

MEMORANDUM

TO: Stephanie Ciccarello, Sustainability Coordinator, Town of Amherst
FROM: Isabel Kaubisch, Kelly Main
DATE: December 8, 2020
RE: Solar Site Suitability Analysis for the Town of Amherst

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Introduction

The Town of Amherst (the Town) is in the process of developing a Climate Action, Adaptation, and Resiliency Plan (CAARP) funded through the FY 2020 statewide Municipal Vulnerability Preparedness (MVP) program grant. The Town Council has adopted long-term climate action goals proposed by the Energy and Climate Action Committee (ECAC) to reduce greenhouse gas emissions within the Town's residential, commercial, and municipal sectors. Previously, Amherst Town Meeting approved a goal to achieve 100 % renewable energy/electricity as a means to reduce greenhouse gas emissions and address a changing climate (Article 16, Fall 2017 Special Amherst Town Meeting, Amherst ECAC).

As part of the MVP CAARP, Nitsch Engineering conducted a high-level Geographic Information System (GIS)-based desktop analysis to identify suitable areas for solar siting within the Town. Per initial conversation with the Sustainability Coordinator, Stephanie Ciccarello, the Town has expressed interest in identifying opportunities for larger scale solar opportunities including solar farms, solar canopies on parking lots, or solar installations on suitable roofs of either municipal or affordable housing buildings. The Town also expressed an interest in accommodating battery storage nearby. The strategy of focusing on municipal/civic properties and affordable housing developments as "low hanging" fruits was agreed upon.

Based on this, our analysis included a high-level suitability screening of sites for three (3) different options: ground solar, parking lot solar canopy, and rooftop solar.¹

¹ This high-level desktop analysis did not include a detailed shading analysis or calculation of electricity generation.

Data and Methodology

Data

As a first step in our analysis, we gathered and reviewed relevant data sets from MassGIS described in Table 1. GIS can be used to conduct a spatial analysis of favorable and unfavorable conditions based on suitability criteria. The datasets used to conduct our analysis are referenced in Table 1.

Table 1. Data Reviewed

Data Description	Source
Land Use & Zoning	Extracted from Mass Parcel Data
Town of Amherst Facilities	Town of Amherst (.docx)
Flood Hazard Layer (Non-Authoritative)	Town of Amherst
Building Footprints/Roof Data	Town of Amherst 2009 Basemap
Parking Lots	Town of Amherst 2009 Basemap
MassDEP Wetlands	MassGIS Oliver
MassDEP Hydrology	MassGIS Oliver
Conservation Areas	MassGIS Oliver
State Parks	MassGIS Oliver
Prime Forested Areas	MassGIS Oliver
Interior Forest	MassGIS Oliver
NHESP Priority Habitat Areas	MassGIS Oliver
Preserved Agricultural Land	MassGIS Oliver
Digital Elevation Model (DEM)	MassGIS Oliver
Assessors/Parcel Data	MassGIS Oliver
Brownfield Sites	Mass.gov
Substations	MIT GeoWeb, NOAA

Methodology: Establishing solar suitability criteria

Property can be identified as either suitable or unsuitable for solar installation. Suitability in this study was understood as favorable physical condition which warrants further exploration of solar implementation opportunities. Unsuitable, or “excluded” areas are those which constrain or prohibit the development of a solar site.

Using GIS, we reviewed and analyzed relevant data sets depending on their suitability for different types of solar systems. We established exclusion and attraction zones for solar development within the City limits. Exclusion zones are areas that exclude the development of solar installations. A more thorough description of different solar systems and their attraction and exclusion zones are listed in Table 2 below.

Table 2. Attraction and Exclusion Zone Description

Type	Description	Suitable Areas (Attraction)	Unsuitable Areas (Exclusion)
Solar Farm	A large installation of solar panels in one (1) area, usually of a large scale that connects back to the grid or substation	Brownfields, public land, slopes less than 3%, areas located in close proximity to electrical substations, vacant land	Wetlands, conservation land, state park, forest, threatened species, local and state protected area, protected soils, flood zones and/or species of conservation and environmental concerns among others; areas with greater than 10% slope
Rooftop Solar	Solar panels positioned on a roof area	Generally preferred to install panels on flat roof but is not required; larger areas are preferred but not required; municipal facilities and public or institutional buildings; affordable housing projects	Rooftops with steep; north-facing orientations are not preferred; high installation costs; safety considerations
Parking Lot Solar Canopy	Solar canopy arrays positioned above parking spaces; require positioning of battery station nearby	Slopes less than 3%; larger areas allow economies of scale but are not required; institutional, commercial, or public parking areas	Slopes greater than 10%, areas not defined as "parking lots;" additional criteria include clearance, shading from nearby buildings/trees

Another attraction factor is the proximity to the point of interconnection into the grid, the substation. The closer the distance to the substation, the lower the installation costs.

We furthermore reviewed the opportunity to install battery storage on a high-level. It is assumed that battery storage would be installed on a flat vacant area adjacent to the building or solar canopy.

As referenced above, different types of solar programs have different suitability criteria. Each section of this memo will have different exclusion and attraction criteria which will be further outlined in detail.

Analysis

Option #1: Solar Farm

Solar farms are large ground installations of solar panels (compare Figure 1). They are typically installed on brownfields or public lands with ideally slopes less than 3%.



Figure 1. Solar Farm (Source: Modernize.com)

Solar Farm – Areas of Exclusion

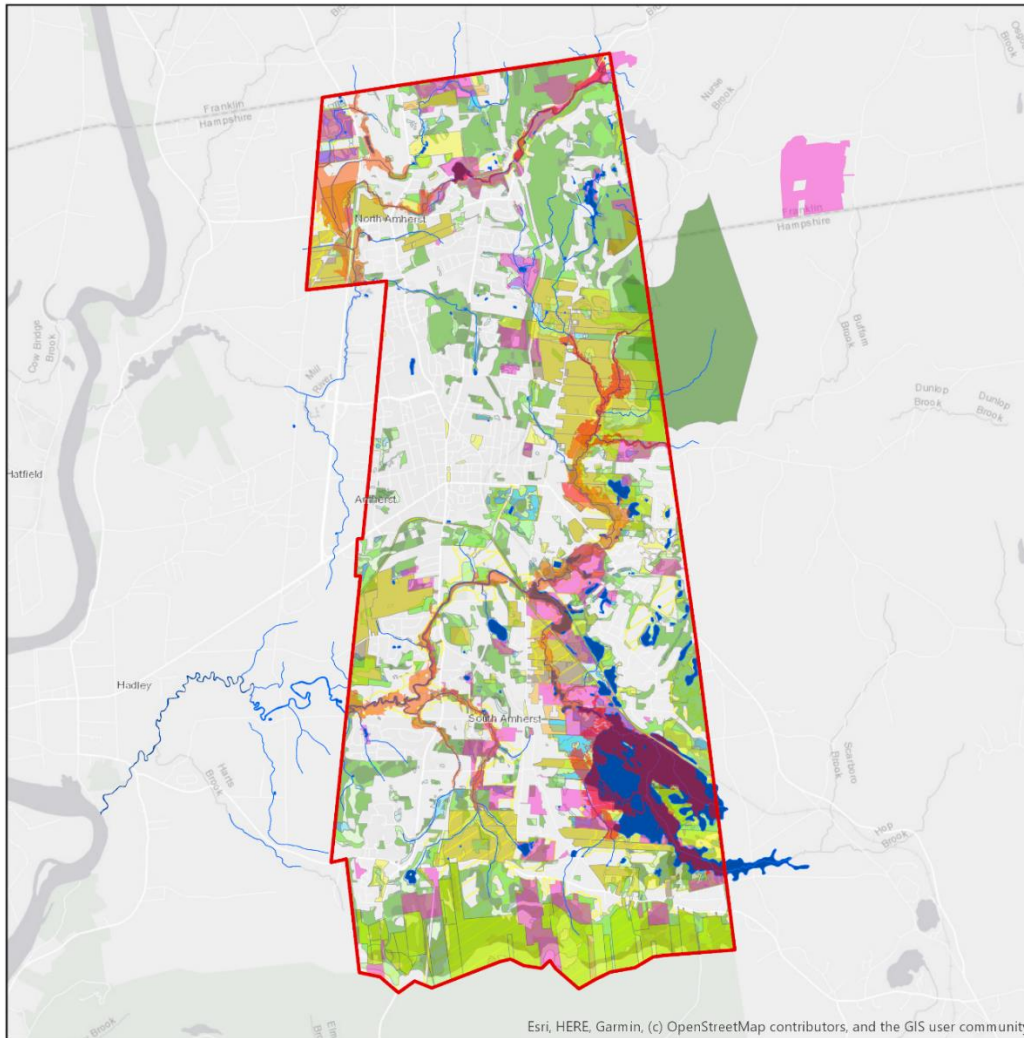
Exclusion zones are areas that exclude the development of solar installations. Areas of exclusion are those areas which are excluded from the site suitability analysis due to their qualities. For example, conservation areas, forests, agricultural lands, and flood zones are all considered to be “unsuitable” for large-scale solar implementation due to the importance of preserving these areas in their current land use.

Table 3. Excluded Areas for Solar Farm Suitability

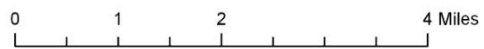
Areas of Exclusion	Data	Source
Flood Zone A	Flood Hazard Layer (Non-Authoritative)	Town of Amherst
Flood Zone AE	Flood Hazard Layer (Non-Authoritative)	Town of Amherst
Wetlands	Mass DEP Wetlands	MassGIS Oliver
Surface Water	Mass DEP Hydrology	MassGIS Oliver
Rivers and Streams	Mass DEP Hydrology	MassGIS Oliver
Conservation Restrictions	Conservation Areas	MassGIS Oliver
Conservation Areas	Conservation Areas	MassGIS Oliver
USGS Conservation Areas	Conservation Areas	MassGIS Oliver
MA DCR Lands	Conservation Areas	MassGIS Oliver
Prime 1	Prime Forested Areas	MassGIS Oliver
Prime 2	Prime Forested Areas	MassGIS Oliver
Prime 3	Prime Forested Areas	MassGIS Oliver
Statewide Importance	Prime Forested Areas	MassGIS Oliver
Local Importance	Prime Forested Areas	MassGIS Oliver
Prime 3 Wet	Prime Forested Areas	MassGIS Oliver
Statewide Importance Wet	Prime Forested Areas	MassGIS Oliver
Local Importance Wet	Prime Forested Areas	MassGIS Oliver
Unique Wet	Prime Forested Areas	MassGIS Oliver
Interior Forest	Interior Forest	MassGIS Oliver
NHESP Priority Habitat Areas ²	NHESP Priority Habitat Areas	MassGIS Oliver
Preserved Agricultural Land	Preserved Agricultural Land	MassGIS Oliver

For the purposes of this analysis, these “areas of exclusion” referenced in Table 3 were consolidated into one (1) single shapefile identified as “Areas of Exclusion,” shown in Figure 2.

