SOLEBURY TOWNSHIP BOARD OF SUPERVISORS
February 20, 2024 – 6:00 P.M.
Solebury Township Hall/Virtual - Hybrid Meeting
MEETING MINUTES

Attendance: Mark Baum Baicker, Chair, Hanna Howe, Vice-Chair, Christy Cheever, John S. Francis, Christopher Garges, Township Manager, Michele Blood, Assistant Township Manager, and Catherine Cataldi, Secretary. Mark L. Freed, Township Solicitor, Curtis J. Genner, Jr., P.E., Township Engineer and Mark Roth, Township Traffic Engineer were also in attendance.
Absent: Kevin Morrissey

The recording device was turned on.

I. The meeting was called to order followed by the Pledge of Allegiance.

II. Approval of Bills Payable – February 1, 2024 & February 15, 2024

Res. 2024-39 – Upon a motion by Ms. Howe, seconded by Mr. Francis, the list of Bills Payable dated February 1, 2024 & February 15, 2024 were unanimously approved as prepared and posted.

III. Approval of Meeting Minutes – February 6, 2024

Res. 2024-40 – Upon a motion by Mr. Francis, seconded by Ms. Howe, the Minutes of the February 6, meeting were unanimously approved as prepared and posted.

IV. Announcements / Resignations / Appointments

Executive Session
Mr. Baum Baicker announced that an Executive Session was held directly prior to the Board of Supervisors meeting discussing a Legal Matter.

V. Supervisor Comment – No Supervisor Comment

VI. Subdivision/Land Development

Subdivision/Land Development – Natalie Hamill & Josh Perlsweig (3211 & 3175 Sugan Road – TMP #'s 41-013- 046 & 41-022-015-001)
The applicants, Natalie Hamill & Josh Perlsweig proposed to redevelop an existing residential lot for use as an accessory farm stand and cooking school to the adjacent property and consolidation of both lots.

A motion was made by Gretchen Rice and seconded by Amishi Castello to recommend conditional approval of the subdivision (lot consolidation) and land development project #23-609, subject to all comments and recommendations in the Wynn Associates memorandum dated January 25, 2024, Simone Collins memorandum dated February 7, 2024, McMahon Associates memorandum dated January 25, 2024 and Solebury Township Zoning Officer memorandum dated January 25, 2024, and subject to Board consideration of fee in lieu of requested waivers.

The applicants, Natalie Hamill & Josh Perlsweig, were present with counsel, Edward F. Murphy, Esquire and Engineer, Sharon Dotts, Gilmore & Associates, Inc.

Mr. Freed and Mr. Genner offered an overview of the project and process leading up to the Board meeting. Mr. Murphy and Ms. Dotts offered an overview of the requested changes and requirements set by Pennsylvania Department of Transportation (PennDOT).

Mark Schmuckler, resident, commented on discussions held at the February 12, 2024 Planning Commission meeting, including PennDOT's decision and proposed changes. Mr. Schmuckler expressed interest in an open discussion with the Planning Commission and the Board of Supervisors to review alternative solutions. Mr. Schumuckler questioned whether Land Trust of Bucks County agreed to the farm lane and the definition of farm lane used in this application.

Discussion ensued between the Board of Supervisors, Mr. Freed, Mr. Schmuckler and Mr. Roth regarding the Subdivision and Land Development process, the conditional approval, PennDOT's requirements, PennDOT's decision, the Conservation Easement, the farm lane and minimum use driveway.

Res. 2024-41 – Upon a motion by Mr. Baum Baicker, seconded by Mr. Francis, it was unanimously agreed to approve the conditional approval of the subdivision (lot consolidation) and land development project #23-609, subject to all comments and recommendations in the Wynn Associates memorandum dated January 25, 2024, Simone Collins memorandum dated February 7, 2024, McMahon Associates memorandum dated January 25, 2024 and Solebury Township Zoning Officer memorandum dated January 25, 2024.

VII. Presentation

<u>EAM Associates, Inc. – Building Energy Audit</u>
Frank Swol, Vice President of EAM Associates, Inc. presented an overview of the Energy Audit (Copy of which is attached). Highlights of the presentation included: Executive Summary; Introductions; Audit Team; Envelope of Building; Area Identification; Diagnostic Testing; Building Analysis; Findings & Recommendation; and Envelope Air Sealing.

VIII. Public Hearing

<u>DeMasi Conditional Use – TMP # 41-036-020, 3515 Windy Bush Road – Board Decision</u>
The public hearing for the DeMasi Conditional Use application was held at the January 16, 2024 Board of Supervisors meeting. Following the close of hearing the Board agreed to table any decision until the February 20, 2024 Board of Supervisors meeting to allow additional time to consider the information provided during the hearing.

Res. 2024-42 – Upon a motion by Mr. Baum Baicker, seconded by Ms. Howe, it was unanimously agreed to approve the Conditional Use of the utilization of a portion of the residence on the Applicant's Property as a Bed-and-Breakfast/Small Short-Term Lodging Facility with a den, a bathroom and a single bedroom to be commercially offered and used for temporary lodging of transient guests per the following conditions, which were cited by the Township Solicitor:

a. **The conditional use approval does not include approval of any new construction and there will be no physical changes to the Property.**
b. **Only the previously identified portion of the residence on the Applicant's Property designated for use as a Bed-and-Breakfast/Small Short-Term Lodging Facility shall be used for the purpose of the Bed-and-Breakfast/Small Short-Term Lodging Facility.**
c. **The living quarters for the Applicant shall have its own bathroom. It may also have its own cooking facilities.**
d. **Housekeeping services shall be provided to all guests staying on the Property.**

e. **No separate kitchen or cooking facilities shall be allowed in the addition to the residence serving as the Bed-and-Breakfast/Small Short-Term Lodging Facility.**
f. **The Applicant shall not provide any food services to guests.**
g. **There shall be no banquet, catering or event use of the Property as such term is defined in Township Ordinance ch. 27, § 27-202.**
h. **All guests of the facility must register with the Applicant and the Applicant shall keep accurate registration records.**
i. **There will be no more than two (2) adult guests and four (4) total guests of any age at the facility at any one time. The term "adult" as used herein refers to any person 18 years of age or older.**
j. **The Applicant shall comply with all requirements of Township Ordinance ch. 27, § 27-2602.1.OO, pertaining to special principal use regulations.**
k. **The Applicant shall comply with all requirements as identified in the definition of Bed-and-Breakfast/Small Short-Term Lodging Facility per Township Ordinance ch. 27, § 27-202.**
l. **The Applicant shall comply with all requirements and conditions in the Zoning Review Letter dated December 19, 2023.**
m. **The Applicant shall comply with all conditions of the ZHB Decision dated December 19, 2023.**
n. **The Applicant must at all times maintain a valid County Department of Health septic permit.**
o. **Signage for the facility shall comply with all Township requirements.**

<u>Historical Architectural Review Board – Certificate of Appropriateness – Jeffrey Bach (TMP # 41-002-051-0C1, 3612 Aquetong Road)</u>
The applicant, Jeffrey Bach, expressed interest in replacing the siding of the residence with a historically approved Hardie Board Siding.

Upon a Motion by Scott Minnucci, seconded by Patrick Strzelec, it was agreed to recommend issuance of a Certificate of Appropriateness to Jeffrey Bach, 3612 Aquetong Road, for the removal of existing siding on front of the home to be replaced with Hardie Board Siding with the following specifications:

1. *The type of siding shall be Hardie Plan in Select Cedar Mill*
2. *There shall be vertical battens of the same color and approximately 1 ½ to 2 inches.*
3. *Any trim that needs to be removed shall be replaced*

Res. 2024-43 – Upon a motion by Mr. Baum Baicker, seconded by Ms. Howe, it was unanimously agreed to authorize the Certificate of Appropriateness to TMP # 41-002-051-0C1, 3612 Aquetong Road, as per the recommendations from the Historical Architectural Review Board. Issuance of the Certificate of Appropriateness does not relieve the applicant from obtaining any and all applicable permits prior to commencement of work.

IX. New Business

<u>Short Term Rental Ordinance Amendment – Authorize to Advertise</u>
Res. 2024-44 – Upon a motion by Mr. Baum Baicker, seconded by Ms. Howe it was unanimously agreed to authorize Township Administration to advertise the Short-Term Rental Ordinance Amendment.

<u>Solebury Gateway Trail – Bid Award</u>
The Bids for the Solebury Gateway Trail project were received and opened via PennBID. The Township was met with a great interest in the project with 12 contractors submitting bids.

Res. 2024-45 – Upon a motion by Mr. Francis, seconded by Ms. Howe, it was unanimously agreed to award the Bid for the Solebury Gateway Trail to the qualified low bidder, Ply-Mar Construction Co., Inc.

Authorize Master Plan Request for Proposals – Route 202 Property

Res. 2024-46 – Upon a motion by Mr. Baum Baicker, seconded by Mr. Francis, it was unanimously agreed to authorize the Route 202 Property Master Plan Request for Proposals.

Electronic Waste Recycling – Authorize to Hold Event

Res. 2024-47- Upon a motion by Mr. Baum Baicker, seconded by Mr. Francis, it was unanimously agreed to authorize the Environmental Advisory Council to host an electronics recycling event at the New Hope Solebury High School Campus on March 23, 2024 from 9:00 am – 12:00 pm. The Township will cover the cost of the event and seek reimbursement from Bucks County. Residents will be responsible for fees for individual devices such as TV's, etc. as determined by the vendor, eForce Recycling.

Authorize Solicitors to Draft Revisions to Township Ordinance Regarding Agricultural Uses and Permitting Requirements

The Farm Committee recommends the Board of Supervisors authorize the drafting of an ordinance to revise the zoning ordinance to permit and create provisions for value added agricultural accessory uses. The Farm Committee also recommends the Board of Supervisors authorize the drafting of ordinance (and possibly fee schedule) revisions that would streamline stormwater management permitting for agricultural uses.

Res. 2024-48 – Upon a motion by Ms. Howe, seconded by Mr. Baum Baicker, it was unanimously agreed to authorize the Township Solicitors to draft revisions to Township Ordinance regarding Agricultural Uses and Permitting Requirements.

X. Public Comment

XI. Adjournment

The meeting was adjourned at 8:02 pm.

Respectfully submitted,
Catherine Cataldi, Secretary

Energy Audit
Solebury Township Municipal Building
Solebury, PA



Prepared for:
Christopher Garges – Township Manager
Solebury Township, PA
3092 Sugan Road
Solebury, PA 18963
September 29, 2023

EAM ASSOCIATES

www.eamenergy.com

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*Photo Record is internally numbered from Page 1 to 203

EAM ASSOCIATES

www.eamenergy.com

Executive Summary:

EAM Associates performed an energy audit at the Solebury Municipal Building, located at 3092 Sugan Road, Solebury, PA, on May 19th and June 30th of 2023. This work was performed to identify opportunities for energy savings, and increased comfort for the occupants.

The ultimate end-users of the data and conclusions obtained from the audit will be the principal stakeholders listed below:

Owner/Developer
SOLEBURY TOWNSHIP, 3092 SUGAN ROAD, SOLEBURY, PA, 18963

Sustainability Consultant
SANDERSON SUSTAINABLE DESIGN, NEW HOPE, PA 18938

Energy Consultant
EAM ASSOCIATES INC, 2640 ROUTE 70 BUILDING 1B, MANASQUAN, NJ 08736

Building 1B • 2640 Route 70 • Manasquan, New Jersey 08736
PHONE: (732) 556-9190 FAX: (732) 556-9195 www.eamenergy.com

Introduction:

An energy audit at the Solebury Municipal Building, located at 3092 Sugan Road, in Solebury, PA, on May 19th and June 10th of 2023 intended to meet the criteria of an ASHRAE Level 2 energy audit. This report constitutes the findings of that audit, arrived at by means of the following major analysis components:

- Generation of energy models from architectural and engineering plans.
- Confirmation of building dimensions, constructions, and specifications via field inspections of the building. Field inspections included:
    - Walk-through survey of facility
    - Discussion with occupants and site operations staff about issues and potential areas for improvement
    - Identification of potential capital improvements for further study, and providing calculations of potential savings
    - Blower door shell leakage testing
    - Duct blaster leakage testing
    - Data collection of the thermal envelope, MEP, and all other energy use affecting characteristics and specifications of the home
    - Infrared camera inspection
- Generation of a preliminary audit report immediately following the field inspections to inform the project teams' design process decisions during as early a stage as possible.
- Use of calibrated energy models to investigate a package of improvements that will increase energy efficiency and improve occupant comfort by addressing safety concerns and existing issues with the design and function of the building as a system.
- Generation of a set of recommended measures based on the above analysis, and completion of this detailed audit report for purposes of documenting the savings potential of those recommended measures.

Building 1B • 2640 Route 70 • Manasquan, New Jersey 08736
PHONE: (732) 556-9190 FAX: (732) 556-9195 www.eamenergy.com

Audit Team:

Frank Swol

- BPI Building Analyst, Envelope Professional, & Multifamily Building Professional
- RESNET QAD & HERS Rater

Charlie Goldgate

- BPI Building Analyst, Envelope Professional, & Multifamily Building Professional
- RESNET HERS Rater

Dillon Swol

- BPI Building Analyst & Envelope Professional
- RESNET QADD & HERS Rater

Dan Hayes

- RESNET HERS Rater

Zach Newcomb

- RESNET HERS Rater

Test Equipment Used:

- Energy Conservatory Digital Manometer DG-1000
- Energy Conservatory Series 3 Blower Door
- Energy Conservatory Series B Ductblaster
- Extech Moisture Meter MO210
- FLIR Series E8 Infrared Camera
- Cooper-Atkins Temperature/Humidity Thermistor SRH77A
- Alnor Flow Hood Model EBT731

Energy Modeling Software Used:

- WUFI Passive V 3.3.0.2

Building 1B • 2640 Route 70 • Manasquan, New Jersey 08736
PHONE: (732) 556-9190 FAX: (732) 556-9195 www.eamenergy.com

Building Floor Plan

GENERAL NOTES:

1. CONTRACTOR TO VERIFY ALL DIMENSIONS IN FIELD.
2. DIMENSIONS GIVEN ARE NOMINAL.
3. REFER TO CODE PLANS ON SHEET A0.1 FOR LOCATIONS OF RATED PARTITIONS AND SMOKE BARRIERS
4. REFER TO FINISH PLAN A8.0 FOR FLOORING PATTERNS.
5. ALL EXISTING DOORS, FRAMES, AND HARDWARE TO BE REPLACED WITH CODE COMPLIANT DOORS, FRAMES, AND HARDWARE. REPAIR/MODIFY DOOR OPENINGS/FRAMING TO ALLOW FOR DOORS.
6. ALL WALLS ON CENTERLINE OF COLUMNS UNLESS NOTED.
7. MEASUREMENT-FACE OF STUD OR CMU

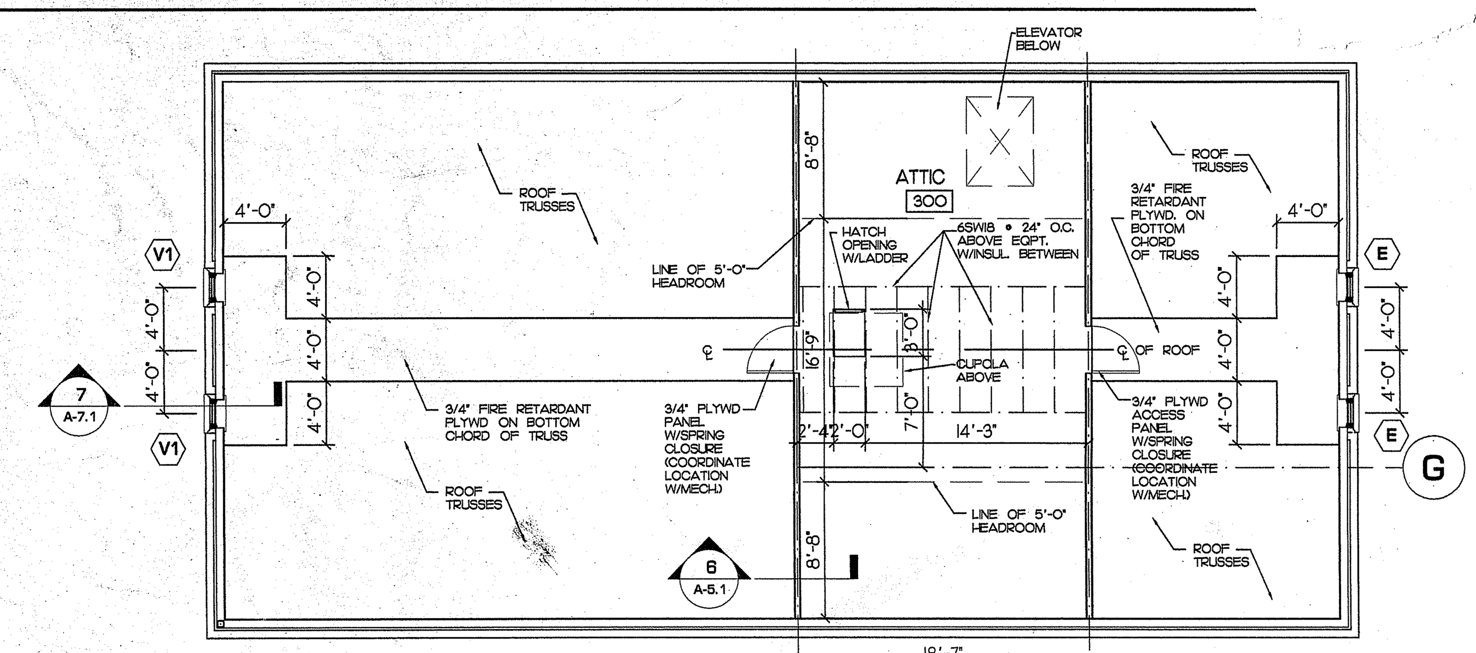
KEY:

- FEC: FIRE EXTINGUISHER W/ CABINET
- FEB: FIRE EXTINGUISHER W/BRACKET MOUNT
- AED: AUTOMATED EXTERNAL DEFIBRILLATOR CABINET

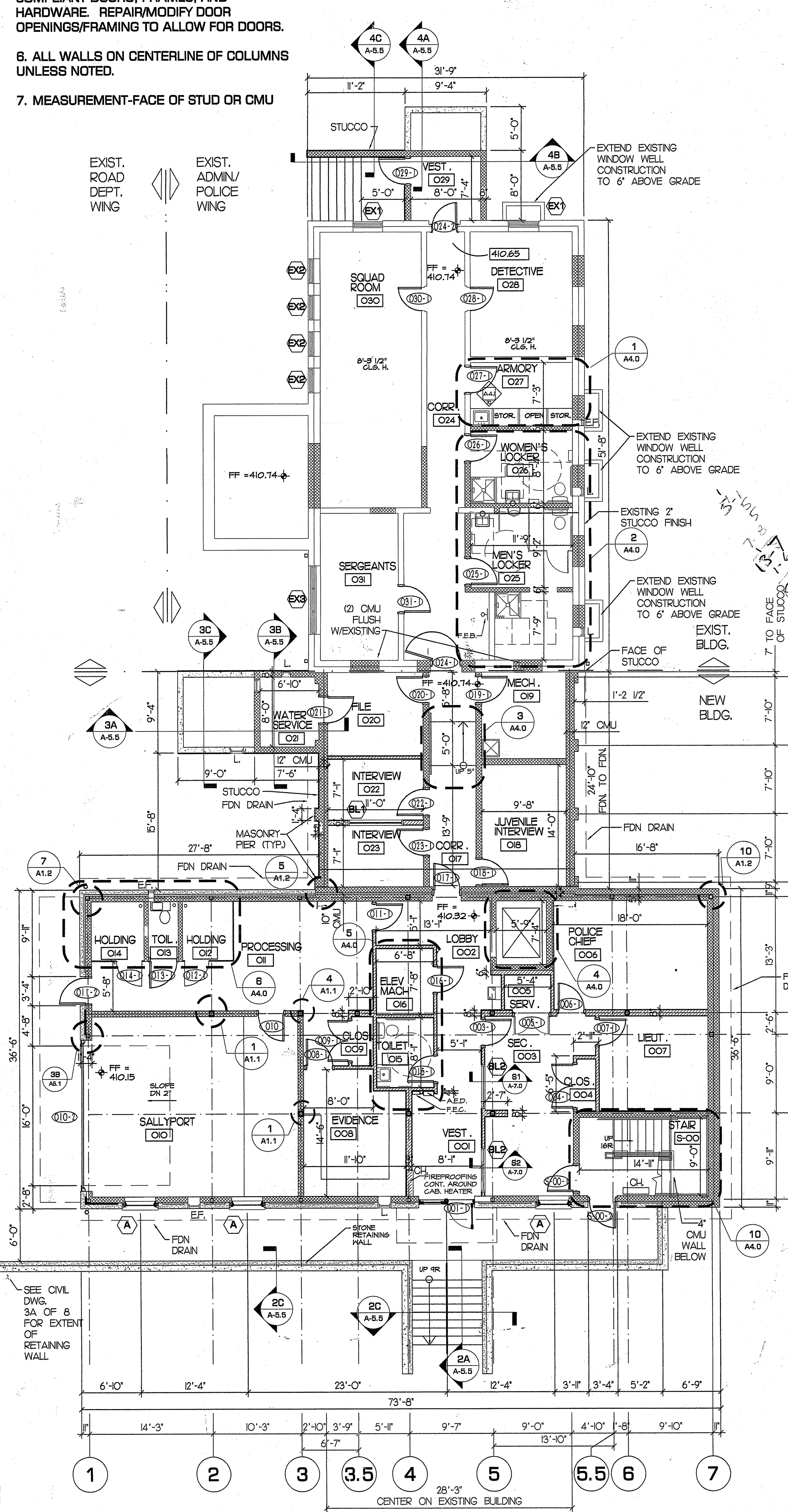
ALL CMU PARTITIONS SHALL NE 8" UNLESS INDICATED. EXTEND TO DECK ABOVE AND SEAL.

ALL GYPSUM WALL BOARD PARTITIONS TO BE 3-5/8" MTL. STUDS AT 16" O.C. W/5/8" GYPSUM WALL BOARD BOTH SIDES UNLESS NOTED. PROVIDE SOUND INSULATION AT ALL WALLS.

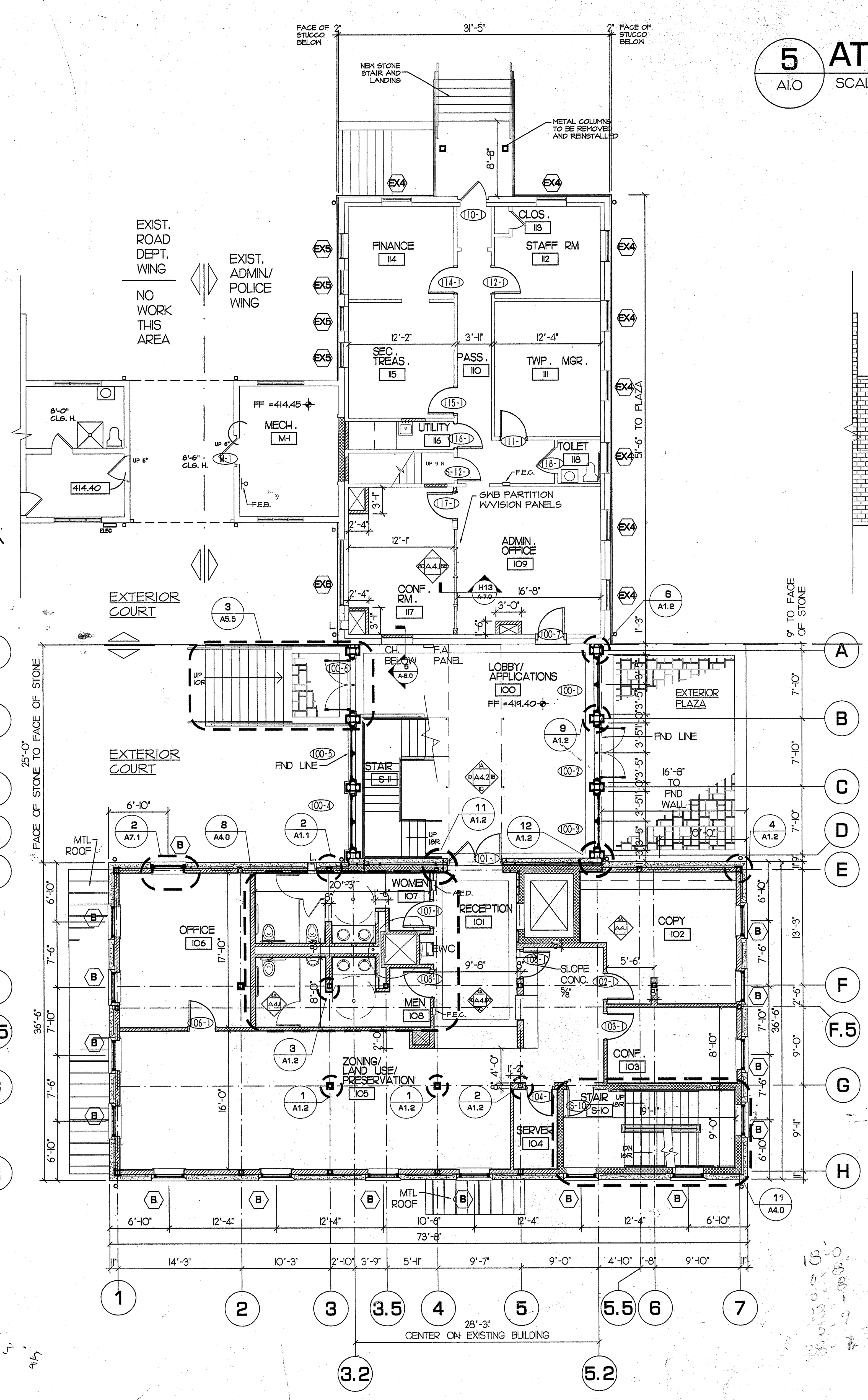
Entire Building Inspected



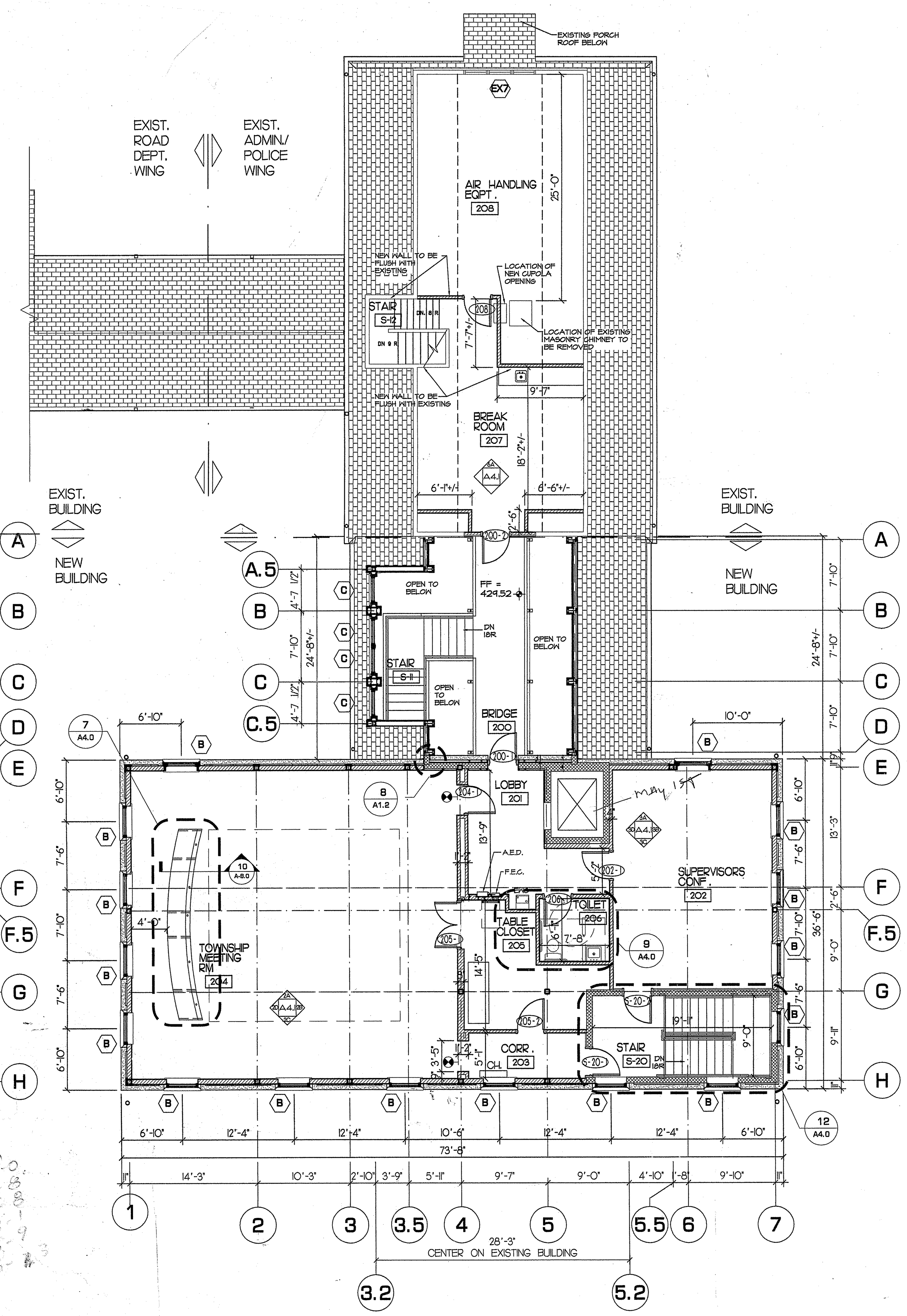
5 ATTIC FLOOR PLAN
A1.0 SCALE: 1/8" = 1'-0"



1 GROUND FLOOR PLAN
A1.0 SCALE: 1/8" = 1'-0"



2 FIRST FLOOR PLAN
A1.0 SCALE: 1/8" = 1'-0"



3 SECOND FLOOR PLAN
A1.0 SCALE: 1/8" = 1'-0"

NORTH

RONALD E. VAUGHN, AIA NJ LICENSE #03906
RONALD E. VAUGHN, AIA PA LICENSE #EX-348
LOUIS J. DeLOSSO, AIA NJ LICENSE #09841
JEROME H. TAYLOR, AIA NJ LICENSE #07791
JOSEF P. BRUDER, AIA NJ LICENSE #1105
JEFFREY B. HILL, AIA NJ LICENSE #08937

THE VAUGHN COLLABORATIVE
ARCHITECTURE PLANNING INTERIOR DESIGN
42 WEST LAFAYETTE STREET TRENTON, NJ 08608
FAX:609-695-2867 • TELE:609-695-7411
POST OFFICE BOX 354 WASHINGTON CROSSING, PA 18977
TELE: 215-493-2701

SOLEBURY TOWNSHIP

RENOVATIONS & ADDITIONS TO SOLEBURY MUNICIPAL BUILDING

3092 SUGAN ROAD
P.O. BOX 139
SOLEBURY, PA 18963

PRINT ISSUES

DATE:	REMARKS:
4/26/04	BID DOCUMENTS

REVISIONS

NO:	DATE:	REMARKS:

DRAWING NAME
FLOOR PLANS

SCALE:	AS NOTED	DRAWING NO.	
DRAWN BY:	JL		
CHECKED BY:	JT		
COMMISSION NO.	03-02600		A1.0
DATE:			

Field Inspection Data

Field Data Table of Contents

AREA IDENTIFICATION

Project Information	
Number of Building Types	1
Number of Building in Project	1
Number of Residences in Project	0
Total Square Footage	13,988
Building Information	**Building Type 1**
Building Type	Municipal
Building Name/Nickname	Administration Bldg
Number of Buildings	1
Number of Stories	3
Year(s) Built	2004
Building Areas (SQFT)	
Lobby	1157
Public Restroom	460
Mechanical Room	970
Storage	260
Community Kitchen	650
Community Room	1544
Office Space	6403

Propane Data		Electric Data			
Usage Dates	Gallons	Usage Dates	KBTUs	Usage Dates	KWH
2/27/22 - 2/6/23	9535.4	1/21/22 - 1/19/23	694438.7328	1/21/22 - 1/19/23	203520
2/11/21 - 2/26/22	9068.8	1/21/21 - 1/20/22	799805.616	1/21/21 - 1/20/22	234400
Average gallons	9302.1	Average	747122.1744	Average	218960
Kbtu/yr	851139.17				
BSMT CFA	4742				
1F CFA	5006	BSMT CFA	4742	BSMT CFA	4742
2F CFA	4240	1F CFA	5006	1F CFA	5006
PD Annex CFA	2682	2F CFA	4240	2F CFA	4240
Total Area	16670	Total Area	13988	Total Area	13988
kbtu/yr/sf	51.05813857	kbtu/yr/sf	53.41165102	kWh/yr/sf	15.65341721

Utility data provided to EAM by Solebury Township Staff

Diagnostic Testing

Testing Type	Building Information	Building Type 1
Testing Type	Building Type	Municipal
	Building Name/Nickname	Administration Bldg
	Sample Field Inspected Unit	**N/A**
Shell Leakage	Blower Door (CFM50)	14,458
	Blower Door (ACH50)	7.84
Duct Leakage	Duct Leakage to Outside (CFM25)	N/A
	Duct Leakage to Outside % CFA	N/A
	Total Duct Leakage (CFM25)	See Air Testing Diagrams (Pages 15-18)
	Total Duct Leakage % CFA	See Air Testing Diagrams (Pages 15-18)
Exhaust Fan Flows	Bathroom Exhaust to Outside (CFM)	See Air Testing Diagrams (Pages 15-18)
	Kitchen Exhaust to Outside (CFM)	N/A
	Laundry Exhaust to Outside (CFM)	N/A

ENVELOPE SUMMARY

General Building/Envelope Description	Steel Framed				
Envelope Components	**Measure?**	**Construction Type/Description**	**Total R-value**	**Verification Method**	**Additional Notes**
Above Grade Exterior Walls	NO	Metal 2x6 16" OC	R-19	As per plans	RESNET Grade 3
Floor Perimeter/Rim Joists	NO	Metal 2x6 16" OC	R-19	As per plans	RESNET Grade 3
Below Grade Walls	NO	12" Concrete	N/A	As per plans	
Floor Above Unconditioned Space	NO	Wood 2x10 Joist 16" OC	0	As per plans	
Slab On/Below Grade	NO	4" Concrete	0	As per plans	
Roof	Yes	Wood 2x10 Rafter 16" OC	R-13	As per plans	RESNET Grade 3
Ceilings to Unconditioned Attics	Yes	Wood 2x10 Joist 16" OC	R-19	As per plans	RESNET Grade 3
Wall to Unconditioned Space	NO	Metal 2x6 16" OC	R-19	As per plans	RESNET Grade 3

Windows	Measure?	Window Type	Frame Type	Condition	Typical Size (H x W)	# of Panes	Gas Filled	Glass Coating	U-value	SHGC	Weather-stripping	Age (yrs)
Windows Type 1	YES	Single Hung	Wood	Poor to Fair	5.5' x 2.5'	Double	Air	Low-E	0.5	0.45	Poor to Fair	20
Windows Type 2	YES	Single Hung	Wood	Poor to Fair	5.5' x 7.5'	Double	Air	Low-E	0.5	0.45	Poor to Fair	20
Windows Type 3	YES	Fixed	Wood	Poor to Fair	3' x 3'	Double	Air	Low-E	0.5	0.45	Poor to Fair	20

Exterior Doors	Measure?	Material	% Glazing	Glazing Type	Weather-stripping	Qty.
Exit 1,2,4,5,6	Yes	Steel-poly/Wood	0	n/a	Poor	4
Exit 3,7,8	Yes	Vinyl	75	Fized	Poor	10

Air Infiltration	Measure?	Location of Leakage	Tightness	Additional Notes
Windows	NO	Frame	High Leakage	Existing windows to be replaced with current code low leakage models (sealed to framing)
	NO	Moving Surfaces	High Leakage	
Exterior Doors	NO	Frame	High Leakage	Existing Weatherstripping for exterior doors to be replaced
	YES	Moving Surfaces	High Leakage	
Laundry Room	N/A	Dryer Vent	N/A	Air Sealing Scope of Work to require sealing of all accessible MEP and framing penetrations
	N/A	Exhaust Fans	N/A	
Attic/Roof	Yes	Hatch Frame	High Leakage	Air Sealing Scope of Work to require sealing of all accessible MEP and framing penetrations
	Yes	Hatch Door	High Leakage	
	YES	Pipe Penetrations	High Leakage	
	N/A	Electrical Boxes	N/A	
	YES	Recessed Lights	High Leakage	
	N/A	Wall Caps	N/A	
	YES	Exhaust Fans	High Leakage	
	YES	Open Chases	High Leakage	
Exterior Walls	YES	Pipe Penetrations	High Leakage	Air Sealing Scope of Work to require sealing of all accessible MEP and framing penetrations
	Yes	Exhaust Fans	High Leakage	
	NO	Electrical Boxes	High Leakage	
	Yes	Patio Doors	High Leakage	

