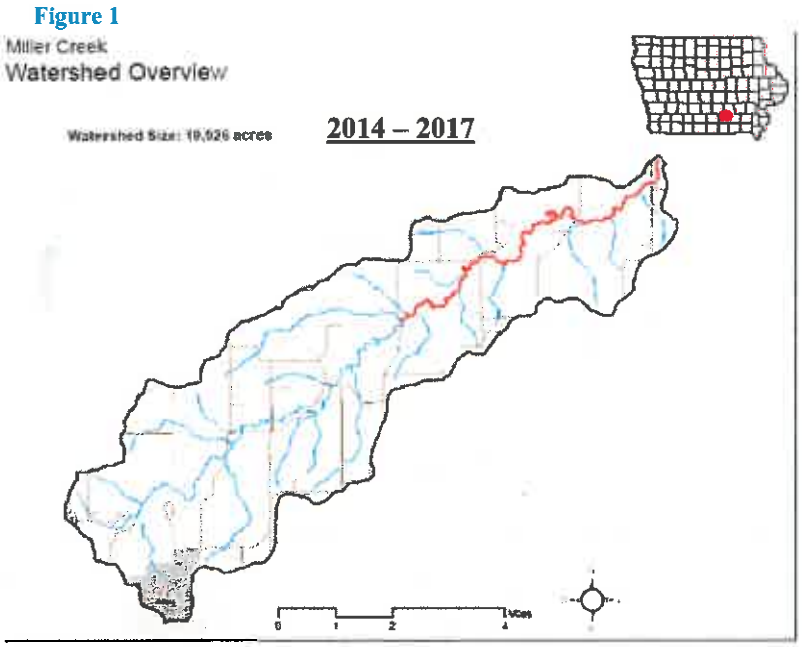
Final Report

1328-013

Miller Creek Phase III Nutrient & Sediment Reduction Project

Watershed Improvement Review Board

Figure 1



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Mervin Mc Danel
Monroe County SWCD Commissioner Chairman

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Executive Summary

Project Title: Miller Creek Phase III Nutrient & Sediment Reduction Project **Grant Number**: 1328-013

Project Start Date: July 1, 2014 **Project Completion Date:** June 30, 2017

Funding: **Total WIRB Budget** $**213,836.00**

	Totals	% of Total App
WIRB	$170,840.16	41%
EQIP	$53,991.53	13%
IDALS-DSC	$774.79	0%
IFIP	$61,422.05	15%
CRP	$34,758.00	8%
Other	$6,850.83	2%
Matching (In-Kind)	$1,165.71	0%
Recipient	$91,763.70	22%
Total Expenditures	**$421,566.77**	**100%**

Summary of Goals

The Phase III goals focused on the use of nutrient management practices to reduce excessive nutrients entering Miller Creek. Phase III was modeled after Iowa's Reduction Strategy due to the Gulf of Mexico hypoxia problem. The SWCD offered cost-share incentives to producers to implement nutrient management tools to address excess nutrient runoff and to improve water quality. Phase III provided support to producers who were working to improve soil health. Along with nutrient management solutions, Phase III also resulted in an additional soil loss reduction of 3,390 tons/year and a decrease in phosphorus application of 4,407 lbs. /year. This resulted in a sediment delivery reduction of 1,805 tons/year and a phosphorus runoff reduction of 2,346 lbs. /year to Miller Creek. The increased use of these newly adopted nutrient management tools will continue to improve water quality and provide producers data that they will be able to use in the future, benefitting them in their operations.