² Priority habitat makes up large areas of municipal land classified under the Natural Heritage & Endangered Species (NHESP) Program. Priority habitat is based on known geographical extent of habitat for all state-listed rare species and subject to the MA Endangered Species Act (MESA). Habitat alteration within priority habitats may result in a take of state-listed species and is subject to regulatory review by the Natural Heritage & Endangered Species Program. DOER’s SMART (Solar Massachusetts Renewable Target) program precludes solar development on sites that have 50 % or more area classified as core habitat, priority habitat or critical natural landscape.



Areas of Exclusion
 Town of Amherst - Solar Suitability Analysis
 Amherst, MA



- | | | |
|---------------------------------------|--------------------------|---------------------------------|
| Amherst Boundary | USGS Conservation Areas | Unique Wet |
| Flood Zone (Non-Authoritative) | Prime Forest | Non-Forested Land |
| A | Prime 1 | Other Areas of Exclusion |
| AE | Prime 2 | NHESP Priority Habitat Areas |
| Rivers and Streams | Prime 3 | MA DEP Wetlands |
| Water | Statewide Importance | Preserved Agricultural Land |
| Conservation Areas | Prime 3 Wet | MA DCR Lands |
| Conservation Restrictions | Statewide Importance Wet | Interior Forest |
| Conservation Areas | Local Importance Wet | |



Source: Mass GIS
 Nitsch Project Number: 14060

Figure 2. Areas of Exclusion

Solar Farm – Areas of Attraction

In addition to areas determined to be unsuitable for solar farms (areas of exclusion), we also identified areas of attraction. As described above, the key elements of suitability for solar farms include publicly owned land and vacant parcels.

Brownfield Sites

The Massachusetts Department of Environmental Protection (MassDEP) defines a brownfield as “a real property whose redevelopment may be complicated by actual or perceived contamination by oil or hazardous materials.” Brownfields are an attractive place to put a solar farm because they make productive use of land that is unsuitable or other uses like agriculture or residential without significant costly improvements. According to the Mass.gov brownfield sites, Environmental Tracker spreadsheet, Amherst has two (2) brownfield locations (compare table below). One (1) of the sites, located downtown at 103 North Pleasant Street, is a commercial property with a building on it. The other site is owned by the Hampshire College Across Admissions Building and seems to host an old gas station.

RTN	Address	Site Name	Current Owner	COCs	Former Use	Acres
1-0015629	West Street	Hampshire College Across Admissions Building	Trustees of Hampshire College	Gasoline	Unknown	17
1-0018965	103 North Pleasant Street	Commercial Property	Roberts, Barry L.	LNAPL (Fuel Oil)	Commercial, Private Property	<1

As shown above, the two (2) brownfield sites in Amherst are not necessarily ideal for a public solar project since there are no publicly owned brownfield sites. The site at Hampshire College could be a potential option but would need further examination and conversation with the current owners. Likewise, the commercial property on North Pleasant Street is currently a small business and would not be suitable for a large solar installation.

Municipal Parcels

To identify municipal parcels, we selected from all parcels downloaded from the Massachusetts Assessor’s Parcel Database that identified the Town or other departments as the owner. Table 4 provides background on the owner, number of parcels and their percentage.

Table 4. Municipal Parcel Criteria

Owner	Number of Parcels	Percentage
Town of Amherst	80	27.78%
Town of Amherst Cemetery Commission	1	0.35%
Town of Amherst Conservation Commission	154	53.47%
Town of Amherst (Inhabitants)	14	4.86%
Town of Amherst School Department	7	2.43%
Town of Amherst Highway Department	2	0.69%
Town of Amherst Library	2	0.69%
Town of Amherst Recreation	9	3.13%
Town of Amherst Sewer Department	3	1.04%
Town of Amherst Water Department	16	5.56%
Total	288	1

Vacant Parcels

288 municipal parcels were identified through this method. Of those 288, 262 were classified with a land use designation of Municipal – Vacant (Municipal V), as shown in Figure 3 below.

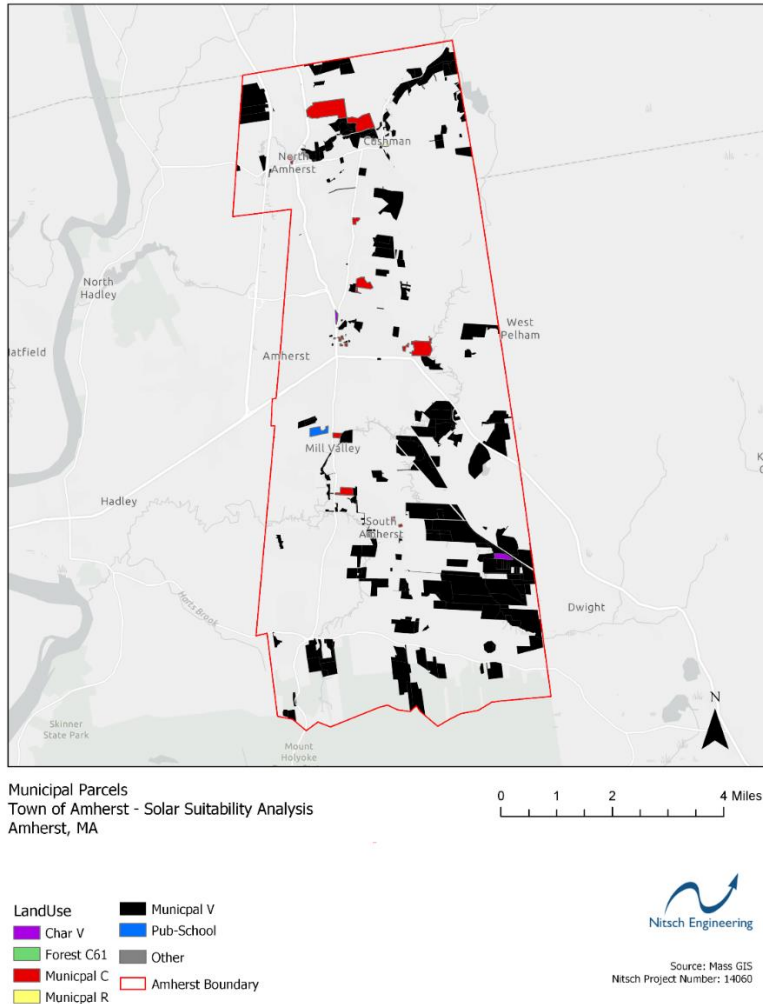
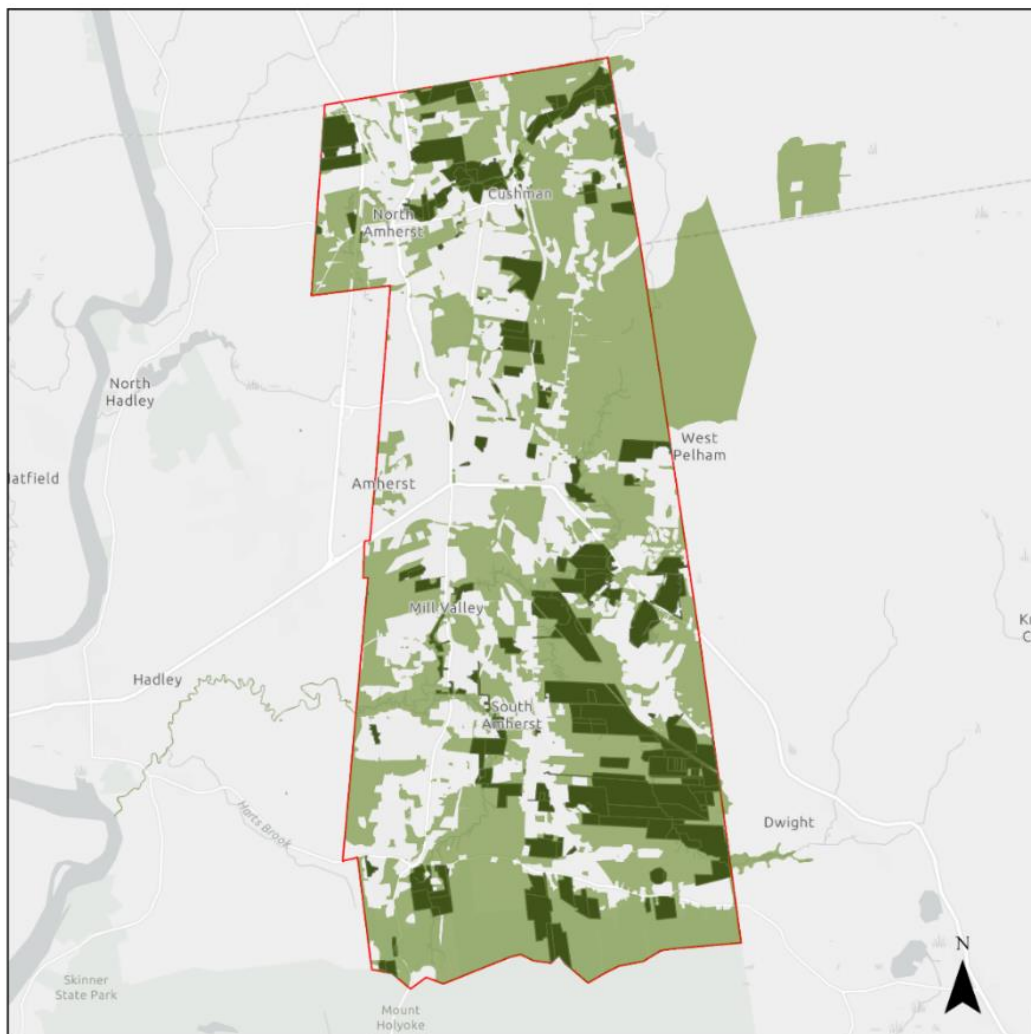


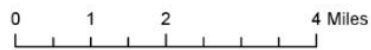
Figure 3. Municipal Parcels Categorized by Land Use




Ground Solar Farm Analysis Results

A binary or two-factor suitability analysis (either suitable or not suitable) was conducted, in which vacant municipal parcels that intersect with any of the above areas of exclusion from Table 3 were identified as *not suitable*. Any parcels not intersecting with the areas of exclusion mentioned above would be determined to be suitable for additional investigation. However, all municipal parcels were found to intersect with one (1) or more of the exclusion variables listed above. This is likely due to the high number of conservation parcels in the Town, and the wide presence of Prime Forest designations from MassDEP. A lack of large vacant municipal parcels that do not meet one (1) or more of the exclusion criteria means that, unfortunately, there are not currently any sites identified as highly suitable for a large solar canopy farm. Figure 4 visualizes the overlay of municipal parcels and exclusion areas. Other solar options, like rooftop solar or parking lot canopies, are explored further in this document.



