Problem Statement

The Pinney Purdue Agricultural Center located near Wanatah, Indiana has two adjacent fields composed of high organic matter soil. Muck soil, although extremely nutrient rich and desirable for agriculture use, poses several problems in terms of management. In its natural wet state, the soil is nearly impossible to drive/work on and it will decompose rapidly if over-drained. The current ditch system does not adequately maintain water levels to prevent subsidence. A modern solution for drainage and water management within the ditches must be developed to allow the soil to be worked during planting and harvesting season, as well as protect the soil from decomposition via subsidence.

Constraints

- Cost efficient as possible
- Easy to manage
- Relatively easy installation
- Maintain water levels for crops/seasons
- Avoid the use of concrete
- Avoid large excavation
- Be able to handle severe temperature changes/corrosive soils
- Comply with county regulations regarding ditch drainage

Structure Implementation

- Soil tests taken confirmed the presence of silty sand, strong foundation to build on
- Structures in both north and south ditches are at least 75 feet away from county ditch
- Flashboard riser is a water control structure with removable wooden logs to raise and lower water table depending on the crop/season
- Structure is very easy to operate and use of plastic and a stainless steel frame resist corrosive conditions
- Flashboard risers preserve the composition of muck soils and prevent oxidation/decay

Example of water movement through flashlight riser

Map/table of two muck fields and soil distribution
Green and blue are drainage ditches
Red is the county ditch

South Ditch

North Ditch

Two parallel aluminum walls anchored to one another are filled with earth
The wall holds the water upstream and forces flow through the flashlight device
The flashlight device is supported by two pine lumber piles driven into the ground and treated to withstand corrosive conditions
HDPE pipe directs flow through the wall and out the downstream side
Two structures will ultimately be constructed: the larger in the north ditch and the smaller in the south ditch
Operator will be able to manage riser from top of wall

Environmental Impact

- Reduces nutrient releases, particularly phosphorous, which can lead to algae blooms and large-scale fish kills
- Drastic reduction of pesticides that eventually enter streams and rivers
- Prevents the deposition of sediment which can block waterways
- Prevents erosion and loss of nutrient rich soils
- All materials made with environmental safe materials with no damaging chemicals

Alternative Solutions

- Combination of a screw gate and riser
- Use of metal stop log structure
- Levee with flashlight riser
- Implementation of weir gate system
- Use of full round riser

Economic Analysis

- Maximizes yield potential of fields
- Cuts down on any financial losses due to fertilizer waste
- Preserves organic rich soil for future seasons
- Although relatively expensive, all materials have high longevity, will not corrode or fall apart

Constraints

- Budget
- Pricing based on local and global market prices, shipping varies depending on supplier

Aluminum Piling S
Aluminum Piling N
HDPE 18'' S Pipe
Anchors
Wooden posts
Backfill N/S
Riser S 4'x10'

Items Item # Price/unit Total Price
Riser N 4'x13' 1 $2,100 $2,100
Riser S 4'x10' 1 $1,450 $1,450
Backfill N/S 358 tons $34 $12,288
Wooden posts 8 $48 $384
Anchors 10 $90 $900
HDPE 24'' N Pipe 1 $2500/ton $2500/ton
HDPE 18'' S Pipe 1 $823 $823
Aluminum Piling N 1 2.67 tons $2500/ton $6,670
Aluminum Piling S 1 2.3 tons $2500/ton $5,800
Total Cost $32,614

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Water Management for PPAC
Muck Soils