

STEPHEN
McLAUGHLIN
ROOFING
CONSULTANT

*SMRC, Roofing for Yesterday
Today and Tomorrow*

December 11, 2018
SMP Architects
1600 Walnut St. 2nd Floor
Philadelphia, PA 19138

Attention: Ms. Megan Strenski, Project Manager

Reference: City of Philadelphia Project # 20-16-4919-99, Additional Services, Infrared Roof Survey at Simons Recreation Center, 7200 Woolston Avenue, Philadelphia, PA 19138

Dear Ms. Strenski,

We performed our infrared survey of the roof at the referenced project on November 21 2018. We began with a safety meeting followed by a roof walk. We arrived at the site about 3:00 pm. The conditions were ideal for an infrared roof survey. We began scanning and most of the images were clear. Some images were spotty which usually indicates either very little moisture present or often it may be water between plies that has not wet the insulation. On the clear images, the exact shape of the anomalies were clear.

The Simons Recreation Center building is a masonry and steel structure with steel trusses, steel purlins and a metal roof deck. The building has multiple roof areas. For this report, we will break the building into 3 general building areas, the northwest Gymnasium, the center Multi-Function area, and the Ice Rink Area.

Gymnasium: The upper most roof is covering the gymnasium. It is comprised of three roof areas, area “A”, “B” & “B-1”. The main Gymnasium roof slopes toward the northeast. A series of gussets diverts the water to the drains. These roofs are covered with an SBS modified bituminous membrane roof. The roof areas northwest and southwest of the main gym roof complete the Gymnasium area.

Classroom Area: The Classroom area is composed of 11 distinct roof areas. All of these roofs covered with an SBS membrane roof. The roofs are penetrated by sloped monitors, clerestory windows, mechanical units plumbing vents and roof drains. Much of these roof areas are drained by means of gravity into gutters and downspouts to a sub-grade drainage system. The base flashings are terminated at a masonry parapet and rising walls. Roof Area ‘L’ is also an SBS membrane roof and is penetrated by a masonry chimney, boiler flue, exhaust fans, fence posts, steel dunnage and roof drains. It appears that all of the roof decks are sloped with the possible exception of area “L”. These roof areas are dissected by masonry parapet walls, sloped monitors and parapet walls.

Ice Rink Area: The Ice Rink has a trapezoidal metal panel (Butler Type) roof as its primary roof. The roof panels are secured through the panels, through a fiberglass (insulation) batt and into steel purlins. This Roof Area is not included in this report. Scanning of these area was not performed.

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There is an out building with a newer SBS roof and a connector roof that bridges from the metal panel wall to the SBS roof. There is a single ply membrane roof that houses the refrigerator equipment for the Ice Rink. This roof also has a single ply membrane roof and a vandal resistant cage.

DATE OF SURVEY AND TESTING

November 21 2018

IR Scanning & Marking Paint

METHODOLOGY

The infrared scan was performed using a hand held infrared camera. The camera is a Fluke TiR, IR Fusion Technology. The ideal conditions prior to beginning an infrared scan on a roof were met at this location.

The theory behind using infrared technology to identify moisture in roofing cross sections has been tried and true over the last 40 years. My personal first involvement with infrared was in the mid 1980's in its earliest use as a roofing tool. Derived from military applications, the infrared spectrum of light is not visible to the human eye. It is based on difference in temperature between an object (roof) and the target of the scan, in this case water in the roof. An infrared camera is used to capture the difference in temperatures and present it in a manner in which the human eye can see it.

The scan is performed after the direct sunlight diminishes. This can be from shadows or the sun setting. As the ambient (air) temperature begins to fall, the theory is that the moisture in the roof cross section will cool at a slower rate and therefore give a clear line of the areas that are wet and those that are dry. These areas are identified as anomalies. Marking paint is used to mark the perimeter of the anomaly.

During colder weather and lower angle from the sun, solar gain is very different due to ambient temperatures, lower daytime temperatures and the lower angle of the sun. Often, good IR images appear in the late afternoon, before dusk. This is often the case during the month before and after the winter solstice (12/21). This was the case for this scan. We were able to get clear images in late afternoon. Most images were clear but some were spotty.

