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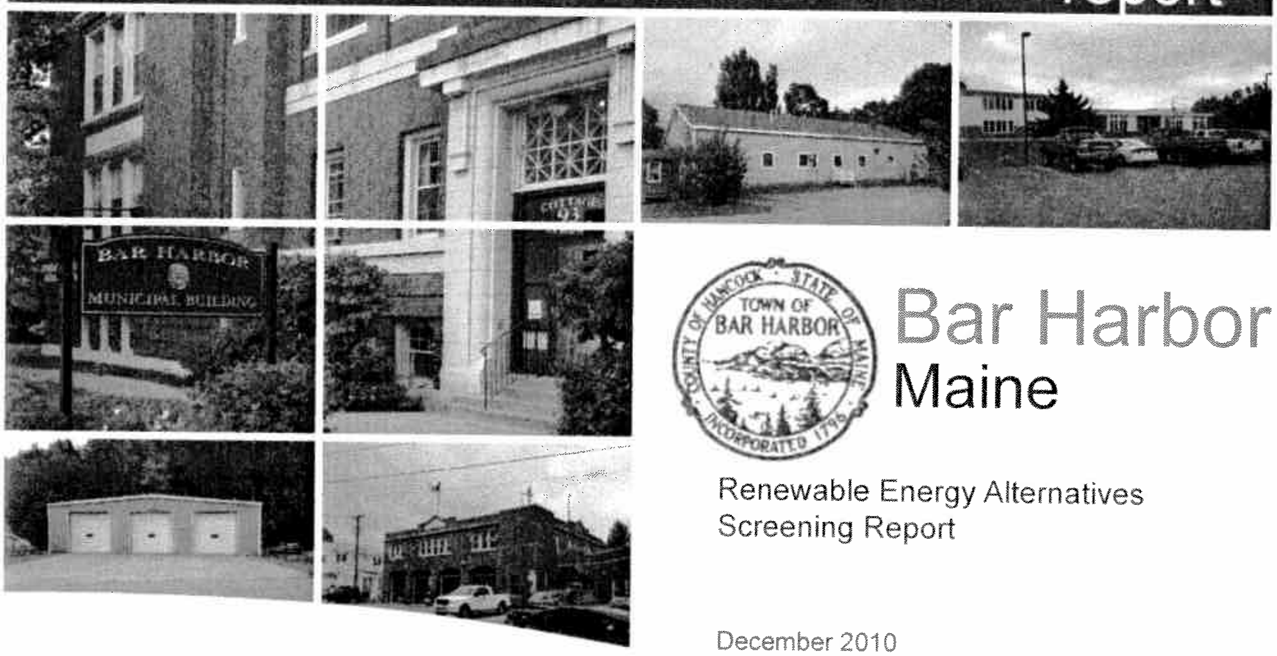

Bar Harbor Maine

Renewable Energy Alternatives Screening Report

December 2010

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1.0 INTRODUCTION

Weston & Sampson Engineers, Inc. (Weston & Sampson) on behalf of the Town of Bar Harbor, has conducted a Renewable Energy Alternatives Screening to provide the Town of Bar Harbor with data and information necessary to make an initial "Go" or "No Go" decision for proceeding with further detailed feasibility studies and/or the possible future implementation of renewable energy systems within the Town. This study was funded through the Energy Efficiency and Conservation Block Grant. As part of the Town of Bar Harbor's commitment to the environment, the Town has expressed their desire to evaluate the potential of installing on-site solar/photovoltaic and/or wind energy systems for direct consumption by municipal facilities.

The following report provides a technology review of commercially viable renewable energy technologies, a site screening for wind and solar development, and an evaluation of a conceptual solar project at the Town's Waste Water Treatment Facility (WWTF); Police/Fire Department; Municipal Building; Conner-Emerson School; Kids Corner Community Childcare Facility; and a conceptual wind project at Mount Desert Island High School. The conceptual project evaluations include required permits, challenges and preliminary project economics. The report also provides a recommended action plan outline and suggested schedule for implementation of the conceptual projects.

2.0 TECHNOLOGY REVIEW

Renewable energy technologies are generally accepted to include: wind, solar, geothermal, bio-energy, hydropower, tidal/wave or ocean, and hydrogen fuel cell. Renewable energy alternatives are also more expensive than energy conservation measures, which should always be considered first, before implementing a renewable energy technology if the goal is to save money on energy expenditures. This study focused on wind and solar photovoltaic renewable energy technologies available to the Town.

2.1 Wind Energy Systems

The terms "wind energy" or "wind power" describe the technology by which the wind is used to generate mechanical power or electricity. In simple terms, wind turbines convert the kinetic energy in the wind into mechanical power. This mechanical power can be used for specific tasks (such as grinding grain or pumping water) or an electrical generator can convert this mechanical power into electricity.

Wind turbine generators represent a proven and effective renewable energy technology given proper site conditions and wind resources. Turbines range in size from 2.5 kW to over 3 MW. Small turbines are generally classified up to 10 kW. Small wind turbines are generally mounted atop 20-to 120-foot tall towers using a combination of self-supporting monopole and guyed arrangements. Commercial scale turbines range from 10 kW to 1 MW. Commercial scale turbines are typically used for on-site, behind the meter use. Utility scale turbines are classified as 1.0 MW and larger. The utility scale turbine is typically community or utility-owned and the electricity generated is exported to the grid. Large turbines are commonly mounted on 70, 80 or 100 meter tall towers and can be over 400 feet tall from base to blade tip. The American Wind Energy Association (AWEA) classifies turbines greater than 100 kW as large scale.

A Site Screening for Wind Development in the Town is provided in Section 3.0 of this report. As detailed in Section 3.0 wind energy is not considered practical at any of the sites with the exception of the Mount Desert High School. All other locations lack sufficient land area and are located near or in downtown Bar Harbor.

2.2 Solar Photovoltaic Systems

Solar photovoltaic (PV) systems are used to produce electricity. Solar PV systems require unshaded open areas on the roof or ground with preferably a southern exposure, and some space in the electric rooms.

Solar electricity supplements existing power from the utility company's grid. PV systems consist of two main components: (1) a number of PV panels and (2) an inverter. The panels convert radiation from the sun into direct current (DC) electricity. The inverter then transforms the DC into alternating current (AC) electricity that can be utilized at the site. A typical PV panel, or module, is approximately 3x6 feet in size or 18 square feet and will generate about 180 Watts (10 Watts per square feet) of electricity under full sun, or enough power to light 10 compact fluorescent light bulbs.

3.0 SITE SCREENING FOR WIND AND SOLAR DEVELOPMENT

Weston & Sampson performed a screening of six Town-owned sites to evaluate the feasibility of installing a solar PV system or large scale wind turbine. A number of critical factors were evaluated including site characteristics, development factors, development risks, and preliminary economics.

3.1 Evaluated Sites

The Mount Desert High School Site was the only site out of the six considered viable for wind development because of the large amount of land area available and its distance from the urbanized downtown area. The other five sites were considered viable for solar PV development, but not wind development, because of the limited land area available and their proximity to the downtown area. Due to safety concerns, setback requirements, and constructability issues, turbines are typically not placed in tight, urbanized sites. A USGS site location map of the Town of Bar Harbor is included as Figure 1. An Aerial Site Location Map of the Mount Desert High School is included as Figure 2A an Aerial Site Location Map of the downtown sites is included as Figure 2B.

3.2 Existing Site Description

The Mount Desert High School Site is approximately 110 acres in size. The Site consists of one main building (± 120,000 ft^2), one baseball field, one softball field, a football field surrounded by a track, a practice field, three ponds, and two medium size parking lots. The majority of the main building is two stories, with what appears to be a flat roof and high number of penetrations. The remainder of the site is undeveloped and surrounded by large wooded areas with a potential electrical easement with transmission lines running from the north east to the south of the parcel. It was assumed the any developed areas such as practice fields and parking lots, were not available for wind development.

The Municipal Building Site is approximately 0.8 acres in size. The Site consists of the building (± 10,000 ft^2) and a parking lot. The parcel has buildings located on the east and west side with large trees in the rear of the building. The building is three stories with what appears to be a flat roof with minimal penetrations. A transformer is located in the rear of the building.

The Conner-Emerson School Site is approximately 12 acres in size. The Site consists of three main buildings, the north (± 30,000 ft^2), south (± 27,000 ft^2), and west (± 20,000 ft^2) buildings, multiple parking lots, a playground, and a small field. The remaining area is appears to be wooded areas. The north building appears to have a flat roof with minimal penetrations. It appears the west side of the south building's roof is flat with minimal penetrations. The west building appears to have no flat roof with a minimal amount of south facing available area.

The Police/Fire Site is approximately 0.6 acres in size. The Site consists of one main building (± 6,000 ft^2), the western section is two stories, and eastern, one story. The remainder of the Site is primarily a parking lot. Both sections of the roof are appear to be flat. The western section appears to have minimal amount of roof penetrations, while the eastern has many.

The Waste Water Treatment Facility is approximately 5 acres in size. The Site is split into east and west sections by Great Meadow Drive and consists of aeration chambers, drying beds, a large garage (± 8,500 ft^2), and operations building (± 8,000 ft^2), and parking lots. The remaining area consists of dense, large trees.

The Kids Corner Community Childcare Center is approximately 1 acre in size consisting primarily of the Childcare Center (± 3,500 ft2) and a large parking lot. The remainder of the Site is appears to be a grassed area with two small swimming pools. The Childcare Center appears to have a pitched roof with one south facing side. Penetrations appear to be minimal.

3.3 Wind and Solar Development Factors

In general, the factors that most often influence the technical feasibility of a wind energy project or a solar PV project include the quality of the wind/solar resource, siting constraints, permitting, energy production, and equipment schedule/lead time. The factors which most often influence the size of the project are cost (i.e. how much money is available for the project) and for wind turbines, height restrictions, which can be limited based on proximity to airports and flight paths and opposition to the sound and visual impacts of the turbine(s). The following sections discuss these factors in greater detail and relate them to the six sites evaluated within the Town of Bar Harbor.

3.3.1 Wind and Solar Resources

Based on review of the AWS TrueWind maps, the wind resource at the high school is 6.3 m/s at a height of 70 meters. This wind resource is considered moderate for the development of a large scale wind turbine. Smaller turbines generally have lower performance efficiencies than larger machines, and therefore require more robust wind speeds to perform effectively. In addition, surface effects, such as vegetation, on the wind resource can be significant at lower elevations and, therefore, initial screening results of the wind resource at lower elevations must be very favorable to qualify the resource as good.

Solar resources for Bar Harbor are moderate at 3.5-4.0 kWh per meter square per day annually. Figure 5 depicts the annual solar resources for the United States. The Town's solar resource is typical of solar resources throughout the northeast.

