2020 INNOVATION CHAMPIONS CONTEST

(previously known as You Show Us Contest)

Pipe Cleaner

COUNTY: Traill County Highway Department

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PROBLEM STATEMENT:
The flow of water through culverts and pipes in roads becomes restricted or reduced for a multitude of reasons: beavers build dam inside structures, heavy rains wash large tree branches and mud into culverts/pipes, corn stalks or other debris get stuck, or huge ice chunks are pushed up against the openings of culverts or pipes, all restricting the flow of water.

An obstructed pipe/culvert causes water to sit against the side of a road. The road becomes a dam. If the water is there for a period of time, the road becomes soft and the road's strength is compromised, possibly resulting in sections of the road to washing away. Not only does the backed up water impact the road, large amounts of backed up water make fields unusable for planting.

The hazards of obstructed pipes/culverts compromise the integrity of roads and create safety issues for the motoring public.

SOLUTION:
The pipe cleaner was designed and fabricated to make pipe and culvert cleanout safer, more efficient, and effective. The innovators started with a 10-foot square tube that was retrofitted with steel plates to allow quick attachment to the arm of a backhoe. Toward the end the 10-foot tube are two paddles and at the very end is a piece of channel iron made into a point. One-inch square tubing is welded inside each paddle for strength and support. A #80 link chain is attached to the 10-foot tube at two points.

Hydraulics and an 18-tooth sprocket are used to drive the chain. The paddles, which extend from the side at 18- or 48 inches, push and pull debris through the pipe/culvert. Quarter inch steel plates (stops) are welded to the tube so the operator does not retract the pipe cleaner too far and compromise the integrity of the paddles.

With the backhoe on the road side, the pipe cleaner reaches into a culvert over 8 feet pushing debris through the pipe. The channel iron point and metal plates bolted to the outside of the paddles are also used to break chunks of ice that have pushed up against the opening of a pipe or culvert. The bolted plates are inverted and flush with the end point when breaking ice chunks.

LABOR, EQUIPMENT, AND MATERIAL:

Equipment/tools used:
Welder
Acetylene torch
Drill press

Materials:
Salvage material:
1 – 17 x 4-inch channel iron
1 – 9 x 4 inch channel iron
1- #80 link chain, 7 feet long
1 - 18 tooth sprocket (used to drive chain)
1 - 6" wide, 18" long, 8-inch flat steel – molded as a cover for the sprocket
1 – 1-inch steel plate, 10"W x 18"L
1 - ½ inch round stock – 30"L (fabricated as arm holders for hoses)
2 - 1/2 inch hydraulic hoses, each 69"L
1 - 6 inch round pipe, 18"L, cut in half for paddles
2 – 3 ½-inch pipe (sleeve) for hinges on paddles
2 – 1 x 1 x 7-inch long square tubing (welded inside paddles)
2 - Angle iron, 2 ½ inch W x 16 inch L x 3/16 inch thick
1 – 1 inch thick flat steel plate – 10" H x 18" L
2 - 2 x 6 x 3/16 inch flat iron for hinge bracket

New material:
Hydraulic motor
10 feet 3 ½ x 3 ½-inch square tube
24-inch piece of 4-inch square tube
2 pieces of flat steel (16"x14"x1")
2 5/8" 6-inch long bolts – attaches paddles to tube
4 3/8" x 1-inch long bolts – attaches angle iron to paddles
1 - 5/16" x 3 1/2-inch bolt – attaches front of chain to tube

Labor Hours: (*Includes time needed for design and discussion)*
2 persons
Total: 82 hours

COST SUMMARY:
Hydraulic motor – $1,036.04
10 feet of 3 ½-inch square tube - $66.91
24 inches of 4-inch square tube – $15.48.
2 pieces of 1 inch flat steel (16"x14") - $20.00
Bolts (fasteners) - $5.00
Cost to fabricate plates for backhoe - $200

Total Cost: $1,338.43 plus labor

SAVINGS AND BENEFITS:

The impacts to roads and fields have all been positive. Water no longer accumulates in the ditches or sits up against the road edge. Roads no longer act as dams, so water flowing over roads no longer occurs. Road edges dry quicker. Water no longer backs up in the fields, thus allowing them to be planted. Roads are safer to drive on. Less maintenance work or reconstruction is required. Road costs are reduced for the county and tax payers.

