STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL
DIVISION OF WATERSHED STEWARDSHIP
ENTERPRISE BUSINESS PARK
285 BEISER BOULEVARD, SUITE 102
DOVER, DELAWARE 19904

CONSERVATION PROGRAMS SECTION

PHONE: (302) 739-9921
FAX: (302) 739-6724

August 4, 2021

Delaware Coastal Management Program
89 Kings Highway
Dover, DE 19901

RE: **Coastal Management Program Federal Consistency Certification**
South Bowers Maintenance Ditch Cleanout, ACOE Individual Permit & DNREC WSLS & WQC Permit - PCN

To whom it may concern,

Enclosed is a request for a Coastal Management Program Federal Consistency Certification for the South Bowers Maintenance Ditch Cleanout Project. The proposed maintenance work will be performed within an existing mosquito ditch channel located on Tax Parcels 5-00-12400-01-0300-00001 and 5-00-12400-01-0200-00001. The existing mosquito ditch is located west of South Bowers Road in Milford, Kent County, Delaware and drains into the Murderkill River. The Latitude and Longitude for the center of the project scope are Lat 39.056217 and Long -75.397368 (see attached).

Statement of Consistency:

Our office (Division of Watershed Stewardship, Drainage Program) has determined that the proposed South Bowers Maintenance Ditch Cleanout Project complies with and will be conducted in a manner that is consistent with Delaware's approved Coastal Management Program. In addition, the South Bowers Maintenance Ditch Cleanout Project does require an Individual Permit from the U.S. Army Corps of Engineers, a 401 Water Quality Certification from the Delaware Division of Water Resources, and a Coastal Zone Management Consistency Certification from your office, the Delaware Coastal Programs.

Project Description:

The purpose of the project is to perform maintenance on the existing mosquito ditch located west of South Bowers Road in order to restore the drainage functionality it has historically provided to the surrounding area. The removal of accumulated sediment from the channel will mitigate drainage issues experienced by residents living and commuting along South Bowers Road which is often flooded during high tides and storm events. This project will remove the minimal amount of accumulated sediment from the channel necessary to provide positive drainage through the channel for stormwater and high tides to outlet into the Murderkill River or remain in the marsh to get off of the road. The total project length is approximately 895 linear feet and will result in a discharge of 0.00 cubic yards and 87.44 cubic yards below the planes of the low tide and high tide elevations respectively.

Pre-Construction Notifications:

Delaware Natural Heritage Program (DNHP), National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS), and Division of Historical and Cultural Affairs were contacted on or around September 11, 2017 (see attached pre-construction notifications). The Delaware Natural Heritage Program responded on September 26, 2017**. According to DNHP the project site is located in an area utilized by marsh nesting birds and they have recommended a time of year restriction for the proposed maintenance activity between April 1 and July 31.** This time of year restriction will be honored and no work is to be conducted during April 1 and July 31. The National Marine Fisheries Service (NMFS) was contacted on or around September 11, 2017 but did not respond with any comments. It has been over 30 days and our office has still received no response and as such, it is our belief that the NMFS did not have any comments in regards to the proposed maintenance activity. The Division of Historical and Cultural Affairs (SHPO) was contacted on or around September 11, 2017 but did not respond with any comments. The notice was sent with the request to indicate if the message was read and it was on September 11, 2017 however, we did not receive a response. As such, it is our belief that the SHPO did not have any comments in regards to the proposed maintenance activity. The USFWS responded on November 6, 2017. According to USFWS, the federally threatened red knot is known to occur in the project vicinity. **However, based on the proposed maintenance activity the USFWS indicated that "this project as proposed is "not likely to adversely affect" the red knot because work will not occur between April 15 and June 7, which is the red knot time-of-year restriction for spring migration".**

To help protect the tidal wetlands and marsh located adjacent to and downstream of the existing mosquito ditch the proposed work will be conducted utilizing the same methods as a marsh replenishment. A rotary excavator which is specifically designed to traverse saltmarshes that result in minimal impacts will be used. This piece of equipment has a hydraulically controlled rotary cutting head that functions similarly to a snow blower. The cutting head emulsifies soils with available marsh water and shoots the mixture across the marsh in a thin veneer, broadcasted up to 40 feet from the site of excavation (Lesser, 2007). For this project the spoil material removed from the channel will be spread thinly across the adjacent marsh. The spoil material will be managed carefully in an effort to ensure changes in marsh elevation do not result in undesirable vegetation changes. If the soils have high sand or clay contents more conventional excavation equipment may be required. In addition, a marsh ATV with front-end blade may be utilized to help spread and grade the excavated spoil if necessary. During the maintenance activity straw wattle may be placed (if necessary) at the most downstream point of the project scope in order to trap sediment in the water column from entering the Murderkill River. The spoil amended areas are anticipated to revegetate naturally with time based on the thin spreading of the material. The project area will be monitored to ensure the vegetation reestablishes in a timely manner and if not, plantings and additional seeding will occur to address.

All work will be conducted during low tide or normal baseflow conditions to further reduce sediment losses during excavation. Under low tide conditions the ditch channel is not tidally influenced which may be the optimal time to get the work completed (if the soils are moist enough for broadcasting). The maintenance work will be scheduled on a day with appropriate weather conditions (in particular wind) to ensure the spoil is spread across the defined area only. In addition this maintenance work will **not** occur between April 1 and July 31 to minimize any disturbance to red knots and other migratory birds that utilize the project area.

By this letter the Division of Watershed Stewardship is formally requesting a Coastal Management Program Federal Consistency Certification for the above project. I appreciate your assistance with this

project and if you have any questions or require additional information associated with this project, please do not hesitate in contacting this office.

Sincerely,

Alissa Buck
Environmental Scientist II
DNREC Drainage Program

Delaware Department of Natural Resources and Environmental Control
Delaware Coastal Management Program

Initial Review: _____
Updated On: _____
Complete: _____
Official Use Only

Coastal Zone Management Act Federal Consistency Form

This document provides the Delaware Coastal Management Program (DCMP) with a Federal Consistency Determination or Certification for activities regulated under the Coastal Zone Management Act of 1972, as amended, and NOAA's Federal Consistency Regulations, 15 C.F.R. Part 930. Federal agencies and other applicants for federal consistency are not required to use this form; it is provided to applicants to facilitate the submission of a Consistency Determination or Consistency Certification. In addition, federal agencies and applicants are only required to provide the information required by NOAA's Federal Consistency Regulations.

