March 1, 2018

Ms. Amber Bock
Superintendent
Westborough School Department
45 West Main Street
Westborough, MA 01581

e-mail: bocka@westboroughk12.org

SUBJECT: Athletic Field – Westborough High School
Background Sound Study and Football Game Sound Levels

Dear Ms. Bock,

We have completed a background sound study and sound level measurements of two high school football games at Westborough High School in connection with the athletics field repair project. The purpose of our sound study was to measure the existing background sound environment in the vicinity of the athletics field and to measure sound levels during football games. This report presents our measurement results and summarizes sound levels during football games.

Baseline Sound Study - Existing Ambient Sound Levels

In order to understand the existing sound environment, existing background sound levels were measured over an approximate ten-day period near neighborhoods surrounding the athletic field. These background sound levels will be utilized in future analysis of the new athletic field sound system design.

We installed three environmental sound level monitors for the ten-day period. One meter (SM1) was installed north of the athletic field near the Charles Street neighborhood. The second meter (SM2) was installed south of the athletic field near along Ruggles Street near the back entrance to the high school. The final monitor (SM3) was located west of the athletic field near the O Neil Drive neighborhood. Monitoring began the afternoon of Saturday October 28, 2017 and concluded the morning of Monday November 6, 2017. Sound monitoring locations are shown on Image 1. Detailed measurement results are shown in attached Figures 1 through 3.

Monitors were programmed to measure several hourly A-weighted sound level descriptors including the 90th percentile sound level (L_{A90}), equivalent sound level (L_{Aeq}), and first percentile (L_{A01}) sound level.

- The 90th percentile sound level (L_{A90}) is the background or residual sound level in an area and is the lowest level of sound typically occurring. It is the A-weighted sound level exceeded 90% of each hour monitored.
- The equivalent sound level (L_{Aeq}) is the energy average sound level for each hour monitored.
- The first percentile sound level (L_{A01}) is the sound level exceeded one percent of each hour and is representative of the highest sound levels reached in each hour.

Image 1 – Sound Monitor Locations

Football Game Sound Levels

To quantify existing sound levels during football games (loudspeakers, band, cheering, etc.) we attended two games and installed two sound level meters near the athletic field, at locations SM1 and SM4 shown on Image 1. Sound levels were measured during an evening game on Friday, October 20, 2017 and the homecoming game on Saturday, October 28, 2017.

Sound monitors were programmed to measure several 1-second and 20-minute A-weighted sound level descriptors, as listed in the section above. For this analysis, we have chosen to focus on the equivalent sound level (L_{Aeq}) which best represents impacts on the nearby communities.

Tables 1 and 2 provide a summary of measured sound levels during the football games. Table 1 presents sound levels during 1-second intervals and Table 2 presents sound levels during 20-minute intervals. Sound levels measured during1-second intervals have a wide range of variability due to transient events such as yelling, whistle blowing, and other short term, loud sound events. Transient sounds are sound of short duration, and sometimes high level. Sound levels measured during 20-minute intervals encompass all sound events that occurred during the period and provide a better representation of the average sound level, without a considerable influence from short term sound events.

Sound Meter Location	Location SM1 – North			Location SM4 - Southeast		
Game Date	Pre Game	During Game	Post Game	Pre Game	During Game	Post Game
October 20, 2017 Evening Game	43-63	54-78	40-54	44-73	55-81	41-71
October 28, 2017 Homecoming Game	45-66	46-79	43-57	44-70	44-80	41-72

Table 1 – Measured Sound Levels During Football Games (1-second L_{Aeq}, dBA)

Sound Meter Location	Location SM1 – North			Location SM4 - Southeast		
Game Date	Pre Game	During Game	Post Game	Pre Game	During Game	Post Game
October 20, 2017 Evening Game	50-53	57-64	46-54	60-64	63-67	58-61
October 28, 2017 Homecoming Game	54-56	56-60	48-55	60-62	61-67	59-61

Table 2 – Measured Sound Levels During Football Games (20-minute L_{Aeq}, dBA)

Sound levels measured at location SM4 were influenced by traffic on Ruggles Road and cars entering the parking lot on the north side of the athletic field. Due to the distance from the field and traffic on nearby roads, sound levels at this location did not change as significantly during football games when compared to location SM1.