Lighting Schedule

Interior Lighting

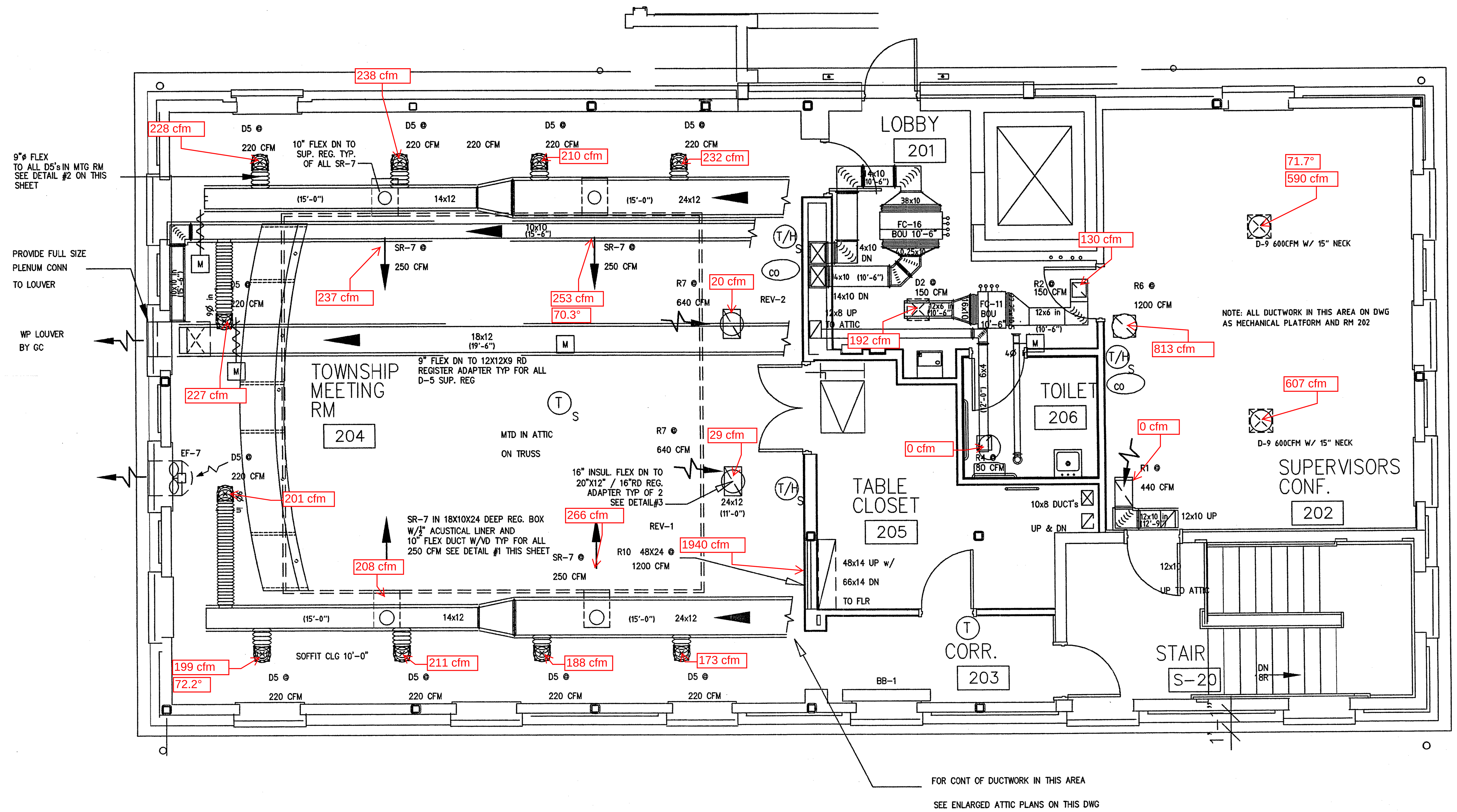
Location				Existing				Proposed				
	Building Type (from Area Identification)	**Building Area**	**Floor #**	**Fixture Type**	**Wattage**	**Qty.**	**Control Type**	**Fixture Measure?**	**Fixture Type**	**Wattage**	**Qty.**	**Control Measure?**
1	Building Type 1	Throughout	1,2,3	Incandescent/ CFL/LED	88	90	None	YES	LED	34	90	None
2	Building Type 1	Throughout	1,2,3	Incandescent/ CFL/LED	58	78	None	YES	LED	34	83	YES
3	Building Type 1	Throughout	1,2,3	Incandescent/ CFL/LED	34	29	None	YES	LED	25	29	Yes
4	Building Type 1	Lobby, Town Hall	2,3	Incandescent/ CFL/LED	300	9	None	YES	LED	27	9	YES
5	Building Type 1	Breakroom	3	CFL	150	1	None	Yes	LED	34	1	YES
6	Building Type 1	Exteriors	1	CFL	52	5	None	YES	LED	30	5	YES

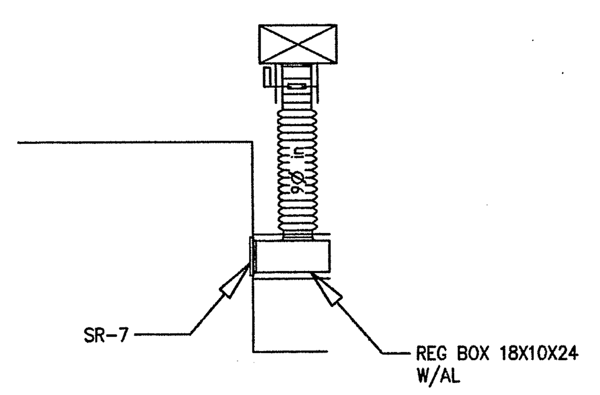
Solebury Township Administration Building Lighting Calculation							
Name	**Watts**	**BSMT**	**1F**	**2F**	**Attic**	**Total**	**Total Watts**
A	88	16	0	0	0	16	1408
A1	77	10	3	6	0	19	1463
B	34	9	6	0	0	15	510
C	58	4	3	6	5	18	1044
D	60	9	9	10	0	28	1680
E	2	7	6	7	0	20	40
F	5	4	1	0	0	5	25
G	88	6	2	1	0	9	792
H	88	6	21	0	0	27	2376
J	58	4	0	4	0	8	464
K	44	0	0	12	0	12	528
K1	68	0	0	10	0	10	680
L	88	0	17	0	0	17	1496
L1	88	2	0	0	0	2	176
M	52	1	0	0	0	1	52
N	60	3	2	0	0	5	300
P	52	4	1	0	0	6	312
R	300	0	0	4	0	4	1200
S	300	0	0	5	0	5	1500
T	40	1	0	0	0	1	40
U	150	0	0	1	0	1	150
V	58	1	1	2	0	4	232
W	58	0	4	0	0	4	232
X	34	0	1	0	0	1	34
Y	12	6	0	0	0	6	72
Z	18	0	1	0	0	1	18
						Total Watts	**16824**
						Bldg CFA	**13988**
						Watts/sf	**1.20274521**

Equipment Schedule

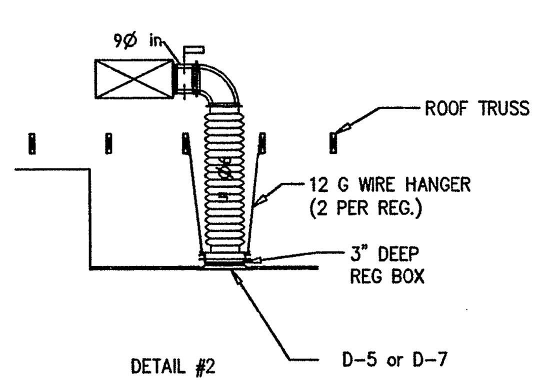
Location				Existing Unit for Energy Modeling				
	Equipment Type	**Building Area**	**Floor #**	**Manufacturer**	**Model Number**	**Fuel Type**	**Qty.**	**Age (yrs.)**
1	Chiller	Mechanical Closet	1	Trane	CGAM (60 HZ)	Electric	1	2
2	Boiler	Mechanical Closet	1	Lochinvar	KBN701	Propane	1	2
3	CW/HW Fan Coils	Throughout	1,2,3	International	Average of Various Models	Electric	18	20
4	Domestic Hot Water	Mechanical Closet	1	Not Provided	Electric Resistance Storage Tank	Electric	1	20
5	ERV	Mechanical Closet	1,2	Greenheck	Average of Various Models	Electric	3	20
6	Exhaust Fans	Bathrooms, Attic	1,2,3	Various	Average of Various Models	Electric	7	20
7	Refrigerator	Break Rooms	2,3	Various	Average of Various Models	Electric	2	20

EAM as tested values in RED. Air temperatures are readings at supply registers.

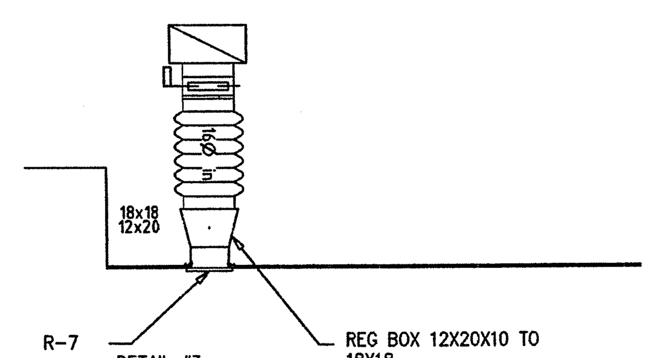




DETAIL # 1



DETAIL #2



DETAIL #3

REVISION NO.	DATE	REVISION

–NOTICE–

AS—BUILT DRAWINGS

AM MECHANICAL CONTRACTING
MECHANICAL CONTRACTORS

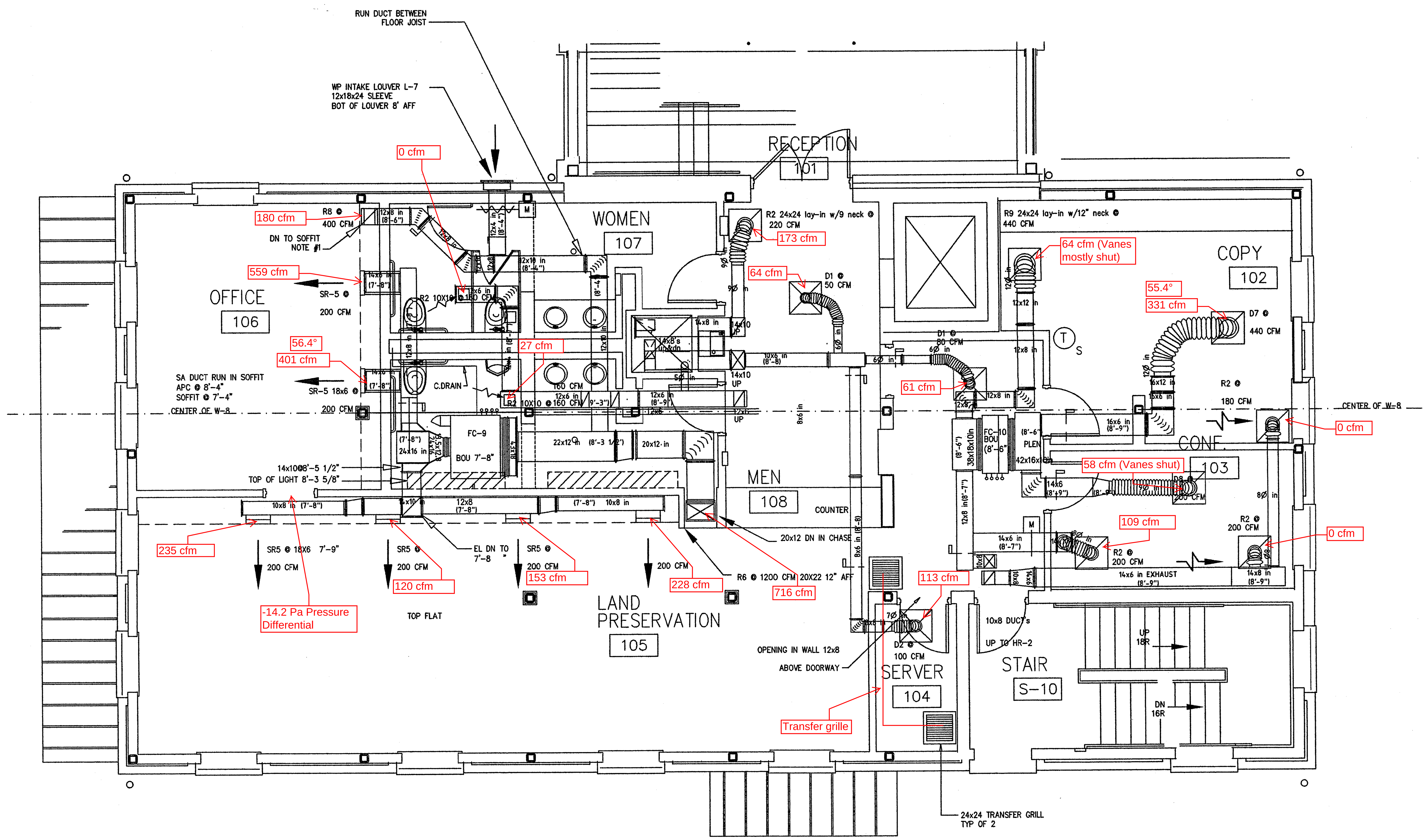
487 STONY HILL RD
YARDLEY PA 19067
TEL. 215 321–7440
FAX.215 321–7045

HVAC DUCT AND EQUIPMENT LAYOUT
SOLEBURY TOWNSHIP MUNICIPAL BUILDING

PROJECT NO	DATE 12/14/05
DRAWN BY DV	DESIGNED BY
SCALE 1/4"=1'	FIELD BOOK
AM MECH	
SHEET NO. 6 of 9	

15

EAM as tested values in RED. Air temperatures are readings at supply registers.



REVISION NO.	DATE	REVISION

-NOTICE-

AS-BUILT DRAWINGS

AM MECHANICAL CONTRACTING
MECHANICAL CONTRACTORS

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YARDLEY PA 19067
TEL. 215 321-7440
FAX.215 321-7045

2ND FLOOR NEW BUILDING ADDITION
HVAC DUCT AND EQUIPMENT LAYOUT
SOLEBURY TOWNSHIP MUNICIPAL BUILDING

PROJECT NO	DATE 12/14/05
DRAWN BY DV	DESIGNED BY
SCALE 1/4"=1'	FIELD BOOK
AM MECH	
SHEET NO. 5 of 9	

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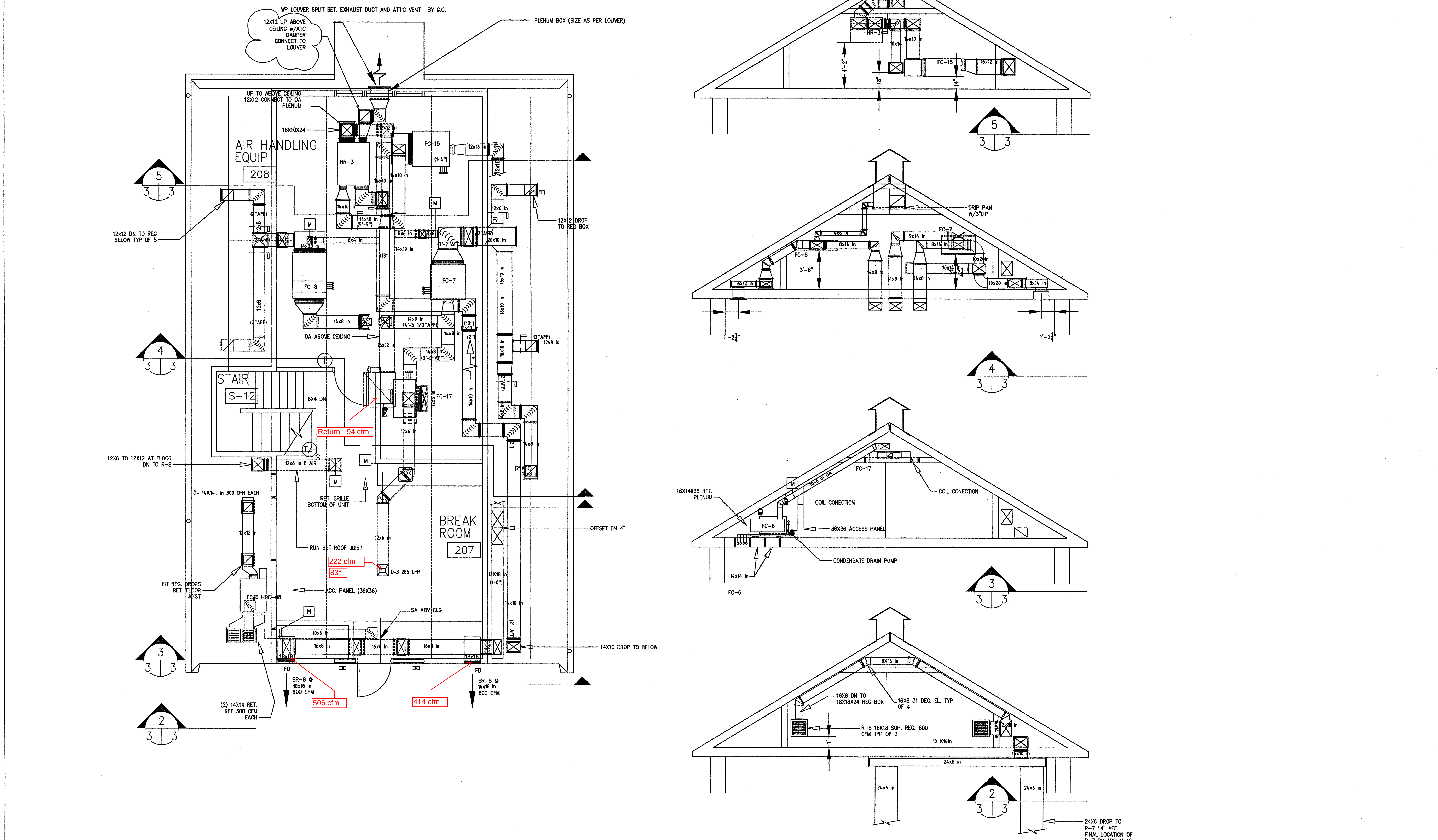

REVISION NO.	DATE	REVISION	-NOTICE-	AS-BUILT DRAWINGS	AM MECHANICAL CONTRACTING / MECHANICAL CONTRACTORS	487 STONY HILL RD, YARDLEY PA 19067, TEL. 215 321-7440, FAX.215 321-7045	2ND FLOOR EXISTING BUILDING / HVAC DUCT AND EQUIPMENT LAYOUT / SOLEBURY TOWNSHIP MUNICIPAL BUILDING	PROJECT NO / DATE 12/14/05 / DRAWN BY / DESIGNED BY / SCALE 1/4"=1' / FIELD BOOK / AM MECH / SHEET NO. 3 of 9

17

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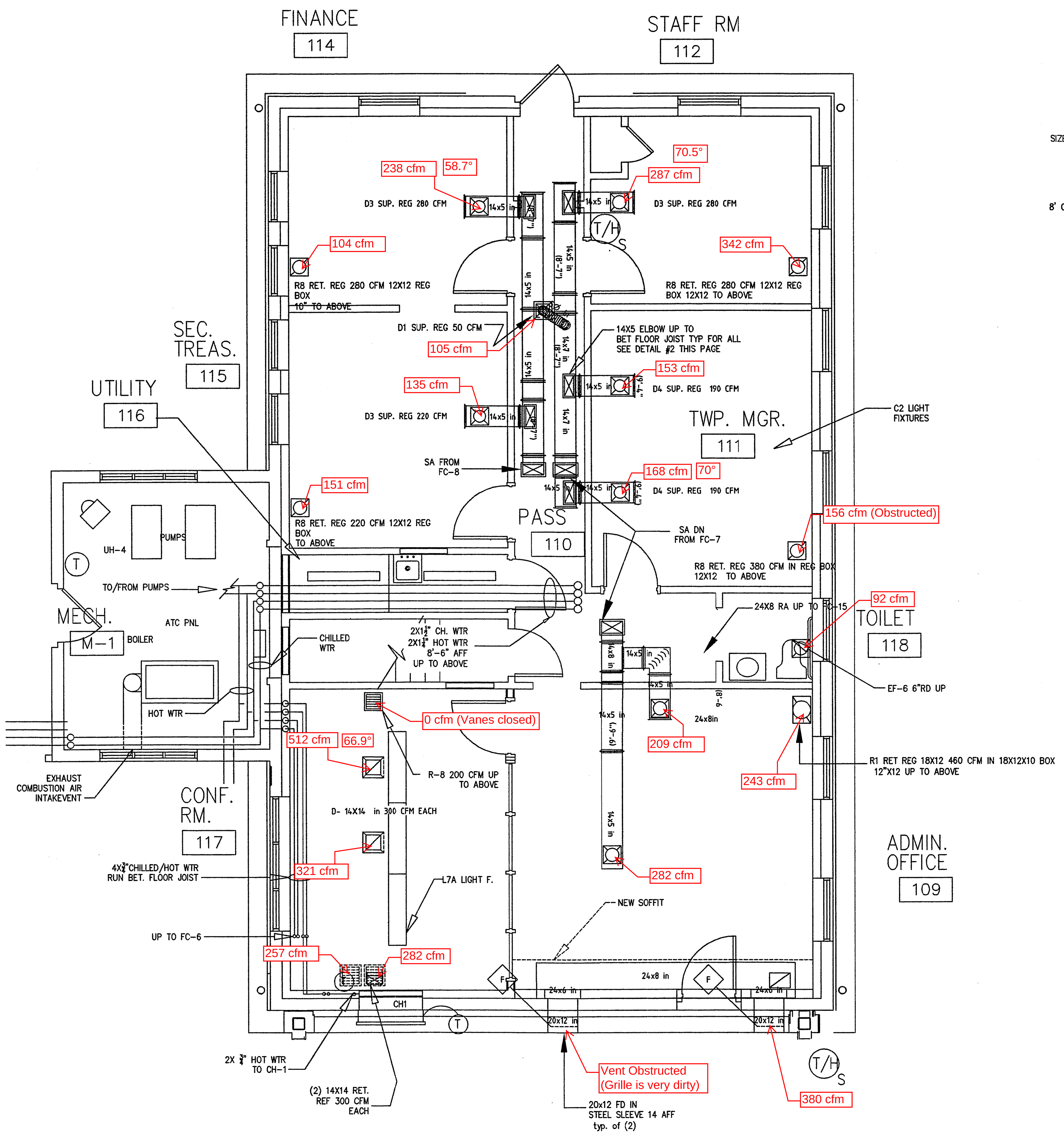
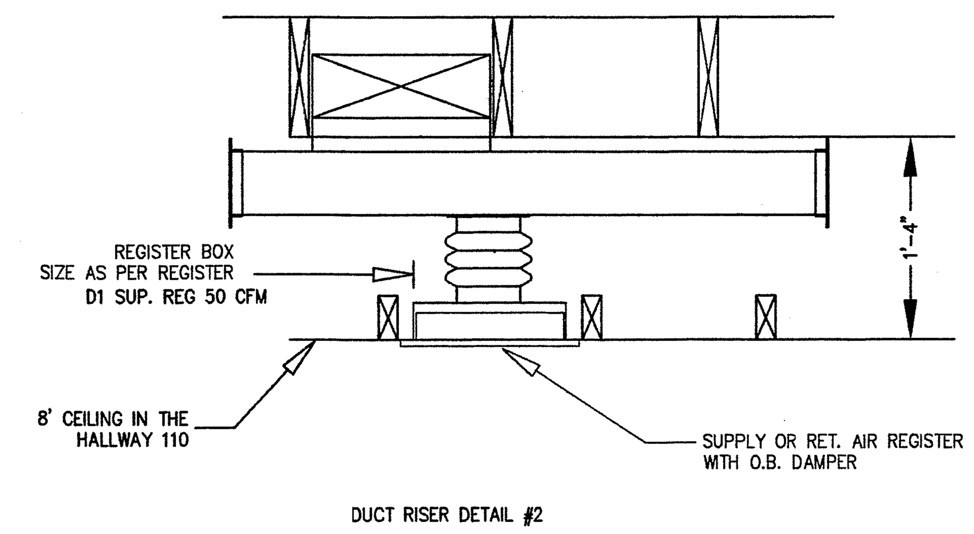
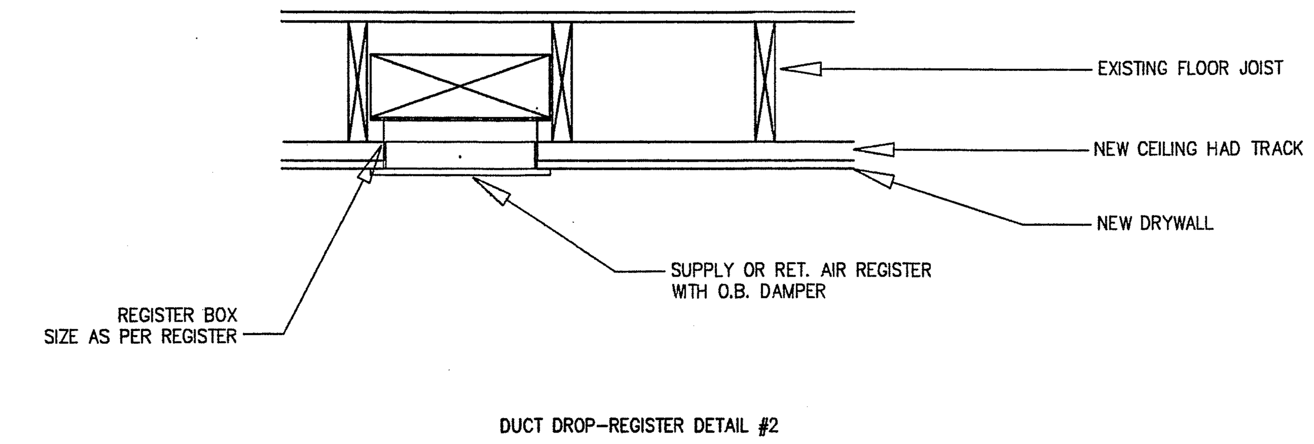
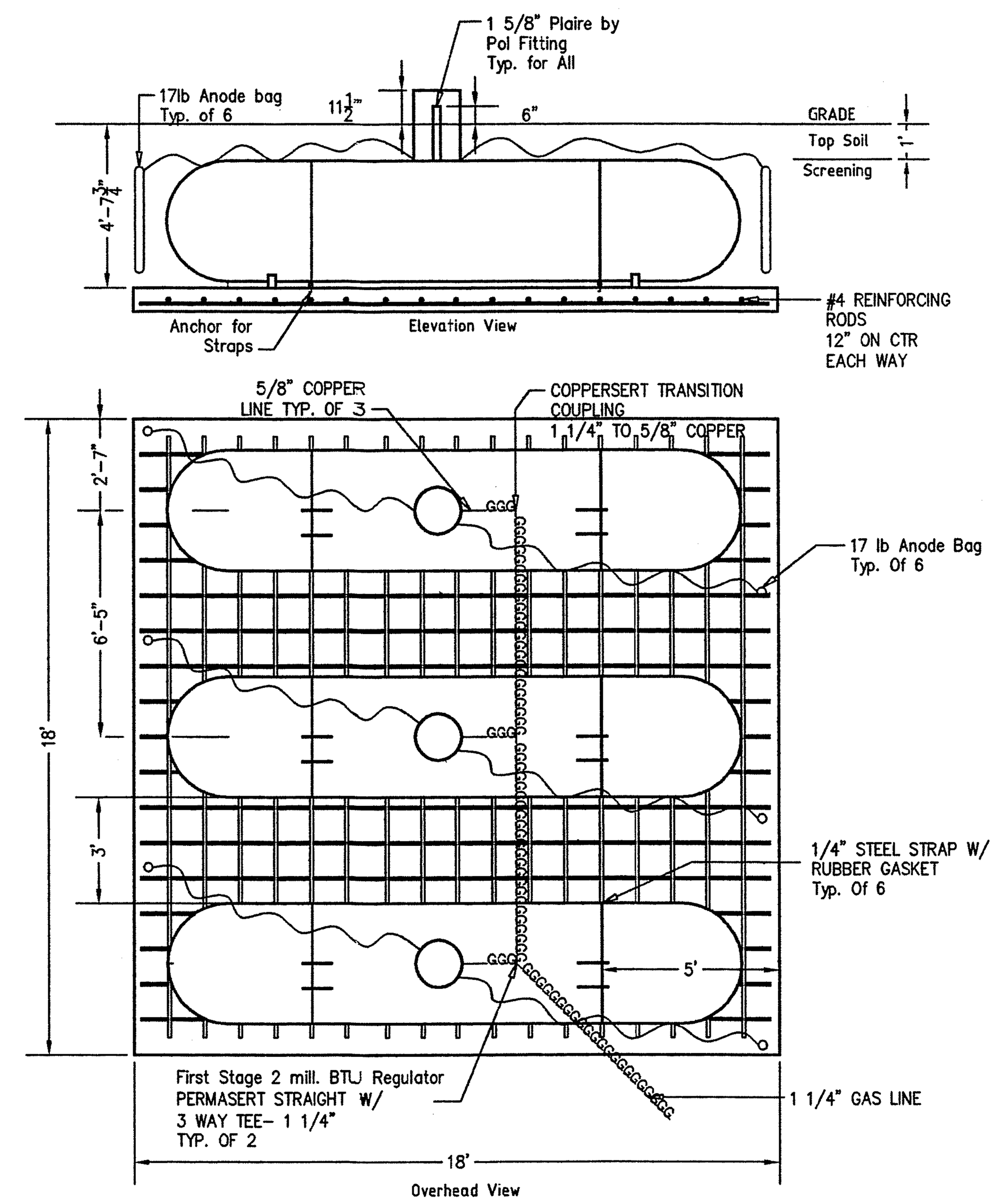








Note: Installation performed by Gas Tec Enterprises, Inc.

FOR LOCATION OF UNDERGROUND PROPANE TANKS SEE AS BUILT SITE DRAWINGS

DWG SCALE 1/4" = 1'

REVISION NO.	DATE	REVISION

–NOTICE–

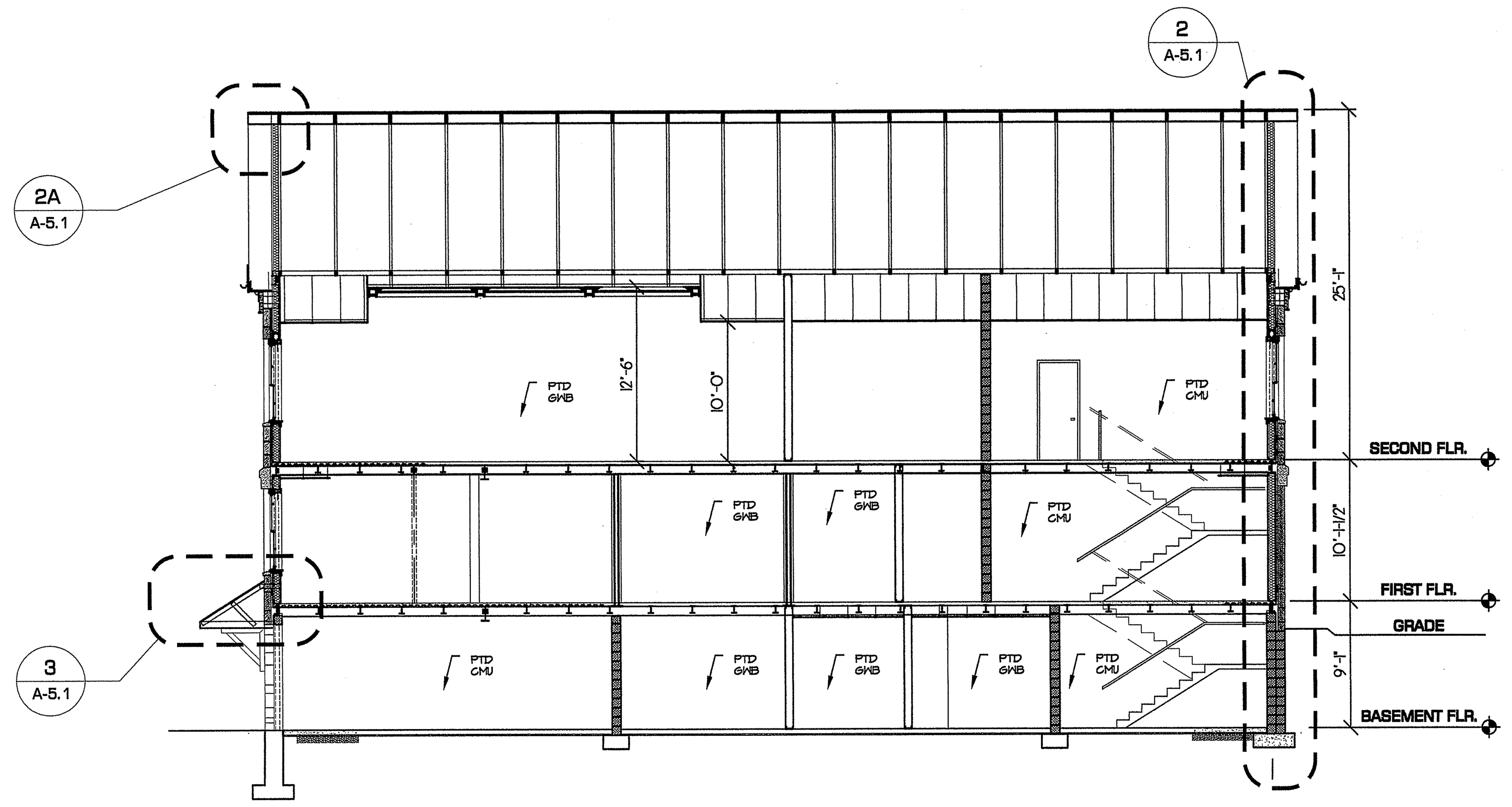
AS—BUILT DRAWINGS

AM MECHANICAL CONTRACTING
MECHANICAL CONTRACTORS

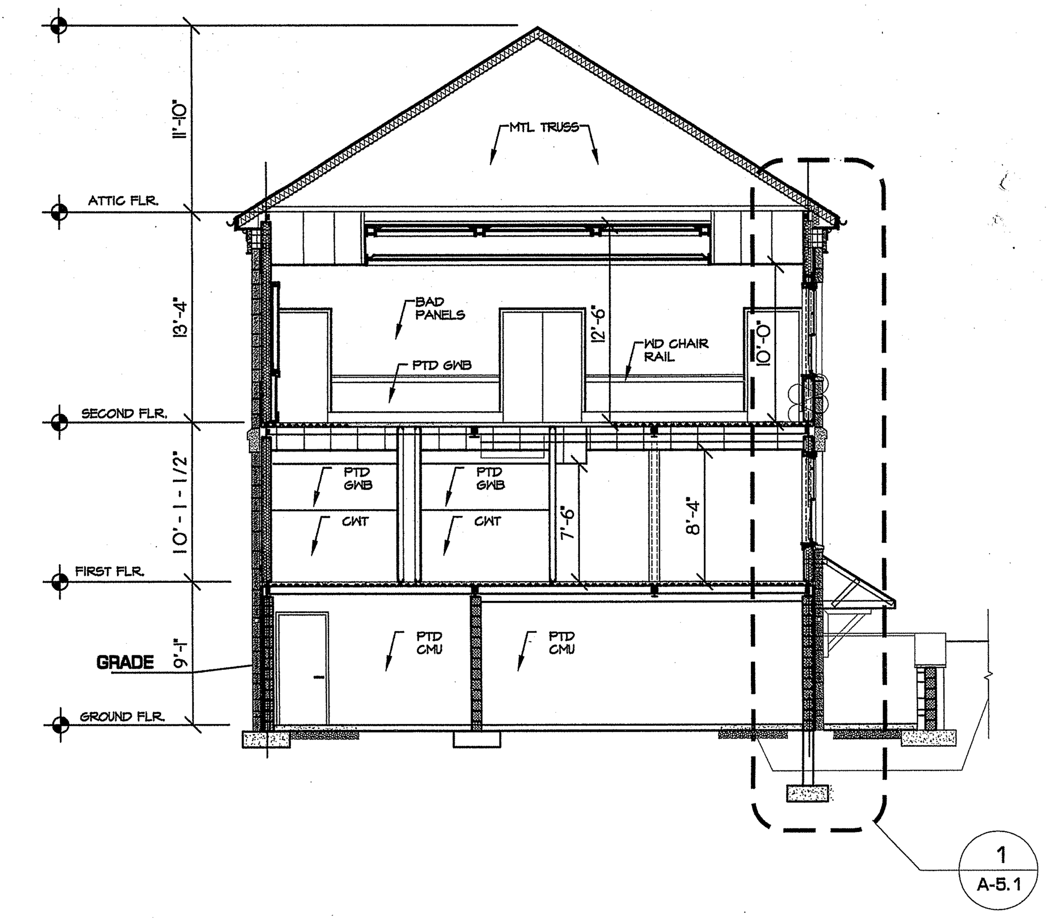
487 STONY HILL RD
YARDLEY PA 19067
TEL. 215 321-7440
FAX.215 321-7045

