

NUTRIENT TRACKING TOOL (NTT) APPLICATION IN OREGON: OVERVIEW AND GUIDELINE

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Contents

SECTION 1. General Overview of NTT Application	1
1.1 Introduction.....	1
1.2 Scope of NTT applications	1
1.3 Steps involved in NTT application	2
1.4 How to interpret NTT output	5
SECTION 2. Illustrative Cases in Oregon.....	7
2.1. CASE 1: A change in tillage practice	7
2.1.1. Option 1. Define AOI using the USDA-NRCS web soil survey	7
2.1.2 Option 2. Define AOI by selecting State and County on NTT screen.....	13
2.2 Management information input.....	14
2.2.1. Selecting pre-loaded management scenarios	14
2.2.2. Uploading existing management files.....	15
2.2.3. Modifying existing management information.....	16
2.2.4 Creating new management information	18
2.2.5 Running NTT program	19
2.3 CASE 2: Filter strip	21
2.3.1. Selecting Structural Conservation Practices	22
2.4. CASE 3: Multiple-practice scenario: no-till and filter strip	24
2.5. CASE 4: Dealing with animals: Riparian fencing and forest buffer	26
SECTION 3. Troubleshooting and Additional Support Information	37
3.1. Using NTT on Specific Oregon Crops.....	37
3.2. Things to Know About Oregon Soil Data	39
3.3. Model Basics: How NTT Works and What NTT Assumes	41
3.4. How NTT Simulates Structural Conservation Practices.....	42
3.5. Where to go for additional help	45
References.....	46

SECTION 1. General Overview of NTT Application

1.1 Introduction

This publication¹ provides a brief overview of the steps needed to effectively operate the Nutrient Tracking Tool² (NTT). NTT is a web-based field model that was developed to assist producers, their technical service providers, and others to calculate nutrient and sediment loss reductions resulting from various conservation practices. Since NTT provides nutrient reduction estimates for a wide array of practices and scenarios, the tool can be used for conservation practice evaluations, as well as a number of other applications in addition to estimating reductions for water quality trading credits.

1.2 Scope of NTT applications

NTT can be used to evaluate a wide variety of conservation practices, including ones that are specific to Oregon conditions. The following are among the typical conservation practices that are evaluated in NTT (USDA-NRCS conservation practice codes are indicated in parentheses³):

- Tillage/Residue Management (329, 345, 346)
- Contour farming (330)
- Cover crops (340)
- Alternative cropping systems (e.g., corn-soy beans versus continuous corn)
- Filter and buffer strips (386)
- Fencing (382)
- Prescribed grazing (528A)
- Forage harvest management (511)
- Riparian zone management
- Heavy Use Area Protection (561)
- Pasture & Hayland planting (521E)

NTT results are edge-of-field reduction estimates, meaning estimates of the nutrient and sediment runoff from the down-slope edge of the field being evaluated. NTT results are combined with other factors in order to calculate the number of water quality credits that may be sold as part of a water quality trading program. Factors that need to be considered to convert NTT estimates into water quality credits include differences in downstream impacts, watershed specific characteristics, variability in nutrient assimilation capacity, and other ecological and trading program issues. Your water quality trading program will provide the equations used in addressing the adjustment factors for your setting.

¹ Much of this document is based on a previous user guide developed as part of a Conservation Innovation Grant (CIG) project collaboration with the Electric Power Research Institute (EPRI) (EPRI, 2011).

² Formerly referred to as the Nutrient Trading Tool.

³ The full list of the USDA-NRCS conservation practices is available through the following site:
<http://www.nrcs.usda.gov/technical/Standards/nhcp.html>

1.3 Steps involved in NTT application

NTT has been designed for use by agricultural professionals familiar with farm procedures and conservation practices. The detailed procedures for use of NTT will be described in Section 2 of this document. However, the basic steps involved in using NTT include:

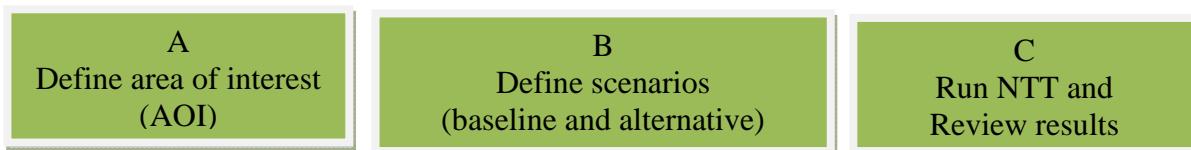


Figure 1.3.1 Steps involved in using NTT

When you first access the NTT home page (<http://ntt.tarleton.edu/nttwebars>), you are presented with a **Welcome** screen (Figure 1.3.2). If you already have an existing NTT project you would like to load, you may click the third button on the **Welcome** screen labeled **Upload Existing Project** to locate the project file and import it into the current session. Otherwise, follow the steps outlined below to start your new NTT project.

A

Define AOI

The first step in using NTT is to define the field or specific area of interest for quantifying nutrient reductions. There are two ways to define a field in NTT. One is to use the web soil survey. The USDA-NRCS web soil survey (**WSS**) (<http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>) is an external web-based application that allows you to zoom into and select an area of interest. The other way is to select the state, county, and weather station of interest, and then specify the dominant soil type and field size. A step by step guide is provided in Section 2.2.1 below.

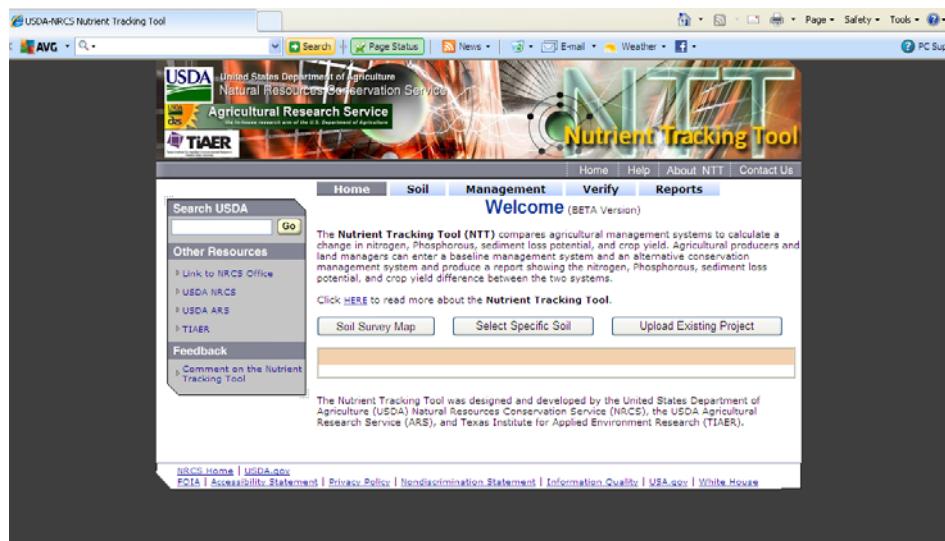


Figure 1.3.2 NTT Welcome Screen

In practice it is likely that users will face situations where using one dominant soil is not appropriate. In such situations, the web soil survey may be the only appropriate option to use. Please refer to Section 2.1.1 for detailed procedures for using the web soil survey.

In drawing a polygon around the area of interest in web soil survey, the 42-year daily precipitation, and minimum and maximum temperature data for the selected area are downloaded automatically by NTT. In addition, the field geometry (area, field slope, slope length, etc.) and soil physical and chemical data (such as texture, density, organic matter, initial soil P, etc.) are also downloaded by NTT.

B Define management scenarios

Users need to define two management scenarios before running NTT's calculation tool. The first scenario (baseline) will determine the reference point from which nutrient reductions will be calculated. The second scenario (alternative) will be the Best Management Practice (BMP) or conservation practice that will be installed. Using these two scenarios, the user will estimate the nutrient load resulting from the anticipated BMP. If you are using NTT to estimate nutrient reductions for water quality trading, you will need to contact your trading program to determine the reference point, or **Baseline**, from which nutrient reductions can be estimated (to obtain water quality credits, the farmer or landowner must implement a conservation practice that reduces nutrient and/or sediment losses above and beyond a pre-defined **Baseline**).

In NTT the **Baseline** and **Alternative** scenario details are presented side by side in one screen for user convenience. Several management scenarios are preloaded into each NTT session to make it easier for you to define your **Baseline** and **Alternative** scenarios.

Illustrative examples on how to define scenarios are provided in Section 2 of this user guide. Once you have selected the cropping systems, crop cultural practices (management information), and structural conservation practices of interest, you have completed scenario definition (under the management information tab) and are ready for the last step in the NTT application.

C Run NTT's calculation tool and review results

The last step in the NTT application process is simply to click **Next** after defining the scenarios. A **Verify Information** screen is presented that allows you to verify that you made the selections you actually intended to make. Once you click **Next** in the **Verify Information** screen, NTT's calculation tool runs and returns the results for the **Baseline** and **Alternative** scenarios in a new screen (Figure 1.3.3).

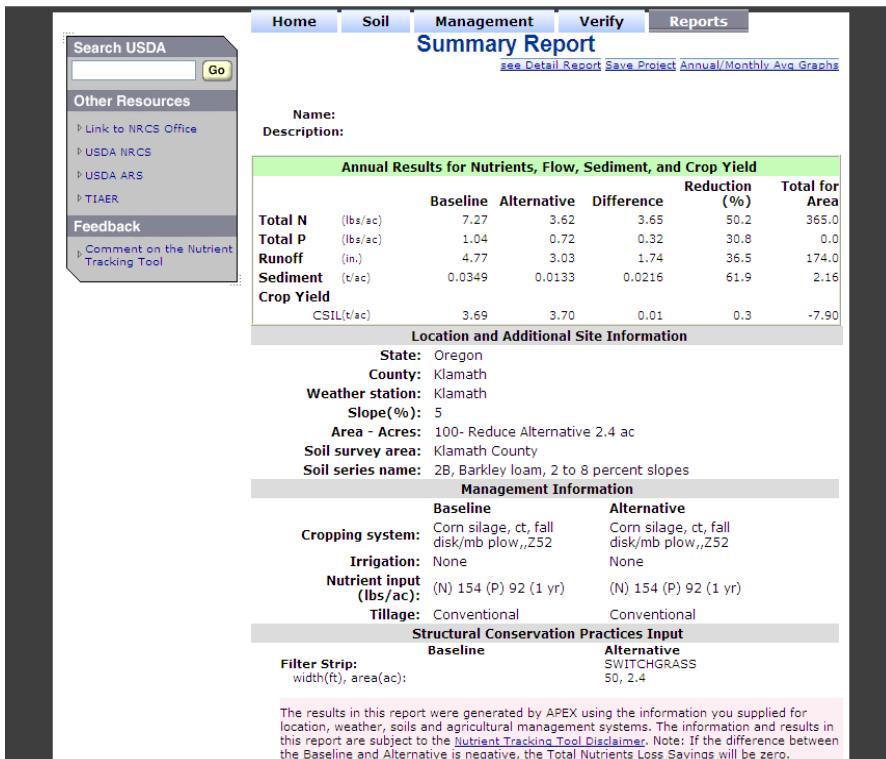


Figure 1.3.3 An example of NTT Summary Report screen showing filter strip impacts

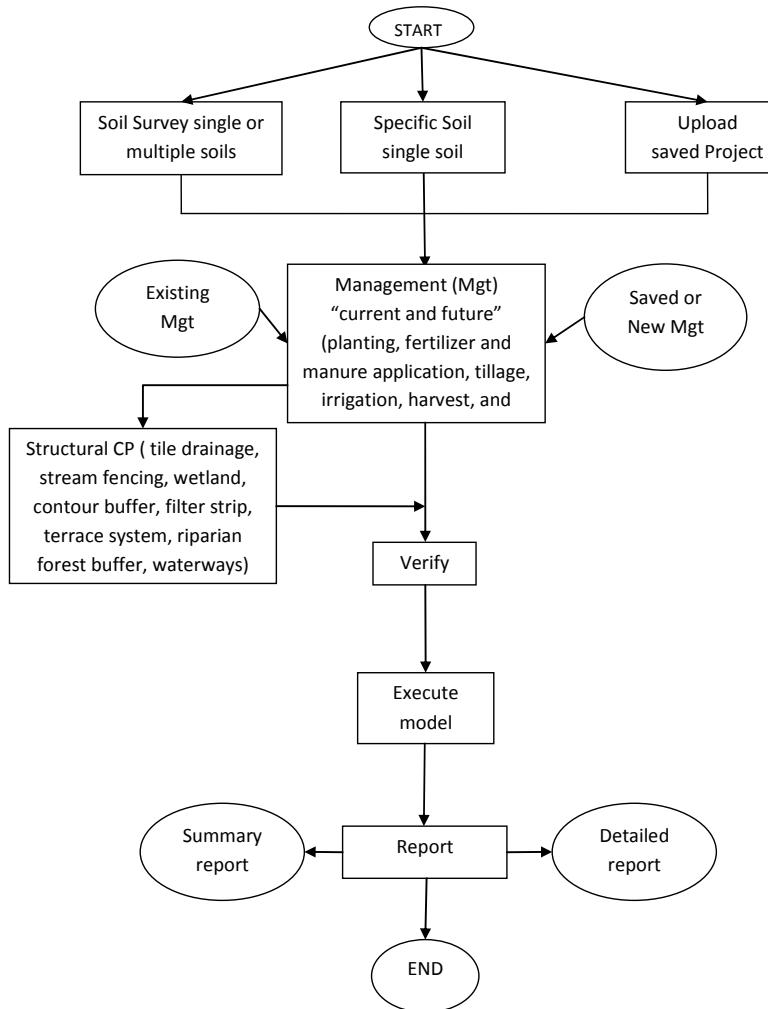


Figure 1.3.4. General NTT flow chart

1.4 How to interpret NTT output

NTT simulates the conditions on the area of interest over a number of years of weather information using a daily time step. After the simulations have been completed, NTT presents only the calculated annual averages for each of the indicators selected by the user and presents these results in the **Summary Report** screen (Figure 1.3.3). NTT results are therefore based upon long-term annual averages and may not reflect the results for any given year. Consequently farmers and others should use the NTT results with this limitation in mind. NTT provides reasonable estimates of the changes you can expect in the **Alternative** management scenario when altered from the **Baseline** scenario.

In the **Summary Report** screen, NTT presents nutrient losses in lbs/acre, sediment losses in tons/acre, runoff volumes (flow) in inches, and crop yields in the relevant yield unit on a per acre basis. The results are shown for the **Baseline** and the **Alternative** scenarios in

separate columns. Then the simple difference between the two scenarios is also shown for each indicator. Finally, the last column displays what results when that difference is multiplied by the field size in acres.

The **Summary Report** screen also presents a summary of the management information that was defined by the user and used as input in the calculations presented in the screen. You can see more detailed results by clicking on the **see Detail Report** link located near the top of the **Summary Report** screen. It is important to note that NTT allows simulation of multi-management scenarios at the same time. For instance one can use NTT to evaluate the effects of both nutrient management and a filter strip on water quality at the same time.

The user is able to save their project using the **Save** function available in NTT (Figure 1.4.1). Simply click the **Save Project** button on the **Verify Information** screen and follow the instructions to save the current project to a file on your computer.

