

MEMORANDUM

TO: Programs, Projects and Operations Subcommittee

FROM: Martin P. Cleveland

SUBJECT: Whitted Creek Stream Restoration Project
Nebraska Department of Environmental Quality and
Nebraska Environmental Trust Fund Applications

DATE: August 5, 2008

The referenced project is located near 25th and Capehart Road in Bellevue, Nebraska (see enclosed location map). The Whitted Creek project extends for about 3,500 ft. from Papio Creek confluence to 25th Street. The District owned levee is located along the north side (left bank) of the creek. The stream bank erosion is threatening the integrity of the levee system.

The referenced project area has been studied by CH2M Hill and a Study report is available on line at <http://sharepoint.papionrd.org/consultants> Complete username: whitted@papionrd.org and password: Wh1ttedc and then double click on the Whitted Folder to access the study report. The report is also available on a CD upon request.

There is a current Request for Proposals (RFP) for project design and construction and consultant proposals will be reviewed by the Ad Hoc Subcommittee in August 2008.

Enclosed are draft Nebraska Department of Environmental Quality Section 319(H) and Nebraska Environmental Trust Fund applications (\$300,000 each) for your consideration. As a result of the once-a-year application submittal timing (September 2008), applications must be submitted prior to design commencement/completion. The grant requests are hoped to offset some of the District's anticipated \$1,000,000 plus construction contract costs.

It is Management's recommendation that the Subcommittee recommend to the Board that the General Manager be authorized to submit grant applications to Nebraska Department of Environmental Quality and Nebraska Environmental Trust Fund for Whitted Creek Stream Restoration Project.

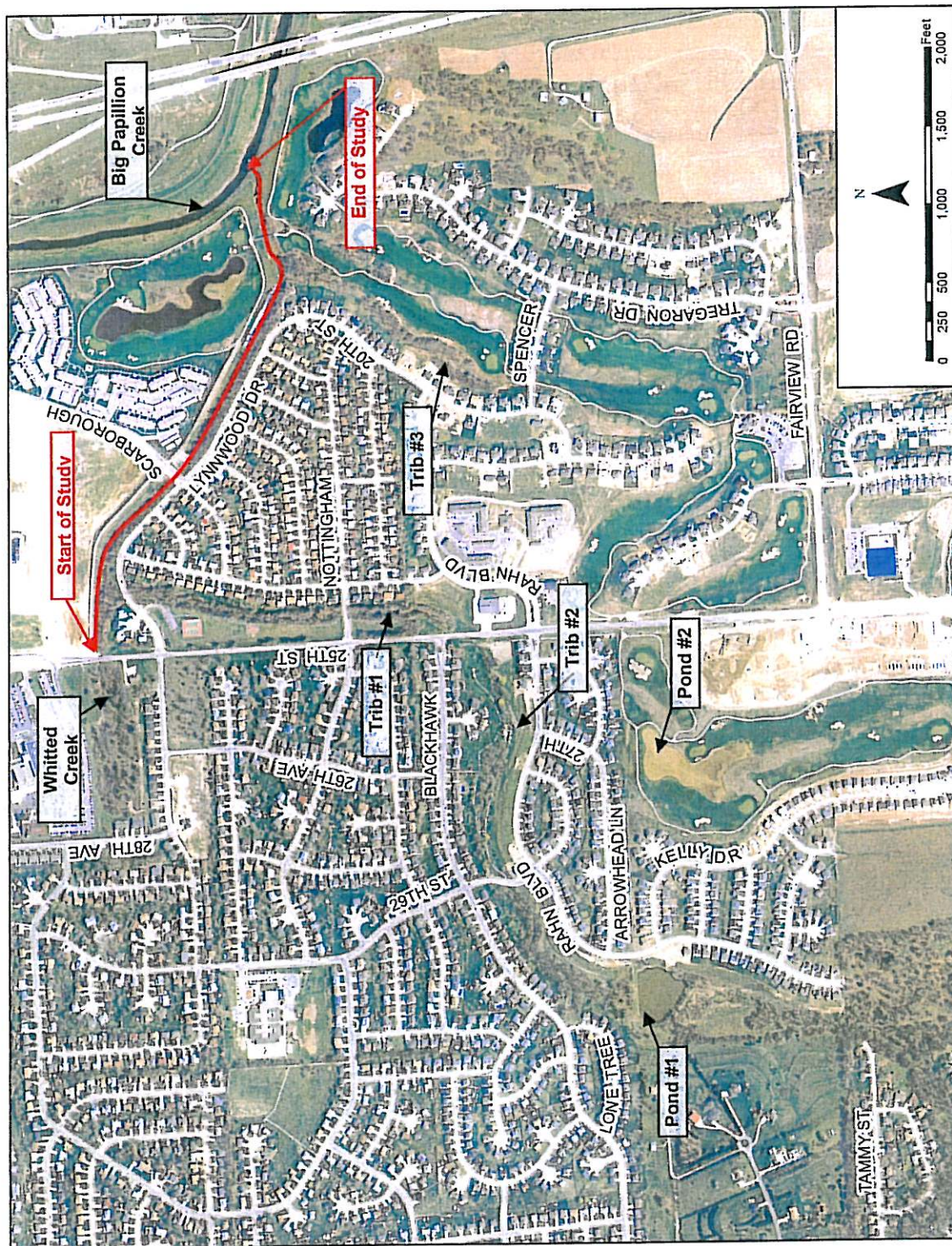


FIGURE 1
 Whitted Creek Watershed and Study Area
 Whitted Creek Stabilization Study



FIGURE 9
Overview of Conceptual Design
Whitted Creek Stabilization Study



FIGURE 5
Typical Moderate Bank Erosion Downstream of Scarborough Drive (looking upstream)
Whitted Creek Stabilization Study



FIGURE 6
Severe Bank Erosion and Incision near Confluence with Big Papillion Creek (looking downstream from golf cart bridge)
Whitted Creek Stabilization Study

**SECTION 319(h) FY08 GRANT
PART A – PROJECT PROPOSAL
COVER SHEET**

1. Project Title:

Whitted Creek Stream Restoration Project

2. Project Sponsor:

Papio-Missouri River Natural Resources District (P-MRNRD)
8901 South 154th Street
Omaha, NE 68138-3621
(402) 444-6222

3. Sponsor's Contact:

Martin Cleveland,
Papio-Missouri River Natural Resources District (P-MRNRD)
8901 South 154th Street
Omaha, NE 68138-3621
(402) 444-6222

4. Project Partners:

City of Bellevue, Nebraska

5. Project Area:

The project includes the stream reach (approximately 3,500 feet of Whitted Creek and its riparian zone) is located in Sarpy County, Nebraska and flows southeast from the intersection of 25th Street and Capehart Road to the confluence with Big Papillion Creek. It lies within the Big Papillion-Mosquito watershed (hydrologic unit code [HUC]-10230006).

