Keep it Down Out There! Pump Station Facility Noise Issues and Mitigation Design

Presented by:

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About SSA Acoustics

Acoustical consulting, noise control engineering, testing and measurements.

- Services we provide:
- Architectural Acoustics
- Mechanical Noise Control
- Environmental Noise Analysis
- Industrial Noise Control
- Vibration Measurements & Analysis
- Sound System & Multi-Media Design

KC BELLEVUE PUMP STATION

KC ALKI CSO TREATMENT FACILITY

Topics

- Noise & Vibration Criteria
- Typical Pump Station Noise Issues
- Noise Mitigation Methods

Design Criteria

Environmental Noise

- dB(A)
- Used for environmental noise, employee noise exposure, and municipality noise ordinances (WAC/Municipal Codes/OSHA)

Interior Occupied Spaces

- Noise Criteria (NC)
  - Used for interior background noise conditions from mechanical equipment
  - ASHRAE

Vibration Levels

- ISO/ANSI/FTA Standards
- Criteria for office, residential, and sensitive equipment

Washington Administrative Code (WAC)

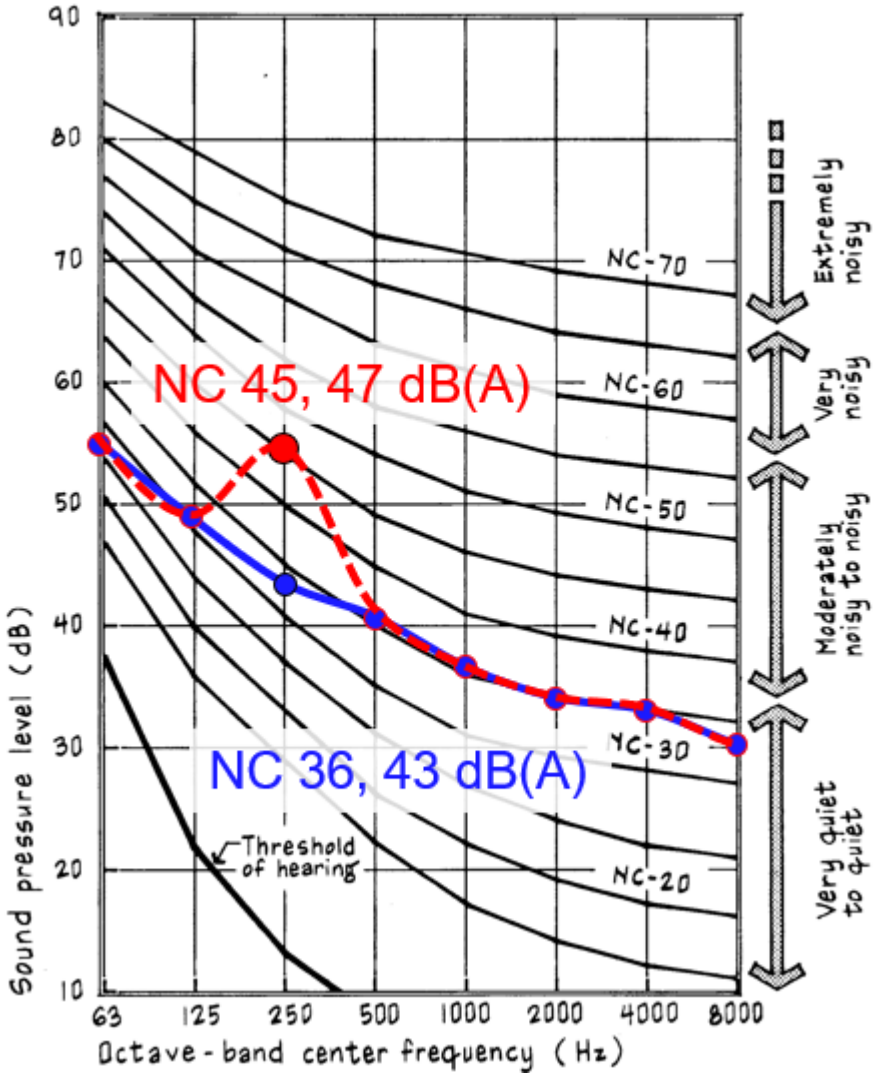
WAC 173-60

Maximum Environmental Noise Levels – Based on use

Sound Source	Receiving Property		
	Class A	Class B	Class C
Class A (Residential)	55 / 45	57	60
Class B (Commercial)	57 / 47	60	65
Class C (Industrial)	60 / 50	65	70