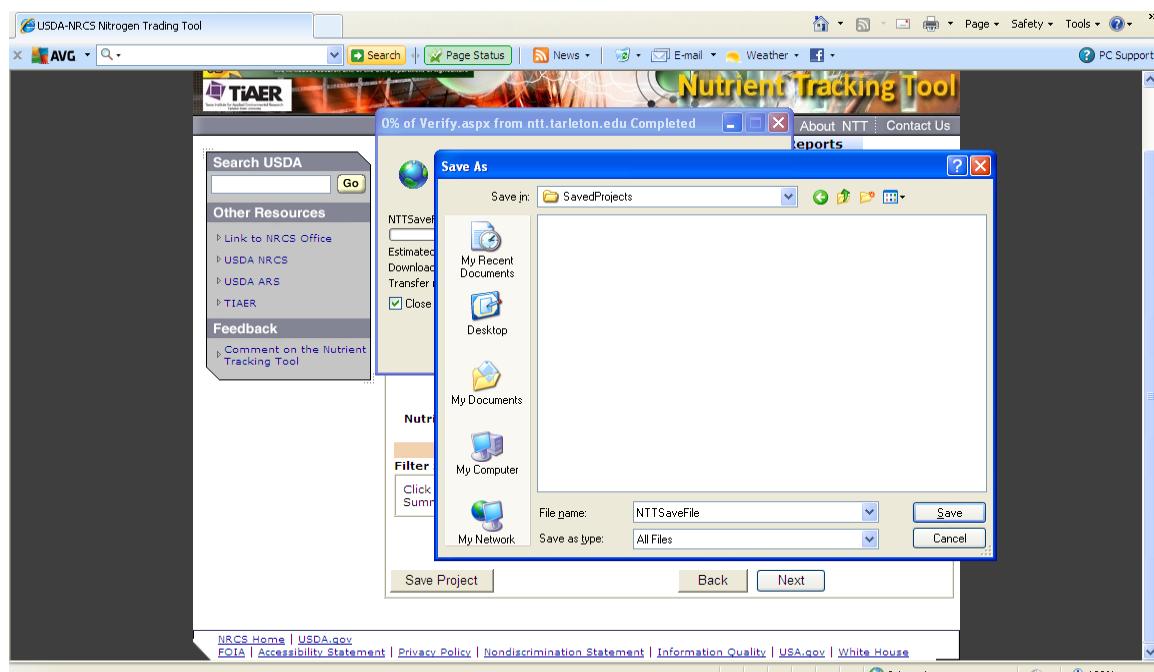


Figure 1.4.1 “Save Project” function in NTT

SECTION 2. Illustrative Cases in Oregon

The following illustrative cases are presented to give you an idea of how to use NTT in specific situations in Oregon. *All illustrations included below are purely hypothetical, and do not necessarily represent the situation on an actual farm. In addition, the numbers used in these illustrations are meant only to illustrate NTT use and do not constitute approved recommendations by USDA-NRCS or any other applicable state or local agency.* Finally, the illustrations shown here use pre-existing crop operations that have been customized for the State of Oregon.

2.1. CASE 1: A change in tillage practice

Background information: A corn silage farmer in Washington County, Oregon, is currently using conventional tillage practices on a 105-acre field. The farmer is considering switching to no-till farming as an **Alternative** practice for which she may also qualify for water quality credits in an ongoing water quality trading program.

NTT implementation: As mentioned in Section 1.3 above, users have two options to query field information (including soil, weather, and area): 1. the **web soil survey** option (using the **Soil Survey map** option from the **Welcome** screen) using the USDA-NRCS web soil survey program, and 2. the dominant soil option (using the **Select Specific Soil** option from the **Welcome** screen) where you select the **State**, **County** and a **Single soil** type of interest. To start, define the 105-acre area of interest (AOI) using the **web soil survey** program or by simply selecting “Oregon” as the **State** value and “Washington” as the **County** value in the **Select Specific Soil** option. For this and the following illustrations we will place more emphasis on the **web soil survey** program, but both options are presented.

2.1.1. Option 1. Define AOI using the USDA-NRCS web soil survey

This option will allow you to include multiple soils in your NTT project, and is generally more accurate than the other option that focuses on the dominant soil. Once selected, the AOI information will be subsequently imported into NTT, along with its field size information, soils and weather data (daily rainfall and temperature). To access the **web soil survey** application, click on the button labeled **Soil Survey Map** in the NTT **Welcome** screen (Figure 1.3.2). A new window is opened, which presents the **Capture Soil Map Information** screen of the **web soil survey** application (Figure 2.1.1).

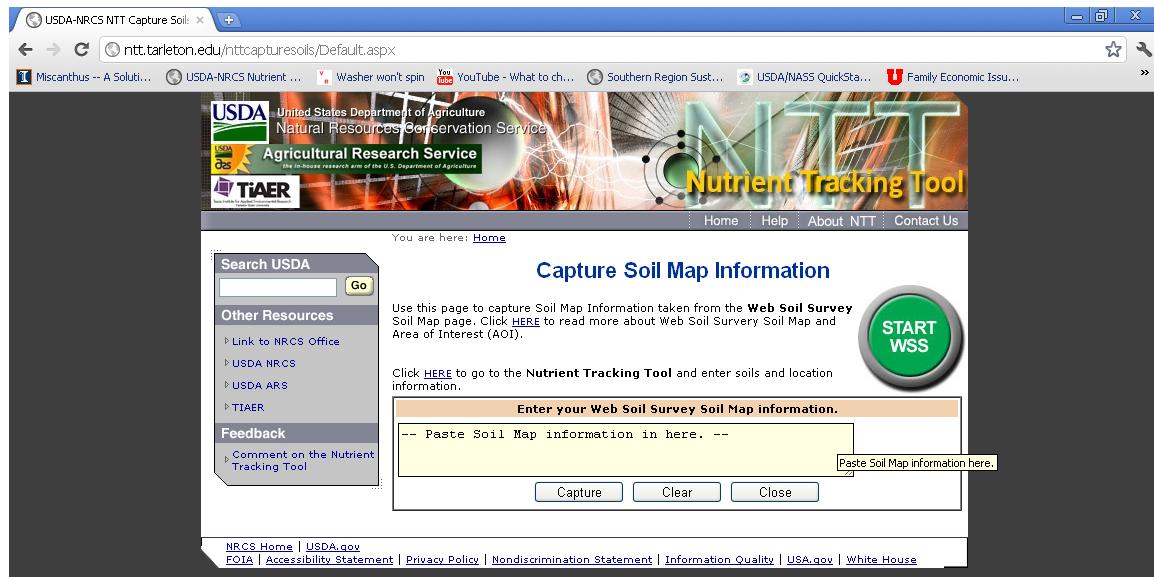


Figure 2.1.1. Option 1: Capture Soil Map Information screen to start web soil survey from within NTT

Click on the circular button labeled **START WSS** to start the **web soil survey** application and select your field or area of interest. Once you have made your selection you will get back to this screen and click **Capture** to transform the AOI information into NTT format.

When you click the **START WSS** button a new window or browser panel appears (Figure 2.1.2), which is the main page of the USDA-NRCS Web Soil Survey. You may need to temporarily enable pop-ups in order for this to work properly if popup blockers have been installed and enabled on your computer. When the **Web Soil Survey** map first appears, the continental United States is shown in full extent on the right panel (Figure 2.1.2). The left panel of the screen displays several tabs that you can use to navigate to your specific area of interest.

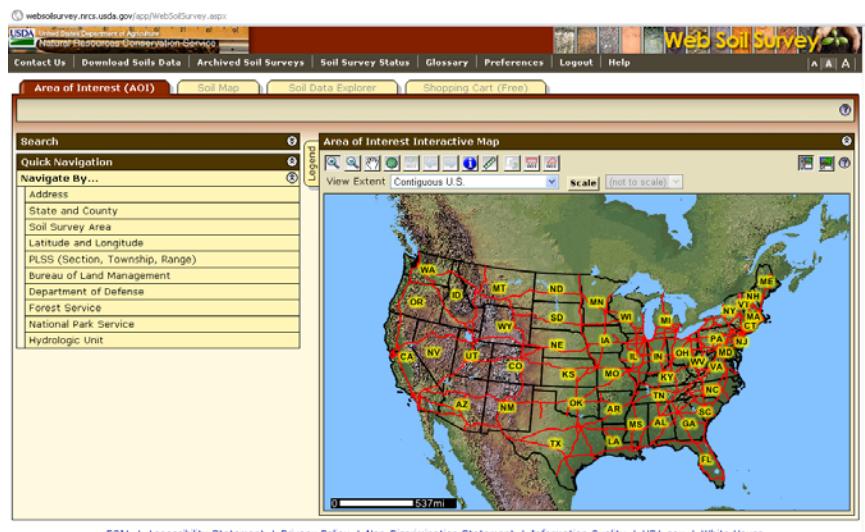
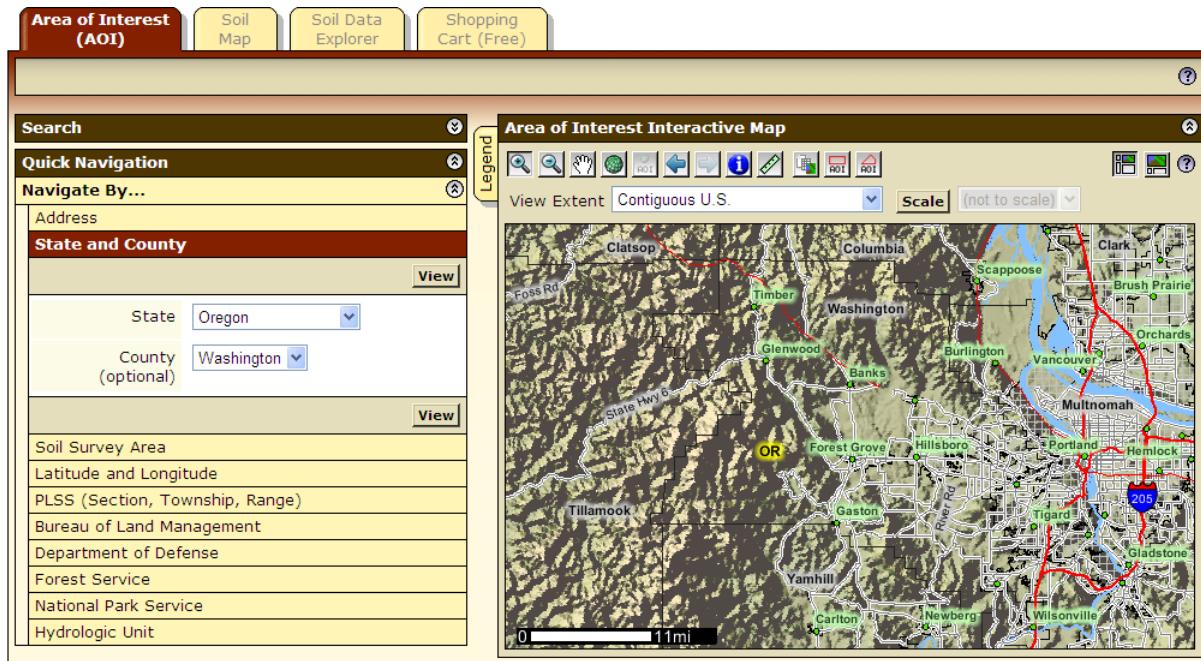


Figure 2.1.2 Initial screen in the WSS program prior to area selection

You can begin to navigate to your AOI by choosing from the **State and County** list, or Alternatively by selecting from the **Soil Survey Area** list. For the example illustrated here select **State and County** and choose Oregon from the **State** drop-down box and Washington from the **County** drop-down box (Figure 2.1.3). Once you click **View** the web soil survey application will zoom in to Washington County, Oregon. Allow enough time for the map to zoom in to the county-level view.



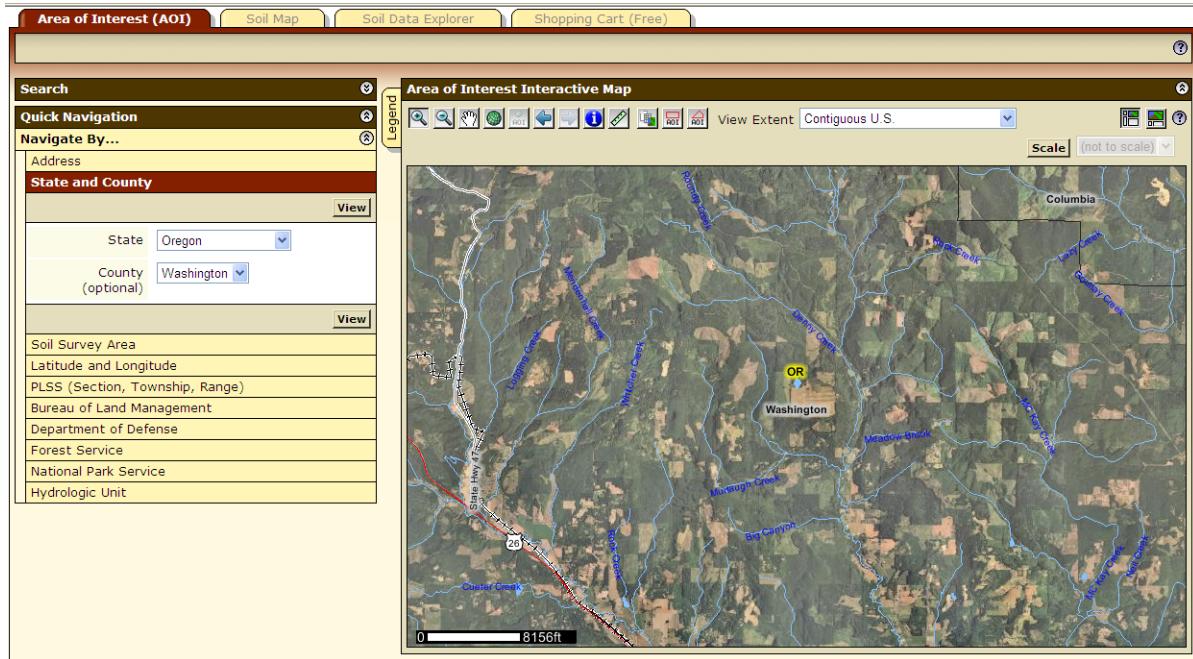
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Figure 2.1.3 Web soil survey screen after selecting state and county of interest

Next navigate to the specific AOI by progressively selecting rectangular areas with the zoom-in feature as the active selection tool. To ensure that the **Zoom In** selection tool is active, you must ensure that the **Zoom In** button right below the **Area of Interest Interactive Map** title bar is the enabled button. Once the **Zoom In** selection tool is active, you can select any rectangular area, making sure that you are within the vicinity of your area of interest – in this case Washington County, Oregon. After an area has been selected, the map zooms in to that area (Figure 2.1.4). The next zoom level would show street and field features more prominently.

Once a reasonable scale has been reached allowing selection of the AOI, use an **AOI selection** tool. One **AOI selection** tool displays a rectangle with “AOI” right below that rectangle. The other **AOI selection** tool just to its right displays an irregular shape, which you can use to select fields that are not rectangular in shape. Click on one of the **AOI selection** buttons to be sure it is enabled. Select an area that corresponds approximately to the field or area to evaluate (Figure 2.1.5). Users need to pay particular attention to the AOI selection process and make sure the boundaries of the AOI coincide as closely as possible to the actual field boundaries they intend to include in the credit calculation. If

necessary, you may need to zoom in to a more detailed view in order to enhance the accuracy of the AOI selection process. If a user is dealing with multiple fields (which may or may not be contiguous) that have very similar soils, climate and management practice information, they could combine these fields into one AOI in order to reduce the number of separate NTT calculations required for the farm. On the other hand if a single field contains very distinct areas with differing soils or management information, users may run separate NTT calculations by defining multiple AOIs for that single field.



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Figure 2.1.4 WSS screen after zooming into Washington County, Oregon to select a field

A message “Creating AOI...” appears on the map, indicating that the AOI is being selected (Figure 2.1.5) along with its soil information. Once the AOI has been selected, summary soil information for the AOI will be displayed in the left pane. If the soil information is not visible, click the **Soil Map** tab (Figure 2.1.6).

