Exhibit E - Soundness of Approach

State of Iowa

Iowa_PhaseII_SoundnessOfApproach.pdf

Soundness of Approach

a. Soundness of Approach Description

As a hybrid proposal (with both programs and projects), this section is organized as follows: 1) two programmatic descriptions—the activities in the upper watersheds and community resilience programming; 2) programmatic assessment approach; and 3) project descriptions.

Program 1: The Iowa Watershed Approach

The Iowa Watershed Approach (IWA) will improve environmental and societal resilience and reduce downstream risk from major storm events through environmentally- and scientifically-sound projects in the upper watershed to increase infiltration and retain water. By addressing water-quantity and -quality issues upstream through cost-effective best practices, the IWA will realize environmental, social, and economic benefits at the project sites and downstream, including flood risk reduction for downstream housing and infrastructure projects. The IWA requires strong community support and dedicated stakeholders and landowners, because 99% of Iowa's land is privately owned. This program will help Iowa move toward its statewide goal of 30% reduction in streamflow and 45% surface-water nutrient load reduction. Specific goals are listed with each project description. *In five years, Iowa will have a well-refined, replicable program, and all participating watersheds will have a long-term vision. Communities, infrastructure, and housing will be less vulnerable and more resilient to future storm events.*

Collaborators/Feasibility: Iowa has a rich field of partners and collaborators across the state with expertise in agriculture, land management and best management practices, soil science, water quality, sustainability, education and engagement, river hydraulics, climatology, program/project design and evaluation, and assessment. In addition to the IWA management organizations, project implementation will include the following in most watersheds (see also

Phase I, Capacity): *Iowa State University* (Iowa Water Center, Extension and Outreach, and Iowa Nutrient Research Center) and *University of Northern Iowa* (Tallgrass Prairie Center) for technical support, collection and analyses of data, development and distribution of educational materials, and other support; *Iowa Department of Natural Resources (IDNR)* for technical support, capacity-building, and project design, outreach, and leadership on WMA formation; *Iowa Department of Agriculture and Land Stewardship (IDALS)* and *National Resources Conservation Service (USDA-NRCS)* for technical support, capacity-building, project design, and outreach; *County Soil and Water Conservation Districts* for technical support and outreach; and *The Nature Conservancy*, *Iowa Natural Heritage Foundation*, *Iowa Soybean Association*, *Iowa Farm Bureau*, *Iowa Agricultural Water Alliance*, local *Resource Conservation & Development* offices, *Iowa Department of Transportation*, *Iowa Association of Counties*, and *Silver Jackets Flood Risk Management Team* for technical support and guidance to the WMAs. The University of Iowa Center for Evaluation and Assessment (CEA) will conduct a comprehensive formative and summative evaluation of the IWA for program improvement and to document outcomes (see page 18). CEA provides third-party evaluation, assessment, and other services. Since 1992, CEA has successfully completed more than 150 evaluations for many clients and sponsors, including FIPSE, NSF, NIH, NIMH, the U.S. Department of Education, and others.

Program 1 includes eight specific programmatic components:

1. Watershed Selection: Six HUC 8 and two HUC 10 watersheds will participate in the IWA based on: 1) the location and extent of their MID-URN and LMI areas; 2) stakeholder commitment/engagement (see Attachment D and project details); 3) representation of Iowa's landforms (Attachment E, Map 5); and 4) other factors, such as watersheds prioritized by the Iowa Nutrient Reduction Strategy. Individual project descriptions include additional details for each watershed.

2. Formation of a Watershed Management Authority (WMA): Two or more eligible political subdivisions within a watershed can form a WMA through a Chapter 28E Agreement. WMA activities include: assessment and reduction of flood risk; assessment and improvement of water quality; flood risk planning and activities; educational activities; and allocation of funds for water quality and flood mitigation. The IDNR will guide WMA formation in each watershed.

The WMAs are the nucleus of the IWA. They comprise stakeholders from throughout the watershed, offering a range of perspectives and experience to achieve common goals. WMAs will be responsible for their site and project selections. A WMA coordinator will be hired for each watershed to manage activities, schedule events, facilitate communication, and assist with engagement, resilience, and assessment activities (see Program 2). One county will serve as the subrecipient from IEDA on behalf of each WMA. That county will use a qualified grant administrator to subaward funds and monitor programs. The CEA will document flood risk planning activities and monitor WMA activities. It will also collaborate with WMA coordinators to observe events and activities and collect survey data from stakeholders.

3. Producer Engagement, Outreach, and Planning: Producer engagement is incorporated program-wide. Activities related to engineered projects will include, for example, public engagement events, site tours/field days, and public presentations at municipal and county meetings. A statewide *WMA Advisory Board* will be formed with at least one advisor from each WMA and representative(s) from Dubuque Bee Branch Creek. Collaborators will represent a wide range of expertise. The board will: review progress; strategize common challenges; make implementation recommendations; discuss long-term solutions for statewide flood peak reduction and water-quality improvements; and share resilience programming strategies and successes. The board will initially meet quarterly. An annual public symposium will share information and build support.

Three Iowa State University (ISU) units and their partners will develop and deliver programming to WMA stakeholders and producers in the target watersheds. *ISU Extension and Outreach* will deliver research-based information on practice effectiveness in target areas. Communication efforts will include fact sheets, broadcast interviews, videos, and interactive webinars. Farmer champions will facilitate farmer-to-farmer learning. Content creators will also draw upon the latest information from ISU's Climate Science Program. At *ISU's Iowa Learning Farm* (a partnership among ISU, IDALS, IDNR, and USDA-NRCS), farmers, schoolchildren, and others will learn about issues in each watershed. ISU will also develop a Watershed Academy to build capacity among the WMA coordinators to improve the effectiveness and repeatability of successful practices. *Iowa Nutrient Research Center* (see Phase II, Long-term Commitment) faculty will evaluate the effectiveness of stacking practices to reduce nutrient loss to surface water in the watersheds. ISU Extension and Outreach will distribute educational materials on these practices to producers in the target watersheds.

The University of Northern Iowa's (UNI) Tallgrass Prairie Center has more than 25 years of experience in the beneficial use of native perennial vegetation. UNI will provide multiple layers of assistance to producers on the establishment and management of native vegetation across a range of agricultural practices. They will share scientifically-based information through workshops, print and online technical guides and videos, an online seed mix calculator, and consultation. Demonstration sites for teaching and learning will be the cornerstone of the effort. Simple, small-scale experiments and side-by-side contrasting practices will communicate basic principles that can be readily applied in many contexts and locations. Statewide partners include the Iowa State STRIPS Project, the Association for Integrated Roadside Management, Iowa Native Plant Society, NRCS, INRC, and the Leopold Center for Sustainable Agriculture.

The CEA will monitor a sample of events in each watershed, as well as collaborator interactions and multimedia delivery of research-based material to producers and stakeholders.

4. Watershed Monitoring: IFC researchers will deploy stream-stage sensors and water-quality sensors in each target watershed. The sensors transmit data to the IFC at set intervals (generally every 10–15 minutes), which are automatically posted to a publically-available online visualization platform (see Program 2). Sensors will collect data for the duration of the program and beyond. Researchers will deploy additional sensors following selection of HUC 12 project sites to monitor results from individual or stacked practices. A hydrologic network with rain gauges, soil moisture and temperature probes, and shallow wells will also be deployed.

5. Hydrologic Assessment: A hydrologic assessment of each watershed is necessary to understand the hydrology, assess flood and water-quality risks, and evaluate scenarios to maximize results. The selected watersheds represent Iowa's varied topography, soils, and land use. The data- and simulation-driven assessments include a review of the water cycle across each watershed and require a large amount of data from collaborators. The IFC will develop HEC-HMS hydrologic models for each basin and run simulations for each watershed. The draft hydrologic assessment will be presented to stakeholders for final public input, and its online availability will be widely promoted. *The IFC will retain the original data and models* so *each plan can be updated to reflect land use and precipitation changes, new floodplain maps, etc.*

6. Watershed Plan: The watershed plan includes an analysis of hypothetical scenarios to reduce downstream flow and improve water quality. It will incorporate stakeholder input and serve as a guide for the selection of sub-watersheds (HUC 12s) and project sites. The number of projects needed to reach water-quantity and -quality goals for each HUC 8 or HUC 10 is beyond the scope of this proposal. Instead, *each plan will be a vision for the future of that watershed*. The WMAs will use the plans to develop priorities, to support future funding requests to other

sponsors, and to monitor progress. *Data and models will be retained so the plan can be adjusted in the future to accommodate changes in key parameters, such as shifting precipitation patterns*.

7. Selection of Construction Projects and Project Design: WMAs will select several HUC 12s in each project watershed for implementation of projects. The location, type, and number of projects in each watershed will be based on the hydrological assessment, watershed plan, stakeholder input, and maximization of peak flow reductions and water-quality improvements in the MID-URN areas. *Each WMA will select the sub-watershed and site locations for project construction based on at least these very specific criteria*: 1) to maximize impact on MID-URN areas; 2) to maximize impact on vulnerable populations; 3) to collaborate with stakeholders/landowners willing to commit to a 25% cost share and a long-term (20-year) maintenance agreement; and 4) to work with landowners committed to other sustainable land use practices and BMPs to further the project goals. A local agency, NGO, or engineering firm will complete project designs. Multiple entities in Iowa have experience designing watershed projects to accepted standards.

Each WMA's lead county will hire a grant administrator (e.g., Council of Government) to oversee the distribution of CDBG funds for project design and construction. The administrator will ensure CDBG program compliance, including clearance on environmental, cultural, and Section 106 reviews; public involvement; Davis-Bacon labor standards compliance; and procurement of services, advertisement, and administration of public bid letting. The administrator will also ensure financial records are maintained and work closely with IEDA to meet all HUD regulations. When ground disturbance is expected, the administrator will be responsible for delineating the Area of Potential Effects and using sufficient methods to identify potential cultural resources, including archaeological sites. He or she will present findings to the State Historic Preservation Office (SHPO) for review and comment.

CEA will monitor collaborations among stakeholders in selecting construction projects and will survey stakeholders/landowners on their commitment to sustainable land-use practices.

8. Construction: IEDA and IFC staff, local agencies, WMA coordinators, and grant administrators will work closely with stakeholders and producers in each watershed through the contractor selection and project construction phase. Many local contractors have experience implementing and constructing these practices. HUD funds will cover 75% of the project cost; landowners will contribute the remaining 25%. Based on IFC and partner experience, there will be no shortage of interested landowners.

The practices available to the WMAs and producers (listed below) are not all equally suitable for all regions in Iowa; a hypothetical suite of projects is listed with each watershed project. A conservative lifespan of 20 years is assumed for each structure/project. Most of the noted benefits are based on data from the Iowa Nutrient Reduction Strategy (WQ = water quality improvement; SF = streamflow reduction). Benefits may vary based on size and landform.

- *Wetland Construction* slows down and filters precipitation runoff, allowing sediment and nutrients to settle out before reaching lakes, rivers, streams, and aquifers. This lowers downstream flood peaks, reduces erosion, and improves water quality. Wetlands may be restored through a variety of techniques (excavation, surface drain removal, low embankments, etc.) to restore the original hydrology. Wetland construction will be based on NRCS standards (NRCS Code 657). (WQ = 52–70%; SF = 10–20%)
- *Farm Ponds* effectively collect and hold surface flow, allow particles (soil) to settle, and remove nutrients. They are generally 0.25–20 acres and may be embankment ponds (a dammed stream) or excavation (digging out the pond or the surrounding area to form levees). Pond construction will be based on NRCS construction standards (NRCS Code 378). (Benefits are size-dependent: WQ = 30–70%; SF = 10–30%)

- *Storm Water Detention Basins* capture and detain water during a precipitation event, lessening downstream flooding. They remain dry between flood events. A storm water detention basin's construction is based on expected 10- or 20-year precipitation events for the area. (WQ = 20%; SF = 30%)
- *Terraces* are earthen embankments or combination ridges and channels constructed across a hillslope to reduce erosion, trap soil, and retain runoff to enhance infiltration. The number of acres terraced will vary. Construction will be based on accepted NRCS construction standards (NRCS Code 600). (WQ = 77%; SF = 5%)
- *Sediment Detention Basins* capture and detain sediment-laden runoff long enough for the sediment to settle out. Building techniques and benefits are similar to ponds. Unlike ponds, they are dry between precipitation events. Basin construction will be based on NRCS construction standards (NRCS Code 350). (WQ = 85%; SF = 5%)
- *Floodplain Restoration* restores flood-prone land to its original function—storing flood waters. Floodplain restoration restores, protects, maintains, and enhances the function of floodplains, while conserving natural values such as fish and wildlife habitat, water quality, flood water retention, and groundwater recharge. It typically involves removal of levees and ceasing agricultural practices in portions of the floodplain. (WQ = 85%; SF = 20%)
- *Channel Bank Stabilization* (Nishnabotna River System) involves reshaping the streambank up to 1,500 feet in length to a 2:1 slope and armoring the lower half of the banks with clean, rounded, well-graded riprap or other material. If the site has too much curve, bendway weirs help redirect the river current away from the banks. The upper half of the streambank is seeded to establish permanent vegetative cover. (WQ = 80%; SF = 5%)
- *Buffer Strips* are small strips of land with permanent vegetation (trees, shrubs, or other plants) used as environmental barriers between crop fields and other land usage. Buffers

help reduce runoff, sediment delivery, and downstream flooding; improve wildlife habitat and water quality; and contribute to productivity. (WQ = 91%; SF = 10%)

- *Saturated Buffers* direct field tile drainage into a buffer as shallow groundwater flow. As the water flows through the buffer, denitrification and uptake by the perennial plants in the buffer remove nitrate, preventing it from entering surface waters. (WQ = 50%; SF = 5%)
- *Perennial Cover* decreases soil erosion, increases biological carbon sequestration, provides wildlife and pollinator habitat, and improves water quality. (WQ = 75%; SF = 40%)
- *Oxbow Restoration* rebuilds disconnected oxbow ponds in the floodplain. Oxbows provide floodwater storage, nutrient processing, and shallow water habitat for wildlife. (WQ = 56% (N) ; SF = N/A)
- *Bioreactor*s are carbon-containing structures that intercept subsurface drains (tiles) or groundwater and improve water quality by reducing the concentration of nitrate-nitrogen. Construction will be based on NRCS standards (NRCS Code 747). (WQ = 43%; SF = 5%)
- *Prairie STRIPS* are the strategic integration of small strips of prairie in crop fields in the form of in-field contour buffer strips and edge-of-field filter strips, which can yield disproportionate benefits for soil, water, and biodiversity. (WQ = 66-90%; SF = 37%)

The CEA will monitor stakeholder involvement in project planning and execution. The CEA will also conduct surveys of downstream residents to assess their knowledge of and attitudes about improved quality of life, such as their perceptions of increased recreational opportunities and improvement of drinking water. Stakeholders will be asked to identify what has changed for them in a way that allows them to report information the team may or may not have anticipated.