At Residential (Class A) receiving properties, the code limit is reduced by 10 dB(A) between 10 PM and 7 AM

Noise Criteria (NC)

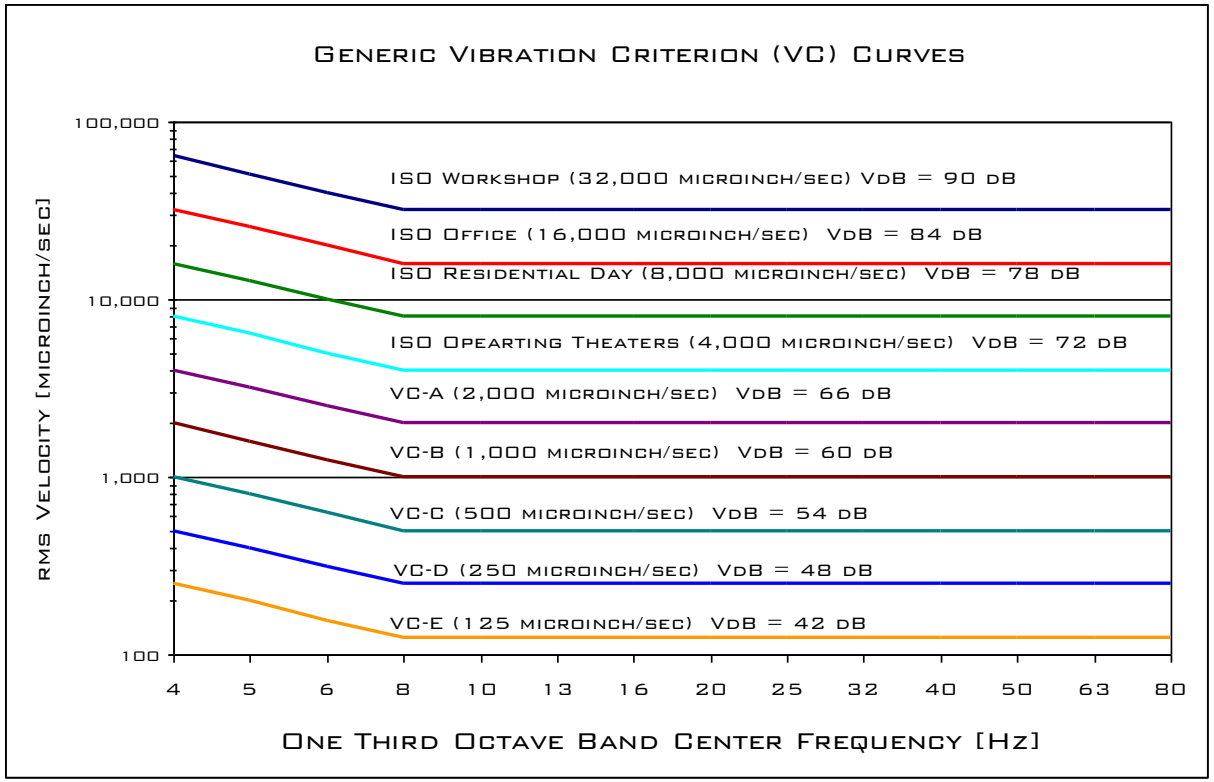


- Noise Criterion (NC) rating uses octave band sound levels to evaluate background noise levels in enclosed spaces (offices, conference rooms, etc)
- Used to establish noise goals in mechanical system design
- Derived from extensive interviews and represents the sensitivity to noise for speech and listening
- ASHRAE Criteria

Industrial Noise Exposure (OSHA, ACGIH & AIHA)

- OSHA / WISHA establishes the threshold limit values for worker noise exposure without hearing protection; critical for public utilities, industrial or maintenance on large mechanical spaces.
  - 90 dB(A) for 8 hours without hearing protection
  - 95 dB(A) for 4 hours without hearing protection
- ACGIH & AIHA have adopted the threshold limit values for worker noise exposure without hearing protection.
  - 85 dB(A) for 8 hours without hearing protection
  - 88 dB(A) for 4 hours without hearing protection

Vibration Design Criteria



- ISO Standard 2631-2, ANSI S3.20, FTA, ASHRAE
- Vibration Criteria is particularly critical for medical equipment, research and patient recovery rooms.