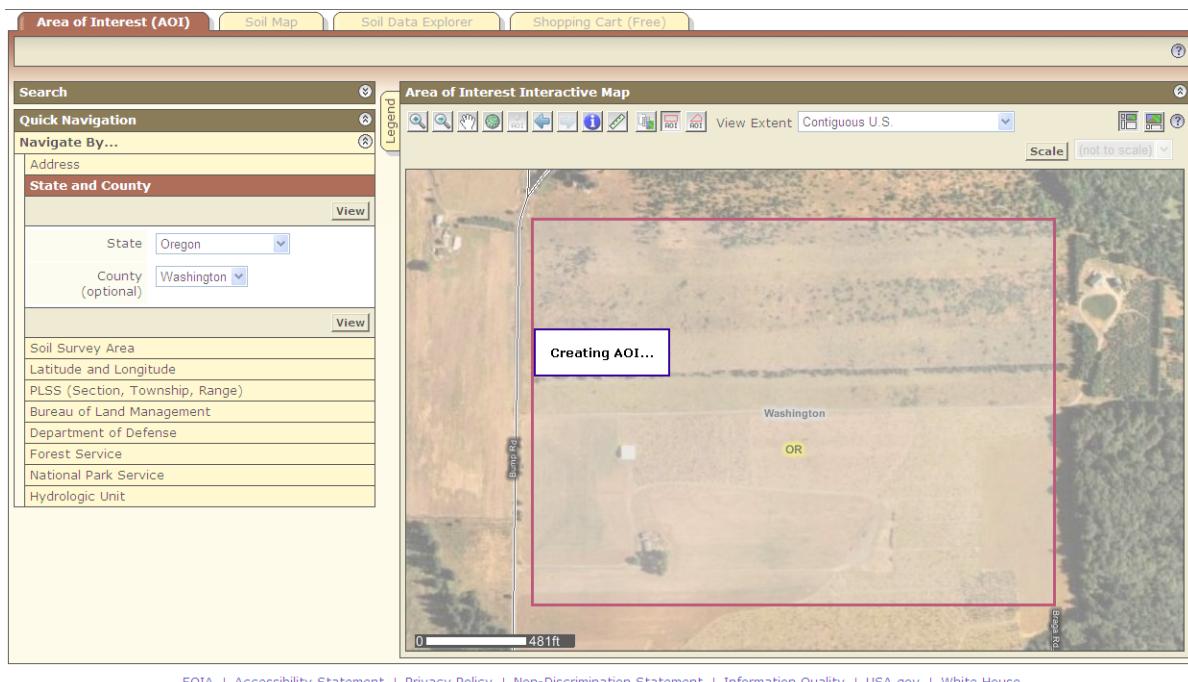


Figure 2.1.5 WSS screen showing AOI creation after selecting area of interest

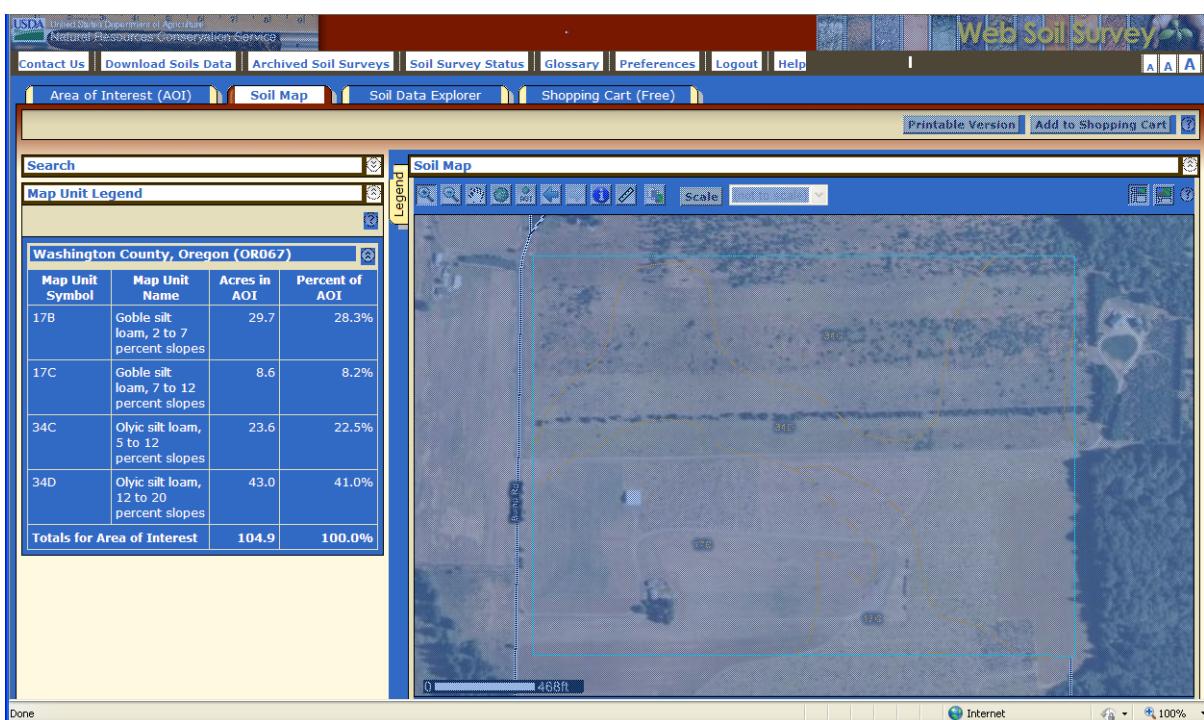


Figure 2.1.6 WSS screen after selecting all contents prior to copying into NTT

To export the soil information to NTT, go to the **Edit** menu tab of the browser and click on **Select All** (or press ctrl-A) and then **Copy** from the **Edit** menu tab of the browser (or press ctrl-C) (Figure 2.1.6).



Figure 2.1.7 NTT program after capturing selected soil information from WSS

Next, move to the main **Capture Soil Map Information** screen on the NTT window, click on the **Clear** button, place the cursor in textbox under the **Enter your Web Soil survey Map information** title, Paste (ctrl-V) the information copied from the soil map in the area provided, and click the **Capture** button so that the soil information is recognized by the program and formatted in the display, as shown in Figure 2.1.7. Then click **Save** to export the data to NTT. The data exported to NTT appears in the NTT window as displayed in Figure 2.1.8. You will notice that in this case the AOI selected by the user is 150 acres in size and includes one soil type. Along with importing the soil information, 42 years of daily precipitation and temperature for the selected field is also uploaded.

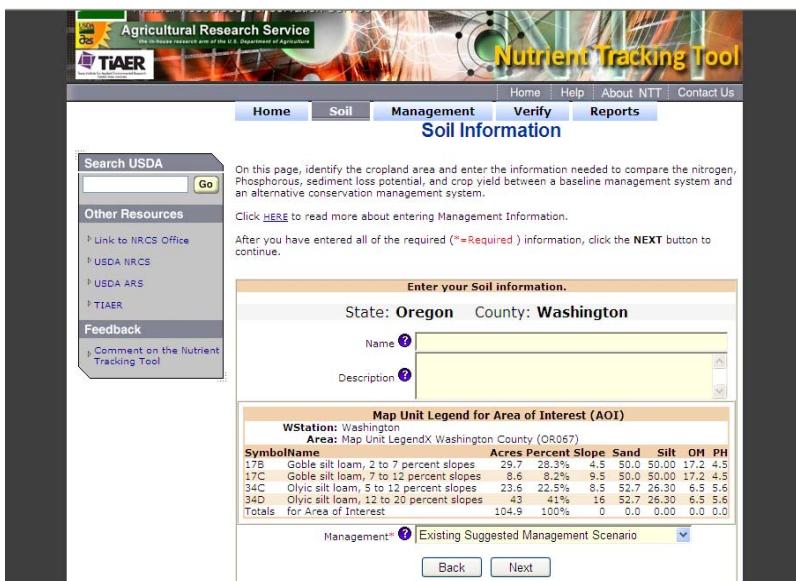


Figure 2.1.8 NTT program after saving (importing) soil information from WSS

NTT allows you to optionally name your project and record a project description. Once this is done, click the **Next** button. You have now defined your area of interest and are ready to define your scenarios in the **Management** selection box by either selecting A) “Existing Suggested Management Scenarios” or B) “Upload/Create/Modify Management Operation File”.

2.1.2 Option 2. Define AOI by selecting State and County on NTT screen

To use this option, click on the **Select Specific Soil** button on the NTT **Welcome** screen. This will allow you to define your area of interest by choosing the State and County where your field is located and then a specific soil, preferably the dominant soil on your field. Once you click that button, the screen is expanded to display a lower pane where you can select your **State** and then **County** and then **Weather station** in that order (Figure 2.1.9). At this point you can also select the indicators you wish to include in the current NTT session. By default, all the available indicators (nitrogen, phosphorus, flow, sediment, and crop yield) are selected.

Once you have made your selections, click **Next** to go to the **Soil Information** screen (Figure 2.1.10) where you can select the soil type applicable to your field and specify the field size. This screen permits you to select only one soil type, unlike the **WSS** program where multiple soil types are captured and exported to the NTT session.

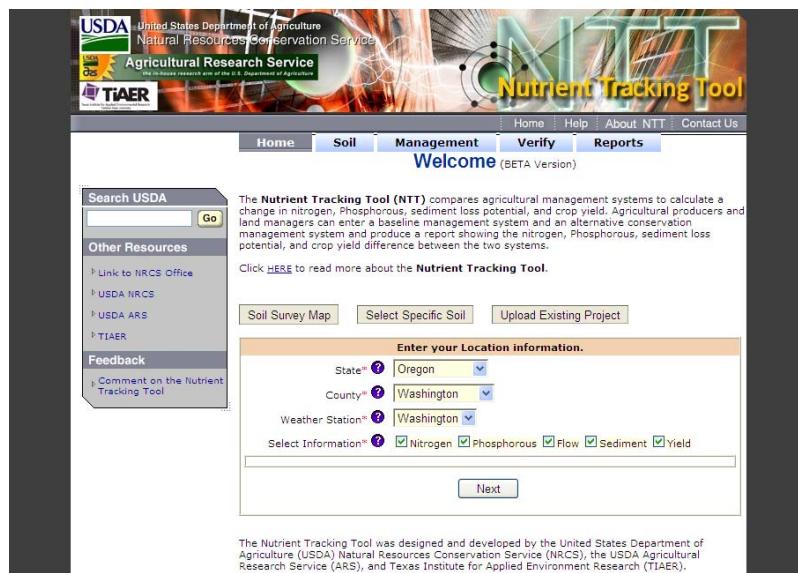


Figure 2.1.9 Option 2: Selection of State, County, and Weather station of interest

The screenshot shows the 'Soil Information' page of the NTT Application. At the top, there's a navigation bar with links to Home, Soil, Management, Verify, Reports, and a search bar. Below the navigation is a sidebar with links to USDA NRCS, USDA ARS, TIAER, and a feedback section. The main content area has a heading 'Enter your Soil information.' It asks for State (Oregon) and County (Washington). The form fields include:

- Name: John Doe
- Description: This is an NTT run for John Doe's corn silage field
- Soil area*: Washington County
- Soil name*: 17B. Goble silt loam, 2 to 7 percent slopes
- Area(acres)*: 105
- Slope(%)*: 7.5
- Soil P (ppm): 0
- Sand (%)*: 13.6
- Silt (%)*: 68.9
- Organic Matter (%)*: 4.5
- PH*: 6.1
- Initial Nitrate (ppm)*: Existing Suggested Management Scenario

At the bottom, there are 'Back' and 'Next' buttons.

Figure 2.1.10 Option 2: Soil Information screen

Your AOI definition is now complete and you can proceed to the next step to define the **Baseline** and **Alternative** scenarios by selecting either **Existing Suggested Management Scenario** or **Upload/Create/Modify Management Operation File**. A zero soil P value in the **Soil Information** screen means that NTT will use the model default of 20 ppm of P.

2.2 Management information input

At the bottom of the **Soil Information** screen, a drop down menu allows you to select **Existing Suggested Management Scenario** or **Upload/Create/Modify Management Operation File**. Select the **Existing Suggested Management Scenario** and click **Next** to get preloaded information. You can still modify the preloaded management information by clicking **Modify** at the bottom of the **Management Information** screen. Alternatively, you may upload a saved management file or create new scenarios from scratch by selecting the **Upload/Create/Modify management Operation File** option at the bottom of the **Soil Information** screen. The following five subsections provide more information about each option available for defining management information in NTT.

- 2.2.1 Selecting pre-loaded management scenarios
- 2.2.2 Uploading existing management files
- 2.2.3 Creating new management information
- 2.2.4 Modifying existing management information
- 2.2.5 Selecting structural conservation practices

2.2.1. Selecting pre-loaded management scenarios

The easiest way to define scenarios in NTT is to select from the list of pre-loaded management information. After the information has been selected users still have the option of making changes via the **Modify** button.

To access the list of pre-loaded management scenarios, simply select **Existing Suggested Management Scenario** from the **Soil Information** screen (Figure 2.1.10). This brings you to the **Management Information** screen that displays drop down buttons for the **Baseline** and **Alternative** scenarios. Each drop down button contains a list of items that can be selected to define each scenario – cropping system, irrigation type, nutrient input, and tillage options. Once you have selected the relevant items to define your scenarios, you can click **Next** to proceed to the NTT calculation phase.

For this illustrative case, you can proceed to define the “conventional” and “no-till” tillage options for the corn silage cropping system from the **Management Information** screen, as shown in Figure 2.2.1. In this case the tillage options are predefined within the list of cropping systems. For our purposes the conventional tillage option is selected by choosing “A_Corn, silage; MT, CMZ53” from the **Cropping system** list. Similarly, the no-till option for corn silage is selected by choosing “A_Corn, silage; NT, CMZ53” from the **Cropping system** list. In Figure 2.2.1, we have already selected the cropping systems (corn silage), nutrient input, and the tillage types for both the **Baseline** and **Alternative** scenarios. Click **Next** to run NTT’s calculation tool.

Map Unit Legend for Area of Interest (AOI)								
Symbol	Name	Acres	Percent	Slope	Sand	Silt	OM	PH
17B	Gobie silt loam, 2 to 7 percent slopes	28.7	28.3%	4.5	58.0	50.0	17.2	4.5
17C	Gobie silt loam, 7 to 12 percent slopes	8.6	8.2%	9.5	50.0	50.0	17.2	4.5
34C	Olivic silt loam, 5 to 12 percent slopes	23.6	22.5%	8.5	52.7	26.30	6.5	5.6
34D	Olivic silt loam, 12 to 20 percent slopes	43	41%	16	52.7	26.30	6.5	5.6
Totals	for Area of Interest	104.9	100%	0	0.0	0.00	0.0	0.0

Figure 2.2.1 Defining **Baseline** and **Alternative** tillage for a corn silage field

2.2.2. Uploading existing management files

If you saved management information to a file in a previous NTT session, you can upload that file by selecting the **Upload/Create/Modify management Operation File** option from the **Soil Information** page. A new screen appears, which offers multiple options – to modify existing management information, to upload an existing management file, or to

create new management information (Figure 2.2.2). To upload management information from an existing file, enter the full path and filename of the file in the text box to the left of the **Browse** button, or simply click **Browse** to navigate to the location of the file. Once the full path and file name has been specified in the text box, click the **Upload** button to load the file into the existing NTT session. Click **Next** to run NTT's calculation tool.



Figure 2.2.2 Modify Management screen with options to upload or create field operations

2.2.3. Modifying existing management information

You can modify existing management information that was uploaded from a previous session, or even pre-loaded management information. To modify management information that exists in a file on your computer, simply upload that file as described above. The management information would be displayed on your screen as shown in Figure 2.2.3. You can then use the options available on that screen to edit, copy, or delete specific lines of management operations.

