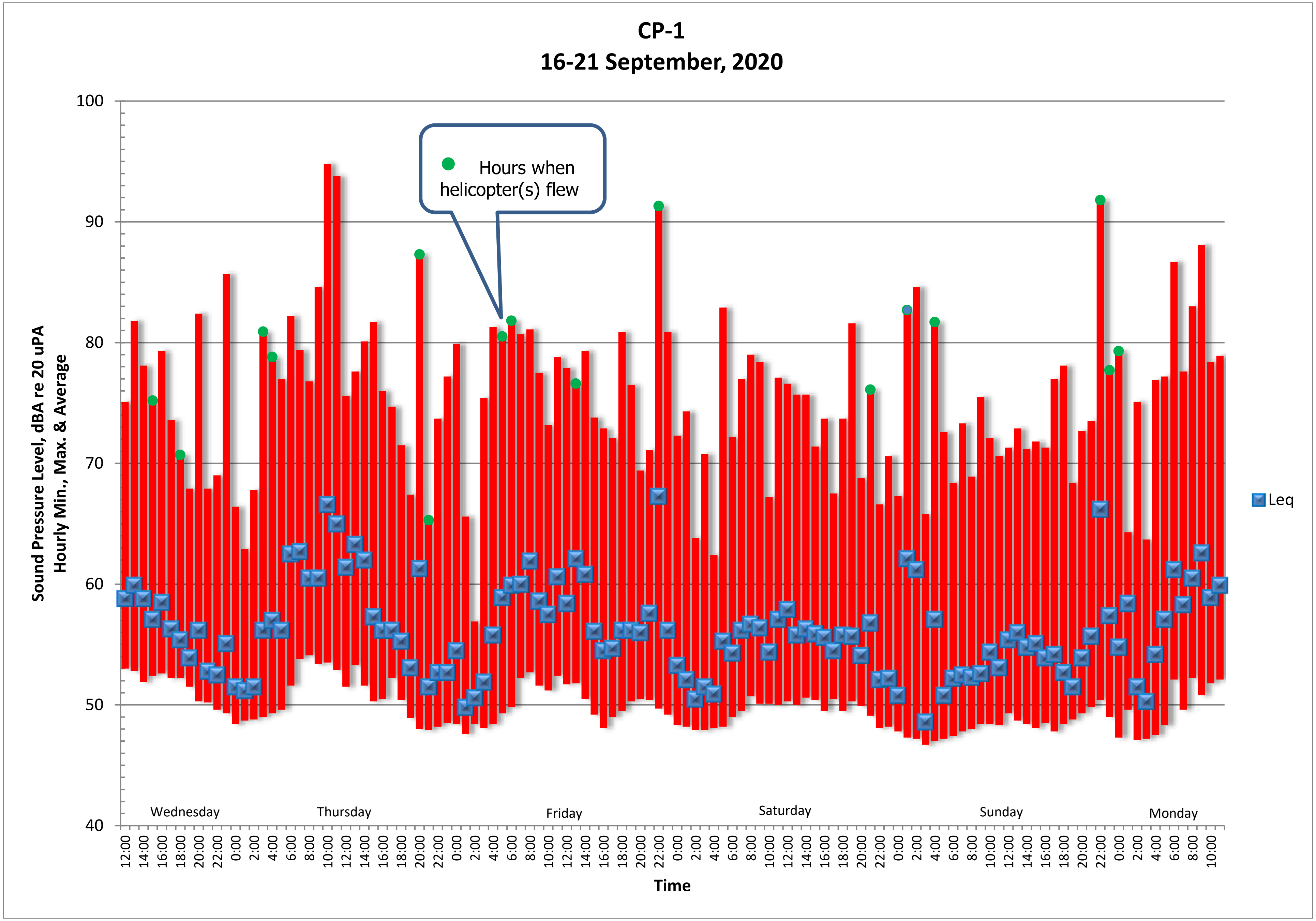
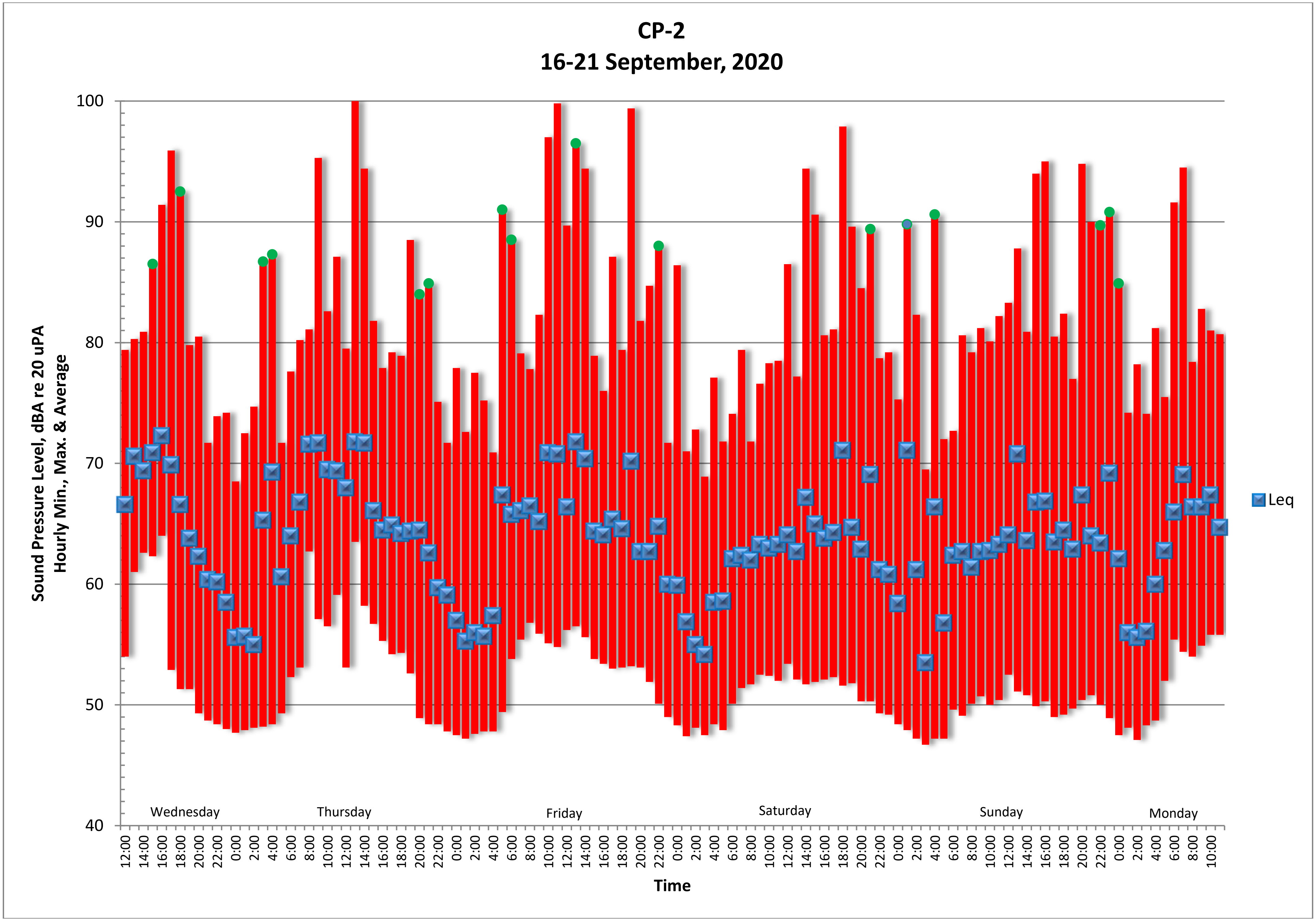