Areas of Exclusion
Town of Amherst - Solar Suitability Analysis
Amherst, MA



-  Municipal Parcels
-  Excluded Areas
-  Amherst Boundary



Source: Mass GIS
Nitsch Project Number: 14060

Figure 4. Municipal Parcels and Areas of Exclusion

Option #2: Parking Lot Solar Canopy

The exclusion analysis found a limited or lack of available vacant land outside of the area of exclusion. We therefore focused the second part of our analysis on a high-level analysis of the potential for parking lot solar canopies (as shown in Figure 5).



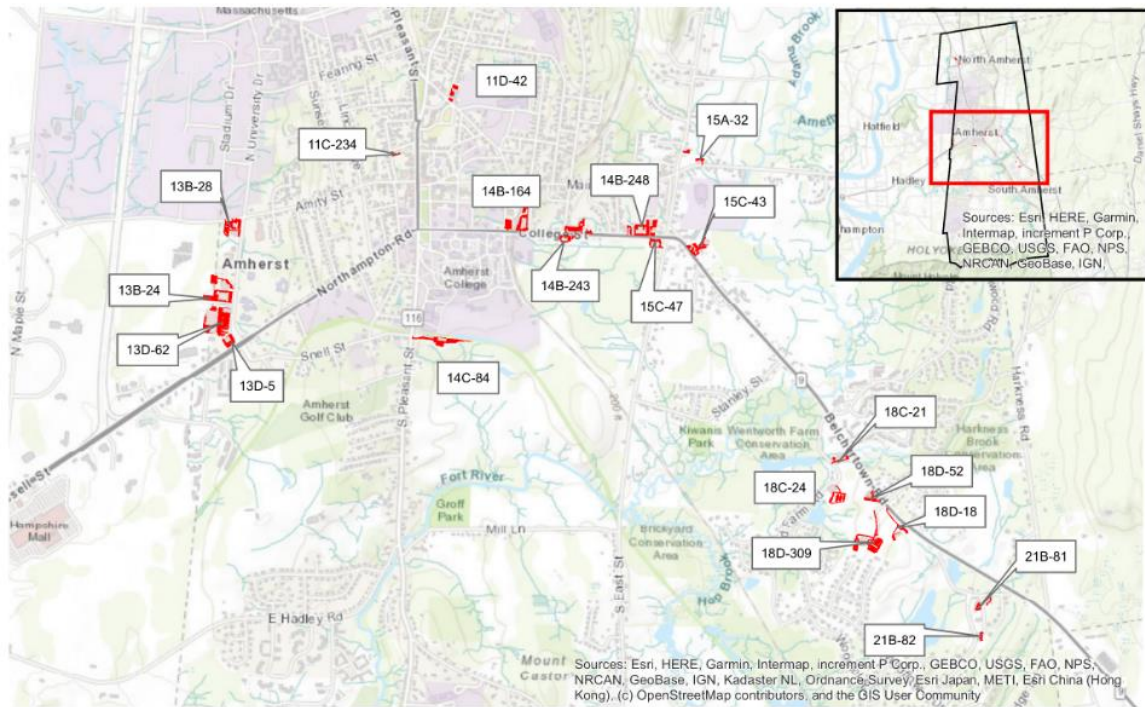
Figure 5. Solar canopy installed at parking lots. (Source: Rutgers University)

Solar Canopy – Attraction Zones

We reviewed attraction factors for installations of solar canopy on parking areas throughout the Town. The Town has parking lot data available through the 2009 base map. More recent data on parking lots may be available through the Town but was not included in our analysis. To identify suitable parking lots for our analysis, we first intersected the parking lot data from the 2009 base map with 2020 MassGIS Assessor’s Parcel data. This spatial join returned 1,378 parking lots across the Town. We ran an analysis to identify the number of potential large parking lot sites, including commercial, institutional, and municipal parking lots and their available acreages.

Commercial Parking Lots

Due to the large number of parking lots, we selected only commercial parking lots that were greater than one (1) acre. As seen in Figures 6, 7 and 8 below, there is a large concentration of large parking lots in Northern Amherst around the large commercial retailers. These large parking areas are highly suitable for solar canopies and provide multiple benefits, including providing shade and reducing urban heat island effect. Since these are not municipal properties, the Town would need to develop some type of incentive program to try to get these owners interested in installing solar canopies. A table of commercial parcels that can be cross-referenced with the parking lot data is available in the appendix.



Parking Lots in Commercial Areas (Central Area)

Town of Amherst - Solar Suitability Analysis
 Amherst, MA

2,800 1,400 0 2,800 Feet

Legend

■ Parking Lot

Data Source: MassGIS
 Nitsch Project #14060



Figure 6. Parking Lots in Commercial Areas (Central)

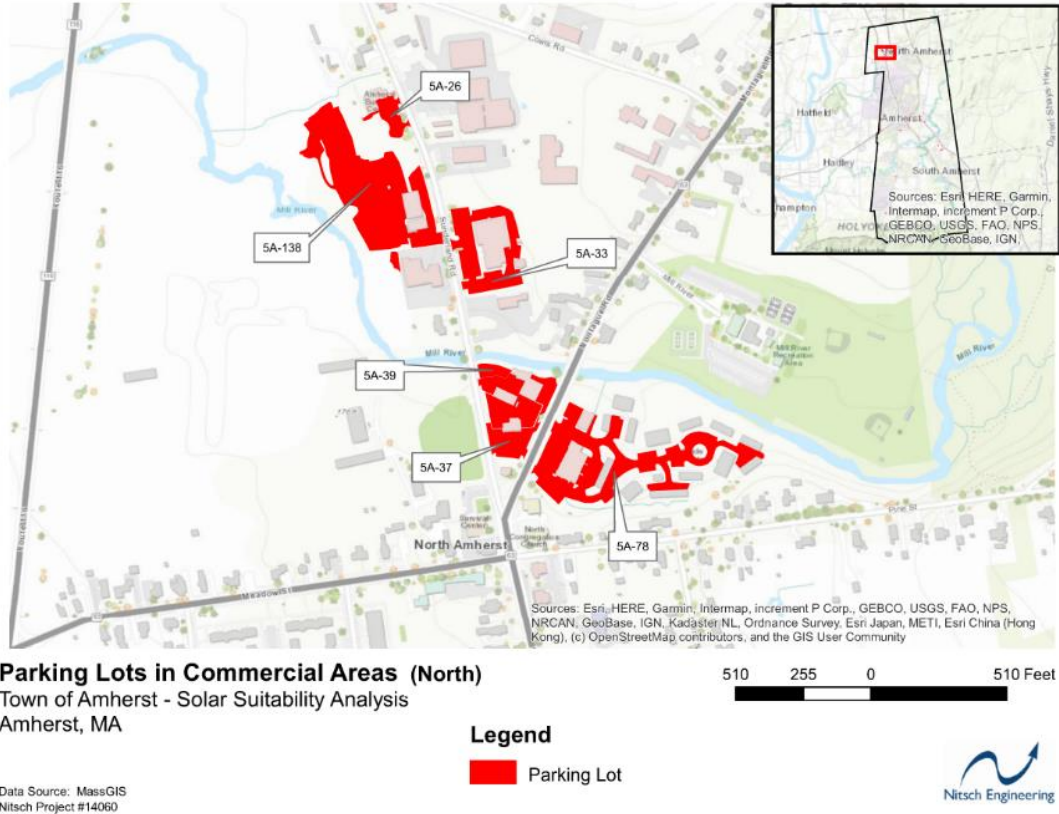


Figure 7. Parking Lots in Commercial Areas (North)

