



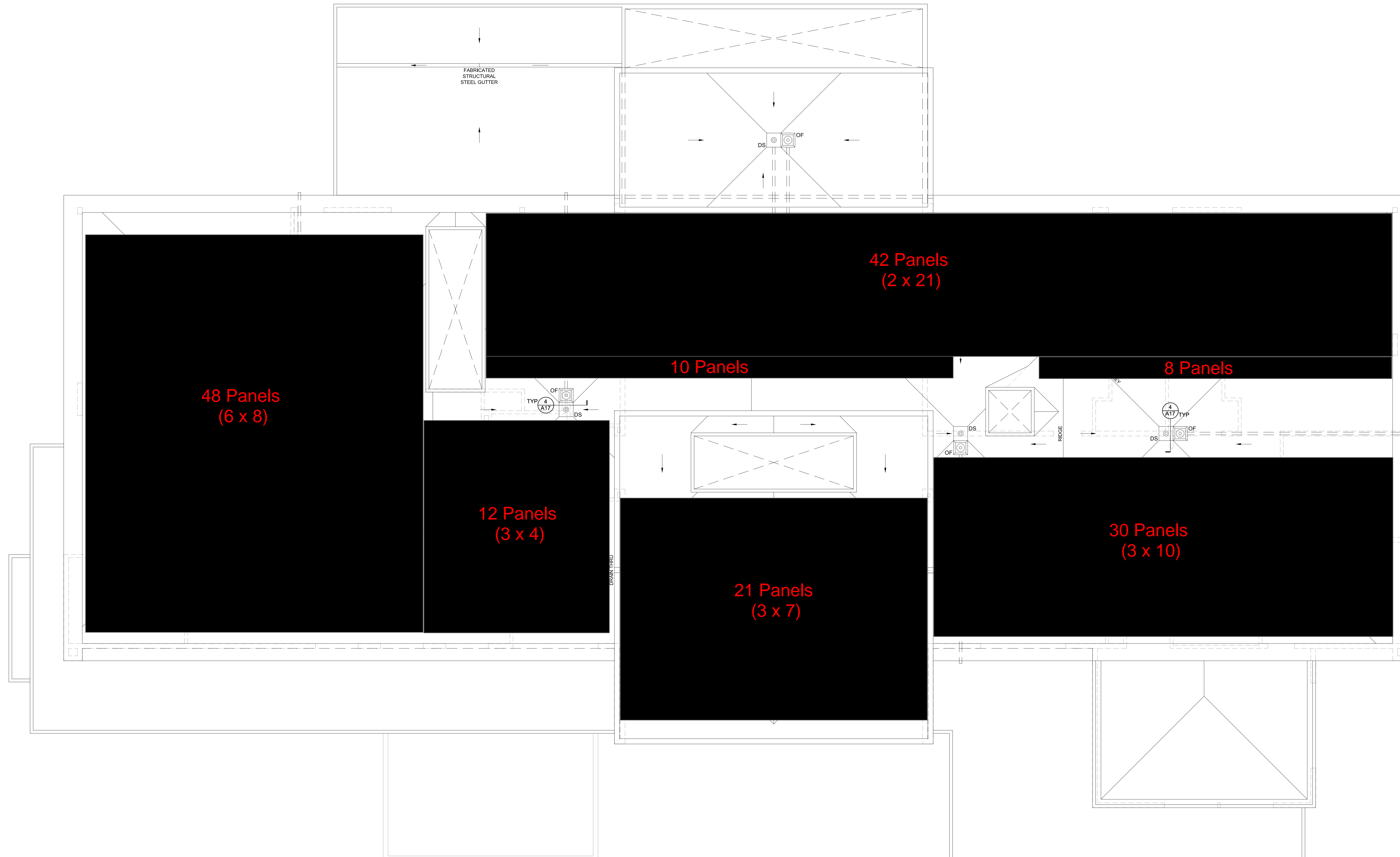
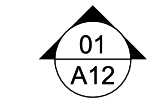
## Cost and Rebate Estimate