ROOF INFRA RED SURVEY

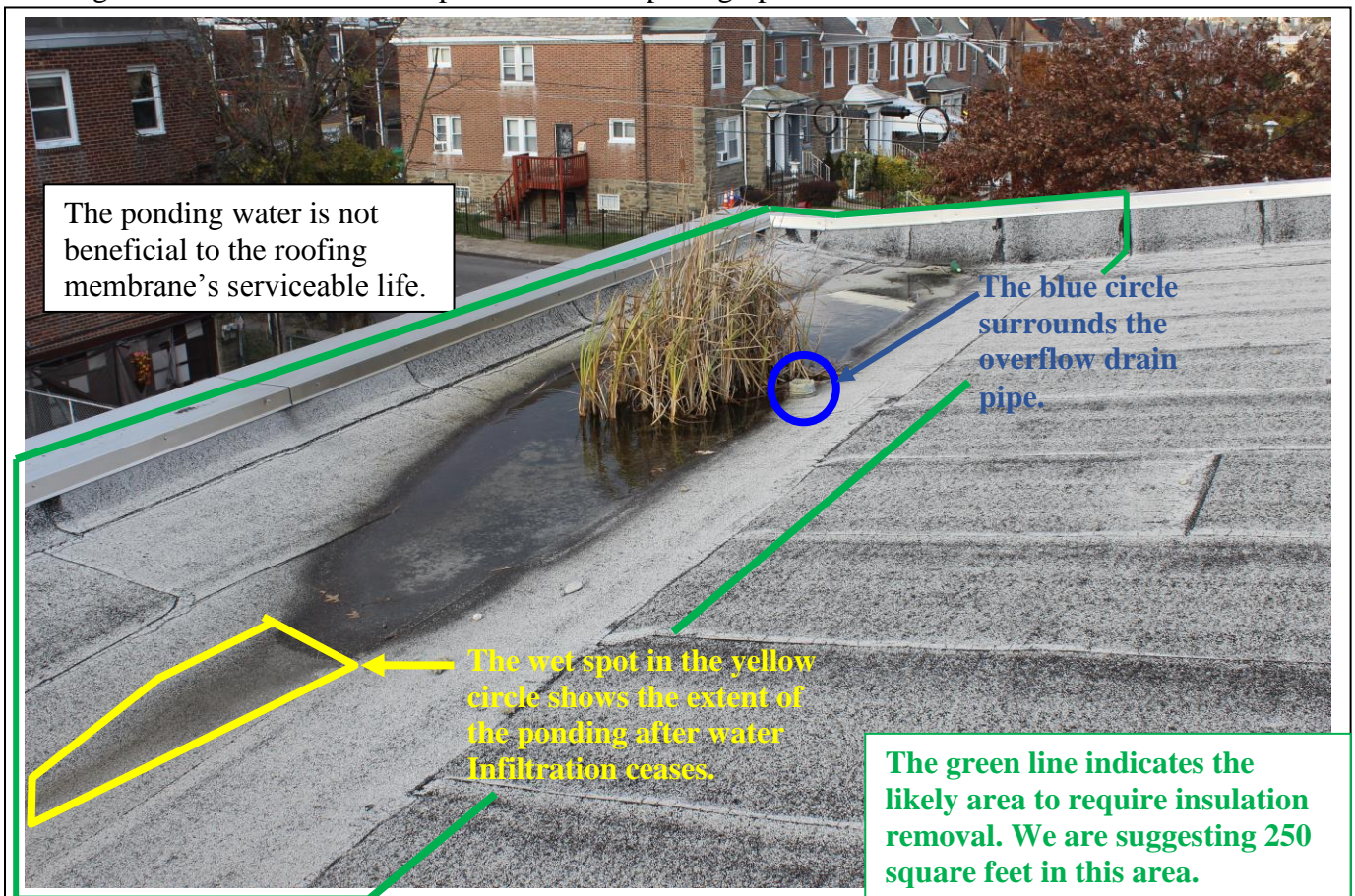
We performed the infra-red (IR) survey at the referenced facility and report our findings as follows:

It should be noted that two of the 3 Gymnasium roofs are not accessible to the Recreation center staff or City employees without a minimum of a 28 foot ladder. There is no interior access to these roof areas to clean the drain strainers. The clogged drain and active water infiltration are a result of the inability of personnel to clean the roof drains bi-annually. We recommend that a roof access ladder and scuttle be provided to alleviate this condition. This will be included in the roof replacement project proposal form as an ADD Alternate bid.

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We observed the interior conditions during previous site visits. We identified areas of roof deck in the Gymnasium that appear to have peeling paint. The north corner of this gym has been experiencing active water infiltration for years. The gym leak area identified is in the northernmost valley area of the roof. This area is experiencing severe ponding and vegetative growth. The roof drain has become completely clogged with organic debris. This area is represented in the photograph below.