Sound levels measured during football games at SM1, near the Charles Street neighborhood, increased approximately 13-15 dB for short duration events and 4-10 dB during the longer 20-minute intervals. Sound levels at SM3 increased approximately 8-10 dB for short duration events and 3-6 dB during the longer 20-minute intervals.

Sample A-weighted sound level graphic time histories measured at location SM1 during the homecoming football game, for the period 1:40 to 2:20 PM, Saturday, October 28, 2017, are attached to this report. These show the variability in short term sound events, some of which are notated on the graph.

Measured sound levels during football games will be used during future analysis of the new athletic field sound system design.

Please feel free to contact us if you have any questions.

Sincerely,
CAVANAUGH TOCCI

Aaron M. Farbo, *Associate Principal Consultant*
17242/Westborough Athletics Field Sound Study Summary Report.docx

FIGURES

Sound Levels Measured North of the stadium, near the Charles Street neighborhood (SM1)

Westborough, MA (October 28 - November 4, 2017)

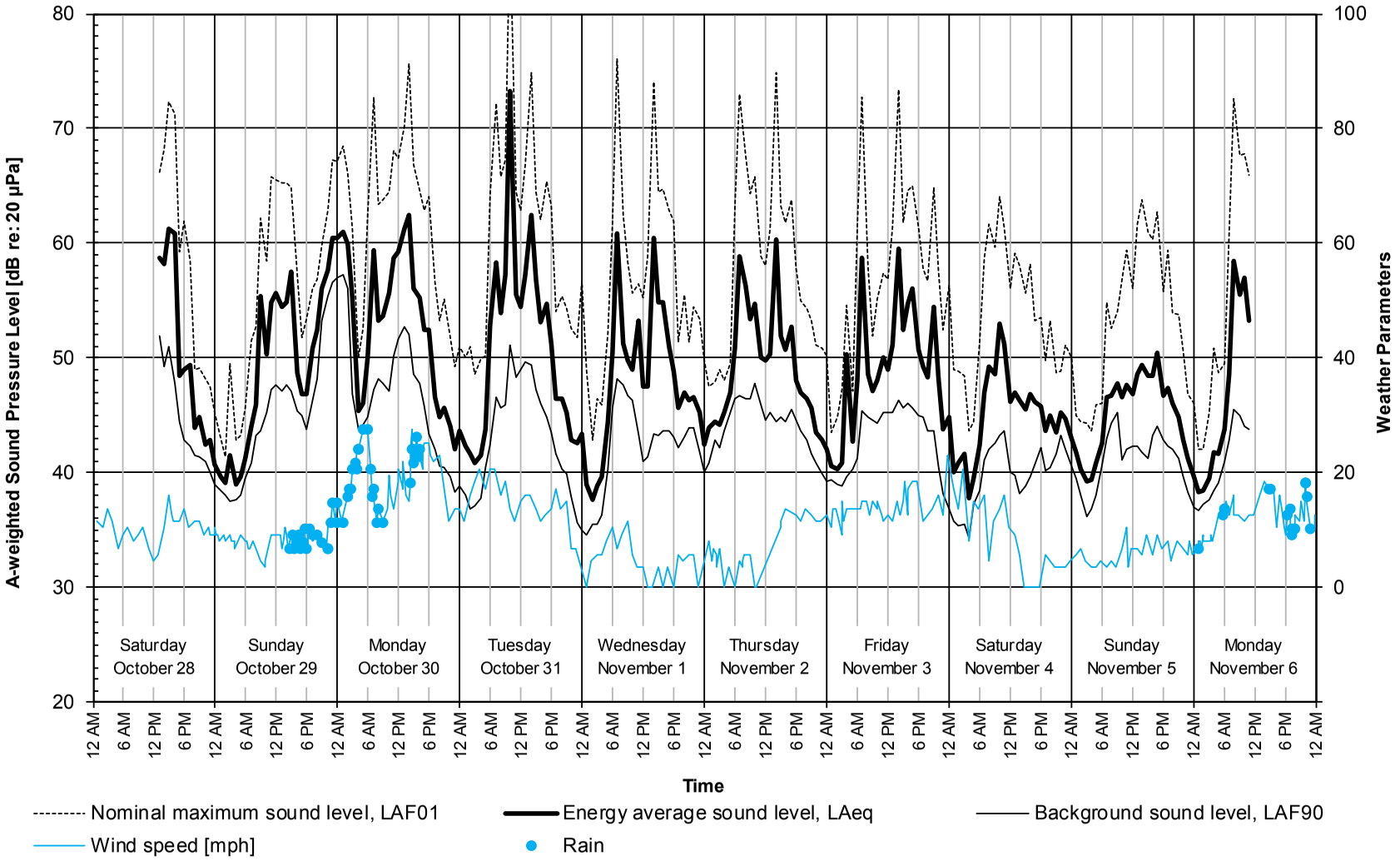

Figure 1

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Sound Levels Measured South of the stadium, near the Ruggles Street neighborhood (SM2)

Westborough, MA (October 28 - November 4, 2017)

