Runoff Water Quality Index (WQI\textsubscript{ag})
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**Introduction**

**Getting Started**

Welcome to the *Water Quality Index for Runoff Water from Agricultural Fields (WQIag)*. This web-based software application was designed to provide a simple, convenient way to express multiple water quality parameters into a single, easy to understand value. A calculated WQIag# value is ranked from 1 to 10, where a value of 10 is assigned to the runoff water of highest quality and value of 1 to lowest water quality.

Below, an image of the WQIag main page shows where to find the following items:

1. Site Information
2. Field Physical Sensitivity Factors
3. Nutrient Management Factors
4. Tillage Management Factors
5. Pest Management Factors
6. Irrigation / Tile Drain Management
7. Runoff Water Quality Index (WQIag#) calculated value
8. Conservation Practices
9. WQIag# adjusted for Conservation Practices
10. Project file and Report

**WQIag** main page example screen:
To generate a single dimensionless **Runoff Water Quality Index** calculated value (\(WQI_{ag}\)), a minimal amount of user information is **required**. The easy to use worksheet design accepts user input for the following categories:
Introduction

- **Site Information** (required; see [Site Information](#))
- **Field Physical Sensitivity Factors** (required; see [Field Factors](#))
- **Nutrient Management Factors** (required; see [Nutrient Factors](#))
- **Tillage Management Factors** (required; see [Tillage Factors](#))
- **Pest Management Factors** (required; see [Pest Factors](#))
- **Irrigation / Tile Drain Management** (optional; see [Irrigation / Tile Drain Management](#))
- **Conservation Practices** (optional; see [Conservation Practices](#))

About WQIag

The **USDA** Natural Resources Conservation Service (NRCS), West National Technology Support Center (WNTSC), Water Quality and Quantity National Technology Development Team, developed and supports the Water Quality Index for Runoff Water from Agricultural Fields (WQIag).

**WQIag** is a simple, convenient way to express multiple water quality parameters into a single, easy to understand value. **WQIag** was developed to evaluate the quality of runoff water from agricultural fields.

The **US Department of Agriculture, Natural Resources Conservation Service** (USDA/NRCS) provides technical assistance (TA) and financial assistance (FA) cost shares that encourage agricultural producers to be good stewards of the Nation’s soil, water, and related natural resources on private and tribal lands. One of the key goals of implementing conservation practices is to safeguard and improve water quality of the watershed.

The **USDA/NRCS** is always looking for approaches and techniques to evaluate the effects of its programs on the environment. For example, the CEAP Program (**USDA/NRCS**, 2011) is one such program that uses the APEX model for this purpose. The **WQIag** may serve as a simple tool in the effort to evaluate the effects of the conservation practices on improving and/or sustaining the quality of water in the watershed.

**Contact Us**

For questions or comments regarding the **Water Quality Index for Runoff from Agricultural Fields (WQIag)**, please contact:
Runoff Water Quality Index (WQIag)

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Other Resources
For additional information relating to the Water Quality Index for Runoff from Agricultural Fields (WQIag), please see:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Description</th>
</tr>
</thead>
</table>
The Georgia Soil and Water Conservation Commission, P.O. BOX 8024, Athens, GA 30603 (706) 652-3065  
External link: www.gaswcc.georgia.gov |
| HUC Codes    | Six Easy Steps to Finding Your 12-digit Hydrologic Unit Code (HUC)            |
| Integrate    | USDA/NRCS Integrated Pest Management (IPM) Practice                         |
| **Pest Management** | Standard 595  
| External link: [IntegratedPestManagementPracticeStandard.pdf](https://www.pestmanagementpractices.org) |
| **Nutrient Management Practice Standard** | USDA/NRCS Nutrient Management Practice Standard 590  
| **RUSLE2** | USDA/NRCS, undated. RUSLE2 - Revised Universal Soil Loss Equation 2  
| **WQIag Review** | The Introduction to the Water Quality Index  
| Expressing water quality information in a format that is simple and easily understood by common people.  
| External link: [http://www.waterefficiency.net/WE/Articles/The_Introduction_to_the_Water_Quality_Index_15374.aspx](http://www.waterefficiency.net/WE/Articles/The_Introduction_to_the_Water_Quality_Index_15374.aspx) |
| **WQIag Tech Note** | Water Quality Index for Runoff from Agricultural Fields  
| Technical Note document by: Harbans Lal and Shaun McKinney  
| **WQIag PowerPoint** | Water Quality Index for Runoff from Agricultural Fields  
| PowerPoint document by: Harbans Lal and Shaun McKinney  
Runoff Water Quality Index (WQIag)

<table>
<thead>
<tr>
<th><strong>WQIag Documentation</strong></th>
<th>Documentation for Water Quality Index for Runoff from Agricultural Fields (WQIag). Select either Adobe Portable Document Format (PDF) or Microsoft Word (DOC) formats.</th>
</tr>
</thead>
</table>

**External links:**

- Adobe PDF: [RunoffWaterQualityIndex.pdf](#)
- Microsoft Word: [RunoffWaterQualityIndex.doc](#)

**Disclaimer**

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Using WQIag

Introduction

The Water Quality Index for Runoff from Agricultural Fields (WQIag) has an easy to use worksheet design.

To generate a single dimensionless Runoff Water Quality Index calculated value (WQIag#), a minimal amount of user information is required. The easy to use worksheet design accepts user input for the following categories:

1. Site Information - several user input fields are required; for details, see Site Information
2. Field Physical Sensitivity Factors - required; for details, see Field Factors
3. Nutrient Management Factors - required; for details, see Nutrient Factors
4. Tillage Management Factors - required; for details, see Tillage Factors
5. Pest Management Factors - required; for details, see Pest Factors
6. Irrigation / Tile Drain Management - optional; for details, see Irrigation / Tile Drain Management
7. Conservation Practices - optional; for details, see Conservation Practices

Note: Click the topic links above for additional information.