Project/Activity Name:	South Bowers Maintenance Ditch Cleanout

I. Federal Agency or Non-Federal Applicant Contact Information:

Contact Name/Title: Tyler Brown

Federal Agency Contractor Name (if applicable): _____

Federal Agency: DNREC Division of Watershed Stewardship
(either the federal agency proposing an action or the federal agency issuing a federal license/permit or financial assistance to a non-federal applicant)

Mailing Address: 21309 Berlin Road, Unit 6

City: Georgetown State: DE Zip Code: 19947

E-mail: tyler.brown@delaware.gov Telephone #: 302-855-1930

II. Federal Consistency Category:

- (●) Federal Activity or Development Project (15 C.F.R. Part 930, Subpart C)
- ( ) Outer Continental Shelf Activity (15 C.F.R. Part 930, Subpart E)
- ( ) Federal Financial Assistance (15 C.F.R. Part 930, Subpart F)
- ( ) Federal License or Permit Activity (15 C.F.R. Part 930, Subpart D)
- ( ) Federal License or Permit Activity which occurs wholly in another state (interstate consistency activities identified in DCMP's Policy document)

III. Detailed Project Description (attach additional sheets if necessary):

The purpose of the project is to perform maintenance on the existing mosquito ditch located west of South Bowers Road in order to restore the drainage functionality it has historically provided to the surrounding area. The removal of accumulated sediment from the channel will mitigate drainage issues experienced by residents living and commuting along South Bowers Road which is often flooded during high tides and storm events. This project will remove the minimal amount of accumulated sediment from the channel necessary to provide positive drainage through the channel for stormwater and high tides to outlet into the Murderkill River or remain in the marsh to get off of the road. The total project length is approximately 895 linear feet and will result in a discharge of 0.00 cubic yards and 87.44 cubic yards below the planes of the low tide and high tide elevations respectively.

IV. General Analysis of Coastal Effects (attach additional sheets if necessary):

There will not be major coastal effects from this project. The project goal is to alleviate flooding within the coastal community of South Bowers and function as a marsh replenishment for the tidal marsh area.

V. Detailed Analysis of Consistency with DCMP Enforceable Policies (attach additional sheets if necessary)**:**

Policy 5.1: Wetlands Management

No significant adverse impacts are expected with this scope of work as equipment designed to traverse saltmarshes will be utilized and the accumulated sediment within the ditch bottom likely originated from the adjacent marsh, where it will be broadcast spread as it is removed during this activity

Policy 5.2: Beach Management

N/A

Policy 5.3: Coastal Waters Management (includes wells, water supply, and stormwater management. Attach additional sheets if necessary)

N/A

Policy 5.4: Subaqueous Land and Coastal Strip Management

No significant adverse impacts are expected with this scope of work as equipment designed to traverse saltmarshes will be utilized and the accumulated sediment within the ditch bottom likely originated from the adjacent marsh, where it will be broadcast spread as it is removed during this activity

Policy 5.5: Public Lands Management

N/A

Policy 5.6: Natural Lands Management

N/A

Policy 5.7: Flood Hazard Areas Management

The maintenance should improve the condition of the road, particularly during storm events which will enhance public health and safety. No negative impact anticipated.

Policy 5.8: Port of Wilmington

N/A

Policy 5.9: Woodlands and Agricultural Lands Management

N/A

Policy 5.10: Historic and Cultural Areas Management

No knowledge of historical places immediately surrounding the ditch channel or in the nearby vicinity of the project scope. Received no comment from DE Historical and Cultural Affairs when we reached out.

Policy 5.11: Living Resources

N/A

Policy 5.12 Mineral Resources Management

N/A

Policy 5.13: State Owned Coastal Recreation and Conservation

N/A

Policy 5.14: Public Trust Doctrine

N/A

Policy 5.15: Energy Facilities

N/A

Policy 5.16: Public Investment

N/A

Policy 5.17: Recreation and Tourism

The existing ditch is located on private property and landowners have approved this project so if this property is used for recreation, the landowners have agreed

Policy 5.18: National Defense and Aerospace Facilities

N/A

Policy 5.19: Transportation Facilities

This project should improve the driving conditions of South Bowers Rd. The work will alleviate flooding concerns that the resident and commuters currently experience

Policy 5.20: Air Quality Management

No impacts to air quality expected

Policy 5.21: Water Supply Management

N/A

Policy 5.22: Waste Disposal Management

This project does involve the excavation of excavated sediment which will result in the immediate broadcast spreading of spoil across the adjacent marsh within a 40’ buffer along the entire length of channel to be maintained. The maintenance work will be performed utilizing the techniques of a march replenishment.

Policy 5.23: Development

N/A

Policy 5.24: Pollution Prevention

No significant adverse impacts are expected with this scope of work as equipment designed to traverse saltmarshes will be utilized and the accumulated sediment within the ditch bottom likely originated from the adjacent marsh, where it will be broadcast spread as it is removed during this activity

Policy 5.25: Coastal Management Coordination

N/A- we shall provide an opportunity for other federal agencies to review and comment on proposed actions (project has already been put on public notice in the past)

VI. JPP and RAS Review (Check all that apply)**:**

Has the project been reviewed in a monthly Joint Permit Processing and/or Regulatory Advisory Service meeting?

☐ JPP ☐ RAS ■ None

*If yes, provide the date of the meeting(s): _____

VII. Statement of Certification/Determination and Signature (Check one and sign below)**:**

☒ **FEDERAL AGENCY CONSISTENCY DETERMINATION.** Based upon the information, data, and analysis included herein, the federal agency, or its contracted agent, listed in (I) above, finds that this proposed activity is consistent to the maximum extent practicable with the enforceable policies of the Delaware Coastal Management Program.

OR

☐ **FEDERAL AGENCY NEGATIVE DETERMINATION.** Based upon the information, data, and analysis included herein, the federal agency, or its contracted agent, listed in (I) above, finds that this proposed activity will not have any reasonably foreseeable effects on Delaware's coastal uses or resources (Negative Determination) and is therefore consistent with the enforceable policies of the Delaware Coastal Management Program.

OR

☐ **NON-FEDERAL APPLICANT'S CONSISTENCY CERTIFICATION.** Based upon the information, data, and analysis included herein, the non-federal applicant for a federal license or permit, or state or local government agency applying for federal funding, listed in (I) above, finds that this proposed activity complies with the enforceable policies of the Delaware Coastal Management Program and will be conducted in a manner consistent with such program.

Signature:	Tyler Brown		
Printed Name:	Tyler Brown	Date:	9/8/2021

Pursuant to 15 C.F.R. Part 930, the Delaware Coastal Management Program must provide its concurrence with or objection to this consistency determination or consistency certification in accordance with the deadlines listed below. Concurrence will be presumed if the state's response is not received within the allowable timeframe.

