# SOLAR PV INSTALLATION PROJECT

# Rao Residence
# 17606 Karli Lane
# Orland Park, IL 60647

## PLAN AND CONSTRUCTION SET

09/28/2018 [UPDATED 10/22/18]

***REFERENCED CODES AND ACTS, Orland Park, IL***

*2015 IBC Building Code w/Village Amendments,Village Code, Title 5, Chapter 1*
*2015 IRC Building Code w/Village Amendments, Village Code, Title 5, Chapter 1*
*2015 International Mechanical Code w/Amendments, Village Code, Title 5, Chapter 6*
*2014 National Electrical Code w/Amendments, Village Code, Title 5, Chapter 3*
*2014 State of Illinois Plumbing Code w/Amendments, Village Code, Title 5, Chapter 4*
*2012 International Fire Code w/Amendments, Village Code, Title 5, Chapter s1 &5*
*2015 International Property Maintenance Code w/Amendments, Village Code, Title 5, Chapter 7*
*2015 Illinois Energy Conservation Code (IECC)*


**PROJECT SUMMARY:**

- 21.24 kW Grid Interactive Solar Array
- (59) 360W SunPower X22-360-D-AC Modules.
- Inverter Output: 240V/1ϕ, 3W.
- SunPower Invisimount Racking: Flush, Attached Roof Mount.
- Building Service: 200A, 240V, 1ϕ, 3W
- Pitch: 36° Azimuth: 90° ,180°, 270°
- AC Point of Common Connection: AC Load Side Connection inside Utility Meter Enclosure.
- AC Disconnect on exterior wall of House next to utility meter.

**SHEET INDEX:**


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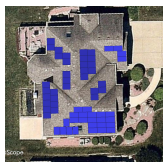
12. RIGHT ELEVATION
13. LEFT ELEVATION
14. REAR ELEVATION
15. SINGLE LINE DIAGRAM

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Ailey Solar

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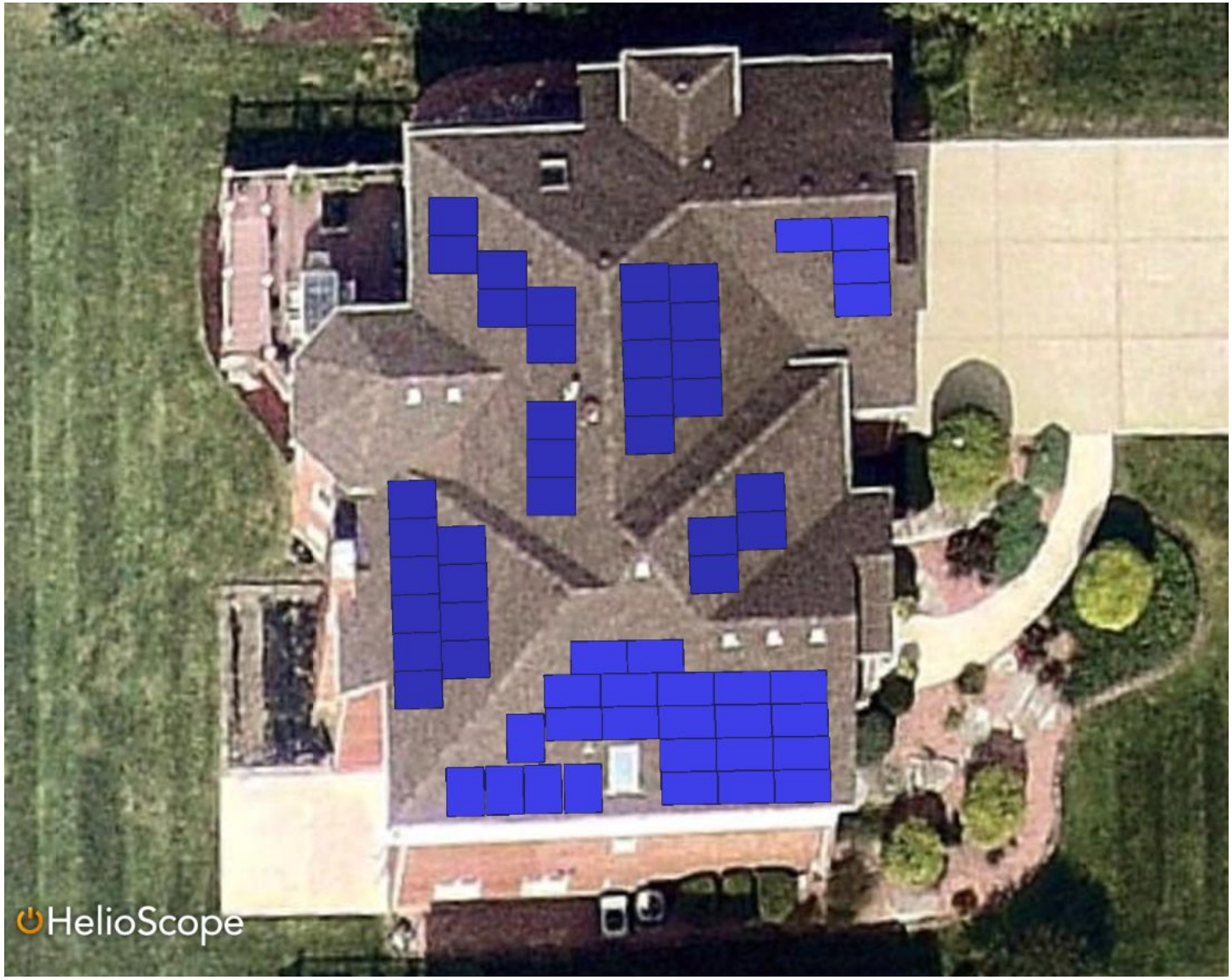
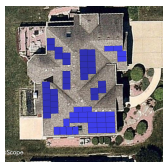
PROJECT/ADDRESS: **17606 Karli Lane Orland Park, IL. 60647**
SHEET NUMBER: **1**

**OWNER CONTACT: 708-337-3274**

# OVERHEAD VIEW OF SITE



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SHEET NUMBER: **2**

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# SITE PLAN

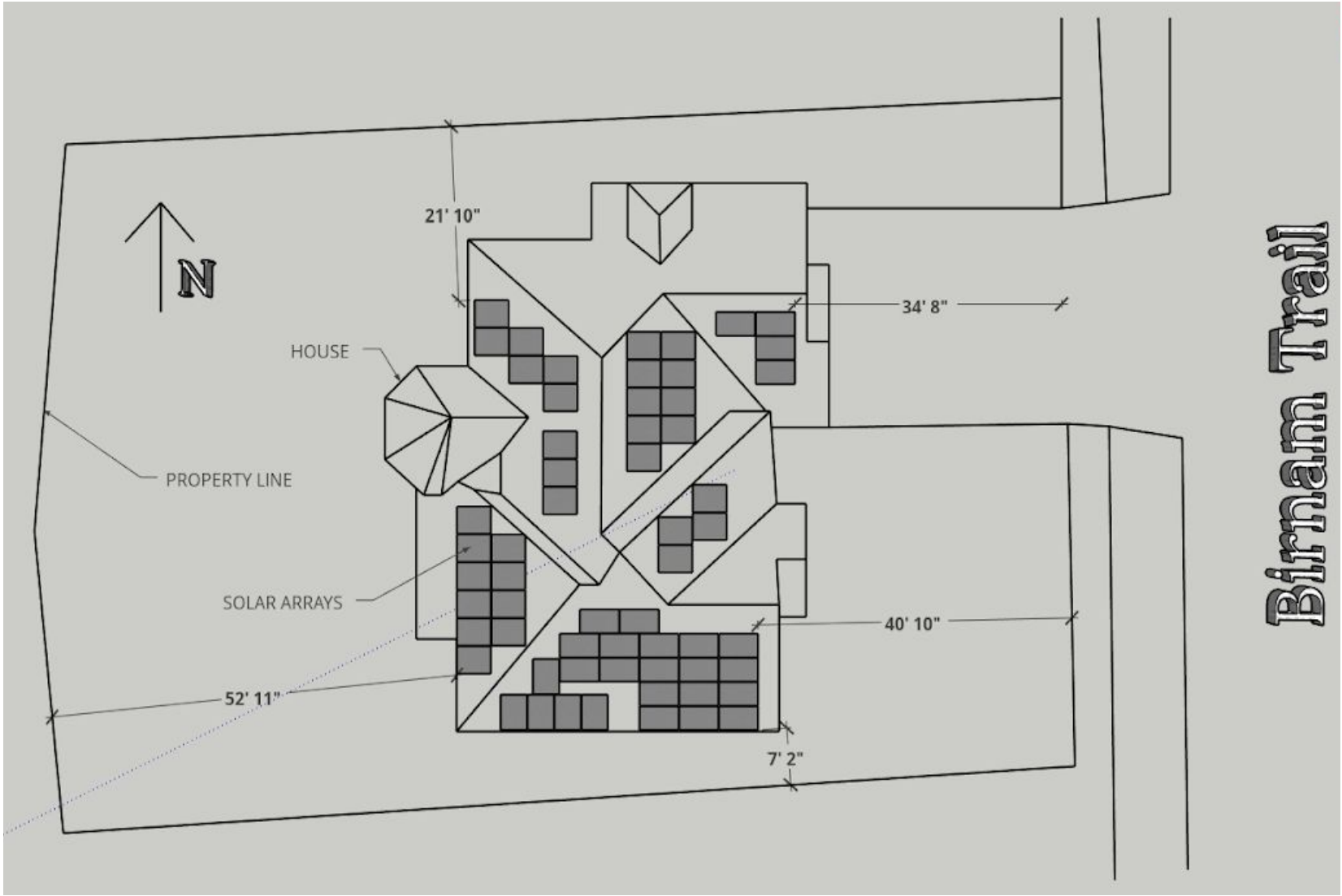
**Total area of proposed Solar panel array:**

