

# Integration of Delaware Tax Ditch Drainage Organization Information into the Statewide Enterprise GIS

596A Penn State Capstone Proposal – March 14, 2022  
Brittany Haywood



# What is a Tax Ditch?

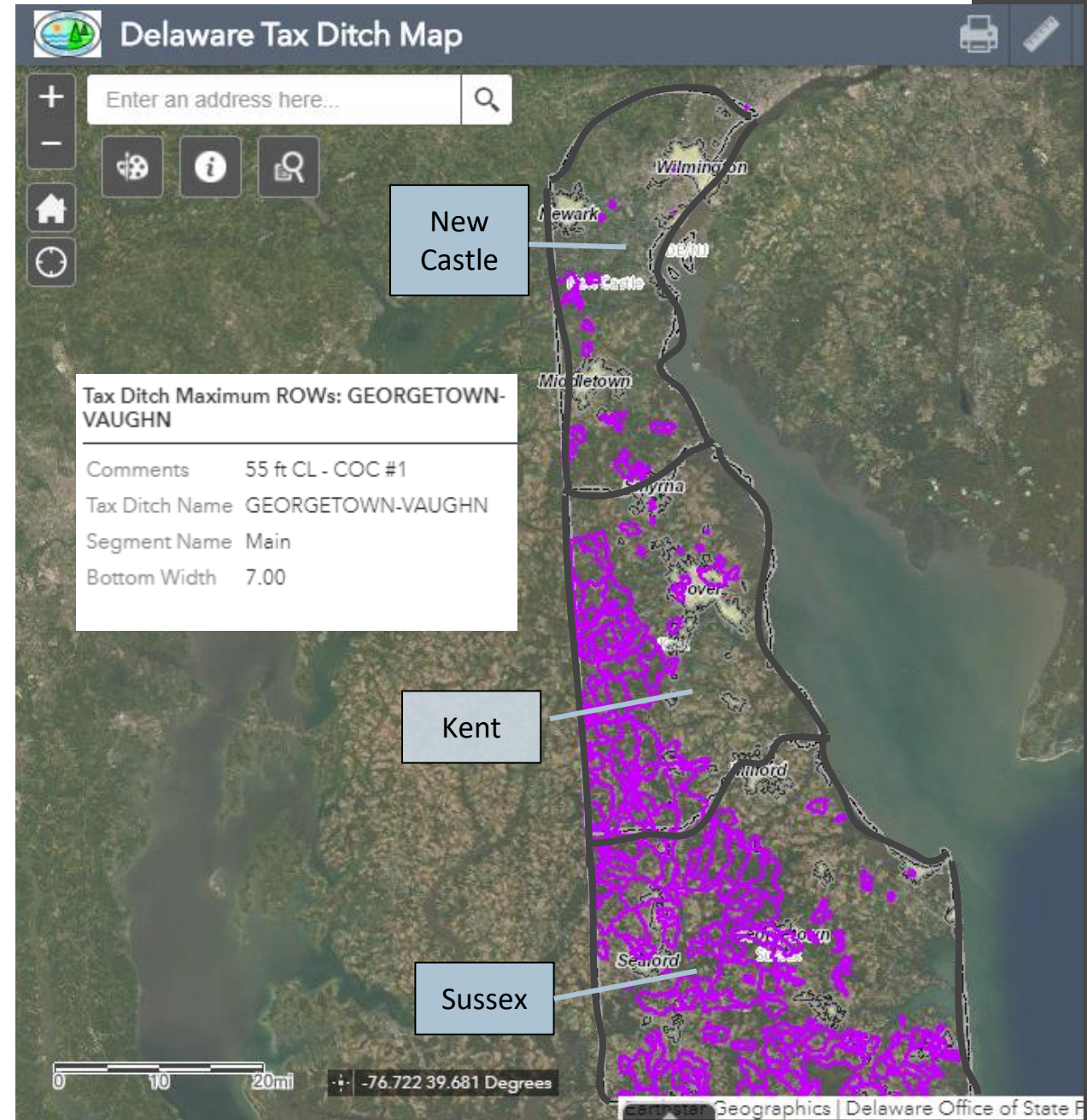
- It is a watershed-based drainage network (ditches) designed to remove water off lands
- A tax ditch organization is a governmental subdivision of the state formed under Delaware Code under Title 7 Chapter 41
- Comprised of and ran by the landowners that own land within that watershed (called taxables)



# Tax Ditch Organization Quick Facts

County	Number of Tax Ditches	Approx. Miles of Channel
New Castle	26	57
Kent	78*	769
Sussex	137*	1,193
<b>Totals</b>	<b>234 (7 are dual county*)</b>	<b>2,019</b>

(Delaware Department of Natural Resources and Environmental Control)