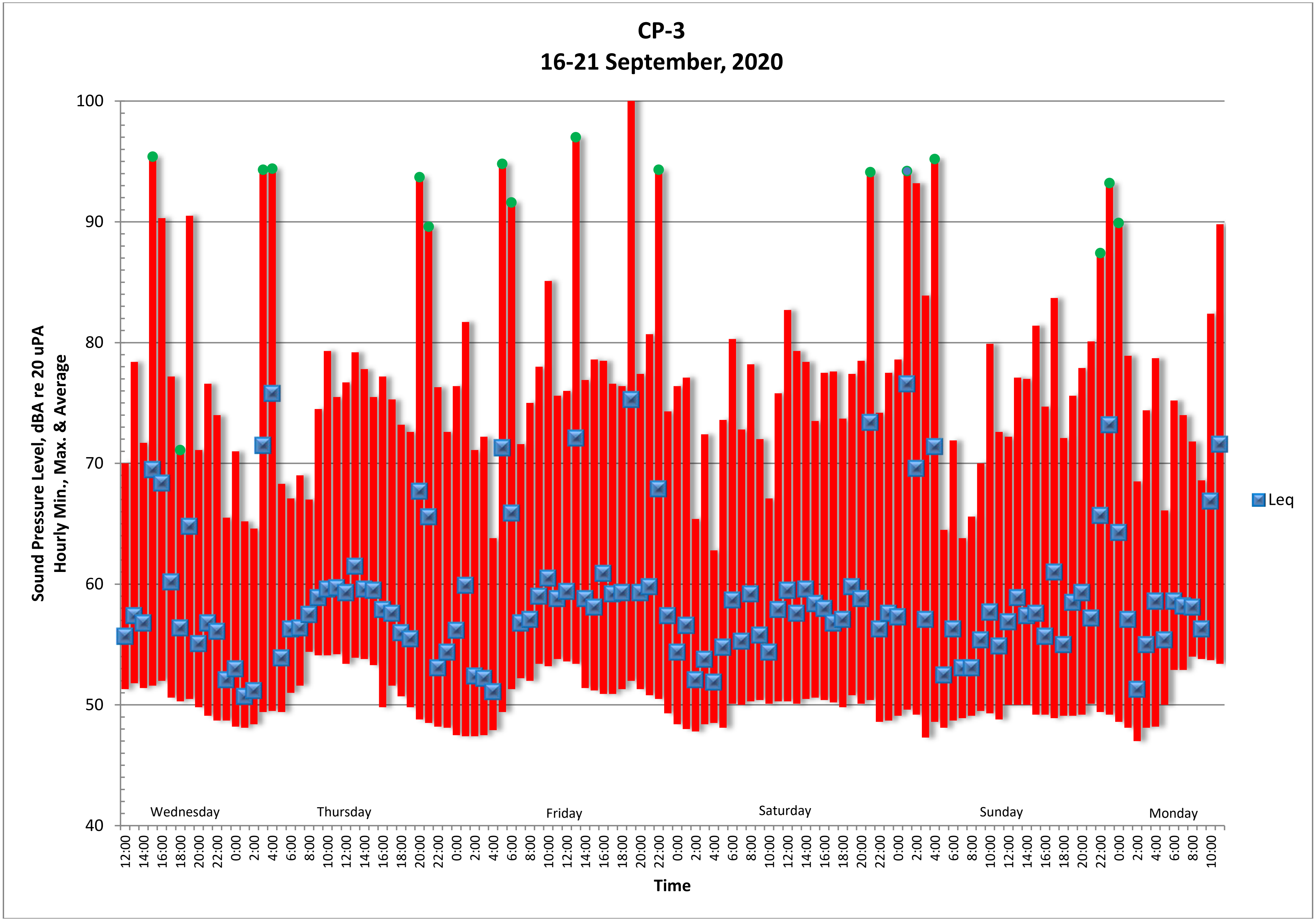

