Environment and Natural Resources Trust Fund
2015 Request for Proposals (RFP)

Project Title: **ENRTF ID: 115-E**

Restorative Integrated Resource Management at Prospect

Category: E. Air Quality, Climate Change, and Renewable Energy

Total Project Budget: $ 499,440

Proposed Project Time Period for the Funding Requested: 1 year, July 2015 - August 2016

Summary:

Develop water/energy recovery and production facility for cities, reducing the need for landfills, dedicated centralized wastewater treatment plants, sourced conventional fossil fuel based power plants and fresh water supply.

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Sponsoring Organization: Clark Engineering Corporation

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Location

Region: Metro

County Name: Hennipen

City / Township:

Alternate Text for Visual:

Process Flow Diagram Clark Integrated Waste Management and Resource Recovery System

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity Readiness	_____ Leverage		_____ TOTAL

PROJECT TITLE: **An *Integrated Waste Management and Resource Recovery Strategy for Minnesota***

I. PROJECT STATEMENT

Develop water/energy recovery and production facility for cities, reducing the need for landfills, dedicated centralized wastewater treatment plants, sourced conventional fossil fuel based power plants and fresh water supply. Minnesota like any other state, faces the challenges of a growing population, diminishing resources and the many environmental issues associated with that growth. Prominent among them are: fresh water supply, solid and liquid waste disposal, waste recycling, power generation, supply of natural gas and propane, and air and water pollution. Recent discussions in the Minnesota House and Senate, as well as commercial media all attest to the fact that Minnesotan's are interested in 21st century solutions. Clark Engineering Corporation's (Clark) cutting edge, Integrated Waste Management and Resource Recovery System (IWMRR) and Clearwater Technologies (CWTI) Process™ patented waste to energy conversion technology offers such a solution. This technology facilitates the conversion of environmental liabilities such as sewage and municipal solid waste into locally-produced renewable energy, clean water and high value micronutrient rich fertilizer for rural and urban agriculture. Our intent is to address item E. Air Quality, Climate Change, and Renewable Energy and item B. Water Resources in this project.

WHY: Current resource management strategies do not effectively address the goals of Minnesota's urban and rural communities who are striving to implement clean energy technologies and buffer Minnesota's ecosystems by making them more resilient to climate change impacts. Current strategies generally operate within a linear 'take, make, and waste' model that generates significant environmental, social, and economic externalities. By proving the applicability of Clark's technology to a dense urban setting will create a replicable model which can be developed in various parts of the State. Minnesota will serve as a model for the entire USA. In particular, extensive trucking for hauling waste, landfills, landfill leachate generation and ground water contamination, extensive addition to existing wastewater treatment facilities and pipeline from areas to such facilities, emission of CO2 and air pollution that contribute to climatic changes could be drastically reduced. In addition, this model will address Minnesotan's departure toward renewable, clean, and zero carbon footprint energy generation.

HOW: This LCCMR grant will build upon numerous investments by the applicant that have been used to advance the said technology and by identifying and addressing the challenges of applying this technology across the State. Challenges such as solid and liquid waste collection, clean energy and water distribution, plant location and social and environmental issues will be researched and addressed. Clark and our partners have approached Prospect Park North (PPN), located adjacent to our beloved University of Minnesota, to serve as a laboratory for this venture. Clark will use the data (daily solid and liquid waste generated, water and power needs, population growth, etc.) from U of M and other neighboring communities to facilitate this research. We will then research devising a system to mitigate the waste, energy, water, and pollution issues in this district. Once validated, this will apply to other communities. Apart from an environmental solution and a value engine, this project will be a working laboratory that supports educational opportunities to the U of M, State of Minnesota, and visitors across the US.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: *Research and gather data such as a259mount and type of waste generated in dense environment such as U of M and PPN, energy and water needs, hauling and tipping fees, landfill proximities and costs, major leachate and groundwater contamination, etc.* Budget: $ 50,000.

Outcome	Completion Date
*1. Generate a report containing tangible data that could serve as input into Clark's IWMRR System to m*aximize technological systems value within broader ecology of urban district.	July, 2016
2. Compare our findings to other already conducted research in this area and validate the data, and conduct additional research and re-adjust.	July, 2016
3. Develop and manage stakeholder engagement and outreach efforts surrounding districts infrastructure implementation through workshops.	July, 2016

Activity 2: Determine the efficacy of the Clark's System to process the applicable feed stocks within and adjacent to PPN as a first laboratory. Demonstrate the viability of the system in reducing wastes and pollution while increasing production of green and environmentally friendly biogas, clean water, and high nutrient organic fertilizer. Clark will utilize its partner's self-funded laboratory for this activity. Waste samples from the neighborhood will be transferred to the lab and used to develop the most efficient processes to convert over 90% of these wastes into biogas. The solid waste will be combined with human waste to further examine the fuel characteristics, elimination of sulfur, and nutrient recovery. Upon completion of lab tests, a large scale study will be conducted in our partner's self-funded $4.5 million dollar waste to energy production pilot facility. This study will enable Clark to ensure that the system will operate properly and effectively in commercial sized plants. Budget: $ 250,000.