Ponding and vegetative growth at roof drain on Roof Area “B”

ROOF COMPOSITION

All existing SBS roofs, “A” – “N”, have two layers of membrane and therefore must be removed. The list below is represented from the roof deck up. All insulation cross sections have perlite on the metal deck. This is good for fire rating. The top layer is perlite as well. With perlite on the top layer, the roof is easily cut and lifted off the insulation. Wet areas are easily visible to remove and replace. Overlaying the existing dry insulation to increase the R-Value will save money and reduce the trash stream.

Roof Area	Insulation	Existing R Value	Needed R-Value
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Roof Type 1A	3/4" perlite, 2" polyisocyanurate, 3/4" perlite	(3.5" R-13.28)	+ R-6.8"
Roof Type 1B	1.5" perlite	(1.5" R-2.08)	+ R-18.0"
Roof Type 1C	3/4" perlite, 3 layers 1" perlite	(3.75" R-5.78)	+ R-14.3"
Roof Type 1D	3/4" perlite, 2 layers 1" perlite	(2.75" R-7.64)	+ R-12.4"
Roof Type 1E	2 layers 3/4" perlite	(1.5" R-2.08)	+ R-18.0"

See list below for roof areas and type.

ROOF IDENTIFICATION AND WET AREAS

A	SBS	Type 1 A	DRY
B	SBS	Type 1 A	600 sq. ft. WET
B1	SBS	Type 1 A	12 sq. ft. WET
C	SBS	Type 1 A	35 sq. ft. WET
D	SBS	Type 1 A	9 sq. ft. WET
E	SBS	Type 1 C	DRY
F	SBS	Type 1 C	50 sq. ft. WET
G	SBS	Type 1 B	DRY
H	SBS	Type 1 B	DRY
J	SBS	Type 1 A	WET
K	SBS	Type 1 A	DRY
L	SBS	Type 1 D	WET
M	SBS	Type 1 E	DRY
N	SBS	Type 1 E	4 sq. ft. WET
P	White Metal Panel	Type 2	N.I.C.
Q	White SP	Type 3	N.I.C.
R	White SP	Type 3	N.I.C.
S	SBS By Others	Type 4	N.I.C.

SUMMARY OF FINDINGS

Our survey findings indicate that the greater percentage of roof areas other than "J" & "L" are mostly free of moisture. Only roof areas "J" and "L" are saturated. It is accepted to assume that anything more than 25% of a roof being wet becomes too costly to specify removal and replacement of the wet areas only. This roof has less than 1% of its areas show to be wet, other than "J" & "L". All of the existing roofs have perlite insulation both on the metal deck and above the polyisocyanurate insulation, where present. Perlite insulation is one of the most accurate in terms of IR in determining wet areas.

Modern construction codes tell us that we must not exceed a total of two roofing systems. This is to avoid overloading and allow for safe loading of the structure. Unfortunately, this facility has two roofs and the roofing must be removed. The good news is that the roofing membrane was installed directly onto the

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perlite cover insulation and it was applied with hot asphalt. This means that the roof can be cut through the SBS membrane only and the roof can be lifted off the perlite and disposed of, leaving the perlite insulation in-situ. Additional insulation and membrane can be installed.

Modern construction codes also tell us that we must target insulation in roofing systems to reach R-20. There are some variants for historic structures and existing structures that do not or cannot meet the intent. This facility meets neither of these requirements and therefore must target the R-20 code. Because the insulation appears to be dry (verified by roof cores and IR survey), the R-Value of the existing insulation board, can be valued in-situ. In accordance with the National Roofing Contractors Association (NRCA), the aged R-Value of polyisocyanurate insulation is 5.6 per inch. The additional insulation required to meet the R-20 code requirement is a matter of the existing R-Value combined with simple math and an industry accepted “Aged R-Value” of existing polyisocyanurate (and other) insulation. New polyisocyanurate insulation will be valued at R-6 per inch for this project. Given the data in the chart above, the column “needed R-Value” will be accomplished by covering the (existing) exposed insulation with a 1.5” polyisocyanurate insulation the R-Value will be increased by R-6 per inch or R-7.

