

***Chesapeake Watershed Cooperative Ecosystems Studies Units Application-
Binghamton University***

- *Expression of desire to enroll in the CHWA CESU as a new partner institution/organization.*

It is with great enthusiasm that Binghamton University submits this application to join the Chesapeake Watershed (CHWA) CESU as a new nonfederal partner institution. As shown in the supporting materials, Binghamton University offers exemplary programs and resources that would benefit the unit's federal and nonfederal partners. Binghamton University has an extensive history of research and outreach related to the natural and cultural resources of the Chesapeake Bay Watershed. Collaboration and outreach serve as the foundation for Binghamton University's research and scholarship. Such collaboration is exemplified in our numerous successful projects conducted with federal agencies, such as the National Park Service, the Department of Defense, and the Federal Emergency Management Agency.

- *Confirmation that the institution/organization has read the CESU agreement and agrees to support the CESU mission and goals and fulfill the roles and responsibilities of a nonfederal partner, as described in the CESU agreement.*

Paul Parker, Officer in Charge and Associate Vice President for Research Administration, has reviewed the CESU agreement and this submission and supports Binghamton University's role as a nonfederal partner in the network. Mr. Parker assures that Binghamton University's administration will make available the university's resources needed to support the university's role in the network. As the technical representative and primary contact, Carl Lipo, Associate Dean for Research and Programs in Harpur College, will work with faculty, staff, and university students to ensure that Binghamton University meets its obligations as a nonfederal partner.

- *Description of the institution/organization, its mission, and the primary focus of collaborative activities to be supported through the CESU in the context of the CESU mission.*

Binghamton University (<https://www.binghamton.edu>) has a long-standing reputation for academic excellence in undergraduate and graduate education. Located in New York State's Southern Tier at the headwaters of the Chesapeake Bay Watershed, Binghamton University has evolved from a four-year liberal arts college offering a superb undergraduate education to a research university with a range of master's and doctoral programs in the liberal arts, sciences, engineering, nursing, and other professional programs. For 18 years, the *U.S. News & World Report* has listed Binghamton among the top 50 public U.S. universities and *Kiplinger's Personal Finance* consistently recognizes the school as a best value among the nation's public universities. Drawn from an applicant pool of over 30,000, the 2016 freshman class of 2,641 students has an average SAT of 1306 for math and critical reading and an average secondary school GPA of 95%. Binghamton ranks high in six-year graduation rates: 81% compared to a national average of 42% and high in the earnings of its graduates. As of 2017, Binghamton University has 586 tenure-track faculty, 13,632 undergraduates, and 3,660 graduate students.

As one of the four research universities of the State University of New York (SUNY) system, Binghamton University's focus is on expanding research and graduate training across all areas of the university. Binghamton University's annual research and development expenditures topped \$38 million in 2016-17 and the rate of new technology disclosures as a function of sponsored research funding places Binghamton University well above the national average. Faculty have

received grants and funding from the National Institutes of Health, National Science Foundation, Department of Education, Department of Defense, U.S. Department of Agriculture, National Park Service, Environmental Protection Agency, New York State, and industry partners. The National Academies, Fulbright, Ford, and Guggenheim have recognized the scholarship of our faculty.

Binghamton's organized research centers have the expertise and resources necessary to achieve CHWA CESU's goals. The Center for Integrated Watershed Studies addresses research questions related to the natural resources associated with watersheds and human impacts on these resources, specifically those within the Chesapeake Bay Watershed. The Public Archaeology Facility (PAF) has conducted archaeological and historical research as well as historic preservation activities in New York, Pennsylvania, Ohio, and the Northeast since 1972. The Center for Research in Advanced Sensor Technologies and Environmental Sustainability's (CREATES) interest in green chemistry and sensor technology helps to better preserve both natural and cultural resources by improving the identification and measurement of toxins and contaminants in ecosystems. The dedicated researchers in these programs would be a valuable asset in researching and preserving the Chesapeake Bay Watershed's natural and cultural resources.

While our university's faculty are dedicated to furthering research and scholarship in their respective disciplines, they are also active in interdisciplinary and transdisciplinary research. As the university is growing in its creative and scholarly work, the faculty have guided the creation of five Transdisciplinary Areas of Excellence (TAE) that bring together diverse teams of researchers to address critical social, scientific, technological, cultural, and economic problems. Such collaboration efforts in areas that range from Sustainable Communities, Smart Energy, Health Sciences, Citizenship and the Material/Visual worlds have proven beneficial to developing innovative research programs and scholarship. Our emphasis on collaborative research is also evident in our Freshman Research Immersion Program (FRI), an initiative that provides training and research opportunities for incoming freshman as a way to better prepare them for research opportunities in their academic and professional careers.

Binghamton University's expertise as well as our geographic location would add to the CHWA CESU. Currently, there are no New York institutions within the CHWA. Binghamton's addition to the CHWA CESU would fill this gap and provide a natural and cultural research perspective from the headwater Chesapeake Bay Watershed region.

- *Description or list of the primary programs, departments, or other institutional divisions of relevance to federal land management, environmental, and research agencies that will likely be engaged in CESU activities. Include website addresses for further information, as appropriate.*

Binghamton University stresses the importance of collaboration and interdisciplinary approaches to address large research questions. Our academic departments housed in the [Harpur College of Arts and Sciences](#), the [Thomas J. Watson School of Engineering and Applied Science](#), and the [College of Community and Public Affairs](#) (CCPA) include a diverse faculty who are actively involved in research related to CHWA CESU activities. These faculty meet and collaborate on shared research through our Organized Research Centers (ORCs) and our Transdisciplinary Areas of Excellence (TAEs). Binghamton University also offers other specialized research programs that are directly applicable to the CHWA CESU's research and programs.