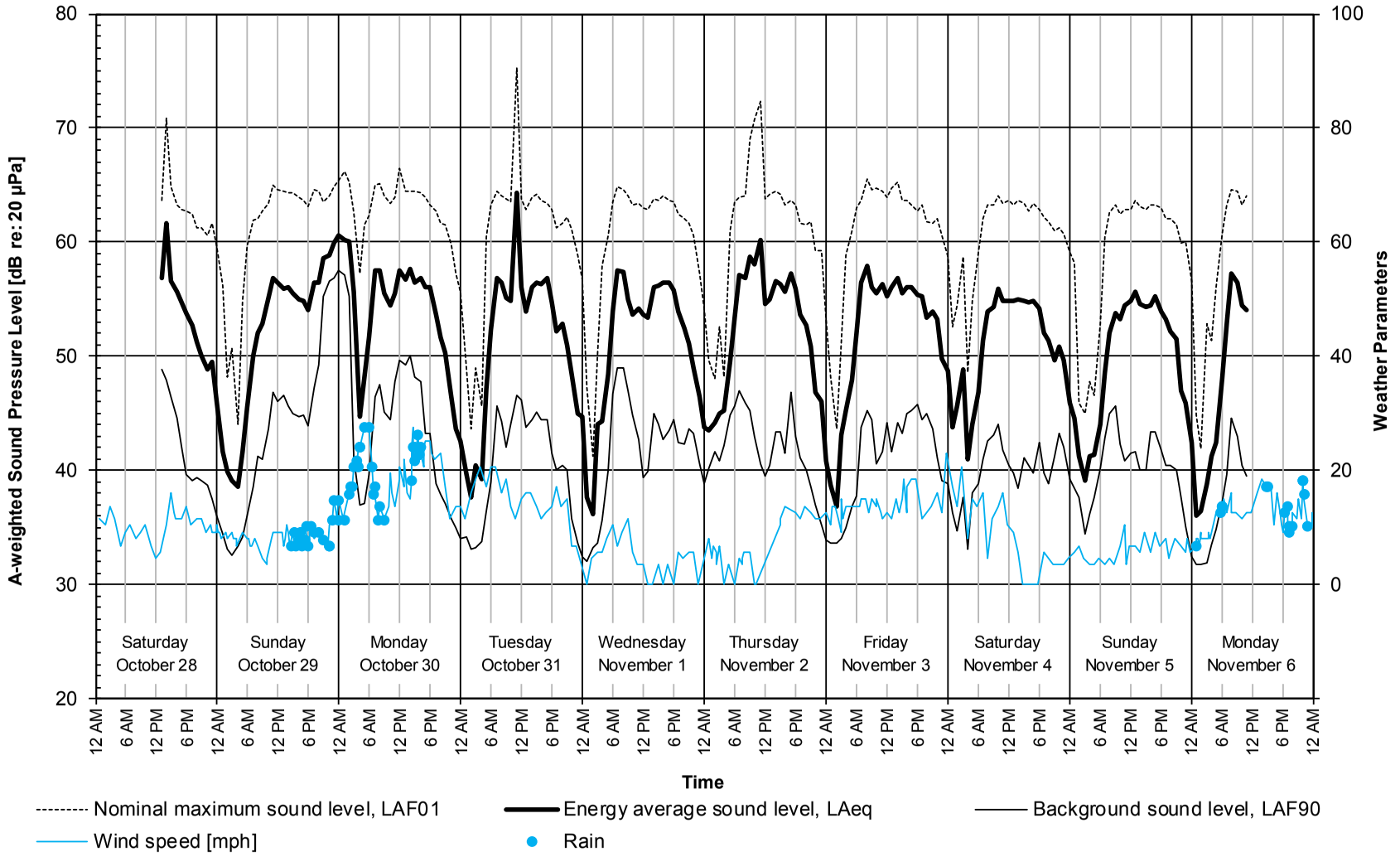

Figure 2

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Sound Levels Measured West of the stadium, near the O Neil Drive neighborhood (SM3)

Westborough, MA (October 28 - November 4, 2017)