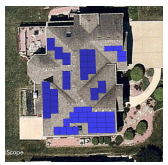
**1,035 ft$^2$**

**Total Area of Rooftop:**

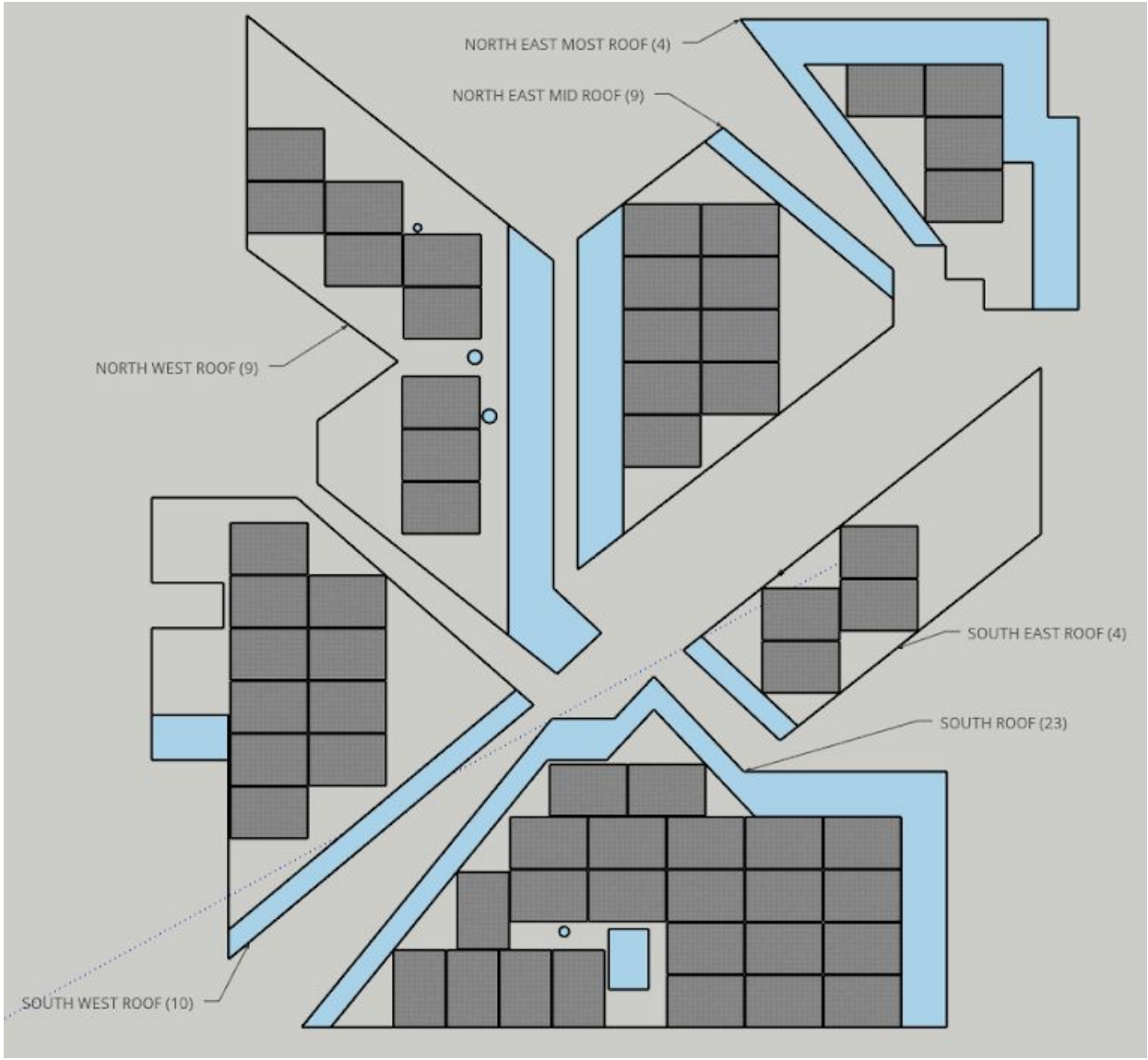
**4467 ft$^2$**

**1,035/4,467= 23.17% total rooftop area covered by solar panel arrays.**




| | | | | |
|---|---|---|---|---|
|  | *VERSION: 9/28/2018 Drawn: DB,KU* | Ailey Solar | *1965 W. Pershing, Chicago, IL 60609 \| Phone: (773) 245-3912 \| Email: info@aileysolar.com* | PROJECT/ADDRESS: **17606 Karli Lane Orland Park, IL. 60647**<br>SHEET NUMBER: **3**<br><br>**OWNER CONTACT: 708-337-3274** |

# ARRAY & RACKING PLAN - OVERVIEW

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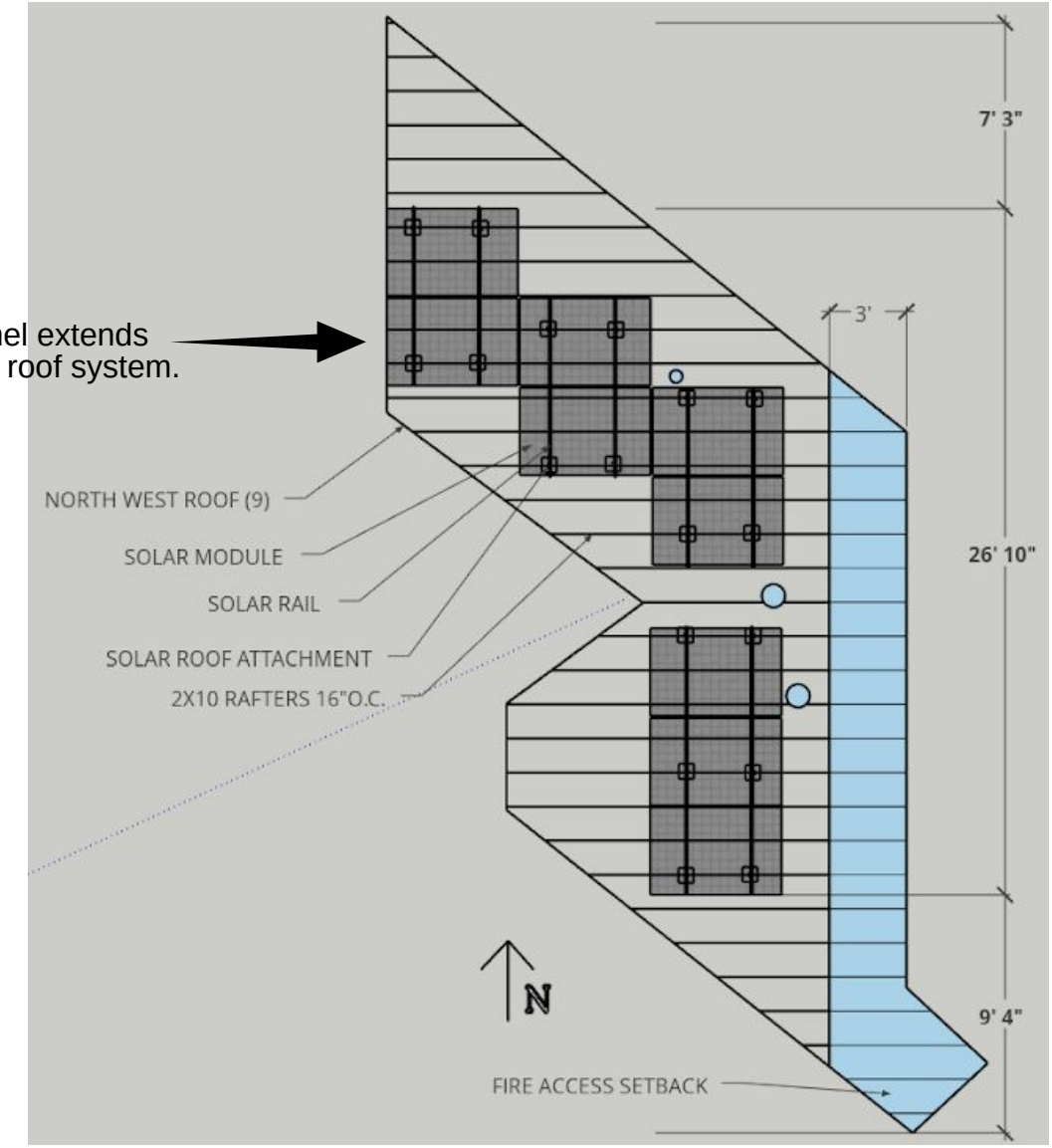
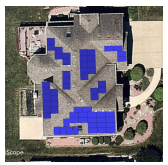
SHEET NUMBER: **4**

**OWNER CONTACT: 708-337-3274**

# ARRAY & RACKING PLAN - NORTHWEST ROOF

Note: No part of the panel extends beyond the edge of the roof system.