Departments

- [Anthropology](#)- archaeology, ethnography, linguistics, forensics, historic preservation, cultural heritage, biomedical anthropology, molecular anthropology, zooarchaeology, paleoethnobotany, remote sensing
- [Biological Sciences](#)- evolutionary biology, ornithology, taxonomy, genetics, microbiology, neurobiology, invasive species, ecotoxicology, aquatic systems, biofilms
- [College of Community and Public Affairs \(CCPA\)](#)- Community research, public administration, education, informal learning
- [Chemistry](#)- analytical, biochemistry, environmental, inorganic chemistry, materials studies, organic chemistry, physical chemistry
- [Geography](#)- biogeography, plant ecology, environmental history, spatial analysis, GIS, remote sensing image processing, ethnic/racial geography, urban geography, internet mapping, demographics, cultural geography, health geography, survey research, refugee/migration, cartography
- [Geology](#)- sedimentology, geochemistry, hydrogeology, environmental policy, petrology, geomorphology, geomicrobiology, remote sensing/geophysics, paleoclimatology, seismicity
- [History](#)- Civil War, Colonial America, race and gender, 20th Century United States, environmental history

Programs

[Transdisciplinary Areas of Excellence](#)- Since 2013, Binghamton University has supported Transdisciplinary Areas of Excellence (TAEs) in the areas of Sustainable Communities; Smart Energy; Citizenship, Rights and Cultural Belonging; Material and Visual Worlds; and Health Sciences. The TAEs bring together researchers from various disciplines to focus on large and/or complex research questions that benefit from transdisciplinary collaborative research and scholarship. Campus support for the TAEs includes internal seed grants, faculty hires, speakers series, and research networking.

[Environmental Studies](#)- The Environmental Studies Program takes a transdisciplinary approach merging Anthropology, Biology, Geology, Geography, Civic Planning, and Public Administration to research issues related to wetlands, natural resources, forestry, sustainability, environmental health/hazards, environmental policy, pollution, hydrology, resource management, community ecotoxicology, phenotypic plasticity, environmental planning, urban ecology, plant ecology, bioremediation.

[MA Program in Public Archaeology \(MAPA\)](#) - The Anthropology Department's MAPA is a 20-month program that prepares archaeological masters students for careers in the government or cultural resource management sectors through course work and internships.

[Freshman Research Immersion \(FRI\)/ Summer Research Immersion \(SRI\) Programs](#)- The FRI and SRI provide first year undergraduate students with research experience in science and engineering. Two of the program's streams or areas specifically address CHWA CSEU interests: Environmental Visualization/Geophysical Remote Sensing and Biogeochemistry.

Certificate in Watershed Studies- Based in the Center for Integrated Watershed Studies (CIWS), the graduate certificate in Watershed Studies and Management provides a foundation in the functioning of watersheds and the effects of anthropogenic factors effecting watersheds.

[Master's program in Sustainable Communities](#) - The 2-year interdisciplinary program integrates the three pillars of sustainability – environmental protection, economic vitality and social equity – to provide a balanced, holistic perspective on sustainability.

[Minor in Sustainable Engineering and Design](#) - Based in the Watson School of Engineering and Applied Science, the minor applies an interdisciplinary approach leading students to understand how their engineering knowledge can be used to design systems that do not compromise the natural environment for current and future generations.

- *A list of and brief description of the staff or faculty with expertise in disciplines and subject areas of relevance to federal land management, environmental, and research agencies (do not submit CVs).*

Faculty and researchers across Binghamton University are conducting research related to issues related to the CHWA CSEU. The following is a list of select faculty.

Dr. Carl Lipo, Professor of Anthropology and Director of Environmental Studies, is an expert in sustainability, cultural resource management, remote sensing, natural resource mapping, geophysical survey, spatial analyses. Carl Lipo is the Director of the Binghamton University Environmental Studies Program and Professor of Anthropology. He also chairs the Sustainable Communities Transdisciplinary Area of Excellence (TAE) committee. Lipo's research focuses on the application of evolutionary theory for understanding communities in the present and past. His work makes use of quantitative methods and remote sensing tools to map cultural and natural resources across landscapes. Lipo has worked in areas across North America as well as on Easter Island in Eastern Polynesia.

Dr. Joseph Graney, Professor of Geological Sciences serves as the Associate Director of the Center for Integrated Watershed Studies at Binghamton University. His research specialty is environmental geochemistry. His current research focuses on tracing natural and anthropogenic geochemical processes to assess ecosystem impacts adjacent to oil sands production facilities in Alberta; assessments of energy resource development on Chesapeake Bay watersheds; and the impact of interstate and local roadway infrastructure on surface and groundwater resources.

Dr. Weixing Zhu, Professor of Biological Sciences and the Director of the Center for Integrated Watershed Studies (CIWS) at Binghamton University, is an ecosystem ecologist and an expert in the fields of biogeochemistry, watershed science, and urban ecology. His research is heavily tied to the questions regarding the sources and quantity of nitrogen (N) input into an ecosystem, transfers and transformations of N within an ecosystem, and pathways leading to the loss of N from an ecosystem, in the context of global environmental changes. He has served since 2007 as the NYS gubernatorial appointee member in the Scientific and Technical Advisory Committee, Chesapeake Bay Program (STAC, CBP).

Dr. Thomas R. Kulp, Associate Professor of Geological Sciences and Environmental Studies, Center for Integrated Watershed Studies Geomicrobiology and Ecology has a research interest focused primarily on the microbiological cycling of environmentally relevant trace metal(loids) including As, Sb, Se, Cr and U. His other interests include novel microbial metabolisms involving metalloids that permit bacterial life at extreme conditions of salinity, temperature, and alkalinity. He also study how microbiologically mediated reactions affect the fate and behavior of these toxic trace metals in freshwater settings. In addition to geomicrobiological processes related to toxic

trace metals and metalloids, he is also interested in food web systematics of biologically sensitive elements such as As, Sb, and Se.

Dr. Jessica Hua, Assistant Professor of Biological Sciences has an expertise in phenotypic plasticity, ecotoxicology, disease ecology, aquatic systems. The Hua Lab investigates a broad range of questions related to the biology and conservation of aquatic systems. In particular, her lab investigates the ecological and evolutionary effects of anthropogenic chemicals (road salt, pesticides, and antibacterials) at the individual through ecosystem levels.