Outcome	Completion Date

1. Characterization Study: Identification of the volume and nature of feed stocks (waste streams, including municipal solid wastes, food wastes, wastewaters, and industrial by-products) within and adjacent to University of Minnesota and PPN.	September, 2015
2. Laboratory and Pilot Plant Procedures Document: Testing results on the inputs/outputs from the system based on the mix of feed stocks from the Characterization Study. Material and Energy mass balance - Impacts of each feed stock on the system operating strategies and input-output efficiency.	March, 2016
3. Material, Nutrient, and Clean Water mass balance – Impacts of feed stocks and system operation on post clean water and nutrient technologies and recovered water and nutrients quality and quantity.	March, 2016

Activity 3: To produce a Project Development document identifying specific location(s) within State of Minnesota, including PPN based on the site selection criteria, population, waste generation, energy and water need, developed in Activity 1 and the appropriate processes and technologies identified in Activity 2. Issues relating to integration, maintainability, neighborhood impacts and ease of operation will be reviewed. Budget: $ 75,000.

Outcome	Completion Date
1. Develop Pre-treatment Material Handling Design & Post-treatment Material Handling Design.	April, 2016
2. Develop design criteria.	April, 2016
3. Complete General Arrangement, Process Flow Drawings, and Rendering of a Typical Facility.	April, 2016
4. Inputs for Environmental Assessment Worksheet (EAW) and research environmental impacts.	May, 2016
5. Identify the Feedstock and Offtake Agreements for the selected site. Complete the Proforma Document identifying a typical plant capital and operating expenditures, and Return on Investment.	June, 2016

Activity 4: Develop a Guidance Plan document that disseminates the findings from the project into a useable document for similar communities. By presenting key findings, and established recommendations and best practices with the involvement from the neighborhood, commercial/industrial/institutional and City participants, this document will support Metropolitan Council and other Minnesota planning agencies in their effort to develop successful waste management, water, and renewable energy projects throughout the State. Budget: $ 74,440.

Outcome	Completion Date
1. Capture and integrate data sets from study.	July, 2016
2. Present opportunities and barriers that can streamline future development.	July, 2016
3. Consolidate information into a format that can be easily disseminated for broader uptake.	July, 2016

III. PROJECT STRATEGY

A. Project Team/Partners The project team consists of three distinct entities.

1. Clark is a Minneapolis-based engineering company which will act as the Grant Administrator and is providing the IWMRR System. Evergreen Energy and CWTI hold a patent to the most robust waste to energy conversion technology that has successfully converted raw sewage, municipal solid waste (MSW) from Hennepin County, and other feedstock sources to renewable energy.
2. Project Partners Not Receiving Funds: Prospect Park 2020 - Neighborhood representation.

B. Project Impact and Long-Term Strategy

Production of greenhouse gasses, depletion of natural resources, impairment of Nation's water bodies, and air pollution has created insurmountable challenges to urban developers and city planners in MINNESOTA and elsewhere. Use and dump culture where natural resources are harvested, and after use converted into liquid and solid wastes, and dumped into the environment, is being firmly rejected by Minnesotans and their representatives. This grant will facilitate the application of a Minnesota-born technology. This model will enable us to reverse this culture and embrace the "Restorative Culture" where these wastes are converted into usable energy, clean water and growth medium. Instead of attracting disposal costs, this model will generate income to the affected population. By application of this technology, dwellers, instead of getting a bill for utilities, solid and liquid disposal, will receive a check or dividends for their wastes which could be used to further enhance community well-being. The space required for a landfill, wastewater treatment plant, etc. can be used for creation of recreation areas and green spaces. Fuel needed for transporting solid and liquid wastes to off-site landfills and wastewater treatment plants (trucks and pumps, etc.) and its associated greenhouse gas emissions is minimized or eliminated.

C. Timeline Requirements

These Activities comprise approximately 12 months of the schedule. The schedule is predicated on the collection of the appropriate feed stocks for the pilot plant in Activity 2 and the implementation process in Activity 1.