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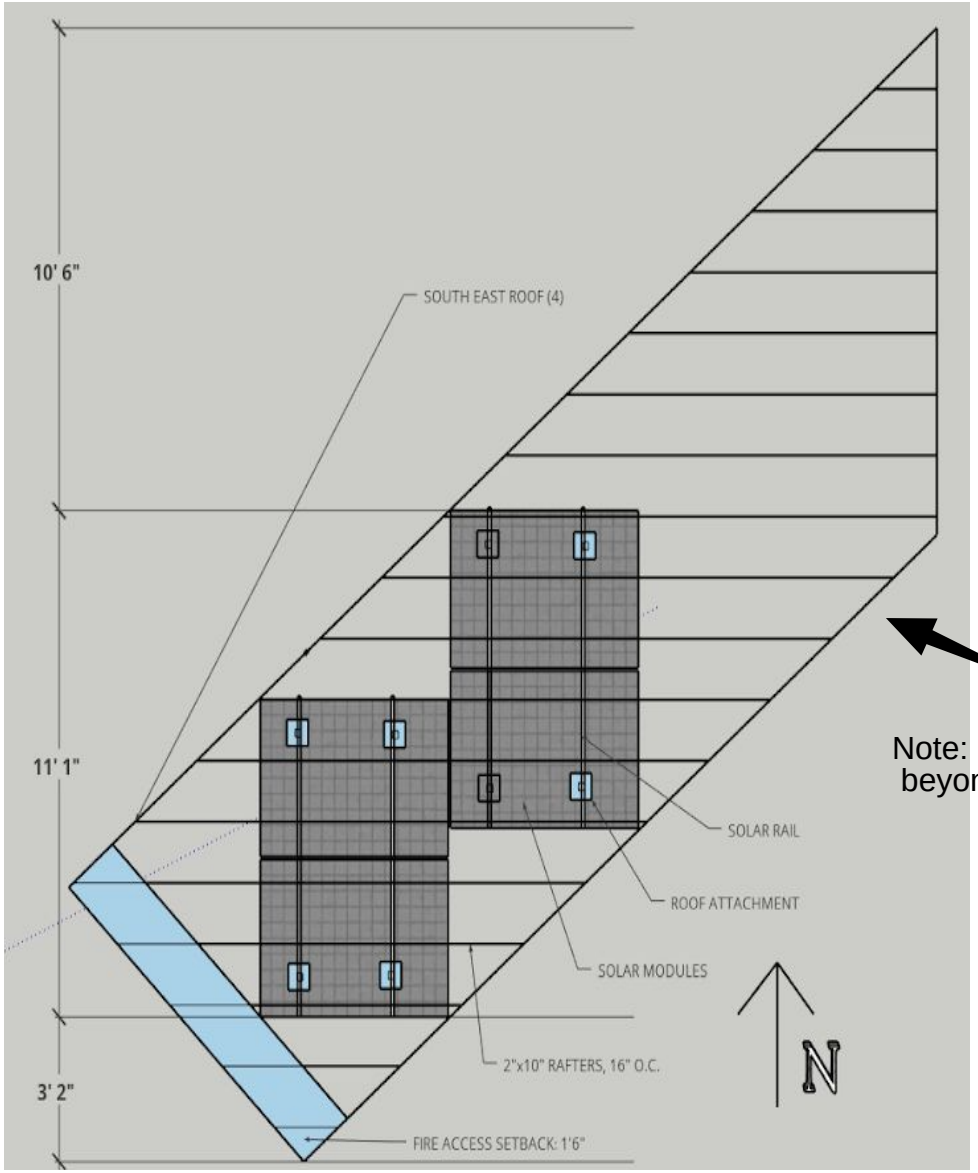
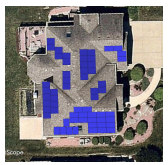
SHEET NUMBER: **5**

# ARRAY & RACKING PLAN - SOUTHEAST ROOF




Note: No part of the panel extends beyond the edge of the roof system.



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PROJECT/ADDRESS: **17606 Karli Lane Orland Park, IL. 60647**
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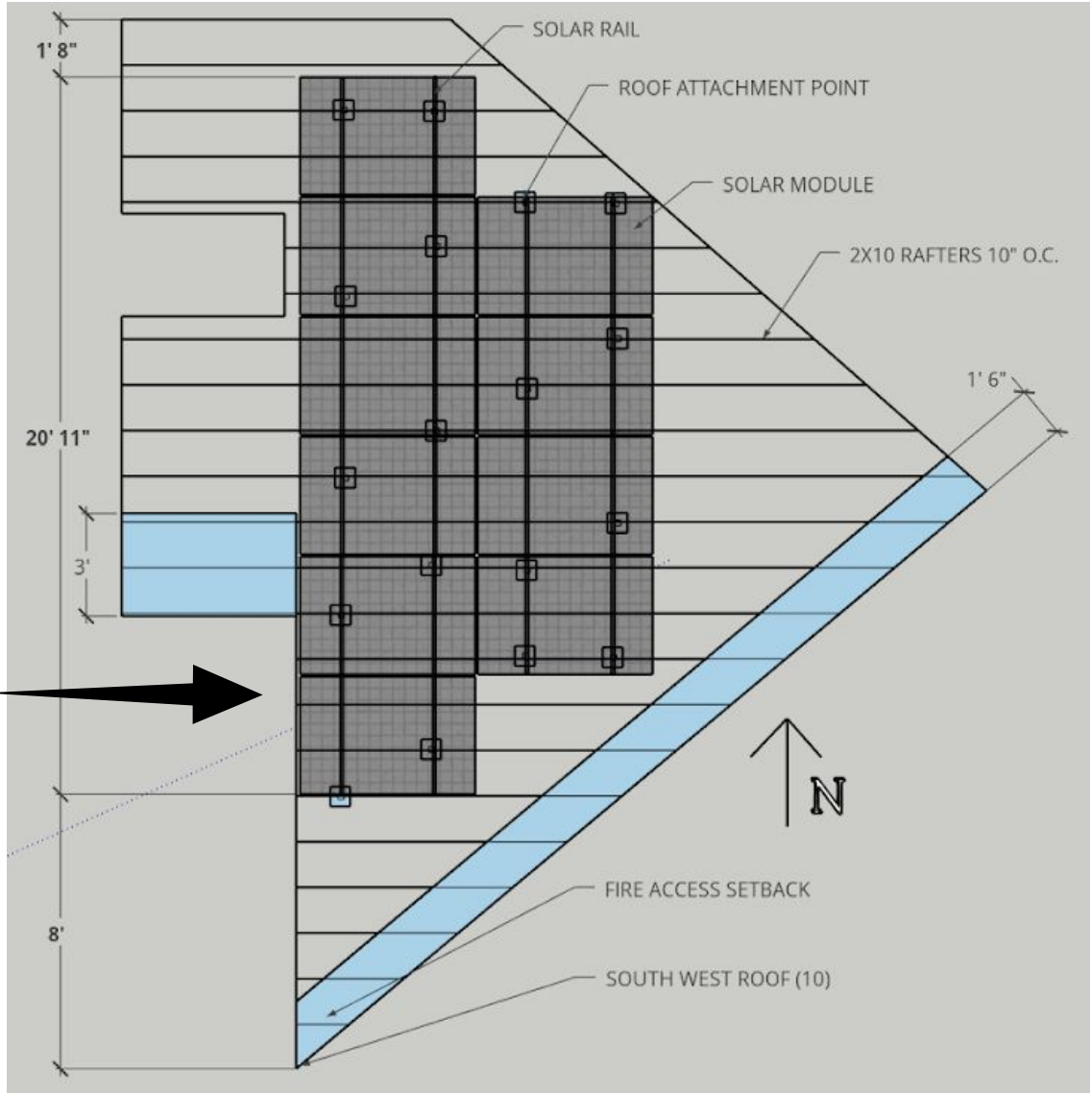
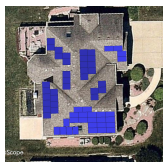
# ARRAY & RACKING PLAN - SOUTHWEST ROOF




Note: No part of the panel extends beyond the edge of the roof system.