Goals of Project:

1. Install BMP's aimed at trapping sediment and reducing sediment and phosphorus delivery rates in surface water entering Miller Creek using grade stabilization structures, water and sediment control basins, and terraces benefitting an estimated 176 acres of high priority land
2. Maximize nutrient efficiency with grid soil sampling to gain knowledge of nutrient levels
3. Improving soil health by implementing cover crops on 240 ac/year/for three years benefitting 720 acres
4. Implement nutrient management practices in high priority areas based on the 4R concept utilizing soil sampling and nitrate testing methods to ensure proper applications
5. Monitor treated waters from selected BMP's and in the main channel of Miller Creek to get a base line to help determine future reductions and benefits
6. Demonstrate a denitrifying bioreactor during a field day training to show the effectiveness of nitrogen reduction practices at the edge of field

Introduction

Miller Creek is a warm-water stream located in the northeastern part of Monroe County in Southern Iowa. The watershed consists of approximately 19,926 acres of land that starts at the northeastern corner of Albia and extends northeast toward the town of Eddyville where it outlets in at the Des Moines River. This area is located in the Iowa and Missouri Heavy-Till Plain, which is best described as steep rolling hills interspersed with areas of uniformly level upland divides and level, alluvial lowlands. The majority of land use is cropland, with the principal crops for the area being corn and beans. Hay and feed grains are also produced but on a smaller scale.

Monroe County's Soil & Water Conservation District (SWCD) & Natural Resource Conservation Service (NRCS) became concerned when Miller Creek had been listed on our State's 303d Impaired Waters list. This list represents lakes and streams failing to fully support our state's water quality standards. With this resource concern in mind, two sediment reduction projects Phase I and II were launched to address the impairments of the stream by implementing sediment control practices. The goal for Phase I & II was to reduce sediment by 4,404 tons/year in which we successfully exceeded this by 6,133.5 tons/year (139%) and Phosphorus loading was also reduced was by 7,975 lbs. /yr., 2,275 pounds over the 5,700 pound goal. As Phase II neared completion, the District wanted to continue water quality efforts in Miller Creek so an application for a Phase III was submitted.

Although Phase I and II were successful at reducing sediment, it was still clear that more assistance was needed. So with a different plan in mind, the District applied for additional funding aimed toward nutrient reductions and soil health. The Phase III project was modeled after the "IA Nutrient Reduction Strategy". The District decided to offer cost-share on nutrient management tools such as late spring nitrate testing (LSNT), fall stalk nitrate testing (FSNT) and soil grid sampling so farmers may obtain valuable data. Obtaining this data if continued, can show if you are over or under applying fertilizers in specific areas which will then help producers make better management decisions ensuring excess nutrient runoff is minimal. Along with these nutrient tools the District also promoted soil health through cover crops, and other various practices controlling sediment and nutrient runoff. To demonstrate how to reduce nutrients leaving tile lines, a field day was held to display a woodchip Denitrification Bioreactor in the process of being installed.

Financial Accountability

Of the $213,836.00 WIRB grant awarded to the SWCD, the total WIRB funds spent were $170,840.16 to implement practices over the past three years. The agreement with WIRB and the SWCD established nutrient and sediment reduction BMPs that were used to achieve the goals for the county; see ***Table 1***. Funds were divided among the following practices: Late Spring Nitrate Test (LSNT), Fall Stalk Nitrate Test (FSNT), Grid Soil Sampling, Cover Crops, Nutrient Application Tiers 1, 2 & 3 (based on the 4R Concept), Denitrification Bioreactor, and Water Monitoring. Sediment reduction practices were also offered to support existing projects. A total of 30 water and sediment control basins, 2,183 feet of terraces, and 3 grade stabilization structures were installed.

With our main focus on nutrient management, the District's goal was to enroll six producers who were willing to apply nutrient management practices on 40 acres over the course of the last three years benefitting up to 720 acres. A decision was made by the District to offer practices at 50% cost share dividing a total of $18,000 between three for a total of $6,000 in each line item, LSNT, FSNT and Soil Grid Sampling. Although we were able enroll six producers, it was a challenge to inspire any additional producers to participate.

Early in the project it was evident that it would be hard to sell these practices due to many variables such as timing and weather and minimal cost-share amounts. Many producers expressed that even with the District gathering samples that the cost-share was too low and not worth their time to complete more paper work. Due to lack of additional interest the District had balances remaining in these thee line items. It was also determined that the project goals were set to high for sediment reduction practices exhausting funding early in the project. Utilizing partnering funds also posed a challenge. With varying financial allotments from the state and timing to utilize federal funds, due to ranking periods, it has hindered approval and implementation dates.