5/18/2022

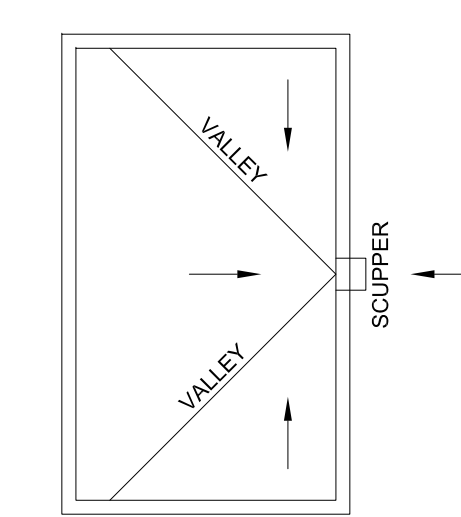
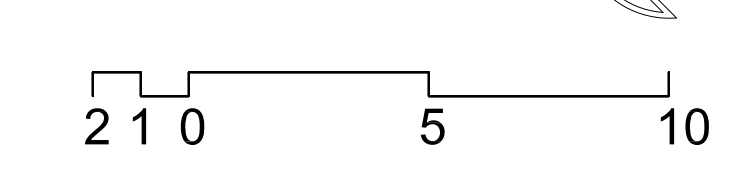
JMK Homes- Koneru (Roof Mount)

Installed Cost of system	<del>\$ 147,690</del>	<i>Installed cost, sales tax included</i>
Cost of system after sales tax exemption	<b>\$ 136,750</b>	<i>Total upfront cost</i>
Cost after 26% Federal tax credit	<b>\$ 101,195</b>	<i>System cost less federal tax credit</i>
Panel Manufacturer	SEG	
Panel Wattage	365	<i>nameplate dc rating of one solar panel</i>
Number of Panels	171	<i>Number of panels</i>
Installed DC Watts of system	62,415	<i>DC nameplate total watts of system</i>
KWH produced per year	62,477	<i>annual kilowatt hours produced by system</i>
Net meter rate	\$ 0.110	<i>current average power rate/avoided cost rate</i>
Annual net meter credit	\$ 6,873	<i>amount of power produced annually</i>
Monthly net meter credit	\$ 572.71	
Total system ROI after 25 years	<b>\$ 332,707</b>	<i>Fed. Tax credit + power savings assuming four percent power inflation</i>

Elensburg Solar LLC  
PO Box 1681 Ellensburg, WA 98926  
509-929-2728  
office@ellensburgsolar.com  
Contractor # ELLENSL891RL ELLENSL864RR



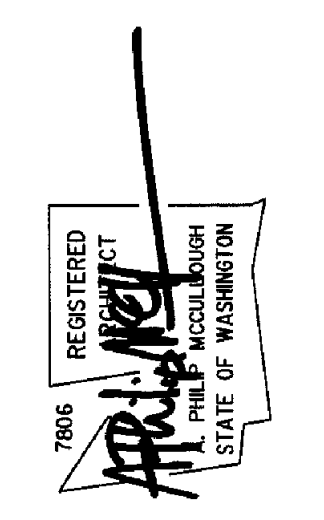
**ROOF DRAINAGE PLAN**  
SCALE: 1/4" = 1'-0"



Comment:  
Updated Plans to Structural  
Structural Backcheck 01  
Structural Backcheck 02  
Structural Backcheck 03