Baseline (Current) Management Information									
	New	Year	Month	Day	Crop	Operation	Fert/Till/Animal Group	Amount	Depth
	1	Apr	15		CORN SILAGE	Tillage	TANDEM DISK REG GE19FT	0	0
	1	May	10		CORN SILAGE	Tillage	FIELD CULTIVATOR 36FT	0	0
	1	May	15		CORN SILAGE	Tillage	FIELD CULTIVATOR 36FT	0	0
	1	May	16		CORN SILAGE	Tillage	SPIKE TOOTH HARROW GT25FT	0	0
	1	May	18		CORN SILAGE	Tillage	CULTI-PACKER PULVERIZER	0	0
	1	May	19		CORN SILAGE	Fertilizer	Elem-N	154.1	2.9528
	1	May	19		CORN SILAGE	Fertilizer	Elem-P	92	2.9528
	1	May	20		CORN SILAGE	Planting		0	0
	1	Sep	15		CORN SILAGE	Harvest		0	0
	1	Sep	16		CORN SILAGE	Kill		0	0

Alternative Management Information									
	New	Year	Month	Day	Crop	Operation	Fert/Till/Animal Group	Amount	Depth
	1	May	19		CORN SILAGE	Fertilizer	Elem-N	154.1	2.9528
	1	May	19		CORN SILAGE	Fertilizer	Elem-P	92	2.9528
	1	May	20		CORN SILAGE	Planting		0	0
	1	Sep	15		CORN SILAGE	Harvest		0	0
	1	Sep	16		CORN SILAGE	Kill		0	0

Figure 2.2.3 Modify Management screen with editing/modification options

To delete an operation, simply click on the **Delete** button – the button with the trash can icon () – to the left of that row. A dialog box appears asking for confirmation to delete that operation (Figure 2.2.4). Click on the **OK** button to delete that operation. To edit an operation, click on the **Open** button – the button with the “file open” icon () – to the left of that row. To copy an operation to the other scenario, click on the **Copy** button to the right of that row – the button with the Copy icon (). This action copies the specific operation from the active scenario to the other scenario.

When you open an operation for editing, two additional buttons are displayed beside that operation: the **Save** button () and the **Cancel** button (). Use the **Save** button to save the changes made and exit editing mode. Use the **Cancel** button to discard the changes made and exit editing mode (Figure 2.2.5).

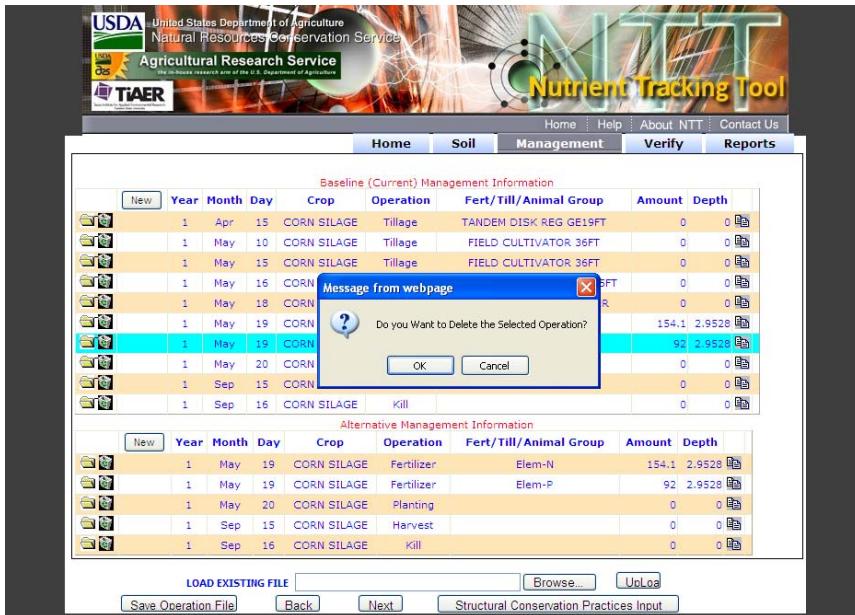


Figure 2.2.4 Modify Management screen asking user to confirm operation deletion



Figure 2.2.5 Modify Management screen showing user editing of a specific operation

The same management modification options are available to you if you select a pre-loaded management scenario and wish to modify it. Simply select the pre-loaded management information that is closest to your desired specifications and click **Modify** (Figure 2.2.2). The **Modify Management** screen appears, as in Figure 2.2.5, displaying the pre-loaded management information details, with all the editing options as discussed in this subsection. Click **Next** to run NTT's calculation tool.

2.2.4 Creating new management information

You can create new management information by selecting the **Upload/Create/Modify management Operation File** option as in the foregoing illustration. In the **Modify Management** screen that is presented (Figure 2.2.3), you enter a new management operation by clicking on the **New** button for the **Baseline** or **Alternative** scenario, as needed. Once you have finished entering all the management information required, you can click **Next** to proceed to the next phase of running and reviewing the NTT results. Note also that on this screen, you can save the management information entered here to an external file on your computer by clicking on the **Save Operation File** button (Figure 2.2.5). Click **Next** to run NTT's calculation tool.

2.2.5 Running NTT program

In Figure 2.2.6, we have already selected the cropping systems (corn silage), nutrient input, and the tillage types for both the **Baseline** and **Alternative** scenarios (using the procedures described in sections 2.1.1 and 2.2.1). Click **Next** to run NTT's calculation tool. To view or edit the specific field operations included in each tillage option, you can use the **Modify** button as described in an earlier section. Once you click **Next** a screen is presented that allows you to **Verify** your selections before the calculation tool runs (Figure 2.2.7).

Symbol	Name	Acres	Percent	Slope	Sand	Silt	OM	PH
17B	Goble silt loam, 2 to 7 percent slopes	29.7	28.3%	4.5	50.0	50.00	17.2	4.5
17C	Goble silt loam, 7 to 12 percent slopes	8.6	8.2%	9.5	50.0	50.00	17.2	4.5
34C	Olivine sand loam, 5 to 12 percent slopes	23.5	22.5%	8.5	50.0	50.00	16.5	5.5
34D	Olivine sand loam, 12 to 20 percent slopes	.43	41%	10	52.7	24.30	8.5	5.5
Totals	for Area of Interest:	104.9	100%	0	0.0	0.00	0.0	0.0

Figure 2.2.6 Defining **Baseline** and **Alternative** tillage for a corn silage field

Verify Information

Verify that your information is correct.

Management

	Baseline	Alternative
Cropping system:	A_Corn, silage; MT, CMZ53	A_Corn, silage; NT, CMZ53
Irrigation:	None	None
Nutrient input(lbs/ac):	(N) 154 (P) 92 (1 yr)	(N) 154 (P) 92 (1 yr)
Tillage:	Conventional	Conventional

SCP

	Baseline	Alternative							
Symbol	Name	Acres	Percent Slope	Sand	Silt	OM	PH		
17B	Olyc silt loam, 2 to 7 percent slopes	29.7	28.3	4.5	0	50	50	17.2	4.5
17C	Olyc silt loam, 7 to 12 percent slopes	8.6	8.2	9.5	0	50	50	17.2	4.5
34C	Olyc silt loam, 5 to 12 percent slopes	23.6	22.5	8.5	0	52.7	26.3	8.5	5.8
34D	Olyc silt loam, 12 to 20 percent slopes	43	41	18	0	52.7	26.3	8.5	5.8

Map Unit Legend for Area of Interest (AOI)

Area:

Symbol	Name	Acres	Percent Slope	Sand	Silt	OM	PH		
17B	Olyc silt loam, 2 to 7 percent slopes	29.7	28.3	4.5	0	50	50	17.2	4.5
17C	Olyc silt loam, 7 to 12 percent slopes	8.6	8.2	9.5	0	50	50	17.2	4.5
34C	Olyc silt loam, 5 to 12 percent slopes	23.6	22.5	8.5	0	52.7	26.3	8.5	5.8
34D	Olyc silt loam, 12 to 20 percent slopes	43	41	18	0	52.7	26.3	8.5	5.8

Totals for Area of Interest (AOI) Total acres: 104.9
AOI Summary / Detail report

Save Project Back Next

Figure 2.2.7 Verify Information screen for user to review and edit information

Summary Report

Name: Description:

Annual Results for Nutrients, Flow, Sediment, and Crop Yield

	Baseline	Alternative	Difference	Reduction (%)	Total for Area
Total N (lbs/ac)	19.31	17.61	1.70	8.8	180.2
Total P (lbs/ac)	4.48	4.08	0.40	8.9	42.4
Flow (in.)	16.21	16.24	-0.03	-0.2	-3.2
Sediment (t/ac)	0.9165	0.7152	0.2013	22.0	21.34
Crop Yield					
CSIL(t/ac)	15.39	15.38	-0.01	-0.1	-1.00

Location and Additional Site Information

State: Oregon
County: Washington
Weather station: Washington
Area - Acres: 104.9
Soil survey area: Washington County

Management Information

	Baseline	Alternative
Cropping system:	A_Corn, silage; spring CT, CMZ53	A_Corn, silage; spring CT, CMZ53
Irrigation:	None	None
Nutrient input (lbs/ac):	(N) 154 (P) 92 (1 yr)	(N) 154 (P) 92 (1 yr)
Tillage:	Conventional	No Till

Structural Conservation Practices Input

	Baseline	Alternative
--	----------	-------------

Map Unit Legend for Area of Interest(AOI)

Symbol	Name	Acres	Percent Slope	Sand	Silt	OM	PH	
61481	Olyc silt loam, 5 to 12 percent slopes	23.6	22.5%	8.5	52.7	26.3	6.5	0.0
61433	Olyc silt loam, 2 to 7 percent slopes	29.7	28.3%	4.5	50.0	50.0	17.2	0.0
61482	Olyc silt loam, 12 to 20 percent slopes (other soils)	43.0	41%	16.0	52.7	26.3	6.5	0.0
Totals for Area of Interest(AOI)	104.9	100%						

Figure 2.2.8 NTT results screen showing summary impact of no-till practice

Once you click **Next** on the **Verify Information** screen (Figure 2.2.7), NTT's calculation tool runs and presents the results (Figure 2.2.8) for the two scenarios (**Baseline** and **Alternative**). The results displayed in the screen indicate that with the **Alternative**

scenario (no-till) Corn silage yields are not projected to change significantly, while nutrient and sediment losses are projected to decline.

NTT's calculation tool indicates that nitrogen losses decline by 1.7 lb/acre or 180 lbs for the 105-acre field. If nitrogen is the relevant nutrient for the water quality trading program, then the farmer can multiply the load reduction (180 lbs) by the program-designated adjustment factors for the field, to arrive at the total number of nitrogen credits that are generated. If phosphorus is the indicator of interest, then the load reduction value that will be used in the credit calculation is 42 lbs. The no-till scenario also significantly reduced soil erosion (by about 22%). Ancillary benefits such as reductions in sediment loading may also be tracked by the water quality trading program.

2.3 CASE 2: Filter strip

Background information: The same farmer in Washington County is interested in putting in a 50-foot wide filter strip at the edge of her 105-acre corn silage field. Both corn and soybeans are conventionally tilled on this field. She wants to know the potential water quality credits from this scenario.

NTT implementation: NTT will provide reasonable estimates of the nutrient and sediment load reductions associated with the 50-foot filter strip. These estimates can then be used with water quality program information to calculate the nutrient credits for this farm.

The first step is to select the corn silage rotation for each scenario “A_Corn, silage; spring CT, CMZ53” on the **Management Information** screen (Figure 2.3.1).

The screenshot shows the 'Management Information' screen of the NTT application. The top navigation bar includes links for Home, Soil, Management, Verify, Reports, and a menu with Home, Help, About NTT, and Contact Us. The main content area is titled 'Management Information' and contains the following sections:

- Search USDA:** A search bar with a 'Go' button.
- Other Resources:** Links to NRCS Office, USDA NRCS, USDA ARS, and TIAER.
- Feedback:** A link to Comment on the Nutrient Tracking Tool.
- Instructions:** Text explaining the purpose of the page and how to enter management information.
- Enter your Management information:** Fields for State (Oregon) and County (Washington).
- Map Unit Legend for Area of Interest (AOI):** A table showing the map unit legend for Washington, specifically for Map Unit LegendX Washington County (OR067). The table includes columns for Symbol, Name, Acres, Percent, Slope, Sand, Silt, OM, and PH. Key entries include:

Symbol	Name	Acres	Percent	Slope	Sand	Silt	OM	PH
17B	Goble silt loam, 2 to 7 percent slopes	29.7	28.3%	4.5	50.0	50.0	17.2	4.5
17C	Goble silt loam, 7 to 12 percent slopes	8.6	8.2%	9.5	50.0	50.0	17.2	4.5
34C	Olyc silt loam, 2 to 12 percent slopes	23.6	22.5%	5.5	52.7	26.3	16.5	5.6
34D	Olyc silt loam, 12 to 20 percent slopes	43	41%	15	52.7	26.3	6.5	5.6
Totals	for Area of Interest	104.9	100%	0	0.0	0.0	0.0	0.0
- Baseline:** Selection dropdown for cropping system, currently set to 'A_Corn, silage; spring CT, CMZ53'.
- Alternative:** Selection dropdown for cropping system, currently set to 'A_Corn, silage; spring CT, CMZ53'.
- Irrigation:** Selection dropdown for irrigation type, currently set to 'None'.
- Nutrient input:** Selection dropdown for nutrient input, currently set to '(N) 154 (P) 92 (1 yr)'.
- Tillage:** Selection dropdown for tillage type, currently set to 'Conventional'.
- Structural Conservation Practices (SCP) Input:** A button to access SCP input options.
- Buttons:** Back, Next, and Modify.

Figure 2.3.1 Management Information screen showing selection of nutrient and tillage options for Case 2

2.3.1. Selecting Structural Conservation Practices

NTT provides the opportunity to evaluate a number of structural conservation practices such as filter strips and tile drainage. To access the structural conservation practices menu, click on the **Structural Conservation Practices (SCP) Input** button that is located near the bottom of the **Management Information** screen (Figure 2.2.2). A new window is displayed (Figure 2.3.2) that allows you to select the structural conservation practices of interest and specify the required information. To select a given structural conservation practice, simply click the check box immediately to the left of its name. Once the practice has been selected, additional options appear that can be used to detail its design specifications. For instance, in the case of filter strips, once you click on the check box to select **Filter Strips (Grassed Buffer)**, two new options appear, one for specifying the type of vegetation on the strip, and the other for specifying the width of the filter strip.

Figure 2.3.2 Structural Conservation Practices Information screen prior to making selections

In the **Structural Conservation Practices Information** screen, select the **Filter Strip** option and for this example specify “Switchgrass⁴” as the crop growing in the selected filter strip field. Then select 50 feet as the filter strip width (Figure 2.3.3). Finally, click **Next** to proceed to run NTT and obtain the results for this scenario.

The **Summary Report** screen will be displayed showing the impacts of the filter strip on the 105-acre field (Figure 2.3.4). The results indicate substantial reductions in nutrient and sediment losses. Crop production is also reduced because land is taken out of production for installation of the filter strip. Thus the farmer is confronted with a trade-

⁴ Switchgrass is a common grass that is often recommended for filter strip applications due to its ability to trap sediment and nutrients more effectively than many other plants.

off situation – lower nutrient and sediment losses with some water quality credits, along with lower crop production for the entire farm, due to land taken out of production.

The screenshot shows the 'Structural Conservation Practices Information' page. It includes a sidebar with 'Search USDA' and 'Other Resources' sections. The main content area has a heading 'Enter your information.' with fields for 'Baseline' and 'Alternative'. Under 'Alternative', there are checkboxes for various practices: 'Tile Drainage Depth (ft)', 'Animals in Stream', 'Wetlands Area (ac)', 'Contour Buffer', 'Terrace System', 'Filter Strip (Grassed Buffer)', 'Riparian Forest Buffer Width (ft)', and 'Waterway'. A dropdown menu for 'Crop' is set to 'SWITCHGRASS' with a width of '50'. At the bottom are 'Back' and 'Next' buttons.

Figure 2.3.3 Addition of 50-foot filter strip to field for Alternative scenario

The screenshot shows the 'Summary Report' page. It includes a sidebar with 'Search USDA' and 'Other Resources' sections. The main content area has sections for 'Annual Results for Nutrients, Flow, Sediment, and Crop Yield', 'Location and Additional Site Information', 'Management Information', 'Structural Conservation Practices Input', and 'Map Unit Legend for Area of Interest(AOI)'. The 'Annual Results' section shows data for Total N, Total P, Flow, Sediment, and Crop Yield. The 'Management Information' section details cropping systems, irrigation, and tillage. The 'Structural Conservation Practices Input' section shows a 'Filter Strip Width(ft)' of 50. The 'Map Unit Legend' lists symbols for different soil types and their properties.