See Getting Started for more information about the location of these and other items on the WQIag main page. Also, WQIag now requires a State selection before any other user inputs. See Site Information for details.

Print a Report

After entering the required user information, use the Report button to review and print a WQIag report. See Reports Introduction for details.

Use a Project File

Using a WQIag project file is optional. A WQIag project file can be used to save / reload user inputs and WQIag values. See Project Files for details.

Some WQIag categories have more than one user input (see partially completed Example 1 below). When all of the user inputs for a category area have been entered, a WEIGHT value for the category area will be calculated (see Example 2 below). When all of the WQIag categories with
Runoff Water Quality Index (WQIag)

required inputs have been entered, the **WQIag#** (Water Quality Index value) will be calculated (see **Example 3** below).

**Example 1**: Shows partially completed Nutrient Management Factors category inputs. The calculated category **WEIGHT** remains zero (0.00) in this example:

![Nutrient Management Factors Diagram]

**Example 2**: Shows all of the Nutrient Management Factors category inputs entered. The calculated category **WEIGHT** is now 1.25 in this example:

![Nutrient Management Factors Diagram]

**Example 3**: When all of the **WQIag** categories with required inputs have been entered, the calculated **WQIag#** (Water Quality Index value) will display:

| Runoff Water Quality Index (WQIag#) | 7.19 |

**Site Information**
Site Information Activities

- Review the **Site Information** user input requirements.
- A **State** location selection is required before other user inputs.
- Enter information into all **required** fields.

Site Information Overview

This is the **Site Information** category (see **Example 1** below). All **required** fields must have user inputs before a report can be produced.

**Note:** See **Other Resources** for additional information.

Provide user inputs for:

**State:** - Select the **State** location (**required**) from the list. A **State** location selection is required before other user inputs. Changing a **State** location selection will result in a complete **WQIag** reset and restart on the main page. Attempting user inputs without a **State** selection will result in the following message:

![State Selection Required](image)

Saving user inputs to a **WQIag** project file is optional. Attempting to change a **State** location selection with previously unsaved user inputs will result in the following message:
Select Yes to continue with the State selection change and WQIag will reset and restart on the main page.
Select No to return to the WQIag main page.

**County:** - After selecting a State, select the County location (required) from the list.

**HUC:** - Enter the 12-digit Hydrologic Unit Code for your watershed classification (optional).

**Field #:** - Enter a unique Field # identifier (required).

**Field name:** - Enter a Field name identifier (required).

**Acres:** - Enter the number of Acres in the field (required).

**Project date:** - Enter a Project date for this WQIag run (required).

**Description:** - Enter a project Description for this WQIag run (required).

**Example 1:** User input fields:

Example with initial values:

Example with required fields values:
Field Physical Sensitivity Factors

Activities

- Review the **Field Physical Sensitivity Factors** category selection requirements (see [Example 1](#) below).
- Use the **Get Slope Interaction** button to input **Slope(%)**, **HS group** (Hydrologic soil group), and **K-factor** (Soil erodibility factor).
- Make a selection for **OM content** (Organic matter) in this category.
- Use the **Get Rain / Vegetation Interaction** button to identify monthly rainfall and monthly vegetation cover.

**Note:** A State, County and Slope(%) selection is required before you can enter Rain/Vegetation information.

Overview

This is the **Field Physical Sensitivity Factors** category. Make a selection from each of the following:

Click the **Get Slope Interaction** button to open a pop-up window (see [Example 2](#) below) allowing you to select Slope(%), Hydrologic soil group, and K-factor. See **Field Slope Interaction** for details.

**OM content** - Select the field percent organic matter content from the list (see [Example 3](#) below).

Click the **Get Rain / Vegetation Interaction** button to open a pop-up window (see [Example 4](#) below) allowing you to select / enter monthly rainfall and monthly vegetation cover. See **Field Rain/Veg Interaction** for details.

**Duration** - Three buttons control the **Duration** selection. Changing the **Duration** results in a change to the Rainfall/Veg WQI Ranking value and a recalculation of the WQIag#.

The **By Year** button is the default selection which uses the Rainfall/Vegetation Interaction value for the entire year, January through December. The **By Year** default selection is shown in [Example 1](#) below.
The **By Month** button allows a single month selection and uses the Rainfall/Vegetation Interaction value for the selected month (see **Example 5** below).

The **By Season** button allows a contiguous months selection and uses the Rainfall/Vegetation Interaction value for the selected range of months (see **Example 6** below).

When all of the user inputs for this category area have been entered, a **WEIGHT** value for the category area will be calculated (see **Example 1** below).

---

**Example 1:** All category selections completed for **Field Physical Sensitivity Factors**:

<table>
<thead>
<tr>
<th>FACTORS</th>
<th>DESCRIPTION</th>
<th>WQI RANKING</th>
<th>WEIGHTING FACTOR</th>
<th>WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field Physical Sensitivity Factors</td>
<td>(2% to 5%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slope (%)</td>
<td>Get Slope Interaction</td>
<td>9.00</td>
<td>0.25</td>
<td>2.25</td>
</tr>
<tr>
<td>HS group</td>
<td>A - low runoff potential</td>
<td>10.00</td>
<td>0.25</td>
<td>2.50</td>
</tr>
<tr>
<td>K-factor</td>
<td>&lt;=0.10 very low erodibility</td>
<td>6.00</td>
<td>0.25</td>
<td>1.50</td>
</tr>
<tr>
<td>OM content</td>
<td>2-4%</td>
<td>4.42</td>
<td>0.25</td>
<td>1.11</td>
</tr>
<tr>
<td>Rainfall/Veg</td>
<td>Get Rain / Vegetation Interaction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duration</td>
<td>By Year, By Month, By Season</td>
<td>Year: January - December</td>
<td>0.25</td>
<td>1.84</td>
</tr>
</tbody>
</table>

**Tooltip**

Hover the mouse over the **Get Rain / Vegetation Interaction** button to show the Rainfall/Veg tooltip:

**Source**: Displays a Station name or 'Custom'.

**Annual Precip**: Annual precipitation in inches.

**Precip/Veg**: Calculated precipitation / vegetation interaction value. **Note**: The **Precip/Veg** value shown corresponds to the **Duration** selection: **By Year**, **By Month** or **By Season**.