Dr. George A. Meindl, Visiting Assistant Professor, Environmental Studies Program, has an expertise in ecology, toxicology, and science education. His research interests include understanding how the abiotic environment mediates species interactions by integrating the ecology of plant-animal interactions, evolution, and toxicology. His specific research interests include plant heavy metal accumulation, pollination ecology, and impacts of anthropogenic contaminants on wetland ecosystems.

Dr. Kirsten Prior, Assistant Professor of Biological Sciences, is an ecologist with expertise in invasive species, terrestrial ecology, plant-insect interactions, and conservation. Her primary research interests include asking questions related to why species become invasive, the impacts of invasive species on ecosystems, and how to manage invaded ecosystems effectively.

Dr. John E. Titus, Associate Professor of Biological Sciences has a primary area of expertise in aquatic plant ecology, especially lake macrophyte ecology. He currently focuses on forest ecology, vegetation dynamics, deer impacts, forest restoration

Dr. Robert Holahan, Assistant Professor of Environmental Studies, US/Domestic Environmental Law & Policy has a research focus on understanding the linkage between ecological or biological conditions of natural resource systems and the humanly devised institutions that manage their use. He focuses on US domestic environmental policy, with a particular interest in the positive and negative environmental, economic, and social impacts, respectively, of hydraulic fracturing for oil and gas.

Dr. Nina M. Versaggi, RPA, serves as director of the Public Archaeology Facility (PAF), a research center on campus. Her technical area of expertise is the cultural resource management process, including initial research and predictions of site locations; field surveys to determine if precontact and historic archaeological sites and structures are present; evaluations of the National Register eligibility of sites and structures; formulation of impact avoidance plans or data recovery as part of mitigation negotiations; and cultural resource management plans to assist agencies with the interpretation and preservation of cultural resources under their stewardship. Her expertise also includes working with Native Americans today as part of the federal consultation process and non-mandated collaborations as part of community outreach activities. Her research interests cover analysis and interpretation of precontact Native American land use patterns in riverine settings based on the modeling of how ancient landscapes were used by both mobile and sedentary groups.

Dr. Ralph Garruto, Professor of Biomedical Anthropology and Biological Sciences, Departments of Anthropology and Biological Sciences, is a human population biologist whose research focus is on natural experimental models of disease. He takes a cross-disciplinary approach to his research interests in neurodegenerative disorders including Amyotrophic Lateral Sclerosis and Parkinson's Disease, food chain disorders, health transition studies, obesity and bionutrition and infectious diseases. He is currently leading two field and laboratory projects related to the

Chesapeake Bay Watershed region: identifying and measuring the impact that ecological and human behavioral factors have on the prevalence of and exposure to Lyme and other tick-borne diseases and studying emerging prion diseases, specifically chronic wasting disease in upstate New York.

Dr. Matthew C. Sanger, Director of the Public Archaeology Program and Assistant Professor of Anthropology, has an expertise in Public Archaeology, collaborations with indigenous peoples, photogrammetry, shell-matrix excavations and analyses. Matthew Sanger's interests revolve around questions of mobility, landscape, heritage, and community formation within Native American societies, especially along the Atlantic coastline. Using a variety of techniques, including geophysics and photogrammetry, Dr. Sanger investigates Native American coastal occupations and how these occupations relate to larger environmental trends, including changing sea levels. Specializing in the excavation and analysis of shell middens, Dr. Sanger's research includes the reconstruction of past subsistence patterns and adaptations to coastal environments.

Dr. BrieAnna Langlie, Assistant Professor of Anthropology, is an expert in paleoethnobotany and the relationship between people and plants. Her research looks at how humans domesticated plants into crops. More broadly, she is interested in how humans domesticate and change landscapes to make them more amenable for human lifeways.

Dr. Tim de Smet, Department of Anthropology, is an anthropologically oriented archaeologist interested in the use of non-invasive remote sensing techniques, geoarchaeology, and the analysis of cultural material remains to answer fundamental anthropological research questions about human behavior, social organization, and cultural change through time. His research interests include spatial statistics, experimental archaeology, historical archaeology, conflict archaeology, and social aggregation in the greater southwest. Tim's firsthand experience of the curation crisis as an Assistant Curator guides his research, which focuses on the stewardship of the archaeological record using remote sensing techniques to non-destructively document and preserve sites. Tim's current research involves statistical analysis and integration of multiple geophysical datasets to reduce interpretational uncertainty, thereby answering the most anthropological research questions with the least amount of costly and destructive excavation in order to preserve these non-renewable archaeological resources in situ for future generations.

Dr. Mark Blumler, Associate Professor of Geography is an expert in biogeography. His research interests include human-environment interaction, invading species, biodiversity, succession theory, climate change and ecosystems, fire and ecosystems, sustainability, urban ecology, history of environmental thought, and ethnicity in evolutionary perspective.

Dr. Qiusheng Wu, Assistant Professor of Geography is an expert in GIS, Remote Sensing, and Environmental Modeling. Dr. Wu's research interests focus on the application of GIS and remote sensing to the study of the physical environment. In particular, he is interested in mapping wetlands and modeling hydrological connectivity using high-resolution aerial imagery and LiDAR (Light Detection and Ranging) data.

Dr. Pamela A. Mischen, Associate Professor of Public Administration, Sustainable Communities Program, Environmental Studies Program, Center for Collective Dynamics of Complex Systems is an expert in adaptive capacity, local governments, interorganizational networks, knowledge management. Her research is on sustainability at the local level and the strategies used by communities to increase their capacity for creating sustainable communities. Her research has focused on how small communities have responded to global forces, including hydraulic fracturing

in Pennsylvania and increased tourism and migration on Easter Island. She employs both qualitative research methods and agent-based models to explore the concepts of adaptive capacity and resilience, focusing on the underlying network structures and knowledge management activities that result in a systems ability to adapt or be resilient to change.

