

Solar Panel Roof Study

The goal of this study is to identify potential buildings in the SPPS district that would be feasible for the installation of solar arrays. Each building roof was analyzed with the following criteria:

Age of Roof

The life of a typical roof in the district is 25 years before it needs to be stripped off and replaced along with the underlying insulation and curbing. The effective life of a solar panel is 20 years, so we are only looking at buildings with roofs that are 5 years old or less or going to be replaced in the next 5 years. Many of the buildings have roofs that are different ages due to additions or only replacing expired portions of roofs. These were separated out in the study.

Size of Roof

The building roofs are primarily multi-level and broken up with curbing. They are made of many sections. Only the sections of 2000 sf or more were considered for solar arrays because of efficiencies.

Roof Interference

The roofs typically have interference from Roof Top Mechanical Units, vents, equipment, skylights, etc. Roof areas with equipment that would need to be serviced and replaced were not considered or if there were areas that had excessive penetrations of vents, hatches, etc. and wouldn't allow for access to repair leaks or service.

Roof Orientation

Roof were analyzed for unobstructed and proper exposure to the sun. Trees shadows, higher building sections casting shadows and poor orientation to the sun were considered.

Structural Integrity

The solar panels and supporting structure adds additional loads to the building structure. The roof areas that meet the above criteria area being analyzed for the addition loading. The codes are constantly evolving and one of the recent changes is the snow load and drift load requirement has increased. Many of the buildings were constructed before these codes were implemented. A licensed structural engineer reviewed the buildings plans and design criteria to make sure that the addition loading of the solar arrays would meet the current code requirements.

The following buildings met the above criteria and were further reviewed for structural needs to support and attach solar panels to the building. Not all sections of the roofs met the criteria above and only the roof sections that met the requirements were analyzed.

STRUCTURAL PROJECT SUMMARY

The study involved the review of existing drawings of 25 buildings selected by SPPS to identify possible candidates for further evaluation of solar panel installations. The buildings were not fully evaluated structurally. The schools included in our scope are:

- Adams Spanish Immersion
- Bridgeview
- Cherokee Heights Elementary
- Como Park Senior High School
- Eastern Heights Elementary
- Focus Beyond
- Four Seasons A+ Elementary
- Galtier Elementary
- Groveland Elementary
- Highland Park Elementary
- Homecroft Early Learning Center
- Horace Mann School
- Hubbs Elementary

- Humboldt High School
- Johnson Senior High School
- Journey's Secondary
- L'etoile Du Nord Lower
- L'etoile Du Nord Upper
- Leap Senior High School
- Linwood Monroe Elementary
- Nokomis Montessori – North
- Nokomis Montessori – South
- River East School
- St. Anthony Park Elementary
- Washington Technological Magnet

REVIEW AND RECOMMENDATIONS

Upon review, TKDA was able to group the 25 candidate schools into three categories: Feasible, Feasible with Exceptions, and Not Feasible.

Feasible schools include facilities whose existing roof systems have the potential to support the installation of solar panels without large scale modifications to existing infrastructure. However, a more in-depth structural review is necessary to confirm if the roof framing has sufficient capacity.

Feasible with Exception schools include facilities that have the potential to support solar panels; however, a more in depth structural review is necessary to confirm if the roof framing has sufficient capacity, and structural modifications will likely be necessary prior to any installation.

Not Feasible schools include facilities whose existing infrastructure is not conducive to roof connections without significant reinforcement or modifications to the framing system.

Feasible

After preliminary review, the following schools have been deemed feasible for solar panel installation.

Eastern Heights Elementary: This building's existing roof infrastructure consists of concrete slabs a minimum of 4-1/2 inches thick over concrete beams, which are conducive to potential connections for solar panels. The building is also rated for a 60 PSF roof load, which includes snow and ponding, and an additional snow drift load in accordance with ASCE 7. See figure 1.

Four Seasons A+ Elementary: The original 1974 building's infrastructure consists of precast double tee concrete beams with a 4-inch topping slab. While the structure is supported by steel columns, solar panels could potentially be connected via anchors into the concrete beams. Only the original 1974 roof falls into the feasible category. See figure 2.

Galtier Elementary: This building's existing infrastructure consists of precast double tee concrete beams with a topping slab. Design loads are unknown; however, connections could potentially be made to the beams themselves or the concrete columns. See figure 3.