Insulation cross section for roof replacement, after roof membrane removal. The top layer (existing) is not included in the calculated R-values assumed. Given this criterion, we assume that the existing polyisocyanurate insulation, based on our roof cores at this facility is 2” thick. Using 5.6 per inch, the polyisocyanurate insulation is R-11.2. The bottom layer of ¾” perlite insulation, when dry, has a stable R-Value of 2.78 per inch or, R-2.08. The total R-Value for the roof assembly type 1 is 11.2 plus 2.08 = R-13.28. To meet the current R-20 (code) we must add additional insulation with an R-Value of 6.75. The other areas will need more R-Value and the wet areas will require a total roof removal. The current building codes also requires a slope of ¼” per foot be achieved in all new construction and when possible on existing structures. Roof areas “J” & “L” will require fully tapered insulation. The roof perimeters at gravel stops, drip edges and gutters will be require additional blocking, everywhere.

Roof Type	Existing R-Value	Mechanically	Adhered
Type 1A	13.28	1.5” R-9	½” Cover Board
Type 1B	2.08	1.5” R-9	1.5” plus ½” Cover Board
Type 1C	5.78	2.5” R-9	1.5” plus ½” Cover Board
Type 1D	7.64	1.5” R-9	1.5” plus ½” Cover Board
Types 1E	13.28	1.5” R-9	½” Cover Board
Type F (Roof K)	0, Tear off	2.5” R-15	½” Cover Board
Type G (Roof J & L)	0, Tear off	2.5” R-15	¼”/1’0” Tapered & ½” Cover Board

RECOMMENDATIONS

In conclusion the benefits of a total roof removal far outweigh a decision to remove only the wet portions of roof areas, “J” & “L”. Removal of the roofing membrane on the balance of the roof areas, leaving the

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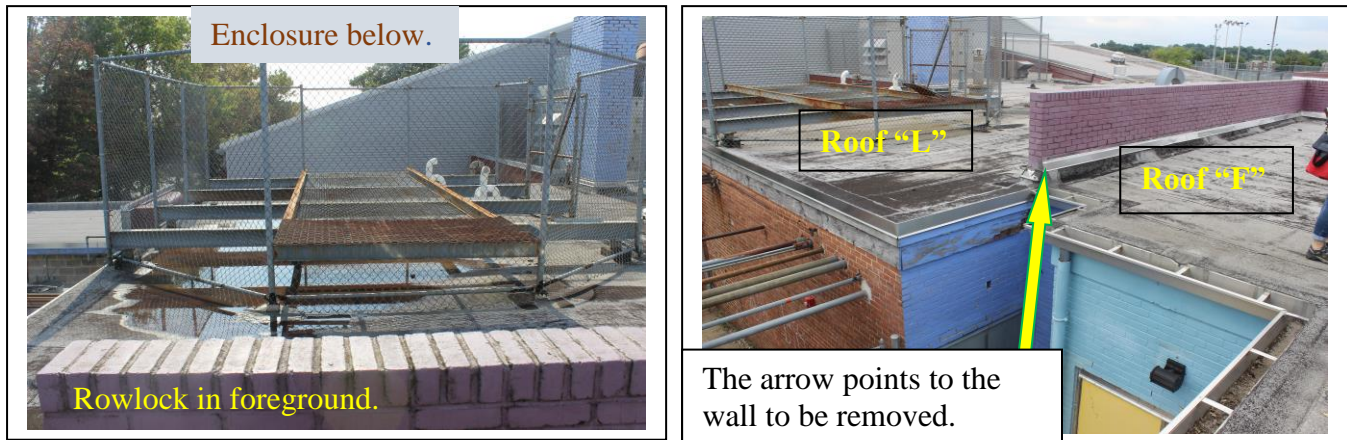
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existing insulation in-situ. The cost of removing the wet areas (anomalies) and providing infill in those areas, in this particular situation, because it is so small in total area, offers the City a significant cost savings to re-use the insulation and therefore it makes economic sense to remove the roofing membrane and flashings leaving the existing insulation only. Remove all wet insulation and replace in kind or with polyisocyanurate insulation. Additional insulation will be required to meet the current code. The additional insulation will be must be adequately secured to the metal deck to meet the FM I-90 wind uplift resistance criterion. A high density insulation should be applied and set in adhesive over the mechanically fastened base layer of insulation. The cover board, as well as additional layers of insulation, set in adhesive, will act as a barrier, breaking the thermal bridge of the fasteners.

The parapet wall between roof area “F” & “L” was formally an exterior wall. A building addition added a roof to the exterior wall. The existing wall has a rowlock capping. On close observation, the mortar is deteriorated. The wall is now a common parapet wall. It is obsolete and in need of repair. Wood blocking and a metal coping system would be required, after completion of masonry repair work.

