# **4.61 Integrated Solutions for Sustainable Communities**

**Project Number & Title**

4.61 - Integrated Solutions for Sustainable Communities

**Project Lead and Deputy**

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**Project Period**

FY16-19 (October 1, 2015 – September 30, 2019)

**Project Summary**

ORD, EPA, and the National Academy of Sciences have recognized that setting goals of sustainable environment, sustainable society, and sustainable economy, and providing communities with the capacity to incrementally reach those goals, will significantly increase our ability to meet the challenges of the future. Since its inception, the SHC research program has focused research on understanding components of sustainability and decision-making and here seeks to bring this research together and provide guidance for communities that is sensitive to individual context, specific issues of interest, existing community capacities, and the drivers and system dynamics that challenge communities. This project seeks to support sustainable communities by conducting research that will: 1) provide clear guidance to decision-makers on selection of tools and best practices 2) improve, extend and functionally integrate tools and approaches for sustainability assessment and 3) demonstrate both the use of a suite of complementary tools and the effectiveness of a holistic approach in resolving complex issues to promote sustainability. The project is divided into three focus areas. Focus Area 1 - Sustainability Toolbox (CSAS) is developing approaches to deliver sustainability tools through the Community Sustainability Analysis System (CSAS). This focus area will work closely with the Office of Policy and the Regions to deliver tools to communities and will also provide a conduit for feedback to inform the development of future tools. Focus Area 2 - Sustainability Assessment & Management (SAM) Process for Communities; will develop integrated approaches that provide tools and information that a community can use to: assess decision alternatives in a holistic or systems context (economic, social, and environmental), evaluate the implications and tradeoffs across the components (sectors) of the system, and move towards more sustainable solutions. The research considers direct and indirect outcomes of decisions related to the sectors of land use, the natural and built environment, transportation, waste management, water, and the larger-scale sectors of air, water, climate, energy, and security. Focus Area 3 - Case Studies is targeting applications of systems approaches for sustainability through demonstration projects. The research will focus on applications to real-world problems where systems approaches are being or can be used, in order to evaluate the effectiveness of sustainability-oriented decision-making and management practices that integrate social, environmental and economic concerns. The demonstrations will utilize, test, and evaluate existing sustainability tools where appropriate and increase our understanding of key relationships that can inform sustainability assessments.

**Project Description**

Problem and Decision Context

Working towards a sustainable future is one of four cross-EPA strategies. Moving towards a sustainable future will require both regulatory and non-regulatory practices, tools and example approaches that will allow communities to weigh and ideally optimize among potential outcomes, and take actions to reduce our impact on land, air and water through use of materials, water and energy in a more sustainable manner, thus achieving improved human health and well-being in a manner that is equitable and proactive. Communities face a variety of challenges moving towards sustainability. For example:

* Many decisions communities routinely face seem simple, but actually have complex implications and unanticipated outcomes.
* Decision-makers at all scales face increasingly complex issues that require new approaches for decisions they routinely make.
* Communities have differing capacity to address complex problems such as sustainability

This project will attempt to assist communities’ efforts to move towards sustainability by developing, testing, and delivering a range of simple to complex tools to support decision making. Holistic approaches that consider all 3 dimensions of sustainability have the potential to identify cascading impacts and opportunities to leverage resources, however methods to clearly identify and communicate the net benefits of actions need work. For complex decisions (suites of interrelated problems) where solving an individual problem often causes or exacerbates another, we propose to develop and test integrated solutions (holistic or systems approach) that capture net benefits through a sustainability assessment process can move a community towards an optimized set of outcomes. These approaches will draw from the available tools inventory (from SHC 1.61) as well as require the development of specific tools and practices that present an overall process for sustainability assessment and management at multiple decision-making levels. The ultimate goal is to develop a unifying approach that integrates social, economic and environmental considerations and measures for decision-making.