6. Project Period:

October 2008 – August 2011

7. Federal Section 319 Funds Requested:

\$300,000

8. Non-Federal Match Funds Committed:

\$900,000 (of this amount, the P-MRNRD has requested \$300,000 from the Nebraska Environmental Trust grant program)

On behalf of the sponsor(s) named above, I hereby certify that the information contained in this application, including all attachments, is true, accurate and complete.

Authorized Signature of Sponsor Organization

Title

Date

Typed or Printed Name of Authorized Signatory Typed or Printed Title

**SECTION 319(h) FY08 GRANT
PART B – PROJECT DESCRIPTION**

Background: The Whitted Creek Stream Restoration Project study reaches flows through a mixed land use urban watershed (single-family residential, multi-family residential, commercial, and a golf course) of about 1.8 square miles. Historically, the channel alignment was modified from its natural meandering path to a relatively straight channel along the toe of a hillside on the south bank, most likely to accommodate agricultural interests. In the last several decades, a levee was constructed on the creek's northern bank to protect property owners from inundation due to the tail water of the Big Papillion Creek's 1 percent annual chance flood stage. As development has occurred in the watershed, two detention ponds have been constructed on tributaries, and (generally bio-engineering) bank stabilization has been installed on a tributary in a subdivision park.

This project was developed to address concerns about bank erosion and channel incision along Whitted Creek, particularly adjacent to private property, which is threatening to undermine a concrete path and residential back yards. The primary reason Whitted Creek has become entrenched is that the mainstem Papillion Creek grade has degraded, causing head cuts up the Whitted Creek channel. Existing grade control exists at a few locations along this segment of the creek; however, the "hard points" are generally comprised of rubble or rip-rap and are not stable. The entrenched channel does not allow flows from smaller storms, such as the 2-year, to access the floodplain and storm flows for these small events (as well as some of the larger ones) are confined within the channel. The erosive forces of storm flows attack the channel banks, which are not well vegetated, causing erosion that degrades water quality and aquatic habitat.

In the past, attempts to stabilize the channel and protect the levee included the application of grouted and loose rip-rap. Currently there are no short term plans being implemented to reduce the erosion at this site. In 2007 the P-MRNRD sponsored a Conceptual Study of Whitted Creek, which provided recommendations to stabilize the study reach (from 25th Street downstream 3,500 ft to the confluence with the Big Papillion Creek). The proposed long term solution to bank erosion in Whitted Creek includes implementation of the recommendations of this Conceptual Study. The conceptual plan for the channel restoration is to reshape the channel cross section and stabilize with geotextiles and native vegetation throughout the project (components requested for funding from 319 grant). Due to deep channel incision on the downstream portion of the reach, Segments 3 and 4 (see Figure 2) will require grade control structures to protect the relatively stable grade of the upstream end of the reach (Segments 1 and 2). The grade control features will be funded by the P-MRNRD. The P-MRNRD issued a request for proposals (RFP) for the Whitted Creek Stream Restoration project, the detailed design of bank stabilization along the above mentioned study reach (proposals were due August 1, 2008 and the project should be awarded in October 2008). Other factors that may influence the approach to this project are private property owner concerns, the presence of the levee (which cannot be impacted), and Federal Emergency Management Agency (FEMA) floodplain concerns.

Objectives: Reduce Bank Erosion - The objectives of the project include reducing the reach's bank erosion, therefore reducing suspended solids (and sediment bound pollutants such as bacteria and nutrients) loads to local waters. The goal is 80 percent reduction in erodable bank surface area along the study reach through the installation of geotextiles (for short term stabilization) and native plants (predominately herbaceous and shrub species). The goal is not 100 percent reduction because some bank erosion, such as undercut banks, provide excellent habitat for aquatic macroinvertebrates. The establishment of this vegetation will also create a dense riparian buffer that will help filter runoff from upland areas. Nutrient loads have not been quantified at this project location, however it is located immediately adjacent to a golf course, so the nutrient loads are most likely elevated.

Reduce Bed Erosion - The second project objective is to arrest and repair the channel bed erosion through the use of low profile rock structures in selected locations. The long term stabilization of the channel grade will rely on these grade control structures, which will prevent further head-ward migration of channel incision up the Whitted Creek system. The goal is that the reach longitudinal profile (at hard points) will not shift from the as-built elevations more than 1.0 ft at three years after construction. This objective relates to reduction of the suspended sediment source, and improvements to deficient aquatic habitat conditions.

Increase Habitat - The riparian vegetation will help meet another objective of the project, which is to increase the study reach's habitat condition, as measured by the Environmental Protection Agency's (EPA's) Rapid Bioassessment Protocol (RBP) for Aquatic Habitat Assessment, from a rating of "Poor" (< 60 points out of 200) to "Suboptimal" (> 113 points out of 200) within three years after construction. Certain physical aspects of the channel (such as the historic

**SECTION 319(h) FY08 GRANT
PART B – PROJECT DESCRIPTION**

straightening) will likely make it unrealistic to expect that the “Optimal” (> 166 points out of 200) rating is achievable for the study reach. This objective relates improvements to deficient aquatic habitat conditions.

Demonstration Use of Technology - Use of bio-engineering techniques such as bio-degradable geotextiles, a variety of low profile grade control structures, and other bank stabilization techniques will provide an educational opportunity for both P-MRNRD maintenance staff and technical staff. Maintenance staff can learn techniques for the proper installation and maintenance of these technologies (rock structures, geotextiles, and vegetation). Technical staff can continue to gain information about how these technologies are designed and constructed, where their installation will be most effective, and how they should perform. Once the project is completed, the site is easily accessible to the public (it is adjacent to a shopping center) and can be used for guided educational tours, or (with the aid of educational signage) self guided tours. The Whitted Creek Stream Restoration Project can be a demonstration project site to demonstrate a variety of bio-engineering techniques.

Pollutant Sources: The unstable and under-vegetated banks of Whitted Creek currently provide very little channel stability, aquatic habitat, or vegetative buffer. All three of these areas of deficiencies contribute to the degraded quality of downstream water and non-attainment of the primary contact recreation and aquatic life beneficial uses. The causes of degradation are a combination of increased erosive flows from adjacent urbanization, channel incision due to degradation of the Papillion Creek and historic channel alterations, and insufficient stabilizing vegetation. Runoff from impervious surfaces (urban areas) can be “starved” of sediment, and when this “clear” water (in terms of suspended solids) reaches the stream it can have the tendency to capture sediment from the stream bed and banks.