Therefore the District requested an amendment of the agreement to move the remaining money from nutrient management practices into water and sediment control basins. This amendment was approved September, 2016. Transferring the remaining balance allowed the District to install an additional 22 basins and an additional grade stabilization structure. NRCS, IDALS and District Technicians along with the IDALS Conservation Aid played a key part in implementing practices.

Table 1 **Grant Agreement Budget Line Item Practices**	**Total WIRB Grant Funds Approved**	**Amended $ transfer between line items**	**Total Funds Expended**	**% of Total Spent Projects**
Salary/Benefits	$127,512.00	No Change	$111,891.70	38%
Grade Stabilization Structures	$7,500.00	$8,717.61	$8,674.25	3%
Water/Sediment Control Basins	$9,166.00	$17,159.45	$14,845.10	5%
Terraces	$4,429.00	No Change	$3,604.04	1%
Soil Grid sampling	6,000	No Change	$456.07	0%
FSNT	6,000	No Change	$646.79	0%
LSNT	6,000	No Change	$350.71	0%
Nutrient Mgt. Tier 1	12,480	No Change	$1,107.00	0%
Nutrient Mgt. Tier 2	----	No Change	$0.00	0%
Nutrient Mgt. Tier 3	----	No Change	$4,160.00	1%
Cover Crops	$24,000.00	No Change	$21,775.42	7%
Denitrification Bioreactor Demo	$2,500.00	No Change	$0.00	0%
Water Monitoring	$7,000.00	No Change	$2,960.08	1%
Info/ Education	$1,249.00	No Change	$369.00	0%
Totals	$213,836.00	$0.00	$170,840.16	56%

Table 2 **Partner Funding Totals** **Funding Source**	**Approved Application Budget($)**	**Total Spent from Budget($)**	**% Total Spent - Projects**
WIRB	$213,836.00	$170,840.16	41%
EQIP	$71,664.00	$53,991.53	13%
IFIP	$70,208.00	$61,422.05	15%
CRP	$0.00	$34,758.00	8%
OTHER (1) (WQI, CSP etc.)	$0.00	$6,850.83	2%
RECIPIENT	$97,156.00	$92,970.41	22%
TOTAL	$452,864.00	$422,773.48	100%

Watershed Improvement fund Contributions: **Approved application budget 47%**
Actual 41%

Environmental Accountability

Best management practices (BMPs) were implemented to supporting further sediment reductions linked to surface run-off while nutrient management tools offered testing to determine Nitrogen and Phosphorus levels so producers may learn how to improve soil health and apply cover crops that will help bind nutrients to the soil. Four indices were used as primary measures of performance to determine nutrient reduction outcomes. While sediment loss was determined by grade stabilizations, basins and terraces. The total sediment reductions were an additional 1,805 tons/year and phosphorus by 2,346 lbs. /year from the Phase II project which also benefiting another 896 acres. Producers were asked to complete a nutrient management survey that can assist in completing a nutrient management 590 plan in the future if they choose.

Our goal with nutrient management tools as practices was more for educational purposes to encourage producers to utilize tools that will not only provide then with valuable data that may help them financially but also help reducing nutrient runoff that affects water quality.

After completing several nutrient mgt. practices it was becoming apparent that the District should have offered incentives for these practices vs. cost share. With cost share of 50%, the amounts a producer would be eligible for they feel are not necessarily worth their time or effort for the types of practices offered. Producers have commented if offered as a greater incentives that would help offset the expense would entice producers to try new practices and continue them in the future. With most of these practices we offered for nutrient management, are based highly on precision and timing. Timing has been very challenging due to weather patterns. Taking samples for the Late Spring Nitrate Test had a very narrow window to complete due to the height of the corn and rain. Producers' interests was found to still be greater for sediment reduction practices vs nutrient management practices. Due to the nature of the WIRB funding and contract deadlines the District was not able to receive an extension until fall of 2017, which would have allowed a full three years of LSN tests.