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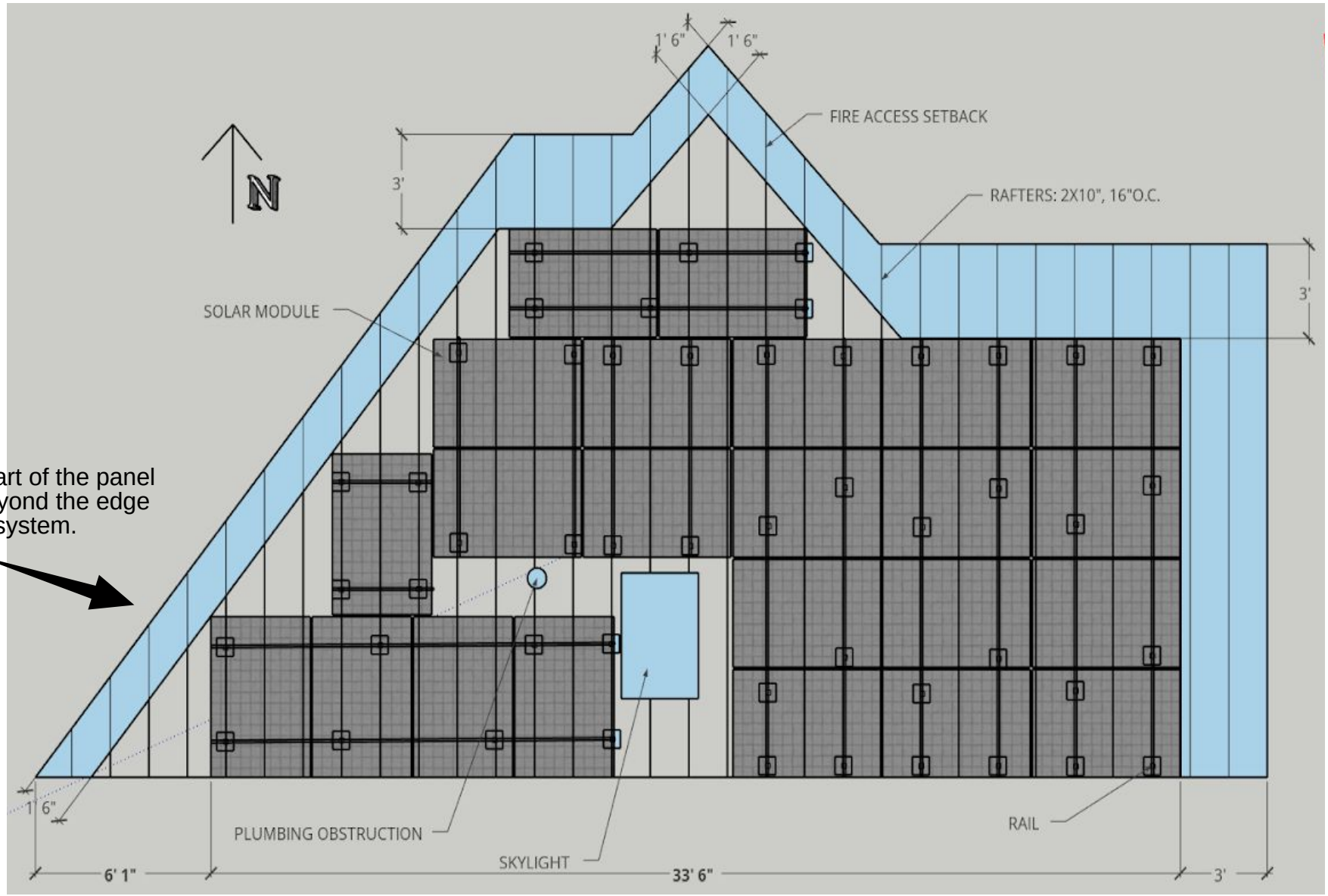
PROJECT/ADDRESS: **17606 Karli Lane Orland Park, IL. 60647**
SHEET NUMBER: **7**

# ARRAY & RACKING PLAN - SOUTH ROOF




Note: No part of the panel extends beyond the edge of the roof system.

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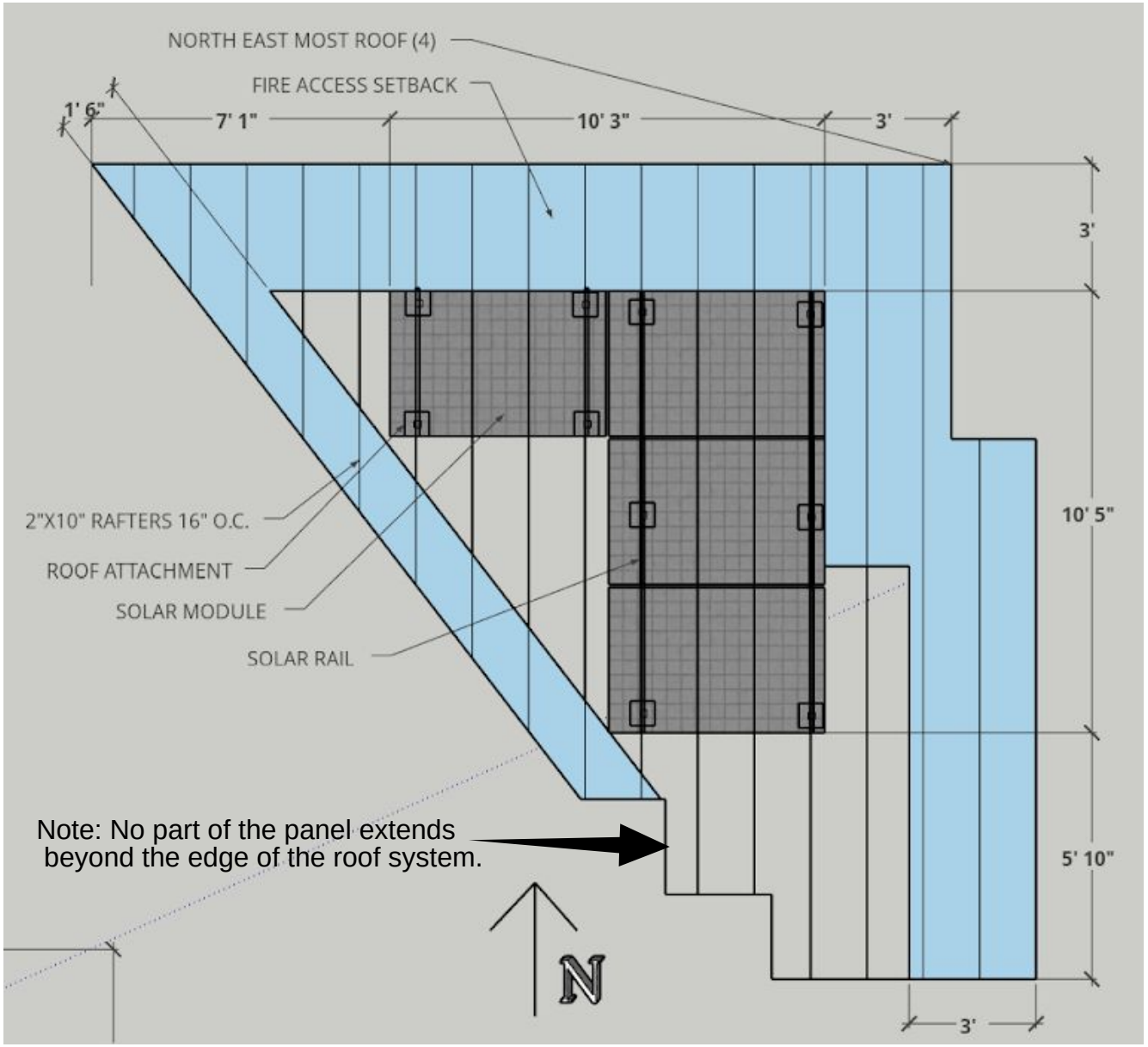
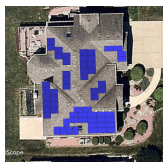
PROJECT/ADDRESS: **17606 Karli Lane Orland Park, IL. 60647**
SHEET NUMBER: **8**