Pollutant Loads: While there have been no detailed studies of bank erosion rates on the study reach, a field estimate of eroded bank area is approximately 7,100 square yards of bank surface area. Assuming a conservative erosion rate of 1 inch per year, this exposed bank surface area has the potential to produce enough sediment to fill almost 40 five cubic yard dump trucks annually. While this is an estimate, it has the potential to be a significant contribution of suspended sediments to the Papillion Creek system. Whitted Creek is one small tributary in the Papillion Creek system, and its conditions are typical of streams in the region. This project will directly address the causes of the impairment by improving in-stream habitat conditions, reducing inputs of sediment from bank erosion, and providing template for future similar projects elsewhere in the watershed. Water quality sampling has not been conducted on Whitted Creek.

Management Practices: The project will involve the use of bio-engineering methods to minimize future bank erosion and provide improved habitat conditions by stabilizing the channel in place. This minimizes grading and uses existing onsite rock materials. The project proposes the following activities to improve habitat and biological conditions: 1.) Cross section adjustments to construct a bankfull bench (at 1 to 2-year storm stage) and re-grading the bank slope to a stable slope suitable for native vegetation. 2.) Bank stabilization with geotextiles, native vegetation, and other bio-engineering techniques will be used to decrease bank erosion, improve habitat, and provide filtration of upland runoff. 3.) Longitudinal profile adjustments with seven low profile, rock step-pool structures to gradually raise the elevation of the deeply incised channel to a series of shorter, less steep channel segments. They maintain the grade of the channel and dissipate energy as water cascades over the rocks.

Stakeholder Participation/Education and Outreach: Stakeholder participation will include coordination with private property owners and the City of Bellevue. Public education will take the form of meetings with stakeholders and permanent educational signage on site, which will explain the project goals, the basics of bio-engineering technologies, and the benefits of this project for improving the stream’s beneficial uses. Virtual site tours can be coordinated with Douglas-Sarpy County Cooperative Extension as part of their annual Sediment and Erosion Control training seminars.

Evaluation Criteria: Prior to and at the completion of the project construction the reach will be evaluated for bank erosion and habitat score. The reach will be re-evaluated once a year for three years following the completion of the project (including survey of cross sections and the longitudinal profile). Habitat assessments will be completed using EPA’s RBP for riffle/run streams. Permanent bench marks and cross section stations will be established on-site to assist with the long term monitoring. Habitat scores and surveys will be kept in a project log book. P-MRNRD maintenance staff will periodically (informally) monitor the site in the interim periods, looking for plant survivorship and bank erosion. Necessary corrective action will be taken by P-MRNRD staff to provide any needed repairs.

SECTION 319(h) FY08 GRANT

PART C – BUDGET

Project Item	unit cost	quantity	unit	319 Grant	P-MRNRD	Nebraska Environmental Trust
Design					\$ 200,000	
Construction						
Mobilization/Demobilization	\$ 85,000	1	LS		\$ 85,000	
Site Clearing and Grubbing	\$ 25,000	1	LS		\$ 25,000	
Segments 1-2						
Excavation	\$ 30.00	3,315	CY		\$ 99,450	
Grading	\$ 0.20	66,300	SF			\$ 13,260
10 ft Right Bank Buffer (2456 SY)		2,210	LF			
Geotextiles	\$ 4.50	2,456	SY	\$ 11,052		
Herbaceous Vegetation	\$ 2.00	2,456	SY	\$ 4,912		
Live Stakes (Trees & Shrubs)	\$ 6.00	13,260	EA	\$ 79,560		
Shrubs in Containers	\$ 18.00	221	EA			\$ 3,978
Trees (Ball and Burlap)	\$ 35.00	221	EA	\$ 7,735		
Top Soil or Soil Amendment	\$ 2.50	2,456	SY	\$ 6,140		
20 ft Left Bank Buffer (4912 SY)		2,210	LF			
Geotextiles	\$ 4.50	4,912	SY	\$ 22,104		
Herbaceous Vegetation	\$ 2.00	4,912	SY	\$ 9,824		
Live Stakes (Trees & Shrubs)	\$ 6.00	24,310	EA	\$ 145,860		
Shrubs in Containers	\$ 18.00	442	EA			\$ 7,956
Trees (Ball and Burlap)	\$ 35.00	442	EA			\$ 15,470
Top Soil or Soil Amendment	\$ 2.50	4,912	SY	\$ 12,280		
Grade Control Structures	\$ 10,000	1	EA		\$ 10,000	
Segments 3-4						
Excavation	\$ 30.00	3,440	CY		\$ 103,200	
Grading	\$ 0.20	51,600	SF			\$ 10,320
20 ft Right Bank Buffer (2867 SY)		1,290	LF			
Geotextiles	\$ 4.50	2,867	SY			\$ 12,901.50
Herbaceous Vegetation	\$ 2.00	2,867	SY			\$ 5,734
Live Stakes (Trees & Shrubs)	\$ 6.00	14,190	EA		-	\$ 85,140
Shrubs in Containers	\$ 18.00	129	EA			\$ 2,322
Trees (Ball and Burlap)	\$ 35.00	129	EA			\$ 4,515
Top Soil or Soil Amendment	\$ 2.50	2,867	SY			\$ 7,167.50
20 ft Left Bank Buffer (2867 SY)		1,290	LF			
Geotextiles	\$ 4.50	2,867	SY			\$ 12,901.50
Herbaceous Vegetation	\$ 2.00	2,867	SY			\$ 5,734
Live Stakes (Trees & Shrubs)	\$ 6.00	14,190	EA			\$ 85,140
Shrubs in Containers	\$ 18.00	258	EA			\$ 4,644
Trees (Ball and Burlap)	\$ 35.00	258	EA			\$ 9,030
Top Soil or Soil Amendment	\$ 2.50	2,867	SY			\$ 7,167.50
Grade Control Structures	\$ 10,000	7	EA		\$ 70,000	
Public Education & Monitoring (in-kind NRD)	\$ 8,000	1	LS		\$ 8,000	
Total				\$ 299,467	\$ 600,650	\$ 293,381
Requested Funding				\$ 300,000	\$ 600,000	\$ 300,000

SECTION 319(h) FY08 GRANT PART D – PROJECT AREA MAP

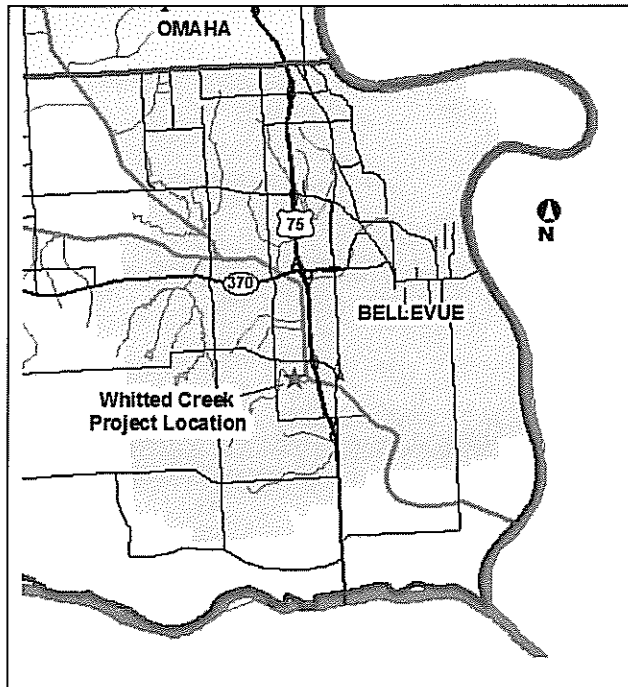


FIGURE 1
Project location map



FIGURE 2
CONCEPTUAL DESIGN - WHITTED CREEK STREAM RESTORATION



NEBRASKA ENVIRONMENTAL TRUST FUND

APPLICATION COVER SHEET

Instructions to word processing users. Double click on each slash character ("\"), including the ones below in the header, and replace them with your entry. Use your find function (Ctrl + F) to find the slash character "\". This will position your cursor at each response.