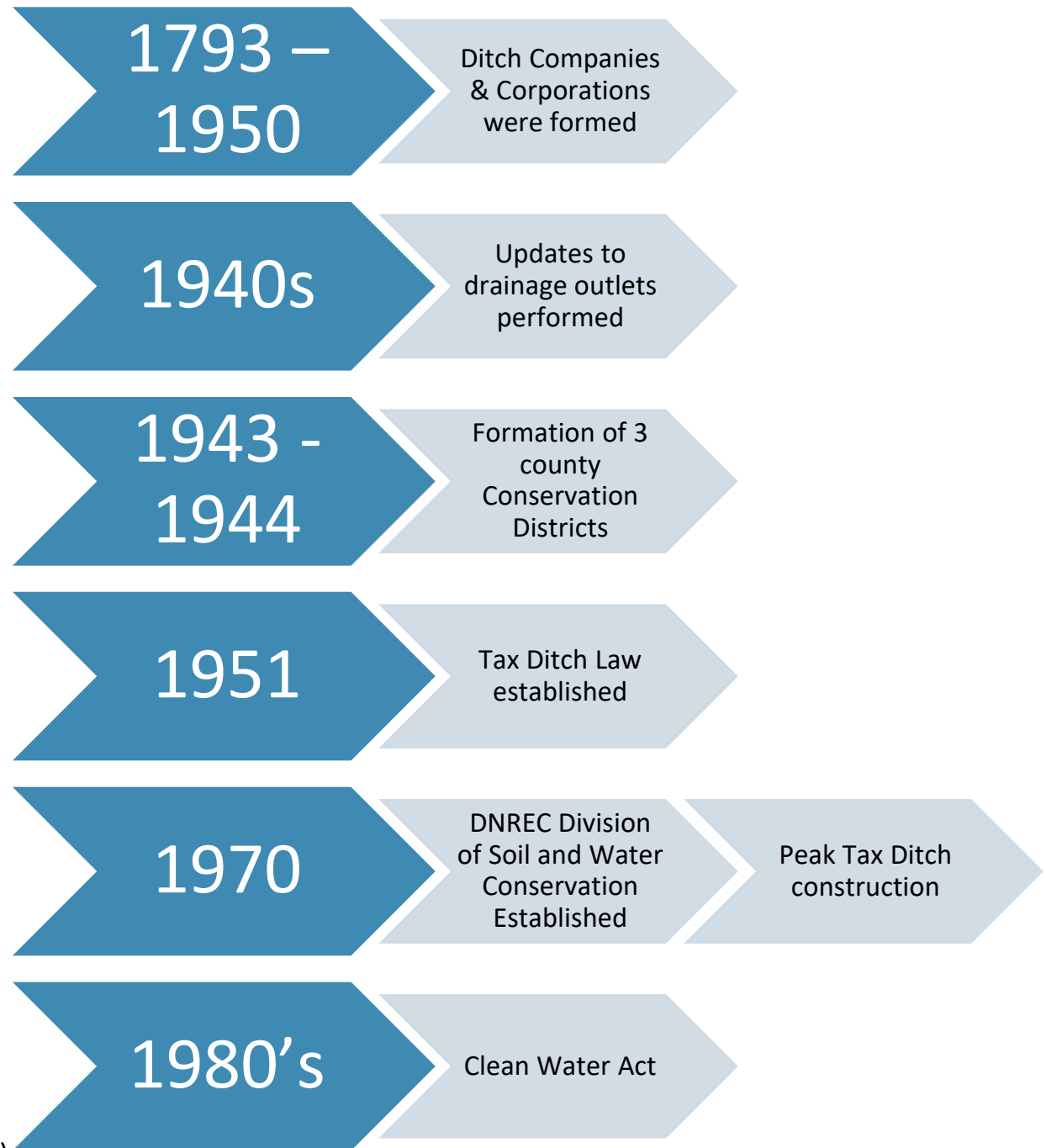


[de.gov/taxditchmap](https://de.gov/taxditchmap)

# History



Delaware Public Archives



# Tax Ditches Impact:

- Drainage across the state
- Where structures can be built on a property
- A property's taxes
- Access by the tax ditch on private property



Photo by [Sonika Agarwal](#) on [Unsplash](#)



# Stakeholders

- Public (Taxables)
- Officers\* (Taxables)
- DNREC\*
- Conservation districts\*
- Land use and stormwater permitting and planning agencies
- County tax collection agencies
- County courts
- Maintenance contractors
- Elected officials
- DeIDOT

\*Key Stakeholders



# Evaluating Stakeholder Needs



DELAWARE DEPARTMENT OF  
NATURAL RESOURCES AND  
ENVIRONMENTAL CONTROL



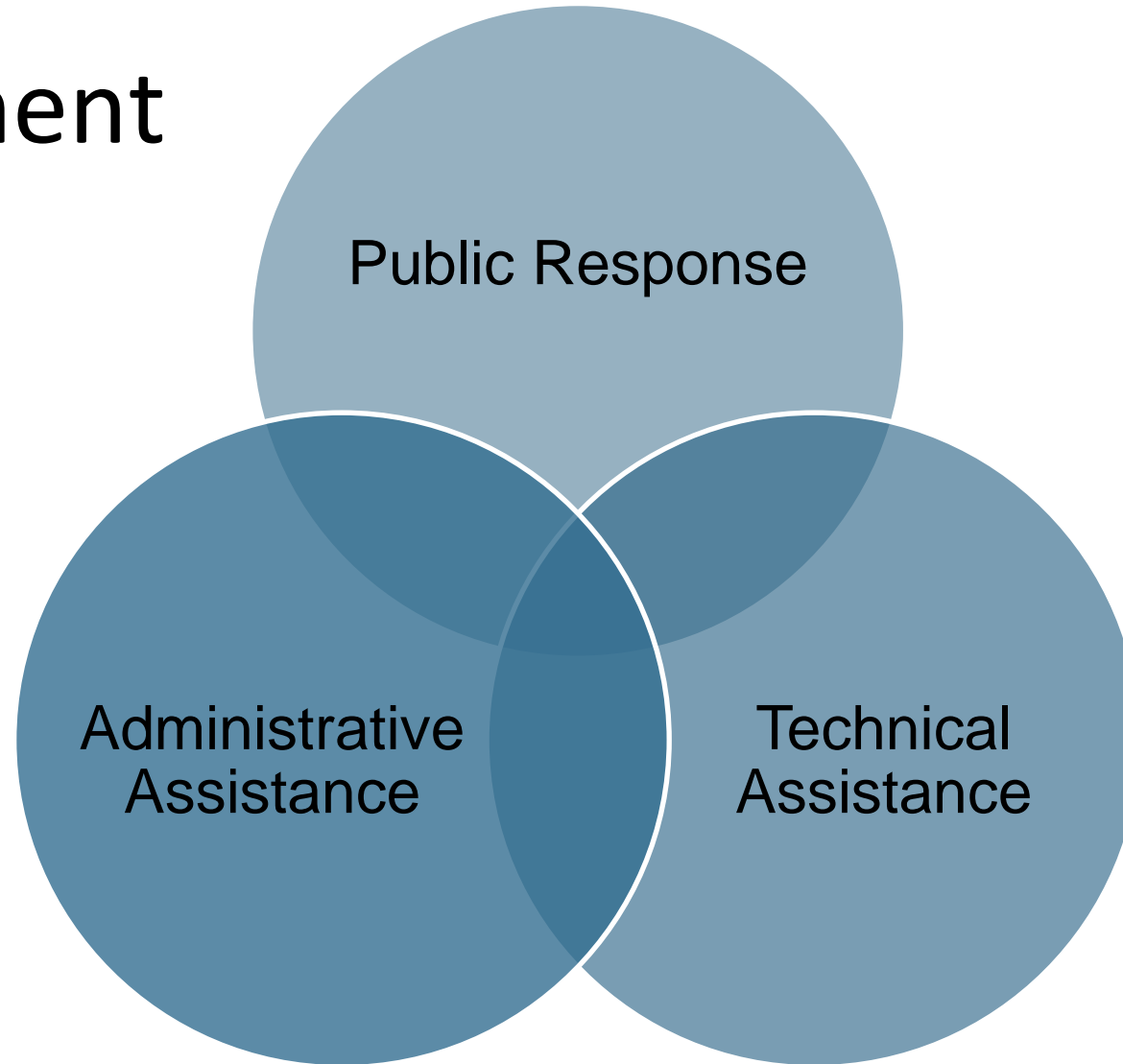
2021

## Tax Ditch Modernization Workgroup Report

A compilation of findings from the Workgroup related to improving the effective function, design and practices around Delaware's tax ditches.

E&O.5 Tax ditch maintenance planning reference materials and resources				
E&O.5.1	Develop a digital/GIS based tax ditch infrastructure and conditions inventory that can be easily shared, including reports provided, to officers and maintenance contractors. Include clearly defined responsibilities for infrastructure in tax ditches.	Findings: 2.0, 3.1, 4.0, 4.3  Workgroup Recommendation: F.1 & F.6	<ul style="list-style-type: none"> <li>Determine funding needed to complete this effort (DNREC/Partner)</li> <li>Secure funding (DNREC/Partner)</li> <li>Prepare and solicit Request for Proposals (RFP) (DNREC/Partner)</li> </ul>	Long Term
F.6 Improve warrant rate recommendations to better reflect anticipated maintenance of the tax ditch system.				
F.6.1	Develop a tool to estimate and project future routine expenses to determine appropriate annual warrant rates.	Findings: 1.1, 7.0, 7.3, 7.4, 8.1, 9.0  Workgroup Recommendation: E&O.5.1	<ul style="list-style-type: none"> <li>Develop tool and document assumptions (DNREC/Partner)</li> <li>Share tool with tax ditch officers and county conservation districts for use. (DNREC/Partner)</li> <li>Provide training as needed (DNREC/Partner)</li> <li>Evaluate and update tool based on expenses every other year (DNREC/county conservation districts)</li> </ul>	Medium Term Implemented continually
F.6.2	Calculate and provide suggested warrant rates ahead of annual meetings for officer and taxable consideration.	Findings: 1.1, 7.0, 7.4, 8.0, 8.1, 9.0  Workgroup Recommendation: F.1 & E&O.5.1	<ul style="list-style-type: none"> <li>Fulfillment of F.6.1 (DNREC/county conservation districts)</li> <li>Calculate and provide warrant rate suggestion and associated paperwork for officers ahead of annual meeting (DNREC/county conservation districts)</li> <li>Consider whether collecting an appropriate warrant rate should be an eligibility criterion for tax ditch matching funds (county conservation districts)</li> </ul>	Medium Term Implemented continually

# Areas for Improvement





# Current Status

Data held in multiple formats and places

Where We Are

Where We're Headed

One-stop-shop to address common tasks

State of Delaware, DNREC

Delaware Tax Ditch Map

Legend

- DE\_Street\_View - STREET\_VIEW
- DE\_Road\_Inventory - Road Inventory
  - Interstate
  - Other Freeway/Expressway
  - Principal Arterial
  - Minor Arterial
  - Major Collector
  - Minor Collector
  - Local
- DE\_State\_Parcels - New Castle Parcels
- DE\_State\_Parcels - Kent Parcels
- DE\_State\_Parcels - Sussex Parcels
- DelDOT Road Drainage - NPDES Structures
  - Culvert Point, Outfall
  - Culvert Point
  - Control Structure
  - Dummy Point, Outfall
  - Dummy Point
  - Inlet, Outfall

Prepared by: DNREC  
Division of Watershed Stewardship  
Return to: 21309 Berlin Road, Unit 6  
Georgetown, DE 19947  
Page 1 of 3

SUNSET BRANCH TAX DITCH C.A. #06M-11-144  
COURT ORDER CHANGE NO. 9  
(SUSSEX COUNTY)

WHEREAS, the present owner of Property No. 17B of the Sunset Branch Tax Ditch desire to change the construction and major maintenance rights-of-way on Sub 1 of Prong 3 on the right side, looking upstream, from Sta 0+35 to Sta 3+16, to 40' from the top of the constructed ditch bank, and to include the ditch from the top of the bank to the centerline; and

WHEREAS, construction, major and minor maintenance costs will not be materially affected; and

WHEREAS, the landowner of Property No. 17B shall be responsible for assuring that this Court Order Change is filed with the Recorder of Deeds for Sussex County; and

WHEREAS, no other landowners are involved;

NOW, THEREFORE, I the undersigned, the present owner of Property No. 17B of the Sunset Branch Tax Ditch, hereby agree to the change in the widths of the construction and major maintenance rights-of-way on Sub 1 of Prong 3 on the right side, looking upstream, from Sta 0+35 to Sta 3+16, to 40' from the top of the constructed ditch bank, and to include the ditch from the top of the bank to the centerline, as shown on the drawing attached hereto and made a part of this agreement; and I, the landowner of Property No. 17B, further agree to be responsible for assuring that this Court Order Change is filed with the Recorder of Deeds for Sussex County.

AS BUILT

6.6.17

# DNREC Tax Ditch GIS Integration

## Needs Assessment (2021-2022)

- 2021 Tax Ditch Modernization Workgroup
- DNREC staff interviews
- Daily task review
- Geodatabase attribute table development

## RFP (2022)

RFP for implementing geodatabase design and application

## Contractor Implements Pilot (2023)

Pilot geodatabase and application, make revisions as necessary

## Contractor Full Scale Implementation (2023-2024)

Modify application and database based on pilot and implement for all 234 tax ditches

## Future Integrations (2025)

- Drone
- Tax ditch watershed modeling

# Capstone Project





# Capstone Goal

To develop a request for proposals (RFP) that will allow the state of Delaware to select a vendor to implement solutions to the concerns identified in the needs assessment.



# *Capstone Deliverable:* Request for Proposals (RFP)

- Introduction to the project's organization
- A description of the need
- Scope and deliverables
- Timeline
- Submission requirements
- Selection criteria
- Contract terms

(Croswell, 2009, Khalimonchuk, 2021 and Reh, 2019)



Gabrielle Henderson Unsplash

# *RFP Deliverable:* GIS Geodatabases



Photo by [Campaign Creators](#) on [Unsplash](#)

Deliverable Type	Category	Specific Items
Geodatabases	Tax Ditch Features	Channels (Layer)
		Right-of-Way (Layer)
		Stations (Layer)
		Watersheds (Layer)
	Tax Ditch Deleted Features	Deleted Channels (Layer)
		Deleted Right-of-Way (Layer)
		Watershed Boundary Change (Layer)
	Assessment	2022 Assessment (Layer)
	Structures	Channel Structures (Layer)
		Gates (Layer)
	Maintenance Concerns	Channel Erosion & Sedimentation (Layer)
		Channel Obstruction (Layer)
Right-of-Way Obstruction (Layer)		
Technical Assistance	Land Development Review (Layer)	
	Stake Out Completed (Layer)	
	Permit Assistance (Layer)	
	Court Order Changes (Layer)	



## *RFP Deliverable:* Input of Data into Geodatabases

- Pilot data entry with 10 ditches from each county
- Full implementation for all 234 tax ditches



Photo by [Scott Graham](#) on [Unsplash](#)

# *RFP Deliverable:* GIS Application

- Pilot an application where DNREC and Conservation District staff can retrieve and update information and create reports
- Full implementation



Photo by [Balázs Kétyi](#) on [Unsplash](#)