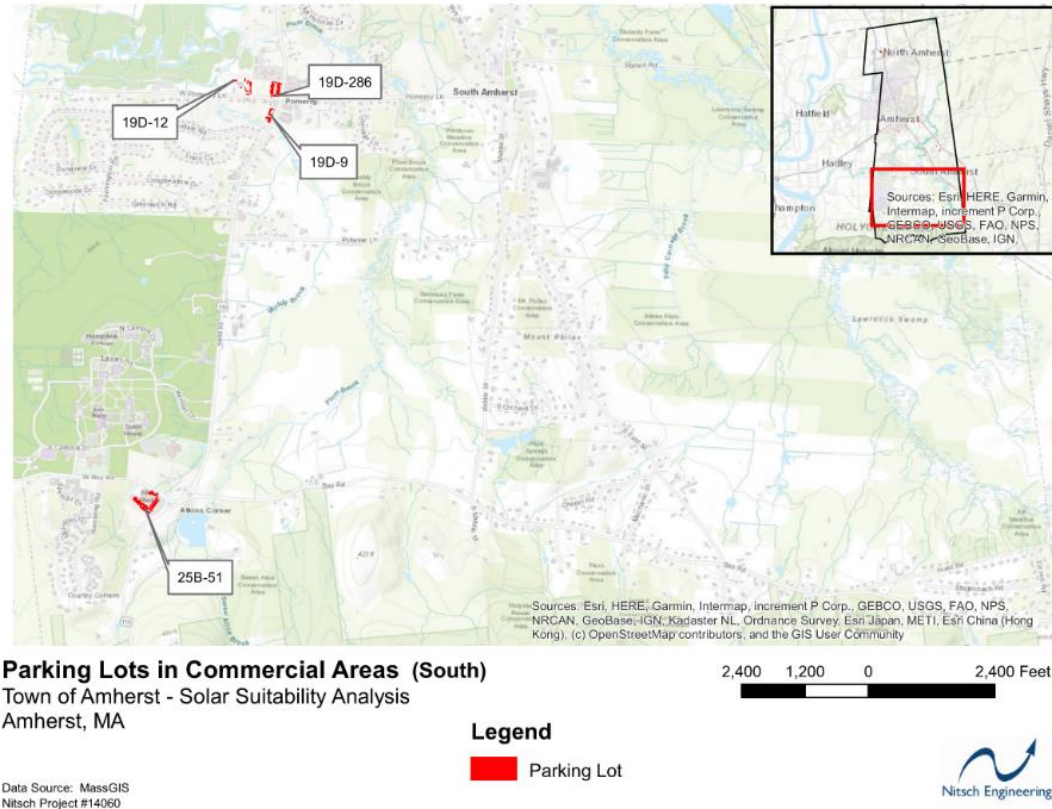


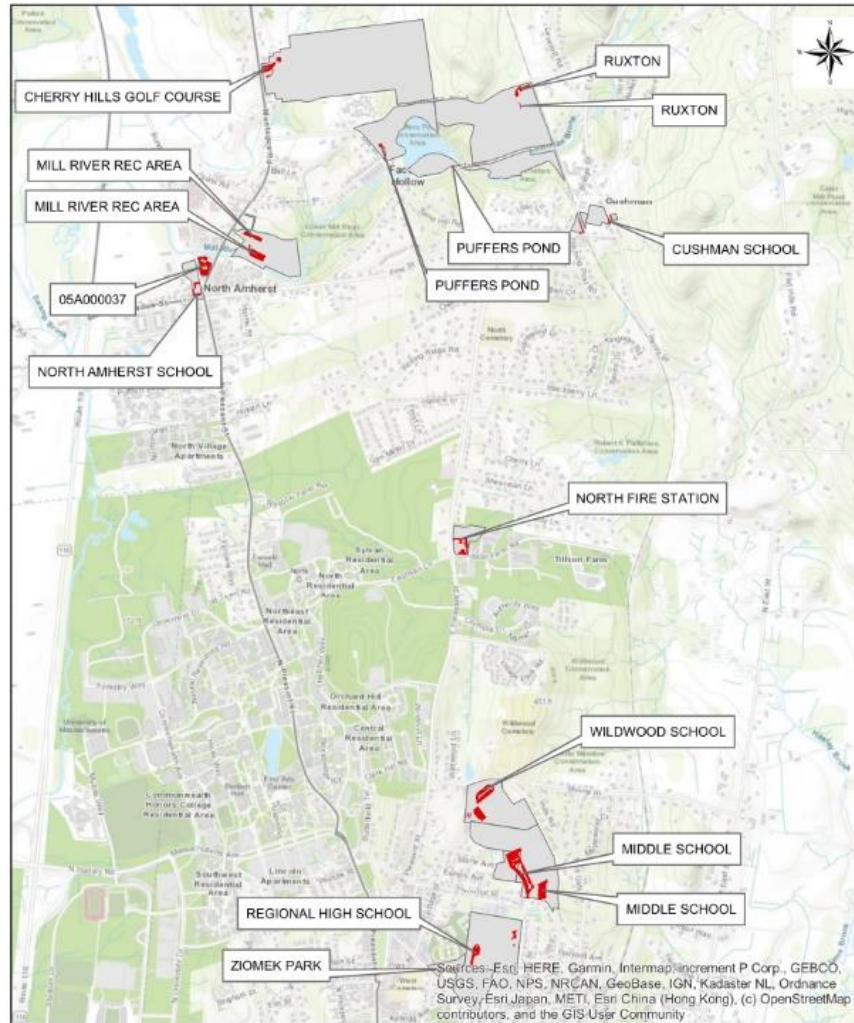
Figure 8. Parking lots in commercial areas (South)

Institutional Parking Lots

Just like the large commercial parking lots, institutional parking lots provide a great opportunity for installing large-scale solar canopies due to their vast area.

Municipal Parking Lots

Municipal parking lots were identified by intersecting the 2009 base map parking lots shapefile with 2020 Assessors parking data. Municipal parking lots in north and south Amherst are shown in the two Figures 9 and 10 below.

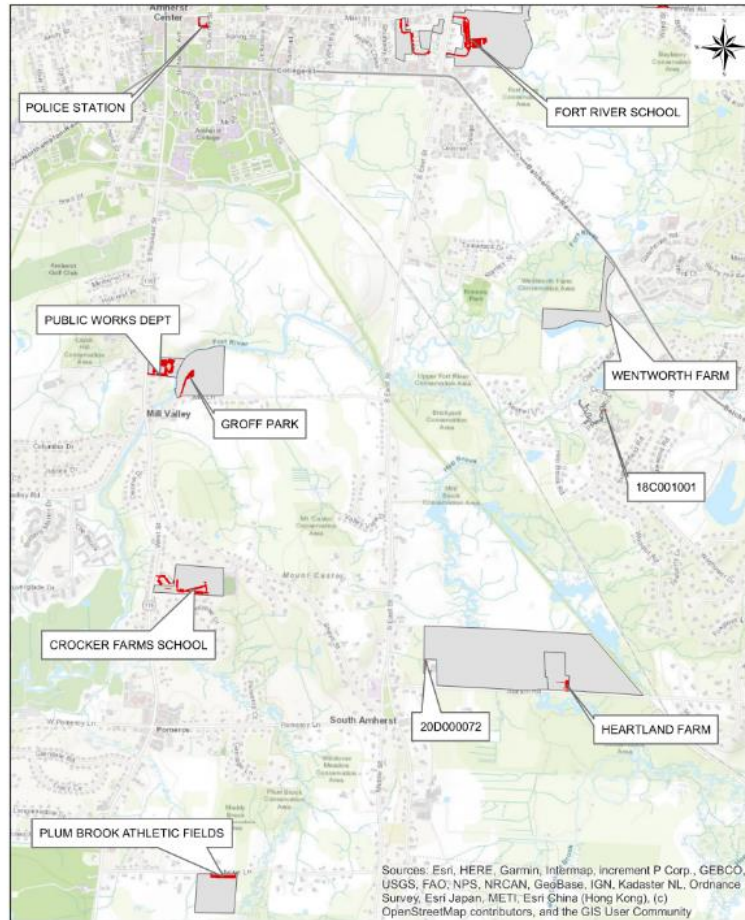


Parking Lots Owned by Town of Amherst (North)
Town of Amherst - Solar Suitability Analysis
Amherst, MA

Data Source: MassGIS
Nitsch Project #14060



Figure 9. Municipal Parking Lots (North)



Parking Lots Owned by Town of Amherst (South)
Town of Amherst - Solar Suitability Analysis
Amherst, MA

Data Source: MassGIS
Nitsch Project #14060



Figure 10. Municipal Parking Lots (South)

Site information specifying the parcel and parking areas per municipal parcel is detailed in Table 5 below. A large amount of suitable parking lot area is characterized as highly suitable with a large acreage.

Table 5. Municipal parcels with parking lots and area calculations in acres

Parcel ID	Address	Site	Parcel (Acres)	Parking (Acres)
15A-47	70 SOUTH EAST ST.	FORT RIVER SCHOOL	11.46	2.69
11D-273	CHESTNUT ST.	MIDDLE SCHOOL	3.56	2.47
17A-70	586 SOUTH PLEASANT ST.	PUBLIC WORKS DEPT	12.75	1.83
20A-38	280 WEST ST.	CROCKER FARMS SCHOOL	36.21	1.76
11B-76	71 STRONG ST.	WILDWOOD SCHOOL	57.36	1.68
5A-126	95 MONTAGUE RD.	MILL RIVER REC AREA	25.62	1.20
5A-37	24 MONTAGUE RD.	05A000037	2.43	0.98
14B-249	683-687 MAIN ST.		8.52	0.94
11B-124	170 CHESTNUT ST.	MIDDLE SCHOOL	22.53	0.88
11D-215	21 MATTOON ST.	REGIONAL HIGH SCHOOL	68.40	0.78
23A-9	POTWINE LN.	PLUM BROOK ATHLETIC FIELDS	12.21	0.72
2D-2	303 MONTAGUE RD.	CHERRY HILLS GOLF COURSE	132.46	0.67
17C-13	MILL LN.	GROFF PARK	10.00	0.64
8B-80	603 EAST PLEASANT ST.	NORTH FIRE STATION	7.70	0.57
5B-33	531 PULPIT HILL RD.	RUXTON	78.00	0.44
14A-329	111 MAIN ST.	POLICE STATION	0.88	0.30
21C-41	72 STATION RD.	HEARTLAND FARM	6.11	0.30
5A-22	1200 NORTH PLEASANT ST.	NORTH AMHERST SCHOOL	7.50	0.26
11D-270	30 MATTOON ST.	ZIOMEK PARK	2.10	0.25
15B-87	PELHAM RD.	AMETHYST BROOK	39.37	0.20
2D-8	MILL ST.	PUFFERS POND	15.38	0.16
6A-23	BRIDGE ST.	CUSHMAN COMMON	1.26	0.09
6A-94	71 HENRY ST.	CUSHMAN SCHOOL	2.44	0.07
18C-1	OLD FARM RD.	18C001001	1.74	0.05
6A-53	HENRY ST.		0.20	0.05
18A-46	BELCHERTOWN RD.	WENTWORTH FARM	9.57	0.04
20D-72	72 STATION RD.	20D000072	76.82	0.04
5B-129	STATE ST.	PUFFERS POND	9.06	0.03
5B-34	MILL ST.	MILL RIVER	7.90	0.01
15A-20	31 SOUTH EAST ST.	EAST STREET SCHOOL	2.34	0.00

