



# Manchester Water Source Protection Plan

## Design Objective

Our client is the city of Manchester and its citizens. Over the course of project, we consistently communicated with the city officials and engineers.

The city of Manchester is faced with contamination of their groundwater. The contaminant is nitrate and is commonly used as a fertilizer for farms and lawns. Our mission is to reduce concentration of nitrate in the groundwater before it reaches municipal wells

Trident Environmental Solutions



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Project Manager



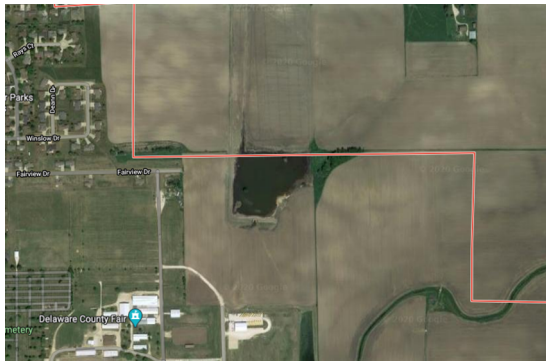
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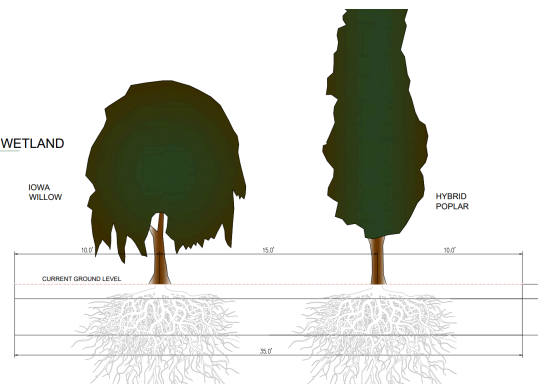
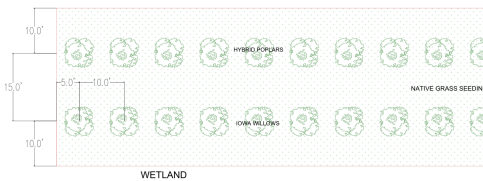
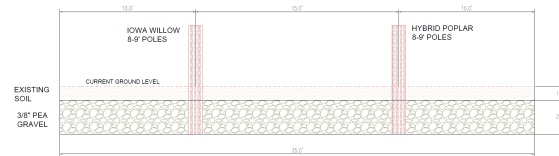
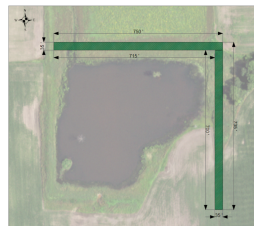
## Site Map

This project involved designing solutions that could be implemented both in the fields used for farming, but also in the city of Manchester itself.



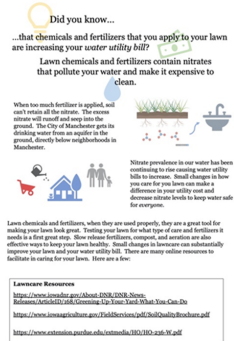
## Wetland Riparian Buffer Zone

A design of a riparian buffer zone in a trough with pea gravel bordering the existing wetland was designed. This solution involved using models provided by the EPA and the advice of several experts involved in the industry. The design consists of a barrier of Willow and Poplar trees that will have microbe biomes at their roots to denitrify the water flowing through. The root zones will also slow water entering, increasing the effectiveness of nitrate removal by the wetland.



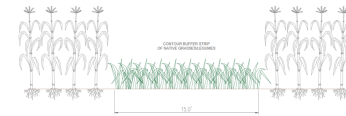
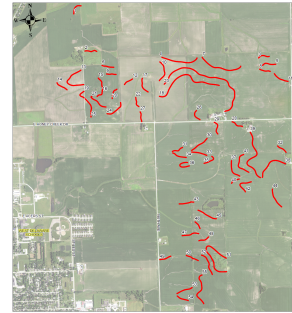
## Urban Nitrate Strategy

Our design team decided to develop a strategy for reducing the amount of nitrate generated from within the city of Manchester. We thought that the best way to do this was thought an educational campaign. We designed a brochure to inform urban residents on what they can do to reduce the nitrate contamination and why it should matter to them.



## Contour Buffer Strips

Implementing contour buffer strips is another viable solution to reducing the nitrate concentration. Researchers at Iowa State University have spent an extensive amount of time demonstrating the viability of these strips for nitrogen removal and erosion control. The ACPF tool was used to determine to best locations to place the buffers. The buffer strip vegetation will include a mixture of grasses and legumes; two seed mixture suggestions are Ladino clover with Timothy for poorly drained soils and Alfalfa with Orchard grass for dryer soils.



## Cost of Project

ITEM	QUANTITY	UNIT	UNIT PRICE	TOTAL
<b>Contour Buffer Strips</b>				
Orchardgrass Seed	32.9	ACRE	\$150.00	\$4,935.00
Alfalfa Seed	32.9	ACRE	\$150.00	\$4,935.00
Seed Distribution	32.9	ACRE	\$45.00	\$1,480.50
Field Tilling	32.9	ACRE	\$50.00	\$1,645.00
Subtotal				\$13,160.00
<b>Riparian Buffer Zone</b>				
3/8" Pea Gravel	6600	TON	\$25.00	\$165,000.00
Iowa Willows/Hybrid Poplars (8-9 ft poles - bag of 50)	6	BAG	\$3,300.00	\$19,800.00
Native Grass Seeding	1.17	ACRE	\$150.00	\$175.50
Trough Excavation	8500	CUB YD	\$5.00	\$42,500.00
Backfill of Soil and Gravel	1900	CUB YD	\$40.00	\$76,000.00
Subtotal				\$303,475.50
<b>Urban Nitrate Removal Education Brochure</b>				
Printing Brochures	2400	EA	\$0.10	\$240.00
Stamps	2400	EA	\$0.55	\$1,320.00
Brochure Design	1	LS	\$1,000.00	\$1,000.00
Subtotal				\$2,560.00
<b>TOTAL</b>				<b>\$319,195.50</b>

Construction Subtotal	\$319,195.50
10% Contingencies	\$31,919.55
20% Engineering and Administration	\$63,839.10
<b>Total Project Cost</b>	<b>\$414,954.15</b>