FIRST FLOOR EXISTING BUILDING
HVAC DUCT AND EQUIPMENT LAYOUT
SOLEBURY TOWNSHIP MUNICIPAL BUILDING

PROJECT NO	DATE 12/14/05
DRAWN BY	DESIGNED BY
SCALE 1/4"=1'	FIELD BOOK
AM MECH	
SHEET NO. 2 of 9	



1 A3.1 **SECTION A-A**
SCALE: 1/8" = 1'-0"



2 A3.1 **SECTION B-B**
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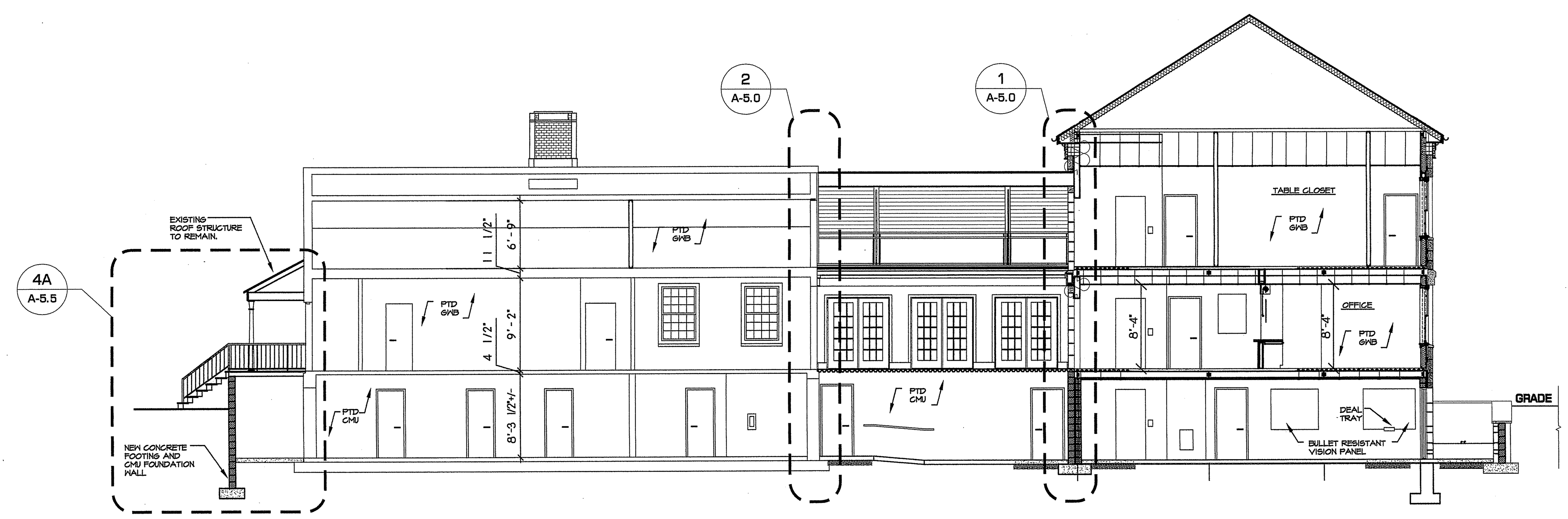

3 A3.1 **SECTION C-C**
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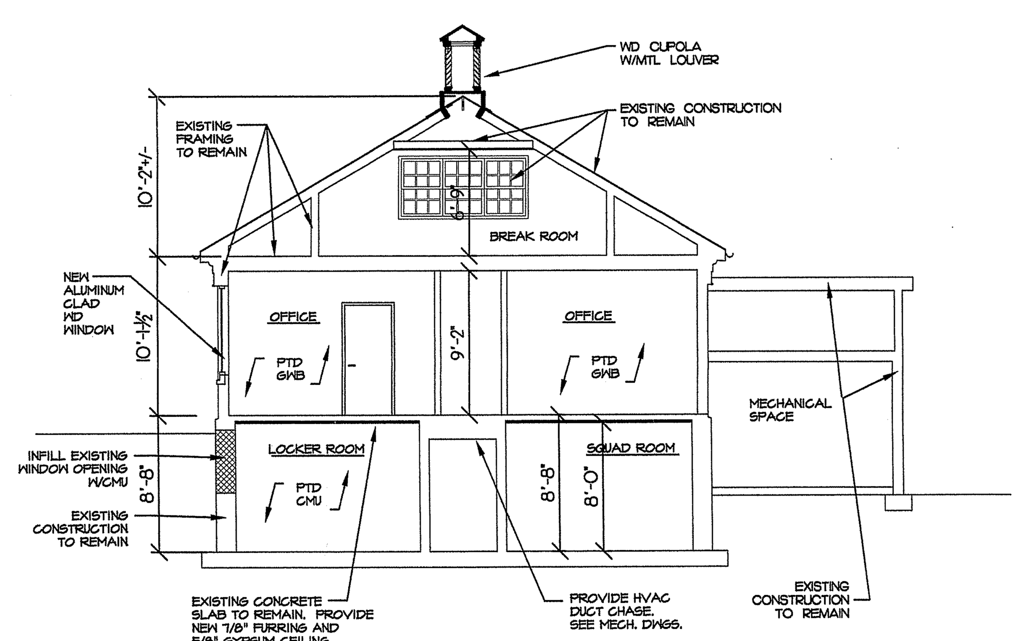

4 A3.1 **SECTION D-D**
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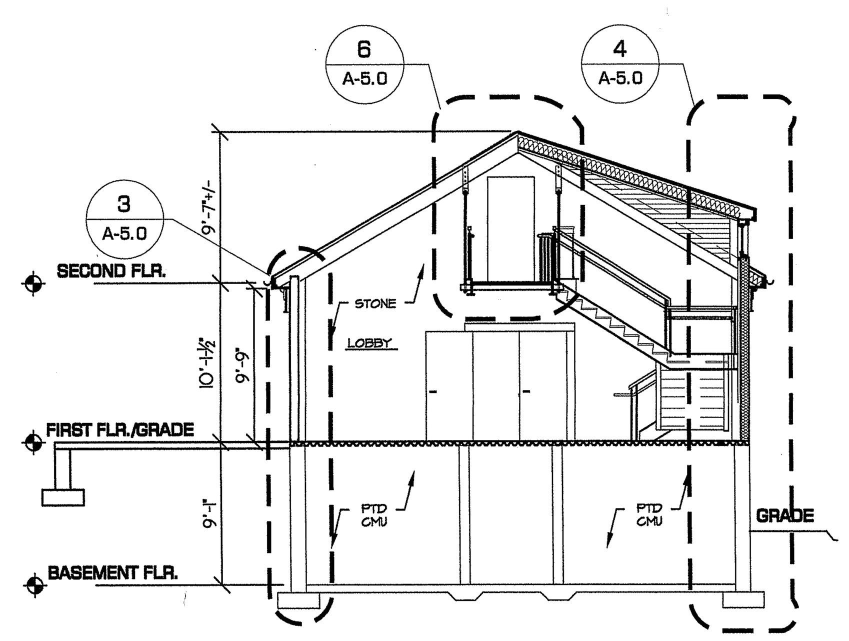
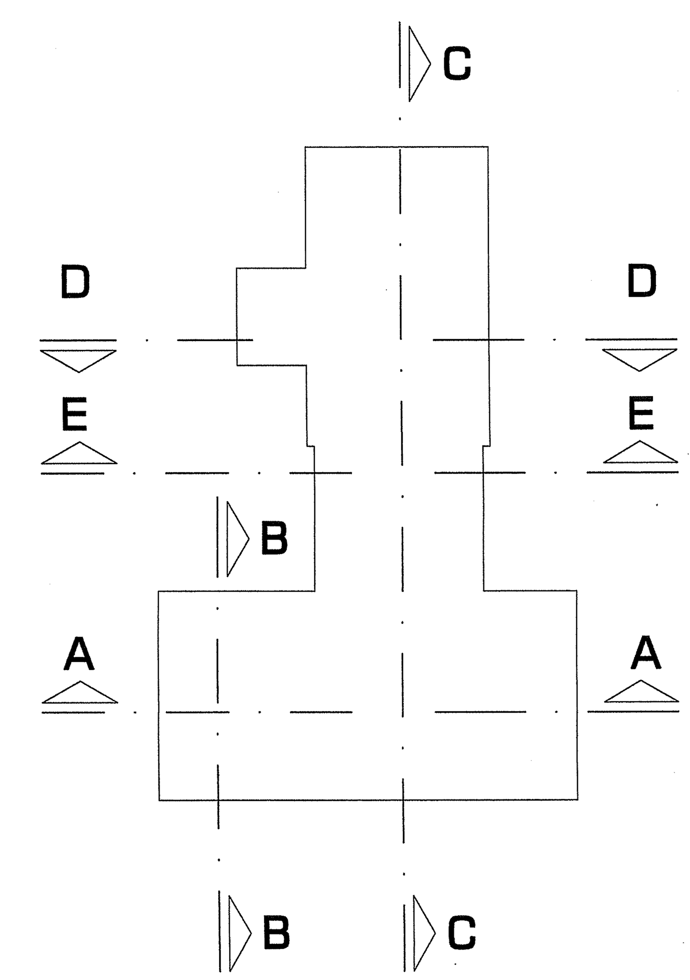


5 A3.1 **SECTION E-E**
SCALE: 1/8" = 1'-0"



K A5.0 **KEY PLAN**
SCALE: 3/4" = 1'-0"

RONALD E. VAUGHN, AIA NJ LICENSE #03906
RONALD E. VAUGHN, AIA PA LICENSE #EX-3418
LOUIS J. DeLOSSO, AIA NJ LICENSE #09841
JEROME H. TAYLOR, AIA NJ LICENSE #07791
JOSEF P. BRUDER, AIA NJ LICENSE #11015
JEFFREY B. HILL, AIA NJ LICENSE #08937

THE VAUGHN COLLABORATIVE
ARCHITECTURE
PLANNING
INTERIOR DESIGN
42 WEST LAFAYETTE STREET
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SOLEBURY TOWNSHIP

RENOVATIONS & ADDITIONS TO
SOLEBURY MUNICIPAL BUILDING

3092 SUGAN ROAD
P.O. BOX 139
SOLEBURY, PA 18963

PRINT ISSUES

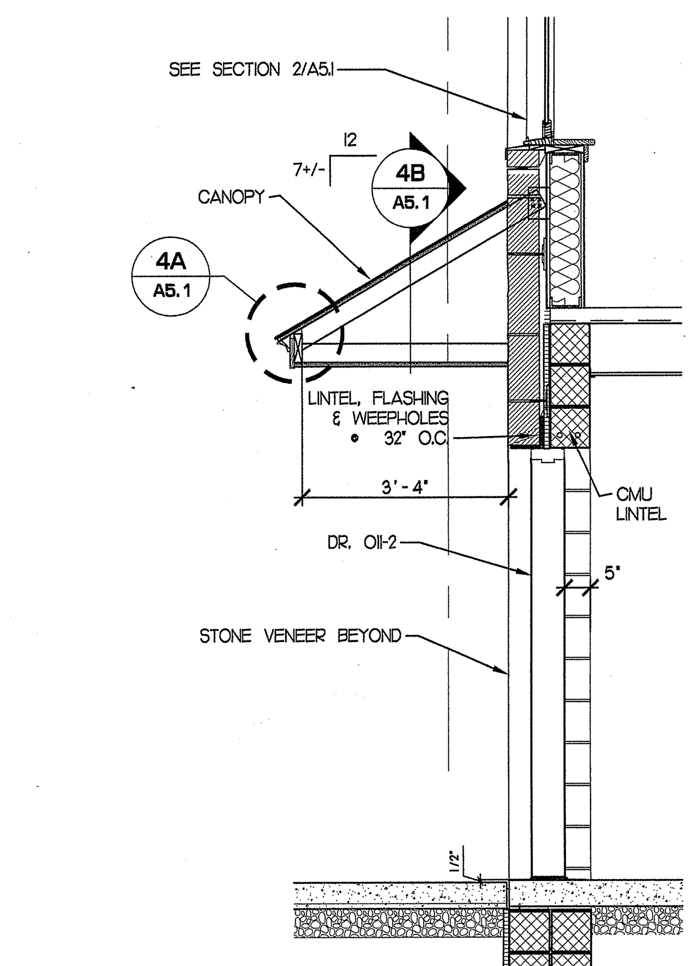
DATE:	REMARKS:
4/26/04	BID DOCUMENTS

REVISIONS

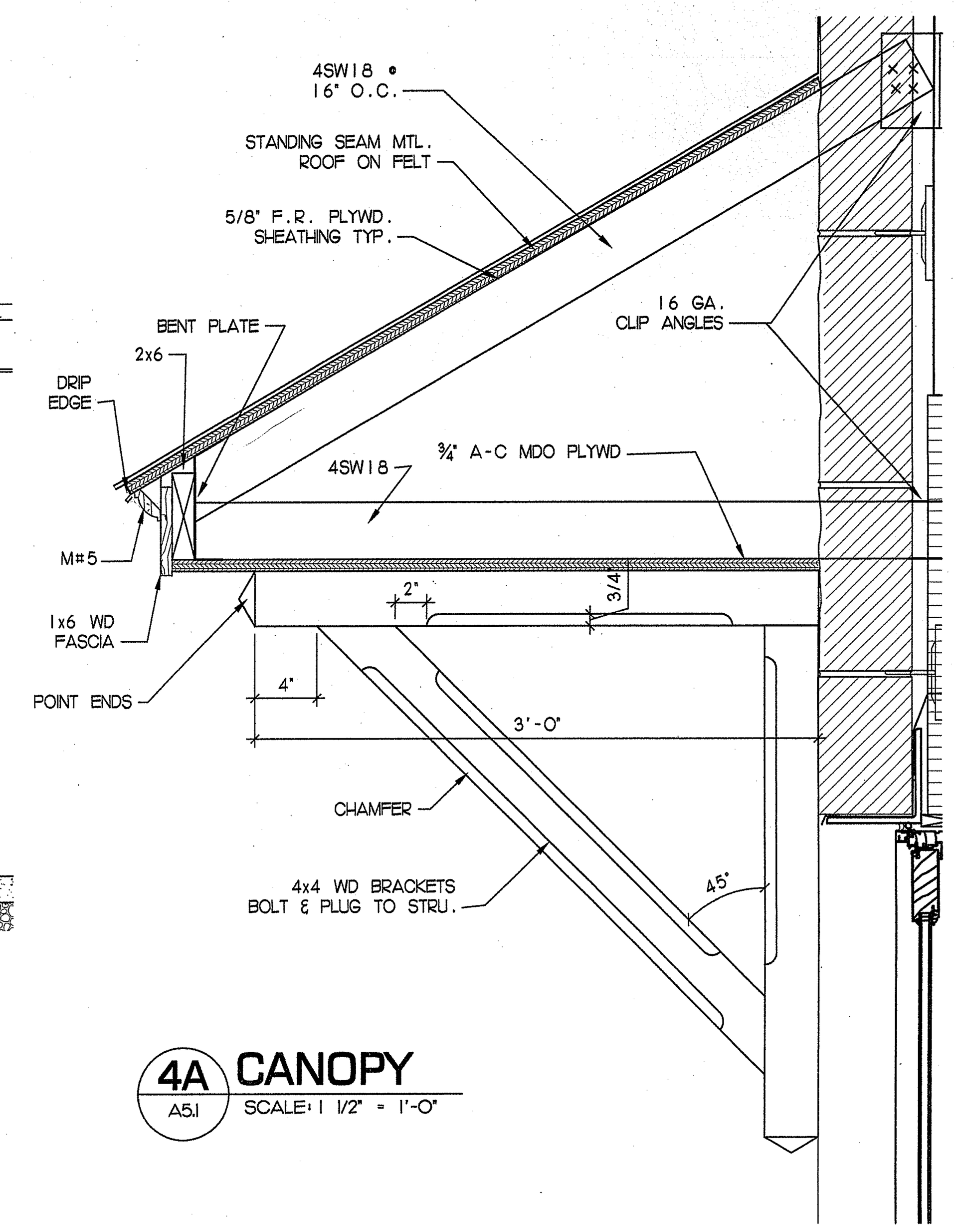
NO:	DATE:	REMARKS:

DRAWING NAME
BUILDING SECTIONS

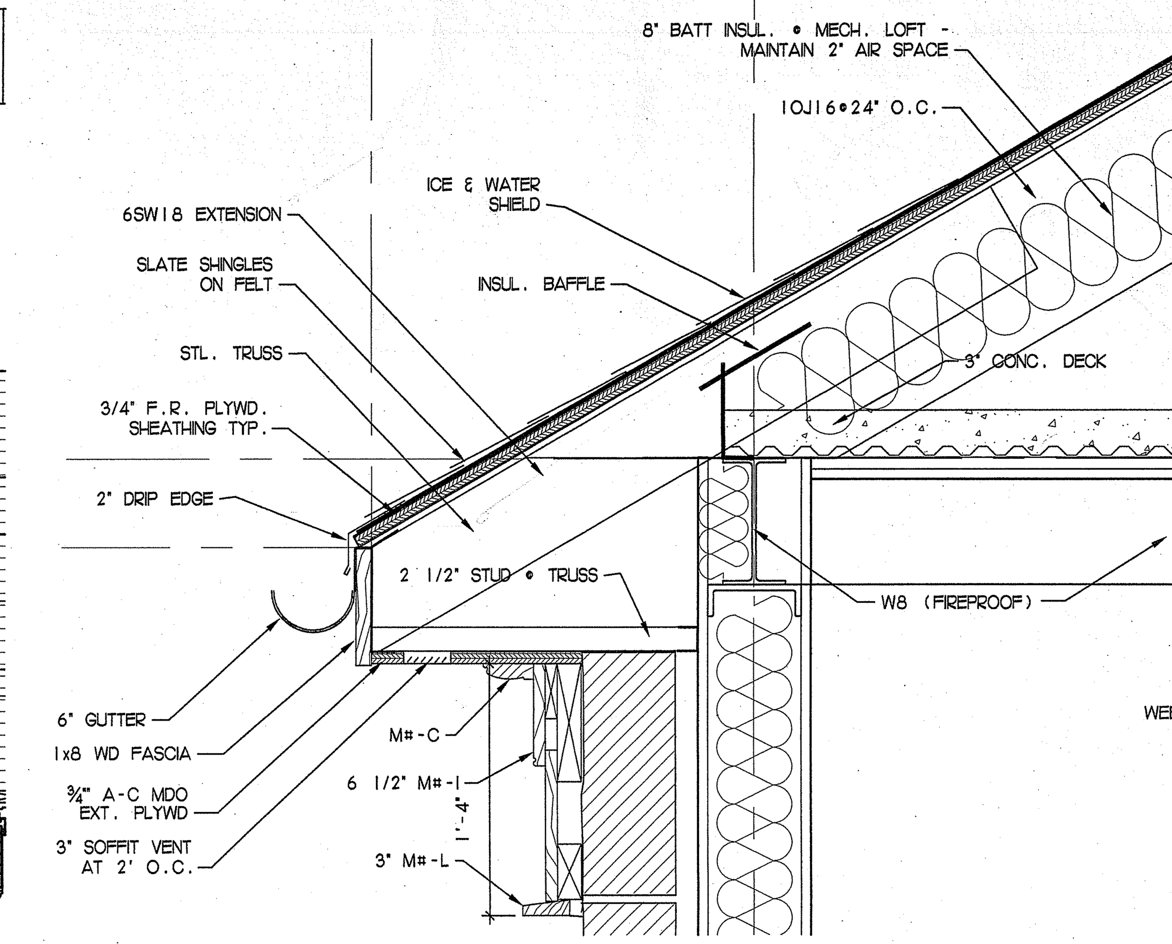
SCALE:	AS NOTED	DRAWING NO.
DRAWN BY:	JL	A3.1
CHECKED BY:	JT	
COMMISSION NO.	03-02600	
DATE:		



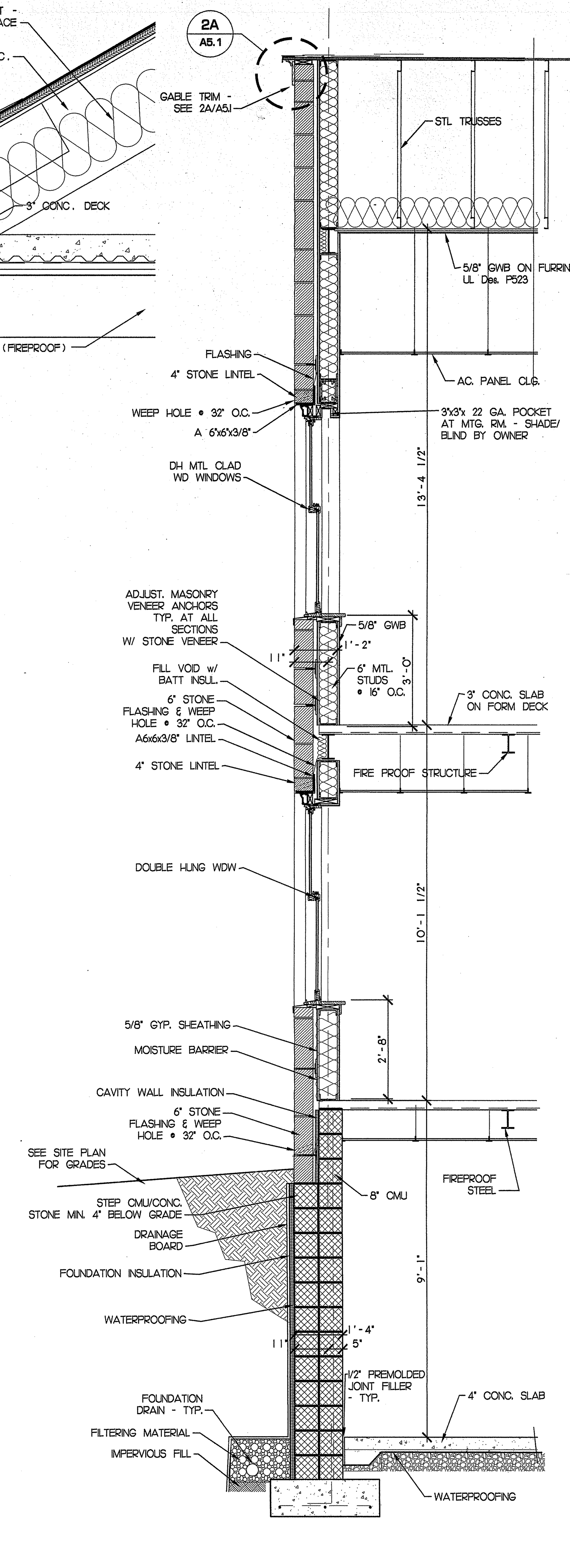
4 CANOPY AT DOOR 011-2
A5.I SCALE: 1/2" = 1'-0"



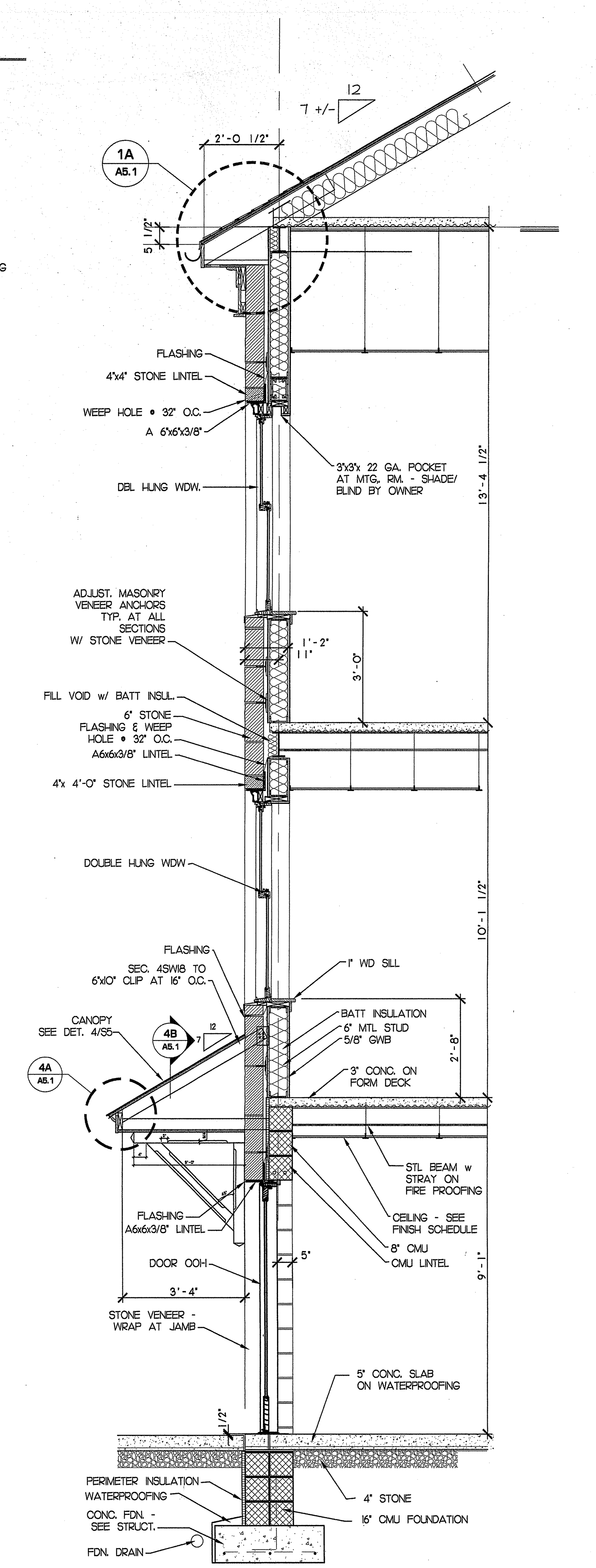
4A CANOPY
A5.I SCALE: 1 1/2" = 1'-0"



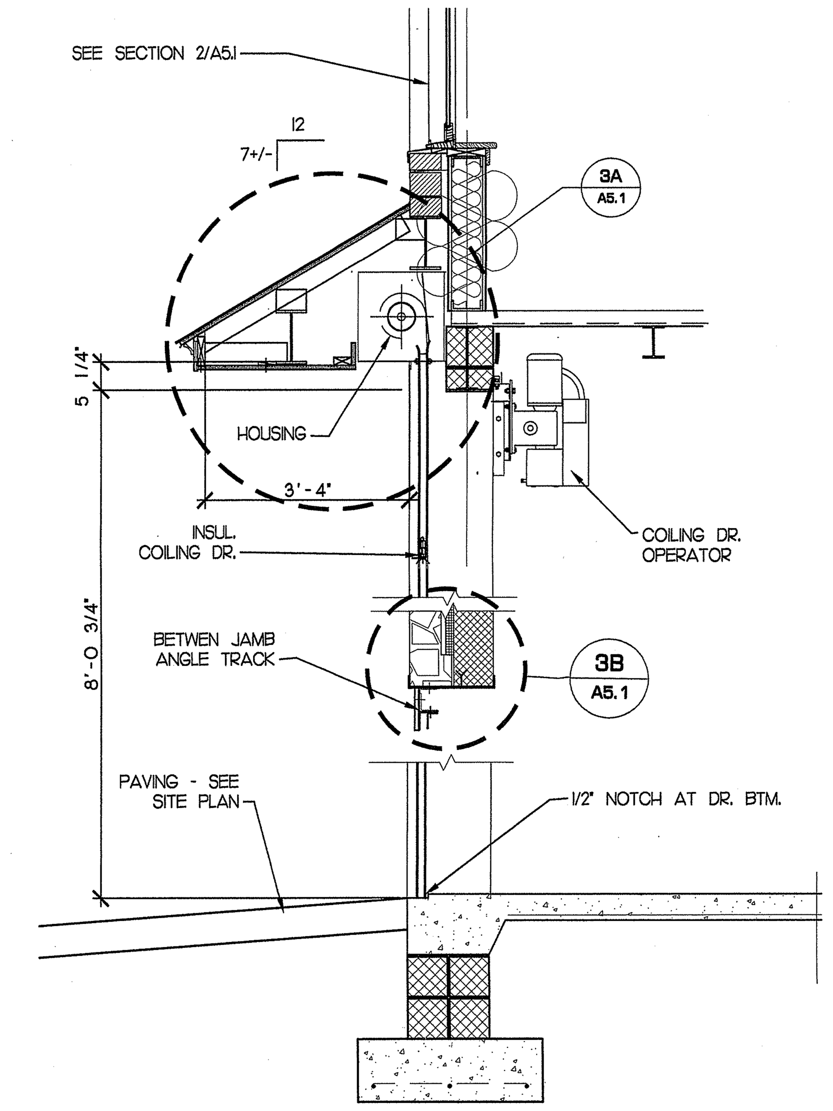
1B EAVE LINE AT MECH. LOFT
A5.I SCALE: 1/2" = 1'-0"



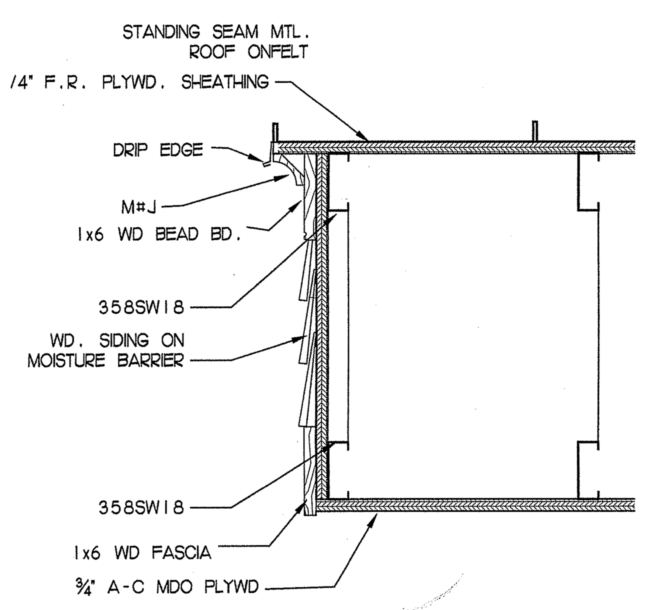
2 SECTION AT GABLE END
A5.I SCALE: 1/2" = 1'-0"



1 EAVE LINE AT POLICE ENTR.
A5.I SCALE: 1/2" = 1'-0"



3 SALLYPORT COILING DOOR/CANOPY
A5.I SCALE: 1/2" = 1'-0"



4B CANOPY
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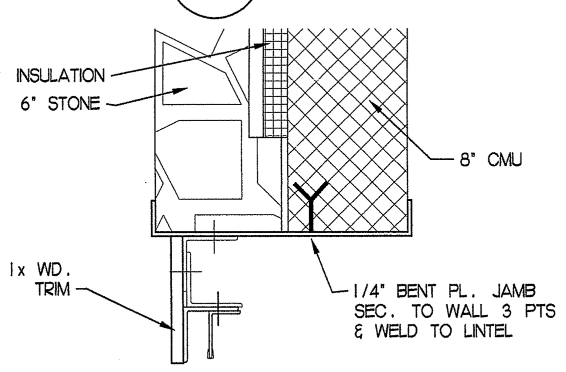
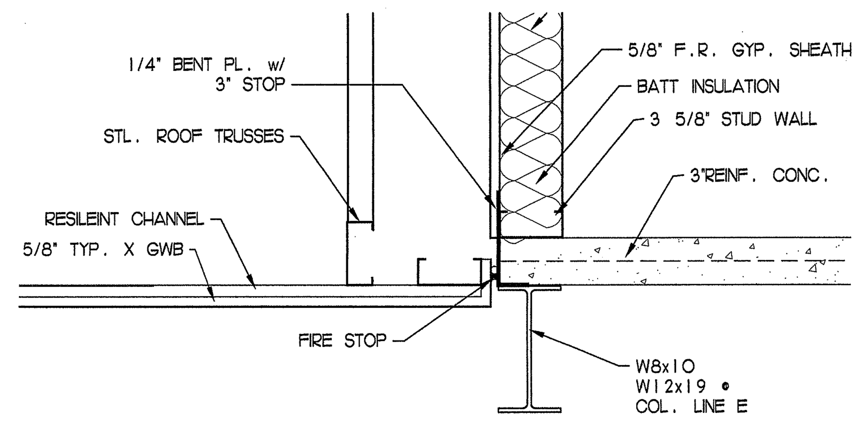
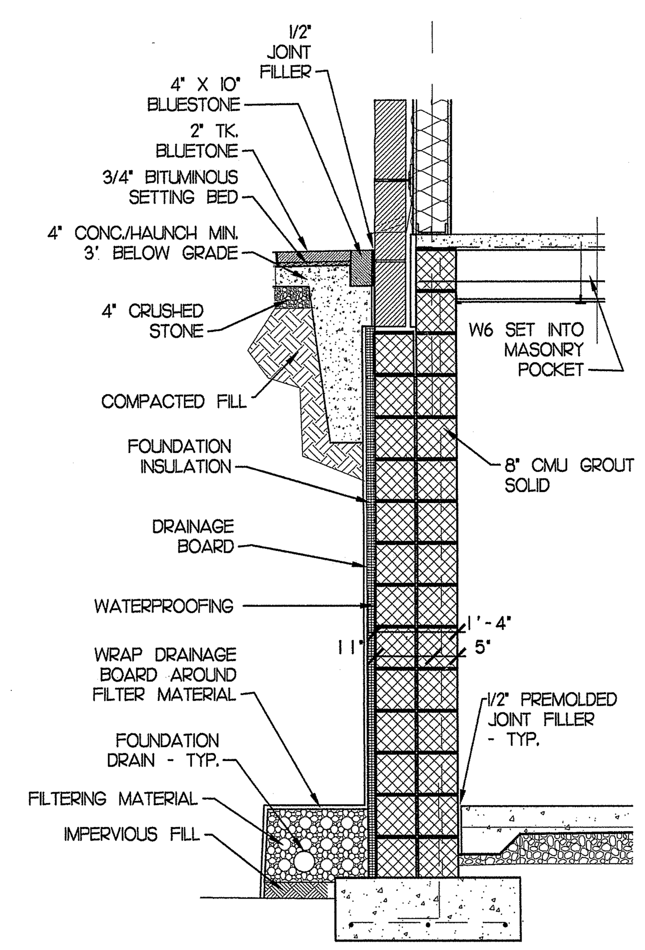


3B COILING DR. JAMB
A5.I SCALE: 1 1/2" = 1'-0"



