

## CCNY College-wide Research Vision (CRV) Initiative Concept White Paper

### **Interdisciplinary approach to critical environmental and municipal infrastructure challenges: application to biosolids management**

#### **Project Team:**

**Principal Investigator:** John Fillos, Professor

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**Other Key Personnel:** Beth Wittig (Civil Eng.), Naresh Devineni (Civil Eng.),  
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#### **Project Concept Description: (Maximum 2 pages)**

**Keywords:** Biosolids, Resource Recovery, Sustainability, Equity

**Objectives:** (1) Establish an interdisciplinary approach that augments scientific and engineering analyses with socio-econometrics and systems modeling to address climate, environmental and municipal infrastructure challenges and create sustainable and equitable solutions that meet the triple bottom line (economic, environmental, and social).

(2) Apply the interdisciplinary approach to divert large and growing amounts of sewage treatment plant biosolids from landfills to beneficial uses such as energy generation, nutrient recovery, brown field restoration, coastal defense shoring, and greening of streets, parks, and open spaces.

(3) Address local community concerns regarding safety and equity for biosolids or derived product uses and create local opportunities for environmental entrepreneurship.

**Approach:** The project team will require expertise from several disciplines to investigate open questions related to economic, environmental, and societal impacts of biosolids management in urban centers. **Natural science** research is needed to determine the biochemical behavior of biosolids in the environment and their impact on biodiversity, public health, and quality of life. Such research will guide the selection and development of innovative biosolids processing and application options as well as resource recovery alternatives. **Engineering** research is needed to evaluate the technical feasibility and development of design criteria of emerging biosolids treatment options. Biosolids treatment alternatives result in several products (soil amendments, fermentation products, biogas, plastics) with unique properties and suitable applications. Therefore, each technology alternative under investigation must be evaluated in collaboration with natural and social scientists to determine its safety and desirability to the public. **Social science inquiry** will be essential to the development of a City-wide biosolids management plan that is both sustainable and equitable. Addressing regulatory barriers to and community perceptions of sewage derived products and the development of a local biosolids industry are challenges that must be addressed. Participants from outside research institutions, government agencies, NGOs, and community organizations will be actively recruited to an advisory board.

**Outcomes:** The practical outcome will be a set of sustainable biosolids management practices, particularly suited for large urban areas. Scientific advances include the development of analytical techniques to support biosolids technology selection and monitoring of emerging contaminants in the environment. Engineering outcomes include adopting existing technologies or developing new technologies for more sustainable biosolids management. Such a framework includes

findings from natural and social sciences, as well as application of triple bottom line (economic, environmental, and social) criteria for technology selection. Social science outcomes include the consideration of environmental justice in the selection or deployment of major municipal initiatives.

**Expected  
Products:**

During the first year, we will identify external funding sources and complete a draft proposal. We will also formalize an Advisory Board and inform City, State, and Federal government representatives of our intent to establish a resource recovery center with an initial focus on biosolids management. The team expects to produce at least 3 articles in high-impact journals during the three-year seed funding period (including a multidisciplinary perspective paper to be initiated in year 1). All key personnel have an established track record of graduate student/postdoc supervision, externally funded research, publication in peer-reviewed journals, presentation at national and international conferences, and external collaboration.

**Merits:**

This work develops an interdisciplinary approach that allows full consideration of all important criteria, enabling solutions that are technically and economically viable, and environmentally sustainable and equitable.

More than one billion gallons of sewage flow through New York City wastewater treatment plants each day, generating approximately 1,200 tons of sludge biosolids per day which must be conditioned, handled and hauled (primarily to landfills) at a cost of more than \$100 per ton. Municipalities have realized the potential resources available in wastewater, and “circular economy” solutions have become a focus of urban policy. Biosolids are the largest untapped resource in wastewater treatment plants, with potential to support several key City initiatives including green job creation, zero waste to landfills, and expansion of green infrastructure.

**Impact:**

The topic of biosolids is a local problem with global scope, making this a natural for convergent research. Reconsideration of the fate of municipal waste and the resulting biosolids is a challenge that absolutely must be met. ***Municipal waste issues are central to New York City’s quality of life but are by no means unique to NYC.*** The scope of the problem in NYC is very large and the resources of the city combined with academic partners provide the expectation for success in defining new solutions, such that ***the City is an ideal laboratory for the developments we propose.*** Solutions to this unavoidable problem – whether these are methods to reduce the amount of waste that must be transported, valorization of a fraction of the waste material and establishment of employment involving biosolids, or improvement of the quality of life in the vicinity of treatment facilities – ***translate to municipalities of various scales in the US and around the globe.*** This is a topic that requires consideration of many alternatives and involves all citizens as stakeholders with varying interaction with the problem to establish new technologies and work out acceptance both by the public and the marketplace.

**Milestones:**

**Months 1-3:**

Exchange knowledge, compile literature and case studies, identify external funding sources

**Months 4-6:**

Travel (as possible) to different sites and conferences to learn about technology status

**Months 7-9:**

Initiate plan to host a workshop in Year 2 on biosolids management solutions, coordinate with the International Water Association (IWA) and Water Environment Federation (WEF)

**Months 9-12:**

Complete draft proposal for external funding

**Budget (Maximum Budget \$200K):**

- Key Personnel: **20k**
- Post-Doctoral Research Fellow: **90k**
- Travel: **20k**
- Graduate Students: **50k**
- Supplies: **20k**