Federal Consistency Review Deadlines:

Federal Activity or Development Project (15 C.F.R. Part 930, Subpart C)	60 days with option to extend an additional 15 days or stay review (15 C.F.R. § 930.41)
Federal License or Permit (15 C.F.R. Part 930, Subpart D)	Six months, with a status letter at three months. The six month review period can be stayed by mutual agreement. (15 C.F.R. § 930.63)
Outer Continental Shelf Activity (15 C.F.R. Part 930, Subpart E)	Six months, with a status letter at three months. If three month status letter not issued, then concurrence presumed. The six month review period can be stayed by mutual agreement. (15 C.F.R. § 930.78)
Federal Financial Assistance to State or Local Governments (15 C.F.R. Part 930, Subpart F)	State Clearinghouse schedule

OFFICIAL USE ONLY:

Reviewed By:	Fed Con ID:	Date Received:
Public notice dates: to	Comments Received: ☐ NO ☐ YES *[attach comments]*	
Decision type: *(objections or conditions attach details)*	_ Decision Date:	

STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL
DIVISION OF WATERSHED STEWARDSHIP
ENTERPRISE BUSINESS PARK
285 BEISER BOULEVARD, SUITE 102
DOVER, DELAWARE 19904

CONSERVATION PROGRAMS SECTION

PHONE: (302) 739-9921
FAX: (302) 739-6724

August 13, 2021

Mr. Michael Yost
U.S. Army Corps of Engineers
Philadelphia District, Field Office
1203 College Park Drive, Suite 103
Dover, DE 19901

RE: **South Bowers Maintenance Ditch Cleanout, ACOE Individual Permit & DNREC WSLS & WQC Permit, Milford, Kent County, Delaware**

Dear Mr. Yost:

The DNREC Conservation Programs Section is notifying your office for a project requiring an Individual Permit. The purpose of the project is to perform maintenance on the existing mosquito ditch located west of South Bowers Road in order to restore the drainage functionality it has historically provided to the surrounding area. The removal of accumulated sediment from the channel will mitigate drainage issues experienced by residents living and commuting along South Bowers Road which is often flooded during high tides and storm events. This project will remove the minimal amount of accumulated sediment from the channel necessary to provide positive drainage through the channel for stormwater and high tides to outlet into the Murderkill River or remain in the marsh to get off of the road. The total project length is approximately 895 linear feet and will result in a discharge of 0.00 cubic yards and 87.44 cubic yards below the planes of the low tide and high tide elevations, respectively. The water depth in the project area is a shallow mosquito ditch, ranging in width from 5-10 feet across. It is not a Federal or navigation channel.

Delaware Natural Heritage Program (DNHP), National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS), and Division of Historical and Cultural Affairs were contacted on or around September 11, 2017 (see attached pre-construction notifications). The Delaware Natural Heritage Program responded on September 26, 2017. According to DNHP the project site is located in an area utilized by marsh nesting birds and they have recommended a time of year restriction for the proposed maintenance activity between April 1 and July 31. This time of year restriction will be honored and no work is to be conducted during April 1 and July 31. The National Marine Fisheries Service (NMFS) was contacted on or around September 11, 2017 but did not respond with any comments. It has been over 30 days and our office has still received no response and as such, it is our belief that the NMFS did not have any comments in regards to the proposed maintenance activity. The Division of Historical and Cultural Affairs (SHPO) was contacted on or around September 11, 2017 but did not respond with any comments. The notice was sent with the request to indicate if the message was read and it was on September 11, 2017 however, we did not receive a response. As such, it is our belief that the SHPO did not have any comments in regards to the proposed

maintenance activity. The USFWS responded on November 6, 2017. According to USFWS, the federally threatened red knot is known to occur in the project vicinity. However, based on the proposed maintenance activity the USFWS indicated that "this project as proposed is "not likely to adversely affect" the red knot because work will not occur between April 15 and June 7, which is the red knot time-of-year restriction for spring migration". As noted within the permit application, measures will be taken to avoid impacts on aquatic resources, avoid/minimize discharges into wetlands, and compensate for any impacts to wetlands.

By this letter and the enclosed application, DNREC Conservation Programs Section is formally requesting an Individual Permit. If you have any questions or require additional information associated with this project, please do not hesitate in contacting this office.

Sincerely,

Alissa Buck
Environmental Scientist II

ENVIRONMENTAL QUESTIONNAIRE
FOR CORPS OF ENGINEERS PERMIT APPLICATIONS
Philadelphia District, Corps of Engineers
Philadelphia, Pennsylvania 19107
CENAP-OP-R

INTRODUCTION AND INSTRUCTIONS

The District Engineer is required by law to assess the initial, cumulative, and long-term effects of any proposed permit on all aspects of the environment.

To speed the analysis of the probable impact of the proposed work, each applicant is required to submit appropriate environmental data as part of a permit application. We ask that you provide a thorough description of your proposed project and answer each question as it applies to the work and the results of that work. Complete and accurate answers will prevent unnecessary delays in processing your permit application

Parts I and II will be filled out by all applicants. Part I is self-explanatory. In Part II, the Environmental Impact Checklist, you should indicate the impacts of your project on all aspects of the environment that are listed. Use the space under "Qualifying Remarks" to indicate the specific impacts that your project will have. This may include types of plants or animals affected, specific adverse, beneficial, or mitigative effects, changes to existing conditions, etc. Although space for answers has been provided, you may wish to supply additional information on attached pages. If you do not anticipate an impact on a certain item, simply place a check in the "No" column.

Part III will be filled out by all applicants applying for a permit to perform dredging.

Part IV will be filled out by all applicants applying for a permit to perform filling operations. This includes activities such as filling behind bulkheads.

Refer any questions you may have concerning this supplemental form to the Regulatory Branch at (215) 656-6728.

PART I

I. PROJECT DESCRIPTION:

A. General Site Location: Accurately locate the project site with respect to State, county, or other subdivision, and in relation to streams and rivers.

The proposed maintenance dredging and marsh replenishment will be performed within a portion of an existing mosquito ditch system, located on Tax Parcels 5-00-12400-01-0300-00001 and 5-00-12400-01-0200-00001 that is an unnamed tributary to the Murderkill River, located west of South Bowers Road in Milford, Kent County, Delaware. The portion of the mosquito ditch to be dredged is approximately 895 feet in length and discharges directly into the Murderkill River.

B. Specific Site Locations: Completely locate the project site with respect to cove, creek, property owner, plot number, etc.

The mosquito ditch passes through Tax Parcels 5-00-12400-01-0300-00001 (Owner: Thomas E. Webb, Sr.) and 5-00-12400-01-0200-00001 (Owner: William H. Webb, Jr.). These parcels will also be utilized as the spoil disposal site as the excavated material will be spread immediately and directly spread across the adjacent parcels as a marsh replenishement. The unnamed mosquito ditch is a tributary of and outfalls directly into the Murderkill River.