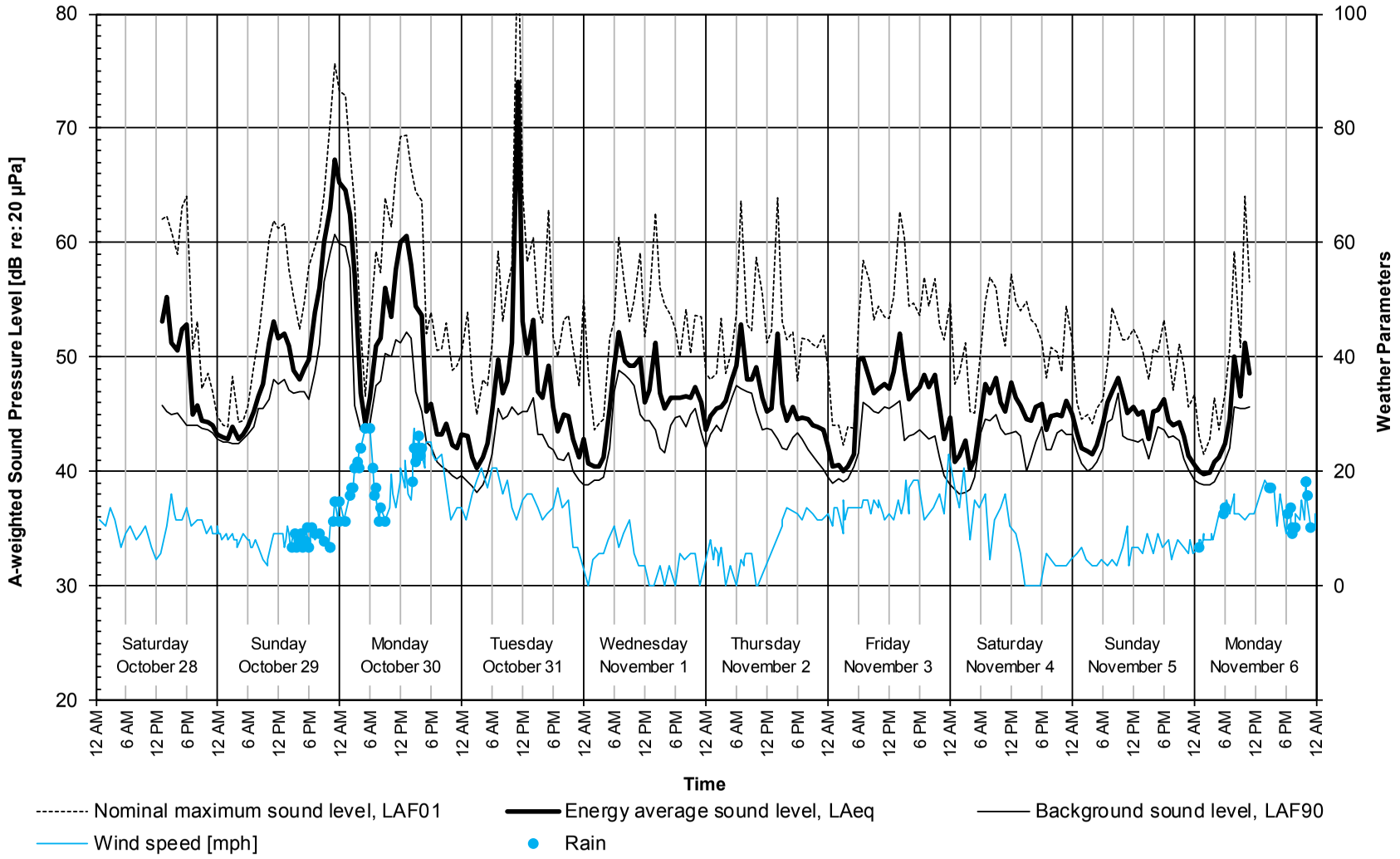

Figure 3

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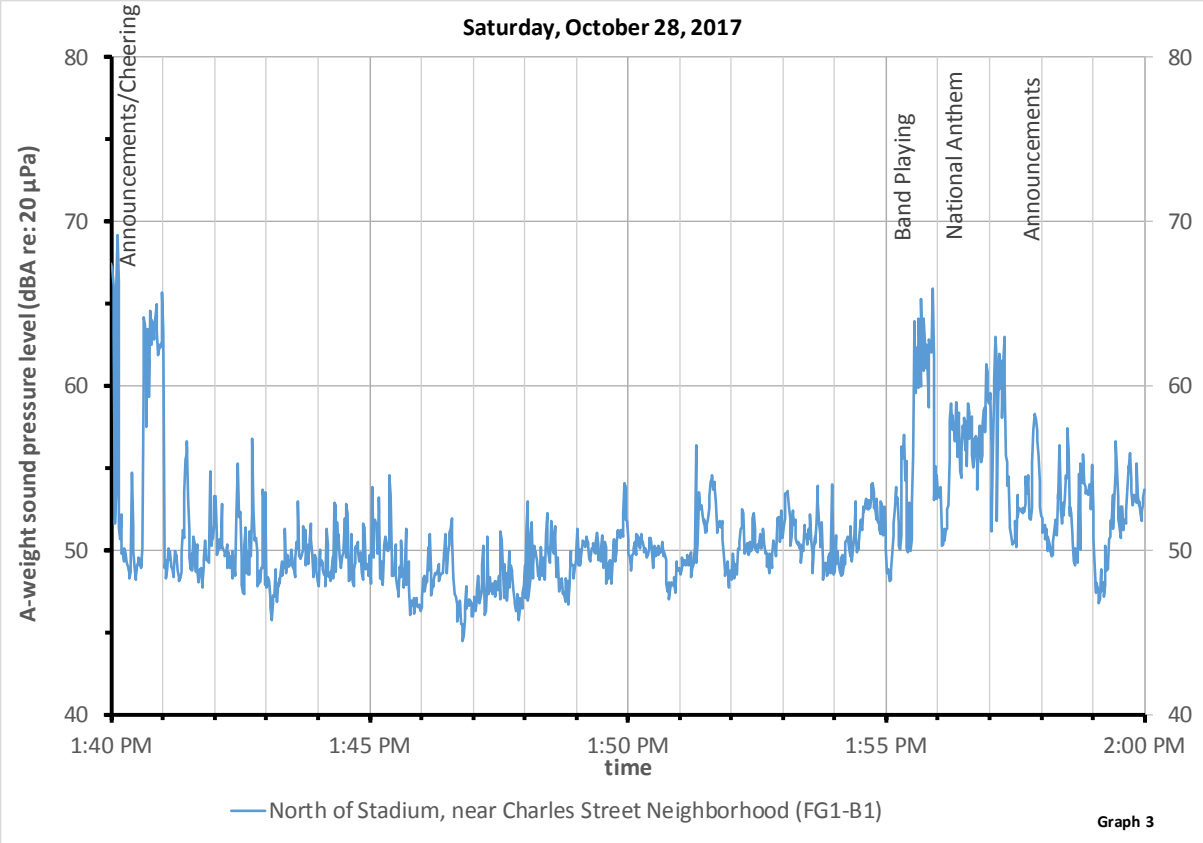
Saturday, October 28, 2017
A-weight sound pressure level (dBA re: 20 µPa)
80
70
60
50
40
Announcements/Cheering
Band Playing
National Anthem
Announcements
1:40 PM
1:45 PM
1:50 PM
1:55 PM
2:00 PM
time
North of Stadium, near Charles Street Neighborhood (FG1-B1)
Graph 3