6 MECH. LOFT
A5.I SCALE: 1/2" = 1'-0"



5 ENTRY PLAZA
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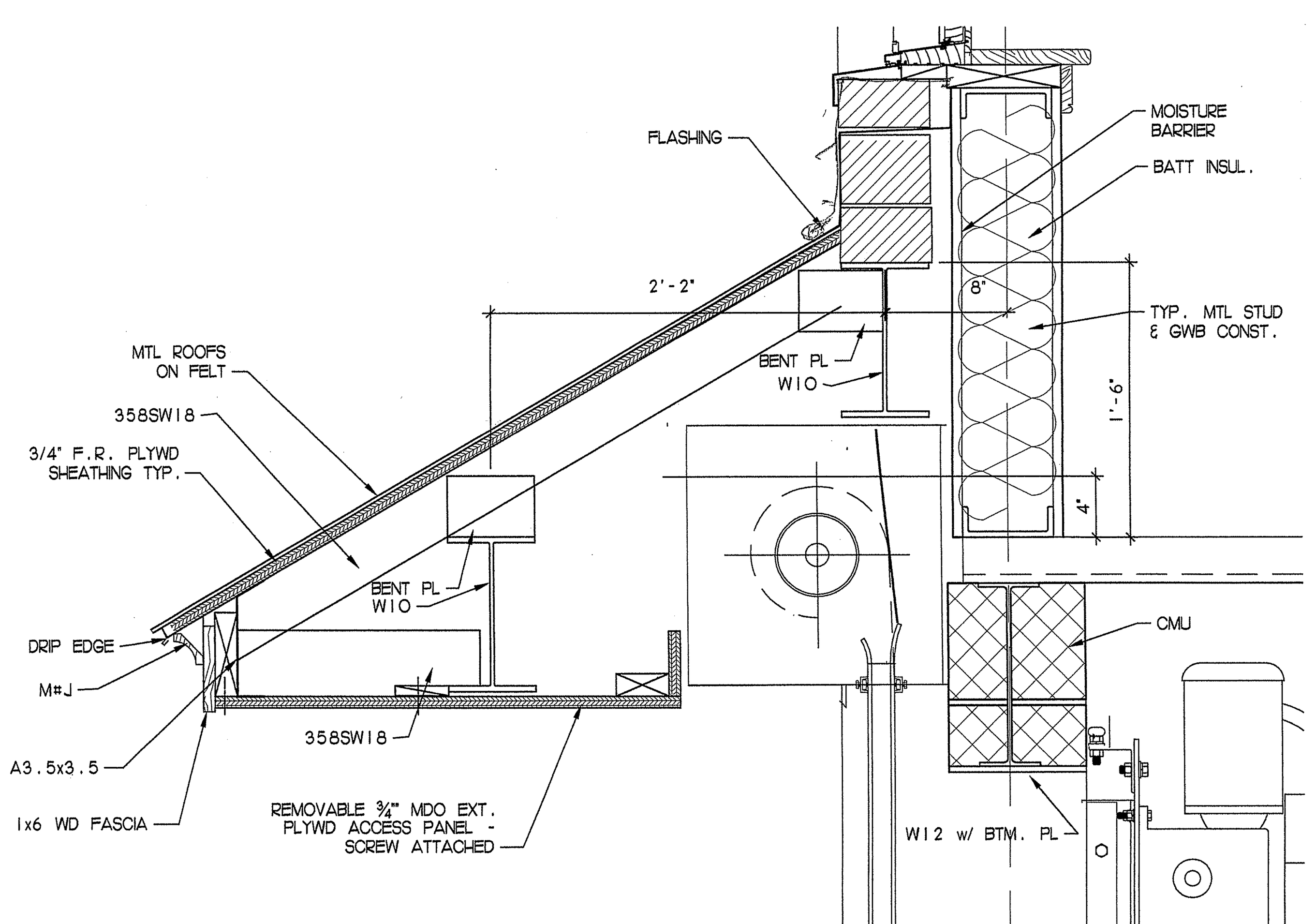
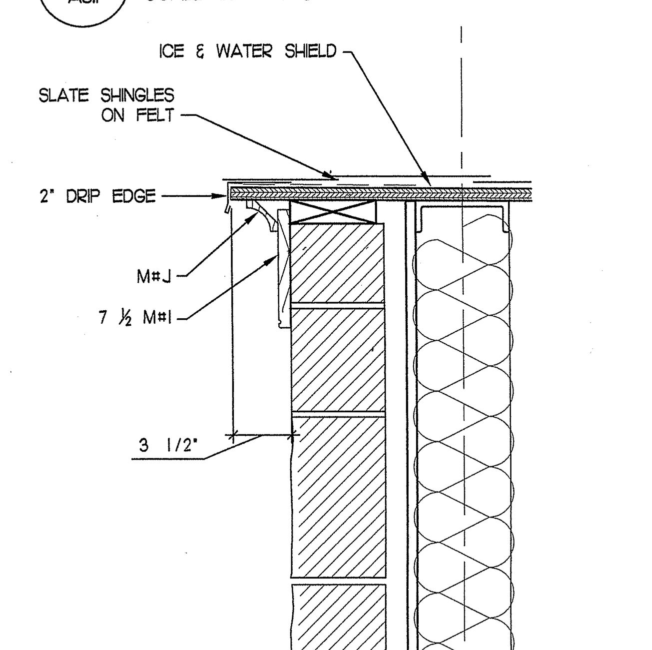


3A CANOPY @ COILING DR.
A5.I SCALE: 1/2" = 1'-0"



2A GABLE END
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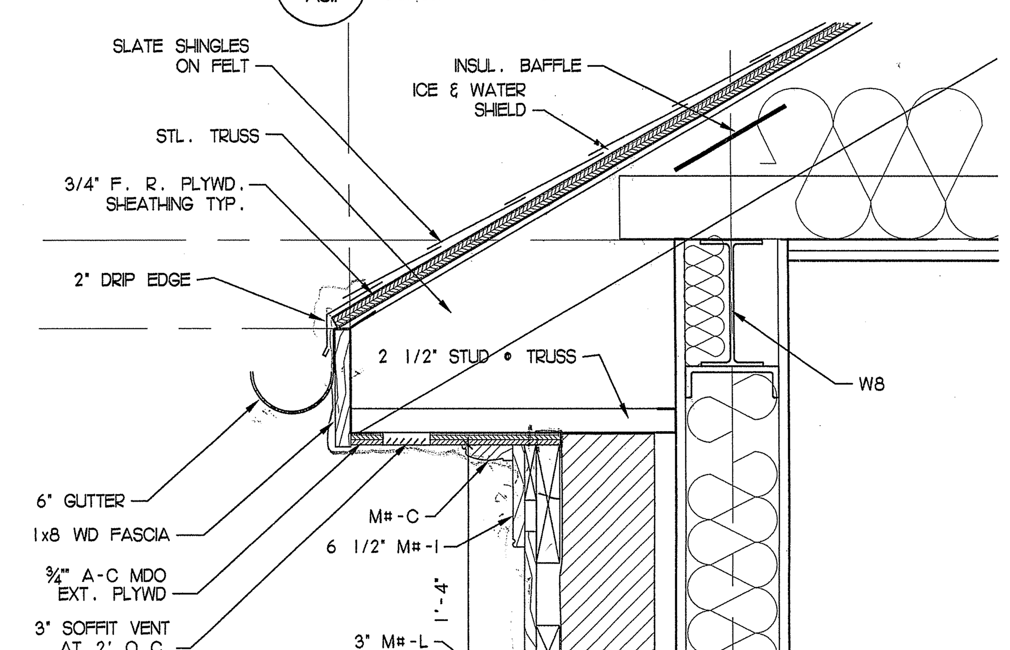

1A TYPICAL SOFFIT
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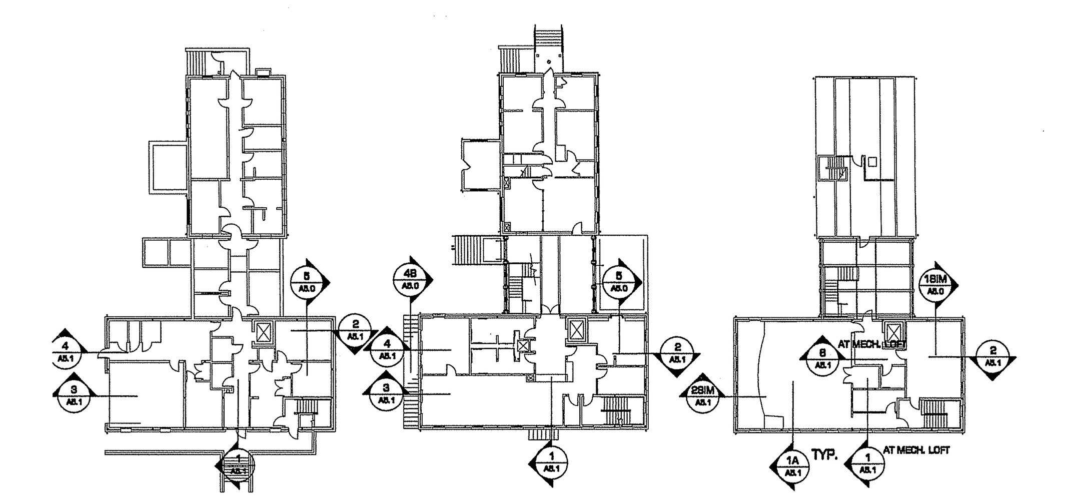

KEY PLAN

RONALD E. VAUGHN, AIA NJ LICENSE #03906
RONALD E. VAUGHN, AIA PA LICENSE #EX-3468
LOUIS J. DeLOSSO, AIA NJ LICENSE #09841
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SOLEBURY TOWNSHIP

RENOVATIONS & ADDITIONS TO
SOLEBURY MUNICIPAL BUILDING

3092 SUGAN ROAD
P.O. BOX 139
SOLEBURY, PA 18963

PRINT ISSUES

DATE:	REMARKS:
4/26/04	BID DOCUMENTS

REVISIONS

NO:	DATE:	REMARKS:

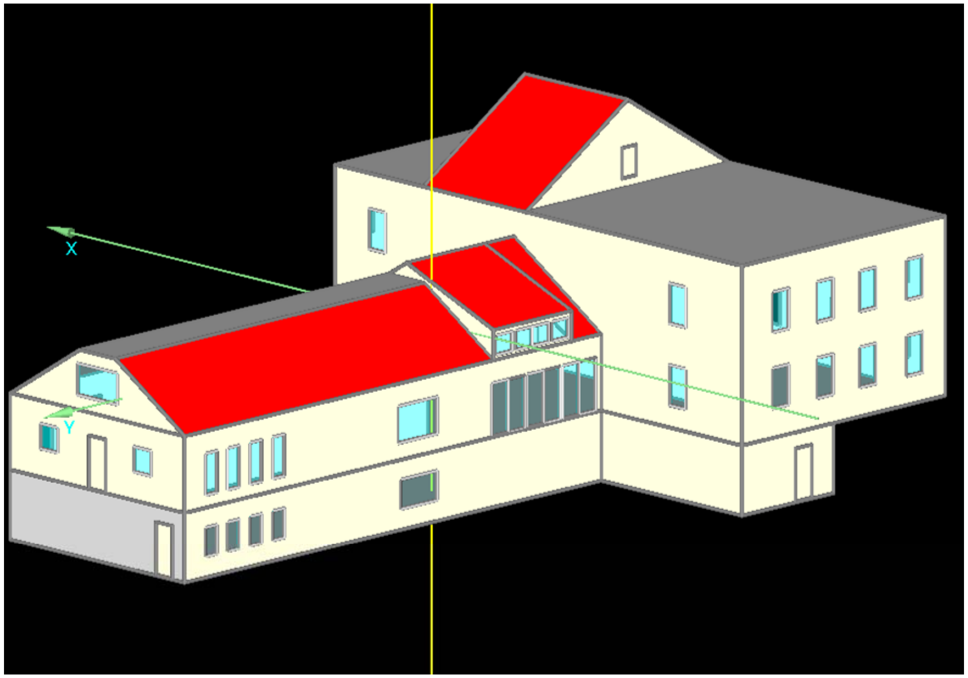
DRAWING NAME
WALL SECTIONS ADDITION

SCALE:	AS NOTED	DRAWING NO.
DRAWN BY:	JL	
CHECKED BY:	JT	
COMMISSION NO.	03-02600	A5.1
DATE:		

WUFI Energy Model
Existing vs. Proposed Design

Before/After Energy Performance

WUFI Energy Model Table of Contents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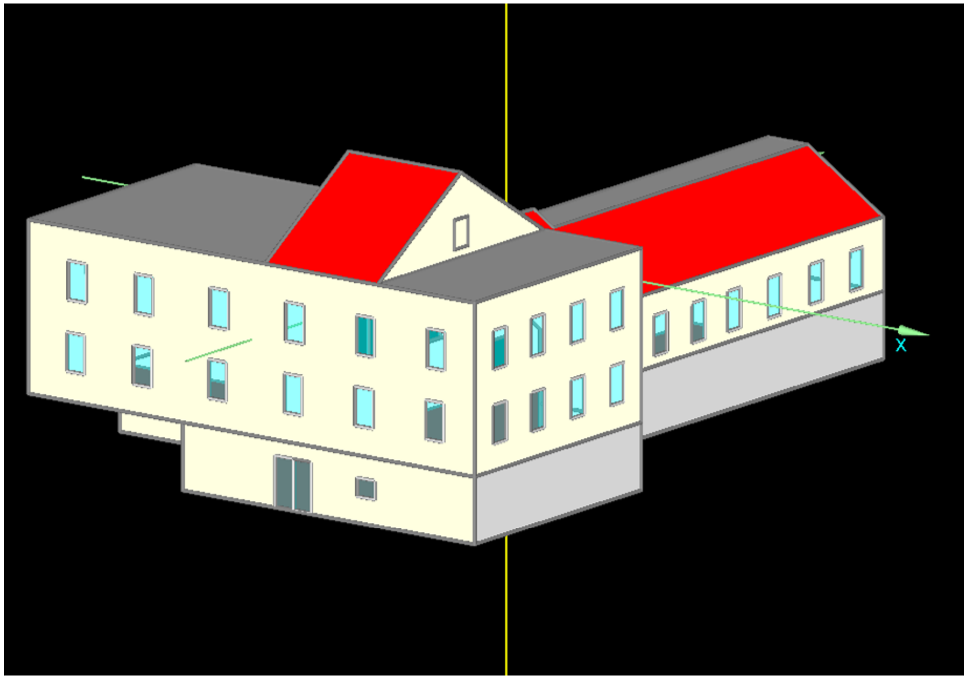
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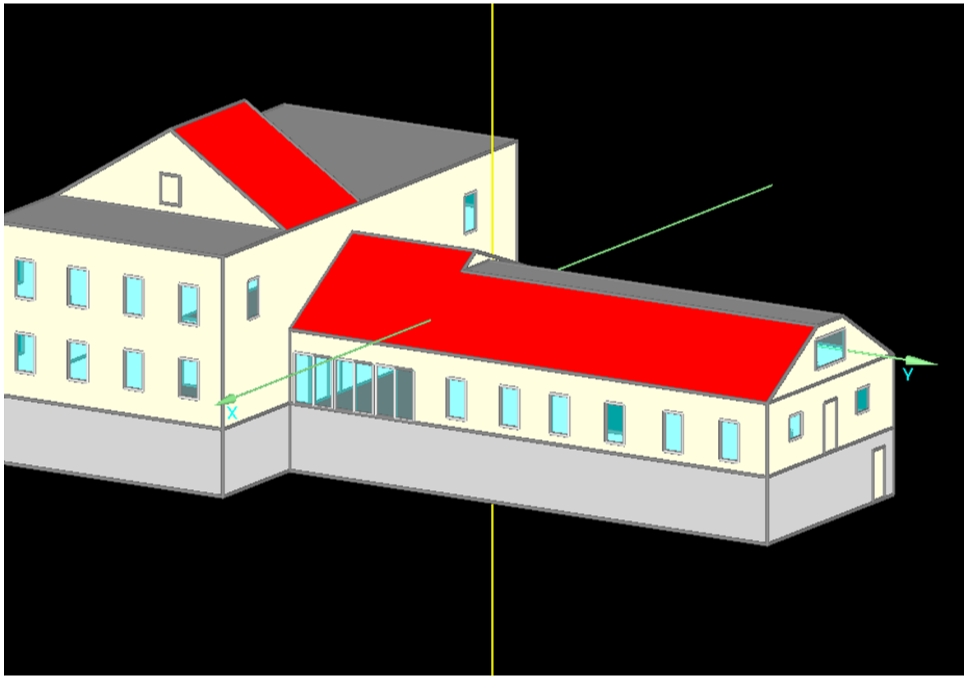
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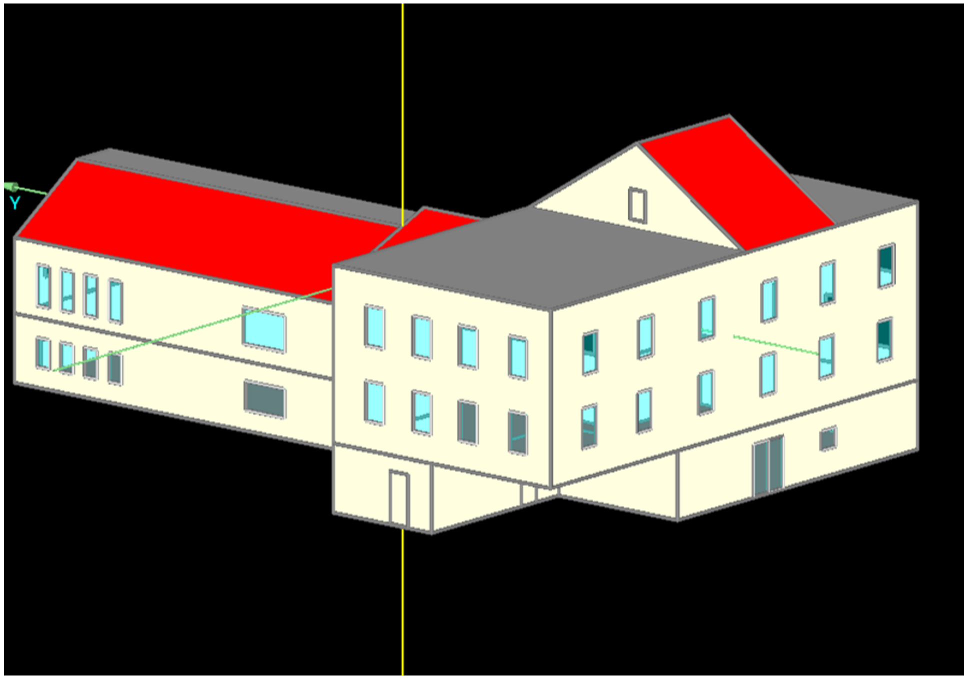
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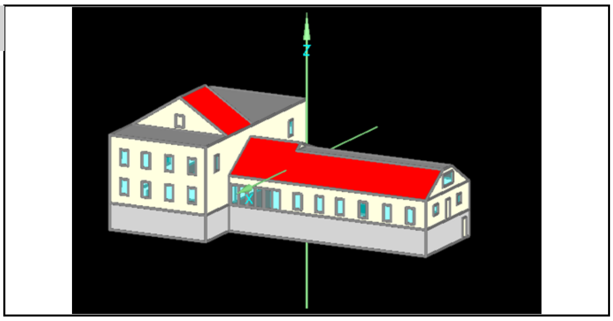
BUILDING INFORMATION

Category:	**Non-residential**
Status:	**Completed**
Building type:	**Retrofit**
Year of construction:	**Reno in 2004**
Units:	**1**
Number of occupants:	**25 (Design)**
Occupant density:	**559.5** ft²/Person



Boundary conditions

Climate:	**WILLOW GROVE NAS PA**
Internal heat gains:	**4** Btu/hr ft²
Interior temperature:	**70** °F
Overheat temperature:	**77** °F

Building geometry

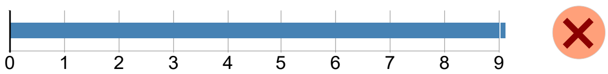
Enclosed volume:	**145,421.4** ft³
Net-volume:	**110,520.3** ft³
Total area envelope:	**21,277.6** ft²
Area/Volume Ratio:	**0.1** 1/ft
Floor area:	**13,988** ft²
Envelope area/iCFA:	**1.521**

Certificate criteria:

Heating/Cooling Demand Targets from CBECS Building Peer Group Data. See Page 91.

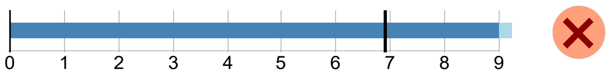
Heating demand

specific:	**37.86** kBtu/ft²yr
target:	**27.1** kBtu/ft²yr
total:	529,545.17 kBtu/yr



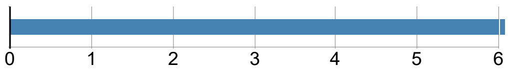
Cooling demand

sensible:	**18.11** kBtu/ft²yr
latent:	**2.45** kBtu/ft²yr
specific:	**20.56** kBtu/ft²yr
target:	**6.9** kBtu/ft²yr
total:	287,594.2 kBtu/yr



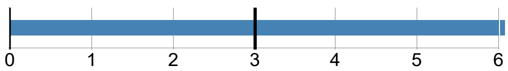
Heating load

specific:	**24.08** Btu/hr ft²
target:	**22** Btu/hr ft²
total:	336,807.88 Btu/hr



Cooling load

specific:	**7.75** Btu/hr ft²
target:	**3** Btu/hr ft²
total:	108,431.61 Btu/hr

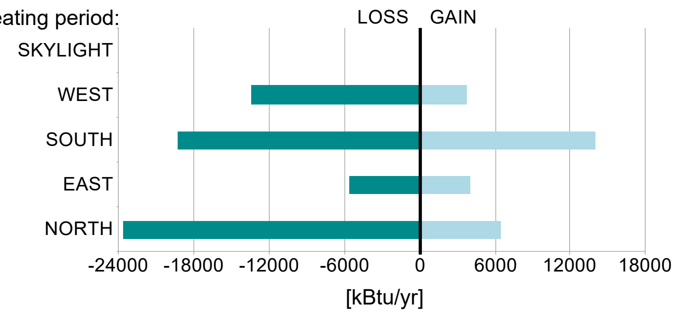


BUILDING ELEMENTS

Windows

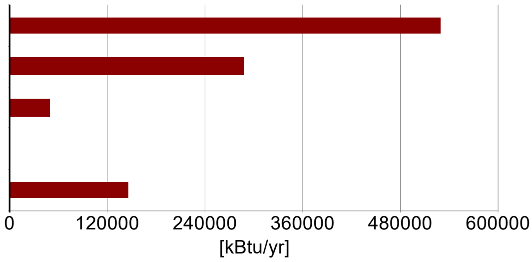
Average SHGC:	**0.45**	
Average solar reduction factor heating:	**0.59**	
Average solar reduction factor cooling:	**0.64**	
Average U-value:	**0.463**	Btu/hr ft² °F
Total glazing area:	**847.3**	ft²
Total window area:	**1,119.6**	ft²

Heat gain/loss heating period:



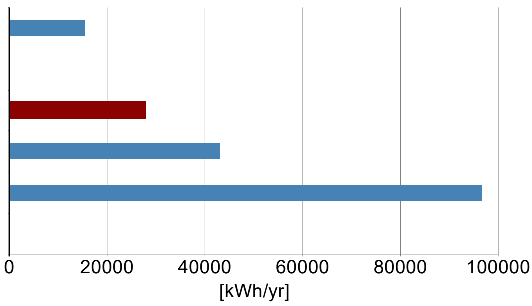
HVAC

Total heating demand:	**529,752**	kBtu/yr
Total cooling demand:	**287,594**	kBtu/yr
Total DHW energy demand:	**47,875**	kBtu/yr
Solar DHW contribution:	**0**	kBtu/yr
Auxiliary electricity:	**146,110**	kBtu/yr



Electricity

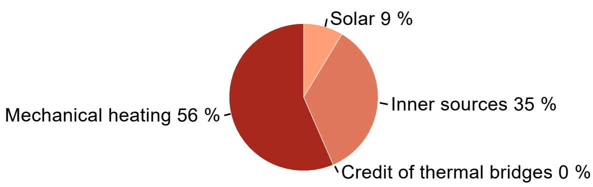
Direct heating / DHW:	**15,421**	kWh/yr
Heatpump heating:	**0**	kWh/yr
Cooling:	**27,682**	kWh/yr
HVAC auxiliary energy:	**42,825**	kWh/yr
Appliances:	**96,813**	kWh/yr
Renewable generation, coincident production and use:	**0**	kWh/yr
Total electricity demand:	**182,740**	kWh/yr



HEAT FLOW - HEATING PERIOD

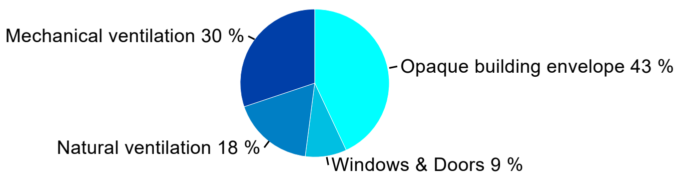
Heat gains

Solar:	**67,217**	kBtu/yr
Inner sources:	**272,884**	kBtu/yr
Credit of thermal bridges:	**0**	kBtu/yr
Mechanical heating:	**529,545**	kBtu/yr



Heat losses

Opaque building envelope:	**374,494**	kBtu/yr
Windows & Doors:	**78,115**	kBtu/yr
Natural ventilation:	**154,588**	kBtu/yr
Mechanical ventilation:	**262,450**	kBtu/yr

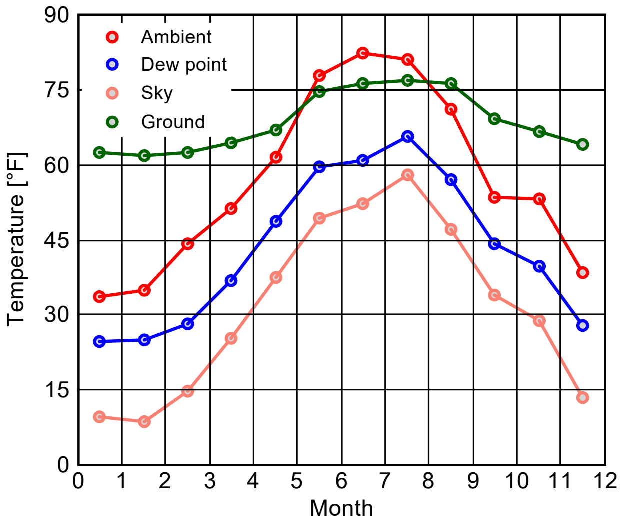


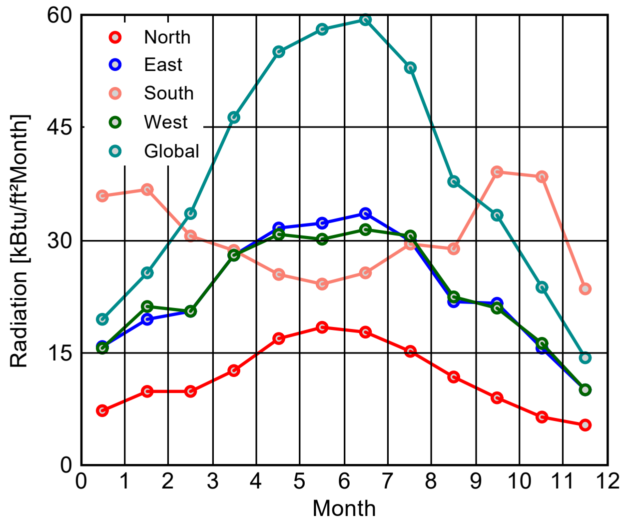
CLIMATE

Latitude:	**40.2** °
Longitude:	**-75.2** °
Elevation of weather station:	**334.6** ft
Elevation of building site:	**334.6** ft
Heat capacity air:	**0.018** Btu/ft³F
Daily temperature swing summer:	**20** °F
Average wind speed:	**13.1** ft/s

Ground

Average ground surface temperature:	**58.7** °F
Amplitude ground surface temperature:	**56.3** °F
Ground thermal conductivity:	**1.2** Btu/hr ft °F
Ground heat capacity:	**29.8** Btu/ft³F
Depth below grade of groundwater:	**9.8** ft
Flow rate groundwater:	**0.2** ft/d





Calculation parameters

Length of heating period	**243** days/yr
Heating degree hours	**111.1** kFh/a
Phase shift months	**0.7** mths
Time constant heating demand	**17** hr
Time constant cooling demand	**0** hr
Time constant cooling demand with night ventilation	**0** hr

Climate for	Heating load 1	Heating load 2	Cooling
Temperature [°F]	23.4	31.3	81.5
Solar radiation North [Btu/hr ft²]	9.5	7.9	24.4
Solar radiation East [Btu/hr ft²]	22.5	16.8	42.2
Solar radiation South [Btu/hr ft²]	51.4	33	39.3
Solar radiation West [Btu/hr ft²]	20.9	14.6	46
Solar radiation Global [Btu/hr ft²]	24.7	18.1	84.3

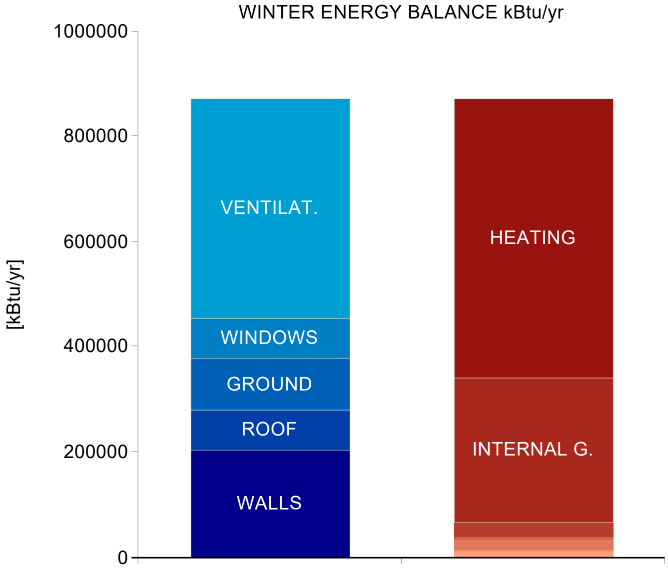
Relevant boundary conditions for heating load calculation: Heating load 1

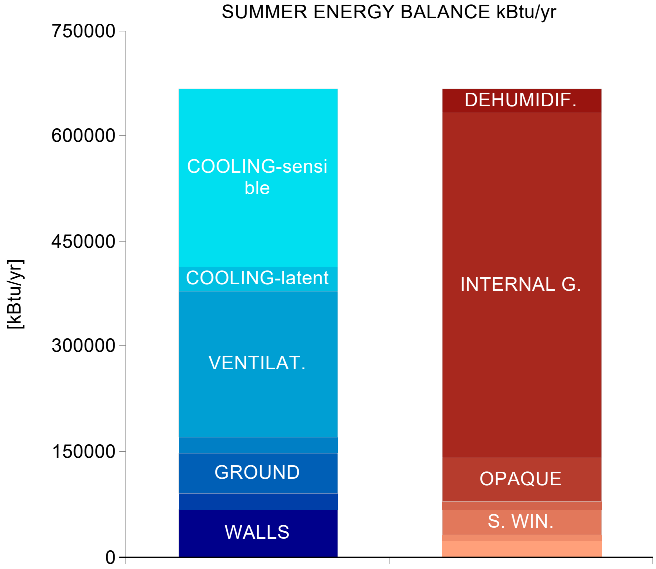
ANNUAL HEAT DEMAND

Transmission losses :	**452,609**	kBtu/yr
Ventilation losses:	**417,037**	kBtu/yr
Total heat losses:	**869,646**	kBtu/yr
Solar heat gains:	**80,619**	kBtu/yr
Internal heat gains:	**327,293**	kBtu/yr
Total heat gains:	**407,912**	kBtu/yr
Utilization factor:	**83.4**	%
Useful heat gains:	**340,100**	kBtu/yr
Annual heat demand:	**529,545**	kBtu/yr
Specific annual heat demand:	**37,860.8**	Btu/ft²yr

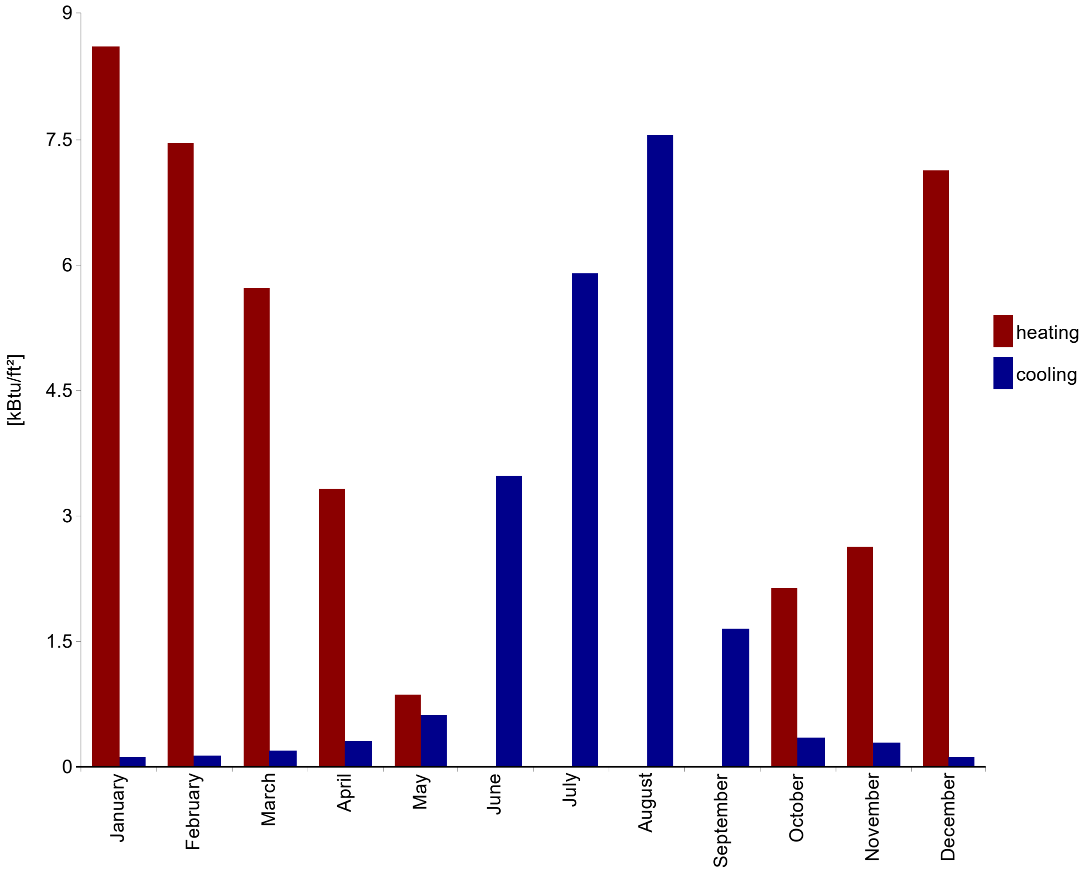
ANNUAL COOLING DEMAND

Solar heat gains:	**140,017**	kBtu/yr
Internal heat gains:	**491,613**	kBtu/yr
Total heat gains:	**631,630**	kBtu/yr
Transmission losses :	**745,414**	kBtu/yr
Ventilation losses:	**910,392**	kBtu/yr
Total heat losses:	**1,655,806**	kBtu/yr
Utilization factor:	**22.8**	%
Useful heat losses:	**378,275**	kBtu/yr
Cooling demand - sensible:	**253,355**	kBtu/yr
Cooling demand - latent:	**34,239**	kBtu/yr
Annual cooling demand:	**287,594**	kBtu/yr
Specific annual cooling demand:	**20.6**	kBtu/ft²yr





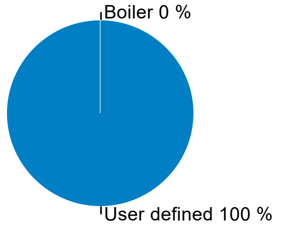
SPECIFIC HEAT/COOLING DEMAND MONTHLY



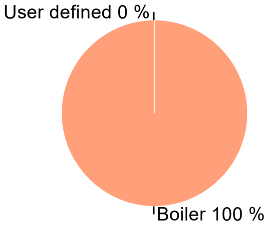
Month	Heating [kBtu/ft²]	Cooling [kBtu/ft²]
January	8.6	0.1
February	7.4	0.1
March	5.7	0.2
April	3.3	0.3
May	0.9	0.6
June	0	3.5
July	0	5.9
August	0	7.6
September	0	1.7
October	2.1	0.4
November	2.6	0.3
December	7.1	0.1

System	DHW			Heating			Total		
	Covered DHW demand [%]	Estimated solar fraction [%]	Final energy demand [kBtu/yr]	Covered heating demand [%]	Estimated solar fraction [%]	Final energy demand [kBtu/yr]	Performance ratio	CO2 equivalent emissions [lb/yr]	Source energy demand [kBtu/yr]
Boiler, Lochinvar Knight XL Boiler	0	0	0	100	0	561,503	0	90,707.3	617,653.3
User defined, Trane Chiller	100	0	52,614.4	0	0	0	1.1	78.9	94,706
Σ	100	0	52,614.4	100	0	561,503		90,786.2	712,359.3

DHW - final energy



Heating - final energy



COOLING UNITS

	sensible	latent
Air cooling:	**0** kBtu/ft²yr	**0** kBtu/ft²yr
Recirculation cooling:	**18.1** kBtu/ft²yr	**3.2** kBtu/ft²yr
Additional dehumidification:		**1.1** kBtu/ft²yr
Panel cooling:	**0** kBtu/ft²yr	
Sum:	**18.1** kBtu/ft²yr	**4.3** kBtu/ft²yr

Boiler

Boiler type:	**Gas**
Condensing:	**yes**
In thermal envelope:	**no**
Boiler output:	**658,000** Btu/hr
Efficiency at 30% load:	**98** %
Efficiency at normal output:	**94** %
Heatloss at 70°C standby:	**0.5** %

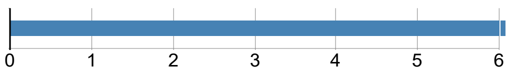
VENTILATION

Energy transportable by supply air

Heating energy

transportable: **6.59** W/ft²

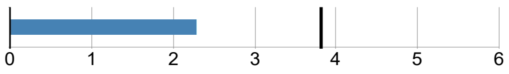
load: **7.06** W/ft²



Cooling energy

transportable: **3.81** W/ft²

load: **2.27** W/ft²



Infiltration pressure test ACH50:	**7.84** 1/hr
Total extract air demand:	**2,760** cfm
Supply air per person:	**18** cfm
Occupancy:	**25**