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Example 2: Pop-up window for Slope (%), Hydrologic soil group and K-factor:

See **Field Slope Interaction** for details.

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Example 3: Selection list for OM content (Organic matter):

- (Select one)
- >8%
- 6-8%
- 4-6%
- 2-4%
- 0.5-2%
- <0.5%

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Example 4: Pop-up window for Rain / Vegetation Interaction:
Runoff Water Quality Index (WQIag)

See **Field Rainfall/Vegetation Interaction** for details.

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**Example 5**: Pop-up window for **By Month** selection:
Click the **OK** button to save your selection or click the **Cancel** button to ignore changes.

**Example 6**: Pop-up window for **By Season** selection examples:
To perform the above example **By Season** selection for a range of contiguous months:

1. Select the starting month - April (shown on the left-side).
2. Select the ending month - September (shown on the right-side). **Note:** The contiguous months in between are automatically selected.
3. Click the **OK** button to save your selections or click the **Cancel** button to ignore changes.

Use the **Clear** button to de-select all previous selected months.
To de-select a single month, **click any selected month to de-select it** as shown for July in the example above. The above example does not contain a valid contiguous set of selected months. Clicking the **OK** button will result in the following error message:
To perform the above example **By Season** selection for a 'fall-winter-spring' range of contiguous months:

1. Select the starting month - January (shown on the left-side).
2. Select the ending month - December (shown in the middle). **Note:** The contiguous months in between are automatically selected.
3. Continue to de-select March through September by clicking each one (shown on the right-side).
4. Click the **OK** button to save your selections or click the **Cancel** button to ignore changes.

**Duration** | **By Year** | **By Month** | **By Season** | Season: October - February

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**Field Slope Interaction**

**Activities**

- Review the **Slope Interaction** selection requirements (see **Example 1** below).
- Make a selection for **Slope(%)**.
- Make a selection for **Hydrologic soil group**.
- Make a selection for **K-factor**.

**Note:** **Slope(%)**, **Hydrologic soil group** and **K-factor** selections are required to calculate a **WQIag#**.

**Overview**
From the main page, click the **Get Slope Interaction** button to open this pop-up window (see **Example 1** below). The **Get Slope Interaction** pop-up window provides a selection from each of the following:

**Slope(%)** - Select the **Slope(%)** from the list (see **Example 2** below). Field slope plays an important role in runoff generation and transport. The higher the slope value, the more susceptible it is to generate runoff and soil erosion. The field slope interacts with the site rainfall, and soil physical and erosion factors such as **Hydrologic soil group** and the **K-factor** in generating runoff.

The field **Slope(%)** selection also interacts with the **Irrigation / Tile Drain Management, Tile Drain** selection. Tile Drain selections are possible only when the field **Slope(%)** selection is 5% or less. If the field **Slope(%)** selection is greater than 5%, the **Tile Drain** selection will be limited to 'No Tile Drain (0%)'.

**Note:** A **Slope(%)** selection is required before you can enter Rain/Vegetation information.

**Hydrologic soil group** - Select the **Hydrologic soil group** from the list (see **Example 3** below). Hydrologic soil group is a group of soils having similar runoff potential under similar storm and cover conditions. Soil map unit components are assigned a hydrologic group in the NASIS soil survey database (USDA/NRCS. 2009). Most soils are placed in hydrologic groups A, B, C, or D. Soils assigned to hydrologic group 'A' have the lowest runoff potential, whereas soils in hydrologic group 'D' have the highest runoff potential.

**K-factor** - Select the **K-factor** from the list (see **Example 4** below). K-factor defines the susceptibility of a soil to sheet and rill erosion by water. It is one of the six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) that are used to predict the average annual rate of soil loss (USDA/NRCS, undated). The K-factor ranges from 0.02 to 0.69 and is based primarily on percentage of silt, sand and organic matter, the soil structure and the saturated hydraulic conductivity. The higher the K value, the more susceptible the soil is to sheet and rill erosion by water thus leading to decreasing the quality of runoff water.

Click the **OK** button to save your selections or click the **Cancel** button to ignore changes.

**Note:** See **Other Resources** for reference links.
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**Example 1:** Initial pop-up window for **Slope Interaction**:

![Slope Interaction Pop-Up Window](image)

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**Example 2:** Selection list for **Slope(%)**:

- (Select one)
- <2%
- 2% to 5%
- 5% to 10%
- 10% to 15%
- >15%

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**Example 3:** Selection list for **Hydrologic soil group**:

- (Select one)
- A - low runoff potential
- B - moderately low runoff potential
- C - moderately high runoff potential
- D - high runoff potential

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**Example 4:** Selection list for **K-factor**:

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Using WQIag

Field Rainfall / Vegetation Interaction

Activities

- Review the Rainfall / Vegetation Interaction selection requirements (see Example 1 below).
- Make a selection for Precip Source (precipitation source ): Station (weather station) or Custom. You can have both Station and Custom information but the calculated WQIag# will only use selected Precip Source.
- When the Precip Source is Station, select a Station: (weather station) from the list and select a Vegetative Cover value (Low, Medium or High) for each month. For the Station: selected, each months Precip(In) (precipitation in inches) will display along with the Annual total precipitation.
- When the Precip Source is Custom, enter Precip(In) (monthly precipitation amounts in inches) for each month and select a Vegetative Cover value (Low, Medium or High) for each month. The Annual total precipitation will accumulate as the monthly Precip(In) values are entered.
- When the Precip Source is Station and a Station: is selected, you can use the Copy button to copy the selected Station: monthly precipitation amounts to Custom monthly precipitation amounts.
- When the Precip Source is Custom, you can use the Clear button to reset all of the Custom monthly precipitation amounts to zero.