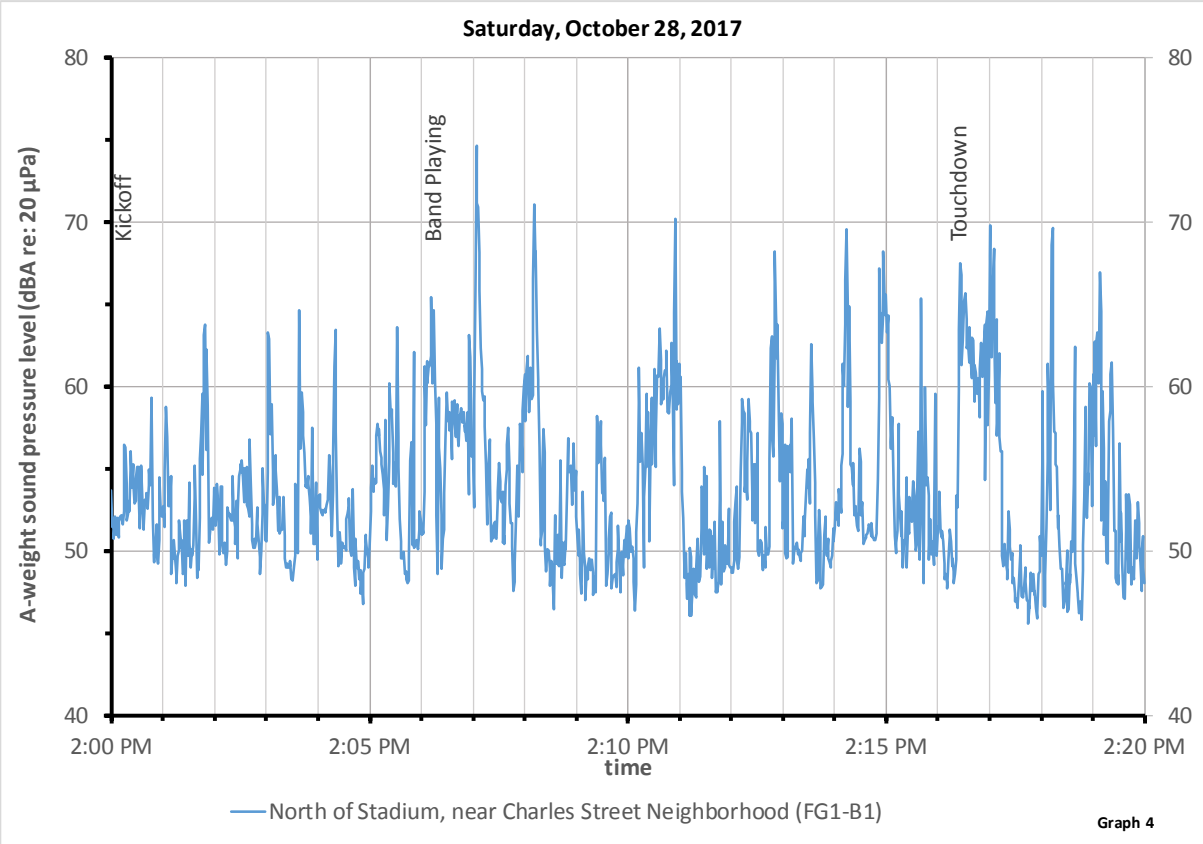
Saturday, October 28, 2017
A-weight sound pressure level (dBA re: 20 µPa)
80
70
60
50
40
Kickoff
Band Playing
Touchdown
2:00 PM
2:05 PM
2:10 PM
2:15 PM
2:20 PM
time
North of Stadium, near Charles Street Neighborhood (FG1-B1)
Graph 4

Figure 4