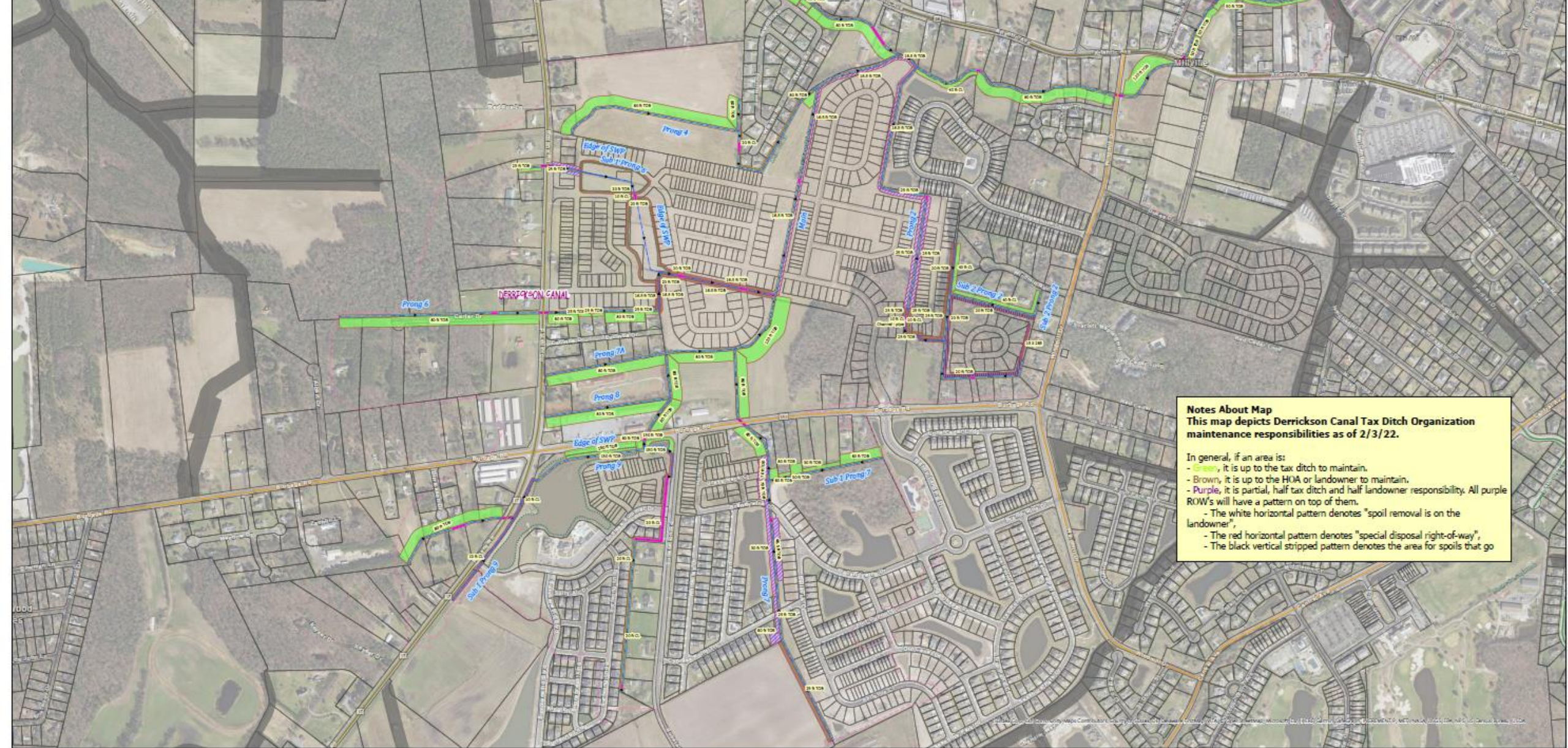
# Example Uses



# Excerpt from Derrickson Canal Tax Ditch Court Order Change #26

- to pay the cost of and be responsible for future major and minor maintenance of Prong 2 (P2) from Sta 23+22 to Sta 28+50, Sub 2 of Prong 2 (S2P2) from Sta 0+00 to Sta 2+50, Sub 1 of Sub 2 of Prong 2 (S1S2P2) from Sta 0+00 to Sta 6+00, Prong 6 (P6) from Sta 0+00 to Sta 12+39, and Sub 1 of Prong 6 (S1P6) from Sta 0+00 to 14+90 to Department of Natural Resources and Environmental Control, Division of Watershed Stewardship, Conservation Programs Section, Drainage Program specifications; and
- to pay the cost of and be responsible for maintenance of any pipes located with Prong 2, Sub 2 of Prong 2, Sub 1 of Sub 2 of Prong 2, and Sub 1 of Prong 6; and





**Notes About Map**  
 This map depicts Derrickson Canal Tax Ditch Organization maintenance responsibilities as of 2/3/22.

In general, if an area is:

- **Green**, it is up to the tax ditch to maintain.
- **Brown**, it is up to the HOA or landowner to maintain.
- **Purple**, it is partial, half tax ditch and half landowner responsibility. All purple ROW's will have a pattern on top of them.
  - The white horizontal pattern denotes "spoil removal is on the landowner".
  - The red horizontal pattern denotes "special disposal right-of-way".
  - The black vertical striped pattern denotes the area for spoils that go



# Derrickson Canal Tax Ditch 2022 Maintenance Map

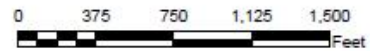
Sussex County

	Communities		HOA/Landowner
	State Parcels		Partial
	Guardrails		Derrickson Tax Ditch
	Tax Ditch Channel		Other Tax Ditch
	Pipes		COC Stipulations
	Special Access ROW		Has Special Disposal Right-of-Way
	Extent of Right-of-Way		Special Disposal Right-of-Way
	Watershed Boundary		Spoil Removal on Landowner

This map was compiled by the DNREC, Division of Watershed Stewardship, Drainage Program. Ditch locations and all features are approximate and based on field information, other agency layers and original tax ditch maps. This map does not replace legal tax ditch instruments on file at the county prothonotary office. Property lines are from the FirstMap 2.0 Parcel Feature service ([https://enterprise.firstmap.delaware.gov/arcgis/rest/services/PlanningCadastre/DE\\_StateParcels/FeatureServer](https://enterprise.firstmap.delaware.gov/arcgis/rest/services/PlanningCadastre/DE_StateParcels/FeatureServer)) and are approximate and may have changed since the date this map was made.

Map Created by: Brittany Haywood

Map Created on: 2/3/2022 at 10:46 AM



1:4,500







# Horse Pound Tax Ditch Inspection Report

Report prepared by Brittany Haywood of the DNREC Drainage Program on February 28, 2022.

## Tax Ditch Summary:

Tax Ditch Maintenance Concern or Feature	Total
Channel & Bank Structures	35
Green Infrastructure	2
Channel Concern	142
ROW Obstruction	53
Grand Total	232

## Channel & Bank Structures Summary:

During the inspection that occurred March through June of 2021, a total of 25 channel structures were noted, the majority being pipes. The majority were noted to be of sound condition although some were blocked due to environmental conditions. Below is a table of the noted structures along with any comments and photos, Object ID denotes the location on the map.

## Channel Concern Summary:

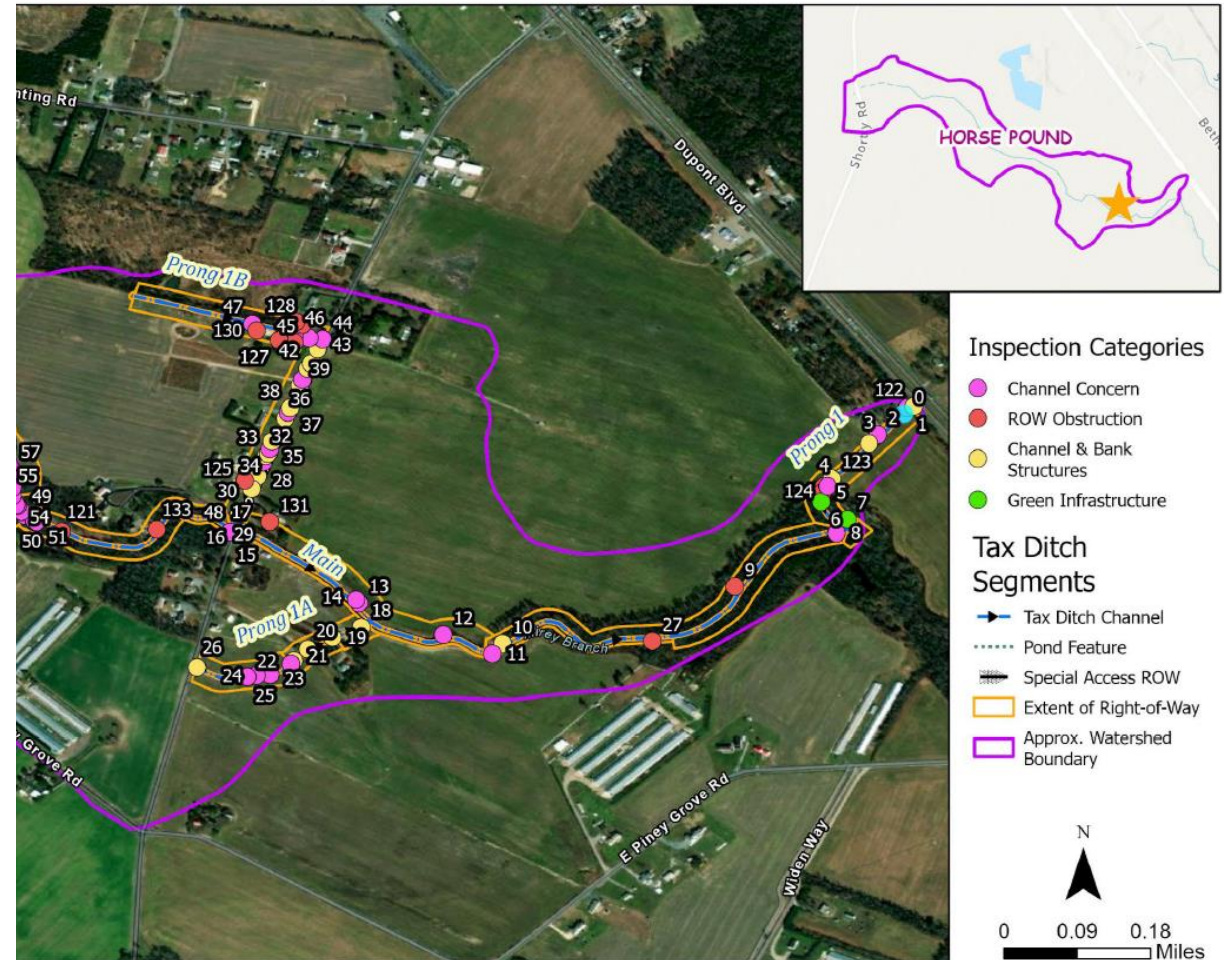
Overall, the most prevalent concern is regarding small to medium sized trees growing within the channel of the tax ditch. The invasive plant, common reed or *Phragmites australis*, issues are present near the outlet of the Main at the intersection of the wetlands and agriculture lands, in the agricultural lands west of Governor Stockley Road (Object IDs: 53-73), on the Main between Prong 2 and Prong 3, on the Main between Prong 3 and Prong 3A, and on the Main to the east of Shortly Road. Cattail present at Object ID 83, downstream of Prong 2. There is a large natural wetland complex at the downstream end of the main that is providing for water storage for upstream portions of the ditch.

- Prong 1A – Issues with muskrat holes in banks, animal crossings, and sedimentation in channel were noted in multiple instances along this Prong.
- Prong 2/ Sub 1 Prong 2 – Issues with sedimentation/ filling in.
- Prong 3 – Issues with trees growing in flow line of ditch, rills and gullies, and sedimentation filling in the end of the prong.
- Prong 3A – Issues with trees growing in the flow line of the ditch, cattail present, straw bales fallen into ditch.
- Prong 4 – Minor issues with trees growing in flow line, and small washouts.

## Right of Way Obstruction Summary:

Overall, the most prevalent concern is regarding small to medium sized trees growing within the right-of-way preventing access to the ditch. In some location structures such as houses, chicken coops and fences prevent access to the ditch.