C. Description of Proposed Action: Carefully describe the action proposed, including the method of construction, equipment, and materials to be used. Details in your description are important. Attach additional sheets if necessary.

Please see attachment

D. Purpose of Proposed Action: Define the purpose of the proposed structure or work. For example, the purpose of bulkheading may be to stabilize an eroding bank; whereas, the purpose for a pier may be for the mooring of a private boat, for access to a public or private facility, for a marina, or for another purpose.

The purpose of the project is to perform maintenance on the existing mosquito ditch located west of South Bowers Road in order to restore the drainage functionality it has historically provided to the surrounding area. The removal of the accumulated sediment from the channel will mitigate the drainage issues experienced by residents living and commuting along South Bowers Road which is often flooded during high tides and storm events. The project will remove the minimum amount of accumulated sediment from the channel required to provide positive drainage through the channel for stormwater and high tides to outlet into the Murderkill River or remain in the marsh in order to get the ponding water off of the road.

E. Submit color photographs of the site, with explanations of the views shown (prints only). Photographs help us to better understand your project. The more photographs you provide, the easier it is to understand and process your application.

Photographs are attached.

PART II – ENVIRONMENTAL IMPACT CHECKLIST			
ENVIRONMENTAL IMPACT	**YES**	**NO**	**QUALIFYING REMARKS**
A. Physical			
1. Topography	☑	☐	No adverse impact but the excavation will remove the accumulated sediment from the ditch bottom to reestablish the minimum positive grade through the channel to restore drainage that it historically provided. In addition, the spoil material will be broadcast across the adjacent marsh as a marsh replenishment. (see attached)
2. Geological Elements and Leaching	☐	☑	No impact because the accumulated sediments in the ditch bottoms are already underwater and/or undergo daily wetting and drying due to tidal influence so any soluble elements or leaching that could occur would already be doing or have done so.
3. Air	☐	☑	No impacts to air quality anticipated. Broadcast of spoil materials will be kept to a 40' area directly adjacent to the channel. The broadcasting of the sediment will occur as the spoil is excavated and the sediments are expected to settle on the ground quickly.
4. Transportation	☐	☑	No impacts to transportation. This project scope is not in a navigable water way and no road closures are needed to access and perform this work.
5. Handling of Hazardous Materials	☐	☑	No hazardous materials are anticipated to be handled here. Surrounding landuse is tidal marsh and residential.
6. Spoil Disposal	☑	☐	This project does involve the excavation of accumulated sediment which will result the immediate broadcast spreading of the spoil across the adjacent marsh within a 40' buffer along the entire length of channel to be maintained. The maintenance work will be performed utilizing the techniques of a marsh replenishment.
7. Sewage and Solid Wastes	☐	☑	No impacts to sewage or solid wastes anticipated with this project scope. All excavation is to be done in the existing ditch channel.
8. Water Resources			
a. Water Quality	☐	☑	No significant adverse impacts are expected with this scope of work as equipment designed to traverse saltmarshes will be utilized and the accumulated sediment within the ditch bottom likely originated from the adjacent marsh where it will be broadcast spread as it is removed during this activity.
b. Hydrography, Circulation, Littoral Drift.	☐	☑	No adverse impact anticipated. All work to be performed in tributary ditch to the Murderkill River. The work will result in a slight positive grade through the ditch channel to improve the drainage function the ditch historically provided.
c. Ground Water	☐	☑	No leaching of contaminants or excavation below what was done at construction of the mosquito ditch will occur.
B. Biological			
1. Vegetation			
a. Terrestrial	☐	☑	The spoil material will be broadcast spread, thinly, across the adjacent marsh. The spoil material will be managed carefully in an effort to ensure changes in marsh elevation do not result in undesirable vegetation changes.
b. Aquatic	☐	☑	The channel is pretty clear of aquatic vegetation and the spoil material will be broadcast spread thinly across the adjacent land to ensure changes in topography that would result in vegetation changes will NOT occur.
2. Fish and Wildlife			
a. Mammals	☐	☑	No impacts expected. Maintenance work will be done carefully to ensure the marsh elevation change does not result in changes in vegetation. Work will be performed in a timely fashion. Also no comments/suggestions were received from the DE Natural Heritage Program or US Fish and Wildlife concerning mammals based on the proposed project
b. Birds	☐	☑	No impacts expected. No work will occur during April 1 to July 31 based on comments received by DE Natural Heritage Program and US Fish and Wildlife which noted presence of red knots and other marsh nesting birds. This time of year restriction will be honored to protect the noted species.
c. Amphibians	☑	☐	While no significant adverse impacts are anticipated from this project it may cause a disturbance to the amphibians present in the channel and the 40' broadcast area. Work is to be done during low tide or normal flow conditions where the ditch is almost if not completely dry. (see attached)
d. Reptiles	☑	☐	While no significant adverse impacts are anticipated from this project it may cause a disturbance to any reptiles present in the ditch and the 40' broadcast area. Work is to be done during low tide or normal flow conditions where the ditch is almost if not completely dry. Also no vegetative cover is anticipated to change as a (see attached)
e. Fish	☑	☐	While no significant adverse impacts are anticipated from this project it may cause a disturbance to fish that make there way into the the ditch channels. However, work is to be done during low tide or normal flow conditions where the ditch is almost if not completely dry. (see attached).
f. Shellfish	☑	☐	During the field visits no shellfish were found in ditch channels to be maintained. However, any sediment transport could affect downstream shellfish and measures will be taken to ensure only incidental fallback may occur.
g. Invertebrates	☑	☐	The removal of the ditch bottom sediments may cause a disturbance to any invertebrates within them.
3. Rare or Endangered Species	☐	☑	No impacts are expected based on agency reviews performed by USFWS and DE Natural Heritage Program, the proposed project is not anticipated to have an impact on rare or endangered species as long as no construction occurs between April 1 and July 31.