The cost of cutting reglets and patch pointing would offset the cost to remove the wall to a point 12 inches above the finished roof surface. We recommend the removal of this wall to 12” above the finished roof surface.



CONCLUSIONS

It is my opinion that the City of Philadelphia will be best served by completing the roof replacement project during the summer of 2019. It is my further conclusion that the reported active water infiltration is primarily at the interface of roof plane and flashing projection at many locations. This has been largely confirmed by a combination of the IR survey and the roof cores. The water infiltration locations not at walls or penetrations were identified in the scan as well. Fortunately, the IR scan indicates that these areas are small and isolated.

The vandal resistant structure on roof area “L” is obsolete. Approximately 1,200 square feet of roof area is penetrated by at least 8 steel dunnage columns, 12 fence posts, an exhaust fan, a vent pipe, triple wall flue,

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masonry chimney, ducts and a roof drain. The enclosure, obsolete dunnage and any other obsolete rooftop equipment should be removed.

The roof drain has no clamping ring and must be replaced. The chain link fencing and 12 fence posts are obsolete and should be removed. The 8 steel pipes are for an obsolete steel dunnage rack and should be removed. If all of these are removed, 20 roof penetrations will be eliminated.

The chimney is in danger of collapse. If possible, it could be demolished. If necessary, it could be re-built or replaced. A photograph sheet was issued showing these masonry issues. Finally, the stainless steel gutters will have to be carefully removed and stored for re-installation as additional wood blocking will be required.

There is an infra-red image sheet and a roof plan showing the anomalies attached. Included on the roof plan is the approximate location of the control joints and roof anomalies identified during the IR survey. Also identified are two roof drains that are clogged. The roof drains on the Gymnasium roof are not accessible by City personnel without 2 ladders. This always represents a safety concern. We recommend that a wall mounted, caged ladder and platform combination along with a ships ladder and roof scuttle should be included in this project to allow safe access to clean drain strainers and avoid future drain blockage. Regular biannual drain cleaning should be performed on all City roofs that are safe to access.

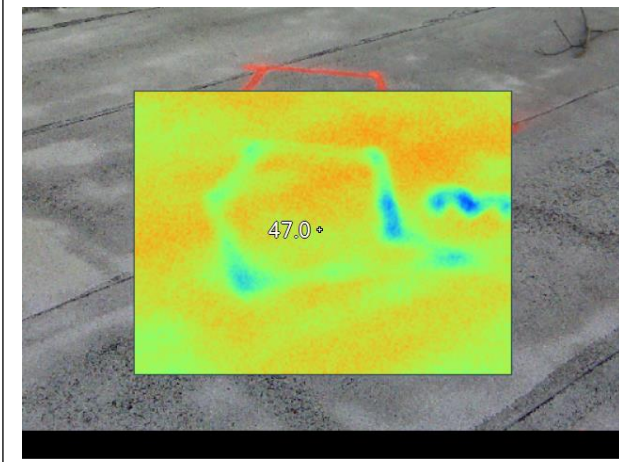
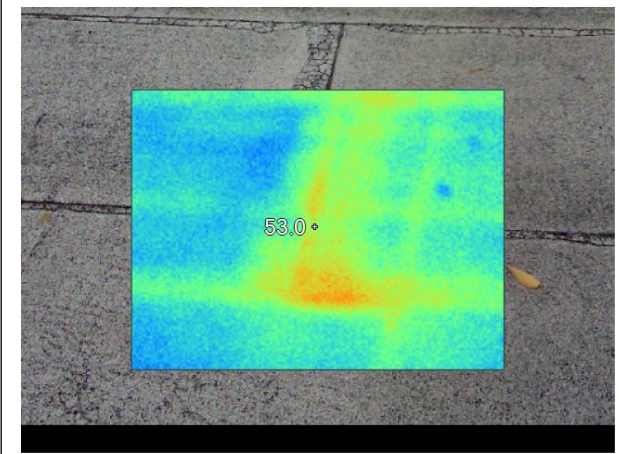
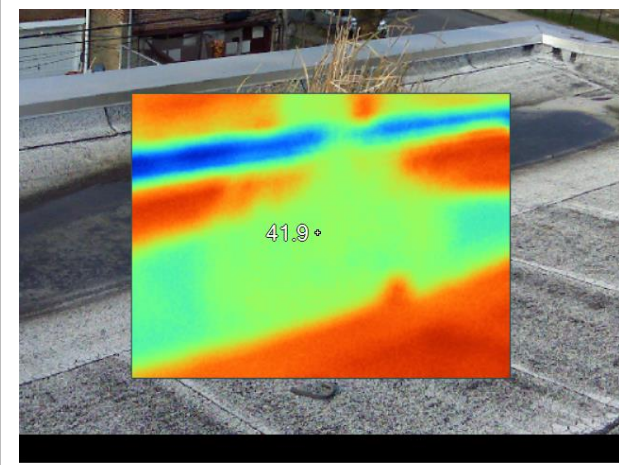
After reviewing this report, if you have any questions or require any additional information, please contact us.