3.3.2 Siting Constraints

In addition to the quality of the wind and solar resource, there are a number of important siting considerations that determine the technical feasibility of a potential wind or solar energy project. These considerations include: site suitability and setback requirements; construction access and laydown area; aesthetic and environmental impacts; electrical interconnection requirements; subsurface conditions (wind); height restrictions and proximity to airports (wind); panel layout & orientation (solar); and structural analysis (solar). Each of these considerations is addressed in this section.

3.3.2.1 Site Suitability and Setback Requirements

The Town of Bar Harbor Wind Turbine bylaw regulates setback requirements for wind projects. The bylaw requires non-residential turbines to be setback from all property lines by the maximum height of the turbine structure. A turbine on property owned, leased, or controlled by the Town however is exempt from this bylaw. Based on an initial look, the Mount Desert High School appears to have sufficient setback area, even though it may not be required.

It was assumed that areas available for PV development would primarily be on the roofs of existing buildings. All six buildings have sufficient roof area for the installation of a solar PV system. Therefore no site clearing or significant site work such as grading would need to be performed. In addition, existing developments such as parking lots and athletic fields were assumed not be available for development. An ideal site will have adequate rooftop area with minimal or no shading. A poor site will have a small rooftop area with many existing roof penetrations and shading issues.

For a solar array to work properly it must be placed roughly three times the penetration's height away from the roof penetration. The panels can either be mounted on an appropriate rack system supported by mountings which penetrate the roof, or by non-penetrating mountings held down by ballasts or aerodynamic design. The same site characteristics apply to non-roof top areas. Structures such as buildings and trees are potential shading issues. Racking systems on the ground can be either ballasted or anchored via driving supports into the ground.

3.3.2.2 Construction Access and Laydown Area

A selected site must also be evaluated from a construction and access standpoint. There must be adequate area on the site for construction activities. It is likely that High School Site would be suitable from a construction standpoint. There is sufficient land area at the High School for equipment storage and construction laydown area. Access to the site from Eagle Lake Road appears to be suitable for equipment delivery. A transportation study for a large wind turbine would be required in order to assess suitability of a site for construction access potential delivery-related issues. A solar PV project requires less access and laydown area when compared with a wind project. It appears as if all six sites have sufficient construction access and laydown area for development of a solar PV project.

3.3.2.3 Aesthetic and Environmental Impacts

The shadow flicker and sound created by a wind turbine are common aesthetic issues, voiced by residential abutters. Shadow flicker is a phenomenon caused by periodic obstruction of light caused by the rotating blades of the turbine. Shadow flicker depends on site geometry, the locations of potential viewers, blade finish, and the relative sunlight and the operational status of the turbine at any given time on a daily basis. Typically, shadow flicker and noise effects at a distance of 1,000 feet or more are less of a concern; however complaints at greater distances are not uncommon. Shadow flicker and noise are not expected to be constraining issues for a wind project at the high school site. Shadow flicker and noise impacts can be easily modeled with commercially available software and is usually performed as part of a comprehensive feasibility study including detailed environmental, avian, and wildlife impact studies.

3.3.2.4 Electrical Interconnection Requirements

For a wind turbine project, the electrical loads and proximity to the electrical distribution system load center must be evaluated for a specific site to determine if any extensive electrical infrastructure improvements would be required. The electrical interconnection components ordinarily required to support a wind turbine include lines, voltage transformers, switchgear, breakers and circuit protection. Generally, the further the wind turbine to the point of interconnection, the more expensive the installed cost will be. An electrical interconnection study would need to be performed as part of a detailed feasibility study for a selected site.

For a solar PV project, the existing electrical room must have adequate space to install the necessary components associated with a PV system. Within the electrical room would be installed the DC disconnect switch, DC TVSS, Inverter, AC TVSS, and an AC Disconnect switch. The entire electrical system shall be designed to meet the National Electric Code and the Maine Electric Code.

3.3.2.5 Subsurface Conditions

A detailed geotechnical study would need to be conducted as part of a more comprehensive feasibility study to further investigate the subsurface conditions. The Geologic Map of the Town is shown in Figure 4. The subsurface soils at the high school are classified as fine grained, glaciomarine deposits.

3.3.2.6 Height Restrictions and Proximity to Airports

The non-residential bylaw dictates a maximum turbine height of 60 feet; however turbines on Town-owned, leased, or otherwise under the control of the Town may be exempt from the bylaw. Form 7640-1 should be filed with the FAA in order to determine if any structure over 200 feet might pose a hazard to air navigation. Wind turbines in the 100 kW to 1,500 kW size range would typically have hub heights which range from 121-328 feet. At these hub heights, overall turbine heights would be 200-400 feet using standard tower and rotor diameters from several commercially-available mid-sized wind turbine manufactures.

Proximity to airports is another important siting factor. The location of the High School Site with respect to nearby airfields was evaluated. The nearest airport is Hancock County Bar Harbor airport at an approximate distance of six miles northwest from the High School Site. No other airports were located within a 10 mile radius of the Site. The Site's location with respect to this airfield could potentially be a limiting factor to turbine height. Permitting with FAA would be required for any structure over 200 feet tall.

3.3.2.7 Panel Layout & Orientation

For a solar PV project, the panel layout is determined during the design phase. It is beneficial to tilt the PV panels, as opposed to laying them horizontally, in order to achieve better annual output. Tilting the panels also helps to shed snow and dust. Typically it is recommended to tilt the panels at the same angle as the latitude of the site. If it is possible to change the tilt of the panels seasonally, then additional output can be achieved. Depending on the suitability of the site, changing the orientation or panel tilt angle may benefit the system.

3.3.2.8 Structural Analysis

The typical PV system design load is on the order of 5 to 10 psf. In order to install a PV system on a roof, the existing roof would need to have adequate structural support to handle this load or modifications may be necessary. A structural engineer would need to be consulted prior to installation of the system(s).

3.3.3 Permitting Requirements

A review of permitting requirements for Local, State and Federal jurisdictions was conducted as part of the site screening for wind development. A summary table of regulatory stakeholders, applicability to the scope of a proposed project, and possible administrative review requirements is attached in Appendix A. As shown in the summary table, potential regulatory permitting for a potential turbine can be extensive. Typical regulatory permitting on the local level can include: planning board approval; design review approval; variances; and building & electrical permit approvals. Typical regulatory permitting on the state level can include: Maine's Department of Environmental Protection approvals; Natural Resource Protection Act approvals; Bureau of Land & Water Quality approvals; State Historic Preservation Commission approvals; interconnection permitting; and Transportation Department approvals. Typical regulatory permitting on the federal level can include: approvals from the US EPA, Federal Energy Regulatory Commission, Fish and Wildlife Service, and FAA.

As part of the Site Plan Review approval it could be expected that aesthetic and environmental concerns may be raised by any residential abutters. This risk should be anticipated in a wind project that is close to residential properties. The degree of siting opposition would presumably be linked to the proposed turbine size, with opposition rising as the turbine size increases.

For a solar PV project, a building and electrical permit would be required to install solar PV arrays. The Town does have bylaws regarding height requirements for the selected sites. The maximum height limits are dependent on how each individual site is zoned. Since all the Conceptual PV system Layouts are roof mounted systems, it is anticipated the system will not exceed the Town's height limit. A variance may be required if the maximum building height is exceeded. There are no bylaws specifically regarding installation of a solar PV system. A Design Review and/ Site Plan Review may be required by the Town.

3.3.4 Estimated Energy Production

3.3.4.1 Wind Turbine Energy Production

Three wind turbines were evaluated as part of this screening study. The wind speed values from the AWS True Wind maps were input in WindPRO® computer software. The modeling software uses the input wind speeds and the power curve for the selected wind turbine to calculate an annual energy output for the various wind turbines at a specified hub height. The results of the modeling indicate the annual energy output for the three wind turbines ranged from 89 MWh for a 100 kW turbine to 2,347 MWh for a 1,500 kW turbine. The results are summarized in the table below:

Turbine Size, kW	100	600	1,500
Manufacturer	Northern Power	Elecon	General Electric
Hub Height, meters	37	50	80
Rotor Diameter, meters	21	48	83
Overall Height, meters	48	74	121
Overall Height, feet	156	243	398
Capacity Factor, %	13.6%	12.5%	27.1%
Energy Production, MWh	89	207	2,347

The capacity factors, based on the predicted wind speeds, are considered average and technically feasible for on-site energy production. A 100 kW and a 600 kW wind turbine would be eligible for net metering. However a 1,500 kW turbine is not eligible for net metering and the remainder of the energy produced from a turbine at this size would be sold to the grid. The annual energy demand at the selected sites is approximately 233 MWh.

3.3.4.2 Solar PV Energy Production

The total conceptual system size for all six sites is approximately 510 kW (DC), which is expected to produce approximately 562,000 kWh annually. Using electricity bills provided by the Town, the selected sites consume approximately 233 MWh annually. Site locations, conceptual system sizes, and corresponding approximate annual energy production can be seen in the table below.

Site Location	System Size (kW)	Approximate Annual Energy Production (kWh)	Annual Facility Energy Use kWh/Year
Municipal Building	40	44,000	129,684
Mount Desert Island High School	290	320,000	537,600
Conner-Emerson School	100	110,000	203,760
Fire/Police Station	10	11,000	66,612
WWTF	60	66,000	699,840
Kids Corner Community Childcare	10	11,000	20,532

Solar PV systems in the northeast United States typically have a capacity factor (efficiency rating) of 10-14%. This capacity factor accounts for seasonal daylight changes, technological constraints and environmental degradation (snow, dirt and dust coverage, etc). With a solar resource of 3.5 kWh/m2/day and an overall system availability of 90% (to account for system maintenance and repairs, grid availability, etc) a capacity factor of 14% was used in this analysis. A panel tilt angle of 20° was assumed for this screening study and a performance degradation rate of 0.5% per year is used in the energy production estimates in this report. The estimated energy production is included in Appendix B.

The conceptual system layouts were designed to optimize the areas available for the development of PV systems. The distance between each of the panel rows, for all the conceptual layouts, are approximately 8 feet, which allows no shading to occur between the rows on the shortest day of the year between the hours of 9 AM and 3 PM. This day is chosen as the worst case scenario because the solar azimuth (the angle of the sun to the horizon) is the lowest of this date (approximately 11 at 9 AM and 3 PM). Figures 8-12 show conceptual solar PV project layouts at the selected Sites. The conceptual layouts and capacities are based on Yingli Solar Panels, model YL 255 P-32b. Each site layout takes into account the area on the roofs which contain vents, air conditioning units, and other roof penetration which could not be used for solar panel installation. The available roof areas are assumed to be flat membrane roofs, otherwise are slightly sloped corrugated metal or shingled roofs.

3.3.5 Schedule/Lead Time

The commercial availability of a wind turbine generator is a major factor in the timely installation of a one or two wind turbine project. Typical lead times can be 3-6 months for a 50-100 kW turbine; 6-12 months for 200-600 kW turbines; and 12-24 months for larger turbines. Please refer to the Action Plan provided in Section 5 for an estimated project schedule.