Dr. George C. Homsy, Assistant Professor of Public Administration, AICP, Director, Sustainable Communities Program is an expert in local government policymaking around issues of sustainability. He investigates the drivers of local policies around environmental protection, economic development, and social equity. He has a particular interest in planning policies and land use regulations, as he was an urban planner, who has worked on sustainability issues with communities throughout New York State and in Western Massachusetts. He also explores the nexus of heritage and sustainability at the neighborhood level as well as the ways that communities plan programs and the built environment to foster lively and health communities for citizens of all ages. He collaborates with local government practitioners through the International City / County Management Association and the American Planning Association.

Dr. Amber Simpson, Assistant Professor, Mathematics Education, Department of Teaching, Learning, and Educational Leadership, has an expertise in STEM Education with Youth (in-school and out-of-school environments) as well as PK-12 Mathematics Teaching and Learning, and informal learning. Dr. Simpson is interested in understanding the role and impact of STEM education, particularly maker education, with a focus on under-represented groups in STEM. She is also concerned with the lack of support to engage in STEM making-related activities in home environments. Her other research interest is related to understanding the interplay of voices shaping and embodying individual’s STEM identity.

Dr. Stephen Ortiz, Associate Professor of History has research and teaching interests related to the political, military, diplomatic, and gender history of the twentieth-century United States. His book *Beyond the Bonus March and GI Bill: How Veteran Politics Shaped the New Deal Era* examines U.S. veteran's policy and the political activism of military veterans during the interwar period. In 2008, Dr. Ortiz was featured on the PBS program *History Detectives*. A 2011 lecture on the New Deal for his Binghamton University HIST 104 class was filmed and aired by CSPAN (found here). Dr. Ortiz is currently working on a new monograph project tentatively titled *Comrades in Arms: Veteran Organizations and the Politics of National Security in the American Century*.

- *For academic institutions, include a description of student demographics and the institution’s status as a minority-serving institution (e.g., as defined by the U.S. Department of Education).*

The tables below present the student demographics for Binghamton University from Fall 2016. Binghamton has a 92% retention rate for freshmen (2015) cohort and a six-year graduation rate of 83% (2010 Freshmen cohort).

Table 1. Enrollment and Degrees awarded

Total Head Count	17,292
Total Undergraduate	13,632
Total Graduate	3,660
Number of Bachelor's degrees awarded	3,463
Number of Master's degrees awarded	1,011
Number of Doctoral degrees awarded	139

Table 2. Student enrollment demographics

Female Students (%)	48
Male Students (%)	52
American Indian or Alaskan Native (%)	0
Asian or Pacific Islander (%)	13
Black - Non Hispanic (%)	6
Hispanic (%)	9
White - Non Hispanic (%)	53
Non-Resident Alien (%)	16
Unknown (%)	2

Table 3. Retention and Graduation Rates

Cohort	% Retained	% Graduated
2015 (1 year)	91.7	0.0
2014 (2 years)	87.7	0.1
2013 (3 years)	84.2	4.7
2012 (4 years)	81.8	72.2
2011 (5 years)	82.8	81.1

- *Description or list of facilities, equipment, centers, or institutes that would provide support to the research, technical assistance, or educational activities of relevance to federal land management, environmental, and research agencies that will be engaged in CESU activities.*

Nuthatch Hollow Living Building: One of 12 living buildings worldwide, construction of the Living Building at Nuthatch Hollow will begin in 2018 and open for use in Spring 2019. The 2,000 to 2,500 square foot building will house a multi-use classroom and laboratory for university courses and community events. Serving as an example of clean material and energy usage, the building will create 105% of its own energy returning the overage to the grid. It will also be constructed with regional materials that are not listed on the Red List. This will lower the carbon footprint, waste, and toxicity of the building’s construction. The site will also have on site composting and storm water treatment lessening the overall environmental impacts of the building.

Geography Department’s GIS and Remote Sensing Core: provides GIS software and training across Binghamton University. Software currently run in the core: ArcGIS 10.x; ArcGIS online, ArcGIS Pro, ArcGIS Business Analyst 10.x; Drone2Map, City Engine, ArcPad 10.x, Idrisi, MatLab, R, ENVI, GPS Pathfinder Office, Contour Storyteller, IBM SPSS 22, WinRAR, Geolytics NCDB, Python. Facility also houses two computer labs for training workshops and research/analysis.

Geospatial Remote Sensing: The equipment housed in the Geospatial Remote Sensing lab can be used to analyze landscapes, features, objects of archaeological, geological, and environmental interest on the surface and subsurface. Our remote sensing instrumentation allows us to measure the world using a wide array of electromagnetic spectra that includes imaging in the visual, multispectral, and thermal bands along with magnetic, resistivity, radar and conductivity a number of multispectral bands. Our remote sensing instruments are useful in numerous applications: environmental hazards detection and monitoring, missing persons and forensics cases, criminal

investigations, military and security, at archaeological and historic cemetery sites, in precision agriculture, architecture, construction, utilities location, and geotechnical planning and management. Our laboratory expertise includes the ability to elementally characterize materials, conduct flora and faunal identifications, lithic and ceramic studies and other forms of archaeometric analyses.