2015 Detailed Project Budget

Project Title: An Integrated Waste Management and Resource Recovery Strategy for Minnesota

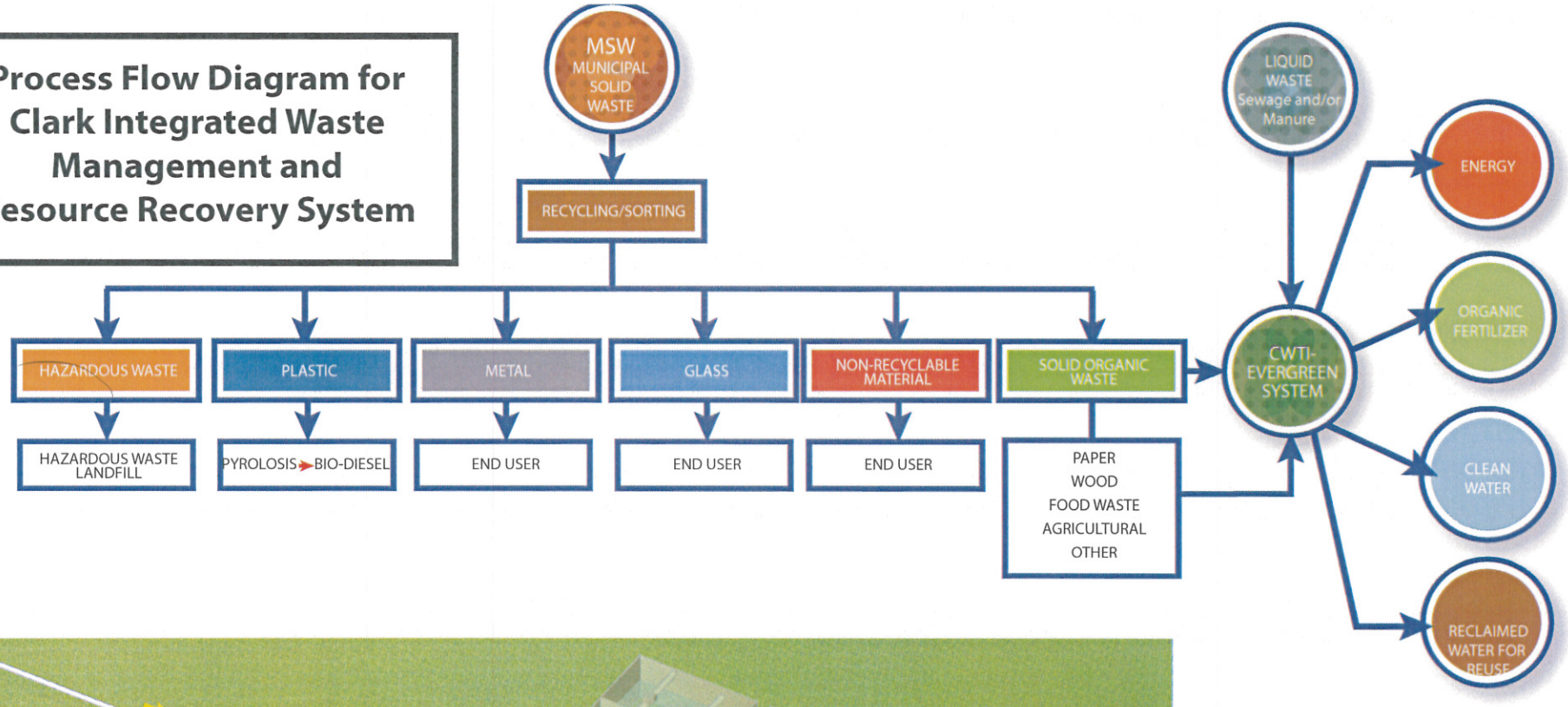
IV. TOTAL ENRTF REQUEST BUDGET $499,440 1 year