ENVIRONMENTAL IMPACT	YES	NO	QUALIFYING REMARKS
C. Cultural			
1. Land Use	☐	☑	No changes in landuse will result following this maintenance activity.
2. Population Density and Trends	☐	☑	No changes in population density and trends will result following this maintenance activity.
3. Regional Development	☐	☑	No changes in regional development will result following this maintenance activity.
4. Historic Places	☐	☑	No knowledge of historical places immediately surrounding the ditch channel or in the nearby vicinity of the project scope. Received no comment from Delaware Historical and Cultural Affairs when we contacted them.
5. Archaeological Sites	☐	☑	No knowledge of archaeological sites immediately surrounding the ditch channels or in the nearby vicinity of the project scope. Received no comment from Delaware Historical and Cultural Affairs when we contacted them.
6. Aesthetics	☐	☑	The ditch channel will look the same even after the maintenance activity. Broadcast spraying of the spoil material will be done carefully and monitored to ensure negative changes in marsh vegetation does not occur. Natural regrowth of marsh vegetation is expected and will be monitored over time following maintenance.
7. Utilities	☐	☑	No knowledge of utilities in the way for the proposed mosquito ditch maintenance.
8. Transportation Systems	☑ positively	☐	This maintenance should improve the driving condition of South Bowers Road. This work will alleviate the flooding concerns that the residents and commuters currently experience during and following storm events. and high tide events.
9. Recreation	☐	☑	The existing mosquito ditch is located on private property and the landowners have approved of this project so if the properties are used for recreation, the landowners have still agreed to its construction.
10. Public Health	☑ positively	☐	The maintenance work should improve the condition of the road particularly during storm events which will enhance public health and safety. No negative impact is anticipated from the proposed maintenance activity on public health.
D. Other Factors			
1. Secondary Effects	☐	☑	No impact on secondary effects from this proposed maintenance dipout.
2. Controversiality	☐	☑	This project has been discussed amongst the surrounding area residents multiple times and the residents really want to see this project to completion. It will help alleviate the flooding issues experienced on the roadway to their home or property. All landowner agreements have been received for the work as well.
3. Is significant dredging involved?	☑	☐	A total of 87.44 C.Y. of sediment is to be removed from the mosquito ditches, and broadcast spread across the adjacent marsh as a marsh replenishment. The minimum grade required to establish positive grade through the channel will be utilized in this project to result in minimal sediment removal
4. Is significant filling involved?	☑	☐	A total of 87.44 C.Y. of spoil material will be broadcast spread thinly across the i adjacent marsh. This will be done carefully and monitored to ensure changes in marsh elevation does not result in negative vegetation changes. Because this project will be performed utilizing the same techniques as a marsh replenishment project, the marsh within the broadcast spread buffer will experience less of an effect to sea level rise.

Part III

Considerations of a Dredging Proposal:

A. Describe characteristics and locations of the proposed dredged material disposal site. Provide photographs.

The disposal site will be the immediately adjacent marsh located on Tax Parcels 5-00-12400-01-0200-00001 and 5-00-12400-01-0300-00001. The maintenance activity will be performed utilizing the same equipment and protocol of a marsh replenishment project. The spoil material will be broadcast sprayed immediately across the adjacent marsh within a 40' swath adjacent to the channel that is maintained. An area of 35,800 sq. ft. will have spoil material spread thinly across it. (Total length of channel to be maintained= 895' and disposal swath width= 40' so 895' x 40' = 35,800 sq. ft. or 0.82 acre marsh replenishment.

B. Is there a comprehensive plan for disposal sites that takes into account the accumulative effect over time and the decreasing amount of suitable sites for disposal?

There is no comprehensive plan for the disposal sites. This project is to be performed by the State of Delaware/DNREC Drainage Program one-time only. Maintenance of the mosquito ditches would only be recommended on an as-needed basis and may never happen again. The maintenance project will be performed as a marsh replenishment and if this same project were to occur 15+ years down the road the project could likely be performed again in the same manner to provide an adjacent marsh area that is less affected by sea level rise. (Photos are attached)

C. Describe the present land use of the disposal site.

The present land use of the disposal site is tidal marsh (estuarine and marine wetland).

D. Describe characteristics of the material to be disposed, including:

1. Physical source of material (i.e. sand, silt, clay, etc.) Give percentages of the various fractions if available.

No sediment samples collected at this time. Sediment samples to be collected at start of construction in order to determine specific equipment needs or changes. All equipment and machinery used will be those utilized during marsh replenishment projects.

2. Chemical composition of material: Many areas, especially marinas, highly industrialized areas, etc., have sediments with high concentrations of pollutants (chemicals, organic material, etc.). These materials may be re-suspended or reintroduced into the water and result in serious environmental damage. If your proposed dredging is in an area such as described above, a chemical analysis of the material to be dredged should be provided.

The landuse surrounding the existing mosquito ditch not considered highly industrialized. The mosquito ditch is surrounded by tidal marsh. In the area surrounding the project scope, there are some residences and hunting plots. Because of this, high concentrations of pollutants are not anticipated and a chemical composition of the sediments was not performed. In addition, any pollutants the sediments could contain would have likely already interacted with the water since the ditch channels typically hold water during high tide. In addition these sediments undergo wet and drying cycles due to the tides so any pollutant interaction in those processes would have already occurred. The deeper sediments that will be exposed following the maintenance are not anticipated to have high levels of pollutants as high concentrations of pollutants of sediments (cont. on attachment)

3. Dewatering properties of the material to be disposed.

Dewatering properties of the material to be disposed was not analyzed. This project will be performed as a marsh replenishment which utilizes techniques of the Open Marsh Water Management (OMWM) program. The spoil material will be excavated with a rotary excavator and the cutting head will broadcast the spoil as a crude slurry. The water in the spoil will help with the broadcast spreading and once applied to the land is not anticipated to be different from the dewatering properties of the soil on which it was placed.

4. Compactability of material and settling rates of material to be disposed.

The compactability and settling rates of the material to be spread across the marsh was not analyzed. However, the spoil is to be spread thinly across the adjacent marsh and careful attention will be paid in order to ensure changes in marsh elevation do not result in negative vegetation changes. The broadcast of material is expected to settle on the adjacent marsh quickly but work will not be conducted on a windy day in order to ensure settling over the 40' swath. If nonamphibious equipment is necessary, the spoil will be spread to a depth less than 10 cm over marsh surface. Every effort to minimize compaction due to the travel of the equipment used will be taken. (cont. on attachment)

5. Dredging and disposal schedule to insure that operations do not degrade water quality during times of anadromous fish migration.

Construction will not occur between April 1 and July 31 to not disturb migratory and nesting birds. No impacts are expected on anadromous fish migration.

E. When the project involves land disposal, discuss the following:

1. Method of disposal to be utilized, i.e., pipeline discharge, barge, hopper (underway or stationary).

A hydraulic rotary cutting head will be used to excavate the ditch bottom materials and the spoil/water slurry will be discharged directly from the cutter head (see attached photo) in a broadcast spread fashion across the marsh.

2. Describe method of dredged material containment (i.e. embankment, behind bulkhead, etc.)

The dredged material will be broadcast spread at the point of excavation across the adjacent marsh. Maintenance work will not occur on windy days as a means to contain the spoil in the defined 40' swath across the marsh, immediately adjacent to the mosquito ditch.

3. What type of leachates will be produced from the spoil material and what is planned for protection of the groundwater?