The commercial availability of the solar panels is the main factor driving the timely installation of PV systems. Our experience has shown that in the spring product demand peaks resulting in longer lead times (2-6 months) for delivery of solar panels. Other times of the year, the lead-time for delivery can be as little as one month. Consideration should be given for placing panel orders during off-peak seasons and storing them until construction is underway. Additionally, components such as the inverter or mounting system may be designed and built specifically for the project. A period of 1-3 months should be allowed for this work. Please refer to the Action Plan provided in Section 5 for an estimated project schedule.

3.4 Project Development Risks

In addition to the site specific technical challenges mentioned above, there are a number of technical risk factors inherent in wind project development, including wind resource uncertainty, unknown site conditions, permitting uncertainty, etc. There may also be a lack of community support. Historically, many abutters support wind energy projects, however some may have a "not in my backyard" mentality.

One development risk for a solar PV system is the unknown future cost of electricity. If rates fall, then a solar PV system will be less economically beneficial than if electricity rates rise. A solar resource evaluation should be conducted prior to pursuing a PV system. This will include an evaluation of nearby structures, roof penetrations, and various roof heights at a facility that may cause shading.

4.0 PRELIMINARY PROJECT ECONOMICS

The preliminary economics will provide insight on the estimated cost of wind and solar projects, and the estimated value of the production, credits and potential incentives.

4.1 Wind Turbine Preliminary Project Economics

For a proposed wind turbine project, the project costs include the following items:

- Engineering studies, design and permitting
- Capital equipment and construction costs
- Interconnection costs
- Financing costs

There are also recurring annual costs associated with a wind turbine project. These annual recurring costs include operation and maintenance, insurance, planned and unplanned service, replacement parts, monitoring, reporting, and project administration.

Like many renewable energy projects, the installed cost per kW for a wind project tends to decrease as the size of the project increases.

Wind Turbine Size	Total Estimated Project Cost	Cost per kW
100 kW	$765,000	$7,650
600 kW	$1,900,000	$3,167
1,500 kW	$4,050,000	$2,700

Cost estimates for wind turbines in the 100 kW through 1,500 kW sizes are listed above. Total project costs for a wind turbine project can range from approximately $760,000 for a 100 kW project to over $4,000,000 for a 1,500 kW project.

Evaluation of the economic scenarios for the three wind turbines selected shows that the project economics improve with the Community Based Renewable Energy Production Incentive program established by the Maine Public Utilities Commission (PUC). This incentive is discussed further in Appendix C. Most scenarios result in a negative internal rate of return, with the exception of the 1,500 kW turbine under a scenario with the incentive applied. This suggests that a smaller wind turbine project is not economically attractive when compared to a larger project. Please refer to Appendix B for detailed project economic calculations.

4.2 Solar PV Preliminary Project Economics

PV systems costs will vary based on the overall size and layout of the system. Standard industry rates range from $5 to $8 per Watt installed. The estimated project costs for the six sites evaluated are provided below.

Site Location	System Size (kW)	Total Estimated Project Cost (without grant funding)	Cost per kW
Municipal Building	40	$320,000	$8,000
Mount Desert Island High School	290	$2,030,000	$7,000
Conner-Emerson School	100	$750,000	$7,500
Fire/Police Station	10	$80,000	$8,000
WWTF	60	$480,000	$8,000
Kids Corner Community Childcare	10	$80,000	$8,000

As the case with wind projects, the installed cost per kW for a solar PV project tends to decrease as the size of the project increases.

All systems under 100 kW would qualify for a $50,000 Voluntary Renewable Resource (VRR) Grant under the Maine Public Utilities Commission (PUC). Using the electricity bills provided by the Town, the project economics were calculated. The table below contains each Site's simple pay back, benefit cost ratio, and internal rate of return (IRR).

	No Grant		
Array Location	**Simple Payback (years)**	**Benefit Cost Ratio**	**Internal Rate of Return**
Municipal Building	25.70	0.41	N/A
Mount Desert Island High School	16.99	0.64	N/A
Conner-Emerson School	23.98	0.43	N/A
Fire/Police Station	16.84	0.69	0.21%
WWTF	25.70	0.41	N/A
Kids Corner Com. Childcare	16.84	0.69	0.21%

	Grant		
Array Location	**Simple Payback (years)**	**Benefit Cost Ratio**	**Internal Rate of Return**
Municipal Building	21.43	0.46	N/A
Mount Desert Island High School	N/A	N/A	N/A
Conner-Emerson School	22.27	0.45	N/A
Fire/Police Station	6.12	1.61	11.01%
WWTF	22.84	0.44	N/A
Kids Corner Com. Childcare	6.12	1.61	11.01%

Not including the VRR grant, simple payback ranges from approximately 16 to 26 years with a benefit cost ratio of 0.41 to 0.69. Including the VRR grant, the simple payback ranges from approximately 6 to 23 years with a benefit cost ratio of 0.44 to 1.61. Please refer to Appendix B for detailed project economic calculations.

4.3 Value of Energy Produced

The primary direct economic benefit of a renewable energy project is the value of displaced retail energy purchased from the grid. The amount of retail energy displaced is a function of the energy produced by the system and the profile of this production as compared to the site's energy demand and the demand profile. This will vary based on the system installed.

A secondary direct economic benefit of a proposed renewable project is the value of excess energy produced by the system. This energy is defined as energy produced by the system but not used by the site and therefore transmitted to the grid. In Maine, certain renewable energy facilities are entitled to benefit from a practice known as "net metering" in which excess energy sent to the grid is metered and can be used to offset future retail demand. The current legislation dictates the maximum qualifying project size up to 660 kW. The excess energy (kWh) will be credited for up to a 12 month period and can used at other Town owned facilities (excluding lighting accounts). An alternative to this is to sell the excess energy at a real time rate set by ISO-New England (ISO-NE), typically at a whole-sale rate. ISO-NE is an independent systems operator of the New England bulk power systems.

In addition to the benefits of displaced retail energy purchases and revenues from the sale of excess power, a third revenue stream related to energy production is from the sale of Renewable Energy Certificates (RECs). RECs were created by the Renewable Portfolio Standards (RPS) legislation enacted over the past several years by several New England states, including Massachusetts. RECs are a tool created to manage and certify compliance with the legislative requirements for power generators to produce a certain amount of their energy from renewable resources. The percentage required is initially very modest, and escalates significantly over the next 5-10 years. Generators that fail to reach the quotas are subject to an alternative compliance payment (ACP) equal to approximately $57/MWh in 2007. RECs are allotted to renewable energy generators at the rate of 1 REC per 1 MWh of production, and these RECs can then be traded on the energy market under the same concept as pollution credits.

Third party ownership is also an option for the Town of Bar Harbor. Many renewable energy installers, especially in the PV industry, take part in third party ownership. In a third party ownership agreement the Town would enter into a long-term power purchase agreement with the third party. The third party would own and operate the renewable energy system, allowing the third party to take advantage of the tax incentives for which the Town would not be eligible as a non-taxable entity. The Town would benefit by purchasing energy at a reduced or fixed cost, lease income, and potentially property tax income on solar equipment. It is typical for the third party developer to have 100 kW as a minimum system requirement. This requirement can be distributed over multiple sites.

Most renewable energy systems qualify for the Community Based Renewable Energy Production Incentive program established by the Maine Public Utilities Commission (PUC). The incentive program provides community-owned renewable energy facilities, including wind and solar, with the opportunity to enter into a long term power purchase agreement (PPA). Excess energy may be able to be purchased at $0.10/kWh. It is assumed that if the Town pursued a smaller sized turbine, such as a 100 kW, any excess energy produced at that facility would be credited to other Town accounts. In Maine, excess energy is sold back to the grid at ISO-NE real time, nodal, rates. It is assumed that rate is approximately $0.045/kWh. It is assumed that excess power produced, not used by Town owned sites would be sold back to the grid at this rate.

5.0 ACTION PLAN

The purpose of an action plan is to detail the tasks and time frames in order to develop and implement a wind or solar project. Development and implementation of municipally owned renewable energy systems can be either standard design-bid-build construction or design/build. This procurement implies that the project will be bought and paid for by the Town as a typical capital project.

Third party ownership is another procurement strategy where the cost of the project is borne by the developer where the Town agrees to enter into a long-term power purchase agreement for the energy that is produced from the system.

These methods for both wind and solar can be seen in the tables below.

Action Plan - Municipal Owned Standard Design-Bid-Build Wind Turbine Project

Task	*Time Frame*	*Comments*
Feasibility Study	3-6 months	In depth study of potential location of proposed turbine.
Wind Study	12-18 months	MET Tower installation and wind speed monitoring.
Public Outreach and Communication	2-4 months	Hold public meetings/forums for project discussion
Design	4-6 months	Design the site, foundation, electrical improvements, etc.
Permitting	6-12 months	Identify and secure the necessary permits
Procurement	2-4 months	Letters of Intent, Request for Qualifications, Request for Proposals
Bid Evaluation & Selection	2-4 months	Award the bid to the contractor with the best bid package.
Equipment Procurement	12-16 months	Order the equipment and schedule a delivery date.
Construction	6-12 months	May includes site preparation, foundation, turbine erection, electrical improvements, etc.
Interconnection & Commissioning	2-4 months	Test the turbine to ensure it is working properly and connect to the grid.

Action Plan – Third Party Owned Wind Turbine Project		
Task	*Time Frame*	*Comments*
Feasibility Study	3-6 months	In depth study of potential location of proposed turbine.
Wind Study	12-18 months	MET Tower installation and wind speed monitoring.
Engineer Procurement	1-2 months	Hire a consultant for third party engineering oversight.
Procurement	2-4 months	Third Party Owners submit Letters of Intent, Request for Qualifications, Request for Proposals, preliminary design/permitting plan, and draft land lease, and draft power purchase agreement.
Bid Evaluation & Selection	2-4 months	Award the bid to the contractor with the best bid package.
Agreement Confirmation	1-2 months	Sign land lease, power purchase agreement and other legal documents.

Action Plan - Municipal Owned Standard Design-Bid-Build Solar PV Project		
Task	*Time Frame*	*Comments*
Design & Permitting	2-6 months	Design the site layout, system size, electrical improvements, structural checks, etc. and secure necessary permits.
Procurement	2-4 months	Letters of Intent, Request for Qualifications, Request for Proposals
Bid Evaluation & Selection	2-4 months	Award the bid to the contractor with the best bid package.
Equipment Procurement	2-6 months	Order the equipment and schedule a delivery date.
Construction	1-6 months	May includes site preparation, electrical improvements, etc.
Interconnection & Commissioning	1-2 months	Test the system to ensure it is working properly and connect to the grid.