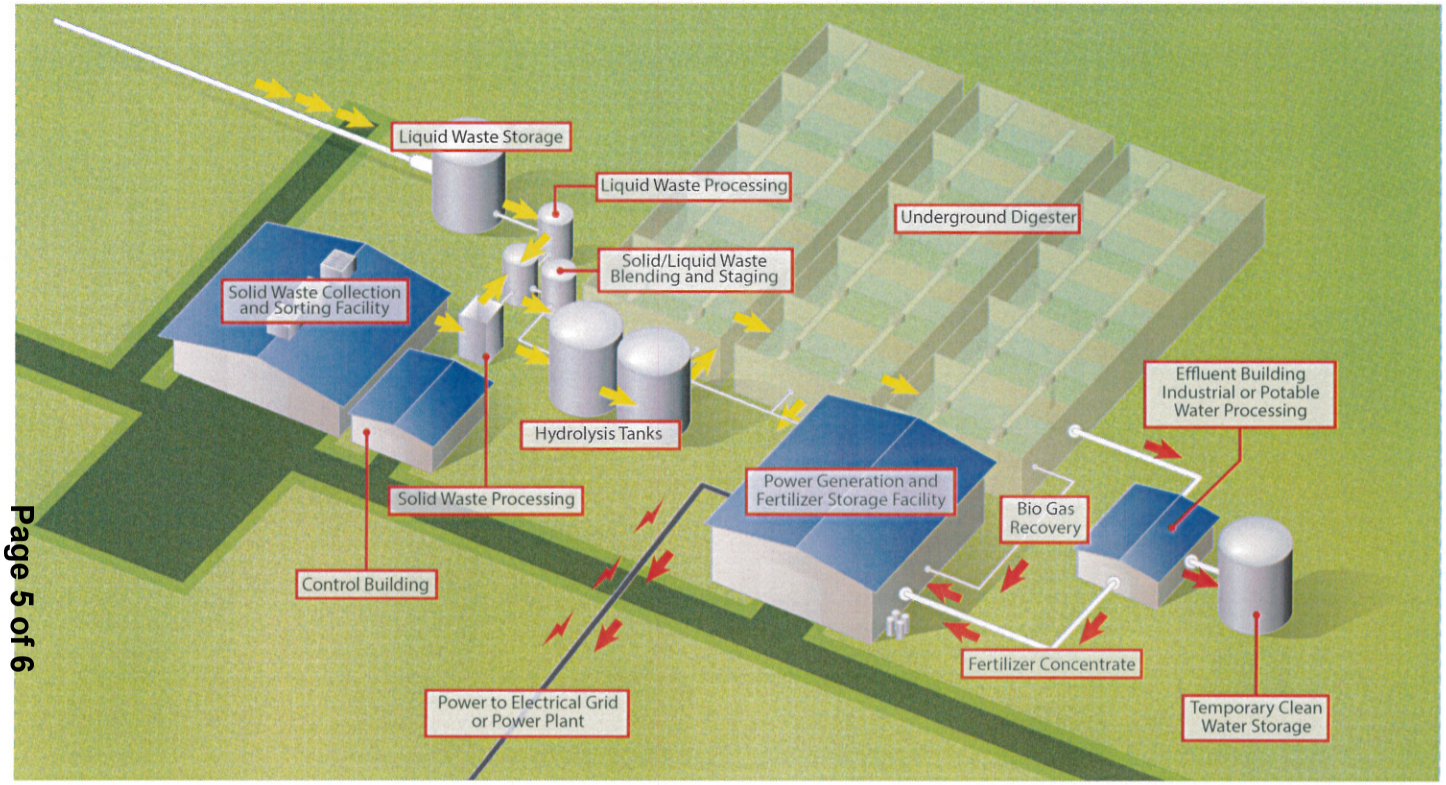
BUDGET ITEM *(See "Guidance on Allowable Expenses", p. 13)*	**AMOUNT**
Personnel:	$ -
Project manager, Clark Engineering Inc. (Clark): manage project outcomes, grant administration, coordinate project team, feedstock assessments, prepare final grant deliverables, 25% FTE. One-year position.	$ 113,760
Project engineer,Clark Engineering; feedstock characterization and analysis procedures, initial plant engineering. 57% FTE. One-year position	$ 214,600
Quality Control , Clark; evaluate testing results at pilot facility. 3% FTE. One-year position	$ 12,080
Administrative Assistant and Drafting Support - Typing, Graphics, Drawings, etc.	$ 20,000
Contracts:	
Subcontractor personnel to develop and resolve substrate/feedstock, energy usage and waste issues within high density urban environment.	$ 20,000
Air Permitting, determine air emission impacts 6% FTE. One-year position	$ 12,000
Evergreen Energy: technology supplier, develop material and energy mass balance for each feedstock, develop material and energy mass balance of post nutrient technologies.	$ 20,000
Evergreen Energy (Clearwater Technology) laboratory testing and large scale pilot testing. Also includes shipping of samples to third party analytical testing lab, 41 samples at a cost of $100 per sample.	$ 80,000
Travel: in-state travel for project staff. Mileage estimates based on a total of 9,000 (72 trips) miles at a rate of $.565 per mile to collect feedstock samples and bring to pilot facility for testing.	$ 5,000
Printing/material production: printing of final report (20 copies), printed engineering drawings and feasibility materials, printed materials of agronomic evaluation reports and documents (500 copies). Printing estimates based on past report production costs.	$ 2,000
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND $ REQUEST =	$ 499,440

