

2025 February 06 Site Visit Data and Observations

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Three elements to consider

- Acoustics

- The process by which sound gets generated and travels from source to listener
- 100% physics
- Sound level meters measure acoustic fluctuations

- Hearing

- The process by which sound gets converted into nerve impulses in the inner ear
- The source of some phenomena like auditory threshold, frequency selectivity, sound masking
- Sound level meters evaluate similar to some aspects of hearing (octaves, decibels)

- Listening

- The process by which nerve impulses get converted into subjective experience and assigned a meaning, value, and/or associations
- The source of focused attention, perceived loudness, annoyance
- Particular to listeners, no simple measurement can simulate this

Lab testing vs. Field testing

- When called upon to determine the noise emission from a source in the laboratory, under controlled conditions
 - The minimum difference between source “on” and source “off” levels should be 6 or more dB in all bands or metrics of interest, absolute minimum 3 dB
 - This ensures that the decibel subtraction by which the source contribution is reasonably accurate
 - It also ensures that the source is perceptually distinct and identifiable
 - No subjective determination is needed
- Field measurements are often influenced by uncontrollable factors
 - Subjective determination of what is being measured
 - Difficult if “on-off” level difference is small
 - We don’t do a subtraction, so all the measured energy is attributed to the subject

General Observations: Background Levels

- Residential

- Heritage Hunt Club

- Quiet area – minimal traffic noise

- Amberleigh Station

- Quiet area – minimal traffic noise
 - A slowly pulsating low-frequency tone was observed just below the threshold of hearing around 30 Hz
 - Corresponds to two identical machines running at nearly the same speed, their tones “beat” in and out of phase
 - Under other conditions (more machines, different weather) this could be audible and annoying
 - Most likely source is 1 mile north: site labeled “RLF Google” with cooling towers

General Observations: Background Levels

- Parks

- Manassas Battlefield

- Brawner Farms
 - Moderate noise from nearby roadways

- Long Park

- Surprisingly high roadway noise levels
 - Exceeds octave band criteria at 500 and 1000 Hz bands

General Observations: Data Center Noise

- Great Oaks

- DC noise mixed with traffic noise during visit – not always clearly distinguishable
- More distinct vs traffic noise at *greater* distance
 - More so at Post Oak Terrace, less so at Powerline Easement
 - Likely because of shielding due to roof parapets
 - Post Oak Terrace was not far enough away to give the desired “traffic only” baseline
- Low-frequency tones are present (esp. 90 Hz), mixed with broadband noise
 - Tones are likely to be audible indoors
 - Levels not associated with feelable vibration
 - Neighbors can probably pick the DC out by focusing attention on it
 - Intentionally or unwillingly
 - Inadvertently “trained” when the DC was louder
 - Possibility: traffic noise that’s sufficiently similar to the DC noise may get assigned to the DC in the listeners’ mind. This is more likely the further the DC noise recedes into traffic noise.

General Observations: Data Center Noise

- Wellington Glen
 - Strongly masked by traffic noise – DC noise not distinguishable
 - Except for a strong tone at 40 Hz, which was not present in previous measurements
 - Possible Genset operation?
 - Two locations to rule out a nearby source within the apartment buildings
- Hornbaker
 - DC noise was prominent against roadway noise background
 - Multiple measurement pauses to remove effect of aircraft
- Cloud HQ
 - DC noise was only rarely distinguishable due to
 - Traffic, near and far
 - Aircraft operations (which were excluded from measurements)

General Observations: Construction Noise

- Construction Noise

- Daytime – 2 locations

- $L_{pA,max} \approx 70$
 - $L_{pC,max} \approx 80$
 - $\Delta 25$ allowed
 - Currently: If > 25 add 5 to Leq and enforce
 - Background was “high” due to roadway traffic, no violation

Proposed daytime impulse limits:

$$L_{pA,max,SLOW} = 52 + 25 = 77$$

$$L_{pC,max,SLOW} = 65 + 25 = 90$$

- Nighttime – 1 location

- Yung Elementary 6 – 7 AM (so “night” per the Ordinance)
 - $L_{pA,max} \approx 60$
 - $L_{pC,max} \approx 70$
 - $\Delta 15$ allowed
 - Currently: If > 15 add 5 to Leq and enforce
 - Background was “high” due to roadway traffic, no violation