Revisions:  
2021.11.17  
2021.12.13  
2021.12.15  
2021.12.22

Date: 2021.10.13  
Job No: 21-041  
Project No:  
Drawn: DJR  
Approved: APM



**KONERU RESIDENCE**  
6610 E Mercer Way  
Mercer Island, WA 98040

PERMIT SET  
Roof Drainage Plan

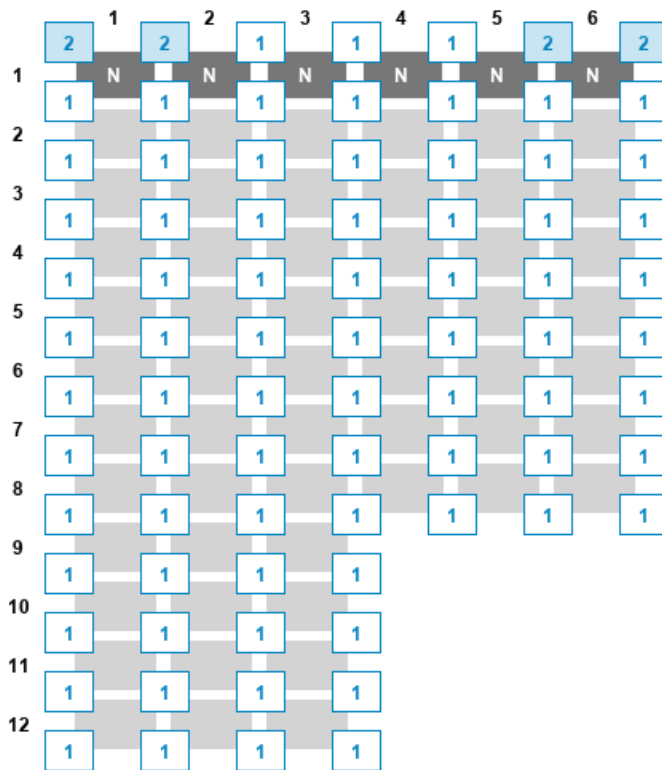


<b>PROJECT TITLE</b>	<b>PROJECT ID</b>	<b>CREATED</b>
ROOFMOUNT RM5	0677FA5D	May 18, 2022, 6:47 a.m.

<b>NAME</b>	Koneru Residence	Designed by ellensburgsolar@gmail.com
<b>ADDRESS</b>	6610 E Mercer Way, Mercer Island WA	ROOFMOUNT RM5
<b>CITY, STATE</b>	Mercer Island, WA	Custom
<b>MODULE</b>	Custom Custom	171 - Custom
		3352.33 ft <sup>2</sup>
		62.42 KW

**INSTALLATION AND DESIGN PLAN**

**Roof Area 1 / Roof Area 1 - Array 1**



## LEGEND

<b>N</b>	Module with north wind deflector (for uplift)	<b>1</b>	Standard corner bay with CMU block count
<b>S</b>	Module with south wind deflector (for fire requirements - type 2)	<b>4</b>	Supplemental bay with CMU block count
<b>NS</b>	Module with both deflector types		
	Module with no deflectors		

## NOTE

Bays in the space above and below modules are supplemental bays. You can fit a maximum of 2 blocks in each bay. If the number of blocks in these bays is more than 2, you will need to add an additional supplemental bay.

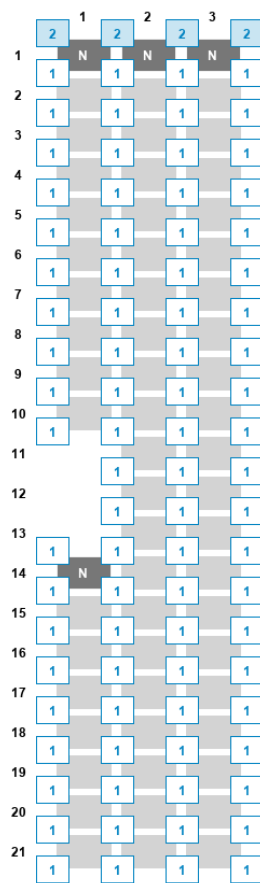
## Layout Dimensions

NS DIMENSION ~ 49.28 ft

EW DIMENSION ~ 34.55 ft

ROW	MODULES	MODULES WITH DEFLECTORS	BAYS	BALLAST BLOCKS (CMU)	BALLAST WEIGHT (LBS)
1	6	6	7	11	176
2	6	0	7	7	112
3	6	0	7	7	112
4	6	0	7	7	112
5	6	0	7	7	112
6	6	0	7	7	112
7	6	0	7	7	112
8	6	0	7	7	112
9	3	0	7	7	112
10	3	0	4	4	64
11	3	0	4	4	64
12	3	0	4	4	64
13	0	0	4	4	64

## Roof Area 1 / Roof Area 1 - Array 2



### LEGEND

N	Module with north wind deflector (for uplift)	1	Standard corner bay with CMU block count
S	Module with south wind deflector (for fire requirements - type 2)	4	Supplemental bay with CMU block count
NS	Module with both deflector types		
	Module with no deflectors		

### NOTE

Bays in the space above and below modules are supplemental bays. You can fit a maximum of 2 blocks in each bay. If the number of blocks in these bays is more than 2, you will need to add an additional supplemental bay.