Note: Either Station or Custom Rainfall/Vegetation information is required before a WQIag# can be calculated.

Overview

The precipitation magnitude and its duration falling on the field becomes the primary source of runoff. The field sensitivity/physical factors such as slope,
soil texture, etc., control the quantity and rate of runoff. The runoff carries with it the sediments and other pollutants, both dissolved constituents as well as entraining particles.

The Precip(LMH) and Precip/Veg data columns are display only and do not allow user input. The values displayed for these two columns are computed values.

From the main page, click the Get Rain / Vegetation Interaction button to open this pop-up window (see Example 1 below). The Get Rainfall / Vegetation pop-up window provides a selection from each of the following:

**Precip Source** - Select either Station (weather station) or Custom.

**Station:** - When the Precip Source is Station, select a Station: (weather station) from the list. For the Station: selected, the monthly Precip(In) (precipitation in inches) values will display along with the Annual total precipitation.

**Precip(In)** - When the Precip Source is Custom, enter Precip(In) (monthly precipitation amounts in inches) for each month. The Annual total precipitation will accumulate as the monthly Precip(In) values are entered.

**Vegetative Cover** - Select a Vegetative Cover value (Low, Medium or High) for each month.

**Copy button** - Optionally, when the Precip Source is Station and a Station: is selected, you can use the Copy button to copy the selected Station: monthly precipitation amounts to Custom monthly precipitation amounts.

**Clear button** - Optionally, when the Precip Source is Custom, you can use the Clear button to reset all of the Custom monthly precipitation amounts to zero.

Click the OK button to save your updates or click the Cancel button to ignore changes.

**Data Entry Examples**

- Making a Precip Source - Station selection (see Example 2 below).
- Making a Precip Source - Custom selection (see Example 3 below).
- **Copy** precipitation amounts from a Station: selection to Custom (see **Example 4** below).
- **Clear** precipitation amounts in Custom (see **Example 5** below).

---

**Example 1**: Initial pop-up window for **Rainfall / Vegetation**: showing initial values (in this example Oregon and Clackamas were previously selected as the State and County):

![Get Rainfall / Vegetation Window](image)

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**Example 2**: Making a **Precip Source - Station** selection:

This example shows a climate **Station** selection in Clackamas county Oregon.
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For the climate **Station** selected, the following columns are automatically populated:

- **Precip(In)** - monthly precipitation amounts in inches.
- **Precip(LMH)** - Low, Med or High designation.
- **Precip/Veg** - Range value from 1 to 9.

### Step 1:
1. **Precip Source**: Select **Station**
2. **Station**: Select a Station: from the list (example N Willamette Exp Stn)

### Step 2:
1. **Surface Vegetation**: For each month (January through December) select the **Surface Vegetation** (Low, Medium or High) that most describes your conditions.
2. Vegetative cover (live or dead) and rainfall is classified into three categories (Low, Medium and High). The following categories are suggested for vegetative cover (live or dead):
   - Less than 30% vegetative cover = Low Vegetation (Vl)
   - 31 to 80% vegetative cover = Medium Vegetation (Vm)
   - More than 80% vegetative cover = High Vegetation (Vh)
3. The example below shows medium and high vegetation from April through November.
Step 3:
1. When all of the Surface Vegetation selections have been completed, click the OK button to save your changes or click Cancel to ignore changes.

Example 3: Making a Precip Source - Custom selection:

This example shows a Custom selection and climate entry. For a Custom selection, the following columns are automatically populated:

- **Precip(In)** - all monthly precipitation amounts (in inches) are set to zero.
- **Precip(LMH)** - set to Low designation.
- **Precip/Veg** - set to 3 (no rain and Low Surface Vegetation).

Step 1:
1. **Precip Source**: Select Custom
### Runoff Water Quality Index (WQIag)

#### Step 2:
1. **Precip(in):** For each month (January through December) enter your monthly total precipitation in inches. As each monthly amount is entered, the **Annual total** will automatically accumulate. Also, the **Precip(LMH)** column may change based on the monthly amount entered. In this example below, monthly precipitation amounts have been entered from January through May and June is waiting for input.

2. **Surface Vegetation:** For each month (January through December) select the Surface Vegetation (Low, Medium or High) that most describes your conditions. The example below shows partial data entry for January through May.

<table>
<thead>
<tr>
<th>Month</th>
<th>Precip(In)</th>
<th>Surface Vegetation (Low, Medium or High)</th>
<th>Precip(LMH)</th>
<th>Precip/Veg</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>5.30</td>
<td>Low Med High</td>
<td>Med</td>
<td>2</td>
</tr>
<tr>
<td>February</td>
<td>4.12</td>
<td>Low Med High</td>
<td>Med</td>
<td>2</td>
</tr>
<tr>
<td>March</td>
<td>2.20</td>
<td>Low Med High</td>
<td>Low</td>
<td>3</td>
</tr>
<tr>
<td>April</td>
<td>0.75</td>
<td>Low Med High</td>
<td>Low</td>
<td>6</td>
</tr>
<tr>
<td>May</td>
<td>0.30</td>
<td>Low Med High</td>
<td>Low</td>
<td>9</td>
</tr>
<tr>
<td>June</td>
<td>0.00</td>
<td>Low Med High</td>
<td>Low</td>
<td>3</td>
</tr>
<tr>
<td>July</td>
<td>0.00</td>
<td>Low Med High</td>
<td>Low</td>
<td>3</td>
</tr>
<tr>
<td>August</td>
<td>0.00</td>
<td>Low Med High</td>
<td>Low</td>
<td>3</td>
</tr>
<tr>
<td>September</td>
<td>0.00</td>
<td>Low Med High</td>
<td>Low</td>
<td>3</td>
</tr>
<tr>
<td>October</td>
<td>0.00</td>
<td>Low Med High</td>
<td>Low</td>
<td>3</td>
</tr>
<tr>
<td>November</td>
<td>0.00</td>
<td>Low Med High</td>
<td>Low</td>
<td>3</td>
</tr>
<tr>
<td>December</td>
<td>0.00</td>
<td>Low Med High</td>
<td>Low</td>
<td>3</td>
</tr>
<tr>
<td>Annual total</td>
<td>12.67</td>
<td></td>
<td>3.58</td>
<td></td>
</tr>
</tbody>
</table>

#### Step 3:
1. When all of the monthly Precip(In) precipitation amounts and Surface Vegetation selections have been completed, click the **OK** button to save your changes or click **Cancel** to ignore changes.