CP-1
16-21 September, 2020
Hours when helicopter(s) flew
Sound Pressure Level, dBA re 20 uPA
Hourly Min., Max. & Average
Leq
Wednesday
Thursday
Friday
Saturday
Sunday
Monday
Time

Figure 2



CP-2
16-21 September, 2020
Sound Pressure Level, dBA re 20 uPA
Hourly Min., Max. & Average
Time
Leq
Wednesday
Thursday
Friday
Saturday
Sunday
Monday

Figure 3



CP-3
16-21 September, 2020
Sound Pressure Level, dBA re 20 uPA
Hourly Min., Max. & Average
100
90
80
70
60
50
40
Wednesday
Thursday
Friday
Saturday
Sunday
Monday
12:00
14:00
16:00
18:00
20:00
22:00
0:00
2:00
4:00
6:00
8:00
10:00
Time
Leq

Figure 4

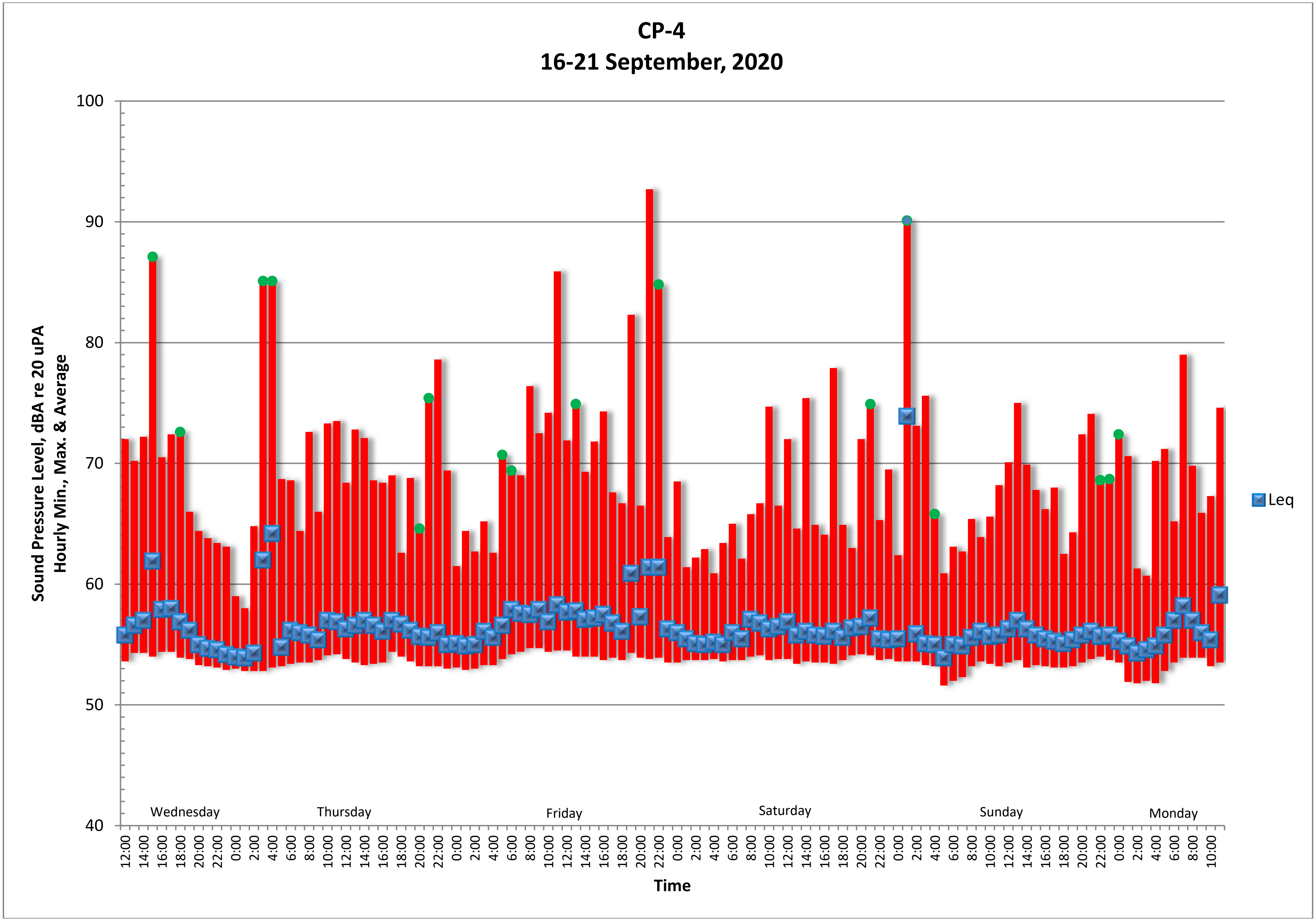

CP-4
16-21 September, 2020
Sound Pressure Level, dBA re 20 uPA
Hourly Min., Max. & Average
100
90
80
70
60
50
40
Wednesday
Thursday
Friday
Saturday
Sunday
Monday
Time
Leq