Geochemical Instruments

The Department of Geological Sciences and Environmental Studies has a variety of facilities that enable us to conduct analyses on materials and artifacts to determine composition and ascertain sourcing. Among the instruments currently in the Department are:

- Perkin Elmer Elan 6000 Inductively Coupled Plasma Mass Spectrometer (PE 6000 ICP-MS) configured with a NewWave 193nm laser ablation system. The present configuration of the PE 6000 ICP-MS allows the analysis of trace metal concentrations (typically ppb and ppm). The laser ablation systems enables users to analyze solid samples, a feature that minimize impact to the object and reduces the preparation time and cost.
- Philips X-pert MPD X-ray diffractometer (XRD). By measuring the angles and intensities of the diffraction beams, XRD can determine a sample's crystallographic information in terms of lattice structure, lattice parameter, and atomic positions in unit cell can be determined. This is useful for characterizing minerals in lithics and ceramics.
- JEOL 8900 Electron Microprobe with 4 wavelength-dispersive spectrometers and 1 energy-dispersive spectrometer. The microprobe enables quantitative analysis of elements from fluorine to uranium and semi-quantitative analysis of elements from boron to oxygen. The microprobe can analyze areas as small as 0.02 microns and produce line and area maps of multi-elemental concentrations.
- Bruker Tracer III Portable X-Ray Fluorescence Instrument. We have 2 portable XRF instruments. Portable XRF instruments provide a nondestructive means of measuring elemental composition in artifacts that is useful for determining sourcing information.
- Varian Vista-MPX ICP-optical emission spectrometer for whole-rock and mineral-separate analyses
- Dionex ICS-2000 ion chromatograph
- DCP-atomic emission spectrometer

Geophysical Instruments

Binghamton University houses a variety of near-surface geophysics equipment for rapid high-resolution surveys of subsurface features and deposits. In addition to field instruments, we are currently building out a laboratory dedicated to geophysical and geospatial studies with a suite of computers, plotters and software for conducting geophysical analyses.

- Geometrics Strataview 24-channel Shallow Seismic Reflection Instrument. The Strataview is a high-resolution shallow seismic reflection/refraction equipment for use in active geophysical experiments.
- Geometrics Geode 24-channel seismic recorder: The Geode can record high-resolution shallow seismic reflection/refraction survey data with either 40 or 100 Hz geophones from an active sludge hammer source.

- Geometrics G-858 Cesium Vapor Total Field Gradiometer System: The G-858 is a total field gradiometer comprising a data logger, battery cassette and either one or two cylindrical magnetometer sensors mounted on a rigid Aluminum carrying bar. The sensors can be positioned to collect horizontal or vertical gradient data at up to 3 m offsets at 10 Hz. Closer spacing of the sensors enhances cultural responses at a sensitivity of up to 0.01 nT.
- Geometrics Micro Fabricated Atomic Magnetometer (MFAM): The MFAM can record magnetic gradiometry data with pico Tesla sensitivity at 1 kHz. The sensors themselves weight only 30 g and can be flown from a drone and collect up to 1 square kilometer of data in around 2 hours.
- Sensors and Software PulseEKKO PRO Ground Penetrating Radar (GPR and cart system with 250 and 500 MHz antennas): This GPR system enables rapid, high-resolution imaging of subsurface structure. With GPS integration, we can generate information about the subsurface in a nondestructive fashion. With 3D slicing software, we can generate plan maps of potential archaeological features and structures without excavation. This system is ultra-flexible and can collect data from multiple polarizations and configurations to enable much more detailed analysis of subsurface velocity and 3D structure.
- Sensors and Software PE1000 GPR system with 110, 900, 225 and 450 Mhz antennas.
- Geoscan resistivity RM85 instrument: The RM85 Resistance Meter forms the heart of a versatile measuring system for rapid area or vertical profile measurements. Targets can be archaeological, environmental, forensic, utility, or geological. The RM 85 can be used in Probe Mode where conventional probes are inserted into the ground for area mapping or vertical profiling. The RM85 is integrated with GPS locations to provide rapid surveying capabilities across large areas.
- GSSI EMP-400 Electromagnetic –induction Profiler: The EMP-400 records the quadrature conductivity and in-phase magnetic susceptibility bulk response of the subsurface at up to 3 frequencies from 1-16 kHz at one time. Lower frequencies record to greater depths than higher frequencies.

Remote Sensing Instruments

The Department of Geological Sciences and Environmental Studies has established a major group of instruments that can be used to generate high-resolution remote sensing data over landscape scales. Powered by UAV (fixed wing and multirotor platforms), faculty can generate high-resolution imagery (up to 1cm) over a square kilometer in as little as several hours. Available resources include multiple sensors include visible light cameras for generating orthophotography, multispectral cameras for measuring vegetation variability (often a proxy for archaeological features) and LiDAR for producing bare-ground topographic information beneath vegetation canopies. In addition to field instruments, we are building a dedicated computer lab for geospatial data processing and integration. This lab will feature high-performance computers, image analysis software, GIS, and other software packages for analyzing aerial, satellite and other forms of remotely sensed data.

- PrecisionHawk Lancaster IV Unmanned Aerial Vehicle (fixed wing)
- PrecisionHawk Lancaster V Unmanned Aerial Vehicle (fixed wing)

- Velodyne LiDAR sensor for the PrecisionHawk UAV.
- Enhanced resolution visual sensor (18.4 megapixels, 0.7 cm at 50m height)
- High-resolution multispectral sensor (18.4 megapixels, 1.3cm at 50m height, blue/green/near-IR)
- 3DRobotics Y6 multicopter with Tarot gimbal
- Phantom 2 Vision multicopter
- MicaSense Red Edge 5-band multispectral camera.
- Parrot Sequoia 4-band multispectral camera.
- FLIR Vue Pro R thermal infrared camera.
- DJI Phantom 4 Professional quadcopter drone with 20-megapixel camera.
- DJI Phantom 3 Professional quadcopter drone with 12-megapixel camera.
- 3DR Solo (3) with breakout boards to power external cameras.
- Parrot Disco Ag Professional delta Wing drone.
- Sywalker X8 delta wing drones (2).
- DJI Matric 600 hexacopter drone.
- Sub-centimeter and sub-decimeter Trimble GPS units.

Additional analytic equipment

- 8 Dell Precision Workstations and 5 Dell Latitude Toughbook field computers
- David Structured Light 3D Scanner.
- Sense 3D Scanner
- NextEngine 3D Scanning.
- High Performance Computing (HPC) cluster for data-intensive image analysis and processing.