H1. Project Sponsor: Papio-Missouri River Natural Resources District

H2. Project Name: Whitted Creek Stream Restoration Project

3. County(s) where project is located: Sarpy

4. Nearest town: Bellevue

5. Total Amount Requested: \$300,000

6. Years of funding requested (select one): (1) 2 3
(multi-year project, only requesting NET funding for 1 year)

Contact Person:

7. Name: Martin Cleveland, PE

8. Title: Construction Engineer

9. Organization: Papio-Missouri River Natural Resources District (P-MRNRD)

10. Address, City, State & Zip: 8901 South 154th Street, Omaha, NE 68138-3621

11. Daytime Phone: (402) 444-6222

12. Alternate phone: N/A

13. Fax: (402) 895-6543

14. E-mail: mcleveland@papionrd.org

15. Sponsor web page: www.papionrd.org

16. Is this a continuation request for a project previously funded by the Trust: YES NO: NO

Is this a resubmission of a project application previously not funded by the Trust: YES NO: NO

17. Please indicate which category best describes the applicant:

Natural Resources District

Selections are: Individual City or County **Natural Resources District** Federal Agency Private for Profit

Private Nonprofit Consortium School, Irrigation, Power or Development District State Agency Other (specify):

18. Will this project receive federal funds or require a federal review or permit? YES NO: YES

If yes, identify the agency(s) and its role:

The P-MRNRD has submitted a grant application to the Nebraska Department of Environmental Quality (NDEQ) for a federally funded (state administered) 319(h) grant for non-point source pollution elimination. The P-MRNRD requested \$300,000 in the grant application for Whitted Creek. Notification of award for the NDEQ 319(h) grants is expected in early 2009.

US Army Corps of Engineers (USACE) will be involved in permitting for this project. The P-MRNRD has notified the Omaha District Corps of Engineers Regulatory Office requesting a pre-application meeting to provide guidance whether a 404 Individual permit or a Nationwide 27 permit (or other general permit) for Aquatic Habitat Restoration Establishment (Stream and Wetland Restoration) Activities. USACE will also be involved in approving the permit for the project.

19. Will this project receive other State of Nebraska funds or require a state review or permit? YES NO: YES

If yes, identify the agency(s) and its role:

The Papio-Missouri River Natural Resources District (P-MRNRD) will be providing the monetary support for this project.

The 319(h) grant requested through the NDEQ is federally funded, and administered by the State of Nebraska.



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APPLICATION COVER SHEET

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H1. Project Sponsor: Papio-Missouri River Natural Resources District

H2. Project Name: Whitted Creek Stream Restoration Project

20. In **300 words or less** provide an overview of the project for which you seek funding. If you are asking the Trust to fund only a portion of the project, indicate the components for which you seek funding.

The Whitted Creek Stream Restoration project site is located in Bellevue, Nebraska southeast of the intersection of 25th Street and Capehart Road. This urban stream reach includes approximately 3,500 feet of Whitted Creek and its riparian zone from 25th Street downstream to the confluence with Papillion Creek. This project was developed to address concerns about the bank erosion, channel incision, and degraded aquatic habitat. The condition, location, and size of this project site provide an opportunity to implement several stream restoration bio-engineering techniques. The project includes channel restoration using innovative hydraulic engineering and fluvial geomorphic principles; including cross section adjustments (channel reshaping), bank stabilization (geotextiles and vegetation), and longitudinal profile adjustments (grade control). The objectives of the project include:

- 1) reducing the reach’s bank erosion (reducing suspended solids and sediment-bound pollutants such as bacteria and nutrients),
- 2) arresting channel bed erosion through the use of low profile rock structures,
- 3) improving the study reach’s aquatic habitat condition, and
- 4) providing an educational opportunity for P-MRNRD maintenance staff and technical staff, and the general public.

Maintenance staff can learn techniques for the proper installation and maintenance of these technologies. Technical staff can continue to gain information about how these technologies are designed and constructed, where their installation will be most effective, and how they should perform. The site is easily accessible to the public and can be used for guided educational tours, or (with the aid of educational signage) self guided tours. This project can be used as a demonstration project site to demonstrate a variety of bio-engineering techniques that can be applied elsewhere in the watershed. The Whitted Creek Stream Restoration project will benefit the public in the surrounding community by helping the stream attain its primary contact and aquatic life beneficial uses.

21. On behalf of the sponsor(s) named above, I hereby certify that the information contained in this application, including all attachments, is true, accurate and complete.

Authorized Signature of Sponsor Organization

Title

Date

Typed or Printed Name of Authorized Signatory Typed or Printed Title

H1. Project Sponsor: Papio-Missouri River Natural Resource District

H2. Project Name: Whitted Creek Stream Restoration Project

Project Overview

The Whitted Creek Stream Restoration project site is located in Sarpy County, Nebraska southeast of the intersection of 25th Street and Capehart Road (Figure 1). It lies within the Papillion-Mosquito watershed (hydrologic unit code [HUC]-10230006) and meanders through a mixed land use watershed (single-family residential, multi-family residential, commercial, and a golf course) of approximately 1.8 square miles. The reach includes approximately 3,500 feet of Whitted Creek and its riparian zone from 25th Street downstream to the confluence with Papillion Creek. This project was developed to address concerns about the bank erosion and channel incision along Whitted Creek, particularly in a segment adjacent to the 13th green of the Tregaron golf course, which is threatening to undermine the concrete golf cart path.

Based on the assessments CH2M HILL conducted for Whitted Creek and for Douglas County as part of the Stream Asset Inventory project, the extent and causes of erosion in Whitted Creek are similar to what was found along many streams throughout the Papillion Creek watershed. The primary reason that segments of Whitted Creek are entrenched is that the Papillion Creek grade has dropped over time, causing head cuts up the Whitted Creek channel. Existing grade control was noted at a few locations along these segments; however, these “hard points” are generally comprised of rubble or rip-rap, are not stable. The entrenched channel does not allow flows from smaller storms, such as the 2-year, to access the floodplain. Therefore, storm flows for these small events (as well as some of the larger ones) are confined within the channel. The erosive forces that accompany the storm flows attack the channel banks, which are not well vegetated with deep-rooted plants such as trees and shrubs.