Table 3 **Practice Activities**							
BMP Practice Goals	**Unit**	**Planned**	**Amendment**	**Installed/ Complete**	**Percent Completed**	**Load Reductions/year**	
						Sediment (tons)	**P (lbs.)**
Grade Stab Structures	EA	6	----------	3	50%	809	1,051.6
Water & Sediment Basins	EA	40	27	30	55%	391	507.7
Terraces	FT	2,000	----------	2,183	100%	32	53.69
Soil Grid Sampling	AC	720 ac	----------	480 ac	66%	N/A	
LSNT (720 ac Benefitted)	EA	72 sample	----------	62 sample	86%	N/A	
FSNT (720 ac Benefitted)	EA	72 sample	----------	87 sample	100%	N/A	
Nutrient Mgt. (Tier 1-3)	AC	720 ac	----------	566	79%	Incentive	
(Cover Crop)	AC	720 ac	----------	30	100%	201.23	261.10
Water Monitoring	EA	12	----------	13 sample	100%	----------	
Denitrification Bioreactor	EA	1	----------	1	100%	N/A	
Total						**1,433.23 (Tons/yr.)**	**1,874.09 (lbs. /yr.)**

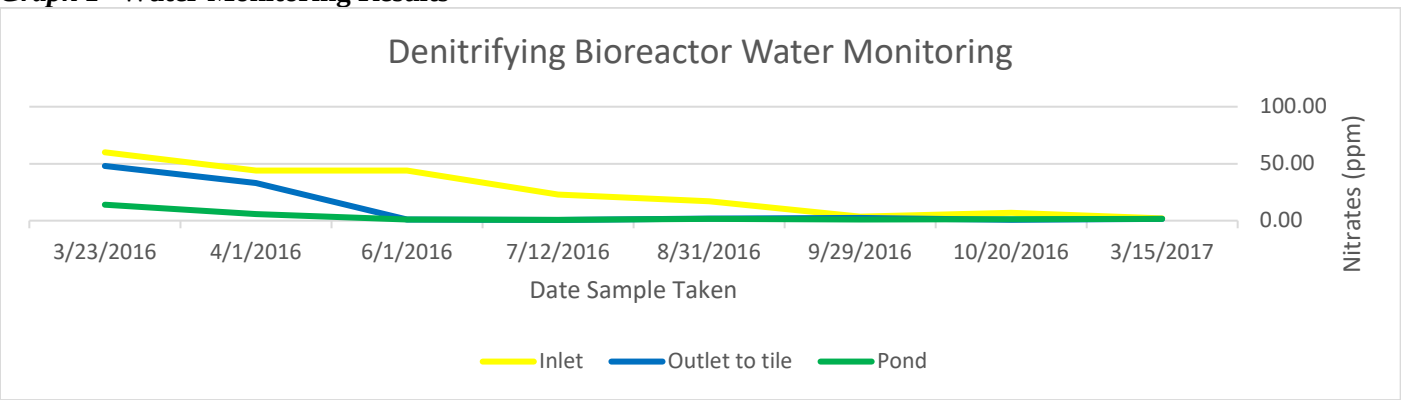
Fall Stalk and Late Spring Nitrate Tests were offered as a tool for producers to determine if they were over applying nitrogen. Between six to eight producers participated in the FSNT practice, with the samples collected fall 2014, 2015 and 2016. The number of samples analyzed in 2015 dropped significantly for the Late Spring Nitrate test, primarily because of an extremely wet spring enabling many from even getting corn planted before July 1. This rainy weather lasted most of the spring throughout mid-August with a brief break from the end of August until then end of October. This also then pushed harvest back several weeks creating a small window of time to get FSNT samples collected due to timing of when the corn matured and when producers wanted to harvest. Variations in rainfall and temperature can make it difficult to compare differences in nitrogen availability and plant use when comparing results across crop years. Although only a small number of producers chose to apply for cost share, there was continuing outreach and education to others in the watershed regarding the benefits. FSNT was also tied to the Tier 3 practice which was an incentive. Tier 3 of the Nutrient Management practice had producers move fall anhydrous to a spring application along with following proper application of Phosphorus determined by soil tests and implementing both the FSNT and LSNT practices. Workshops were held to review test results and to answer questions. Results of the FSNT from 2014 to 2016 show the effectiveness of using nutrient management tools. More producers' tests were in the optimum levels in 2016 vs. 2014. Producers that participated are able to utilize data gathered to continue building a strong management plan that will not only help in reducing excess nitrogen but also improve water quality in the future.