Action Plan – Third Party Owned Solar PV Project		
Task	*Time Frame*	*Comments*
Engineer Procurement	1-2 months	Hire a consultant for third party engineering oversight.
Procurement	2-4 months	Third Party Owners submit Letters of Intent, Request for Qualifications, Request for Proposals, preliminary design/permitting plan, and draft land lease, and draft power purchase agreement.
Bid Evaluation & Selection	2-4 month	Award the bid to the contractor with the best bid package.
Agreement Confirmation	1-2 months	Sign land lease, power purchase agreement and other legal documents.

6.0 CONCLUSION

Weston & Sampson has conducted a Renewable Energy Alternatives Screening on behalf of the Town of Bar Harbor. The site screening for wind development concludes that a wind turbine project at the Mount Desert High School is technically feasible due to the estimated wind resource of 6.3 m/s at a height of 70 m and the favorable siting conditions. However, a wind project is only economically feasible when evaluating a large-scale turbine and incentives are applied from the Community Based Renewable Energy Production Incentive program established by the Maine Public Utilities Commission (PUC). Due to standards, any system above 660 kW will not be eligible for net metering. This limits larger turbine production to be solely consumed by a single Site and excess energy must be sold back to the grid at the ISO-NE rate. If the Town were to consider third party ownership, the project may become more economically viable. A third party developer may qualify for tax incentives, and may be able to offer the Town an attractive power purchasing agreement, lease income, and potential property tax income on wind turbine equipment.

Development of a solar PV project appears to be both technically and economically feasible for all six Sites including the Municipal Building, Mount Desert High School, Police/Fire Station, Conner-Emerson School, Waste Water Treatment Facility, and the Kids Corner Community Childcare Center. A preliminary economic analysis of the six conceptual solar PV systems suggests that depending on the size of systems that are built, the Town will be able to offset a percentage and potentially all of the Site's electricity consumption, in an economically attractive manner. This is due primarily to the current average energy rates paid by the Town and the current availability of grant funding from the Maine Public Utilities Commission. The Town may also consider third party ownership for development of the solar PV projects. A third party developer may qualify for tax incentives, and may be able to offer the Town an attractive power purchasing agreement, lease income, and potential property tax income on solar equipment.

Weston & Sampson recommends that the Town consider development of Solar PV at some or all of the selected sites. In addition, Weston & Sampson recommends continuing to monitor project financing and incentive opportunities at a local, state, and federal level to aid in the development of an economically feasible Wind Energy Generating and/or solar PV systems, and to solicit interest and proposals from viable third-party renewable energy system developers.

7.0 REFERENCES

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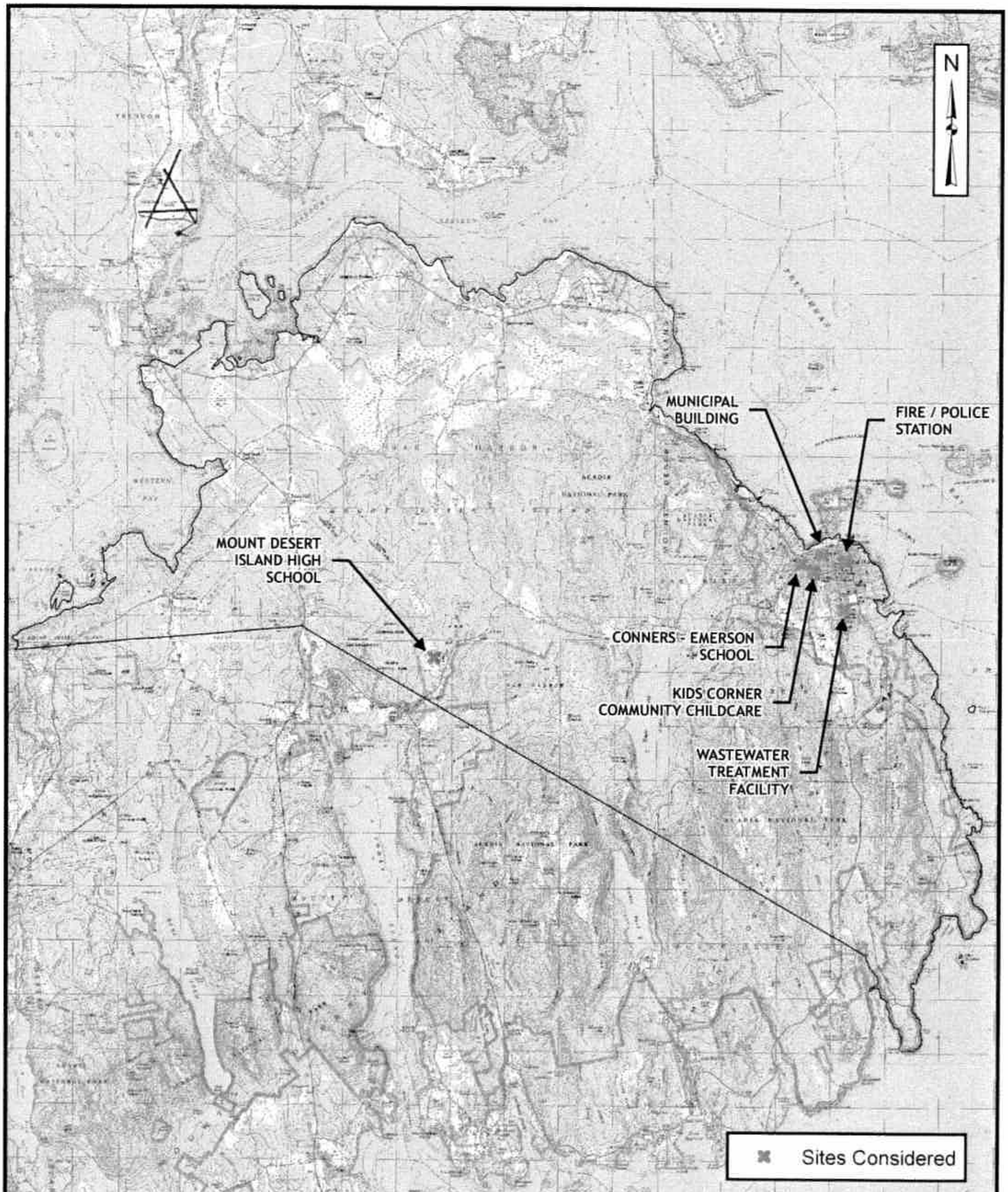
Zen, E-an, Goldsmith, Richard, Ratcliffe, N.M., Robinson, Peter, Stanley, R.S., Hatch, N.L., Shride, A.F., Weed, E.G.A. and Wones, D.R., 1983, Bedrock geologic map of Massachusetts: U.S. Geological Survey, scale 1:250000.

Maine. Public Utilities Commission. Electricity Rules; Chapter 65: Independent Agencies – Regulatory; Section 407 Public Utilities Commission; Subsection 313-Customer Net Energy Billing. Approved by the Attorney General, June 10, 2009.

Maine. Public Utilities Commission. Electricity Rules; Chapter 65: Independent Agencies – Regulatory; Section 407 Public Utilities Commission; Subsection 315-Small Generation Aggregation. Approved by the Attorney General, September 10, 2004.

Figures



Data Source:

USGS, Topographic Quadrangles Bar Harbor, Salsbury Cove, Seal Harbor, Southwest Harbor 1982, 1981, 1983

Horizontal Datum: NAD1927
Vertical Datum: NGVD1929
Contour Interval: 20 feet, 6 meters

FIGURE 1

BAR HARBOR, ME
SOLAR AND WIND FEASIBILITY STUDY

USGS Site Location Map

0 4,000 8,000 12,000 16,000

Scale in Feet

OVERVIEW MAP

Weston&Sampson

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Sites Considered

FIGURE 2A
BAR HARBOR, ME
SOLAR AND WIND FEASIBILITY STUDY

Aerial Site Location Map (Mount Desert High School)

0 300 600 900 1,200
Scale in Feet

Data Source:
Town of Bar Harbor

Weston&Sampson

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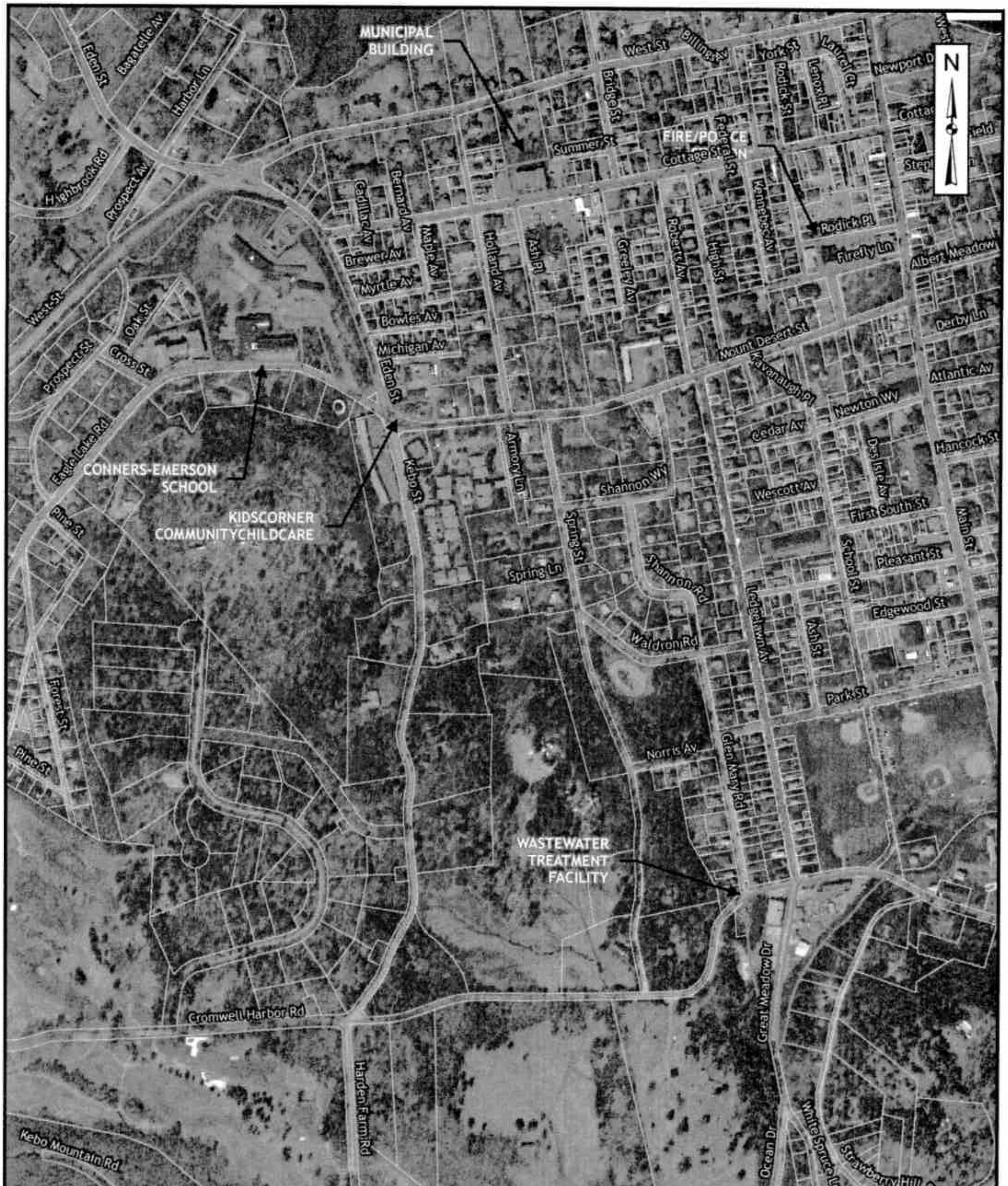

Sites Considered

FIGURE 2B
BAR HARBOR, ME
SOLAR AND WIND FEASIBILITY STUDY

Aerial Site Location Map (Downtown Sites)

0 300 600 900 1,200
Scale in Feet

Data Source:
Town of Bar Harbor

Weston&Sampson

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FIGURE 3A
BAR HARBOR, ME
SOLAR AND WIND FEASIBILITY STUDY

AWS Truewind Wind Speeds (Mount Desert High School)

Data Sources:
Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs.