# ARRAY & RACKING PLAN - NORTHEAST MOST ROOF



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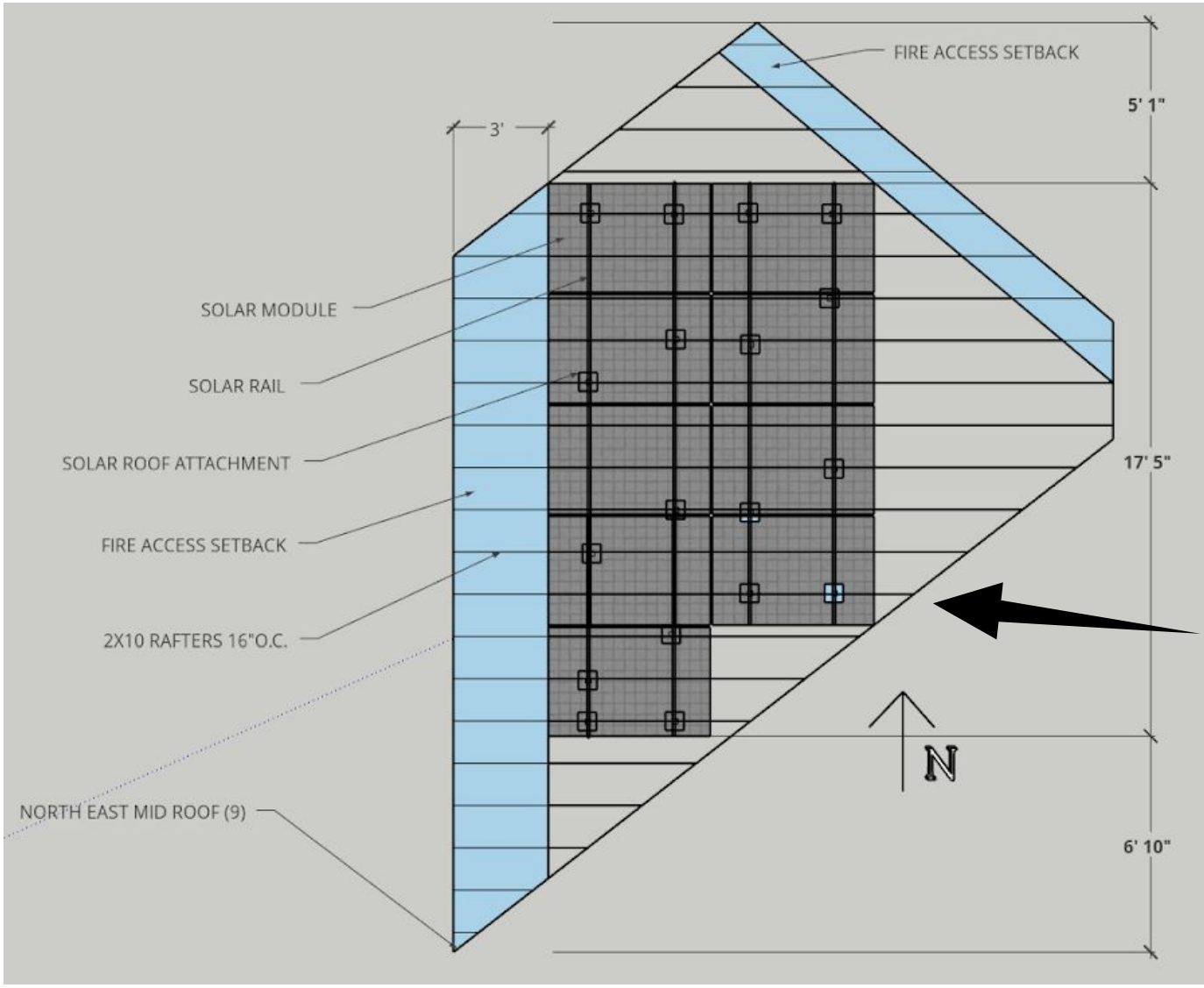
SHEET NUMBER: **9**

# ARRAY & RACKING PLAN - NORTHEAST MID ROOF




Note: No part of the panel extends beyond the edge of the roof system.

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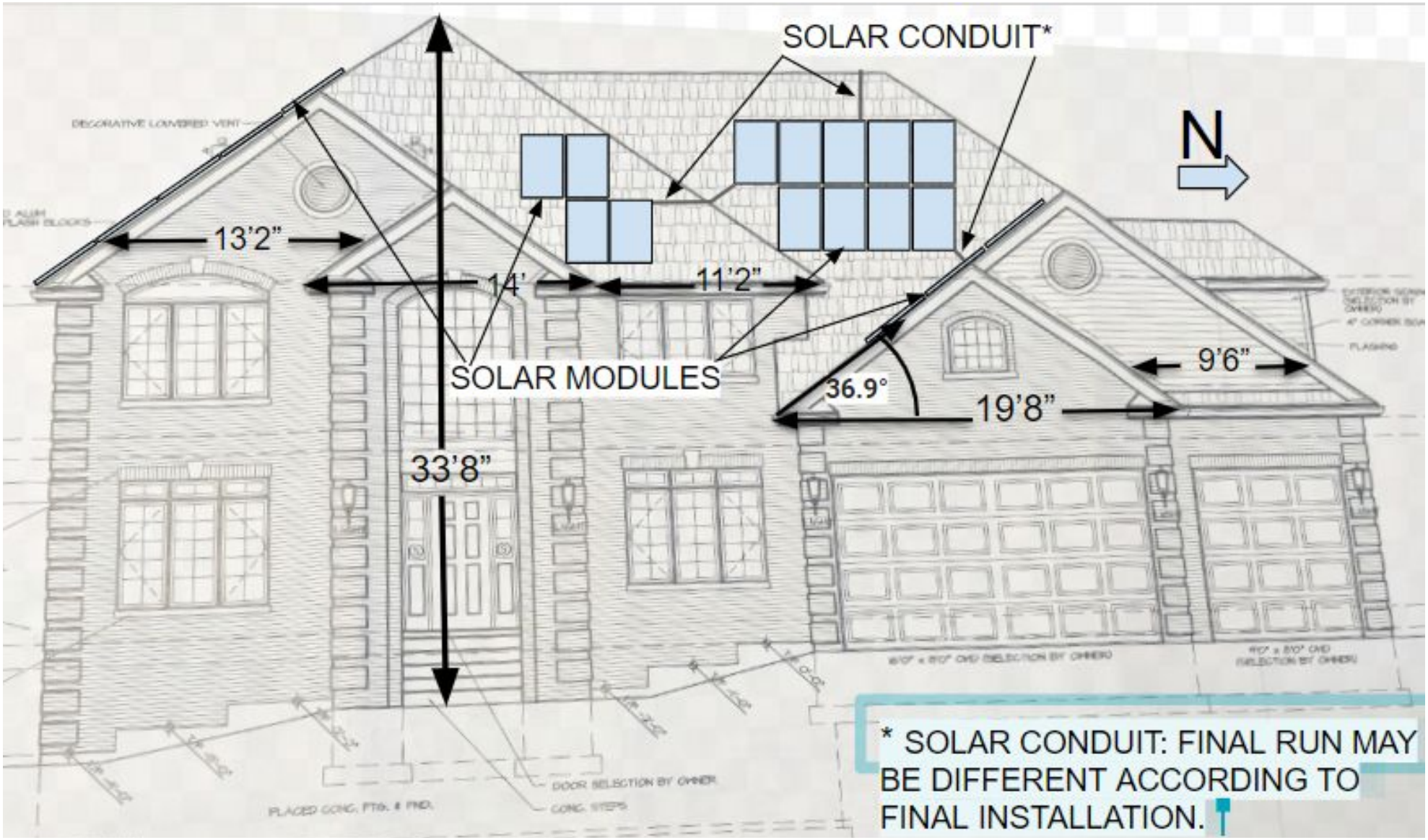
PROJECT/ADDRESS: **17606 Karli Lane Orland Park, IL. 60647**
SHEET NUMBER: **10**

# FRONT/EAST ELEVATION

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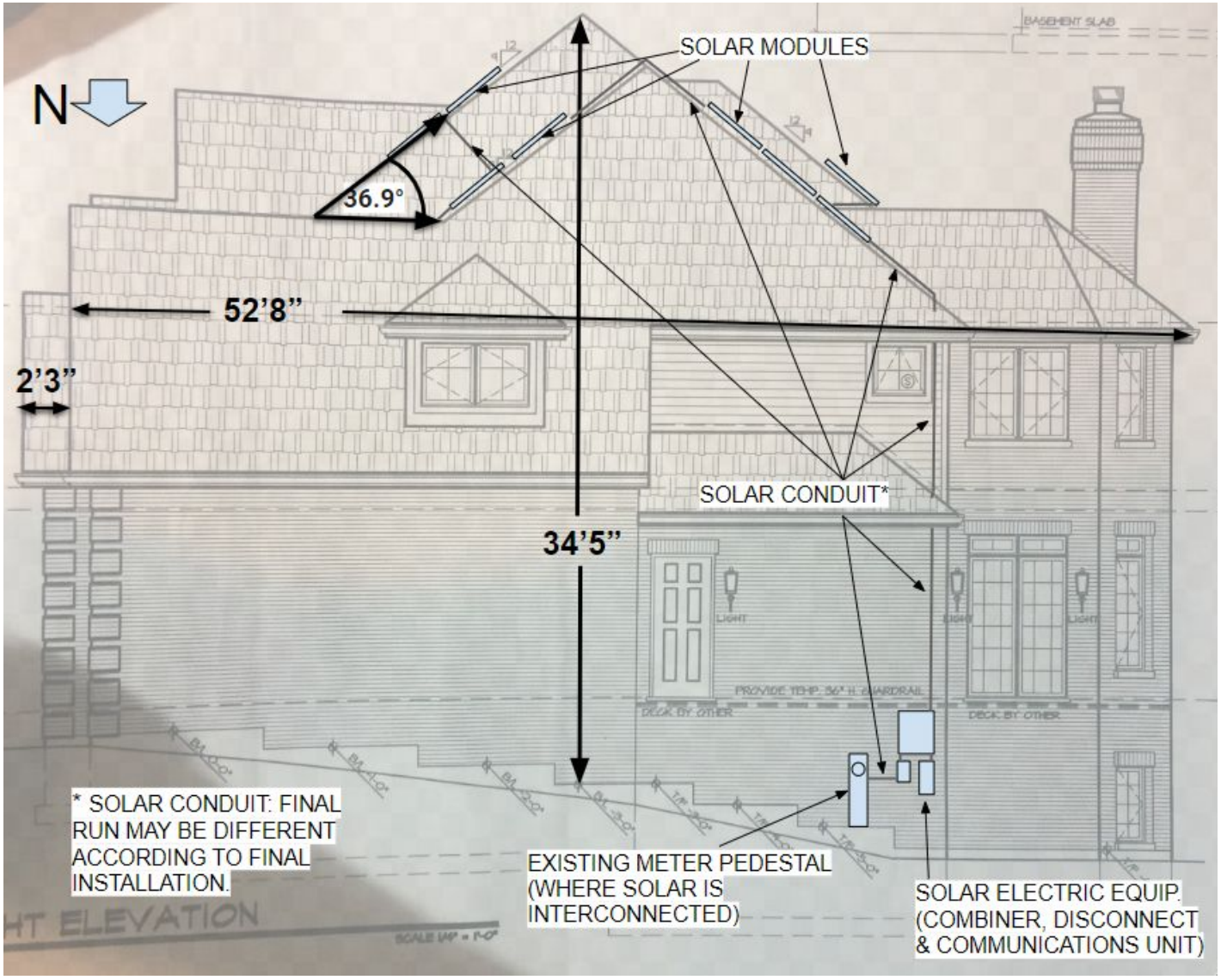
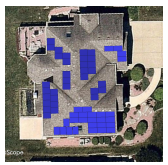
PROJECT/ADDRESS: **17606 Karli Lane Orland Park, IL. 60647**
SHEET NUMBER: **11**