No harmful leachates are anticipated to be produced from the spoil material. Any elements or chemicals in the spoil material would have been exposed to saturated conditions and already have the potential to become soluble in the ditch channel. No additional measures are being taken for the protection of groundwater because no effects are likely to result from the excavated spoil material.

4. Methods to insure that spoil water does not adversely affect water quality, both during construction and after completion of the project.

Spoil water is not expected to adversely affect water quality during and after completion of the project. The spoil will be broadcast spread across the adjacent marsh where it will settle. The spoil excavated will be spread as a sediment/ditch water slurry which is anticipated to be similar to the water across the marsh.

5. Provisions for monitoring during discharge: water quality, sediment transport, and precautions to prevent "short-circuiting" dumping.

The maintenance work is to be performed utilizing the standard practices, protocols, and equipment used during a marsh replenishment project or open marsh water management project. The work will not be performed on a windy day to ensure spreading in the defined area of the marsh. In the event that sediment losses are being observed a straw wattle or other sediment trap may be placed at the most downstream end of the project to prevent sediment losses from the channel.

F. Consider and discuss the following for water disposal:

1. Describe methods to be used for water disposal, including volumes and site selection.

There will be no method used for water disposal. Work will be done during low tide or normal flow conditions. The water in the ditch sediments will be useful in this procedure of broadcast spreading across the marsh.

2. Describe the existing water characteristics at the site, including chemical analysis for water quality.

No water quality analysis was completed as no adverse impacts are anticipated based on current and historical landuse of this marsh land. In addition the ditch channel is dry under low tide conditions but holds water during high tide. The water in the ditch channel is anticipated to be of the same quality as that in the adjacent marsh area and downstream.

G. Discuss the frequency and amount of maintenance dredging which will be required; discuss the resulting impacts.

The frequency of maintenance dredging of mosquito ditches occurs very rarely, on an as-needed basis, no more than once every 15 years. In addition this channel is located on private property so this project may be a one-time event. The project will alleviate the flooding concerns experienced by surrounding residents but in the future if permission of the property owners is not granted again it will not occur at that time.

H. Alternatives.

1. Discuss all alternatives to the project, including the "no action" alternative.

The only alternative to this project would be to take "no action". However, this would not help to alleviate the flooding issues experienced through by the surrounding community. This project is designed to only remove the sediment necessary to provide positive fall through the mosquito ditch channel to provide an improved outlet for the storm flows and high tides received and transported through this channel to the Murderkill River. The procedures and equipment utilized during this maintenance activity will be that of a marsh replenishment project as a means to address the residents' drainage concerns while promoting the health and resiliency of the marsh.

2. Discuss alternative types and methods of dredging and disposal, such as pipeline discharge, barging, or hopper method.

Based on the site conditions, project scope, and size of the channel to undergo maintenance no other alternative method for dredging and disposal were considered. It is our belief that performing the maintenance as described, with a rotary cutting head and immediately broadcast spreading across a 40' area immediately adjacent to the channel, will result in the least disturbance and provide an environmental benefit by replenishing an area of the marsh to make it more resilient to sea-level rise.

3. Discuss alternatives to dredging.

Because this channel has accumulated sediment over time and no longer provides the drainage benefit it historically provided after construction, a maintenance dredge is required.

4. Discuss alternative areas of sites for spoil disposal.

Hauling the spoil material to an upland disposal site was thought to have a larger impact on the marsh than performing this project as a marsh replenishment. The equipment traveling back and forth along the project scope to load the material to have it hauled to an upland disposal site would lead to more compaction and damages to the marsh vegetation and habitat.

5. Discuss impact of port docking patterns upon the demand for dredging. Can alternative patterns reduce the amount of dredging required to support port operations?

Not applicable.

6. Support alternative means of construction that would prevent or minimize water quality degradation using EPA standards for guidance.

Best management practices for sediment and stormwater control will be implemented, as far as applicable, during the maintenance dipout. All work is to be performed during low tide or normal flow conditions to minimize sediment losses and help protect water quality. During low tide the ditch does not hold water which will help to minimize negative impacts on water quality. A straw wattle or other sediment trap may be installed at the downstream end of the project scope to contain any sediment losses from the channel during excavation.

7. State in detail impacts resulting in alternative locations for the proposed project.

The mosquito ditch requiring maintenance only exists in this location so no alternative locations are an option. This one channel was selected for maintenance instead of any others within the mosquito ditch grid on these parcels as it connected directly with the roadside ditch and will provide an outlet for runoff from the road more effectively than any of the other mosquito ditch channels located on these properties.

Part IV

CONSIDERATIONS OF A FILLING PROPOSAL:

A. Describe in detail the existing characteristics of the area proposed for filling (i.e. aquatic area, marsh, mudflat, swamp, etc.). In your description, be sure to include the types of vegetation present and the types of animals that use the area. Provide photographs.

The existing area where fill will be placed is tidal marsh. Animals that use the area include migratory birds including the red knot which is why the maintenance activity is not to be performed from April 1 to July 31. Waterfowl, wading, and other waterbird utilize the marsh as habitat or nesting areas. The vegetation in the marsh is primarily spartina alterniflora, phragmites, and spartina patens. The spartina alternifl away from the channel Spartina patens dominates.

B. Give the following information in regard to the project size:

1. Total area to be filled.

An area no more than 35,800 sq. ft. or 0.82 acres is to have spoil material broadcast spread, thinly, across it.
Length of channel maintained: 895 L.F. x Width of Broadcast 40 L.F. max = 35,800 sq. ft. area

2. Size of underwater area to be filled.

There will be no filling in an area that is completely submerged/underwater. The spoil material will be broadcast spread across the adjacent marsh.

3. Area of intertidal zone to be filled.

The mosquito ditch itself would be the intertidal zone in this project area as it receives water during high tides however, the channel will not be filled, it will be dredged.

4. Area of wetlands to be filled.

An area no more than 35,800 sq. ft. or 0.82 acres is to have spoil material broadcast spread, thinly, across it.
Length of channel maintained: 895 L.F. x Width of Broadcast 40 L.F. max = 35,800 sq. ft. area

5. Proposed height of fill.

The spoil material will be spread as thin as possible across the marsh. However, if there is ever a point where the spoil must be spread with equipment (other than the broadcast method) it will be spread to a depth <10 cm in height.

6. Volume of material that will be used in filling.

Based on the field data collected, approximately 87.44 C.Y. of spoil material is to be excavated from the ditch channel and spread across the adjacent marsh.

C. Describe in detail the material to be used as fill including as follows:

1. Type of fill to be used (sand, stone, rubble, etc.). If the material is a composite (i.e., rubble), list the types of materials it will contain.

The material that will be broadcast spread across the marsh will be the mosquito ditch bottom sediments. It should be similar in consistency and material as those across the marsh but more coarse.

