QTS Digital Gateway Data Center

Noise Assessment Report

21 July 2023

Project No.: 0695575

Quality Technical Services

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QTS Digital Gateway Data Center

Noise Assessment Report

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Acronyms and Abbreviations

Name	Description
dB	decibels
dB(A)	A-weighted decibels
ERM	Environmental Resources Management, Inc.
HVAC	Heating Ventilation and Cooling
Hz	Hertz
NSA	Noise Sensitive Area
QTS	Quality Technology Services

1. INTRODUCTION

1.1 Scope of Report

This report presents the results of a noise assessment conducted for the Quality Technology Services (QTS) Aurora Phase 2 project (Project) in Aurora, Colorado. This report has been undertaken by Environmental Resources Management, Inc. (ERM) on behalf of QTS and includes operational noise predictions that have been carried out to understand if noise levels from the operation of building cooling equipment, emergency generators, and substation transformers, which will be the main noise sources associated with the Project, meet the relevant State of Colorado noise standard.

1.2 General Information on Noise

Noise is defined as unwanted sound. Excessive noise can cause annoyance and adverse health effects. Annoyance can include sleep disturbance and speech interference. It can also distract attention and make activities more difficult to perform (EPA, 1978).

The range of pressures that cause the vibrations that create noise is large. Noise is therefore measured on a logarithmic scale, expressed in decibels (dB). The frequency of a sound is the “pitch”. The unit for frequency is hertz (Hz), or cycles per second. Most sounds are composed of a composite of frequencies. The human ear can usually distinguish frequencies from 20 Hz (low frequency) to about 20,000 Hz (high frequency), although people are most sensitive to frequencies between 500 and 4000 Hz. The individual frequency bands can be combined into one overall dB level.

Noise is typically measured on the A-weighted scale (dBA). The A-weighting scale has been shown to provide a good correlation with the human response to sound and is the most widely used descriptor for community noise assessments (Harris, 1991). The faintest sound that can be heard by a healthy ear is about 0 dBA, while an uncomfortably loud sound is about 120 dBA. In order to provide a frame of reference, ERM has listed some common sound levels below.

- Pile Driver at 100 feet 90 to 100 dBA
- Chainsaw at 30 feet 90 dBA
- Truck at 100 feet 85 dBA
- Noisy Urban Environment 75 dBA
- Lawn Mower at 100 feet 65 dBA
- Average Speech 60 dBA
- Average Office 50 dBA
- Rural Residential During the Day 40 dBA
- Quiet Suburban nighttime 35 dBA
- Soft Whisper at 15 feet 30 dBA

1.3 Project Description

The Project evaluated herein consists of two data center buildings, denoted as DC2 and DC3. The project site is located in a mixed-use regional zone immediately south of the I-70 and east of Colorado E470, in Aurora, Colorado (Figure 1). Each building will be equipped with rooftop HVAC units and grade level emergency generators. The buildings will be serviced by a common substation containing electrical transformers. During normal operating conditions, only the rooftop HVAC units and substation transformers will be in operation. The emergency generators would only be put into operation when a complete loss of grid power occurs at the site, which is not anticipated to be a frequent occurrence.

The nearest noise sensitive areas (NSA) are residential neighborhoods on East 6th Avenue and North de Gaule Court, with the nearest approximately 2,000 feet to the south. ERM has provided the noise model receptor locations in Table 1 and has depicted the Project layout and the NSAs on Figure 1.

Table 1: Noise Model Receptors

Receiver	Land Use Type	Approximate Distance/Direction from Project Property Line
East 6th Avenue	Residential	2,000 feet / South
N de Gaule Court	Residential	2,200 feet / South
Project Property Line	Industrial	NA

1.4 Applicable Noise Standards

The State of Colorado has a detailed noise standard that is applicable to the Project (Colorado Noise Statute 25-12-103, Maximum permissible noise levels). The standard limits noise from a source, as measured 25 feet beyond the property line of the use in different zoning land uses. ERM has provided a summary of the standard in Table 2.

Table 2: State of Colorado Noise Standard (dBA)

Zone	Daytime (7 am to 7 pm)	Nighttime (7 pm to 7 am)
Residential	55	50
Commercial	60	55
Light Industrial	70	65
Industrial	80	75
Note: Sound levels as measured 25 feet beyond the property line.		