**OWNER CONTACT: 708-337-3274**

# RIGHT/NORTH ELEVATION



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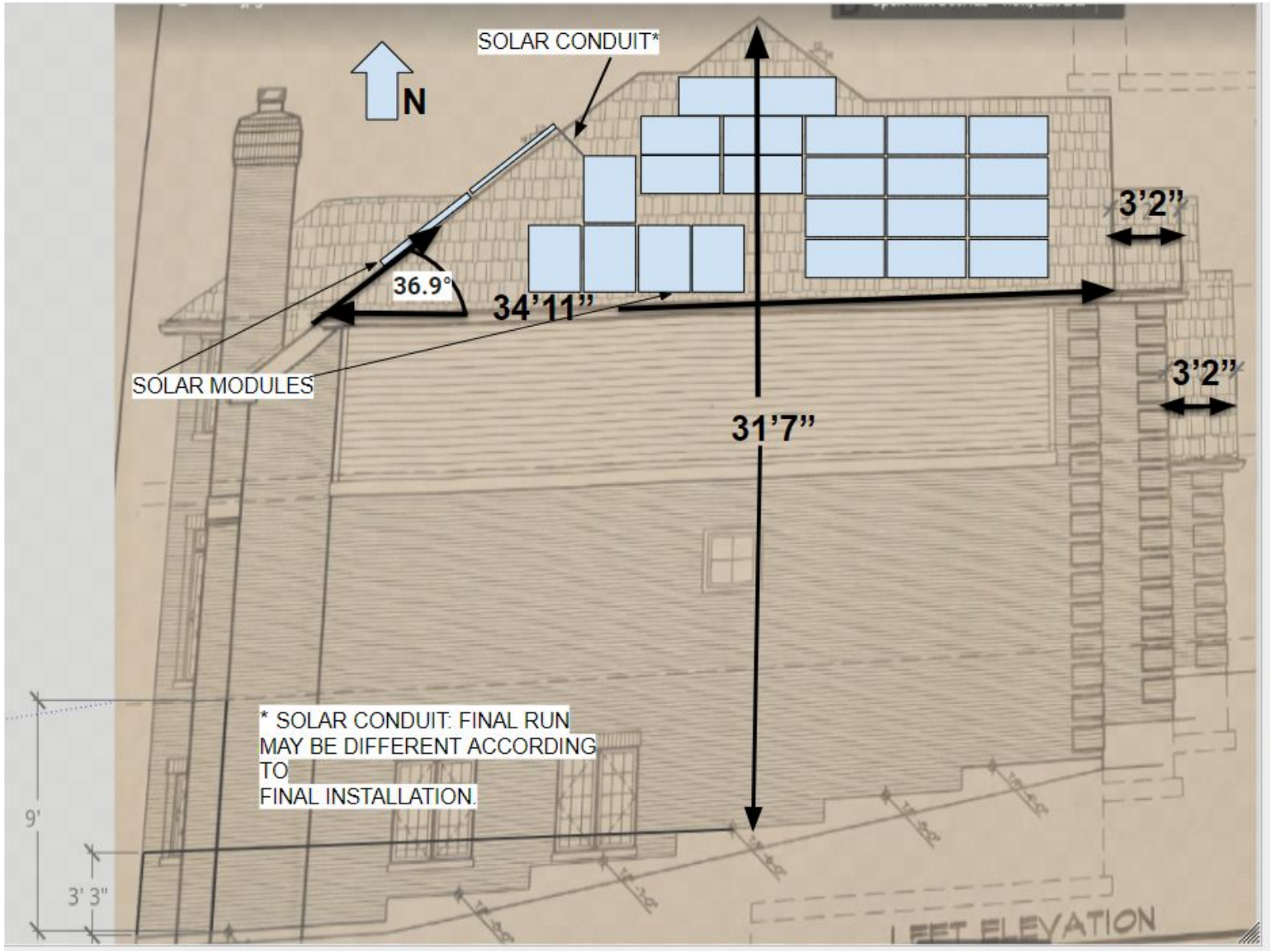
PROJECT/ADDRESS: **17606 Karli Lane Orland Park, IL. 60647**
SHEET NUMBER: **12**

**OWNER CONTACT: 708-337-3274**

# LEFT/SOUTH ELEVATION




*VERSION: 9/28/2018*
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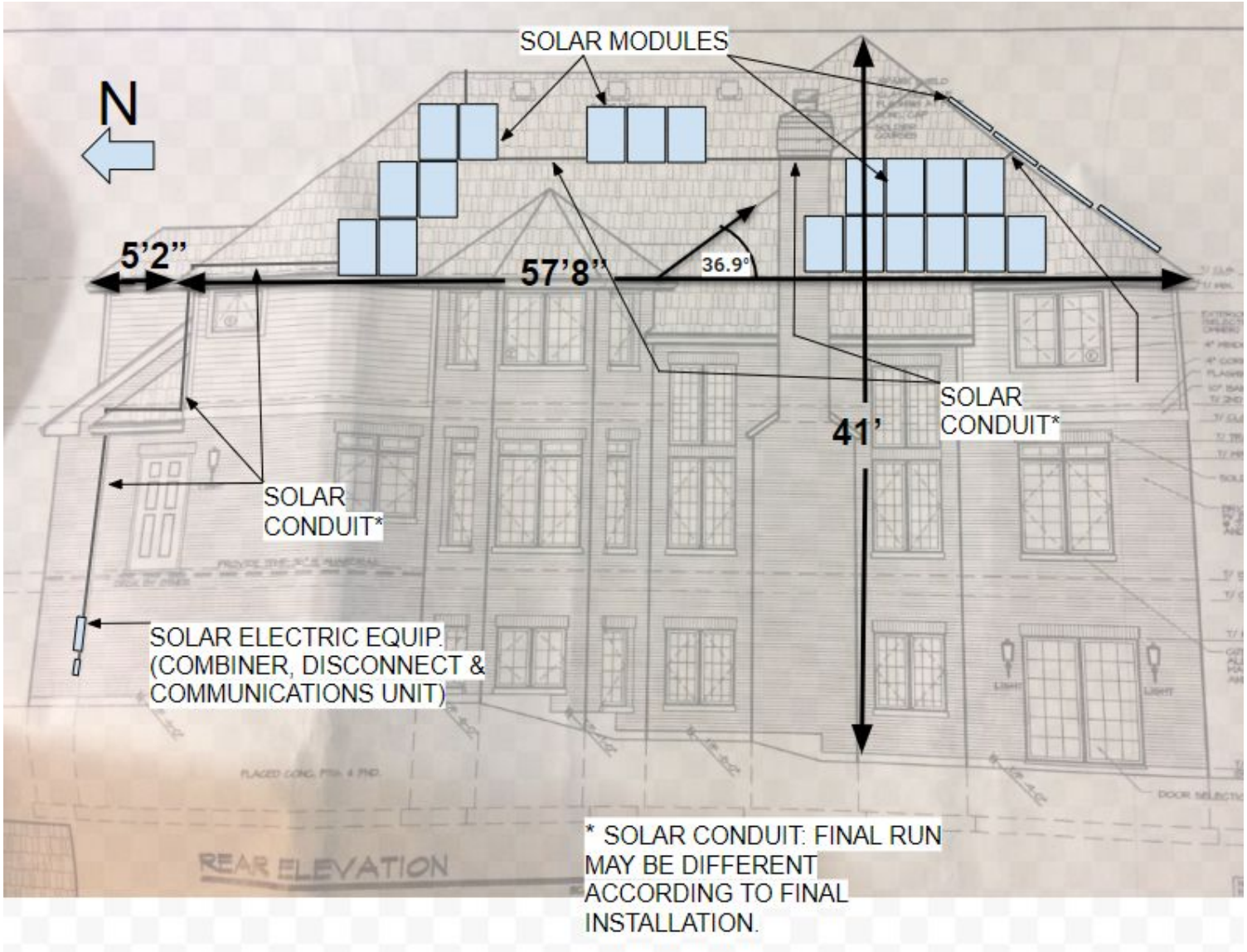
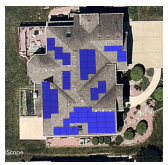
PROJECT/ADDRESS: **17606 Karli Lane Orland Park, IL. 60647**
SHEET NUMBER: **13**

