# Amec Foster Wheeler Qualifications and Experience

Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler) is pleased to provide this qualifications summary of environmental permitting and engineering for solar PV projects.

Amec Foster Wheeler businesses employ 35,000 people in over 55 countries and manage projects worldwide across the public and private sectors. Amec Foster Wheeler Environment & Infrastructure, Inc., headquartered in Atlanta, GA, is a leading environment and infrastructure consulting business, providing multi-disciplined solutions covering all aspects of environmental and energy services, infrastructure, materials testing and engineering, geotechnical engineering, and water resource services.

## Why Amec Foster Wheeler?

### Hands-On Solar Experience

Since entering the solar market, Amec Foster Wheeler has been involved in the design, permitting, and/or installation of more than 100 MW of solar photovoltaic power. Amec Foster Wheeler is a life-of-asset, single-source service provider for distributed and utility scale photovoltaic projects, from site assessment through operations and maintenance. Amec Foster Wheeler's New England team of experts has provided engineering and consulting services to renewable energy developers for development of solar PV systems on numerous closed municipal landfills, ground-mounted sites, and carport systems. Amec Foster Wheeler's involvement begins with site identification and assessment and proceeds through environmental planning and permitting, site layout and design, construction, and long-term asset support.

### Landfill PV Solar System Planning and Design Support

Amec Foster Wheeler capitalizes on experience with landfill design and closure, geotechnical evaluation, environmental assessment, and site remediation to address the unique engineering requirements for installation of solar projects on closed landfills. Recent local experience includes over two dozen solar PV systems in Massachusetts (Acton Landfill, Westford Street Landfill in Lowell, Scituate Landfill, Braintree Landfill, Ashland Landfill, Saugus Landfill, Weston Landfill, Pittsfield Landfill, Groton Landfill, Northampton Landfill, Newton, Lenox Landfill, Stockbridge Landfill, Sudbury Sand Hill Landfill, along with over 10 ground-mount solar PV sites), as well as one in New Jersey (Bernards Township).

Amec Foster Wheeler understands the technical challenges and solutions for successfully developing PV Solar Systems at Closed Landfill Sites:

- Non-penetrating ballasted footing/foundation designs
- Bias towards fixed tilt systems which are less sensitive to output reduction due to settlement tilting and require far less substantial foundations than tracking systems
- Flexible and adjustable panel racking system designs to accommodate settlement and maintain system performance (for rigid poly or mono crystalline panels)
- Use of flexible conduit systems or adjustable conduit supports to accommodate settlement
- Rack and wiring design details to facilitate cost-effective panel removal/replacement in the event intrusive activities must be performed at current panel location
- Conduct all aspects of facility design, operations, construction, operation and maintenance, and eventual deconstruction in ways that ensure no adverse impacts on the site's ongoing post closure operations (active remediation systems, landfill gas venting or flare systems, leachate recovery systems, landfill settlement surveys, landfill gas surveys, erosion inspections, routine cap maintenance, areas of potential future intrusive remedial measures, etc.)
- Careful planning of onsite construction traffic for system installation – use of temporary roadways to minimize localized compaction and soil disturbance
- Planning of permanent access roads for system operations and maintenance – making full use of existing roads

Based on our experience and understanding of the solar industry, Amec Foster Wheeler has been able to streamline the permitting process to save our clients both time and money.

## Ground-Mounted Solar Photovoltaic System Planning and Design Support

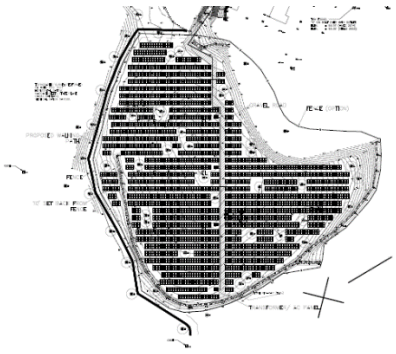
Amec Foster Wheeler has worked on a range of solar photovoltaic array designs, including ground-mounted arrays and carport systems. We have performed civil engineering design and environmental permitting for ground-mounted solar arrays for well over 20 sites at various properties, including seven sites across Massachusetts on highway medians, on highway embankments, and on land within highway interchanges. We have also performed civil engineering design and environmental permitting for a ground-mounted system in West Newbury, MA, and a carport system in Natick, MA. These installations have created energy outputs ranging from 183 kW to 650 kW per site.