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Example 4: Copy precipitation amount to Custom:

Use the Copy button to copy the selected Station: monthly precipitation amounts to Custom monthly precipitation amounts.

Step 1:
1. Precip Source: Select Station
2. Station: Select a Station: from the list to see the monthly precipitation amounts in inches.

Step 2:
1. Click the Copy button to copy the selected Station: monthly precipitation amounts to Custom monthly precipitation amounts.

Example 5: Clear precipitation amounts in Custom

Use the Clear button to reset all of the Custom monthly precipitation amounts to zero.

Step 1:
1. Precip Source: Select Custom

Step 2:
1. Click the Clear button to clear the Custom monthly precipitation amounts. The monthly precipitation amounts will be reset to zero.

- Less than 30% vegetative cover = Low Vegetation (VI)
- 31 to 80% vegetative cover = Medium Vegetation (Vm)
- More than 80% vegetative cover = High Vegetation (Vh)

Nutrient Management Factors

Activities
• Review the **Nutrient Management Factors** category selection requirements (see Example 1 below).

• Make a selection for **Application rate** in this category. An **Application rate** selection is required before the other user **Nutrient Management Factors** inputs.

• Make a selection for **N-source and timing** in this category.

• Make a selection for **P-source and timing** in this category.

• Make a selection for **Soil condition / application** in this category.

**Overview**

This is the **Nutrient Management Factors** category. Nutrient management is composed of four inputs: the rate, timing, form, and method of fertilizer application. The primary objective of nutrient/pest management is to balance the application of nutrients and pesticides for the vegetative requirement to achieve sustainable crop yields while minimizing their off-site transport and losses.

The USDA/NRCS Practice Standards 590 (Nutrient Management Practice Standard) and 595 (Integrated Pest Management) respectively describes these practices in much greater details (USDA/NRCS, 2006 and USDA/NRCS, 2010).

**Note:** See Other Resources for reference links.

Make a selection from each of the following:

**Application rate** - Select the nutrient application rate from the list (see Example 2 below). An **Application rate** selection is required before the other user **Nutrient Management Factors** inputs. Many of the selections are based on State Land Grant University (LGU) recommendations.

Higher fertilizer application rates lead to increasing water quality concerns. Farmers generally apply fertilizers using LGU recommendations.

**N-source and timing** - Select the nitrogen (N) source and timing from the list (see Example 3 below).

The timing of fertilizer application plays an important role in the fate of nutrients because of the physiological effectiveness of the plant to uptake the applied nutrients. If applied at the optimum time, a large percentage of nutrients are taken up by the plants, thus minimizing negative impact on the water quality.
**P-source and timing** - Select the phosphorus (P) source and timing from the list (see **Example 4** below).

The timing of fertilizer application plays an important role in the fate of nutrients because of the physiological effectiveness of the plant to uptake the applied nutrients. If applied at the optimum time, a large percentage of nutrients are taken up by the plants, thus minimizing negative impact on the water quality.

**Soil condition / application** - Select the soil condition / nutrient application method from the list (see **Example 5** below).

Application method and soil condition at the time of fertilizer application are two additional factors that play key role in plant nutrient uptake and impact on water quality. Fertilizer directly injected into dry/well drained soils is best for plant uptake and also causes minimal impact on the water quality.

Attempting to make a selection for **N-source and timing, P-source and timing** or **Soil condition / application** before an **Application rate** has been selected will result in the following message:

![WQIag Message](image)

When all of the user inputs for this category area have been entered, a **WEIGHT** value for the category area will be calculated (see **Example 1** below).

---

**Example 1**: All category selections completed for **Nutrient Management Factors**:

---
Runoff Water Quality Index (WQI\textsubscript{ag})

<table>
<thead>
<tr>
<th>FACTORS</th>
<th>DESCRIPTION</th>
<th>WQI RANKING</th>
<th>WEIGHTING FACTOR</th>
<th>WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nutrient Management Factors</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application rate</td>
<td>LGU recommendations</td>
<td>5.00</td>
<td>0.25</td>
<td>1.25</td>
</tr>
<tr>
<td>N-source and timing</td>
<td>Synthetic fertilizer, single, pre-growing season</td>
<td>6.00</td>
<td>0.25</td>
<td>1.50</td>
</tr>
<tr>
<td>P-source and timing</td>
<td>Synthetic fertilizer, pre-growing season</td>
<td>2.00</td>
<td>0.25</td>
<td>0.50</td>
</tr>
<tr>
<td>Soil condition / application</td>
<td>Dry/well drained, N fertilizer, broadcasted</td>
<td>6.00</td>
<td>0.25</td>
<td>1.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.25</td>
</tr>
</tbody>
</table>

Example 2: Selection list for Application rate:

- (Select one)
  - No fertilizer applied
  - 50\% less than LGU recommendations
  - 40\% less than LGU recommendations
  - 30\% less than LGU recommendations
  - 20\% less than LGU recommendations
  - 10\% less than LGU recommendations
  - LGU recommendations
  - 10\% more than LGU recommendations
  - 20\% more than LGU recommendations

Example 3: Selection list for N-source and timing:

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### Example 4: Selection list for P-source and timing:

<table>
<thead>
<tr>
<th>(Select one)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Synthetic fertilizer, single, during growing season</td>
<td></td>
</tr>
<tr>
<td>Synthetic fertilizer, single, pre-growing season</td>
<td></td>
</tr>
<tr>
<td>Synthetic fertilizer, single, slow release</td>
<td></td>
</tr>
<tr>
<td>Composted organics, single, pre-growing season</td>
<td></td>
</tr>
<tr>
<td>Uncomposted manure, single, pre-growing season</td>
<td></td>
</tr>
<tr>
<td>Synthetic fertilizer, split application, during growing season</td>
<td></td>
</tr>
<tr>
<td>Synthetic fertilizer, split application, pre-growing season</td>
<td></td>
</tr>
<tr>
<td>Composted organics, split application, pre-growing season</td>
<td></td>
</tr>
<tr>
<td>Uncomposted manure, split application, 1-2 days prior to planting</td>
<td></td>
</tr>
<tr>
<td>Uncomposted manure, split application, 3-7 days prior to planting</td>
<td></td>
</tr>
<tr>
<td>Uncomposted manure, split application, &gt; 7 days prior to planting</td>
<td></td>
</tr>
</tbody>
</table>

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### Example 5: Selection list for Soil condition / application method:

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Tillage Management Factors

Activities

- Review the Tillage Management Factors category selection requirements (see Example 1 below).
- Make a selection for Description / STIR.

Overview

This is the Tillage Management Factors category.

The effect of soil tillage on soil erosion is well established. The more the soil is tilled, the more susceptible it becomes to erosion. Thus, it is an important factor in evaluating the quality of runoff water from a field. Soil Tillage Intensity Rating (STIR) is a tool that has been widely used for evaluating the soil disturbance as well as the severity of the disturbance caused by tillage operations. Specific components of STIR value include: Operational
speed of tillage operation, tillage type, depth of tillage operation and percentage of soil surface area disturbed.

**Note:** See Other Resources for reference links.

Make a selection from each of the following:

**Description / STIR** - Select the **Description / STIR** from the list (see **Example 2** below).

The STIR value can range between 0-200. Low STIR value reduces likelihood of sheet rill erosion. By definition, No-Till operation gets the STIR value of 30.

When all of the user inputs for this category area have been entered, a **WEIGHT** value for the category will be calculated (see **Example 1** below).

**Example 1:** All category selections completed for **Tillage Management Factors**:

<table>
<thead>
<tr>
<th>FACTORS</th>
<th>DESCRIPTION / STIR</th>
<th>WQI RANKING</th>
<th>WEIGHTING FACTOR</th>
<th>WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tillage Management Factors</td>
<td>Mulch Till or STIR Value 31 to 60</td>
<td>7.50</td>
<td>1.00</td>
<td>7.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.25</td>
<td>1.88</td>
</tr>
</tbody>
</table>

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**Example 2:** Selection list for **Description / STIR**:

(Select one)

- No Till or STIR Value < 30
- Mulch Till or STIR Value 31 to 60
- Conventional Till or STIR Value 60 to 100
- Intensive Till or STIR Value > 100

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**Pest Management Factors**

**Activities**
Runoff Water Quality Index (WQIag)

- Review the **Pest Management Factors** category selection requirements (see Example 1 below).
- Make a selection for **Description**.

**Overview**

This is the **Pest Management Factors** category.

Pests (weeds, insects, and diseases) are expected elements of a farming system. Considerable amount of efforts and resources are devoted on controlling and/or managing them. Modern pest management approach uses combination of practices generally referred to as **Integrated Pest Management (IPM)**. They incorporate crop rotations, cultural practices, scouting, crop selections, and other field practices to prevent pest problems from occurring. When pest infestations do occur at damaging levels they are controlled using chemicals in the most effective way with minimum risk to environmental including water quality.

Make a selection from each of the following:

**Description** - Select the **Description** from the list (see Example 2 below). Several of the selections are based on **IPM** recommendations.

When all of the user inputs for this category have been entered, a **WEIGHT** value for the category will be calculated (see Example 1 below).

---

**Example 1**: All category selections completed for **Pest Management Factors**:

<table>
<thead>
<tr>
<th>FACTORS</th>
<th>DESCRIPTION</th>
<th>WQI RATING</th>
<th>WEIGHTING FACTOR</th>
<th>WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pest Management Factors</td>
<td>Basic IPM - Threshold-based suppression with additiona ▼</td>
<td>7.00</td>
<td>1.00</td>
<td>7.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.25</td>
<td>0.25</td>
<td>1.75</td>
</tr>
</tbody>
</table>

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---

**Example 2**: Selection list for **Description**:
Irrigation / Tile Drain Management

Activities

- Review the **Irrigation / Tile Drain Management** category selection requirements. An **Irrigation / Tile Drain Management** category selections are optional and the initial default selection values are 'No irrigation (0%)' and 'No Tile Drain (0%)' (see [Example 1](#) below).
- Make a selection for **Irrigation**.
- Make a selection for **Tile Drain**.

Overview

This is the **Irrigation / Tile Drain Management** category.

Irrigation is used to supplement rainfall for successful crop production. There is no indication how irrigation could influence the overall quality of water from an agricultural field. In addition, the irrigation methods could influence the runoff and its quality differently based upon field slope and its soil physical properties such as slope, organic matter (OM) content and rain pattern. For example, surface irrigation on level basins with blocked ends will not affect the aggregated seasonal runoff from agricultural field. On the other hand, irrigation using wild flooding could add significantly to the seasonal runoff water quality. It is mainly due to uncertain and unpredictable rainfall patterns. At the tail end of a dry spell if the producer decides to irrigate and saturates a field; it would generate much higher runoff from a rainfall event than another adjacent field that did not get any irrigation -- thus leading to lower **WQIag** value. However, the magnitude of the negative impact of irrigation on **WQIag** could vary significantly depending on the method of irrigation.

Make a selection from each of the following:

**Irrigation** - Select the **Irrigation** from the list (see [Example 2](#) below).
The magnitude of the negative impact (percentage used for reducing the WQIag\(^\#\) value) of irrigation on the WQIag\(^\#\) can vary significantly depending on the method of irrigation.