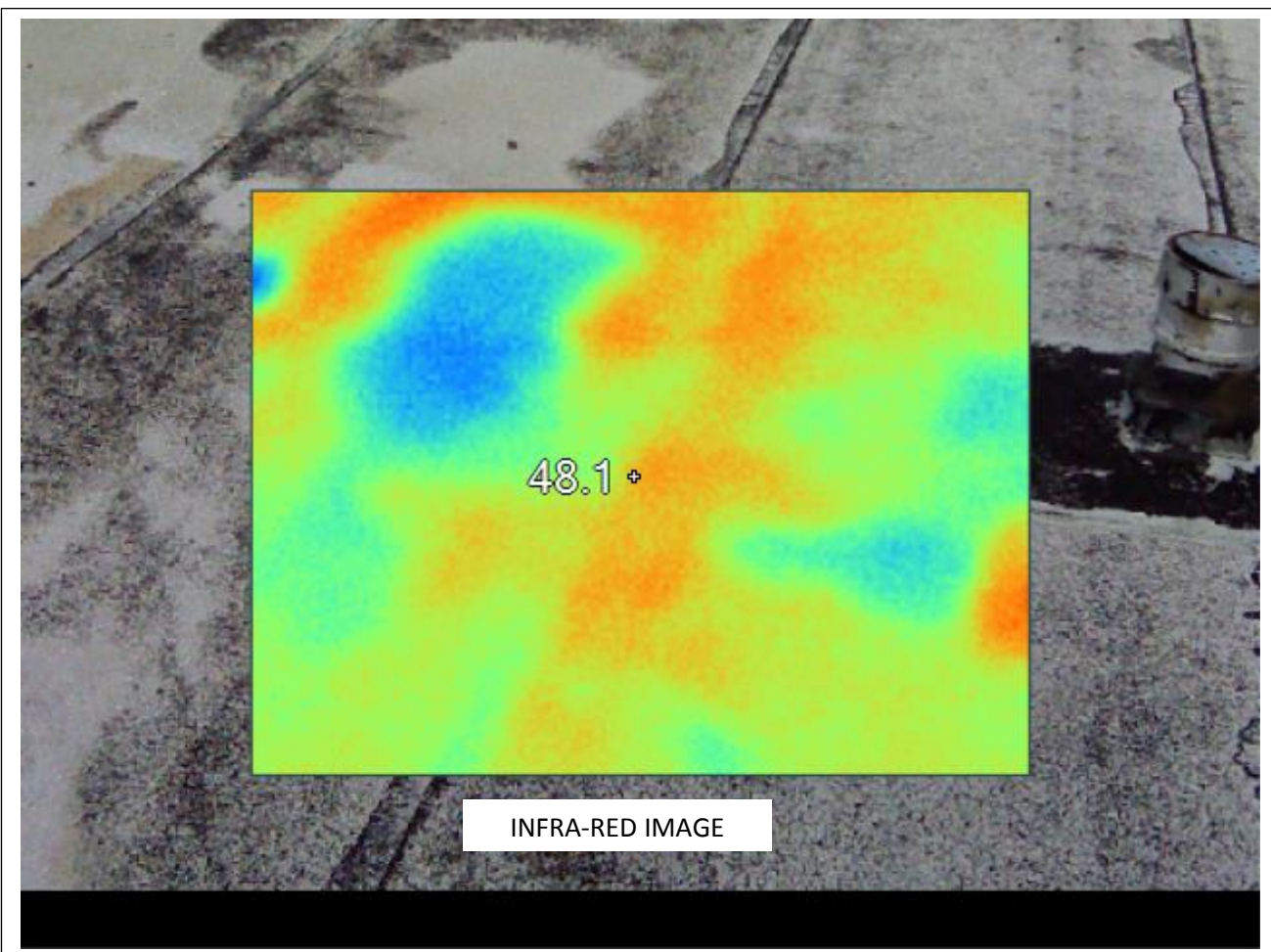
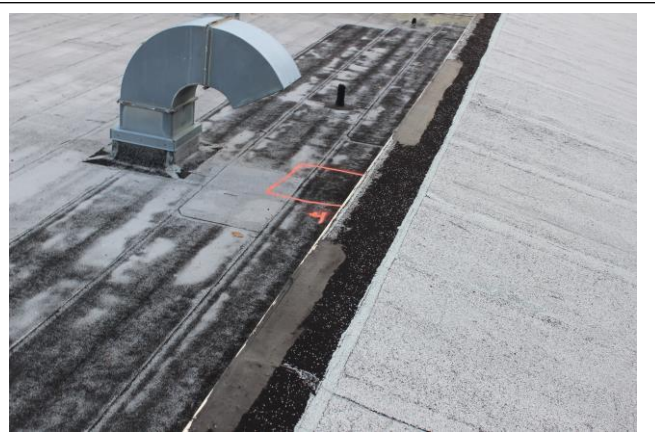
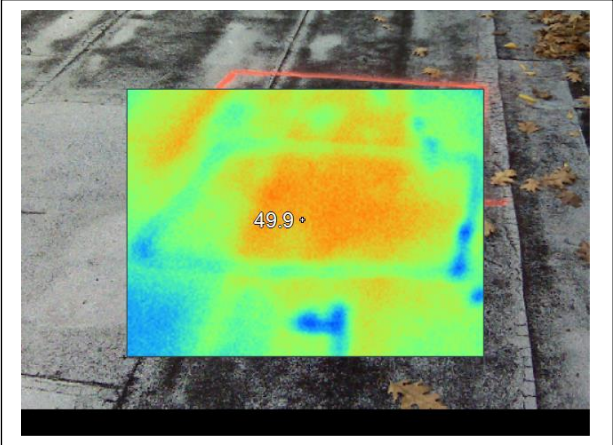
Sincerely,