Feasible with Exceptions

The schools deemed Feasible with Exceptions mainly consist of precast hollow core concrete planks. While it is possible to anchor into hollow core planks, it requires careful consideration and poses more challenges in comparison to a conventional reinforced concrete slab. After preliminary review, the following schools have been deemed feasible with exceptions for solar panel installation.

Como Park Senior High School: While all of the highlighted areas are not eligible for solar panels, parts of the existing roof system consist of 10-inch hollow core concrete planks with thin topping slabs. The building is also designed for an extra 10 psf superimposed load. See figure 4.

Nokomis Montessori – South: The 1994 addition consists of hollow core concrete planks over concrete beams. Concrete beams frame into concrete columns, which could potentially provide viable connection options. See figure 5.

Washington Technological Magnet: The existing infrastructure ranges from 4-inch concrete slabs to 8-inch precast hollow core concrete planks. The existing loads also account for ponding, which may need to be addressed prior to solar panel installation. See figure 6.

Not Feasible

The schools deemed not feasible consist of bar joists with metal decks or clay tile roofs. While some of the schools may be capable of accommodating additional load due to solar panel installation, the existing infrastructure is not conducive to roof connections. After preliminary review, the following schools have been deemed not feasible for solar panel installation.

- Adams Spanish Immersion
- Bridgeview
- Cherokee Heights Elementary
- Focus Beyond
- Groveland Park Elementary
- Highland Park Elementary
- Homecroft Early Learning Center
- Horace Mann
- Hubbs Elementary
- Humboldt High School
- Johnson Senior High School
- Journey's Secondary
- L'etoile Du Nord Lower
- L'etoile Du Nord Upper
- Leap Senior High School
- Linwood Monroe Elementary
- Nokomis Montessori – North
- River East School
- St. Anthony Park Elementary

SUMMARY

After preliminary review, TKDA has determined that the following are worthy candidates for further investigation for solar panel installation.

Eastern Heights Elementary	12,600 sf
Four Seasons A+ Elementary	30,315 sf
Galtier Elementary	<u>36,540 sf</u>
	79,455 sf

The next tier of schools worthy of further investigation for solar panel installation; however, they will likely require structural modifications.

Como Park Senior High School	15,845 sf
Nokomis Montessori – South	14,455 sf
Washington Technological Magnet	<u>136,305 sf</u>
	166,605 sf

All schools will require further in- depth structural analysis in order to confirm these assumptions.