The condition, location, and size of this project site provide an opportunity to implement several stream restoration bio-engineering techniques in specific, limited areas with minimal risk of increased flooding. Whitted Creek, a relatively small channel, is bordered on the left bank by a levee and by a high (15 – 20 feet), steep embankment on the right bank. There are no habitable structures within the limits of the floodplain and, based on the existing hydraulic model, the culvert at Scarborough Drive is adequately sized to convey the 100-year event. The project features channel restoration using hydraulic engineering and fluvial geomorphic principles and is applied to the 3,500-ft reach. The P-MRNRD maintains a levee system along the left bank (looking downstream) of Whitted Creek, so channel grading modifications are not proposed within 20 feet of the toe of the levee.

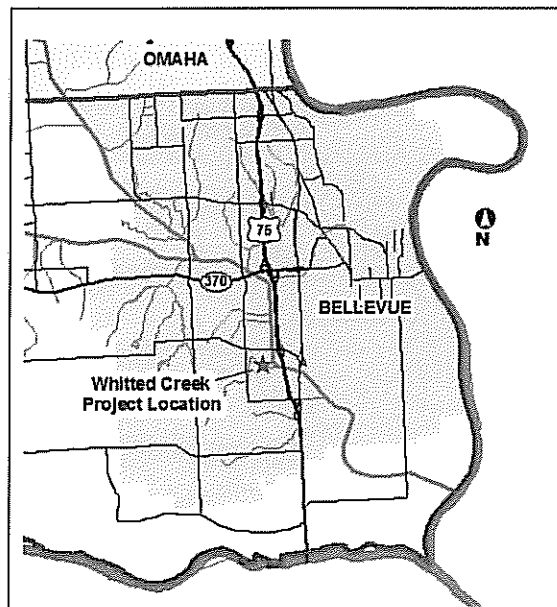


FIGURE 1
Project location map

Design and Implementation Details

The channel restoration design includes the following components; cross section adjustments (channel reshaping), bank stabilization (geotextiles and vegetation), and longitudinal profile adjustments (grade control). Due to the site constraints (levee on left bank and steep hill on right bank), channel restoration in this reach will be achieved primarily by stabilizing the channel along its existing alignment (the channel centerline will not be altered beyond its current banks). This minimizes grading as much as possible and uses existing rock materials that are on site (maximizing cost effectiveness), including native weathered rock and existing grouted rip-rap, where appropriate.

The proposed design includes reshaping of the channel cross-sectional area, installing a bankfull bench (at about the 1- to 2-year storm stage), and stabilizing stream banks using soil bioengineering techniques including geotextiles and vegetation. Channel bank side slopes will generally be between 2:1 to 3:1 (horizontal to vertical) at the steepest, and will be refined in the detailed design phase of the project based on the study reach's soil composition. These stable slopes, which will allow the establishment of native species, will prevent future bank erosion. Biodegradable geotextiles, selected applications of rock

H1. Project Sponsor: Papio-Missouri River Natural Resource District

H2. Project Name: Whitted Creek Stream Restoration Project

stabilization, and native vegetation will be used, with stouter applications where steeper bank slopes may be required. Deep-rooted native vegetation (grass and low shrub species) will be used on the channel banks along the left bank (facing downstream, levee side of stream). Native tree and larger shrub species are recommended for the right bank as this bank already has many trees. The P-MRNRD's levee maintenance practices prevent the growth of woody vegetation on the levee (left bank). Therefore, the shrub and grass species will only be applied within a limited range of the top of bank (10 to 20 feet), and no closer than 20 feet from the toe of the levee.



FIGURE 2
 Conceptual Design - Whitted Creek Stream Restoration

The conceptual design of the Whitted Creek Stream Restoration project can be seen in Figure 2 and the specific bioengineering techniques to be used are described below. Segments 1 and 2 have a generally stable grade, as they have incised to the depth of the existing bedrock in several locations, and the channel has banks ranging from 5 to 12 foot high along these segments. Improvements to these segments include earthwork to reshape the channel cross section so it contains a bankfull bench and stable bank side slopes on both sides of the channel. The right bank will be reshaped primarily on the lower bank (not beyond the flat overbank area adjacent to the toe of the levee). The key bio-engineering techniques used here include the use of densely woven coir fabric that can withstand high velocities and shear stresses (lasts 4-6 years) and potentially a rock layer buried into the toe of the bank where necessary. These reaches have weathered bedrock apparent in the channel bed, and a geotechnical investigation is needed to confirm the extent of the bedrock and whether the use of additional bank toe stabilization is necessary. The coir fabric will be underlain with compost and native grass seeding, and densely planted with smaller woody native species such as sandbar and black willows, silky and red-osier dogwoods, and button bush shrubs, and flowering native species such as goldenrod, bundleflower, partridge pea, and a variety of asters.



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Specific species selection will be determined based on the intended management of the Whitted Creek corridor by the P-MRNRD and the availability from suppliers.

In Segment 2, there is an existing grouted rip-rap apron downstream of the Scarborough Drive culverts. At the end of this apron there is a 2-foot vertical drop-off to the channel bed. To prevent continued undermining of the grouted rip-rap a grade control structure will be placed near the 2-foot vertical drop-off to step the flow down to the channel bed. This innovative type of rock structure is designed to be low profile, essentially buried into the channel bed and banks and does not change the grade of the stream. The cross vane arms protect the channel bank for a distance one arm length upstream and downstream of the vane itself.

Segment 3 is a transition between Segment 2 and 4 and could be stabilized at different levels of effort (removing the grouted rip-rap overbank channel or leaving it in place). The grouted rip-rap is stable and could incur unnecessary costs to remove. However, the edge of the grouted rip-rap channel abuts the left bank of the stream channel and is experiencing severe undercutting due to the channel bank erosion. Stabilization of Segment 3 will include constructing a modified cross vane rock structure to allow stormwater to flow into the grouted rip-rap overbank channel without eroding the channel bank. The channel stabilization will include tying the existing grouted rip-rap overbank channel into the stabilized left bank of the creek and using the same bio-engineering techniques as the other segments.

Improvements to Segment 4 are more extensive due to the larger size of the channel at this location. Channel reshaping would include earthwork to narrow the existing base flow channel to include a wide bankfull bench within the existing channel and stabilize the upper bank slopes. In approximately the first 200 feet of Segment 4 (upstream of the golf cart bridge) the channel centerline should be shifted within the existing channel toward the left bank by 5 to 10 feet. This will allow the construction of a stable slope on the right bank adjacent to the residential properties. This shift of the centerline will not reduce the capacity of the channel, simply move the base flow channel away from the toe of the right bank. Grade control is a major component of the Segment 4 stabilization.