ERM did not identify any county or local noise ordinances.

2. NOISE MODELING

ERM performed computer modeling to calculate noise levels that will be generated during Project operation and used the commercially available CadnaA model developed by DataKustik GmBH (2006) for the analyses. The software has the ability to account for spreading losses, ground and atmospheric effects, shielding from barriers and buildings, and reflections from surfaces. The software is standards-based. ERM used the International Organization for Standardization (ISO) 9613 standard for air absorption and other noise propagation calculations (ISO 1996). ERM took credit for only a partially acoustically absorptive ground surface (0.5 setting in the model). A setting of “0” corresponds to an acoustically reflective surface, such as pavement or water, while a setting of 1.0 corresponds to loose soils and grassy surfaces. ERM did not take credit for any vegetation or foliage. ERM also included reflections off of the Project building walls and generator barriers in each model.

ERM has provided a summary of the equipment sources included in the noise modeling assessment, their locations, and their height above grade in Table 3 below. Table 4 provides the noise emissions data and the derivation of each. ERM provided the noise emissions data for the Daikin HVAC units at various loads and modeled each load condition.

Table 3: Equipment Source Listing

Source	Number for Each Building	Source Location
Daikin HVAC	52(1)	DC2 Rooftop, 48 feet above grade
Kohler DC2500 Emergency Generators	52(1)	Grade Level
Substation Transformers	4	Grade Level in Substation
Total of 104 each for buildings DC2 and DC3.		

Table 4: Noise Emissions Derivation for Project Sources

Equipment	Noise Emissions Data	Data Source
Daikin HVAC		
100 Percent Load	76 dBA at 30 feet	Daikin
75 Percent Load	73 dBA at 30 feet	
50 Percent Load	69 dBA at 30 feet	
Kohler DC2500 Emergency Generators		
100 Percent Load	85 dBA at 23 feet	Kohler
Substation Transformers		
100 Percent Load	68 dBA at 50 feet	(1)
(1) Emissions data developed utilizing maximum transformer 125 mega-volt Ampere rating.		

The rooftops of buildings DC2 and DC3 will include parapet walls that extend an additional 5 feet above the roof. Additionally, a visual screening wall, extending 1 foot higher than the top of the emergency generators, will be constructed and will also act as a noise barrier. ERM included the shielding effect of the parapet and visual screening wall in the noise model.

2.1 Noise Model Results

2.1.1 Normal Operation

Normal operation of the Project will include use of the rooftop HVAC units and the transformers. The models for normal operation were developed for each of the load conditions data as provided by Daikin in Table 4 above. The worst-case scenario includes all 104 HVAC units and the four transformers in operation simultaneously at 100 percent load. This condition would rarely, if ever, occur and would only do so during daytime hours on the hottest days with full project utilization. Table 5 provides a summary of the modeled noise levels during normal conditions at the nearby NSA locations and at the Project property line as compared to the appropriate noise standard limit. ERM has provided a contour map depicting modeled noise levels for the worst-case normal operating condition over the area as Figure 2.

Table 5: Noise Modeling Results – Normal Operation (dBA)

Receiver	Daytime Noise Limit (7 am to 7 pm)	Nighttime Noise Limit (7 pm to 7 am)	HVAC at 100 Percent(1)	HVAC at 75 Percent	HVAC at 50 Percent
East 6th Avenue (Residential)	55	50	48	46	42

Receiver	Daytime Noise Limit (7 am to 7 pm)	Nighttime Noise Limit (7 pm to 7 am)	HVAC at 100 Percent[1]	HVAC at 75 Percent	HVAC at 50 Percent
N de Gaule Court (Residential	55	50	46	44	41
Project Property Line	80	75	61[2]	58[2]	54[2]
Worst-case normal operation. *Highest modeled noise level at any point on the Project property line.*					

As provided in Table 5, the highest modeled Project noise level at any residential location under normal worst-case operating conditions is 48 dBA, below the more restrictive nighttime limits at residential zones and at the industrial zone. As noted above, this condition would not be expected to occur during nighttime hours. Much lower noise levels would be expected under lower load operating conditions for the HVAC units and/or if only a portion of the HVAC units are in operation.