Figure 1: Eastern Heights Elementary

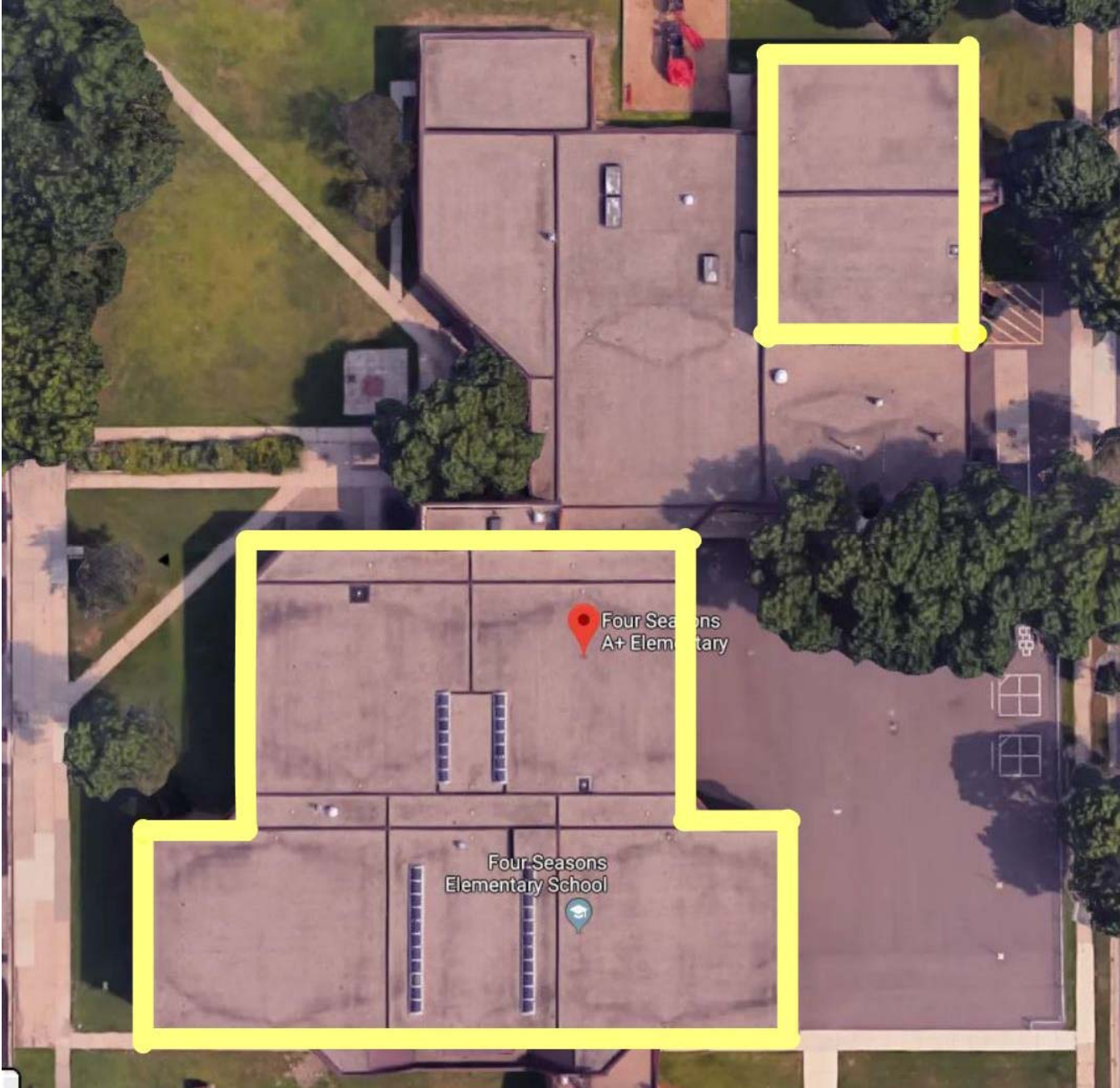


Figure 2: Four Seasons A+ Elementary