2. Give the specific location of the source of this material.

The location of the material will be the mosquito ditch channel as you can see on the maps.

3. What types of leachates will be produced from the fill material and what is planned for protection of surface and groundwater?

No harmful leachates are anticipated from the fill material as it is the spoil from the mosquito ditch bed that is saturated during high tides and it has always been a marsh habitat.

D. Carefully describe the method of fill, including the following:

1. Method of fill placement, including equipment used in deposition and grading.

The fill material will be removed with a rotary excavator and immediately broadcast spread as a spoil/water slurry in a thin layer across the adjacent marsh. The depth of spoil broadcasted will be paid careful attention to in order to maintain current or improved marsh vegetation. In the event that additional equipment is needed to address the spoil spreading it will be equipment typically used during OMWM projects, specifically designed to traverse the marsh with minimal impacts.

2. Method of stabilization of banks from erosion, sloughing, wave action, boat wakes, etc.

The banks of the ditch are not going to be touched during this maintenance activity. The adjacent marsh where the spoil was spread should revegetate naturally. However, the site will be monitored following maintenance to ensure vegetation regrowth for stabilizing the spoils. If vegetation does not stabilize the spoils within an appropriate time frame, additional plantings and seeding will be performed to establish the regrowth needed.

3. Method of stabilization of the surface of the fill.

The adjacent marsh where the spoil was spread should revegetate naturally. However, the site will be monitored following maintenance to ensure vegetation regrowth for stabilizing the spoils. If vegetation regrowth does not occur in a timely fashion, additional plantings and broadcast seeding will occur and be monitored to reestablish the vegetation.

4. Length of time needed for completion of the project. State if filling will be continuous, intermittent, etc.

Weather and site conditions permitting this work should be completed within 2 business days. However, a maximum of 1 week would allow plenty of time. The filling will be continuous while the equipment is running on the marsh but will end at the close of business each day.

5. Method of controlling turbidity when filling an underwater area.

Not applicable. Will not be filling an underwater area.

E. Purpose of the Project:

1. What is the intended use of the filled area?

The area that is filled as a result of this dredging project will still be a marsh. No changes from the use it experiences currently are expected.

2. What structures, if any, will be constructed on the fill?

No structures will be constructed on the fill.

3. What benefits would you gain from the proposed fill?

The proposed fill will help the marsh to become more resilient to sea level rise. The proposed fill will allow for the dredging of the mosquito ditch which requires maintenance and will alleviate the flooding concerns on and along South Bowers Road.

F. Alternatives

1. Discuss the "no action" alternative and how this would affect your present and future plans for the development of the area.

No action will not provide for any drainage and flooding relief experienced by those residents and commuters along South Bowers Road. The maintenance or lack of maintenance of this channel is not expected to have an impact on the development of this area. However, if this maintenance work cannot be completed, if another project exists to address the drainage concerns of the area (ex. raising the road) it will result in more environmental impacts and be more destructive to the marsh and wetlands.

2. Discuss alternative locations for the proposed fill.

The proposed fill could be hauled offsite instead of broadcast spread thinly across the marsh. However, hauling the material offsite to an upland disposal location would result in more degradation of the marsh due to equipment needed to perform the task and the tracking of equipment that would result. By performing the maintenance in this manner we hope to take advantage of the maintenance need and improve the resilience of the adjacent marsh.

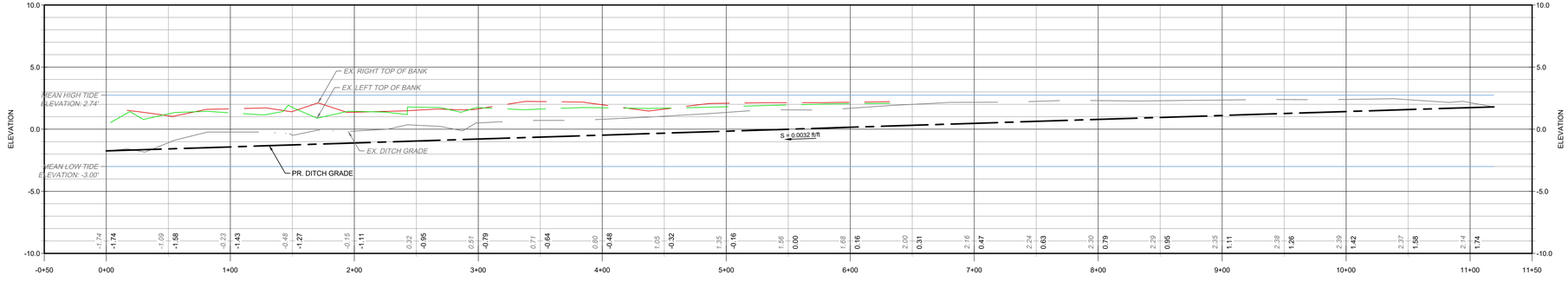
3. Discuss the use of elevated structures (i.e. causeways, elevated platforms, etc.) in place of the proposed fill.

Not applicable. No elevated structures will be placed on the proposed fill.

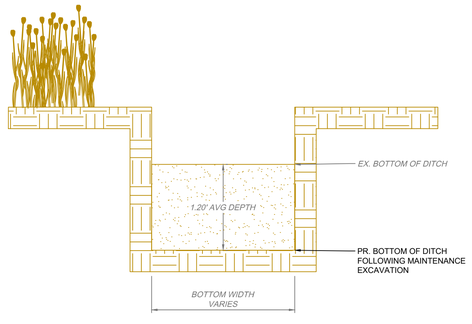
4. Discuss any other alternatives you have considered prior to formulating the presently submitted proposal.

A drainage study was performed on the area and the solution proposed was to raise South Bowers Road and construct drainage ditches along both sides of the road. However, it is our opinion that raising the road and constructing the roadside ditches would result in more drainage of the marsh when an alternative would be to maintain the existing mosquito ditch. Raising the road would require more fill and dredging than the proposed project and the proposed project will alleviate the flooding concerns expressed.

PLAN VIEW
1" = 50'



SOUTH BOWERS DIPOUT
STATION RANGE: -0+50 TO 11+50
SCALE: 1" = 50' H - 5' V



TYPICAL CROSS SECTION
NOT TO SCALE

NOTE:
1. FEATURES THAT ARE OFFSET FROM THE CENTERLINE ARE NOT SHOWN IN THE PROFILE VIEWS. REFERENCE PLAN VIEW FOR STATION/OFFSET IDENTIFICATION.
2. REFERENCE PLAN VIEW FOR LOCATIONS OF RIGHT-OF-WAY CHANGE, AS WELL AS ADDITIONAL CENTERLINE AND RIGHT-OF-WAY INFORMATION.
3. REFERENCE THE STRUCTURE AND PIPE DETAILS AND NOTATIONS FOR ADDITIONAL INFORMATION.