	Baseline	Alternative	Reduction (%)	Total for Area
Total N (lbs/ac)	19.31	8.12	57.9	1186.1
Total P (lbs/ac)	4.48	3.29	26.6	126.1
Flow (in.)	16.21	11.39	4.82	510.9
Sediment (t/ac)	0.9165	0.6556	0.2609	27.66
Crop Yield CSIL(t/ac)	15.39	15.39	0.0	-24.20

Symbol Name	Acres	Percent Slope	Sand	Silt	OM	PH	
61481 slopes	23.6	22.5%	8.5	52.7	26.3	6.5	0.0
61433 slopes	29.7	28.3%	4.5	50.0	50.0	17.2	0.0
61482 slopes (other soils)	43.0	41%	16.0	52.7	26.3	6.5	0.0
	8.6	8.2%					

Figure 2.3.4 NTT Summary Report screen showing impact of 50-foot filter strip

2.4. CASE 3: Multiple-practice scenario: no-till and filter strip

Background information: In this case, our Washington County corn silage farmer is considering a combination of the two practices illustrated in the above two cases. In the baseline scenario corn silage is conventionally tilled on this field and the total nutrient application rate is 154 lb/acre nitrogen and 92 lb/acre phosphate. She is considering switching completely to no-till production on this field. In addition she is also interested in placing a 50-foot wide filter strip at the bottom edge of this field. She wants to know the potential water quality benefits from this combined scenario.

NTT implementation: NTT will provide reasonable estimates of the nutrient and sediment load reductions associated with this combined scenario. These estimates can then be used along with water quality program-specific information to calculate the nutrient credits for this farm.

After defining the AOI, the next step is to select corn silage rotation for each scenario, “A_Corn silage, spring CT. CMZ53” for both scenarios. Then select the **Modify** button, and as described in Section 2.2.3, delete all the tillage operations in the **Alternative** scenario (should now look like Figure 2.4.1). Finally click on the **Structural Conservation Practices (SCP) Input** button to add the filter strip to the **Alternative** scenario (Figure 2.4.2).

The screenshot shows the NTT Management Information interface. At the top, there's a navigation bar with links to Home, Soil, Management, Verify, and Reports. Below that is a search bar for USDA and other resources like NRCS, ARS, and TIAER. The main area is titled "Management Information". It displays a "Map Unit Legend for Area of Interest (AOI)" for Washington County (OR057), listing soil types (17B, 17C, 34C, 34D) with their respective acres, percent, slope, sand, silt, OM, and PH values. Below this is a table for selecting cropping systems. The "Baseline" section shows "A_Corn, silage, spring CT, CMZ53" selected. The "Alternative" section shows "A_Corn, silage, spring CT, CMZ53" selected. Under "Irrigation", "None" is chosen. Under "Nutrient input (lb/ac)", "(N) 154 (P) 92 (1 yr)" is selected. Under "Tillage", "Conventional" is selected. At the bottom, there are buttons for "Structural Conservation Practices (SCP) Input", "Back", "Next", and "Modify".

Figure 2.4.1. Selection of Cropping systems for **Baseline** and **Alternative** scenarios



Figure 2.4.2 Illustration of no-till in the Alternative scenario

The screenshot shows the Structural Conservation Practices Information screen with the following details:

Structural Conservation Practices Information

On this page, identify the cropland area and enter the information needed to compare the nitrogen, Phosphorous, sediment loss potential, and crop yield between a baseline management system and an alternative conservation management system.

Click [HERE](#) to read more about entering Management Information.

After you have entered all of the required (*=Required) information, click the **NEXT** button to continue.

Enter your information.

State: Oregon County: Klamath

Baseline [?](#) **Alternative** [?](#)

<input type="checkbox"/> Tile Drainage Depth (ft)	<input type="checkbox"/> Tile Drainage Depth (ft)
<input type="checkbox"/> Animals in Stream	<input type="checkbox"/> Stream Fencing
<input type="checkbox"/> Wetlands Area (ac)	<input type="checkbox"/> Wetlands Area (ac)
Buffer Structural Conservation Practices	
<input type="checkbox"/> Contour Buffer	<input type="checkbox"/> Contour Buffer
<input type="checkbox"/> Terrace System	<input type="checkbox"/> Terrace System
<input type="checkbox"/> Filter Strip (Grassed Buffer)	<input checked="" type="checkbox"/> Filter Strip (Grassed Buffer)
<input type="checkbox"/> Riparian Forest Buffer Width (ft)	<input type="checkbox"/> Riparian Forest Buffer Width (ft)
<input type="checkbox"/> Waterway	<input type="checkbox"/> Waterway

Switchgrass dropdown: Crop: **50** Width(ft)

Buttons: Back, Next

Figure 2.4.3 Addition of 50-foot filter strip to field for Alternative scenario

In the **Structural Conservation Practices** screen, select the **Filter Strip** option and then select “Switchgrass” and specify 50 feet as the filter strip width (Figure 2.4.3). Then click **Next** to run NTT and obtain results for the combined scenario. The **Summary Report** screen will be displayed showing the impacts of no-till and the filter strip on the 105-acre field (Figure 2.4.4). The results indicate substantial reductions in nutrient and sediment losses. Whereas a portion of land is taken out of production, in this particular situation, the NTT results indicate no significant impact on corn silage yield on the 105-acre field.

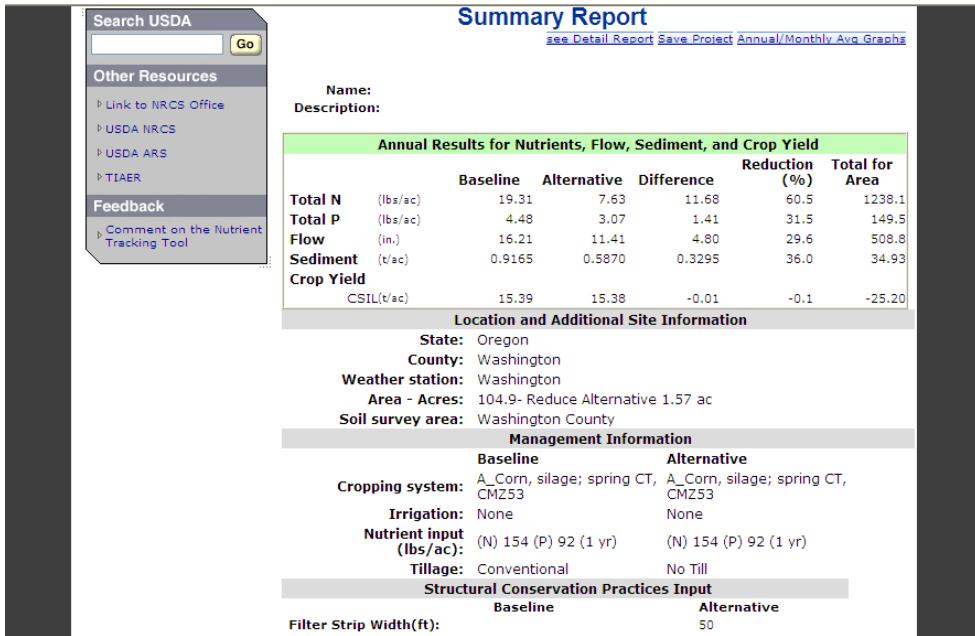


Figure 2.4.4 NTT Summary Report screen showing combined impact of filter strip and no-till

2.5. CASE 4: Dealing with animals: Riparian fencing and forest buffer

Background information: A rancher in Klamath County, Oregon, currently grazes 300 beef cattle on a 300-acre pasture May through November. The field is a flood irrigated natural pasture with no regular seeding, tilling, or fertilizer applied other than the manure from the cattle. The field borders a stream where the cattle spend on average about 20 minutes per cow per day watering in the river. He is considering installing off-stream watering and a fence to keep his cattle out of the river. He is also considering planting willow and other trees and shrubs in the 60 foot riparian buffer created by the fence to stabilize the bank, shade the water, and filter manure runoff from the pasture. He wants to know the potential water quality benefits from the fencing and riparian forest buffer planting.

NTT implementation: NTT will provide reasonable estimates of the nutrient load reductions dissolved in manure runoff and manure in the stream. NTT captures the full sediment and organic nutrient load reductions associated with reduced pasture, stream bank, and streambed erosion, but those estimates have not been extensively reviewed. After defining the AOI, and Capturing the soils (as illustrated in Figure 2.5.1), the next step is to select “Furrow” Irrigation and then a pasture rotation for each scenario (**Baseline** and **Alternative**).

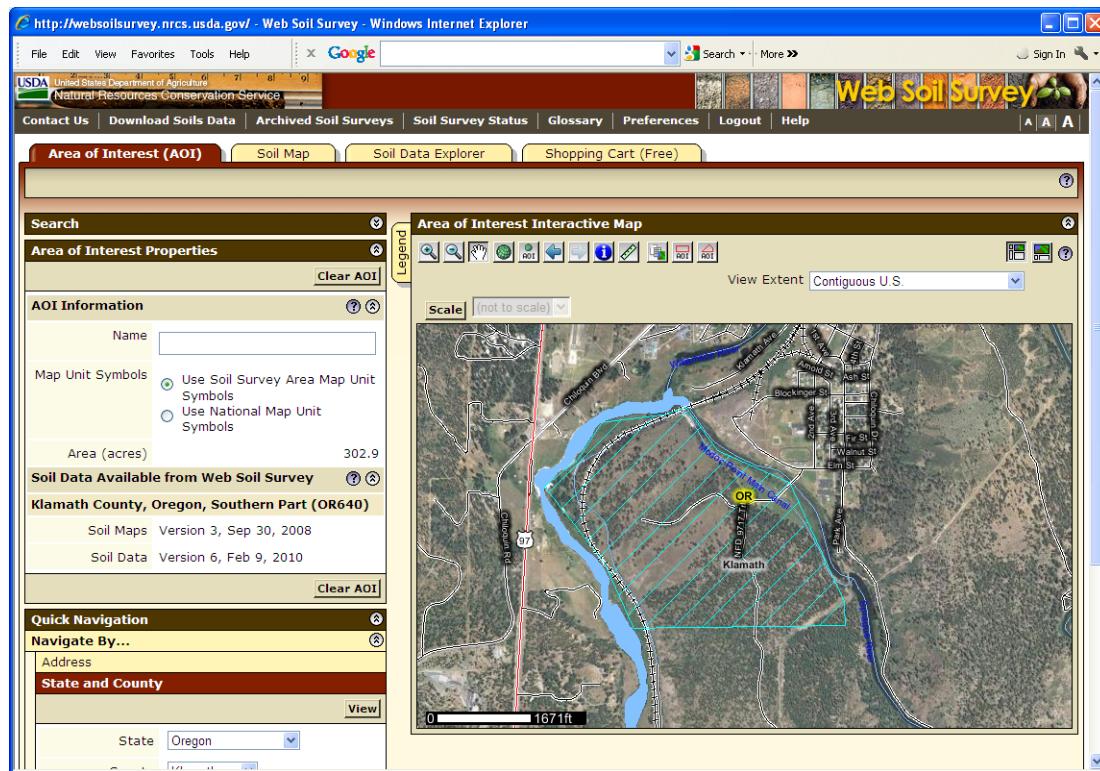


Figure 2.5.1 Web Soil Survey showing AOI

For the **Baseline Scenario** select the “Pasture, yr1 spring plant: manure appl., Z52 – Modified”. Additional drop-down boxes will appear for number and kind of animal. Enter “300” in the **Number of Animals** box, and select “Beef” from the **Kind of Animal** dropdown list. Repeat these steps for the **Alternative Scenario**. The **Management Information** screen should now look like Figure 2.5.2.

Symbol	Name	Acres	Percent	Slope	Sand	Silt	OM	PH
10	Chiloquin loam	19.9	6.6%	0.5	37.7	39.80	2.5	7.0
34	Klamath-Medford-Olmian association	5.5	1.8%	0.5	49.9	37.0	6.0	7.0
56B	Maset coarse sandy loam, 1 to 12 percent slopes	19.2	6.3%	0.5	22.9	69.60	2.5	6.3
56E	Maset coarse sandy loam, 12 to 35 percent south slopes	81.2	26.8%	23.5	22.9	69.60	2.5	6.3
Totals	for Area of Interest	302.9	100%	0	0.0	0.00	0.0	0.0

Figure 2.5.2 NTT Management Information Screen

With this information, NTT will populate the management files. Once the management files have been populated once for a project, it will not change without manually changing the operations in the management files.

In the **Modify Management** screen, for both **Baseline** and **Alternative** scenarios, first click on the **Open** button for the Planting Operation, and modify the planting date to April 1, and then click the **Save** button to save this change. Then to reflect the fact that no extra manure is applied, use the **Delete** button to delete the manure applications (two Fertilizer--Liquid Manure applications, and one Fertilizer—Manure application).

Next use the **Open** button to change the date of the first “Grazing” operation, and then save this change, and use the **Open** button to change the date of the last “Stop Grazing” operation to Nov. 1, and save this. Finally use the **Delete** button to delete the four “Grazing” operations after the first one, and the first four “Stop Grazing” operations. You should now be left with only three operations in the **Baseline** and **Alternative** as illustrated by Figure 2.5.3.

Baseline (Current) Management Information								
New	Year	Month	Day	Crop	Operation	Fert/Till/Animal Group	Amount	Depth
	1	Mar	1	COASTAL BERMUDA	Planting		0	0
	1	May	1	COASTAL BERMUDA	Grazing	Beef	300	0
	1	Nov	1	COASTAL BERMUDA	Stop Grazing		0	0

Alternative Management Information								
New	Year	Month	Day	Crop	Operation	Fert/Till/Animal Group	Amount	Depth
	1	Mar	1	COASTAL BERMUDA	Planting		0	0
	1	May	1	COASTAL BERMUDA	Grazing	Beef	300	0
	1	Nov	1	COASTAL BERMUDA	Stop Grazing		0	0

Figure 2.5.3 NTT Modify Management Screen

Then select the **Structural Conservation Practices Input** button. On the **Structural Conservation Practices Information** screen, select **Animals in Stream** for the **Baseline** scenario (Figure 2.5.4).

You are here: [Home](#) / Management Go: [Home](#) | [Management](#) | [Report](#)

Structural Conservation Practices Information

On this page, identify the cropland area and enter the information needed to compare the nitrogen, Phosphorous, sediment loss potential, and crop yield between a baseline management system and an alternative conservation management system.

Click [HERE](#) to read more about entering Management Information.

After you have entered all of the required (*=Required) information, click the **NEXT** button to continue.

Enter your information.	
State: Oregon County: Washington	
Baseline ?	Alternative ?
<input type="checkbox"/> Tile Drainage Depth (ft)	<input type="checkbox"/> Tile Drainage Depth (ft)
<input checked="" type="checkbox"/> Animals in Stream	<input type="checkbox"/> Stream Fencing
Number of Animals <input type="text"/>	Hours/day in Stream <input type="text"/>
Select Animals <input type="button" value="Dry Manure/day (lbs)"/>	Dry Manure/day (lbs) <input type="text"/>
<input type="checkbox"/> Wetlands Area (ac)	<input type="checkbox"/> Wetlands Area (ac)
Buffer Structural Conservation Practices	
<input type="checkbox"/> Contour Buffer	<input type="checkbox"/> Contour Buffer
<input type="checkbox"/> Terrace System	<input type="checkbox"/> Terrace System
<input type="checkbox"/> Filter Strip (Grassed Buffer)	<input type="checkbox"/> Filter Strip (Grassed Buffer)
<input type="checkbox"/> Riparian Forest Buffer Width (ft)	<input type="checkbox"/> Riparian Forest Buffer Width (ft)
Waterway <input type="checkbox"/>	Waterway <input type="checkbox"/>
Back	Next

Figure 2.5.4 Structural Conservation Practices Information screen

Enter the average number of animals in the stream *over the whole year*. To represent the animals watering in the river 6 months out of the year, enter 150 animals in the **Baseline** scenario to represent the average of 300 animals grazing for half of the year. For the Hours/day in stream enter 0.333, to represent the average animal accessing the stream for 20 minutes a day. Select “Beef” in the **Animals** drop down list, and the model will automatically display “8.5” in the Dry Manure/day (lbs) box. For the **Alternative** scenario, we are assuming that none of the animals will have access to the stream, so to simulate this in model check the **Stream Fencing** box and enter the number of animals (typically zero) that would access the stream when the fence is in place. Include the hours per day and type of animal just as in the Baseline scenario. Next in the **Alternative** scenario select **Riparian Forest Buffer** and enter 60 feet for the buffer width. The **Structural Conservation Practices Information** screen should then look like Figure 2.5.5.