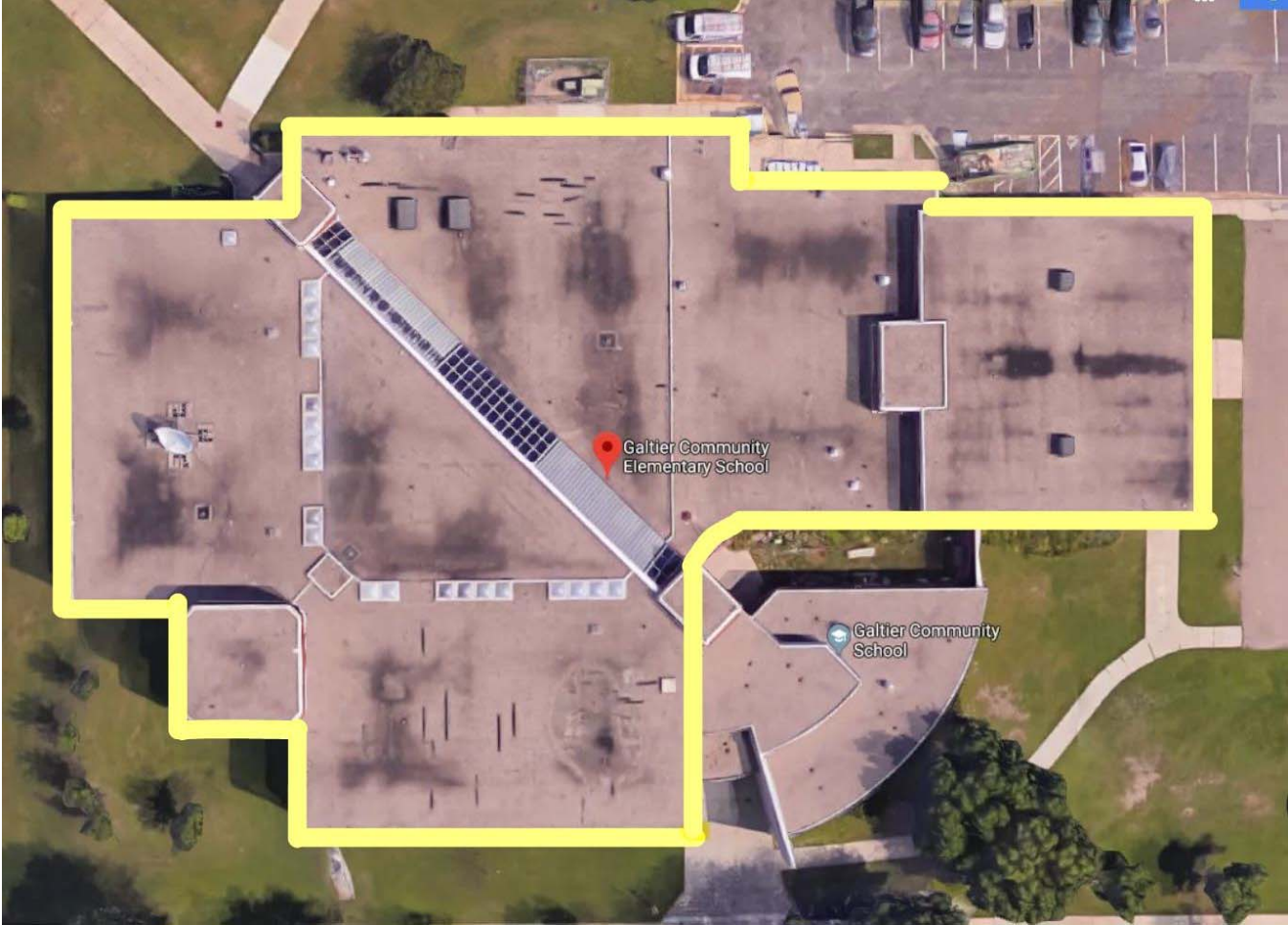


Figure 3: Galtier Elementary

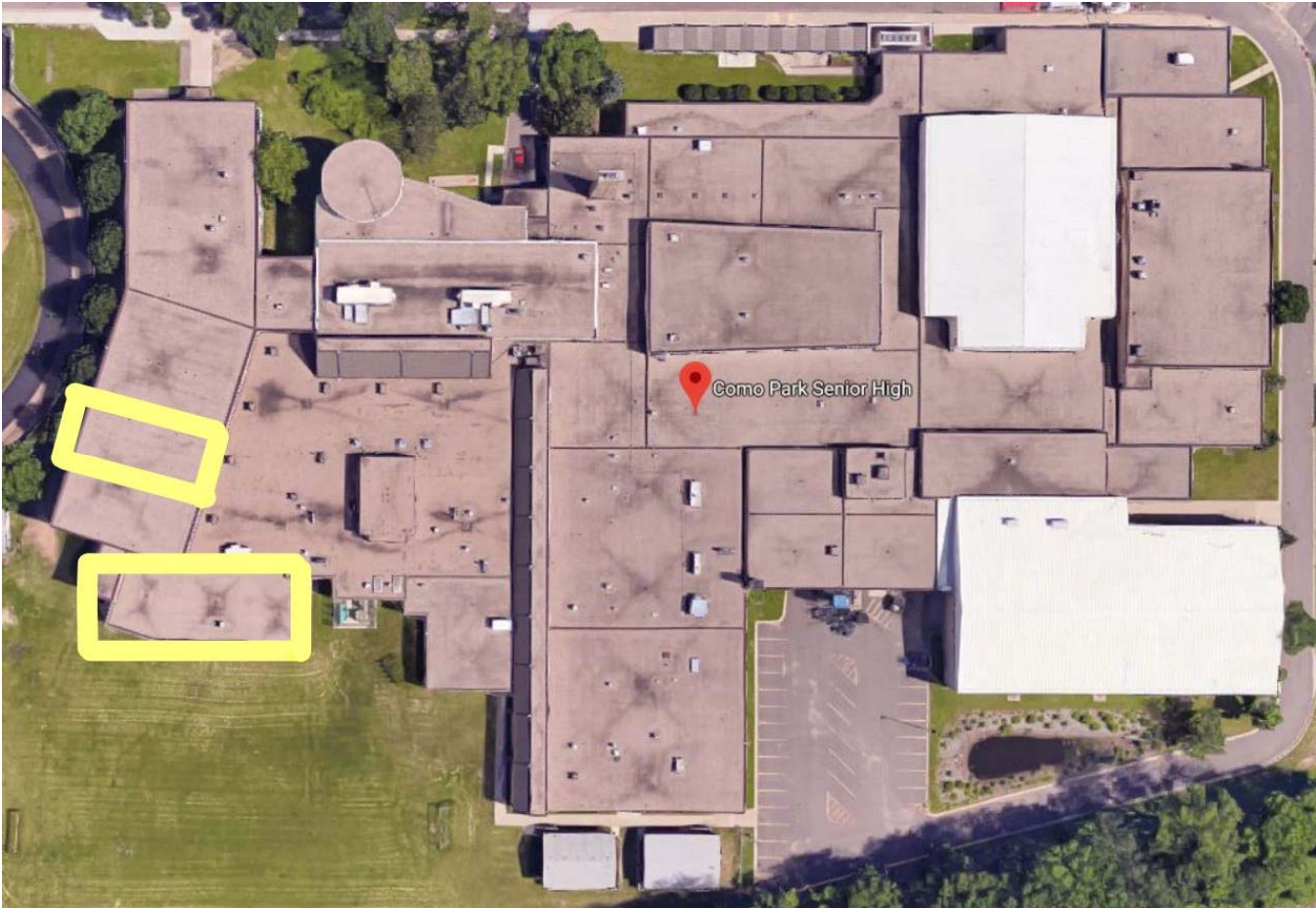


Figure 4: Como Park Senior High School