ANNUAL OPERATING COSTS:

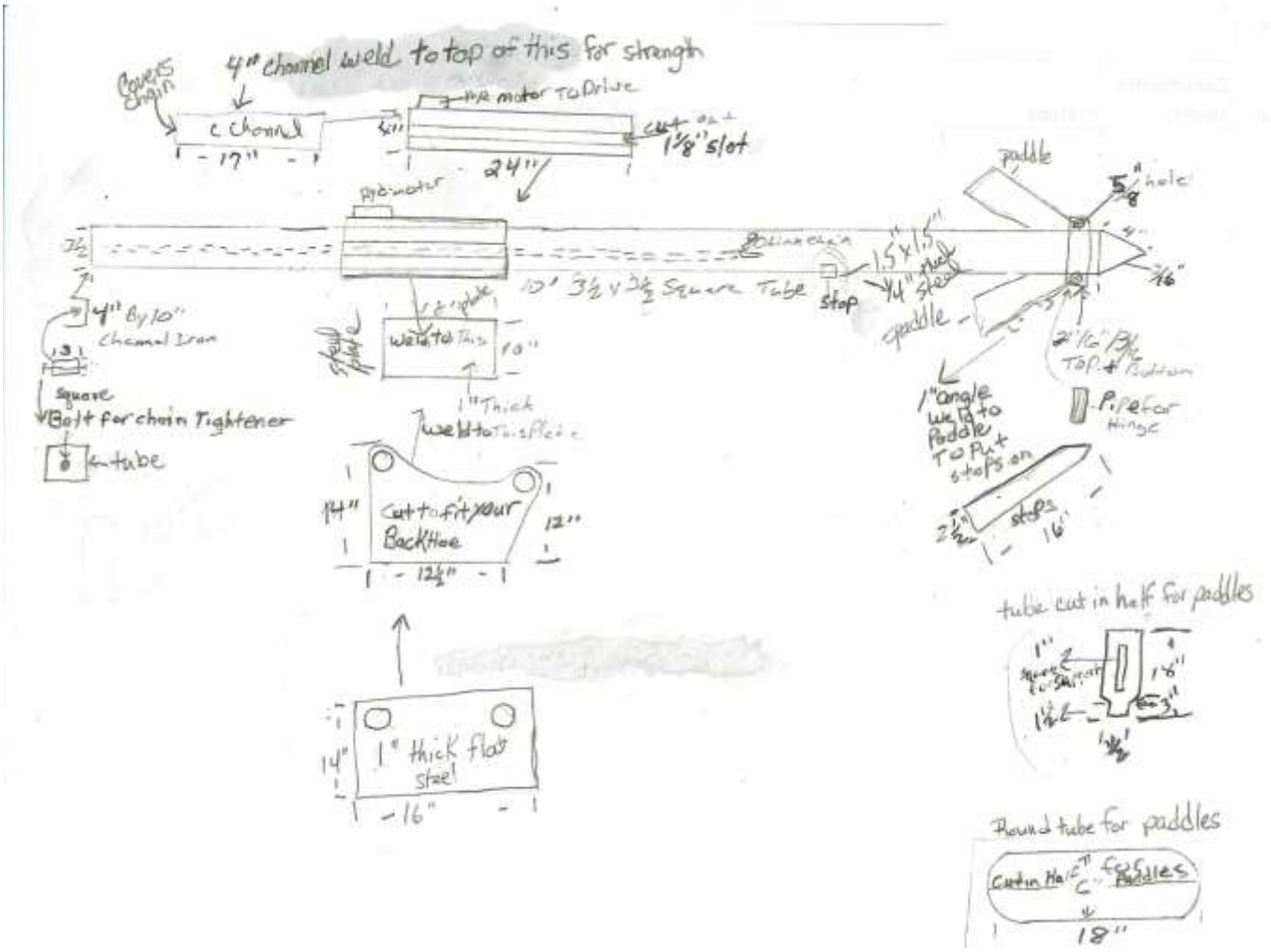
Before using the innovation:

Prior to the pipe/culvert cleaner innovation, the county was able to clean out only the ends of the culverts using the backhoe and a thumb. Debris caught deeper in the pipe/culvert remained there. Ice chunks that were quite large and frozen together were more difficult to remove. Water would sit in the ditches and up against the road edges causing them to become soft. Roads would sometimes wash out as a result of the excess water and the extended period of time they were exposed to water. Large amounts of water would back up in the field, preventing the farmer from using it. Typically the person running the backhoe was the only person working on a pipe/culvert cleanout.

After using the innovation:

With the pipe/culvert cleaner, all the debris in the pipe or culvert is removed. The work done is more effectively. Road maintenance costs for the county are reduced. The number of personnel doing the job remains at one. Because a culvert or pipe is cleaned out in its entirety as opposed to the just at the ends, the time it takes is a bit longer. The benefits far outweigh the additional time. Roads are in better condition and safer for the motoring public.

DRAWING (SCHEMATIC) WITH DETAILS:



Pipe Cleaner.

Pipe cleaner extended away from backhoe. Bolt tightener on the end.

Quick attach to backhoe, hydraulics, 18-tooth sprocket (under cover).

Hydraulic motor.

Sideview of steel plate cut to fit backhoe.

Bottom plate

Link chain attached to 10-foot tubing using cotter pin and bolt.

Spacer and guard for chain.

Stops prevent operator from retracting pipe cleaner to far.

Channel iron end point and metal plates with points bolted to paddles are used for breaking up debris in pipe.The points on the metal plates are also stops, preventing the paddles from over extending when retracting the cleaner with debris from the pipe.

Channel iron tip, metal plates on paddles are inverted for breaking ice chunks. One-inch square tubing inside paddles is for reinforcement and support.

Video:

LTAP Video.mp4