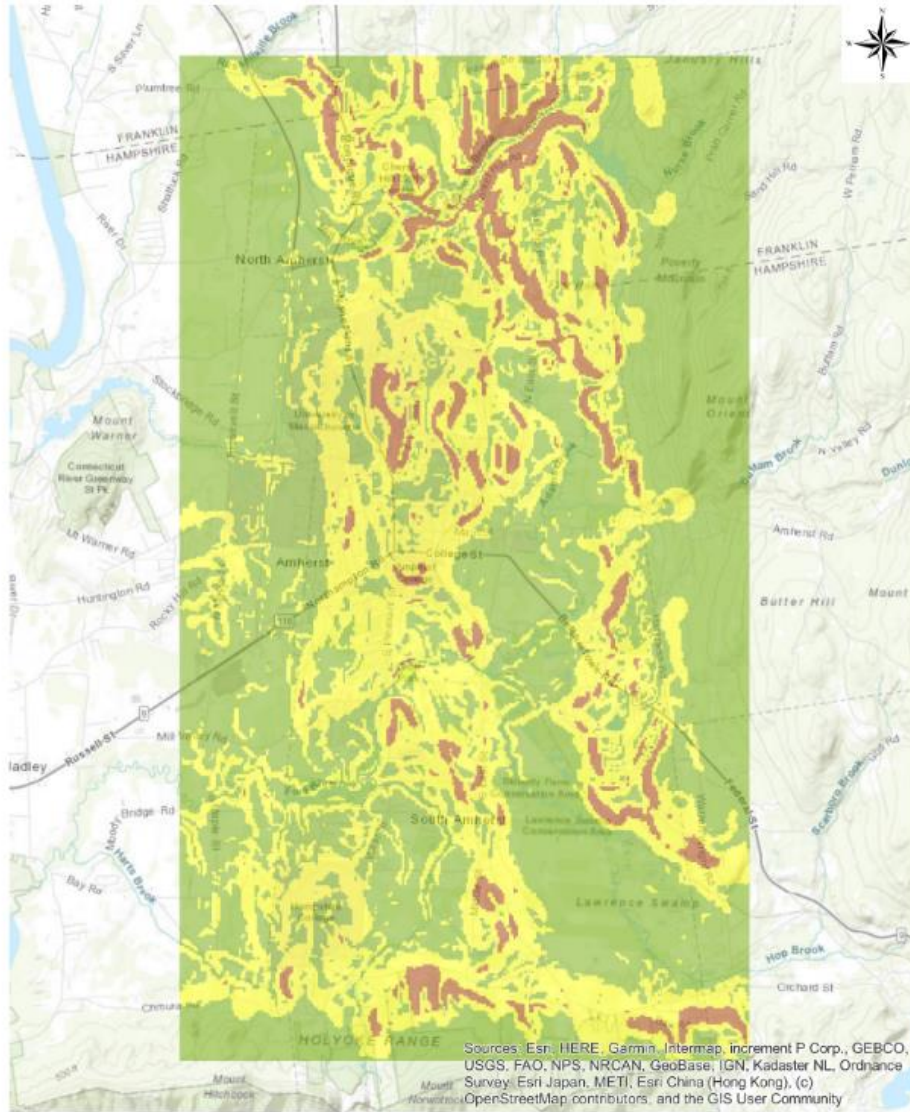
Topography/Slope

Topography plays an important role in the development of a ground solar site or solar canopy parking. Flat terrain or a gentle slope are preferred because of access convenience. Based on several studies (DOI 2016, Nebey et. Al, 2020), the following slope suitability was determined for parking lot solar canopies (Table 6):

Table 3. Slope Suitability Key

Slope	Suitability	Key
Less than 3% slope	Highly Suitable	1
3% - 10% slope	Suitable	2
Greater than 10%	Unsuitable	3

We classified the slope data in GIS according to the key in Table 6 and applied the classification to the slope data for the Town. The slope classification results can be seen on the slope Figure 11. We then intersected the slope information with parking lot data to identify parking lots with a suitable slope in Amherst (compare Figure 12).



Slope Map
 Town of Amherst - Solar Suitability Analysis
 Amherst, MA

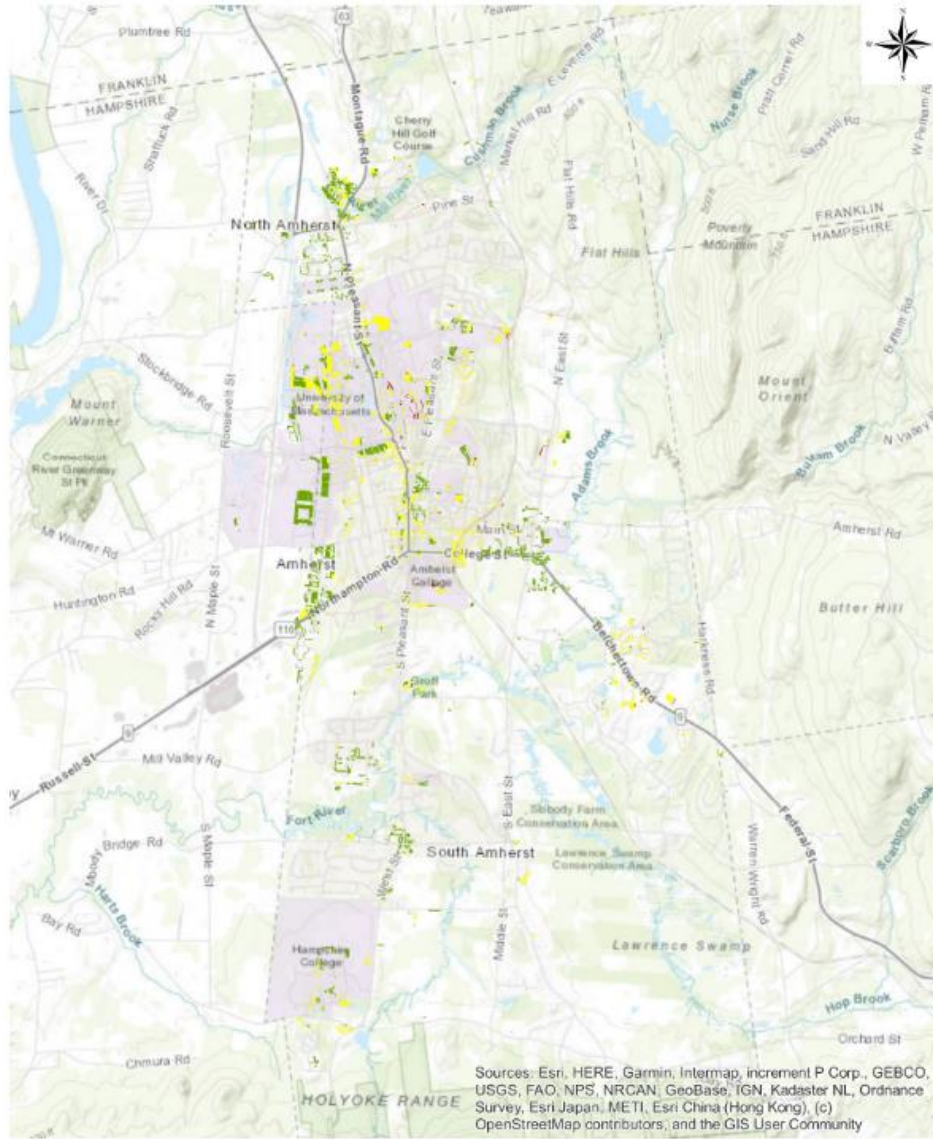
0 0.5 1 2 Miles

- Legend**
- suitabilit**
- Highly Suitable (3% or less)
 - Suitable (Between 3% and 10%)
 - Not Suitable (Greater than 10%)

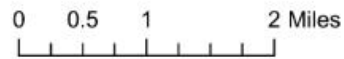
Data Source: MassGIS
 Nitsch Project #14060.P



Figure 11. Slope Map



Parking by Slope Suitability
 Town of Amherst - Solar Suitability Analysis
 Amherst, MA



Data Source: MassGIS
 Nitsch Project #14060.P

- Legend**
- Suitability**
- Highly Suitable (3% or less)
 - Suitable (Between 3% and 10%)
 - Not Suitable (Greater than 10%)



Figure 12. Parking Lots by Slope Suitability

Parking Lot Solar Canopy Analysis

Based on the analysis factors above, we identified six (6) municipal parcels that are strong candidates for parking lot canopies. Each of the parcels below have parking lots greater than 1 acre with a slope calculation of either 1 (less than 3%, or highly suitable) or 2 (between 3 and 10%, suitable). These sites can be identified in Figure 8 and Figure 9.

It is worth noting that four (4) of the six (6) sites identified through this analysis are schools. Schools make excellent candidates for solar installations not just because of their large footprints, but also because they provide an educational opportunity for students to learn more about climate change and the benefits of renewable energy. Schools are also considered to be a piece of critical infrastructure for their community. In the case of Amherst, the regional school district also makes them a highly advantageous location for regional resilience funding opportunities such as the Federal Emergency Management Agency’s (FEMA) BRIC program.

MapParID	Facility	Address	Acres (Parcel)	Acres (Parking)	Slope
11B-76	WILDWOOD SCHOOL	71 STRONG ST	57.36	1.68	2
11D-273	REGIONAL MIDDLE SCHOOL	170 CHESTNUT ST	3.56	2.47	1
15A-47	FORT RIVER SCHOOL	70 SOUTH EAST ST	11.46	2.69	1
17A-70	PUBLIC WORKS DEPT	586 SOUTH PLEASANT ST	12.75	1.83	2
20A-38	CROCKER FARMS SCHOOL	280 WEST ST	36.21	1.76	2
5A-126	MILL RIVER REC AREA	95 MONTAGUE RD	25.62	1.20	2

Figure 13. Municipal Facilities Suitable for Parking Lot Canopy

Recommendation #1: Fort River Elementary School



Figure 14. Fort River Elementary School Parking Lot and Parcel



Figure 15. Fort River Elementary School Aerial

Recommendation #2: Amherst Regional Middle School



Figure 16. Amherst Regional Middle School Parking Lot and Parcel



Figure 17. Amherst Regional Middle School Aerial

Option #3: Rooftop Solar

As described in Section 1 on solar farms, the vast majority of municipal vacant land is not suitable for ground solar. Parking lots are another viable option for solar development, but an additional type of solar installation is rooftop solar. Figure 18 depicts a typical rooftop solar installation on a flat roof.



Figure 18. Rooftop Solar (Source: Inside Climate News)

For the installation of a rooftop solar facility, several suitability factors come into play such as the age and condition of a roof. Other important aspects that affect a roof's compatibility with solar panels are:

- Material;
- Pitch;
- Shape and size;
- Orientation; and
- Amount of shade.

Rooftop Solar – Areas of Attraction

Suitable Municipal Parcels/Facilities

According to the information provided by the Town, Amherst has 45 municipal facilities which are detailed below. We geo-coded location information on municipal facilities from the Town (received November 20, 2020) and incorporated the data into GIS.