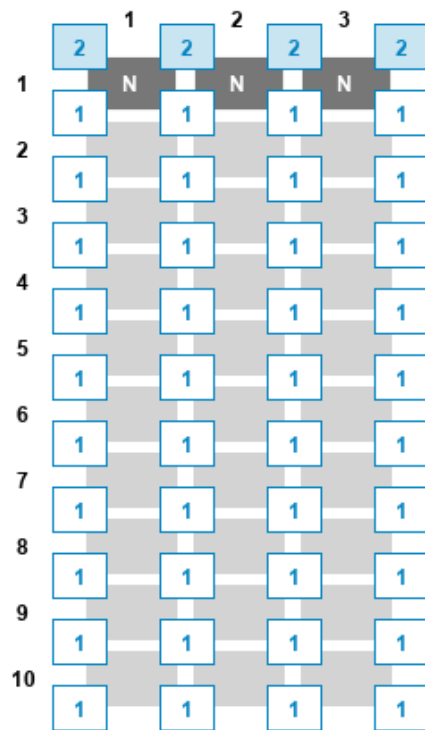
# Layout Dimensions

NS DIMENSION ~ 85.55 ft

EW DIMENSION ~ 17.27 ft

ROW	MODULES	MODULES WITH DEFLECTORS	BAYS	BALLAST BLOCKS (CMU)	BALLAST WEIGHT (LBS)
1	3	3	4	8	128
2	3	0	4	4	64
3	3	0	4	4	64
4	3	0	4	4	64
5	3	0	4	4	64
6	3	0	4	4	64
7	3	0	4	4	64
8	3	0	4	4	64
9	3	0	4	4	64
10	3	0	4	4	64
11	2	0	4	4	64
12	2	0	3	3	48
13	2	0	3	3	48
14	3	1	4	4	64
15	3	0	4	4	64
16	3	0	4	4	64
17	3	0	4	4	64
18	3	0	4	4	64
19	3	0	4	4	64
20	3	0	4	4	64
21	3	0	4	4	64
22	0	0	4	4	64

## Roof Area 1 / Roof Area 1 - Array 3



### LEGEND

N	Module with north wind deflector (for uplift)	1	Standard corner bay with CMU block count
S	Module with south wind deflector (for fire requirements - type 2)	4	Supplemental bay with CMU block count
NS	Module with both deflector types		
	Module with no deflectors		

### NOTE

Bays in the space above and below modules are supplemental bays. You can fit a maximum of 2 blocks in each bay. If the number of blocks in these bays is more than 2, you will need to add an additional supplemental bay.

# Layout Dimensions

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NS DIMENSION ~ 41.22 ft

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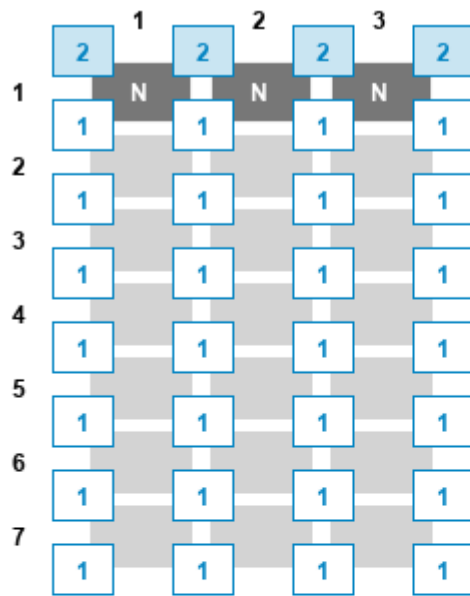
EW DIMENSION ~ 17.27 ft