Structural Conservation Practices Information

Search USDA

Other Resources

- [Link to NRCS Office](#)
- [USDA NRCS](#)
- [USDA ARS](#)
- [TIAER](#)

Feedback

- [Comment on the Nutrient Tracking Tool](#)

On this page, identify the cropland area and enter the information needed to compare the nitrogen, Phosphorous, sediment loss potential, and crop yield between a baseline management system and an alternative conservation management system.

Click [HERE](#) to read more about entering Management Information.

After you have entered all of the required (*=Required) information, click the **NEXT** button to continue.

Enter your information.	
State: Maryland County: Carroll	
Alternative ?	
Baseline ?	Alternative ?
<input type="checkbox"/> Tile Drainage Depth (ft) <input checked="" type="checkbox"/> Animals in Stream <div style="border: 1px solid #ccc; padding: 2px; display: inline-block;">150</div> Number of Animals <div style="border: 1px solid #ccc; padding: 2px; display: inline-block;">0.333</div> Hours/day in Stream <div style="display: flex; justify-content: space-between;"> <div style="flex: 1;"> BEEF <input type="button" value="▼"/> Animals </div> <div style="flex: 1;"> 8.5 Dry Manure/day (lbs) </div> </div>	<input type="checkbox"/> Tile Drainage Depth (ft) <input checked="" type="checkbox"/> Stream Fencing <div style="border: 1px solid #ccc; padding: 2px; display: inline-block;">0</div> Number of Animals <div style="border: 1px solid #ccc; padding: 2px; display: inline-block;">0</div> Hours/day in Stream <div style="display: flex; justify-content: space-between;"> <div style="flex: 1;"> BEEF <input type="button" value="▼"/> Animals </div> <div style="flex: 1;"> 8.5 Dry Manure/day (lbs) </div> </div>
<input type="checkbox"/> Wetlands Area (ac)	<input type="checkbox"/> Wetlands Area (ac)
Buffer Structural Conservation Practices	
<input type="checkbox"/> Contour Buffer <input type="checkbox"/> Terrace System <input type="checkbox"/> Filter Strip (Grassed Buffer) <input type="checkbox"/> Riparian Forest Buffer Width (ft) <input type="checkbox"/> Waterway	<input type="checkbox"/> Contour Buffer <input type="checkbox"/> Terrace System <input type="checkbox"/> Filter Strip (Grassed Buffer) <input checked="" type="checkbox"/> Riparian Forest Buffer <div style="border: 1px solid #ccc; padding: 2px; display: inline-block;">60</div> Width (ft) <input type="checkbox"/> Waterway
<input type="button" value="Back"/> <input type="button" value="Next"/>	

Figure 2.5.5 Structural Conservation Practices Information screen representing Stream Fencing and a 60 ft Riparian Forest Buffer

Then click **Next** to proceed to the **Verify Information** screen, and click **Next** again to run NTT and obtain results for both scenarios. These results, as shown in Figure 2.5.6, illustrate the effects in the **Alternative** scenario of eliminating all Beef cow access to the stream, and implementing a 60ft wide Riparian Forest buffer.

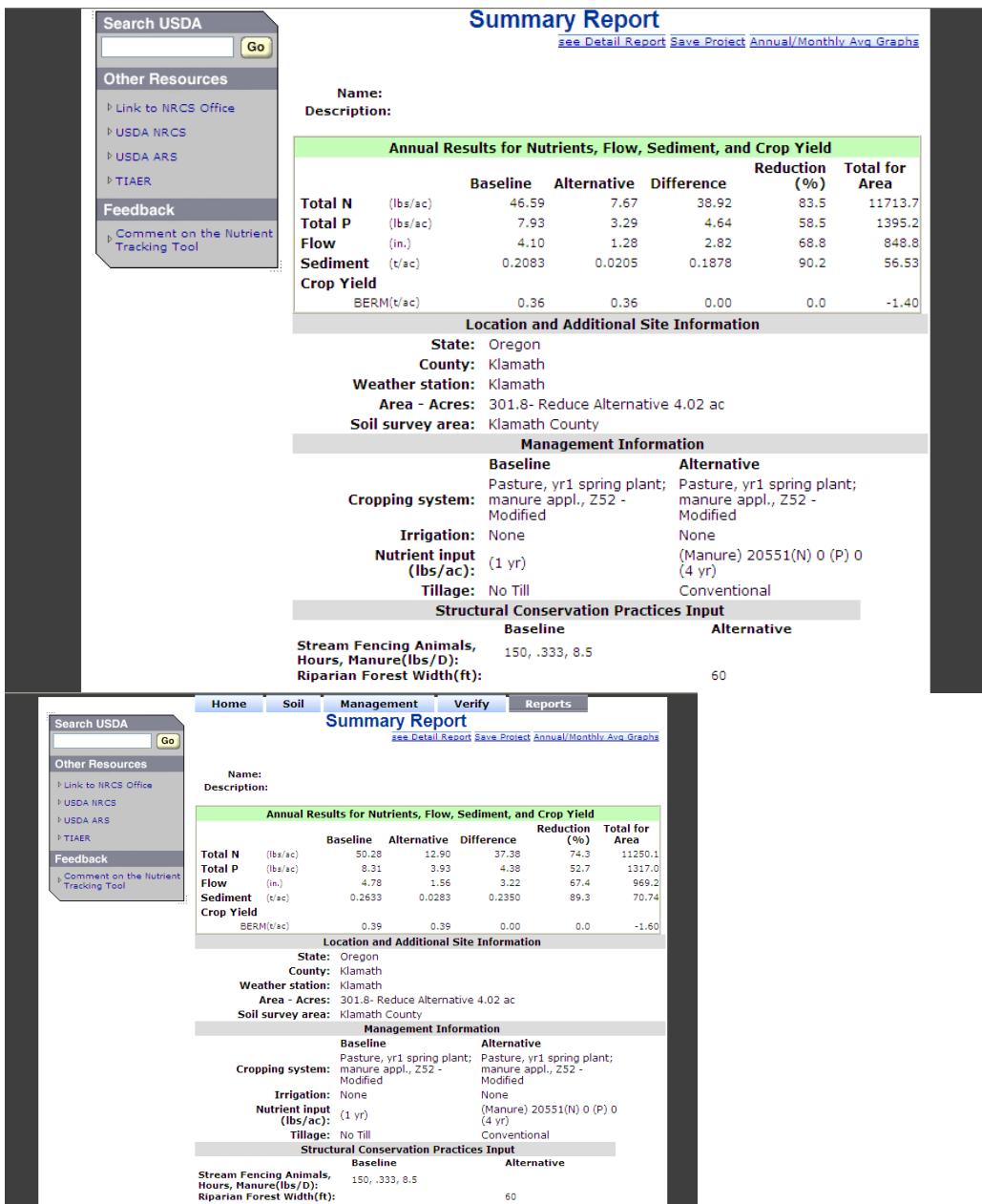


Figure 2.5.6 NTT Summary Report screen showing the combined impact of Stream Fencing and a 60 ft Riparian Forest Buffer

Note: Management shown in this case is representative of ranch operations in this region and does not necessarily represent the current practices for this farm.

2.6. CASE 5: Specialty Crops: grass rows, drip irrigation and fertilizer reduction

Background information: A family operates an 80-acre Blueberry farm in Washington County, Oregon. Conventionally, the fertilizer application rate is 75 lb/acre nitrogen and 13 lb/acre phosphate. Currently they roto-till regularly and spray as needed to keep the rows between blueberry bushes clear, but they are considering planting a permanent grass

groundcover between the rows that they would only need to mow. They also want to know the potential water quality benefits of installing drip irrigation and eliminating phosphorus application.

NTT implementation: NTT will provide an estimate of nutrient reductions from adding grass between rows, but it is unclear how accurate estimates for fertilizer reduction and changing to drip irrigation will be in this scenario. NTT does not yet have data for blueberry crops, so you will have to use a “Vineyard” cropping system using “Grapes” as a proxy for the blueberry crop. Define the AOI, as illustrated in Figure 2.6.1, and Capture the soils for the project.

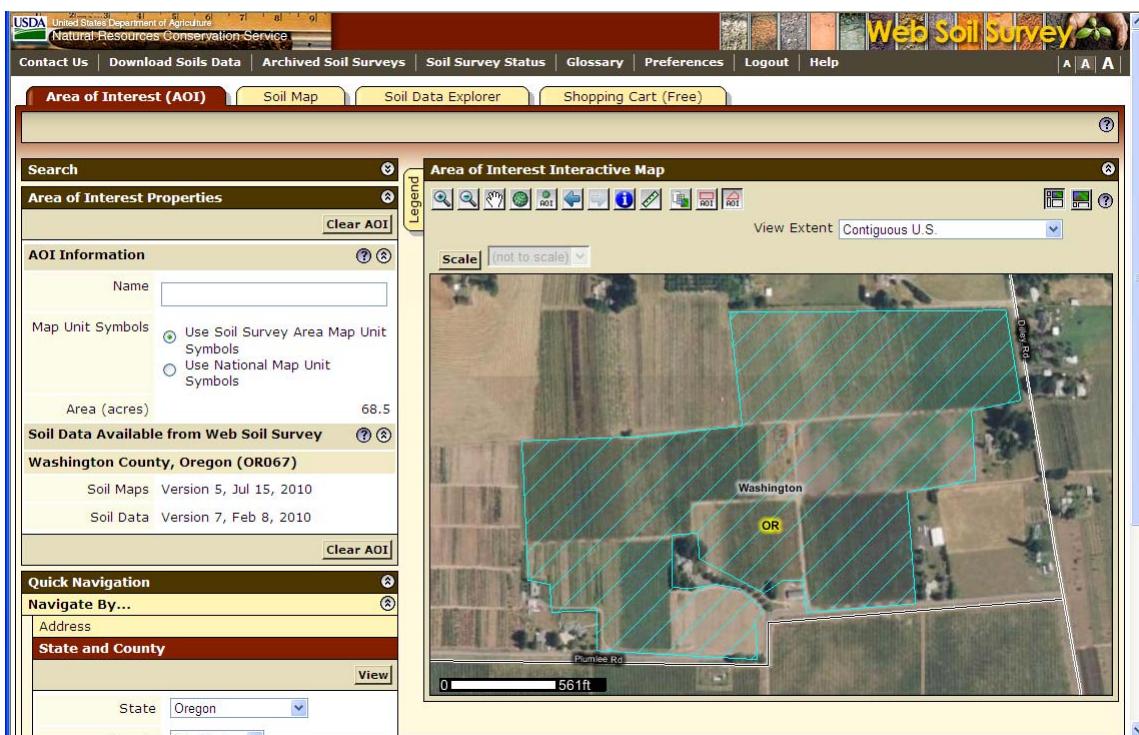


Figure 2.6.1 WSS showing AOI

Next on the **Management Information** screen select the “A_Vineyard, new; planting through yr5, clean tilled rows, CMZ 53” for both **Baseline** and **Alternative Cropping Systems**, and then select “Sprinkler” **Irrigation** for the **Baseline**, and “Drip” **Irrigation** for the **Alternative**, as illustrated in Figure 2.6.2.

The screenshot shows the 'Management Information' screen of the Nutrient Tracking Tool (NTT) application. At the top, there are tabs for Home, Soil, Management, Verify, and Reports, with 'Management' selected. A sidebar on the left includes links for Search USDA, Other Resources (Link to NRCS Office, USDA NRCS, USDA ARS, TIAER), and Feedback (Comment on the Nutrient Tracking Tool). The main content area is titled 'Management Information' and displays 'Enter your Management information.' It specifies 'State: Oregon' and 'County: Washington'. Below this, a table titled 'Map Unit Legend for Area of Interest (AOI)' lists soil types and their properties. The table includes columns for Symbol, Name, Acres, Percent, Slope, Sand, Silt, OM, and PH. A legend indicates WStations and Area. The 'Baseline' section shows cropping system (A_Vineyard, new planting through yr5, clean tilled rows, CMZ 53), irrigation (Sprinkler), nutrient input ((N) 0 (P) 40 (5 yr)), and tillage (Conventional). The 'Alternative' section shows similar details but with different irrigation (Drip) and nutrient input ((N) 0 (P) 40 (5 yr)). Buttons at the bottom include Back, Next, and Modify.

Figure 2.6.2 NTT Management Information screen

Next modify the management information using the **Modify** option (as described in the above section) until the **Baseline** and **Alternative** match those illustrated in Figure 2.6.3. This management information represents a simplified one year rotation for the **Baseline** and **Alternative**, with the **Alternative** scenario additionally eliminating P fertilizer application, and adding an operation for the planting of "Orchard grass".

The screenshot shows the 'Modify Management Information' screen of the NTT application. At the top, there are tabs for Home, Soil, Management, Verify, and Reports, with 'Management' selected. The title is 'Baseline (Current) Management Information'. Below it is a table with columns: New, Year, Month, Day, Crop, Operation, Fert/Till/Animal Group, Amount, Depth. The table lists operations for 'GRAPES': Tillage (SPRINGTOOTH HARROW GE15FT), Fertilizer (Elem-N), Fertilizer (Elem-P), Planting, and Harvest. The 'Alternative Management Information' table shows similar operations but includes an additional row for 'ORCHARD GRASS' with a Planting operation. Buttons at the bottom include LOAD EXISTING FILE, Browse..., UpLoad, Save Operation File, Back, Next, and Structural Conservation Practices Input.

Figure 2.6.3 NTT Modify Management screen

Click **Next** to get to the **Verify Information** screen (Figure 2.6.4). Note that on the **Verify Information** screen the user has the option to modify the Slope, Soil P, Sand and

Silt percentage, Organic Matter (OM), and PH of the soils in the selected AOI to better reflect actual conditions on the user's farm (see Soil P example below for further information).

The screenshot shows the 'Verify Information' screen with the following details:

- Information Selected:** Nitrogen Phosphorous Flow Sediment Yield
- Soil survey area:** Washington County
- Soil series name:** Amity silt loam
- Slope(%):** 1.5
- Area(acres):** 80.1
- Management** (Baseline vs Alternative)
 - Cropping system:** A_Vineyard, new; planting through yr5, clean tilled rows, CMZ 53
 - Irrigation:** None
 - Nutrient input(lbs/ac):** (N) 0 (P) 40 (5 yr)
 - Tillage:** Conventional
- SCP** (Baseline vs Alternative)
 - Baseline:** A_Vineyard, new; planting through yr5, clean tilled rows, CMZ 53
 - Alternative:** A_Vineyard, new; planting through yr5, clean tilled rows, CMZ 53
- Map Unit Legend for Area of Interest (AOI)**

Symbol	Name	Acres	Percent Slope	Sand	Silt	OM	PH
2	Amity silt loam	17.1	21.3	1.5	68.8	11.2	4.0
11C	Cornelius and Kinton silt loams, 7 to 12 percent slopes	29.5	36.8	9.5	68.8	11.4	3.0
11D	Cornelius and Kinton silt loams, 12 to 20 percent slopes	8.4	10.4	1.6	68.8	11.4	3.0
22	Huberly silt loam	0.6	0.7	1.5	68.8	13.8	2.5
28B	Laurelwood silt loam, 3 to 7 percent slopes	6.5	8.1	6	68.8	11.7	3.0
45A	Woodburn silt loam, 0 to 3 percent slopes	18.1	22.6	0.5	63.4	29.1	2.5
45B	Woodburn silt loam, 3 to 7 percent slopes	0	0	0.5	63.4	29.1	2.5
Totals for Area of Interest (AOI) Total acres: 80.1							
AOI Summary / Detail report							
- Save Project**, **Back**, **Next**

Figure 2.6.4 Verify Information screen showing the user's options to modify Slope, Soil P, Sand, Silt, OM, and PH. Keep in mind that a zero soil P value entered here means NTT will use the model default of 20 ppm of phosphorus.

