Exhibit 1

Water Quality Improvement Plan
for

Raccoon River, Iowa

Total Maximum Daily Load
for Nitrate and *Escherichia coli*

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6.2 Local BMP Implementation

6.2.1 NPS Load Reductions from Agricultural Sources

At the scale of an individual landowner, there are many options available for implementing BMPs that will help reduce loads of nitrate and bacteria in streams. Many BMPs will help reduce loads for both nitrate and bacteria, whereas other BMPs are targeted for one pollutant more than the other. Of the two target pollutants, nitrate reduction strategies are better documented than bacteria reduction strategies. For example, Dinnes et al. (2002) provides a useful summary of strategies to reduce nitrate leaching in tile-drained landscapes. However, because nitrate is ubiquitous in the environment and is delivered to streams from many sources, the ability of a single landowner to make a difference in reducing stream pollutant loads may be greater for bacteria than for nitrate.

Table 6-4 lists the conservation practice and identifies the effectiveness of the practice to reduce pollutant loads. Load reductions are evaluated in terms of reducing loads from surface water runoff or reducing groundwater loads as either baseflow or tile drainage. Practices that provide the greatest potential for load reductions are highlighted in the table and discussed below.

Improving nutrient use efficiencies by changing the timing and rate of nitrogen applications are considered among the best practices that an individual landowner could adopt that reduce losses of nitrate to streams with subsurface flow (Table 6-4). Changing the fertilizer application methods to injection methods that minimize surface application and volatilization may reduce runoff losses of nitrogen. Bacteria losses may be reduced if landowners improved manure management practices to take appropriate nutrient credit for manure applications and minimize the application of manure during periods that would facilitate runoff.

Table 6-4. List of conservation practices available to reduce nonpoint source loads of nitrate and *E.coli* bacteria and their potential effectiveness.

		Nitrate Load Reduction Effectiveness[1]		*E.coli* Load Reduction Effectiveness[1]	
Conservation Practice	**Description**	**Surface runoff**	**Baseflow or Tile drainage**	**Surface runoff**	**Baseflow or Tile drainage**
Improve Nutrient Use					
Spring application of fertilizers	Change fertilizer application from the fall to spring to reduce N loss and increase fertilizer use efficiency. The closer the application is timed to crop needs, the less N is lost to streams.	+	++	±	±
Reduce fertilizer application rate	Reduce the rate of fertilizer applications below currently applied rate. A variable rate or site-specific fertilizer program could reduce applications on individual fields. Improved methodologies are needed to reliably assess site-specific N recommendations.	+	++	±	±
Change fertilizer application method	Change from conventional anhydrous NH3 application to innovative subsurface injection methods to minimize volatilization and reduce leaching.	++	- to +	±	±
Use nitrification inhibitors	Use of controlled or slow-release N fertilizers to slow conversion of fall-applied fertilizer to nitrate.	+	+	±	±
Manure management	Manage the application of manure to cropped fields according to the nutrient application rates of nitrogen or phosphorus. Manure should not be applied at rates that exceed the soil infiltration rate or during wet periods of runoff.	+	+	++	+
Adopt comprehensive farm nutrient management plan	Follow the guidance of NRCS Conservation Practice Standard 590 to manage the amount, source, placement, form and timing of the application of plant nutrients and soil amendments.	+	+	+	+
In-field Management					
Adopt conservation tillage	Utilize no-till or mulch-till practices on crop ground.	+	-	+	±
Contour planting and terracing	Plant crops in rows parallel to land surface topographic contours or install terraces to shorten the slope lengths of hillsides in order to reduce overland runoff.	+	-	+	±
Use cover crops	Plant cover crops of legumes, cereals, or grasses in fields during non-crop periods to reduce nitrate leaching during vulnerable fall and spring periods.	+	++	±	±

Table 6-4. …continued

Diversification of cropping systems and rotations	Include perennial legume or nonlegume crops in rotation with corn and soybeans to decrease water yield due to longer growing season. Perennial crops receive less fertilizer and tillage than annual cropping systems.	+	++	±	±
Retire lands through CRP	Convert vulnerable crop lands to perennial grass through Conservation Reserve Program.	++	++	±	±
Exclude livestock from streams	Manage pastures to exclude livestock access to streams. Install alternative watering systems if needed.	+	±	++	±
Establish rotational grazing systems	Establish fenced paddock system and rotate livestock grazing around pasture to reduce pasture degradation and manure buildup.	+	±	++	±
Incorporate manure into subsoil	Use techniques to incorporate manure into subsoil rather than spreading or applying manure to land surface.	+	± or -	++	± or -
Control feedlot runoff	Utilize run-on control (divert clean water away) and install berms, detention basins or other control structures to capture runoff and settle solids from feedlot runoff events.	+	± or -	++	± or -
Manage manure storage	Manage manure storage or modify manure storage structures to safely contain the manure until conditions are appropriate for field applications.	+	±	++	±
Use alternative tile drainage system design and management	Decrease drainage intensity using shallower tile depth or wider spacing to reduce subsurface flow and nitrate loss. Use controlled drainage when site conditions permit.	±	++	±	±
Install denitrification bioreactors	Use organic materials (corn stalks, wood chips, sawdust, etc.) as organic amendments to encourage denitrification during treatment of tile drain effluent or interception of subsurface drainage through a wall or trench.	±	++	±	±
Utilize in-field conservation buffers	Install conservation buffers, including field borders, filter strips, contour buffer strips, grass waterways, windbreaks hedgerows and other practices, to reduce surface water runoff and sediment erosion.	+	±	+	±
Off-site Management					
Plant riparian buffers	Riparian buffers of forest and herbaceous cover planted along stream corridors reduce pollutant transport to streams with surface runoff through combined processes of deposition, infiltration and dilution. Stream buffers may reduce groundwater nitrate concentrations but flows from tile drainage may bypass the buffer.	++	+ or ±	+	±
Install wetlands	Strategically site wetlands in the landscape to capture and remove nitrate from surface and subsurface water sources. For greatest reductions, wetlands should be placed in locations with highest nitrate concentrations. Utilize USDA programs (CREP) to install wetlands that intercept flows from large tile drainage systems.	+	++	±	±