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ROW	MODULES	MODULES WITH DEFLECTORS	BAYS	BALLAST BLOCKS (CMU)	BALLAST WEIGHT (LBS)
1	3	3	4	8	128
2	3	0	4	4	64
3	3	0	4	4	64
4	3	0	4	4	64
5	3	0	4	4	64
6	3	0	4	4	64
7	3	0	4	4	64
8	3	0	4	4	64
9	3	0	4	4	64
10	3	0	4	4	64
11	0	0	4	4	64



## Roof Area 1 / Roof Area 1 - Array 4



### LEGEND

<div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="width: 20px; height: 15px; background-color: #808080; margin-right: 5px;"></div> <div>N</div> <div style="margin-left: 10px;">Module with north wind deflector (for uplift)</div> </div> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="width: 20px; height: 15px; background-color: #FF8C00; margin-right: 5px;"></div> <div>S</div> <div style="margin-left: 10px;">Module with south wind deflector (for fire requirements - type 2)</div> </div> <div style="display: flex; align-items: center; margin-bottom: 5px;"> <div style="width: 20px; height: 15px; background-color: #A52A2A; margin-right: 5px;"></div> <div>NS</div> <div style="margin-left: 10px;">Module with both deflector types</div> </div> <div style="display: flex; align-items: center;"> <div style="width: 20px; height: 15px; background-color: #808080; margin-right: 5px;"></div> <div>Module with no deflectors</div> </div>	<div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="width: 20px; height: 15px; border: 1px solid black; background-color: white; margin-right: 5px;"></div> <div>1</div> <div style="margin-left: 10px;">Standard corner bay with CMU block count</div> </div> <div style="display: flex; align-items: center;"> <div style="width: 20px; height: 15px; background-color: #000080; margin-right: 5px;"></div> <div>4</div> <div style="margin-left: 10px;">Supplemental bay with CMU block count</div> </div>
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### NOTE

Bays in the space above and below modules are supplemental bays. You can fit a maximum of 2 blocks in each bay. If the number of blocks in these bays is more than 2, you will need to add an additional supplemental bay.

# Layout Dimensions

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NS DIMENSION ~ 29.13 ft

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EW DIMENSION ~ 17.27 ft

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ROW	MODULES	MODULES WITH DEFLECTORS	BAYS	BALLAST BLOCKS (CMU)	BALLAST WEIGHT (LBS)
1	3	3	4	8	128
2	3	0	4	4	64
3	3	0	4	4	64
4	3	0	4	4	64
5	3	0	4	4	64
6	3	0	4	4	64
7	3	0	4	4	64
8	0	0	4	4	64



# U-BUILDER PROJECT REPORT

VERSION: 3.1.6

<b>PROJECT TITLE</b>	<b>PROJECT ID</b>	<b>CREATED</b>
ROOFMOUNT RM5	0677FA5D	May 18, 2022, 6:47 a.m.

<b>NAME</b>	Koneru Residence	Designed by ellensburgsolar@gmail.com
<b>ADDRESS</b>	6610 E Mercer Way, Mercer Island WA	ROOFMOUNT RM5
<b>CITY, STATE</b>	Mercer Island, WA	Custom
<b>MODULE</b>	Custom Custom	171 - Custom
		3352.33 ft <sup>2</sup>
		62.42 KW

**UNVALIDATED MODULE SIZE:** The module selected was based on a typical or custom module size. DO NOT USE this information to purchase or install without verifying the exact module dimensions.