Stephen McLaughlin,
Roofing Consultant (SMRC)
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roofdr118@aol.com
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INFRA-RED IMAGES

DIGITAL PHOTOGRAPHY IMAGES

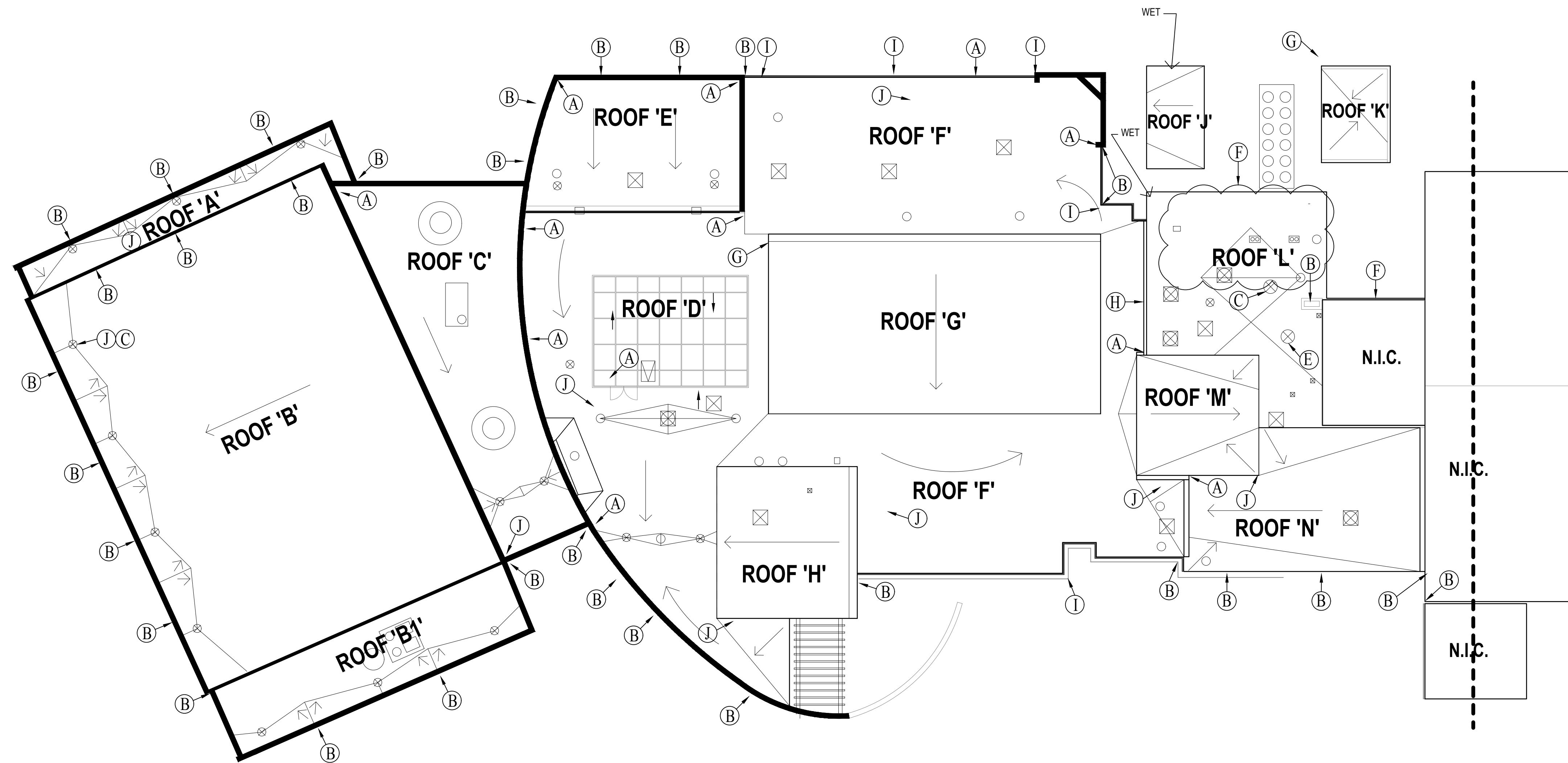




INFRA-RED IMAGE

ROOF NOTES:

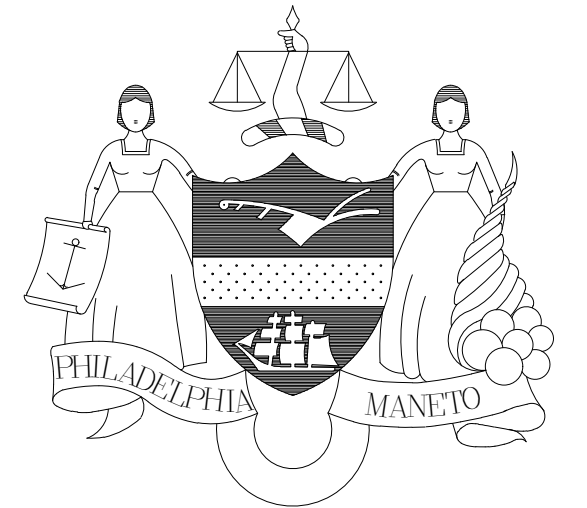
- (A) CONTROL JOINT ROOF
- (B) CONTROL JOINT EXTERIOR
- (C) CLOGGED ROOF DRAIN
- (D) EXISTING CHIMNEY
- (E) EXISTING TRIPLE WELL FLUE
- (F) EXISTING ENCLOSURE AND DUNNAGE
- (G) CUTTING AND POINTING
- (H) DEMOLISH MASONRY WALL TO 12" ABOVE FINISHED ROOF SURFACE
- (I) CAST IRON RAIN WATER CONDUCTOR
- (J) ANOMALY



1 INFRA-RED SURVEY ROOF PLAN - GYM & CLASSROOMS
A1.60 1/16" = 1'-0"

REVISIONS

ISSUE	DATE	REVISIONS
1	xxxxxx	ADDENDUM #1



DESIGN DEVELOPMENT

PROJECT COORDINATOR
MICHELLE SHUMAN

Approver

SEALS

SPACE FOR CONSULTANT RECOGNITION

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**CITY OF PHILADELPHIA
PHILADELPHIA PARKS & RECREATION**

1515 ARCH STREET
11TH FLOOR, ONE PARKWAY BUILDING
PHILADELPHIA PENNSYLVANIA

PROJECT TITLE
**SIMONS RECREATION CENTER
ROOF REPLACEMENT**

DRAWING TITLE
**EXISTING ROOF
PLAN INFRA-RED SURVEY**

PROJECT NO.
20-16-4919-99

DATE
12/14/18

SCALE
AS NOTED

DRAWN BY
SCG

CHECKED BY
SMC

A1.60

**PRESENTATION SET
NOT FOR BIDDING**

NOTE: ALL DIMENSIONS AND CONDITIONS SHALL BE VERIFIED BY THE CONTACTOR AT THE SITE BEFORE PROCEEDING WITH THE WORK