2.1.2 Emergency Operation

In the event of a power outage at the site, some or all of the emergency generators may be put into operation. Emergency operation is an unlikely scenario and would only occur during a complete loss of grid power to the site; it would not be expected to occur for extended periods of time. ERM generated an additional noise model to determine noise levels that would occur under this infrequent scenario that included near capacity conditions with the HVAC units, emergency generators, and the substation transformers, all operating at full load conditions. This worst-case emergency scenario would only be expected on the hottest days if a loss of grid power occurred. Cooling requirements at night when temperatures are lower would require fewer generators and cooling units under lower load conditions, resulting in lower noise levels than presented herein. Table 6 provides the modeling results for this scenario. ERM has provided a contour map depicting modeled noise levels for the worst-case emergency operating condition over the area as Figure 3.

Table 6: Noise Model Results – Emergency Operation (dBA)

Receiver	Daytime Noise Limit (7 am to 7 pm)	Nighttime Noise Limit (7 pm to 7 am)	Worst Case Emergency Operation
East 6th Avenue (Residential)	55	50	55
N de Gaule Court (Residential	55	50	53
Project Property Line	80	75	71

Modeled results indicate that under this scenario, with units operating at full load emergency conditions, noise levels would still comply with the Colorado noise standard at residential locations during daytime hours and at the Project property line for all hours, but noise levels would exceed the Colorado noise standard at the residential locations at night. However, as mentioned above, the modeled noise levels are those that would be expected to occur only during the hottest daytime conditions. Lower noise levels would occur at night and during cooler conditions.

3. CONCLUSION

This report presents the results of the noise assessment ERM conducted for the QTS Aurora Phase 2 project in Aurora, Colorado. The noise model of the major facility noise generating equipment includes rooftop HVAC units, grade level emergency generators, and grade level electrical transformers. The assessment included several normal operating conditions, during which only the HVAC units and transformers would be in operation. ERM also modeled a worst-case emergency scenario, which added the emergency generators in operation. ERM evaluated noise model results against the State of Colorado noise standard for residential and industrial uses.

The assessment revealed that under all of the evaluated normal operating conditions, Project-generated noise levels would be below the State of Colorado noise standard at all residential locations and at the Project property line. Model results for the emergency operating condition were shown to be in compliance with the standard for daytime hours at all locations but were shown to exceed the nighttime standard for residential locations, but the emergency operation noise levels would only occur during the hottest daytime conditions. Lower noise levels would occur at night with cooler temperatures. Emergency operation would only occur during a complete loss of grid power to the site and would not be expected to occur regularly or for extended periods of time.

4. REFERENCES

State of Colorado, “Colorado Noise Statute 25-12-103 – Maximum permissible noise levels.” Noise Pollution Clearinghouse. 5 June 2023. https://www.nonoise.org/lawlib/states/colorado/colorado.htm.