Click **Next** again on the **Verify Information** screen to get the results for this scenario (see Figure 2.6.5). These results illustrate the impacts for this farm of using “Drip” irrigation, as opposed to “Sprinkler” irrigation, eliminating the P fertilizer application, and planting Orchard grass between the crop rows (Figure 2.6.5).

The screenshot shows the 'Annual Results for Nutrients, Flow, Sediment, and Crop Yield' screen with the following details:

- Annual Results for Nutrients, Flow, Sediment, and Crop Yield**

	Baseline	Alternative	Difference	Reduction (%)	Total for Area
Total N (lbs/ac)	20.78	8.99	11.79	56.7	943.2
Total P (lbs/ac)	2.41	0.44	1.97	81.7	157.6
Flow (in.)	17.58	16.98	0.60	3.4	48.0
Sediment (t/ac)	4.5881	1.2732	3.3149	72.2	265.19
Crop Yield					
GRAP(t/ac)	11.06	12.14	1.08	9.8	86.60
ORCH(t/ac)	0.00	1.70	1.70	N/A	136.30
- Location and Additional Site Information**
 - State:** Oregon
 - County:** Washington
 - Weather station:** Washington
 - Area - Acres:** 80.2
 - Soil survey area:** Washington County
- Management Information**
 - Cropping system:** A_Vineyard, new; planting through yr5, clean tilled rows, CMZ 53
 - Irrigation:** None
 - Nutrient input (lbs/ac):** (N) 75 (P) 13 (1 yr)
 - Tillage:** Conventional
- Structural Conservation Practices Input**

	Baseline	Alternative
--	----------	-------------
- Map Unit Legend for Area of Interest(AOI)**

Symbol	Name	Acres	Percent Slope	Sand	Silt	OM	PH
61443	Amity silt loam	17.1	21.3%	1.5	68.6	11.4	4.0
61512	Woodburn silt loam, 0 to 3 percent slopes	18.1	22.6%	0.5	53.4	29.1	2.5
61422	Cornelius and Kinton silt loams, 7 to 12 percent slopes (other soils)	29.5	36.8%	9.5	68.6	11.4	3.0
Totals	for Area of Interest(AOI)	80.2	100%				

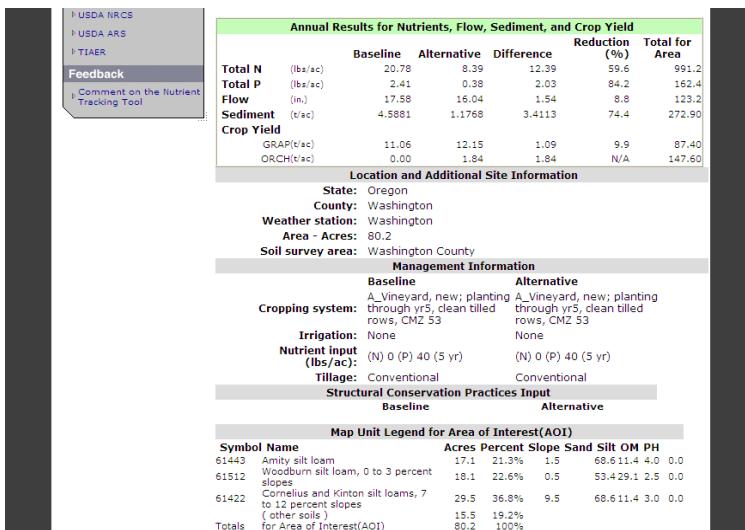


Figure 2.6.5 NTT Summary Report screen showing the combined impact of Drip irrigation, elimination of P fertilizer, and Orchard Grass

If the User chooses to modify soil values on the **Verify Information** screen, these changes will impact the results that NTT generates. In the example illustrated below the Soil P levels for all the soils in the AOI have been changed from 0 to 60 ppm (Figure 2.6.6). Click “Next” on the **Verify Information** screen to run this updated example.

The screenshot shows the 'Information Selected: Nitrogen Phosphorous Flow Sediment Yield' section of the Verify Information screen. It includes fields for Soil survey area: Washington County, Soil series name: Amity silt loam, Slope(%): 1.5, and Area(acres): 17.1. The 'Management' section shows Baseline and Alternative scenarios for Cropping system, Irrigation (None), Nutrient input (0 P), and Tillage (Conventional). A note says 'Click the Next button at the bottom of the page to process your information. Wait for your report to automatically display.' Below is a 'Map Unit Legend for Area of Interest (AOI)' table with columns for Symbol, Name, Acres, Percent Slope, Sand, Silt, OM, and pH. The table lists various soil types with their respective properties.

Symbol	Name	Acres	Percent Slope	Sand	Silt	OM	pH
2	Amity silt loam	17.1	21.3	1.5	68.6	11.4	4.0
11C	Cornelius and Kinton silt loams, 7 to 12 percent slopes	29.5	36.8	9.5	68.6	11.4	3.0
11D	Cornelius and Kinton silt loams, 12 to 20 percent slopes	8.4	10.4	1.6	68.6	11.4	3.0
22	Huberly silt loam	0.6	0.7	1.5	68.6	13.6	2.8
28B	Laurewood silt loam, 3 to 7 percent slopes	6.5	8.1	6	68.6	11.7	3.0
45A	Woodburn silt loam, 0 to 3 percent slopes	10.1	22.6	0.5	68.6	29.1	2.5
45B	Woodburn silt loam, 3 to 7 percent slopes	0	0	0.5	68.6	29.1	2.5
Totals for Area of Interest (AOI)	Total acres: 80.1						

Figure 2.6.6 Verify Information Screen showing Soil P modified to 60 ppm

Figure 2.6.7 illustrates the new results NTT generates with these higher Soil P values (for both scenarios), with the **Alternative** scenario again illustrating a switch to Drip irrigation, elimination of P fertilizer, and the planting of Orchard grass. Notice the only effect of this Soil P change, is on Total P—which increases in both the **Baseline** and **Alternative** scenarios.

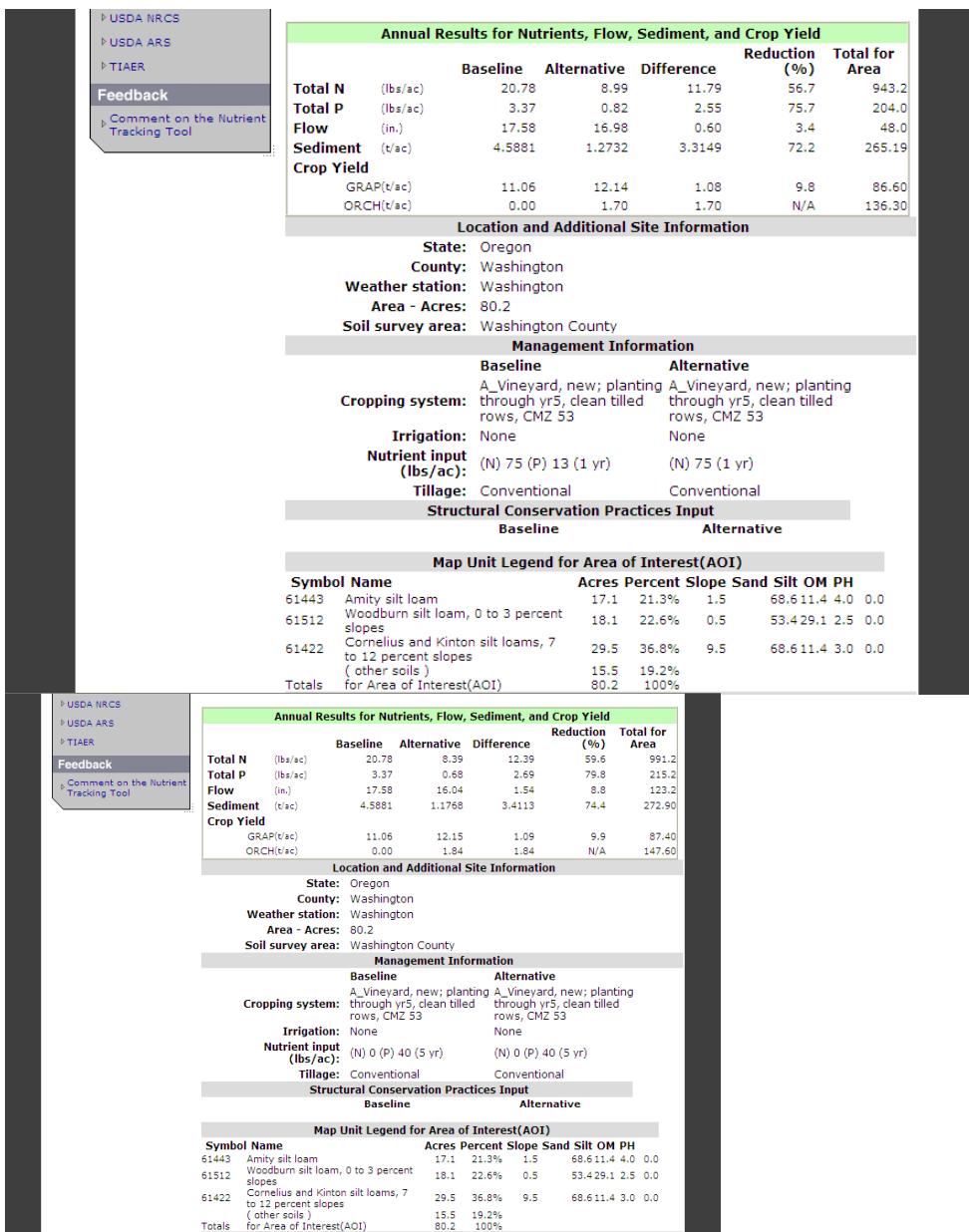


Figure 2.6.7 NTT Summary Report Screen showing the combined impact of Drip irrigation, elimination of P fertilizer, and Orchard grass with a Soil P level of 60 ppm for the AOI

Note: The management information shown in this case is broadly representative of berry crops in this region and does not necessarily represent the current practices for this farm.

SECTION 3. Troubleshooting and Additional Support Information

3.1. Using NTT on Specific Oregon Crops

Table 3.1 lists the top Oregon crops and indicates what these crops are called in NTT, or if not present in NTT, which crop to use as a proxy (noting crop yield data generated will not be accurate). More Oregon cropping systems may be added to NTT as time goes on.

Table 3.1 Top Oregon Crops—NTT Crop to use

Crops	Proxy*	NTT Crop to Use
Nursery		<i>Choose From:</i> NURSERY-EVERGREEN-TREE-STOCK NURSERY-EVERGREEN-SHRUB-STOCK
Hay		HAY
Wheat		<i>Choose From:</i> WINTER WHEAT SPRING WHEAT CANADIAN SPRING WHEAT DURAM WHEAT
Potatoes		POTATOES
Fescue		FESCUE
Ryegrass		ANNUAL RYE GRASS
Pears		PEAR
Onions		ONIONS
Cherries		CHERRY
Hazelnuts (filberts)	X	OAK
Grapes		GRAPES
Hops	X	AGRICULTURAL-ROW CROPS
Mint	X	AGRICULTURAL-ROW CROPS
Blueberries	X	GRAPES
Corn, sweet		SWEET CORN
Blackberry group	X	GRAPES
Apples		APPLE TREES
Beans, snap	X	AGRICULTURAL-ROW CROPS
Corn		CORN
Bluegrass, Kentucky		KENTUCKY BLUEGRASS
Sugar beets		SUGARBEETS

*An X in this column means a proxy was used since the specific crop is not in the APEX crop database.

Nursery

NTT does not yet have yield data or a stock management profile for Nursery crops, but it can model runoff from nursery operations. You must create a new management profile

as described in 2.2.4, selecting “Nursery” from the dropdown menu and adding appropriate fertilizer, tillage, harvest, and kill operations. If bare root stock, you must also add a proxy tillage operation (such as a chisel plow) at the time of harvest that simulates loosening of the soil to allow for removal of young trees.

Ranch/Dairy⁵

You can select the “pasture” stock management profile for any kind of animal. Dropdown boxes will then appear for you to enter the number and type of animal. After leaving the main **Management Information** screen for the first time on a project, changing these boxes will not change the number or kind of animals in the simulation. To change the number or kind of animal in future simulations, you must edit the grazing operations by hitting the modify button. If your field is natural pasture, you will also need to delete the manure applications as these represent fertilizer beyond manure generated on-field. The structural practices portion of the model does not take into account when animals start and stop grazing so number of animals should be a yearly average. For example, if animals graze near the water 6 months out of the year, divide the herd number in half for this field.

Hay, Fescue, Ryegrass, Wheat, or Corn

NTT is equipped to calculate nutrient losses and yield from these crops. You can choose one of the standard management profiles and modify it as needed. NTT does not yet have yield data for seed crops.

Grapes, Blueberries, Blackberries, Marion Berries, and other vine or bush crops.

NTT has a stock profile for grapes, but does not yet have yield or management data for blueberries, raspberries or blackberries. You can use and modify the grapes profile to estimate nutrient losses on vine and bush crops, but yield numbers will be for grapes.

Pears, Cherries, Hazelnuts, Apple, or other non-harvested tree crops.

NTT does not have a stock profile for nut or fruit tree crops, but does have yield data for pear, cherry, and apple. You must create a new management profile as described in 2.2.4, selecting the appropriate tree from the dropdown menu and adding appropriate fertilizer, tillage, harvest operations. NTT does not have yield data for Hazelnuts and other tree crops, so you will have to choose a proxy. If your orchard includes grass cover, include a planting operation for a grass. Mowing operations are not necessary as they do not affect nutrient loading.

Potatoes, Sugar Beets, Onions, and Strawberries

NTT is equipped to calculate nutrient losses and yield from this crop. You can choose one of the stock management profiles and modify it as needed.

Crimson Clover

NTT does not yet have yield data or a stock management profile for Crimson Clover. You can choose “Red Clover” as a proxy and modify it as needed

⁵ This category applies mainly to non-Confined Animal Feeding Operation (CAFO) enterprises – such as pasture dairies and ranch or pasture-fed beef operations.