Decisions facing communities often involve multiple stakeholders, interventions, and outcomes that exist across multiple spatial and temporal scales (local, regional and national). In this project, we will work to develop, apply and test the systems-based tools produced within SHC, across other EPA programs and other available tools that elucidate the tradeoffs inherent to decisions facing communities. Methods and approaches that incorporate the economic, environmental, and social dimensions of communities will be developed, applied and tested to determine whether these applications result in decisions that better support community sustainability. Connected research and approaches from all other research program areas will also be brought into this project research where appropriate. We realize this is an ambitious goal because in many cases there are data limitations and research gaps, lack of causal relationships between human actions and the three dimensions of sustainability (such as adequate stressor-response relationships for a broad range of ecosystem services), or gaps in perspective that prevent us from reaching this goal today. A key component of this work is developing a process to assist communities in framing their decisions and to connect decision-makers to specific tools and information needed for their particular decisions. This would mean that we need ways to stratify and organize tools and information by types of decisions, size of community, etc. Thus, for many decisions and many systems, there is a need to further develop the causal relationships between human actions and the three dimensions of sustainability and to continue to improve our understanding of key causal relationships. We may not currently have all the tools and indicators we need to carry out this work, for each sector, stressor or system, but this project will assemble and apply the current tools to address questions facing communities. Another key component is addressing where gaps exist in knowledge and understanding, especially where addressing those gaps has the potential to significantly benefit to communities making difficult and complex decisions. This research effort will attempt to preliminarily evaluate whether holistic systems-level approaches in real-world applications result in improved efficiencies, a reduction in unintended consequences, and desired improvements in social, economic and environmental dimensions of communities at local, regional and national scales, but recognizes that these responses may take many years to become evident.

Outputs

Output 4.61.1: Implications of Decisions in Land Use, Transportation, Buildings, Infrastructure, Waste, and Materials Management on Community-Level Sustainability. (FY15)

Output 4.61.2: Prototype of a web-based information portal (CSAS) to provide access to tools and information related to community sustainability (FY15)

Output 4.61.3 Sector-based guidance and improved decision tools (including sustainability assessment) for pursuing community sustainability through holistically-informed (i.e. using a systems approach) community decisions in land use, transportation, buildings and infrastructure, and waste and materials management. (FY18)

Output 4.61.4 Tools to inform regulatory and non-regulatory solutions to nitrogen pollution through the consideration of impacts/effects on ecosystem services. (FY18)

Output 4.61.5 Refine the Community Sustainability Analysis System (CSAS), web-based information portal, based on partner and community feedback and interests. (FY19)

Output 4.61.6 Interim and updated Guidance for Sustainability assessment approaches, for use to proactively inform community decisions and advance sustainability. (FY19)

Output 4.61.7 Achieving community sustainability: synthesis of findings from case studies. (FY19)

Focus Areas

This project is divided into three focus areas. Focus Area 1 Sustainability Toolbox (CSAS) is developing approaches to deliver sustainability tools where appropriate through the Community Sustainability Analysis System (CSAS). Focus area 2 Sustainability Assessment & Management (SAM) Process for Communities. This focus area builds from earlier sector-based analyses and is designed to provide communities with approaches to weigh the consequences of various decisions including those related to land use change, the built environment, green infrastructure, ecosystem services, water resources, and public health. Focus Area 3 consists of case studies intended to apply and test systems approaches for sustainability through demonstration projects. Each demonstration project utilizes a systems framework. The demonstrations utilize, test, and evaluate existing sustainability tools where appropriate and increase our understanding of key relationships that can inform the development and application of future sustainability assessments.

*Focus Area #1: Sustainability Toolbox (CSAS) -* This focus area is delivering tools and resources needed to inform sustainability approaches through a web-based portal, the Community Sustainability Analysis System (CSAS). Access to the tools and resources necessary to implement these approaches will be the focus of work in this area. As part of the Cross-Agency Communities Strategy, the Office of Research and Development (ORD) is partnering with Office of Policy (OP) and Region 1 to enhance EPA’s communities’ microsite (user-friendly, one-stop resource to serve local government officials and community members).  ORD is developing a question-based interactive tool (commonly referred to as a wizard, or “turbo-tax” tool), leveraging existing tools and efforts to identify the most pertinent information and tools based on background and needs provided by the end user. This effort will initially focus on (a) supporting community decisions related to green infrastructure (GI)/stormwater management/integrated planning; and (b) supporting community decisions focused on materials management.

The wizards would take the form of web-based question trees that guide local decision makers to our decision tools by asking pertinent questions about decision context such as: What size of community do you represent? What geographical area do you represent? What are the most compelling issues (in the 2 initial focus areas) are you seeking to address? With each subsequent question, the wizard/question tree would guide end users to appropriate information resources and decision support tools/modules. SHC is calling this “CSAS” – Community Sustainability Analysis System, which would initially be a portal including these 2 separate wizards. The CSAS will be a pilot approach to providing user-friendly access to multiple relevant information sources and tools to facilitate community decision-making. An important goal will be balancing front-end usability for EPA community stakeholders with the range of tools to address their needs. For the initial effort, existing tools in ORD/Office of Water (OW)/Office of Solid Waste and Emergency Response (OSWER)/Regions will be considered (e.g., Green Infrastructure Tools and Resources (GITAR), Stormwater Calculator, Municipal Solid Waste Decision Support Tool (MSW-DST), cross-Regional zero waste tool, Waste Reduction Model (WARM) as well as initial ORD/SHC efforts towards a searchable library of community-focused tools. CSAS will empower communities to find appropriate tools, from a select group of existing tools, and information to support decisions toward achieving sustainability, including goals associated with green infrastructure and materials management. This focus area will contribute to outputs 4.61.2 and 4.61.5.

The key products for this focus area will be:

* Identify and convene a workgroup, including key EPA partners and external stakeholders – intended CSAS end users – to prioritize materials and stormwater management issues, collectively consider available relevant tools for leveraging, and conceptually design the prototype. The stakeholders will be identified as willing, enthusiastic collaborators throughout the design process and case study demonstrations.
* Initial prototype of web-based wizard(s) to facilitate tool access by community leaders with understanding water management issues, information, and tools.
* Test and refine Prototype of the materials and water management web-based wizards, in full collaboration with stakeholders who are critical members of the team, to support pilot community decisions.
* External peer review and public release of the green infrastructure and materials management wizards.

*Focus Area #2: Sustainability Assessment & Management (SAM) Process for Communities -* This research will develop integrated approaches to allow communities to holistically evaluate decisions across multiple sectors. The research considers direct and indirect outcomes of decisions related to the sectors of land use, the natural and built environment, transportation, waste management, water, and the larger-scale sectors of air, climate, energy, and security. Sector based synthesis papers (land use, buildings and infrastructure, materials management and waste, and transportation) delivered in 2014 will be the initial foundation for developing a systems approach to interpret the implications of decisions across those sectors through the lens of sustainability. Approaches will range from simple conceptual integration and synthesis to more complex systems dynamic models. We define Sustainability Assessment and Management (SAM) as an approach that provides tools and information that a community can use to assess decision alternatives in a systems context (economic, social, environmental), evaluate the implications and tradeoffs across the components (sectors) of the system, and move towards more sustainable solutions.

Other efforts across the SHC program will also inform the development of sustainability assessment approaches. This research will be closely coordinated with future efforts in the Office of Policy and initiatives in the Regions, as well as other SHC projects/products. For example, from other SHC Projects: 1.61: e.g., Guidance to support the design of software applications and decision processes for different types of communities (Initial version FY16); A searchable library of available decision support tools (FY-18); 2.61: e.g., Ecosystem goods and services production and benefit functions case studies report (FY16); Incremental report on the impacts of human actions and environmental forces (particularly climate change), on the production and supply of final ecosystem goods and services (FEGS) and the effects on human health and wellbeing(FY17); 2.62: e.g., Demonstrations of Applying Tools, Methods, and Community Engagement to Mitigate Environmental Health Impacts In At-Risk Communities; and Synthesis of Best Practices Learned from Community Participatory Studies that Address Environmental Health Concerns within Communities; 2.63: e.g., Development of a systems level approach to understanding children’s environmental exposures, health and environmental diseases, FY16; Translational research to incorporate data and information on children’s environmental health (CEH) into tools to inform community actions, FY19; Research to inform Tribal sustainability, FY19.

Informed by products coming from the above outputs, feedback from partners and users of the CSAS and its content, and augmented as necessary by targeted literature reviews (including total cost accounting and trade off analyses), ORD will also seek to determine which approaches are most valuable and appropriate for the Regions and Program offices to use as they assist communities in meeting regulatory and voluntary compliance. This will include: evaluating where the approaches have been used and what was learned from those applications; trying to determine what the barriers to adoption of these approaches might be; determining what adaptive management strategies are effective in a systems and sustainability rubric, as well as, identifying the key future research needs. This focus area will contribute to outputs 4.61.1, 4.61.3, and 4.61.6.

The key products for this focus area will be:

* Synthesis of decision sector analyses.
* Sector-based guidance and improved decision tools for pursuing community sustainability through holistically-informed (i.e. using a systems approach) community decisions in land use, transportation, buildings and infrastructure, and waste and materials management.
* Interim and updated Guidance for Sustainability assessment approaches, for use to proactively inform community decisions and advance sustainability.
* A transferrable, scalable, transdisciplinary methodology to estimate net risk/benefits (i.e. sustainability assessment) using multi-sector approaches.
* Application of structured decision making approach (Decision Analysis for a Sustainable, Environment, Economy, and Society (DASEES)) to community decisions

*Focus Area #3: Case Studies -* This focus area is targeting applications of systems approaches for sustainability through demonstration projects. This research will focus on applications to real-world problems where systems approaches are being or can be used, in order to evaluate the effectiveness of sustainability-oriented decision-making and management practices that integrate social, environmental and economic concerns. The demonstrations will utilize, test, and evaluate existing sustainability tools where appropriate and increase our understanding of key relationships that can inform sustainability assessments. These case studies will be selected based on their potential to provide information needed by stakeholders and decision makers to make informed decisions and choices related to their communities, as well as providing information and insights that would be scalable and transferable to other places. Some case studies are ongoing in SHC from FY12-15 Research Action Plans (RAPs), but we will also be identifying new case studies in FY15 to be part of this new RAP. The following initial criteria will be used to aid in the identification of demonstration case examples:

* Provides opportunity for coordination with other national programs (e.g., OW, OSWER, Office of Transportation and Air Quality (OTAQ) or Office of Air Quality Planning and Standards (OAQPS) programs) to focus on community needs or developing approaches to sustainability
* Provides an opportunity to look at impacts and outcomes across the 3 dimensions of sustainability using a systems approach
* Provides an opportunity to look across multiple decision sectors (for synergies, improved efficiencies, co-benefits etc.)
* Utilizes multiple SHC (and other) tools and approaches, thus allowing refinement and evaluation (a sustainability analysis approach might use a suite of tools from various sources)
* Builds on prior work from within SHC, within ORD, Program Offices, Regions and outside of the agency where approaches require assessment (e.g. NOAA and EPA-OTAQ work on ports, State and local integrative floodplain management, nitrogen management tools
* Addresses the interests of communities and other key partners (EPA Regions) outside of ORD
* Informs decision making in other locations (transferable) and broader geographic areas (scalable)
* Does not duplicate work being done in other parts of SHC and other programs.

Summary and analysis of the case study assessments will also help to inform future directions of the Program. Completion of this project will allow identification of applications where systems approaches to decision-making provide insight to complex indirect relationships, avoidance of unintended consequences, identification and estimation of co-benefits, and analysis of trade-offs, thus demonstrating how systems-based approaches can inform outcomes that support sustainability. This focus area will contribute to outputs 4.61.4 and 4.61.7.

1. *Integrated Nitrogen Management* - The excess release of nitrogen to the environment is a significant and pervasive cause of degradation of air and water quality across the nation that affects human health, as well as economic and environmental conditions. The implications of nitrogen pollution and nitrogen management will be holistically evaluated through application and testing of systems based tools. The research that addresses issues of concern related to nitrogen will build on the portfolio of nitrogen research inside and outside of the SHC Program and the Agency including research on ecosystem goods and services (SHC 2.61), SHC Project 1.62 EnviroAtlas, Air Climate and Energy (ACE) MDST-3, SSWR 2.3 and the Nitrogen and Co-Pollutant Road Map, to provide and/or apply relevant decision making approaches to address a range of environmental decision making. The basic goal is to provide stakeholders a way to determine which interventions to nitrogen sources and inputs will meet their goals, including social, environmental and economic endpoints. The research will recognize that multiple source sectors (land-use, energy, transportation, infrastructure, materials management) at a variety of scales contribute to the nitrogen cascade and multiple sectors respond to the effects of nitrogen on human well-being and ecosystem services. The research also recognizes that nitrogen interacts with other co-pollutants and will provide a basis to more fully capture the positive benefits of nitrogen use while limiting the negative impacts on human health, well-being and ecosystems. This focal area uses data from across EPA program offices and research programs using a variety of models and inventory data sources, and also many other data and models generated by USDA, USGS and other organizations. Research outputs will include tools, model sets, maps, databases, case studies and what-if scenarios that support consideration of the total resource impacts on air, land and water media and outcomes through the systems framework suggested by the nitrogen cascade and consider associated co-pollutants, climate change, and socio-economic factors related to the tradeoffs inherent to environmental decision making at local, regional and national scales. Partners: OW-IO, OW-OST, OW-OWOW, OAR-OAQPS, OAR-OAP, Regions, Hypoxia Task Force, Chesapeake Bay Program, Numerous local partners in community target areas (coastal watersheds with N TMDLs in Connecticut and Rhode Island, Nitrate GWMAs in Washington and Oregon).

Some key products include:

* State of the science frameworks, tools, approaches and data to evaluate the implications of nitrogen pollution and nitrogen management options (regulatory and non-regulatory) holistically, within the context of changing climate, food production demands, and demography.
* Updated information on dose-response relationships, in particular effects of N on ecosystem services.
* Publically accessible data and information on historic, current, and future projected N sources, loading and trends by origin and/or sector available to decision makers and planners.
* Integrated total resource analyses accounting for the costs and benefits of nitrogen for a range of human health and ecosystem endpoints.
* Multi-endpoint scenarios of nitrogen futures, addressing tradeoffs and unintended consequences and incorporating interactions with climate change effects, to show communities what will be gained and lost under different management and policy actions.
* Cutting edge tools and approaches that can be used by local, regional, or national decision makers and planners to facilitate holistic, sustainable nitrogen management.
* Approaches, methods, and actions to manage nitrogen and build coastal resiliency to climate change are identified.
* Performance metrics (provision of specific ecosystem services - for example water quality maintenance and flood abatement) and targets of success are agreed upon at stakeholder meetings.
* Monitoring of nitrogen management and climate adaptation actions with appropriate tools.
1. *Sustainable Ports* - In real-world situations, communities make decisions that have their origins in one sector or another, but whose outcomes occur either as a cascade of impacts through multiple sectors or can be optimized by coordinating actions arising from different sectors. Such multi-sector interactions are especially important for emergent outcomes, such as community health, resilience, and sustainability. The tools that currently exist to support sector-specific decisions are seldom designed to take into account these interactions or the emergent outcomes, even as the impetus to do so increases. The purpose of the present demonstration project, then, is to consider how existing tools and those currently under development by SHC can, when used in combination and in concert, account for the interactions among sectors to translate sector-specific decision to emergent outcomes.This Ports demonstration presents an excellent opportunity to integrate aspects of existing and planned SHC products - such as C-FERST (Community Focused Exposure and Risk Screening Tool), C-PORT (Community-Port assessment model) and the EnviroAtlas – and can be used to analyze cumulative risk, exposed populations, and the extent to which ecosystems services, or their absence, affects mitigation of stressors and/or access to services that promote well-being in response to actions ranging from sector-specific (i.e. transportation systems) to more general (e.g. globalization, climate change). The principal interacting sectors include materials safety and contaminated sites (Waste, Energy, Homeland Security), buildings and infrastructure, and water resources. Each of the needed assessment tool products listed above already includes some port communities among their applications; this effort would look to increase their co-location as a basis for integration. HIA is an important tool for ports communities, and the availability of source emissions and air quality data and models will be a strong input to HIAs for the planned US port expansions anticipated as a result of the Panama Canal expansion. The consideration of multi-modal freight transportation (marine, truck, train), brownfields, contaminated sites, and other sectors of the built environment (e.g. housing, water infrastructure, etc.) will draw heavily on work in other SHC project areas as well.