Average air flow rate:	**3,880** cfm
Average air change rate:	**2.11** 1/hr
Effective ACH ambient:	**1.48** 1/hr
Effective ACH ground:	**0** 1/hr
Energetically effective air exchange:	**1.48** 1/hr
Infiltration air change rate:	**0.55** 1/hr
Infiltration air change rate (heating load):	**1.37** 1/hr

Type of ventilation system:	**Balanced ventilation**
Wind screening coefficient (e):	**0.07**
Wind exposure factor:	**15**
Wind shield factor:	**0.05**

Ventilation heat losses: **345,607.75** kBtu/yr

Devices

Name	Sensible recovery efficiency [-]	Electric efficiency [W/cfm]	Heat recovery efficiency SHX [-]	Effective recovery efficiency [-]
Greenheck ERVs	0.8	0.03	0	0.8
Altogether	0.6	0.02	0	0.6

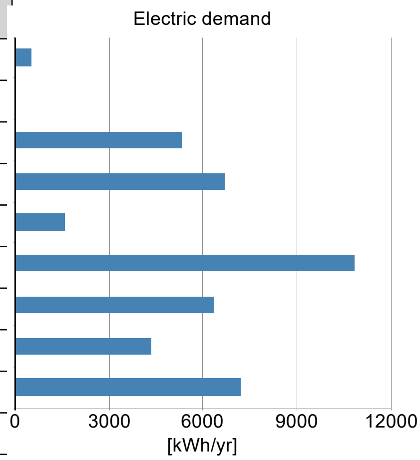
Ducts

Name	Length (total) [ft]	Clear cross-section [ft²]	U-value [Btu/hr ft² °F]	Assigned ventilation units
Supply / outdoor air duct	15	1.3889	4.62	Greenheck ERVs
Extract / Exhaust air duct	15	1.3889	4.62	Greenheck ERVs
Σ	30			

*length * quantity ** thermal conductivity / thickness

ELECTRICITY DEMAND - AUXILIARY ELECTRICITY

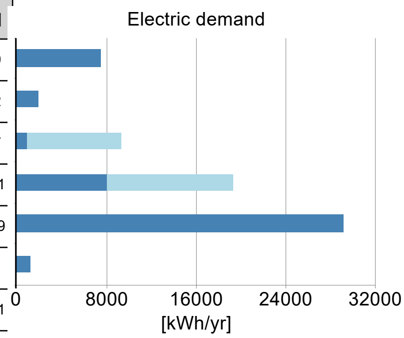
Type	Quantity	Indoor	Norm demand	Electric demand [kWh/yr]	Source energy [kBtu/yr]
Boiler heating auxiliary energy	1	no	187.5 W	503.2	3090.2
Other	1	no	0 W	0	0
DHW circulating pump	1	yes	754 W	5301.7	32558.8
Heating system circulation pump	1	yes	2,262 W	6672.2	40975.4
Heating system circulation pump	18	yes	30 W	1592.8	9781.9
Other	1	yes	3,770 W	10857.6	66679.2
Ventilation winter	1	yes	0.4 W/cfm	6313.4	38772.3
Ventilation Defrost	1	yes	20,107.1 W	4358	26763.5
Ventilation summer	1	yes	0.4 W/cfm	7226	44376.9
Σ				42824.9	262998.2



ELECTRICITY DEMAND NON-RESIDENTIAL BUILDING

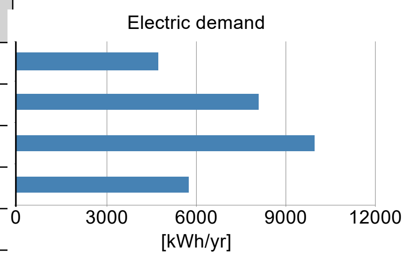
Equipment

Type	Quantity	Indoor	Utilization pattern	Power rating norm demand	Electric demand [kWh/yr]	Source energy [kBtu/yr]
PC	25	yes	Pattern 1: Government Building	82 (+82) W	7,482.5 (+0)	45951.9
Monitor	25	yes	Pattern 1: Government Building	21 (+21) W	1,916.3 (+0)	11768.2
Printer	6	yes	Pattern 1: Government Building	425 (+425) W	930.8 (+8,376.8)	57159.7
Server	1	yes	Pattern 1: Government Building	2,200 (+2,200) W	8,030 (+11,242)	118354.1
User defined	1	yes		13,988 (+0) W	29,095 (+0)	178679.9
Refrigerator	2	yes		1.6 kWh/d	1197.2	7352.3
Σ	60				48,651.7 (+19,618.8)	419266.1



Lighting

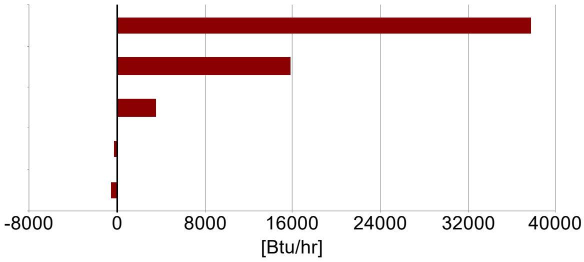
Name	Utilization pattern	Installed lighting power [W/ft²]	Daylight utilization	Lighting full load hours [hrs/yr]	Electric demand [kWh/yr]	Source energy [kBtu/yr]
Lighting 1	Pattern 1: Government Building	1.2	Low	3120	4713.4	28946.1
Lighting 2	Pattern 1: Government Building	1.2	Low	1560	8117.5	49851.7
Lighting 3	Pattern 1: Government Building	1.2	Low	1560	9950.5	61108.5
Lighting 4	Pattern 1: Government Building	1.2	Low	1560	5760.8	35378.6
Σ					28542.2	175285



INTERNAL HEAT GAINS

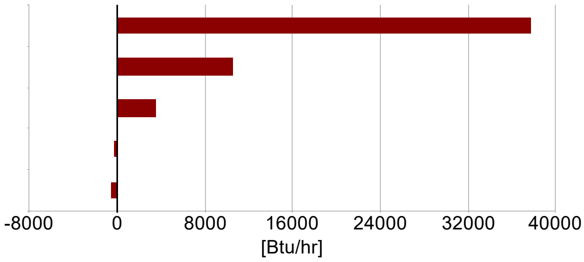
Heating season

Electricity total:	**37,709.9**	Btu/hr
Auxiliary electricity:	**15,736.5**	Btu/hr
People:	**3,554.3**	Btu/hr
Cold water:	**-341.8**	Btu/hr
Evaporation:	**-533.1**	Btu/hr
Σ:	**56,125.7**	Btu/hr
Specific internal heat gains:	**4**	Btu/hr ft²



Cooling season

Electricity total:	**37,709.9**	Btu/hr
Auxiliary electricity:	**10,465.9**	Btu/hr
People:	**3,554.3**	Btu/hr
Cold and hot water:	**-341.8**	Btu/hr
Evaporation:	**-533.1**	Btu/hr
Σ:	**56,125.7**	Btu/hr
Specific internal heat gains:	**4**	Btu/hr ft²



DHW AND DISTRIBUTION

DHW consumption per person per day:	**3.2**	gal/Person/day
Average cold water temperature supply:	**58.7**	°F
Useful heat DHW:	**6,921.1**	kBtu/yr
Specific useful heat DHW:	**494.8**	Btu/ft²yr
Total heat losses of the DHW system:	**40,953.7**	kBtu/yr
Specific losses of the DHW system:	**2,928.1**	Btu/ft²yr
Performance ratio DHW distribution system and storage:	**6.9**	
Utilization ratio DHW distribution system and storage:	**0.1**	
Total heat demand of DHW system:	**47,874.8**	kBtu/yr
Total specific heat demand of DHW system:	**3,422.9**	Btu/ft²yr
Total heat losses of the hydronic heating distribution:	**207**	kBtu/yr
Specific losses of the hydronic heating distribution:	**14.8**	Btu/ft²yr
Performance ratio of heat distribution:	**100**	%

Region	Length [ft]	Annual heat loss [kBtu/yr]
Hydronic heating distribution pipes		
In conditioned space	715	207
Σ	715	207
DHW circulation pipes		
In conditioned space	430	36352.3
Σ	430	36352.3
Individual pipes		
In conditioned space		0
Σ		0
Water storage		
Σ		0

SPECIFICATIONS REPORT

Property/Site

Building name **Solebury Township Municipal Building**

Property information

Owner's name	**Solebury Township**
Property address	**3092 Sugan Road**
City	**Solebury**
Zip	**18963**

Site information

Climate Location **WILLOW GROVE NAS PA**

Building

Building Information

Area of Conditioned Space	**13,988** ft^2
Volume of conditioned space	**110,520.3** ft^3
Number of bedrooms	**4**
Foundation Type	**Heated basement, or underground floor slab / Slab on grade**
Winter setpoint temperature	**70** °F
Summer setpoint temperature	**77** °F

Below grade walls

Name	Area [ft^2]	Assembly
Below Grade Basement Walls	1,455.9	Uninsulated CMU Wall

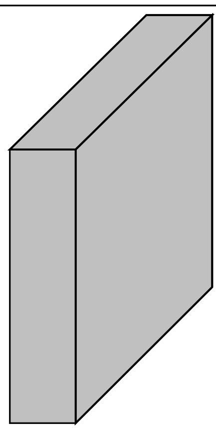
Assembly (Id.2): Uninsulated CMU Wall

Homogenous layers

Thermal resistance: 1.859 hr ft^2 °F/Btu (without Rsi, Rse)

Heat transfer coefficient (U-value): 0.354 Btu/hr ft^2 °F

Thickness: 9.449 in



Nr.	Material/Layer (from outside to inside)	ρ [lb/ft^3]	c [Btu/lb°F]	λ [Btu/hr ft °F]	Thickness [in]	Color
1	Concrete Brick	144.52	0.19	0.4235	9.449	

Slab floor

Name	Area [ft²]	Assembly
Slab	4,540.7	4" concrete Uninsulated

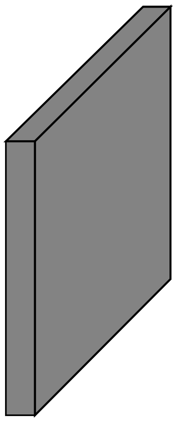
Assembly (Id.4): 4" concrete Uninsulated

Homogenous layers

Thermal resistance: 0.42 hr ft² °F/Btu (without Rsi, Rse)

Heat transfer coefficient (U-value): 0.722 Btu/hr ft² °F

Thickness: 4 in



Nr.	Material/Layer (from outside to inside)	ρ [lb/ft³]	c [Btu/lb°F]	λ [Btu/hr ft °F]	Thickness [in]	Color
1	Concrete	131.35	0.19	0.7933	4	

Heated basement, or underground floor slab

Floor slab area	**2,271** ft²
U-Value of basement slab	**0.7** Btu/hr ft² °F
Floor slab perimeter (P)	**395** ft
Depth of basement slab below grade	**6** ft
U-Value of basement wall	**0.4** Btu/hr ft² °F
Total R-value of perimeter insulation	**2.8** hr ft² °F/Btu

Slab on grade

Floor slab area	**2,271** ft²
U-Value of basement slab	**0.7** Btu/hr ft² °F
Floor slab perimeter (P)	**546** ft
Total R-value of perimeter insulation	**NaN** hr ft² °F/Btu

Above-grade walls & Rim/band joists

Name	Orientation	Area [ft²]	Short wave radiation absorption	Assembly
Flat Attic New Building	Horizontal (100 %)	2,011.1	0.4	Solebury Flat Attic New Building
Cathedral Ceiling2	Horizontal (100 %)	236	0.4	Solebury Mech Loft Cathedral Ceiling
Floor over Sallyport	Horizontal (100 %)	510.7	0.4	Solebury Floor over Sallyport
Above Grade Wall New Building	SE (29 %), SW (17 %), NE (17 %), NW (37 %)	4,249.3	0.4	Solebury Above Grade Wall New Building
Walkout Basement Walls	SE (13 %), NE (53 %), NW (34 %)	1,797.8	0.4	Uninsulated CMU Wall
Above Grade Walls Old Building	SE (28 %), SW (34 %), NE (36 %), NW (2 %)	1,577.5	0.4	Solebury Above Grade Wall Old Building
Attic Knee-Wall	SW (50 %), NE (50 %)	400.7	0.4	Solebury Attic Knee-Wall
Flat Attic Old Building	Horizontal (100 %)	362	0.4	Solebury Mech Loft Cathedral Ceiling
Cathedral Ceiling1	SE (14 %), SW (41 %), NE (32 %), NW (14 %)	2,911.1	0.4	Solebury Mech Loft Cathedral Ceiling
Total		**14,056.3**		

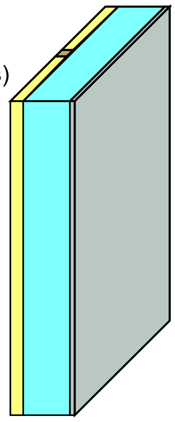
Assembly (Id.9): Solebury Flat Attic New Building

Inhomogenous layers

Thermal resistance: 7.054 / 7.523 hr ft² °F/Btu (EN ISO 6946 / homogenous layers)

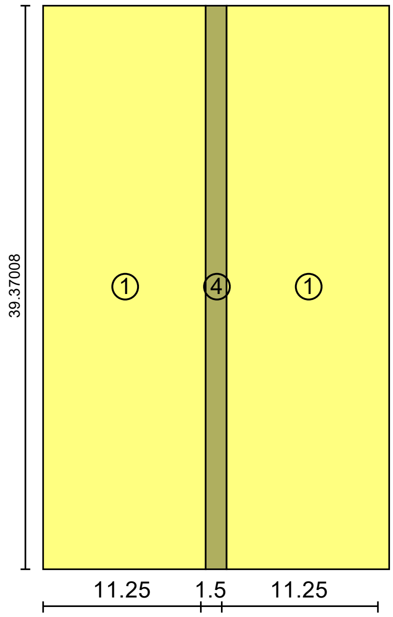
Heat transfer coefficient (U-value): 0.127 Btu/hr ft² °F

Thickness: 7.898 in



Nr.	Material/Layer (from outside to inside)	ρ [lb/ft³]	c [Btu/lb°F]	λ [Btu/hr ft °F]	Thickness [in]	Color
1	Fibre Glass	1.87	0.2	0.0202	1.5	
2	Air Layer 150 mm	0.08	0.24	0.5431	5.906	
3	Gypsum Board (USA)	53.06	0.21	0.0942	0.492	
Exchange materials						
4	Spruce	24.97	0.45	0.0497	---	

Exchange material(s), Assembly (Id.9): Solebury Flat Attic New Building
Layer: 1



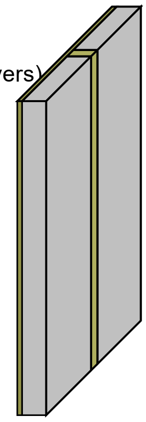
Assembly (Id.8): Solebury Mech Loft Cathedral Ceiling

Inhomogenous layers

Thermal resistance: 12.115 / 13.034 hr ft² °F/Btu (EN ISO 6946 / homogenous layers)

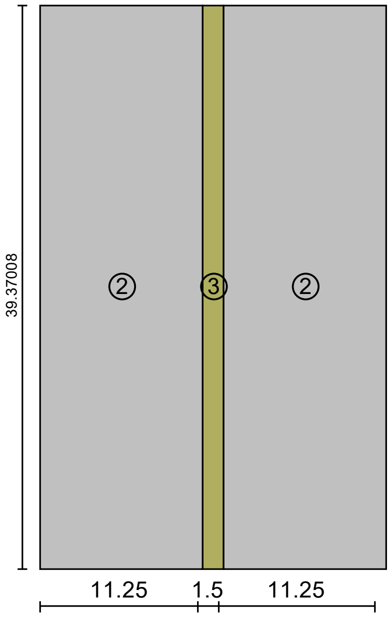
Heat transfer coefficient (U-value): 0.077 Btu/hr ft² °F

Thickness: 3.591 in



Nr.	Material/Layer (from outside to inside)	ρ [lb/ft³]	c [Btu/lb°F]	λ [Btu/hr ft °F]	Thickness [in]	Color
1	Plywood (USA)	29.34	0.45	0.0485	0.591	
2	Cellulose Fibre Insulation	1.87	0.45	0.0208	3	
	Exchange materials					
3	Spruce	24.97	0.45	0.0497	---	

Exchange material(s), Assembly (Id.8): Solebury Mech Loft Cathedral Ceiling
Layer: 2



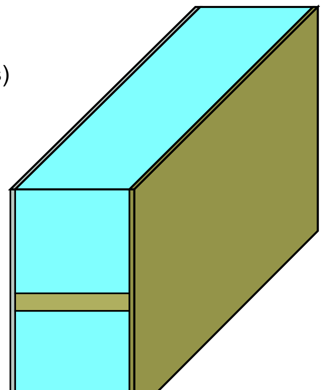
Assembly (Id.3): Solebury Floor over Sallyport

Inhomogenous layers

Thermal resistance: 4.888 / 4.603 hr ft² °F/Btu (EN ISO 6946 / homogenous layers)

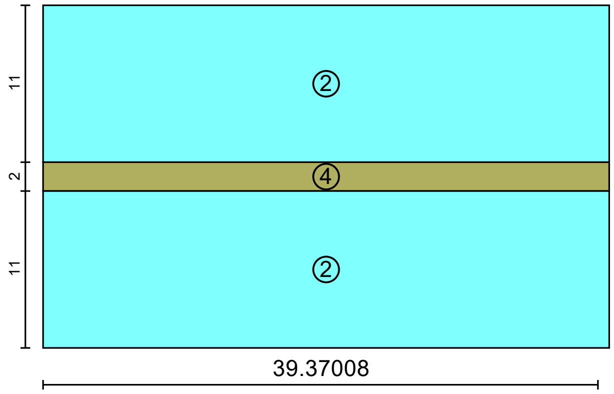
Heat transfer coefficient (U-value): 0.164 Btu/hr ft² °F

Thickness: 12.992 in



Nr.	Material/Layer (from outside to inside)	ρ [lb/ft³]	c [Btu/lb°F]	λ [Btu/hr ft °F]	Thickness [in]	Color
1	Gypsum Board (USA)	53.06	0.21	0.0942	0.492	
2	Air Layer 90 mm; without additional moisture capacity	0.08	0.24	0.3022	12	
3	Plywood (USA)	29.34	0.45	0.0485	0.5	
Exchange materials						
4	Spruce	24.97	0.45	0.0497	---	

Exchange material(s), Assembly (Id.3): Solebury Floor over Sallyport
Layer: 2



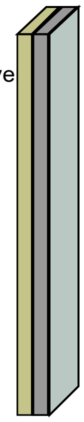
Assembly (Id.6): Solebury Above Grade Wall New Building

Inhomogenous layers

Thermal resistance: 10.763 / 18.276 hr ft² °F/Btu (EN ISO 6946 / homogenous laye

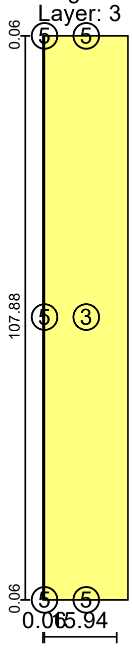
Heat transfer coefficient (U-value): 0.085 Btu/hr ft² °F

Thickness: 9.083 in



Nr.	Material/Layer (from outside to inside)	ρ [lb/ft³]	c [Btu/lb°F]	λ [Btu/hr ft °F]	Thickness [in]	Color
1	Sandstone	138.84	0.18	0.973	4	
2	Plywood (USA)	29.34	0.45	0.0485	0.591	
3	Fibre Glass	1.87	0.2	0.0202	4	
4	Gypsum Board (USA)	53.06	0.21	0.0942	0.492	
Exchange materials						
5	Metal Deck, unperforated	486.94	0.11	26.5784	---	

Exchange material(s), Assembly (Id.6): Solebury Above Grade Wall New Building



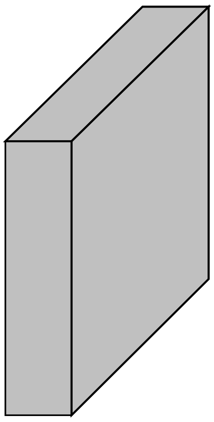
Assembly (Id.2): Uninsulated CMU Wall

Homogenous layers

Thermal resistance: 1.859 hr ft² °F/Btu (without Rsi, Rse)

Heat transfer coefficient (U-value): 0.354 Btu/hr ft² °F

Thickness: 9.449 in



Nr.	Material/Layer (from outside to inside)	ρ [lb/ft³]	c [Btu/lb°F]	λ [Btu/hr ft °F]	Thickness [in]	Color
1	Concrete Brick	144.52	0.19	0.4235	9.449	

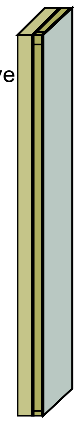
Assembly (Id.7): Solebury Above Grade Wall Old Building

Inhomogenous layers

Thermal resistance: 10.301 / 11.851 hr ft² °F/Btu (EN ISO 6946 / homogenous laye

Heat transfer coefficient (U-value): 0.089 Btu/hr ft² °F

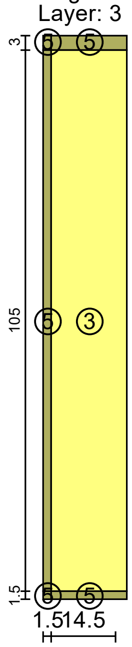
Thickness: 7.484 in



Nr.	Material/Layer (from outside to inside)	ρ [lb/ft³]	c [Btu/lb°F]	λ [Btu/hr ft °F]	Thickness [in]	Color
1	Sandstone	138.84	0.18	0.973	4	
2	Oriented Strand Board	40.58	0.45	0.0532	0.492	
3	Fibre Glass	1.87	0.2	0.0202	2.5	
4	Gypsum Board (USA)	53.06	0.21	0.0942	0.492	
Exchange materials						
5	Spruce	24.97	0.45	0.0497	---	

Exchange material(s), Assembly (Id.7): Solebury Above Grade Wall Old Building

Layer: 3



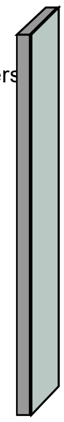
Assembly (Id.5): Solebury Attic Knee-Wall

Inhomogenous layers

Thermal resistance: 7.617 / 14.858 hr ft² °F/Btu (EN ISO 6946 / homogenous layers

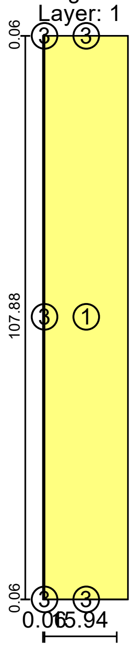
Heat transfer coefficient (U-value): 0.117 Btu/hr ft² °F

Thickness: 3.992 in



Nr.	Material/Layer (from outside to inside)	ρ [lb/ft³]	c [Btu/lb°F]	λ [Btu/hr ft °F]	Thickness [in]	Color
1	Fibre Glass	1.87	0.2	0.0202	3.5	
2	Gypsum Board (USA)	53.06	0.21	0.0942	0.492	
Exchange materials						
3	Metal Deck, unperforated	486.94	0.11	26.5784	---	

Exchange material(s), Assembly (Id.5): Solebury Attic Knee-Wall



Windows and Glass Doors

Name	Orientation	Area [ft²]	Window type
Windows	SE (9 %), SW (31 %), NE (38 %), NW (22 %)	1,119.6	Glazing: Reflective 2, Frame: Wood/Vinyl - Operable

Window type (Id 1): Glazing: Reflective 2, Frame: Wood/Vinyl - Operable

Basic data

Uw -mounted [Btu/hr ft² °F]	0.4614
Frame factor	0.7859
Glass U-value [Btu/hr ft² °F]	0.45
SHGC/Solar energy transmittance (perpendicular)	0.45

Frame data

Setting	Left	Right	Top	Bottom
Frame width [in]	3	3	3	3
Frame U-value [Btu/hr ft² °F]	.23	.23	.23	.23
Glazing-to-frame psi-value [Btu/hr ft °F]	.04	.04	.04	.04
Frame-to-Wall psi-value [Btu/hr ft °F]	.029	.029	.029	.029

Solar radiation angle dependent data

Angle [°]	Total solar trans.
0	0.22

Doors

Name	Orientation	Area [ft²]	Short wave radiation absorption	Assembly
Opaque Doors	SE (40 %), SW (11 %), NE (30 %), NW (19 %)	105.1	0.4	Exterior Door

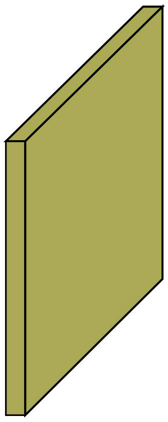
Assembly (Id.1): Exterior Door

Homogenous layers

Thermal resistance: 3.333 hr ft² °F/Btu (without Rsi, Rse)

Heat transfer coefficient (U-value): 0.233 Btu/hr ft² °F

Thickness: 2.75 in



Nr.	Material/Layer (from outside to inside)	ρ [lb/ft³]	c [Btu/lb°F]	λ [Btu/hr ft °F]	Thickness [in]	Color
1	Southern Yellow Pine	31.21	0.45	0.0688	2.75	

Ceilings

Name	Area [ft²]	Short wave radiation absorption	Assembly
Flat Attic New Building	2,011.1	0.4	Solebury Flat Attic New Building
Cathedral Ceiling2	236	0.4	Solebury Mech Loft Cathedral Ceiling
Floor over Sallyport	510.7	0.4	Solebury Floor over Sallyport
Flat Attic Old Building	362	0.4	Solebury Mech Loft Cathedral Ceiling
Total	**3,119.8**		

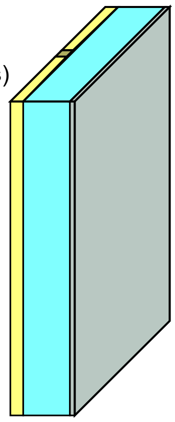
Assembly (Id.9): Solebury Flat Attic New Building

Inhomogenous layers

Thermal resistance: 7.054 / 7.523 hr ft² °F/Btu (EN ISO 6946 / homogenous layers)

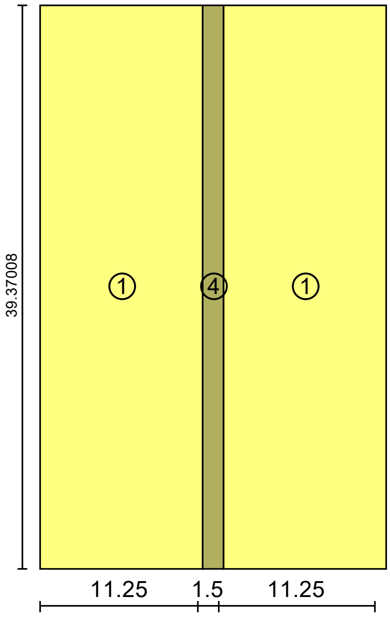
Heat transfer coefficient (U-value): 0.127 Btu/hr ft² °F

Thickness: 7.898 in



Nr.	Material/Layer (from outside to inside)	ρ [lb/ft³]	c [Btu/lb°F]	λ [Btu/hr ft °F]	Thickness [in]	Color
1	Fibre Glass	1.87	0.2	0.0202	1.5	
2	Air Layer 150 mm	0.08	0.24	0.5431	5.906	
3	Gypsum Board (USA)	53.06	0.21	0.0942	0.492	
Exchange materials						
4	Spruce	24.97	0.45	0.0497	---	

Exchange material(s), Assembly (Id.9): Solebury Flat Attic New Building
Layer: 1



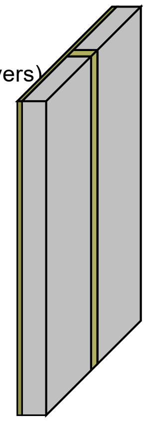
Assembly (Id.8): Solebury Mech Loft Cathedral Ceiling

Inhomogenous layers

Thermal resistance: 12.115 / 13.034 hr ft² °F/Btu (EN ISO 6946 / homogenous layers)

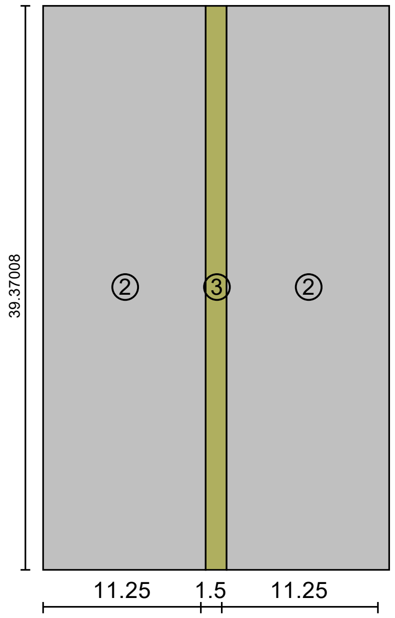
Heat transfer coefficient (U-value): 0.077 Btu/hr ft² °F

Thickness: 3.591 in



Nr.	Material/Layer (from outside to inside)	ρ [lb/ft³]	c [Btu/lb°F]	λ [Btu/hr ft °F]	Thickness [in]	Color
1	Plywood (USA)	29.34	0.45	0.0485	0.591	
2	Cellulose Fibre Insulation	1.87	0.45	0.0208	3	
Exchange materials						
3	Spruce	24.97	0.45	0.0497	---	

Exchange material(s), Assembly (Id.8): Solebury Mech Loft Cathedral Ceiling
Layer: 2



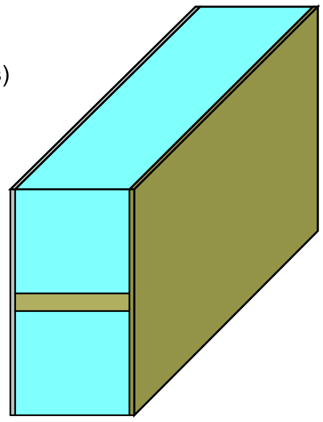
Assembly (Id.3): Solebury Floor over Sallyport

Inhomogenous layers

Thermal resistance: 4.888 / 4.603 hr ft² °F/Btu (EN ISO 6946 / homogenous layers)

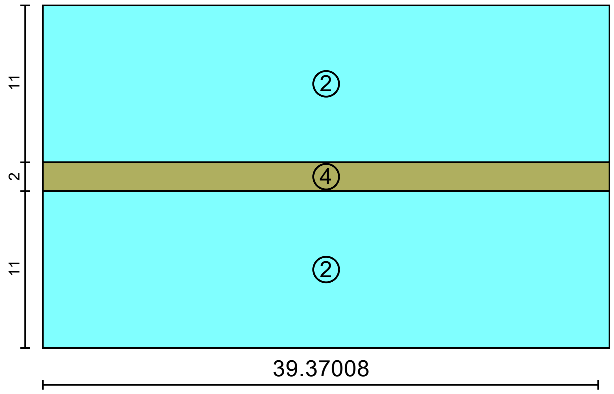
Heat transfer coefficient (U-value): 0.164 Btu/hr ft² °F

Thickness: 12.992 in



Nr.	Material/Layer (from outside to inside)	ρ [lb/ft³]	c [Btu/lb°F]	λ [Btu/hr ft °F]	Thickness [in]	Color
1	Gypsum Board (USA)	53.06	0.21	0.0942	0.492	
2	Air Layer 90 mm; without additional moisture capacity	0.08	0.24	0.3022	12	
3	Plywood (USA)	29.34	0.45	0.0485	0.5	
Exchange materials						
4	Spruce	24.97	0.45	0.0497	---	

Exchange material(s), Assembly (Id.3): Solebury Floor over Sallyport
Layer: 2



Space heating

Type	Performance ratio of heat generator [-]	Fuel type
Boiler	1.06	Natural Gas

Space cooling

Type	Distribution	Capacity [kBtu/hr]	COP
Heat pump	| Recirculation air| Dehumidification	480	4.4 | 0.7
Total		**480**	

Water heating

Type	Performance ratio of heat generator [-]	Fuel type
User defined	1.1	Electricity

Water storage

Nr	Capacity [gal]

Infiltration/Ventilation

ACH @ 50 Pascal **7.8** 1/hr

CFM @ 50 Pascal **14,437.1** cfm

Nr	Sensible recovery efficiency [-]	Rate [cfm]	Electric efficiency [W/cfm]	Fan [W]	Defrost	Temperature below which defrost must be used [°F]	Subsoil heat exchanger efficiency [-]
2	0.46	1,624.47	0.02	909.71	yes	16.48	0
Total	**0.33**	**1,624.47**		**909.71**			

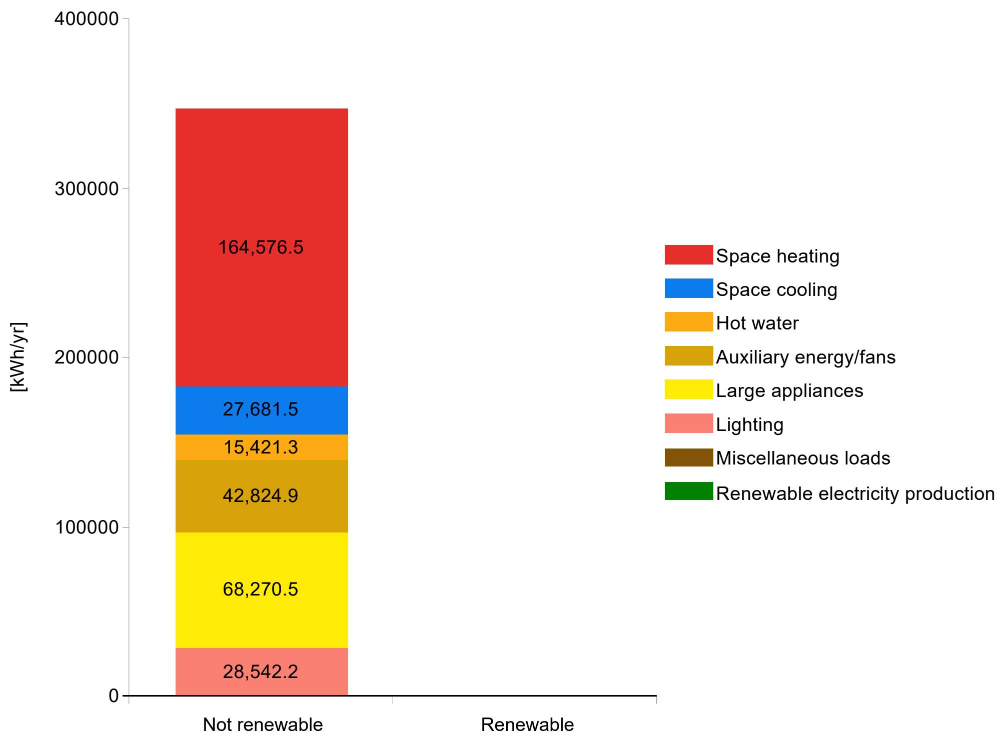
Lights and appliances

Type	Energy use [kWh/yr]	In conditioned space
Boiler heating auxiliary energy	503.19	no
Other	0	no
DHW circulating pump	5,301.65	yes
Heating system circulation pump	6,672.16	yes
Heating system circulation pump	1,592.82	yes
Other	10,857.6	yes
Ventilation winter	6,313.42	yes
Ventilation Defrost	4,357.98	yes
Ventilation summer	7,226.03	yes
Total	**42,824.87**	

SITE ENERGY REPORT

Project name	**Existing Building Conditions**
Climate	**WILLOW GROVE NAS PA**
Type	**Non-residential**
Interior conditioned floor area	**13,988** ft²
Number of units	**1**
Occupants	**25**
Site energy use	**1,184,977.5** kBtu/yr
Specific site energy use	**84.7** kBtu/ft²yr
Site energy use	**347,316.9** kWh/yr
Specific site energy use	**24.8** kWh/ft²yr
Site energy use per person	**13,892.7** kWh/Person yr
Net site energy use (with 100% renewables)	**1,184,977.5** kBtu/yr
Specific net site energy use (with 100% renewables)	**84.7** kBtu/ft²yr
Net site energy use (with 100% renewables)	**347,316.9** kWh/yr
Specific net site energy use (with 100% renewables)	**24.8** kWh/ft²yr
Net site energy use per person (with 100% renewables)	**13,892.7** kWh/Person yr