**Tile Drain** - Select the Tile Drain from the list (see Example 3 below).

The selection of a Tile Drain method can have an effect on the Nutrient Management Factors, Tillage Management Factors and Pest Management Factors (NTP) category calculated weight values.

The magnitude of the positive or negative impact (percentage used for increasing or reducing the NTP category calculated weight values) of a Tile Drain selection on the NTP category calculated weight values can vary significantly depending on the Tile Drain method selected.

---

**Example 1**: Category selections for Irrigation / Tile Drain Management:

```
<table>
<thead>
<tr>
<th>Irrigation / Tile Drain Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigation</td>
</tr>
<tr>
<td>No irrigation (0%)</td>
</tr>
<tr>
<td>Tile Drain</td>
</tr>
<tr>
<td>No Tile Drain (0%)</td>
</tr>
</tbody>
</table>
```

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---

**Example 2**: Selection list for Irrigation:

<table>
<thead>
<tr>
<th>No irrigation (0%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Center Pivot (-10%)</td>
</tr>
<tr>
<td>Center Pivot with Polyacrylamide (PAM) (-1.5%)</td>
</tr>
<tr>
<td>Level basinblocked end (0%)</td>
</tr>
<tr>
<td>Sprinkler (-5%)</td>
</tr>
<tr>
<td>Surface - Graded border and surge (-15%)</td>
</tr>
<tr>
<td>Surface - Graded furrow (-20%)</td>
</tr>
<tr>
<td>Surface - Graded furrow with Polyacrylamide (PAM) (-5%)</td>
</tr>
<tr>
<td>Surface - Wild flood (-25%)</td>
</tr>
<tr>
<td>Trickle/Drip (0%)</td>
</tr>
</tbody>
</table>

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Example 3: Selection list for **Tile Drain**:

<table>
<thead>
<tr>
<th>Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Tile Drain (0%)</td>
</tr>
<tr>
<td>Tile Drain standard density (-20% NTP)</td>
</tr>
<tr>
<td>Tile Drain standard density with Bio-reactor (+10% NTP)</td>
</tr>
<tr>
<td>Tile Drain standard density with Wetland/Pond (+10% NTP)</td>
</tr>
<tr>
<td>Tile Drain standard density with vegetative filter (0% NTP)</td>
</tr>
<tr>
<td>Tile Drain high density (-25% NTP)</td>
</tr>
<tr>
<td>Tile Drain high density with Bio-reactor (+5% NTP)</td>
</tr>
<tr>
<td>Tile Drain high density with Wetland/Pond (+5% NTP)</td>
</tr>
<tr>
<td>Tile Drain high density with vegetative filter (0% NTP)</td>
</tr>
</tbody>
</table>

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**Conservation Practices**

**Activities**

- Review the optional **Conservation Practices** category selection requirements. **Conservation Practice** category selections are optional and the initial default # selected value is zero (see **Example 1** below).
- Make up to 3 **Conservation Practices** selections.

See **Definitions** for an explanation of each of the **Conservation Practices**.

**Overview**

This is the **Conservation Practices** category:

Click the **Get Conservation Practice(s)** button to open a pop-up window allowing you to select up to 3 **Conservation Practices** (see **Example 2** below).

**Note:** See **Other Resources** for additional information.

---

Example 1: **Conservation Practices** and **Get Conservation Practice(s)** button on main page:
Example 2: Selection window for Conservation Practices:

<table>
<thead>
<tr>
<th>Practice Name</th>
<th>NRCS Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conservation Cover</td>
<td>327</td>
<td>The establishment and maintenance of permanent vegetative cover on retired agricultural land or highly erodible land.</td>
</tr>
<tr>
<td>Contour Buffer</td>
<td>332</td>
<td>Strips of permanent vegetation</td>
</tr>
<tr>
<td><strong>Strip</strong></td>
<td>established on a field’s contour to reduce erosion, slow sediment transport and reduce runoff.</td>
<td></td>
</tr>
<tr>
<td>-----------</td>
<td>-----------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Contour Stripcropping</strong></td>
<td>A planting system in which crops are grown in an alternating pattern with fallow strips of equal width to reduce soil erosion and water degradation.</td>
<td></td>
</tr>
<tr>
<td><strong>Field Borders</strong></td>
<td>Permanently vegetated borders established around fields and pastures to reduce soil erosion.</td>
<td></td>
</tr>
<tr>
<td><strong>Field Stripcropping</strong></td>
<td>A planting system in which crops are grown in alternating strips with grasses to reduce soil erosion and runoff.</td>
<td></td>
</tr>
<tr>
<td><strong>Filter Strip</strong></td>
<td>Strips of vegetation located between cropland, grazing land or disturbed areas and water sources to protect water quality.</td>
<td></td>
</tr>
<tr>
<td><strong>Grassed Waterway</strong></td>
<td>Natural or constructed grass channels established within a field to slow the flow of water, re-direct excess water from fields and to prevent soil erosion.</td>
<td></td>
</tr>
<tr>
<td><strong>Riparian Forest Buffer</strong></td>
<td>Use trees or shrubs to reduce sediment, organic matter, nutrients and pesticides in surface runoff alongside watercourses.</td>
<td></td>
</tr>
<tr>
<td><strong>Sediment Basin</strong></td>
<td>An impoundment constructed to temporarily capture runoff, trap sediment, reduce soil erosion and improve water quality.</td>
<td></td>
</tr>
<tr>
<td><strong>Water and Sediment Control Basins</strong></td>
<td>A water recovery system designed to collect, store and transport tailwater for reuse in an irrigation system.</td>
<td></td>
</tr>
</tbody>
</table>

### Project Files

### Activities

- **Open** an existing **WQIag** project file.
Runoff Water Quality Index (WQIag)

- **Save** user inputs / selections to a new **WQIag** project file. The **WQIag** project file extension is: **wqiproj** (e.g. a project file named 'FieldOne' would have a complete file name of: **FieldOne.wqiproj**).
- **Save** user inputs / selections to another project file name (**Save As**).