0 600 1,200
Scale in Feet

Overview Map

Weston&Sampson

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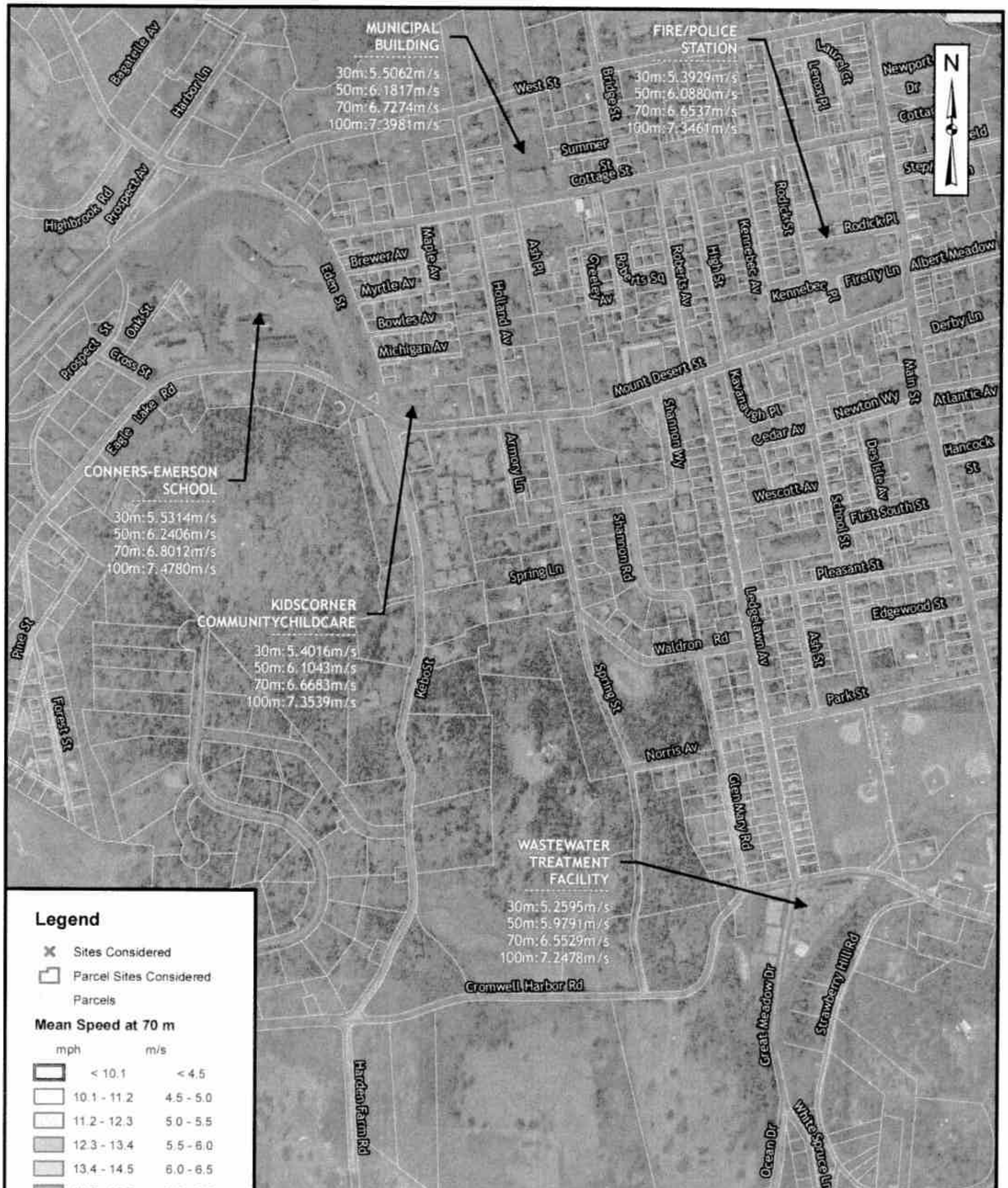

FIGURE 3B
BAR HARBOR, ME
SOLAR AND WIND FEASIBILITY STUDY

AWS Truewind Wind Speeds (Downtown Sites)

0 600 1,200
Scale in Feet

Data Sources:
Office of Geographic and Environmental Information (MassGIS), Commonwealth of Massachusetts Executive Office of Environmental Affairs

Weston&Sampson

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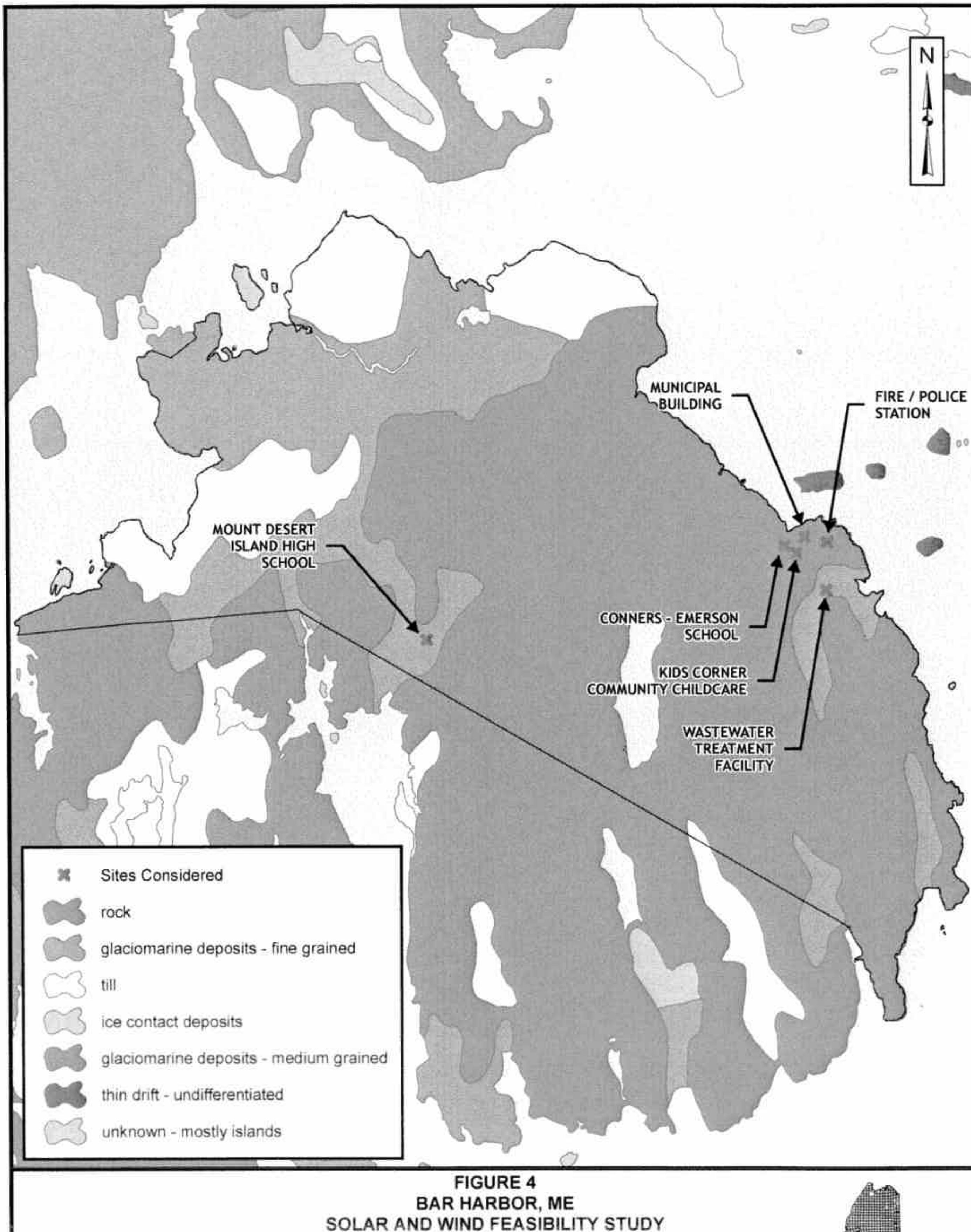