# Amec Foster Wheeler Project Experience

Amec Foster Wheeler has supported numerous projects for the repurposing of closed landfills, open spaces, parking areas, and hazardous waste sites for solar PV system installations. Our solar PV experience includes the following projects:

Pittsfield, Groton, Saugus, Northampton, Lenox, Stockbridge and Newton Landfill Solar Redevelopment, Ameresco, Inc., Massachusetts. Amec Foster Wheeler has worked on the redevelopment of closed landfills ranging from 1.0 to over 3 megawatt solar photovoltaic generating systems. The projects are in various stages of permitting and include engineering and permitting in order to require a Post-Closure Use Permit through MassDEP. Engineering evaluation includes geotechnical analysis of bearing capacity, slope and sliding stability, and settlement; access road design; structural design of cast-in-place concrete inverter/transformer pads and conduit support blocks; and stormwater analysis to assess the potential increase in stormwater runoff volume and rate due to the proposed development. In addition to the Post-Closure Use Permit, additional permitting requirements include local wetlands and planning board approval; state historic commission and endangered species protection agency permitting, and federal coverage under EPA's NPDES construction general permit.

Braintree Landfill Solar Redevelopment, Ameresco, Inc., Braintree, Massachusetts. Amec Foster Wheeler managed the redevelopment of a closed landfill as a 1.263 megawatt solar photovoltaic generating system. The project included engineering and permitting in order to require a Post-Closure Use Permit through MassDEP. Engineering evaluation included geotechnical analysis of bearing capacity, slope and sliding stability, and settlement; access road design; structural design of cast-in-place concrete inverter/transformer pads and conduit support blocks; and stormwater analysis to assess the potential increase in stormwater runoff volume and rate due to the proposed development. In addition to the Post-Closure Use Permit. Construction oversight of earthwork activities on the landfill cap was also provided. Post-construction inspections and reporting to MassDEP continue to be conducted monthly.



Weston Landfill Solar Redevelopment, Ameresco, Inc., Weston, Massachusetts. Amec Foster Wheeler has worked on the redevelopment of a closed landfill as a 2.27 megawatt solar photovoltaic generating system. The project included engineering and permitting in order to require a Post-Closure Use Permit through MassDEP. Engineering evaluation included geotechnical analysis of bearing capacity, slope and sliding stability, and settlement; access road design; structural design of cast-in-place concrete inverter/transformer pads and conduit support blocks; and stormwater analysis to assess the potential increase in stormwater runoff volume and rate due to

the proposed development. In addition to the Post-Closure Use Permit, additional permitting requirements included local wetlands and planning board permit approval. Construction oversight of earthwork activities on the landfill cap was also provided.

Landfill Solar Project, Environmental Engineering Design and Permitting Support, Town of Acton, Massachusetts. Amec Foster Wheeler, under contract to Ameresco, Inc., provided engineering and permitting support for a 1.59 MW photovoltaic system on the 17.5-acre closed municipal landfill in Acton, MA. The project included engineering and permitting in order to require a Post-Closure Use Permit through MassDEP. Engineering evaluation included grading/earthwork design to accommodate maximum allowable slopes for solar PV development; geotechnical analysis of bearing capacity, slope and sliding stability, and settlement; stormwater analysis to assess the potential increase in stormwater runoff volume and rate due to the proposed development; and structural cast-in-place concrete design for equipment pads. MassDEP issued the permit in 2012. Amec Foster Wheeler began providing construction inspection services in Spring 2013. Amec Foster Wheeler also provided construction inspection services.

Landfill Solar Project, Environmental Engineering Design and Permitting Support, City of Lowell, Massachusetts. Amec Foster Wheeler, under contract to Ameresco, Inc., provided engineering and permitting support for a 1.502 MW photovoltaic system on the 56-acre closed Westford Street Landfill in Lowell, MA. The project included engineering and permitting in order to require a Post-Closure Use Permit through MassDEP. Engineering evaluation included geotechnical analysis of bearing capacity, slope and sliding stability, and settlement; and stormwater analysis to assess the potential increase in stormwater runoff volume and rate due to the proposed development; and structural design of cast-in-place concrete equipment pads. Amec Foster Wheeler also provided construction inspection services.

Landfill Solar Project, Environmental Engineering Design and Permitting Support, Town of Sudbury, Massachusetts. Amec Foster Wheeler, under contract to Ameresco, Inc., provided engineering and permitting support for a 1.512 MW photovoltaic system at the 23-acre closed Sudbury Sand Hill Landfill in Sudbury, MA. The project included engineering and permitting in order to require a Post-Closure Use Permit through MassDEP. Engineering evaluation included geotechnical analysis of bearing capacity, slope and sliding stability, and settlement; stormwater analysis to assess the potential increase in stormwater runoff volume and rate due to the proposed development; and structural design of cast-in-place concrete equipment pads. In addition to the Post-Closure Use Permit, additional permitting requirements included submittal of NHESP clearance, as well as local permit applications, including an ANRAD, Site Plan Review, and local Stormwater Permit. Amec Foster Wheeler also provided construction inspection services, as-built plan preparation, and construction certification.