A series of about 6 step pool structures is recommended to gradually raise the elevation of the deeply incised channel to a series of shorter, less steep channel segments (about 200 feet long each), that step down about 1 foot at each grade control structure. These structures not only maintain the grade of the channel, but also dissipate energy as water cascades over the rocks. Once a flatter gradient and stable bank slopes are established, soil should be covered with densely woven coir geotextiles, compost, and planted with native shrub and grass species described previously. More stout turf reinforcing mat (TRM) fabric may be necessary on slopes exceeding 2:1. Selected vegetation management will be utilized for existing mature trees on the right bank. Some of the existing trees will be incorporated into the project; however, others that are already unstable may have to be removed. The approximately 40 feet of the steep right bank (looking downstream) adjacent to the golf cart path around the Tregaron Golf Course 13th green will be stabilized as part of the Segment 4 work. The grade of the banks can be constructed at a flatter slope than currently exists. The key to the long term stability of the banks is a solid foundation at the toe of slope, and a bank slope that can be maintained with geotextiles in the short term and deep rooted vegetation in the long term. A series of 3 to 4 layers of soil encapsulated lifts (soil layers wrapped in coir geotextiles and planted densely with willows) will comprise the base of the slope and TRM fabric may be required on the upper part of this portion of Segment 4.

What are the project objectives, how will they be evaluated, and what constitutes success?

The objectives of the project include reducing the reach's bank erosion, therefore reducing suspended solids (and sediment-bound pollutants such as bacteria and nutrients) loads to local waters. The goal is 80 percent reduction in erodable bank surface area along the study reach through the installation of geotextiles (for short term stabilization) and native plants (predominately herbaceous and shrub species). The goal is not 100 percent reduction because some bank erosion, such as undercut banks, provide excellent habitat for aquatic macroinvertebrates. The establishment of this vegetation will also create a dense riparian buffer that will help filter runoff from upland areas. Nutrient loads have not been quantified at this project location, however it is located immediately adjacent to a golf course, so the nutrient loads are most likely elevated.



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H2. Project Name: Whitted Creek Stream Restoration Project

The second project objective is to arrest and repair the channel bed erosion through the use of low profile rock structures in selected locations. The long term stabilization of the channel grade will rely on these grade control structures, which will prevent further head-ward migration of channel incision up the Whitted Creek system. The goal is that the reach longitudinal profile (at hard points) will not shift from the as-built elevations more than 1.0 ft at three years after construction. This objective relates to reduction of the suspended sediment source, and improvements to deficient aquatic habitat conditions.

The riparian vegetation will help meet another objective of the project, which is to increase the study reach's habitat condition, as measured by the Environmental Protection Agency's (EPA's) Rapid Bioassessment Protocol (RBP) for Aquatic Habitat Assessment, from a rating of "Poor" (< 60 points out of 200) to "Suboptimal" (> 113 points out of 200) within three years after construction. Certain physical aspects of the channel (such as the historic straightening) will likely make it unrealistic to expect that the "Optimal" (> 166 points out of 200) rating is achievable for the study reach. This objective relates improvements to deficient aquatic habitat conditions.

Use of bio-engineering techniques such as bio-degradable geotextiles, a variety of low profile grade control structures, and other bank stabilization techniques will provide an educational opportunity for both P-MRNRD maintenance staff and technical staff. Maintenance staff can learn techniques for the proper installation and maintenance of these technologies (rock structures, geotextiles, and vegetation). Technical staff can continue to gain information about how these technologies are designed and constructed, where their installation will be most effective, and how they should perform. Once the project is completed, the site is easily accessible to the public (it is adjacent to a shopping center) and can be used for guided educational tours, or (with the aid of educational signage) self guided tours. The Whitted Creek Stream Restoration Project can be a pilot project site to demonstrate a variety of bio-engineering techniques.

Prior to and at the completion of the project construction the reach will be evaluated for bank erosion and habitat score. The reach will be re-evaluated once a year for three years following the completion of the project (including survey of cross sections and the longitudinal profile). Habitat assessments will be completed using EPA's RBP for riffle/run streams. Permanent bench marks and cross section stations will be established on-site to assist with the long term monitoring. Habitat scores and surveys will be kept in a project log book. P-MRNRD maintenance staff will periodically (informally) monitor the site in the interim periods, looking for plant survivorship and bank erosion. Necessary corrective action will be taken by P-MRNRD staff to provide any needed repairs. Successful stabilization will have minimized the erosion of the banks and created a better stream and riparian habitat.

Who will benefit from this project and how?

The Whitted Creek Stream Restoration project will benefit the public in the surrounding community by helping the stream attain its primary contact and aquatic life beneficial uses. Although Whitted Creek has not been sampled directly, six stream segments within the Papillion Creek watershed are listed as impaired based on data collected in 2005 by the Nebraska Department of Environmental Quality (NDEQ); the pollutant of concern for two segments is *Escherichia coli* (*E. coli*) bacteria and low dissolved oxygen and unknown pollutants for the other four segments. *E. coli* are bacteria that are a species of fecal coliform bacteria, which is specific to fecal material from humans and other warm-blooded animals. The US EPA recommends using *E. coli* as the best indicator of health risk from water contact in recreational waters; some states, including Nebraska, have established water quality standards for and monitor for *E. coli*. In accordance with the Clean Water Act, the NDEQ recently released a draft total maximum daily load (TMDL) for the Papillion Creek watershed to address excessive *E. coli*. The TMDL for *E. coli* is designed to allow the impaired Papillion Creek watershed stream segments to fully support the primary contact recreation beneficial use.

Based on the assessments the P-MRNRD's engineering consultant (CH2M HILL) conducted for Whitted Creek and for Douglas County as part of the Stream Asset Inventory project, the extent and causes of erosion in Whitted Creek are similar to what was found along many streams throughout the Papillion Creek watershed. The most effective means to improve water quality in a sustainable manner is through a comprehensive approach to improve stream ecosystem function. Stream ecosystem function includes stream and near-stream environments for aquatic habitat, floodplains, channel stability, sediment



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transport, and hydraulics all intended to support the stream's natural tendencies (as measured by macroinvertebrate and fish populations) rather than work to control the stream.

P-MRNRD technical and maintenance staff will benefit from this project, as it can be used as a demonstration project site to show how to construct and maintain a variety of bio-engineering techniques, which can be applied elsewhere in the watershed.

Who is contributing to this project?

The P-MRNRD is the sponsor for the Whitted Creek Stream Restoration project and will be the primary contributor to the construction of this project and the continued maintenance. The P-MRNRD Board of Directors issued a request for proposals (RFP) for the Whitted Creek Stream Restoration project, the detailed design of bank stabilization along the above mentioned study reach. Proposals were due August 1, 2008 and the engineering contract is expected to be awarded in October 2008. This project will be a demonstration project for the P-MRNRD as an example of bio-engineering techniques that are appropriate for urban streams. The P-MRNRD will support the construction and maintenance of this project through its general funds.