# ENGINEERING REPORT

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## Plan review

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<b>AVERAGE PSF</b>	<b>3.39 psf</b>
TOTAL NUMBER OF MODULES	171
TOTAL KW	62.42 KW
TOTAL MODULE AREA	~4001 ft <sup>2</sup>
TOTAL WEIGHT ON ROOF	13546 lbs
RACKING WEIGHT	2081 lbs
MODULE WEIGHT	7353 lbs
BALLAST WEIGHT	4112 lbs
MAX BAY LOAD (DEAD)	68 lbs

## Loads Used for Design

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BUILDING CODE	ASCE 7-10
BASIC WIND SPEED	110.00 mph
GROUND SNOW LOAD	20.00 psf
SEISMIC (SS)	1.36
ELEVATION	87.00 ft
WIND EXPOSURE	B
MRI	25
RISK CATEGORY	II
VELOCITY PRESSURE, QZ	15.91 psf

## Loads Determined by Zip

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98040

CITY, STATE	Mercer Island, WA
BASIC WIND SPEED	110.00 mph
GROUND SNOW LOAD	0.00 psf

## Inspection

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PRODUCT	ROOFMOUNT RM5
MODULE MANUFACTURER	Custom
MODEL	Custom
MODULE WATTS	365 watts
MODULE LENGTH	69.09"
MODULE WIDTH	40.86"
MODULE THICKNESS	1.37"
MODULE WEIGHT	43.00 lbs
BALLAST BLOCK (CMU) WEIGHT	16.0 lbs
MAX BLOCKS PER BAY	2
BUILDING HEIGHT	30.00 ft
ROOF TYPE	TPO
PARAPET HEIGHT	<= 1/2 Array Height (<= 4 inches)

## Roof Area 1 - Array 1

<b>AVERAGE PSF</b>	<b>3.27 psf</b>	<b>MINIMUM SEISMIC SEPARATION (UNATTACHED ARRAYS) *</b>	
TOTAL NUMBER OF MODULES:	60	ARRAY TO ARRAY:	7.7"
TOTAL KW:	21.90 KW	TO FIXED OBJECT ON ROOF:	15.4"
TOTAL AREA:	1405 ft <sup>2</sup>	TO ROOF EDGE WITH QUALIFYING PARAPET:	15.4"
TOTAL WEIGHT ON ROOF:	4595 lbs	TO ROOF EDGE WITHOUT QUALIFYING PARAPET:	23.1"
RACKING WEIGHT:	687 lbs	<b>MAX ARRAY (SEISMIC) (FOR UNATTACHED ARRAYS) *</b>	
MODULE WEIGHT:	2580 lbs	MAX NUMBER OF NORTH-SOUTH ROWS:	42
BALLAST WEIGHT:	1328 lbs	MAX NUMBER OF EAST-WEST COLUMNS:	34
ROW SPACING:	7.5"	*In jurisdictions that follow SEAOC PV-1 methodology.	

## Roof Area 1 - Array 2

<b>AVERAGE PSF</b>	<b>3.39 psf</b>	<b>MINIMUM SEISMIC SEPARATION (UNATTACHED ARRAYS) *</b>	
TOTAL NUMBER OF MODULES:	60	ARRAY TO ARRAY:	7.7"
TOTAL KW:	21.90 KW	TO FIXED OBJECT ON ROOF:	15.4"
TOTAL AREA:	1401 ft <sup>2</sup>	TO ROOF EDGE WITH QUALIFYING PARAPET:	15.4"
TOTAL WEIGHT ON ROOF:	4752 lbs	TO ROOF EDGE WITHOUT QUALIFYING PARAPET:	23.1"
RACKING WEIGHT:	732 lbs	<b>MAX ARRAY (SEISMIC) (FOR UNATTACHED ARRAYS) *</b>	
MODULE WEIGHT:	2580 lbs	MAX NUMBER OF NORTH-SOUTH ROWS:	42
BALLAST WEIGHT:	1440 lbs	MAX NUMBER OF EAST-WEST COLUMNS:	34
ROW SPACING:	7.5"	*In jurisdictions that follow SEAOC PV-1 methodology.	