**Overview**

Using a project file in **WQIag** is optional. You can **save** user inputs / selections to a project file or **open** a previously saved project file to restore user inputs / selections:

- **Project file:** - The optional **Project file:** value is set to '(none)' and can be found toward the bottom of the WQIag main page (see **Example 1** below).

  **Open** - Click the **Open** button to load a previously saved project file (see **Example 2** below).

  **Close** - Click the **Close** button to close an open project file (see **Example 3** below). If changes were made to the open project file, a warning message will display.

  **Save** - Making a change in **WQIag** will cause the **Save** button to appear. To save inputs / selections to a project file, click the **Save** button. Enter a **Save in:** location and a **File name:** (see **Example 4** below).

  **Save As** - To save inputs / selections to an existing or another project file, click the **Save** button. Enter a **Save in:** location and the existing or different **File name:** (see **Example 4** below).

---

**Example 1:** Project file: location and initial value:

```
Runoff Water Quality Index (WQIag) with additional Conservation Practices 0.00

Project file: (none) Open Report
```

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**Example 2:** To **Open** a **WQIag** project file:

1. Click the **Open** button to see the **Open** dialog screen.
2. Identify a **Look in**: location (e.g. Temp1)
3. Select a **File name**: (e.g. FieldOne.wqiproj).
4. Click the **Open** dialog screen **Open** button. The **Project file**: value will show the now opened file name and the **Close** button appears.
5. You can open a project file when the **Open** button and **Save** button are present. A warning message (see below) will display allowing you to continue without saving your previous changes.
Example 3: To close a WQIag project file:

1. Click the Close button to close the opened file and return to the '(none)' value.

2. If changes were made after the project file was opened, the Close button and the Save button will appear (see below). A warning message (see below) will display when changes were made and you attempt to close an open project file.
Example 4: To **Save** a project file:

1. Click the **WQI Save** button to see the **Save As** dialog screen.
2. Identify a **Save in**: location (e.g. Temp1)
3. Enter a **File name**: (e.g. FieldOne).
4. Click the **Save As** dialog screen **Save** button.

**Example saving changes to a new project file or open a project file:**

**Example saving changes to an opened project file or close the project file:**

**Example saving changes to a new project file named 'FieldFour':**
Runoff Water Quality Index (WQIag)

Example saving changes to an existing project file named 'FieldOne':

Warning message when saving to an existing project file:
Save As

C:\Temp\FieldOne.wqproj already exists.
Do you want to replace it?

Yes  No

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Reports

Introduction

The Water Quality Index for Runoff from Agricultural Fields (WQIag) produces a report when all required fields have been entered and a WQIag# value has been calculated. Use the Report button at the bottom right-side of the WQIag main page to access the pop-up Report window.

Overview

From the main page, click the Report button (see Example 1 below) to view the WQIag Report pop-up window.

If all required fields have not been entered or a WQIag# value has not been calculated, a message will display showing what information is still required (see Example 2 below).

When all required fields have been entered and a WQIag# value has been calculated, a WQIag Report pop-up window will show the report (see Example 3 below).

Click the Print button (bottom right-side) to select a printer and print the WQIag report (see Example 4 below).

Example 1: Report button location on main page:

Example 2: Report: button requirements message:
Example 3: WQIag Report:
### WQIag Report

**Runoff Water Quality Index (WQIag) Report**

- **Report date:** 12/5/2012 3:08 PM
- **Project date:** 11/12/2012
- **Project desc:** Oregon Hay Farms
- **State:** Oregon  **County:** CLACKAMAS  **HUC:** 17090009
- **Station:** OREGON CITY OR6334
- **Field #:** 1  **Acres:** 80  **Field name:** Westside Hay

WQIag# with additional Conservation Practices: 7.62

### WQIag Factors

#### Field Physical Sensitivity

- **Slope(%):** (<2%)
- **HS group:** (A - low runoff potential)
- **K-factor:** (0.11 - 0.20 low erodibility)
- **OM content:** 2-4%
- **Rainfall/Veg:** Station
- **Duration:** Year: January - December

<table>
<thead>
<tr>
<th>Month</th>
<th>Precip (In)</th>
<th>Veg Cover</th>
<th>Month</th>
<th>Precip (In)</th>
<th>Veg Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>7.13</td>
<td>Low</td>
<td>July</td>
<td>0.78</td>
<td>High</td>
</tr>
<tr>
<td>February</td>
<td>5.21</td>
<td>Low</td>
<td>August</td>
<td>1.16</td>
<td>High</td>
</tr>
<tr>
<td>March</td>
<td>4.78</td>
<td>Low</td>
<td>September</td>
<td>2.05</td>
<td>Medium</td>
</tr>
<tr>
<td>April</td>
<td>3.41</td>
<td>Medium</td>
<td>October</td>
<td>3.44</td>
<td>Low</td>
</tr>
<tr>
<td>May</td>
<td>2.54</td>
<td>Medium</td>
<td>November</td>
<td>6.87</td>
<td>Low</td>
</tr>
<tr>
<td>June</td>
<td>1.91</td>
<td>High</td>
<td>December</td>
<td>7.79</td>
<td>Low</td>
</tr>
</tbody>
</table>

#### Nutrient Management

- **Application rate:** LGU recommendations
- **N-source and timing:** Composted organics, single, pre-growing season
- **P-source and timing:** Composted organics, pre-growing season
- **Soil condition / application method:** Moist (25% field capacity in upper 24 in), N-broadcasted

#### Tillage Management

- **Mulch Till or STIR Value 31 to 60**

#### Pest Management

- **Basic IPM - Threshold-based suppression with additional site-specific risk mitigation**

#### Irrigation / Tile Drain Management

- **No irrigation (0%)**
- **No Tile Drain (0%)**

#### Conservation Practices

- **Filter Strip**
Example 4: Print the WQIag Report:

![Print dialog box](image)

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