Figure 5

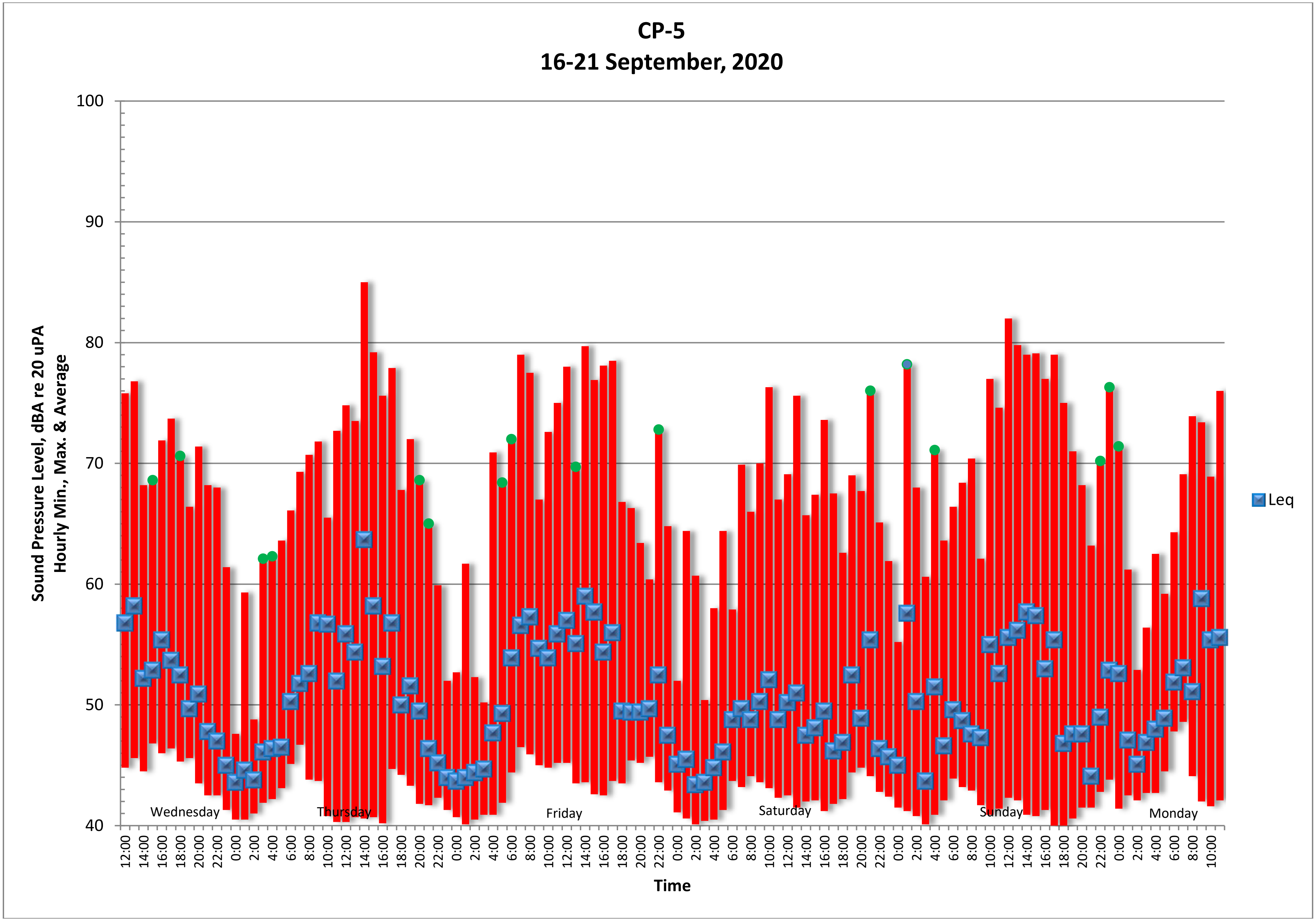

CP-5
16-21 September, 2020
Sound Pressure Level, dBA re 20 uPA
Hourly Min., Max. & Average
100
90
80
70
60
50
40
Wednesday
Thursday
Friday
Saturday
Sunday
Monday
Time
Leq