Advanced Diagnostic Laboratory: The Advanced Diagnostic Laboratory at Binghamton University is a centralized, interdisciplinary, multi-user research and development facility. The ADL is equipped with full array of state of the art instruments for various characterization and analytical tasks. Among the wide array of instrumentation available at the ADL instruments relevant to cultural resource management include:

- Fourier Transform InfraRed (FTIR) Spectrometer, Nicolet 8700 from Thermo Electron Corp. FTIR spectroscopy is an analytical technique that is used to determine the molecular composition of organic and inorganic materials. The technique works by measuring the absorption of light as a function of wavelength. The infrared absorption bands identify molecular components and structures. FTIR complements portable-XRF by providing information about the molecular structure of artifacts and deposits, both crystalline and non-crystalline. Since exposure to heat induces little or no change in elemental concentrations measured by XRF but may dramatically alter the chemical bonding of sedimentary materials, FTIR, a molecular-characterization technique, is well suited for investigation of studies of the firing history of archaeological sediments.
- Veeco Instruments Dektak 8 Contact profilimeter. This instrument is useful for measuring wear patterns on lithics and can be used to determine degree of heat treatment on stone tools.
- PANalytical X'Pert PRO XRD system.

- Nova NanoLab™ 600 high-resolution SEM column with a fine-probe ion source (Focused Ion Beam). The Nova is equipped with light element EDS X-ray detector.
- Zeiss Field Emission SEM, Supra 55. This SEM is equipped EDS detector for chemical analysis in point, line or map scan modes and an EBSD detector for crystal orientation imaging and mapping.
- NanomeX, Phoenix x-ray imaging system from GE
- Thermal Analysis Suite that includes Thermogravimetric Analyzers (TGA), Differential Scanning Calorimetry (DSC), Thermomechanical Analyzer (TMA), TGA with Mass Spectrometry (TG/MS), Thermal Diffusivity System (TDS), Dynamic Mechanical Analyzer (DMA). These instruments are useful for characterizing the products of pyrotechnology such as ceramics, metals, and heat-treated lithics.
- Optical Microscopy. These instruments include a Micro Particle Imaging Velocimeter, Nikon TE2000-U Inverted Microscope, VT-Eye Ultra-Fast Laser Confocal Imaging System, Leica TCS SP5 Confocal Laser Scanning Microscope

Organized Research Centers

Center for Integrated Watershed Studies (CIWS) - Started as a research center in 2003, the center's goal is to conduct interdisciplinary research and education on watersheds. Although CIWS conducts research on wetlands across New York State, the Northeastern United States, Costa Rica and China, the center takes advantage of Binghamton's location near the headwaters of the Susquehanna River and the Chesapeake Bay Watershed. The center seeks to address the biological, geological, geographic, economic and societal components of watersheds, at all scales of integration - local, regional, and international. The center's activities range from field data collection for scholarly research to policy analysis and education.

Public Archaeology Facility (PAF) - Established in 1972, PAF provides cultural resource management services to private and government sponsors across the Northeastern United States with a focus on New York and Pennsylvania. The services provided by PAF include archaeological surveys and excavations (from Phase 1 surveys to Phase 3 data recoveries), historical research, historic preservation planning, historic architectural surveys (HABS/HAER documentation), Native American outreach and consultation services, and public outreach and interpretation. The managing editor of the journal *Northeast Historical Archaeology* is based at PAF.

Center for Research in Advanced Sensor Technologies and Environmental Sustainability (CREATES) - CREATES works to develop sensors and sensor systems that can identify, quantify, classify and remove chemical and biological agents, man-made pollutants, and for identification of analytes that are of interests to environmental, clinical and security applications. CASE has over 2,000 square feet of space including four laboratories that are equipped with state-of-the art instrumentation and microfabrication tools.

Center for Imaging, Acoustics, and Perception Science (CIAPS) - Imaging Science, Acoustic Science, and Perception Science (IAP) are the highly interdisciplinary fields that combine science, mathematics, and engineering to solve problems that range from understanding the environment at both large and microscopic scales, to understanding how the human eye-brain system allows us to visually understand the world. We use imaging systems to learn about the long-hidden content of ancient documents, recognize human face and fingerprints, identify manipulated pictures, and support disaster relief efforts with images from airplanes and satellites.

[Center for Collective Dynamics of Complex Systems at Binghamton University \(CoCo\)](#) – Since 2007, CoCo has conducted interdisciplinary research into the collective dynamics of various types of interacting agents as complex systems. CoCo's aims to advance our understanding of the collective dynamics of physical, biological, social, and engineered complex systems through interdisciplinary research and translate the results of this research to improve the well-being of people at both local and global scales.

- *Description or list of past research, technical assistance, and educational services supported through federal financial assistance awards that are of relevance to federal land management, environmental, and research agencies that will be engaged in CESU activities.*

For nearly a decade, Binghamton University's Public Archaeology Program (PAF) has conducted various research, interpretive, and outreach projects directly or in conjunction with partners of the NPS- American Battlefield Protection Program (NPS-ABPP). Most of these projects have related to historical and archaeological research of Revolutionary War battlefields. In projects related to the Newtown, Chemung, Fort Anne, and Fort Stanwix/Oriskany battlefields, PAF also conducted public outreach in the form of public presentations, websites, historic preservation plans, printed materials (posters/brochures), and educational curriculum. Most recently, PAF, in conjunction with the Civil War Trust and NPS-ABPP, is developing troop and preservation GIS maps for over 200 Revolutionary War and War of 1812 battlefields across the Midwest and Eastern United States. PAF is developing maps for internal agency use as well as public versions that will be available in an online interpretive GIS format.

- *Description or list of current formal agreements and informal relationships with federal agencies that are of relevance to federal land management, environmental, and research agencies that will be engaged in CESU activities.*

As stated, Binghamton University's Public Archaeology Facility (PAF) has an ongoing relationship with the National Park Service's- American Battlefield Protection Program (NPS-ABPP). We have worked with the staff at NPS-ABPP through grants, consultation, workshops, and conferences. PAF served as a consulting party on the NPS-ABPP's National Programmatic Agreement that specified the application of Section 106 regulations on agency sponsored research. PAF also collaborated on research and outreach projects with the NPS units of Fort Stanwix National Monument and Saratoga National Battlefield. PAF has also participated in Fort Stanwix National Monument's Day of Archaeology event for the past few years.