Mint, Snap Beans, Hops

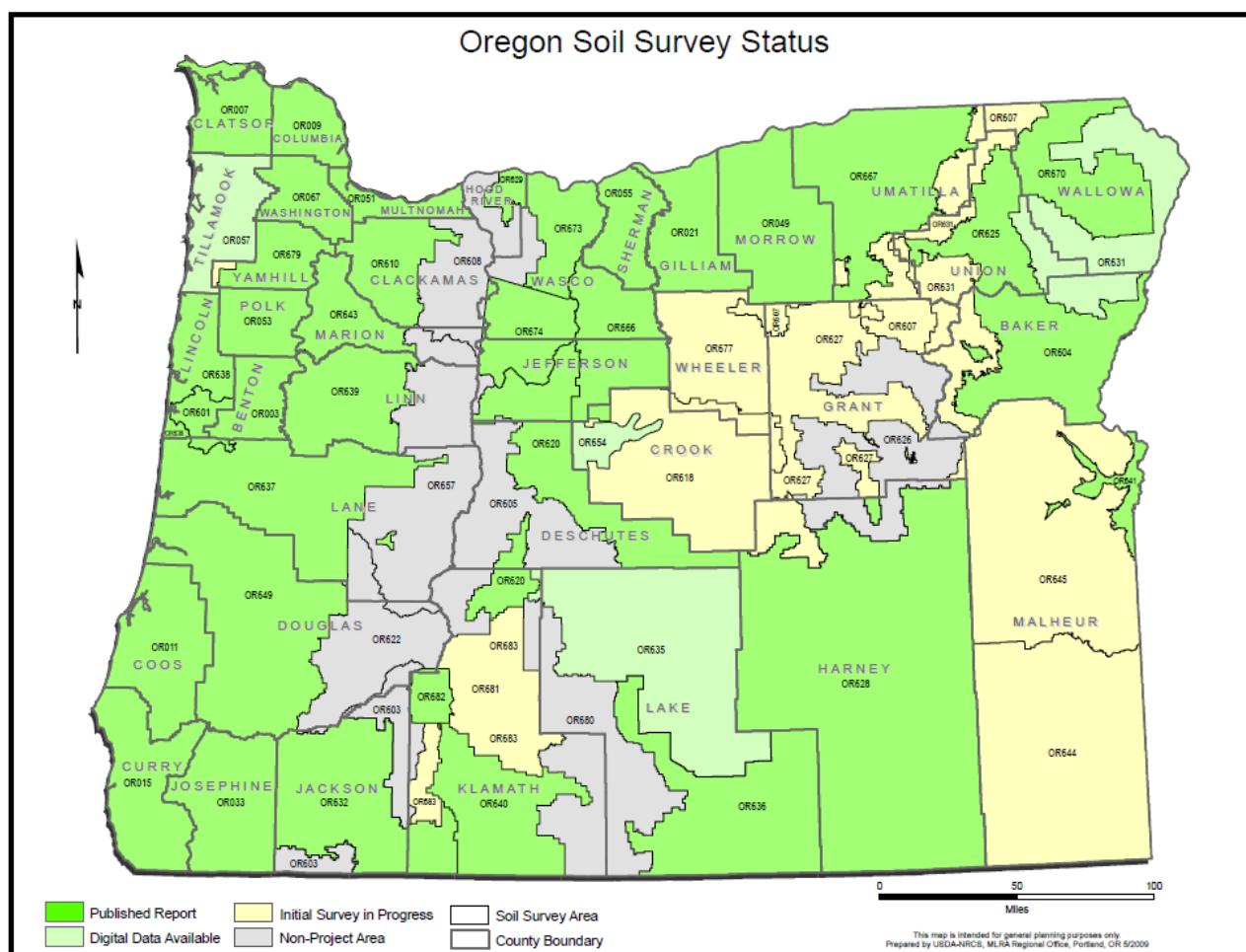
NTT does not yet have yield data or a stock management profile for Mint, so you must select “agricultural-row crops” to simulate.

Christmas Tree

NTT does not have a stock profile for Christmas Trees, but you can choose “Nursery-Evergreen-tree-stock” to simulate.

3.2. Things to Know About Oregon Soil Data

Not all of Oregon has soil data available through the Web Soil Survey tool. Figure 3.2.1 illustrates areas, in yellow or grey, lacking Web Soil Survey data, and where it will have to be entered manually as described in Section 2.1.2. Figure 3.2.1 describes the Soil Survey areas in Oregon. If the Soil Survey area is green (light or dark) it means that for this area the Soil survey map and soil data are up to date. Any soil data captured through the Web Soil Survey tool for this area will thus be current.



If the user happens to select an AOI in the Web Soil Survey for which no soil data exists, an “Incomplete data Available in Web Soil Survey” message will appear, as illustrated in Figure 3.2.2.

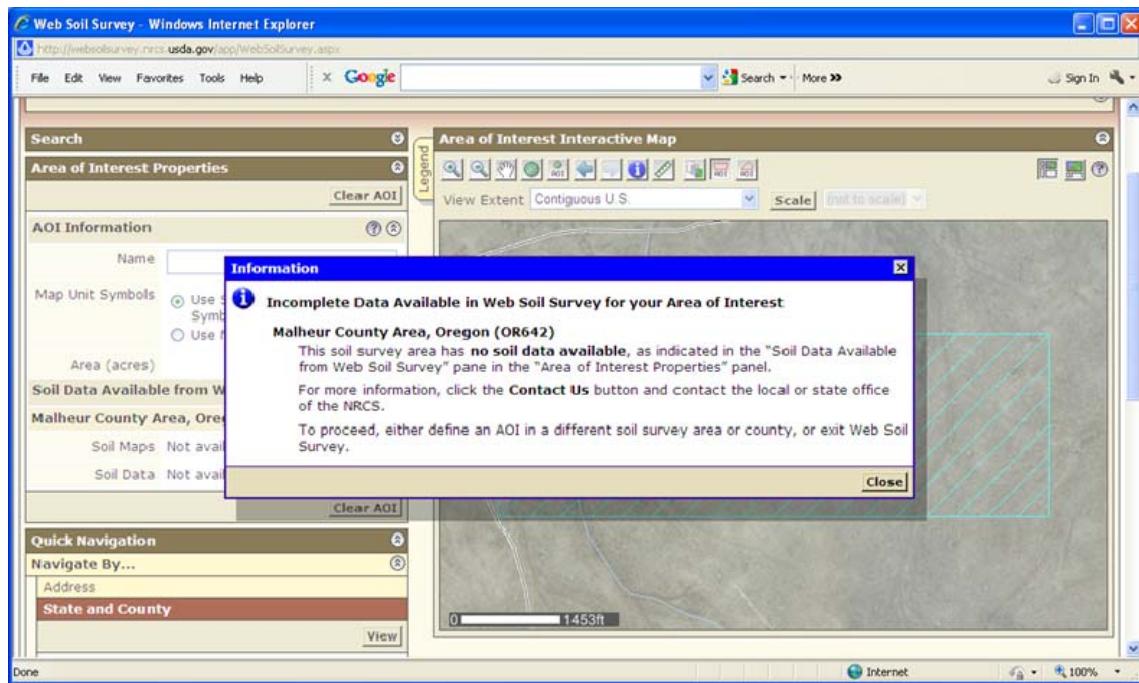


Figure 3.2.2 Web Soil Survey—Missing Soil Data message

In these cases the User will have to use the **Select Specific Soil** option from the NTT homepage and then enter the appropriate **Soil Name**, **Area** and **Slope** directly on the **Soil Information** screen.

3.3 Troubleshooting with the NTT User Guide

Missing Data

Web Soil Survey gave me an error saying that there is no soil data available for my field.

- You will have to manually choose your weather station and enter soil and slope data as described in 2.1.2

Cultural Practices

I have more than one crop on the same field.

- Not a problem. APEX can simulate multiple crops both in rotation and overlapping. If you have a rotation, add planting and kill operations in the management file at the appropriate times regardless of overlap. If you have one crop growing between the rows or underneath another crop (e.g. grass and fruit trees, vines, or bushes), add a planting operation for grass. If you do not kill a crop it will continue to grow on the field throughout the simulation.

My crop rotation does not appear in the Cropping System list.

- You will have to create your own management file as described in 2.2.4.

I tried to create my own management file, but my crop does not appear in the list of crops.

- You will have to either choose an appropriate proxy from Table 3.1 or select “Agricultural-General”.

The fertilizer I use does not appear in the drop-down list of fertilizers.

- You will have to use a combination of existing fertilizers in different amounts to create an equivalent. For example, 150 lbs/acre of 20-10-0 could be simulated with 30lbs/acre “element-N” and 15lbs/acre “element-P”.

Structural Practices:

My entire field does not drain through my buffer.

- Not a problem. just select the polygon of the portion of the field that does for running NTT. If different sections drain through different buffers, run them as separate NTT projects.

My field has small drainage ditches that are not captured on Web Soil Survey, but affect hydrology.

- In some cases, it may be appropriate to add very shallow drain tiles in the NTT structural practices to simulate your drainage ditches.

3.4. Model Basics: How NTT Works and What NTT Assumes

Data sources

All the datasets required for running NTT in selected states and counties are housed on the NTT server for ready user access. However, users may enter management information that is different from the pre-defined set available on the NTT program for their county of interest and can also save their information for future use. The following are the NTT databases that are available on the NTT server for selected states and counties and are being developed for the remaining counties in the U.S.

- Weather (precipitation, minimum temperature, maximum temperature)
- Soils
- Crop parameters
- Tillage parameters
- Properties of major fertilizer and manure products
- Typical management practices for each major crop in selected crop management zones

Weather: Temperature and precipitation information was previously downloaded from the USDA-NRCS High-resolution Climate Extractor (HCE) web page using the latitude

and longitude point for each county. Forty two years of information was downloaded. The period runs from 1960 to 2001.

Soils: NTT users import all the soils data used in simulations directly and automatically from the USDA-NRCS Web Soil Survey when they select an AOI.

Crop parameters: Most of the crop parameters used in NTT are from the APEX crop parameters file (the CROP.DAT file) that is based on years of extensive research. A few crop parameters (specifically crop agronomic uptake rates) are based on widely accepted recommendations published by cooperative extension and research centers in the United States.

Tillage: Most of the tillage parameters used in NTT simulation are based on data in the APEX tillage parameters file (the TILL.DAT file), which is also based on years of extensive research. However, a few tillage parameters, such as tillage depth are quite user-specific and are derived from local crop management information.

Management: The default crop and livestock management data used in NTT were developed from the RUSLE2 database for all crop management zones in the United States. However, management editing features in NTT allow users to create or edit management data, so the actual management data used in a simulation may be a hybrid of the RUSLE2 database information and site-specific NTT user input.

Fertilizer: The fertilizer nutrient fractions used in NTT were developed primarily from typical fertilizer compositions that are reported in commercial fertilizer sales brochures and in the USDA National Agricultural Statistics Service's (USDA-NASS's) Agricultural Prices and Chemical Usage publications. Additional nutrient fractions for various manures were based on manure nutrient compositions as reported in the American Society of Agricultural and Biological Engineers (ASABE) Data and Standards as well as cooperative extension and research service publications for land applied manure. The nutrient fractions data are stored in the APEX FERT.DAT file and include nitrogen, phosphorus, and potassium fractions in commercial fertilizers and land applied manure.

Fertigation: Fertigation is a type of field operation that applies nutrients to crops through irrigation water. Users who wish to simulate fertigation in NTT simply need to select the fertigation option from the Irrigation drop down box and then enter the nitrogen concentration of the irrigation water. Currently, nitrogen is the only nutrient that can be applied through fertigation in NTT. During NTT simulation, the APEX fertigation option is invoked, which simply applies the specified concentration of nitrogen whenever an irrigation operation occurs.

3.5. How NTT Simulates Structural Conservation Practices

3.5.1 Tile Drainage

Tile drainage is a practice for removing excess water from the subsurface of soil intended for agriculture. Drainage brings excessive soil moisture levels down for optimal crop growth. Tile drainage is often the best recourse for reducing high subsurface water levels to improve crop yields. Too much subsurface water can be counterproductive to agriculture by preventing root development, and inhibiting the growth of crops. Excessive water also can limit access to the land, particularly by farm machinery.

For NTT applications, underground drainage systems are simulated in APEX using a number of key parameters. The depth of the drainage system and the time required for the drainage system to reduce plant stress are two key parameters used in simulating tile drainage systems in NTT. Tile drainage simulation in NTT increases subsurface flow, which may provide an avenue for increased nutrient losses in subsurface flow.

3.5.2 Wetlands

Wetlands are those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas.

The wetland area is simulated as a shallow reservoir (1 ft depth) with growing wetland vegetation – it is essentially simulated as an artificial⁶ wetland and not a natural wetland. The slope of wetland area is set as one percent. Finally, the saturated hydraulic conductivity of the wetland soil is reduced to 10 percent of what is recorded for the upland soil. This reduction is based on the assumption that soils would be compacted during preparation of the area for wetland establishment. Simulated wetlands trap sediment, reduce runoff, increase infiltration, and also increase uptake of water and nutrients by the vegetation in the area covered by the wetland.

3.5.3 Contour Buffer Strip

A **contour buffer strip** is an area of land maintained in permanent vegetation that helps to control air, soil, and water quality and other environmental problems primarily on land that is used for agriculture. Buffer strips trap sediment and enhance filtration of nutrients and pesticides by slowing down runoff that could enter the local surface waters.

The buffer strip is simulated based on the width of the buffer, the crop planted, and a practice factor (PEC) that is based on soil slope, with PEC values ranging from 0.5 to 1.0. The main field area is reduced by the area calculated for the buffer strip. It is assumed that the last portion of the field next to the buffer strip has the same type of crop as the buffer strip and that the buffer strip is situated at the edge of the field.

3.5.4 Filter Strip

⁶ Artificial wetlands are often referred to as constructed wetlands.

A **filter strip** is a type of buffer strip that is an area of vegetation, generally narrow in width and long across the downslope edge of a field, that slows the rate of runoff, allowing sediments, organic matter, and other pollutants that are being conveyed by the water to be removed by settling out. Filter strips reduce erosion and the accompanying sediment-bound pollution.

A filter strip is specified in NTT by indicating its width and the type of crop planted. The width of filter strip is used to calculate its area. The area of filter strip is subtracted from the main farmland and is simulated as a separate field. Flow, sediment, and nutrients are routed from the farmland to this filter strip before leaving the edge of the farmland.

In NTT, filter strips function by providing for better infiltration of soluble nutrients, trapping of sediment, and uptake of water and nutrients by the filter strip vegetation. The saturated conductivity value was also modified for filter strip simulation in NTT.

3.5.5 Terrace System

Terrace system is a leveled section of a hill cultivated area, designed as a method of soil conservation to slow or prevent the rapid surface runoff of water. Terraces decrease hill slope-length, reduce formation of gullies, and intercept and conduct runoff to a safe outlet thereby reducing sediment content in runoff water. Often, in application the landscape is formed into multiple terraces, giving a stepped appearance. Terraces are simulated by reducing the practice factor (PEC) and adjusting the curve number (CN) values.

3.5.6 Riparian Forest

A **riparian forest** is a forested area of land adjacent to a body of water such as a river, stream, pond, lake, marshland, estuary, canal, playa or reservoir. Riparian forests are simulated in a manner similar to the filter strip practice with the additional assumption that there are trees along the length of the riparian zone in addition to selected crops that are growing in the simulated area. The forested area traps sediment and increases infiltration, thereby reducing sediment and nutrient losses. Plant uptake of nutrient in the forested area also reduces nutrient losses downstream.

3.5.7 Waterways

Waterways are vegetated channels that conduct and dispose of overland flow from upstream areas. Waterways typically work by increasing surface roughness which reduces the velocity of flow.

Waterways are simulated by assuming the area of the waterway is 5% of the total simulated area with a practice factor (PEC) of 0.40. The main area is reduced by the area calculated for the waterway. Also, the channel is assumed to be extremely shallow so that the runoff water flows in the floodplain mimicking the flow through an actual grassed waterway. Effects of waterways are simulated by adjusting the following parameters: Channel C-factor, Channel Manning's Roughness Coefficient (Channel Manning's N).

Simulated grassed waterways reduce flow, trap sediment, and increase infiltration on the grassed waterway.

3.5.8 Stream Fencing

Stream fencing to keep cattle out of streams is seen as a way to improve water quality and prevent erosion. Stream fencing will prevent animal defecation in streams, which constitutes a direct contribution of manure, manure nutrients, and pathogens to the surface water resource. In addition, stream fencing prevents bank erosion and protects the aquatic habitat.

Stream fencing is simulated by indicating the number of animals in stream, the daily amounts of manure produced by the selected animal (including horses, dairy cows, swine, cattle, sheep, and goats), and the time (hours/day) the animals stay in stream. NTT calculates nutrient deposition in the stream based on the number of animals and the manure nutrient production characteristics of those animals. The tool also estimates stream bank erosion rates and adds those to the sediment losses presented to the user in the report page.

3.6. Where to go for additional help

For additional help or to find out more about NTT, please contact Ali Saleh, Texas Institute for Applied Environmental Research, [\(254\)968-9799](tel:(254)968-9799), saleh@tiaer.tarleton.edu

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