Figure 6

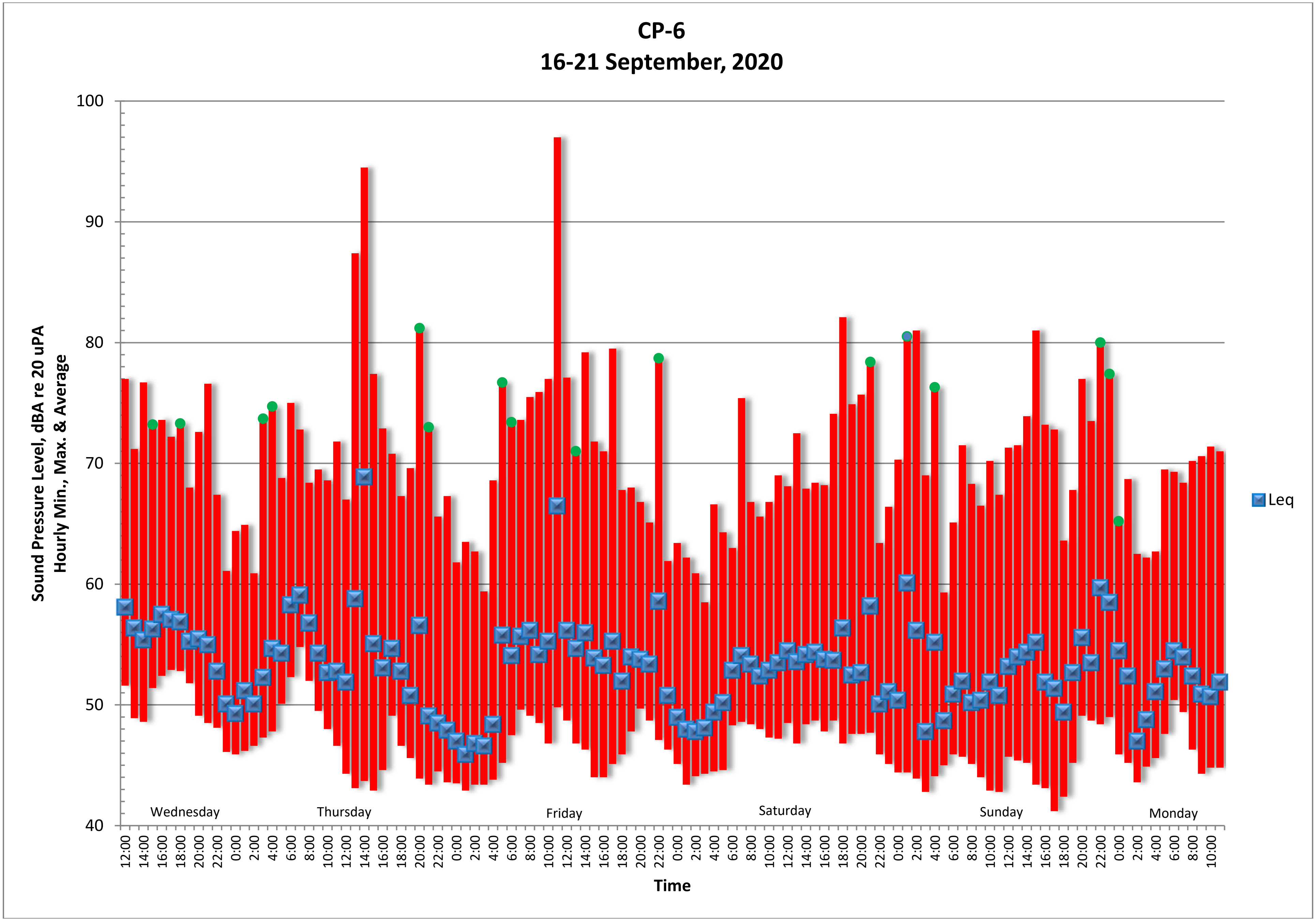