The USACE Omaha District Corps of Engineers Regulatory Office will be involved in the permitting decisions and approval for the project. A pre-application meeting has been requested to enable them to become familiar with the project and determine the required permit applications. A Nationwide 27 permit (or other general permit) for Aquatic Habitat Restoration Establishment (Stream and Wetland Restoration) Activities will probably be adequate, however, there is a possibility they will require a 404 Individual permit. The USACE Nationwide 27 permit is in draft format, under discussion with the Omaha District office.

Feature Bonus

This project may be eligible for Feature Bonus points because it has the potential to shift an engineering design paradigm for how to stabilize degraded stream channels in eastern Nebraska. The proposed design is focused on maintaining and enhancing flood protection while, at the same time, restoring the natural stream processes and improving habitat within the corridor. The conceptual design of the project was based on an eco-system enhancement approach through the creation of aquatic habitat and stream buffers. The project includes components to inform and educate the public as a demonstration project for bio-engineering techniques and through permanent signage on site. Although none are specifically planned yet, guided or virtual project site tours could also provide opportunities for public education. The project includes representatives of a public agency (P-MRNRD) and coordination with private interested parties (adjacent property owners). The project provides economic value through implementing a sustainable solution, which will not need to be reconstructed because the project is designed to work with nature, not try to control it. The project proposes to use P-MRNRD staff for monitoring and maintenance of the project, potentially influencing the general maintenance practices throughout the P-MRNRD's jurisdiction to include similar project components such as vegetated buffers and grade stabilization techniques.

The aesthetic, recreational, and urban life enhancements are organized around the central principles of ecological restoration and flood protection, and are in many ways a shift in traditional stream stabilization design philosophy. The P-MRNRD is taking the lead on this project, without formal interagency agreements from other entities, and this project has the potential to inspire future, large-scale collaborative project that will have significant environmental impact. This project supports the Papillion Creek Watershed Partnership's (Partnership's) collaborative efforts on the Papillion Creek Watershed Stormwater Masterplan to improve the water quality in regional streams. The Partnership formed to address our watershed's critical water quality and flood prevention needs. This watershed connects and joins multiple communities, encompassing 402 square miles and more than one-third of Nebraska's population. The Partnership is comprised of 11 local governments that are wholly or partially in the Papillion Creek Watershed. Bellevue, Girls and Boys Town, Gretna, La Vista, Omaha, Papillion, Ralston, Douglas County, Sarpy County and the P-MRNRD have an inter-local cooperative agreement to work together as the Partnership. The P-MRNRD is a leader in the Partnership, and by implementing the Whitted Creek Stream Restoration Project, there is great potential for the other members of the Partnership to observe the success of this demonstration project (both technically and through public appreciation) to gain confidence in implementing similar projects within their own jurisdictions.



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NEBRASKA ENVIRONMENTAL TRUST FUND

APPLICATION BUDGET YEAR ONE

H1. Project Sponsor: Papio-Missouri River Natural Resource District

H2. Project Name: Whitted Creek Stream Restoration Project

BUDGET YEAR: July 1, 2008 to June 30, 2009 (shown to demonstrate initial phases of project, no NET funds requested)

Column A	Column B	Column C	Column D	Column E	Column F
1. Source of Funds ►	Nebraska Environmental Trust	Papio-Missouri River Natural Resource District	Federal 319 Grant		TOTALS ▼
2. Budget Category ▼					
3. Detailed Design	\$0	\$200,000	\$0	\	\$200,000
4. Mobilization and Site Clearing	\$0	\$0	\$0	\	\$0
5. Excavation	\$0	\$0	\$0		\$0
6. Fine Grading	\$0	\$0	\$0		\$0
7. Geotextiles	\$0	\$0	\$0		\$0
8. Buffer Plants	\$0	\$0	\$0		\$0
9. Top Soil and Amendments	\$0	\$0	\$0		\$0
10. Grade Control Structures	\$0	\$0	\$0		\$0
11. Signage & Public Education	\$0	\$0	\$0		\$0
12. Monitoring	\$0	\$0	\$0		\$0
13.					
14.					
15.					
16.					
17.					
18. TOTALS ►	\$0	\$200,000	\$0		\$200,000



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NEBRASKA ENVIRONMENTAL TRUST FUND APPLICATION BUDGET YEAR TWO

H1. Project Sponsor: Papio-Missouri River Natural Resource District

H2. Project Name: Whitted Creek Stream Restoration Project

BUDGET YEAR: July 1, 2009 to June 30, 2010 (only year requesting NET funding)

(This page is used by multi-year grants only. If your project is not a multi-year grant, then ignore or delete this page.)

Column A	Column B	Column C	Column D	Column E	Column F
1. Source of Funds ►	Nebraska Environmental Trust	Papio-Missouri River Natural Resource District	Federal 319 Grant		TOTALS ▼
2. Budget Category ▼					
3. Detailed Design	\$0	\$0	\$0	\	\$0
4. Mobilization and Site Clearing	\$0	\$ 110,000	\$0	\	\$ 110,000
5. Excavation	\$0	\$ 202,650	\$0		\$ 202,650
6. Fine Grading	\$ 23,580	\$0	\$0		\$ 23,580
7. Geotextiles	\$ 25,803	\$0	\$ 33,156		\$ 58,959
8. Buffer Plants	\$ 243,998	\$0	\$ 247,891		\$ 491,889
9. Top Soil and Amendments	\$0	\$0	\$ 18,420		\$ 18,420
10. Grade Control Structures	\$0	\$ 80,000	\$0		\$ 80,000
11. Signage & Public Education	\$0	\$ 6,000	\$0		\$ 6,000
12. Monitoring	\$0	\$0	\$0		\$0
13.					
14.					
15.					
16.					
18. TOTALS ►	\$ 293,381	\$ 398,650	\$ 299,467		\$ 991,498



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NEBRASKA ENVIRONMENTAL TRUST FUND

APPLICATION BUDGET YEAR THREE

H1. Project Sponsor: Papio-Missouri River Natural Resource District

H2. Project Name: Whitted Creek Stream Restoration Project

BUDGET YEAR: July 1, 2010 to June 30, 2011 (shown to demonstrate multi-year project, no NET funds requested)
(This page is used by multi-year grants only. If your project is not a multi-year grant, then ignore or delete this page.)