Common Pump Station Issues

Equipment Sources:

- Pumps
- Exhaust fans
- Generators
- HVAC Equipment

Construction Noise

Facilities are often located in residential areas.

Exterior Noise Study

Property Line Noise Evaluation

- Establish noise code limits
- Measure existing conditions
  - Ambient noise (24-hour noise measurement)
  - Existing facility noise

- Evaluate noise from proposed equipment
  - Exterior equipment
  - Equipment within facility with path to receiver

- Design Mitigation
- Acoustical Report for Code Compliance to Municipality
- Field Verification

Noise Control / Mitigation

Source Location / Site Configuration

- Utilize Building, Berms, etc to block/enclose sources
- Relocate / face sources away from sensitive receivers

Noise Barrier

- Solid screen wall that blocks direct sound path
  - Practical barrier effectiveness is 10 to 15 dB(A)

Noise Enclosure

- 3-sided barrier with a roof.

Silencers / Acoustic Louvers

Duct / Shaft Lining

Sound Absorbing Plenums

Exhaust mufflers

Vibration Isolation

- Springs / Pads
- Duct/Pipe Supports/Hangers
- Inertia Bases
- Flex Connectors
- Penetration Isolation

Example Project

City of Spokane Central Avenue Well Facility Rehabilitation

Site Location

Project Background

Central Ave Well Facility Rehabilitation

Location – North Central Spokane, Washington
Owner – City of Spokane
Facility – Wellfield (2 wells) with 2 submersible pump per well (3,500 to 4,200 gpm)
Structure – Two below grade vaults with electrical/chlorination building
Zoning – Residential Single-Family

Project Background

Facility Improvements:

- Upgrade to Above Ground Well Station Facility
  - Submersible Pump to Vertical Turbine Pump
  - Replacement of vault with a building
  - Ventilation System – Exhausting Hot Air and Economizer/Make Up
  - Initial Noise Abatement Measures
    - Incorporated Duct Silencers and Acoustical Louvers
    - Standard Door Seals and Insulation

Noise Concerns

Key Issues:

- Increased Noise Levels

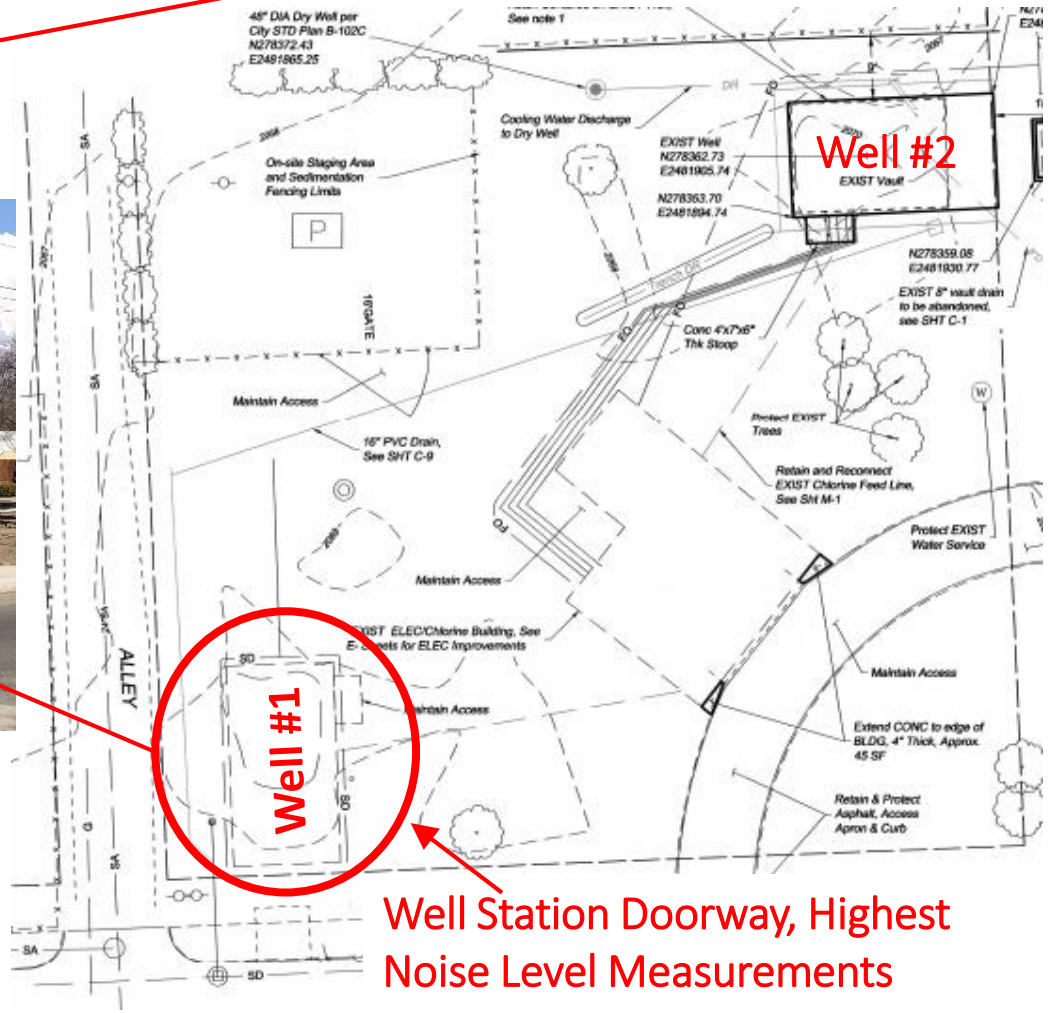
Noise Concerns

Key Issues:

- Increased Noise Levels
- Measured Noise Levels at property line
  40 – 44 dBA
  55 dBA is max allowable (45 dBA 10 pm to 7 am)

Site Plan – Central Ave Well #1

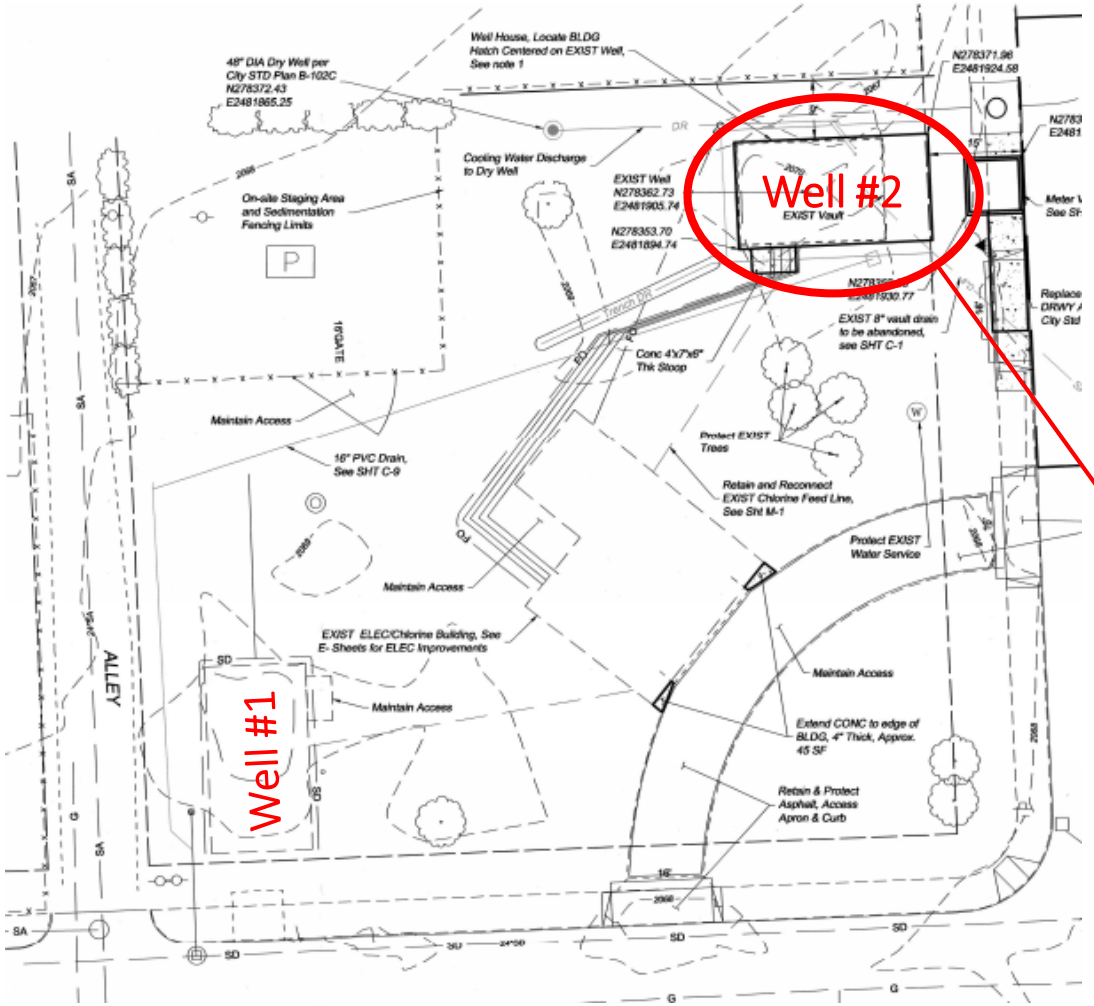
Adjacent Residential Property – Recent Noise Concerns