**OWNER CONTACT: 708-337-3274**

# REAR/WEST ELEVATION



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PROJECT/ADDRESS: **17606 Karli Lane Orland Park, IL. 60647**
SHEET NUMBER: **14**

**OWNER CONTACT: 708-337-3274**

# SINGLE LINE DIAGRAM

## EQUIPMENT SCHEDULE

| Tag | Description | Qty. | Part # | Location | Notes |
|---|---|---|---|---|---|
| A | PV Module/microinverter | 51 | Sunpower X22-360-D-AC | Roof | 360W AC modules |
| B | Junction Box - roof | 1 | Nema 3R Junction Box | Roof, near PV modules | |
| C | Combiner panel | 1 | Homeline 125A main lug | Outside | 5 20A double pole breakers, max. Output current 68A |
| D | Communications Unit | 1 | PVS 5X - SunPower | Outside, ground level near utility meter | Fed by 15A double pole breaker in combiner panel |
| E | AC disconnect | 1 | 100A NEMA 3R disconnect | Outside, ground level near utility meter | Fused with 90A NON FUSES |
| F | Utility meter panel | 1 | Existing | Outside | Location of Load Side AC connection using listed ILSCO 4/0-2/0 Insulation piercing taps. |
| G | Service panel | 1 | 200A | Basement | Existing. Shown for reference. |

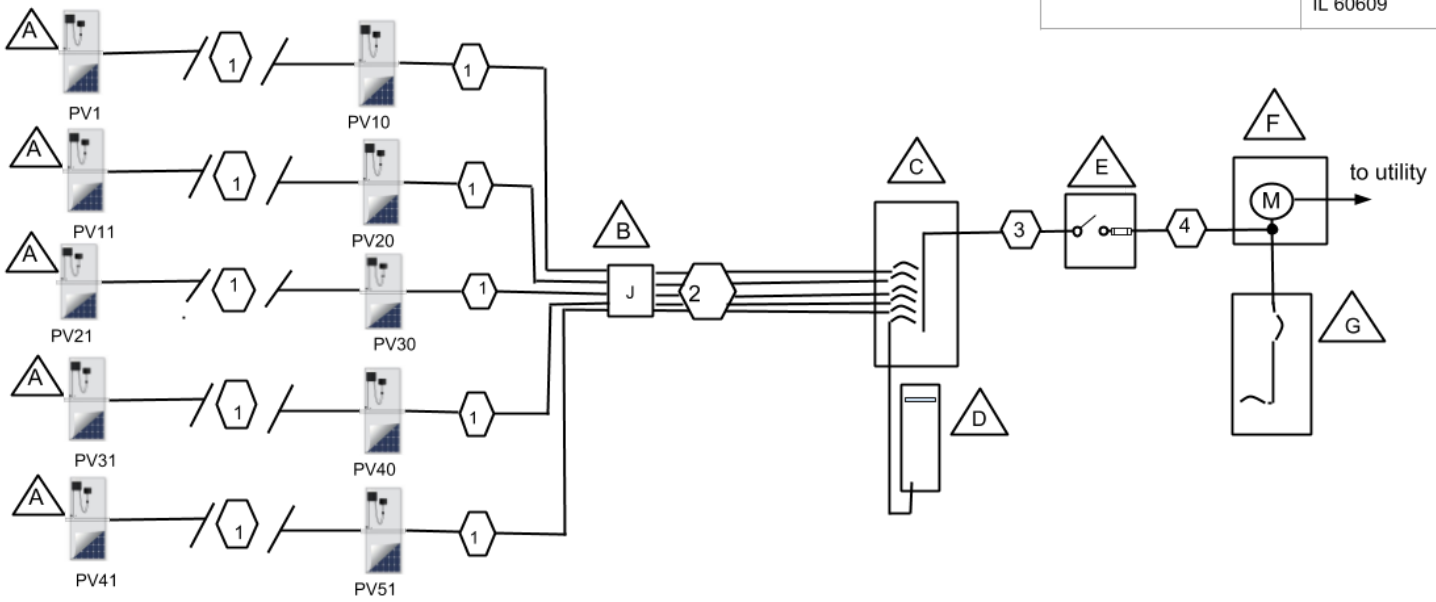
## CONDUCTOR-CONDUIT SCHEDULE

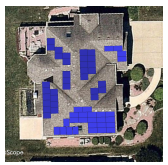
| Tag | Conductor type | Temp | Quantity and gauge | Conduit |
|---|---|---|---|---|
| 1 | Sunpower trunk cable | 55ºC | (2) #12, (1) #12 EGC | None |
| 2 | THWN-2 | 55ºC | (10) #10, (1) #10EGC | 1" EMT |
| 3 | THWN-2 | 35ºC | (3) #4, (1) #10EGC | 1"EMT |
| 4 | THWN-2 | 35ºC | (3) #4, (1) #10EGC | 1" EMT |

**17606 Karli Lane,** Orland Park, IL 60467
Single Line Diagram

Drawn: JA 9/13/18

Ailey Solar Electric
1965 W Pershing, Chicago, IL 60609



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PROJECT/ADDRESS: **17606 Karli Lane Orland Park, IL. 60647**
SHEET NUMBER: **15**

**OWNER CONTACT: 708-337-3274**

# SunPower® X22-360-D-AC | Residential AC Module Series

## Design-Driven Advantages

- #1 module aesthetics and efficiency[1]
- Unmatched module reliability[2]
- No electrolytic capacitors
- 25-year Combined Power and Product Warranty
- California Rule 21 Phase 1 compliant

## Maximize Value for Roof

- Size system for roof, not string inverter
- Optimize performance of each module

## Expand Deployment Options

- Complex roofs and partial shading
- Small systems
- System expandability

## Simplify & Speed Installation

- Factory-integrated microinverter
- Robust, double-locking AC connectors
- Design flexibility offsite and onsite
- No DC string sizing process
- Fewer installation steps than competing systems
- Intuitive commissioning

## Component of Complete System

- Built for use with SunPower® InvisiMount™ and the SunPower Monitoring System (PVS5x)
- Superior system reliability and aesthetics

X22 SERIES

## Optimize System and Installation Efficiency

SunPower® AC modules, which include a factory-integrated SunPower microinverter, provide a revolutionary combination of high efficiency, high reliability, and module-level DC-to-AC power conversion. Designed specifically for use with SunPower InvisiMount™ and the SunPower Monitoring System, SunPower AC modules enable rapid installation, best-in-class system aesthetics, and intuitive visibility into system performance. All this comes with the best Combined Power and Product Warranty in the industry.

## Grid Support Utility-Interactive Smart Inverter

SunPower's new Type D AC module is UL tested and certified to UL 1741 SA and provides advanced smart inverter functions. SunPower Type D AC modules are fully compliant with the California Rule 21 Phase 1 requirements, and the Rule 21 grid profile is easily set during commissioning with SunPower PVS5x monitoring hardware.

sunpower.com

# SunPower® X22-360-D-AC | Residential AC Module Series

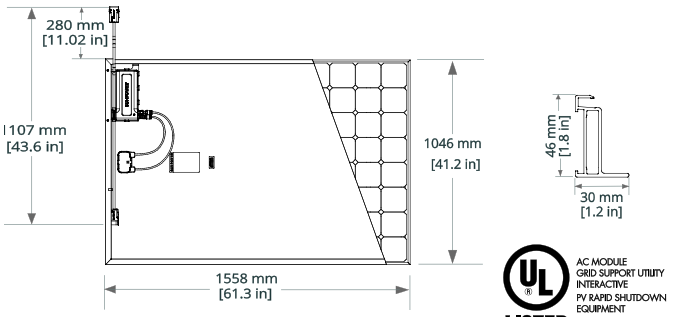
| AC Electrical Data[3] | | | |
|---|---|---|---|
| SRD Profile | | IEEE 1547a-2014[3] (default settings) min. / nom. / max. | CA Rule 21[3] min. / nom. / max. |
| Frequency (Hz) | | 59.5 / 60.0 / 60.5 | 58.5 / 60.0 / 60.5 |
| Power Factor | | 0.99 / 1.00 / 1.00 | 0.85 lead. / 1.00 / 0.85 lag. |
| Reactive Power | | | ±169 Var Volt-VAr |
| Voltage | @240 V<br>@208 V | 211.2 / 240 / 264 V<br>183 / 208 / 228.8 V | |
| Max. Current | @240 V<br>@208 V | 1.33 A<br>1.54 A | |
| DC/AC CEC Conversion Efficiency | @240 V<br>@208 V | 96.0%<br>95.5% | |
| Max. Units Per 20 A Branch Circuit | @240 V<br>@208 V | 12 (single phase)<br>10 (two pole) wye | |
| Power | | 320 W, 320 VA | |
| No active phase balancing for 3 phase installations | | | |