Proposed nighttime impulse limits:

$$L_{pA,max,SLOW} = 47 + 15 = 62$$

$$L_{pC,max,SLOW} = 60 + 15 = 75$$

Data - Residential

Date	Time	Class	Location	LpA'eq		Lp,50 OBSPL										LpA'50 LpC'50		
				LpAeq	LpC,eq	31.5	63	125	250	500	1000	2000	4000	8000	LpA'50	LpC'50		
10/9/24	Day	Residential	Kingsbrooke	52	65	66	54	50	44	41	38	33	27	19	43	63	Idling Bus	
11/5/24	Day	Residential	Montclair Subdivision	44	57	49	49	45	39	33	36	34	32	28	38	52		
11/5/24	Day	Residential	Cloverdale	39	54	51	50	47	40	32	35	35	32	31	38	53		
11/5/24	Day	Residential	Rollingwood	47	62	55	57	55	47	37	36	32	31	26	43	60		
11/27/24	Day	Residential	Nokesville	37	53	52	50	40	35	33	31	21	14	13	35	52		
1/30/25	Day	Residential	Heritage Hunt Club	40	55	54	50	43	39	36	33	27	22	21	38	53	LF Tone 31.5, Pulsating, < Threshold	
1/30/25	Day	Residential	Amberleigh Station	36	59	59	54	46	34	30	27	23	21	17	35	58		
10/9/24	Day	Education	Yung Elementary	46	63	61	56	54	46	42	40	33	26	23	45	61		
11/5/24	Day	Education	Beville MS	48	64	57	55	47	38	30	35	34	26	16	38	58		
11/5/24	Day	Education	Montclair Library	43	59	56	55	49	45	39	36	33	24	17	42	58		
10/9/24	Day	Park	Rollins Ford	47	62	56	56	56	49	39	38	31	23	14	45	60	Lawn Maintenance	
11/5/24	Day	Park	Locust Shade	52	63	60	58	54	49	49	48	42	36	30	51	62	Traffic	
1/30/25	Day	Park	Manassas Battlefield/Browner Farms	43	62	60	56	49	41	39	37	25	21	18	41	60	Traffic	
1/30/25	Day	Park	Long Park	51	62	57	58	52	46	49	47	38	21	16	50	61	Traffic	

False Positives – Residential

Date	Time	Class	Location	LpA ^{eq}		Lp,50 OBSPL										LpA ⁵⁰ LpC ⁵⁰		
				LpA ^{eq}	LpC ^{eq}	31.5	63	125	250	500	1000	2000	4000	8000	LpA ⁵⁰	LpC ⁵⁰		
10/9/24	Day	Residential	Kingsbrooke	52	65	66	54	50	44	41	38	33	27	19	43	63	Idling Bus	
11/5/24	Day	Residential	Montclair Subdivision	44	57	49	49	45	39	33	36	34	32	28	38	52		
11/5/24	Day	Residential	Cloverdale	39	54	51	50	47	40	32	35	35	32	31	38	53		
11/5/24	Day	Residential	Rollingwood	47	62	55	57	55	47	37	36	32	31	26	43	60		
11/27/24	Day	Residential	Nokesville	37	53	52	50	40	35	33	31	21	14	13	35	52		
1/30/25	Day	Residential	Heritage Hunt Club	40	55	54	50	43	39	36	33	27	22	21	38	53		
1/30/25	Day	Residential	Amberleigh Station	36	59	59	54	46	34	30	27	23	21	17	35	58	LF Tone 31.5, Pulsating, < Threshold	
10/9/24	Day	Education	Yung Elementary	46	63	61	56	54	46	42	40	33	26	23	45	61		
11/5/24	Day	Education	Beville MS	48	64	57	55	47	38	30	35	34	26	16	38	58		
11/5/24	Day	Education	Montclair Library	43	59	56	55	49	45	39	36	33	24	17	42	58		
10/9/24	Day	Park	Rollins Ford	47	62	56	56	56	49	39	38	31	23	14	45	60	Lawn Maintenance	
11/5/24	Day	Park	Locust Shade	52	63	60	58	54	49	49	48	42	36	30	51	62	Traffic	
1/30/25	Day	Park	Manassas Battlefield/Browner Farms	43	62	60	56	49	41	39	37	25	21	18	41	60	Traffic	
1/30/25	Day	Park	Long Park	51	62	57	58	52	46	49	47	38	21	16	50	61	Traffic	
Day Criterion				52	65	65	60	55	50	45	41	38	36	35	48	65		

Data – Data Centers - Night

Date	Time	Class	Location	Lp	A'EQ	C'EQ	Lp OBSPL										LpA'50	LpC'50
							31.5	63	125	250	500	1000	2000	4000	8000			
10/23/24	03:23	Data Center	Tanner Way Powerline Easement	L50	47	61	58	57	54	49	45	40	37	41	19	46	60	
1/30/25	05:35	DC/Traffic	Tanner Way Powerline Easement	L50	52	65	61	60	56	50	50	48	37	22	17	52	63	
				L90			59	57	53	48	48	47	36	20	15	49	61	
1/30/25	04:24	DC/Traffic	10200 Winged Elm	L50	48	61	57	58	51	47	45	43	32	23	20	47	60	
				L90			56	57	49	45	44	41	30	21	17	45	59	
1/30/25	04:44	DC/Traffic	10224 Winged Elm	L50	52	63	59	58	56	48	46	44	33	20	17	48	62	
				L90			57	56	52	46	44	41	31	17	14	45	59	
1/30/25	05:06	DC/Traffic	10087 Post Oak Terrace	L50	49	60	54	56	50	46	45	45	35	20	17	47	58	
				L90			52	54	47	44	42	41	32	16	15	44	56	
10/23/24	04:47	Data Center	Wellington Glen	L50	56	66	60	61	53	49	50	49	44	35	26	52	63	
11/12/24	05:40	Data Center	Wellington Glen	L50	54	70	59	60	55	49	42	44	43	34	22	47	62	
1/30/25	06:13	Data Center	Wellington Glen A	L50	60	72	72	67	60	54	54	56	52	39	26	58	72	
				L90			71	65	57	51	52	54	49	36	22	55	70	
1/30/25	06:21	Data Center	Wellington Glen B	L50	62	73	70	66	61	58	55	57	53	42	30	59	71	
				L90			69	63	58	53	53	55	49	37	23	56	68	
10/23/24	05:06	Data Center	Hornbaker 1	L50	55	70	66	64	63	56	54	51	48	44	40	55	68	
10/23/24	05:09	Data Center	Hornbaker 2	L50	52	67	65	63	61	54	50	48	46	43	38	52	67	

90 Hz Tone
Straddles (2) Oct Bands

Apparent Violations – Data Centers - Night

Date	Time	Class	Location	Lp	A'EQ	C'EQ	Lp OBSPL										LpA'50	LpC'50	
							31.5	63	125	250	500	1000	2000	4000	8000				
10/23/24	03:23	Data Center	Tanner Way Powerline Easement	L50	47	61	58	57	54	49	45	40	37	41	19	46	60		
1/30/25	05:35	DC/Traffic	Tanner Way Powerline Easement	L50	52	65	61	60	56	50	50	48	37	22	17	52	63		
				L90			59	57	53	48	48	47	36	20	15	49	61		
1/30/25	04:24	DC/Traffic	10200 Winged Elm	L50	48	61	57	58	51	47	45	43	32	23	20	47	60	90 Hz Tone	
				L90			56	57	49	45	44	41	30	21	17	45	59	←	
1/30/25	04:44	DC/Traffic	10224 Winged Elm	L50	52	63	59	58	56	48	46	44	33	20	17	48	62	90 Hz Tone	
				L90			57	56	52	46	44	41	31	17	14	45	59	←	
1/30/25	05:06	DC/Traffic	10087 Post Oak Terrace	L50	49	60	54	56	50	46	45	45	35	20	17	47	58	90 Hz Tone	
				L90			52	54	47	44	42	41	32	16	15	44	56	←	
10/23/24	04:47	Data Center	Wellington Glen	L50	56	66	60	61	53	49	50	49	44	35	26	52	63		
11/12/24	05:40	Data Center	Wellington Glen	L50	54	70	59	60	55	49	42	44	43	34	22	47	62		
1/30/25	06:13	Data Center	Wellington Glen A	L50	60	72	72	Traffic?								26	58	72	LF Tone 40 Hz
				L90			71									22	55	70	←
1/30/25	06:21	Data Center	Wellington Glen B	L50	62	73	70	Traffic?								30	59	71	LF Tone 40 Hz
				L90			69									23	56	68	←
10/23/24	05:06	Data Center	Hornbaker 1	L50	55	70	66	64	63	56	54	51	48	44	40	55	68		
10/23/24	05:09	Data Center	Hornbaker 2	L50	52	67	65	63	61	54	50	48	46	43	38	52	67		
Night Criterion					47	60	60	55	50	45	40	36	33	31	30	43	60		

Data – Data Centers - Day

Date	Time	Class	Location	LpA'eq	LpC,eq	Lp OBSPL										LpA'50	LpC'50	
						31.5	63	125	250	500	1000	2000	4000	8000				
10/9/24	Day	Data Center	Tanner Way	54	66	64	61	56	51	51	51	42	31	24	53	65		
10/9/24	Day	Data Center	Wellington Glen	59	73	64	65	59	53	51	53	49	41	30	55	67		
10/9/24	Day	Data Center	Hornbaker 1	60	71	69	64	63	59	59	57	51	44	29	60	70		
10/9/24	Day	Data Center	Hornbaker 2	62	75	66	64	64	56	56	54	50	43	29	57	69		
1/30/25	Day	DC/Traffic	Hornbaker 1 (11C)			56	68	65	62	59	52	52	51	48	37	22	54	66
								L90	62	60	57	51	51	50	48	36	20	53
1/30/25	Day	Traffic/DC	Cloud HQ			52	64	60	59	56	51	46	43	33	25	20	48	62
								L90	57	56	53	47	43	40	31	21	17	45

Apparent Violations – Data Centers - Day

Date	Time	Class	Location		LpA'eq	LpC,eq	Lp OBSPL								LpA'50	LpC'50	
							31.5	63	125	250	500	1000	2000	4000			8000
10/9/24	Day	Data Center	Tanner Way	L50	54	66	64	61	56	51	51	51	42	31	24	53	65
10/9/24	Day	Data Center	Wellington Glen	L50	59	73	64	65	59	53	51	53	49	41	30	55	67
10/9/24	Day	Data Center	Hornbaker 1	L50	60	71	69	64	63	59	59	57	51	44	29	60	70
10/9/24	Day	Data Center	Hornbaker 2	L50	62	75	66	64	64	56	56	54	50	43	29	57	69
1/30/25	Day	DC/Traffic	Hornbaker 1	L50	56	68	65	62	59	52	52	51	48	37	22	54	66
				L90			62	60	57	51	51	50	48	36	20	53	64
1/30/25	Day	Traffic/DC	Cloud HQ	L50	52	64	60	59	56	51	46	43	33	25	20	48	62
				L90			57	56	53	47	43	40	31	21	17	45	59
Day Criterion					52	65	65	60	55	50	45	41	38	36	35	48	65

Recommendations - Enforcement

- Ordinance addresses
 - Single noise source
 - Discernible and identifiable most or all of the time
 - Basic sound level meter use and interpretation capabilities by Officer

To enforce against _____ criterion	Must be able to attest Source was distinct and identifiable against the louder background
Leq	throughout the measurement
L50	50% of the time
L90	10% of the time
Lmax	At the time of the highest reading

Recommendations – Enforcement (2)

- Define octave bands as for “continuous noise sources”
- Define “continuous noise sources” – 100% of the time
- Enforce using L90
 - Picks out the periods of lowest interference
 - The quietest 60 seconds out of 10 minutes.
 - If the source is truly continuous, this is just shy of the L50 anyway
 - “Just shy” addresses the lack of a background level subtraction.
- It may be necessary to measure between 1AM and 4 AM to reduce traffic noise interference

Recommendations – Public Relations

- Because of the differences between hearing and listening, Complainants may:
 - assume that the meter is measuring what their attention is focused on.
 - They are not aware their brains are focusing – it’s an automatic function
 - The sound level meter cannot focus attention or direction.
 - be upset that the Officer cannot immediately discern the source and/or cannot confidently attest what was measured in some circumstances
- Strongly discourage “looking over the shoulder” during measurements
 - Scrolling through different measurement screens exposes big or different numbers, creating confusion, prompting movement or even questions during the measurement.
 - All measurements are “subject to review” – answer cannot be given on the spot.