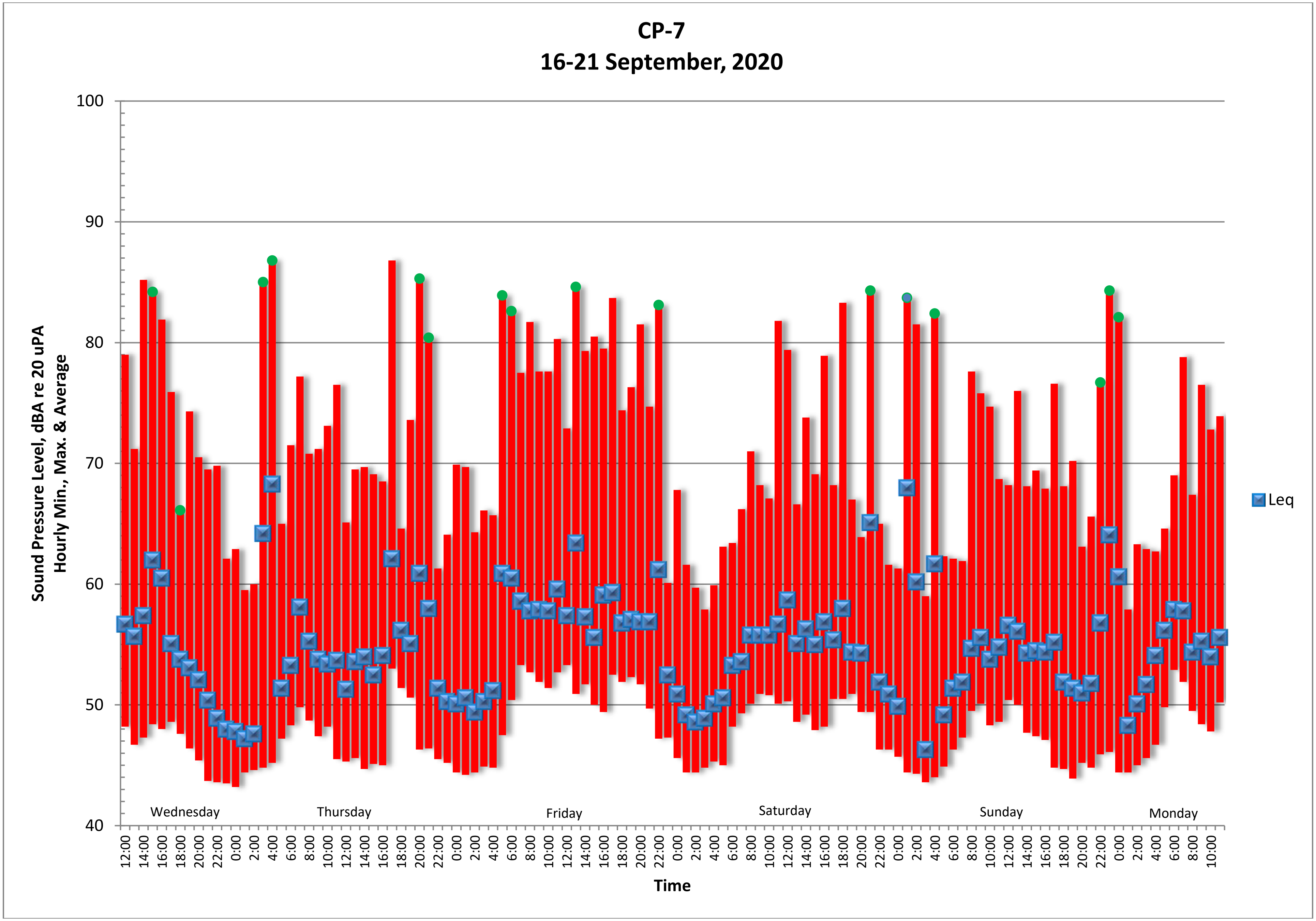