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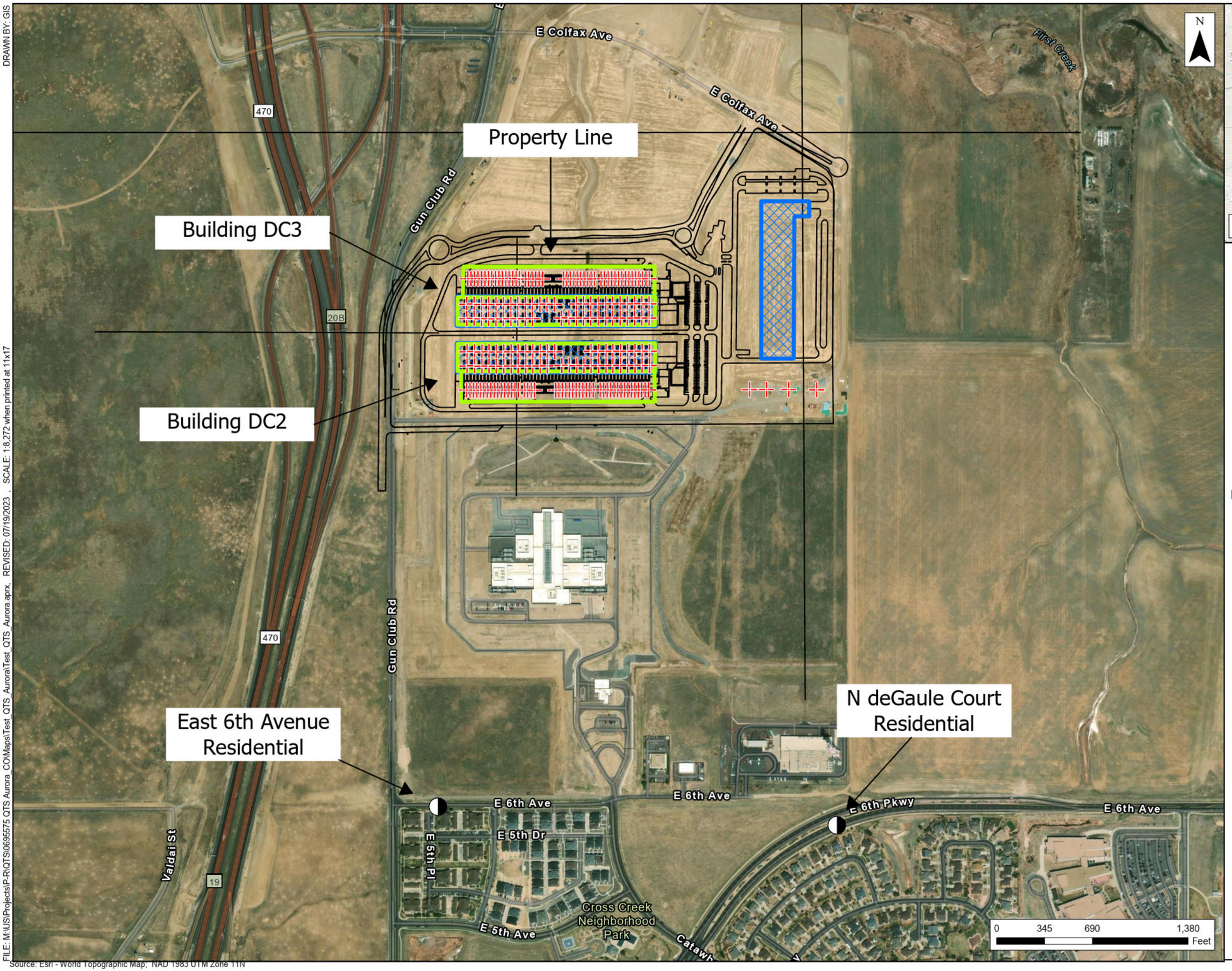
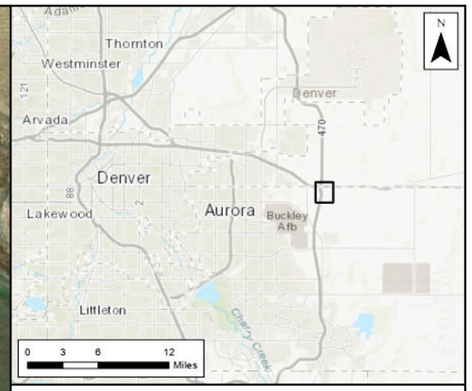
FIGURES





Legend

- Site Plan
- Barriers
- Buildings

Notes:

N

0 750 1,500 Feet

Figure #1
Area Map
Aurora Phase 2 Project
Quality Technology Services
Arapahoe County, Colorado

Environmental Resources Management
www.erm.com

Source: Esri - World Topographic Map; NAD 1983 UTM Zone 11N

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Source: Esri - World Topographic Map; NAD 1983 UTM Zone 11N

Property Line

Building DC3

Building DC2

East 6th Avenue Residential

N deGaule Court Residential

E Colfax Ave

Gun Club Rd

Valdai St

E 6th Ave

E 5th Dr

E 5th Pl

E 6th Pkwy

Cross Creek Neighborhood Park

Sand Creek

470

20B

19

45

50

55

60

65

70

0 345 690 1,380 Feet

N

0 750 1,500 Feet

Ada

Thornton

Westminster

Arvada

Denver

Lakewood

Aurora

Buckley Afb

Littleton

0 3 6 12 Miles

Legend

- Site Plan
- Normal Operations Contours
- Barriers
- Buildings

Notes:

Figure #2
Normal Operation
Aurora Phase 2 Project
Quality Technology Services
Arapahoe County, Colorado