MassDOT Solar PV Development, Ameresco, Inc., Massachusetts. Amec Foster Wheeler managed the civil engineering and environmental permitting of 10 sites within the MassDOT right-of-way including sites within the highway median, on highway embankments, and on land within highway interchanges. Civil engineering and surveying tasks included the development

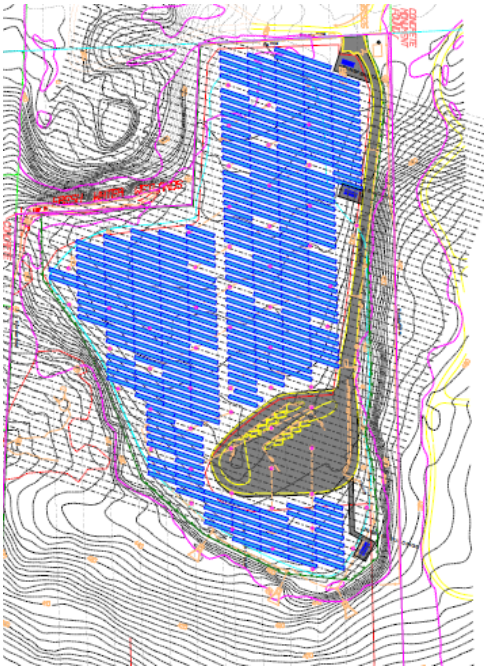
of proposed site plans, erosion & sedimentation control plans, traffic management plans, highway alteration plans, and structural design of concrete equipment pads. Permitting included wetlands permitting, local site plan review, and development of Stormwater Pollution Prevention Plans as required by the USEPA's construction general permit. Construction inspections were performed for equipment pad installations and for compliance with wetlands permit conditions.

Landfill Solar Project, Environmental Engineering Design and Permitting Support, Town of Scituate, Massachusetts. Amec Foster Wheeler provided engineering and permitting support for a 3.0 MW photovoltaic system on a closed municipal landfill in Scituate, MA. The project site was challenging due to constantly changing slopes, subterranean drainage and gas piping, and landfill loading and settlement constraints. Amec Foster Wheeler was able to increase the available landfill area by closely examining the constraints for ballast stability and increased the capacity of the project by 25 percent. Amec Foster Wheeler design included dead and transient loading calculations, ballasts, racks, 500kVa inverter pads, and identification of locations suitable for PV arrays. Central to the design was the requirement not to negatively affect landfill storm water features, avoid excess differential settlement, and protect the integrity of landfill maintenance and monitoring operations.

Landfill Solar Redevelopment, Bethel, Connecticut. Amec Foster Wheeler worked on the redevelopment of a closed landfill into a 948 kilowatt solar photovoltaic generating system. The project included engineering and permitting in order to obtain approval from CT DEEP for an Application for Disruption of a Solid Waste Disposal Area. Engineering evaluation included geotechnical analysis of bearing capacity, slope and sliding stability, and settlement; access road design; structural design of cast-in-place concrete inverter/transformer pads and conduit support blocks; and stormwater analysis to assess the increase potential increase in stormwater runoff volume and rate due to the proposed development. Local inland wetlands and planning/zoning board permit approval were also obtained.

Ground-Mounted Solar PV Development, New England. Amec Foster Wheeler has supported the development of over 15 ground-mounted solar PV sites in Massachusetts, Rhode Island, and New Hampshire in 2016 and 2017. Services performed include constraints identification, wetlands delineation, topographic and ALTA survey, civil site design (roadways, layout, stormwater management), local and state permitting, and construction support.

Landfill Solar Project, Bernards Township, New Jersey. Amec Foster Wheeler provided engineering, land use permitting and site plan design to allow the installation of a 3-MW solar installation on this closed municipal landfill. Working in collaboration with the solar array designer, Amec Foster Wheeler has developed solar array layouts compatible with the site topography, wetlands buffers, and site geotechnical characteristics. Engineering analyses were performed to develop foundation recommendations for ballasted solar arrays to assure landfill cap and closure system integrity. Surface water analyses were performed to assess the potential for incremental surface runoff, and engineering application necessary to comply with NJDEP stormwater management regulations. A wetlands survey was completed to update wetland and habitat boundaries affecting the extent of developable area on the site. Amec Foster Wheeler worked with NJDEP's Office of Permit Coordination and Review to expedite project permitting and development. A site plan was developed and reviewed by the township engineer and planning board for consistency with local codes and regulations.