## Roof Area 1 - Array 3

<b>AVERAGE PSF</b>	<b>3.47 psf</b>
TOTAL NUMBER OF MODULES:	30
TOTAL KW:	10.95 KW
TOTAL AREA:	702 ft <sup>2</sup>
TOTAL WEIGHT ON ROOF:	2438 lbs
RACKING WEIGHT:	380 lbs
MODULE WEIGHT:	1290 lbs
BALLAST WEIGHT:	768 lbs
ROW SPACING:	7.5"

### MINIMUM SEISMIC SEPARATION (UNATTACHED ARRAYS) \*

ARRAY TO ARRAY:	7.7"
TO FIXED OBJECT ON ROOF:	15.4"
TO ROOF EDGE WITH QUALIFYING PARAPET:	15.4"
TO ROOF EDGE WITHOUT QUALIFYING PARAPET:	23.1"
MAX ARRAY (SEISMIC) (FOR UNATTACHED ARRAYS) *	
MAX NUMBER OF NORTH-SOUTH ROWS:	42
MAX NUMBER OF EAST-WEST COLUMNS:	34

\*In jurisdictions that follow SEAOC PV-1 methodology.

## Roof Area 1 - Array 4

<b>AVERAGE PSF</b>	<b>3.57 psf</b>
TOTAL NUMBER OF MODULES:	21
TOTAL KW:	7.66 KW
TOTAL AREA:	493 ft <sup>2</sup>
TOTAL WEIGHT ON ROOF:	1760 lbs
RACKING WEIGHT:	281 lbs
MODULE WEIGHT:	903 lbs
BALLAST WEIGHT:	576 lbs
ROW SPACING:	7.5"

### MINIMUM SEISMIC SEPARATION (UNATTACHED ARRAYS) \*

ARRAY TO ARRAY:	7.7"
TO FIXED OBJECT ON ROOF:	15.4"
TO ROOF EDGE WITH QUALIFYING PARAPET:	15.4"
TO ROOF EDGE WITHOUT QUALIFYING PARAPET:	23.1"
MAX ARRAY (SEISMIC) (FOR UNATTACHED ARRAYS) *	
MAX NUMBER OF NORTH-SOUTH ROWS:	42
MAX NUMBER OF EAST-WEST COLUMNS:	34

\*In jurisdictions that follow SEAOC PV-1 methodology.

## RM5 U-BUILDER PRODUCT ASSUMPTIONS

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### RM5 – Ballasted Flat Roof Systems

Limitations of Responsibility: It is the user's responsibility to ensure that inputs are correct for your specific project. Unirac is not the solar, electrical, or building engineer of record and is not responsible for the solar, electrical, or building design for this project.

#### Building Assumptions

1. Risk Category III
2. Building Height  $\leq$  50 ft.
3. Building Height > 50 ft: only where  $(\text{longest length of building} \times \text{building height})^{0.5} \leq 50$  ft
4. Roof Slope  $\geq 0^\circ$  (0:12) and  $< 3^\circ$  (5/8:12) for Seismic Design Category C, D, E and F. For low seismic regions Seismic Design Category A and B (provided Array Importance factor = 1.0), Roof Slope  $\geq 0^\circ$  (0:12) and  $\leq 7^\circ$  (1 1/2:12).
5. Roofing Material Types: EDPM, PVC, TPO, and Mineral Cap
6. Required Setback from Module Edge to Building Edge for Wind Tunnel: 3 ft (See Item 14)
7. Surrounding Building Grade: Level

#### Ballast Blocks

The installer is responsible for procuring the ballast blocks (Concrete Masonry Units – CMU) and verifying the required minimum weight needed for this design. CMU should comply with ASM standard specification for concrete roof pavers designation (C1491 or C90) with an integral water repellent suitable for the climate it is placed.

It is recommended that the blocks are inspected periodically for any signs of degradation. If degradation of the block is observed, the block should immediately be replaced. The CMU ballast block should have nominal dimensions of 4"x8"x16". The actual block dimensions are 3/8" less than the nominal dimensions. Ballast blocks should have a weight as specified for the project in the "Inspection" section of this report.