	Fall 2014 FSNT						
Lab #	Farmer ID	Sample #	Field #	Stalk NO3-N (ppm)	Nitrogen Application	Rotation	
P24424	E	1	19	5530	CMS-30lbs(P) 15lbs(K) 200lbs (N)	CC	Above 2,000 ppm
P24426	E	3	19	4780	CMS-30lbs(P) 15lbs(K) 200lbs (N)	CC	
P24567	D	1	17	4330	32% liquid nitrogen	CC	
P23609	A	1	47	4220	32% liquid nitrogen	CB	
P24427	E	4	19	3790	CMS-30lbs(P) 15lbs(K) 200lbs (N)	CC	
P23610	A	2	47	3430	32% liquid nitrogen	CB	
P24644	G	1	9	3340	32% liquid nitrogen	CB	
P24425	E	2	19	3130	CMS-30lbs(P) 15lbs(K) 200lbs (N)	CC	
P24568	D	2	18	2970	32% liquid nitrogen	CC	
P24641	B	2	60	1910	32% liquid nitrogen	CB	Optimum 700 - 2000 ppm
P24643	B	4	60	1860	32% liquid nitrogen	CB	
P24640	B	1	60	1720	32% liquid nitrogen	CB	
P24642	B	3	60	1300	32% liquid nitrogen	CB	
P24648	F	1	8	1110	32% liquid nitrogen	CB	
P24645	G	2	9	1030	32% liquid nitrogen	CB	
P23612	A	4	15	833	32% liquid nitrogen	CB	
P24570	D	4	16	789	32% liquid nitrogen	CC	
P24649	F	2	8	445	32% liquid nitrogen	CB	Less than 700 ppm
P24650	F	3	8	272	32% liquid nitrogen	CB	
P24647	G	4	9	216	32% liquid nitrogen	CB	
P24646	G	3	9	160	32% liquid nitrogen	CB	
P23611	A	3	61	<20	32% liquid nitrogen	CB	
P24569	D	3	18	<20	32% liquid nitrogen	CC	

Fall 2016 FSNT							
Lab #	Farmer ID	Sample #	Field #	Stalk NO3-N (ppm)	Nitrogen Application	Rotation	
33079	B	3		3670	32% liquid nitrogen, /CMS	CB	Above 2,000 ppm
32948	B	4		3340	32% liquid nitrogen, /CMS	CB	
32949	E	3		3310	Anhydrous/CMS	CB	
32946	A	2		2850	32% liquid nitrogen, /CMS	CB	
32947	D	3		2820	32% liquid nitrogen, /CMS	CB	
32948	E	3		2670	Anhydrous/CMS	CB	
32949	E	2		2580	Anhydrous/CMS	CB	
32006	G	1		2580	Anhydrous	CB	
32949	B	5		2510	32% liquid nitrogen, /CMS	CB	
32676	D	6		2320	32% liquid nitrogen, /CMS	CB	
32677	E	4		2140	Anhydrous/CMS	CB	
32945	A	1		1850	32% liquid nitrogen, /CMS	CB	Optimum 700 - 200 ppm
33078	B	2		1850	32% liquid nitrogen, /CMS	CB	
33079	D	3		1800	32% liquid nitrogen, /CMS	CB	
33080	D	4		1790	32% liquid nitrogen, /CMS	CB	
33077	B	1		1760	32% liquid nitrogen, /CMS	CB	
32499	D	1		1760	32% liquid nitrogen, /CMS	CB	
32783	C	2		1580	Anhydrous	CB	
32782	C	3		1530	Anhydrous	CB	
32785	C	4		1390	Anhydrous	CB	
32786	G	3		1340	Anhydrous	CB	
32787	E	4		1270	Anhydrous/CMS	CB	
32786	C	5		1180	Anhydrous	CB	
32781	C	1		950	Anhydrous	CB	
32782	D	2		944	32% liquid nitrogen, /CMS	CB	
32783	D	3		937	32% liquid nitrogen, /CMS	CB	
32784	F	2		833	32% Liquid Nitrogen	CB	
32785	G	2		679	Anhydrous	CB	Less than 700 ppm
33080	F	1		623	32% Liquid Nitrogen	CB	
33081	G	4		556	Anhydrous	CB	
32784	C	5		433	Anhydrous	CB	
32785	E	2		364	Anhydrous/CMS	CB	
32786	F	3		334	32% Liquid Nitrogen	CB	
32787	D	4		160	32% liquid nitrogen, /CMS	CB	
32788	E	1		110	Anhydrous/CMS	CB	
32829	E	1		100	Anhydrous/CMS	CB	
32947	A	3		98	32% liquid nitrogen, /CMS	CB	
32787	C	4		35	Anhydrous	CB	