CIWS has ongoing collaborations with parties interested in watershed conservation and restoration in headwater watersheds of the Chesapeake Bay, notably the Upper Susquehanna Coalition (USC), a network of 16 Soil and Water Conservation Districts in New York and 3 Conservation Districts in Pennsylvania. CIWS also has good working relationships with the Chesapeake Bay Program and the Susquehanna River Basin Commission (SRBC).

The ongoing work with the SRBC involves sensor deployment and data acquisition and interpretation associated with the SRBC's Real Time Water Quality Monitoring Network. In recent years, CIWS has collaborated with the USC, to secure grants involving watershed conservation and research through the Chesapeake Bay Program. Collaborative funding has included a grant from the National Fish and Wildlife Foundation, Chesapeake Bay Targeted Watersheds Grant Program (Graney and Zhu 2006-09), an EPA Region 2 WPDG "Integrating watershed-based wetland protection into the Upper Susquehanna Coalition Wetland Program" (Zhu, Titus, and Graney 2010-12), and a multiple year Upper Susquehanna Coalition Research

Fellowship funded by EPA Region 3-Chesapeake Bay Program that supported CIWS affiliated graduate student research (Zhu, Graney, and Titus 2009-13). CIWS co-sponsored a Watershed Symposium at Binghamton University in fall 2017, to commemorate the 25th anniversary of USC and its many achievements in watershed conservation.

Although Binghamton University does not have many active formal agreements with federal agencies, it continues to maintain informal relationships with many federal agencies. The Anthropology Department has placed many of its graduate students as interns in federal agencies including the NPS, USDA-Forest Service, and FEMA.

- *Confirmation of the institution's/organization's willingness to accept a limited overhead rate of 17.5% and cost items to which the rate is applicable for activities conducted through the CESU, including research, technical assistance, and educational services (this overhead rate applies to the entire institution/organization for CESU activities).*

Officer in Charge and Associate Vice President for Research Administration Paul Parker supports this application and confirms Binghamton University's willingness to accept the maximum overhead rate of 17.5% for all research, technical assistance and educational service projects conducted with CESU.

- *Designation of a technical representative (with full contact information – name, title, full address, phone, fax, email) to serve on the CESU steering committee, participate in CESU annual/semi-annual partner meetings, and facilitate internal and external communication, promotion, and response to CESU correspondence and administrative actions (e.g., announcements, new member applications, processing agreements/amendments, five-year reviews).*

Carl Lipo, Ph.D. will serve as the technical representative for Binghamton University and serve on the CHWA Steering Committee. His contact information is as follows:

Carl Lipo
Associate Dean for Research and Programs, Harpur College
Director, Environmental Studies Program
Professor, Department of Anthropology
Binghamton University
PO Box 6000
Binghamton, NY 13902-6000
Phone: 562-225-3684
Email: clipo@binghamton.edu

Tanja deMauro will serve as the administrative representative for Binghamton University. Her contact information is as follows:

Tanja deMauro
Director
Office of Sponsored Programs
Binghamton University
PO Box 6000
Binghamton, NY 13902-6000
Phone: (607)777-6136
Email: tdemauro@binghamton.edu

- *Participation in the CESU annual/semiannual partner meetings and facilitation internal and external communication, promotion and response to CESU correspondence and administrative actions (e.g., announcement, new member applications, processing agreements/amendments, five-year reviews).*

As a member of the CESU, Binghamton University will enthusiastically participate in CSEU partner meetings. Carl Lipo will serve as the communications link between Binghamton University and the CSEU. In this role, Lipo will relay information from the CSEU to Binghamton University administration, faculty and staff and share all internal and external communications related to CESU activities to CESU and related stakeholders. He will also respond to all requests and correspondence from CESU in a timely manner. As the administrative representative, Tanja deMauro, Director of Binghamton University's Office of Sponsored Programs, will ensure that all CESU funded projects are proceeding according to CSEU and Federal partner requirements. We will also provide information on metrics and performance for CSEU five-year reviews.

- *Agreement to relay agency-specific research, technical assistance, and educational needs and associated funding opportunities to other institutional/organizational members (e.g., faculty, students).*

As the point of contact, Carl Lipo, will relay information from the CHWA CSEU agency partners to the Binghamton University administration, faculty, and staff. Lipo will reach out to Binghamton University deans, program directors, department chairs, Organized Research Center directors and Transdisciplinary Areas of Excellence chairs. Lipo will also directly provide information on funding opportunities to faculty and staff based on their research expertise. Lipo will also work with Binghamton University's Office of Strategic Research Initiatives to help research teams develop their research proposals.

- *Signature (or endorsement) from an appropriate official, with authority to commit institutional resources in a binding multi-year federal cooperative and joint venture agreement (e.g., president, executive director, chief financial officer, vice president for research, director of sponsored programs).*

Officer in Charge and Associate Vice President for Research Administration Paul Parker has provided a letter of support and endorsement of Binghamton University's participation in the CHWA CSEU as part of this application. Mr. Parker sees Binghamton University's membership in the CHWA CSEU as a way to benefit Binghamton's research community and the interests of the partner agencies associated with CHWA CSEU.

- *Letter(s) of support from one or more CESU federal agency partners sponsoring the new partner's application, including a description of successful past collaborative work supported through federal financial assistance awards.*

Letters of support for this application from Mr. Brock A Giordano, EHP Supervisor, Federal Emergency Management Agency and Ms. Kristen McMasters, Archaeologist and Grants manager, National Park Service- American Battlefield Protection Program are included.

Both letters note Binghamton University researchers' effective use of federal funds to aid the research and compliance goals of NPS and FEMA.