Table 7. Town of Amherst Municipal Facilities

Department	Facility	Address	Lat	Lon
General	Town Hall	4 Boltwood Ave.	42.37552	-72.5187
General	Bangs Community Center	70 Boltwood Walk	42.377012	-72.5184
General	Munson Memorial Library	1046 South East St.	42.340886	-72.5034
Public Safety	Amherst Police Dept.	111 Main St.	42.375676	-72.5173
Public Safety	Central Fire Station	68 North Pleasant St.	42.376734	-72.5203
Public Safety	North Fire Station	603 East Pleasant St.	42.398898	-72.5151
Public Safety	Boltwood Parking Garage	51 Boltwood Walk	42.376685	-72.5182
Public Works	Public Works Garage	586 South Pleasant St.	42.358363	-72.5203
Public Works	Tree and Ground Garage	205 Triangle St.	42.379772	-72.5154
Water	Atkins Water Treatment Plant	Market Hill Rd.	42.416331	-72.5048
Water	Centennial Water Treatment	Amherst Rd.	42.377561	-72.4593
Water	Well #1 and 2Station Rd.	Station Rd.	42.332165	-72.4695
Water	Well #4 and Baby Carriage Treatment	South East St.	42.329155	-72.4765
Water	Well #4 and Baby Carriage Treatment	South East St.	42.327572	-72.4936
Water	Village Park Water Storage	East Pleasant St.	42.392793	-72.5102
Water	Bay Rd. Water Storage	Bay Rd.	42.3126	-72.5013
Water	East Pleasant St. Water Storage	East Pleasant St.	42.390822	-72.5172
Water	Old Cushman Chlorination Station	Market Hill Rd.	42.415868	-72.5065
Water	Water Storage Building	586 South Pleasant St.	42.358363	-72.5203
Sewer	Wastewater Treatment Plant	1 Mullins Way	42.386205	-72.5375
Sewer	Pumping Station Stanely St.	Stanely St.	42.362832	-72.4992
Sewer	Animal Control Fac/Equipment Storage	1 Mullins Way	42.386205	-72.5375
Solid Waste	Ruxton	531 Pulpit Hill Rd.	42.419376	-72.512
Solid Waste	Landfill Storage	740 Belchertown Rd.	42.356758	-72.4792
Conservation	Hitchcock Center	525 South Pleasant St.	42.359641	-72.5222
Library	Jones Library	43 Amity St.	42.376216	-72.521
Library	North Amherst Library	8 Montague Rd.	42.410863	-72.5311
Recreation	Ziomek Field Lighting	Triangle St.	42.37973	-72.5136
Recreation	Community Field Comfort Station	205 Triangle St.	42.378867	-72.5151
Recreation	War Memorial Pool	205 Triangle St.	42.379713	-72.5149
Recreation	Groff Park Comfort Station	76 Mill Ln.	42.357891	-72.5175
Recreation	Mill River Park Shelter/Open Pavilion	95 Montague Rd.	42.412221	-72.5275
Recreation	Mill River Maint/Storage	95 Montague Rd.	42.412221	-72.5275
Recreation	Mill River Rec Area Pool	95 Montague Rd.	42.412221	-72.5275
Recreation	Mill River Pump House	95 Montague Rd.	42.412221	-72.5275
Recreation	Cherry Hill Golf Course	303 Montague Rd	42.42036	-72.5273
Recreation	Cherry Hill Garage	303 Montague Rd.	42.42036	-72.5273
Schools	Crocker Farm Elementary	280 West St.	42.347394	-72.5174
Schools	East St. School	31 South East St.	42.375228	-72.5016
Schools	Fort River Elementary	70 South East St.	42.375406	-72.4988
Schools	Wildwood Elementary	71 Strong St.	42.387276	-72.5133
Schools	South East Campus	1001 South East St.	42.342291	-72.5052
Schools	Fort River Comfort Station	70 South East St.	42.375406	-72.4988

Schools	North Amherst School	1200 North Pleasant St.	42.410253	-72.5314
Schools	Amherst Child Care	61 Strong St.	42.386139	-72.5147

Affordable Housing Sites

The Town contains approximately eight (8) affordable housing projects that range in size, type of structure, and amount of roof area. The projects have a variety of different parking and rooftop arrangements, as shown in the table below. We began our analysis by geocoding the addresses of the seven (7) affordable housing projects which had addresses associated with them on the Amherst Housing Authority Website. Affordable housing site throughout the Town are shown in Figure 19 below.

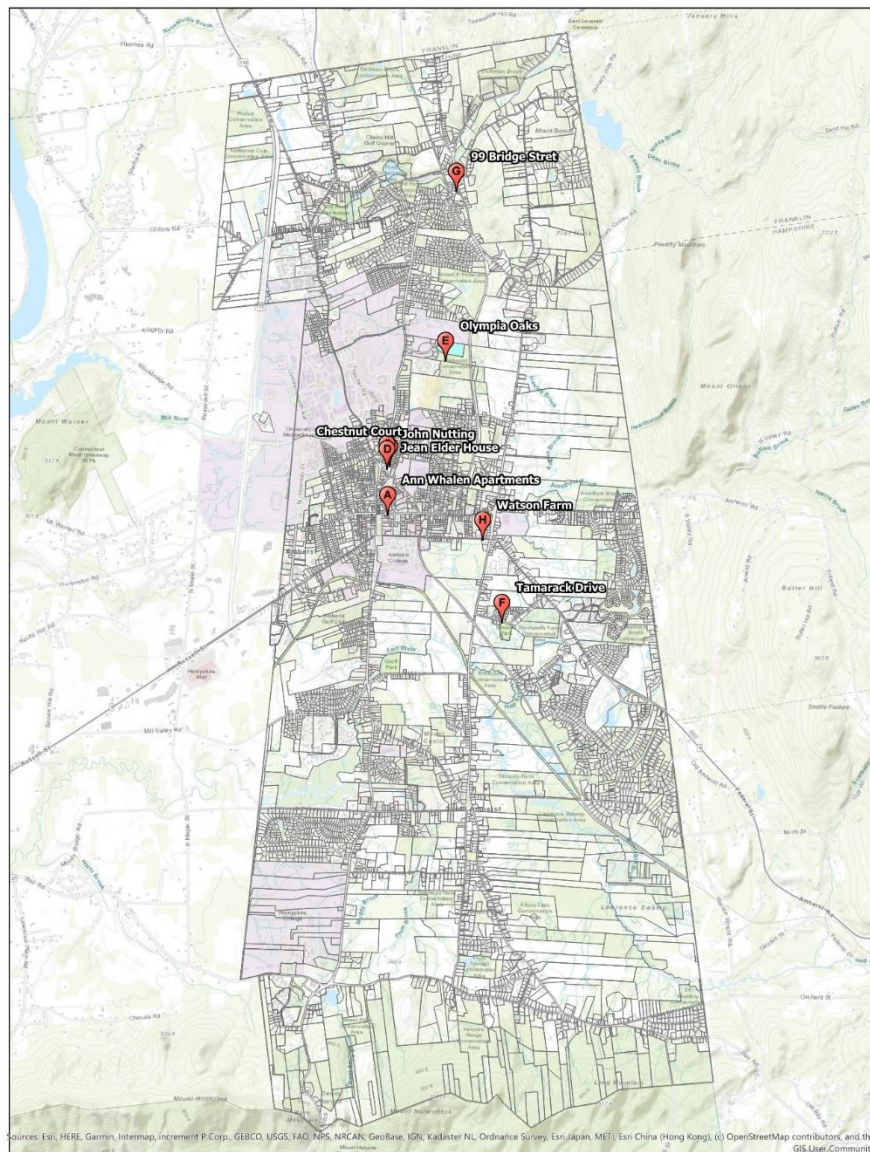







Figure 19. Affordable Housing Projects in Amherst

After geocoding the addresses into GIS, we joined the affordable housing data to structural footprints found in the 2009 Amherst Base Map that includes roofprint areas gathered from the ROLTA data set, shown in the table below. Table 8 gives an overview of the eight (8) affordable housing projects and details some of their characteristics including amount of units, type of structure, and amount of roof area.

Table 8. Affordable Housing Roof Area

Project	Buildings	Units	Roof Area (Sq. Feet)	Photo
<p>Ann Whalen: Ann Whalen Apartments, 33 Kellogg Avenue in downtown Amherst, next to the Senior Center, is a five-story elevator building containing 80 one-bedroom apartments, four (4) of which are wheelchair accessible. The building includes a community room, laundry facilities, and a greenhouse.</p>	1	80	13538.95	
<p>Chestnut Court: Located just off East Pleasant Street and less than 1 mile from the Town center, Chestnut Court is comprised of five (5) buildings for a total of 30 apartments. Each of these one-bedroom apartments has an individual outside entrance, and most are located on the ground floor. A community room and laundry facilities are available.</p>	5	30	13767.49	
<p>Jean Elder House: Jean Elder House is a former fraternity house with a community room and laundry facilities close to the center of Town that has been converted into apartments for elderly and disabled people. There are three (3) units: a one, a two, and a three-bedroom apartment, as well as three (3) apartments that are rented to social service agencies whose clients have specific disabilities.</p>	1	3	N/A	

<p>John Nutting: Next to Chestnut Court, John Nutting Apartments is a five-unit program in three (3) buildings for families who have a member with a mobility impairment. Each apartment is wheelchair accessible, has a roll-in shower, and three (3) or four (4) bedrooms (one [1] of which may be set aside for use by a live-in personal care attendant, if required). Laundry facilities are available.</p>	<p>3</p>	<p>5</p>	<p>20988.08</p>	
<p>Olympia Drive/Olympia Oaks: No information available on the Amherst Housing Authority website.</p>	<p>12</p>		<p>34487.58</p>	
<p>Scattered Site Housing: Funded by the State 705 Family Housing program, these 22 two- or three-bedroom apartments (including one [1] wheelchair accessible unit) are located in duplexes on five (5) sites in the Town. Each unit has laundry hook-ups and a storage shed. Tenants are responsible for utilities, snow removal, and lawn mowing.</p>	<p>5</p>	<p>22</p>	<p>N/A</p>	

<p>Tamarack Drive: Project based Section 8 funded units at these two (2) addresses are eight (8) two- or three-bedroom apartments (including one [1] wheelchair accessible unit).</p>	<p>2</p>		<p>1468.702</p>	
<p>99 Bridge Street: Project based Section 8 funded units at these two (2) addresses are eight (8) two- or three-bedroom apartments (including one [1] wheelchair accessible unit).</p>		<p>1</p>	<p>1817.57</p>	
<p>Watson Farms: A 15-unit Federally funded program located at 693 Main Street, Watson Farms Apartments range from one (1) to four (4) bedrooms with two (2) wheelchair accessible units. Each apartment has laundry hook-ups and a private fenced yard with a storage shed. These units are on a bus line and next to an elementary school. Tenants are responsible for their own utilities.</p>		<p>7</p>	<p>13000.33</p>	

Municipal Facilities

We joined the municipal facilities data to the roof ROLTA data provided through MassGIS. Table 9 ranks municipal facilities from largest roof area to smallest. Many facilities' roof data were not able to be determined through this preliminary investigation. Additional steps would be needed to identify the true suitability of any of the below facilities.