Well Station Doorway, Highest Noise Level Measurements

Focus on being a good neighbor

Site Plan – Central Ave Well #2 Construction Ongoing



Adjacent Residential property of concern

Proposed Modifications For Noise Mitigation

Well #1

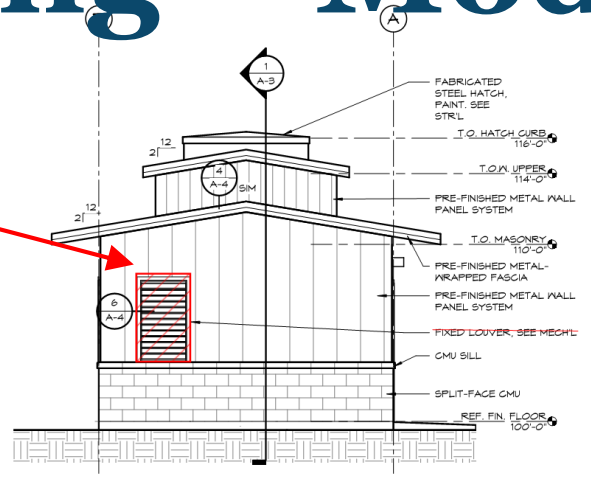
- Upgrade to acoustical door seals
- Polyester Sound Absorbing Material Paneling (2” thick)

Well #2

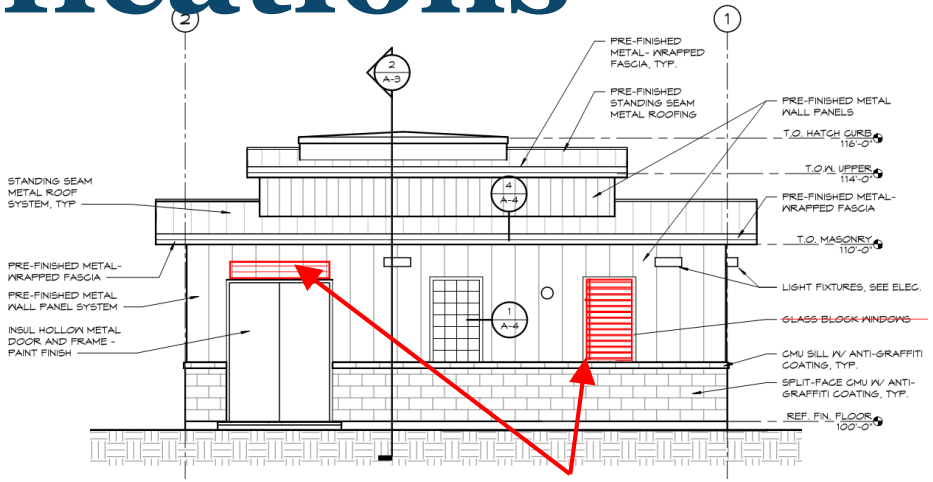
- No Wall Penetrations on the North and West
- Polyester Sound Absorbing Material Paneling (2” thick)
- Ventilation System: Relocated louvers to south side of building
- Maintained Acoustical Louvers and Duct Silencer
- Duct Liner Insulation (1” thick)
- Acoustical Sealant Interior Joints
- Acoustical Door Seals