FIGURE 4
BAR HARBOR, ME
SOLAR AND WIND FEASIBILITY STUDY

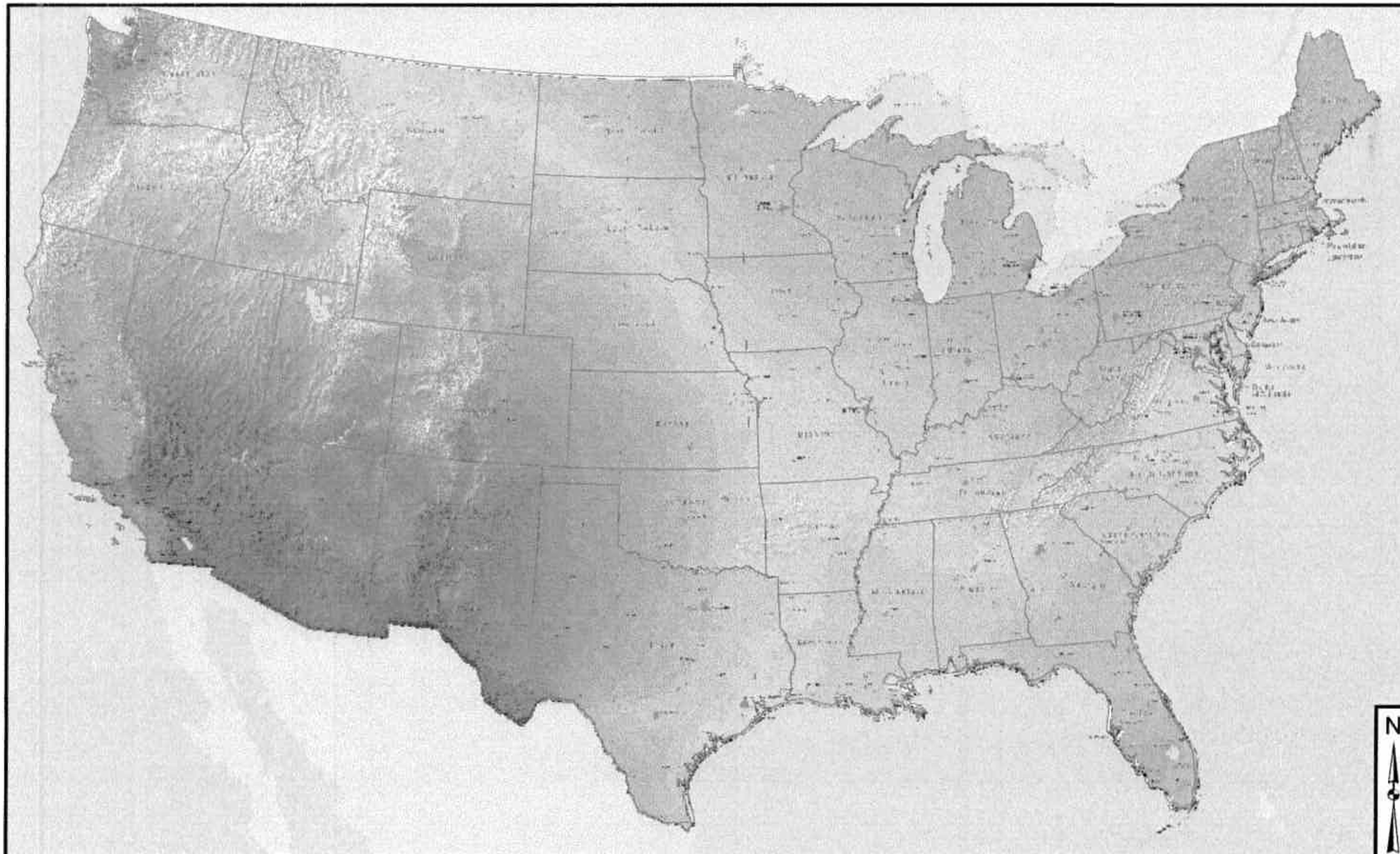
Geologic Map

Data Source:
Maine Office of GIS (MEGIS)

Horizontal Datum:
UTM Zone 19, Meters, NAD 83

0 4,000 8,000 12,000 16,000
Scale in Feet

Weston&Sampson



Disclaimer:

Map not prepared by W&S, Inc.
W&S, Inc. does not assume responsibility for any possible misrepresentations or incorrect data.

Data acquired from:
National Renewable Energy Laboratory
http://www.nrel.gov/gis/solar.html

FIGURE 5
BAR HARBOR, ME
SOLAR AND WIND FEASIBILITY STUDY

Solar Resource Map

Annual average solar resource data is shown for a tilt = latitude collector. The data for the 48 contiguous states is a 10km, satellite modeled dataset (SUNY/NREL, 2007) representing data from 1998-2005.

kWh/m²/Day

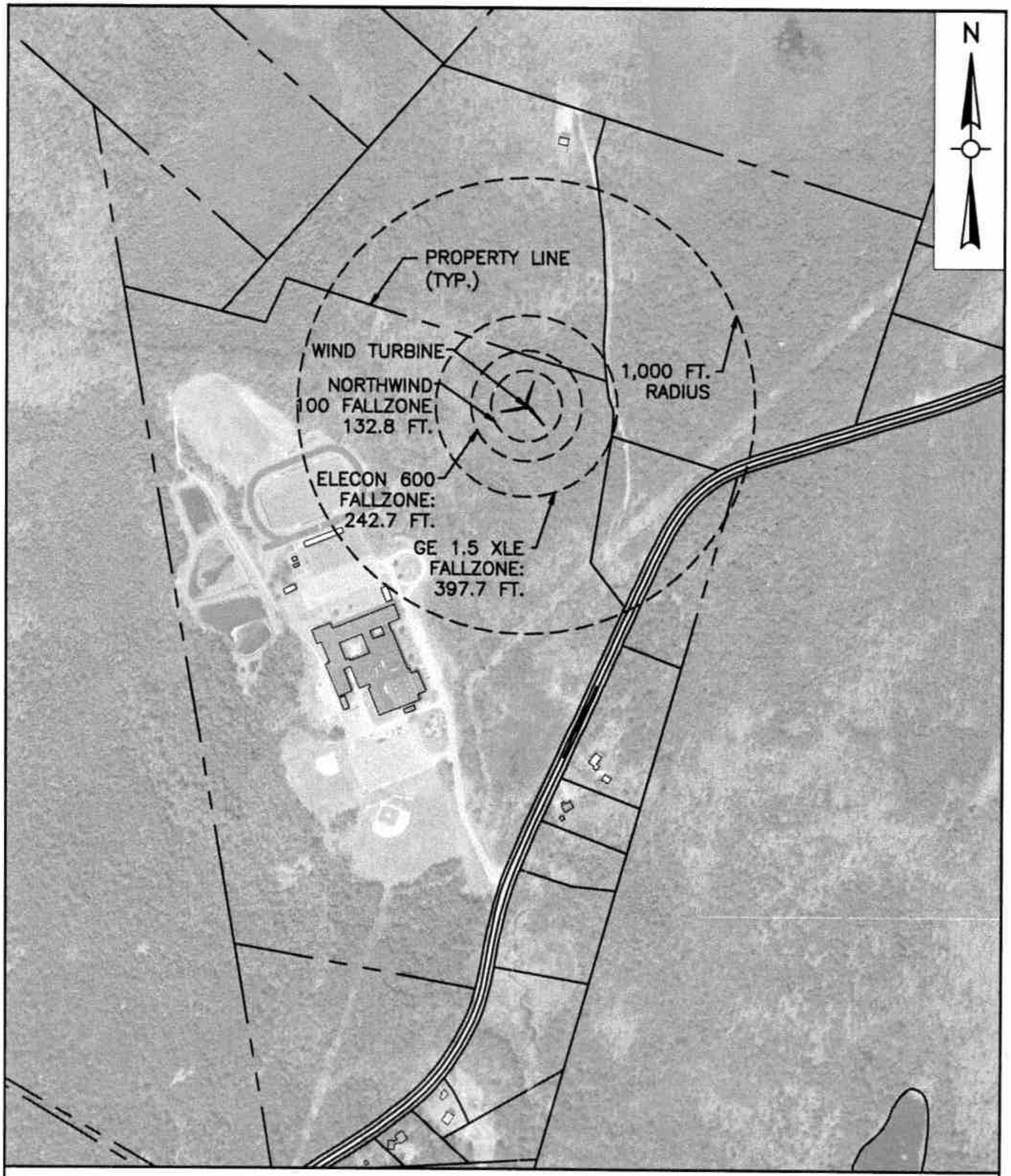


FIGURE 6
TOWN OF BAR HARBOR, ME.
RENEWABLE ENERGY ALTERNATIVES SCREENING REPORT

MOUNT DESERT HIGH SCHOOL CONCEPTUAL TURBINE LAYOUT

SCALE: 1"=600'

0 600 1,200

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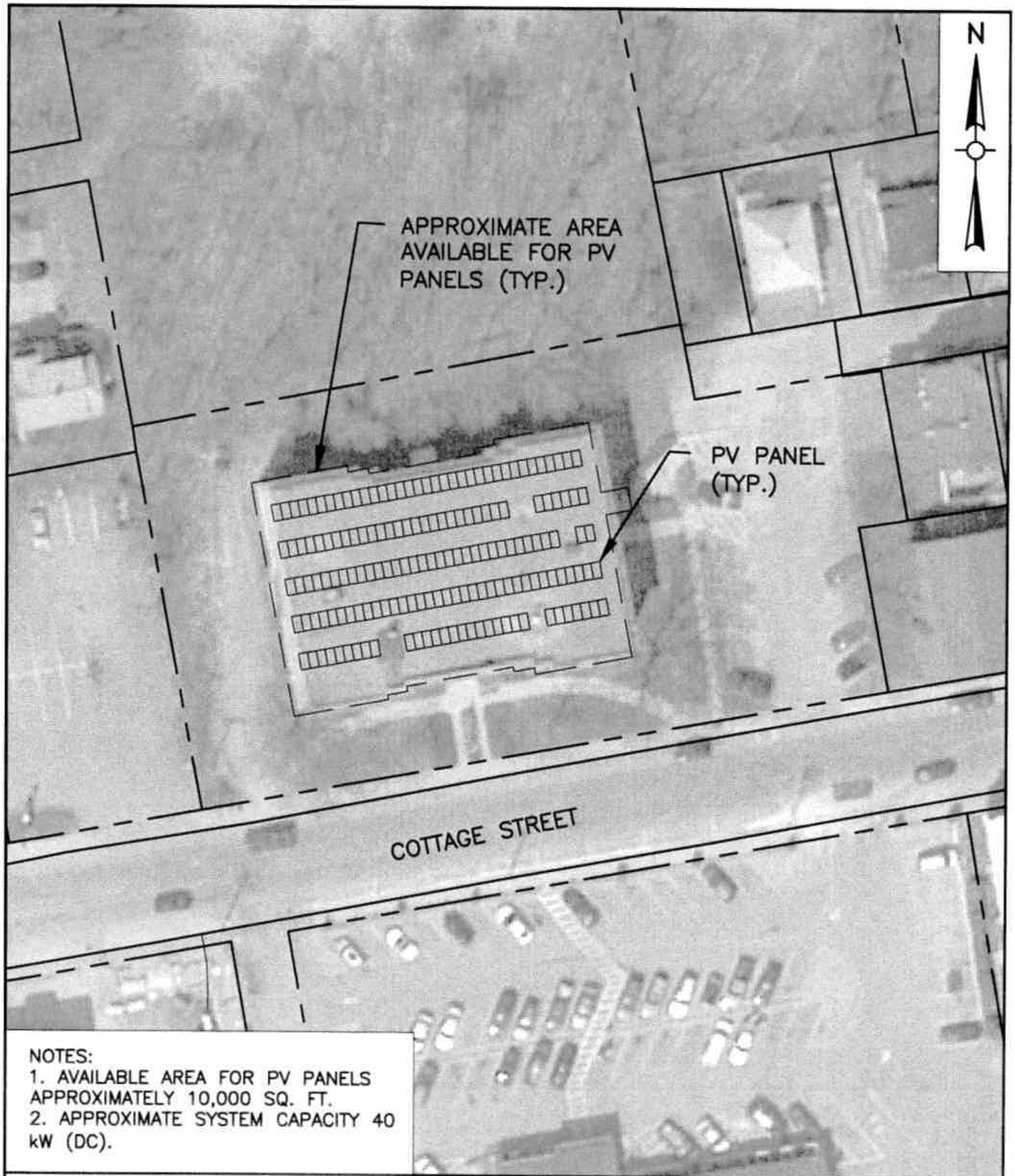

NOTES:
1. AVAILABLE AREA FOR PV PANELS APPROXIMATELY 10,000 SQ. FT.
2. APPROXIMATE SYSTEM CAPACITY 40 kW (DC).