Table 9. Municipal Facilities Roof Areas

Department	Facility	Address	Roof Area (Sq Ft)
Schools	Fort River Elementary	70 South East St.	79432.32
Schools	Fort River Comfort Station	70 South East St.	-
Schools	Wildwood Elementary	71 Strong St.	78453.62
Library	Jones Library	43 Amity St.	18067.87
General Government	Bangs Community Center	70 Boltwood Walk	17347.62
Water	Atkins Water Treatment Plant	Market Hill Rd.	12858.20
Public Safety	North Fire Station	603 East Pleasant St.	11140.50
Schools	South East Campus	1001 South East St.	7351.85
General Government	Town Hall	4 Boltwood Ave.	7029.68
Schools	Amherst Child Care	61 Strong St.	6869.35
Schools	North Amherst School	1200 North Pleasant St.	5094.88
Water	Village Park Water Storage	East Pleasant St.	4275.86
Solid Waste	Ruxton	531 Pulpit Hill Rd.	3999.87
Water	Bay Rd. Water Storage	Bay Rd.	3624.89
Public Works	Tree and Ground Garage	205 Triangle St.	3297.83
Water	Well #4 and Baby Carriage Treatment	South East St.	3241.61
Conservation	Hitchcock Center	525 South Pleasant St.	2860.41
Schools	East St. School	31 South East St.	2680.40
Public Safety	Central Fire Station	68 North Pleasant St.	2351.89
Public Works	Public Works Garage	586 South Pleasant St.	1887.93
Water	Water Storage Building	586 South Pleasant St.	1887.93
Recreation	Groff Park Comfort Station	76 Mill Ln.	1276.35
Library	North Amherst Library	8 Montague Rd.	1245.99
Sewer	Pumping Station Stanely St.	Stanely St.	657.83
Recreation	Community Field Comfort Station	205 Triangle St.	414.27
General Government	Munson Memorial Library	1046 South East St.	N/A
Public Safety	Amherst Police Dept.	111 Main St.	N/A
Public Safety	Boltwood Parking Garage	51 Boltwood Walk	N/A
Water	Centennial Water Treatment	Amherst Rd.	N/A
Water	Well #1 and 2 Station Rd.	Station Rd.	N/A
Water	Well #4 and Baby Carriage Treatment	South East St.	N/A

Water	East Pleasant St Water Storage	East Pleasant St.	N/A
Water	Old Cushman Chlorination Station	Market Hill Rd.	N/A
Sewer	Wastewater Treatment Plant	1 Mullins Way	N/A
Sewer	Animal Control Fac/Equipment Storage	1 Mullins Way	N/A
Solid Waste	Landfill Storage	740 Belchertown Rd.	N/A
Recreation	Ziomek Field Lighting	Triangle St.	N/A
Recreation	War Memorial Pool	205 Triangle St.	N/A
Recreation	Mill River Park Shelter/Open Pavilion	95 Montague Rd.	N/A
Recreation	Mill River Maint/Storage	95 Montague Rd.	N/A
Recreation	Mill River Rec Area Pool	95 Montague Rd.	N/A
Recreation	Mill River Pump House	95 Montague Rd.	N/A
Recreation	Cherry Hill Golf Course	303 Montague Rd	N/A
Recreation	Cherry Hill Garage	303 Montague Rd.	N/A
Schools	Crocker Farm Elementary	280 West St.	N/A

Rooftop Solar Suitability Analysis

Only a preliminary analysis was done for rooftop solar suitability for affordable housing and municipal facilities. Rooftop solar requires a much more substantial analysis of each building’s unique roof characteristics which would require more in-depth study.

For further suitability analysis of the solar installation on roofs, we recommend conducting the following next analysis steps for municipal facilities and affordable housing:

- Perform a LIDAR analysis to evaluate the roof pitch of suitable buildings;
- Perform an orientation analysis and shade analysis;
- Confirm the roof building material is suitable; and
- Conduct a visual screening of suitable building roofs according to the shape and size of their roofs. An average residential solar system in the U.S. is 5 kilowatts, which requires at least 300 feet of surface area on the roof. Based on this, we suggest applying a threshold of 300 square feet (SF) of roof area as a minimum criteria for the attraction zone. Furthermore, a large, square roof is a preferred shape as it allows for most easy installation and maintenance.

Conclusion Summary

Our solar suitability analysis reviewed options for solar development within the Town to include ground solar, solar canopies (parking lots), and rooftop solar. Our analysis established exclusion and attraction criteria to screening for suitable sites.

1. **Ground solar is not feasible on municipal land.**

Background: Our analysis reviewed vacant parcels and publicly owned land. We found a lack of large vacant municipal parcels which do not meet one (1) or more of the exclusion criteria of our exclusion analysis. The Town has a strong commitment to conserve and preserve their land. A lot of the vacant municipal land is classified as conservation area or is protected land. Ground solar development on municipal land is not recommended.

Our recommendation is to develop solar on highly suitable areas as follows (compare Figure 20):

2. **Tier 1 sites for solar canopy development** (municipal land).

The Regional Middle School is highly recommended for solar development.³

Background:

- Several parking lots are highly suitable for solar development due to their large area of parking space for solar canopy;
- Two (2) educational facilities (schools), the Fort River and Middle School (regional school) are highly suitable for solar canopy buildout; and
- The Regional Middle School has vast, flat area for solar canopy development and is located in closest distance to the substation, resulting in reduced interconnection costs.

3. **Tier 2 sites for rooftop solar development:**

The Jean Elder House affordable housing sites are highly suitable for solar buildout.⁴

Background:

- The Jean Elder House and Anne Whalen affordable housing sites feature flat roofs and associated space for battery storage (i.e. on the adjacent parking lot); and
- The Jean Elder House is located in closest distance to the POI (point of interconnection), resulting in reduced interconnection costs.⁵

4. **Tier 3: Brownfield sites solar development**

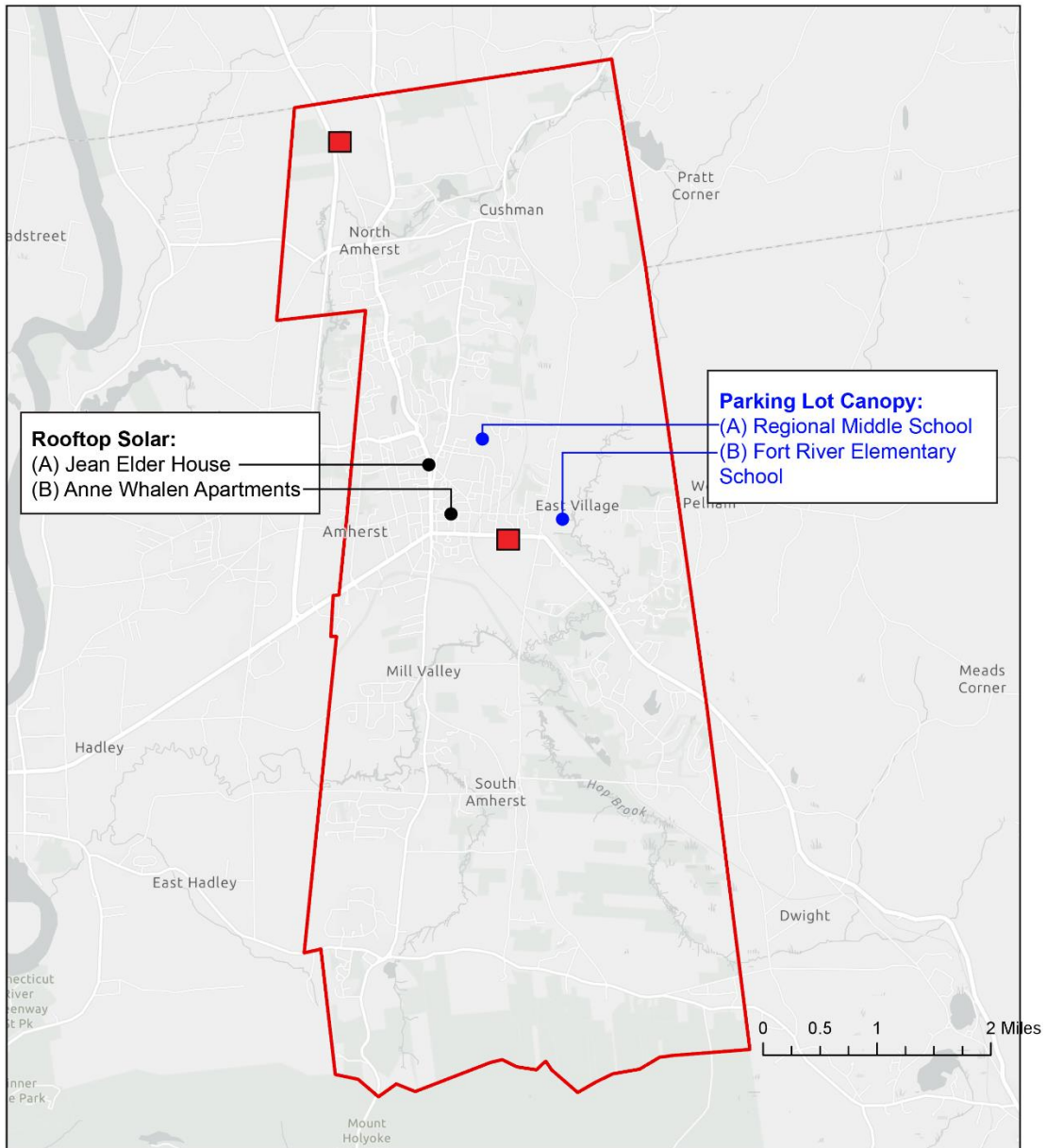
There are no public brownfield sites in Amherst, making it less ideal for a public solar project.⁶

³ Wildwood School might also be suitable for solar development. This report is showing the two (2) best sites.

⁴ Affordable housing sites may also be suitable for solar parking canopy buildout. This aspect could be evaluated further in a next analysis.



⁵ Rooftop solar results are preliminary findings. We recommend further screening.

⁶ Hampshire College contains a brownfield site, but this would warrant further examination and owner conversation.