CP-6
16-21 September, 2020
Sound Pressure Level, dBA re 20 uPA
Hourly Min., Max. & Average
100
90
80
70
60
50
40
Wednesday
Thursday
Friday
Saturday
Sunday
Monday
Time
Leq

Figure 7



CP-7
16-21 September, 2020
Sound Pressure Level, dBA re 20 uPA
Hourly Min., Max. & Average
100
90
80
70
60
50
40
Wednesday
Thursday
Friday
Saturday
Sunday
Monday
Time
Leq

Figure 8

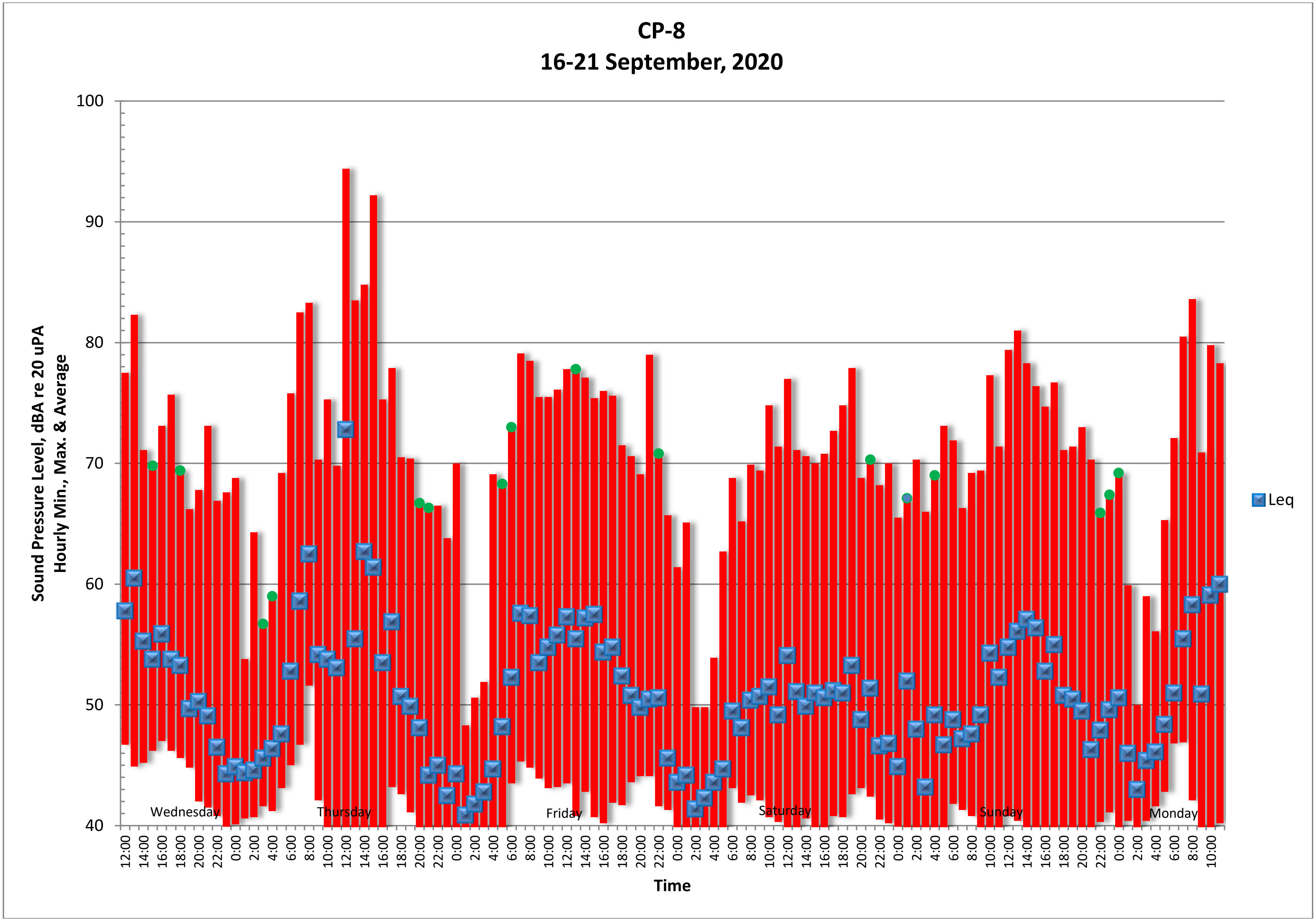

CP-8
16-21 September, 2020
Sound Pressure Level, dBA re 20 uPA
Hourly Min., Max. & Average
100
90
80
70
60
50
40
Wednesday
Thursday
Friday
Saturday
Sunday
Monday
Time
Leq