Wind and Solar Energy Study, Confidential Client, Active Chemical Plant, Newark, New Jersey. This ongoing project seeks to quantify the wind and solar energy potential, as well as economic viability for constructing a maximum capacity wind and solar energy system at this industrial facility located adjacent to Newark Bay. Wind speed and direction along with other weather data are being continuously collected for a period of 12 months and will be utilized to determine the actual available energy of the wind resource, type of turbine design most suitable for the wind speed distribution present, and wind turbine layout options which will optimize energy yield of various system sizes. A variety of PV solar array layouts, along with a solar shading analysis and PV-Watts data is being used to assess the PV solar energy potential, as well, including a review of a hybrid wind/solar renewable energy system. An economic evaluation incorporating available state and utility incentives is also being prepared as required to assist the customer in developing the business case for proceeding with implementing this project.

City Redevelopment Project, PV Solar Concept Evaluation, Northern New Jersey. Amec Foster Wheeler was retained by the developer/landowner of an undeveloped 100-acre parcel (with an approved re-development plan) to investigate generating revenue from the undeveloped portions of the site throughout the 2015 to 2052 build-out cycle via large-scale PV Solar. The 25MW PV Solar concept developed, which will be compared to other interim development approaches, includes a combination of a ground mount, rooftop, and a "transitional" system which is engineered to be cost-effectively relocated from a ground mounted configuration to a rooftop configuration as open land diminishes and rooftop space becomes available.

Solar Plant Siting and Feasibility Study, Joint Base McGuire-Dix-Lakehurst, Burlington and Ocean Counties, New Jersey. Amec Foster Wheeler provided environmental and engineering services to evaluate candidate land areas and rooftop locations for installation of solar arrays to meet federal renewable energy goals at this military complex. Siting criteria included

compatibility with base missions, relative age and size of available or future roof top areas, compatibility with environmentally sensitive habitats, and hazardous waste site avoidance. Five candidate sites were identified. Preliminary cost benefit analyses were developed to rank these sites for subsequent detailed evaluation and project implementation.

9 MW Solar Development, Mountain Creek Project, Vernon, New Jersey. Amec Foster Wheeler is providing a wide range of engineering and permitting services to the Solar Developer, including site constraints mapping; wetlands delineation and permitting; local planning and permitting support; geotechnical investigation; site civil and stormwater design; solar shading evaluations; solar array layout and power production estimates; meter consolidation plan; detailed A.C. electrical distribution design; utility interconnection agreements; detailed design of parking canopy structures; and development of RFPs for solar facility construction, A.C. power distribution, site civil, and structural steel contractors. This project consists of developing seven total solar facilities (4 ground mount and 3 parking canopy systems), as well as power distribution to off-takers which currently are served by over 80 electric meters and 2 electric utilities. The developer will enter into a long-term power purchase agreement with several off-takers on properties contiguous with the Solar Facility sites.

Hamilton Ontario Solar PV Landfill Feasibility Study, City of Hamilton, ON, Canada. Amec Foster Wheeler worked on the feasibility study of solar PV at several landfill sites in the City of Hamilton. We developed criteria for feasibility screening including site features, environmental receptors, and potential interconnection. The screening process evaluated over a dozen sites and criteria evaluation narrowed it down to two sites for further evaluation to include conceptual solar PV array design and detailed permitting evaluation.

# Client Commendations

## In Our Clients' Words:

*"AMEC (now Amec Foster Wheeler) stands out because all personnel recognize that they are not merely a consultant or contractor, but a part of the MMR Project Delivery Team. This lends credibility to their technical opinions, and fosters strong professional relationships. When developing resolutions to problems and concerns, AMEC is responsive and remains aware of cost, schedule, and regulatory impacts to the overall program. AMEC appears to have a business philosophy based on professional respect, being customer focused, and providing total quality to services and product."*

David Margolis, PE, Senior Technical Lead
USACE New England District

*"AMEC (now Amec Foster Wheeler) is one of the most responsive and innovative AFCEE contract team partners we have. They consistently deliver high quality products ahead of schedule and under budget. An excellent company and welcomed addition to the AFCEE Team."*

Tom Russell, Director MAJCOM,
HQ AFCEE

*"First and foremost, the work provided to date by ABB-ES (now Amec Foster Wheeler) has been nothing short of outstanding. This project has been extremely challenging with changes occurring in the field and the regulations. I cannot emphasize the value added by the ABB-ES staff. Every step of the way and bump in the road ABB-ES has been there to recommend changes and implement solutions to save time and money. Whether it be chemistry, risk assessment, air monitoring, design or construction practice professionals the present Title II contract services provided by ABB-ES is of enormous benefit to the AFCEE and the program in general at MMR."*

Edward L Pesce, P.E.
Environmental Engineer
HQ AFCEE/MMR

# Attachment A
## Resumes