Solar Siting Recommendations

Town of Amherst - Solar Suitability Analysis
Amherst, MA

-  Amherst Boundary
-  Substation



Source: Mass GIS
Nitsch Project Number: 14060

Figure 20. Solar Siting Recommendations

Appendix 1: Commercial Parking Lots

MapParID	Address	Owner	Other Name	LandUse	Zoning	Acres
19D-12	71 WEST POMEROY LN	DAVIS, ROBERT H & DEBORA T LIFE ESTATE	19D000012	Two Family	BVC	32.19
14B-173	246 COLLEGE ST	WESTERN MASS ELECTRIC CO	14B000173	Elecsubsta	CO20	16.00
5A-138	100 SUNDERLAND RD	100 SUNDERLAND ROAD LLC	05A000138	Auto Repr	CO	11.96
13D-62	UNIVERSITY DR	CP AMHERST LLC	13D000062	Devel Land	BL20	9.08
13B-17	101 UNIVERSITY DR	SLOBODY DEVELOPMENT CORP	13B000017	Office Bld	BL20	8.86
25B-51	1151 WEST ST	LANNON, PAULINE A & ETAL D/B/A	ATKINS FRUIT BOWL	Supermarket - Ind	BG10	7.64
18D-309	31 HALL DR	AMHERST MEDICAL PROPERTIES LLC	18D000309	Prof Bldg	PRP	6.16
13B-24	UNIVERSITY DR	UNITED STATES POSTAL SERVICE	13B000024	Us Govt C	BL20	4.64
18C-24	210 OLD FARM RD	STAVROS CENTER FOR INDEPENDENT LIVING	18C000024	Char C	PRP	4.52
11D-42	29 COTTAGE ST	W D COWLS INC	11D000042	Office Bld	BL20	4.48
18D-18	611 BELCHERTOWN RD	AMHERST CHINESE CHRISTIAN CHURCH	18D000018	Church C	PRP	4.13
13D-59	175 UNIVERSITY DR	CP AMHERST LLC	13D000059	Supermarket	BL20	4.10
14B-809	RAILROAD ST	NEW ENGLAND CENTRAL RAILROAD INC	14B000809	Devel Land	BVC	4.07
19D-286	479 WEST ST	SLOBODY DEVELOPMENT CORP	19D000286	Office Bld	BVC	3.84
14B-164	150 COLLEGE ST	FILION LEASING, INC	LEADER HOME CENTER	Hrdware St	CO20	3.58
21B-73	9 RESEARCH DR	AMHERST OFFICE PARK LLC	21B000073	Office	PRP	3.58
21B-18	159 OLD BELCHERTOWN RD	ADB 2 PROPERTIES LLC	21B000018	Apt 4 - 8 Com	PRP	3.48
14C-84	SOUTH PLEASANT ST	SMITH, PATRICIA A &GRYBKO,MICH	AMHERST FARMERS SUPPLY	Undev Land	CO23	3.06
5A-26	138 SUNDERLAND RD	SURVIVAL CENTER INC	05A000026	Char C	CO	3.06
5A-33	79-85 SUNDERLAND RD	VILLAGE CENTER NORTH AMHERST LLC	05A000033	Store/Shop Com	CO20	2.83
18C-21	160 OLD FARM RD	HOLYOKE PROPERTY MANAGEMENT	18C000021	Office Bld	PRP	2.56
15C-43	48 BELCHERTOWN RD	PATEL, NEAL B & ET AL	15C000043	Single Fam	BL20	2.48
5A-37	24 MONTAGUE RD	TOWN OF AMHERST	05A000037	Municipal C	CO20	2.43
13B-28	25-35 UNIVERSITY DR	WEST AMHERST LLC		Office Bld	BL	2.29
15A-32	782-800 MAIN ST	LILLIAN CAMPBELL REVOCABLE TRU	782-800 MAIN ST	Office Bld	BL20	2.28
15A-31	45 NORTH EAST ST	LILLIAN CAMPBELL REVOCABLE TRU	15A000031	Apt 4 - 8 Com	BL20	2.09
18D-52	529 BELCHERTOWN RD	SAMEK, AUDREY	18D000052	Pri Comm Com	PRP	2.00
5A-78	15-47 MONTAGUE RD	PCJ RIVERSIDE PARTNERS LLC RUTH JONES MBR MGR	05A000078	Store/Shop	BL20	1.95
5A-39	38-40 MONTAGUE RD	POTTER FAMILY LLC	41 SUNDERLAND RD (AKA)	Comm Whse - Ind	BL20	1.89
21B-81	15 RESEARCH DR	CAREX LLC		Office Bld	PRP	1.75
11C-234	122 NORTH PLEASANT ST	ROMAN CATHOLIC BISHOP OF SPFLD	SAINT BRIGIDS CHURCH	Church - Res	BG10	1.74
14B-248	312 COLLEGE ST	J & N SALEMA FAMILY LTD PARTNERSHIP	14B000248	Rest/Clubs	CO20	1.73
14B-243	213 COLLEGE ST	ROUTE 9 REAL ESTATE INC	14B000243	Auto Repr	CO20	1.73
15C-47	381-385 COLLEGE ST	FLORENCE SAVINGS BANK	15C000047	Store/Shop	CO	1.61
13D-5	351 NORTHAMPTON RD	WU & CHOU LLC	13D000005	Rest/Clubs	BL20	1.45
19D-9	505 WEST ST	PRATT SR LEONARD H & RUTH C	19D000009	Store/Shop Com	BL20	1.18
21B-82	19 RESEARCH DR	HART, LORRAINE A & PATTERSON, CHERYL A		Office	PRP	1.04
15A-82	338 COLLEGE ST	SPIRIT CORP OF AMHERST	15A000082	Store/Shop Com	CO20	1.03

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December 8, 2020
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Appendix 1: Commercial Parking Lots Greater Than One (1) Acre

Town of Amherst Solar Site Suitability Analysis

MapParlID	Address	Owner	Other Name	LandUse	Zoning	Acres
19D-12	71 WEST POMEROY LN	DAVIS, ROBERT H & DEBORA T LIFE ESTATE	19D000012	Two Family	BVC	32.19
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5A-138	100 SUNDERLAND RD	100 SUNDERLAND ROAD LLC	05A000138	Auto Repr	CO	11.96
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13B-17	101 UNIVERSITY DR	SLOBODY DEVELOPMENT CORP	13B000017	Office Bld	BL20	8.86
25B-51	1151 WEST ST	LANNON, PAULINE A & ETAL D/B/A	ATKINS FRUIT BOWL	Supermarket - Ind	BG10	7.64
18D-309	31 HALL DR	AMHERST MEDICAL PROPERTIES LLC	18D000309	Prof Bldg	PRP	6.16
13B-24	UNIVERSITY DR	UNITED STATES POSTAL SERVICE	13B000024	Us Govt C	BL20	4.64
18C-24	210 OLD FARM RD	STAVROS CENTER FOR INDEPENDENT LIVING	18C000024	Char C	PRP	4.52
11D-42	29 COTTAGE ST	W D COWLS INC	11D000042	Office Bld	BL20	4.48
18D-18	611 BELCHERTOWN RD	AMHERST CHINESE CHRISTIAN CHURCH	18D000018	Church C	PRP	4.13
13D-59	175 UNIVERSITY DR	CP AMHERST LLC	13D000059	Supermarket	BL20	4.10
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19D-286	479 WEST ST	SLOBODY DEVELOPMENT CORP	19D000286	Office Bld	BVC	3.84
14B-164	150 COLLEGE ST	FILION LEASING, INC	LEADER HOME CENTER	Hrdware St	CO20	3.58
21B-73	9 RESEARCH DR	AMHERST OFFICE PARK LLC	21B000073	Office	PRP	3.58
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14C-84	SOUTH PLEASANT ST	SMITH, PATRICIA A &GRYBKO,MICH	AMHERST FARMERS SUPPLY	Undev Land	CO23	3.06
5A-26	138 SUNDERLAND RD	SURVIVAL CENTER INC	05A000026	Char C	CO	3.06
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18C-21	160 OLD FARM RD	HOLYOKE PROPERTY MANAGEMENT	18C000021	Office Bld	PRP	2.56
15C-43	48 BELCHERTOWN RD	PATEL, NEAL B & ET AL	15C000043	Single Fam	BL20	2.48
5A-37	24 MONTAGUE RD	TOWN OF AMHERST	05A000037	Municipal C	CO20	2.43
13B-28	25-35 UNIVERSITY DR	WEST AMHERST LLC		Office Bld	BL	2.29
15A-32	782-800 MAIN ST	LILLIAN CAMPBELL REVOCABLE TRU	782-800 MAIN ST	Office Bld	BL20	2.28
15A-31	45 NORTH EAST ST	LILLIAN CAMPBELL REVOCABLE TRU	15A000031	Apt 4 - 8 Com	BL20	2.09
18D-52	529 BELCHERTOWN RD	SAMEK, AUDREY	18D000052	Pri Comm Com	PRP	2.00
5A-78	15-47 MONTAGUE RD	PCJ RIVERSIDE PARTNERS LLC RUTH JONES MBR MGR	05A000078	Store/Shop	BL20	1.95
5A-39	38-40 MONTAGUE RD	POTTER FAMILY LLC	41 SUNDERLAND RD (AKA)	Comm Whse - Ind	BL20	1.89
21B-81	15 RESEARCH DR	CAREX LLC		Office Bld	PRP	1.75
11C-234	122 NORTH PLEASANT ST	ROMAN CATHOLIC BISHOP OF SPFLD	SAINT BRIGIDS CHURCH	Church - Res	BG10	1.74
14B-248	312 COLLEGE ST	J & N SALEMA FAMILY LTD PARTNERSHIP	14B000248	Rest/Clubs	CO20	1.73
14B-243	213 COLLEGE ST	ROUTE 9 REAL ESTATE INC	14B000243	Auto Repr	CO20	1.73
15C-47	381-385 COLLEGE ST	FLORENCE SAVINGS BANK	15C000047	Store/Shop	CO	1.61
13D-5	351 NORTHAMPTON RD	WU & CHOU LLC	13D000005	Rest/Clubs	BL20	1.45
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21B-82	19 RESEARCH DR	HART, LORRAINE A & PATTERSON, CHERYL A		Office	PRP	1.04
15A-82	338 COLLEGE ST	SPIRIT CORP OF AMHERST	15A000082	Store/Shop Com	CO20	1.03