FIGURE 7
TOWN OF BAR HARBOR, ME.
RENEWABLE ENERGY ALTERNATIVES SCREENING REPORT

MUNICIPAL BUILDING CONCEPTUAL SOLAR LAYOUT

SCALE: 1"=50'

0 50 100

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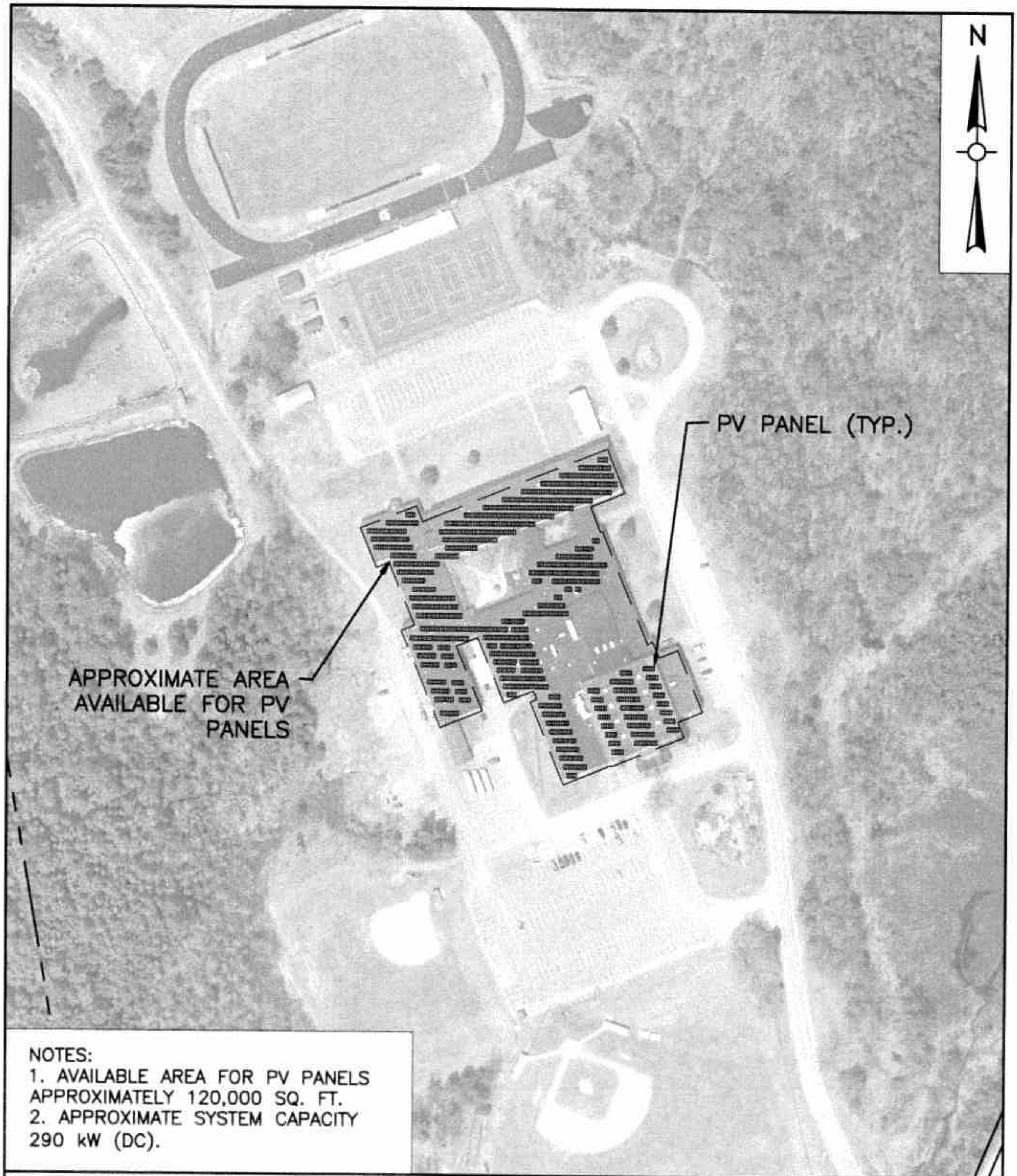

FIGURE 8
TOWN OF BAR HARBOR, ME.
RENEWABLE ENERGY ALTERNATIVES SCREENING REPORT

MOUNT DESERT HIGH SCHOOL CONCEPTUAL SOLAR LAYOUT

SCALE: 1"=200'

0 200 400

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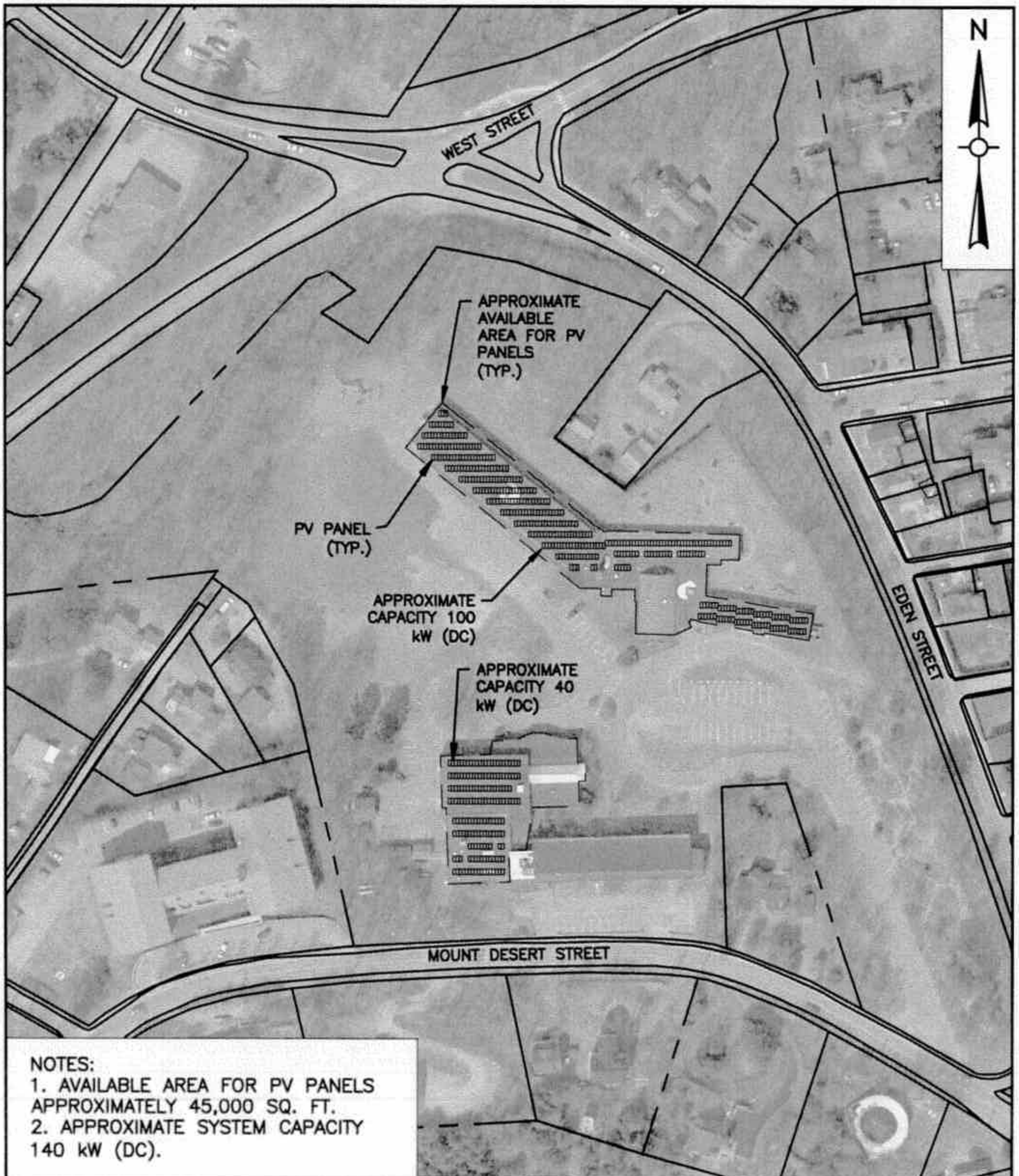

NOTES:
1. AVAILABLE AREA FOR PV PANELS APPROXIMATELY 45,000 SQ. FT.
2. APPROXIMATE SYSTEM CAPACITY 140 kW (DC).

FIGURE 9
TOWN OF BAR HARBOR, ME.
RENEWABLE ENERGY ALTERNATIVES SCREENING REPORT
CONNER-EMERSON SCHOOL CONCEPTUAL SOLAR LAYOUT
SCALE: 1"=150'
0 150 300

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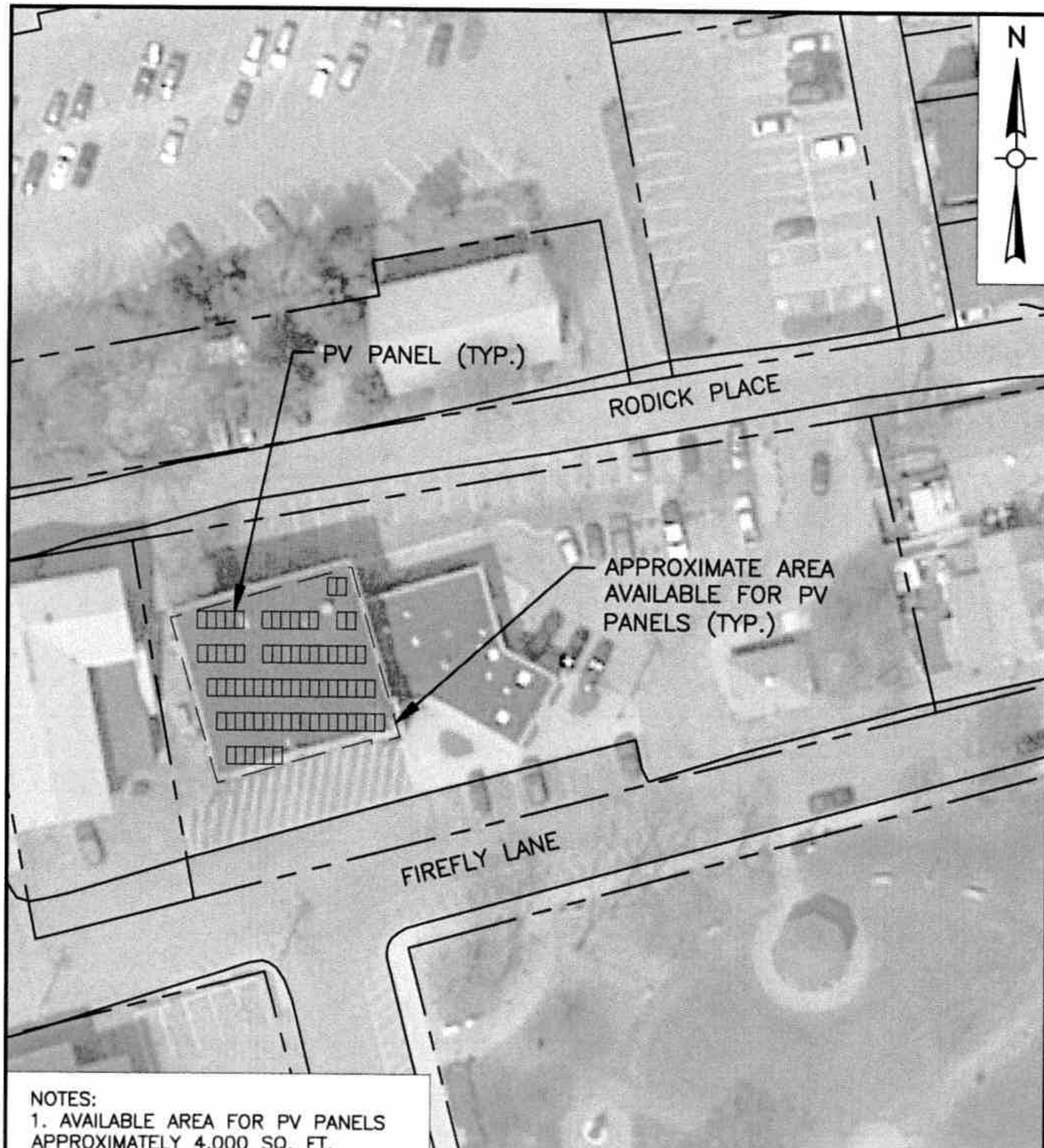

NOTES:
1. AVAILABLE AREA FOR PV PANELS APPROXIMATELY 4,000 SQ. FT.
2. APPROXIMATE SYSTEM CAPACITY 10 kW (DC).

FIGURE 10
TOWN OF BAR HARBOR, ME.
RENEWABLE ENERGY ALTERNATIVES SCREENING REPORT

POLICE/FIRE STATION CONCEPTUAL SOLAR LAYOUT

SCALE: 1"=50'

0 50 100

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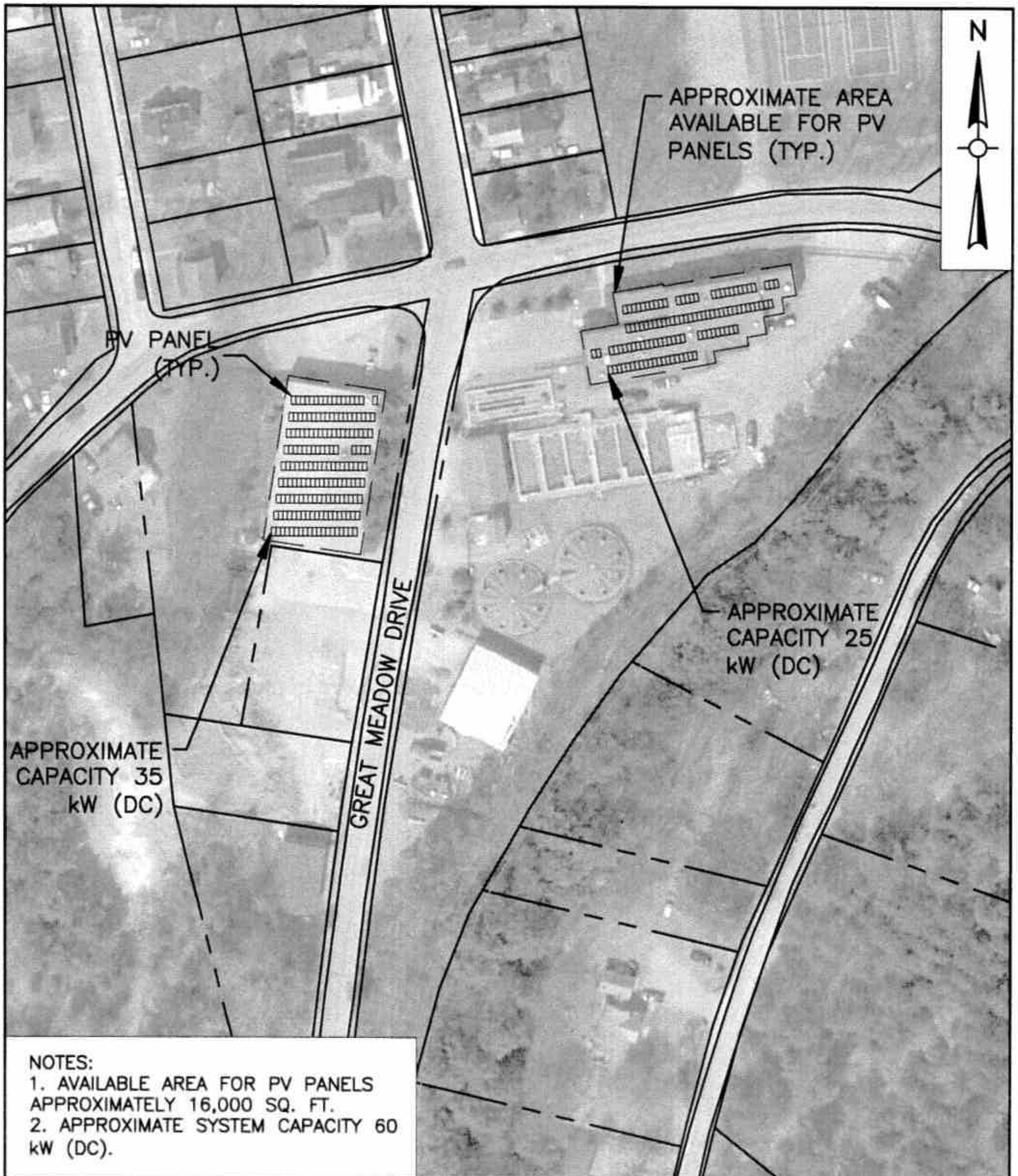

FIGURE 11
TOWN OF BAR HARBOR, ME.
RENEWABLE ENERGY ALTERNATIVES SCREENING REPORT

WASTEWATER TREATMENT FACILITY CONCEPTUAL SOLAR LAYOUT

SCALE: 1"=100'

0 100 200

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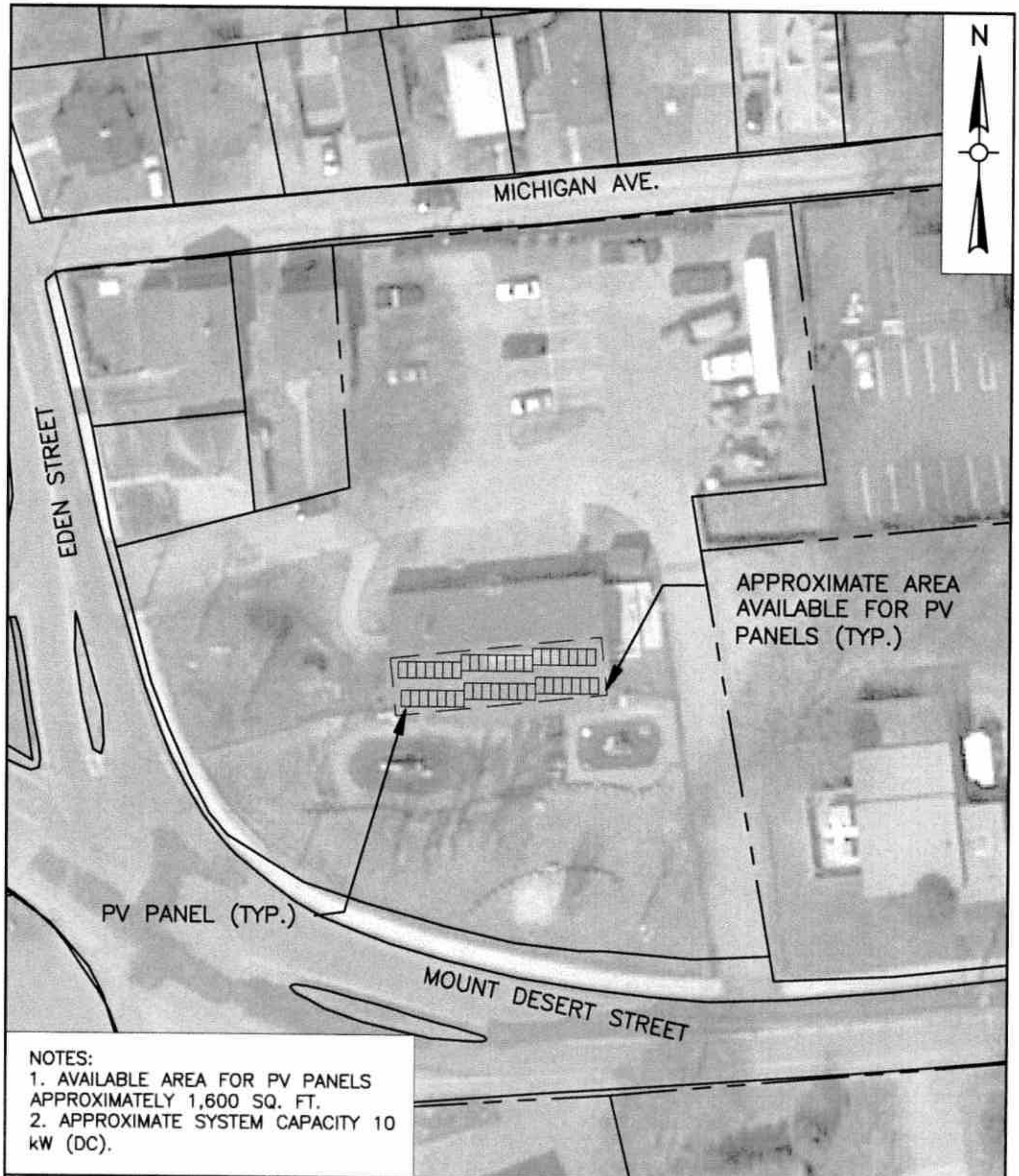

FIGURE 12
TOWN OF BAR HARBOR, ME.
RENEWABLE ENERGY ALTERNATIVES SCREENING REPORT

KIDS CORNER COMMUNITY CHILDCARE CENTER

SCALE: 1"=50'

0 50 100