Figure 9

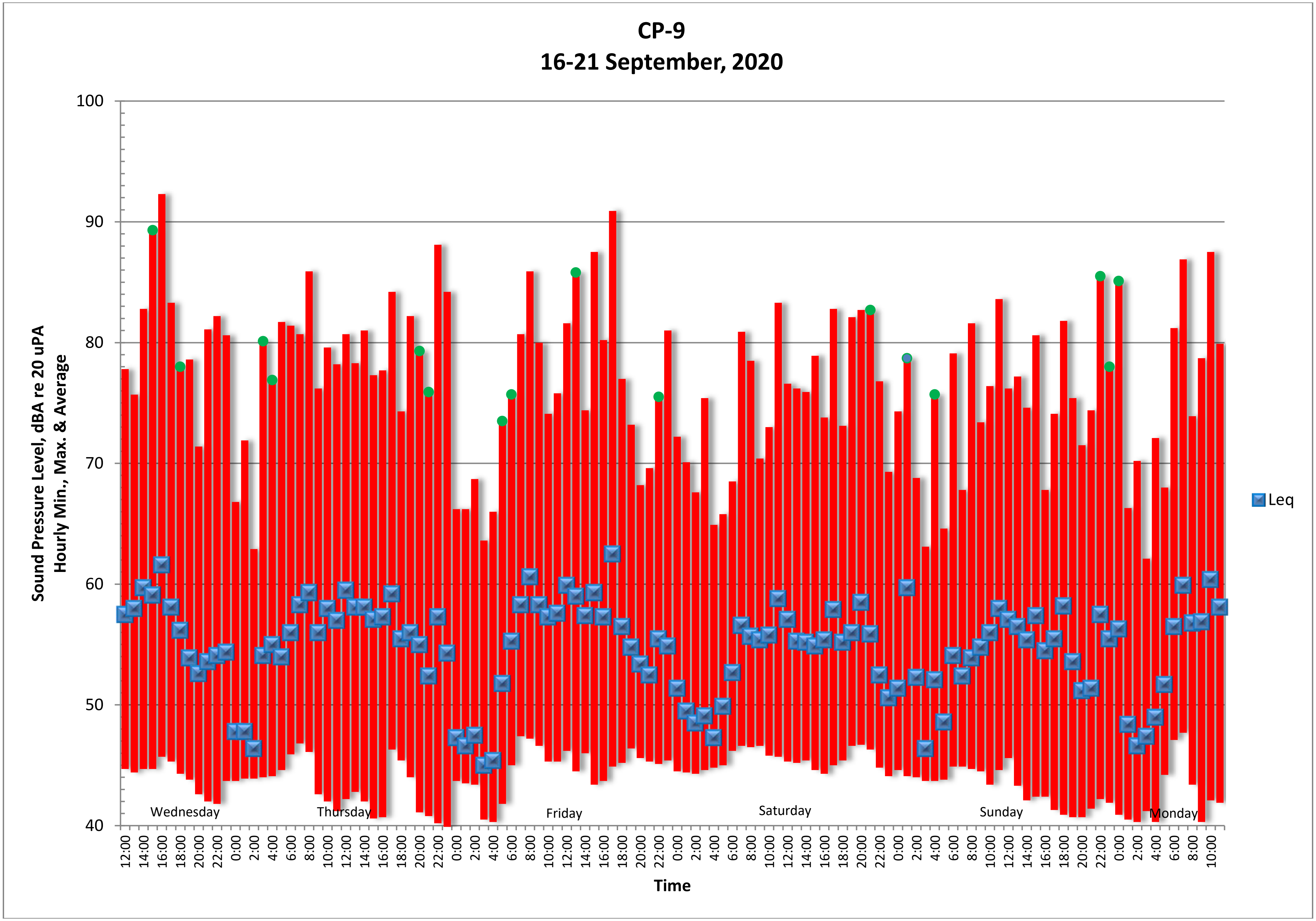

CP-9
16-21 September, 2020
Sound Pressure Level, dBA re 20 uPA
Hourly Min., Max. & Average
100
90
80
70
60
50
40
Wednesday
Thursday
Friday
Saturday
Sunday
Monday
Time
Leq

Figure 10