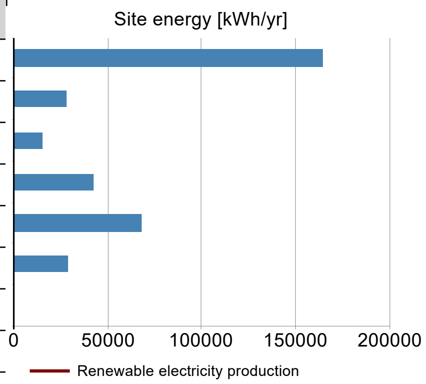
OVERVIEW



SITE ENERGY REPORT

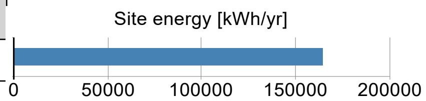
TOTAL USE BY TYPE

Type	Site Energy [kWh/yr]	Specific site energy [kWh/ft² yr]	Site Energy [kBtu/yr]	Specific Site Energy [kBtu/ft² yr]
Space heating	164,576.5	11.8	561,503	40.1
Space cooling	27,681.5	2	94,443.9	6.8
Hot water	15,421.3	1.1	52,614.4	3.8
Auxiliary energy/fans	42,824.9	3.1	146,110.1	10.4
Large appliances	68,270.5	4.9	232,925.6	16.7
Lighting	28,542.2	2	97,380.5	7
Miscellaneous loads	0	0	0	0
Renewable electricity production	0	0	0	0
Total	**347,316.9**	**24.8**	**1,184,977.5**	**84.7**



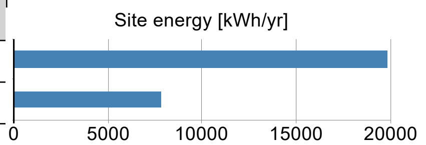
SPACE HEATING

Type	Site Energy [kWh/yr]	Specific site energy [kWh/ft² yr]	Site Energy [kBtu/yr]	Specific Site Energy [kBtu/ft² yr]
Boiler	164,576.5	11.8	561,503	40.1
Total	**164,576.5**	**11.8**	**561,503**	**40.1**



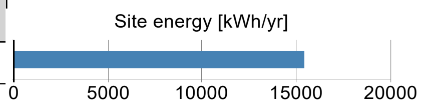
SPACE COOLING

Type	Site Energy [kWh/yr]	Specific site energy [kWh/ft² yr]	Site Energy [kBtu/yr]	Specific Site Energy [kBtu/ft² yr]
Recirculation Cooling	19,836.2	1.4	67,677.4	4.8
Dehumidification	7,845.3	0.6	26,766.5	1.9
Total	**27,681.5**	**2**	**94,443.9**	**6.8**



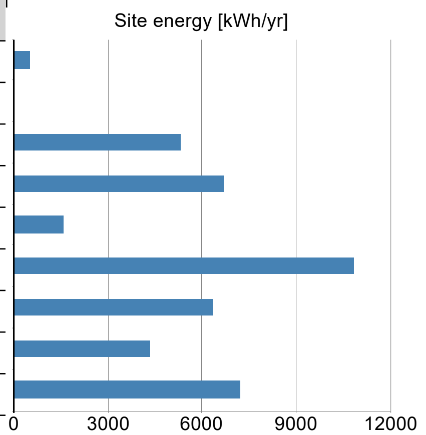
DHW

Type	Site Energy [kWh/yr]	Specific site energy [kWh/ft² yr]	Site Energy [kBtu/yr]	Specific Site Energy [kBtu/ft² yr]
User defined	15,421.3	1.1	52,614.4	3.8
Total	**15,421.3**	**1.1**	**52,614.4**	**3.8**



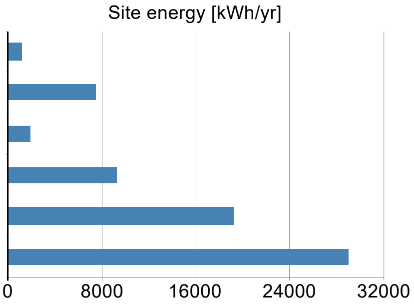
AUXILIARY ENERGY/FANS

Type	Site Energy [kWh/yr]	Specific site energy [kWh/ft² yr]	Site Energy [kBtu/yr]	Specific Site Energy [kBtu/ft² yr]
Boiler heating auxiliary energy	503.2	0	1,716.8	0.1
Other	0	0	0	0
DHW circulating pump	5,301.7	0.4	18,088.2	1.3
Heating system circulation pump	6,672.2	0.5	22,764.1	1.6
Heating system circulation pump	1,592.8	0.1	5,434.4	0.4
Other	10,857.6	0.8	37,044	2.6
Ventilation winter	6,313.4	0.5	21,540.2	1.5
Ventilation Defrost	4,358	0.3	14,868.6	1.1
Ventilation summer	7,226	0.5	24,653.8	1.8
Total	**42,824.9**	**3.1**	**146,110.1**	**10.4**



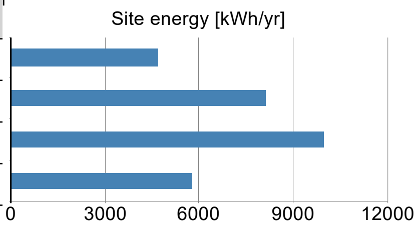
LARGE APPLIANCES

Type	Site Energy [kWh/yr]	Specific site energy [kWh/ft² yr]	Site Energy [kBtu/yr]	Specific Site Energy [kBtu/ft² yr]
Refrigerator	1,197.2	0.1	4,084.6	0.3
PC	7,482.5	0.5	25,528.8	1.8
Monitor	1,916.3	0.1	6,537.9	0.5
Printer	9,307.5	0.7	31,755.4	2.3
Server	19,272	1.4	65,752.3	4.7
User defined	29,095	2.1	99,266.6	7.1
Total	**68,270.5**	**4.9**	**232,925.6**	**16.7**



LIGHTING

Type	Site Energy [kWh/yr]	Specific site energy [kWh/ft² yr]	Site Energy [kBtu/yr]	Specific Site Energy [kBtu/ft² yr]
Lighting	4,713.4	0.3	16,081.2	1.1
Lighting	8,117.5	0.6	27,695.4	2
Lighting	9,950.5	0.7	33,949.2	2.4
Lighting	5,760.8	0.4	19,654.8	1.4
Total	**28,542.2**	**2**	**97,380.5**	**7**



MISC LOADS

Type	Site Energy [kWh/yr]	Specific site energy [kWh/ft² yr]	Site Energy [kBtu/yr]	Specific Site Energy [kBtu/ft² yr]
Total	**0**	**0**	**0**	**0**

SITE ENERGY MONTHLY REPORT

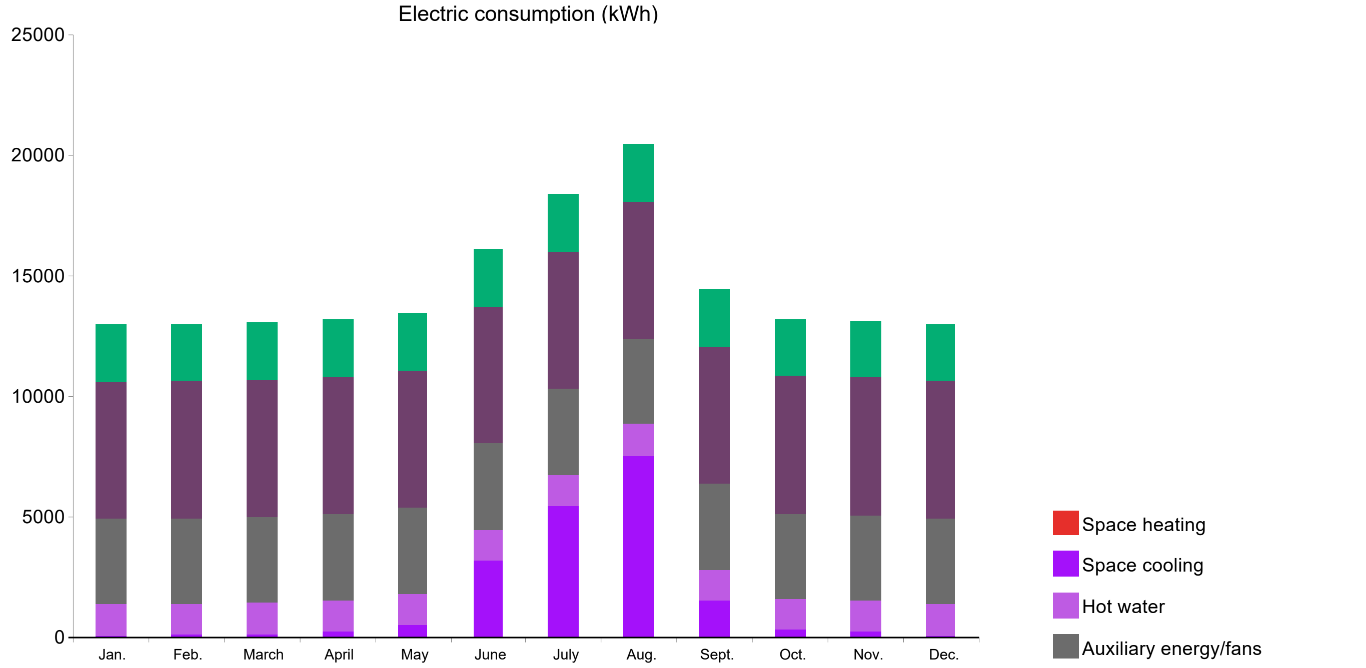
ELECTRICITY USE [kWh]

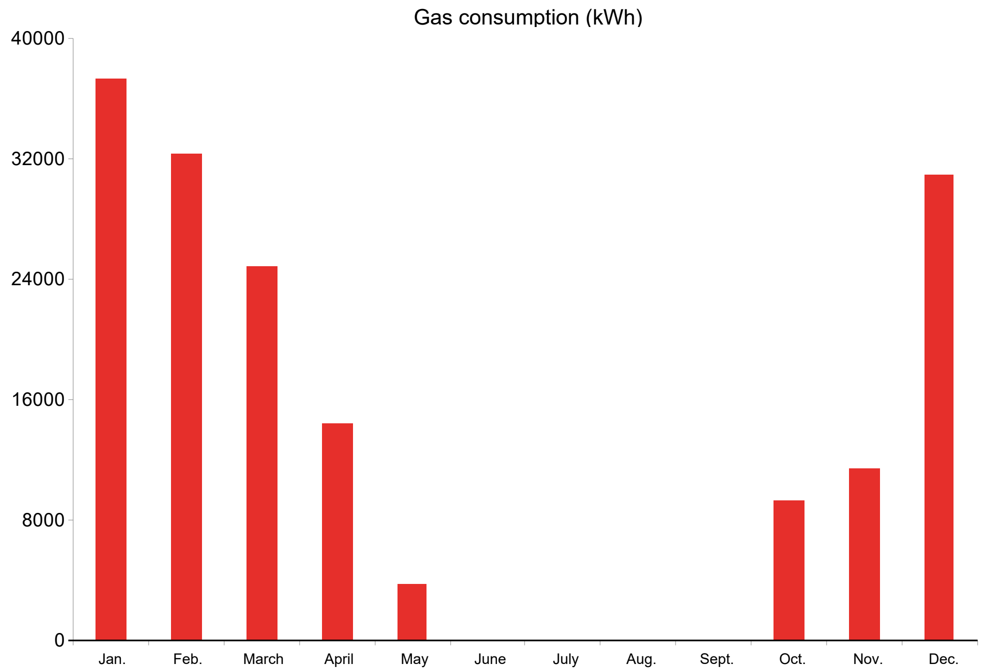
Type	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Space heating	0	0	0	0	0	0	0	0	0	0	0	0
Space cooling	110.88	120.19	177.21	280.38	568.01	3,235.68	5,494.11	7,582.11	1,542.34	327.27	264.95	115.62
Hot water	1,285.11	1,285.11	1,285.11	1,285.11	1,285.11	1,285.11	1,285.11	1,285.11	1,285.11	1,285.11	1,285.11	1,285.11
Auxiliary energy/fans	3,568.74	3,568.74	3,568.74	3,568.74	3,568.74	3,568.74	3,568.74	3,568.74	3,568.74	3,568.74	3,568.74	3,568.74
Large appliances	5,689.21	5,689.21	5,689.21	5,689.21	5,689.21	5,689.21	5,689.21	5,689.21	5,689.21	5,689.21	5,689.21	5,689.21
Lighting	2,378.52	2,378.52	2,378.52	2,378.52	2,378.52	2,378.52	2,378.52	2,378.52	2,378.52	2,378.52	2,378.52	2,378.52
Miscellaneous loads	0	0	0	0	0	0	0	0	0	0	0	0
Renewable electricity production	0	0	0	0	0	0	0	0	0	0	0	0

GAS USE [kWh]

Type	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Space heating	37,391.74	32,359.09	24,891.74	14,420.68	3,755.87	0	0	0	0	9,293.93	11,469.13	30,930.05
Space cooling	0	0	0	0	0	0	0	0	0	0	0	0
Hot water	0	0	0	0	0	0	0	0	0	0	0	0
Auxiliary energy/fans	0	0	0	0	0	0	0	0	0	0	0	0
Large appliances	0	0	0	0	0	0	0	0	0	0	0	0
Lighting	0	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous loads	0	0	0	0	0	0	0	0	0	0	0	0
Renewable electricity production	0	0	0	0	0	0	0	0	0	0	0	0

SITE ENERGY MONTHLY REPORT

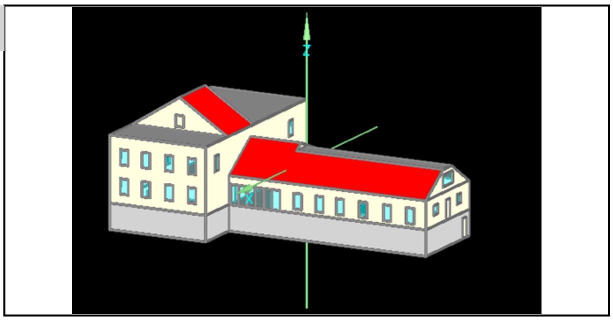




This page begins reporting on the model with potential upgrades.

BUILDING INFORMATION

Category:	**Non-residential**
Status:	**In Planning**
Building type:	**Retrofit**
Year of construction:	**TBD**
Units:	**1**
Number of occupants:	**25 (Design)**
Occupant density:	**559.5** ft²/Person



Boundary conditions

Climate:	**WILLOW GROVE NAS PA**
Internal heat gains:	**2.9** Btu/hr ft²
Interior temperature:	**70** °F
Overheat temperature:	**77** °F

Building geometry

Enclosed volume:	**145,421.4** ft³
Net-volume:	**110,520.3** ft³
Total area envelope:	**21,277.6** ft²
Area/Volume Ratio:	**0.1** 1/ft
Floor area:	**13,988** ft²
Envelope area/iCFA:	**1.521**

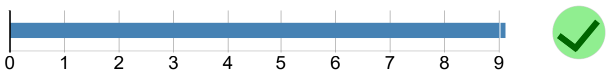
PASSIVEHOUSE REQUIREMENTS

Certificate criteria:

Heating/Cooling Demand Targets from CBECS Building Peer Group Data. See Page 91.

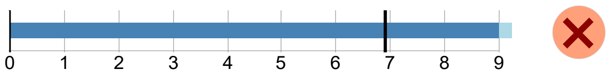
Heating demand

specific:	**26.18** kBtu/ft²yr
target:	**27.1** kBtu/ft²yr
total:	366,137.81 kBtu/yr



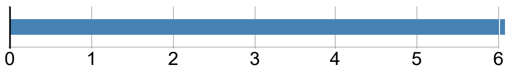
Cooling demand

sensible:	**12.92** kBtu/ft²yr
latent:	**1.52** kBtu/ft²yr
specific:	**14.45** kBtu/ft²yr
target:	**6.9** kBtu/ft²yr
total:	202,050.92 kBtu/yr



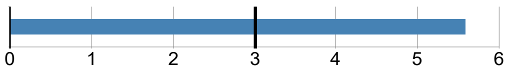
Heating load

specific:	**17.09** Btu/hr ft²
target:	**22** Btu/hr ft²
total:	239,017.54 Btu/hr



Cooling load

specific:	**5.6** Btu/hr ft²
target:	**3** Btu/hr ft²
total:	78,319.94 Btu/hr

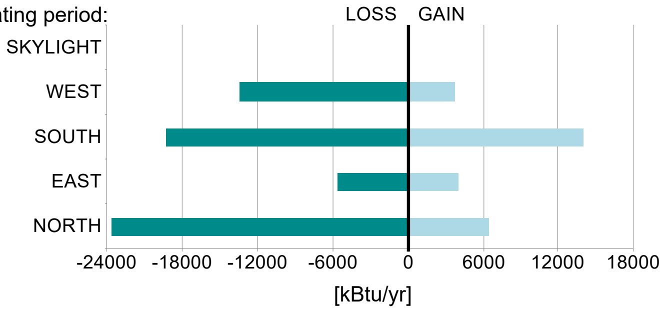


BUILDING ELEMENTS

Windows

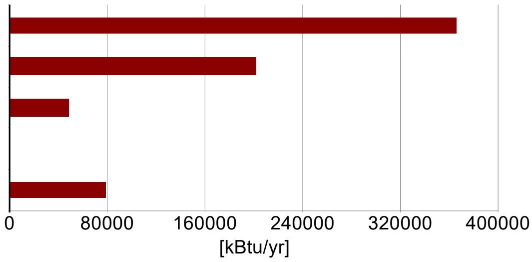
Average SHGC:	**0.45**
Average solar reduction factor heating:	**0.59**
Average solar reduction factor cooling:	**0.64**
Average U-value:	**0.463** Btu/hr ft² °F
Total glazing area:	**847.3** ft²
Total window area:	**1,119.6** ft²

Heat gain/loss heating period:



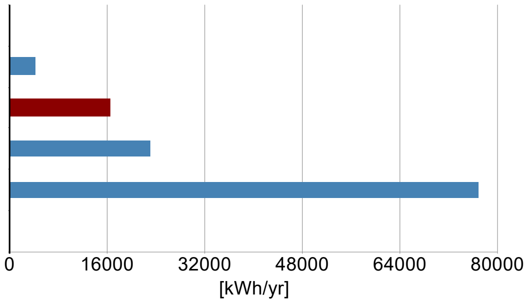
HVAC

Total heating demand:	**366,381** kBtu/yr
Total cooling demand:	**202,051** kBtu/yr
Total DHW energy demand:	**48,772** kBtu/yr
Solar DHW contribution:	**0** kBtu/yr
Auxiliary electricity:	**78,558** kBtu/yr



Electricity

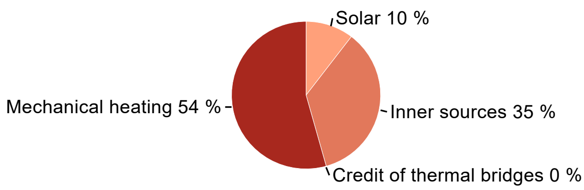
Direct heating / DHW:	**0** kWh/yr
Heatpump heating:	**4,003** kWh/yr
Cooling:	**16,492** kWh/yr
HVAC auxiliary energy:	**23,025** kWh/yr
Appliances:	**76,832** kWh/yr
Renewable generation, coincident production and use:	**0** kWh/yr
Total electricity demand:	**120,351** kWh/yr



HEAT FLOW - HEATING PERIOD

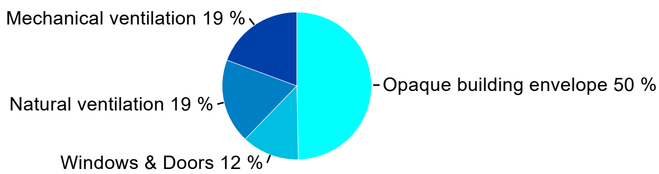
Heat gains

Solar:	**59,221** kBtu/yr
Inner sources:	**200,565** kBtu/yr
Credit of thermal bridges:	**0** kBtu/yr
Mechanical heating:	**366,138** kBtu/yr



Heat losses

Opaque building envelope:	**311,020** kBtu/yr
Windows & Doors:	**78,113** kBtu/yr
Natural ventilation:	**115,881** kBtu/yr
Mechanical ventilation:	**120,910** kBtu/yr

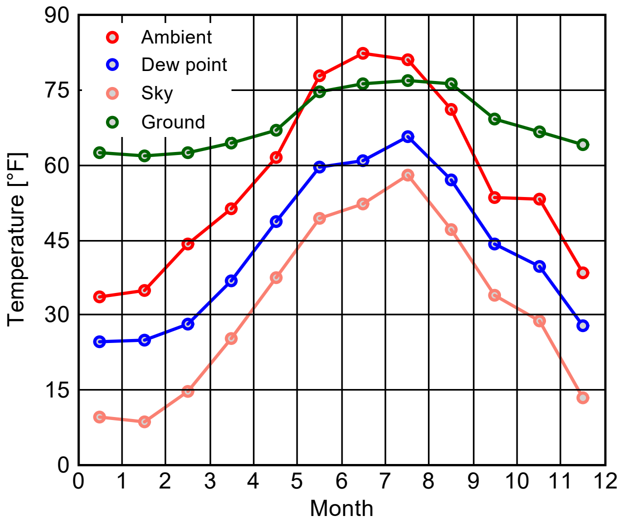


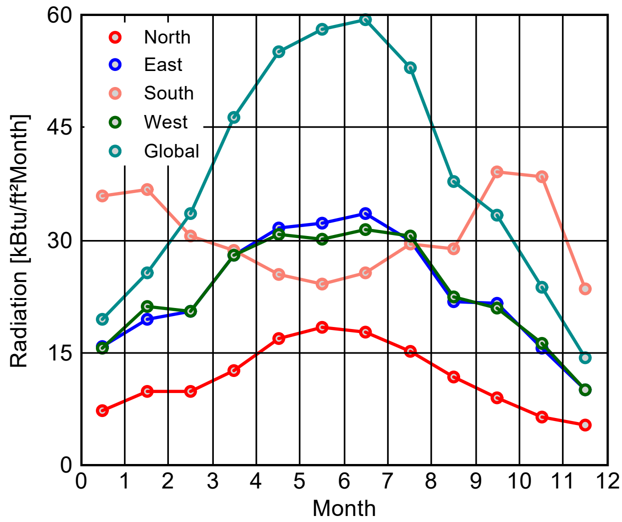
CLIMATE

Latitude:	**40.2** °
Longitude:	**-75.2** °
Elevation of weather station:	**334.6** ft
Elevation of building site:	**334.6** ft
Heat capacity air:	**0.018** Btu/ft³F
Daily temperature swing summer:	**20** °F
Average wind speed:	**13.1** ft/s

Ground

Average ground surface temperature:	**58.7** °F
Amplitude ground surface temperature:	**56.3** °F
Ground thermal conductivity:	**1.2** Btu/hr ft °F
Ground heat capacity:	**29.8** Btu/ft³F
Depth below grade of groundwater:	**9.8** ft
Flow rate groundwater:	**0.2** ft/d





Calculation parameters

Length of heating period	**243** days/yr
Heating degree hours	**111.1** kFh/a
Phase shift months	**0.7** mths
Time constant heating demand	**20.9** hr
Time constant cooling demand	**0** hr
Time constant cooling demand with night ventilation	**0** hr

Climate for	Heating load 1	Heating load 2	Cooling
Temperature [°F]	23.4	31.3	81.5
Solar radiation North [Btu/hr ft²]	9.5	7.9	24.4
Solar radiation East [Btu/hr ft²]	22.5	16.8	42.2
Solar radiation South [Btu/hr ft²]	51.4	33	39.3
Solar radiation West [Btu/hr ft²]	20.9	14.6	46
Solar radiation Global [Btu/hr ft²]	24.7	18.1	84.3

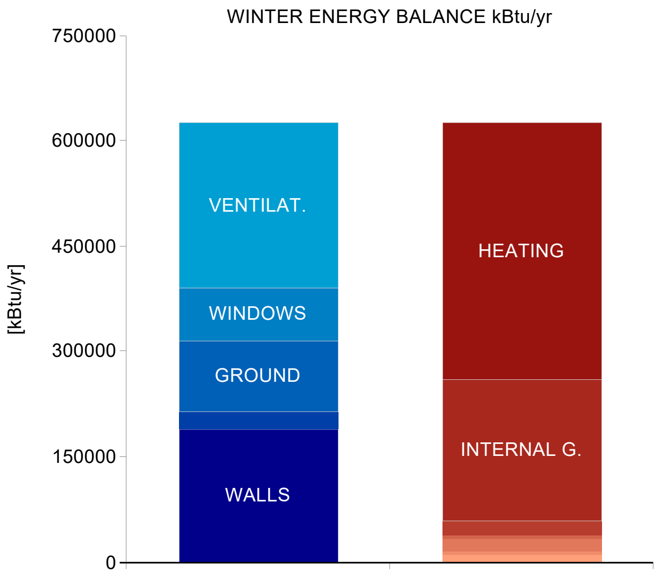
Relevant boundary conditions for heating load calculation: Heating load 1

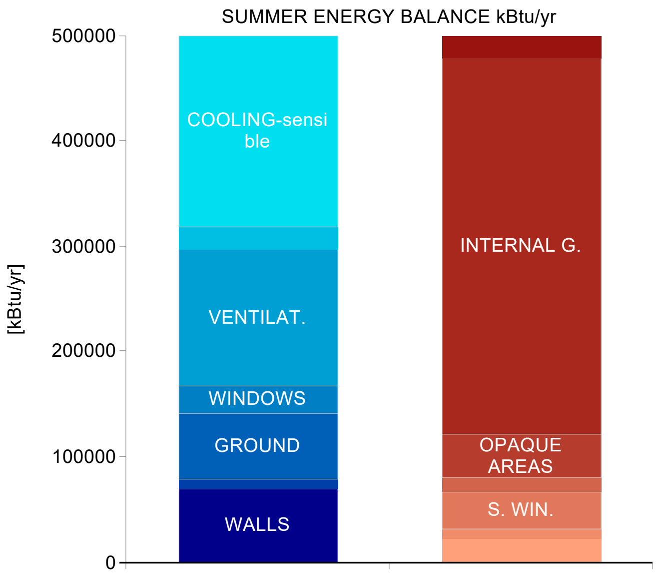
ANNUAL HEAT DEMAND

Transmission losses :	**389,133**	kBtu/yr
Ventilation losses:	**236,791**	kBtu/yr
Total heat losses:	**625,923**	kBtu/yr
Solar heat gains:	**70,077**	kBtu/yr
Internal heat gains:	**237,331**	kBtu/yr
Total heat gains:	**307,409**	kBtu/yr
Utilization factor:	**84.5**	%
Useful heat gains:	**259,786**	kBtu/yr
Annual heat demand:	**366,138**	kBtu/yr
Specific annual heat demand:	**26,177.7**	Btu/ft²yr

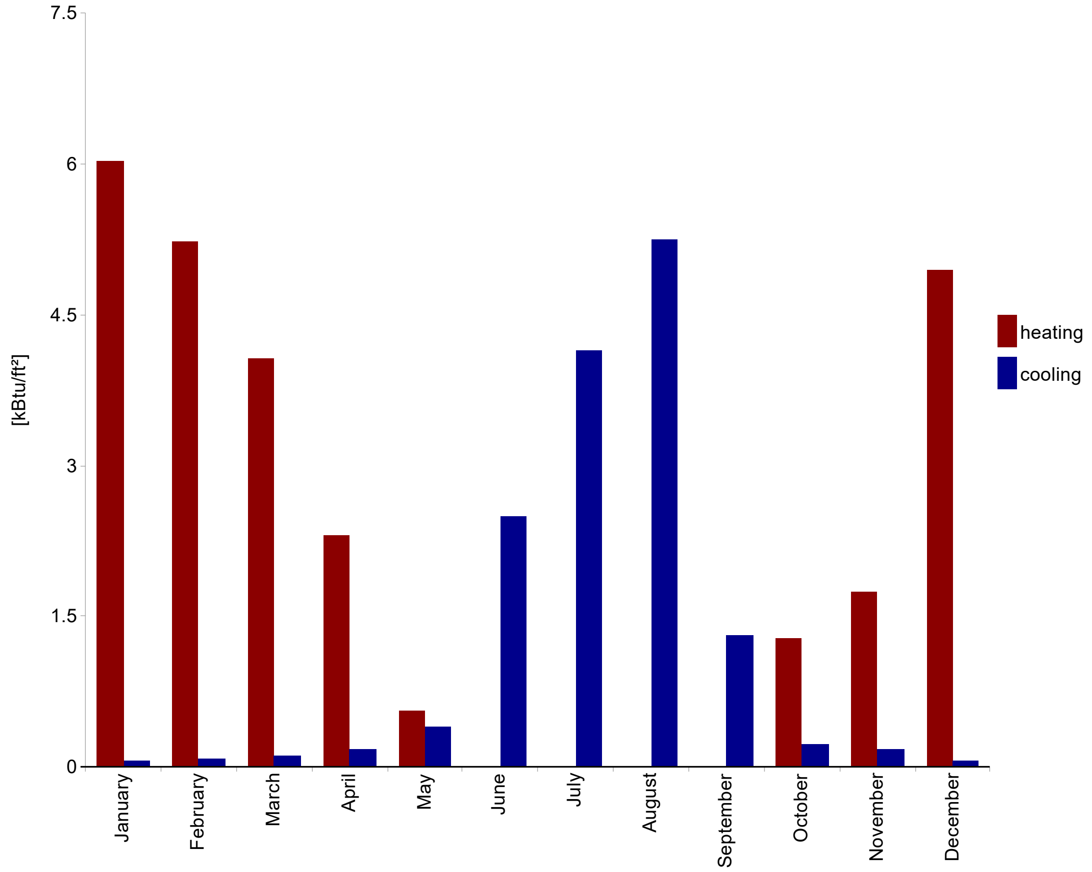
ANNUAL COOLING DEMAND

Solar heat gains:	**121,000**	kBtu/yr
Internal heat gains:	**356,485**	kBtu/yr
Total heat gains:	**477,485**	kBtu/yr
Transmission losses :	**651,277**	kBtu/yr
Ventilation losses:	**509,283**	kBtu/yr
Total heat losses:	**1,160,560**	kBtu/yr
Utilization factor:	**25.6**	%
Useful heat losses:	**296,711**	kBtu/yr
Cooling demand - sensible:	**180,774**	kBtu/yr
Cooling demand - latent:	**21,277**	kBtu/yr
Annual cooling demand:	**202,051**	kBtu/yr
Specific annual cooling demand:	**14.4**	kBtu/ft²yr



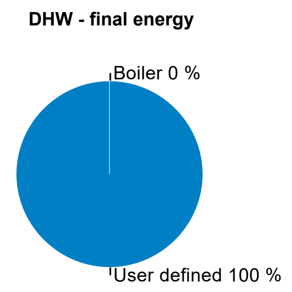


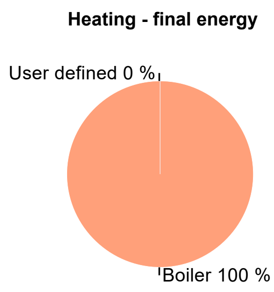
SPECIFIC HEAT/COOLING DEMAND MONTHLY



Month	Heating [kBtu/ft²]	Cooling [kBtu/ft²]
January	6	0.1
February	5.2	0.1
March	4.1	0.1
April	2.3	0.2
May	0.6	0.4
June	0	2.5
July	0	4.1
August	0	5.3
September	0	1.3
October	1.3	0.2
November	1.7	0.2
December	5	0.1

System	DHW			Heating			Total		
	Covered DHW demand [%]	Estimated solar fraction [%]	Final energy demand [kBtu/yr]	Covered heating demand [%]	Estimated solar fraction [%]	Final energy demand [kBtu/yr]	Performance ratio	CO2 equivalent emissions [lb/yr]	Source energy demand [kBtu/yr]
Boiler, Lochinvar Knight XL Boiler	0	0	0	100	0	390,230.2	0	63,039.2	429,253.2
User defined, Trane Chiller	100	0	13,656.1	0	0	0	0.3	20.5	24,581
Σ	100	0	13,656.1	100	0	390,230.2		63,059.7	453,834.2





COOLING UNITS

	sensible	latent
Air cooling:	**0** kBtu/ft²yr	**0** kBtu/ft²yr
Recirculation cooling:	**12.9** kBtu/ft²yr	**0.4** kBtu/ft²yr
Additional dehumidification:		**1.4** kBtu/ft²yr
Panel cooling:	**0** kBtu/ft²yr	
Sum:	**12.9** kBtu/ft²yr	**1.7** kBtu/ft²yr

Boiler

Boiler type:	**Gas**
Condensing:	**yes**
In thermal envelope:	**no**
Boiler output:	**658,000** Btu/hr
Efficiency at 30% load:	**98** %
Efficiency at normal output:	**94** %
Heatloss at 70°C standby:	**0.5** %

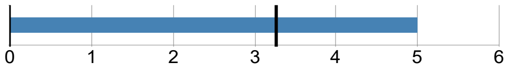
VENTILATION

Energy transportable by supply air

Heating energy

transportable: **3.27** W/ft²

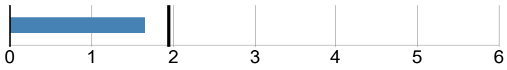
load: **5.01** W/ft²



Cooling energy

transportable: **1.94** W/ft²

load: **1.64** W/ft²



Infiltration pressure test ACH50: **5.88** 1/hr

Total extract air demand: **2,760** cfm

Supply air per person: **18** cfm

Occupancy: **25**

Average air flow rate: **1,978.27** cfm

Average air change rate: **1.07** 1/hr

Effective ACH ambient: **0.84** 1/hr

Effective ACH ground: **0** 1/hr

Energetically effective air exchange: **0.84** 1/hr

Infiltration air change rate: **0.41** 1/hr

Infiltration air change rate (heating load): **1.03** 1/hr

Type of ventilation system: **Balanced ventilation**

Wind screening coefficient (e): **0.07**

Wind exposure factor: **15**

Wind shield factor: **0.05**

Ventilation heat losses: **196,238.59** kBtu/yr

Devices

Name	Sensible recovery efficiency [-]	Electric efficiency [W/cfm]	Heat recovery efficiency SHX [-]	Effective recovery efficiency [-]
Greenheck ERVs	0.8	0.03	0	0.8
Altogether	0.6	0.02	0	0.6

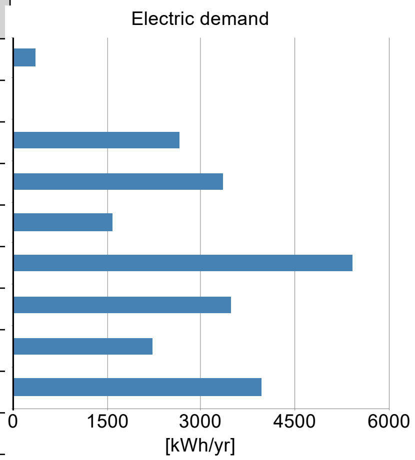
Ducts

Name	Length (total) [ft]	Clear cross-section [ft²]	U-value [Btu/hr ft² °F]	Assigned ventilation units
Supply / outdoor air duct	15	1.3889	4.58	Greenheck ERVs
Extract / Exhaust air duct	15	1.3889	4.58	Greenheck ERVs
Σ	30			

*length * quantity ** thermal conductivity / thickness

ELECTRICITY DEMAND - AUXILIARY ELECTRICITY

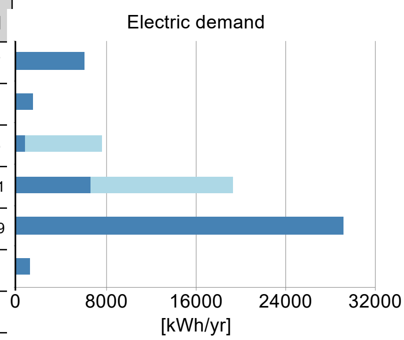
Type	Quantity	Indoor	Norm demand	Electric demand [kWh/yr]	Source energy [kBtu/yr]
Boiler heating auxiliary energy	1	no	187.5 W	348	2137.2
Other	1	no	0 W	0	0
DHW circulating pump	1	yes	377 W	2650.8	16279.4
Heating system circulation pump	1	yes	1,131 W	3336.1	20487.7
Heating system circulation pump	18	yes	30 W	1592.8	9781.9
Other	1	yes	1,885 W	5428.8	33339.6
Ventilation winter	1	yes	0.4 W/cfm	3472.4	21324.8
Ventilation Defrost	1	yes	10,251.9 W	2222	13645.7
Ventilation summer	1	yes	0.4 W/cfm	3974.3	24407.3
Σ				23025.2	141403.6



ELECTRICITY DEMAND NON-RESIDENTIAL BUILDING

Equipment

Type	Quantity	Indoor	Utilization pattern	Power rating norm demand	Electric demand [kWh/yr]	Source energy [kBtu/yr]
PC	25	yes	Pattern 1: Government Building	82 (+82) W	6,150 (+0)	37768.7
Monitor	25	yes	Pattern 1: Government Building	21 (+21) W	1,575 (+0)	9672.5
Printer	6	yes	Pattern 1: Government Building	425 (+425) W	765 (+6,885)	46980.6
Server	1	yes	Pattern 1: Government Building	2,200 (+2,200) W	6,600 (+12,672)	118354.1
User defined	1	yes		13,988 (+0) W	29,095 (+0)	178679.9
Refrigerator	2	yes		1.6 kWh/d	1197.2	7352.3
Σ	60				45,382.2 (+19,557)	398808