Building – Modifications

Entire wall solid



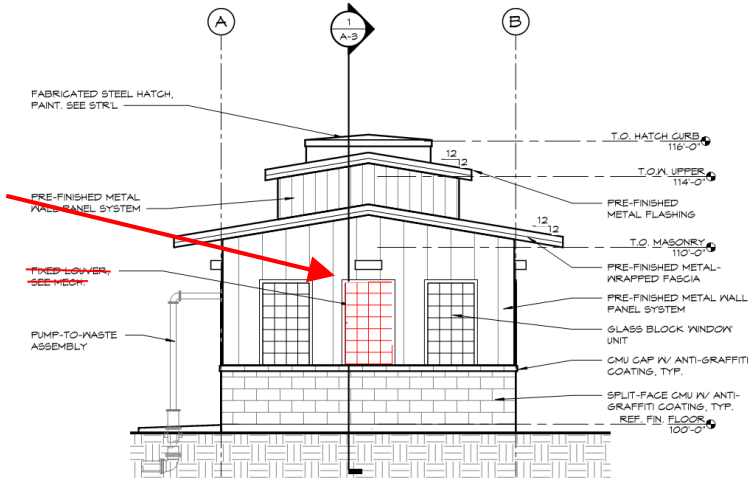
1 WEST ELEVATION
1/4" = 1'-0"



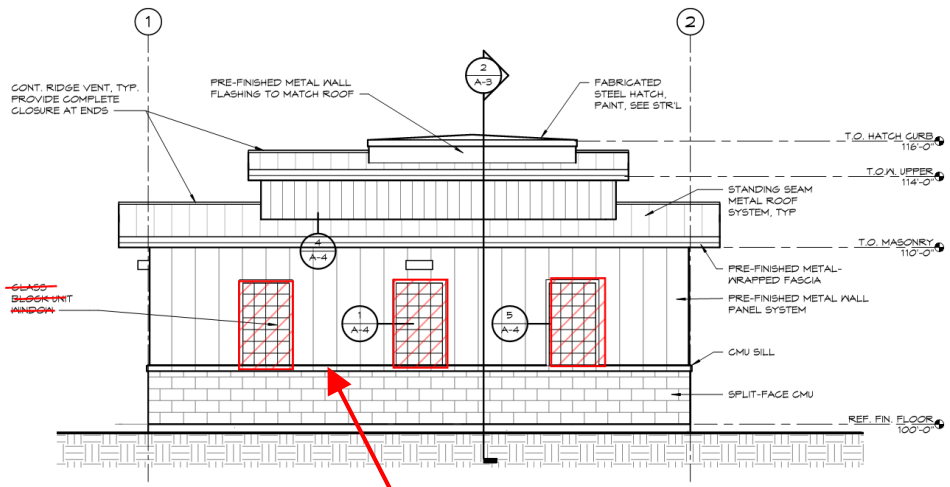
Louvers relocated away from properties

2 SOUTH ELEVATION
1/4" = 1'-0"

No louver, replace with glass block window



3 EAST ELEVATION
1/4" = 1'-0"



Entire wall solid

4 NORTH ELEVATION
1/4" = 1'-0"

Well #2 Modifications

No Windows on West and North Sides

Relocated Louvers and Specified Acoustical Type

Solid Glass Block Windows

Door Seals – Both Wells

Sound Paneling – Both Wells

Cost Summary

Ventilation System Modifications (Well #2): $3,800

Interior Modifications (Well #2): $8,600 (Well #1 similar cost)

Door Seals and Sealant (Well #2): $2,100

Total Cost Impact: $14,500 – ~1.5% of $995,429.30 (Contract Value)

Considerations

- Acoustical Paneling
  - Permanently Mounted or Framed
- HVAC
  - Routing Ductwork
  - Duct Silencer
- Door Seals

Q&A

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Thank you!