[1]Ranking criteria: ++ = very effective, + = effective, ± = no effect, - = negative effect

In terms of improving in-field management of conservation practices, surface and subsurface nitrate losses could be reduced by incorporating perennial or cover vegetation into farming systems. Diversifying cropping systems, retiring lands to the CRP, or using cover crops during non-crop periods operate similarly by reducing annual water yield and nitrate losses during vulnerable spring and fall periods. Subsurface nitrate losses could also be reduced in heavily drained areas by using alternative tile drainage designs that decrease drainage density or enhance subsurface denitrification. Reducing bacteria losses from fields would involve better management of pastured systems either by excluding livestock from streams or incorporating rotational grazing systems. Improved handling of manure would reduce bacteria losses from surface runoff from fields, feedlots and manure storage structures.

Off-site measures could be adopted that reduce nitrate losses from surface runoff and subsurface delivery (Table 6-4). Riparian buffers planted along stream corridors would decrease nitrate and bacteria loads from surface runoff, whereas installing wetlands to intercept tile flows offers promise for reducing nitrate loads from larger geographic areas. Iowa State University studies of CREP (Conservation Reserve Enhancement Program) wetlands demonstrate that relatively small areas of wetlands intercepting tile drainage can remove up to 70% of the nitrate loads. Off-site actions may be facilitated or installed by individual landowners or by groups of individuals that seek to make landscape-wide changes that affect many landowners directly or indirectly.

6.2.2 NPS and Point Source Reductions from Human Sources

Pollutant losses from human sources includes urban stormwater runoff and discharge from WWTPs and septic systems. While these sources do not contribute significantly to nitrate and bacteria impairments in the Raccoon River, actions may be justified to improve local water quality.

Urban runoff comes from a variety of sources, including impervious surfaces like roads, rooftops and parking lots, as well as pervious surfaces like lawns. Urban runoff can be an important source of pollutants at a local scale. There are a variety of actions to control nonpoint urban sources, including both structural and non-structural practices. Many of these practices are described in detail in an USEPA guidance document (USEPA, 2005). Structural practices include those engineered to manage or alter the flow, velocity, duration and other characteristics of runoff by physical means (USEPA, 2005). These practices are designed to control storm water volume and peak discharge to improve water quality, reduce downstream erosion, provide flood control and promote groundwater recharge, in some cases. Nonstructural practices prevent or reduce urban runoff by reducing potential pollutants or manage runoff at the source. These practices may take the form of regulatory controls (e.g., codes, ordinances, regulations, standards, or rules) or voluntary pollution prevention practices. Nonstructural practices can be further divided into land use practices and source control practices. Land use practices are designed to prevent or reduce impacts from new development or in sensitive areas of the watershed. Source control practices are aimed at preventing or reducing potential pollutants at their source before they come in contact with runoff. This may involve educating citizens about proper disposal of used motor oil and application of lawn fertilizers and pesticides.

Permitted point source discharges include sewage treatment plants and industrial sources. Although they do not represent a dominant source of nitrogen or bacteria, they may account for a measurable portion of pollutant loads especially at lower streamflows. Existing technology may be used to reduce nitrogen or bacteria loads to stream from point sources. In some areas, nutrient and bacteria reductions from WWTPs have proven to be cost-effective and more certain than estimated reductions from agricultural BMPs. Use of Biologic Nutrient Removal and Enhanced Nutrient Removal technologies have been implemented to reduce N concentrations by 50 to 80 percent. Industrial WWTPs should be evaluated for opportunities to reduce nitrogen and bacteria discharges through pollution prevention, process modification or treatment.

Loads from failing septic systems do not significantly contribute to stream impairments, but they may be the easiest to address with readily available technology. Inspections of septic systems should be used to identify failing or outdated septic systems and these systems should be upgraded accordingly. While these upgrades may not substantially affect pollutant loadings the Raccoon River, they may improve local water quality noticeably.