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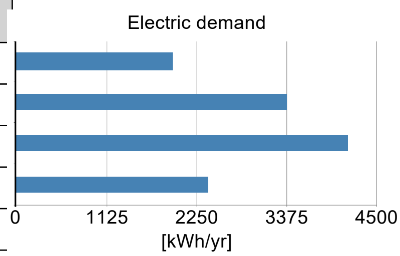
Lighting

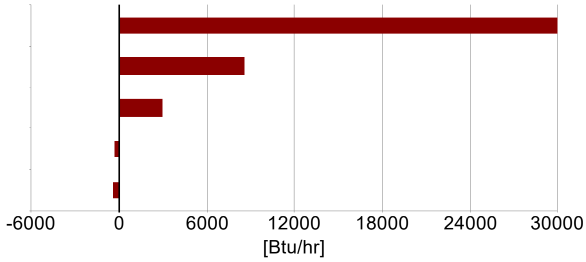
Name	Utilization pattern	Installed lighting power [W/ft²]	Daylight utilization	Lighting full load hours [hrs/yr]	Electric demand [kWh/yr]	Source energy [kBtu/yr]
Lighting 1	Pattern 1: Government Building	0.5	Low	3120	1963.9	12060.9
Lighting 2	Pattern 1: Government Building	0.5	Low	1560	3382.3	20771.5
Lighting 3	Pattern 1: Government Building	0.5	Low	1560	4146	25461.9
Lighting 4	Pattern 1: Government Building	0.5	Low	1560	2400.3	14741.1
Σ					11892.6	73035.4



INTERNAL HEAT GAINS

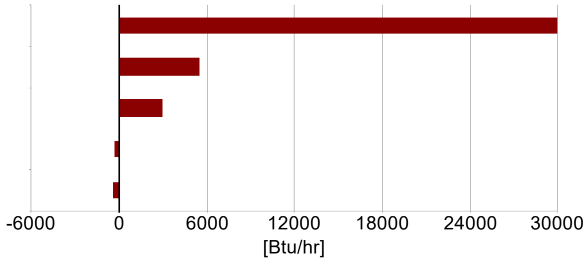
Heating season

Electricity total:	**29,927.1**	Btu/hr
Auxiliary electricity:	**8,569.4**	Btu/hr
People:	**2,921.4**	Btu/hr
Cold water:	**-280.9**	Btu/hr
Evaporation:	**-438.2**	Btu/hr
Σ:	**40,698.7**	Btu/hr
Specific internal heat gains:	**2.9**	Btu/hr ft²



Cooling season

Electricity total:	**29,927.1**	Btu/hr
Auxiliary electricity:	**5,496.7**	Btu/hr
People:	**2,921.4**	Btu/hr
Cold and hot water:	**-280.9**	Btu/hr
Evaporation:	**-438.2**	Btu/hr
Σ:	**40,698.7**	Btu/hr
Specific internal heat gains:	**2.9**	Btu/hr ft²



DHW AND DISTRIBUTION

DHW consumption per person per day:	**3.2**	gal/Person/day
Average cold water temperature supply:	**58.7**	°F
Useful heat DHW:	**6,921.1**	kBtu/yr
Specific useful heat DHW:	**494.8**	Btu/ft²yr
Total heat losses of the DHW system:	**41,850.8**	kBtu/yr
Specific losses of the DHW system:	**2,992.2**	Btu/ft²yr
Performance ratio DHW distribution system and storage:	**7**	
Utilization ratio DHW distribution system and storage:	**0.1**	
Total heat demand of DHW system:	**48,771.9**	kBtu/yr
Total specific heat demand of DHW system:	**3,487**	Btu/ft²yr
Total heat losses of the hydronic heating distribution:	**242.8**	kBtu/yr
Specific losses of the hydronic heating distribution:	**17.4**	Btu/ft²yr
Performance ratio of heat distribution:	**100.1**	%

Region	Length [ft]	Annual heat loss [kBtu/yr]
Hydronic heating distribution pipes		
In conditioned space	715	242.8
Σ	715	242.8
DHW circulation pipes		
In conditioned space	430	37148.5
Σ	430	37148.5
Individual pipes		
In conditioned space		0
Σ		0
Water storage		
Σ		0

SPECIFICATIONS REPORT

Property/Site

Building name **Solebury Township Municipal Building**

Property information

Owner's name	**Solebury Township**
Property address	**3092 Sugan Road**
City	**Solebury**
Zip	**18963**

Site information

Climate Location **WILLOW GROVE NAS PA**

Building

Building Information

Area of Conditioned Space	**13,988** ft²
Volume of conditioned space	**110,520.3** ft³
Number of bedrooms	**4**
Foundation Type	**Heated basement, or underground floor slab / Slab on grade**
Winter setpoint temperature	**70** °F
Summer setpoint temperature	**77** °F

Below grade walls

Name	Area [ft²]	Assembly
Below Grade Basement Walls	1,455.9	Uninsulated CMU Wall

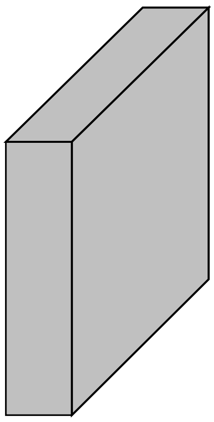
Assembly (Id.2): Uninsulated CMU Wall

Homogenous layers

Thermal resistance: 1.859 hr ft² °F/Btu (without Rsi, Rse)

Heat transfer coefficient (U-value): 0.385 Btu/hr ft² °F

Thickness: 9.449 in



Nr.	Material/Layer (from outside to inside)	ρ [lb/ft³]	c [Btu/lb°F]	λ [Btu/hr ft °F]	Thickness [in]	Color
1	Concrete Brick	144.52	0.19	0.4235	9.449	

Slab floor

Name	Area [ft²]	Assembly
Slab	4,540.7	4" concrete Uninsulated

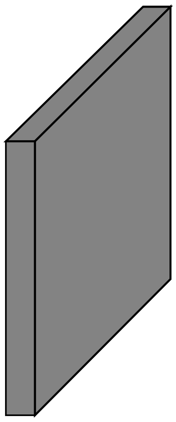
Assembly (Id.4): 4" concrete Uninsulated

Homogenous layers

Thermal resistance: 0.42 hr ft² °F/Btu (without Rsi, Rse)

Heat transfer coefficient (U-value): 0.722 Btu/hr ft² °F

Thickness: 4 in



Nr.	Material/Layer (from outside to inside)	ρ [lb/ft³]	c [Btu/lb°F]	λ [Btu/hr ft °F]	Thickness [in]	Color
1	Concrete	131.35	0.19	0.7933	4	

Heated basement, or underground floor slab

Floor slab area	**2,271** ft²
U-Value of basement slab	**0.7** Btu/hr ft² °F
Floor slab perimeter (P)	**395** ft
Depth of basement slab below grade	**6** ft
U-Value of basement wall	**0.4** Btu/hr ft² °F
Total R-value of perimeter insulation	**2.8** hr ft² °F/Btu

Slab on grade

Floor slab area	**2,271** ft²
U-Value of basement slab	**0.7** Btu/hr ft² °F
Floor slab perimeter (P)	**546** ft
Total R-value of perimeter insulation	**NaN** hr ft² °F/Btu

Above-grade walls & Rim/band joists

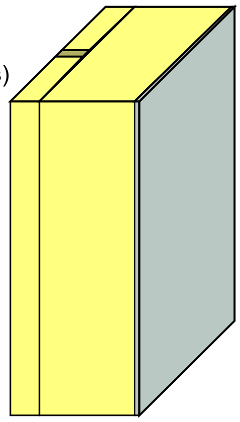
Name	Orientation	Area [ft²]	Short wave radiation absorption	Assembly
Flat Attic New Building	Horizontal (100 %)	2,011.1	0.4	Solebury Flat Attic New Building (Cavity Blown Full to Truss Chords)
Cathedral Ceiling2	Horizontal (100 %)	236	0.4	Solebury Mech Loft Cathedral Ceiling (Corrected Install + Air Barrier)
Floor over Sallyport	Horizontal (100 %)	510.7	0.4	Solebury Floor over Sallyport (Cavity Blown Full)
Above Grade Wall New Building	SE (29 %), SW (17 %), NE (17 %), NW (37 %)	4,249.3	0.4	Solebury Above Grade Wall New Building
Walkout Basement Walls	SE (13 %), NE (53 %), NW (34 %)	1,797.8	0.4	Uninsulated CMU Wall
Above Grade Walls Old Building	SE (28 %), SW (34 %), NE (36 %), NW (2 %)	1,577.5	0.4	Solebury Above Grade Wall Old Building
Attic Knee-Wall	SW (50 %), NE (50 %)	400.7	0.4	Solebury Attic Knee-Wall (2" Rigid Foam Air Barrier Installed)
Flat Attic Old Building	Horizontal (100 %)	362	0.4	Solebury Mech Loft Cathedral Ceiling (Corrected Install + Air Barrier)
Cathedral Ceiling1	SE (14 %), SW (41 %), NE (32 %), NW (14 %)	2,911.1	0.4	Solebury Mech Loft Cathedral Ceiling (Corrected Install + Air Barrier)
Total		**14,056.3**		

Assembly (Id.10): Solebury Flat Attic New Building (Cavity Blown Full to Truss Chords)

Inhomogenous layers

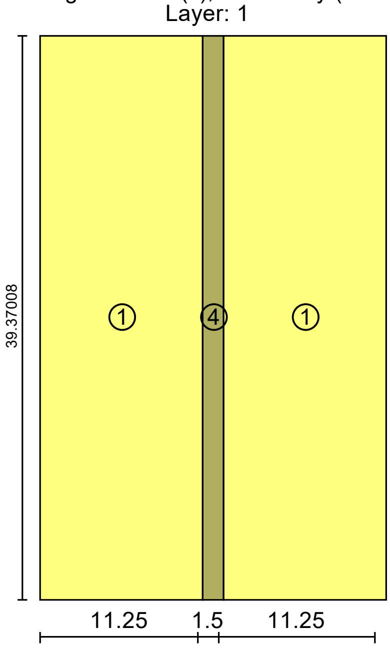
Thermal resistance: 63.4 / 64.308 hr ft² °F/Btu (EN ISO 6946 / homogenous layers)

Thickness: 15.992 in



Nr.	Material/Layer (from outside to inside)	ρ [lb/ft³]	c [Btu/lb°F]	λ [Btu/hr ft °F]	Thickness [in]	Color
1	Fibre Glass	1.87	0.2	0.0202	3.5	
2	Fibre Glass	1.87	0.2	0.0202	12	
3	Gypsum Board (USA)	53.06	0.21	0.0942	0.492	
Exchange materials						
4	Spruce	24.97	0.45	0.0497	---	

Exchange material(s), Assembly (Id.10): Solebury Flat Attic New Building (Cavity Blown Full to Truss Chords)

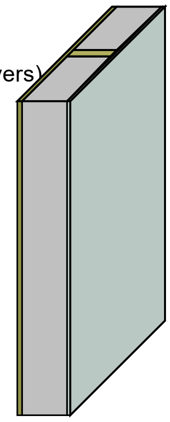


Assembly (Id.11): Solebury Mech Loft Cathedral Ceiling (Corrected Install + Air Barrier)

Inhomogenous layers

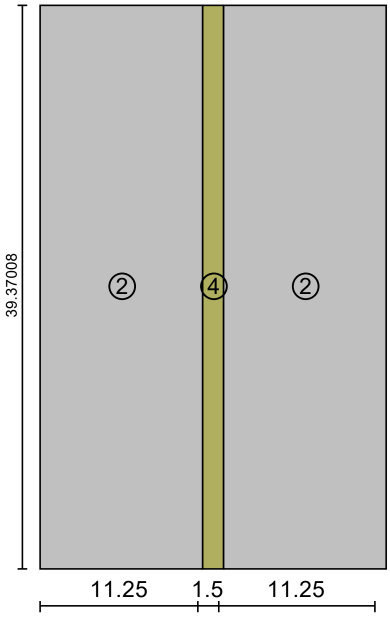
Thermal resistance: 21.786 / 23.485 hr ft² °F/Btu (EN ISO 6946 / homogenous layers)

Thickness: 6.583 in



Nr.	Material/Layer (from outside to inside)	ρ [lb/ft³]	c [Btu/lb°F]	λ [Btu/hr ft °F]	Thickness [in]	Color
1	Plywood (USA)	29.34	0.45	0.0485	0.591	
2	Cellulose Fibre Insulation	1.87	0.45	0.0208	5.5	
3	Gypsum Board (USA)	53.06	0.21	0.0942	0.492	
Exchange materials						
4	Spruce	24.97	0.45	0.0497	---	

Exchange material(s), Assembly (Id.11): Solebury Mech Loft Cathedral Ceiling (Corrected Install + Air Barrier)
Layer: 2

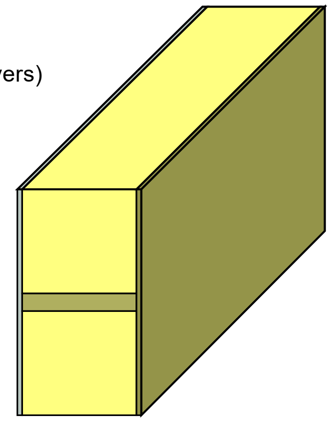


Assembly (Id.12): Solebury Floor over Sallyport (Cavity Blown Full)

Inhomogenous layers

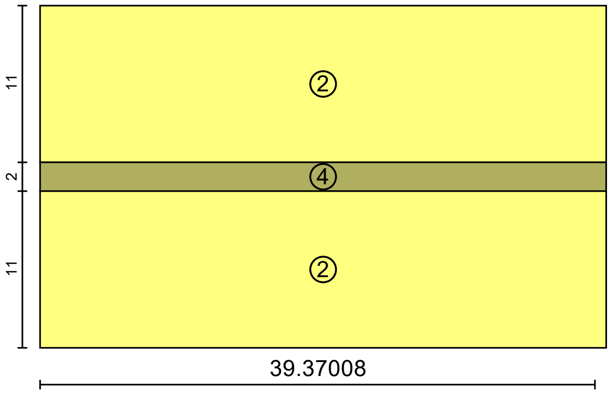
Thermal resistance: 45.468 / 50.743 hr ft² °F/Btu (EN ISO 6946 / homogenous layers)

Thickness: 12.992 in



Nr.	Material/Layer (from outside to inside)	ρ [lb/ft³]	c [Btu/lb°F]	λ [Btu/hr ft °F]	Thickness [in]	Color
1	Gypsum Board (USA)	53.06	0.21	0.0942	0.492	
2	Fibre Glass	1.87	0.2	0.0202	12	
3	Plywood (USA)	29.34	0.45	0.0485	0.5	
Exchange materials						
4	Spruce	24.97	0.45	0.0497	---	

Exchange material(s), Assembly (Id.12): Solebury Floor over Sallyport (Cavity Blown Full)
Layer: 2



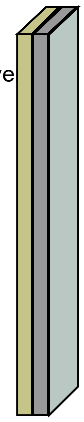
Assembly (Id.6): Solebury Above Grade Wall New Building

Inhomogenous layers

Thermal resistance: 10.763 / 18.276 hr ft² °F/Btu (EN ISO 6946 / homogenous laye

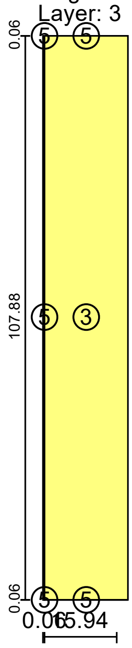
Heat transfer coefficient (U-value): 0.085 Btu/hr ft² °F

Thickness: 9.083 in



Nr.	Material/Layer (from outside to inside)	ρ [lb/ft³]	c [Btu/lb°F]	λ [Btu/hr ft °F]	Thickness [in]	Color
1	Sandstone	138.84	0.18	0.973	4	
2	Plywood (USA)	29.34	0.45	0.0485	0.591	
3	Fibre Glass	1.87	0.2	0.0202	4	
4	Gypsum Board (USA)	53.06	0.21	0.0942	0.492	
Exchange materials						
5	Metal Deck, unperforated	486.94	0.11	26.5784	---	

Exchange material(s), Assembly (Id.6): Solebury Above Grade Wall New Building



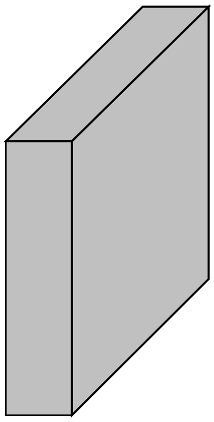
Assembly (Id.2): Uninsulated CMU Wall

Homogenous layers

Thermal resistance: 1.859 hr ft² °F/Btu (without Rsi, Rse)

Heat transfer coefficient (U-value): 0.385 Btu/hr ft² °F

Thickness: 9.449 in



Nr.	Material/Layer (from outside to inside)	ρ [lb/ft³]	c [Btu/lb°F]	λ [Btu/hr ft °F]	Thickness [in]	Color
1	Concrete Brick	144.52	0.19	0.4235	9.449	

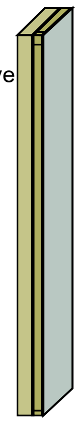
Assembly (Id.7): Solebury Above Grade Wall Old Building

Inhomogenous layers

Thermal resistance: 10.301 / 11.851 hr ft² °F/Btu (EN ISO 6946 / homogenous laye

Heat transfer coefficient (U-value): 0.089 Btu/hr ft² °F

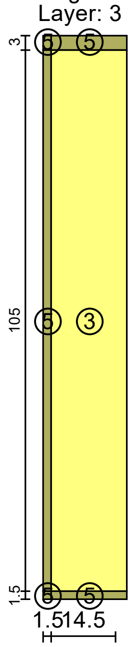
Thickness: 7.484 in



SPECIFICATIONS REPORT

Nr.	Material/Layer (from outside to inside)	ρ [lb/ft³]	c [Btu/lb°F]	λ [Btu/hr ft °F]	Thickness [in]	Color
1	Sandstone	138.84	0.18	0.973	4	
2	Oriented Strand Board	40.58	0.45	0.0532	0.492	
3	Fibre Glass	1.87	0.2	0.0202	2.5	
4	Gypsum Board (USA)	53.06	0.21	0.0942	0.492	
	Exchange materials					
5	Spruce	24.97	0.45	0.0497	---	

Exchange material(s), Assembly (Id.7): Solebury Above Grade Wall Old Building
Layer: 3

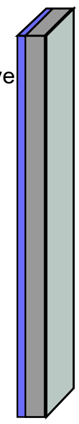


Assembly (Id.13): Solebury Attic Knee-Wall (2" Rigid Foam Air Barrier Installed)

Inhomogenous layers

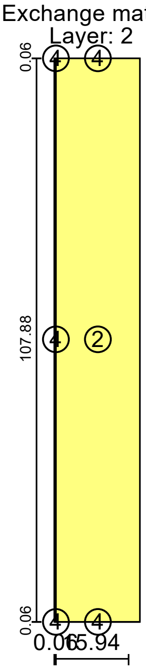
Thermal resistance: 24.684 / 34.638 hr ft² °F/Btu (EN ISO 6946 / homogenous laye

Thickness: 7.992 in



Nr.	Material/Layer (from outside to inside)	ρ [lb/ft³]	c [Btu/lb°F]	λ [Btu/hr ft °F]	Thickness [in]	Color
1	Extruded Polystyrene Insulation	1.79	0.35	0.0144	2	
2	Fibre Glass	1.87	0.2	0.0202	5.5	
3	Gypsum Board (USA)	53.06	0.21	0.0942	0.492	
	Exchange materials					
4	Metal Deck, unperforated	486.94	0.11	26.5784	---	

Exchange material(s), Assembly (Id.13): Solebury Attic Knee-Wall (2" Rigid Foam Air Barrier Installed)



Windows and Glass Doors

Name	Orientation	Area [ft²]	Window type
Windows	SE (9 %), SW (31 %), NE (38 %), NW (22 %)	1,119.6	Glazing: Reflective 2, Frame: Wood/Vinyl - Operable

Window type (Id 1): Glazing: Reflective 2, Frame: Wood/Vinyl - Operable

Basic data

Uw -mounted [Btu/hr ft² °F]	0.4614
Frame factor	0.7859
Glass U-value [Btu/hr ft² °F]	0.45
SHGC/Solar energy transmittance (perpendicular)	0.45

Frame data

Setting	Left	Right	Top	Bottom
Frame width [in]	3	3	3	3
Frame U-value [Btu/hr ft² °F]	.23	.23	.23	.23
Glazing-to-frame psi-value [Btu/hr ft °F]	.04	.04	.04	.04
Frame-to-Wall psi-value [Btu/hr ft °F]	.029	.029	.029	.029

Solar radiation angle dependent data

Angle [°]	Total solar trans.
0	0.22

Doors

Name	Orientation	Area [ft²]	Short wave radiation absorption	Assembly
Opaque Doors	SE (40 %), SW (11 %), NE (30 %), NW (19 %)	105.1	0.4	Exterior Door

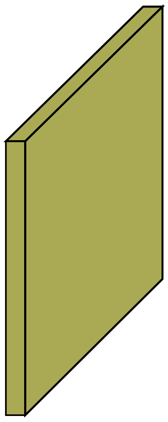
Assembly (Id.1): Exterior Door

Homogenous layers

Thermal resistance: 3.333 hr ft² °F/Btu (without Rsi, Rse)

Heat transfer coefficient (U-value): 0.233 Btu/hr ft² °F

Thickness: 2.75 in



Nr.	Material/Layer (from outside to inside)	ρ [lb/ft³]	c [Btu/lb°F]	λ [Btu/hr ft °F]	Thickness [in]	Color
1	Southern Yellow Pine	31.21	0.45	0.0688	2.75	

Ceilings

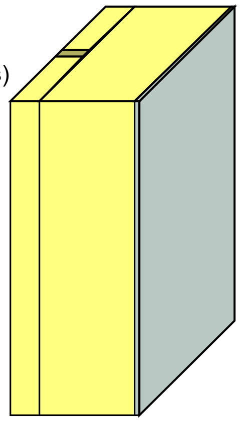
Name	Area [ft²]	Short wave radiation absorption	Assembly
Flat Attic New Building	2,011.1	0.4	Solebury Flat Attic New Building (Cavity Blown Full to Truss Chords)
Cathedral Ceiling2	236	0.4	Solebury Mech Loft Cathedral Ceiling (Corrected Install + Air Barrier)
Floor over Sallyport	510.7	0.4	Solebury Floor over Sallyport (Cavity Blown Full)
Flat Attic Old Building	362	0.4	Solebury Mech Loft Cathedral Ceiling (Corrected Install + Air Barrier)
Total	**3,119.8**		

Assembly (Id.10): Solebury Flat Attic New Building (Cavity Blown Full to Truss Chords)

Inhomogenous layers

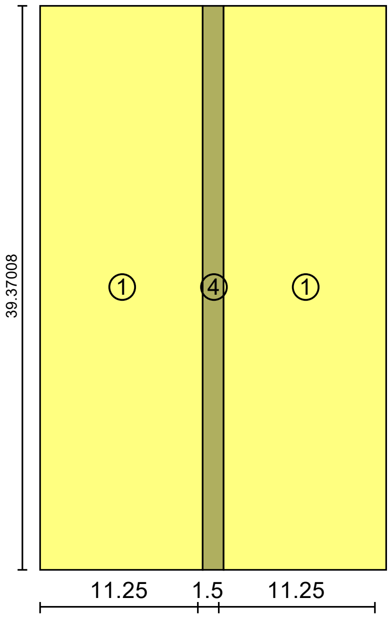
Thermal resistance: 63.4 / 64.308 hr ft² °F/Btu (EN ISO 6946 / homogenous layers)

Thickness: 15.992 in



Nr.	Material/Layer (from outside to inside)	ρ [lb/ft³]	c [Btu/lb°F]	λ [Btu/hr ft °F]	Thickness [in]	Color
1	Fibre Glass	1.87	0.2	0.0202	3.5	
2	Fibre Glass	1.87	0.2	0.0202	12	
3	Gypsum Board (USA)	53.06	0.21	0.0942	0.492	
Exchange materials						
4	Spruce	24.97	0.45	0.0497	---	

Exchange material(s), Assembly (Id.10): Solebury Flat Attic New Building (Cavity Blown Full to Truss Chords)

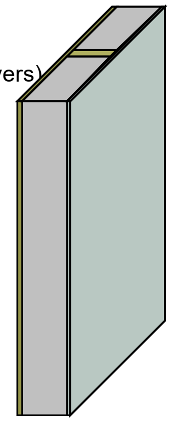


Assembly (Id.11): Solebury Mech Loft Cathedral Ceiling (Corrected Install + Air Barrier)

Inhomogenous layers

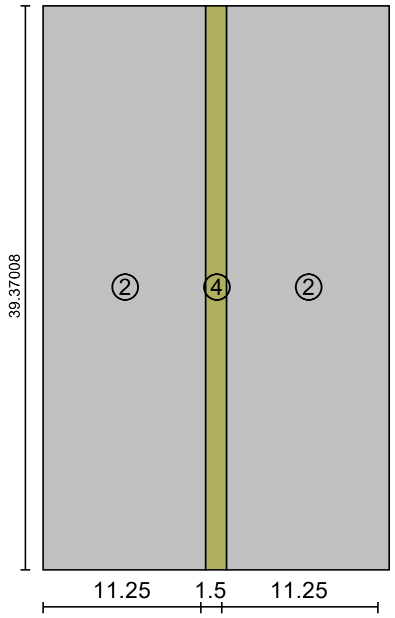
Thermal resistance: 21.786 / 23.485 hr ft² °F/Btu (EN ISO 6946 / homogenous layers)

Thickness: 6.583 in



Nr.	Material/Layer (from outside to inside)	ρ [lb/ft³]	c [Btu/lb°F]	λ [Btu/hr ft °F]	Thickness [in]	Color
1	Plywood (USA)	29.34	0.45	0.0485	0.591	
2	Cellulose Fibre Insulation	1.87	0.45	0.0208	5.5	
3	Gypsum Board (USA)	53.06	0.21	0.0942	0.492	
Exchange materials						
4	Spruce	24.97	0.45	0.0497	---	

Exchange material(s), Assembly (Id.11): Solebury Mech Loft Cathedral Ceiling (Corrected Install + Air Barrier)
Layer: 2

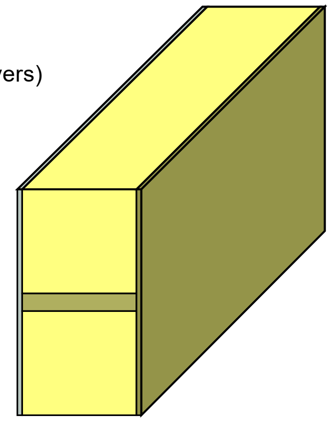


Assembly (Id.12): Solebury Floor over Sallyport (Cavity Blown Full)

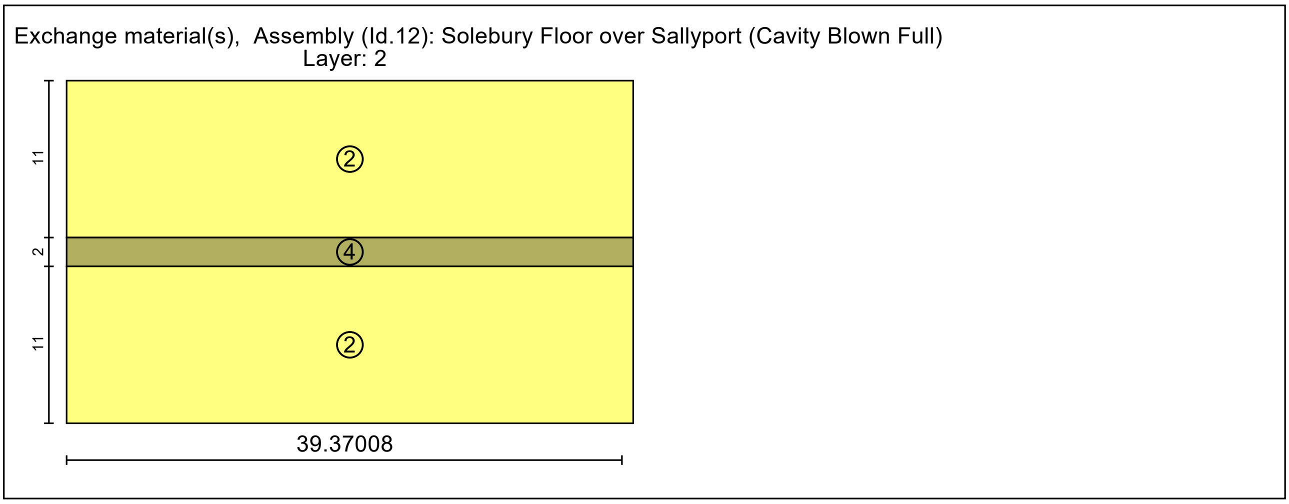
Inhomogenous layers

Thermal resistance: 45.468 / 50.743 hr ft² °F/Btu (EN ISO 6946 / homogenous layers)

Thickness: 12.992 in



Nr.	Material/Layer (from outside to inside)	ρ [lb/ft³]	c [Btu/lb°F]	λ [Btu/hr ft °F]	Thickness [in]	Color
1	Gypsum Board (USA)	53.06	0.21	0.0942	0.492	
2	Fibre Glass	1.87	0.2	0.0202	12	
3	Plywood (USA)	29.34	0.45	0.0485	0.5	
	Exchange materials					
4	Spruce	24.97	0.45	0.0497	---	



Space heating

Type	Performance ratio of heat generator [-]	Fuel type
Boiler	1.07	Natural Gas

Space cooling

Type	Distribution	Capacity [kBtu/hr]	COP
Heat pump	| Recirculation air| Dehumidification	480	5 | 1.2
Total		**480**	

Water heating

Type	Performance ratio of heat generator [-]	Fuel type
User defined	0.28	Electricity

Water storage

Nr	Capacity [gal]

Infiltration/Ventilation

ACH @ 50 Pascal **5.9** 1/hr

CFM @ 50 Pascal **10,822.5** cfm

Nr	Sensible recovery efficiency [-]	Rate [cfm]	Electric efficiency [W/cfm]	Fan [W]	Defrost	Temperature below which defrost must be used [°F]	Subsoil heat exchanger efficiency [-]
2	0.46	1,250.85	0.02	700.47	yes	16.48	0
Total	**0.36**	**1,250.85**		**700.47**			

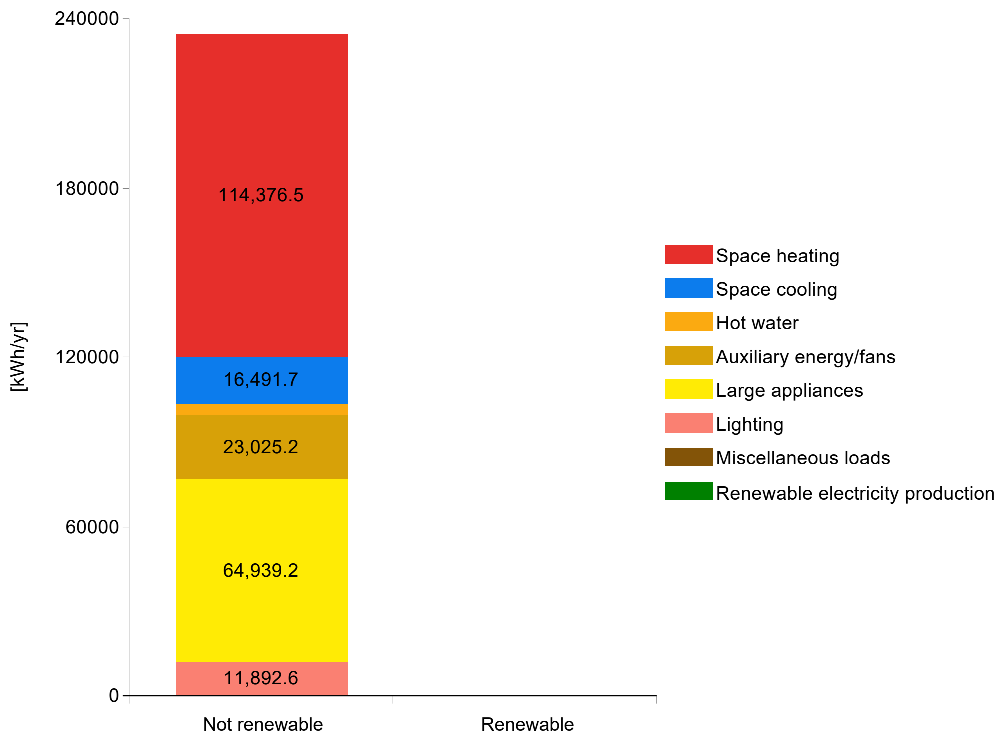
Lights and appliances

Type	Energy use [kWh/yr]	In conditioned space
Boiler heating auxiliary energy	348.01	no
Other	0	no
DHW circulating pump	2,650.83	yes
Heating system circulation pump	3,336.08	yes
Heating system circulation pump	1,592.82	yes
Other	5,428.8	yes
Ventilation winter	3,472.38	yes
Ventilation Defrost	2,221.98	yes
Ventilation summer	3,974.32	yes
Total	**23,025.22**	

SITE ENERGY REPORT

Project name	**Potential Improvements Package**
Climate	**WILLOW GROVE NAS PA**
Type	**Non-residential**
Interior conditioned floor area	**13,988** ft²
Number of units	**1**
Occupants	**25**
Site energy use	**800,845.5** kBtu/yr
Specific site energy use	**57.3** kBtu/ft²yr
Site energy use	**234,727.8** kWh/yr
Specific site energy use	**16.8** kWh/ft²yr
Site energy use per person	**9,389.1** kWh/Person yr
Net site energy use (with 100% renewables)	**800,845.5** kBtu/yr
Specific net site energy use (with 100% renewables)	**57.3** kBtu/ft²yr
Net site energy use (with 100% renewables)	**234,727.8** kWh/yr
Specific net site energy use (with 100% renewables)	**16.8** kWh/ft²yr
Net site energy use per person (with 100% renewables)	**9,389.1** kWh/Person yr

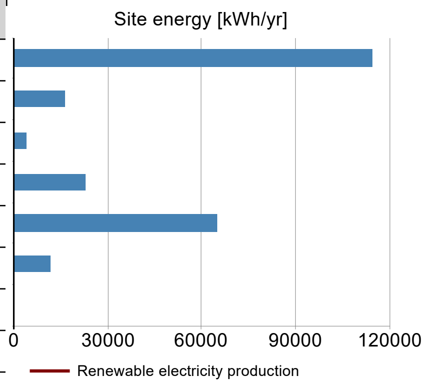
OVERVIEW



SITE ENERGY REPORT

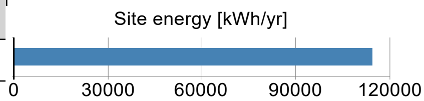
TOTAL USE BY TYPE

Type	Site Energy [kWh/yr]	Specific site energy [kWh/ft² yr]	Site Energy [kBtu/yr]	Specific Site Energy [kBtu/ft² yr]
Space heating	114,376.5	8.2	390,230.2	27.9
Space cooling	16,491.7	1.2	56,266.4	4
Hot water	4,002.6	0.3	13,656.1	1
Auxiliary energy/fans	23,025.2	1.6	78,557.6	5.6
Large appliances	64,939.2	4.6	221,560	15.8
Lighting	11,892.6	0.9	40,575.2	2.9
Miscellaneous loads	0	0	0	0
Renewable electricity production	0	0	0	0
Total	**234,727.8**	**16.8**	**800,845.5**	**57.3**



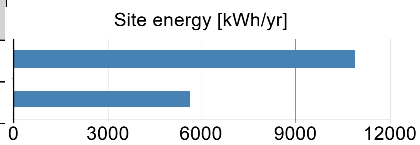
SPACE HEATING

Type	Site Energy [kWh/yr]	Specific site energy [kWh/ft² yr]	Site Energy [kBtu/yr]	Specific Site Energy [kBtu/ft² yr]
Boiler	114,376.5	8.2	390,230.2	27.9
Total	**114,376.5**	**8.2**	**390,230.2**	**27.9**