Water monitoring was conducted in Phase III to help determine effectiveness of the over-all project and benefits of practices installed. On May 3rd 2014 Lynette Siegly with IOWATER, a division of the Iowa Department of Natural Resources, provided training to the watershed coordinator, Albia FFA Chapter and local volunteers who will collecting water samples monthly and during heavy rain events. The SWCD then partnered with the Albia FFA students to help collect and water samples. The Students were also able to utilize a HACH water testing kit purchased through a grant to help complete some of the tests. The SWCD then contracted a local certified lab MESI to test for additional parameters such as Total Phosphorus. The SWCD was able to gather a general idea of the reductions in nutrients entering Miller Creek from these results. In the fall of 2015 the Albia FFA Advisor said the students were going to be involved in competitions and their participation would be minimal in collecting and processing the samples. A local volunteer also a Miller Creek landowner took on this task along with the watershed coordinator. With the approval of the Iowa WIRB Board the District was able to purchase the equipment needed to complete the project. MESI the certified lab said they would analysis the samples taken for a discount since the Miller Creek project was for educational purposes. Results from the main channel of Miller Creek were inconclusive due to the fact water sampling was not conducted at the beginning of Phase I. Water samples for the Denitrification Bioreactor were processed in house with the "Soil Scan 360" which NRCS provided. The "Soil Scan 360" is fairly new equipment NRCS is able to use to detect both Nitrogen in soil and water to give landowners and producers ball park figure without sending samples to a lab. *Samples from Bioreactor Graph 1.*

Graph 1 **Water Monitoring Results**



Project Management and Accountability

The bulleted items below show the on-going public outreach activities and education that was key to this project's success. Quarterly newsletters and informative hand-outs also kept the public aware of Miller Creek's progress. One-on-one landowner contacts along with Field Day tours provided public education on how proper conservation efforts can help land productivity and the environmental impact of the creek. The District began working with the local Albia FFA students and local volunteers in April 2014 upon the start of Miller Creek's Phase III project. The Phase III project for Miller Creek focused on Nutrient Management in efforts working toward the Iowa's Reduction Strategy. Education and awareness from Phase I and II was utilized in the Phase III project for continued future support for Miller Creek.