## Horsepound Tax Ditch Inspection Details







### Overview

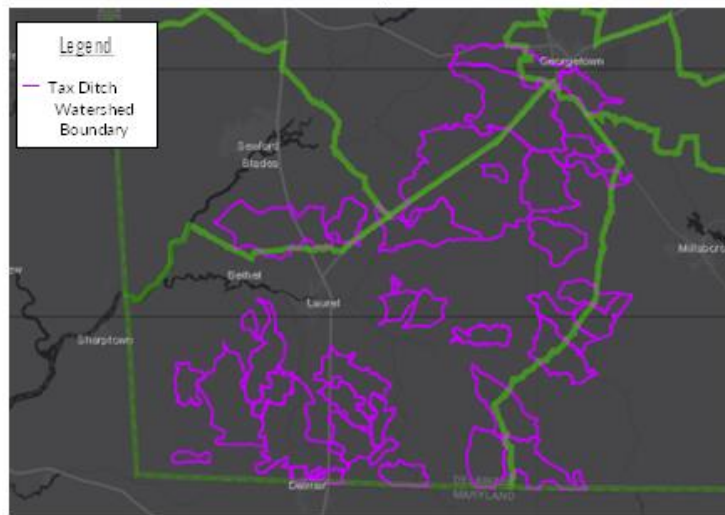
There are a total of 35 Tax Ditch Organizations located within Representative District-40. These Tax Ditch Organizations include approximately 337 miles of tax ditch channels- a longer distance in miles than a round trip from Wilmington to Delmar.

Each tax ditch has a minimum of 3 officer positions: Chairperson, Secretary-Treasurer, and Manager, with some electing to have a fourth Manager. Of the 35 Tax Ditch Organizations, 24 currently have all 3 officers, 3 have no officers, and 4 have only 1 officer.

### Tax Ditch Terms to Know

- **Assessment Base:** the amount of money spent to construct the tax ditch system at formation.
- **Assessment:** that parcel's portion or share of the initial construction cost of the tax ditch system. Assessment assignments may be variable across the watershed and/or parameters enforced at formation of the system
- **Warrant Rate:** the percentage of the tax ditch assessment base that a landowner will be charged by the county on yearly tax bills.

### Tax Ditch Watersheds in Representative District 40



Last Updated on 4/1/2021

### Bacon and Kenney Tax Ditch

The Bacon and Kenney Tax Ditch system is generally situated west of Saint George Road and east of Horsey Church Road, and tax ditch channels are found both north and south of Bacons Road in Laurel, DE. This Tax Ditch Organization was formed in 1988.

The Bacon and Kenney Tax Ditch system provides a benefit to 80 properties or 867 acres. This Tax Ditch Organization is responsible for maintaining nearly 7 miles of tax ditch channels.

### Tax Ditch Officers

As of January 2021, this Tax Ditch Organization has a full complement of officers.

Officer Position	Officer Elected	Phone Number	Email
Chairperson	Clarke Hastings	(302) 875-5338	
Manager	Jay Hastings		jwestwindfarms@gmail.com
Secretary/ Treasurer	Lisa Dorey		dorey@udel.edu

### 2020 Revenue Details

- Tax Ditch Assessment Base: \$57,715.37
- Warrant Rate : 2%
- Financial Report: 2018

Financial Report is based on year of financial records submitted to DNREC Drainage Program.



### Tax Ditch Officer Bonding

Under § 4164 of the Tax Ditch Law the Secretary-Treasurer of each tax ditch shall be bonded. This is an insurance type policy for which the officer will, in-good-faith, perform his/her duties in relation to tax ditch funds.

Is the Secretary-Treasurer bonded? → No

# Expected Outcomes

- RFP will allow for:
  - Project to come to fruition while not depleting DNREC staffing resources
  - Outside input and expertise
    - See options for approaches and costs



# 2022 Capstone Timeline

Mar. 14

Mar. - Oct.

Oct. - Dec.

TBD

Dec.

**596A Presentation**

**Development of RFP  
Materials**

**596B: Fall Semester 2**

**Final Presentation**

**RFP Posted**

Development of RFP  
materials

Possible URISA GIS Pro in  
Oct.

RFP submitted to the  
state of Delaware's  
contracting website.



# References

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- Khalimonchuk, Kateryna. “How to Write an Effective RFP (Request for Proposal).” Fulcrum Blog, 26 Aug. 2021, <https://fulcrum.rocks/blog/how-to-write-an-effective-rfp/>.
- Reh, F. John. “Learn How to Write a Great RFP, or Request for Proposal.” The Balance Careers, 13 Nov. 2019, <https://www.thebalancecareers.com/how-to-write-an-rfp-2276025>.