Figure 5: Nokomis Montessori – South

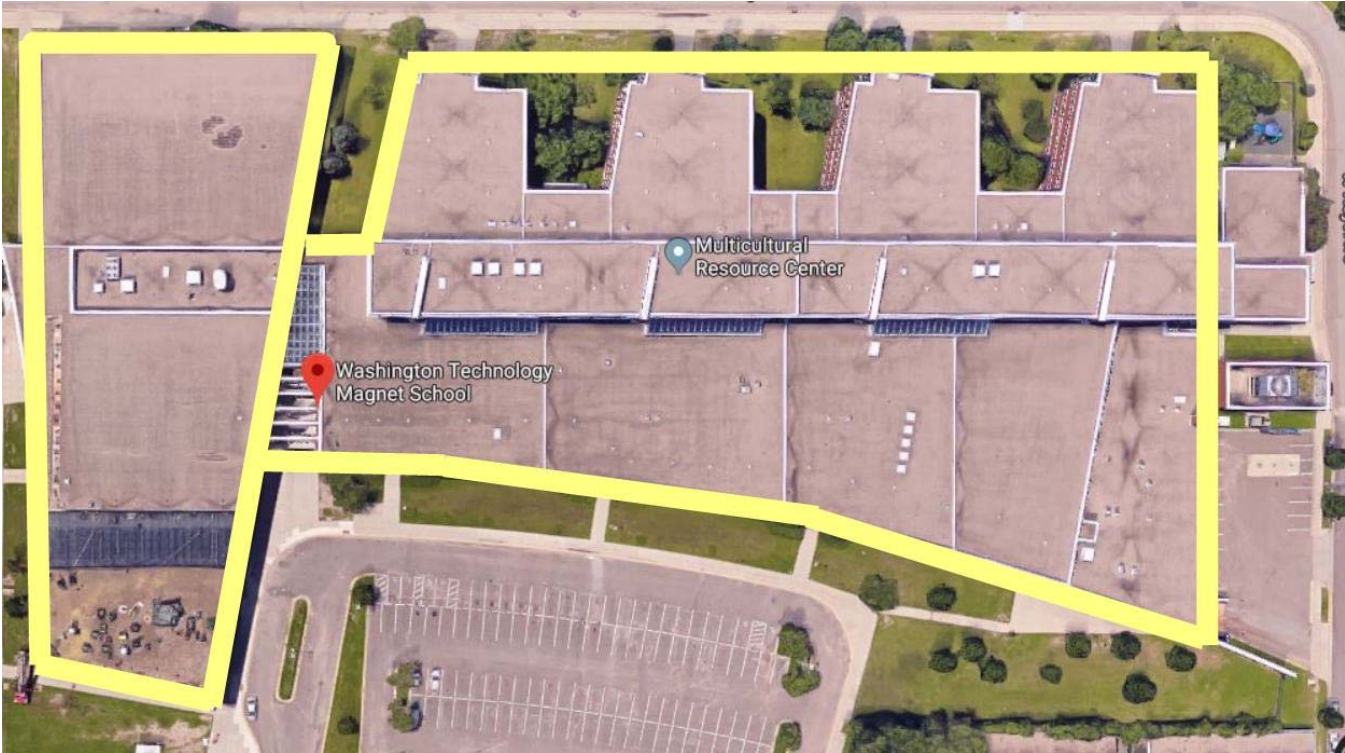


Figure 6: Washington Technology Magnet School