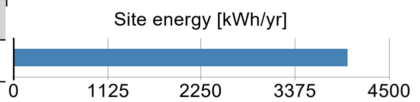
SPACE COOLING

Type	Site Energy [kWh/yr]	Specific site energy [kWh/ft² yr]	Site Energy [kBtu/yr]	Specific Site Energy [kBtu/ft² yr]
Recirculation Cooling	10,889.7	0.8	37,153.5	2.7
Dehumidification	5,602	0.4	19,112.9	1.4
Total	**16,491.7**	**1.2**	**56,266.4**	**4**



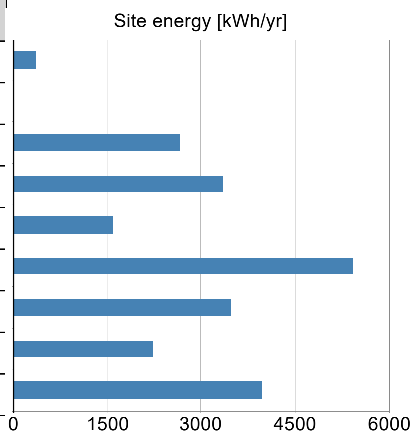
DHW

Type	Site Energy [kWh/yr]	Specific site energy [kWh/ft² yr]	Site Energy [kBtu/yr]	Specific Site Energy [kBtu/ft² yr]
User defined	4,002.6	0.3	13,656.1	1
Total	**4,002.6**	**0.3**	**13,656.1**	**1**



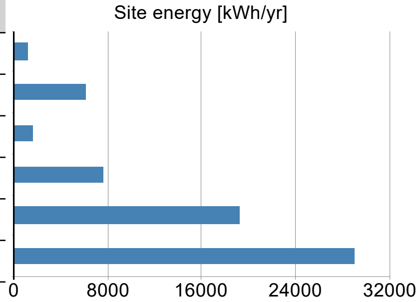
AUXILIARY ENERGY/FANS

Type	Site Energy [kWh/yr]	Specific site energy [kWh/ft² yr]	Site Energy [kBtu/yr]	Specific Site Energy [kBtu/ft² yr]
Boiler heating auxiliary energy	348	0	1,187.3	0.1
Other	0	0	0	0
DHW circulating pump	2,650.8	0.2	9,044.1	0.6
Heating system circulation pump	3,336.1	0.2	11,382.1	0.8
Heating system circulation pump	1,592.8	0.1	5,434.4	0.4
Other	5,428.8	0.4	18,522	1.3
Ventilation winter	3,472.4	0.2	11,847.1	0.8
Ventilation Defrost	2,222	0.2	7,581	0.5
Ventilation summer	3,974.3	0.3	13,559.6	1
Total	**23,025.2**	**1.6**	**78,557.6**	**5.6**



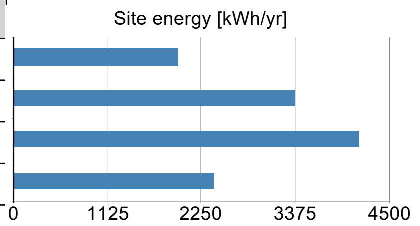
LARGE APPLIANCES

Type	Site Energy [kWh/yr]	Specific site energy [kWh/ft² yr]	Site Energy [kBtu/yr]	Specific Site Energy [kBtu/ft² yr]
Refrigerator	1,197.2	0.1	4,084.6	0.3
PC	6,150	0.4	20,982.6	1.5
Monitor	1,575	0.1	5,373.6	0.4
Printer	7,650	0.5	26,100.3	1.9
Server	19,272	1.4	65,752.3	4.7
User defined	29,095	2.1	99,266.6	7.1
Total	**64,939.2**	**4.6**	**221,560**	**15.8**



LIGHTING

Type	Site Energy [kWh/yr]	Specific site energy [kWh/ft² yr]	Site Energy [kBtu/yr]	Specific Site Energy [kBtu/ft² yr]
Lighting	1,963.9	0.1	6,700.5	0.5
Lighting	3,382.3	0.2	11,539.7	0.8
Lighting	4,146	0.3	14,145.5	1
Lighting	2,400.3	0.2	8,189.5	0.6
Total	**11,892.6**	**0.9**	**40,575.2**	**2.9**



MISC LOADS

Type	Site Energy [kWh/yr]	Specific site energy [kWh/ft² yr]	Site Energy [kBtu/yr]	Specific Site Energy [kBtu/ft² yr]
Total	**0**	**0**	**0**	**0**

SITE ENERGY MONTHLY REPORT

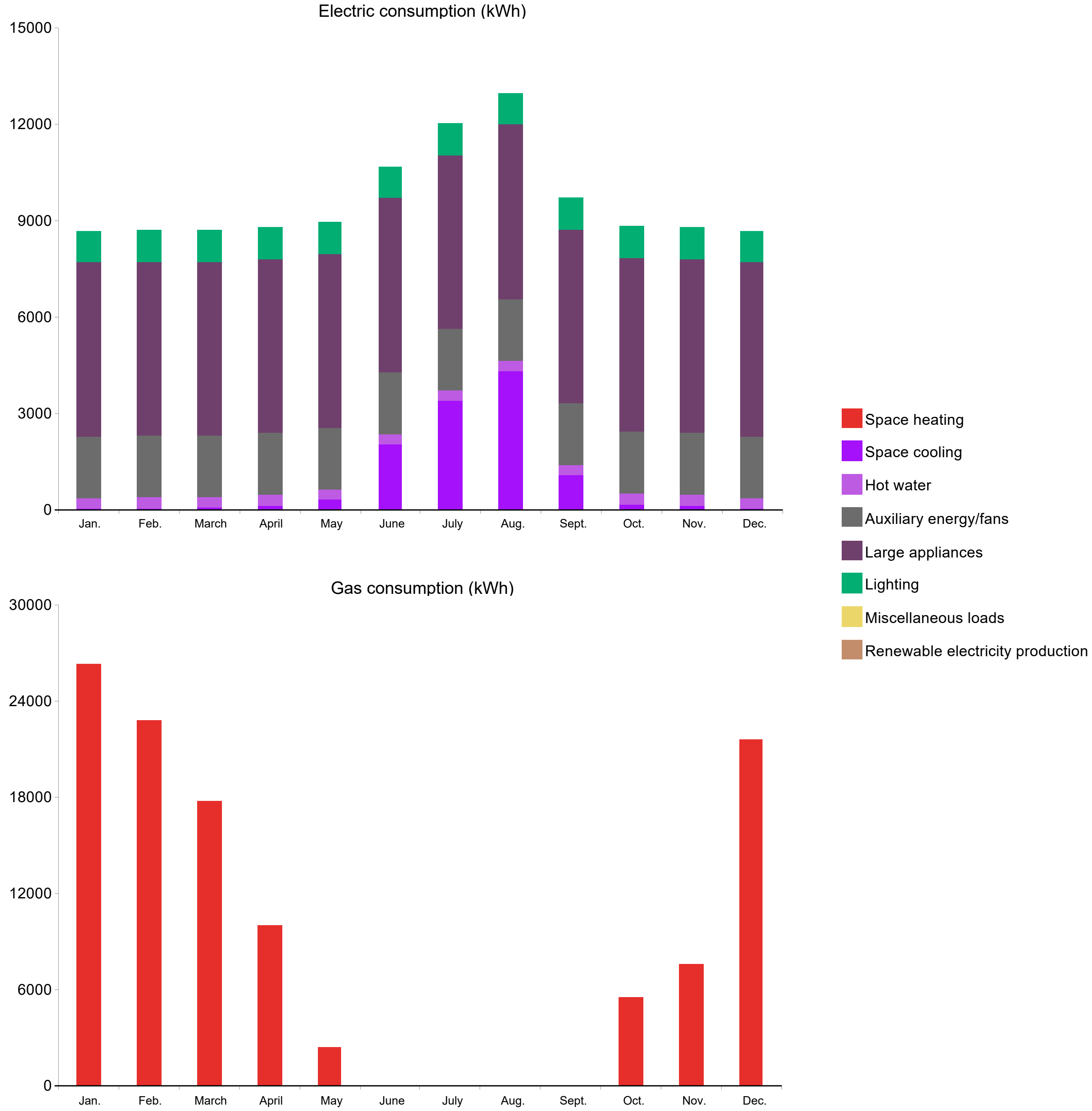
ELECTRICITY USE [kWh]

Type	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Space heating	0	0	0	0	0	0	0	0	0	0	0	0
Space cooling	54.66	61.37	89.35	150.76	323.81	2,053	3,395.81	4,333.77	1,076.12	188.62	143.59	55.82
Hot water	333.55	333.55	333.55	333.55	333.55	333.55	333.55	333.55	333.55	333.55	333.55	333.55
Auxiliary energy/fans	1,918.77	1,918.77	1,918.77	1,918.77	1,918.77	1,918.77	1,918.77	1,918.77	1,918.77	1,918.77	1,918.77	1,918.77
Large appliances	5,411.6	5,411.6	5,411.6	5,411.6	5,411.6	5,411.6	5,411.6	5,411.6	5,411.6	5,411.6	5,411.6	5,411.6
Lighting	991.05	991.05	991.05	991.05	991.05	991.05	991.05	991.05	991.05	991.05	991.05	991.05
Miscellaneous loads	0	0	0	0	0	0	0	0	0	0	0	0
Renewable electricity production	0	0	0	0	0	0	0	0	0	0	0	0

GAS USE [kWh]

Type	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Space heating	26,344.46	22,844.54	17,781.77	10,055.82	2,432.09	0	0	0	0	5,580.63	7,636.75	21,624.59
Space cooling	0	0	0	0	0	0	0	0	0	0	0	0
Hot water	0	0	0	0	0	0	0	0	0	0	0	0
Auxiliary energy/fans	0	0	0	0	0	0	0	0	0	0	0	0
Large appliances	0	0	0	0	0	0	0	0	0	0	0	0
Lighting	0	0	0	0	0	0	0	0	0	0	0	0
Miscellaneous loads	0	0	0	0	0	0	0	0	0	0	0	0
Renewable electricity production	0	0	0	0	0	0	0	0	0	0	0	0

SITE ENERGY MONTHLY REPORT



Projected Energy Savings Tables

EAM ASSOCIATES

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kBTU WHOLE PROJECT ANNUAL SAVINGS

Unit Type	Annual Saved (kBtu/sf/yr)	Building Floor Area	Annual Saved (kBtu)
Administration Building	27.4	13,988	383,271

	Total Lifetime* Saved (kBtu)
	7,013,859

*See Expected Useful Lifetime Table on Page 90 for the modeled lifetime (in years) for each measure that was used to generate the total lifetime saved figured above.

kBTU PER UNIT SAVINGS

	Existing		Proposed		
Unit Type	**Quantity**	**Annual End-Use Consumption (kBtu/sf/yr)**	**Annual End-Use Consumption (kBtu/sf/yr)**	**Difference (kBtu/sf/yr)**	**Percentage Improvement**
Administration Building	1	84.7	57.3	27.4	32.35%

EXPECTED USEFUL LIFETIME TABLE

	Measure Name	Years of Useful Life
1	Envelope Air Sealing	15
2	Appliances	12
4	Domestic Hot Water	13
5	Exhaust Fans	19
6	HVAC	18
7	Insulation	25
8	Lighting	20
9	Fenestration	25

United States Energy Information Administration

Commercial Buildings Energy Consumption Survey (CBECS)

6,436 Buildings sampled to represent 5.9 million buildings across the US

Release date: December 2022

Table E2. Major fuels consumption intensities by end use

	Major fuels energy intensity[a] (thousand Btu/square foot in buildings using any major fuel for the end use)									
	Total	Space heating	Cooling	Venti-lation	Water heating	Lighting	Refrig-eration	Office equip-ment	Com-puting	Other
Building floorspace (square feet)										
10,001 to 25,000	59.5	23.6	6.2	5.0	2.8	6.1	4.2	0.6	3.1	10.4
Principal building activity										
Office	65.6	20.1	5.1	12.9	1.0	7.8	1.6	0.8	5.2	11.4
Public assembly	81.1	41.4	15.8	4.0	0.8	5.1	3.0	0.4	1.0	12.3
Public order and safety	86.3	30.2	9.2	6.1	10.7	11.5	2.0	0.6	2.7	11.7
Year constructed										
1990 to 1999	63.6	21.6	6.8	7.9	3.3	7.4	4.4	0.5	2.1	10.4
2000 to 2009	80.7	25.9	8.0	8.9	4.0	8.4	5.7	0.5	3.5	13.5
Census region and division										

Table E2. Major fuels consumption intensities by end use

	Major fuels energy intensity[a] (thousand Btu/square foot in buildings using any major fuel for the end use)									
	Total	Space heating	Cooling	Venti-lation	Water heating	Lighting	Refrig-eration	Office equip-ment	Com-puting	Other
Northeast	77.5	32.8	4.4	8.4	3.7	8.1	3.8	0.5	3.5	11.8
New England	74.1	33.7	3.2	7.9	4.2	7.3	5.4	0.5	2.1	12.7
Middle Atlantic	78.6	32.6	4.7	8.6	3.6	8.3	3.3	0.5	3.9	11.6
Climate zone[b]										
Mixed mild	77.3	29.3	6.2	8.7	4.1	7.9	3.9	0.5	3.5	11.8
Number of floors										
2	62.1	23.1	6.1	6.3	3.3	7.1	3.8	0.5	2.1	9.4
3	71.5	27.0	6.5	7.9	3.5	7.3	3.5	0.5	3.4	11.2
Elevators and escalators (more than one may apply)										
1 elevator	65.5	26.3	6.1	7.1	3.0	6.6	2.8	0.5	2.6	9.9
Weekly operating hours										
61 to 84	80.9	28.8	7.0	7.9	3.6	9.3	5.7	0.6	2.5	11.8
Ownership and occupancy										
Government owned	72.5	29.5	8.4	6.7	3.5	6.4	2.9	0.5	3.0	11.8
Local	64.8	27.5	7.9	5.5	2.9	5.9	2.7	0.5	2.9	9.5
Party responsible for operation of energy systems										
Building owner	71.2	25.5	7.0	8.1	3.8	7.2	4.4	0.5	3.1	11.6
Property management	73.9	17.2	7.3	10.1	5.8	9.0	5.6	0.7	2.9	12.1
Predominant exterior wall material										
Brick, stone, or stucco	78.6	26.7	7.6	8.6	4.7	7.4	4.6	0.6	3.0	11.5
Predominant roof material										
Slate or tile shingles	68.4	21.6	7.8	6.4	5.2	6.2	5.1	0.6	1.8	10.2

Table E2. Major fuels consumption intensities by end use

Major fuels energy intensity[a]
(thousand Btu/square foot in buildings using any major fuel for the end use)

	Total	Space heating	Cooling	Venti-lation	Water heating	Lighting	Refrig-eration	Office equip-ment	Com-puting	Other
Steeper pitch	57.9	22.9	6.3	5.2	3.7	5.6	4.5	0.5	1.3	10.2
Renovations since 2000 (more than one may apply)										
Window replacement	78.9	29.5	5.8	9.2	4.3	7.5	3.9	0.5	2.9	10.6
HVAC equipment upgrade	80.1	27.8	6.7	9.8	4.3	7.7	4.1	0.6	3.6	11.9
Lighting upgrade	80.5	27.8	6.4	10.0	4.2	7.8	4.4	0.6	3.8	11.9
Electrical upgrade	85.6	29.5	6.9	10.3	4.4	7.8	4.2	0.6	4.2	12.6
Plumbing system upgrade	83.7	29.2	6.8	10.5	4.6	7.6	3.9	0.6	3.7	12.2
Insulation upgrade	83.1	29.6	6.6	10.1	4.2	7.7	3.7	0.5	3.6	12.7
Energy sources (more than one may apply)										
Electricity	71.6	25.0	7.0	8.0	4.0	7.5	4.8	0.5	3.1	11.4
Natural gas	80.4	28.2	6.4	8.5	4.5	7.9	4.8	0.5	2.9	11.4
Space-heating energy sources (more than one may apply)										
Electricity	72.4	17.3	7.3	8.2	5.0	8.3	5.4	0.6	3.3	12.0
Natural gas	78.4	29.6	6.1	8.2	3.8	7.9	4.7	0.5	2.6	10.1
Primary space-heating energy source										
Natural gas	77.8	31.9	6.0	8.0	3.1	7.7	4.4	0.5	2.3	9.6
Cooling energy sources (more than one may apply)										
Electricity	73.4	24.3	6.9	8.2	4.0	7.9	4.9	0.6	3.3	10.2
Water-heating energy sources (more than one may apply)										
Natural gas	85.4	29.3	6.9	9.0	5.5	8.1	5.5	0.6	3.1	11.0

Table E2. Major fuels consumption intensities by end use

	Major fuels energy intensity[a] (thousand Btu/square foot in buildings using any major fuel for the end use)									
	Total	Space heating	Cooling	Venti-lation	Water heating	Lighting	Refrig-eration	Office equip-ment	Com-puting	Other
Energy end uses (more than one may apply)										
Buildings with space heating	74.1	25.0	6.7	8.1	4.0	7.7	4.7	0.5	2.9	11.4
Buildings with cooling	74.5	24.8	7.0	8.3	4.1	7.9	4.9	0.6	3.2	10.9
Buildings with water heating	75.1	25.5	6.9	8.2	4.0	7.7	4.8	0.6	3.2	11.5
Buildings with lighting	72.0	25.0	6.9	8.0	4.0	7.5	4.8	0.5	3.1	11.4
Percentage of floorspace heated										
100%	78.3	28.2	7.0	8.2	4.1	7.8	4.2	0.6	3.1	12.0
Percentage of floorspace cooled										
100%	83.3	25.1	8.8	9.6	4.9	8.6	5.3	0.7	3.7	12.5
Percentage lit when open										
51% to 99%	80.2	26.4	6.8	9.1	4.6	8.0	5.0	0.6	3.3	12.3
Percentage lit during off hours										
1% to 50%	72.3	25.2	6.8	8.1	3.6	7.5	4.5	0.6	2.9	11.0
Heating equipment (more than one may apply)										
Boilers	84.9	32.0	6.7	9.5	4.4	7.6	3.3	0.5	3.1	12.8
Cooling equipment (more than one may apply)										
Central chillers	93.6	30.4	9.0	12.8	4.2	8.3	3.1	0.6	6.0	14.0
HVAC features (more than one may apply)										
Economizer cycle	88.5	29.5	6.9	11.0	4.6	8.1	4.5	0.6	4.8	13.5

Table E2. Major fuels consumption intensities by end use

	Major fuels energy intensity[a] (thousand Btu/square foot in buildings using any major fuel for the end use)									
	Total	Space heating	Cooling	Venti-lation	Water heating	Lighting	Refrig-eration	Office equip-ment	Com-puting	Other
Variable air volume (VAV) system	86.1	29.0	7.8	10.5	4.0	7.9	3.3	0.6	4.7	14.7
Dedicated outside air system (DOAS)	97.7	29.5	7.3	11.3	5.7	8.0	6.0	0.7	4.1	18.0
Demand controlled ventilation (DCV)	81.2	30.2	7.0	8.4	3.3	8.0	3.8	0.5	5.6	11.7
Building automation system (BAS) controls heating or cooling	88.4	28.0	7.6	10.8	4.4	8.2	4.4	0.6	5.0	14.8
Main equipment replaced since 2000 (more than one may apply)										
Heating	67.5	23.6	6.1	7.4	3.8	7.4	4.4	0.6	2.4	9.3
Cooling	71.0	27.7	6.6	7.9	4.4	7.1	3.5	0.5	3.1	9.0
Water-heating equipment										
Centralized system	74.5	26.4	6.8	7.8	4.0	7.3	4.9	0.5	2.9	11.4
Lighting equipment types (more than one may apply)										
Standard fluorescent	73.0	25.5	6.9	8.2	4.1	7.5	4.5	0.6	3.3	11.3
Office equipment (more than one may apply)										
Desktop computers	75.4	25.4	6.8	8.4	4.0	7.9	4.7	0.6	3.1	11.6
Separate computer areas (more than one may apply)										
Server closet	77.5	25.8	6.5	9.3	4.2	8.3	4.2	0.6	3.1	11.7
Electric vehicle (EV) charging										
Charging stations associated with the building	72.3	21.2	5.8	10.0	3.9	7.9	3.9	0.5	3.7	11.4
AVERAGES OF ALL COLUMNS	**76.5**	**27.1**	**6.9**	**8.5**	**4.1**	**7.7**	**4.3**	**0.6**	**4.4**	**12.9**

Table E2. Major fuels consumption intensities by end use

	Major fuels energy intensity[a] (thousand Btu/square foot in buildings using any major fuel for the end use)									
	Total	Space heating	Cooling	Venti-lation	Water heating	Lighting	Refrig-eration	Office equip-ment	Com-puting	Other

Data source: U.S. Energy Information Administration, Forms EIA-871A, C, D, E, and F of the *2018 Commercial Buildings Energy Consumption Survey*

Notes: Because of rounding, data may not sum to totals. The *Guide to the 2018 CBECS Tables* and *CBECS Terminology* contain definitions of terms used in these tables and comparisons between previous CBECS tables. You can access both references from http://www.eia.gov/consumption/commercial/data/2018/.

Estimates for types of equipment represent consumption in buildings that have the equipment, not the consumption by the specific piece of equipment.

HVAC = Heating, ventilation, and air conditioning.

[a] The major fuels intensity calculation is conditional on the presence of the end use, and therefore the intensities for each end use will not sum to the total intensity. In this table, each column is calculated as the sum of electricity, natural gas, fuel oil and district heat use for the end use divided by the floorspace in buildings that use any of those sources for the particular end use. The *total* column only includes the floorspace of buildings that use at least one of the major fuels and differs from the gross energy intensity in Table C4 which includes the floorspace for all buildings, regardless of whether the building uses energy.

[b] *Climate zones* are based on ASHRAE Standard 169-2021; see https://www.eia.gov/consumption/commercial/maps.php#defined.

[c] *Other sources* includes wood, coal, solar, and all other energy sources.

[d] *Office devices* refers to any combination of printers, copiers, scanners, or FAX machines.

Q = Data withheld either because the relative standard error was greater than 50% or the reporting sample had fewer than 20 buildings.

N = No buildings in reporting sample.

EAM ASSOCIATES

Findings & Recommendations:

Items are not listed in order of priority or payback potential

In general the building specifications, conditions, and operations were found to be fair when reviewed against the energy model, aggregated data from a mass peer group of buildings, and EAM's long experience in examining building energy use and performance for its occupants. However we would conclude that there is certainly room for meaningful improvements in all these areas. Things to be done which should not only lower energy use, but also help remedy some of the building comfort issues that were voiced during the audit, and which prompted it in the first place.

As detailed in the energy saving calculations of the report the building is using approximately 10% more energy in total that its refined peer group of buildings from the most recent EIA CBECs data. That energy intensity data chart included in this report was refined by EAM, removing many dozens of line items which reflected sampled buildings with dissimilar characteristics from the Solebury Township building. The remaining line items which were averaged together form energy use intensities for all major end uses which come form the actual utility of many hundreds of like buildings.

In particular the building is using ~39% more space heating energy than expected by the peer group data and the energy modeling. Cooling demand even farther above the expected levels, at roughly 3 times the average intensity of the peer CBECs group.

The proposals below project a total savings potential of over 30% against the existing utility bills, and ~25% savings against the average usage figures from the CBECs peer group. Perhaps just as important they are designed to help remedy the comfort issues expressed by building occupants.

1. Envelope Air Sealing

Existing Conditions (also see Diagnostic Testing table)

Blower door shell leakage testing found a whole building air infiltration rate 0.68 cfm50/sqft of building shell area. This represents a fairly well sealed building envelope. The current ASHRAE 90.1 energy codes would require a target of ~0.40 cfm75/sqft of building shell area. While a reduction to that level, which would represent a 40% lowering is likely unattainable for a building of this age and construction, envelope air sealing then represents a large opportunity for efficiency and comfort improvement at the project. Accordingly we have modeled a 25% reduction in our proposed model.

IR camera inspection was used in conjunction with the blower door to identify specific areas of leakage to inform the work scope. The project scope would likely not include a full gut-rehab down to the studs, so the below air sealing scope of work takes into account the level of access the contractor will have for remediation.

Air leaks through building walls via two primary modes:

- Bypasses, or large holes in the home’s air barrier
- Seams between building materials

Materials for Air Sealing

Materials used to seal air leakage sites must be as close to impermeable to air movement as possible and must form a continuous, nonporous surface over the opening being sealed.

Use caulk or spray foam sealant to seal cracks or holes smaller than a pencil width in the ceiling, floor, or exterior walls. Seal holes on the inside and outside surfaces of walls. Silicone or acrylic latex caulk works best for gaps of 1/4” to 3/8” or less. Expanding spray foam sealant is best for filling larger gaps up to ~3”, care must be taken however to use low expanding foam around fenestration openings.

For larger openings, use spray foam sealant with backing material and caulk the surface (fibrous insulation is not an air sealing material).

For very large openings use sheet materials, such as insulation board or plywood, to cover large holes. Seal the edges of the sheet materials with caulk or spray foam sealant. Seal openings between the attic and house.

Solebury Air Sealing Scope of Work

Review IR photos. These were done in conjunction with blower door to show air leakage points. Look for areas of streaking that are either darker or lighter than the surrounding assembly.

- The major air leakage pathway that needs to be corrected, and which is also the likely cause of comfort complaints in the upstairs meeting rooms, is the huge stack effect that is being created by the large attic vent fan in the new building attic. This fan was not installed with proper make up air which should be coming directly from outside. Instead two hatches are being kept open at the attic knee wall into the mech loft, and then down from the mech loft into the floor below. This airflow pathway is causing an enormous amount of conditioned air to move up through the space and out the building. Also because the plans were not followed, and an air barrier was not installed against the bottom of the trusses in those attic spaces, this fan airflow is also rendering all the insulation in these spaces as essentially useless.
- Any leakage points found in the attic plane. Should been done in conjunction with the flat attic insulation upgrade detailed in the envelope section.
- Windows and Doors. Check gaskets, weatherstrips and sweeps. Replace worn items.
- Engineered penetrations for mechanical systems need to have their motorized dampers and backdraft dampers checked to ensure they are sealing as well as can be expected when not in use. These devices tend to fail over time due to corrosions, pests, etc. and often go totally unnoticed.

2. Building Envelope Components

Because a major gut-rehab is unlikely, proposals for envelope upgrades have been kept to non-invasive variety. This means that some existing assemblies that are uninsulated, poorly insulated, or compromised by major thermal bridges have not been recommended and model for upgrades. These include the slab and basement walls which are uninsulated, the old building above grade walls which show low R-value on IR inspections, and the above grade walls of the new building which show the typical extreme thermal bridges of metal studs on IR. The windows have also not been recommended for upgrade as their performance and operating condition is not yet poor enough to justify what is an extremely costly upgrade, particularly for older historic type buildings.

However the proposed model does include the following envelope upgrades. Exact details of existing and proposed components can be found in the specifications reports.

- Floor over the sallyport is uninsulated, should be filled with blown insulation product.
- Cathedral ceiling areas at mech lofts should be corrected with minimum R-21 batts, currently many sections are falling out, which very quickly destroys the R-value of the overall assembly. Rafter depth is available for at least R-25 batts if not even R-30. As much insulation as possible should be installed in these areas. Spray foam would not be recommended unless it was accompanied by a cohesive strategy to ensure correct moisture flows through the building.

- Attic knee-walls in the new building mech loft are again barely functional as they are not enclosed on all 6 sides. This combined with the airflow from attic ventilation fan renders their actual R-value as very little. A sealed air barrier should be installed on the backside of both knee-walls, because the walls are metal framed, this air barrier should be a layer of rigid foam to also stop the thermal bridging occurring here. 2” R-10 XPS has been modeled.
- The flat attic ceilings below the upstairs meeting rooms in the new building are compromised because the gypsum layer and insulation were not installed in alignment as they are drawn on the plans. The multi foot air gap between the gypsum ceiling and the fiberglass batts stapled to the trusses, plus the areas of falling and missing batts, makes this control layer totally ineffective. With the attic fan running the energy loss through this assembly is huge. The batts should be removed, and these entire areas should be blown with deep insulation, R-60 has been modeled.

3. Domestic Hot Water

Existing Conditions (also see Equipment Schedule table)

50 Gallon storage, 0.91 EF electric resistance water heater is a very inefficient unit in general, but especially to be used in a centralized recirculating system like Solebury has, and one that is controlled via simple temperature feedback. Given the use type of the building, the hot water demands are likely quite low, and in reality the vast majority of energy being used by this system is being lost as standby losses at the recirculation controller keeps the entire building loop at temperature despite what are likely infrequent and brief hot water calls.

Solebury Domestic Hot Water Scope of Work

In the proposed model we have included two systems changes. First we have replaced this inefficient electric resistance unit with a heat pump hot water unit. For sure this change will in reality require some engineering planning, but it is very achievable to install given the building characteristics. A 3.5 COP model has been included. Second we have replaced the simple temperature controller for the recirculation loop which are known to waste large amounts of energy, with a demand based controller. An example of the product would be the AutoHot line from Enovative. These are relatively inexpensive and easy to install systems which use flow sensors to operate the system only when there is actual demand for hot water AND the circulation loop temperature has cooled below target levels.

4. Exhaust Fans

Existing Conditions (also see Equipment Schedule table)

The building has various exhaust fans installed to ventilate bathrooms and other areas. There is also the aforementioned large attic ventilation fan. On the day of airflow testing, none of the bathroom ventilation fans, or those meant to ventilate spaces like the copy room were functioning. These fans do not appear to be user actuated, but instead are likely meant to be continuous run during operational hours. It was confirmed EAM's inspection was taking place during operational hours, and so obviously something is not functioning correctly with the controls for that system.

Solebury Exhaust Fans Scope of Work

The exhaust fan control system needs to be investigated and corrected. On the day of our inspection at least the building does not have code required ventilation flows in spaces such as the public and private restrooms.

Assuming the exhaust systems are controlled by the building automation system, and were not simply shut down or malfunctioning for some other reason, the other critical item is that their usage schedules need to be set correctly. Ventilation does not need to be occurring during off hours, this wastes electricity directly of course, but often even more costly is the impact this has on the building heating and cooling systems which must condition all the makeup air that infiltrates the building in balance with the exhaust outflows. The proposed model has been done conservatively with exhaust systems running 300 days per year for 12 hours per day. Lower usage schedules are likely achievable but building occupants are best able to make those decisions.

Finally as mentioned also in the air leakage section, the large attic vent fan needs to have a makeup air pathway installed that comes from outside, and does not pull air from inside the building envelope.

5. HVAC Systems & Equipment

Existing Conditions (also see Equipment Schedule table)

Central heating boiler and central cooling chiller units are quite new and efficient in terms of nameplate values. There is no reason to expect replacing them any time soon given the large investment made in them.

Hot water/chilled water fan coil units are of much older installation, and can be considered outdated at this point in time due to components such as their single speed PSC fan motors.

Existing room thermostats, ventilation controllers, and humidistats are of older type which are terrible opaque to the occupants in terms of their function.

Sample duct leakage testing was found to be on the high side at ~25-30% of total system airflow. Workmanship of the sheet metal assembly of exposed ducts that could be viewed did appear good however, and so the systems could be a good candidate for aerosolized duct sealing, however this has not been included in the proposed modeling because it would need to be ascertained if the ductwork could be sectioned off from the fan coils and OA systems during this process so those components wouldn't be damaged by the aerosol sealant.

Outdoor air ventilation systems are of energy recovery type which is certainly good, however during EAM's inspection it was found that all these systems were shut off, and likely had been for some time. This was found when township staff contacted the monitoring company for us so that we could ask for certain OA dampers to be shut to allow us to complete some sample duct leakage testing. It turned out that the systems had been shut down likely some months before, and not just recently in response to the wildfire event which was lowering outdoor air quality badly at the time of inspection.

This question of how well the building HVAC systems are being monitored and maintained came into sharper focus as our testing proceeded. As details in our findings of air flows and supply/return temperature readings on the marked up mechanical plans, it seems clear that the control systems on all the zones are not working properly. This testing was done on a late June day in the 80's with high humidity, and yet we could not get many of the zones to actuate cooling. Despite overriding the zone control thermostats to tell the system the zone was occupied, and turning the thermostats to well below the room temperatures, the supply register air was clearly only being recirculated over warm coils. These zones had supply air temps in the high 70's to low 80's, while other clearly functional zones were at the correct levels in the low to mid 50's. So either the feedback controllers or the zone dampers or some other components are not working on all the zones. The central heat/AC plants are obviously working, but the buildings comfort levels are limping along with some zones compensating for others over time as air eventually circulates, but the system is not designed to work this way, and temperatures not end up well above and below setpoints across the building just to keep people roughly comfortable.

Solebury HVAC Systems & Equipment Scope of Work

Due to the above issues the foremost recommendation for the HVAC scope is to have the monitoring contractor do a thorough check of these systems to ensure proper function. This building has HVAC systems which are fairly atypical for a building of this size class. It's a small facility to have central boiler and chiller plant systems. Very often when these sorts of systems are used, they are in much larger facilities which have permanent staff on hand to monitor operations. Now there were probably reasons these types of systems were used at Solebury, and there is no reason they can't work very well, but its important for the township staff to understand exactly what the HVAC monitoring contract is including, and even more importantly what it doesn't. There could be a misunderstanding in the level of service that the township is paying for, or perhaps the township is paying for some services that it isn't currently receiving. The major point is that central systems of this type need to be checked on by professionals on a fairly regular basis, especially as they age. So again we would recommend starting with a top to bottom review of each system to make sure fans are operating, hot water/chilled water zone valves are opening when controls systems call, outdoor air dampers on the ERV systems are open and closing as per schedule or CO2 monitoring demand, etc. Basic functioning tests of air flows and temperatures go a long way.

Outdoor air ventilation is designed obviously to provide fresh air during occupancy. The township should review these typical occupancy levels and schedules to ensure that the building is not being over ventilated during times when it is not in use, or when only very lightly occupied. As with the exhaust fans there are large energy penalties for this. The proposed model calls for fresh air ventilation only days per week with 12 hours per day at the design rated airflows, and 12 hours per days at 50% of the design rated airflows. Again depending on the real occupancy counts and typical schedules, even these numbers may be high given the amount of CFMs the installed systems are designed to move.

The building occupants need better room/zone control systems. Ones they can understand how to use, and ones which show occupants how the system is operating at that time to control temperature, humidity, and indoor air quality. The current controls would be more typical of those used in a larger facility being monitored on site by HVAC trained facilities management. Even we had to read a manual to figure out how to hold down certain buttons for certain lengths of time to see certain light flash patterns which told us we had put that zone into occupant override. We will not make any specific recommendations here, because any new controls will need to work with existing building automation system, and we do not know the specifics of that current system, but suffice to say there are multitudes of HVAC controllers out there which can combine the functions of the all the different current controllers, and do so with informative screens which show the occupants what the system is doing. The fact that the current controls are so opaque is probably the major reasons why certain zones not functioning correctly has gone uncorrected, we won't say unnoticed because the comfort complaints certainly indicate otherwise.

Flow hood air flow testing was found to be good in general, however some rooms are quite out of balance when it come to supply and return volumes. The marked up mechanical plans should be a good for future balancing efforts. The as-built plans show what are clearly design airflows, and not as test airflows. These airflows are often extremely high given the space sizes and characteristics which would affect the heating/cooling load calcs. This is fairly common in commercial buildings as defaults in commercial load calc software can often generate loads which are much higher than will exist in reality. For this reason and because they are nearing end of useful life, the township should consider a project to replace the zone fan coil units with newer ECM models with variable speed air handlers. These units would be both more efficient on energy, and also better able to cope with humidity removal by running at lower air flow settings for longer periods which his needed for proper moisture removal. The very large airflows seen in some of these smaller office spaces will very quickly satisfy thermostat setpoints, at least when the chiller water zone coil is working properly to deliver 50-55 degree supply air.

Finally the circulation pumps on boiler and chiller water loops are all of inefficient standard types. As these are fairly high horsepower motors, especially the chiller loop, they could seriously benefit from being replaced with VFD (variable frequency drive) units which can reduce energy consumption by ~50% by ramping down to lower flow levels based on the demand. These have been modeled in the proposed after energy model.

6. Lighting

Existing Conditions (also see Lighting Schedule table and wattage calcs)

Field inspection found many different types of fixtures installed with Incandescent/CFL/LED bulbs in the building. In general, the lighting represents a good area of potential improvement as the calculated installed wattage per square foot is 1.2.

Solebury Lighting Scope of Work

In order to improve energy efficiency and to allow for easier tenant/site manager maintenance it is recommended to replace the existing fixtures with iLEDs. These will use fewer watts, have longer lifetimes, and will consolidate the variety of fixtures and bulbs in use down to a more manageable set.

With modern LED fixtures and bulbs it is easily attainable to reach the 0.5 watts/sqft we have included in the proposed model. Even lower figures can be achieved while retaining, if not improving on the quality and quality of the light, as well as taking the opportunity to design lighting intensities which are appropriate to the different work and use space types in the building.