Also in SHC, two Regional Sustainable Environmental Science (RESES) grants have been awarded investigating sustainable port development and assessment. One grant will expand the use and applicability of the C-PORT model to a web resource capable of assessing multiple port locations. The other RESES grant will provide inland port communities with a review of models and tools that can be used to understand and improve their options for resiliency in the face of extreme weather events, anticipated to increase with climate change concerns. This effort will review existing tools and models for assessing alternative freight transport options from an environmental, social and economic perspective, and provide recommendations for future model development and research needs. Research conducted in ACE on truck, rail, and marine emissions and impacts will also provide input to the systems-based tools developed or refined through SHC’s ports focus area. This ports-related research will also aid partners within EPA (e.g. OTAQ, Regions) and external agencies (e.g. NOAA, Army Corps of Engineers (USACE)) in the development of best management practices for sustainable ports. Partners: OTAQ, Communities in the RESES project, regional offices, NOAA, USACE.

Some key products include:

* Approach that incorporates social, economic and environmental dimensions of sustainability for inland and seaports.
* Tools and resources for scenario planning and sustainable best practice identification for ports development and resiliency planning, using SHC and external resources (e.g. OTAQ, NOAA Port Resilience Tool, Geospatial Intermodal Freight Transportation (GIFT) model, C-PORT, EnviroAtlas, MARKAL (an acronym for MARKal ALlocation)).
* Expansion of C-PORT development for air quality impacts (current SHC task 4.1.3.2) from multi-modal freight transport.
* Development and evaluation of best practices to provide guides and resources for ports including the evaluation and expansion of resources developed under SHC, ACE, and SSWR research programs.
* Methods and tools to compare and improve multi-modal transportation system planning and options to promote sustainability and efficiency at the port and surrounding communities.

*Sustainable Community Water Management* - Water management issues (storm water, wastewater, water quality and water quantity) intersect with other sectors (transportation, land use, buildings and infrastructure, materials and waste management, energy, agriculture, public health) of concern for communities. Communities need to consider water management within a systems context that allows for connections between these sectors. For instance decisions about storm water have implications for land use, green and gray infrastructure, transportation, waste management, economics, public health, water quality and adaptation to climate change to name a few. This project would be an integrative effort explicitly linked with the watershed sustainability research effort in the Safe and Sustainable Water Research Program (SSWR). This research will use a systems approach (ranging from simple conceptual models to more complex systems dynamics models) to address all three dimensions of sustainability, considering aspects of the land-use, energy, waste, and materials sectors as they intersect with watersheds, water quality, water quantity, and communities. This research will also will consider explicitly the linkages between social science, human health and well-being and environmental outcomes. Systems approaches (e.g., VenSim/3VS, Hygeia, or DPSIR (a causal framework for describing the interactions between society and the environment)/structured decision making) will frame this research. Their application will draw from other portions of SHC (particularly 2.61), as well as from complementary efforts in SSWR, ACE, and the 3VS demonstrations occurring across the country. Emphasis will be given to partnering within EPA (e.g., with SSWR, OW, OSWER, Regions), with other governmental agencies, with private sector groups, and of course, with the community itself.