Programmatic Options: Water quantity and quality are inextricably linked; during most flood events in Iowa, the water contains elevated nutrient loads. Thus, floods pose both a physical and health hazard at a time when people and the environment are most vulnerable. The timing of this

program is critical, as Iowa is experiencing a trend toward increased heavy precipitation events (see Phase II, Need/ Extent). The flexibility of this approach will allow Iowa to build upon this program for cumulative impacts in the future as local needs and conditions change.

Risks and Vulnerabilities: The IWA will help make Iowa's important agricultural economy more sustainable. Failure to implement the proposed (or similar) practices would likely result in continued degradation of the land and water, especially in the face of current climatological trends. This would likely result in loss of agricultural productivity, increased water treatment costs, and the loss of biodiversity, recreational opportunities, and tourism.

Scalability and Replicability: This program is scalable and replicable, appropriate for implementation at a variety of scales represented by the broad range of watersheds and infrastructure projects. Data collected throughout the program will help quantify costs of implementing this program across the Midwest for different water-quality or -quantity impacts. To this end, the *program will develop a comprehensive guide for other watersheds and communities striving to replicate the IWA*.

Goals and Metrics, Timelines, and Local Consultation are specified in each project description. Programmatic and scientific evaluation is described on pages 58-60.

Eligible Activity – NDRC Watershed Projects: Watershed Projects meet the Eligible Activity of Public Facilities and Improvements – 105(a)(2): For a century, Iowa law has recognized drainage systems as valued public facilities. Traditional flood protection/drainage infrastructure includes levees, floodwalls, and reservoirs. In rural areas, it also includes farm ponds, stream channelization tile drainage of farm fields, constructed earth terraces, debris basins, and conservation practices. Iowa proposed three pilot Iowa watershed construction projects to HUD in 2011. In June 2011, the HUD-Disaster office in D.C. approved the watershed projects, which they determined met the Eligible Activity of Public Facilities and Improvements. NDRC

watershed construction projects will mirror the pilot projects. The public facilities will be constructed on private land, but will include a 20-year ownership easement to the county to maintain the structures. They meet the National Objective Urgent Need (UN).

Program 2: Community Resilience Programming

Community Resilience Programming is needed to increase community resilience to floods. The IWA proposes use of the Zurich Insurance Flood Resilience Program framework to implement the Vulnerability and Capacity Assessment (VCA) methodology to assess flood resilience in target watersheds. The International Federation of Red Cross (IFRC) and Red Crescent Societies have used the VCA methodology worldwide for more than a decade. It helps to: 1) assess risks and hazards facing communities and their capacity to manage them; 2) involve communities, local authorities, and development organizations in the assessment from the outset; 3) create action plans to prepare for and respond to identified risks; and 4) identify risk-reduction activities to prevent or lessen the effects of future hazards (www.ifrc.org/vca).

The IWA will partner with communities in the MID-URN areas to increase resilience by facilitating activities that help communities prepare for, respond to, recover from, and adapt to floods. The National Academy of Science (NAS) publication "Disaster Resilience – A National Imperative" suggests an approach to: 1) develop and encourage processes for sharing information; 2) build public awareness and understanding of risk; 3) gather community input; and 4) develop tools to monitor progress toward resilience. Floods affect more people globally than the combined effects of earthquakes, tornados, droughts, and hurricanes. Further, a focus on pre-event risk reduction, rather than post-event relief, promotes greater resilience. The Zurich resilience framework measures community resilience as functions of robustness, redundancy, resourcefulness, and rapidity, as well as the community's social, human, financial, natural, and physical environments. The IWA will pair the Zurich framework with the CEA's focus on

watershed-specific needs assessments informing situated strategic planning as a comprehensive approach to needs and outcomes assessment, planning, and implementation.

Program Partners and Feasibility: The WMA coordinators will be the critical communication hubs. The IWA will work with groups like the Iowa Community Action Association and several regional *Community Action Programs (CAPs)* to leverage existing capacity-building platforms and networks for flood resiliency programming. The CAPs represent "boots on the ground," with established local relationships and trust. The *CEA* will guide the use of tools and assessment metrics to measure the effectiveness of program activities to improve resilience. *The IFC*, with expertise in data analysis and visualization, will provide watershed-monitoring tools to share and access information. *Homeland Security and Emergency Management (HSEMD)*, in coordination with *local emergency management agency (EMA) coordinators*, will develop strategies and local flood preparedness.

Resilience Assessments and Tools to Guide Programming and Monitor Progress: The IWA team will work with stakeholders in each target watershed using the VCA frameworks and assessments. Preliminary activities will focus on qualitative and quantitative indicators of community resilience. The investigation will include individual or group interviews and annual surveys of selected constituents in the most vulnerable areas. Baseline data will guide WMAs as they select initial programming and interventions in the target communities. Qualitative data will clarify how stakeholders and community collaborators identify and understand the breadth of resilience issues. This will guide assessment of outcomes/impacts of programming and interventions, recognizing that: 1) the process of defining resilience goals and assessment requires collaboration and cooperation to build trust and highlight existing needs and capacities; and 2) regular monitoring of resilience can guide planning and decision making, and help assess progress toward resilience goals. A staggered annual survey will gather information from each

watershed. The IWA team will refine the process annually to understand changes in community resilience and provide actionable information.

Resilience Awareness, Communication, and Planning (Primary Audience: community citizens. Secondary Audience: local decision makers, agencies): The WMA coordinators and local collaborators (e.g. CAPs) will partner with local leaders and individuals to develop community-specific activities to engage residents, especially vulnerable populations, in discussions about flood resilience. Engagement formats will vary (presentations, workshops, site visits, focus groups) until each community determines the most effective methods. Residents will be notified through existing events/groups, postings at key locations, local television and newspaper coverage, direct mail, and even door-to-door campaigns. Rural areas with low population densities will be engaged at the community scale, but also at county fairs and other regional events. Incentives will be considered to encourage participation.

Early engagement activities will focus on sharing experiences and perspectives, building participation and relationships, and discussing flood resilience. Discussion prompts might include: How did a specific flood or storm event impact individuals, and how did it vary among different people and neighborhoods? What were the greatest challenges during the event and during recovery? Who did people trust for information and help (and why)? Initial discussions will help frame subsequent activities in which participants use their experience and knowledge to plan for the future. Example program topics might include: How does an individual or community assess risk? How can individuals make their homes or businesses more flood resilient? What actions should the community, county, and watershed consider for improved resilience? The focus will ultimately shift to preparing for, planning for, responding to, recovering from, and adapting to floods.

Community programs will include opportunities for people who cannot attend to provide input (e.g., an online app and/or materials at a local library or civic center) and a means for recording and saving key programmatic outcomes. WMAs will have access to evaluation materials and event summaries, recordings, and other archived information, with highlights posted on the watershed website. *As communities work through the process of resilience assessment and planning, the WMA will facilitate the creation of a flood resilience action plan for each target community.*

Platform for Sharing Data and Experience (Primary Audience: local decision makers, EMA. Secondary Audience: Citizens): *The IWA will develop a platform to visualize hydrologic and water-quality data and to share watershed information*. As previously described, sensors in each target watershed will monitor precipitation and water quantity and quality. The IWA will share data for each watershed via a convenient information system. The system will be based on the Iowa Flood Information System (IFIS), built on the familiar Google Maps platform, which allows users to access and visualize data, including flood stages and warnings. The system will provide invaluable up-to-date information to decision makers and EMAs during a flood.

Demonstrations of the online platform at community programs will help stakeholders visualize and understand their home or business as a physical location within the watershed. It will incorporate an app for stakeholders to upload place-specific information. For example, the system might encourage users to respond to a topic of the week, current events, or other prompts to provide appropriate, actionable information. It is, in essence, a crowd-sourcing tool to collect water-related issues, photos, and stories that will be invaluable to the community and to IWA partners. It will be available at local libraries, community centers, and other public venues for users who do not have Internet access. Community input may help identify priorities to improve flood resilience. For example, EMAs might monitor this platform prior to and during an event

for information about particularly susceptible groups and areas. The online platform will be just one element of the expanded WMA websites to help connect people in the watershed. The IFC will implement the visualization platform, and the WMA coordinators will manage content.

Capacity Building through Planning and Technical Assistance. Comprehensive Emergency Management Planning ensures that emergency services, local authorities, and other organizations communicate effectively and coordinate their efforts toward hazard mitigation and disaster preparedness, response, and recovery. Section 29C of the Iowa Code provides the authority for Iowa Homeland Security and Emergency Management (HSEMD) and the county emergency management commissions to plan for emergencies. HSEMD and the Emergency Management Agency (EMA) coordinators will be key partners in resilience programming, especially as communities work toward local strategies and flood resilience action plans. Their participation in the resilience program will facilitate development of a "whole community" approach and culture to disaster resilience. This will allow the IWA to tailor its efforts to engage the community, neighborhood, or individual, creating a template for future events in Iowa.

As the target communities consider their resilience needs, the EMA coordinators will provide guidance in identifying sound government policies and practices to further build disaster resilience. This may include: providing datasets for communities to analyze as part of their risk-assessment and -reduction activities; identifying critical asset inventories; building a flexible, scalable recovery structure for pre- and post-disaster decision making; and conducting loss avoidance studies for hazard mitigation, land-use, and comprehensive planning. Engagement activities and materials will be tailored to each community and its vulnerable population(s).

Assessment of future risk cannot be based solely on records of past events. *An accurate evaluation of future risk must also take into account relevant new or changing conditions, and the availability of new and refined data and tools*. The IWA's many resources will be invaluable

to HSEMD and EMA's efforts to update Iowa's Enhanced Mitigation Plan and the Iowa Disaster Recovery Plan. IWA collaborators will help identify unmet needs and build a statewide science-based flood risk assessment for implementing a resilience mitigation strategy. For example, HSEMD and EMA will work closely with ISU's Climate Science Program and the IFC to understand the latest science on precipitation and temperature trends across Iowa. The WMAs will provide valuable information on the local landscape and hydrology and how these change as new practices are implemented. The IFC's new floodplain maps for Iowa (see Phase II, Long-term Commitment) will be an important resource in refining risk. The accompanying new one-meter-resolution depth grids for the 2-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year floodplains will allow planners to consider flood extent *and* depth. The IFC's flood inundation maps provide planners with an exceptional level of detail for any potential flood stage. The CEA's community resilience tools and metrics will reveal unique vulnerabilities in each partner community, feeding directly into HSEMD and EMA's planning and technical assistance activities.

State and Regional Impact: Although these key activities occur in the identified MID-URN areas, the programs provide a unique opportunity for the state to broaden its perspective to: 1) better understand communities' capacity to recover from potential future disasters; 2) refine strategies to identify the most critical disaster resilience challenges; 3) build and continue to refine this process for activities in other watersheds; and 4) develop future strategies to improve disaster resilience. *Information from these activities will support development of a vision for the future, similar to the watershed hydrologic plans, as Iowa continues to seek ways to improve disaster resilience.*

Timeline: The staggered start engages three watersheds during each of the first three years of the five-year program, with the following timeline. Year 1: Contract with CAP, conduct initial qualitative and quantitative baseline data collection of local resilience issues. Year 2: [Repeat

Year 1 for three new WMAs] *and* engagement program development and implementation, launch pilot of visualization platform, watershed-wide community engagement events to discuss resilience, initial HSEMD and EMA disaster planning events, development of resilience assessment, and annual resilience survey and reporting. Year 3: [Repeat Year 1 for final three WMAs] *and* continued engagement program development and implementation, visualization platform enhancements in response to feedback, engagement events to discuss resilience, HSEMD and EMA disaster planning events, and annual resilience survey and reporting. Year 4: Same as Year Three (no new WMAs). Year 5: Maintain visualization platform, finalize disaster resilience action plans, and final resilience survey and reporting.

Replicability: This program is scalable and replicable at a wide variety of scales (neighborhoods, small communities, or large cities). Specifically, the IWA is a replicable model to enhance the social, economic, hydrologic, and environmental resiliency of rural America and will influence future policies for rural and downstream development and urban-rural collaboration. The IWA will prepare a full program description and evaluation guide at the project conclusion. IWA staff will also share their experiences widely at public and agency events.

IWA Program and Project Assessment and Evaluation

Scientific Assessment: IFC staff will project post-construction results using a detailed, coupled surface water–groundwater model, HydroGeoSphere. Collection and analysis of sensor data will continue for one or more years after construction to verify that water-quality and -quantity improvement goals are met, to validate the hydrologic models, and to improve model performance. Analysis of field data and use of hydrologic models will guide future projects in the watershed and inform planning and policy decisions in watersheds throughout the Midwest.

The Iowa Water Center (IWC) at ISU will use its Daily Erosion Project (DEP), along with field measurements, to monitor the success of built projects to reduce erosion and water runoff and to develop and distribute informative materials on practices to reduce soil loss in modern agricultural operations. DEP is an erosion model that generates daily estimates of soil erosion and water runoff at the HUC 12 watershed level using high-resolution National Weather Service NEXRAD radar data to estimate precipitation, and remotely-sensed soil and land management data to parameterize the model. The IWC will perform a detailed assessment of each selected HUC 12 before, during, and after the completion of built projects.

Programmatic Assessment: The CEA will design and implement methodologies to describe and document the environmental, social, and economic benefits of the IWA as informed by preliminary needs assessments and ongoing interactions with local and program stakeholders. In conjunction with a stakeholder needs assessment, CEA will facilitate stakeholder development of an initial logic model for program activities. The collaborative needs assessment and preliminary logic models within each watershed will lay the groundwork for defining success by identifying the information needs or "evaluation questions" and will also facilitate future program replications in other watersheds. Evaluation processes based on community-defined indicators of success will inform program improvements.