BINGHAMTON UNIVERSITY
DIVISION OF RESEARCH

January 4, 2018

Eric Davidson
Director and Professor
University of Maryland Center for Environmental Science
Appalachian Laboratory
301 Braddock Road
Frostburg, MD 21532

Dear Director Davidson:

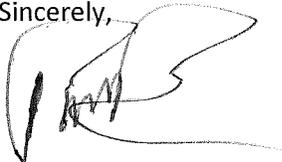
I am pleased to provide my enthusiastic support for Binghamton University's application to join the Chesapeake Watershed Cooperative Ecosystem Studies Unit (CHWA CESU) as a nonfederal partner institution.

Joining the CHWA CESU presents Binghamton University with the opportunity to expand its dedication to research and scholarship related to the study and preservation of the natural and cultural resources of the Chesapeake Watershed. Binghamton's faculty follow a collaborative approach to research. Our Transdisciplinary Areas of Excellence and Organized Research Centers provide venues for researchers to come together and address large and complex research issues. The Center for Integrated Watershed Studies and the Public Archaeology Facility exemplify this commitment to interdisciplinary research in their study of the long-term interplay of human activity and the natural environment in the Chesapeake Watershed. Membership in the CHWA CESU would allow Binghamton's faculty to expand their research by collaborating with partners within federal agencies and nonfederal institutions and organizations.

Binghamton University's involvement in the CHWA CESU will allow the unit to expand its reach and gain an added perspective on the natural and cultural environment of the region. With its location in the northern and upstream portions of the Chesapeake Watershed, Binghamton University can provide a view of the activities that impact the rest of the watershed. The results of Binghamton's research can inform the research and activities of the rest of CHWA CESU's federal and nonfederal partners.

I fully endorse Binghamton University's application for membership in the CHWA CESU. I will help to ensure that the resources needed to make this collaboration successful are available.

Sincerely,

A handwritten signature in black ink, appearing to read "Paul C. Parker". The signature is stylized and somewhat abstract, with a large, sweeping flourish at the end.

Paul C. Parker, CRA
Officer in Charge, Research Division



United States Department of the Interior

NATIONAL PARK SERVICE

1849 C Street, N.W.
Washington, D.C. 20240

7225

IN REPLY REFER TO:

January 9, 2018

H32(2278)

Eric Davidson
Director and Professor
University of Maryland Center for Environmental Science
Appalachian Laboratory
301 Braddock Road
Frostburg, MD 21532

RE: Letter of Support for Public Archaeological Facility/Binghamton University

SENT VIA EMAIL. NO HARD COPY TO FOLLOW.

Dear Dr. Davidson,

Thank you for the opportunity to support the good work of the Public Archaeological Facility (PAF) at State University of New York, Binghamton University with a letter of recommendation. We have had a long and successful series of partnerships with PAF which I am happy to highlight here. We started together as grantor and grantee in 2008 and have been working on a total of seven grants together. They have served as both a grant applicant and as a vendor for successful grant applicants.

PAF has the same vision and mission as our program for the preservation and protection of historical resources. They have been flexible in the service they offer us from historic research, archeology, and National Register nominations, to complex preservation documents that require significant public input to be successful. They have aptly negotiated our concerns and issues directly with the NY State Historic Preservation Office and Native American partners.

Throughout our projects together, I have found them to be efficient with our modest Federal funding, very concerned with good financial stewardship, and timely with their products. The quality of their work is superior. As a Federal agency lead, I can confidently say they have the needed management structure in place to successfully manage every project we have conducted as a team.

I appreciate the excellent scholarship PAF offers us on a consistent basis. They always seem to excel even with the most basic and standard project requirements. Although we know they use student help, I have never felt the product reflected less than a full technically proficient level of effort. They rise to challenges and often surprise me with high quality scholarship. They have been both creative and highly responsible with our projects. I consider them a regional powerhouse of good skills and great outcomes.

Overall, I find the team especially pleasant to work with. On rare occasions, when I perceive some issue, they always address it swiftly and find a solution that works for

both organizations. They take initiative and solve challenges quickly. I appreciate their efforts and hope to continue in our ongoing work together.

I realize I have been brief here in my letter of recommendation. Feel free to contact me with any specific questions you may have about particular projects at Kristen_McMasters@nps.gov. I will be happy to talk to you about the good skills, excellent responsiveness, set management structure, and passion this organization brings to our projects.

Sincerely,

Kristen McMasters
Archeologist and Grants Manager
American Battlefield Protection Program



FEMA

January 8, 2018

To Whom It May Concern:

I am writing in support of the application by Binghamton University to join the Chesapeake Watershed Cooperative Ecosystem Studies Unit (CESU). As a federal agency responsible for awarding grants to communities as they recover from natural disasters, we oversee compliance with Section 106 of the National Historic Preservation Act (NHPA) and its implementing regulations (36CFR800).

I have worked with Binghamton University's Public Archaeology Facility (PAF) when they have been contracted by our grant sub-awardees to conduct cultural resource investigations and agency consultations. Federal undertakings have included post-Hurricane Sandy replacements of an elementary school in Owego (NY), a waterline in Horseheads (NY), a public safety building (multiple alternates) and associated utility corridors in Schoharie (NY), and the siting of 125 Mesonet stations throughout New York State.

Binghamton University's Public Archaeology Facility has demonstrated their expertise in cultural resources management in conducting archaeological surveys, historical research, technical reporting, and alternative mitigation measures such as public education panels. While working with PAF on these multifaceted projects, they met their project timelines, participated in meetings, and delivered products that met federal and state requirements. In particular, the Mesonet weather station project included 125 individual locations that required archaeological testing and reporting across New York State. The project resulted in over 500 archaeological test units and 18 archaeological reports submitted to, and accepted by, FEMA and the New York State Historic Preservation Office (NYSHPO).

In working with FEMA, Binghamton University's Public Archaeology Facility has had successful results in these projects, been responsive and cooperative in working closely with FEMA, state partners, and the sub-grantees to meet project demands.

If you have questions please do not hesitate to contact me at 347-574-1467 or brock.giordano@fema.dhs.gov.

Sincerely,

Brock Giordano, RPA
EHP Supervisor
4085-DR-NY