#### Design Parameters

1. Risk Category I to III
2. Wind Design
  - a. Basic Wind Speed: 110-150 mph (ASCE 7-10)/90-180 mph (ASCE 7-16)
  - b. Exposure: B or C (ASCE 7-10/ASCE 7-16)
  - c. 25 year Design Life/50 year Design Life for ASCE 7-16
  - d. Elevation: Insertion of the project at - grade elevation can result in a reduction of wind pressure. If your project is in a special case study region or in an area where wind studies have been performed, please verify with your jurisdiction to ensure that elevation effects have not already been factored into the wind speed. If elevation effects have been included in your wind speed, please select 0 ft as the project site elevation.
  - e. Wind Tunnel Testing: Wind tunnel testing coefficients have been utilized for design of the system.
3. Snow Design
  - a. Ground Snow Load: 0-80 psf (ASCE 7-10/ASCE 7-16)
  - b. Exposure Factor: 0.9
  - c. Thermal Factor: 1.2
  - d. Roof Snow Load: Calculation per Section 7.3 (ASCE 7-10/ASCE 7-16)
  - e. Unbalanced/Drifting/Sliding: Results are based on the uniform snow loading and do not consider unbalanced, drifting, and sliding conditions
4. Seismic Design
  - a. Report *SEAOC PV1-2012/ASCE 7-16 SECTION 13.6.12 – Structural Seismic Requirements and Commentary for Rooftop Solar Photovoltaic Arrays*
  - b. Seismic Site Class: A, B, C, or D (ASCE 7-10/ASCE 7-16)
  - c. Importance Factor Array (I<sub>p</sub>): 1.0
  - d. Importance Factor Building (I<sub>e</sub>): 1.0
  - e. Site Class: D

## Properties

1. Bay Weight: ~7.2 lbs
2. Wind Deflector Weight: ~6.4 lbs
3. Module Gaps (E/W) = 0.25 in
4. Wind Deflectors: Wind deflectors on the east and west edges of the array should overhang the east and west modules by six inches for Type 1 modules on the north rows only. Wind deflectors on the east and west edges of the array should overhang the east and west modules by six inches for Type II modules.
5. Bays: North row bays overhang the module by ~6.5 inches and south row bays overhang the module by ~12.25 inches.

## Testing

1. Coefficient of Friction
2. Wind Tunnel
3. UL 2703
4. Component Testing (Bay and Clamp)

## Setbacks

For the wind tunnel recommendations in U-Builder to apply, the following setbacks should be observed/followed for U-Builder wind design:

1. Modules should be placed a minimum of 3 feet from the edge of the building in any direction.
2. If the array is located near an obstruction that is 3.5 feet wide and 3.5 feet high or larger, the nearest module of the array must be located a distance from the obstruction that is greater than or equal to the height of the obstruction. Exception: When using ASCE 7-16 Building Code and using the obstruction feature in the module editor to accurately model the size and location of obstruction
3. Installations within the setbacks listed above require site specific engineering.<sup>2</sup>
4. The setbacks above are for wind. High seismic areas, fire access isles, mechanical equipment, etc., may require larger setbacks than listed above for wind.

## Site Specific Engineering

Conditions listed below are beyond the current capabilities of U-Builder. Site specific engineering is required.

1. Wind designs for a project design life exceeding 25 years.<sup>1/ASCE 7-16</sup>
2. Building assumptions and design parameters outside of U-Builder assumptions
3. Attachments
4. Risk Category III or IV projects (U-Builder can be adjusted for the correct wind, but not the seismic or snow design)
5. Wind tunnel testing reduction factors are not permitted by the Authority Having Jurisdiction (AHJ).<sup>3</sup>
6. Seismic designs that fall outside SEAOC PV1-2012/ASCE 7-16 SECTION 13.6.12 recommendations (>3% roof slope, or AHJ's that require shake table testing or non-linear site-specific response history analysis)
7. Signed and sealed site-specific calculations, layouts, and drawings

## Notes:

1. Please contact [info@unirac.com](mailto:info@unirac.com).
2. Please contact [EngineeringServices@unirac.com](mailto:EngineeringServices@unirac.com) for more information.
3. Please contact Theresa Allen with PZSE Structural Engineers at [theresa@pzse.com](mailto:theresa@pzse.com). These items will require direct coordination with PZSE to complete the requested services.