CEA staff will conduct interviews and focus groups with local stakeholders, surveying people directly involved in engagement programming, and observing a large sample of programs over the program's duration in Dubuque and rural watersheds. This qualitative and quantitative information, aligned with community-defined success indicators, will provide formative information for the purposes of project improvement and monitoring, as well as summative findings to inform scale-up and provide evidence of project value. CEA will provide rapid-response evaluation information to project staff, regular formal and informal reports to project

personnel and the WMA Advisory Board, and annual reports. Along with the annual reports, CEA will conduct a systematic internal formative quality control and assurance review to ensure the evaluation remains responsive to users and collaborators and adapts to the needs of the program and individual watersheds. CEA will also produce a final report for project sponsors and a replicable plan to evaluate similar future projects.

b. Benefit Cost Analysis

The total IWA benefit is $1,224,507,991 with a benefit-cost ratio of 7.07 (see Attachment F).

c. Scaling/Scoping

	Full Request	**Alternative 1**	**Alternative 2**	**Alternative 3**
Dubuque Healthy Homes	$11,091,767	$9,124,460	$8,427,665	$8,318,826
Dubuque Infrastructure	$28,100,000	$28,100,000	$23,100,000	$11,500,000
Coralville Infrastructure	$1,834,800	$1,834,800	$1,834,800	$1,834,800
Storm Lake Infrastructure	$6,474,750	$6,474,750	$6,474,750	$6,474,750
Watershed Projects	$50,055,000	$41,352,713	$31,459,292	$22,422,409
Data Collection/Modeling/etc.	$8,400,000	$6,972,000	$5,303,179	$3,440,000
WMA Coordinators	$3,000,000	$3,000,000	$2,250,000	$1,500,000
Planning + Admin	$22,037,911	$20,484,957	$17,937,491	$13,066,199
TOTAL	**$130,994,228**	**$117,313,680**	**$96,787,177**	**$68,556,984**
Overall BCA	**7.07**	**6.41**	**5.36**	**5.12**

The table above shows three additional scenarios. Planning projects would retain as much of the assessment, stakeholder education, and resiliency programming as possible. For the Bee Branch Healthy Homes Resiliency Program, alternative one proposes to reduce the scope to 400 units in

36 months. Alternative two reduces the scope to 320 units in 30 months. Under alternative three, IWA proposes 375 units, but at 25% budget scale-back for each structure in 36 months. For Dubuque infrastructure, in alternative two, the Bee Branch 17th Street/West Locust Storm Sewer Improvements would be started by 2019, but only the first 3,100 feet of the 3,700-foot-long project could be completed. Under alternative three, construction of the Bee Branch 22nd Street/Kaufmann Avenue Storm Sewer Improvements would be limited to an initial proportionate section until additional funds are secured. The West Locust improvements would be delayed until the city is able to budget for the improvements. Reduced funding for the watershed projects reflects a reduction in the number of HUC 12s in the target watersheds. Priority would be given to retaining HUC 12s that serve vulnerable areas. Goals/metrics for the selected HUC 12s would not change. In alternative two, the WMA coordinator would be shared in the E. and W. Nishnabotna Rivers and between the English River and Clear Creek. In alternative three, each watershed would have a half-time coordinator.

Scaling/Scoping alternatives two and three meet the 50% LMI requirement.

d. Program Schedule

Project descriptions include schedules. The IWA will be complete in Sept 2021 (see waiver).

e. Budget Table

See bottom of next page for total budget request from CDBG.

f. Consistency and Other Planning Documents

See Attachment D, Consultation Summary, pages D-122 to D-124; Attachment C, Certifications.

Ten Iowa Watershed Approach Projects

Background for Projects 1-2: City of Dubuque, Bee Branch Creek

Dubuque is one of the oldest cities in the Midwest. With a population just under 60,000, Dubuque is set along the Mississippi River and serves as a commercial, industrial, educational,

and cultural hub for the Tri-States Area. Dubuque is known for its hilly terrain, unique architecture, and picturesque river setting.

IWA activities in Dubuque will focus in the Bee Branch MID-URN area. The Bee Branch Creek Watershed is critical to the city; nearly 50% of Dubuque's residents live and work in the historic 6.5-square mile basin. The watershed is a highly developed urban area, with just 3% agricultural land and 23% open space. The Bee Branch watershed is relatively steep, with an average terrain slope of approximately 37%. The overall slope of the main channel in the upland areas is approximately 2%, while the slope of the main channel in the flat Couler Valley area to the outlet is approximately 0.5%. Elevations in the basin range from 594 feet NGVD at the Mississippi River to 962 feet NGVD in the upper reaches. The drainage system consists of both natural channel and closed conduit sections. Storm water runoff moves through the watershed

Budget Table						
Activity Type	Natl. Obj.	CDBG Budget	City Direct	Producer/ Other Direct	Dates	Accomplish.
Watershed Cons.	UN	$61,455,000		$15,876,250	07/16–09/21	25% flow ↓
Watershed Plan.	N/A	$15,635,491		$1,067,951	07/16–09/21	↑ resilience
Infrastructure	LMA	$36,409,550	$24,369,850		12/16–07/20	↓ flood risk
Housing Rehab	LMH	$8,871,667	$800,000		07/16–09/21	400 units
Housing Rehab	UN	$2,220,100			07/16–09/21	100 Units
Application	NA	$164,600				
Admin.	NA	$6,237,820				
Total		**$130,994,228**	**$25,169,850**	**$16,944,201**		

primarily via storm sewer systems. The lower reaches of the Bee Branch Creek were confined to a buried storm sewer from the turn of the 20th century until recently.

Between 1999 and 2011, the Bee Branch received six Presidential Disaster Declarations for floods, with total damage of nearly $70M. The residents, homeowners, and business owners have suffered trauma, health impacts from occupying flood-damaged structures, depreciated home values, and loss of economic prosperity. (From 2004–09, commercial property values grew by 39% citywide, but fell 6% in flood-prone areas.)

The series of flooding events, combined with aging housing, has contributed to lower housing and commercial property values. This has taken a toll on neighborhood residents, many of whom are unable to find quality, affordable housing outside this area. The neighborhood is primarily residential; about 60% of residents live in rental units. An estimated 1,300+ Dubuque homes and businesses in the watershed are prone to flooding, including 70 businesses that employ more than 1,400 people and have more than $500M in annual sales.

The Bee Branch Watershed is entirely within city limits. Work in the Bee Branch Watershed during the past 14 years represents an urban strategy to watershed management that mirrors the comprehensive IWA. In 2001, the Drainage Basin Master Plan for the Bee Branch Creek was developed to “daylight” the creek to an expanded open channel waterway, creating a more natural and resilient environment. The goals were to reduce flooding, preserve historic and affordable housing, maintain affordability, preserve neighborhood and community resources, minimize health and safety risks, and create an environment promoting higher quality of life. During heavy rain, flood waters remain in the green space along the creek instead of flooding streets and homes. The project has progressed quickly. In 2003, the Carter Road Detention Basin was created, followed by another in 2009. A series of permeable alleys was installed throughout the flood-prone area of the Bee Branch; more are planned.

The Disaster (DR-4018): The Bee Branch Creek Watershed has experienced significant flooding, particularly in recent years. In July 2011, a storm event stalled over Northeast Iowa and dropped more than 14 inches of rain in less than 12 hours on parts of the city. The aftermath was devastating. The city's storm drains were unable to handle the water, and substantial flash flooding occurred, tearing up roads and bridges, flooding homes and businesses, and claiming two lives. The reports included 32 sewer back-ups, 259 requests for basement pumping, and 47 sanitary/storm sewer maintenance requests. The Bee Branch watershed was hit hardest.

Project Description #1: Bee Branch Healthy Homes Resiliency Program

With Bee Branch Creek improvements in place to reduce and slow floodwaters and run-off, Dubuque is now able to turn its attention and resources to the nearly 1,300 homes and businesses that have suffered damage from numerous recent flooding events. Many homeowners have experienced flooding on such a regular basis that they have fallen behind on repairs, suffer from chronic mold and mildew problems, and live with the residual structural effects of flood waters that climbed to their basement ceilings. Little if any support exists for residents and small businesses struggling to recover from this devastation. The Bee Branch Healthy Homes Resiliency Program (BBHHRP) is designed to support residential properties with flood damage from the 2011 storms in the low to moderate income areas of Dubuque that are strategically aligned with and extending to and from the Bee Branch Creek restoration project.

National Objective, MID-URN, and Vulnerable Populations: The program will provide homeowner rehabilitation for 160 units under the Low Moderate Housing (LMH) CDBG National Objective, homeowner rehabilitation for 100 units under the Urgent Need National Objective, Residential Rehabilitation for 96 units under the Low Moderate Housing Objective, and rehabilitation for 144 small multi-family housing structures within the target areas of the BBHHRP [Eligible Activity: Housing Rehabilitation – 105(a)(4)]. Each home will be assessed

through a Healthy Home Resiliency Approach, which aims to reduce or avoid potential losses from hazards, ensure prompt and appropriate assistance to victims of disaster, and achieve rapid and effective recovery. The project will help government, businesses, nonprofits, and residents plan for and reduce the impact of disasters, react during and immediately after a disaster, and take steps to recover after a flood.

The BBHHRP will use four basic strategies to increase resiliency in the homes and neighborhoods: 1) Preventive measures – minimizing the effects of disaster; 2) Preparedness – planning response during disaster; 3) Response – minimizing the hazards created by disaster; and 4) Recovery – returning the community to its pre-disaster state or better. Each housing unit will be inspected to identify the seven principles of a healthy home (dry, clean, pest-free, safe, contaminant-free, ventilated, and maintained), and resiliency work will be completed to address: foundation repairs, foundation raising or shifting to accommodate water levels, water and sewage services, furnace replacement, basement windows, mold and mildew remediation, lead remediation, water heater replacement, soil modification, lateral connection repairs, asbestos, sidewalk and curb cuts, sump pumps, and downspouts. A variety of community resources will improve housing, repair damages, and make homes more resilient to future flooding.

The program will address individual homeowners' needs by increasing education, awareness, and resources needed to live in an urban watershed. Like the community resilience programs in the rural communities, CEA will work with the Bee Branch Healthy Homes Advocate to assess general resilience needs and challenges faced by residents and businesses in the Bee Branch Watershed. From this information, the Homes Advocate will work one-on-one with residents to complete a comprehensive assessment at the household level. The Homes Advocate will assist with education and referrals to increase understanding of what it means to live in a watershed,

and what resources and services are available to support development, employment, and neighborhood revitalization.

Clear and compelling evidence shows that unsafe, unhealthy housing leads to wealth depletion, abandoned properties, housing instability, potential homelessness, and increased risk of housing-based illnesses. Evidence also shows that healthy and safe hosing in the most distressed and impacted communities improves health, social, and economic outcomes for families – ultimately creating safer neighborhoods. Dubuque will partner with the Community Foundation to inform, motivate, and educate residents, homeowners, and businesses on how to break the links among unhealthy housing, unhealthy families, and unhealthy neighborhoods. An informed and engaged community is a healthy community.

Current and Future Risks: Work to date in the watershed has decreased the residents' flood risk. But failure to implement BBHHRP leaves people at continued exposure to risks associated with living or working in unsafe, unhealthy structures. Work in the structures will make them more resilient to future flood events; community resilience programming will help people be more prepared for and resilient to future floods.

Vulnerable Populations: The target area contains some of Dubuque's oldest and most affordable housing. More than 66% of the households qualify as LMI. More than 21% of residents in the area received Supplemental Nutritional Assistance Program (SNAP or Food Stamps) in the past 12 months, and 28% of households contain one or more persons with a disability. Fifteen percent of the residents belong to racial or ethnic minority groups, which is more than double the representation of R/E minority groups for all of Dubuque County (7%).

Metrics: *Resiliency Value:* At least one improvement in each home will increase the home's resilience to flooding (e.g., stronger foundation, relocation of furnace). *Social Value:* This neighborhood is inhabited by the most at-risk residents, who often cannot afford to miss work or

find new housing after flooding. Home improvements will result in increased opportunities for resilient, affordable housing for these populations and reduced mental stress associated with the life disruptions common during flood events. *Economic Value:* Improvements to housing structures will lead to measurable increases in property values. *Environmental Value:* Reduction of mold and mildew will lead to improved indoor air quality and reduced asthma rates among residents. The CEA will help to evaluate the activities and metrics.

Replicable Model: Dubuque's approach to extreme flooding in the Bee Branch Watershed represents a forward-thinking, holistic, and replicable strategy that will result in reduced local flood risk, healthier and more resilience structures, and more resilient residents.

Timeline: July–August 2016: Hire and train/certification of inspection and support staff; August–October 2016: Identify benchmarks, goals performance indicator; develop/refine policies and procedures; August 2016–December 2018: Outreach/recruitment/enrollment of 400 residential property owners, home inspections, individual property owners' contracts executed; October 2018–April 2021: BBHHRP units completed and cleared; September 2016–April 2021: Home advocacy interventions in enrolled BBHHRP units; April 2021–September 2021: Close out and completion of contracts, final completion clearance on any remaining units, evaluation; October 2017–September 2021: Home advocacy post-evaluation of BBHHRP interventions.

Budget: The BBHHRP budget of about $11M represents: Rehabilitation of 160 single-unit resident properties at about $16K/structure (LMH Objective); rehabilitation of 100 single-unit resident (homeowner) properties at about $32K/structure (Urgent Need); rehabilitation of 96 single-unit resident properties at about $16K/structure (LMH Objective); and rehabilitation of 144 multi-unit/multi-family properties at about $16K/structure (LMH Objective). Delivery of the Healthy Homes programmatic core by the Home Advocate is included in project delivery costs.

Benefit Cost Analysis: 2.38.

Project Description #2: Bee Branch Watershed Infrastructure Improvements

Imagine waiting out a tornado warning in the apparent safety of your basement. Suddenly, heavy rains produce flash flooding, and floodwaters start pouring in around you. Should you stay in a flooded basement or take your children upstairs? Unfortunately, Bee Branch Watershed residents have faced situations such as this repeatedly since 1999, most recently during the July 2011 rainstorm that prompted a Presidential Disaster Declaration.

The National Climatic Data Center lists 65 flood events in Dubuque County from 1950–2012. Prior to 1973, when construction of a 6.4-mile-long earthen levee and concrete floodwall system was completed along the Mississippi River, the flooding experienced by Dubuque residents was primarily related to the Mississippi River and usually forecast well in advance. Flash flooding, however, occurs with little or no warning. Disasters related to the Mississippi River are rare since 1973. However, intense rainstorms have caused six disasters in Dubuque since 1999.

In addition to private infrastructure damage in 2011, the storm overwhelmed and damaged Dubuque's storm sewer system tasked with conveying the burgeoning creek through the city's at-risk neighborhoods. The damage extends from the Lower Bee Branch Creek just south of Garfield Avenue through the flood prone area, crossing under Garfield Avenue, Rhomberg Avenue, Lincoln Avenue, and E. 22nd Street, all the way to W. 32nd Street. The system includes significant contributing limbs, from west at E. 22nd Street and from the east at E. 24th Street.

The damaged portion of the system, twin 10-foot wide by 12-foot high pipes, occurred where the storm sewer system outlets into the Lower Bee Branch Creek just south of Garfield Avenue, where the sewer crosses under an active Canadian Pacific railroad yard. The 20-foot end section of the storm sewer partially collapsed. Repaired to its pre-disaster condition, the system remains inadequate to handle even storms that are much smaller than the 2011 event. *Based on an*

engineering study by Strand Associates, more than 900 properties are likely to be flooded on average once every 10 years.

The current capacity of the lower watershed's storm sewer system is limited to handling minor nuisance rains, such as the once-in-five-year events. Based on the 2011 Presidential Disaster Declaration and the five that preceded it, the system clearly does not provide adequate drainage. As a result, flooding has repeatedly damaged hundreds of properties. Strand Associates determined that improvements to the existing system could significantly reduce the flood-prone area to only a handful of properties, which would experience less severe damage.

Using the same principles associated with the Iowa Watersheds Approach, a plan for the Bee Branch Watershed was developed as part of the Drainage Basin Master Plan. The watershed plan reflects a holistic and fiscally responsible approach to increasing the resiliency of the community, mitigating flooding and improving water quality, stimulating investments, and enhancing the quality of life in the flood-prone neighborhoods in the MID-URN area. The watershed plan includes two upstream detention basins, pervious pavement in alleys, and daylighting the buried Bee Branch Creek to allow storm water to move safely through the area. The system has two remaining shortcomings: 1) getting the floodwaters safely into the newly restored creek; and 2) getting the floodwaters from the upper reach of the Bee Branch Creek through an active, multi-track railroad yard to the lower reach of the Bee Branch Creek.

Three Projects: The proposed mitigation strategy has three components. The most important Bee Branch infrastructure improvement is the *Bee Branch Railroad Culvert Infrastructure Improvement Project*, which will augment the storm sewer drainage system damaged in July 2011 that currently conveys storm water through the Canadian Pacific railroad yard at 506 Garfield Avenue. The improvement involves the installation of six 8-foot-diameter culverts using tunneling methods from the Lower Bee Branch Creek approximately 165 feet through Canadian

Pacific Railroad right-of-way to a proposed junction box. It also includes the construction of five 12-foot wide by 10-foot high box storm sewers from the proposed junction box 200 feet north toward Garfield Avenue and the Upper Bee Branch Creek.

The second most important infrastructure improvement is the *Bee Branch Kaufmann Avenue Storm Sewer Improvements Project*. Based on Strand's hydraulic modeling of the existing system using XPSWMM, the storm sewer between Hempstead and Central Street has less than a 10-year storm capacity. It is clearly the "bottleneck" of the Kaufmann Avenue drainage system. The proposed new system will comprise a 10-foot by 6-foot reinforced concrete box culvert designed to handle the 25-year storm through the Kaufmann Avenue Project Corridor. The layout allows for all storm water to be conveyed through the storm sewer just west of Kane Street. During a 25-year event, some overland flow from the upstream portions of the watershed will drain along Kaufmann Avenue into the project corridor. Large high-capacity inlets (three were assumed for the construction cost) will be placed in the terrace along Kaufmann Avenue to capture this overland drainage. In addition, 80 standard single-grate inlets will be provided with the local storm sewer and connecting to the new box culvert. The project requires the reconstruction of the street and the relocation of existing underground utilities along the right-of-way.

The third most important infrastructure improvement is the *Bee Branch West Locust Storm Sewer Improvements Project*. Based on the results of Strand's modeling, no portions of the existing West Locust Street storm sewer systems have the capacity for a 25-year event, which would require the replacement of the entire system with new piping. The proposed West Locust Street corridor storm sewer will be a 10-foot by 5-foot RCBC from 17th Street to approximately 280 feet west of Angella Street; 10-foot by 4-foot RCBC from 280 feet west of Angella Street to 400 feet west of Kirkwood Street; and 8-foot by 4-foot RCBC from 400 feet west of Kirkwood

Street to Rosedale Avenue. This layout allows for all storm water to be conveyed within the storm sewer just west of Rosedale Avenue. During a 25-year design storm, excess overland flow from upstream portions of the watershed will drain along Rosedale Avenue into the West Locust Street project corridor. Large high-capacity inlets will be placed in the terrace along West Locust Street near Rosedale Avenue to capture the overland drainage. In addition, 100 standard single grate inlets and 28 high-capacity inlets will be provided with the local storm sewer and connecting to the new storm sewer system. The project requires the reconstruction of the street and the relocation of existing underground utilities along the right-of-way.

National Objective, MID-URN, and Vulnerable Populations: These infrastructure projects meet the National Objective of L/M Income Area Benefit (LMA). The projects help address unmet needs in an area that was subject to a Presidential Disaster Declaration in 2011. The target MID-URN area of Bee Branch Creek, which is also an LMI area, will have significantly reduced flood risk following completion of these projects.

Consultation: In response to the repeated disasters, the City of Dubuque engaged engineering consultants, state and federal partners, citizen advisory committees, and the general public to help create, fund, and implement a watershed plan to address the flooding. The plan outlines multiple improvements throughout the Bee Branch Watershed that will benefit upstream and downstream properties. Dubuque hired a full-time communications specialist to develop and implement communication plans to inform and engage residents and stakeholders impacted by the various Bee Branch Watershed improvement projects. The plan identifies goals, messages, and objectives for communicating with the residents, schools, businesses, churches, daycares, and community centers most impacted by construction. The proposed improvements through Canadian Pacific property reflect input of Canadian Pacific engineers and staff.

Metrics: *Resiliency Value*: Infrastructure improvements will hold water onsite for slow release, as opposed to quickly flushing it downstream. This will lead to a measurable reduction in peak storm water flow. A reduction of expected property damages from future flash flooding events is also expected. *Social Value*: As a STAR certified community, Dubuque aims to ensure that at least 85% of residents live within a half-mile walk of a park or other green infrastructure. Completion of these infrastructure projects will help meet this goal. *Economic Value*: Measureable increases in property values are expected in the Bee Branch neighborhood to rates that are more in line with the rest of Dubuque. *Environmental Value*: Detention of water onsite will lead to a measurable improvement in water quality downstream as the water is captured and cleaned via permeable surfaces.

Timeline: The City of Dubuque will manage the design and the hiring of a contractor to construct the improvements on the following schedule:

Railroad Culvert Infrastructure Improvement Project: July 2016–December 2016: Establish agreements with landowners, selection of contractors; January 2017–March 2017: Contractor submittal review and construction preparatory work: April 2017–September 2018: Construction.

Kaufmann Avenue Storm Sewer Improvements Project: July 2017–December 2017: Selection of contractor; April 2017–September 2017: Construction.

West Locust Storm Sewer Improvements Project: July 2020–December 2020: Selection of contractor; April 2021–September 2021: Construction.

Budget: The estimated construction cost of the Railroad Culvert Infrastructure Improvement Project is $17,900,000. The estimated construction cost of *Bee Branch Kaufmann Avenue Storm Sewer Improvements Project* is $11,500,000. The estimated construction cost of *Bee Branch West Locust Storm Sewer Improvements Project* is $7,600,000.

Benefit Cost Analysis: 2.10

Project Description #3: Upper Iowa River Watershed

The 1,000-square-mile (640,900 acres) Upper Iowa River, a tributary of the Mississippi River, originates in Minnesota, but 78% of its watershed is in Northeast Iowa (Attachment E, Map 6). The Upper Iowa River Watershed (UIRW) is part of the Driftless Region of Iowa. Its karst topography features limestone bluffs that rise 250 to 450 feet above the valley floor, dozens of coldwater trout streams, nearly 3,000 sinkholes and waterfalls, and hundreds of springs. Cropland accounts for more than 40% of the watershed, which also includes grassland (35%) and hardwood forests (19%). The EPA and Iowa recognize the UIRW as a *Priority Watershed*. Iowa designates 244 miles of the Upper Iowa River as *High-quality Resource Waters* or *High-quality Waters,* and the Upper Iowa was among the initial rivers included in the *National Wild and Scenic River* System.

The UIRW is a popular tourist destination. It has excellent walleye and bass fishing, but is best known for its 152 miles of coldwater trout streams, which lure anglers from around the world. A study conducted by Trout Unlimited found recreational angling in the Driftless Area generates more than $1B in annual economic benefit to local communities. The Upper Iowa is a popular water trail: *National Geographic Adventure Magazine* listed canoeing the Upper Iowa as one of the top 100 adventures in the United States. More than 150 protected species of animals and plants live in the watershed, which also harbors endangered ecosystems. Unfortunately, frequent flooding and severe erosion are causing serious damage to the streams and river.

Additional Mitigating Information: NE Iowa Resource Conservation and Development, SWCDs in Iowa and Minnesota, state and federal agencies, NGOs, businesses, and landowners formed the UIRW Alliance in 1999 to improve water quality and watershed health. Since then, they have conducted one of the longest water monitoring projects in Iowa, documenting the water-quality benefits of their projects, which include reforestation and CRP plantings on highly

erodible slopes, animal feedlot renovation, stream bank stabilization, wetland restoration, and other practices. The group is now working toward a WMA to strengthen the partnership.

Northeast Iowa RC&D published the "Upper Iowa River Watershed: Assessment and Management Strategies" in 2004 to document the watershed's condition and guide actions to improve water quality. Parts of the report are dated, but will provide foundational information for the IWA's new hydrologic assessment and watershed plan.

The North Bear Creek (NBC) Project, a UIRW subwatershed, demonstrated reduction of storm water discharge by constructing 18 small retention structures in the upper reaches of the NBC watershed. Four structures use the road as a detention structure or dam, improving the width, visibility, and safety of the road while also protecting downstream creeks, the river, and infrastructure from flash floods, sedimentation, and nutrient loading. Partners are eager to carry out similar projects using roads in other strategic locations of the UIRW.

The Disaster (DR-4135): Torrential rains on June 21, 2013, triggered flash flood warnings for more than half of Iowa's 99 counties. Another major storm followed on June 23. Flash flooding and rapid runoff damaged road networks, homes, and businesses; caused the evacuation of campgrounds; and damaged trout habitat. Storm damage severely impacted the tourism industry, which is the second largest area employer.

The most impacted region includes Tracts 9601, 9602, 9603, and 9604 in Allamakee County, where infrastructure damage totaled $2,752,381 (Phase I, Exhibit B). Overland and creek flooding washed out more than 10 miles of roadway in the UIRW. Many rural roads remain closed today because of flood damage that occurred in 2013 and more recently. Repeated flooding has strained county budgets; county officials cannot keep up with the need to replace bridges and culverts.

Environmental degradation has also occurred in distressed regions of the watershed in Winneshiek and Allamakee counties. Nearly the entire UIRW suffers from environmental distress, with the presence of Category 4 or Category 5 Impaired Waters as defined by section 303 of the Clean Water Act. Nutrient and sediment loading of streams and rivers increased through disaster DR-4135, magnifying existing problems in the watershed and downstream. The impaired waters include the main stem of the river and multiple tributaries. Impairments include the presence of bacteria (*e. coli*), nitrates, and turbidity, all with detrimental effects for the river's ecosystem (particularly trout) and the region's tourism economy.

In addition to environmental and infrastructure damages, this disaster directly impacted individuals throughout the watershed. DR-4135 did not trigger federal individual assistance programs, so Allamakee County organized an assistance program funded by donations to help low income populations recover. The program received applications from more than 40 homeowners and 10 businesses to replace water heaters, furnaces, carpet, drywall, and other materials in their residences or businesses. The county only had funds to fulfill 30% of requests. The Iowa Individual Assistance Grant Program also made 194 awards totaling $164K for personal property and home repair assistance in the area.

The Iowa Department of Agriculture and Land Stewardship (IDALS) estimated that it would cost $9,247,220 to repair the damage from environmental degradation.

<u>National Objective, MID-URN, and Vulnerable Populations</u>: The project meets the National Objective of Urgent Need. The project will help address unmet needs in an area subject to a Presidential Disaster Declaration in 2013. As a result of DR-4135, the MID-URN area of the UIRW encompasses nearly the entire watershed in Winneshiek and Allamakee counties, as demonstrated in Phase I, Exhibit B. The entire HUC 8 is compromised by water-quality issues and is vulnerable to flash flooding and erosion. No selected service area qualifies as LMI, but

several census tracts in western Allamakee County include L/M income populations; at least two HUC 12s will be selected for projects with a direct benefit to these populations.

Perennial Cover/Grass	28	Prairie STRIPS	5
Floodplain Restoration	10	Terrace	10
Small Farm Pond (0.25–2 acres)	10	Buffer Strips	10
Medium Farm Pond (2–5 acres)	30	Bioreactor	5
Large Farm Pond (5+ acres)	3	Small Wetland	10
Sediment Detention Basin	20	Large Wetland	4
Storm Water Detention Basin	10	Saturated Buffer	4

The UIRW is no stranger to flood events similar to DR-4135. According to the NWS, *all or parts of the UIRW have experienced flooding in each of the past eight years*. In 2013 alone, the NWS issued 13 flash flood warnings for the watershed. Thus, while the proposed projects in Winneshiek and Allamakee counties will target the unmet needs from DR-4135, they will also help to address annual flooding and water-quality challenges in the watershed. The WMA will select up to six HUC 12 watersheds for project implementation. An example distribution of the types and numbers of likely projects appears above. The WMA will finalize selection and distribution of projects. Resilience programming will especially focus in the vulnerable tracts in western Allamakee County.

Consultation: A public engagement event on August 20, 2015, in Winneshiek County drew representatives from Winneshiek and Allamakee County Boards of Supervisors, agencies and NGOs (NRCS, NE Iowa RC&D, SWCD offices, Farm Bureau, Seed Savers), and landowners/private citizens. The Fillmore County, Minn., SWCD District Administrator noted that this project complements watershed projects in the Minnesota reaches of the UIRW. Minnesota has partnered with Iowa in the UIRW for more than a decade. Landowners and others expressed their enthusiasm for more retention structures and for preservation of natural resources. Participants expressly stated that farmers should drive this program.

Metrics: *Resiliency Value*: Activities in the targeted watersheds will reduce flood flows by 25%, thereby reducing damage to repetitive loss sites of the past (agricultural lands, roads, infrastructure, homes) at the outlet of each HUC 12. *Environmental Value*: Project water-quality goals call for the reduction of nitrate loads by 30% and phosphorus loads by 20% at the outlet of each HUC 12. *Social Value*: This project will result in improved resilience to flooding, especially in the L/M income area, through programs to promote awareness and develop a community-wide flood resilience action plan. *Economic Revitalization*: This project will have an (unquantifiable) benefit to the local economy through preservation of coldwater fishing streams. Researchers will evaluate these metrics by collecting hydrologic data with support from the CEA.

Timeline: July 2016–March 2017: Meetings, forums, submission and acceptance of Chapter 28E Agreement documents for formation of new WMA; April 2017–September 2020: Social Resilience Programming core activities (community engagement, networking, needs assessment); April 2017–December 2017: Collection of data and development of hydrologic assessment of the full HUC 8 watershed; January 2018–June 2018: Development of hydrologic plan for eligible areas, modeling of different project scenarios; July 2018–September 2018: WMA selects final sites and projects for implementation; October 2018–March 2019: Establish agreements with landowners, select contractors; April 2019–September 2020: Design and construct projects; October 2020–September 2021: Post-construction data collection and analysis, work with WMA members to help them define future steps.

Budget: The estimated costs associated with the construction and design in the UIRW totals $9,207,500 ($6,990,000 from HUD, $2,217,500 in landowner contribution). Other items include: $350,000 for hydrologic assessment and watershed plan; $375,000 for WMA coordinator; and $1,200,000 for data collection, modeling, and analysis. Benefit Cost Analysis: 7.34

Project Description #4: The Upper Wapsipinicon River Watershed

Although the Upper Wapsipinicon River Watershed (UWRW) begins in Southeast Minnesota, most of this long narrow watershed is in the northeast corner of Iowa, encompassing 991,980 acres and portions of 11 Iowa counties (Attachment E, Map 7). The watershed lies in the Iowan Surface Region, characterized by broad, gently-rolling slopes and heavily wooded floodplains. This agricultural watershed, of which more than 85% is in row crops, pasture, or grass, is also heavily used for recreation, including fishing, canoeing, hunting, and wildlife watching. According to a survey by ISU's Center for Agriculture and Rural Development, visitors made approximately 226,801 trips to the Wapsipinicon River in 2009 and spent $6M on outdoor recreation activities.

Additional mitigating information: The Wapsipinicon River is a State of Iowa Protected Water Area (PWA) known for its public greenbelt corridor, which includes floodplain forests and wetlands, steep bluffs, and wildlife habitat, all with associated water-quality benefits. The Iowa DNR found the Wapsipinicon River to have the longest continuous stretch of natural and scenic river corridor in the Iowan Surface Region. Voluntary public lands acquisition in response to flood damage, water-quality issues, and recreational interests over the last several years has enhanced the river's riparian ecosystem. In Buchanan County alone, the local County Conservation Board manages 10 areas adjoining the river, and the Iowa DNR manages five riverside areas. Sixteen of the 27 communities in the watershed are located on, or adjacent to, a stream or river, providing recreational and economic opportunities that are impacted by flooding.

There are currently 159 miles of impaired waters in the UWRW, including 17 segments of impaired streams, most of which are on the Wapsipinicon River or Buffalo Creek (main tributary to the Wapsipinicon). In September 2014, 13 communities, eight counties, and nine Soil and Water Conservation Districts united to form the Upper Wapsipinicon River Watershed

Management Authority (WMA). Many of these partners report being motivated by the declining water quality and increased in-stream sedimentation in the Upper Wapsipinicon River and its tributaries. Because the watershed is long and narrow, most of the communities are on or close to river or stream corridors and are therefore concerned about the increased frequency and extent of flooding. At a recent WMA meeting, the Independence representative expressed frustration with the sedimentation in the river and the constant threat of flooding, potentially so destructive to downtown infrastructure. The Independence representative reminded the WMA partners that the city has already physically buried the main floor of their downtown businesses in an attempt to deal with flooding issues.

One of the first actions of the UWR WMA was to plan, fund, and implement a comprehensive, watershed-wide, water-quality testing effort. The UWR WMA now monitors 20 sites. With assistance from Coe College and NE Iowa Resource Conservation and Development Inc., water-quality data are recorded and analyzed, and will soon be published on the Upperwapsi.com website. The WMA communities are also meeting as a committee of the larger group to share information, learn about what other communities are doing to deal with storm water runoff and water-quality issues, and to inform WMA planning. These efforts demonstrate a commitment to achieving, measuring, and sharing long-term success in the UWR WMA.

The Disaster (RD-4135): Torrential rains that began on June 21, 2013, caused the National Weather Service (NWS) to issue flash flood warnings for more than half of Iowa's 99 counties. Parts of the northern end of the UWRW received up to six inches of rain overnight; by morning, residents of Independence, the largest community in the watershed, were sandbagging around businesses and homes. Iowa's wettest spring on record had left the region with already saturated soils; with the latest heavy rains, the NWS forecasted that the UWR in Independence would crest at record levels. Multiple businesses and residences were evacuated, and community members

spent the night filling sandbags and building sandbag levees. However, the flat topography and nature of flash floods created forecasting challenges with this event. The river eventually crested above flood stage, but not as high as forecasters had projected. IDALS estimated that it would cost $9,228,674 to repair the damage from environmental degradation; the Iowa Individual Assistance Grant Program made 50 awards totaling $40,700 for personal property and home repair assistance in the area.

National Objective, MID-URN, and Vulnerable Populations: The project meets the National Objective of Urgent Need. The project will help address unmet needs in an area subject to a Presidential Disaster Declaration in 2013. The flood hit portions of lower Buchanan County, Tract 9506, in the UWRW the hardest; these areas qualified as impacted under criterion D of Appendix G–Environmental Degradation. In the community of Quasqueton, eight inches of rain fell in less than three hours. The designated sub-county area had excessive soil loss as a result of the heavy rains, resulting in increased sediment delivery to waterways in the immediate vicinity, as well as additional downstream effects. If another event occurs, the area can expect to see further loss of nutrients and soil, which will reduce farmland productivity, impact the local economy, and accelerate environmental degradation downstream.

The sub-county area, Tract 9506 in Buchanan County, has prior documented environmental distress in the form of a Category 5 Impaired Waters. The presence of nutrients increased because of the heavy rainfall that occurred in Disaster DR-4135, magnifying existing problems in the watershed and downstream of this sub-county area. Buffalo Creek is impaired as the result of its declining freshwater mussel population. (Freshwater mussels are important filter feeders. Their decline in species diversity is likely from siltation, destabilization of stream substrate, stream flow instability, and high in-stream levels of nutrients.)

Perennial Cover/Grass	15	Prairie STRIPS	5
Oxbow Restoration	5	Terrace	9
Floodplain Restoration	3	Buffer Strips	25
Small Farm Pond (0.25–2 acres)	14	Bioreactor	5
Medium Farm Pond (2–5 acres)	25	Small Wetland	4
Large Farm Pond (5+ acres)	2	Large Wetland	2
Sediment Detention Basin	20	Saturated Buffer	5
Storm Water Detention Basin	7		

A sample distribution of the types and numbers of projects for the Upper Wapsipinicon River is listed (left). The WMA will finalize the selection and distribution of projects based on the selection criteria. Projects in the UWRW will target practices that focus on runoff reduction to lessen flooding and retain topsoil and sediment; these practices could include farm ponds and retention ponds, which capture and store water temporarily, allowing it to be released downstream more slowly.

Resilience programming will include both Buchanan and Delaware counties, with the initial assessment helping to identify the most vulnerable areas for programmatic focus. This will likely include the communities of Quasqueton, Rowley, and/or Robinson.

Consultation: During the community engagement meeting held on August 5, 2015, watershed residents demonstrated their support for the IWA. Discussion centered on ways to communicate information on current efforts, which focus on protecting the corridor and reducing flood risk. Residents emphasized the strong engagement the watershed receives from stakeholders and producers in the area. Meeting attendees showed enthusiasm and dedication for implementing the project, as well as eagerness to provide assistance and resources.

Metrics: *Resiliency Value*: This approach in the targeted watersheds will reduce flood flows by 25%, thereby reducing damage to repetitive loss sites of the past (agricultural lands, roads, infrastructure, homes) at the outlet of the selected HUC 12s. *Environmental Value*: Project water-quality goals include reduction of nitrate loads by 30% and phosphorus loads by 20% at

the outlet of the HUC 12s. *Social Value*: This project will result in improved resilience to flooding, especially in the MID-URN areas, through programs to promote awareness and a community-wide flood resilience action plan. *Economic Revitalization*: Expected economic revitalization includes increased use (and associated tourism income) of the river as a source of recreation (See BCA, unquantifiable benefits). Further, implemented projects will help to retain soil on the land, preserving Iowa's agricultural economy. Researchers will evaluate these metrics through the collection of scientific data, and through the activities of the CEA.

Project Timeline: July 2016–March 2017: Collection of data (topography, soil conditions, etc.) and development of hydrologic assessment of the full HUC 8 watershed; April 2017–September 2017: Development of hydrologic plan for eligible areas, modeling of different project scenarios; July 2018–June 2021: Implementation of Resilience Programming in the project area (community engagement, networking, needs assessment); October 2017–December 2017: WMA selects final sites and projects for implementation; January 2018–June 2018: Establish agreements with landowners, selection of contractors; July 2018–June 2020: Construction of projects. July 2020:–June 2021: Post-construction data collection and analysis; July 2021–September 2021: Final reports, work with WMA members to help define future steps and funding.

Budget: The estimated costs associated with the construction and design in the UWRW totals $6,122,500 ($4,660,000 from HUD, $1,462,500 in landowner contribution). Other items include: $550,000 for hydrologic assessment and watershed plan; $375,000 for WMA coordinator; and $800,000 for data collection, modeling, and analysis.

Benefit Cost Analysis: 18.93

Project Description #5: Middle Cedar River Watershed

The Middle Cedar River Watershed (MCRW) is a 1.5M-acre watershed that spans parts of 10 counties in Eastern Iowa (Attachment E, Map 8). It encompasses primarily the Iowan Surface landform, characterized by long, gently rolling hills and well-developed stream networks. The MCRW is part of the Cedar River Basin that stretches from Minnesota to Southeast Iowa, where it meets the Iowa River. The MCRW includes some of the richest farmland in the nation. Seventy-three percent of the land is dedicated to row crop agriculture and seed corn production. The MCRW also supports a substantial portion of Iowa's urban areas, including Cedar Rapids (the second largest city in Iowa), Waterloo, and Cedar Falls. The river runs through these metropolitan areas and provides a sense of place. Each community is exploring opportunities to invest in river enhancements and reduce environmental impacts, from policy changes that disallow development in the floodplain and integration of green infrastructure (Cedar Falls) to consideration of recreational amenities such as whitewater parks (Waterloo). The river is of particular interest to Cedar Rapids, which uses shallow groundwater under the influence of the river for its municipal water supply.

Additional Mitigating Information: Interest in opportunities to mitigate flood risk and improve water quality runs high in the MCRW. The Cedar River Watershed Coalition formed in response to the 2008 flood and brought together concerned citizens, farmers, soil and water commissioners, and local governmental staff and elected officials. The County Conservation Boards organized another large-scale initiative to develop the Cedar River Watershed Education Program. The program produced television and radio PSAs to educate homeowners and farmers about ways to reduce runoff. The IWA will complement and enhance these programs.

In 2013, the MCRW was identified as a priority watershed under the Iowa Nutrient Reduction Strategy. The statewide Water Quality Initiative (WQI) selected five HUC 12s in the

Middle Cedar for initial implementation of projects aimed at improving water quality. The City of Cedar Rapids led a 2015 effort to organize the Middle Cedar Partnership Project (MCPP) to directly support WQI watershed projects. The MCPP received $2M from USDA-NRCS through the Regional Conservation Partnership Program (RCPP) and leveraged another $2.3M in partner contributions. The MCPP has drawn support from 16 partners, including state agencies, agribusinesses, nonprofits, local conservation districts, and universities. The WQI and MCPP projects in the Middle Cedar will complement IWA projects, further reducing downstream flooding and improving water quality. WQI and MCPP projects will benefit from the hydrologic assessment and watershed plan developed by the IWA.

An effort is currently underway to form a WMA for the MCRW that would unite 47 cities, 10 counties, and 10 soil and water conservation districts. The group will pursue an aggressive timeline for WMA formation. Several counties and cities in the MCRW have indicated support, and those already active in other WMAs will provide leadership and assistance.

Two Disasters (DR-4126, DR-4135): Portions of the MCRW were impacted by two severe weather events that resulted in Presidential Disaster Declarations in 2013. The most significant and damaging of these occurred in 2013, when severe storms produced more than 10 inches of rain in late May and early June. Locals feared river levels would reach those of the historic 2008 flood. Cities deployed HESCO barriers, and residents filled and placed sandbags to protect their homes and businesses. The Cedar River at Vinton crested at 18.5 feet, the fourth highest crest at this location, causing widespread damage throughout the community and rural areas. Three weeks later, severe storms hit the region again; the area experienced significant runoff from agricultural fields and urban infrastructure into already high streams and rivers.

While river levels fell short of the 2008 flood, damages were significant. In Benton County alone, infrastructure damages totaled $4,955,844 (Phase I, Attachment B). Widespread overland

flooding washed out gravel roads throughout the county as well as several recreational areas, including many miles of a rails-to-trails park maintained by Benton County Conservation. In Vinton a deteriorating wood truss bridge was inundated for 72 hours, closing a main link between the community and rural residents. The lost bridge and multiple road washouts required significant detours and additional travel time for emergency responders, threatening the health and safety of rural residents.

In adjacent Tama County, which was hit by the same events, the loss of valuable topsoil trumped infrastructure damage. Heavy rains on saturated soils resulted in significant runoff, leading to the loss of tons of topsoil and the leeching of nutrients into the drainage network across the entire watershed. In the MCRW within Tama County, soil losses from DR-4126 were estimated at *2.5–5.0* tons of soil per acre. IDALS estimated that it would cost $27,426,813 to repair the damage from environmental degradation.

National Objective, MID-URN, and Vulnerable Populations: The project meets the National Objective of Urgent Need. It will help address unmet needs in an area subject to two Presidential Disaster Declarations in 2013. The MID-URN area of the MCRW, impacted by flooding, includes portions of Benton, Tama, and Buchanan counties, as demonstrated in Phase I and Phase II, Exhibit B. The population in Census Tracts 9602, 9603, and 9604 in the Hinkie, Mud, Opossum, and Wildcat Creek watersheds, within the MID-URN area in Benton County, represent an LMA area, but the area is not primarily residential; proposed projects in those four HUC 12s will have a direct benefit to this area. The project will reduce flood damages to infrastructure, agricultural lands, and urban areas of Vinton and improve water quality for local residents. Local homes will benefit from flood risk reduction.

Local transportation infrastructure will incur less damage (in the four identified HUC 12s, flooding washed out gravel roads, making them impassable at more than 25 locations and causing dangerous loss of public and emergency access).

The WMA will select six additional HUC 12s in Benton and Tama counties for a total of 10 HUC 12 watersheds. An example distribution of the type and number of projects likely to be implemented in the MCRW is listed above. The WMA will finalize the project sites and types based on the selection criteria. The cumulative impact of MCRW activities will also include improved municipal water for Cedar Rapids.

Perennial Cover/Grass	60	Oxbow Restoration	4
Floodplain Restoration	5	Terrace	10
Small Farm Pond (0.25– 2 acres)	20	Buffer Strips	30
Medium Farm Pond (2–5 acres)	50	Bioreactor	5
Large Farm Pond (5+ acres)	20	Small Wetland	10
Sediment Detention Basin	20	Large Wetland	20
Storm Water Detention Basin	20	Saturated Buffer	7

Resilience programming will include Tama, Benton, and Buchanan counties, with the initial assessment helping to identify the most vulnerable areas for programmatic focus. This will likely include the communities of Vinton and Traer.

Metrics: *Resiliency Value*: This approach in the targeted watersheds will reduce flood flows by 25%, thereby reducing damage to repetitive loss sites of the past (agricultural lands, roads, infrastructure, homes), at the outlet of each HUC 12. *Environmental Value*: Water-quality goals call for the reduction of nitrate loads by 30% and phosphorus loads by 20% at the outlet of each HUC 12. *Social Value*: This project will result in improved resilience to flooding, especially in the Vinton L/M income area, through programs to promote awareness and a community-wide flood resilience action plan. *Economic Revitalization*: IWA projects will help reduce future soil

loss and erosion, helping to preserve agricultural productivity. Metrics will be evaluated by the collection of scientific data, and activities of the Center for Evaluation and Assessment.

Local input: IFC staff participated in a Benton County Board of Supervisors meeting on Sept. 1, 2015, and a Black Hawk County Conservation Board meeting on August 26, 2015. Both groups expressed enthusiasm for the program; they particularly appreciated the fact that participation is voluntary and that they could hire a WMA Coordinator. Participants suggested that these efforts might include levees and voluntary land acquisition as possibilities. (Levees are currently not part of this program, but land acquisition may be considered.)

Project Timeline: July 2016–March 2017: Meetings, forums, and the submission and acceptance of Chapter 28E Agreement documents for formation of new Watershed Management Authority; July 2016–June 2019: Social Resilience Programming core activities (community engagement, networking, needs assessment); April 2017–December 2017: Collection of data (topography, soil conditions, etc.) and development of hydrologic assessment of the full HUC 8 watershed; January 2018–June 2018: Development of hydrologic plan for eligible areas, modeling of different project scenarios; July 2018–September 2018: WMA selects final sites and projects for implementation; October 2018–March 2019: Establish agreements with landowners, selection of contractors; April 2019–September 2020: Construction of projects; October 2020–September 2021: Post-construction data collection and analysis, work with WMA members to help them define future steps.

Budget: Estimated costs associated with the construction and design totals $16,800,000 ($12,775,000 from HUD; $4,025,000 in landowner contributions). Other items include: $550,000 for hydrologic assessment and watershed plan; $375,000 for WMA coordinator; and $2,000,000 for data collection, modeling, and analysis.

Benefit Cost Analysis: 12.79.

Project Description #6: Clear Creek Watershed with Coralville Infrastructure

The Clear Creek Project includes projects in the upper watershed (Attachment E, Map 9) to reduce flooding and improve water quality, and infrastructure projects in Coralville to protect commercial and residential property from flooding. The impact of these two activities will be cumulative in Coralville, which will have flood protection by infrastructure to the 500-year flood, and upstream measures that will reduce flood flow and provide additional protection.

The Clear Creek Watershed (CCW) covers 66,132 acres (104 square miles), spanning parts of Iowa and Johnson counties in Southeast Iowa. Clear Creek empties into the Iowa River at Coralville. The watershed lies entirely within the Southern Iowa Drift Plain, comprised of glacial deposits broken up by many small creeks that have molded the landscape into rolling hills and valleys. Abundant rainfall and fertile soils allowed the conversion of the natural prairie and forested landscape to large-scale intensive agriculture, consisting mainly of a corn-soybean rotation. Eighty-four percent of cropland in the upper portions of the watershed is classified as highly erodible. Intensive agriculture on these soils in a moist climate, coupled with stream channelization in the headwaters and increasing urbanization in the lower portions of the watershed, contribute to flash flooding and water-quality degradation after intense spring storms.

Additional Mitigating Information: A WMA is in the final stages of formation in the CCW, led by the cities of Coralville, Iowa City, North Liberty, Tiffin, and Oxford; Johnson County; and the Soil & Water Conservation Districts (SWCD) in both Johnson and Iowa counties. These groups agreed to work together to improve and protect the CCW. The Clear Creek Watershed Enhancement Board (CCWEB) has also been active since 1998.

Two Disasters (DR-4119, DR-4126): Torrential rains on April 17, 2013, resulted in the declaration of DR-4119. Coralville reported six inches of rain in 24 hours. Following Iowa's wettest spring on record, these storms created significant runoff. A USGS gauge near Coralville

reported a crest of nearly 7,000 cfs (normally 100 cfs). Flooding caused severe washouts and loss of roadway materials on 60 road sections in Johnson County at a cost of $114K. More severe weather hit the area in late May and early June 2013. Impacts from the second disaster focused more on flooding of the Iowa River. Coralville and Iowa City, at Clear Creek's outlet to the Iowa River, braced for potentially historic flooding. Volunteers filled sandbags to protect public facilities and private homes, and the University of Iowa deployed seven miles of HESCO barriers along its riverfront campus. Meanwhile, Clear Creek in Coralville experienced backwater effects as the Iowa River reached its fourth highest crest in history. Damage to Coralville recreational trails totaled $374K. Numerous homes took on water, including many that had never before flooded. Federal assistance was not available for individual assistance for property damage. The Iowa Individual Assistance Grant Program made 47 modest awards totaling $31.5K for personal property and home repair assistance in Johnson County after these floods. IDALS estimated it would cost $4,676,492 to repair damage from soil loss.

Coralville Infrastructure: The City of Coralville is set along Clear Creek where it joins the Iowa River — a position that leaves it particularly vulnerable to flooding. Flooding originates from either (or both) Clear Creek and backwater from the Iowa River. Recent floods (from 1993 to 2013) have had a devastating impact on the local economy, causing many businesses to relocate. Unprotected storm sewer discharge points along the creeks and river leave systems vulnerable to backwater. The city determined that it was imperative to construct flood mitigation projects, especially for the existing storm sewer system, to protect businesses and residents from future floods. Today Coralville is finished or nearly finished implementing most of these flood protection improvements, but two major projects remain incomplete: a flood wall on the south side of Clear Creek and the reconstruction of Stormwater Pump Stations (PS) 7 and 8. *These pump stations are now the "weak links" in Coralville's Flood Protection System*. Failure to

update these pump stations may allow flood water to bypass the other flood protection improvements and cause catastrophic flooding. The proposed infrastructure project in Coralville is to modify PS 7 and 8 to the same design level as all other Coralville flood mitigation projects. This is the most cost-effective solution to provide consistent flood protection throughout Coralville (the city regulates to the 500-year flood plus one foot freeboard) to minimize property risks. Without these improvements, flood risk in these regions remains unchanged from 2013.

The flood-vulnerable area includes 178 acres of developed land with 116 properties, including commercial buildings and multi-family residences, critical infrastructure, U.S. Highway 6 (a major transportation corridor), an AT&T Point of Presence building (covering communications for all of Southeast Iowa), and a Mediacom Internet switch gear. PS 7 protects about 42.8 acres of developed property and PS 8 protects about 135.9 acres. This project will benefit every property owner and tenant within these regions (Attachment E, Maps 10-11, Diagrams 1-2).

National Objective, MID-URN, and Vulnerable Populations: *Infrastructure*: The project will help address unmet needs in an area subject to Presidential Disaster Declarations in 2013. The project meets the National Objective of L/M income, Area Benefit (LMA). This area qualifies as most impacted and distressed due to continued flood damage, including two 2013 floods (DR-4119, DR-4126). It qualifies as an unmet recovery need; the pumps remain unmodified and unable to protect previously impacted areas from future flooding.

Watershed Projects: Portions of Johnson County, Tract 103.01, and Iowa County, Tract 9601, were hardest hit in the CCW, suffering environmental degradation from DR-4119. The project meets the National Objective of Urgent Need (UN). The service area represents an LMA area, but the area is not primarily residential. The sub-county area had excessive soil loss as a result of the heavy rains. An estimated 0.16–0.30 tons of soil were lost per acre, resulting in increased sediment delivery to waterways. Excessive topsoil loss degraded the productive

Perennial Cover/Grass	10	Prairie STRIPS	5
Oxbow Restoration	2	Terrace	5
Floodplain Restoration	3	Buffer Strips	7
Small Farm Pond (0.25–2 acres)	10	Bioreactor	5
Medium Farm Pond (2–5 acres)	24	Small Wetland	5
Large Farm Pond (5+ acres)	5	Large Wetland	3
Sediment Detention Basin	15	Saturated Buffer	5
Storm Water Detention Basin	10		

capability of the land, endangering the local agricultural economy. The event also introduced nutrients into the streams, including nitrates and phosphorus.

IWA projects will be realized in Upper and Middle Clear Creek based on the distribution of MID-URN. Examples of the types and numbers of projects are listed in the above table. The WMA will finalize project selection and distribution based on criteria (see Soundness of Approach, Program 1). The IWA will provide resources to existing partners and stakeholder groups and build on current collaborations. Community resilience programming (see Soundness of Approach, Program 2) in the CCW will help improve local flood resilience.

Metrics: *Resiliency Value*: The watershed projects will reduce flood flows at the outlet of Middle Clear Creek by 25%, thereby reducing damage to repetitive loss sites (agricultural lands, roads, infrastructure, homes). The Coralville infrastructure project will protect at least 116 properties. *Environmental Value*: Project water-quality goals call for reduction of nitrate loads by 30% and phosphorus loads by 20% at the outlet of Middle Clear Creek. *Social Value*: This project will result in improved resilience to flooding, especially in the Coralville LMA, through programs to promote awareness and a community flood resiliency action plan. *Economic Revitalization*: IWA projects will reduce future soil loss and erosion, preserving agricultural productivity. Infrastructure mitigation will also create an estimated 16 jobs in Coralville in year

one (see BCA). These metrics will be evaluated by the collection of hydrologic data, and through the activities of the CEA.

Local Input: An August 2015 event at the Johnson County Administration Building featured community discussion of the IWA and inclusion of the CCW in the proposal. The Johnson County Board of Supervisors supports IWA for the resources it will provide to CCW residents and the connections it will build among urban and rural communities. Participants noted the need for funding to apply practices to retain soil health, improve water quality, and reduce flooding.

Timeline: *Watershed Projects*: July 2016–March 2017: Meetings with partners, construction of shovel-ready practices; April 2017–December 2017: Collection of data (topography, soil conditions, etc.) and development of hydrologic assessment of the full HUC 8 watershed; January 2018–June 2018: Development of hydrologic plan for eligible areas, modeling of different project scenarios; July 2018–September 2018: WMA selects final sites and projects for implementation; July 2018-June 2021: Social Resilience Programming core activities; October 2018–March 2019: Establish agreements with landowners, selection of contractors; April 2019–September 2020: Construction of projects; October 2020–September 2021: Post-construction data collection and analysis, work with WMA members to define future steps. *Infrastructure*: July–October 30, 2016: Engineering design plans and specifications; November 2016–December 2016: Permitting; January–February 2017: Construction and Letting; March 2017–October 2018: Construction; November–December 2018: Acceptance and Closeout.

Budget: *Watershed Projects*: Estimated costs associated with construction and design total $6,148,750 ($4,660,000 from HUD; $1,488,750 from landowner contributions). Other items: $375K for hydrologic assessment and watershed plan; $375K for WMA coordinator; and $800K for data collection, modeling, and analysis. *Infrastructure*: $2,446,400 (HUD + direct leverage).

BCA: 6.81 (4.77 for Watershed Projects and 12.89 for Infrastructure).

Project Description #7: English River Watershed

The English River Watershed is a 639-square mile watershed that encompasses parts of six counties in Southeast Iowa (Attachment E, Map 9). The English River Watershed (ERW) is part of the Lower Iowa River and is characteristic of an agricultural watershed within the Southern Iowa Drift Plain. This landform is typified by an undulating landscape with tabular uplands and a complex dendritic network of incised river and stream valleys.

The ERW is an agricultural watershed that is home to about 21,700 people, the majority of whom live in several small communities. Most of the farmland has been modified with tile drainage and two-thirds of the landscape is row crop. A quarter of the area is grassland or pasture, and approximately 6% is timber.

Additional Mitigating Information and Unique Partners: The English River Watershed Management Authority (ERWMA) was formed in 2013 to address flooding and water-quality issues. The IDNR awarded the ERWMA a grant through the Section 319 program to develop a comprehensive watershed management plan to develop a roadmap for future mitigation efforts. The watershed plan is out for public comment and will be finalized in late 2015.

The watershed plan identifies two key natural resource concerns: water quality and flooding. As with most Iowa watersheds, nutrient loss is problematic in the ERW. As part of the comprehensive watershed plan development process, the Iowa Soybean Association performed water-quality testing three times in 2014 at 20 sites in the watershed. Results indicated seven of subwatersheds in the English River Valley had elevated nitrate levels (greater than 10 ppm). Significant spikes were observed in April and July, which may correlate to heavy rain events. The highest nitrate levels were found in the Upper North English, Camp, and Deer Creek subwatersheds across multiple seasons. Phosphorus is also of concern in the ERW, causing nuisance algal blooms in Lake Iowa in the ERW.

The IFC conducted a hydrologic analysis of the ERW as part of the watershed plan development. According to the analysis, flood events have occurred in one-third of the last 75 years; 13 of those floods occurred between May and July. The hydrologic analysis also provided information on areas of the watershed most vulnerable to high runoff or high flood potential, and identified areas where increased filtration, through practices like ponds, could provide the most potential flood relief. Areas with high average runoff were generally located in the upper and middle portion of the watershed.

The comprehensive watershed plan also includes a survey of ERW residents, both urban and rural. Of the 688 randomly sampled watershed landowners, nearly 25 percent participated in the survey, providing their unique perspectives as farmers, urban homeowners, business owners, and taxpayers. Nearly 42% of responders had watershed properties that were impacted by flooding in the last 10 years, but only 33% indicated that they were concerned about future flooding. In addition, 42% of respondents indicated that they were unsure whether enough was being done to address flooding in Iowa, and 27% felt that not enough was being done. In general, respondents agreed (either "strongly" or "somewhat") with the following statements: 1) We need to improve water quality (85%); 2) We need to improve soil health (84%); 3) We need to provide more education for landowners on water-quality issues (76%); and 4) We need to increase incentives for farmers to protect soil and water (71%).

The Disaster (DR-4119): Heavy rains in April 2013 resulted in the English River at Kalona cresting at 22.47 feet, the second highest crest for the river at that location. In Iowa County, the MID-URN area of this watershed, nearly *38 miles* of roads in the ERW were washed out.

The heaviest rains from this storm moved through the southern half of Iowa County in the ERW, where some areas experienced up to eight inches of rain during the event (Phase I, Attachment B-17). These rains in April came on the heels of Iowa's wettest spring on record and

resulted in significant runoff and loss of valuable topsoil on agricultural fields. An estimated 0.5 tons of soil for every acre of farmland was lost during this disaster. Valuable carbon and nitrogen that crops rely on for production washed away with soil. These soils help make Iowa (and the Midwest) the agricultural breadbasket of the country; soil loss threatens the economic vitality of this watershed.

As a result of the overland flooding and the loss of topsoil, ditches filled to capacity because of the significant amount of soil moving with the runoff. Locations throughout the county required assistance and unanticipated costs to remove the topsoil from the ditches so waters could properly drain. Additional societal costs included sedimentation of downstream water bodies and heightened turbidity, which interrupted the natural cycles of aquatic life and reduced the aesthetic value for recreation in the watershed. IDALS estimated that it would cost $3,211,683 to repair the damage from environmental degradation.

National Objective, MID-URN, and Vulnerable Populations: The project meets the National Objective of Urgent Need. The project helps address unmet needs in an area subject to a Presidential Disaster Declaration in 2013. The MID-URN area of the ERW is in the upper reaches of the watershed, with unmet needs located in southern Iowa County because of the localized heavy rain and significant topsoil loss from DR-4119. Projects will be implemented in this area because of the damages sustained during DR-4119 and the long history of flooding challenges in this watershed.

An example distribution of the types and numbers of likely projects for the ERW is listed below. Projects and practices in the ERW will target practices, such as retention ponds, that focus on runoff reduction to decrease flooding and retain topsoil and sediment; these can be used to capture and store water temporarily, allowing it to be released more slowly downstream. The

WMA will finalize the exact selection and distribution of projects based on the selection criteria. These practices will have long-term flood reduction and water-quality benefits for landowners, nearby residents, and downstream residents. The target area served does not qualify as LMI, but Iowa County Tract 3705 Block Group 1 in North English represents an L/M income area that will directly benefit from this project.

Perennial Cover/Grass	20	Prairie STRIPS	6
Oxbow Restoration	3	Terrace	10
Floodplain Restoration	5	Buffer Strips	10
Small Farm Pond (0.25–2 acres)	10	Bioreactor	5
Medium Farm Pond (2–5 acres)	30	Small Wetland	10
Large Farm Pond (5+ acres)	10	Large Wetland	5
Sediment Detention Basin	20	Saturated Buffer	5
Storm Water Detention Basin	10		

The initial assessment will be used to help identify the most vulnerable areas for the resilience programming focus. This will likely include the communities of North English and Millersburg.

Consultation: Information on the IWA was presented at a public Iowa County Board of Supervisors meeting on August 28, 2015. After describing the program, participants reiterated that they are interested in project implementation funding (not just planning and monitoring). Iowa County participants were also concerned about the role of a "Watershed Management Authority," how their community would benefit from projects, and whether other groups, such as NRCS and USACE, were involved. Questions were answered to their satisfaction.

Metrics: *Resiliency Value*: This approach in the targeted watersheds will reduce flood flows by 25%, thereby reducing damage to repetitive loss sites of the past (agricultural lands, roads, infrastructure, homes) at the outlet of each HUC 12. *Environmental Value*: Project water-quality goals call for the reduction of nitrate loads by 30% and phosphorus loads by 20% at the outlet of

each HUC 12. *Social Value*: This project will result in improved resilience to flooding, including the English River LMI area, through programs to promote awareness and a community-wide flood resilience action plan. These metrics will be evaluated by the collection of scientific data (water quality and quantity), and activities of the CEA.

Project Timeline: July 2016–March 2017: Collection of data (topography, soil conditions, etc.) and development of a (refined) hydrologic assessment of the full HUC 8 watershed; April 2017–September 2017: Development of hydrologic plan for eligible areas, modeling of different project scenarios; July 2018–June 2021: Implementation of Resilience Programming (community engagement, networking, needs assessment) in the project area; October 2017–December 2017: WMA selects final sites and projects for implementation; January 2018–June 2018: Establish agreements with landowners, selection of contractors; July 2018–June 2020: Construction of projects. July 2020–June 2021: Post-construction data collection and analysis; July 2021–September 2021: Final reports, work with WMA members to help define future steps and funding.

Budget: The estimated costs associated with the construction and design in the ERW totals $9,208,750 ($6,990,000 from HUD; $2,218,750 in landowner contributions). Other items include: $250,000 for hydrologic assessment and watershed plan; $375,000 for WMA coordinator; and $1,200,000 for data collection, modeling, and analysis.

Benefit Cost Analysis: 5.17

Project Description #8: North Raccoon River and Storm Lake Infrastructure

The North Raccoon River in Central Iowa is a tributary of the Des Moines River, flowing mainly through the Des Moines Lobe landform, which retains imprints of glacial occupation, such as abundant moraines and shallow wetland basins (potholes) (Attachment E, Map 12). This "prairie pothole" landscape is dominated by flat land and poor surface drainage. The North Raccoon River Watershed (NRRW) is heavily tiled. Row crop production (corn and soybeans) accounts for 85% of its land area. The North Raccoon is used for swimming, canoeing, and fishing. The NRRW landscape is considered the most important and threatened waterfowl habitat in North America, supporting more than 300 migratory bird species.

Additional Mitigating Information: The 2011 Raccoon River Watershed Water Quality Master Plan informs and guides efforts to improve environmental conditions and maintain the vigor of local agricultural production. The plan will provide foundational information for the hydrologic assessment and watershed plan. In 2013, the Iowa Nutrient Reduction Strategy named the NRRW a priority watershed. Many organizations are currently active in the Water Quality Initiative (WQI) project in the NRRW watershed. This project and others, such as a recent Department of Energy award to Antares Group Inc., will complement IWA projects, resulting in significant data sharing among groups.

Two Disasters (DR-1977, DR-4126): In May 2013, Buena Vista County experienced high winds, tornadoes, and heavy rainfall countywide, with an average of seven inches of rain. Some areas received 8–10 inches in 48 hours. Spring 2013 was the wettest on record statewide, and soils were already saturated. The storms resulted in runoff from agricultural fields and urban infrastructure into streams and rivers already flowing high. In Buena Vista County alone, these storms resulted in $5,635,426 in infrastructure damages (see Phase I, Threshold). More than 30 secondary roads were washed out, and nearly five miles of roads had to be replaced at a cost of

$.5M. Many properties in the City of Storm Lake were impacted. The Iowa Individual Assistance Grant Program made 242 awards (less than $5K each) totaling $222,700 for personal property and home repair assistance in Buena Vista County after the 2013 flood.

April 2011 storms caused major topsoil loss in Pocahontas County (see Phase II, Threshold) and increased sediment delivery to waterways, introducing nutrients into the stream system that would otherwise have been available for crops. IDALS estimated that it would cost $8,123,344 to repair the damage from environmental degradation.

Watershed Projects: Outlet Creek, which includes Alta and Storm Lake, will be selected as a target HUC 12 to minimize the impact of heavy rains on these communities, to mitigate damage to secondary road networks and agricultural land, and to improve water quality. This will complement proposed infrastructure work in Storm Lake. Headwaters Cedar Creek in Pocahontas will be selected as one HUC 12 to support and complement the WQI in that watershed. The WMA will select two more HUC 12s in Buena Vista and Pocahontas counties. A sample distribution of the type and number of likely projects in the NRRW is listed above. The WMA will finalize selection and distribution of projects based on selection criteria.

Perennial Cover/Grass	28	Buffer Strips	10
Oxbow Restoration	10	Bioreactor	4
Small Farm Pond (0.25–2 acres)	8	Small Wetland	15
Medium Farm Pond (2–5 acres)	4	Large Wetland	7
Sediment Detention Basin	5	Saturated Buffer	4
Storm Water Detention Basin	5		

Infrastructure: Storm Lake is prone to flooding, resulting in frequent damage to public and private property (Attachment E, Maps 13-24). The city is undertaking a multifaceted approach to make the community more flood resilient. This includes a sanitary sewer flood mitigation upgrade to the wastewater treatment plant and conveyance system to reduce sewer backups

into homes and avoid release of untreated wastewater into the environment. These projects are necessary before subsequent work can move forward. The effort comprises eight phases.

Activity 1: Spooner and Seneca Street storm sewers are inadequate to convey a typical two-inch rainfall event. Heavy rains in 2011 and 2013 caused system deterioration and damage to private residences. The city will reconstruct the roadways with pervious (or permeable) pavement and a storm water quality system, which stores and conveys storm water to the former railroad line controlled by the city. The system will include a treatment train with bio-swales and other features to improve water quality. **Activity 2:** 4th Street and Oates Street experienced severe flooding contaminated with high concentrations of *e. coli.* Storm water improvements to the area will include installation of pervious pavers along with bio-retention cells and rain gardens to reduce flooding and nutrient load entering the lake.

Activity 3: The trunk sanitary sewer on 7th and Geneseo will be replaced. The current 10" sanitary sewer line is undersized, causing severe surcharging during two-year rain events. This causes significant backups and flooding in the neighborhood. It also requires localized bypass pumping. The project would replace the undersized system with a 15" sewer line from the intersection of 7th and Ontario to the trunk sewer by Highway 7. **Activity 4**: Storm water improvements in the Memorial Park area directly above the lake inlet will reduce flooding on Highway 7. Flooding has damaged retail establishments to the detriment of Storm Lake's economy. Improvements include a treatment train of bio-swales in conjunction with pervious pavement at the ballfield parking lot to collect, treat, and convey the storm water to the lake.

Activity 5: The area near Mae and 1st Street east to the Memorial Street Lift Station is very susceptible to surcharging and bypass events, as well as frequent, significant backups and floods. A cured-in-place pipe (CIPP), a lining of the 24" and 18" sanitary trunk sewers, will be put in place from Mae and 1st Street east to the Memorial Street Lift Station to help to prevent release

of raw sewage directly into the lake and avoid sewer backups into homes. **Activity 6**: Flooding of the 10th and Ontario storm water system impacts numerous LMI property owners. The addition of storm water capacity on city-owned property across from the Field of Dreams (FOD) sports complex will reduce flooding. Bio-swales and retention basins along the FOD parking area and a storm water basin north of the field will protect the area from a 100-year storm.

Activity 7: 4th Street from Western to Barton Streets experiences flash flooding that inundates homes during nearly all rain events. Reconstruction of the streets with pervious pavement and replacement of the existing storm sewer will reduce flooding and significantly improve the quality of the storm water runoff to the lake. **Activity 8:** Construction of wetland ponds will complement projects partially funded by the Hazard Mitigation Grant Program and help settle out nutrients before the water is released to the Raccoon River.

National Objective, MID-URN, and Vulnerable Populations: The project meets the National Objective of Urgent Need and will address unmet needs in areas subject to 2011 and 2013 Presidential Disaster Declarations. The target MID-URN area of the NRRW is in Buena Vista and Pocahontas counties. Buena Vista County qualifies under significant remaining infrastructure damage, especially in Storm Lake. The infrastructure projects meet the National Objective of LMA. Pocahontas County qualifies under environmental damage.

Local Input: A community meeting in Storm Lake on Sept. 22, 2015, brought together representatives from NRRW city and county entities. Participants expressed concerns about water-quality degradation and recognized the IWA's potential. This project will help stakeholders protect and enhance their natural resources.

Metrics: *Resiliency Value*: The IWA in the targeted watersheds will reduce flood flows by 25%, thereby reducing damage to repetitive loss sites of the past (agricultural lands, roads, infrastructure, homes) at the outlet of each HUC 12. Infrastructure updates in Storm Lake will

increase local property values. *Environmental Value*: Water-quality goals call for the reduction of nitrate loads by 30% and phosphorus loads by 20% at the outlet of each HUC 12. *Social Value*: This project will result in improved flood resilience, especially in Storm Lake, by promoting awareness and a community-wide flood resilience action plan. *Economic Revitalization*: IWA projects will reduce future soil loss and erosion, preserving agricultural productivity. In Storm Lake, this project will help prevent flooding of homes and businesses.

Project Timeline: *Watershed Projects*: July 2016–March 2017: Meetings, forums, submission and acceptance of Chapter 28E Agreement documents for formation of new WMA; April 2017–September 2020: Social Resilience Programming; June 2018–June 2021: Collection of data and development of hydrologic assessment of the full HUC 8 watershed; January 2018–June 2018: Development of hydrologic plan for eligible areas, modeling of scenarios; July 2018–September 2018: WMA selects final sites and projects for implementation; October 2018–March 2019: Establish agreements with landowners, selection of contractors; April 2019–September 2020: Projects construction; October 2020–September 2021: Post-construction data collection and analysis, work with WMA members to help them define future steps. *Infrastructure*: July 2016–December 2017: Phases 2–7 (simultaneous); July 2017–December 2018: Phases 1 and 8.

Budget: *Watershed Projects*: Estimated construction/design costs total $6,146,250 ($4,660,000 from HUD; $1,486,250 in landowner contributions). Other items include: $350,000 for hydrologic assessment and watershed plan; $375,000 for WMA coordinator; and $800,000 for data collection, modeling, and analysis. *Infrastructure*: Phase 1: $1,787,000; Phase 2: $895,000; Phase 3: $295,000; Phase 4: $430,000; Phase 5: $1,228,000; Phase 6: $1,943,000; Phase 7: $780,000; Phase 8: 1,275,000.

BCA: 14.71 (30.68 for Watershed Projects and 1.17 for Infrastructure)

Project Description #9: East Nishnabotna River Watershed

The East Nishnabotna Watershed (ENW) encompasses 696,400 acres and touches 10 counties in Southwest Iowa (Attachment E, Map 25). The ENW is part of the Nishnabotna Basin that drains to the Missouri River, a crucial water body that provides feeding, breeding, and resting areas for hundreds of species of birds and fish. Located in the Southern Iowa Drift Plain Region with broad rolling uplands and deep valleys, the ENW's adjoining woodland areas provide abundant habitat for wildlife and are frequently used for recreation. Abundant archaeological sites and artifacts from the area provide insight into pre-historic life in the region.

In the early 1900s, farmers began to transform the landscape from prairie to farmland. Channel straightening during this time altered the naturally meandering streams. About 75% of the lower 100 miles of the East Nishnabotna River were straightened. The fertile loess soils are intensively farmed and susceptible to erosion and streambank degradation. The predominant land use is for row crops; about 76% of the watershed is in corn and soybeans.

Additional Mitigating Information and Unique Partners: In 2011, a comprehensive plan was developed for seven counties in the Loess Hills region in Western Iowa, including Fremont County in the East Nishnabotna. The plan looked at changes in the area during the last 20 years and set goals for the future. It found that from 1992–2006, cropland in the Loess Hills region increased by more than 50,000 acres, and impervious surfaces increased by 30,000 acres. The Loess Hills Alliance is one local group working to restore woodland and prairie areas. The IWA will build upon the 2011 comprehensive plan and complement work of the Loess Hills Alliance.

The ENW was selected by the Iowa Water Resources Coordinating Council as a high priority area for implementing conservation practices outlined in Iowa's Nutrient Reduction Strategy. The Bluegrass and Crabapple Project in the ENW received $1.2M in project funds to

demonstrate practices to improve water quality, network with landowners, and provide education and outreach opportunities.

The IWA will also build upon existing assessment and modeling work completed by the U.S. Army Corp of Engineers (USACE). The USACE will share site information for practices that are "shovel ready" to help mitigate flooding and improve water quality. The IFC and the USACE will partner to ensure consistent hydrologic assessment and modeling in the ENW.

East Nishnabotna IWA projects will also build upon the current work of the Golden Hills Resource Conservation and Development (RC&D). The RC&D's Hungry Canyon Alliance (HCA) is dedicated to working with landowners to implement streambank stabilization structures. The HCA estimates that for every $1 invested in streambed stabilization structures, about 0.98 tons of soil are protected from erosion. The IWA will provide additional resources to help implement streambank stabilization structures that will serve the dual purpose of benefiting soil health and improving water quality by decreasing sediment transportation.

The Disaster: In 2011, the Missouri River experienced record-setting floods, affecting six Southwest Iowa counties, including the East Nishnabotna in Fremont County. Above average rain in the fall of 2010, followed by record-setting winter snowfall and spring rain, caused the flooding. Super-saturated soils were unable to absorb the immense amount of precipitation. Intense flooding covered roads and bridges with debris, undermined roads and culverts, and damaged bridges. In a report released by the Iowa DOT, estimated costs to repair flood damage to transportation infrastructure on primary and secondary roads in the affected counties in Southwest Iowa totaled $63.5M. The Iowa Farm Bureau calculated damage to fields and lost crop income at $52.2M in Fremont County alone.

Moving flood waters carry with them hazardous chemicals and diseases, and currents also carry materials that can cause personal injuries. Standing, stagnant water following a flood event

also poses a threat to public health and wildlife. The degradation of water quality in Fremont County in the ENW following the 2011 Missouri River floods led to its Presidential Disaster Declaration in June 2011. IDALS estimated that it would cost $1,932,648 to repair the damage from environmental degradation.

Proposed Project in the East Nishnabotna: Based on the distribution of environmental MID-URN, the project will target two HUC 12s (Mill and Ledgewood creeks) in Fremont County to implement built projects. Practices will be aimed at protecting the soil and increasing its water holding capacity, channel bank stabilization, reducing runoff and downstream flooding, and improving water quality. The presence of impaired waters in Fremont County threatens recreation, tourism, and wildlife, and thus could have an economic impact on the watershed. This project will work to make the distressed area more resilient to future flood events that can compromise water quality and impact public health during floods.

Channel Bank Stabilization	15	Prairie STRIPS	5
Perennial Cover/Grass	8	Terrace	5
Oxbow Restoration	5	Buffer Strips	4
Floodplain Restoration	2	Bioreactor	1
Small Farm Pond (0.25–2 acres)	2	Small Wetland	1
Medium Farm Pond (2–5 acres)	2	Large Wetland	1
Sediment Detention Basin	2	Saturated Buffer	1
Storm Water Detention Basin	2		

An example of the suite of practices to be installed in the watershed is listed left). Implemented practices substantially lessen flood impacts on the watershed, which will directly reduce the amount of runoff leading to water-quality impairments. Residents downstream of installed practices will benefit from reduced peak flows during flood events, safer drinking water for communities dependent on

shallow groundwater, and recreation opportunities. Conservation practices will provide habitat for many unique species of plants and animals residing in the diverse ecology found only in this part of Iowa.

National Objective, MID-URN, and Vulnerable Populations: The project meets the National Objective of Urgent Need. The project will help address unmet needs in an area subject to a Presidential Disaster Declaration in 2011. The presence of water-quality 303d impairments resulted in the MID-URN classification for Tract 9701 in Fremont County. Several segments of the East Nishnabotna are listed on Iowa's 303d impaired waters list per the Clean Water Act—including the entire 28-mile stretch of the river that runs east to west and spans the full width of Tract 9710. This stretch of the East Nishnabotna is impaired due to heightened levels of *e. coli* and does not support recreational uses. The MID-URN areas of the watershed are located in Fremont County, where four HUC 12s will be identified to implement practices designed to reduce flood risk, improve water quality, and improve resiliency to future disaster events. The IWA will address the needs of the East Nishnabotna Watershed in response to the 2011 Missouri River floods. The project will create a replicable model that the East Nishnabotna Watershed can rely on to secure additional funding and resources to carry out project implementation for years to come.

The initial assessment will be used to help identify the most vulnerable areas for the resilience programming focus. This will likely include Farragut.

Consultation: A Phase II community engagement meeting was held on Sept. 14, 2015. Participants recognized an immediate correlation between the current needs of the watershed and the work proposed by the IWA. Residents of the county embraced the project description for the multiple benefits it will provide to their livelihood and for protection of the natural resources they enjoy and rely upon.

Metrics: *Resiliency Value*: This approach in the targeted watersheds will reduce flood flows by 25%, thereby reducing damage to repetitive loss sites of the past at the outlet of each HUC 12. *Environmental Value*: Project water-quality goals are reduction of nitrate loads by 30% and phosphorus loads by 20% at the outlet of each HUC 12. *Social Value*: This project will result in improved resilience to flooding, especially in the MID-URN areas, through programs to promote awareness and develop a community-wide flood resilience action plan. *Economic Revitalization*: IWA projects will help reduce future soil loss and erosion, helping to preserve agricultural productivity. These metrics will be evaluated through the collection of scientific data and the activities of the Center for Evaluation and Assessment.

Project Timeline: July 2016–March 2017: Meetings, forums, submission and acceptance of Chapter 28E Agreement documents for formation of new Watershed Management Authority; April 2017–June 2020: Social Resilience Programming (community engagement, networking, needs assessment); April 2017–December 2017: Collection of data (topography, soil conditions, etc.) and development of hydrologic assessment of the full HUC 8 watershed; January 2018–June 2018: Development of hydrologic plan for eligible areas, modeling of different project scenarios; July 2018–September 2018: WMA selects final sites and projects for implementation; October 2018–March 2019: Establish agreements with landowners, selection of contractors; April 2019–September 2020: Construction of projects; October 2020–September 2021: Post-construction data collection and analysis, work with WMA to define future steps.

Budget: The estimated costs associated with the construction and design in the ENW totals $3,076,250 ($2,330,000 from HUD, $746,250 in landowner contributions). Other items include: $350,000 for hydrologic assessment and watershed plan; $375,000 for WMA coordinator; and $400,000 for data collection, modeling, and analysis.

Benefit Cost Analysis: 25.51

Project Description #10: West Nishnabotna River Watershed

The West Nishnabotna River in Southwest Iowa is a tributary of the Missouri River (Attachment E, Map 25). The watershed includes 489,500 acres within the Southern Iowa Drift Plain Region, with its steeply rolling uplands and wide valleys. This area consists of thick loess deposits with underlying glacial till and is highly erodible and susceptible to severe stream degradation. The river is used heavily for recreation, tourism, provides many historic and cultural resources, and includes the only state-designated water trail in Southwest Iowa. Currently, 80% of the watershed is cropland.

Prior to the 1900s, the West Nishnabotna River meandered naturally, with gently sloping stream banks and wet prairies. Channel straightening in the early 1900s affected about 90 percent of the lower 100 miles of the river. An estimated $1.1B in damage has since accrued from damaged bridges, utility lines, culverts, farmland, and sediment deposition from post-channelization streambank erosion. Today, the West Nishnabotna River Water Trail is one of the most physically altered state water trails in Iowa, with 15-foot high banks and no riparian zone.

Additional Mitigating Information: The West Nishnabotna River provides numerous recreational opportunities—paddling, canoeing, camping, fishing, hunting, and wildlife watching. Besides the Missouri River, the West Nishnabotna is the most heavily used recreational river in the area. A report by ISU's Center for Agricultural and Rural Development ("Iowa Rivers & River Corridors Recreation Survey") showed 134,755 trips reported and total spending of $3,654,920 in 2010. In May 2014, the West Nishnabotna River Trail Plan was created, examining existing conditions of the water trail and providing recommendations for improvements. This plan will provide information for the IWA hydrologic assessment.

In 2013, the Iowa Nutrient Reduction Strategy identified the West Nishnabotna River Watershed (WNRW) as a high priority area for implementing best management practices

(BMPs) for reducing nitrogen and phosphorous loads. The Walnut Creek Watershed Project encompasses three HUC 12s in the watershed that receive Water Quality Initiative funding. The project includes $1M to be used for building partner relationships and demonstrating BMPs. These projects will complement the IWA by increasing awareness of watershed management, building upon existing producer relationships, and continuing momentum for implementing environmentally-sound land management practices.

There are several strong partners in the WNRW, including the Golden Hills Resource Conservation and Development (RC&D). The RC&D's Hungry Canyons Alliance Project provides state and federal money to 23 counties in Western Iowa, including those within the WNRW. Since 1992, the program has provided $20.5M for technical assistance for grade control structures and streambed stabilization practices. Local stakeholder groups, including Mills and Fremont County Conservation Boards, Boards of Supervisors, and local NRCS Service Centers will be essential resources for project development. The IWA hydrologic assessment and watershed plan will build upon existing hydrologic modeling and inundation mapping projects recently completed by the U.S. Army Corps of Engineers.

The Disaster (DR-1998): From late May through August 2011, the Missouri River Basin experienced widespread record flooding that severely impacted six counties in Western Iowa. As the Missouri River swelled, a levee near Hamburg, Iowa, broke, sending an immense amount of raging water toward the small town and to the north, displacing about 300 residents from their homes and businesses. The extreme flood caused five fatalities and major damage to communities, livelihoods, infrastructure, transportation, agriculture, and public health. Flooding closed more than 100 miles of secondary roads in Iowa, as well as several interchanges along Interstate 29 (I-29). Bridges, roads, and culverts were washed out or left covered with a thick layer of mud and debris. The estimated cost of the damages was more than $2B. The Iowa DOT

estimated that repairs to flood damaged transportation infrastructure on primary and secondary roads in the affected Iowa counties would cost $63.5M. The Iowa Farm Bureau calculated damage to fields and lost crop income at $22.2M in Mills County alone.

The MID-URN classification for Tract 401 in Mills County is based on water-quality impairments. Several segments and tributaries of the West Nishnabotna are listed on Iowa's 303d impaired waters list—including a 15.5-mile stretch of the West Nishnabotna and the 5.5-mile long Mud Creek, both in Mills County. This stretch of the West Nishnabotna is impaired due to high levels of *e. coli* and thus cannot currently support recreational uses. Mud Creek is impaired due to the lack of biological diversity. DR-1998 exacerbated both of these impairments, making the already dangerous floodwaters an even greater risk to health and the environment. IDALS estimated that it would cost $5,939,324 to repair the damage from environmental degradation.

Two HUC 12s in Mills County, including a portion of Mud Creek and Willow Slough-West Nishnabotna River, have been selected as project watersheds because the service area (Census Tract 401, Block Group 1) is also an LMA area, though it is not residential. This area has many remaining challenges since the 2011 flood, including both a displacement of families after the flood, not all of whom have returned, and a shortage of affordable housing.

National Objective, MID-URN, and Vulnerable Populations: The project meets the National Objective of Urgent Need. The project will help address unmet needs in an area receiving a Presidential Disaster Declaration in 2011. It will address environmental MID-URN. The two selected HUC 12s in Mills County will directly benefit vulnerable populations through decreased flow and improved water quality, and may also improve local shallow wells. Channel bank stabilization, oxbow reconnection, and floodplain restoration will help slow erosion. The WMA will select four additional HUC 12s based on the required criteria. An example of the type and number of practices to be implemented in the WNRW is listed below. The project will set a

precedent for future work in the watershed to help communities become more resilient to disasters, connecting the watershed, reducing flood risk, and improving water quality and environmental resilience.

Resilience programming will include both Fremont and Mills counties, with the initial assessment helping to identify the most vulnerable areas for programmatic focus. One focus area will include the Mud Creek HUC 12 in north Mills County.

Channel Bank Stabilization	52	Prairie STRIPS	10
Perennial Cover/Grass	20	Terrace	10
Oxbow Restoration	5	Buffer Strips	10
Floodplain Restoration	9	Bioreactor	3
Small Farm Pond (0.25–2 acres)	5	Small Wetland	3
Medium Farm Pond (2–5 acres)	5	Large Wetland	1
Sediment Detention Basin	5	Saturated Buffer	2
Storm Water Detention Basin	10		

Consultation: A community engagement event was held on Sept. 14, 2015. Participants recognized an immediate correlation between the current needs of the watershed and the work proposed by the IWA. Residents embraced the project description for the multiple benefits it will provide to their livelihood and to protect the natural resources upon which they rely.

Metrics: *Resiliency Value*: This approach in the targeted watersheds will reduce flood flows by 25%, thereby reducing damage to repetitive loss sites of the past (agricultural lands, roads, infrastructure, homes) at the outlet of each HUC 12. *Environmental Value*: Project water-quality goals call for the reduction of nitrate loads by 30% and phosphorus loads by 20% at the outlet of each HUC 12. *Social Value*: This project will result in improved resilience to flooding, especially in the LMI area, through programs to promote awareness and a community-wide flood resilience action plan (See Soundness of Approach, Program 2). *Economic Revitalization*: Soil erosion is a

significant problem in the WNRW and a threat to agricultural productivity. IWA projects will help reduce soil loss and erosion, maintaining Iowa's important agricultural economy. We will evaluate these metrics by the collection of hydrologic data (water quality and quantity), and with assistance from the Center for Evaluation and Assessment.

Project Timeline: July 2016–March 2017: Meetings, forums, submission and acceptance of Chapter 28E Agreement documents for formation of new Watershed Management Authority; April 2017–September 2020: Social Resilience Programming core activities (community engagement, networking, needs assessment); April 2017–December 2017: Collection of data (topography, soil conditions, etc.) and development of hydrologic assessment of the full HUC 8 watershed; January 2018–June 2018: Development of hydrologic plan for eligible areas, modeling of different project scenarios; July 2018–September 2018: WMA selects final sites and projects for implementation; October 2018–March 2019: Establish agreements with landowners, selection of contractors; April 2019–September 2020: Construction of projects; October 2020–September 2021: Post-construction data collection and analysis, work with WMA members to help define future steps.

Budget: The estimated costs associated with the construction and design in the ENW totals $9,221,250 ($6,990,000 from HUD; $2,231,250 in landowner contributions). Other items include: $350,000 for hydrologic assessment and watershed plan; $375,000 for WMA coordinator; and $1,200,000 for data collection, modeling, and analysis.

Benefit Cost Analysis: 16.11