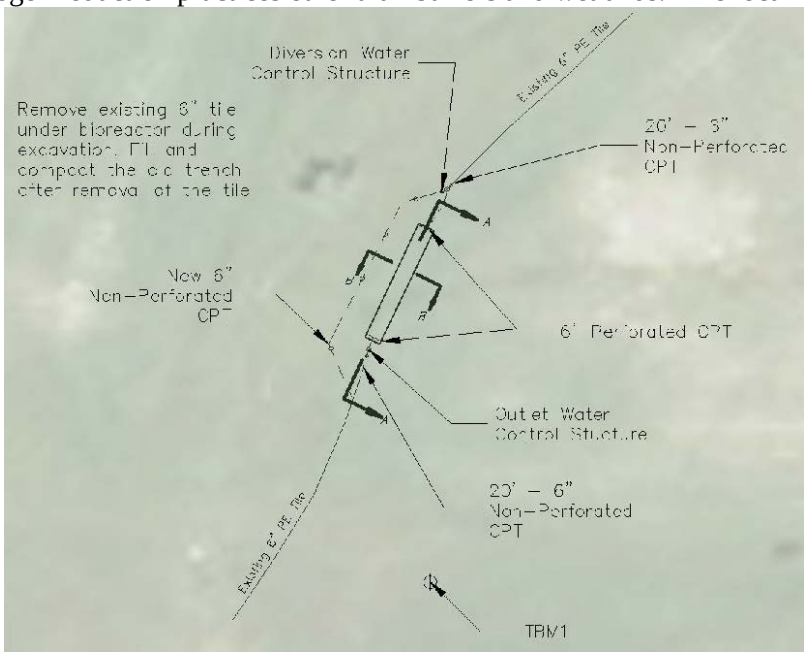
The information the Project Coordinator and FFA helped to gather, assisted farmers in obtaining base line data of before and after practices are installed to help determine their effectiveness and help estimate load reductions. The District hoped that by working with the FFA students it would bring more awareness for the watershed in which they live while and develop tools our next generation farmers can utilize in their farming operations or agricultural professions from years to come. As the second year approached, commitment in the project from the FFA Advisor and students' was not there due to other academe tic activities. If future partnerships with the FFA students are pursued, participation may be encourage more if a donation was made to the Chapter. This may keep more students involved knowing this donation may be used for their FFA activities and Convention trips.

Education/Activities Conducted

- Articles in the county newspaper & Quarterly Newsletters
- Farm Bureau AG Day presentation of watershed functions
- Seasonal Producer outreach workshops to review test results with Iowa State Extension
- Field Day Tour of demonstration practice installed within the watershed & the contractor meetings

Denitrification Bioreactor Field day

The Monroe County SWCD hosted a field day to demonstrate the installation of a denitrification bioreactor to help educate landowners and operators of alternatives nitrogen reduction practices other than buffers and wetlands. The local NRCS Engineering staff designed the structure and was on hand to answer questions that day. This field day focused on explaining about how Nutrient run-off has been determined as a contributing factor of the Gulf's Hypoxic (Dead Zone) where the Mississippi River outlets into the Gulf of Mexico. De-Nitrification Bioreactors are designed to treat subsurface water by directing underground patterned tile lines into a localized area to filter nitrates thru woodchips. As the woodchips decompose nitrates are converted to a nitrogen gas that is released into the air and not back into a water source. Project areas vary in size depending on the number of acres of pattern tile that entering the structure. Our demonstration was approximately 30 feet wide by 75 feet long. By installing this structure in an existing waterway made this very appealing to the land owner that he wasn't taking land out of production. The Engineers for Area 5 provided the design drawing for the installed bioreactor near Eddyville, Iowa during the field day in July. With the help from Iowa Learning Farms, Iowa Soybean Association and Agri Drain Corp., presentations on design and functionality were given prior to viewing the actual demonstration site. Stephanie Allgood, Area 5 NRCS Engineer along with Jeremy Hollingsworth, Civil Engineering Technician was on hand at the site to explain this site specific design and to answer any questions. The following photos are of before and after the bioreactor was installed.



Conclusion

In conclusion, Phase III of the Miller Creek Watershed project was successful in accomplishing most of its major goals as set forth in the agreement. Many producers that may not have utilized nutrient management tools were still in support of the project but choose to implement then on their own. With his being said, those that did participate became more aware of their operations overhead costs helping many cut costs. A big achievement in Phase III was public knowledge and awareness of how farmers are doing their part to reduce excess nutrient loss and improve water quality. Although Miller Creek Phase III is complete, producers have still expressed interest in continuing sediment reduction practices further supporting the health of Miller Creek.