| DC Power Data | |
|---|---|
| | SPR-X22-360-D-AC |
| Nominal Power[4] (Pnom) | 360 W |
| Power Tolerance | +5/–0% |
| Avg. Panel Efficiency[5] | 22.2% |
| Temp. Coef. (Power) | –0.29%/° C |
| Shade Tolerance | • Three bypass diodes<br>• Integrated module-level maximum power point tracking |

| Tested Operating Conditions | |
|---|---|
| Operating Temp. | –40° F to +185° F (–40° C to +85° C) |
| Max. Ambient Temp. | 122° F (50° C) |
| Max. Load | Wind: 62 psf, 3000 Pa, 305 kg/m² front & back<br>Snow: 125 psf, 6000 Pa, 611 kg/m² front |
| Impact Resistance | 1 inch (25 mm) diameter hail at 52 mph (23 m/s) |

| Mechanical Data | |
|---|---|
| Solar Cells | 96 Monocrystalline Maxeon Gen III |
| Front Glass | High-transmission tempered glass with anti-reflective coating |
| Environmental Rating | Outdoor rated |
| Frame | Class 1 black anodized (highest AAMA rating) |
| Weight | 45.5 lbs (20.6 kg) |
| Recommended Max. Module Spacing | 1.3 in. (33 mm) |

| Warranties and Certifications | |
|---|---|
| Warranties | · 25-year limited power warranty<br>· 25-year limited product warranty |
| Certifications | UL listed to UL 1741 SA<br>· SRDs: IEEE 1547-2003, IEEE 1547a-2014, CA Rule 21 Phase 1<br>· PV Rapid Shutdown Equipment<br>· Equipment Grounding<br>· UL 6703, UL 9703 Connectors and cables (load break disconnection)<br>· UL 1741 AC Module (Type 2 fire rating)<br>Enables installation in accordance with:<br>· NEC 690.6<br>· NEC 690.12 Rapid Shutdown (inside and outside the array)<br>· NEC 690.15 AC Connectors, 690.33(A) – (E)(1)<br>FCC and ICES-003 Class B<br>When used with InvisiMount racking (UL 2703):<br>· Integrated grounding and bonding<br>· Class A fire rated |
| PID Test | Potential-induced degradation free |




Please read the safety and installation instructions for details.

AC MODULE
GRID SUPPORT UTILITY INTERACTIVE
PV RAPID SHUTDOWN EQUIPMENT
LISTED E478330
Module Fire Performance: Type 2

[1]Highest of over 3,200 silicon solar panels, Photon Module Survey, Feb. 2014
[2]#1 rank in "PV Module Durability Initiative Public Report," Fraunhofer CSE, Feb 2013. Five out of the top eight largest manufacturers were tested. Campeau, Z. et al. "SunPower Module Degradation Rate," SunPower white paper, Feb 2013. See www.sunpower.com/facts for details.
[3]Factory set to 1547a-2014 default settings. CA Rule 21 default settings profile set during commissioning. See the *Equinox Installation Guide #518101* for more information.
[4]Standard Test Conditions (1000 W/m² irradiance, AM 1.5, 25° C). NREL calibration standard: SOMS current, LACCS FF and voltage. All DC voltage is fully contained within the module.
[5]Based on average of measured power values during production.

See www.sunpower.com/facts for more reference information.
For more details, see extended datasheet: www.sunpower.com/datasheets.

518986 RevB



SUNPOWER®

# SunPower® InvisiMount™ | Residential Mounting System

## Simple and Fast Installation

- Integrated module-to-rail grounding
- Pre-assembled mid and end clamps
- Levitating mid clamp for easy placement
- Mid clamp width facilitates consistent, even module spacing
- UL 2703 Listed integrated grounding

## Flexible Design

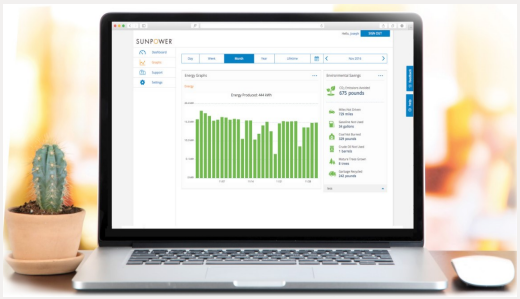
- Addresses nearly all sloped residential roofs
- Design in landscape and portrait with up to 8' rail span
- Pre-drilled rails and rail splice
- Rails enable easy obstacle management

## Customer-Preferred Aesthetics

- #1 module and #1 mounting aesthetics
- Best-in-class system aesthetics
- Premium, low-profile design
- Black anodized components
- Hidden mid clamps and new capped, flush end clamps

## Part of Superior System

- Built for use with SunPower DC and AC modules
- Best-in-class system reliability and aesthetics
- New optional rooftop transition flashing, rail-mounted J-box, and wire management rail clips
- Combine with SunPower modules and SunPower EnergyLink® monitoring app



## Elegant Simplicity

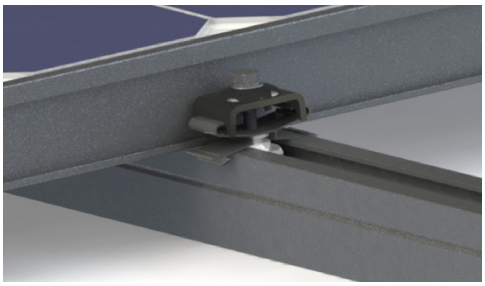
SunPower® InvisiMount™ is a SunPower-designed rail-based mounting system. The InvisiMount system addresses residential sloped roofs and combines faster installation time, design flexibility, and superior aesthetics. The InvisiMount product was specifically envisioned and engineered to pair with SunPower modules. The resulting system-level approach amplifies the aesthetic and installation benefits—for homeowners and for installers.

sunpower.com

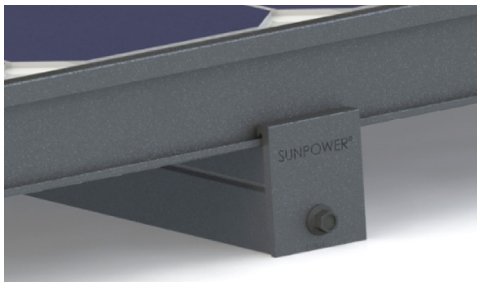
# SunPower® InvisiMount™ | Residential Mounting System

## InvisiMount Components

Module[1] / Mid Clamp and Rail



Module[1] / End Clamp and Rail

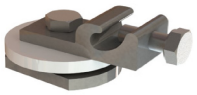



Mid Clamp

End Clamp


Rail & Rail Splice

Ground Lug Assembly (*for DC systems only*)



| InvisiMount Component Details | | |
|---|---|---|
| Mid Clamp | Black oxide stainless steel 300 series | 63 g (2.2 oz) |
| End Clamp | Black anodized aluminum 6000 series | 110 g (3.88 oz) |
| Rail | Black anodized aluminum 6000 series | 830 g/m (9 oz/ft) |
| Rail Splice | Aluminum alloy 6000 series | 830 g/m (9 oz/ft) |
| Ground Lug Assembly | 304 stainless steel (A2-70 bolt; tin-plated copper lug) | 106.5 g/m (3.75 oz) |

| InvisiMount Component LRFD Capacities[2] | | |
|---|---|---|
| Mid Clamp | Uplift | 664 lbf |
| | Shear | 540 lbf |
| End Clamp | Uplift | 899 lbf |
| | Shear | 220 lbf |
| Rail | Moment: upward | 548 lbf-ft |
| | Moment: downward | 580 lbf-ft |
| Rail Splice | Moment: upward | 548 lbf-ft |
| | Moment: downward | 580 lbf-ft |
| L-foot | Uplift | 1000 lbf |
| | Shear | 390 lbf |

| InvisiMount Operating Conditions | |
|---|---|
| Temperature | −40° C to 90° C (−40° F to 194° F) |
| Max. Load (LRFD) | • 3000 Pa uplift<br>• 6000 Pa downforce |

| Roof Attachment Hardware Supported by Design Tool | |
|---|---|
| Application | • Composition Shingle Rafter Attachment<br>• Composition Shingle Roof Decking Attachment<br>• Curved and Flat Tile Roof Attachment<br>• Universal interface for other roof attachments |

| InvisiMount Warranties And Certifications | |
|---|---|
| Warranties | • 25-year product warranty<br>• 5-year finish warranty |
| Certifications | • UL 2703 Listed<br>• Class A Fire Rated |

| Roof Attachment Hardware Warranties |
|---|
| Refer to roof attachment hardware manufacturer's documentation. |

[1] Module frame that is compatible with the InvisiMount system required for hardware interoperability.

[2] SunPower recommends that all Equinox™, InvisiMount™, and AC module systems always be designed using the SunPower Design Tool. If a designer decides to instead use the component capacities listed in this document to design a system, note that the capacities shown are Load and Resistance Factor Design (LRFD) design loads, and are NOT to be used for Allowable Stress Design (ASD) calculations; and that a licensed Professional Engineer (PE) must then stamp all calculations. Should you have any questions please contact SunPower Technical Support at 1-800-SUNPOWER (1-800-786-7693).



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