Column A	Column B	Column C	Column D	Column E	Column F
1. Source of Funds ►	Nebraska Environmental Trust	Papio-Missouri River Natural Resources District	Federal 319 Grant		TOTALS ▼
2. Budget Category ▼					
3. Detailed Design	\$0	\$0	\$0	\	\$0
4. Mobilization and Site Clearing	\$0	\$0	\$0	\	\$0
5. Excavation	\$0	\$0	\$0	\	\$0
6. Fine Grading	\$0	\$0	\$0	\	\$0
7. Geotextiles	\$0	\$0	\$0	\	\$0
8. Buffer Plants	\$0	\$0	\$0	\	\$0
9. Top Soil and Amendments	\$0	\$0	\$0	\	\$0
10. Grade Control Structures	\$0	\$0	\$0	\	\$0
11. Signage & Public Education	\$0	\$0	\$0	\	\$0
12. Monitoring	\$0	\$2,000	\$0	\	\$2,000
13.					
14.					
15.					
16.					
18. TOTALS ►	\$0	\$2,000	\$0		\$2,000



NEBRASKA ENVIRONMENTAL TRUST FUND APPLICATION BUDGET JUSTIFICATION

H1. Project Sponsor: Papio-Missouri River Natural Resource District

H2. Project Name: Whitted Creek Stream Restoration Project

1. Have other sources of funding not listed in the Budget Worksheet been approached for project support? If yes, name them and explain the outcome of your request.

The P-MRNRD has submitted a grant application to the Nebraska Department of Environmental Quality (NDEQ) for a 319(h) grant for non-point source pollution elimination. The P-MRNRD requested \$300,000 in the grant application for Whitted Creek. Notification of award for the NDEQ 319(h) grants is expected in early 2009.

2. Are all of the matching funds in the Budget Worksheet confirmed? If not, please identify those entities and list the date when confirmation is expected. Explain how you will implement the project if these sources do not confirm participation.

The NDEQ 319(h) grant is not confirmed, notification of award for the NDEQ 319(h) grants is expected in early 2009. If the NDEQ or NET grant funding is not awarded, the P-MRNRD will support this project. The P-MRNRD is in the process of reviewing proposals submitted August 1, 2008 for the detailed design of this project. Refined project scopes and cost estimates will be part of the detailed design phase.

3. If any of the project costs identified in Column B of the Budget Worksheet have been expended or if debt has been incurred for these costs or a sponsor or partner is obligated for these costs in any other way: List these costs here. Explain clearly why Trust grant funds are requested for these costs.

There are no Column B costs that have been expended already, or will be expended prior to July 1, 2009.

4. For each line item in column A of the Budget Worksheet, justify the basis for the dollar amount indicated for that item.

CATEGORY/COMPONENT (from Column A of the Budget Worksheet)	BASIS USED TO DETERMINE COST	Attachment? Y or N	ATTACHMENT LABEL
3. Detailed Design	Engineering consultant experience designing similar projects	N	
4. Mobilization and Site Clearing	Engineering consultant experience and bid tabs from constructing similar projects	N	
5. Excavation	Engineering consultant experience and bid tabs from constructing similar projects	N	
6. Fine Grading	Engineering consultant experience and bid tabs from constructing similar projects	N	
7. Geotextiles	Engineering consultant experience and bid tabs from constructing similar projects	N	
8. Buffer Plants	Engineering consultant experience and bid tabs from constructing similar projects	N	



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9. Top Soil and Amendments	Engineering consultant experience and bid tabs from constructing similar projects	N	
10. Grade Control Structures	Engineering consultant experience and bid tabs from constructing similar projects	N	
11. Signage & Public Education	Estimate for permanent signage, and preparation of presentation materials	N	
12. Monitoring	Estimate for annual in-kind monitoring by P-MRNRD	N	



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NEBRASKA ENVIRONMENTAL TRUST FUND PROJECT SPONSOR FINANCIAL INFORMATION

H1. Project Sponsor: Papio-Missouri River Natural Resource District

H2. Project Name: Whitted Creek Stream Restoration Project

Please see the instructions for section C-3. Attachments to this document may be necessary to complete this section. Include these attachments with your hard copy submission.

The following is a summary of the project sponsor's, P-MRNRD, financial information;

Source(s) of Income Available: \$16,086,186.87 (property tax revenue)

Current Revenue: \$39,478,855.01 (FY 2009)

Appropriation and/or Current levy and levy limit: current levy (FY 2009)=0.033301; levy limit=0.045

Current Annual Budget Summary: \$39,478,855.01 (FY 2009)



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NEBRASKA ENVIRONMENTAL TRUST FUND TIMELINE

H1. Project Sponsor: Papio-Missouri River Natural Resource District

H2. Project Name: Whitted Creek Stream Restoration Project

See instructions for section D.

Begin Month/Year	End Month/Year	Task Description:
October 2008	October 2008	Design Notice to Proceed
October 2008	October 2008	Topographic Survey
October 2008	October 2008	Pre-Construction Evaluations
October 2008	July 2012	Permitting Coordination
December 2008	December 2008	30 Percent Design Workshop
February 2008	February 2008	60 Percent Design Workshop
March 2009	March 2009	100 Percent Design
March 2009	March 2009	Pre-Bid Meeting
April 2009	April 2009	Construction Bidding
April 2009	April 2009	Bidding Services
June 2009	June 2009	Construction Notice to Proceed
June 2009	June 2009	Pre-Construction Meeting
July 1, 2009		Trust Grant Awarded
July 2009		Construction Begins
July 2009	May 2010	Construction Management
March 2010	May 2010	Additional Vegetation Installation
May 2010	May 2010	Post Construction Evaluations
	May 2010	Construction Completion
	June 30, 2010	Trust Grant Ends
July 2010	July 2012	Annual Monitoring Evaluations
July 2010	July 2012	Annual Maintenance





NEBRASKA ENVIRONMENTAL TRUST FUND

REAL ESTATE / SITE PLAN

H1. Project Sponsor: Papio-Missouri River Natural Resource District

H2. Project Name: Whitted Creek Stream Restoration Project

This section will not apply to every project. Please see instructions for section F. Attachments should be sent with the hardcopy submission.

The proposed project will be conducted within the P-MRNRD flood control easement of Whitted Creek. No additional property will be acquired as part of this project.

Plans, profiles, cross sections, and updated construction cost estimates from the detailed design will be available for review in the spring of 2009. The basis of design for this project is the professional engineering experience of the P-MRNRD's consultant (CH2M HILL); experience designing and constructing similar projects throughout the country. This experience and the associated planning level cost estimates were incorporated into the Conceptual Plan included in the Whitted Creek Stabilization Study (35 page document, available in digital or hard copy upon request).

The Whitted Creek Stabilization Study explains the rationale used to locate the project and develop the design. It also describes the analysis and field investigations made to substantiate the design of the project. Pending project components of the project include the detailed design (to be awarded by P-MRNRD in October 2008), which will include detailed survey, geotechnical oversight for levee integrity, and hydrologic and hydraulic analysis for stream stability considering a range of design storms. The project description on the previous pages (Narrative Summary) is essentially an executive summary of the Stabilization Study.

Legal Description	County	#Acres
NA		