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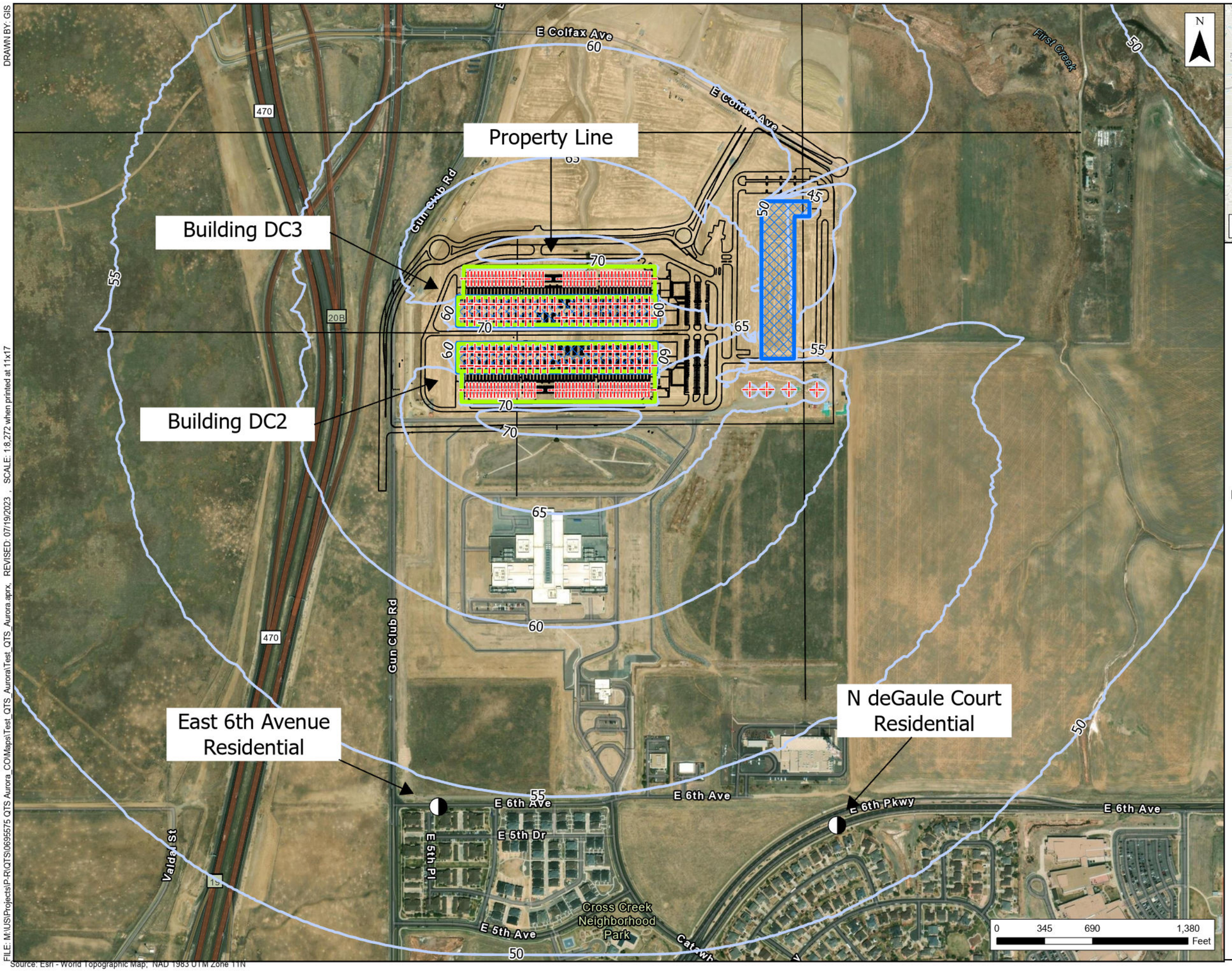

Legend

- Site Plan
- Emergency Operations Contours
- Barriers
- Buildings

Notes:

N

0 750 1,500 Feet

Figure #3
Emergency Operation
Aurora Phase 2 Project
Quality Technology Services
Arapahoe County, Colorado

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Source: Esri - World Topographic Map; NAD 1983 UTM Zone 11N

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