A number of potential locations are currently under consideration. The key selection criteria, in addition to those listed above, would include: active EPA partner engagement (PO and Region); community engagement; opportunity for cross ORD coordination; opportunity for ORD research to influence/inform decision making; transferability of research to other communities. Cape Cod, MA is one potential candidate for a demonstration in that this region faces acute challenges in sustainably managing its water resources, has established community groups who are engaged in seeking sustainable outcomes, has concerns about environmental equity (who pays, who benefits), has an interest in partnering in a demonstration, has a strong advocate in the form of EPA Region 1 and has multiple small watersheds that may represent quasi replicates for experimental evaluation and model testing at community and regional scales.. The Puget Sound’s Snohomish Basin is another viable candidate for a demonstration, where sustainable watershed management solutions are needed to protect Puget Sound, and tribal fish and shellfish beds, in particular.  In addition, climate change is of great concern in the area because it is predicted to have a great effect on the hydrology and fisheries of the region and associated commercial and recreational activities.  Other communities, such as Phoenix, AZ, Lower Yakima River Basin, WA, and Austin, TX, might also be logical candidates. The efforts will coordinate with other demonstrations and Net Zero efforts to populate SHC’s developing sustainability assessment approaches for water, waste, energy, and materials management strategies. Water infrastructure sustainability research would review and utilize outputs from ORD/STAR on health effect-water infrastructure links, ORD/NRMRL and OW water infrastructure research and decision support tools (e.g. [www.epa.gov/awi](http://www.epa.gov/awi) and <http://water.epa.gov/infrastructure/sustain/>), ORD human health and ecological research, and tool testing and application will be critical for the sustainability conceptual framework. Modules and information from existing tools such as DASEES, C-FERST, EnviroAtlas, Stormwater Calculator, the Regional zero waste tool will be demonstrated as appropriate. Additionally this research will also coordinate closely with the Safe and Sustainable Water Research Program, SSWR 3.1 (green infrastructure (GI) tools and modeling approaches) and SSWR 3.2.1 Informing GI implementation through community pilots. This work addresses outputs 4.62.2 and 4.62.3. Partners: Relevant program offices, regions and local communities.

Some key products include:

* Summary of outcomes from the sustainable watershed focal areas, emphasizing how the 3 dimensions of sustainability were incorporated into community decisions and illustrating outcomes.
* Sustainability assessment of differing suites of interventions with opportunities to test model results.
* Improved systems approaches through improved understanding of key relationships.
* Guidance to communities for sustainable decisions that balance, social equity, land use, public health, waste management, transportation, energy use, water management, innovation and climate change adaptation.

**Nature of the Work**

This research will draw on intramural FTE and funding as well as extramural resources. Extramural resources will be used to support students and post-docs, and where necessary and appropriate, contracts, cooperative agreements and interagency agreements that lead us to the outputs. Community outreach and engagement will be a critical component of this work in the demonstration areas. The precise nature of the work will be more defined during the next phase of developing the project management plan. Additionally, the Regional Sustainable Environmental Science (RESES), a competitive program that promotes Regional and ORD collaboration and engagement on key sustainability science needs will be part of this project.

**Collaboration**

Our partners made it clear, during their review of the draft charters, that it is essential that they be engaged up front in the development of these projects to ensure that the results of this research could be applied to the problems being addressed by our partners. The subsequent project plans will need to engage key partners and collaborators. Specific collaborators will depend upon the focal area development. Also, there is the intention that this project serve in a synthesis role for SHC. So, there are a number of internal collaborators from SHC that would interact with and provide input to this project and the outputs (e.g. tools developed in decision support (1.61), data from the EnviroAtlas (1.62), the FEGS information (2.61), possible example case studies (2.61), health tools (2.62 and 2.63), indicators and indices of community sustainability (2.64), information about contaminated sites, waste and fuels (3.61, 3.62 and 3.63) and the approaches developed and integrated from the entire program (4.61).

For the case studies, stakeholders will include the community members of each of the case studies assessed; Regional partners; Program Office partners; other ORD research programs, SHC Program managers who can adjust future directions based on the findings of the assessment; and other sustainability researchers in government and academia. For example, Output 4.61.4 will draw on findings from a variety of sources (e.g. Air Climate and Energy (ACE), Human Health Risk Assessment (HHRA), SSWR nutrient research, OW, OAR, Regions, communities, local governments, POs, other federal and state agencies (e.g., USGS, USDA, state environment and health departments, watershed councils, soil and water conservation districts), NGOs, and academia). Specific stakeholders and collaborators will depend on the exact nature of the task (for example, the “Ports” component would target port communities) and are, in large part, addressed in the example task descriptions above. OTAQ is a primary a partner in the Ports work, and has a good handle on the relevant stakeholder group at a variety of decision scales. Generally speaking, the primary stakeholders are community leaders such as state & local governments, watershed councils, soil and water conservation districts, USDA NRCS, utilities, city planners, developers. Other interested parties and potential cooperators include program and regional EPA offices, other federal agencies, NGOs, and academia.

7. Project Charter Team Members

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| --- | --- | --- |
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