Environmental Impacts Summary – South Bowers Proposed Ditch Dipout	
Length of Channel Impacted	1119 L.F.
Width of Channel Impacted	5 L.F.
Area of Channel Disturbed	5595 sq.ft. (*multiply the above 2 numbers*)
Maintenance Excavation for Proper Grading beneath High Tide	87.44 C.Y.
Maintenance Excavation for Proper Grading beneath Low Tide	0.00 C.Y.
Total Maintenance Excavation for Proper Grading	87.44 C.Y.

0' 25' 50' 100' 150'
SCALE: 1" = 50'

REVISIONS

DESCRIPTION	DATE

DELAWARE DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL
Division of Watershed Stewardship
Drainage Program
Dover Office
89 Kings Highway Phone:(302) 739 - 9921
Dover DE, 19901 Fax: (302) 739 - 6724
Georgetown Office
21389 Berlin Rd. Unit 6 Phone:(302) 855 - 1930
Georgetown DE, 19947 Fax:(302) 857 - 3059

SOUTH BOWERS
MAINTENANCE DITCH CLEANOUT
EXISTING CONDITIONS / CONSTRUCTION PLAN & PROFILE
MURDERKILL RIVER - DELAWARE BAY WATERSHED
KENT COUNTY, DELAWARE

PRELIMINARY FOR REVIEW ONLY

Date: 12-18-2017
Designed: PB
Planned: MH
Drawn: BY
Sheet No. X of X

File Location: G:\Engineering Projects\Kent\21st Century\South Bowers\CAD\2017-12 South Bowers Ditch Cleanout.dwg Layout:Permitting Plan User: Brian.Yates Plot time: 02-27-18 @ 2:24pm

N

South Bowers
Drainage Improvements
Aerial Photographic Map

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 approximate and may have changed since the date this map was made.

Map Created by: melissa.hubert Map Created on: 9/11/2017 at 11:58:48 AM

Feet
300 0 300
1 inch = 300 feet

Division of Watershed Stewardship

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Kent County, Delaware

South Bowers Beach Ditch Maintenance Web Soil Survey

August 29, 2017

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:2,150 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 30 60 120 180

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Kent County, Delaware
Survey Area Data: Version 13, Sep 22, 2016

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 31, 2009—Mar 16, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Kent County, Delaware (DE001)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
AbC	Acquango-Beaches complex, 0 to 10 percent slopes	0.1	2.0%
TP	Transquaking and Mispillion soils, very frequently flooded, tidal	3.5	97.7%
W	Water	0.0	0.3%
Totals for Area of Interest		**3.6**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or

landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Kent County, Delaware

AbC—Acquango-Beaches complex, 0 to 10 percent slopes

Map Unit Setting

National map unit symbol: 1qx5s
Elevation: 0 to 80 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 52 to 58 degrees F
Frost-free period: 180 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Acquango and similar soils: 50 percent
Beaches: 45 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Acquango

Setting

Landform: Dunes, backshores
Landform position (three-dimensional): Talf, rise
Down-slope shape: Convex, concave
Across-slope shape: Linear
Parent material: Sandy eolian deposits and/or sandy marine deposits

Typical profile

A - 0 to 3 inches: sand
C1 - 3 to 20 inches: sand
C2 - 20 to 26 inches: fine sand
C3 - 26 to 72 inches: sand

Properties and qualities

Slope: 0 to 10 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Very high (19.98 to 99.90 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline to moderately saline (0.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 3.0
Available water storage in profile: Very low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: A
Hydric soil rating: No

Description of Beaches

Setting

Landform: Beaches
Landform position (three-dimensional): Talf
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Beach sand

Typical profile

C - 0 to 80 inches: sand

Properties and qualities

Slope: 0 to 5 percent
Natural drainage class: Very poorly drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Very high (19.98 to 99.90 in/hr)
Depth to water table: About 0 to 10 inches
Frequency of flooding: Very frequent
Salinity, maximum in profile: Slightly saline to strongly saline (4.0 to 22.0 mmhos/cm)
Available water storage in profile: Very low (about 3.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydric soil rating: Yes

Minor Components

Brockatonorton

Percent of map unit: 3 percent
Landform: Back-barrier beaches
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Transquaking

Percent of map unit: 2 percent
Landform: Tidal marshes
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

TP—Transquaking and Mispillion soils, very frequently flooded, tidal

Map Unit Setting

National map unit symbol: 1qxch
Elevation: 0 to 100 feet

Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 52 to 58 degrees F
Frost-free period: 180 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Mispillion and similar soils: 40 percent
Transquaking and similar soils: 40 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mispillion

Setting

Landform: Tidal marshes
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Herbaceous organic material over silty estuarine sediments

Typical profile

Oe - 0 to 24 inches: mucky peat
Oa - 24 to 40 inches: muck
Cg1 - 40 to 54 inches: mucky silt loam
Cg2 - 54 to 80 inches: silt loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 1.98 in/hr)
Depth to water table: About 0 to 5 inches
Frequency of flooding: Very frequent
Frequency of ponding: None
Salinity, maximum in profile: Moderately saline to strongly saline (15.0 to 50.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 35.0
Available water storage in profile: Very high (about 21.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: A/D
Hydric soil rating: Yes

Description of Transquaking

Setting

Landform: Tidal marshes
Down-slope shape: Linear
Across-slope shape: Linear

Typical profile

Oe - 0 to 46 inches: mucky peat
Oa - 46 to 65 inches: muck
Cg - 65 to 80 inches: silty clay loam

Properties and qualities

Slope: 0 to 1 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Very poorly drained
Runoff class: Negligible
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to high (0.06 to 5.95 in/hr)
Depth to water table: About 0 to 5 inches
Frequency of flooding: Very frequent
Frequency of ponding: None
Salinity, maximum in profile: Strongly saline (25.0 to 40.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 32.0
Available water storage in profile: Very high (about 26.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: A/D
Hydric soil rating: Yes

Minor Components

Sunken

Percent of map unit: 10 percent
Landform: Flats, submerged upland tidal marshes
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Honga

Percent of map unit: 5 percent
Landform: Submerged upland tidal marshes
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: Yes

Othello, undrained

Percent of map unit: 5 percent
Landform: Depressions, swales, drainageways, flats
Landform position (three-dimensional): Dip
Down-slope shape: Concave, linear
Across-slope shape: Concave, linear
Hydric soil rating: Yes

W—Water

Map Unit Setting

National map unit symbol: 1qxcv
Mean annual precipitation: 42 to 48 inches

Mean annual air temperature: 52 to 58 degrees F
Frost-free period: 180 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf