Greenhouse Gas Calculator for Organic Waste Management:

User Guide

Environment and Climate Change Canada
Environnement et Changement climatique Canada

Canada

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Environment and Climate Change Canada
Public Inquiries Centre
12th Floor, Fontaine Building
200 Sacré-Coeur Boulevard
Gatineau QC K1A 0H3
Telephone: 819-938-3860
Toll Free: 1-800-668-6767 (in Canada only)
Email: enviroinfo@ec.gc.ca

Aussi disponible en français

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1. Purpose

Environment and Climate Change Canada (ECCC) developed this *GHG Calculator for Organic Waste Management* (hereafter referred to as the *GHG Calculator* or *Calculator*) for use by private and public sector organizations to calculate and compare greenhouse gas (GHG) emissions of baseline and alternative management scenarios for a variety of organic waste materials. This *User Guide* is intended to support the use of the *GHG Calculator for Organic Waste Management*.

The *Guide* is organized into the following sections:

- **Section 2: General Information** provides an overview of the *GHG Calculator* worksheet organization and cell colour codes.
- **Section 3: Entering User Input** provides an illustrated walkthrough of user inputs required in the *GHG Calculator*.
- **Section 4: Viewing Results** provides information on the format of results provided by the *GHG Calculator*
- **Section 5: Frequently Asked Questions** provides answers to common questions.

For information about the methodologies adopted in the *Calculator*, please refer to the *Methodology Report*.

2. General Information

The *GHG Calculator for Organic Waste Management* includes five worksheets that are visible to the user. These worksheets are summarized in Table 2-1 (below), and the sheet tabs are shown in Figure 2-1 (below). User input is entered on the "User Input" sheet, and results are viewed on the "Output_Cumulative Emissions" and "Output_Annual Emissions" sheets.

Figure 2-1: Screenshot of the worksheet tabs that are visible to a user of the *GHG Calculator*.

Table 2-1: Summary of visible worksheets in the *GHG Calculator*.

Worksheet	Description
Introduction	Provides information about the *GHG Calculator*, including a brief description of how it works, the file structure and instructions for use
User Input	Accepts user input required to model GHG emissions associated with the selected waste management options
Output_Cumulative Emissions	Summarizes the cumulative emissions associated with waste management scenarios entered on the "User Input" sheet
Output_Annual Emissions	Summarizes the annual emissions associated with waste management scenarios entered on the "User Input" sheet for a specific year
MSW&SSO Calc	Allows users to define a custom mixed municipal solid waste (MSW) composition

The cells of the *GHG Calculator* are colour-coded to indicate whether and how a user can interact with them:

Table 2-2: Legend and descriptions of cell colours and icons used throughout the *GHG Calculator*.

Colour	Description
White	Provides information or instruction, or serves as a placeholder when something is not application (“NA”).
Grey	Provides a value that is automatically calculated based on a formula within the cell.
Green	Accepts a numerical, non-zero, positive value.
Yellow	Accepts a numerical, non-zero, positive value. Yellow cells are associated with recommended defaults that can be viewed by clicking on a nearby green ***?*** (question mark) symbol.
Blue	Includes a drop-down list that is accessed by clicking on the cell. Only accepts a value selected from its drop-down list.
Green question mark	Provides additional information, such as recommended default values and descriptions of terminology. Click on the icon to view the information.
Orange	Help a user navigate through the file by switching to the next (or previous) worksheet. Click on the cell to move to the next (or previous) worksheet.
Grey buttons	Perform an action (by running a hidden macro). Click on the button to perform the specified action.

2.1. Software Requirements

The GHG Calculator for Organic Waste Management was developed in Microsoft Office Excel 2016. It is recommended that the Calculator be opened using Excel 2016 or a newer version.

In order for the GHG Calculator to work, users must enable macros upon opening the Calculator file by clicking on “Enable Content” in the dialog box that appears at the top of the window (see Figure 2-2, at right).

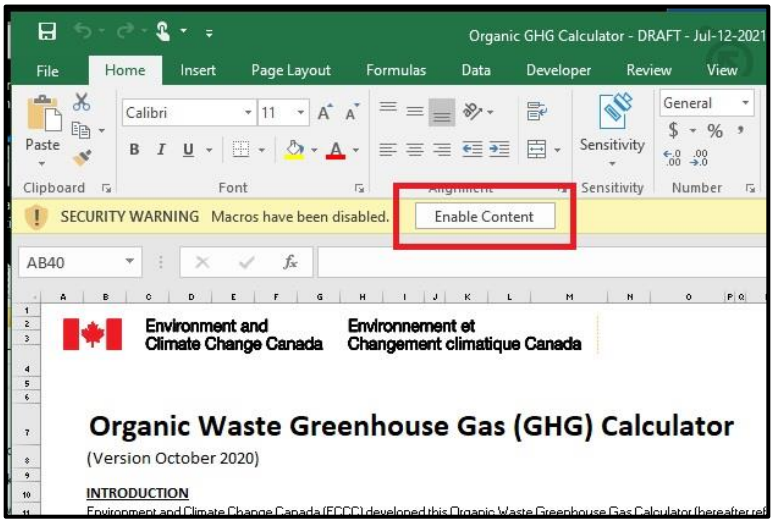


Figure 2-2: Screenshot of the “Introduction” sheet, identifying the “Enable Content” button that must be pressed in order to enable macros.

3. Entering User Input

Using the *GHG Calculator* involves three steps, which are all completed on the "User Input" sheet (Figure 3-1, at right):

- Step 1: Define Your Modeling Options
- Step 2: Define Your Waste Stream Inputs
- Step 3: Define Your Management Endpoint Options

These steps should be completed in order (i.e. Step 1, Step 2, and then Step 3). The steps are explained in the following subsections.

No other input is required to use the *GHG Calculator*, although users may enter user-defined waste composition data for mixed MSW, if available.

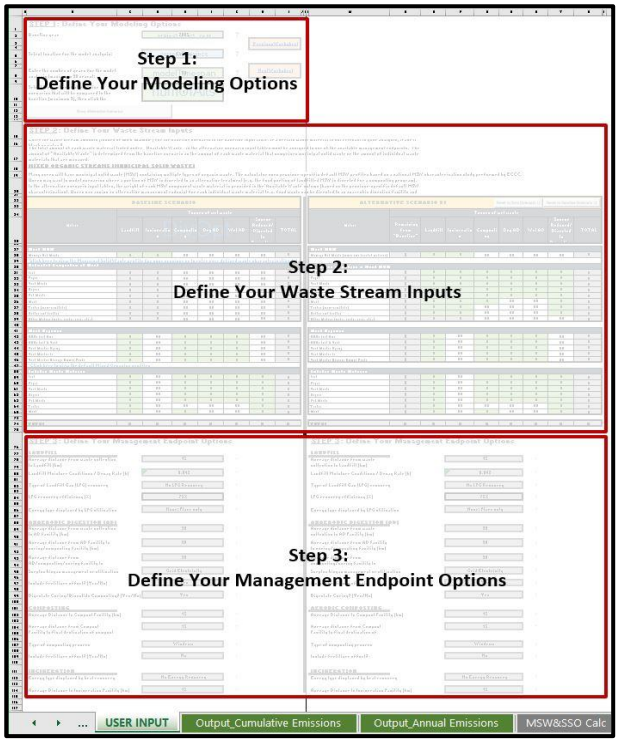


Figure 3-1: Screenshot of the "User Input" sheet, identifying the three steps required to model GHG emissions from organic waste management.

3.1. Step 1: Define Your Modeling Options

The first step in the *Calculator* requests information on modeling options, including:

- The baseline year;
- The location for model analysis;
- The number of years for model analysis; and
- The number of alternative scenarios that will be compared to the baseline.

This information is entered at the top of the "User Input" sheet, under the title "Step 1: Define Your Modeling Options", as shown in Figure 3-2 (below). These inputs are described in Table 3-1 (below).

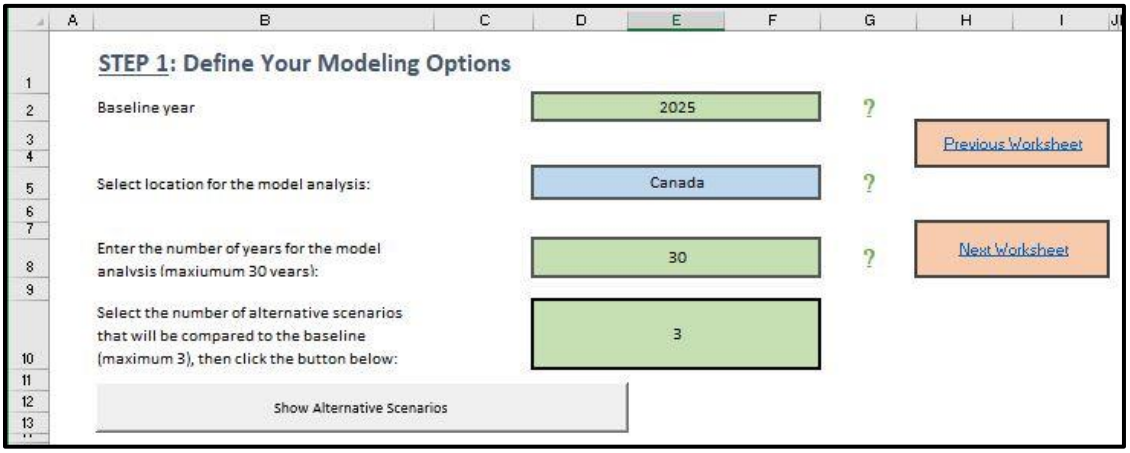


Figure 3-2: Screenshot of the "User Input" sheet, showing the "Step 1" portion of the sheet.

Table 3-1: Four parameters required to complete “Step 1” on the “User Input” sheet.

Parameter	Description	Options
Baseline year	Indicates the year at which to start the model analysis	Enter any whole number between 2000 and 2200
Location for model analysis	Province/territory-specific or national average values will be assigned for grid electricity GHG intensity, default landfill decay rates, and default municipal solid waste characterization	Select an option from the drop-down list, which includes the 13 provinces and territories as well as “Canada” (to use national average values instead of values specific to a province or territory)
Number of years for model analysis	Indicates the number of years for the model to analyze	Enter any whole number between 1 and 30
Number of alternative scenarios that will be compared to the baseline	Indicates how many alternative scenarios will be displayed on the “User Input”, “Output_Cumulative Emissions”, and “Output_Annual Emissions” sheets	Enter any whole number between 1 and 3, then press the “Show Alternative Scenarios” button

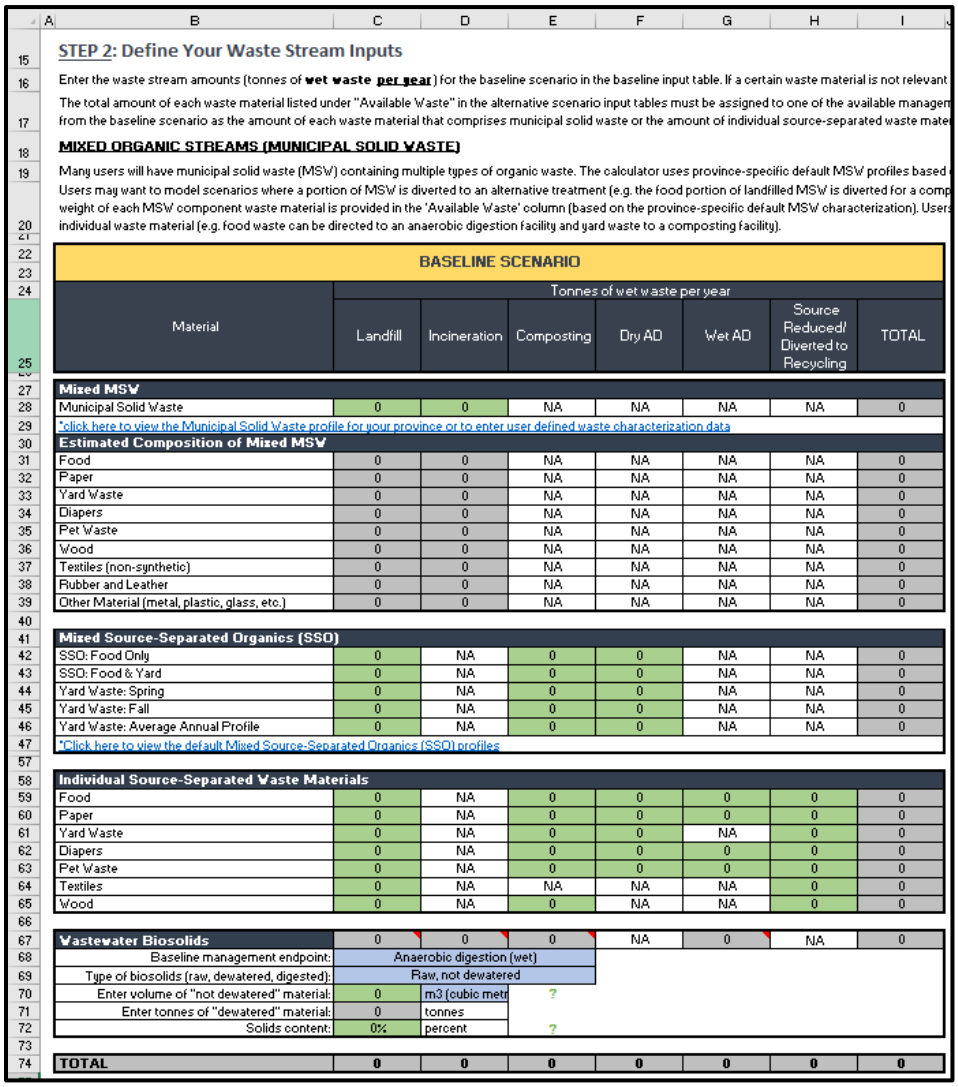
3.2. Step 2: Define Your Waste Stream Inputs

Once the modeling options have been entered under “Step 1” of the “User Input” sheet, the next step is to define the waste stream being modeled. This is done by entering values into the appropriate cells within the tables under the title “Step 2: Define Your Waste Stream Inputs”. This section includes two to four tables, depending on how many alternative scenarios are selected under Step 1. The first table defines the baseline scenario (shown in Figure 3-3, below) to which the alternative scenario(s) will be compared. The remaining table(s) define the alternative scenario(s).

The tables are organized into four general categories of materials:

- Mixed municipal solid waste (MSW);
- Mixed source-separated organics (SSO);
- Individual source-separated waste materials; and
- Wastewater biosolids.

Mixed MSW can only be managed through landfilling or incineration. When separated from the mixed MSW stream, mixed source-separated organics (SSO) and the individual source-separated waste materials can be managed through landfilling, incineration, composting, dry AD, or wet AD, as summarized in Table 3-2 (below).



STEP 2: Define Your Waste Stream Inputs

Enter the waste stream amounts (tonnes of **wet waste per year**) for the baseline scenario in the baseline input table. If a certain waste material is not relevant

The total amount of each waste material listed under "Available Waste" in the alternative scenario input tables must be assigned to one of the available managem from the baseline scenario as the amount of each waste material that comprises municipal solid waste or the amount of individual source-separated waste mate

MIXED ORGANIC STREAMS (MUNICIPAL SOLID WASTE)

Many users will have municipal solid waste (MSW) containing multiple types of organic waste. The calculator uses province-specific default MSW profiles based Users may want to model scenarios where a portion of MSW is diverted to an alternative treatment (e.g. the food portion of landfilled MSW is diverted for a comp weight of each MSW component waste material is provided in the 'Available Waste' column (based on the province-specific default MSW characterization). Users individual waste material (e.g. food waste can be directed to an anaerobic digestion facility and yard waste to a composting facility).

BASELINE SCENARIO

Material	Tonnes of wet waste per year						
	Landfill	Incineration	Composting	Dry AD	Wet AD	Source Reduced/ Diverted to Recycling	TOTAL
Mixed MSW							
Municipal Solid Waste	0	0	NA	NA	NA	NA	0
*click here to view the Municipal Solid Waste profile for your province or to enter user defined waste characterization data							
Estimated Composition of Mixed MSW							
Food	0	0	NA	NA	NA	NA	0
Paper	0	0	NA	NA	NA	NA	0
Yard Waste	0	0	NA	NA	NA	NA	0
Diapers	0	0	NA	NA	NA	NA	0
Pet Waste	0	0	NA	NA	NA	NA	0
Wood	0	0	NA	NA	NA	NA	0
Textiles (non-synthetic)	0	0	NA	NA	NA	NA	0
Rubber and Leather	0	0	NA	NA	NA	NA	0
Other Material (metal, plastic, glass, etc.)	0	0	NA	NA	NA	NA	0
Mixed Source-Separated Organics (SSO)							
SSO: Food Only	0	NA	0	0	NA	NA	0
SSO: Food & Yard	0	NA	0	0	NA	NA	0
Yard Waste: Spring	0	NA	0	0	NA	NA	0
Yard Waste: Fall	0	NA	0	0	NA	NA	0
Yard Waste: Average Annual Profile	0	NA	0	0	NA	NA	0
*Click here to view the default Mixed Source-Separated Organics (SSO) profiles							
Individual Source-Separated Waste Materials							
Food	0	NA	0	0	0	0	0
Paper	0	NA	0	0	0	0	0
Yard Waste	0	NA	0	0	NA	0	0
Diapers	0	NA	0	0	0	0	0
Pet Waste	0	NA	0	0	0	0	0
Textiles	0	NA	NA	NA	NA	0	0
Wood	0	NA	0	NA	NA	0	0
Wastewater Biosolids	0	0	0	NA	0	NA	0
Baseline management endpoint:	Anaerobic digestion (wet)						
Type of biosolids (raw, dewatered, digested):	Raw, not dewatered						
Enter volume of "not dewatered" material:	0	m3 (cubic metr	?				
Enter tonnes of "dewatered" material:	0	tonnes					
Solids content:	0%	percent	?				
TOTAL	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Figure 3-3: Screenshot of the "User Input" sheet, showing the "Step 2" portion of the sheet.

Table 3-2: Management endpoints available for mixed and individual source-separated waste materials

Material	Landfilling	Incineration	Composting	Dry AD	Wet AD	Source Reduced/ Diverted
Mixed MSW	✓	✓				
Mixed source separated organics (SSO)	✓		✓	✓		
Food	✓		✓	✓	✓	✓
Paper	✓		✓	✓	✓	✓
Yard waste	✓		✓	✓		✓
Diapers	✓		✓	✓	✓	✓
Pet waste	✓		✓	✓	✓	✓
Wood	✓		✓			✓
Textiles	✓					✓
Wastewater biosolids	✓	✓	✓		✓	

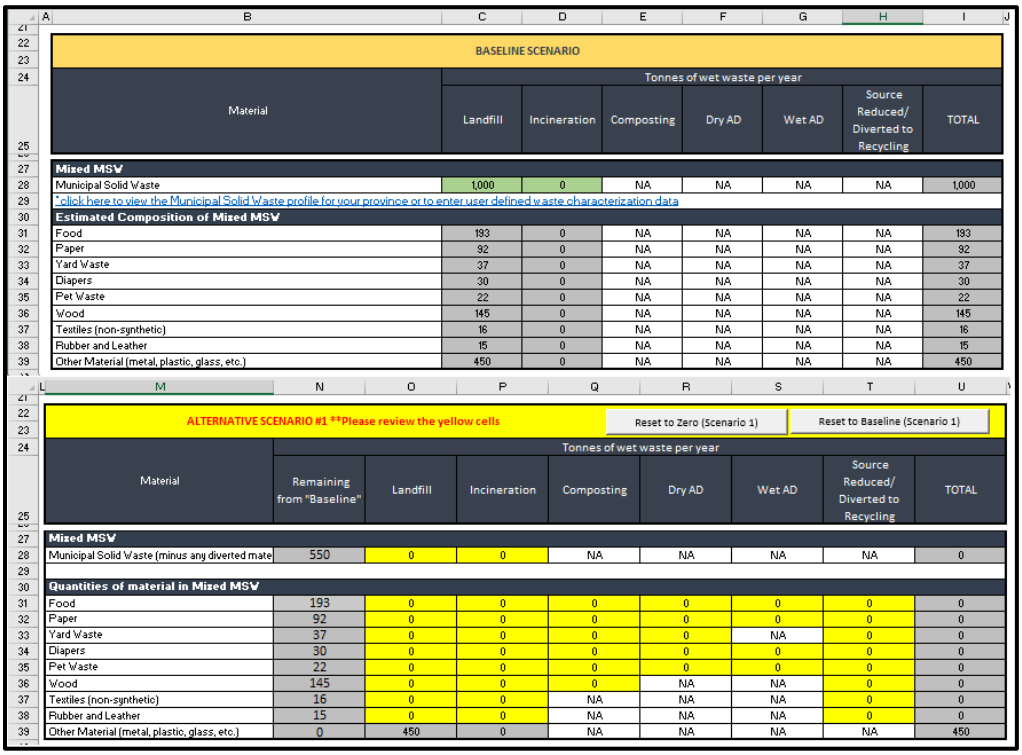
The option “Source Reduced/Diverted” is included to allow for the removal of waste from the analysis. Waste included under “Source Reduced/Diverted” is not managed under any of the baseline or alternative scenarios, so it does not contribute to waste management GHG emissions.

Any combination of waste materials and waste management endpoints can be entered under Step 2, as long as the total mass of each material type is the same between each of the scenarios being compared.

3.2.1. Mixed MSW

This waste material is mixed municipal solid waste (MSW) with a composition based on the location selected under “Step 1”. When a total quantity of mixed MSW is entered under the “Baseline” scenario, the quantity of individual organic materials is calculated automatically based on the selected location’s waste composition. Under the “Alternative” scenarios, the mixed MSW can either be managed as a single mass, or the individual waste materials can be managed separately.

The quantities of individual source-separated waste materials included in mixed MSW are displayed in the grey cells beneath the row for “Municipal Solid Waste” (Figure 3-4, below). These values are included under “Remaining from Baseline” within the “Alternative” scenarios to show how much material must be entered into the green cells within the “Alternative” scenarios in order to balance the mass between the “Baseline” and “Alternative” scenarios (Figure 3-4, below). If the materials are not balanced between the “Baseline” and “Alternative” scenarios, the cells under the “Alternative” scenarios will be bright yellow.



BASELINE SCENARIO

Material	Tonnes of wet waste per year						
	Landfill	Incineration	Composting	Dry AD	Wet AD	Source Reduced/ Diverted to Recycling	TOTAL
Mixed MSW							
Municipal Solid Waste	1,000	0	NA	NA	NA	NA	1,000
click here to view the Municipal Solid Waste profile for your province or to enter user defined waste characterization data							
Estimated Composition of Mixed MSW							
Food	193	0	NA	NA	NA	NA	193
Paper	92	0	NA	NA	NA	NA	92
Yard Waste	37	0	NA	NA	NA	NA	37
Diapers	30	0	NA	NA	NA	NA	30
Pet Waste	22	0	NA	NA	NA	NA	22
Wood	145	0	NA	NA	NA	NA	145
Textiles (non-synthetic)	16	0	NA	NA	NA	NA	16
Rubber and Leather	15	0	NA	NA	NA	NA	15
Other Material (metal, plastic, glass, etc.)	450	0	NA	NA	NA	NA	450

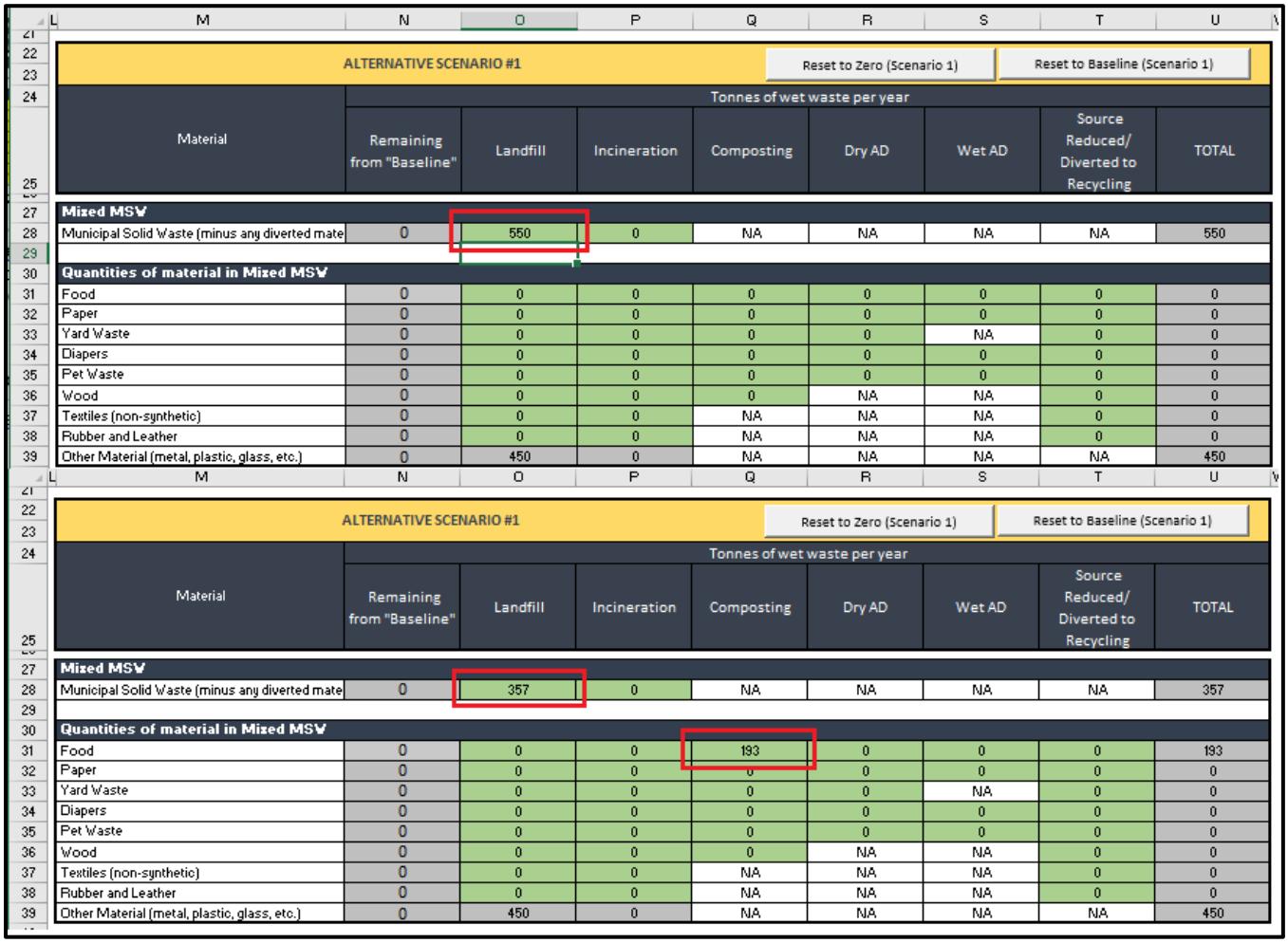
ALTERNATIVE SCENARIO #1 **Please review the yellow cells | Reset to Zero (Scenario 1) | Reset to Baseline (Scenario 1)

Material	Tonnes of wet waste per year							
	Remaining from "Baseline"	Landfill	Incineration	Composting	Dry AD	Wet AD	Source Reduced/ Diverted to Recycling	TOTAL
Mixed MSW								
Municipal Solid Waste (minus any diverted mate	550	0	0	NA	NA	NA	NA	0
Quantities of material in Mixed MSW								
Food	193	0	0	0	0	0	0	0
Paper	92	0	0	0	0	0	0	0
Yard Waste	37	0	0	0	0	NA	0	0
Diapers	30	0	0	0	0	0	0	0
Pet Waste	22	0	0	0	0	0	0	0
Wood	145	0	0	0	NA	NA	0	0
Textiles (non-synthetic)	16	0	0	NA	NA	NA	0	0
Rubber and Leather	15	0	0	NA	NA	NA	0	0
Other Material (metal, plastic, glass, etc.)	0	450	0	NA	NA	NA	NA	450

Figure 3-4: Screenshot of the “User Input” sheet, showing the “Baseline Scenario” (top image) and “Alternative Scenario #1” (bottom image) under “Step 2”. When a total quantity of mixed MSW is entered under the “Baseline” scenario, the quantities of individual organic materials (e.g. “Food”) are calculated automatically based on the selected location’s waste composition (top image). These values are included under “Remaining from Baseline” within the “Alternative” scenarios (bottom image).

Under the “Alternative” scenarios, the mixed MSW can be managed as a single mass, or the individual waste materials (e.g. “Food”) can be managed separately (Figure 3-5, below). The values under

"Remaining from Baseline" indicate how much of each material must be accounted for in each row of the "Alternative" scenario.



ALTERNATIVE SCENARIO #1 — Reset to Zero (Scenario 1) — Reset to Baseline (Scenario 1)

Material	Tonnes of wet waste per year: Remaining from "Baseline"	Landfill	Incineration	Composting	Dry AD	Wet AD	Source Reduced/ Diverted to Recycling	TOTAL
Mixed MSW								
Municipal Solid Waste (minus any diverted mate	0	550	0	NA	NA	NA	NA	550
Quantities of material in Mixed MSW								
Food	0	0	0	0	0	0	0	0
Paper	0	0	0	0	0	0	0	0
Yard Waste	0	0	0	0	0	NA	0	0
Diapers	0	0	0	0	0	0	0	0
Pet Waste	0	0	0	0	0	0	0	0
Wood	0	0	0	0	NA	NA	0	0
Textiles (non-synthetic)	0	0	0	NA	NA	NA	0	0
Rubber and Leather	0	0	0	NA	NA	NA	0	0
Other Material (metal, plastic, glass, etc.)	0	450	0	NA	NA	NA	NA	450

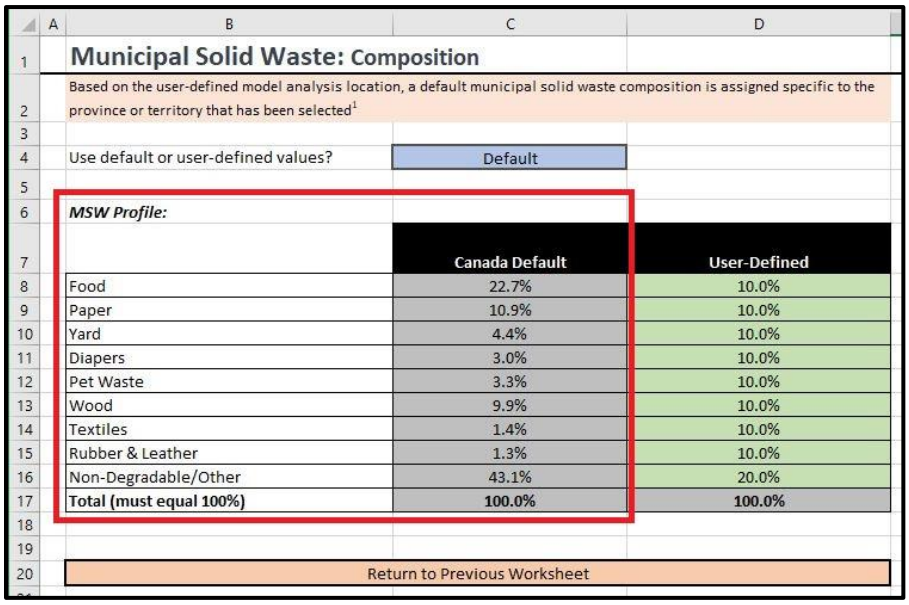
ALTERNATIVE SCENARIO #1 — Reset to Zero (Scenario 1) — Reset to Baseline (Scenario 1)

Material	Tonnes of wet waste per year: Remaining from "Baseline"	Landfill	Incineration	Composting	Dry AD	Wet AD	Source Reduced/ Diverted to Recycling	TOTAL
Mixed MSW								
Municipal Solid Waste (minus any diverted mate	0	357	0	NA	NA	NA	NA	357
Quantities of material in Mixed MSW								
Food	0	0	0	193	0	0	0	193
Paper	0	0	0	0	0	0	0	0
Yard Waste	0	0	0	0	0	NA	0	0
Diapers	0	0	0	0	0	0	0	0
Pet Waste	0	0	0	0	0	0	0	0
Wood	0	0	0	0	NA	NA	0	0
Textiles (non-synthetic)	0	0	0	NA	NA	NA	0	0
Rubber and Leather	0	0	0	NA	NA	NA	0	0
Other Material (metal, plastic, glass, etc.)	0	450	0	NA	NA	NA	NA	450

Figure 3-5: Screenshot of the "User Input" sheet, showing "Alternative Scenario #1" under "Step 2". When a total quantity of mixed MSW is entered under the "Baseline" scenario, the mixed MSW can be managed as a single mass (top image), or the individual waste materials (e.g. "Food") can be managed separately (bottom image).

Viewing the Composition of Mixed MSW

To view the municipal solid waste profile for the selected location, click the hyperlink included under the "Baseline" scenario. This will open the "MSW&SSO Calc" sheet. The "MSW&SSO Calc" sheet includes a table that shows the municipal solid waste profile for the selected location (Figure 3-6, below).



	A	B	C	D
1		**Municipal Solid Waste: Composition**		
2		Based on the user-defined model analysis location, a default municipal solid waste composition is assigned specific to the province or territory that has been selected[1]		
3				
4		Use default or user-defined values?	Default	
5				
6		***MSW Profile:***		
7			**Canada Default**	**User-Defined**
8		Food	22.7%	10.0%
9		Paper	10.9%	10.0%
10		Yard	4.4%	10.0%
11		Diapers	3.0%	10.0%
12		Pet Waste	3.3%	10.0%
13		Wood	9.9%	10.0%
14		Textiles	1.4%	10.0%
15		Rubber & Leather	1.3%	10.0%
16		Non-Degradable/Other	43.1%	20.0%
17		**Total (must equal 100%)**	**100.0%**	**100.0%**
18				
19				
20		Return to Previous Worksheet		

Figure 3-6: Screenshot of the "MSW&SSO Calc" sheet. A red box indicates the municipal solid waste profile for the selected location (e.g. "Canada").

Changing the Composition of Mixed MSW

By default, the composition of "Mixed MSW" is specific to the location selected under Step 1. However, the composition can be changed to a set of values defined by the user. To change the municipal solid waste profile to user-defined values, click the hyperlink included under the "Baseline" scenario. This will open the "MSW&SSO Calc" sheet. The "MSW&SSO Calc" sheet includes a drop-down cell with the option to select whether the *Calculator* uses "default" or "user-defined" values for the MSW composition. Click the drop-down cell and switch it from "Default" to "User-Defined". Then, enter the custom MSW composition into the green cells of the proceeding table (Figure 3-7, below).

	A	B	C	D
1		**Municipal Solid Waste: Composition**		
2		Based on the user-defined model analysis location, a default municipal solid waste composition is assigned specific to the province or territory that has been selected[1]		
3				
4		Use default or user-defined values?	Default	
5			Default / User-Defined	
6		***MSW Profile:***		
7			**Canada Default**	**User-Defined**
8		Food	22.7%	10.0%
9		Paper	10.9%	10.0%
10		Yard	4.4%	10.0%
11		Diapers	3.0%	10.0%
12		Pet Waste	3.3%	10.0%
13		Wood	9.9%	10.0%
14		Textiles	1.4%	10.0%
15		Rubber & Leather	1.3%	10.0%
16		Non-Degradable/Other	43.1%	20.0%
17		**Total (must equal 100%)**	**100.0%**	**100.0%**
18				
19				
20		Return to Previous Worksheet		

Figure 3-7: Screenshot of the "MSW&SSO Calc" sheet, showing the drop-down cell with the option to select whether the Calculator uses "default" or "user-defined" values for mixed MSW composition. If "user-defined" is selected, the waste composition must be defined in the table beneath the drop-down cell.

3.2.2. Mixed Source-Separated Organics (SSO)

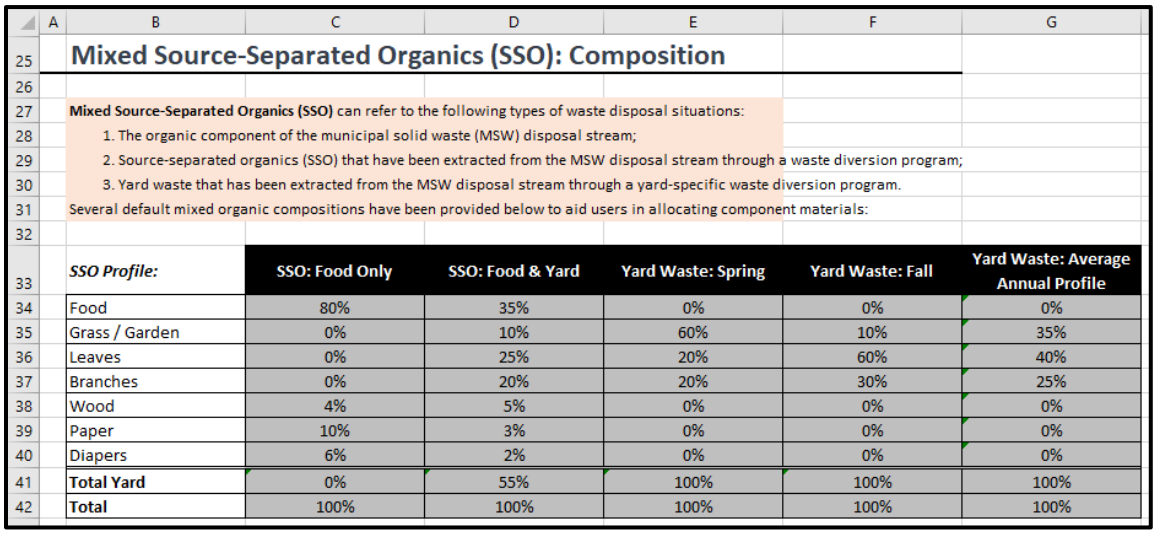
The mixed source-separated organics (SSO) streams approximate the composition of organic waste that has been separated from the mixed MSW stream through a source-separated organics program. The waste composition varies between the five options included under “Mixed Source-Separated Organics” to represent organic waste streams typical of diversion programs that collect:

- Food waste only;
- Food waste and yard waste; or
- Yard waste only:
    - Spring profile;
    - Fall profile; or
    - Average annual profile.

To view the composition of the five mixed organic waste streams, click the hyperlink included under the “Baseline” scenario (Figure 3-8, below). This will open the “MSW&SSO Calc” sheet, where there is a table that shows five default mixed organic compositions corresponding to the five mixed source-separated organics waste streams (see Figure 3-9, below).

	A	B	C	D	E	F	G	H	I
22		BASELINE SCENARIO							
24		Material	Tonnes of wet waste per year						
25			Landfill	Incineration	Composting	Dry AD	Wet AD	Source Reduced/ Diverted to Recycling	TOTAL
27		**Mixed MSW**							
28		Municipal Solid Waste	1,000	0	NA	NA	NA	NA	1,000
29		*click here to view the Municipal Solid Waste profile for your province or to enter user defined waste characterization data							
30		**Estimated Composition of Mixed MSW**							
31		Food	193	0	NA	NA	NA	NA	193
32		Paper	92	0	NA	NA	NA	NA	92
33		Yard Waste	37	0	NA	NA	NA	NA	37
34		Diapers	30	0	NA	NA	NA	NA	30
35		Pet Waste	22	0	NA	NA	NA	NA	22
36		Wood	145	0	NA	NA	NA	NA	145
37		Textiles (non-synthetic)	16	0	NA	NA	NA	NA	16
38		Rubber and Leather	15	0	NA	NA	NA	NA	15
39		Other Material (metal, plastic, glass, etc.)	450	0	NA	NA	NA	NA	450
41		**Mixed Source-Separated Organics (SSO)**							
42		SSO: Food Only	0	NA	0	0	NA	NA	0
43		SSO: Food & Yard	0	NA	0	0	NA	NA	0
44		Yard Waste: Spring	0	NA	0	0	NA	NA	0
45		Yard Waste: Fall	0	NA	0	0	NA	NA	0
46		Yard Waste: Average Annual Profile	0	NA	0	0	NA	NA	0
47		*Click here to view the default Mixed Source-Separated Organics (SSO) profiles							

Figure 3-8: Screenshot of the “User Input” sheet, showing the “Baseline Scenario” under “Step 2”. The red box shows the hyperlink for the “MSW&SSO Calc” sheet.



Mixed Source-Separated Organics (SSO): Composition

Mixed Source-Separated Organics (SSO) can refer to the following types of waste disposal situations:

1. The organic component of the municipal solid waste (MSW) disposal stream;
2. Source-separated organics (SSO) that have been extracted from the MSW disposal stream through a waste diversion program;
3. Yard waste that has been extracted from the MSW disposal stream through a yard-specific waste diversion program.

Several default mixed organic compositions have been provided below to aid users in allocating component materials:

SSO Profile:	SSO: Food Only	SSO: Food & Yard	Yard Waste: Spring	Yard Waste: Fall	Yard Waste: Average Annual Profile
Food	80%	35%	0%	0%	0%
Grass / Garden	0%	10%	60%	10%	35%
Leaves	0%	25%	20%	60%	40%
Branches	0%	20%	20%	30%	25%
Wood	4%	5%	0%	0%	0%
Paper	10%	3%	0%	0%	0%
Diapers	6%	2%	0%	0%	0%
Total Yard	0%	55%	100%	100%	100%
Total	100%	100%	100%	100%	100%

Figure 3-9: Screenshot of the “MSW&SSO Calc” sheet, showing five default mixed organic material compositions corresponding to the five mixed source-separated organics waste streams included on the “User Input” sheet.

The compositions of the five material categories included under “Mixed Source-Separated Organics” cannot be changed**.**

3.2.3. Individual Source-Separated Waste Materials

Individual source-separated waste materials that can be modeled in the Calculator include:

- Food waste
- Paper
- Yard waste
- Diapers
- Pet waste
- Textiles
- Wood

Users interested in modeling waste management alternatives for these individual waste materials enter quantities of each waste material into the “Baseline” and “Alternative” scenario sections. If the materials are not balanced between the “Baseline” and “Alternative” scenarios, the cells under the “Alternative” scenarios will be bright yellow.

3.2.4. Wastewater Biosolids

To model the management of biosolids, the following information must be entered into the “Wastewater Biosolids” section of Step 2, under the “Baseline” scenario (Table 3-3, below):

Table 3-3: Information required to model management of wastewater biosolids.

Parameter	Options
Baseline management endpoint	• Landfilling • Incineration • Compost • Anaerobic digestion (wet)
Type of biosolids (raw, dewatered, digested)	• Raw, not dewatered • Raw, dewatered • Digested, not dewatered • Digested, dewatered

Volume of sludge or biosolids (not-dewatered)	Enter a whole number and select the volumetric units from the drop-down cell (m^3, L, or ft^3) if the type of biosolids or sludge selected is not-dewatered
Mass (tonnes) of dewatered biosolids	Enter a whole number (in tonnes) if the type of biosolids selected is dewatered
Solids content	Enter a whole number; suggested values: • Raw, not dewatered = 1% • Raw, dewatered = 25% • Digested, not dewatered = 3% • Digested, dewatered = 25%

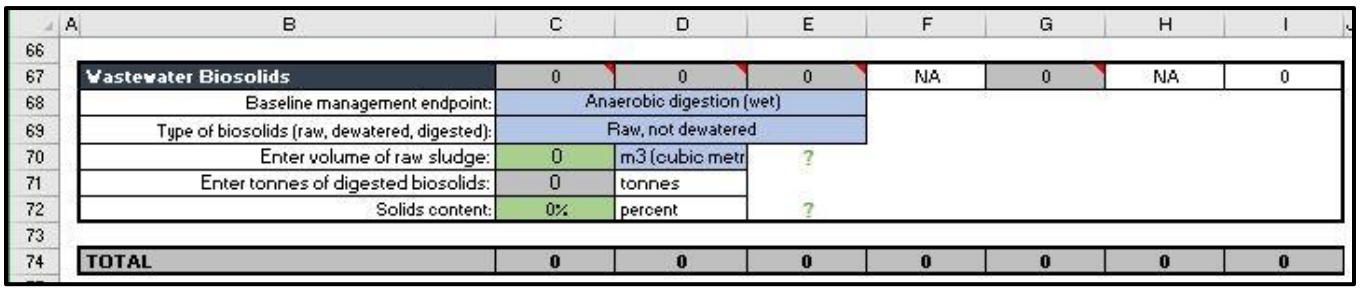


Figure 3-10: Screenshot of the "User Input" sheet, showing the wastewater biosolids portion of Step 2, under the "Baseline".

Whether the quantity is entered as a mass or a volume depends on the type of biosolids, as summarized in Table 3-4 (at right).

After the information in Table 3-3 has been entered into the "Wastewater Biosolids" section under the "Baseline" scenario, only the "Alternative management endpoint" must be selected for the "Alternative" scenarios.

Table 3-4: Information required to model management of wastewater biosolids.

Type of Biosolids	Units for Quantity
Raw, not dewatered	Volume
Raw, dewatered	Mass
Digested, not dewatered	Volume
Digested, dewatered	Mass

3.3. Step 3: Define Your Management Endpoint Options

Once the waste stream has been defined under “Step 2” of the “User Input” sheet, the next step is to define the management endpoint options. This is done by completing the fields under the title “Step 3: Define Your Management Endpoint Options”. The fields must be completed for the “Baseline” scenario as well as each of the “Alternative” scenarios that are included within the model analysis (as indicated under Step 1). The fields are organized by waste management endpoint, as summarized in Table 3-5 and shown in Figure 3-11 (below). The fields associated with a particular management endpoint will be colored grey until waste has been entered under that management endpoint, at which point the fields will be colored yellow (enter a value) or blue (select a drop-down option). For example, the fields associated with the “Landfill” option will be colored grey until waste has been entered under the “Landfill” portion of the table within Step 2.

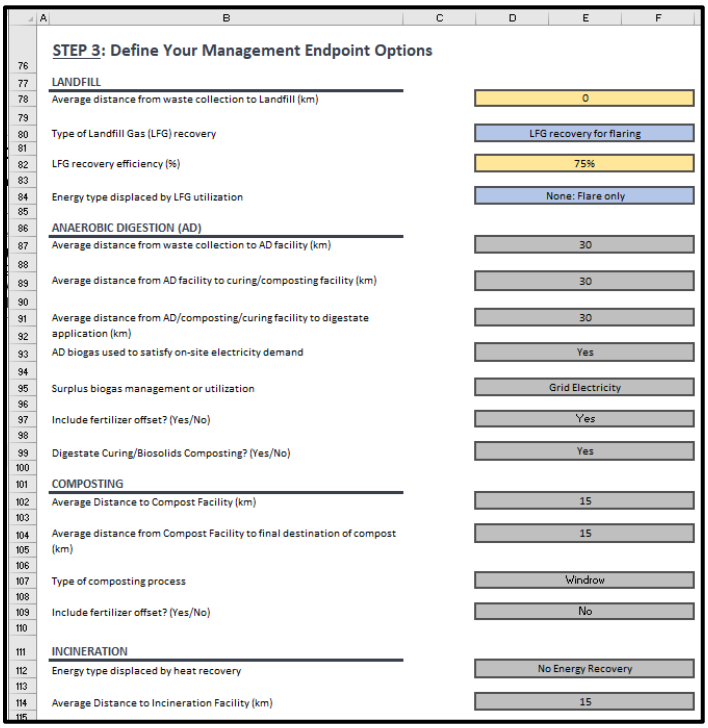


Figure 3-11: Screenshot of the “User Input” sheet, showing the “Step 3” portion of the sheet. The fields associated with a particular management endpoint will be colored grey until waste has been entered under that management endpoint in the table under Step 2.

Table 3-5: Management endpoint options available under “Step 3” on the “User Input” sheet.

Field	Options
Landfill	
Average distance from waste collection to landfill (km)	Enter a whole number that is greater than zero (0)
Type of landfill gas (LFG) recovery	Select an option from the drop-down list
LFG recovery efficiency (%)	Enter a whole number that is greater than zero (0)
Energy type displaced by LFG utilization	Select an option from the drop-down list
Anaerobic Digestion	
Average distance from waste collection to AD facility (km)	Enter a whole number that is greater than zero (0)
Average distance from AD facility to curing/composting facility (km)	Enter a whole number that is greater than zero (0)
Average distance from AD/composting/curing facility to digestate application (km)	Enter a whole number that is greater than zero (0)
AD biogas used to satisfy on-site electricity demand	Select an option from the drop-down list
Surplus biogas management or utilization	Select an option from the drop-down list
Include fertilizer offset?	Select an option from the drop-down list
Digestate curing/biosolids composting?	Select an option from the drop-down list
Composting	
Average distance to compost facility (km)	Enter a whole number that is greater than zero (0)
Average distance from compost facility to final destination of compost (km)	Enter a whole number that is greater than zero (0)
Type of composting process	Select an option from the drop-down list
Include fertilizer offset?	Select an option from the drop-down list
Incineration	
Energy type displaced by heat recovery	Select an option from the drop-down list
Average distance to incineration facility (km)	Enter a whole number that is greater than zero (0)

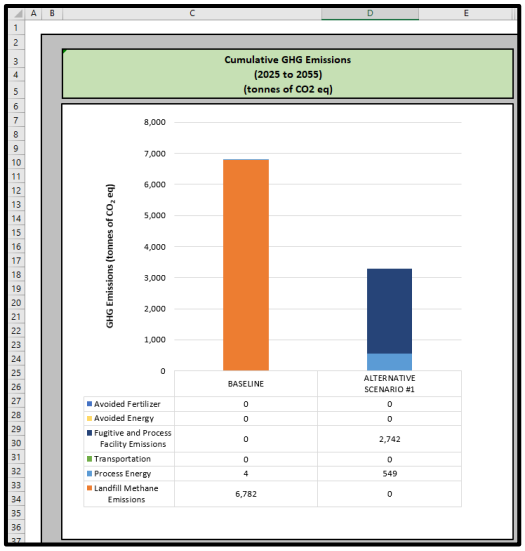
4. Viewing Results

Once Step 3 of the User Input is complete, the model output can be viewed on the “Output_Cumulative Emissions” and “Output_Annual Emissions” sheets.

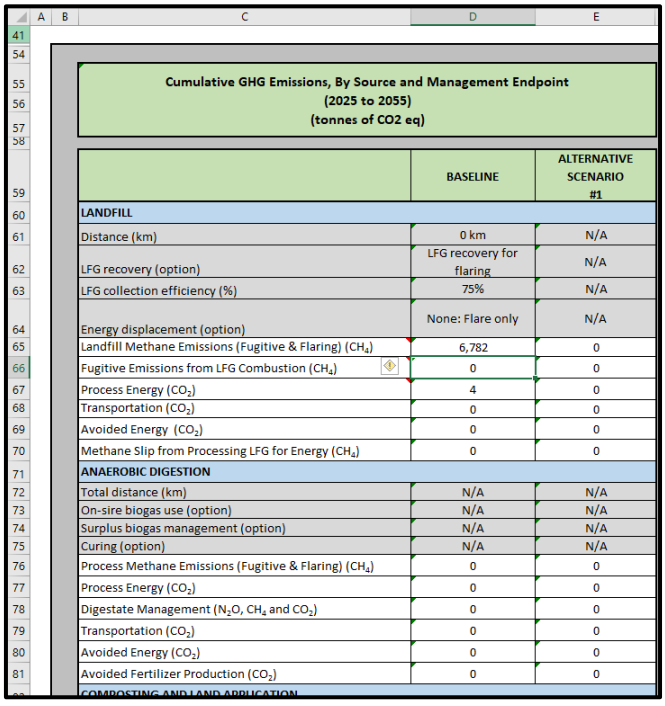
4.1. “Output_Cumulative Emissions”

The “Output_Cumulative Emissions” sheet displays the cumulative GHG emissions associated with the values entered on the “User Input” sheet, for the timespan selected under “Step 1” on the “User Input” sheet. The “Output_Cumulative Emissions” sheet is organized into three sections as follows:

A **bar graph at the top of the worksheet** provides a visual summary of the cumulative emissions associated with the model timespan, which is indicated above the graph.



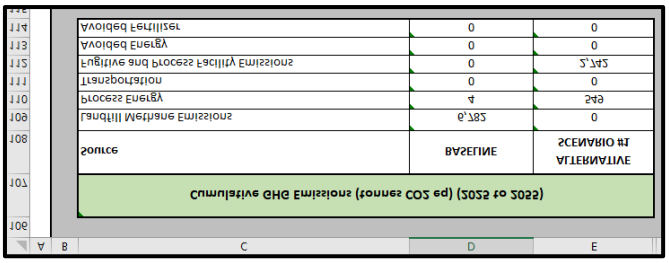
A **table in the middle of the worksheet** provides the itemized GHG emissions and emission reductions associated with the Baseline Scenario and Alternative scenarios identified on the “User Input” sheet. The grey cells indicate options that were selected under “Step 3” on the “User Input” sheet, and the white cells provide the *GHG Calculator* outputs.



Cumulative GHG Emissions, By Source and Management Endpoint
(2025 to 2055)
(tonnes of CO2 eq)

	BASELINE	ALTERNATIVE SCENARIO #1
LANDFILL		
Distance (km)	0 km	N/A
LFG recovery (option)	LFG recovery for flaring	N/A
LFG collection efficiency (%)	75%	N/A
Energy displacement (option)	None: Flare only	N/A
Landfill Methane Emissions (Fugitive & Flaring) (CH_4)	6,782	0
Fugitive Emissions from LFG Combustion (CH_4)	0	0
Process Energy (CO_2)	4	0
Transportation (CO_2)	0	0
Avoided Energy (CO_2)	0	0
Methane Slip from Processing LFG for Energy (CH_4)	0	0
ANAEROBIC DIGESTION		
Total distance (km)	N/A	N/A
On-sire biogas use (option)	N/A	N/A
Surplus biogas management (option)	N/A	N/A
Curing (option)	N/A	N/A
Process Methane Emissions (Fugitive & Flaring) (CH_4)	0	0
Process Energy (CO_2)	0	0
Digestate Management (N_2O, CH_4 and CO_2)	0	0
Transportation (CO_2)	0	0
Avoided Energy (CO_2)	0	0
Avoided Fertilizer Production (CO_2)	0	0
COMPOSTING AND LAND APPLICATION		

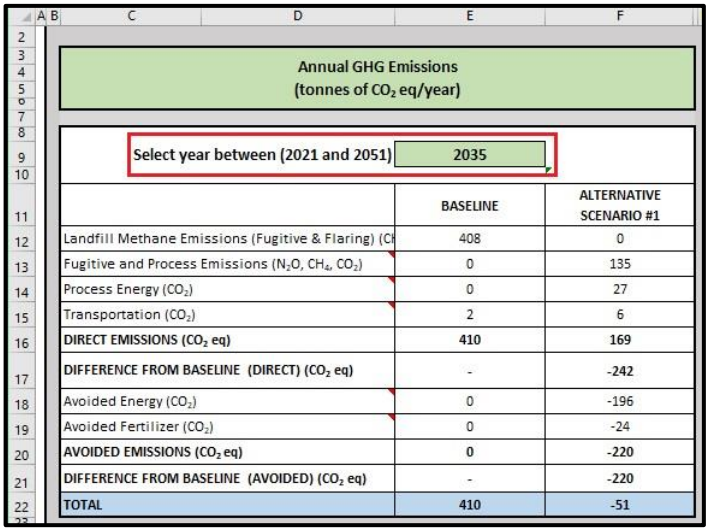
A **summary table at the bottom of the worksheet** summarizes the itemized GHG emissions and emission reductions. This table is used to populate the bar graph at the top of the worksheet.



4.2. “Output_Annual Emissions”

The “Output_Annual Emissions” sheet displays the annual GHG emissions associated with the values entered on the “User Input” sheet, for the year selected at the top of the “Output_Annual Emissions” sheet. The “Output_Annual Emissions” sheet is organized into four sections as follows:

A **summary table at the top of the worksheet** summarizes the GHG emissions and emission reductions for the year specified above the table This table is used to populate the bar graph beneath the table.

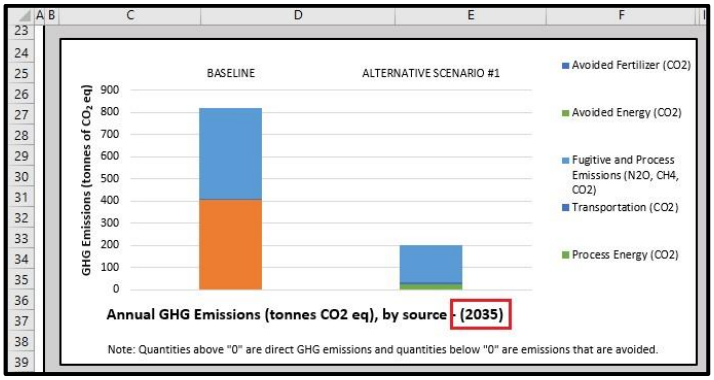


Annual GHG Emissions
(tonnes of CO_2 eq/year)

Select year between (2021 and 2051): 2035

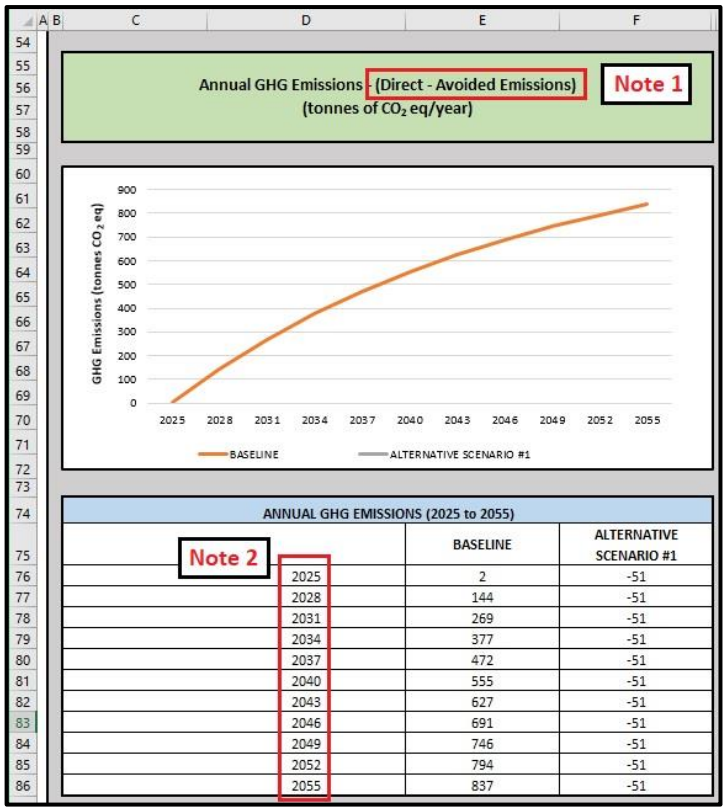
	BASELINE	ALTERNATIVE SCENARIO #1
Landfill Methane Emissions (Fugitive & Flaring) (CH	408	0
Fugitive and Process Emissions (N_2O, CH_4, CO_2)	0	135
Process Energy (CO_2)	0	27
Transportation (CO_2)	2	6
DIRECT EMISSIONS (CO_2 eq)	**410**	**169**
DIFFERENCE FROM BASELINE (DIRECT) (CO_2 eq)	-	**-242**
Avoided Energy (CO_2)	0	-196
Avoided Fertilizer (CO_2)	0	-24
AVOIDED EMISSIONS (CO_2 eq)	**0**	**-220**
DIFFERENCE FROM BASELINE (AVOIDED) (CO_2 eq)	-	**-220**
TOTAL	**410**	**-51**

A **bar graph in the middle of the worksheet** provides a visual summary of the annual emissions associated with the year specified at the top of the worksheet



A **net emissions line graph and associated table** follow, which provide the annual net GHG emissions (i.e. direct emissions minus avoided emissions) for select years between the first and last years of the model timespan.

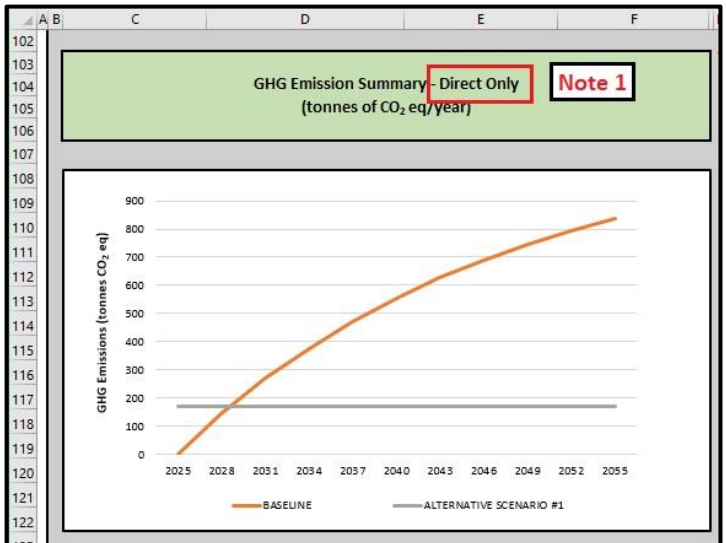
Note 1: results account for both direct emissions and emission reductions achieved through avoided energy and fertilizer production emissions.
Note 2: results are shown for select years between the first and last years of the model timespan.



ANNUAL GHG EMISSIONS (2025 to 2055)			
Note 2		BASELINE	ALTERNATIVE SCENARIO #1
	2025	2	-51
	2028	144	-51
	2031	269	-51
	2034	377	-51
	2037	472	-51
	2040	555	-51
	2043	627	-51
	2046	691	-51
	2049	746	-51
	2052	794	-51
	2055	837	-51

A **direct emissions line graph and associated table** at the bottom of the worksheet provide the annual direct GHG emissions (not accounting for the emissions reductions) for select years between the first and last years of the model timespan.

Note 1: results include direct emissions only.
Note 2: results are shown for select years between the first and last years of the model timespan.



ANNUAL GHG EMISSIONS (2025 to 2055)			
Note 2		BASELINE	ALTERNATIVE SCENARIO #1
	2025	2	169
	2028	144	169
	2031	269	169
	2034	377	169
	2037	472	169
	2040	555	169
	2043	627	169
	2046	691	169
	2049	746	169
	2052	794	169
	2055	837	169

5. Frequently Asked Questions

5.1. Why Are the Cells under Step 2 on the "User Input" Sheet Colored Yellow?

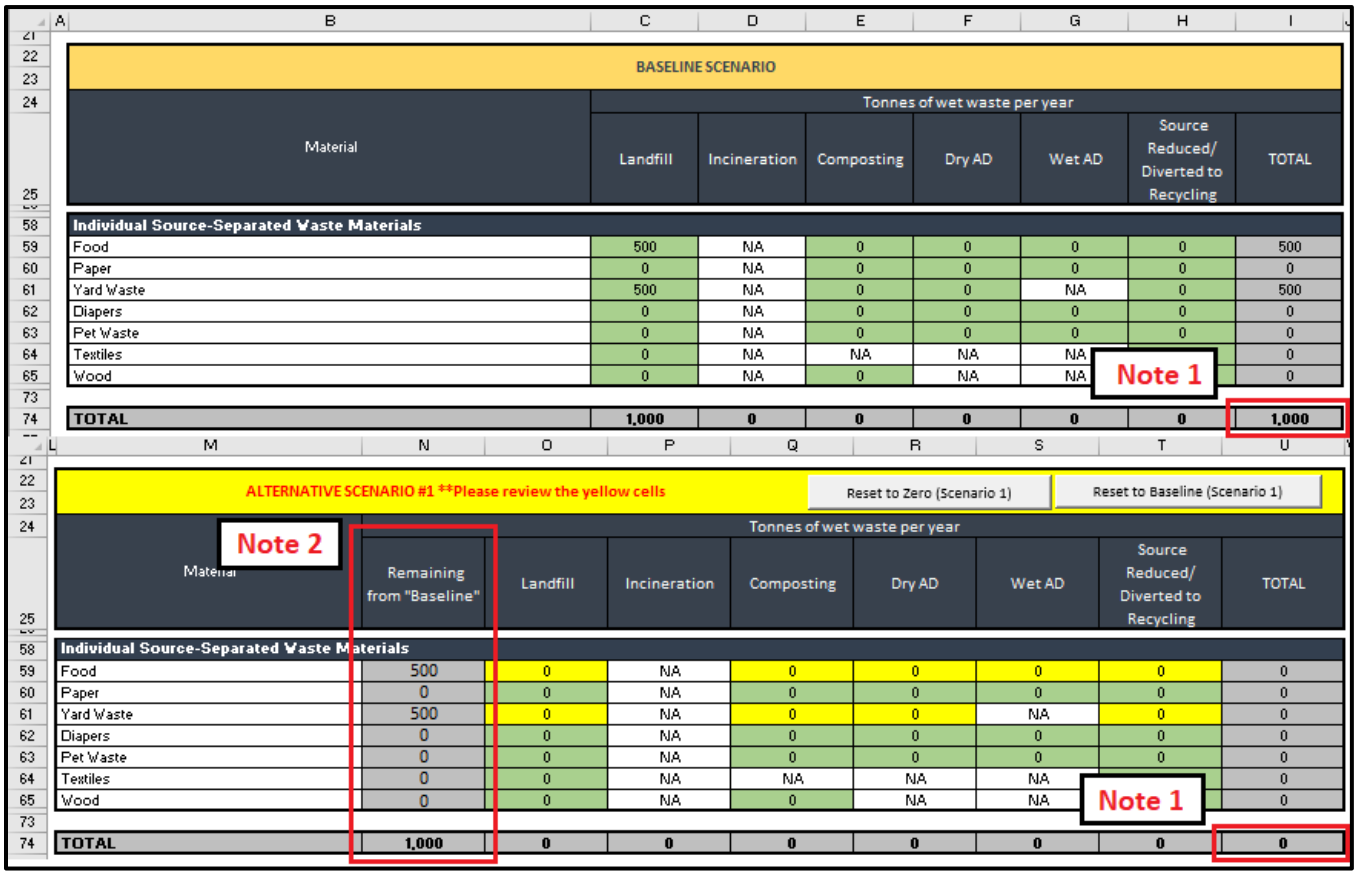
When using the *GHG Calculator* to model the management of an organic waste stream, the waste stream must be defined under "Step 2" of the "User Input" sheet. This is done by entering values into the tables under the title "Step 2: Define Your Waste Stream Inputs". This section includes two to four tables, depending on how many alternative scenarios are selected under Step 1. The first table defines the baseline scenario to which the alternative scenario(s) are compared. The remaining table(s) define the alternative scenario(s).

In order to compare a baseline scenario with an alternative scenario, the same quantity of each type of waste material must be entered in both the "Baseline" section as well as each of the "Alternative" sections that are included in the analysis. For example, if 1,000 tonnes of "Food" is entered under "Individual Waste Materials" within the "Baseline" section, 1,000 tonnes of "Food" must also be entered under the "Individual Waste Materials" within the "Alternative" sections. Although the total quantity of "Food" must be the same between the sections, it can be distributed differently among the waste management endpoints. For example, 1,000 tonnes of "Food" could be entered in the "Landfill" column within the "Baseline" section, and 1,000 tonnes of "Food" could be entered in the "Compost" column within the "Alternative Scenario #1" section. Some examples of how to balance the mass of waste between the sections are shown in Table 5-1 (below).

Table 5-1: Examples of how to balance the mass of waste between the baseline and alternative sections under "Step 2" on the "User Input" sheet.

Baseline Scenario	Alternative Scenario #1	Comments
1,000 tonnes of "Food" in the "Landfill" column	500 tonnes of "Food" in the "Landfill" column, and 500 tonnes of "Food" in the "Compost" column	Mass is balanced – both the baseline and alternative sections have a total of 1,000 tonnes of "Food"
500 tonnes of "Food" in the "Landfill" column, and 500 tonnes of "Food" in the "Compost" column	1,000 tonnes of "Food" in the "Compost" column	
500 tonnes of "Food" in the "Compost" column, and 500 tonnes of "Food" in the "Wet AD" column	1,000 tonnes of "Food" in the "Wet AD" column	

If the mass of each type of waste material is not balanced between the baseline and alternative sections, some of the cells within the alternative section will turn yellow (Figure 5-1, below). This indicates that the total quantity of material within that row under the "Alternative" section does not match the total quantity of material within that row under the "Baseline" section.



BASELINE SCENARIO

Material	Tonnes of wet waste per year						
	Landfill	Incineration	Composting	Dry AD	Wet AD	Source Reduced/ Diverted to Recycling	TOTAL
Individual Source-Separated Waste Materials							
Food	500	NA	0	0	0	0	500
Paper	0	NA	0	0	0	0	0
Yard Waste	500	NA	0	0	NA	0	500
Diapers	0	NA	0	0	0	0	0
Pet Waste	0	NA	0	0	0	0	0
Textiles	0	NA	NA	NA	NA		0
Wood	0	NA	0	NA	NA		0
TOTAL	**1,000**	**0**	**0**	**0**	**0**	**0**	**1,000**

Note 1

ALTERNATIVE SCENARIO #1 **Please review the yellow cells

Reset to Zero (Scenario 1) | Reset to Baseline (Scenario 1)

Note 2

Material	Remaining from "Baseline"	Tonnes of wet waste per year						
		Landfill	Incineration	Composting	Dry AD	Wet AD	Source Reduced/ Diverted to Recycling	TOTAL
Individual Source-Separated Waste Materials								
Food	500	0	NA	0	0	0	0	0
Paper	0	0	NA	0	0	0	0	0
Yard Waste	500	0	NA	0	0	NA	0	0
Diapers	0	0	NA	0	0	0	0	0
Pet Waste	0	0	NA	0	0	0	0	0
Textiles	0	0	NA	NA	NA	NA		0
Wood	0	0	NA	0	NA	NA		0
TOTAL	**1,000**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Note 1

Figure 5-1: Screenshot of the "User Input" sheet, showing the "Baseline Scenario" and "Alternative Scenario #1" under the "Step 2" portion of the sheet (some rows have been hidden). The mass of "Food" and "Yard Waste" under "Individual Waste Materials" is not balanced between the "Baseline" and "Alternative" scenarios. Note 1 shows that the total quantity of waste enter for the "Baseline" is 1,000 tonnes, whereas the total quantity of waste entered for the "Alternative" is 0 (zero) tonnes. Note 2 shows that 500 tonnes of "Food" and 500 tonnes of "Yard Waste" still remain from the "Baseline" and must be allocated. Figure 5-2 (below) demonstrates how the mass could be balanced.

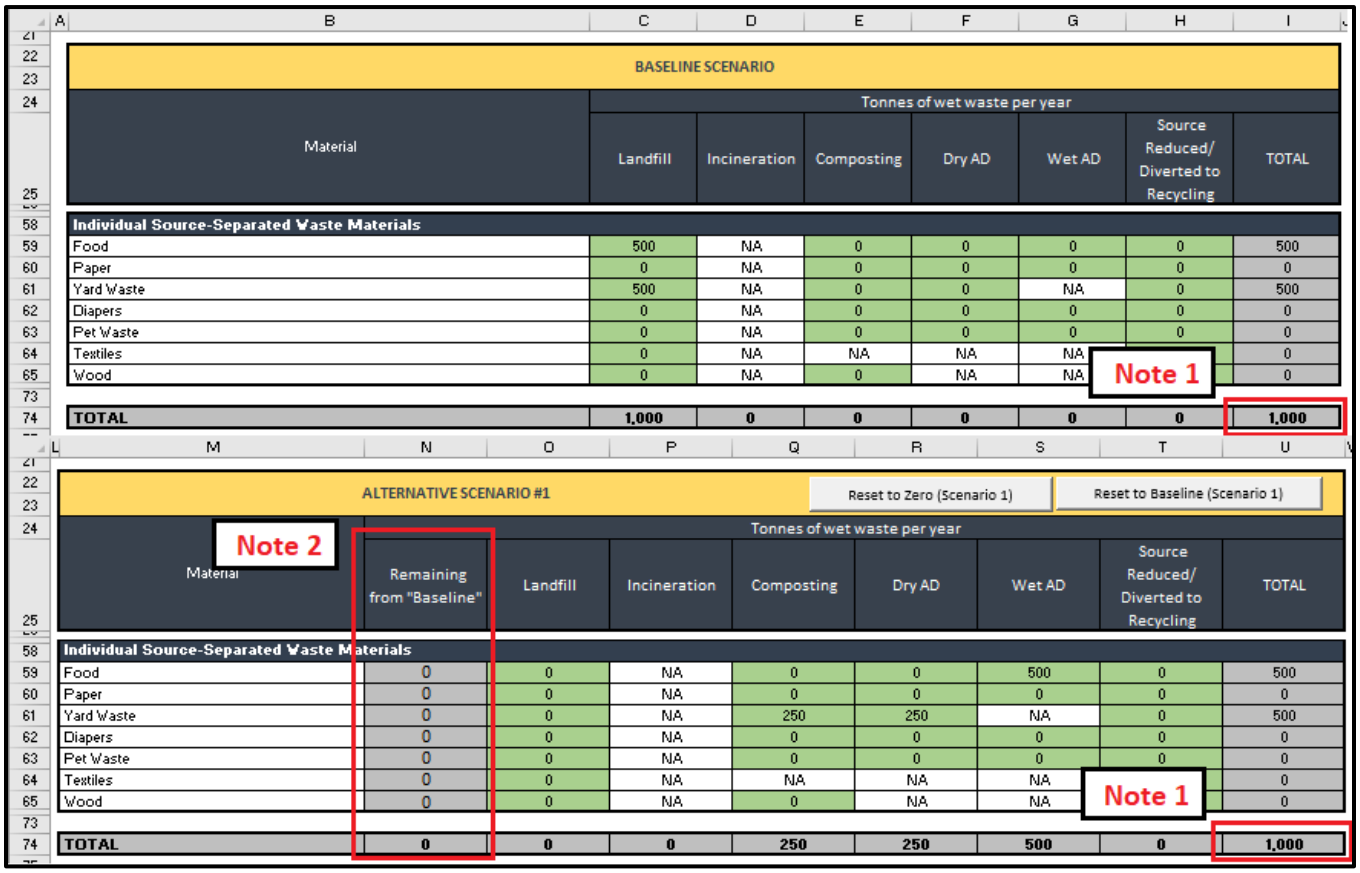
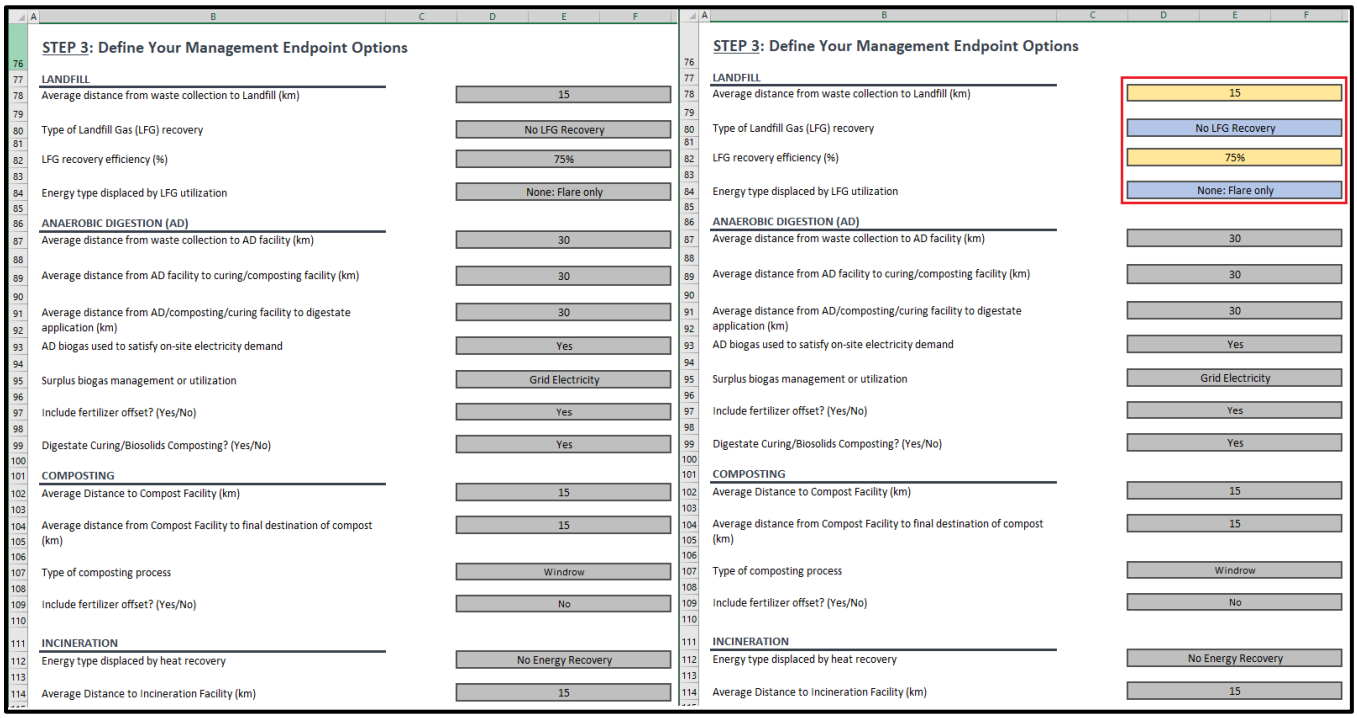


Figure 5-2: Screenshot of the “User Input” sheet, showing the “Baseline Scenario” and “Alternative Scenario #1” under the “Step 2” portion of the sheet (some rows have been hidden). The mass of “Food” and “Yard Waste” under “Individual Waste Materials” is balanced between the “Baseline” and “Alternative” scenarios. Note 1 shows that the total quantity of waste enter for both the “Baseline” and “Alternative” is 1,000 tonnes. Note 2 shows that 0 (zero) tonnes waste remain from the “Baseline” as all of the waste had been allocated. Figure 5-1 (above) demonstrates how the mass could have been unbalanced.

5.2. Why Are the Fields under Step 3 on the "User Input" Sheet Colored Grey?

When using the GHG Calculator to model the management of organic waste, the management endpoint options must be defined under "Step 3" of the "User Input" sheet. This is done by entering values into the fields under the title "Step 3: Define Your Management Endpoint Options" for both the "Baseline" scenario as well as the "Alternative" scenario(s). The fields are grouped by waste management endpoint (Figure 5-3, below). The fields under a particular waste management endpoint will remain grey until waste has been entered under that waste management endpoint in the table under "Step 2". For example, under the "Baseline" scenario, if 1,000 tonnes of mixed MSW is entered under "Landfill", the fields under "Landfill" will change from grey to yellow and blue, and the fields under the other waste management endpoints will remain grey (Figure 5-3, below). Yellow indicates that the field can receive any non-zero, positive value, whereas blue indicates that the filed contains a drop-down list (Figure 5-4, below).



STEP 3: Define Your Management Endpoint Options	
LANDFILL	
Average distance from waste collection to Landfill (km)	15
Type of Landfill Gas (LFG) recovery	No LFG Recovery
LFG recovery efficiency (%)	75%
Energy type displaced by LFG utilization	None: Flare only
ANAEROBIC DIGESTION (AD)	
Average distance from waste collection to AD facility (km)	30
Average distance from AD facility to curing/composting facility (km)	30
Average distance from AD/composting/curing facility to digestate application (km)	30
AD biogas used to satisfy on-site electricity demand	Yes
Surplus biogas management or utilization	Grid Electricity
Include fertilizer offset? (Yes/No)	Yes
Digestate Curing/Biosolids Composting? (Yes/No)	Yes
COMPOSTING	
Average Distance to Compost Facility (km)	15
Average distance from Compost Facility to final destination of compost (km)	15
Type of composting process	Windrow
Include fertilizer offset? (Yes/No)	No
INCINERATION	
Energy type displaced by heat recovery	No Energy Recovery
Average Distance to Incineration Facility (km)	15

Figure 5-3: Screenshot of the "User Input" sheet, showing the "Step 3" portion of the sheet. Fields associated with a particular management endpoint will be colored grey until waste has been entered under that management endpoint in the table under Step 2.

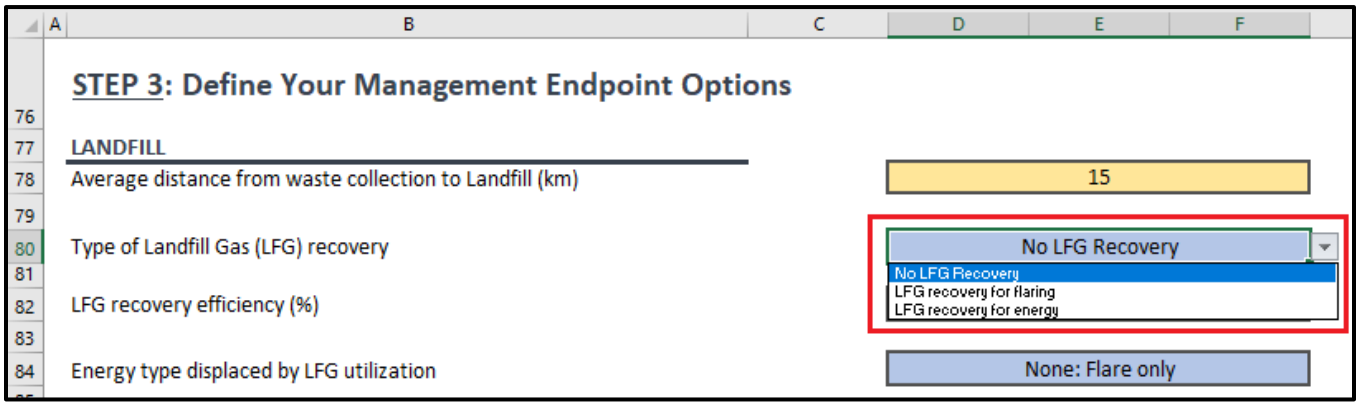


Figure 5-4: Screenshot of the "User Input" sheet, showing the "Step 3" portion of the sheet. Yellow indicates that the field can receive any non-zero, positive value, whereas blue indicates that the filed contains a drop-down list.

5.3. Why Are There Multiple Rows for "Food" on the "User Input" Sheet?

The *GHG Calculator* was designed with the intention that it would be useful to a wide audience, such as:

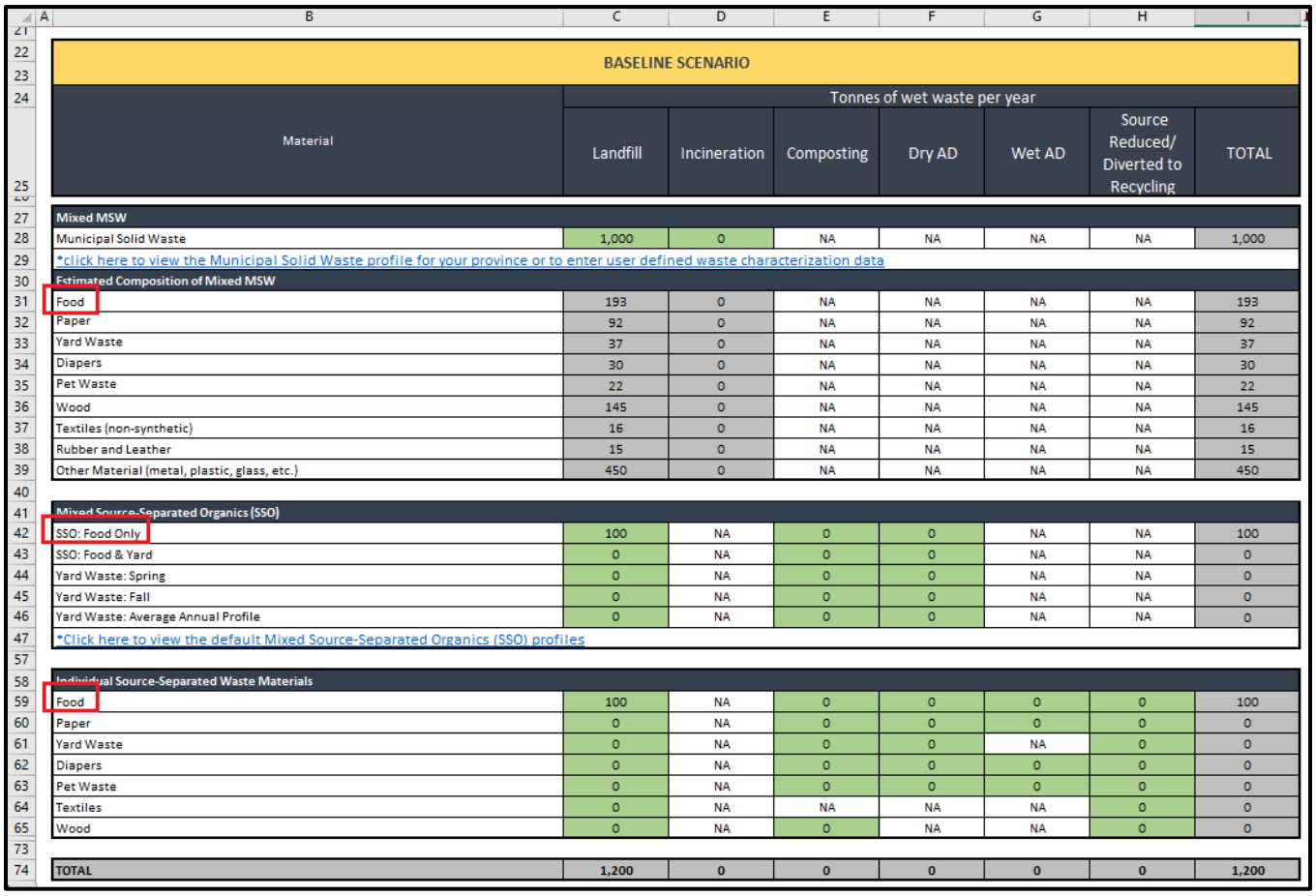
- A municipality looking at its mixed MSW stream to see the effect of diverting particular organic materials, such as food waste;
- A municipality looking at its mixed source-separated organics stream and comparing diversion management endpoints;
- A waste generator looking at diverting a particular waste material, such as food waste.

As such, the tables under "Step 2" on the "User Input" sheet are organized into four general categories of materials:

- Mixed municipal solid waste (MSW)
- Mixed source-separated organics
- Individual source-separated waste materials
- Wastewater biosolids

Some materials, such as "Food", are included under several of the four general categories:

- As a fraction of the mixed MSW stream, "Food" is included under "Mixed MSW" so that the effect of separating food waste from mixed MSW (e.g. through an SSO program) can be assessed.
- Food waste is also included as a fraction of the mixed source-separated organics streams resulting from an existing SSO program, like the streams listed under "Mixed Source-Separated Organics".
- "Food" can also be modeled as an independent material under the "Individual Source-Separated Waste Materials" portion of the table.



BASELINE SCENARIO

Material	Tonnes of wet waste per year						
	Landfill	Incineration	Composting	Dry AD	Wet AD	Source Reduced/ Diverted to Recycling	TOTAL
Mixed MSW							
Municipal Solid Waste	1,000	0	NA	NA	NA	NA	1,000
*click here to view the Municipal Solid Waste profile for your province or to enter user defined waste characterization data							
Estimated Composition of Mixed MSW							
Food	193	0	NA	NA	NA	NA	193
Paper	92	0	NA	NA	NA	NA	92
Yard Waste	37	0	NA	NA	NA	NA	37
Diapers	30	0	NA	NA	NA	NA	30
Pet Waste	22	0	NA	NA	NA	NA	22
Wood	145	0	NA	NA	NA	NA	145
Textiles (non-synthetic)	16	0	NA	NA	NA	NA	16
Rubber and Leather	15	0	NA	NA	NA	NA	15
Other Material (metal, plastic, glass, etc.)	450	0	NA	NA	NA	NA	450
Mixed Source-Separated Organics (SSO)							
SSO: Food Only	100	NA	0	0	NA	NA	100
SSO: Food & Yard	0	NA	0	0	NA	NA	0
Yard Waste: Spring	0	NA	0	0	NA	NA	0
Yard Waste: Fall	0	NA	0	0	NA	NA	0
Yard Waste: Average Annual Profile	0	NA	0	0	NA	NA	0
*Click here to view the default Mixed Source-Separated Organics (SSO) profiles							
Individual Source-Separated Waste Materials							
Food	100	NA	0	0	0	0	100
Paper	0	NA	0	0	0	0	0
Yard Waste	0	NA	0	0	NA	0	0
Diapers	0	NA	0	0	0	0	0
Pet Waste	0	NA	0	0	0	0	0
Textiles	0	NA	NA	NA	NA	0	0
Wood	0	NA	0	NA	NA	0	0
TOTAL	**1,200**	**0**	**0**	**0**	**0**	**0**	**1,200**

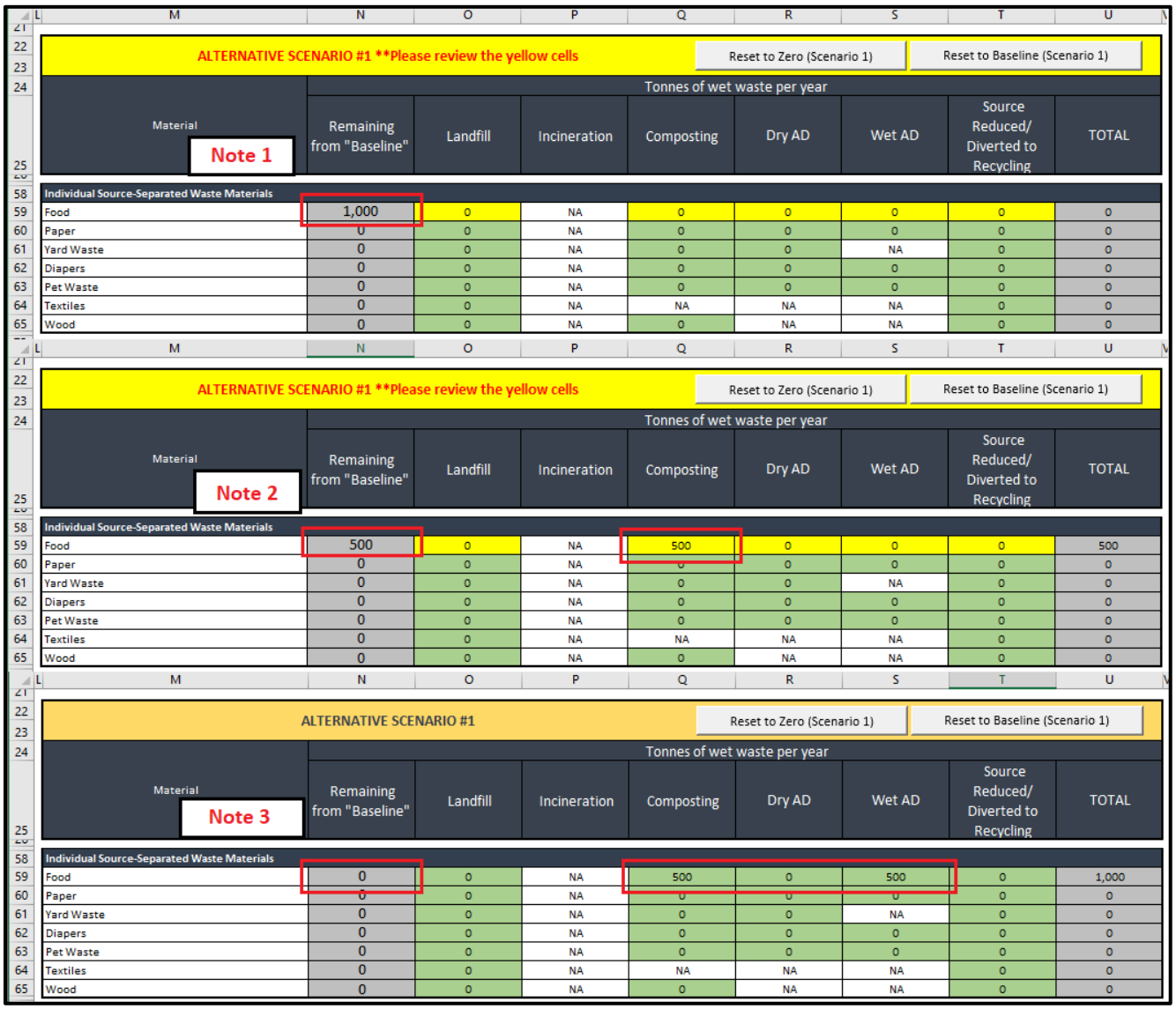
Figure 5-5: Screenshot of the “User Input” sheet, showing the “Baseline Scenario” under “Step 2”. Red boxes highlight three rows associated with “Food”.

Values can be entered in any of the rows associated with “Food”, as long as the total quantity of waste for each row is equal between the “Baseline” and “Alternative” scenarios.

5.4. What Is the "Remaining from Baseline" Column on the "User Input" Sheet?

When using the *GHG Calculator* to model the management of an organic waste stream, the waste stream must be defined under "Step 2" of the "User Input" sheet. For more information on how to complete Step 2, please refer to Section 3.2 (*Step 2: Define Your Waste Stream Inputs*) and Section 5.1 (*Why Are the Cells under Step 2 on the "User Input" Sheet Colored Yellow?*).

When completing Step 2, values can be entered into the green cells corresponding to any of the waste material types (i.e. in any of the rows) and any of the waste management endpoints (i.e. any of the columns). However, the total quantity of any particular waste material must be equal between the "Baseline" and "Alternative" scenarios. After entering values into the "Baseline" scenario, the total quantity of each waste material that must be allocated within each "Alternative" scenario is indicated in the columns entitled "Remaining from Baseline". "Remaining from Baseline" is the quantity of a waste material that has not yet been allocated under the "Alternative" scenario. In the example below (Figure 5-6), 1,000 tonnes of "Food" was entered under "Landfill" within the Baseline scenario. This quantity can be seen under "Remaining from Baseline" within Alternative Scenario #1 (Figure 5-6, Note 1 and Note 2). Once the waste material has been allocated to a waste management endpoint under Alternative Scenario #1, "Remaining from Baseline" will show 0 (zero) (Figure 5-6, Note 3).



ALTERNATIVE SCENARIO #1 **Please review the yellow cells

Reset to Zero (Scenario 1) | Reset to Baseline (Scenario 1)

Tonnes of wet waste per year

Material	Remaining from "Baseline"	Landfill	Incineration	Composting	Dry AD	Wet AD	Source Reduced/ Diverted to Recycling	TOTAL
Note 1								
Individual Source-Separated Waste Materials								
Food	1,000	0	NA	0	0	0	0	0
Paper	0	0	NA	0	0	0	0	0
Yard Waste	0	0	NA	0	0	NA	0	0
Diapers	0	0	NA	0	0	0	0	0
Pet Waste	0	0	NA	0	0	0	0	0
Textiles	0	0	NA	NA	NA	NA	0	0
Wood	0	0	NA	0	NA	NA	0	0

ALTERNATIVE SCENARIO #1 **Please review the yellow cells

Reset to Zero (Scenario 1) | Reset to Baseline (Scenario 1)

Tonnes of wet waste per year

Material	Remaining from "Baseline"	Landfill	Incineration	Composting	Dry AD	Wet AD	Source Reduced/ Diverted to Recycling	TOTAL
Note 2								
Individual Source-Separated Waste Materials								
Food	500	0	NA	500	0	0	0	500
Paper	0	0	NA	0	0	0	0	0
Yard Waste	0	0	NA	0	0	NA	0	0
Diapers	0	0	NA	0	0	0	0	0
Pet Waste	0	0	NA	0	0	0	0	0
Textiles	0	0	NA	NA	NA	NA	0	0
Wood	0	0	NA	0	NA	NA	0	0

ALTERNATIVE SCENARIO #1

Reset to Zero (Scenario 1) | Reset to Baseline (Scenario 1)

Tonnes of wet waste per year

Material	Remaining from "Baseline"	Landfill	Incineration	Composting	Dry AD	Wet AD	Source Reduced/ Diverted to Recycling	TOTAL
Note 3								
Individual Source-Separated Waste Materials								
Food	0	0	NA	500	0	500	0	1,000
Paper	0	0	NA	0	0	0	0	0
Yard Waste	0	0	NA	0	0	NA	0	0
Diapers	0	0	NA	0	0	0	0	0
Pet Waste	0	0	NA	0	0	0	0	0
Textiles	0	0	NA	NA	NA	NA	0	0
Wood	0	0	NA	0	NA	NA	0	0

Figure 5-6: Screenshot of the "User Input" sheet, showing "Alternative Scenario #1" under the "Step 2" portion of the sheet (some rows have been hidden). Note 1: when 1,000 tonnes of "Food" is entered within the Baseline Scenario, the quantity of "Food" that must be allocated under Alternative Scenario #1 is shown in the "Remaining from Baseline" column. Note 2: when 500 tonnes of "Food" is allocated under Alternative Scenario #1, 500 tonnes remains from the Baseline. Note 3: when 1,000 tonnes of "Food" is allocated under Alternative Scenario #1, 0 (zero) tonnes remain from the Baseline.

5.5. Why Do I Get an Error Message during Step 1 on the "User Input" Sheet?

The first step in modeling GHG emissions from organic waste is to define the modeling options. This requires four (4) pieces of information:

- The baseline year;
- The location for model analysis;
- The number of years for model analysis; and
- The number of alternative scenarios that will be compared to the baseline.

These four pieces of information are entered into four fields at the top of the "User Input" sheet, under the title "Step 1: Define Your Modeling Options". If any of the four fields under "Step 1" receive an invalid entry, an error message will be displayed as shown in Figure 5-7 (below). The error message indicates that "This value doesn't match the data validation restrictions defined for this sheet", and can be closed by pressing "Retry" or "Cancel". For more information on completing Step 1, please refer to Section 3.1 (*Step 1: Define Your Modeling Options*).

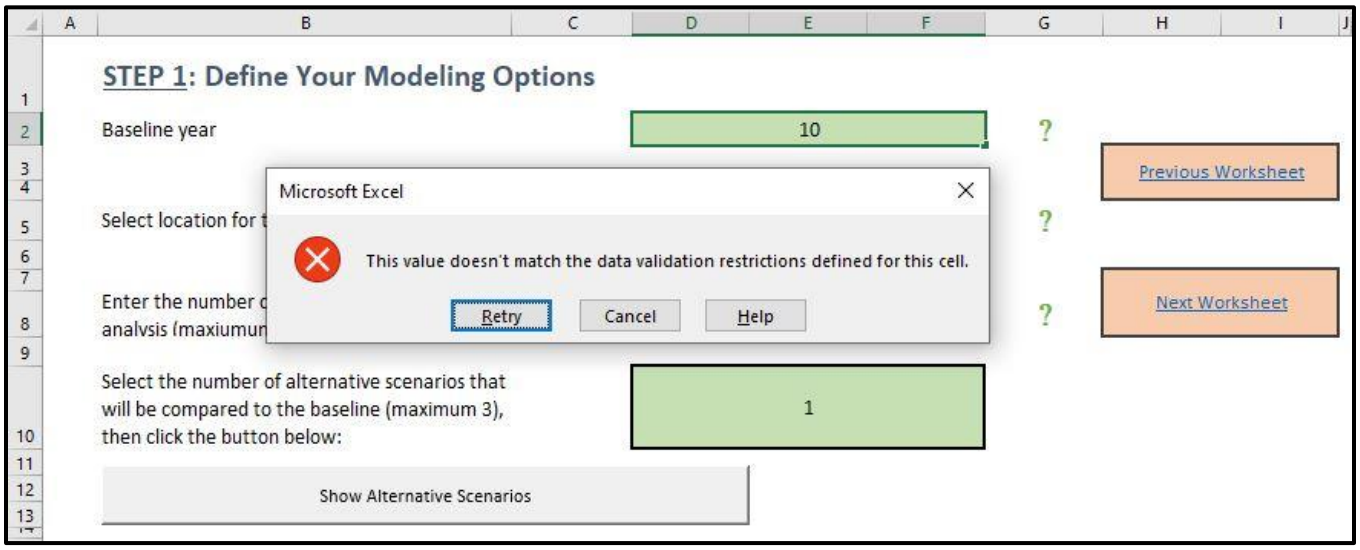


Figure 5-7: Screenshot of the "User Input" sheet, showing the error message that is displayed when an invalid entry is entered within the "Step 1" portion of the sheet.