V. OTHER FUNDS		
Other Non-State $ To Be Applied To Project During Project Period: *Indicate any additional non-state cash dollars secured or applied for to be spent on the project during the funding*	NA	
Other State $ To Be Applied To Project During Project Period:	NA	
In-kind Services To Be Applied To Project During Project Period:	**$50,000**	
Funding History:	NA	
Remaining $ From Current ENRTF Appropriation:	NA	

Process Flow Diagram for Clark Integrated Waste Management and Resource Recovery System

04/22/2014





PROJECT DIRECTOR BIO/LEAD GRANT ADMINISTRATOR

Kazem Oskoui, PhD is the Project Director and the Director of Resource Recovery and Renewable Energy at Clark Engineering Corporation (Clark). Dr Oskoui, a former professor at the University of Minnesota, and Edinburgh, Scotland, has over 30 years of research, engineering, design, and project management experience in environmental, resource recovery, wastewater, and innovative green technologies in wide range of applications in over 100 projects throughout the world. He successfully managed a LCCMR project in 2002 Commercial Fertilizer Plant for Livestock Solid Waste Processing (ACI, Inc.) that established a commercial grade fertilizer plant, processing and enhancing the waste of 1,800 dairy cows using micronization technology. Dr. Oskoui holds several US patents and has several publications in environmental clean-up projects.

Assisting Dr Oskoui, Grant Administrator will be Patricia Breher who has a BA in Accounting and is a Certified Design Accountant. She has worked as Controller for Clark for 20 years. In her position as Controller, she produces and analyzes monthly departmentalized financial reports, does compliance reporting for various State agencies, manages the Deltek Project-Based ERP computer software, and oversees the daily accounting functions of three staff members.

Robert Peplin, PE, BCEE is the lead process engineer for Clark for Activities 2 and 3. Mr. Peplin has over 25 years of experience in the analyses and designs of anaerobic digesters, as well as water and wastewater treatment for both municipal and industrial clients. His experience includes design development, process layouts, preparation of contract documents, and construction management.

Ron Sleight, PE, President of Evergreen Energy, Consulting Engineers to Clark, is the inventor of the bio-catalytic anaerobic digester technology and founder of Evergreen Energy. He has vast experience as a process engineer in the mining, manufacturing, industrial, and renewable energy sectors. Mr. Sleight is also the COO of Universal Energy solutions in The Netherlands.

Dr. Abi Assadi, PE, a former educator of Civil Engineering, University of Minnesota, is the CEO of Clark. He has published tens of papers in refereed journals and has served as principal investigator in many R&D projects. Dr. Assadi is also the CTO of Universal Energy Solutions, a renewable energy company in the Netherlands that utilizes Clark's Integrated Waste Management and Resource Recovery System in European Union. As an expert in in engineering and ISO 9001 QA/QC, he will serve as the lead Quality Control engineer throughout the project development.

Organization Description
Lead: Clark Engineering Corporation - Clark provides award-winning and innovative engineering, land surveying, resource recovery, conventional and renewable energy, water and wastewater treatment, and project management services throughout the world. Our commitments to ethical standards and quality solutions have earned our clients' respect for over 75 years. Clark is dedicated to "Making Visions a Reality," achieving this by listening carefully and working closely and collaboratively with clients to meet project goals while respecting environmental and social concerns. The engineering staff is registered in 47 United States and three Canadian Provinces. Clark provides professional services throughout the United States and internationally from their headquarters in Minneapolis, Minnesota and locations in Aberdeen, Sioux Falls, and Watertown, South Dakota, and consortium offices in Leeuwarden, The Netherlands; Dakar, Senegal; and Abu Dhabi, UAE.

Evergreen Energy, a subcontractor to Clark, provides one of the most robust anaerobic digestion systems in the world. The process has successfully converted organic waste streams to energy and clean water utilizing the CWTI Process (Hogen) ™ including municipal solid waste from Hennepin County. This Minnesota born technology is a patented anaerobic bio-catalytic digestion process that efficiently (close to 91%) converts organic waste of any kind into a spectrum of high margin (1) methane rich biogas, (2) NPK specific organic fertilizer and (3) clean, irrigation quality water. This AD technology stands alone from previous AD technologies since it significantly limits sulfur content in bio-solids and virtually removes hydrogen sulfide from gas production phase of system. Evergreen will serve as a sub-contractor to Clark for substrate analysis, process set up, process control, bench testing through its partner and inventor, Clear Water Technologies of Fridley, Minnesota, and large scale pilot testing.